PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT8216218

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	EXCLUSIVE LICENSE WITH ALL SUBSTANTIAL RIGHT

CONVEYING PARTY DATA

Name	Execution Date
KT CORPORATION	12/23/2022

RECEIVING PARTY DATA

Name:	PEGASUS WIRELESS INNOVATION LLC
Street Address:	20319 KIAWAH ISLAND DR
City:	ASHBURN
State/Country:	VIRGINIA
Postal Code:	20147

PROPERTY NUMBERS Total: 92

Property Type	Number
Patent Number:	9894644
Patent Number:	9998269
Patent Number:	10181931
Patent Number:	10306546
Patent Number:	10341806
Patent Number:	10728693
Patent Number:	10085249
Patent Number:	10568071
Patent Number:	11082957
Patent Number:	10432361
Patent Number:	10742364
Patent Number:	10644819
Patent Number:	10412731
Patent Number:	10616889
Patent Number:	10581560
Patent Number:	11197309
Patent Number:	10892867
Patent Number:	11431460
Patent Number:	11431461
Patent Number:	11115976

Petitioners' Exhibit 1002
Google et al. v. KT Corporation et al.
IPR2025-00291

Property Type	Number
Patent Number:	10849111
Patent Number:	11330573
Patent Number:	10237084
Patent Number:	10735967
Patent Number:	10708893
Patent Number:	9713094
Patent Number:	10178626
Patent Number:	10091736
Patent Number:	9461771
Patent Number:	9629010
Patent Number:	10009161
Patent Number:	11258532
Patent Number:	10791530
Patent Number:	11569958
Patent Number:	11363548
Patent Number:	11115157
Patent Number:	10925079
Patent Number:	10506630
Patent Number:	11405942
Patent Number:	11044743
Patent Number:	11765735
Patent Number:	10856307
Patent Number:	10869303
Patent Number:	10897720
Patent Number:	10609699
Patent Number:	11240785
Patent Number:	11160051
Patent Number:	10715290
Patent Number:	10966253
Patent Number:	10594460
Patent Number:	10638463
Patent Number:	11219000
Patent Number:	10715283
Patent Number:	10616916
Patent Number:	10764099
Patent Number:	10868702
Patent Number:	10952206
Patent Number:	11540272

Property Type	Number
Patent Number:	10979190
Patent Number:	11671218
Patent Number:	10284404
Patent Number:	10616024
Patent Number:	10721765
Patent Number:	10721031
Patent Number:	10958380
Patent Number:	10805050
Patent Number:	10616834
Patent Number:	9497666
Patent Number:	9832806
Patent Number:	10334657
Patent Number:	10420067
Patent Number:	10159025
Patent Number:	10667322
Patent Number:	10986530
Patent Number:	10511994
Patent Number:	10448386
Patent Number:	10721118
Patent Number:	10880222
Patent Number:	11044777
Patent Number:	11627631
Patent Number:	11012911
Patent Number:	10869236
Patent Number:	10708968
Patent Number:	10616932
Patent Number:	10660004
Patent Number:	10869243
Patent Number:	10470159
Patent Number:	10499376
Patent Number:	10812230
Patent Number:	10873671
Patent Number:	11178573
Patent Number:	10772148

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.

Phone:	4349062975
Email:	yoon@pegasuswi.com
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Address Line 1:	20319 KIAWAH ISLAND DR
Address Line 4:	ASHBURN, VIRGINIA 20147

ATTORNEY DOCKET NUMBER:	ASSIGNMENT KT PEGASUS 01
NAME OF SUBMITTER:	YEASUN YOON
SIGNATURE:	/yoon/
DATE SIGNED:	10/11/2023
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 33

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PATENT RIGHTS ASSIGNMENT

WHEREAS, **KT Corporation**, having a place of business at KT Kwanghwamun Bldg, East 33, Jong-ro 3-gil, Seoul, Korea 03155 (hereinafter "Assignor") is the sole owner of any and all patents and/or patent applications in the Patent Families listed in Schedule 1 annexed hereto (collectively referred to as the "Patents"). Herein, the term "Patent Families" means a collection of (i) a patent or a patent application; (ii) any and all foreign counterparts of the patent or the patent application described in (i); (iii) any divisionals, continuations, continuations-in-part, reissues, reexaminations, utility models, parents, or extensions, relating to any of the patents and patent applications described in (i) and (ii);, and (iv) any patent or patent application whose priority is based upon or in common with any patents and patent applications described in (i), (ii) and (ii).

WHEREAS, **Pegasus Wireless Innovation LLC**, having a place of business at 20319 Kiawah island Drive Ashburn VA 20147 USA (hereinafter "Purchaser") is desirous of acquiring all substantial rights in and to the Patents; and

Now, Therefore,

For good and valuable consideration, the receipt of which is hereby acknowledged, Assignor does hereby sell, assign, transfer and set over to Assignee, subject to existing encumbrances, (a) an exclusive, worldwide license to import, manufacture, have manufactured, use, lease, sell, offer to sell, or otherwise dispose of products encompassed by one or more claims of the Patents; (b) the exclusive right to: (i) enforce the Patents; (ii) sublicense or otherwise grant rights under the Patents; (iii) collect and receive damages, royalties, injunctive relief, and/or settlements for past, current, and future infringements of and to the Patents; (iv) sue or otherwise assert causes of action for the past, current,

and future infringements of and to the Patents; (v) control the prosecution of the Patents before any patent office in the world; (vi) indulge infringement of the Patents; and (c) any and all other substantial rights to and in the Patents necessary and sufficient under any applicable law or precedent to confer standing to Assignee and permit Assignee to initiate any actions on its own.

Assignor has executed this Assignment by its duly authorized representative.

KT Corporation

By: 閔燦鎬.

Name: Chanho Min

Title: Team Manager.

Date: 12/23/2022

SCHEDULE 1

No.	REF-NO	Country	Application/Issue No.	Application/issue date
1	P20130686	Provisional Application	10-2013-0114759	2013.09.26
	P20140028	KR Application	10-2014-0007262	2014.01.21
		KR Issue	10-1940344	2019.01.14
	P20130686PC	PCT	PCT/KR2014/008216	2014.09.02
	P20130686US	US Application	15/024,862	2016.03.25
		US Issue	9,894,644	2018.02.13
	P20130686CN	CN Application	201480053323.5	2016.03.25
		CN Issue	CN105659511B	2019.02.12
2	P20130687	Provisional Application	10-2013-0114763	2013.09.26
	P20130953	Provisional Application	10-2013-0138703	2013.11.15
	P20140134	KR Application	10-2014-0027531	2014.03.10
		KR Issue	10-1561838	2015.10.14
	P20140134P1	KR Application(DA)	10-2015-0139479	2015.10.05
		KR Issue(DA)	10-1645898	2016.07.28
	P20130687PC	PCT	PCT/KR2014/008708	2014.09.18
	P20130687US	US Application	15/024,873	2016.03.25
		US Issue	10,432,361	2019.10.01
	P20130687USC1	US Application(CA)	16/542,513	2019.08.16
		US Issue(CA)	10,742,364	2020.08.11
	P20130687CN	CN Application	201480053584.7	2016.03.28

3	P20130698	Provisional Application	10-2013-0115367	2013.09.27
	P20140216	KR Application	10-2014-0057938	2014.05.14
		KR Issue	10-1904572	2018.09.27
	P20130698PC	PCT	PCT/KR2014/008765	2014.09.22
	P20130698US	US Application	15/025,262	2016.03.25
		US Issue	10,181,931	2018.01.15
	P20130698CN	CN Application	201480053321.6	2016.03.25
		CN Issue	CN105594139B	2019.10.25
4	P20130737	Provisional Application	10-2013-0118593	2013.10.04
	P20131006	Provisional Application	10-2013-0142479	2013.11.21
	P20140221	KR Application	10-2014-0067128	2014.06.02
		KR Issue	10-1919636	2018.11.12
	P20140221PC	PCT	PCT/KR2014/008995	2014.09.26
	P20140221US	US Application	15/026,260	2016.03.31
		US Issue	9,998,269	2018.06.12
	P20140221CN	CN Application	201480054504.X	2016.04.01
		CN Issue	CN105659514B	2018.06.01
5	P20140587	Provisional Application	10-2014-0101467	2014.08.07
	P20150161	KR Application	10-2015-0094846	2015.07.02
		KR Issue	10-1875255	2018.06.29
	P20140587PC	PCT	PCT/KR2015/008037	2015.07.31
	P20140587US	US Application	15/501,263	2017.02.02
		US Issue	10,644,819	2020.05.05

	P20140587USD1	US Application(DA)	16/832,151	2020.03.27
	P20140587CN	CN Application	201580042296.6	2017.02.06
		CN Issue	CN106664697B	2020.06.16
6	P20150017	Provisional Application	10-2015-0008486	2015.01.19
	P20150734	Provisional Application	10-2015-0135899	2015.09.24
	P20150844	KR Application	10-2016-0005012	2016.01.15
		KR Issue	10-1856304	2018.05.02
	P20150017PC	PCT	PCT/KR2016/000494	2016.01.18
	P20150017US	US Application	15/544,363	2017.07.18
		US Issue	10,306,546	2019.05.28
	P20150017CN	CN Application	201680004482.5	2017.06.23
		CN Issue	CN107113149B	2020.12.08
7	P20150278	Provisional Application	10-2015-0068715	2015.05.18
	P20150609	Provisional Application	10-2015-0114876	2015.08.13
	P20160030	KR Application	10-2016-0027594	2016.03.08
		KR Issue	10-1956978	2019.03.05
	P20150278PC	PCT	PCT/KR2016/005215	2016.05.17
	P20150278US	US Application	15/569,133	2017.10.25
		US Issue	10,341,806	2019.07.02
	P20150278USC1	US Application(CA)	16/412,376	2019.05.14
		US Issue(CA)	10,728,693	2020.07.28
	P20150278CN	CN Application	201680006425.0	2017.07.19

		CN Issue	CN107211238B	2020.11.06
8	P20150724	Provisional Application	10-2015-0135756	2015.09.24
	P20150865	Provisional Application	10-2015-0162286	2015.11.19
	P20160287	KR Application	10-2016-0098858	2016.08.03
		KR Issue	10-1896766	2018.09.03
	P20150724US	US Application	15/260,373	2016.09.09
		US Issue	10,085,249	2018.09.25
	P20150724CN	CN Application	201610806693.2	2016.09.06
		CN Issue	CN106559161B	2019.01.04
9	P20160067	Provisional Application	10-2016-0014509	2016.02.04
	P20160076	Provisional Application	10-2016-0015050	2016.02.05
	P20160169	Provisional Application	10-2016-0039529	2016.03.31
	P20160548	KR Application	10-2016-0117138	2016.09.12
		KR Issue	10-1910245	2018.10.15
	P20160067US	US Application	15/415,781	2017.01.25
		US Issue	10,568,071	2020.02.18
	P20160067CN	CN Application	201710021966.9	2017.01.12
10	P20160126	Provisional Application	10-2016-0030172	2016.03.14
	P20160855	KR Application	10-2017-0022956	2017.02.21
		KR Issue	10-2237525	2021.04.01
	P20160126PC	PCT	PCT/KR2017/002535	2017.03.08
	P20160126US	US Application	16/084,594	2018.09.13

		US Issue	11,197,309	2021.12.07
	P20160126CN	CN Application	201780017398.1	2018.09.14
		CN Issue	CN 108781154B	2021.12.14
11	P20160143	Provisional Application	10-2016-0037224	2016.03.28
	P20160856	KR Application	10-2017-0022964	2017.02.21
		KR Issue	10-2065432	2020.01.07
	P20160143PC	PCT	PCT/KR2017/002536	2017.03.08
	P20160143US	US Application	16/088,914	2018.09.27
		US Issue	10,892,867	2021.01.12
	P20160143CN	CN Application	201780013601.8	2018.08.27
		CN Issue	CN 108702280 B	
12	P20160240	Provisional Application	10-2016-0051737	2016.04.27
	P20160818	KR Application	10-2016-0171232	2016.12.15
		KR Issue	10-1963483	2019.03.22
	P20160240US	US Application	15/497,362	2017.04.26
		US Issue	10,412,731	2019.09.10
	P20160240USC1	US Application(CA)	16/529,789	2019.08.02
		US Issue(CA)	10,616,889	2020.04.07
	P20160240CN	CN Application	201710280467.X	2017.04.26
		CN Issue	CN 107317662 B	2020.12.08
13	P20160257	Provisional Application	10-2016-0055676	2016.05.04
	P20160265	Provisional Application	10-2016-0058317	2016.05.12

	P20170206	KR Application	10-2017-0056206	2017.05.02
		KR Issue	10-2120976	2020.06.03
	P20170207	KR Application	10-2017-0056011	2017.05.02
		KR Issue	10-2093906	2020.03.20
	P20160257PC	PCT	PCT/KR2017/004702	2017.05.02
	P20160257US	US Application	16/098,812	2018.11.02
		US Issue	11,431,460	2022.08.30
	P20160257CN	CN Application	201780027159.4	2018.11.01
		CN Issue	CN 109075949 B	2021.12.14
	P20170207P1	KR Application(DA)	10-2020-0031570	2020.03.13
		KR Issue(DA)	10-2121009	2020.06.03
	P20160257USD1	US Application(DA)	16/179,863	2018.11.02
		US Issue(DA)	11,431,460	2022.08.30
	P20160257CND1	CN Application(DA)	201811307533.9	2018.11.05
		CN Issue(DA)	CN 109547182 B	2021.07.23
14	P20160645	Provisional Application	10-2016-0116784	2016.09.09
	P20170334	KR Application	10-2017-0098820	2017.08.04
		KR Issue	10-2120856	2020.06.03
	P20160645PC	PCT	PCT/KR2017/008734	2017.08.11
	P20160645US	US Application	16/331,969	2019.03.09
		US Issue	11,115,976	2021.09.07
	P20160645CN	CN Application	201780055337.4	2019.03.08
		CN Issue	CN 109691000 B	2021.11.05

15	P20160670	Provisional Application	10-2016-0122509	2016.09.23
	P20170648	KR Application	10-2017-0118923	2017.09.15
		KR Issue	10-2186397	2020.11.27
	P20160670PC	PCT	PCT/KR2017/010496	2017.09.22
	P20160670US	US Application	16/335,717	2019.03.22
		US Issue	10,849,111	2020.11.24
	P20160670CN	CN Application	201780058930.4	2019.03.25
		CN Issue	CN 109792315 B	2021.10.26
16	P20160683	Provisional Application	10-2016-0127089	2016.09.30
	P20170199	KR Application	10-2017-0080594	2017.06.26
		KR Issue	10-2085195	2020.02.28
	P20160683US	US Application	15/716,568	2017.09.27
		US Issue	10,581,560	2020.03.03
	P20160683CN	CN Application	201710795343.5	2017.09.06
		CN Issue	CN 107888333 B	2020.12.08
17	P20140174	Provisional Application	10-2014-0033579	2014.03.21
	P20140196	Provisional Application	10-2014-0034955	2014.03.25
	P20140207	Provisional Application	10-2014-0037394	2014.03.31
	P20140784	KR Application	10-2014-0175190	2014.12.08
		KR Issue	10-1722300	2017.03.27
	P20140174PC	PCT	PCT/KR2015/002021	2015.03.03
	P20140174US	US Application	14/664,853	2015.03.21
		US Issue	9,629,010	2017.04.18

	P20140174USC1	US Application(CA)	15/454,020	2017.03.09
		US Issue(CA)	10,009,161	2018.06.26
	P20140174CN	CN Application	201580006948.0	2016.08.02
		CN Issue	CN 106063214 B	2019.07.02
	P20140174CND1	CN Application(DA)	201910480118.1	2019.06.04
		CN Issue(DA)	CN 110149169 B	2021.12.14
18	P20140253	Provisional Application	10-2014-0046986	2014.04.18
	P20141039	KR Application	10-2015-0021154	2015.02.11
		KR Issue	10-1674791	2016.11.03
	P20140253US	US Application	14/687,865	2015.04.15
		US Issue	10091736	2018.10.02
	P20140253CN	CN Application	201510188805.8	2015.04.20
		CN Issue	CN 105007616 B	2019.09.24
19	P20160508	Provisional Application	10-2016-0089972	2016.07.15
	P20170351	KR Application	10-2017-0087597	2017.07.11
		KR Issue	10-2178412	2020.11.09
	P20160508PC	PCT	PCT/KR2017/007466	2017.07.12
	P20160508US	US Application	16/316,774	2019.01.10
		US Issue	10,791,530	2020.09.29
	P20160508EP	EP Application	17827948.5	2018.12.28
	P20160508CN	CN Application	201780041919.7	2019.01.04
		CN Issue	CN 109417422 B	

20	P20160627	Provisional Application	10-2016-0112748	2016.09.01
	P20170169	KR Application	10-2017-0059543	2017.05.12
		KR Issue	10-2123233	2020.06.10
	P20160627PC	PCT	PCT/KR2017/008944	2017.08.17
	P20160627US	US Application	16/318,466	2019.01.17
		US Issue	11,044,743	2021.06.22
	P20160627USC1	US Application(CA)	17/307,945	2021.05.04
	P20160627EP	EP Application	17846885.6	2018.12.28
	P20160627CN	CN Application	201780039745.0	2018.12.26
		CN Issue	CN 109328481 B	
21	P20160720	Provisional Application	10-2016-0130101	2016.10.07
	P20170649	KR Application	10-2017-0124261	2017.09.26
		KR Issue	10-2156672	2020.09.10
	P20160720PC	PCT	PCT/KR2017/010863	2017.09.28
	P20160720US	US Application	16/340,096	2019.04.05
		US Issue	11,038,735	2021.06.15
	P20160720USC1	US Application(CA)	17/314,034	2021.05.06
		US Issue(CA)		
	P20160720USC1C1	US Application(CA)	18/078,965	2022.12.11
		US Issue(CA)		
	P20160720EP	EP Application	17858693.9	2019.04.16
	P20160720CN	CN Application	201780061902.8	2019.04.04
		CN Issue	CN 109792429 B	2021.12.14

22	P20160768	Provisional Application	10-2016-0141451	2016.10.27
	P20170778	Provisional Application	10-2017-0130023	2017.10.11
	P20170798	KR Application	10-2017-0139598	2017.10.25
		KR Issue	10-2057127	2019.12.12
	P20160768PC	PCT	PCT/KR2017/011958	2017.10.27
	P20160768US	US Application	16/344,947	2019.04.25
		US Issue	11,115,157	2021.09.07
	P20160768USC1	US Application(CA)	17/379,977	2021.07.19
	P20160768EP	EP Application	17865477.8	2019.04.26
	P20160768CN	CN Application	201780062118.9	2019.04.08
		CN Issue	CN 109804692 B	2022.07.15
23	P20160836	Provisional Application	10-2016-0152659	2016.11.16
	P20170803	KR Application	10-2017-0151983	2017.11.15
		KR Issue	10-2156668	2020.09.10
	P20160836PC	PCT	PCT/KR2017/012992	2017.11.16
	P20160836US	US Application	16/349,874	2019.05.14
		US Issue	11,405,942	2022.08.02
	P20160836CN	CN Application	201780069729.6	2019.05.10
24	P20160837	Provisional Application	10-2016-0152587	2016.11.16
	P20170804	KR Application	10-2017-0153125	2017.11.16
		KR Issue	10-2195869	2020.12.21
	P20160837PC	PCT	PCT/KR2017/013045	2017.11.16
	P20160837US	US Application	16/461,640	2019.05.16

		US Issue	11,240,785	2022.02.01
	P20160837USC1	US Application(CA)	17/543,675	2021.12.06
	P20160837EP	EP Application	17871249.3	2019.05.27
	P20160837CN	CN Application	201780070560.6	2019.05.15
25	P20160768	Provisional Application	10-2016-0141451	2016.10.27
	P20170778	Provisional Application	10-2017-0130023	2017.10.11
	P20170142	Provisional Application	10-2017-0037553	2017.03.24
	P20170428	Provisional Application	10-2017-0079911	2017.06.23
	P20170808	KR Application(병합)	10-2017-0139885	2017.10.26
		KR Issue(병합)	10-2162591	2020.09.28
	P20170142PC	PCT	PCT/KR2017/011968	2017.10.27
	P20170142US	US Application	16/340,460	2019.04.09
		US Issue	10,925,079	2021.02.16
	P20170142EP	EP Application	17865212.9	2019.04.26
	P20170142CN	CN Application	201780066539.9	2019.04.26
		CN Issue	CN 109891988 B	2022.08.09
26	P20170011	Provisional Application	10-2017-0002589	2017.01.06
	P20170296	Provisional Application	10-2017-0066632	2017.05.30
	P20170933	KR Application	10-2018-0001157	2018.01.04
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	P20170011CN	CN Application	201880004512.1	2019.05.22
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27	P20170132	Provisional Application	10-2017-0035615	2017.03.21
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	P20170935	KR Application	10-2018-0014576	2018.02.06
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	P20170132US	US Application	15/924,553	2018.03.19
		US Issue	10,856,307	2020.12.01
	P20170132CN	CN Application	201810236651.9	2018.03.21
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	P20170622	Provisional Application	10-2017-0101782	2017.08.10
	P20170132	Provisional Application	10-2017-0035615	2017.03.21
	P20170866	Provisional Application	10-2017-0101169	2017.08.09
	P20180049	KR Application	10-2018-0018656	2018.02.14
		KR Issue	10-2100483	2020.04.07

	P20170479US	US Application	15/923,658	2018.03.16
		US Issue	10,869,303	2020.12.15
	P20170479CN	CN Application	201810217863.2	2018.03.16
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29	P20170142	Provisional Application	10-2017-0037553	2017.03.24
	P20170428	Provisional Application	10-2017-0079911	2017.06.23
	P20170800	KR Application	10-2017-0139604	2017.10.25
		KR Issue	10-2010019	2019.08.06
	P20170428US	US Application	15/934,927	2018.03.23
		US Issue	10,506,630	2019.12.10
	P20170428CN	CN Application	201810251436.6	2018.03.26
		CN Issue	CN 108633076 B	
30	P20170318	Provisional Application	10-2017-0067957	2017.05.31
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		US Issue	10,805,050	2020.10.13
	P20170318CN	CN Application	201810524233.X	2018.05.28
		CN Issue	CN 108988984 B	2021.07.09
31	P20170531	Provisional Application	10-2017-0089654	2017.07.14
	P20180193	KR Application	10-2018-0054207	2018.05.11
		KR Issue	10-2128964	2020.06.25
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	P20170621	Provisional Application	10-2017-0102577	2017.08.11
	P20180204	KR Application	10-2018-0057278	2018.05.18
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		US Issue	10,594,460	2020.03.17
	P20170594CN	CN Application	201810801096.X	2018.07.20
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	P20180207	KR Application	10-2018-0077270	2018.07.03
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		KR Issue(DA)	10-2246988	2021.04.26
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		US Issue	10,638,463	2020.04.28
	P20170764USD1	US Application(DA)	16/826,482	2020.03.23
		US Issue(DA)	11,219,000	2022.01.04
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	P20180507	KR Application	10-2018-0132306	2018.10.31
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		US Issue	11,258,532	2022.02.22
	P20180014USC1	US Application(CA)	17/565,353	2021.12.29
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		US Issue	11,330,573	2022.05.10
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36	P20160666	Provisional Application	10-2016-0122506	2016.09.23
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		KR Issue	10-2001301	2019.07.11
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	P20160666CN	CN Application	201710864759.8	2017.09.22
		CN Issue	CN 108307543 B	2021.06.15
37	P20150003	Provisional Application	10-2015-0002930	2015.01.08
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	P20150003CN	CN Application	201580066326.7	2017.06.06
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38	P20130110	Provisional Application	10-2013-0034603	2013.03.29
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	P20130110CN	CN Application	201480019499.9	2015.09.29
		CN Issue	CN 105103613 B	2018.12.25
39	P20130124	Provisional Application	10-2013-0036870	2013.04.04
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	P20131105	KR Application	10-2013-0161241	2013.12.23
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		KR Issue(DA)	10-2133255	2020.07.07
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	P20160805EP	EP Application	17867340.6	2019.05.16
	P20160805CN	CN Application	201780068268.0	2019.05.05
		CN Issue	CN 109906630 B	9/16/2022
41	P20170009	Provisional Application	10-2017-0002440	2017.01.06
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		US Issue	10,880,222	2020.12.29
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43	P20160264	Provisional Application	10-2016-0058157	2016.05.12
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44	P20170082	Provisional Application	10-2017-0027919	2017.03.03
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		US Issue	11,012,911	2021.05.18
45	P20170144	Provisional Application	10-2017-0037934	2017.03.24
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		KR Issue	10-2174936	2020.10.30

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		US Issue	10,708,968	2020.07.07
47	P20180026	Provisional Application	10-2018-0006980	2018.01.19
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		US Issue	10,812,230	2020.10.20
48	P20150254	Provisional Application	10-2015-0067848	2015.05.15
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49	P20130907	Provisional Application	10-2013-0135867	2013.11.08
	P20140043	Provisional Application	10-2014-0012709	2014.02.04
	P20140224	KR Application	10-2014-0088948	2014.07.15
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		US Issue(CA)	10,178,626	2019.01.08
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		CN Issue	CN 105594263 B	2019.11.01
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	P20140208	Provisional Application	10-2014-0037398	2014.03.31
	P20140325	Provisional Application	10-2014-0059630	2014.05.19
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	P20140175US	US Application	14/664,854	2015.03.21
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		CN Issue	CN 106464647 B	2019.09.13
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53	P20160663	Provisional Application	10-2016-0122503	2016.09.23
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		KR Issue	10-2127753	2020.06.23
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54	P20160696	Provisional Application	10-2016-0127093	2016.09.30
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		US Issue	11,363,548	2022.06.14
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55	P20160790	Provisional Application	10-2016-0143013	2016.10.31
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		US Issue(CA)	11540272	2022.12.08
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56	P20160806	Provisional Application	10-2016-0146950	2016.11.04
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	P20160806DE	DE Application	17866547.7	2019.05.13
		DE Issue	3537794	2021.09.08
	P20160806GB	GB Application	17866547.7	2019.05.13
		GB Issue	3537794	2021.09.08
	P20160806FR	FR Application	17866547.7	2019.05.13
		FR Issue	3537794	2021.09.08
	P20160806CN	CN Application	201780067632.1	2019.04.30
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		US Issue(CA)	11,044,718	2021.06.22
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	P20170131CN	CN Application	201810217772.9	2018.03.16
		CN Issue	CN 108633071 B	8/23/2022
59	P20170303	Provisional Application	10-2017-0065379	2017.05.26
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	P20180017	KR Application	10-2018-0037938	2018.04.02
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		US Issue	10,979,190	2021.04.13

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		CN Issue	CN 108966181 B	2021.07.23
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	P20180097P1	KR Application(DA)	10-2020-0034779	2020.03.23
		KR Issue(DA)	10-2198758	2020.12.29
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		US Issue	10,284,404	2019.05.07
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	P20170741CN	CN Application	201811085562.5	2018.09.17
62	P20170743	Provisional Application	10-2017-0118409	2017.09.15
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		KR Issue	10-2193191	2020.12.14

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63	P20170765	Provisional Application	10-2017-0128177	2017.09.29
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		US Issue	10,721,765	2020.07.21
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	P20180084	Provisional Application	10-2018-0022186	2018.02.23
	P20180208	KR Application	10-2018-0096773	2018.08.20
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		US Issue	10,715,283	2020.07.14
	P20170795CN	CN Application	201811168010.0	2018.10.08
		CN Issue	CN 109600212 B	2021.08.31
65	P20140677	Provisional Application	10-2014-0119263	2014.09.05
	P20150247	KR Application	10-2015-0094021	2015.07.01

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		US Issue	10,735,967	2020.08.04
	P20140677CN	CN Application	201580047094.0	2017.03.02
		CN Issue	CN 106717045 B	2021.03.05
66	P20150098	Provisional Application	10-2015-0032665	2015.03.09
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		KR Issue	10-1987525	2019.06.03
	P20150098PC	PCT	PCT/KR2016/002281	2016.03.08
	P20150098US	US Application	15/556,028	2017.09.06
		US Issue	10,708,893	2020.07.07
	P20150098CN	CN Application	201680013808.0	2017.09.05
		CN Issue	CN 107431592 B	2020.07.07
67	P20160241	Provisional Application	10-2016-0054935	2016.05.03
	P20170025	KR Application	10-2017-0044062	2017.04.05
		KR Issue	10-2016106	2019.08.23
	P20160241US	US Application	15/498,607	2017.04.27
		US Issue	10,420,067	2019.09.17
	P20160241CN	CN Application	201710282167.5	2017.04.26
		CN Issue	CN 107360561 B	2020.09.11
68	P20160249	Provisional Application	10-2016-0054937	2016.05.03
	P20160250	Provisional Application	10-2016-0054936	2016.05.03

	P20170178	KR Application	10-2017-0053295	2017.04.26
		KR Issue	10-2057212	2019.12.12
	P20160249PC	PCT	PCT/KR2017/004432	2017.04.26
	P20160249US	US Application	16/098,841	2018.11.02
		US Issue	10,667,322	2020.05.26
	P20160249CN	CN Application	201780027502.5	2018.11.02
		CN Issue	CN 109076496 B	2021.09.03
69	P20160251	Provisional Application	10-2016-0054930	2016.05.03
	P20170076	KR Application	10-2017-0045815	2017.04.10
		KR Issue	10-2005910	2019.07.25
	P20160251US	US Application	15/582,906	2017.05.01
		US Issue	10,159,025	2018.12.18
	P20160251CN	CN Application	201710291278.2	2017.04.28
		CN Issue	CN 107343299 B	2021.01.05
70	P20170098	Provisional Application	10-2017-0030764	2017.03.10
	P20170317	Provisional Application	10-2017-0068074	2017.05.31
	P20170896	Provisional Application	10-2017-0152149	2017.11.15
	P20180044	KR Application	10-2018-0026611	2018.03.07
		KR Issue	10-2065137	2020.01.06
	P20170098PC	PCT	PCT/KR2018/002750	2018.03.08
	P20170098US	US Application	16/349,259	2019.05.10
		US Issue	10,986,530	2021.04.20
	P20170098CN	CN Application	201880004237.3	2019.05.06

		CN Issue	CN 109937587 B	2022.06.14
71	P20170397	Provisional Application	10-2017-0076126	2017.06.15
	P20170930	KR Application	10-2018-0051293	2018.05.03
		KR Issue	10-2023672	2019.09.16
	P20170397US	US Application	16/004,783	2018.06.11
		US Issue	10,511,994	2019.12.17
	P20170397CN	CN Application	201810612491.3	2018.06.14
	P20170397CN	CN Issue	CN 109151878 B	2021.12.14
72	P20160282	Provisional Application	10-2016-0062068	2016.05.20
	P20160481	KR Application	10-2016-0088331	2016.07.13
		KR Issue	10-2100491	2020.04.07
	P20160481PC	PCT	PCT/KR2017/007452	2017.07.12
	P20160481US	US Application	16/316,092	2019.01.08
		US Issue	10,869,243	2020.12.15
73	P20170018	Provisional Application	10-2017-0005590	2017.01.12
	P20170938	KR Application	10-2018-0002947	2018.01.09
		KR Issue	10-2117098	2020.05.25
	P20170018PC	PCT	PCT/KR2018/000518	2018.01.11
	P20170018US	US Application	16/343,819	2019.04.22
		US Issue	10,660,004	2020.05.19
74	P20170234	Provisional Application	10-2017-0054983	2017.04.28
	P20170673	KR Application	10-2018-0000256	2018.01.02
		KR Issue	10-1957087	2019.03.05
	P20170234US	US Application	15/967,512	2018.04.30

		US Issue	10,772,148	2020.09.08
75	P20170238	Provisional Application	10-2017-0057299	2017.05.08
	P20180146	KR Application	10-2018-0036753	2018.03.29
		KR Issue	10-2066689	2020.01.09
	P20170238US	US Application	15/969,858	2018.05.03
		US Issue	10,470,159	2019.11.05
76	P20170389	Provisional Application	10-2017-0076924	2017.06.16
	P20180250	KR Application	10-2018-0053053	2018.05.09
		KR Issue	10-2042036	2019.11.01
	P20170389US	US Application	16/007,050	2018.06.13
		US Issue	10,499,376	2019.12.03
77	P20180202	Provisional Application	10-2018-0039897	2018.04.05
	P20190047	KR Application	10-2019-0020835	2019.02.22
		KR Issue	10-2206773	2021.01.19
	P20180202US	US Application	16/373,808	2019.04.03
		US Issue	10,873,671	2020.12.22
78	P20180557	Provisional Application	10-2018-0090004	2018.08.01
	P20190287	KR Application	10-2019-0075402	2019.06.25
		KR Issue	10-2198010	2020.12.28
	P20180557US	US Application	16/528,980	2019.08.01
		US Issue	11,178,573	2021.11.16
79	P20160807	가출원	10-2016-0146955	2016.11.04
	P20170669	KR 출원	10-2017-0135215	2017.10.18

		KR 등록	10-2130999	2020.07.01
	P20160807PC	PCT 국제출원	PCT/KR2017/012003	2017.10.27
	P20160807US	US 출원	16/347,571	2019.05.03
	P20160807EP	EP 출원	17867332.3	2019.05.13
	P20160807CN	CN 출원	201780067633.6	2019.04.30
80	P20170184	가출원	10-2017-0047545	2017.04.12
	P20170239	가출원	10-2017-0056477	2017.05.02
	P20170507	가출원	10-2017-0086107	2017.07.06
	P20180096	정규출원	10-2018-0034955	2018.03.27
	P20170184US	US 출원	15/951,349	2018.04.12
		US 등록	10,958,380	2021.03.23
	P20170184USC1	US 출원(CA)	17/173,097	2021.02.10
	P20170184CN	CN 출원	201810318869.9	2018.04.11

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/048,210	03/17/2020	10594460	811.0136	1073

76277 7590 02/26/2020

IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

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

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

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

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

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

Kyujin PARK, Seoul, KOREA, REPUBLIC OF;
KT CORPORATION, Gyeonggi-do, KOREA, REPUBLIC OF;
Woo-jin CHOI, Seoul, KOREA, REPUBLIC OF;

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.

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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.
16/048,210	07/27/2018	Kyujin PARK	811.0136	1073

7590 02/11/2020

IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

EXAMINER	
MEW, KEVIN D	

ART UNIT	PAPER NUMBER
2471	

NOTIFICATION DATE	DELIVERY MODE
02/11/2020	ELECTRONIC

ACKNOWLEDGEMENT OF REQUEST

Notice of Allowance/Allowability Mailed

The request for a corrected notice of allowance/allowability, dated 1/21/2020, has been received by the U.S.Patent and Trademark Office. A corrected notice of allowance/allowability will not be mailed, but the Office has verified the following information, and made any necessary corrections to Office computer data:

- **Applicant claims "Foreign Priority" (benefit of an earlier Foreign application pursuant to 35 U.S.C. 119(a)-(d) or (f)).**

☑ Certified copies of the priority documents have been received.

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

C. Garner
571-272-4200 or 1-888-786-0101
For Application Assistance Unit
Office of Data Management

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

76277 7590 01/08/2020

IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

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

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/048,210	07/27/2018	Kyujin PARK	811.0136	1073

TITLE OF INVENTION: APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	04/08/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
MEW, KEVIN D	2471	370-329000

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

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

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

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

1 IP Legal Services, LLC
2
3

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

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

(A) NAME OF ASSIGNEE: KT CORPORATION

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Gyeonggi-do, Republic of Korea

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

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

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

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

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 602802

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature /Ian M. Hughes/ Date 01/29/2020

Typed or printed name Ian M. Hughes Registration No. 41,083

Electronic Patent Application Fee Transmittal

Application Number:	16048210
Filing Date:	27-Jul-2018
Title of Invention:	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL
First Named Inventor/Applicant Name:	Kyujin PARK
Filer:	Kyung Hee Kim/yujin Chun
Attorney Docket Number:	811.0136

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
UTILITY APPL ISSUE FEE	1501	1	1000	1000
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1000**

Electronic Acknowledgement Receipt

EFS ID:	38431766
Application Number:	16048210
International Application Number:	
Confirmation Number:	1073
Title of Invention:	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	76277
Filer:	Kyung Hee Kim/yujin Chun
Filer Authorized By:	Kyung Hee Kim
Attorney Docket Number:	811.0136
Receipt Date:	29-JAN-2020
Filing Date:	27-JUL-2018
Time Stamp:	13:34:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1000
RAM confirmation Number	E20201SD35043992
Deposit Account	602802
Authorized User	yujin Chun

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

37 CFR 1.16 (National application filing, search, and examination fees)

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)

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)	8110136IssueFeeTransmittal.pdf	89690 c4db4faeef9ebc9267d6d6883f02f3c654ced03c	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31941 4fa41d2073f88cde81c19254e70f4435f278f1fb	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	121631		

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 application of: Kyujin PARK et al.		Re: Attorney Docket No.: 811.0136	
Serial No.:	16/048,210	Group Art Unit:	2471
Filed:	07/27/2018	Examiner:	MEW, KEVIN D
Matter No.:	811.0136	Conf. No.:	1073

For: APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

REQUEST FOR CORRECTED NOTICE OF ALLOWANCE

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

Dear Sir:

In response to the Notice of Allowance mailed January 8, 2020, Applicant respectfully submits that a claim for foreign priority under 35 U.S.C. 119 has been made in the present application and that the priority documents have been electronically retrieved by USPTO from KIPO and placed in PAIR on 09/27/2018. Accordingly, Applicant respectfully requests an acknowledgement of the claim for foreign priority.

Respectfully submitted,

Date: 21 January 2020
Customer No. 76277
IP Legal Services, LLC
P.O. Box 651325
Sterling, VA 20165

/Ian M. Hughes/
Ian M. Hughes, Reg. No. 41,083
Kyung Hee Kim, Reg. No. 69,183
Attorney/Agent for Applicant
(571) 267-7183 (phone)

Electronic Acknowledgement Receipt

EFS ID:	38358163
Application Number:	16048210
International Application Number:	
Confirmation Number:	1073
Title of Invention:	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	76277
Filer:	Kyung Hee Kim/yujin Chun
Filer Authorized By:	Kyung Hee Kim
Attorney Docket Number:	811.0136
Receipt Date:	21-JAN-2020
Filing Date:	27-JUL-2018
Time Stamp:	18:57:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Corrected Notice of Allowance	8110136RequestforCorrectedNOA.pdf	96884 0353b645a9470a1512bfacc043a62e0ae17a8998	no	1

Warnings:

Information:	
Total Files Size (in bytes):	96884

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

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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
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NOTICE OF ALLOWANCE AND FEE(S) DUE

76277 7590 01/08/2020

IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

EXAMINER
MEW, KEVIN D

ART UNIT	PAPER NUMBER
2471	

DATE MAILED: 01/08/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/048,210	07/27/2018	Kyujin PARK	811.0136	1073

TITLE OF INVENTION: APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	04/08/2020

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

76277 7590 01/08/2020

IP LEGAL SERVICES, LLC
P.O. Box 651325
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Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/048,210	07/27/2018	Kyujin PARK	811.0136	1073

TITLE OF INVENTION: APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	04/08/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
MEW, KEVIN D	2471	370-329000

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

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

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

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

1 _____
2 _____
3 _____

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

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

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

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

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

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

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

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/048,210	07/27/2018	Kyujin PARK	811.0136	1073

76277 7590 01/08/2020

IP LEGAL SERVICES, LLC
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Sterling, VA 20165

EXAMINER	
MEW, KEVIN D	
ART UNIT	PAPER NUMBER
2471	

DATE MAILED: 01/08/2020

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

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

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

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

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 16/048,210	Applicant(s) PARK et al.	
	Examiner KEVIN D MEW	Art Unit 2471	AIA (FITF) Status Yes

-- 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 11/21/19.
   ☐ 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 See Continuation Sheet . 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 11/19/19.
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 _____.

/KEVIN D MEW/
Primary Examiner, Art Unit 2471

Continuation of 3. The allowed claim(s) is/are: 1-2, 4-5, 7-8, 10-11, 13-14, 16-17, renumbered as claims 1-12, respectively

Detailed Action

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Amendment

2. Applicant's Remarks/Arguments filed 11/21/2019 have been considered. Claims 3, 6, 9, 12, 15 and 18 have been canceled by applicant. Claims 1-2, 4-5, 7-8, 10-11, 13-14, 16-17 are currently pending.

Response to Arguments

3. Applicant's arguments, see page 6, paragraph 3 - page 10, paragraph 2 of the Remarks, filed 11/21/2019, with respect to claims 1-2, 7-8, 13-14 have been fully considered and are persuasive in light of the amended claim base claims 1, 7 and 13. The 35 U.S.C. 102(a)(2) rejection of claims 1-2, 7-8, 13-14 as set forth in the previous Office action has been withdrawn.

4. Applicant's arguments, see page 6, paragraph 3 - page 10, paragraph 2 of the Remarks, filed 11/21/2019, with respect to claims 3-5, 9-11, 15-17 have been fully considered and are persuasive in light of the amended base claims 1, 7 and 13. The 35 U.S.C. 103 rejection of claims 3-5, 9-11, 15-17 as set forth in the previous Office action has been withdrawn.

EXAMINER'S STATEMENT OF REASONS FOR ALLOWANCE

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

The present application relates to a method for a user equipment (UE) to transmit an uplink (UL) control channel and a UL data channel to a base station (BS), including:

"wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values, and wherein a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)" in combination with other recited elements in claim 1.

The present application also related to a method for a base station (BS) to receive an uplink (UL) control channel and a UL data channel from a user equipment (UE), including:

"wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values, and wherein a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)" in combination with other recited elements in claim 7.

The present application also relates to a user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS), including:

"wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values, and wherein a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)" in combination with other recited elements in claim 13.

The closest prior art, Kim et al. (US Publication 2014/0169316 A1), teaches transmitting an uplink grant of a DCI to a user equipment UE such that a resource block is assigned to the UE for PUSCH transmission in the uplink. In addition, Kim teaches allocating a frequency hopping of a RB pair to the PUCCH in a slot boundary and using a frequency hopping flag to indicate whether frequency hopping is used for PUSCH transmission. Kim also teaches PUCCH is used for carrying control information whereas PUSCH is used for carrying data.

A second prior art, Zhang et al. (US Publication 2012/0250653 A1), teaches using the frequency offset used during frequency hopping is fixed for an uplink channel.

A third prior art, Yi et al. (US Publication 2015/0195069 A1), teaches transmitting the start offset and frequency hopping gap to a user terminal through uplink grant in the DCI.

However, Kim, Zhang and Yi, when either taken individually or in combination, fail to teach or make obvious the aforementioned claim features of the base claims above, which renders the claims of the instant application allowable.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Mew whose telephone number is (571)272-3141. The examiner can normally be reached on Monday - Friday 9 am - 5 pm.

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

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chi Pham can be reached on 571-272-3179. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/KEVIN D MEW/
Primary Examiner, Art Unit 2471

Notice of References Cited	Application/Control No. 16/048,210	Applicant(s)/Patent Under Reexamination PARK et al.	
	Examiner KEVIN D MEW	Art Unit 2471	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-20140169316-A1	06-2014	Kim; Hakseong	H04L5/0048	370/329
*	B	US-20150180621-A1	06-2015	Guan; Yanfeng	H04B1/713	370/330
*	C	US-20140376468-A1	12-2014	He; Hong	H04B1/713	370/329
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

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.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/048,210	PARK et al.
	Examiner	**Art Unit**
	KEVIN D MEW	2471

CPC						
Symbol					**Type**	**Version**
H04L	/	5	/	0051	F	2013-01-01
H04B	/	1	/	713	I	2013-01-01
H04L	/	5	/	0091	I	2013-01-01
H04L	/	5	/	0012	I	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/KEVIN D MEW/ Primary Examiner, Art Unit 2471	17 December 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office — Part of Paper No.: 20191217

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/048,210	PARK et al.
	Examiner	**Art Unit**
	KEVIN D MEW	2471

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	5	/	00

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/KEVIN D MEW/ Primary Examiner, Art Unit 2471	17 December 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office — Part of Paper No.: 20191217

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/048,210	PARK et al.
	Examiner	**Art Unit**
	KEVIN D MEW	2471

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

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	7	10												
2	2	8	11												
	3		12												
3	4	9	13												
4	5	10	14												
	6		15												
5	7	11	16												
6	8	12	17												
	9		18												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 12	
/KEVIN D MEW/ Primary Examiner, Art Unit 2471 (Primary Examiner)	17 December 2019 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 5

U.S. Patent and Trademark Office Part of Paper No.: 20191217

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/048,210	PARK et al.
	Examiner	Art Unit
	KEVIN D MEW	2471

CPC - Searched*		
Symbol	Date	Examiner
H04L 5/0037, 0039, 0041, 0042, 0048, 0051, 0053, 0055, 0057, 0058, H04B 1/713, 7136	12/17/2019	KM

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

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

Search Notes		
Search Notes	Date	Examiner
Inventor and assignee search in PALM and East - see search history printout	12/17/2019	KM
EAST (USPAT,USPGPUB,EPO,FERS,JPO,DERWENT,IBM_TDB) - see search history printout	12/17/2019	KM
H04L 5/0037, 0039, 0041, 0042, 0048, 0051, 0053, 0055, 0057, 0058 , H04B 1/713, 7136 (Text search - see search history printout) (limited by text)	12/17/2019	KM

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/048,210	PARK et al.
	Examiner	Art Unit
	KEVIN D MEW	2471

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
(Interference search - see search history printout)		12/17/2019	KM

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/048,210	PARK et al.
	Examiner	Art Unit
	KEVIN D MEW	2471

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

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

CLAIM		DATE								
Final	Original	08/13/2019	12/17/2019							
1	1	✓	=							
2	2	✓	=							
	3	✓	-							
3	4	✓	=							
4	5	✓	=							
	6	✓	-							
5	7	✓	=							
6	8	✓	=							
	9	✓	-							
7	10	✓	=							
8	11	✓	=							
	12	✓	-							
9	13	✓	=							
10	14	✓	=							
	15	✓	-							
11	16	✓	=							
12	17	✓	=							
	18	✓	-							

Bibliographic Data

Application No: 16/048,210

Foreign Priority claimed: (•) Yes ( ) No

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

Verified and Acknowledged: /KEVIN MEW/ (Examiner's Signature) KM (Initials)

Title: APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
07/27/2018	370	2471	811.0136
RULE			

APPLICANTS

KT CORPORATION, Gyeonggi-do, KOREA, REPUBLIC OF

INVENTORS

Kyujin PARK Seoul, KOREA, REPUBLIC OF

Woo-jin CHOI Seoul, KOREA, REPUBLIC OF

CONTINUING DATA

FOREIGN APPLICATIONS

KOREA, REPUBLIC OF 10-2017-0095980 07/28/2017

KOREA, REPUBLIC OF 10-2017-0102577 08/11/2017

KOREA, REPUBLIC OF 10-2018-0057278 05/18/2018

IF REQUIRED, FOREIGN LICENSE GRANTED**

09/10/2018

STATE OR COUNTRY

KOREA, REPUBLIC OF

ADDRESS

IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165
UNITED STATES

FILING FEE RECEIVED

$1,720

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	444	((bandwidth$1 band$1) near3 (allocat$3 assign$6 grant$3)) same (frequency near3 hopping) and pusch and pucch and prb$1 and (frequency near2 hopping)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:44
L6	235	((bandwidth$ band$1) near3 configur$5) and (frequency near2 hopping) and ((uplink ul) near2 "control channel") and ((uplink ul) near2 "data channel") and ((downlink dl) near2 "control channel") and dci and (frequency near2 hopping)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:45
L7	17535	h04l5/0037.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:45
L8	4084	h04l5/0039.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:45
L9	4037	h04l5/0041.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:45
L10	4085	h04l5/0042.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:45
L11	60765	h04l5/0048.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:45
L12	18300	h04l5/0051.cpc.	US-PGPUB;	OR	OFF	2019/12/19

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			18:45
L13	67389	h04l5/0053.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:45
L14	32135	h04l5/0055.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L15	16634	h04l5/0057.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L16	4927	h04l5/0058.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L17	7000	h04b1/713.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L18	928	h04b1/7136.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L19	16	5 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L20	0	5 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2019/12/19 18:46

			IBM_TDB			
L21	0	5 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L22	0	5 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L23	156	5 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L24	43	5 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L25	122	5 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L26	65	5 and 14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L27	48	5 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L28	2	5 and 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L29	19	5 and 17	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	2019/12/19 18:46

			JPO; DERWENT; IBM_TDB			
L30	0	5 and 18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L31	9	6 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L32	1	6 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L33	0	6 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L34	1	6 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L35	65	6 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L36	42	6 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L37	92	6 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L38	39	6 and 14	US-PGPUB; USPAT;	OR	OFF	2019/12/19 18:46

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L39	13	6 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L40	0	6 and 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:46
L41	13	6 and 17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L42	7	6 and 18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L43	126	((ul "uplink") near3 grant$1) and ((bandwidth$1 band$1) near2 configur$5) and (frequency near2 hopping) and ((uplink ul) near2 "control channel") and ((uplink ul) near2 "data channel") and prb$1 and dci	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L44	6	43 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L45	1	43 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L46	0	43 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47

L47	1	43 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L48	26	43 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L49	22	43 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L50	42	43 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L51	19	43 and 14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L52	8	43 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L53	0	43 and 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L54	12	43 and 17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:47
L55	7	43 and 18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2019/12/19 18:47

			DERWENT; IBM_TDB			
L56	90	(frequency near3 hopping with offset$1) and pusch and pucch and (bwp$1 "bandwidth part" bp$1) and (prb$1 "physical resource block")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L57	1	56 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L58	0	56 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L59	0	56 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L60	0	56 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L61	23	56 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L62	13	56 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L63	15	56 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L64	6	56 and 14	US-PGPUB; USPAT; USOCR;	OR	OFF	2019/12/19 18:48

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
L65	4	56 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L66	0	56 and 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L67	3	56 and 17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L68	0	56 and 18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:48
L69	98	("bwp" bp$1 "bandwidth part") and (frequency near2 hopping with offset$1) and pucch and pusch and dci	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L70	1	69 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L71	0	69 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L72	0	69 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L73	0	69 and 10	US-PGPUB;	OR	OFF	2019/12/19

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			18:49
L74	30	69 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L75	13	69 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L76	19	69 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L77	6	69 and 14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L78	4	69 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L79	2	69 and 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L80	3	69 and 17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:49
L81	0	69 and 18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2019/12/19 18:49

			IBM_TDB			
L82	426	(frequency near3 hopping) and pusch and pucch and (bwp$1 "bandwidth part" bp$1) and dci	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L83	4	82 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L84	5	82 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L85	0	82 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L86	2	82 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L87	112	82 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L88	54	82 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L89	112	82 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L90	64	82 and 14	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	2019/12/19 18:50

			JPO; DERWENT; IBM_TDB			
L91	62	82 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L92	2	82 and 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L93	13	82 and 17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L94	0	82 and 18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:50
L96	61	(("frequency hopping" near2 offset$1) same (resource near2 block$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L97	0	96 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L98	0	96 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L99	0	96 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L100	0	96 and 10	US-PGPUB; USPAT;	OR	OFF	2019/12/19 18:51

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L101	7	96 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L102	13	96 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L103	14	96 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L104	18	96 and 14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L105	14	96 and 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L106	0	96 and 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L107	20	96 and 17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L108	2	96 and 18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51

L109	352	"park, kyujin".in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L110	495	"choi, woo-jin".in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L111	1660	"kt corporation".as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L112	1	5 and 109	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:51
L113	1	5 and 110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L114	1	5 and 111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L115	5	6 and 109	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L116	9	6 and 110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L117	13	6 and 111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2019/12/19 18:52

			DERWENT; IBM_TDB			
L118	4	43 and 109	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L119	8	43 and 110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L120	8	43 and 111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L121	1	56 and 109	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L122	1	56 and 110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L123	1	56 and 111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L124	1	69 and 109	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L125	1	69 and 110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L126	1	69 and 111	US-PGPUB; USPAT; USOCR;	OR	OFF	2019/12/19 18:52

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
L127	1	82 and 109	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L128	1	82 and 110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L129	1	82 and 111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:52
L130	1	96 and 109	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:53
L131	1	96 and 110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:53
L132	1	96 and 111	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/12/19 18:53

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L133	1	(((mobile wireless subscriber) near2 (station unit terminal device apparatus)) ue "user equipment" wtru) and (((uplink ul) near3 (control near2 channel)) pucch) and (((uplink ul) near3 (data near2 channel)) pusch) and receiver and ("base station" enb enode) and (((bandwidth near2 part) bwp) with configuration) and (bwps "bandwidth parts") and (frequency near3 hopping near6 configuration) and ((("bwp set") "bandwidth	US-PGPUB; USPAT	OR	OFF	2019/12/19 18:59

		part") near3 set) and transmitter and dci and (frequency near2 hopping near6 offset) and (frequency near2 hopping near6 offset with values) and (frequency near2 hopping near6 offset with set) same (((uplink ul) near3 (data near2 channel)) pusch) same dci				

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16048210
Filing Date	2018-07-27
First Named Inventor	Kyujin PARK
Art Unit	2471
Examiner Name	MEW, KEVIN D
Attorney Docket Number	811.0136

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16048210
	Filing Date	2018-07-27
	First Named Inventor	Kyujin PARK
	Art Unit	2471
	Examiner Name	MEW, KEVIN D
	Attorney Docket Number	811.0136

/K.D.M/	1	SAMSUNG, "Bandwidth Part Hopping for CORESETS", R1-1710702, 3GPP TSG RAN WG1 NR ad-Hoc#2, Qingdao, China, June 27 – 30, 2017, pp. 1-3	X

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EXAMINER SIGNATURE

Examiner Signature	/KEVIN D MEW/	Date Considered	12/17/2019

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16048210
	Filing Date	2018-07-27
	First Named Inventor	Kyujin PARK
	Art Unit	2471
	Examiner Name	MEW, KEVIN D
	Attorney Docket Number	811.0136

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the 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 the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Ian M. Hughes/	Date (YYYY-MM-DD)	2019-11-19
Name/Print	Ian M. Hughes	Registration Number	41083

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/048,210	Filing Date 07/27/2018	☐ 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	300
☐ 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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	300

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	11/21/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $460 =	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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/FELICIA ALLEN-JENKINS/
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EFS ID:	37826198
Application Number:	16048210
International Application Number:	
Confirmation Number:	1073
Title of Invention:	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	76277
Filer:	Kyung Hee Kim
Filer Authorized By:	
Attorney Docket Number:	811.0136
Receipt Date:	21-NOV-2019
Filing Date:	27-JUL-2018
Time Stamp:	22:20:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	8110136Reply.pdf	161024 e829b61ccae39f2084b36e6de4a074c8b35a76d1	no	11

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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 application of: Kyujin PARK		Re: Attorney Docket No.: 811.0136	
Serial No.:	16/048,210	Art Unit:	2471
Filed:	07/27/2018	Examiner:	MEW, KEVIN D
Matter No.:	811.0136	Conf. No.:	1073

For: APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

REPLY TO OFFICE ACTION

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

Dear Sir:

In response to the Non-Final office action of **09/21/2019**, please reconsider the application in light of the following amendments/remarks.

Applicant believes that no extensions of time and fees are required at this time. However, if extensions of time are necessary to prevent abandonment of this application, such extensions of time are hereby petitioned for under 37 C.F.R. §1.136 (a). The Director is hereby authorized to charge any fees that may be required, or also credit any overpayment, to Deposit Account Number 60-2802.

AMENDMENT TO THE CLAIMS

1. (**Currently Amended**) A method for a user equipment (UE) to transmit an uplink (UL) control channel and a UL data channel to a base station (BS), the method comprising:

receiving, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE;

receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set; and

transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information,

wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values, and

wherein a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI).

2. (Original) The method of claim 1, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

3. (**Canceled**)

4. (**Currently Amended**) The method of ~~claim 3~~claim 1, wherein a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP.

5. (Original) The method of claim 4, wherein the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less.

6. **(Canceled)**

7. **(Currently Amended)** A method for a base station (BS) to receive an uplink (UL) control channel and a UL data channel from a user equipment (UE), the method comprising:

transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE;

transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE; and

receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information,

wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values, and

wherein a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI).

8. (Original) The method of claim 7, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

9. **(Canceled)**

10. **(Currently Amended)** The method of ~~claim 9~~ claim 7, wherein a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the reception BWP.

11. (Original) The method of claim 10, wherein the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the reception BWP is a preset threshold value or less.

12. **(Canceled)**

13. **(Currently Amended)** A user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS), the UE comprising:

a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set; and

a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information,

wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values, and

wherein a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI).

14. (Original) The UE of claim 13, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

15. **(Canceled)**

16. **(Currently Amended)** The UE of ~~claim 15~~ claim 13, wherein a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP.

17. (Original) The UE of claim 16, wherein the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number

of PRBs constituting the transmission BWP is a preset threshold value or less.

18. **(Canceled)**

REMARKS

Applicant appreciates the Examiner's review of the present application and respectfully requests reconsideration in view of the foregoing amendments and the following remarks.

Claims Amendments/Status

Claims 1-18 are previously pending in the instant application. Claims 1, 4, 7, 10, 13, and 16are amended to better define the claimed invention and to improve claim language. Claims 3, 6, 9, 12, 15, and 18 are canceled without prejudice and disclaimer. Now, claims 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, and 17 are pending in the instant application. Applicant respectfully submits that no new matter is added and the support for the statements herein may be found throughout the specification as originally filed.

35 U.S.C. §102(a) and §103(a)

Claims 1-2, 7-8, and 13-14 are rejected under 35 U.S.C. §102(a)(2) as being anticipated by U.S. Patent Application Publication No. 2014/0169316 to Kim et al. (hereinafter "*Kim*"). Claims 3-5, 9-11, and 15-17 are rejected under 35 U.S.C. §103 as being unpatentable over *Kim* in view of U.S. Patent Application Publication No. 2012/0250653 to Zhang et al. (hereinafter "*Zhang*"). Claims 6, 12, and 18 are rejected under 35 U.S.C. §103 as being unpatentable over *Kim* in view of *Zhang*, and in further view of U.S. Patent Application Publication No. 2015/0195069 to Yi et al. (hereinafter "*Yi*"). This rejection is respectfully traversed for the reasons set forth below. Accordingly, it is believed that independent claim 1 is patentable at least for the aforementioned reasons. Withdrawal of this rejection is respectfully requested.

Applicant's independent claim 1 recites in pertinent part:

> **First feature:** "…receiving…**frequency hopping configuration information** for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set."
>
> **Second feature:** "…wherein the frequency hopping configuration information for a UL data channel includes **a frequency hopping offset set composed of one or more frequency hopping offset values**," and "…wherein **a frequency hopping offset value** used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set **is indicated by UL grant downlink control information (DCI)**."

The claimed invention is directed to performing **frequency hopping** for UL channel transmission and reception in a 5G radio access network. In particular, the claimed invention is directed to performing frequency hopping for preventing collision between resources used by user equipments, which use **different bandwidth part (BWP) configurations** to transmit UL channels in NR. In order to perform the frequency hopping without collision, the frequency hopping configuration information is provided to the UE. Based on the frequency hopping configuration information, the UE transmits the UL data channel and the UP control channel based on the frequency hopping configuration information.

Regarding the first feature

On page 3 of the outstanding office action, the Examiner asserts that *Kim* teaches "…**receiving...frequency hopping configuration information**…" for transmitting a UL control channel and a UL data channel through one transmission BWP of the BWP set. Applicant **respectfully disagrees**.

Kim is directed to determining a resource index for transmitting a PUCCH, determining a transmission point for transmitting the PUCCH based on the determined resource index, and transmitting the PUCCH at the determined transmission point. See, *Kim*, Abstract. As described, *Kim* might teach communication between a terminal and a base station in LTE. However, *Kim* **does not** teach the claimed frequency hopping configuration information.

In particular, *Kim* **fails** to teach i) the UE receives the claimed frequency hopping configuration information from the BS and ii) the claimed frequency hopping configuration information includes a frequency hopping offset composed of one or more frequency hopping offset values.

For example, the Examiner pointed paragraphs [0057] and [0078] for supporting his assertions. In the pointed paragraphs [0057], *Kim* merely discloses "…**DCI format 0**…may include….**a frequency hopping flag indicating whether frequency hopping is used for uplink PUSCH transmission, information about resource block assignment to be used by a UE for PUSCH transmission**." Further, in the pointed paragraph [0078], *Kim* merely discloses "…In order to **maintain a single carrier priority**, one UE does not simultaneously transmit a PUCCH

and a PUSCH. The PUCCH for one UE is allocated to a resource block (RB) pair in a subframe. RBs belonging to the RB pair occupy different subcarriers with respect to two slots. **This is referred to as frequency hopping of an RB pair allocated to the PUCCH in a slot boundary**."

As shown, the paragraph [0057] teaches about the definition of DCI format including a frequency hopping flag, and the paragraph [0078] teaches about frequency hopping. However, *Kim* **does not** teach the UE receives the DCI format 0 or the frequency hopping flag from the BS. Furthermore, *Kim* is **silent on** the claimed frequency-hopping offset **set composed of frequency hopping offset values**.

Regarding the second feature

On page 7 of the outstanding office action, the Examiner **admitted** that *Kim* fails to teach the second feature of amended claim 1, such as "…the frequency hopping configuration information for a UL data channel includes **a frequency hopping offset set composed of frequency hopping offset values**," and "…wherein **a frequency hopping offset value** used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set **is indicated by UL grant downlink control information (DCI)**." The Examiner cited a secondary prior art reference of *Zhang* and asserted that *Zhang* alleviates the defects of Kim. However, Applicant respectfully **disagrees**.

In particular, *Zhang* also **fails** to teach i) the claimed frequency hopping offset **set**, **not a offset value**, ii) the frequency hopping configuration information **including the frequency hopping offset set**, and iii) **transmitting or receiving** the claimed frequency hopping offset set **through the frequency hopping configuration information.**

For example, the Examiner pointed a paragraph [0040] for supporting his assertion. In the pointed paragraph [0040], *Zhang* discloses "…[f]or a base station, **the frequency offset** during frequency hopping is fixed, therefore, it only needs to allocate the frequency physical resources of the first time slot to **the frequency-hopping-transmission-based non-frequency-selective user**, and **based on the fixed offset during the frequency hopping**, the user terminal will occupy the frequency physical resource block n.about.n+3 of the second time slot S1 after occurring the fixed

offset at the second time slot."

As described, *Zhang* might teach about **the fixed and single frequency offset value**. Such a fixed and single frequency offset value **is different** from the claimed frequency hopping offset **set** composed of multiple frequency hopping offset values. Unlike the fixed and single frequency offset value of *Zhang*, i) the claimed frequency hopping offset set includes **multiple frequency offset values**, and ii) each frequency offset value included in the frequency hopping offset set **is not a fixed value**. In particular, the frequency hopping offset value is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP.

Furthermore, *Zhang* is **silent** on providing information on the offset value to the UE using the frequency hopping configuration information. Since *Zhang*'s offset value is fixed, the BS does not need to transmit specific information on the fixed offset value to the UE.

Accordingly, *Kim* and *Zhang* fail to teach the above-emphasized first and second features of amended claim 1, such as, "…receiving…**frequency hopping configuration information** for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set," "…wherein the frequency hopping configuration information for a UL data channel includes **a frequency hopping offset set composed of one or more frequency hopping offset values**," and "…wherein **a frequency hopping offset value** used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set **is indicated by UL grant downlink control information (DCI)**."

The secondary prior art reference of *Yi* is directed to a method and apparatus for transmitting and receiving data. See *Yi* Abstract. However, *Yi* cannot makeup the defects of *Kim* and *Zhang* because *Yi* also fails to teach the above-emphasized feature of claim 1, such as "…receiving…**frequency hopping configuration information** for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set," "…wherein the frequency hopping configuration information for a UL data channel includes **a frequency hopping offset set composed of one or more frequency hopping offset values**," and "…wherein **a frequency hopping offset value** used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set **is indicated by UL grant**

downlink control information (DCI)."

Therefore, for the reasons stated above, neither *Kim, Zhang*, nor *Yi*, either when taken alone or in combination, disclose or suggest all of the features recited in Applicant's claim 1.

Independent claims 7 and 13, while not identical to claim 1, contain similar features as claim 1. Therefore, Applicant submits that claims 7 and 13 are also patentable over the cited reference for at least the reasons set forth above with regard to claim 1. Claims 2, 4, 5, 8, 10, 11, 14, 16, and 17, which are directly or indirectly dependent one of independent claims 1, 7, and 13, are also patentable for at least set forth above with regard to claim 1. Consequently, Applicant respectfully requests that the rejection of the claims under 35 U.S.C. §103(a) be withdrawn.

CONCLUSION

Applicant believes that a full and complete response has been made to the Office Action and respectfully submits that all of the stated objections and/or grounds for rejection have been overcome or rendered moot. Accordingly, Applicant respectfully submits that the now-pending claims are in condition for allowance and that the entire application is now in condition for allowance.

Should the Examiner feel that there are any issues outstanding after consideration of this response, the Examiner is invited to contact the Applicant's undersigned representative at the number below to expedite prosecution. Prompt and favorable action is respectfully solicited.

Respectfully submitted,

Date: 21 November 2019

/Ian M. Hughes/

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Ian M. Hughes, Reg. No. 41,083
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16048210
Filing Date	2018-07-27
First Named Inventor	Kyujin PARK
Art Unit	2471
Examiner Name	MEW, KEVIN D
Attorney Docket Number	811.0136

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16048210
	Filing Date	2018-07-27
	First Named Inventor	Kyujin PARK
	Art Unit	2471
	Examiner Name	MEW, KEVIN D
	Attorney Docket Number	811.0136

	1	SAMSUNG, "Bandwidth Part Hopping for CORESETS", R1-1710702, 3GPP TSG RAN WG1 NR ad-Hoc#2, Qingdao, China, June 27 – 30, 2017, pp. 1-3	X

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16048210
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	Examiner Name	MEW, KEVIN D
	Attorney Docket Number	811.0136

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the 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 the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Ian M. Hughes/	Date (YYYY-MM-DD)	2019-11-19
Name/Print	Ian M. Hughes	Registration Number	41083

This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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.

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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 Acknowledgement Receipt

EFS ID:	37797399
Application Number:	16048210
International Application Number:	
Confirmation Number:	1073
Title of Invention:	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	76277
Filer:	Kyung Hee Kim
Filer Authorized By:	
Attorney Docket Number:	811.0136
Receipt Date:	19-NOV-2019
Filing Date:	27-JUL-2018
Time Stamp:	16:24:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	8110136IDSForm.pdf	612347 ead5f87eaa57e20d641671cd879cf64cf7499bda	no	4

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2	Non Patent Literature	Ref1nonpatent1.pdf	583900 ea4190545c220e99561b4804960dad95875ab226	no	3
Warnings:					
Information:					
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New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/048,210	07/27/2018	Kyujin PARK	811.0136	1073

76277 7590 08/21/2019

IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

EXAMINER
MEW, KEVIN D

ART UNIT	PAPER NUMBER
2471	

NOTIFICATION DATE	DELIVERY MODE
08/21/2019	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):

email@iplsllc.com

Office Action Summary	Application No. 16/048,210	Applicant(s) PARK et al.	
	Examiner KEVIN D MEW	Art Unit 2471	AIA (FITF) Status Yes

-- 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 7/27/18.

☐ 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) 1-18 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) 1-18 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 7/27/18 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, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 102

2. 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.

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

4. Claims 1-2, 7-8, 13-14 are rejected under 35 U.S.C. 102(a)(2) as being anticipated by Kim et al. (US Publication 2014/0169316 A1).

Regarding claim 1, Kim discloses a method for a user equipment (UE) to transmit an uplink (UL) control channel and a UL data channel to a base station (BS) (PUCCH and PUSCH transmissions by a UE, see paragraphs 0057, 0078), the method comprising:

receiving, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE (resource block assignment to be used by a

UE for PUSCH transmission, see paragraph 0057, PUSCH is transmitted via resources indicated resource block allocation indicated by uplink grant information by DCI formats 0 and 4, see paragraph 0196);

receiving, from the BS, frequency hopping configuration information for a UL control channel (frequency hopping of an RB pair is allocated to the PUCCH in a slot boundary, see paragraph 0078) and a UL data channel (frequency hopping flag indicating whether frequency hopping is used for uplink PUSCH transmission, see paragraph 0057) transmitted through one transmission BWP of the BWP set (resource block assignment to be used for PUSCH transmission, see paragraph 0057); and

transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information (PUCCH for control information and PUSCH for user data transmission based on the resource block assignment for PUSCH and frequency hopping resource block for PUCCH, see paragraphs 0078, 0057).

Regarding claim 2, Kim discloses the method of claim 1, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel (resource block pair allocation for PUCCH transmission, see paragraph 0078, resource block is physical resource

block PRB, see paragraph 0187), and PRB allocation information of a second frequency resource region of the UL control channel.

Regarding claim 7, Kim discloses a method for a base station (BS) to receive an uplink (UL) control channel and a UL data channel from a user equipment (UE) (PUCCH and PUSCH transmissions by a UE, see paragraphs 0057, 0078), the method comprising:

transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE (resource block assignment to be used by a UE for PUSCH transmission, see paragraph 0057, PUSCH is transmitted via resources indicated resource block allocation indicated by uplink grant information by DCI formats 0 and 4, see paragraph 0196);

transmitting frequency hopping configuration information for a UL control channel (frequency hopping of an RB pair is allocated to the PUCCH in a slot boundary, see paragraph 0078) and a UL data channel transmitted (frequency hopping flag indicating whether frequency hopping is used for uplink PUSCH transmission, see paragraph 0057) through one reception BWP of the BWP set to the UE (resource block assignment to be used for PUSCH transmission, see paragraph 0057); and

receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information (PUCCH for control information and PUSCH for user data transmission

based on the resource block assignment for PUSCH and frequency hopping resource block for PUCCH, see paragraphs 0078, 0057).

Regarding claim 8, Kim discloses the method of claim 7, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel (resource block pair allocation for PUCCH transmission, see paragraph 0078, resource block is physical resource block PRB, see paragraph 0187), and PRB allocation information of a second frequency resource region of the UL control channel.

Regarding claim 13, Kim discloses a user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS) (PUCCH and PUSCH transmissions by a UE, see paragraphs 0057, 0078), the UE comprising:

a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE (resource block assignment to be used by a UE for PUSCH transmission, see paragraph 0057, PUSCH is transmitted via resources indicated resource block allocation indicated by uplink grant information by DCI formats 0 and 4, see paragraph 0196); and

receive, from the BS, frequency hopping configuration information for a UL control channel (frequency hopping of an RB pair is allocated to the PUCCH in a slot boundary, see paragraph 0078) and a UL data channel (frequency hopping flag indicating whether frequency hopping is used for uplink PUSCH transmission, see paragraph 0057) transmitted through one transmission BWP of the BWP set (resource block assignment to be used for PUSCH transmission, see paragraph 0057); and

a transmitter configured to transmit a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information (PUCCH for control information and PUSCH for user data transmission based on the resource block assignment for PUSCH and frequency hopping resource block for PUCCH, see paragraphs 0078, 0057).

Regarding claim 14, Kim discloses the UE of claim 13, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel (resource block pair allocation for PUCCH transmission, see paragraph 0078, resource block is physical resource block PRB, see paragraph 0187), and PRB allocation information of a second frequency resource region of the UL control channel.

Claim Rejections - 35 USC § 103

5. 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.

6. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 3-5, 9-11, 15-17 are rejected under 35 U.S.C. 103 as being unpatentable over Kim et al. (US Publication 2014/0169316 A1) in view of Zhang et al. (US Publication 2012/0250653 A1).

Regarding claim 3, Kim discloses the method of claim 1.

Kim may not explicitly show "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values."

However, Zhang teaches "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values (the frequency offset during frequency hopping is fixed, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "the frequency hopping

configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

Regarding claim 4, Kim discloses the method of claim 3.

Kim may not explicitly show "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP."

However, Zhang teaches "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP (the frequency offset is determined based on allocating the frequency physical resources of the first time slot, and based on the fixed offset during the frequency hopping, the user terminal will occupy the frequency physical resource blocks n~n+3 of the second time slot S1 after occurring the fixed offset at the second time slot, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

Regarding claim 5, Kim discloses the method of claim 4.

Kim may not explicitly show "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less."

However, Zhang teaches "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less (based on the fixed offset during the frequency hopping, the user terminal will occupy the frequency physical resource blocks n~n+3 of the second time slot S1 after occurring the fixed offset at the second time slot, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

Regarding claim 9, Kim discloses the method of claim 7.

Kim may not explicitly show "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values."

However, Zhang teaches "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values (the frequency offset during frequency hopping is fixed, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

Regarding claim 10, Kim discloses the method of claim 9.

Kim may not explicitly show "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP."

However, Zhang teaches "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP (the frequency offset is determined based on allocating the

frequency physical resources of the first time slot, and based on the fixed offset during the frequency hopping, the user terminal will occupy the frequency physical resource blocks n~n+3 of the second time slot S1 after occurring the fixed offset at the second time slot, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

Regarding claim 11, Kim discloses the method of claim 10.

Kim may not explicitly show "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less."

However, Zhang teaches "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less (based on the fixed offset during the frequency hopping, the user terminal will occupy the frequency physical resource blocks n~n+3 of the second time slot S1 after occurring the fixed offset at the second time slot, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

Regarding claim 15, Kim discloses the UE of claim 13.

Kim may not explicitly show "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values."

However, Zhang teaches "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values (the frequency offset during frequency hopping is fixed, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

Regarding claim 16, Kim discloses the UE of claim 15.

Kim may not explicitly show "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP."

However, Zhang teaches "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP (the frequency offset is determined based on allocating the frequency physical resources of the first time slot, and based on the fixed offset during the frequency hopping, the user terminal will occupy the frequency physical resource blocks n~n+3 of the second time slot S1 after occurring the fixed offset at the second time slot, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

Regarding claim 17, Kim discloses the UE of claim 16.

Kim may not explicitly show "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less."

However, Zhang teaches "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less (based on the fixed offset during the frequency hopping, the user terminal will occupy the frequency physical resource blocks n~n+3 of the second time slot S1 after occurring the fixed offset at the second time slot, see paragraph 0040)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less" as taught by Zhang so that it would form a complementary frequency physical resource allocation (see paragraph 0040).

8. Claims 6, 12, 18 are rejected under 35 U.S.C. 103 as being unpatentable over Kim et al. (US Publication 2014/0169316 A1) in view of Zhang et al. (US Publication 2012/0250653 A1), and in further view of Yi et al. (US Publication 2015/0195069 A1).

Regarding claim 6, Kim and Zhang disclose the method of claim 3.

Kim may not explicitly show "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)."

However, Yi teaches "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI) (the start offset and the frequency hopping gap may be transmitted to the terminal through an uplink grant and DCI, see paragraph 0284)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)" as taught by Yi so that it would allow a terminal to position its PUSCH data at the overall PUSCH resource based on the start offset and the frequency hopping gap (see paragraph 0284).

Regarding claim 12, Kim and Zhang disclose the method of claim 9.

Kim may not explicitly show "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)."

However, Yi teaches "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI) (the start offset and the frequency hopping gap may be transmitted to the terminal through an uplink grant and DCI, see paragraph 0284)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)" as taught by Yi so that it would allow a terminal to position its PUSCH data at the overall PUSCH resource based on the start offset and the frequency hopping gap (see paragraph 0284).

Regarding claim 18, Kim and Zhang disclose the UE of claim 15.

Kim may not explicitly show "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)."

However, Yi teaches "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI) (the start offset and the frequency hopping gap may be transmitted to the terminal through an uplink grant and DCI, see paragraph 0284)."

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the invention to modify the method of Kim to include "a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI)" as taught by Yi so that it would allow a terminal to position its PUSCH data at the overall PUSCH resource based on the start offset and the frequency hopping gap (see paragraph 0284).

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Mew whose telephone number is (571)272-3141. The examiner can normally be reached on Monday - Friday 9 am - 5 pm.

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

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chi Pham can be reached on 571-272-3179. 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.

/KEVIN D MEW/
Primary Examiner, Art Unit 2471

Notice of References Cited	Application/Control No. 16/048,210	Applicant(s)/Patent Under Reexamination PARK et al.	
	Examiner KEVIN D MEW	Art Unit 2471	Page 1 of 2

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*	B	US-20130058317-A1	03-2013	Park; Kyujin	H04L5/0053	370/336
*	C	US-20150229450-A1	08-2015	Noh; Min Seok	H04W72/0406	370/329
*	D	US-20150155928-A1	06-2015	Seo; Dongyoun	H04L5/0053	370/329
*	E	US-20140169316-A1	06-2014	Kim; Hakseong	H04L5/0048	370/329
*	F	US-20140044083-A1	02-2014	Kim; Jinmin	H04L5/001	370/329
*	G	US-20170164350-A1	06-2017	SUN; Feifei	H04L5/0007	1/1
*	H	US-20140092787-A1	04-2014	HAN; SEUNGHEE	H04W4/70	370/280
*	I	US-20130322376-A1	12-2013	Marinier; Paul	H04W72/06	370/329
*	J	US-20140219202-A1	08-2014	Kim; Hakseong	H04L1/1861	370/329
*	K	US-20120076028-A1	03-2012	Ko; Hyunsoo	H04L1/0026	370/252
*	L	US-20170223640-A1	08-2017	Dinan; Esmael Hejazi	H04W72/0473	1/1
*	M	US-20180007668-A1	01-2018	YUM; Kunil	H04L1/0067	1/1

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	
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	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.

Notice of References Cited	Application/Control No. 16/048,210	Applicant(s)/Patent Under Reexamination PARK et al.	
	Examiner KEVIN D MEW	Art Unit 2471	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
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*	B	US-20130322361-A1	12-2013	Ko; Hyunsoo	H04B7/0632	370/329
*	C	US-20130077523-A1	03-2013	Ko; Hyunsoo	H04W24/00	370/252
*	D	US-20120014330-A1	01-2012	Damnjanovic; Jelena M.	H04L5/001	370/329
*	E	US-8897249-B2	11-2014	Tiirola; Esa T.	H04W72/04	370/329
*	F	US-20170163391-A1	06-2017	KIMURA; Ryota	H04W16/14	1/1
*	G	US-20140376468-A1	12-2014	He; Hong	H04B1/713	370/329
*	H	US-20120170525-A1	07-2012	Sorrentino; Stefano	H04L5/0007	370/329
*	I	US-20120250653-A1	10-2012	Zhang; Changsheng	H04B1/7143	370/330
*	J	US-20180014143-A1	01-2018	Rico Alvarino; Alberto	H04W4/70	1/1
*	K	US-20150195069-A1	07-2015	Yi; Yunjung	H04W4/70	370/329
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	M					

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
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	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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/048,210	PARK et al.
	Examiner	Art Unit
	KEVIN D MEW	2471

CPC - Searched*		
Symbol	Date	Examiner
H04L 5/0037, 0039, 0041, 0042, 0048, 0051, 0053, 0055, 0057, 0058, H04B 1/713, 7136	08/14/2019	KM

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

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

Search Notes		
Search Notes	Date	Examiner
Inventor and assignee search in PALM and East - see search history printout	08/14/2019	KM
EAST (USPAT,USPGPUB,EPO,FERS,JPO,DERWENT,IBM_TDB) - see search history printout	08/14/2019	KM
H04L 5/0037, 0039, 0041, 0042, 0048, 0051, 0053, 0055, 0057, 0058, H04B 1/713, 7136 (Text search - see search history printout) (limited by text)	08/14/2019	KM

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

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/048,210	PARK et al.
	Examiner	Art Unit
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✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant						☐ CPA		☐ T.D.		☐ R.1.47
CLAIM		DATE								
Final	Original	08/13/2019								
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	3	✓								
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	16	✓								
	17	✓								
	18	✓								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			20:47
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L72	22	66 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:47
L73	45	66 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:47
L74	40	66 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:47
L75	52	66 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:47
L76	0	66 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:47
L77	9	66 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:47
L78	0	66 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2019/08/15 20:47

			IBM_TDB			
L79	295	("bwp" bp$1 "bandwidth part") and (frequency near2 hopping) and pucch and pusch and dci	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L80	2	79 and 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L81	1	79 and 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L82	0	79 and 4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L83	0	79 and 5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L84	93	79 and 6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L85	30	79 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L86	76	79 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L87	41	79 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	OFF	2019/08/15 20:48

			JPO; DERWENT; IBM_TDB			
L88	53	79 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L89	2	79 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L90	8	79 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L91	0	79 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L92	386	(frequency near3 hopping) and pusch and pucch and (bwp$1 "bandwidth part" bp$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L93	4	92 and 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L94	1	92 and 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L95	0	92 and 4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L96	0	92 and 5	US-PGPUB; USPAT;	OR	OFF	2019/08/15 20:48

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L97	121	92 and 6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L98	33	92 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L99	96	92 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:48
L100	49	92 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L101	79	92 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L102	2	92 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L103	9	92 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L104	0	92 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49

L105	49	(("frequency hopping" near2 offset$1) with (resource near2 block$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L106	0	105 and 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L107	0	105 and 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L108	0	105 and 4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L109	0	105 and 5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L110	3	105 and 6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L111	13	105 and 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L112	5	105 and 8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L113	18	105 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2019/08/15 20:49

			DERWENT; IBM_TDB			
L114	14	105 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L115	0	105 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L116	15	105 and 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L117	2	105 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L118	14	105 and dci	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:49
L121	324	"park, kyujin".in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:51
L122	427	"choi, woo-jin".in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:51
L123	1591	"kt corporation".as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:51
L124	4	1 and 121	US-PGPUB; USPAT; USOCR;	OR	OFF	2019/08/15 20:51

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
L125	4	1 and 122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:51
L126	8	1 and 123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:51
L127	4	26 and 121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L128	6	26 and 122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L129	6	26 and 123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L130	1	39 and 121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L131	1	39 and 122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L132	1	39 and 123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L133	0	53 and 121	US-PGPUB;	OR	OFF	2019/08/15

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			20:52
L134	0	53 and 122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L135	0	53 and 123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L136	1	66 and 121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L137	1	66 and 122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L138	1	66 and 123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L139	1	79 and 121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L140	1	79 and 122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L141	1	79 and 123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2019/08/15 20:52

			IBM_TDB			
L142	1	92 and 121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L143	2	92 and 122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L144	2	92 and 123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L145	1	105 and 121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:52
L146	1	105 and 122	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:53
L147	1	105 and 123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/15 20:53

EAST Search History (Interference)

< This search history is empty>

8/ 15/ 2019 8:53:21 PM
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35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /KEVIN MEW/ (Examiner's Signature) KM (Initials)

Title: APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
07/27/2018	370	2471	811.0136
RULE			

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CONTINUING DATA

FOREIGN APPLICATIONS

KOREA, REPUBLIC OF 10-2017-0095980 07/28/2017

KOREA, REPUBLIC OF 10-2017-0102577 08/11/2017

KOREA, REPUBLIC OF 10-2018-0057278 05/18/2018

IF REQUIRED, FOREIGN LICENSE GRANTED**

09/10/2018

STATE OR COUNTRY

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This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office.

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Application Number

출 원 년 월 일 : 2018년 05월 18일
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출 원 인 : 주식회사 케이티
Applicant(s) KT Corporation

2018년 09월 25일

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COMMISSIONER

제출 일자 : 2018-05-18

【서지사항】

【서류명】 특허출원서

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【포괄위임등록번호】 2017-079044-3

【발명의 국문명칭】 차세대 무선망에서 상향링크 채널을 송수신하기 위한 주파수 호핑 방법 및 그 장치

【발명의 영문명칭】 Method for frequency hopping to transmit and receive uplink channel and Apparatuses thereof

【발명자】

【성명】 박규진

【성명의 영문표기】 PARK, Kyu Jin

【주민등록번호】 811018-1XXXXXX

【우편번호】 137-140

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【출원번호】 10-2017-0095980

【출원일자】 2017.07.28

【증명서류】 첨부

【우선권 주장】

【출원국명】 KR

【출원번호】 10-2017-0102577

【출원일자】 2017.08.11

【증명서류】 첨부

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 특허법인(유한)유일하이스트 (서명 또는 인)

【수수료】

【출원료】	0	면	46,000 원
【가산출원료】	62	면	0 원
【우선권주장료】	2	건	36,000 원
【심사청구료】	0	항	0 원
【합계】	82,000 원		

【발명의 설명】

【발명의 명칭】

차세대 무선망에서 상향링크 채널을 송수신하기 위한 주파수 호핑 방법 및 그 장치{Method for frequency hopping to transmit and receive uplink channel and Apparatuses thereof}

【기술분야】

<1> 본 실시예는 차세대/5G 무선 액세스망(이하 본 발명에서는 NR[New Radio]라 지칭하도록 함.)에서 상향 링크 채널 송수신을 위한 주파수 호핑(frequency hopping)을 수행하는 방법 및 장치를 제안한다.

【배경기술】

<2> 3GPP는 최근 차세대/5G 무선 액세스 기술에 대한 연구를 위한 스터디 아이템인 "Study on New Radio Access Technology"를 승인하고, 이를 기반으로 RAN WG1에서는 각각 NR(New Radio)을 위한 프레임 구조, 채널 코딩 및 변조, 파형 및 다중 접속 방식 등에 대한 논의를 진행하고 있다. NR은 LTE/LTE-Advanced에 대비하여 향상된 데이터 전송률뿐만 아니라 세분화되고 구체화된 사용 시나리오 별로 요구되는 다양한 요구를 만족시킬 수 있는 설계가 이루어지도록 요구되고 있다.

<3> NR의 대표적 사용 시나리오로서 eMBB(enhancement Mobile BroadBand), mMTC(massive Machine Type Communication) 및 URLLC(Ultra Reliable and Low Latency Communications)가 제기되고, 각각의 사용 시나리오 별 요구를 만족시키기

위하여 LTE/LTE-Advanced 대비 플렉서블한 프레임 구조 설계가 요구되고 있다.

<4> 특히, NR의 단말이 다양한 대역폭 파트(BWP, bandwidth part)를 사용하는 경우에 전술한 대역폭 파트를 기초로 단말이 상향링크 채널, 즉 상향링크 제어 채널 또는 상향링크 데이터 채널을 기지국으로 전송하기 위한 구체적이고 효율적인 방법을 설정해야 할 필요성이 증대되고 있다.

【발명의 내용】

【해결하려는 과제】

<5> 본 실시예들의 목적은 NR에서 상향링크 채널을 전송하기 위해 서로 다른 대역폭 파트(BWP, bandwidth part) 설정을 사용하는 단말들이 사용하는 자원 간의 충돌(collision)을 막기 위한 주파수 호핑(frequency hopping) 적용 방법을 제공한다.

【과제의 해결 수단】

<6> 전술한 과제를 해결하기 위해서 안출된 일 실시예는 단말이 상향링크 제어 채널 및 상향링크 데이터 채널을 기지국으로 전송하는 방법에 있어서, 기지국으로부터 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신하는 단계, 기지국으로부터 대역폭 파트 셋 중 하나의 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 수신하는 단계 및 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여,

전술한 하나의 대역폭 파트를 통해 상향링크 제어 채널 또는 상향링크 데이터 채널을 기지국으로 전송하는 단계를 포함하는 것을 특징으로 하는 방법을 제공한다.

<7> 또한, 일 실시예는 기지국이 상향링크 제어 채널 및 상향링크 데이터 채널을 단말로부터 수신하는 방법에 있어서, 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 단말로 전송하는 단계, 대역폭 파트 셋 중 하나의 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 단말로 전송하는 단계 및 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여, 전술한 하나의 대역폭 파트를 통해 상향링크 제어 채널 또는 상향링크 데이터 채널을 단말로부터 수신하는 단계를 포함하는 것을 특징으로 하는 방법을 제공한다.

<8> 또한, 일 실시예는 상향링크 제어 채널 및 상향링크 데이터 채널을 기지국으로 전송하는 단말에 있어서, 기지국으로부터 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신하고, 대역폭 파트 셋 중 하나의 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 수신하는 수신부 및 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여, 전술한 하나의 대역폭 파트를 통해 상향링크 제어 채널 또는 상향링크 데이터 채널을 기지국으로 전송하는 송신부를 포함하는 것을 특징으로 하는 단말을 제공한다.

<9> 또한, 일 실시예는 상향링크 제어 채널 및 상향링크 데이터 채널을 단말로부터 수신하는 기지국에 있어서, 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 전송하고, 대역폭 파트 셋 중 하나의 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 전송하는 송신부 및 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여, 전술한 하나의 대역폭 파트를 통해 상향링크 제어 채널 또는 상향링크 데이터 채널을 단말로부터 수신하는 수신부를 포함하는 것을 특징으로 하는 기지국을 제공한다.

【발명의 효과】

<10> 본 실시예들을 통해 NR에서 상향링크 채널을 전송하기 위해 서로 다른 대역폭 파트(BWP, bandwidth part) 설정을 사용하는 단말들이 사용하는 자원 간의 충돌(collision)을 막기 위한 주파수 호핑(frequency hopping) 적용 방법을 제공할 수 있다.

【도면의 간단한 설명】

<11> 도 1은 본 실시예들에 따른 서로 다른 서브캐리어 스페이싱을 사용하는 경우에서 OFDM 심볼의 정렬을 나타낸 도면이다.

도 2는 본 실시예에서 대역폭 파트(bandwidth part)에 대한 개념적 예시를 도시한 도면이다.

도 3은 LTE/LTE-A 시스템에서 정의된 PUCCH에 대한 주파수 호핑(frequency hopping)의 일 예를 도시한 도면이다.

도 4는 본 실시예에서 단말-특정(UE-specific) 대역폭 파트(bandwidth part) 설정에 대한 개념적 예시를 도시한 도면이다.

도 5는 본 실시예에서 PUCCH 지속기간(duration)에 기반한 주파수 호핑(frequency hopping)의 룰(rule)의 일 예를 도시한 도면이다.

도 6은 본 실시예에서 DCI를 통한 주파수 호핑 오프셋(frequency hopping offset)을 지시하는 방법의 일 예를 도시한 도면이다.

도 7은 본 실시예에서 단말이 상향링크 제어 채널 또는 상향링크 데이터 채널을 기지국으로 전송하는 절차를 도시한 도면이다.

도 8은 본 실시예에서 기지국이 상향링크 제어 채널 또는 상향링크 데이터 채널을 단말로부터 수신하는 절차를 도시한 도면이다.

도 9는 본 실시예들에 따른 기지국의 구성을 보여주는 도면이다.

도 10은 본 실시예들에 따른 단말의 구성을 보여주는 도면이다.

【발명을 실시하기 위한 구체적인 내용】

<12> 이하, 본 발명의 일부 실시예들을 예시적인 도면을 통해 상세하게 설명한다. 각 도면의 구성요소들에 참조부호를 부가함에 있어서, 동일한 구성요소들에 대해서는 비록 다른 도면상에 표시되더라도 가능한 한 동일한 부호를 가지도록 하고 있음에 유의해야 한다. 또한, 본 발명을 설명함에 있어, 관련된 공지 구성 또는 기능에

대한 구체적인 설명이 본 발명의 요지를 흐릴 수 있다고 판단되는 경우에는 그 상세한 설명은 생략한다.

<13> 본 명세서에서 무선 통신 시스템은 음성, 패킷 데이터 등과 같은 다양한 통신 서비스를 제공하기 위한 시스템을 의미한다. 무선 통신 시스템은 사용자 단말(User Equipment, UE) 및 기지국(Base Station, BS)을 포함한다.

<14> 사용자 단말은 무선 통신에서의 단말을 의미하는 포괄적 개념으로서, WCDMA, LTE, HSPA 및 IMT-2020(5G 또는 New Radio) 등에서의 UE(User Equipment)는 물론, GSM에서의 MS(Mobile Station), UT(User Terminal), SS(Subscriber Station), 무선 기기(wireless device) 등을 모두 포함하는 개념으로 해석되어야 할 것이다.

<15> 기지국 또는 셀(Cell)은 일반적으로 사용자 단말과 통신하는 지점(station)을 말하며, 노드-B(Node-B), eNB(evolved Node-B), gNB(gNode-B), LPN(Low Power Node), 섹터(Sector), 싸이트(Site), 다양한 형태의 안테나, BTS(Base Transceiver System), 액세스 포인트(Access Point), 포인트(예를 들어, 송신포인트, 수신포인트, 송수신포인트), 릴레이 노드(Relay Node), 메가 셀, 매크로 셀, 마이크로 셀, 피코 셀, 펨토 셀, RRH(Remote Radio Head), RU(Radio Unit), 스몰 셀(small cell) 등 다양한 커버리지 영역을 모두 포괄하는 의미이다.

<16> 앞서 나열된 다양한 셀은 각 셀을 제어하는 기지국이 존재하므로 기지국은 두 가지 의미로 해석될 수 있다. 1) 무선 영역과 관련하여 메가 셀, 매크로 셀, 마이크로 셀, 피코 셀, 펨토 셀, 스몰 셀(small cell)을 제공하는 장치 그 자체이거나, 2) 무선 영역 그 자체를 지시할 수 있다. 1)에서 소정의 무선 영역을 제공하는

장치들이 동일한 개체에 의해 제어되거나 무선 영역을 협업으로 구성하도록 상호 작용하는 모든 장치들을 모두 기지국으로 지시한다. 무선 영역의 구성 방식에 따라 포인트, 송수신 포인트, 송신 포인트, 수신 포인트 등은 기지국의 일 실시예가 된다. 2)에서 사용자 단말의 관점 또는 이웃하는 기지국의 입장에서 신호를 수신하거나 송신하게 되는 무선 영역 그 자체를 기지국으로 지시할 수 있다.

<17> 본 명세서에서 셀(Cell)은 송수신 포인트로부터 전송되는 신호의 커버리지 또는 송수신 포인트(transmission point 또는 transmission/reception point)로부터 전송되는 신호의 커버리지를 가지는 요소 반송파(component carrier), 그 송수신 포인트 자체를 의미할 수 있다.

<18> 본 명세서에서 사용자 단말과 기지국은, 본 발명에서 기술되는 기술 또는 기술적 사상을 구현하는데 사용되는 두 가지(Uplink 또는 Downlink) 송수신 주체로 포괄적인 의미로 사용되며 특정하게 지칭되는 용어 또는 단어에 의해 한정되지 않는다.

<19> 여기서, 상향링크(Uplink, UL, 또는 업링크)는 사용자 단말에 의해 기지국으로 데이터를 송수신하는 방식을 의미하며, 하향링크(Downlink, DL, 또는 다운링크)는 기지국에 의해 사용자 단말로 데이터를 송수신하는 방식을 의미한다.

<20> 상향링크 전송 및 하향링크 전송은 서로 다른 시간을 사용하여 전송되는 TDD(Time Division Duplex) 방식이 사용될 수 있고, 서로 다른 주파수를 사용하여 전송되는 FDD(Frequency Division Duplex) 방식, TDD 방식과 FDD 방식의 혼용 방식이 사용될 수 있다.

<21> 또한, 무선 통신 시스템에서는 하나의 반송파 또는 반송파 쌍을 기준으로 상향링크와 하향링크를 구성하여 규격을 구성한다.

<22> 상향링크와 하향링크는, PDCCH(Physical Downlink Control CHannel), PUCCH(Physical Uplink Control CHannel) 등과 같은 제어 채널을 통하여 제어 정보를 전송하고, PDSCH(Physical Downlink Shared CHannel), PUSCH(Physical Uplink Shared CHannel) 등과 같은 데이터 채널로 구성되어 데이터를 전송한다.

<23> 하향링크(downlink)는 다중 송수신 포인트에서 단말로의 통신 또는 통신 경로를 의미할 수 있으며, 상향링크(uplink)는 단말에서 다중 송수신 포인트로의 통신 또는 통신 경로를 의미할 수 있다. 이때, 하향링크에서 송신기는 다중 송수신 포인트의 일부분일 수 있고, 수신기는 단말의 일부분일 수 있다. 또한, 상향링크에서 송신기는 단말의 일부분일 수 있고, 수신기는 다중 송수신 포인트의 일부분일 수 있다.

<24> 이하에서는 PUCCH, PUSCH, PDCCH 및 PDSCH 등과 같은 채널을 통해 신호가 송수신되는 상황을 'PUCCH, PUSCH, PDCCH 및 PDSCH를 전송, 수신한다'는 형태로 표기하기도 한다.

<25> 한편, 이하에서 기재하는 상위계층 시그널링(High Layer Signaling)은 RRC 파라미터를 포함하는 RRC 정보를 전송하는 RRC 시그널링을 포함한다.

<26> 기지국은 단말들로 하향링크 전송을 수행한다. 기지국은 유니캐스트 전송(unicast transmission)을 위한 주 물리 채널인 하향링크 데이터 채널의 수신에 필

요한 스케줄링 등의 하향링크 제어 정보 및 상향링크 데이터 채널에서의 전송을 위한 스케줄링 승인 정보를 전송하기 위한 물리 하향링크 제어 채널을 전송할 수 있다. 이하에서는, 각 채널을 통해 신호가 송수신 되는 것을 해당 채널이 송수신되는 형태로 기재하기로 한다.

<27> 무선 통신 시스템에서 적용되는 다중 접속 기법에는 제한이 없다. TDMA(Time Division Multiple Access), FDMA(Frequency Division Multiple Access), CDMA(Code Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), NOMA(Non-Orthogonal Multiple Access), OFDM-TDMA, OFDM-FDMA, OFDM-CDMA와 같은 다양한 다중 접속 기법을 사용할 수 있다. 여기서, NOMA는 SCMA(Sparse Code Multiple Access)와 LDS(Low Density Spreading) 등을 포함한다.

<28> 본 발명의 일 실시예는 GSM, WCDMA, HSPA를 거쳐 LTE/LTE-Advanced, IMT-2020으로 진화하는 비동기 무선 통신과, CDMA, CDMA-2000 및 UMB로 진화하는 동기식 무선 통신 분야 등의 자원 할당에 적용될 수 있다.

<29> 본 명세서에서 MTC(Machine Type Communication) 단말은 low cost(또는 low complexity)를 지원하는 단말 또는 coverage enhancement를 지원하는 단말 등을 의미할 수 있다. 또는 본 명세서에서 MTC 단말은 low cost(또는 low complexity) 및/또는 coverage enhancement를 지원하기 위한 특정 카테고리로 정의된 단말을 의미할 수 있다.

<30> 다시 말해 본 명세서에서 MTC 단말은 LTE 기반의 MTC 관련 동작을 수행하는 새롭게 정의된 3GPP Release-13 low cost(또는 low complexity) UE category/type

을 의미할 수 있다. 또는 본 명세서에서 MTC 단말은 기존의 LTE coverage 대비 향상된 coverage를 지원하거나, 또는 저전력 소모를 지원하는 기존의 3GPP Release-12 이하에서 정의된 UE category/type, 또는 새롭게 정의된 Release-13 low cost (또는 low complexity) UE category/type을 의미할 수 있다. 또는, Release-14에서 정의된 further Enhanced MTC 단말을 의미할 수도 있다.

<31> 본 명세서에서 NB-IoT(NarrowBand Internet of Things) 단말은 셀룰러 IoT를 위한 무선 액세스를 지원하는 단말을 의미한다. NB-IoT 기술의 목적은 향상된 인도어(Indoor) 커버리지, 대규모의 저속 단말에 대한 지원, 저지연민감도, 초저가 단말 비용, 낮은 전력 소모, 그리고 최적화된 네트워크 구조를 포함한다.

<32> 3GPP에서 최근 논의 중인 NR(New Radio)에서 대표적인 사용 시나리오(usage scenario)로서, eMBB(enhanced Mobile BroadBand), mMTC(massive Machine Type Communication), URLLC(Ultra Reliable and Low Latency Communication)가 제기되고 있다.

<33> 본 명세서에서 NR(New Radio)과 관련한 주파수, 프레임, 서브프레임, 자원, 자원블럭, 영역(region), 밴드, 서브밴드, 제어채널, 데이터채널, 동기신호, 각종 참조신호, 각종 신호, 각종 메시지는 과거 또는 현재 사용되는 의미 또는 장래 사용되는 다양한 의미로 해석될 수 있다.

<35> NR(New Radio)

<36> 3GPP는 최근 차세대/5G 무선 액세스 기술에 대한 연구를 위한 스터디 아이템인 "Study on New Radio Access Technology"를 승인하고, 이를 기반으로 각각 NR(New Radio)를 위한 프레임 구조, 채널 코딩 및 변조, 파형 및 다중 접속 스킴(frame structure, channel coding & modulation, waveform & multiple access scheme)등에 대한 논의가 시작되었다.

<37> NR은 LTE/LTE-Advanced 대비 향상된 데이터 전송률뿐 아니라, 세분화되고 구체화된 사용 시나리오(usage scenario) 별로 요구되는 다양한 요구(requirements)를 만족시킬 수 있는 설계가 이루어지도록 요구되고 있다. 특히 NR의 대표적 사용 시나리오(usage scenario)로서 eMBB(enhancement Mobile BroadBand), mMTC(massive MTC) 및 URLLC(Ultra Reliable and Low Latency Communications)가 제기되었으며, 각각의 사용 시나리오(usage scenario)별 요구(requirements)를 만족하기 위한 방법으로서 LTE/LTE-Advanced 대비 플렉서블한 프레임 구조(frame structure) 설계가 요구되고 있다.

<38> 구체적으로 3GPP에서 논의 중인 NR의 대표적 사용 시나리오(usage scenario)로서 eMBB, mMTC, URLLC가 고려되고 있다. 각각의 사용 시나리오(usage scenario)는 데이터 레이트(data rates), 레이턴시(latency), 커버리지(coverage) 등에 대한 요구(requirements)가 서로 상이하기 때문에 임의의 NR 시스템을 구성하는 주파수 대역을 통해 각각의 사용 시나리오(usage scenario) 별 요구(requirements)를 효율적으로 만족시키기 위한 방법으로서 서로 다른 뉴머롤러지(numerology)(e.g. subcarrier spacing, subframe, TTI, etc.) 기반의 무선 자원

유닛(unit)을 효율적으로 다중화(multiplexing)하는 방안에 대한 필요성이 제기되고 있다.

<39> 이를 위한 한 방법으로서, 서로 다른 서브캐리어 스페이싱(SCS, subcarrier spacing)값을 갖는 뉴머롤러지(numerology)에 대해 하나의 NR 캐리어(carrier)를 통해 TDM, FDM 또는 TDM/FDM 기반으로 다중화하여 지원하는 방법 및 시간 도메인(time domain)에서의 스케줄링 단위를 구성함에 있어서 하나 이상의 시간 유닛(time unit)을 지원하는 방안에 대한 논의가 이루어졌다. 이와 관련하여 NR에서는 시간 도메인 구조(time domain structure)의 한 종류로서 서브프레임(subframe)에 대한 정의가 이루어졌으며, 해당 서브프레임 지속기간(subframe duration)을 정의하기 위한 레퍼런스 뉴머롤러지(reference numerology)로서 LTE와 동일한 15kHz SCS(Sub-Carrier Spacing) 기반 normal CP overhead의 14개의 OFDM 심볼로 구성된 단일한 서브프레임 지속기간을 정의하기로 결정하였다. 이에 따라 NR에서 서브프레임은 1ms의 지속기간(time duration)을 가진다. 단, LTE와 달리 NR의 서브프레임은 절대적인 레퍼런스 지속기간(reference time duration)으로서, 실제 상/하향 링크 데이터 스케줄링의 기반의 되는 시간 유닛(time unit)으로서 슬롯(slot) 및 미니 슬롯(mini-slot)이 정의될 수 있다. 이 경우, 해당 슬롯을 구성하는 OFDM 심볼의 개수, y값은 뉴머롤러지에 관계없이 y=14의 값을 갖도록 결정되었다.

<40> 이에 따라 임의의 슬롯은 14개의 심볼로 구성될 수 있으며, 또한 해당 슬롯의 전송 지시(transmission direction)에 따라 모든 심볼이 하향 링크 전송(DL transmission)을 위해 이용되거나, 또는 모든 심볼이 상향 링크 전송(UL

transmission)을 위해 이용되거나, 또는 하향 링크 부분(DL portion) + (gap) + 상향 링크 부분(UL portion)의 형태로 이용될 수 있다.

<41> 또한 임의의 뉴머롤러지(numerology)(또는 SCS)에서 해당 슬롯보다 적은 수의 심볼로 구성된 미니 슬롯이 정의되어 이를 기반으로 상/하향 링크 데이터 송수신을 위한 짧은 길이의 시간 도메인 스케줄링 간격(time-domain scheduling interval)이 설정되거나, 또는 슬롯 병합(slot aggregation)을 통해 상/하향 링크 데이터 송수신을 위한 긴 길이의 시간 도메인 스케줄링 간격(time-domain scheduling interval)이 구성될 수 있다.

<42> 특히 URLLC와 같이 지연 크리티컬(latency critical)한 데이터에 대한 송수신의 경우, 15kHz와 같이 SCS값이 작은 뉴머롤러지 기반의 프레임 구조에서 정의된 0.5ms(7 symbols) 또는 1ms(14 symbols) 기반의 슬롯 단위로 스케줄링이 이루어질 경우, 지연 시간 요구 사항(latency requirement)를 만족시키기 힘들 수 있기 때문에 이를 위해서 해당 슬롯보다 적은 수의 OFDM 심볼로 구성된 미니-슬롯(mini-slot)을 정의하여 이를 기반으로 해당 URLLC와 같은 지연 크리티컬(latency critical)한 데이터에 대한 스케줄링이 이루어지도록 정의할 수 있다.

<43> 또는 전술한 바와 같이 하나의 NR 캐리어 내에서 서로 다른 SCS값을 갖는 뉴머롤러지를 TDM 방식 또는 FDM 방식으로 다중화하여 지원함으로써, 각각의 뉴머롤러지 별로 정의된 슬롯(또는 미니-슬롯) 길이를 기반으로 지연 시간 요구 사항(latency requirement)에 맞추어 데이터를 스케줄링하는 방안도 고려되고 있다. 예를 들어 도 1과 같이 SCS가 60kHz인 경우, SCS 15kHz인 경우보다 심볼 길이가 1/4

정도로 줄어들기 때문에 동일하게 7개의 OFDM 심볼로 하나의 슬롯을 구성할 경우, 해당 15kHz 기반의 슬롯 길이는 0.5ms이 되는 반면, 60kHz 기반의 슬롯 길이는 약 0.125ms으로 줄어들게 된다.

<44> 이처럼 NR에서는 서로 다른 SCS 또는 서로 다른 TTI 길이를 정의함으로써, URLLC와 eMBB 각각의 요구사항을 만족시키는 방법에 대한 논의가 진행되고 있다.

<46> 보다 넓은 대역폭 동작(Wider bandwidth operations)

<47> 기존 LTE system의 경우, 임의의 LTE CC(Component Carrier)에 대한 확장성 있는(scalable) 대역폭 동작(bandwidth operation)을 지원하였다. 즉, 주파수 배포 시나리오(deployment scenario)에 따라 임의의 LTE 사업자는 하나의 LTE CC를 구성함에 있어서, 최소 1.4 MHz부터 최대 20 MHz의 대역폭을 구성할 수 있었고, 이에 따라 임의의 노멀 LTE 단말은 하나의 LTE CC에 대해 20 MHz 대역폭의 송수신 캐퍼빌리티를 지원하였다.

<48> 하지만, NR의 경우, 하나의 NR CC에서 서로 다른 송수신 대역폭 캐퍼빌리티(bandwidth capability)를 갖는 NR 단말에 대한 지원이 가능하도록 그 설계가 이루어지고 있으며, 이에 따라 아래의 도 2와 같이 임의의 NR CC에 대해 세분화된 대역폭으로 구성된 하나 이상의 대역폭 파트(BWP, bandwidth part)를 구성하여, 단말별로 서로 다른 대역폭 파트(bandwidth part)의 설정 및 활성화를 통해 플렉서블(flexible)한 보다 넓은 대역폭 동작(wider bandwidth operation)을 지원하도록 요

구되고 있다.

<49> 이와 같이 임의의 NR CC는 하나 이상의 대역폭 파트(bandwidth part)로 구분될 수 있으며, 이에 따라 각각의 단말에서는 하나 이상의 대역폭 파트(bandwidth part)가 구성될 수 있으며, 임의의 단말을 위해 구성된 하나 이상의 대역폭 파트(bandwidth part) 중 하나 이상의 대역폭 파트(bandwidth part)에 대한 활성화(activation)를 통해 해당 단말을 위한 상/하향 링크 무선 신호 및 무선 채널에 대한 송수신을 수행하도록 정의할 수 있다.

<50> 또한 임의의 NR CC에서 복수의 뉴머롤러지(numerology(e.g. SCS, CP length, etc.))가 지원될 경우, 각각의 대역폭 파트(bandwidth part) 별로 송수신을 위한 서로 다른 뉴머롤러지(numerology)가 설정될 수 있다.

<52> LTE에서 PUCCH를 위한 주파수 호핑(Frequency hopping for PUCCH in LTE)

<53> 3GPP LTE/LTE-A 시스템에서 단말의 상향 링크 제어 정보(UCI, Uplink Control Information)을 전송하기 위한 상향 링크 무선 제어 채널인 PUCCH의 경우, 하나의 서브프레임 내에서 슬롯 단위로 주파수 호핑(frequency hopping)이 이루어졌다. 이 때 해당 PUCCH의 주파수 호핑(frequency hopping) 단위, 즉, 호핑(hopping)이 이루어지는 대역폭은 해당 UL 서브프레임의 시스템 대역폭에 의해 결정되었다.

<54> 즉, 아래의 도 3과 같이 임의의 UL 서브프레임에서의 주파수 호핑(frequency

hopping)은 각각의 슬롯에서 중심 주파수를 기준으로 대칭적인 형태로 이루어지도록 정의되었다.

<56> 이하에서 설명하는 실시예들은 모든 이동통신 기술을 사용하는 단말, 기지국, 코어망 개체(MME)에도 적용될 수 있다. 예를 들어, 본 실시예들은 LTE 기술이 적용되는 이동통신 단말뿐만 아니라 차세대 이동통신(5G 이동통신, New-RAT) 단말, 기지국, 코어망 개체(AMF: Access and Mobility Function)에도 적용될 수 있다. 설명의 편의를 위해 이하에서 기지국은 LTE/E-UTRAN의 eNB를 나타낼 수도 있고, CU(Central Unit)와 DU(Distributed Unit)가 분리된 5G 무선망에서 기지국(CU, DU, 또는 CU와 DU가 하나의 논리적인 개체로 구현된 개체), gNB를 나타낼 수도 있다.

<57> 또한, 본 명세서에서 설명하는 뉴머롤러지(numerology)는 데이터 송수신에 관한 수치적 특성 및 수치의 의미를 뜻하며, 서브캐리어 스페이싱(이하, SCS 또는 Subcarrier Spacing으로도 호칭 가능)의 값에 의해 결정될 수 있다. 따라서 뉴머롤러지(numerology)가 상이하다는 것은 뉴머롤러지(numerology)를 결정하는 서브캐리어 스페이싱이 상이하다는 것을 의미할 수 있다.

<58> 그리고 본 명세서에서 슬롯 길이(slot length)는 슬롯을 구성하는 OFDM 심볼의 개수로도 표현될 수 있고, 슬롯이 점유하는 시간으로 표현될 수도 있다. 예를 들어 15kHz의 SCS를 기초로 한 뉴머롤러지가 사용될 경우에, 하나의 슬롯의 길이는 14개의 OFDM 심볼로 표현될 수 있고, 1ms로 표현될 수도 있다.

<59> 그리고 본 명세서에서 상향링크 채널은 단말이 기지국으로 전송하는 상향 링크 데이터 채널(PUSCH) 및 상향 링크 제어 채널(PUCCH)을 포괄하는 개념이며, 단말과 기지국이 상향링크 채널을 송수신하는 것은 단말이 기지국으로 상향 링크 채널을 전송하거나 기지국이 단말로부터 상향링크 채널을 수신하는 것을 의미할 수 있다.

<60> 이하, 차세대/5G 무선 액세스망에서 상향 링크 채널 송수신을 위한 주파수 호핑(frequency hopping)을 수행하는 방법에 대한 보다 다양한 실시예를 구체적으로 설명한다. 이하에서 설명하는 실시예들은 개별적으로 또는 임의의 조합으로 적용될 수 있다.

<62> 전술한 바와 같이 임의의 NR 컴포넌트 캐리어(CC, component carrier)는 하나 이상의 대역폭 파트(BWP, bandwidth part(s))로 구성될 수 있다. 임의의 NR CC에서 대역폭 파트(bandwidth part)를 구성함에 있어서, 해당 대역폭 파트(bandwidth part)는 단말-특정(UE-specific)하게 구성되거나, 또는 셀-특정(cell-specific)하게 구성될 수 있다.

<63> 즉, 도 4와 같이 각각의 단말 별로 서로 다른 대역폭 파트(bandwidth part) 설정이 이루어지거나, 또는 임의의 NR CC에 대해 모든 단말에서 동일한 대역폭 파트(bandwidth part) 설정이 이루어질 수 있다. 단, 도 4는 하나의 예시일 뿐, NR CC의 구체적인 대역폭 및 대역폭 파트(bandwidth part) 별 대역폭에 의해 본 발명

이 제한되지는 않는다.

<64> 임의의 NR CC에 대해 대역폭 파트(bandwidth part) 구성이 이루어지면, 구성된 대역폭 파트(bandwidth part) 중 기지국과 단말 간 PDCCH/PDSCH 송수신을 위한 하향 링크 대역폭 파트(bandwidth part)에 대한 활성화(activation) 및 PUCCH/PUSCH 송수신을 위한 상향 링크 대역폭 파트(bandwidth part)에 대한 활성화(activation)을 통해 단말과 기지국 간 통신을 위한 상/하향 링크 대역폭 파트(bandwidth part)가 설정될 수 있다.

<65> 본 실시예에서는 이처럼 임의의 NR CC에서 구성된 임의의 슬롯(slot)에서 각각의 단말 별로 PUCCH 전송을 위해 구성되거나, 또는 활성화(activation)된 대역폭 파트(bandwidth part)의 크기가 서로 상이한 경우를 고려한 주파수 호핑(frequency hopping) 방법에 대해 제안한다.

<66> 구체적으로 NR에서는 단말의 상향링크 제어 정보(UCI, uplink control information) 전송을 위해 하나의 슬롯(slot)에서 1개에서 2개 사이의 심볼을 통해 전송되는 짧은 지속기간(short duration) PUCCH와 4개에서 14개 사이의 심볼을 통해 전송되는 긴 지속기간(long duration) PUCCH의 2가지 형태의 PUCCH가 정의되었다. 이하에서 짧은 지속기간(short duration) PUCCH는 short PUCCH로도 호칭될 수 있고, 긴 지속기간(long duration) PUCCH는 long PUCCH로도 호칭될 수 있다.

<67> 이 때, 임의의 단말에서 UCI 전송을 위해 하나의 슬롯 내에서 2개의 심볼로 구성된 짧은 지속기간(short duration) PUCCH를 사용하거나, 또는 긴 지속기간(long duration) PUCCH를 사용할 경우, 주파수 다이버시티 게인(frequency

diversity gain)을 얻기 위해 주파수 호핑(frequency hopping)을 적용할 필요성이 있다.

<68> 특히, 2개의 심볼로 구성된 짧은 지속기간(short duration) PUCCH의 경우, 각각의 심볼 단위로 주파수 호핑(frequency hopping)이 이루어질 수 있으며, 긴 지속기간(long duration) PUCCH의 경우에 대해서도 하나의 슬롯 내에서 최대 1번의 주파수 호핑(frequency hopping)을 지원하도록 정의할 수 있다.

<69> 이처럼 NR에서 단일한 슬롯 내에서의 PUCCH에 대한 주파수 호핑(frequency hopping)을 지원할 경우, 임의의 단말에서 2개의 심볼로 구성된 짧은 지속기간(short duration) PUCCH 또는 긴 지속기간(long duration) PUCCH를 통해 UCI를 전송할 때, 해당 PUCCH에 대한 구체적인 주파수 호핑(frequency hopping) 방법을 정의할 필요가 있다.

<70> 구체적으로 NR에서는 UE 대역폭 적응(bandwidth adaption) 지원에 따라 임의의 NR CC에서 서로 다른 송수신 대역폭을 갖는 단말에 대한 지원이 이루어짐에 따라, 전술한 바와 같이 각각의 단말 별로 PUCCH 송수신을 위한 대역폭 파트(bandwidth part)가 별도로 구성되고 활성화될 수 있으며, 그에 따라 LTE와 같이 해당 CC의 시스템 대역폭에 의존하는 단일한 주파수 호핑 룰(frequency hopping rule)을 적용하기 어렵다.

<71> 본 실시예에서는 이를 고려한 구체적인 주파수 호핑(frequency hopping) 방법에 대해 제안한다.

<73> 실시예 1: 암묵적인(implicit) 호핑 대역폭 결정 방법

<74> 구체적인 주파수 호핑(frequency hopping) 방법에 대한 첫번째 실시예로서, 긴 지속시간(long duration) PUCCH와 짧은 지속시간(short duration) PUCCH에 대해 서로 다른 주파수 호핑 룰(frequency hopping rule)을 정의할 수 있다. 또는 임의의 슬롯 또는 임의의 단말에서 PUCCH 전송을 위해 할당된 심볼의 수에 따라 서로 다른 주파수 호핑 룰(frequency hopping rule)을 정의할 수 있다.

<75> 즉, PUCCH 지속기간(duration) 또는 PUCCH전송을 위해 할당된 심볼의 수 및 PUCCH 전송을 위해 설정되고 활성화된 대역폭 파트(bandwidth part)의 대역폭 또는 NR CC의 시스템 대역폭 등의 함수로서 임의의 단말에서 적용할 PUCCH에 대한 주파수 호핑 대역폭(frequency hopping bandwidth)이 정의될 수 있다.

<76> 이에 대한 일 예로써, 긴 지속시간(long duration) PUCCH의 경우, 임의의 단말을 위해 활성화(activation)된 대역폭 파트(bandwidth part)의 대역폭과 관계 없이, 해당 단말이 접속한 NR CC의 시스템 대역폭에 따라 주파수 호핑(frequency hopping) 대역폭이 결정되고, 짧은 지속시간(short duration) PUCCH의 경우, 각각의 단말 별로 상향 링크 송수신을 위해 활성화(activation)된 대역폭 파트(bandwidth part)의 대역폭에 따라 주파수 호핑(frequency hopping) 대역폭이 결정되도록 정의할 수 있다.

<77> 또는 이와 유사하게 임의의 슬롯에서 임의의 단말을 위해 할당된 PUCCH의 심

볼 수에 따라 해당 심볼 수가 특정 값 이상일 경우, NR CC의 시스템 대역폭에 따라 주파수 호핑(frequency hopping) 대역폭이 결정되고, 그렇지 않을 경우 활성화(activation)된 대역폭 파트(bandwidth part)의 대역폭에 따라 주파수 호핑(frequency hopping) 대역폭이 결정되도록 정의할 수 있다.

<78> 이에 대한 구체적인 일례로서, NR CC의 시스템 대역폭에 기반한 주파수 호핑 룰(frequency hopping rule(i.e. 타입-1 주파수 호핑(type-1 frequency hopping)))과 단말 별로 활성화(activation)된 대역폭 파트(bandwidth part)의 대역폭에 기반한 주파수 호핑 룰(frequency hopping rule(i.e. 타입-2 주파수 호핑(type-2 frequency hopping)))을 정의하고, (단, 타입-1 주파수 호핑(type-1 frequency hopping) 및 타입-2 주파수 호핑(type-2 frequency hopping)과 같은 명칭에 의해 본 발명이 제한되는 것은 아니다.) 임의의 단말에서 UCI 전송을 위해 적용할 주파수 호핑 룰(frequency hopping rule)이 해당 UCI 전송을 위해 사용할 PUCCH의 지속시간(duration)에 의해 결정되도록 정의할 수 있다.

<79> 즉, 도 5와 같이 임의의 긴 지속기간(long duration) PUCCH의 경우, 타입-1 주파수 호핑(type-1 frequency hopping)을 적용하고, 짧은 지속기간(short duration) PUCCH의 경우 타입-2 주파수 호핑(type-2 frequency hopping)을 적용하도록 정의하거나, 또는 PUCCH 전송을 위해 할당된 심볼의 수에 따라 주파수 호핑 타입(frequency hopping type)을 결정하도록 정의할 수 있다.

<80> 단, 시스템 대역폭에 기반한 주파수 호핑 룰(frequency hopping rule(즉, 타입-1 주파수 호핑(type-1 frequency hopping)))이 적용될 경우, 해당 호핑 대역폭

이 단말의 송수신 대역폭보다 큰 경우에, PUCCH의 주파수 홉(frequency hop) 간 리터닝 갭(retuning gap)이 정의될 수 있다. 또는 기지국/네트워크에서 단말-특정/셀-특정(UE-specific/cell-specific)한 상위 레이어 시그널링(higher layer signalling) 또는 MAC CE 시그널링(MAC CE signalling) 또는 L1 제어 시그널링(L1 control signalling)을 통해 각각의 단말 별로 임의의 PUCCH 전송을 위한 주파수 호핑 타입(frequency hopping type)을 설정 및 지시하도록 정의할 수 있다.

<82> 실시예 2: 명시적인(explicit) 호핑 대역폭 설정 방법

<83> 기지국/네트워크에서 각각의 단말 별로 PUCCH에 대한 주파수 호핑(frequency hopping) 대역폭을 설정/지시하도록 정의할 수 있다. 이에 대한 구체적인 방법으로서, 단말-특정(UE-specific) 또는 셀-특정(cell-specific)한 상위 레이어 시그널링(higher layer signalling)을 통해 각각의 단말 별로 PUCCH에 대한 주파수 호핑(frequency hopping) 대역폭을 기지국/네트워크에서 직접 설정하여 시그널링해주도록 정의할 수 있다.

<84> 단, 추가적으로 해당 PUCCH에 대한 주파수 호핑(frequency hopping) 설정 전에 임의의 단말에서 적용할 디폴트 주파수 호핑(default frequency hopping) 대역폭이나 디폴트 주파수 호핑 룰(default frequency hopping rule)이 정의될 수 있다. 그리고 해당 디폴트 주파수 호핑(default frequency hopping) 대역폭 또는 디디폴트 주파수 호핑 룰(default frequency hopping rule)은 전술한 실시예 1 및 도 5와 같은 방식으로 대역폭 파트(bandwidth part)의 대역폭이나 또는 NR CC의 대

역폭에 의해 결정될 수 있다.

<85> 단, 단말-특정/셀-특정(UE-specific/cell-specific)한 상위 레이어 시그널링(higher layer signaling)에 의한 PUCCH 호핑(hopping) 대역폭 설정 시, PUCCH 지속기간(duration), UCI의 종류(e.g. SR, CSI 피드백 또는 HARQ ACK/NACK 피드백 등)나 페이로드 크기(payload size)등과 관계없이 단일한 호핑(hopping) 대역폭을 설정하도록 정의할 수 있다.

<86> 또는 전술한 실시예 1과 같이 PUCCH 지속기간(duration)이나 또는 임의의 슬롯에서 PUCCH 전송을 위해 할당된 심볼 수, 또는 UCI 종류나 페이로드 크기(payload size) 등에 따른 PUCCH 포맷 별로 별도의 주파수 호핑(frequency hopping) 대역폭을 설정하도록 정의할 수 있다.

<87> 기지국/네트워크에서 각각의 단말 별로 PUCCH에 대한 주파수 호핑(frequency hopping) 대역폭을 설정/지시하도록 하는 또 다른 방법으로서, 기지국/네트워크에서 L1 제어 시그널링(L1 control signaling)을 통해 각각의 PUCCH 전송 별로 적용할 주파수 호핑(frequency hopping) 대역폭을 지시하도록 정의할 수 있다. 구체적으로 임의의 단말을 위한 하향링크 할당(DL assignment) DCI 또는 상향 링크 그랜트(UL grant)와 같은 DCI를 통해 임의의 단말에서 HARQ ACK/NACK 피드백 또는 CSI 피드백을 위한 PUCCH 전송이 지시될 경우, 해당 DCI를 통해 PUCCH 전송 자원 할당 정보와 함께 주파수 호핑(frequency hopping) 대역폭 지시 정보가 직접 전송되도록 정의할 수 있다.

<88> 단, 제어 오버헤드(control overhead)를 줄이기 위한 방안으로서, 해당 DCI

의 PUCCH 주파수 호핑(frequency hopping) 대역폭 지시 정보를 통해 기지국/네트워크에서 지시 가능한 후보값들(candidate value(s))을 정의하고, DCI를 통해 해당 후보값들(candidate value(s)) 중 하나의 값을 지시하도록 정의할 수 있다.

<89> 이 때 PUCCH 주파수 호핑(frequency hopping)을 위한 후보값들(candidate value(s))은 대역폭 파트(bandwidth part)의 대역폭 또는 NR CC의 시스템 대역폭 등에 의해 정의되거나, 또는 셀-특정/단말-특정(cell-specific/UE-specific)한 상위 레이어 시그널링(higher layer signaling)을 통해 기지국/네트워크에 의해 설정될 수 있다.

<90> 또는 임의의 디폴트 주파수 호핑(default frequency hopping) 대역폭 또는 디폴트 주파수 호핑 룰(default frequency hopping rule)을 정의하고, 해당 디폴트 주파수 호핑(default frequency hopping) 대역폭 또는 디폴트 주파수 호핑 룰(default frequency hopping rule)을 적용한 해당 PUCCH의 제2 홉(second hop)의 주파수 위치(frequency location(즉, 해당 PUCCH의 제2 홉(second hop)의 PRB(s)))로부터의 오프셋(offset) 값(e.g. PRB 오프셋 값)을 해당 하향 링크 할당(DL assignment) DCI 또는 상향링크 그랜트(UL grant) 등의 L1 제어 시그널링(L1 control signaling)을 통해 기지국/네트워크에서 동적(dynamic)으로 지시하도록 정의할 수 있다.

<91> 또는 기지국/네트워크에서 해당 오프셋(offset) 값을 단말-특정/그룹-공통/셀-특정(UE-specific/group common/cell-specific)한 상위 레이어 시그널링(higher layer signaling)이나 MAC CE 시그널링(MAC CE signaling)을 통해 설정하도록 정의

할 수 있다.

<92> 예를 들어, 도 6과 같이 전술한 실시예 1에서 기술한 방법 중 단말 별로 설정 및 활성화된 대역폭 파트(bandwidth part)의 대역폭에 따른 타입-2 주파수 호핑(type-2 frequency hopping)이 임의의 단말에서 PUCCH 전송을 위한 디폴트 주파수 호핑 룰(default frequency hopping rule)로서 정의되고, 기지국/네트워크는 해당 디폴트 주파수 호핑 룰(default frequency hopping rule)에 따른 해당 PUCCH의 제2 주파수 홉(second frequency hop)으로부터의 주파수 오프셋(frequency offset)값을 L1 제어 시그널링(L1 control signaling)을 통해 지시하도록 정의할 수 있다.

<93> 단, 본 실시예는 구체적인 디폴트 주파수 호핑 룰(default frequency hopping rule)과 관계없이 적용될 수 있다. 예를 들어, 디폴트 주파수 호핑 대역폭(default frequency hopping bandwidth)의 경우 셀-특정/단말-특정(cell-specific/UE-specific)한 상위 레이어 시그널링(higher layer signaling)을 통해 단말 별로 반-고정적(semi-static)으로 설정되거나, 전술한 실시예 1의 타입-2 ㅈ 주파수 호핑(type-2 frequency hopping)이 디폴트 호핑 룰(default hopping rule)로서 정의되거나, 또는 전술한 실시예 1과 같이 PUCCH 지속기간(duration)이나 PUCCH 심볼의 수에 따라 서로 다른 디폴트 호핑 룰(default hopping rule)이 정의될 수 있다.

<94> 또한 제어 오버헤드(control overhead)를 줄이기 위해 DCI를 통해 지시할 수 있는 해당 호핑 오프셋(hopping offset)값들에 대한 후보값(candidate values)들이 전술한 L1 제어 시그널링(L1 control signaling)을 통한 주파수 호핑(frequency

hopping) 대역폭 지시 방법과 동일한 방법으로 정의될 수 있다.

<96> 실시예 3: 주파수 홉(frequency hop) 별로 주파수 자원(e.g. PRB)를 분리해서 할당하는 방법

<97> 임의의 슬롯 내에서 또는 인터-슬롯(inter-slot) 간 PUCCH에 대한 주파수 호핑(frequency hopping)이 적용될 경우, 기지국/네트워크에서 각각의 주파수 홉(frequency hop) 별로 각각 별도의 주파수 자원 할당 정보(e.g. PRB 할당 정보)를 구성하여 이를 단말에게 직접 설정/지시하도록 정의할 수 있다.

<98> 예를 들어, 도 5 또는 도 6과 같이 임의의 단말에서 하나의 UL 슬롯을 통해 PUCCH 전송이 설정/지시되고, 주파수 호핑(frequency hopping)이 적용될 경우, 해당 PUCCH의 제1 주파수 홉(first frequency hop)을 위한 주파수 자원 할당 정보(e.g. PRB 할당 정보)와 해당 PUCCH의 제2 주파수 홉(second frequency hop)을 위한 주파수 자원 할당 정보(e.g. PRB 할당 정보)를 각각 별도로 설정하여 이를 해당 단말에 시그널링해주도록 정의할 수 있다.

<99> 즉, 기지국/네트워크에서 단말의 PUCCH 전송을 위한 주파수 자원 할당 정보(e.g. PRB 할당 정보)를 시그널링하는 방법에 있어서, 해당 PUCCH 전송의 제1 주파수 홉(first frequency hop)을 위한 주파수 자원 할당 정보(e.g. PRB 할당 정보)와 해당 PUCCH 전송의 제2 주파수 홉(second frequency hop)을 위한 주파수 자원 할당 정보(e.g. PRB 할당 정보)를 별도로 구성하여, 이를 단말-특정/그룹-공통/

셀-특정(UE-specific/group common/cell-specific)한 상위 레이어 시그널링(higher layer signaling)이나 MAC CE 시그널링(MAC CE signaling) 또는 L1 제어 시그널링(L1 control signaling)을 통해 해당 단말에 전송하도록 정의할 수 있다.

<100> 추가적으로 기지국/네트워크에서 셀-특정/단말-특정(cell-specific/UE-specific)한 상위 레이어 시그널링(higher layer signalling), MAC CE 시그널링(MAC CE signalling) 또는 L1 제어 시그널링(L1 control signaling)을 통해 PUCCH에 대한 주파수 호핑(frequency hopping)을 인에이블링(enabling)하거나, 디스에이블링(disabling)하도록 정의할 수 있다.

<101> 또한, 전술한 주파수 호핑(frequency hopping) 방법들의 조합으로서 PUCCH에 대한 주파수 호핑(frequency hopping) 방법이 정의되는 경우도 본 발명의 범주에 포함될 수 있으며, PUCCH 외에 PUSCH 또는 SRS 또는 PRACH 등 모든 상향 링크 물리 채널/신호에 대해 본 발명에서 제안한 주파수 호핑(frequency hopping) 방법이 적용될 수 있으며, 이는 본 발명의 범주에 포함된다.

<103> 도 7은 본 실시예에서 단말이 상향링크 제어 채널 및 상향링크 데이터 채널을 기지국으로 전송하는 절차를 도시한 도면이다.

<104> 도 7을 참조하면, 단말은 기지국으로부터 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신할 수 있다(S700). 이 대역폭 파트 설정 정보는 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 정보이다.

<105> 이 때, 일 예로 대역폭 파트 설정 정보는 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대해서, 대역폭 파트 셋의 각각의 대역폭 파트를 지시하는 인덱스 정보를 포함할 수 있다.

<106> 단말은 이 대역폭 파트 설정 정보를 기초로 하여, 전술한 대역폭 파트 셋에 포함된 하나 이상의 대역폭 파트들 중 하나를 지시하는 하향링크 제어 정보를 기지국으로부터 수신할 수 있다.

<107> 이 때, 단말이 사용할 수 있는 최대 대역폭 파트의 개수 N(N은 1 이상의 자연수)에 따라 전술한 하향링크 제어 정보에서 대역폭 파트를 지시하는 정보의 비트 수가 결정될 수 있다. 일 예로 N = 4로 설정된 경우, 서로 다른 4개의 정보는 최대 2비트만으로 표현할 수 있다. 따라서, 전술한 하향링크 제어 정보에서 대역폭 파트를 지시하는 정보의 비트 수는 1비트 또는 2비트일 수 있다.

<108> 다른 예로 대역폭 파트 설정 정보는 전술한 대역폭 파트 셋의 각각의 대역폭 파트에 대한 서브캐리어 스페이싱(SCS, subcarrier spacing) 정보 및 CP(cyclic prefix)를 추가로 포함할 수 있다.

<109> 이 때, 전술한 대역폭 파트의 각 대역폭 파트는 기지국이 구성한 컴포넌트 캐리어에 대한 공통 자원 블록 인덱싱(common Resource Block indexing) 정보에 의해 구성될 수 있다. 여기서 컴포넌트 캐리어는 협대역(NB, narrowband) 또는 광대역(WB, wideband) 컴포넌트 캐리어가 될 수 있으며 캐리어 병합(CA, Carrier Aggregation)을 구성하는 하나 이상의 컴포넌트 캐리어를 지칭할 수도 있다.

<110> 같은 컴포넌트 캐리어를 사용하는 모든 단말은 동일한 공통 자원 블록 인덱싱 정보를 공유할 수 있다. 즉, 임의의 컴포넌트 캐리어가 단일 뉴머롤러지(single numerology) 기반인지 또는 복수 뉴머롤러지(multiple numerology)에 대한 멀티플렉싱(multiplexing)이 이루어지는지에 대해 관계없이 단일한 RB 인덱싱이 적용될 수 있다.

<111> 구체적으로, 전술한 대역폭 파트의 각 대역폭 파트에 대한 구성 정보는 전술한 공통 자원 블록 인덱싱 정보를 기반으로 하는 시작 자원 블록 인덱스(starting RB index), 즉 대역폭 파트의 시작점을 포함할 수 있다. 이러한 시작 물리 자원 블록 인덱스는 공통 자원 블록 인덱싱에 기반한 RB 인덱스 단위로 표시될 수 있다. 또한, 각 대역폭 파트에 대한 구성 정보는 상기 공통 자원 블록 인덱싱 정보를 기반으로 하는 시작 자원 블록 인덱스 정보 및 해당 대역폭 파트의 사이즈 정보를 추가로 포함할 수 있다. 그리고 기지국은 상위 계층 시그널링(e.g. RRC 시그널링)을 통해 대역폭 파트 설정 정보를 단말로 전송할 수 있다.

<112> 또한, 단말은 기지국으로부터 전술한 대역폭 파트 셋 중에서 하나의 전송 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 수신할 수 있다(S710).

<113> 이 때, 상향링크 제어 채널에 대한 주파수 호핑 설정 정보는 주파수 호핑 실시 여부를 지시하는 정보, 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 및 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 중 적어도 하나를 포함할 수 있다.

<114> 이하에서 설명하는 제1 주파수 자원 영역 및 제2 주파수 자원 영역은 주파수 호핑이 수행될 경우 상향링크 제어 채널을 구성하는 제1 PUCCH, 제2 PUCCH가 각각 할당된 주파수 자원 영역을 의미하며 각각 제1 주파수 홉(first frequency hop), 제2 주파수 홉(second frequency hop)으로 호칭될 수도 있다.

<115> 주파수 호핑 실시 여부를 지시하는 정보는 상향링크 제어 채널에 대한 주파수 호핑을 인에이블(enable)할지 디스에이블(disable)할지 여부를 지시하는 정보로서, 주파수 호핑이 인에이블(enable)되면 주파수 호핑이 수행되고, 주파수 호핑이 디스에이블(disable)되면 주파수 호핑이 수행되지 않는다.

<116> 만약 주파수 호핑이 수행될 경우, 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보는 제 1 주파수 자원 영역의 시작 PRB 인덱스 정보를 포함할 수 있다.

<117> 만약 주파수 호핑이 수행될 경우, 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보는 제 2 주파수 자원 영역의 시작 PRB 인덱스 정보를 포함할 수 있다.

<118> 그리고, 상향링크 데이터 채널에 대한 주파수 호핑 설정 정보는 하나 이상의 주파수 호핑 오프셋값으로 구성된 주파수 호핑 오프셋 집합을 포함할 수 있다. 이 때, 주파수 호핑 오프셋값은 PRB의 개수의 형태로 지시될 수 있다.

<119> 이 때, 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는 전술한 전송 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수를 기초로 결정될

수 있다.

<120> 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수를 결정하는 방법의 일 예로서, 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는 전술한 전송 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수 K가 미리 설정된 임계값 T(T는 1 이상의 자연수) 이하인지 여부에 따라 결정될 수 있다.

<121> 예를 들어, 만약 T(e.g 50 PRB) 이하인 경우에는 K값이 미리 설정된 제1 호핑 오프셋 개수(e.g. 2개)로 설정되고, T를 초과하는 경우에는 K값이 미리 설정된 제2 호핑 오프셋 개수(e.g. 4개)로 설정될 수 있다. 이 때, 대역폭 파트의 크기가 커질 수록 주파수 호핑 오프셋이 커질 수 있으므로 제2 호핑 오프셋 개수의 값이 제1 호핑 오프셋 개수의 값보다 크도록 설정될 수 있다.

<122> 단말은 전술한 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋 값 중에서 어떤 주파수 호핑 오프셋 값을 사용할 지 여부를 지시하는 정보를 기지국으로부터 수신할 수 있다. 이 때, 기지국은 상향링크 그랜트(UL grant) DCI를 통해서 해당 정보를 단말로 지시할 수 있다.

<123> 또한, 단말은 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여, 전술한 전송 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채널을 기지국으로 전송할 수 있다(S720).

<124> 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보는 상위 레이어 시

그널링(e.g. RRC 시그널링)을 통해 기지국으로부터 지시될 수 있다.

<126> 도 8을 본 실시예에서 기지국이 상향링크 제어 채널 및 상향링크 데이터 채널을 단말로부터 수신하는 절차를 도시한 도면이다.

<127> 도 8을 참조하면, 기지국은 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 단말로 전송할 수 있다(S800). 이 대역폭 파트 설정 정보는 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 정보이다.

<128> 이 때, 일 예로 대역폭 파트 설정 정보는 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대해서, 대역폭 파트 셋의 각각의 대역폭 파트를 지시하는 인덱스 정보를 포함할 수 있다.

<129> 기지국은 이 대역폭 파트 설정 정보를 기초로 하여, 전송한 대역폭 파트 셋에 포함된 하나 이상의 대역폭 파트들 중 하나를 지시하는 하향링크 제어 정보를 단말로 전송할 수 있다.

<130> 이 때, 단말이 사용할 수 있는 최대 대역폭 파트의 개수 N(N은 1 이상의 자연수)에 따라 전술한 하향링크 제어 정보에서 대역폭 파트를 지시하는 정보의 비트수가 결정될 수 있다. 일 예로 N = 4로 설정된 경우, 서로 다른 4개의 정보는 최대 2비트만으로 표현할 수 있다. 따라서, 전술한 하향링크 제어 정보에서 대역폭 파트를 지시하는 정보의 비트 수는 1비트 또는 2비트일 수 있다.

<131> 다른 예로 대역폭 파트 설정 정보는 전술한 대역폭 파트 셋의 각각의 대역폭 파트에 대한 서브캐리어 스페이싱(SCS, subcarrier spacing) 정보 및 CP(cyclic prefix)를 추가로 포함할 수 있다.

<132> 이 때, 전술한 대역폭 파트의 각 대역폭 파트는 기지국이 구성한 컴포넌트 캐리어에 대한 공통 자원 블록 인덱싱(common Resource Block indexing) 정보에 의해 구성될 수 있다. 여기서 컴포넌트 캐리어는 협대역(NB, narrowband) 또는 광대역(WB, wideband) 컴포넌트 캐리어가 될 수 있으며 캐리어 병합(CA, Carrier Aggregation)을 구성하는 하나 이상의 컴포넌트 캐리어를 지칭할 수도 있다.

<133> 같은 컴포넌트 캐리어를 사용하는 모든 단말은 동일한 공통 자원 블록 인덱싱 정보를 공유할 수 있다. 즉, 임의의 컴포넌트 캐리어가 단일 뉴머롤러지(single numerology) 기반인지 또는 복수 뉴머롤러지(multiple numerology)에 대한 멀티플렉싱(multiplexing)이 이루어지는지에 대해 관계없이 단일한 RB 인덱싱이 적용될 수 있다.

<134> 구체적으로, 전술한 대역폭 파트의 각 대역폭 파트에 대한 구성 정보는 전술한 공통 자원 블록 인덱싱 정보를 기반으로 하는 시작 자원 블록 인덱스(starting RB index), 즉 대역폭 파트의 시작점을 포함할 수 있다. 이러한 시작 물리 자원 블록 인덱스는 공통 자원 블록 인덱싱에 기반한 RB 인덱스 단위로 표시될 수 있다. 또한, 각 대역폭 파트에 대한 구성 정보는 상기 공통 자원 블록 인덱싱 정보를 기반으로 하는 시작 자원 블록 인덱스 정보 및 해당 대역폭 파트의 사이즈 정보를 추가로 포함할 수 있다. 그리고 기지국은 상위 계층 시그널링(e.g. RRC 시그널링)을

통해 대역폭 파트 설정 정보를 단말로 전송할 수 있다.

<135> 또한, 기지국은 전술한 대역폭 파트 셋 중 하나의 수신 대역폭 파트를 통해 수신되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 단말로 전송할 수 있다(S810).

<136> 이 때, 상향링크 제어 채널에 대한 주파수 호핑 설정 정보는 주파수 호핑 실시 여부를 지시하는 정보, 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 및 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 중 적어도 하나를 포함할 수 있다.

<137> 주파수 호핑 실시 여부를 지시하는 정보는 상향링크 제어 채널에 대한 주파수 호핑을 인에이블(enable)할지 디스에이블(disable)할지 여부를 지시하는 정보로서, 주파수 호핑이 인에이블(enable)되면 주파수 호핑이 수행되고, 주파수 호핑이 디스에이블(disable)되면 주파수 호핑이 수행되지 않는다.

<138> 만약 주파수 호핑이 수행될 경우, 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보는 제 1 주파수 자원 영역의 시작 PRB 인덱스 정보를 포함할 수 있다.

<139> 만약 주파수 호핑이 수행될 경우, 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보는 제 2 주파수 자원 영역의 시작 PRB 인덱스 정보를 포함할 수 있다.

<140> 그리고, 상향링크 데이터 채널에 대한 주파수 호핑 설정 정보는 하나 이상의

주파수 호핑 오프셋값으로 구성된 주파수 호핑 오프셋 집합을 포함할 수 있다. 이 때, 주파수 호핑 오프셋값은 PRB의 개수의 형태로 지시될 수 있다.

<141> 이 때, 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는 전술한 수신 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수를 기초로 결정될 수 있다.

<142> 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수를 결정하는 방법의 일 예로서, 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는 전술한 수신 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수 K가 미리 설정된 임계값 T(T는 1 이상의 자연수) 이하인지 여부에 따라 결정될 수 있다.

<143> 예를 들어, 만약 T(e.g 50 PRB) 이하인 경우에는 K값이 미리 설정된 제1 호핑 오프셋 개수(e.g. 2개)로 설정되고, T를 초과하는 경우에는 K값이 미리 설정된 제2 호핑 오프셋 개수(e.g. 4개)로 설정될 수 있다. 이 때, 대역폭 파트의 크기가 클 수록 주파수 호핑 오프셋이 커질 수 있으므로 제2 호핑 오프셋 개수의 값이 제1 호핑 오프셋 개수의 값보다 크도록 설정될 수 있다.

<144> 단말은 전술한 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋 값 중에서 어떤 주파수 호핑 오프셋 값을 사용할 지 여부를 지시하는 정보를 기지국으로부터 수신할 수 있다. 이 때, 기지국은 상향링크 그랜트(UL grant) DCI를 통해서 해당 정보를 단말로 지시할 수 있다.

<145> 또한, 기지국은 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여, 전술한 수신 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채널을 단말로부터 수신할 수 있다(S820).

<146> 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보는 상위 레이어 시그널링(e.g. RRC 시그널링)을 통해 단말로 지시될 수 있다.

<148> 도 9는 본 실시예들에 따른 기지국의 구성을 보여주는 도면이다.

<149> 도 9를 참조하면, 기지국(900)은 제어부(910)와 송신부(920), 수신부(930)을 포함한다.

<150> 송신부(920)와 수신부(930)는 전술한 본 발명을 수행하기에 필요한 신호나 메시지, 데이터를 단말과 송수신하는데 사용된다.

<151> 구체적으로 송신부(920)는 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 전송하고, 전술한 대역폭 파트 셋 중 하나의 수신 대역폭 파트를 통해 수신되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 전송할 수 있다.

<152> 여기서 대역폭 파트 설정 정보는 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 정보이다.

<153> 이 때, 일 예로 대역폭 파트 설정 정보는 단말에 대해 설정된 하나 이상의

대역폭 파트로 구성된 대역폭 파트 셋에 대해서, 대역폭 파트 셋의 각각의 대역폭 파트를 지시하는 인덱스 정보를 포함할 수 있다.

<154> 기지국은 이 대역폭 파트 설정 정보를 기초로 하여, 전술한 대역폭 파트 셋에 포함된 하나 이상의 대역폭 파트들 중 하나를 지시하는 하향링크 제어 정보를 단말로 전송할 수 있다.

<155> 이 때, 단말이 사용할 수 있는 최대 대역폭 파트의 개수 N(N은 1 이상의 자연수)에 따라 전술한 하향링크 제어 정보에서 대역폭 파트를 지시하는 정보의 비트 수가 결정될 수 있다. 일 예로 N = 4로 설정된 경우, 서로 다른 4개의 정보는 최대 2비트만으로 표현할 수 있다. 따라서, 전술한 하향링크 제어 정보에서 대역폭 파트를 지시하는 정보의 비트 수는 1비트 또는 2비트일 수 있다.

<156> 다른 예로 대역폭 파트 설정 정보는 전술한 대역폭 파트 셋의 각각의 대역폭 파트에 대한 서브캐리어 스페이싱(SCS, subcarrier spacing) 정보 및 CP(cyclic prefix)를 추가로 포함할 수 있다.

<157> 이 때, 전술한 대역폭 파트의 각 대역폭 파트는 기지국이 구성한 컴포넌트 캐리어에 대한 공통 자원 블록 인덱싱(common Resource Block indexing) 정보에 의해 구성될 수 있다. 여기서 컴포넌트 캐리어는 협대역(NB, narrowband) 또는 광대역(WB, wideband) 컴포넌트 캐리어가 될 수 있으며 캐리어 병합(CA, Carrier Aggregation)을 구성하는 하나 이상의 컴포넌트 캐리어를 지칭할 수도 있다.

<158> 같은 컴포넌트 캐리어를 사용하는 모든 단말은 동일한 공통 자원 블록 인덱

싱 정보를 공유할 수 있다. 즉, 임의의 컴포넌트 캐리어가 단일 뉴머롤러지(single numerology) 기반인지 또는 복수 뉴머롤러지(multiple numerology)에 대한 멀티플렉싱(multiplexing)이 이루어지는지에 대해 관계없이 단일한 RB 인덱싱이 적용될 수 있다.

<159> 구체적으로, 전술한 대역폭 파트의 각 대역폭 파트에 대한 구성 정보는 전술한 공통 자원 블록 인덱싱 정보를 기반으로 하는 시작 자원 블록 인덱스(starting RB index), 즉 대역폭 파트의 시작점을 포함할 수 있다. 이러한 시작 물리 자원 블록 인덱스는 공통 자원 블록 인덱싱에 기반한 RB 인덱스 단위로 표시될 수 있다. 또한, 각 대역폭 파트에 대한 구성 정보는 상기 공통 자원 블록 인덱싱 정보를 기반으로 하는 시작 자원 블록 인덱스 정보 및 해당 대역폭 파트의 사이즈 정보를 추가로 포함할 수 있다. 그리고 기지국은 상위 계층 시그널링(e.g. RRC 시그널링)을 통해 대역폭 파트 설정 정보를 단말로 전송할 수 있다.

<160> 그리고, 상향링크 제어 채널에 대한 주파수 호핑 설정 정보는 주파수 호핑 실시 여부를 지시하는 정보, 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 및 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 중 적어도 하나를 포함할 수 있다.

<161> 주파수 호핑 실시 여부를 지시하는 정보는 상향링크 제어 채널에 대한 주파수 호핑을 인에이블(enable)할지 디스에이블(disable)할지 여부를 지시하는 정보로서, 주파수 호핑이 인에이블(enable)되면 주파수 호핑이 수행되고, 주파수 호핑이 디스에이블(disable)되면 주파수 호핑이 수행되지 않는다.

<162> 만약 주파수 호핑이 수행될 경우, 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보는 제 1 주파수 자원 영역의 시작 PRB 인덱스 정보를 포함할 수 있다.

<163> 만약 주파수 호핑이 수행될 경우, 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보는 제 2 주파수 자원 영역의 시작 PRB 인덱스 정보를 포함할 수 있다.

<164> 그리고, 상향링크 데이터 채널에 대한 주파수 호핑 설정 정보는 하나 이상의 주파수 호핑 오프셋값으로 구성된 주파수 호핑 오프셋 집합을 포함할 수 있다. 이 때, 주파수 호핑 오프셋값은 PRB의 개수의 형태로 지시될 수 있다.

<165> 이 때, 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는 전술한 수신 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수를 기초로 결정될 수 있다.

<166> 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수를 결정하는 방법의 일 예로서, 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는 전술한 수신 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수 K가 미리 설정된 임계값 T(T는 1 이상의 자연수) 이하인지 여부에 따라 결정될 수 있다.

<167> 예를 들어, 만약 T(e.g 50 PRB) 이하인 경우에는 K값이 미리 설정된 제1 호핑 오프셋 개수(e.g. 2개)로 설정되고, T를 초과하는 경우에는 K값이 미리 설정된

제2 호핑 오프셋 개수(e.g. 4개)로 설정될 수 있다. 이 때, 대역폭 파트의 크기가 클 수록 주파수 호핑 오프셋이 커질 수 있으므로 제2 호핑 오프셋 개수의 값이 제1 호핑 오프셋 개수의 값보다 크도록 설정될 수 있다.

<168> 단말은 전술한 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋 값 중에서 어떤 주파수 호핑 오프셋 값을 사용할 지 여부를 지시하는 정보를 기지국으로부터 수신할 수 있다. 이 때, 기지국은 상향링크 그랜트(UL grant) DCI를 통해서 해당 정보를 단말로 지시할 수 있다.

<169> 그리고 수신부(930)는 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여, 전술한 수신 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채널을 단말로부터 수신할 수 있다.

<170> 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보는 상위 레이어 시그널링(e.g. RRC 시그널링)을 통해 단말로 지시될 수 있다.

<172> 도 10은 본 실시예들에 따른 단말의 구성을 보여주는 도면이다.

<173> 도 10을 참조하면, 단말(1000)은 수신부(1010), 제어부(1020) 및 송신부(1030)를 포함한다.

<174> 수신부(1010)는 기지국으로부터 해당 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신하고, 대역폭 파트 셋 중 하나의 전송 대역폭 파트를 통해 전송되는 상

향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 수신할 수 있다.

<175> 여기서 대역폭 파트 설정 정보는 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 정보이다.

<176> 이 때, 일 예로 대역폭 파트 설정 정보는 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대해서, 대역폭 파트 셋의 각각의 대역폭 파트를 지시하는 인덱스 정보를 포함할 수 있다.

<177> 단말은 이 대역폭 파트 설정 정보를 기초로 하여, 전술한 대역폭 파트 셋에 포함된 하나 이상의 대역폭 파트들 중 하나를 지시하는 하향링크 제어 정보를 기지국으로부터 수신할 수 있다.

<178> 이 때, 단말이 사용할 수 있는 최대 대역폭 파트의 개수 N(N은 1 이상의 자연수)에 따라 전술한 하향링크 제어 정보에서 대역폭 파트를 지시하는 정보의 비트 수가 결정될 수 있다. 일 예로 N = 4로 설정된 경우, 서로 다른 4개의 정보는 최대 2비트만으로 표현할 수 있다. 따라서, 전술한 하향링크 제어 정보에서 대역폭 파트를 지시하는 정보의 비트 수는 1비트 또는 2비트일 수 있다.

<179> 다른 예로 대역폭 파트 설정 정보는 전술한 대역폭 파트 셋의 각각의 대역폭 파트에 대한 서브캐리어 스페이싱(SCS, subcarrier spacing) 정보 및 CP(cyclic prefix)를 추가로 포함할 수 있다.

<180> 이 때, 전술한 대역폭 파트의 각 대역폭 파트는 기지국이 구성한 컴포넌트

캐리어에 대한 공통 자원 블록 인덱싱(common Resource Block indexing) 정보에 의해 구성될 수 있다. 여기서 컴포넌트 캐리어는 협대역(NB, narrowband) 또는 광대역(WB, wideband) 컴포넌트 캐리어가 될 수 있으며 캐리어 병합(CA, Carrier Aggregation)을 구성하는 하나 이상의 컴포넌트 캐리어를 지칭할 수도 있다.

<181> 같은 컴포넌트 캐리어를 사용하는 모든 단말은 동일한 공통 자원 블록 인덱싱 정보를 공유할 수 있다. 즉, 임의의 컴포넌트 캐리어가 단일 뉴머롤러지(single numerology) 기반인지 또는 복수 뉴머롤러지(multiple numerology)에 대한 멀티플렉싱(multiplexing)이 이루어지는지에 대해 관계없이 단일한 RB 인덱싱이 적용될 수 있다.

<182> 구체적으로, 전술한 대역폭 파트의 각 대역폭 파트에 대한 구성 정보는 전술한 공통 자원 블록 인덱싱 정보를 기반으로 하는 시작 자원 블록 인덱스(starting RB index), 즉 대역폭 파트의 시작점을 포함할 수 있다. 이러한 시작 물리 자원 블록 인덱스는 공통 자원 블록 인덱싱에 기반한 RB 인덱스 단위로 표시될 수 있다. 또한, 각 대역폭 파트에 대한 구성 정보는 상기 공통 자원 블록 인덱싱 정보를 기반으로 하는 시작 자원 블록 인덱스 정보 및 해당 대역폭 파트의 사이즈 정보를 추가로 포함할 수 있다. 그리고 기지국은 상위 계층 시그널링(e.g. RRC 시그널링)을 통해 대역폭 파트 설정 정보를 단말로 전송할 수 있다.

<183> 그리고, 상향링크 제어 채널에 대한 주파수 호핑 설정 정보는 주파수 호핑 실시 여부를 지시하는 정보, 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 및 상향링크 제어 채널의 제2 주파수 자원 영역에

대한 물리 자원 블록(PRB) 할당 정보 중 적어도 하나를 포함할 수 있다.

<184> 주파수 호핑 실시 여부를 지시하는 정보는 상향링크 제어 채널에 대한 주파수 호핑을 인에이블(enable)할지 디스에이블(disable)할지 여부를 지시하는 정보로서, 주파수 호핑이 인에이블(enable)되면 주파수 호핑이 수행되고, 주파수 호핑이 디스에이블(disable)되면 주파수 호핑이 수행되지 않는다.

<185> 만약 주파수 호핑이 수행될 경우, 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보는 제 1 주파수 자원 영역의 시작 PRB 인덱스 정보를 포함할 수 있다.

<186> 만약 주파수 호핑이 수행될 경우, 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보는 제 2 주파수 자원 영역의 시작 PRB 인덱스 정보를 포함할 수 있다.

<187> 그리고, 주파수 호핑 설정 정보는 하나 이상의 주파수 호핑 오프셋값으로 구성된 주파수 호핑 오프셋 집합을 포함할 수 있다. 이 때, 주파수 호핑 오프셋값은 PRB의 개수의 형태로 지시될 수 있다.

<188> 이 때, 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는 전술한 전송 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수를 기초로 결정될 수 있다.

<189> 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수를 결정하는 방법의 일 예로서, 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값

의 개수는 전술한 전송 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수 K가 미리 설정된 임계값 T(T는 1 이상의 자연수) 이하인지 여부에 따라 결정될 수 있다.

<190> 예를 들어, 만약 T(e.g 50 PRB) 이하인 경우에는 K값이 미리 설정된 제1 호핑 오프셋 개수(e.g. 2개)로 설정되고, T를 초과하는 경우에는 K값이 미리 설정된 제2 호핑 오프셋 개수(e.g. 4개)로 설정될 수 있다. 이 때, 대역폭 파트의 크기가 클 수록 주파수 호핑 오프셋이 커질 수 있으므로 제2 호핑 오프셋 개수의 값이 제1 호핑 오프셋 개수의 값보다 크도록 설정될 수 있다.

<191> 단말은 전술한 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋 값 중에서 어떤 주파수 호핑 오프셋 값을 사용할 지 여부를 지시하는 정보를 기지국으로부터 수신할 수 있다. 이 때, 기지국은 상향링크 그랜트(UL grant) DCI를 통해서 해당 정보를 단말로 지시할 수 있다.

<192> 송신부(1030)는 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여, 전술한 전송 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채널을 기지국으로 전송할 수 있다.

<193> 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보는 상위 레이어 시그널링(e.g. RRC 시그널링)을 통해 기지국으로부터 지시될 수 있다.

<195> 전술한 실시예에서 언급한 표준내용 또는 표준문서들은 명세서의 설명을 간

략하게 하기 위해 생략한 것으로 본 명세서의 일부를 구성한다. 따라서, 위 표준내용 및 표준문서들의 일부의 내용을 본 명세서에 추가하거나 청구범위에 기재하는 것은 본 발명의 범위에 해당하는 것으로 해석되어야 한다.

<196> 이상의 설명은 본 발명의 기술 사상을 예시적으로 설명한 것에 불과한 것으로서, 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자라면 본 발명의 본질적인 특성에서 벗어나지 않는 범위에서 다양한 수정 및 변형이 가능할 것이다. 따라서, 본 발명에 개시된 실시예들은 본 발명의 기술 사상을 한정하기 위한 것이 아니라 설명하기 위한 것이고, 이러한 실시예에 의하여 본 발명의 기술사상의 범위가 한정되는 것은 아니다. 본 발명의 보호 범위는 아래의 청구범위에 의하여 해석되어야 하며, 그와 동등한 범위 내에 있는 모든 기술 사상은 본 발명의 권리범위에 포함되는 것으로 해석되어야 할 것이다.

【특허청구범위】

【청구항 1】

단말이 상향링크 제어 채널 및 상향링크 데이터 채널을 기지국으로 전송하는 방법에 있어서,

상기 기지국으로부터 상기 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신하는 단계;

상기 기지국으로부터 상기 대역폭 파트 셋 중 하나의 전송 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 수신하는 단계; 및

상기 대역폭 파트 설정 정보 및 상기 주파수 호핑 설정 정보를 기초로 하여, 상기 전송 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채널을 상기 기지국으로 전송하는 단계를 포함하는 것을 특징으로 하는 방법.

【청구항 2】

제 1항에 있어서,

상기 상향링크 제어 채널에 대한 주파수 호핑 설정 정보는,

주파수 호핑 실시 여부를 지시하는 정보, 상기 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 및 상기 상향링크 제어 채

널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 중 적어도 하나를 포함하는 것을 특징으로 하는 방법.

【청구항 3】

제 1항에 있어서,

상기 상향링크 데이터 채널에 대한 주파수 호핑 설정 정보는,

하나 이상의 주파수 호핑 오프셋값으로 구성된 주파수 호핑 오프셋 집합을 포함하는 것을 특징으로 하는 방법.

【청구항 4】

제 3항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는,

상기 전송 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수를 기초로 결정되는 것을 특징으로 하는 방법.

【청구항 5】

제 4항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는,

상기 전송 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수가 미리 설정

된 임계값 이하인지 여부에 따라 결정되는 것을 특징으로 하는 방법.

【청구항 6】

제 3항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값 중에서 상기 상향링크 데이터 채널의 전송에 사용되는 주파수 호핑 오프셋값은 상향링크 그랜트 DCI를 통해 지시되는 것을 특징으로 하는 방법.

【청구항 7】

기지국이 상향링크 제어 채널 및 상향링크 데이터 채널을 단말로부터 수신하는 방법에 있어서,

상기 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 상기 단말로 전송하는 단계;

상기 대역폭 파트 셋 중 하나의 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 상기 단말로 전송하는 단계; 및

상기 대역폭 파트 설정 정보 및 상기 주파수 호핑 설정 정보를 기초로 하여, 상기 하나의 수신 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채

널을 상기 단말로부터 수신하는 단계를 포함하는 것을 특징으로 하는 방법.

【청구항 8】

제 7항에 있어서,

상기 상향링크 제어 채널에 대한 주파수 호핑 설정 정보는,

주파수 호핑 실시 여부를 지시하는 정보, 상기 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 및 상기 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 중 적어도 하나를 포함하는 것을 특징으로 하는 방법.

【청구항 9】

제 7항에 있어서,

상기 상향링크 데이터 채널에 대한 주파수 호핑 설정 정보는,

하나 이상의 주파수 호핑 오프셋값으로 구성된 주파수 호핑 오프셋 집합을 포함하는 것을 특징으로 하는 방법.

【청구항 10】

제 9항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는,

상기 수신 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수를 기초로 결정되는 것을 특징으로 하는 방법.

【청구항 11】

제 10항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는,

상기 수신 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수가 미리 설정된 임계값 이하인지 여부에 따라 결정되는 것을 특징으로 하는 방법.

【청구항 12】

제 9항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값 중에서 상기 상향링크 데이터 채널의 수신에 사용되는 주파수 호핑 오프셋값은 상향링크 그랜트 DCI를 통해 지시되는 것을 특징으로 하는 방법.

【청구항 13】

상향링크 제어 채널 및 상향링크 데이터 채널을 기지국으로 전송하는 단말에 있어서,

상기 기지국으로부터 상기 단말에 대해 설정된 하나 이상의 대역폭 파트로

구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신하고, 상기 대역폭 파트 셋 중 하나의 전송 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 수신하는 수신부; 및

상기 대역폭 파트 설정 정보 및 상기 주파수 호핑 설정 정보를 기초로 하여, 상기 전송 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채널을 상기 기지국으로 전송하는 송신부를 포함하는 것을 특징으로 하는 단말.

【청구항 14】

제 13항에 있어서,

상기 상향링크 제어 채널에 대한 주파수 호핑 설정 정보는,

주파수 호핑 실시 여부를 지시하는 정보, 상기 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 및 상기 상향링크 제어 채널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 중 적어도 하나를 포함하는 것을 특징으로 하는 단말.

【청구항 15】

제 13항에 있어서,

상기 상향링크 데이터 채널에 대한 주파수 호핑 설정 정보는,

하나 이상의 주파수 호핑 오프셋값으로 구성된 주파수 호핑 오프셋 집합을 포함하는 것을 특징으로 하는 단말.

【청구항 16】

제 15항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는,

상기 전송 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수를 기초로 결정되는 것을 특징으로 하는 단말.

【청구항 17】

제 16항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는,

상기 전송 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수가 미리 설정된 임계값 이하인지 여부에 따라 결정되는 것을 특징으로 하는 단말.

【청구항 18】

제 15항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값 중에서 상기 상향링크 데이터 채널의 전송에 사용되는 주파수 호핑 오프셋값은 상향링크 그

랜트 DCI를 통해 지시되는 것을 특징으로 하는 단말.

【청구항 19】

상향링크 제어 채널 및 상향링크 데이터 채널을 단말로부터 수신하는 기지국에 있어서,

상기 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 전송하고, 상기 대역폭 파트 셋 중 하나의 수신 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑(frequency hopping) 설정 정보를 전송하는 송신부; 및

상기 대역폭 파트 설정 정보 및 상기 주파수 호핑 설정 정보를 기초로 하여, 상기 수신 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채널을 상기 단말로부터 수신하는 수신부를 포함하는 것을 특징으로 하는 기지국.

【청구항 20】

제 19항에 있어서,

상기 상향링크 제어 채널에 대한 주파수 호핑 설정 정보는,

주파수 호핑 실시 여부를 지시하는 정보, 상기 상향링크 제어 채널의 제1 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 및 상기 상향링크 제어 채

널의 제2 주파수 자원 영역에 대한 물리 자원 블록(PRB) 할당 정보 중 적어도 하나를 포함하는 것을 특징으로 하는 기지국.

【청구항 21】

제 19항에 있어서,

상기 상향링크 데이터 채널에 대한 주파수 호핑 설정 정보는,

하나 이상의 주파수 호핑 오프셋값으로 구성된 주파수 호핑 오프셋 집합을 포함하는 것을 특징으로 하는 기지국.

【청구항 22】

제 21항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는,

상기 수신 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수를 기초로 결정되는 것을 특징으로 하는 기지국.

【청구항 23】

제 22항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값의 개수는,

상기 수신 대역폭 파트를 구성하는 물리 자원 블록(PRB)의 개수가 미리 설정

된 임계값 이하인지 여부에 따라 결정되는 것을 특징으로 하는 기지국.

【청구항 24】

제 21항에 있어서,

상기 주파수 호핑 오프셋 집합을 구성하는 주파수 호핑 오프셋값 중에서 상기 상향링크 데이터 채널의 수신에 사용되는 주파수 호핑 오프셋값은 상향링크 그랜트 DCI를 통해 지시되는 것을 특징으로 하는 기지국.

제출 일자 : 2018-05-18

【요약서】

【요약】

본 실시예는 차세대/5G 무선 액세스망에서 상향 링크 채널 송수신을 위한 주파수 호핑(frequency hopping)을 수행하는 방법 및 장치를 제공하며, 일 실시예는 단말이 상향링크 제어 채널 및상향링크 데이터 채널을 기지국으로 전송하는 방법에 있어서, 기지국으로부터 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트 설정 정보를 수신하는 단계, 기지국으로부터 대역폭 파트 셋 중 하나의 대역폭 파트를 통해 전송되는 상향링크 제어 채널 및 상향링크 데이터 채널에 대한 주파수 호핑 설정 정보를 수신하는 단계 및 전술한 대역폭 파트 설정 정보 및 주파수 호핑 설정 정보를 기초로 하여, 대역폭 파트 셋 중 하나의 대역폭 파트를 통해 상향링크 제어 채널 및 상향링크 데이터 채널을 기지국으로 전송하는 단계를 포함하는 것을 특징으로 하는 방법을 제공한다.

【대표도】

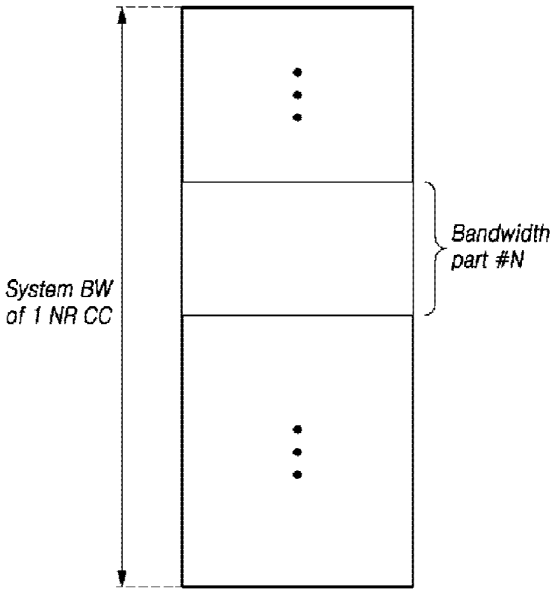
도 7

【도 1】

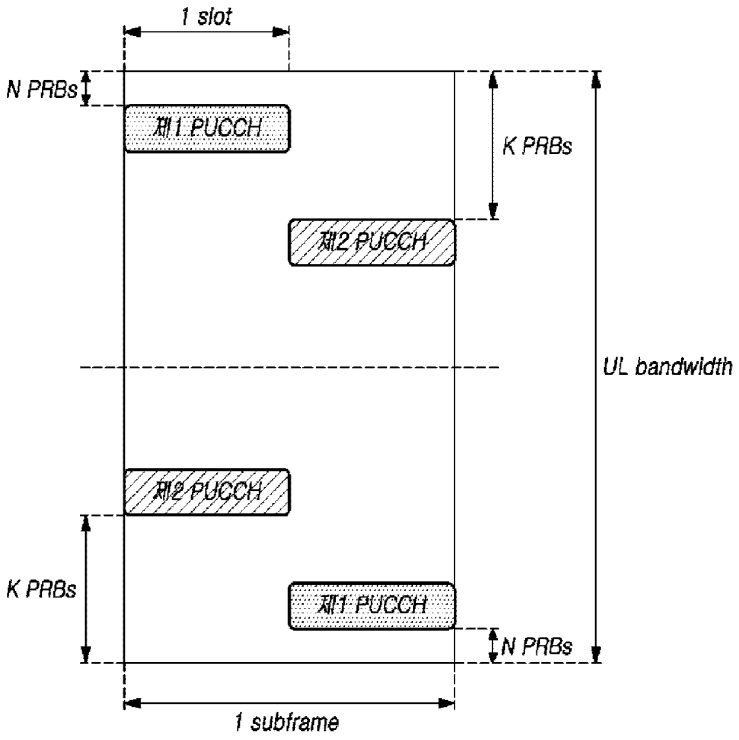
【도면】

제출 일자 : 2018-05-18

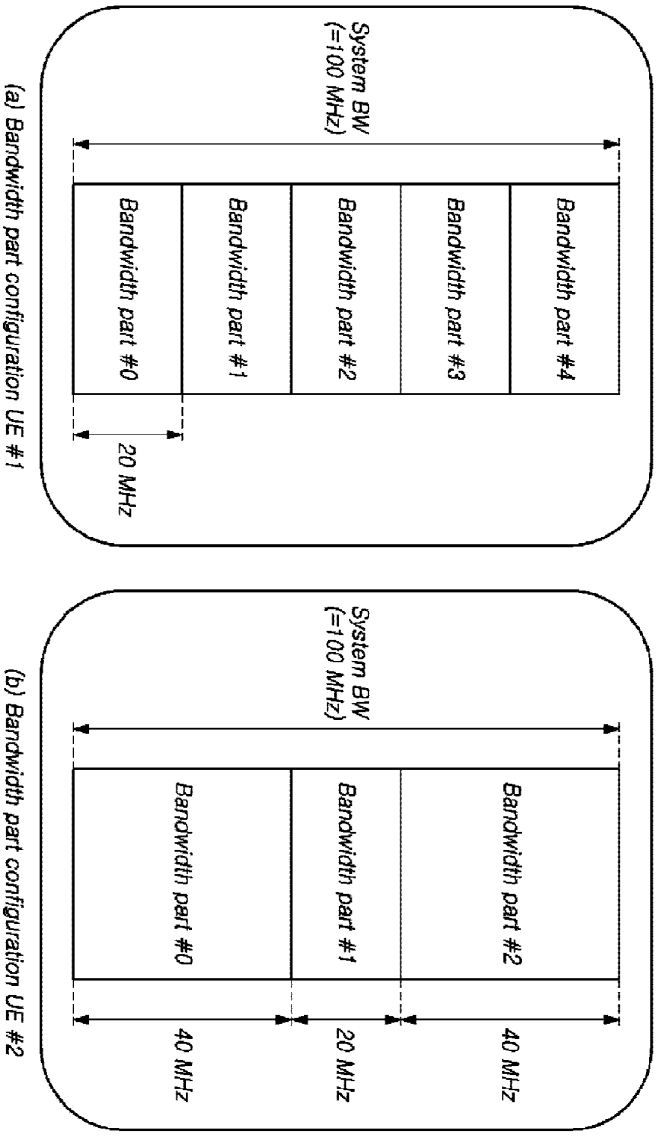
【도 2】



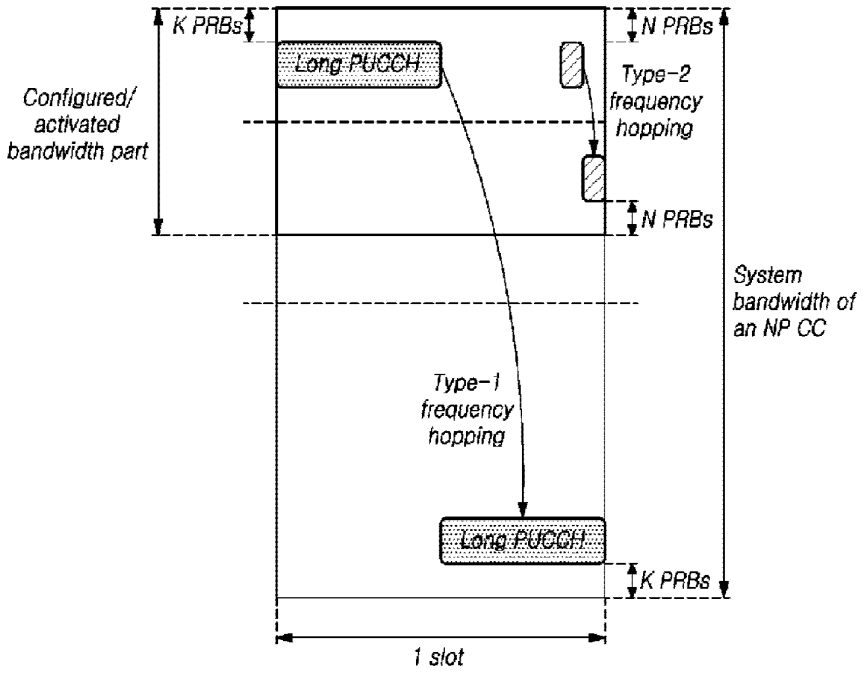
【도 3】


1 slot
N PRBs
제1 PUCCH
K PRBs
제2 PUCCH
UL bandwidth
제2 PUCCH
K PRBs
제1 PUCCH
N PRBs
1 subframe

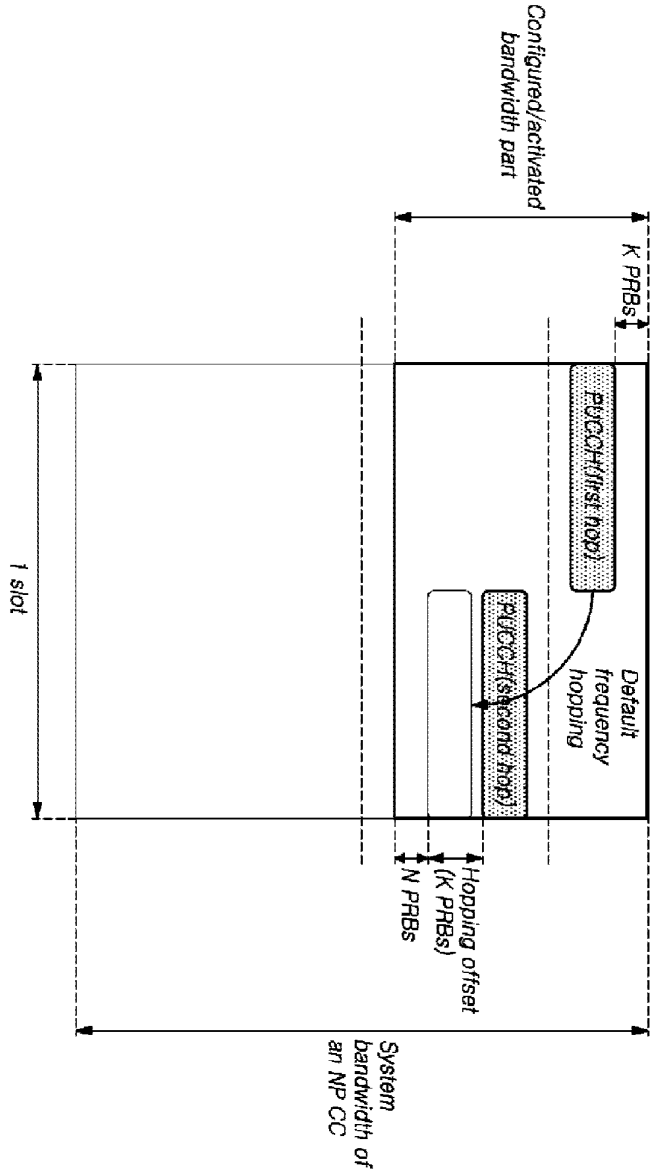
【도 4】


(a) Bandwidth part configuration UE #1
System BW (=100 MHz)
Bandwidth part #0
Bandwidth part #1
Bandwidth part #2
Bandwidth part #3
Bandwidth part #4
20 MHz
(b) Bandwidth part configuration UE #2
System BW (=100 MHz)
Bandwidth part #0
Bandwidth part #1
Bandwidth part #2
40 MHz
20 MHz
40 MHz

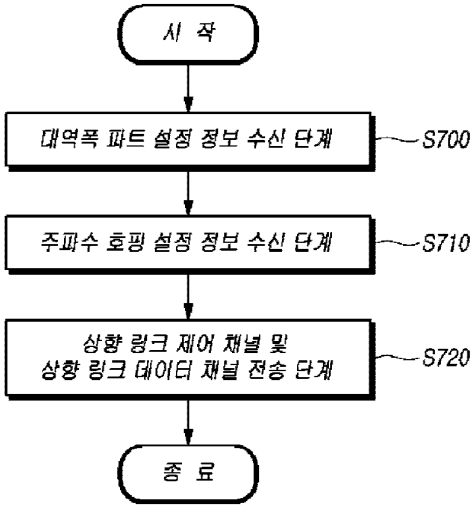
【도 5】


K PRBs
N PRBs
Long PUCCH
Type-2
frequency
hopping
Configured/
activated
bandwidth part
N PRBs
System
bandwidth of
an NP CC
Type-1
frequency
hopping
Long PUCCH
K PRBs
1 slot

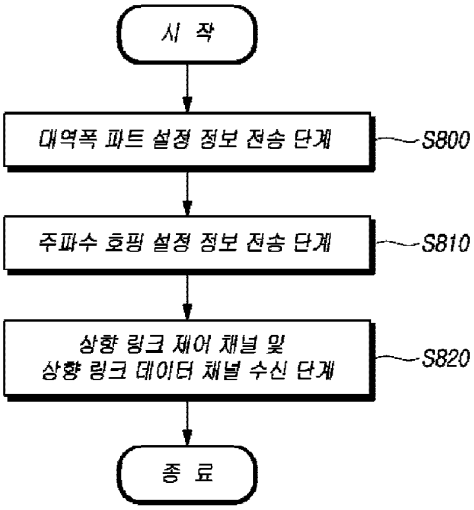
【도 6】


Configured/activated bandwidth part
K PRBs
PUCCH(first hop)
PUCCH(second hop)
Default frequency hopping
1 slot
N PRBs
Hopping offset (K PRBs)
System bandwidth of an NP CC

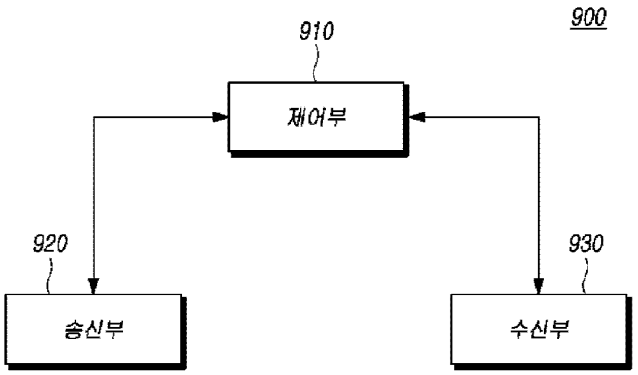
【도 7】


시 작
대역폭 파트 설정 정보 수신 단계
S700
주파수 호핑 설정 정보 수신 단계
S710
상향 링크 제어 채널 및
상향 링크 데이터 채널 전송 단계
S720
종 료

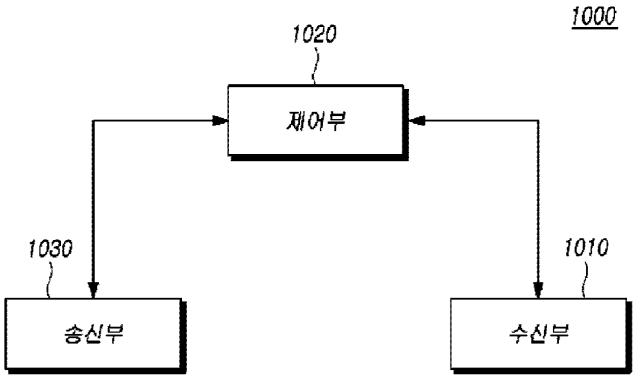
【도 8】


시 작
대역폭 파트 설정 정보 전송 단계
S800
주파수 호핑 설정 정보 전송 단계
S810
상향 링크 제어 채널 및
상향 링크 데이터 채널 수신 단계
S820
종 료

【도 9】



【도 10】



대한민국특허청
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【발명의 국문명칭】 차세대 무선망을 위한 주파수 호핑 방법 및 그 장치

【발명의 영문명칭】 Apparatus and method of frequency hopping for new radio

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【수수료】

【출원료】	0	면	46,000 원
【가산출원료】	27	면	0 원
【우선권주장료】	1	건	18,000 원
【심사청구료】	0	항	0 원
【합계】	64,000 원		

【발명의 설명】

【발명의 명칭】

차세대 무선망을 위한 주파수 호핑 방법 및 그 장치{Apparatus and method of frequency hopping for new radio}

【기술분야】

<1> 본 발명은 차세대/5G 무선 액세스망(이하 본 발명에서는 NR[New Radio]라 지칭하도록 함.)에서 상향 링크 제어 채널 송수신을 위한 frequency hopping 방안을 제안한다.

【발명의 내용】

【과제의 해결 수단】

<2> 본 발명의 일 실시예는 차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서, 기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것을 특징으로 하는 방법을 제공한다.

【도면의 간단한 설명】

<3> 도 1은 다른 SCS간의 symbol level alignment의 예를 도시한 도면이다.

도 2는 Bandwidth part에 대한 개념적 예시를 도시한 도면이다.

도 3은 LTE/LTE-A 시스템에서 정의된 PUCCH frequency hopping의 일례를 도시한 도면이다.

도 4는 UE-specific Bandwidth part 설정에 대한 개념적 예시를 도시한 도면이다.

도 5는 PUCCH duration에 기반한 frequency hopping rule의 예를 도시한 도면이다.

도 6은 DCI를 통한 hopping offset indication 방법의 일례를 도시한 도면이다.

도 7은 또 다른 실시예에 의한 기지국의 구성을 보여주는 도면이다.

도 8은 또 다른 실시예에 의한 사용자 단말의 구성을 보여주는 도면이다.

【발명을 실시하기 위한 구체적인 내용】

<4> 이하, 본 발명의 일부 실시예들을 예시적인 도면을 통해 상세하게 설명한다. 각 도면의 구성요소들에 참조부호를 부가함에 있어서, 동일한 구성요소들에 대해서는 비록 다른 도면상에 표시되더라도 가능한 한 동일한 부호를 가지도록 하고 있음에 유의해야 한다. 또한, 본 발명을 설명함에 있어, 관련된 공지 구성 또는 기능에 대한 구체적인 설명이 본 발명의 요지를 흐릴 수 있다고 판단되는 경우에는 그 상세한 설명은 생략한다.

<5> 본 명세서에서 무선 통신 시스템은 음성, 패킷 데이터 등과 같은 다양한 통신 서비스를 제공하기 위한 시스템을 의미한다. 무선 통신 시스템은 사용자 단말(User Equipment, UE) 및 기지국(Base Station, BS)을 포함한다.

<6> 사용자 단말은 무선 통신에서의 단말을 의미하는 포괄적 개념으로서, WCDMA,

LTE, HSPA 및 IMT-2020(5G 또는 New Radio) 등에서의 UE(User Equipment)는 물론, GSM에서의 MS(Mobile Station), UT(User Terminal), SS(Subscriber Station), 무선 기기(wireless device) 등을 모두 포함하는 개념으로 해석되어야 할 것이다.

<7> 기지국 또는 셀(Cell)은 일반적으로 사용자 단말과 통신하는 지점(station)을 말하며, 노드-B(Node-B), eNB(evolved Node-B), gNB(gNode-B), LPN(Low Power Node), 섹터(Sector), 싸이트(Site), 다양한 형태의 안테나, BTS(Base Transceiver System), 액세스 포인트(Access Point), 포인트(예를 들어, 송신포인트, 수신포인트, 송수신포인트), 릴레이 노드(Relay Node), 메가 셀, 매크로 셀, 마이크로 셀, 피코 셀, 펨토 셀, RRH(Remote Radio Head), RU(Radio Unit), 스몰 셀(small cell) 등 다양한 커버리지 영역을 모두 포괄하는 의미이다.

<8> 앞서 나열된 다양한 셀은 각 셀을 제어하는 기지국이 존재하므로 기지국은 두 가지 의미로 해석될 수 있다. 1) 무선 영역과 관련하여 메가 셀, 매크로 셀, 마이크로 셀, 피코 셀, 펨토 셀, 스몰 셀(small cell)을 제공하는 장치 그 자체이거나, 2) 무선 영역 그 자체를 지시할 수 있다. 1)에서 소정의 무선 영역을 제공하는 장치들이 동일한 개체에 의해 제어되거나 무선 영역을 협업으로 구성하도록 상호작용하는 모든 장치들을 모두 기지국으로 지시한다. 무선 영역의 구성 방식에 따라 포인트, 송수신 포인트, 송신 포인트, 수신 포인트 등은 기지국의 일 실시예가 된다. 2)에서 사용자 단말의 관점 또는 이웃하는 기지국의 입장에서 신호를 수신하거나 송신하게 되는 무선 영역 그 자체를 기지국으로 지시할 수 있다.

<9> 본 명세서에서 셀(Cell)은 송수신 포인트로부터 전송되는 신호의 커버리지

또는 송수신 포인트(transmission point 또는 transmission/reception point)로부터 전송되는 신호의 커버리지를 가지는 요소 반송파(component carrier), 그 송수신 포인트 자체를 의미할 수 있다.

<10> 본 명세서에서 사용자 단말과 기지국은, 본 발명에서 기술되는 기술 또는 기술적 사상을 구현하는데 사용되는 두 가지(Uplink 또는 Downlink) 송수신 주체로 포괄적인 의미로 사용되며 특정하게 지칭되는 용어 또는 단어에 의해 한정되지 않는다.

<11> 여기서, 상향링크(Uplink, UL, 또는 업링크)는 사용자 단말에 의해 기지국으로 데이터를 송수신하는 방식을 의미하며, 하향링크(Downlink, DL, 또는 다운링크)는 기지국에 의해 사용자 단말로 데이터를 송수신하는 방식을 의미한다.

<12> 상향링크 전송 및 하향링크 전송은 서로 다른 시간을 사용하여 전송되는 TDD(Time Division Duplex) 방식이 사용될 수 있고, 서로 다른 주파수를 사용하여 전송되는 FDD(Frequency Division Duplex) 방식, TDD 방식과 FDD 방식의 혼용 방식이 사용될 수 있다.

<13> 또한, 무선 통신 시스템에서는 하나의 반송파 또는 반송파 쌍을 기준으로 상향링크와 하향링크를 구성하여 규격을 구성한다.

<14> 상향링크와 하향링크는, PDCCH(Physical Downlink Control CHannel), PUCCH(Physical Uplink Control CHannel) 등과 같은 제어 채널을 통하여 제어 정보를 전송하고, PDSCH(Physical Downlink Shared CHannel), PUSCH(Physical Uplink

Shared CHannel) 등과 같은 데이터 채널로 구성되어 데이터를 전송한다.

<15> 하향링크(downlink)는 다중 송수신 포인트에서 단말로의 통신 또는 통신 경로를 의미할 수 있으며, 상향링크(uplink)는 단말에서 다중 송수신 포인트로의 통신 또는 통신 경로를 의미할 수 있다. 이때, 하향링크에서 송신기는 다중 송수신 포인트의 일부분일 수 있고, 수신기는 단말의 일부분일 수 있다. 또한, 상향링크에서 송신기는 단말의 일부분일 수 있고, 수신기는 다중 송수신 포인트의 일부분일 수 있다.

<16> 이하에서는 PUCCH, PUSCH, PDCCH 및 PDSCH 등과 같은 채널을 통해 신호가 송수신되는 상황을 'PUCCH, PUSCH, PDCCH 및 PDSCH를 전송, 수신한다'는 형태로 표기하기도 한다.

<17> 한편, 이하에서 기재하는 상위계층 시그널링(High Layer Signaling)은 RRC 파라미터를 포함하는 RRC 정보를 전송하는 RRC 시그널링을 포함한다.

<18> 기지국은 단말들로 하향링크 전송을 수행한다. 기지국은 유니캐스트 전송(unicast transmission)을 위한 주 물리 채널인 하향링크 데이터 채널의 수신에 필요한 스케줄링 등의 하향링크 제어 정보 및 상향링크 데이터 채널에서의 전송을 위한 스케줄링 승인 정보를 전송하기 위한 물리 하향링크 제어 채널을 전송할 수 있다. 이하에서는, 각 채널을 통해 신호가 송수신 되는 것을 해당 채널이 송수신되는 형태로 기재하기로 한다.

<19> 무선 통신 시스템에서 적용되는 다중 접속 기법에는 제한이 없다. TDMA(Time

Division Multiple Access), FDMA(Frequency Division Multiple Access), CDMA(Code Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), NOMA(Non-Orthogonal Multiple Access), OFDM-TDMA, OFDM-FDMA, OFDM-CDMA와 같은 다양한 다중 접속 기법을 사용할 수 있다. 여기서, NOMA는 SCMA(Sparse Code Multiple Access)와 LDS(Low Density Spreading) 등을 포함한다.

<20> 본 발명의 일 실시예는 GSM, WCDMA, HSPA를 거쳐 LTE/LTE-Advanced, IMT-2020으로 진화하는 비동기 무선 통신과, CDMA, CDMA-2000 및 UMB로 진화하는 동기식 무선 통신 분야 등의 자원 할당에 적용될 수 있다.

<21> 본 명세서에서 MTC(Machine Type Communication) 단말은 low cost(또는 low complexity)를 지원하는 단말 또는 coverage enhancement를 지원하는 단말 등을 의미할 수 있다. 또는 본 명세서에서 MTC 단말은 low cost(또는 low complexity) 및/또는 coverage enhancement를 지원하기 위한 특정 카테고리로 정의된 단말을 의미할 수 있다.

<22> 다시 말해 본 명세서에서 MTC 단말은 LTE 기반의 MTC 관련 동작을 수행하는 새롭게 정의된 3GPP Release-13 low cost(또는 low complexity) UE category/type을 의미할 수 있다. 또는 본 명세서에서 MTC 단말은 기존의 LTE coverage 대비 향상된 coverage를 지원하거나, 혹은 저전력 소모를 지원하는 기존의 3GPP Release-12 이하에서 정의된 UE category/type, 혹은 새롭게 정의된 Release-13 low cost (또는 low complexity) UE category/type을 의미할 수 있다. 또는, Release-14에서 정의된 further Enhanced MTC 단말을 의미할 수도 있다.

<23> 본 명세서에서 NB-IoT(NarrowBand Internet of Things) 단말은 셀룰러 IoT를 위한 무선 액세스를 지원하는 단말을 의미한다. NB-IoT 기술의 목적은 향상된 인도어(Indoor) 커버리지, 대규모의 저속 단말에 대한 지원, 저지연민감도, 초저가 단말 비용, 낮은 전력 소모, 그리고 최적화된 네트워크 구조를 포함한다.

<24> 3GPP에서 최근 논의 중인 NR(New Radio)에서 대표적인 사용 시나리오(usage scenario)로서, eMBB(enhanced Mobile BroadBand), mMTC(massive Machine Type Communication), URLLC(Ultra Reliable and Low Latency Communication)가 제기되고 있다.

<25> 본 명세서에서 NR(New Radio)과 관련한 주파수, 프레임, 서브프레임, 자원, 자원블럭, 영역(region), 밴드, 서브밴드, 제어채널, 데이터채널, 동기신호, 각종 참조신호, 각종 신호, 각종 메시지는 과거 또는 현재 사용되는 의미 또는 장래 사용되는 다양한 의미로 해석될 수 있다.

<26> NR(New Radio)

<27> 3GPP는 최근 차세대/5G 무선 액세스 기술에 대한 연구를 위한 study item인 "Study on New Radio Access Technology"를 승인하고, 이를 기반으로 RAN WG1에서는 각각 NR(New Radio)를 위한 frame structure, channel coding & modulation, waveform & multiple access scheme 등에 대한 논의가 시작되었다. NR은 LTE 대비 향상된 데이터 전송율 뿐 아니라, 세분화되고 구체화된 usage scenario 별로 요구되는 다양한 QoS requirements를 만족시킬 수 있는 설계가 이루어지도록 요구되고

있다. 특히 NR의 대표적 usage scenario로서 eMBB(enhancement Mobile BroadBand), mMTC(massive MTC) 및 URLLC(Ultra Reliable and Low Latency Communications)가 정의되었으며, 각각의 usage scenario별 requirements를 만족하기 위한 방법으로서 LTE 대비 flexible한 frame structure 설계가 요구되고 있다. 각각의 usage scenario는 data rates, latency, reliability, coverage 등에 대한 requirements가 서로 상이하기 때문에 임의의 NR 시스템을 구성하는 주파수 대역을 통해 각각의 usage scenario 별 requirements를 효율적으로 만족시키기 위한 방법으로서 서로 다른 numerology(e.g. subcarrier spacing, subframe, TTI, etc.) 기반의 무선 자원 유닛(unit)을 효율적으로 multiplexing하는 방안에 대한 필요성이 제기되고 있다.

<28> 이를 위한 한 방법으로서, 서로 다른 subcarrier spacing값을 갖는 numerology에 대해 하나 혹은 복수의 NR component carrier(s)를 통해 TDM, FDM 혹은 TDM/FDM 기반으로 다중화하여 지원하는 방법 및 time domain에서의 스케줄링 단위를 구성함에 있어서 하나 이상의 time unit을 지원하는 방안에 대한 논의가 이루어졌다. 이와 관련하여 NR에서는 time domain structure의 한 종류로서 subframe에 대한 정의가 이루어졌으며, 해당 subframe duration을 정의하기 위한 reference numerology로서 LTE와 동일한 15kHz SCS(Sub-Carrier Spacing) 기반 normal CP overhead의 14개의 OFDM symbols로 구성된 단일한 subframe duration을 정의하기로 결정하였다. 이에 따라 NR에서 subframe은 1ms의 time duration을 가진다. 단, LTE와 달리 NR의 subframe은 절대적인 reference time duration으로서, 실제 상/하향

링크 데이터 스케줄링의 기반의 되는 time unit으로서 slot 및 mini-slot이 정의될 수 있다. 이 경우, 해당 slot을 구성하는 OFDM 심볼의 개수, y값은 up to 60kHz의 SCS값을 갖는 numerology에 대해 y=7 and 14으로 정의되고, 60kHz보다 큰 SCS값을 갖는 numerology의 경우 y=14의 값을 갖도록 결정되었다.

<29> 이에 따라 임의의 slot은 7개 혹은 14개의 심볼로 구성될 수 있으며, 또한 해당 slot의 transmission direction에 따라 모든 심볼이 DL transmission을 위해 이용되거나, 혹은 모든 심볼이 UL transmission을 위해 이용되거나, 혹은 DL portion + (gap) + UL portion의 형태로 이용될 수 있다.

<30> 또한 임의의 numerology(혹은 SCS)에서 해당 slot보다 적은 수의 심볼로 구성된 mini-slot이 정의되어 이를 기반으로 상/하향 링크 데이터 송수신을 위한 짧은 길이의 time-domain scheduling interval이 설정되거나, 혹은 slot aggregation을 통해 상/하향 링크 데이터 송수신을 위한 긴 길이의 time-domain scheduling interval이 구성될 수 있다. 특히 URLLC와 같이 latency critical한 데이터에 대한 송수신의 경우, 15kHz와 같이 SCS값이 작은 numerology 기반의 frame 구조에서 정의된 0.5ms(7 symbols) 혹은 1ms(14 symbols) 기반의 slot 단위로 스케줄링이 이루어질 경우, latency requirement를 만족시키기 힘들 수 있기 때문에 이를 위해서 해당 slot보다 적은 수의 OFDM 심볼로 구성된 mini-slot을 정의하여 이를 기반으로 해당 URLLC와 같은 latency critical한 데이터에 대한 스케줄링이 이루어지도록 정의할 수 있다.

<31> 또는 상기에서 서술한 바와 같이 하나의 NR Carrier 내에서 서로 다른 SCS값

을 갖는 numerology를 TDM and/or FDM 방식으로 다중화하여 지원함으로써, 각각의 numerology 별로 정의된 slot(혹은 mini-slot) length를 기반으로 latency requirement에 맞추어 데이터를 스케줄링하는 방안도 고려되고 있다. 예를 들어 아래의 도 1과 같이 SCS가 60kHz인 경우, SCS 15kHz인 경우보다 심볼 길이가 1/4정도로 줄어들기 때문에 동일하게 7개의 OFDM 심볼로 하나의 slot을 구성할 경우, 해당 15kHz 기반의 slot length는 0.5ms이 되는 반면, 60kHz 기반의 slot length는 약 0.125ms으로 줄어들게 된다.

<32> 이처럼 NR에서는 서로 다른 SCS 혹은 서로 다른 TTI length를 정의함으로써, URLLC와 eMBB 각각의 requirement를 만족시키는 방법에 대한 논의가 진행되고 있다.

<33> Wider bandwidth operations

<34> 기존 LTE system의 경우, 임의의 LTC CC(Component Carrier)에 대한 scalable bandwidth operation을 지원하였다. 즉, 주파수 deployment scenario에 따라 임의의 LTE 사업자는 하나의 LTE CC를 구성함에 있어서, 최소 1.4 MHz부터 최대 20 MHz의 대역폭을 구성할 수 있었고, 이에 따라 임의의 normal LTE 단말은 하나의 LTE CC에 대해 20 MHz bandwidth의 송수신 capability를 지원하였다.

<35> 하지만, NR의 경우, 하나의 NR CC에서 서로 다른 송수신 bandwidth capability를 갖는 NR 단말에 대한 지원이 가능하도록 그 설계가 이루어지고 있으며, 이에 따라 아래의 도 2와 같이 임의의 NR CC에 대해 세분화된 대역폭으로 구성된 하나 이상의 bandwidth part(s)를 구성하여, 단말 별로 서로 다른 bandwidth

part configuration 및 activation을 통해 flexible한 wider bandwidth operation을 지원하도록 요구되고 있다.

<36> 이와 같이 임의의 NR CC는 하나 이상의 bandwidth part로 구분될 수 있으며, 이에 따라 각각의 단말에서는 하나 이상의 bandwidth part가 구성될 수 있으며, 임의의 단말을 위해 구성된 하나 이상의 bandwidth part(s) 중 하나 이상의 bandwidth part(s)에 대한 activation을 통해 해당 단말을 위한 상/하향 링크 무선 신호 및 무선 채널에 대한 송수신을 수행하도록 정의할 수 있다.

<37> 또한 임의의 NR CC에서 복수의 numerology(e.g. SCS, CP length, etc.)가 지원될 경우, 각각의 bandwidth part 별로 송수신을 위한 서로 다른 numerology가 설정될 수 있다.

<38> Frequency hopping for PUCCH in LTE

<39> 3GPP LTE/LTE-A 시스템에서 단말의 상향 링크 제어 정보(UCI, Uplink Control Information)을 전송하기 위한 상향 링크 무선 제어 채널인 PUCCH의 경우, 하나의 서브프레임 내에서 슬롯 단위로 frequency hopping이 이루어졌다. 이 때 해당 PUCCH의 frequency hopping 단위, 즉, hopping이 이루어지는 대역폭은 해당 UL 서브프레임의 시스템 대역폭에 의해 결정되었다. 즉, 아래의 도 3과 같이 임의의 UL 서브프레임에서의 frequency hopping은 각각의 슬롯에서 중심 주파수를 기준으로 대칭적인 형태로 이루어지도록 정의되었다.

<40> 본 발명은 NR에서 임의의 슬롯에서 PUCCH 전송을 위해 서로 다른 bandwidth

part(s) 설정이 이루어지는 단말들 간의 PUCCH 자원 간 collision을 막기 위한 PUCCH frequency hopping 적용 방법에 대해 제안한다.

<41> 상기에서 서술한 바와 같이 임의의 NR CC는 하나 이상의 bandwidth part(s)로 구성될 수 있다. 임의의 NR CC에서 bandwidth part(s)를 구성함에 있어서, 해당 bandwidth part(s)는 UE-specific하게 구성되거나, 혹은 cell-specific하게 구성될 수 있다. 즉, 아래의 도 4와 같이 각각의 단말 별로 서로 다른 bandwidth part 설정이 이루어지거나, 혹은 임의의 NR CC에 대해 모든 단말에서 동일한 bandwidth part 설정이 이루어질 수 있다. 단, 도 4는 하나의 예시일 뿐, NR CC의 구체적인 대역폭 및 bandwidth part 별 대역폭에 의해 본 발명이 제한되지는 않는다.

<42> 임의의 NR CC에 대해 bandwidth part 구성이 이루어지면, 구성된 bandwidth part 중 기지국과 단말 간 PDCCH/PDSCH 송수신을 위한 하향 링크 bandwidth part에 대한 activation 및 PUCCH/PUSCH 송수신을 위한 상향 링크 bandwidth part에 대한 activation을 통해 단말과 기지국 간 통신을 위한 상/하향 링크 bandwidth part가 설정될 수 있다.

<43> 본 발명에서는 이처럼 임의의 NR CC에서 구성된 임의의 slot에서 각각의 단말 별로 PUCCH 전송을 위해 구성되거나, 혹은 activation된 bandwidth part의 크기가 다른 경우를 고려한 PUCCH의 frequency hopping 방법에 대해 제안한다.

<44> 구체적으로 NR에서는 단말의 UCI 전송을 위해 하나의 slot에서 1~2 심볼을 통해 전송되는 short duration PUCCH와 4~14심볼을 통해 전송되는 long duration PUCCH의 2가지 형태의 PUCCH가 정의되었다. 이 때, 임의의 단말에서 UCI 전송을 위

해 하나의 슬롯 내에서 2 symbol로 구성된 short PUCCH를 사용하거나, 혹은 long duration PUCCH를 사용할 경우, frequency diversity gain을 얻기 위해 frequency hopping을 적용할 필요성이 있다. 특히, 2 symbol로 구성된 short PUCCH의 경우, 각각의 symbol 단위로 frequency hopping이 이루어질 수 있으며, long duration PUCCH의 경우에 대해서도 하나의 slot 내에서 최대 1번의 frequency hopping을 지원하도록 정의할 수 있다.

<45> 이처럼 NR에서 단일한 slot 내에서의 PUCCH에 대한 frequency hopping을 지원할 경우, 임의의 단말에서 2 symbols로 구성된 short duration PUCCH 혹은 long duration PUCCH를 통해 UCI를 전송할 때, 해당 PUCCH에 대한 구체적인 frequency hopping 방법을 정의할 필요가 있다.

<46> 구체적으로 NR에서는 UE bandwidth adaption 지원에 따라 임의의 NR CC에서 서로 다른 송수신 대역폭을 갖는 단말에 대한 지원이 이루어짐에 따라 상기에서 서술한 바와 같이 각각의 단말 별로 PUCCH 송수신을 위한 bandwidth part가 별도로 구성 및 활성화될 수 있으며, 그에 따라 LTE와 같이 해당 CC의 시스템 대역폭에 의존하는 단일한 frequency hopping rule을 적용하기 어렵다.

<47> 본 발명에서는 이를 고려한 구체적인 PUCCH frequency hopping 방법에 대해 제안한다.

<48> 방안 1: 암묵적인 호핑 대역폭 결정 방법

<49> 구체적인 frequency hopping 방법에 대한 첫번째 실시예로서, long duration

PUCCH와 short duration PUCCH에 대해 서로 다른 frequency hopping rule을 정의할 수 있다. 또는 임의의 slot 혹은 임의의 단말에서 PUCCH 전송을 위해 할당된 심볼의 수에 따라 서로 다른 frequency hopping rule을 정의할 수 있다. 즉 PUCCH duration(short vs. long) 혹은 PUCCH전송을 위해 할당된 심볼의 수 및 PUCCH 전송을 위해 설정/활성화된 bandwidth part의 대역폭 혹은 NR CC의 시스템 대역폭 등의 함수로서 임의의 단말에서 적용할 PUCCH에 대한 frequency hopping bandwidth가 정의될 수 있다. 이에 대한 한 예로써, long duration PUCCH의 경우, 임의의 단말을 위해 activation된 bandwidth part의 대역폭과 관계 없이, 해당 단말이 접속한 NR CC의 시스템 대역폭에 따라 frequency hopping 대역폭이 결정되고, short duration PUCCH의 경우, 각각의 단말 별로 상향 링크 송수신을 위해 activation된 bandwidth part의 대역폭에 따라 frequency hopping 대역폭이 결정되도록 정의할 수 있다. 또는 이와 유사하게 임의의 slot에서 임의의 단말을 위해 할당된 PUCCH의 심볼 수에 따라 해당 심볼 수가 특정 값 이상일 경우, NR CC의 시스템 대역폭에 따라 frequency hopping 대역폭이 결정되고, 그렇지 않을 경우 activation된 bandwidth part의 대역폭에 따라 frequency hopping 대역폭이 결정되도록 정의할 수 있다.

<50> 이에 대한 구체적인 일례로서, NR CC의 시스템 대역폭에 기반한 frequency hopping rule(i.e. type-1 frequency hopping)과 단말 별로 activation된 bandwidth part의 대역폭에 기반한 frequency hopping rule(i.e. type-2 frequency hopping)을 정의하고, (단, type-1 frequency hopping 및 type-2 frequency hopping과 같은 명칭에 의해 본 발명이 제한되는 것은 아님) 임의의 단말에서 UCI

전송을 위해 적용할 frequency hopping rule이 해당 UCI 전송을 위해 사용할 PUCCH의 duration에 의해 결정되도록 정의할 수 있다. 즉, 상기의 도 5와 같이 임의의 long PUCCH의 경우, type-1 frequency hopping을 적용하고, short PUCCH의 경우 type-2 frequency hopping을 적용하도록 정의하거나, 혹은 PUCCH 전송을 위해 할당된 symbol의 수에 따라 frequency hopping type을 결정하도록 정의할 수 있다. 단, 시스템 대역폭에 기반한 frequency hopping rule(즉, type-1 frequency hopping)이 적용될 경우, 해당 hopping 대역폭이 단말의 송수신 대역폭보다 큰 경우, PUCCH의 frequency hop 간 retuning gap이 정의될 수 있다. 또는 기지국/네트워크에서 UE-specific/cell-specific higher layer signalling 혹은 MAC CE signalling 혹은 L1 control signaling을 통해 각각의 단말 별로 임의의 PUCCH 전송을 위한 frequency hopping type을 설정/지시하도록 정의할 수 있다.

<51> 방안 2: 명시적인 호핑 대역폭 설정 방법

<52> 기지국/네트워크에서 각각의 단말 별로 PUCCH에 대한 frequency hopping 대역폭을 설정/지시하도록 정의할 수 있다. 이에 대한 구체적인 방법으로서, UE-specific 혹은 cell-specific higher layer signalling 각각의 단말 별로 PUCCH에 대한 frequency hopping 대역폭을 기지국/네트워크에서 직접 설정하여 시그널링해 주도록 정의할 수 있다. 단, 추가적으로 해당 PUCCH frequency hopping 설정 전에 임의의 단말에서 적용할 default frequency hopping 대역폭이나 default frequency hopping rule이 정의될 수 있으며, 해당 default frequency hopping 대역폭 혹은 default frequency hopping rule은 상기의 방안 1 및 도 5와 같은 방식으로

bandwidth part의 대역폭이나 혹은 NR CC의 대역폭에 의해 결정될 수 있다. 단, UE-specific/cell-specific higher layer signaling에 의한 PUCCH hopping 대역폭 설정 시, PUCCH duration, UCI의 종류(e.g. SR, CSI feedback or HARQ ACK/NACK feedback 등)나 payload size 등과 관계 없이 단일한 hopping 대역폭을 설정하도록 정의하거나, 혹은 상기의 방안 1과 같이 PUCCH duration이나 혹은 임의의 slot에서 PUCCH 전송을 위해 할당된 심볼 수, 또는 UCI 종류나 payload size 등에 따른 PUCCH format 별로 별도의 frequency hopping 대역폭을 설정하도록 정의할 수 있다.

<53> 기지국/네트워크에서 각각의 단말 별로 PUCCH에 대한 frequency hopping 대역폭을 설정/지시하도록 하는 또 다른 방법으로서, 기지국/네트워크에서 L1 control signaling을 통해 각각의 PUCCH 전송 별로 적용할 frequency hopping 대역폭을 지시하도록 정의할 수 있다. 구체적으로 임의의 단말을 위한 DL assignment DCI 혹은 UL grant와 같은 DCI를 통해 임의의 단말에서 HARQ ACK/NACK 피드백 혹은 CSI 피드백을 위한 PUCCH 전송이 지시될 경우, 해당 DCI를 통해 PUCCH 전송 자원 할당 정보와 함께 frequency hopping 대역폭 지시 정보가 직접 전송되도록 정의할 수 있다. 단, control overhead를 줄이기 위한 방안으로서, 해당 DCI의 PUCCH frequency hopping 대역폭 지시 정보를 통해 기지국/네트워크에서 지시 가능한 candidate value(s)를 정의하고, DCI를 통해 해당 candidate value(s) 중 하나의 값을 지시하도록 정의할 수 있다. 이 때 PUCCH frequency hopping을 위한 candidate value(s)는 bandwidth part의 대역폭 혹은 NR CC의 시스템 대역폭 등에

의해 정의되거나, 혹은 cell-specific/UE-specific higher layer signaling을 통해 기지국/네트워크에 의해 설정될 수 있다.

<54> 또는 임의의 default frequency hopping 대역폭 혹은 default frequency hopping rule을 정의하고, 해당 default frequency hopping 대역폭 혹은 default frequency hopping rule을 적용한 해당 PUCCH second hop의 frequency location(즉, 해당 PUCCH의 second hop의 PRB(s))로부터의 offset값(e.g. PRB offset값)을 해당 DL assignment DCI 혹은 UL grant 등의 L1 control signaling을 통해 기지국/네트워크에서 dynamic하게 indication해주도록 정의할 수 있다. 또는 기지국/네트워크에서 해당 offset 값을 UE-specific/group common/cell-specific higher layer signaling이나 MAC CE signaling을 통해 설정하도록 정의할 수 있다. 예를 들어, 도 6과 같이 상기의 방안 1에서 기술한 방법 중 단말 별로 설정/활성화된 bandwidth part의 대역폭에 따른 type-2 frequency hopping이 임의의 단말에서 PUCCH 전송을 위한 default frequency hopping rule로서 정의되고, 기지국/네트워크는 해당 default frequency hopping rule에 따른 해당 PUCCH의 second frequency hop으로부터의 frequency offset값을 L1 control signaling을 통해 indication해주도록 정의할 수 있다. 단, 본 발명은 구체적은 default frequency hopping rule과 관계없이 적용될 수 있다. 예를 들어, default frequency hopping bandwidth의 경우 cell-specific/UE-specific higher layer signaling을 통해 단말 별로 semi-static하게 설정되거나, 상기의 방안 1의 type-2 frequency hopping이 default hopping rule로서 정의되거나, 혹은 상기의 방안 1과 같이 PUCCH duration이나

PUCCH symbol의 수에 따라 서로 다른 default hopping rule이 정의될 수 있다. 또한 control overhead를 줄이기 위해 DCI를 통해 indication할 수 있는 해당 hopping offset값들의 candidate values들이 상기에서 서술한 L1 control signaling을 통한 frequency hopping 대역폭 지시 방법과 동일한 방법으로 정의될 수 있다.

<55> 방안 3: frequency hop 별로 주파수 자원(e.g. PRB)를 분리해서 할당하는 방법

<56> 임의의 slot 내에서 혹은 inter-slot 간 PUCCH에 대한 frequency hopping이 적용될 경우, 기지국/네트워크에서 각각의 frequency hop 별로 각각 별도의 주파수 자원 할당 정보(e.g. PRB 할당 정보)를 구성하여 이를 단말에게 직접 설정/지시하도록 정의할 수 있다. 예를 들어, 상기의 그림 5, 혹은 그림 6과 같이 임의의 단말에서 하나의 UL 슬롯을 통해 PUCCH 전송이 설정/지시되고, frequency hopping 적용될 경우, 해당 PUCCH의 first frequency hop을 위한 주파수 자원 할당 정보(e.g. PRB 할당 정보)와 해당 PUCCH의 second frequency hop을 위한 주파수 자원 할당 정보(e.g. PRB 할당 정보)를 각각 별도로 설정하여 이를 해당 단말에 signaling해주도록 정의할 수 있다.

<57> 즉, 기지국/네트워크에서 단말의 PUCCH 전송을 위한 frequency 자원 할당 정보(e.g. PRB 할당 정보)를 시그널링 하는 방법에 있어서, 해당 PUCCH 전송의 first frequency hop을 위한 frequency 자원 할당 정보(e.g. PRB 할당 정보)와 해당 PUCCH 전송의 second frequency hop을 위한 frequency 자원 할당 정보(e.g. PRB 할

당 정보)를 별도로 구성하여, 이를 UE-specific/group common/cell-specific higher layer signaling이나 MAC CE signaling 혹은 L1 control signaling을 통해 해당 단말에 전송하도록 정의할 수 있다.

<58> 추가적으로 기지국/네트워크에서 cell-specific/UE-specific higher layer signalling, MAC CE signalling 혹은 L1 control signaling을 통해 PUCCH에 대한 frequency hopping 여부를 enabling하거나, disabling하도록 정의할 수 있다.

<59> 또한 상기에서 서술한 frequency hopping 방법들의 조합으로서 PUCCH에 대한 frequency hopping 방법이 정의되는 경우도 본 발명의 범주에 포함될 수 있으며, PUCCH 외에 PUSCH 혹은 SRS 혹은 PRACH 등 모든 상향 링크 물리 채널/신호에 대해 본 발명에서 제안한 frequency hopping 방법이 적용될 수 있으며, 이는 본 발명의 범주에 포함된다.

<60> 도 7은 또 다른 실시예에 의한 기지국(1000)의 구성을 보여주는 도면이다.

<61> 도 7을 참조하면, 또 다른 실시예에 의한 기지국(1000)은 제어부(1010)과 송신부(1020), 수신부(1030)를 포함한다.

<62> 제어부(1010)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서 기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것에 따른 전반적인 기지국(1000)의 동작을 제어한다.

<63> 송신부(1020)와 수신부(1030)는 전술한 본 발명을 수행하기에 필요한 신호나

메시지, 데이터를 단말과 송수신하는데 사용된다.

<64> 도 8은 또 다른 실시예에 의한 사용자 단말(1100)의 구성을 보여주는 도면이다.

<65> 도 8을 참조하면, 또 다른 실시예에 의한 사용자 단말(1100)은 수신부(1110) 및 제어부(1120), 송신부(1130)를 포함한다.

<66> 수신부(1110)는 기지국으로부터 하향링크 제어 정보 및 데이터, 메시지를 해당 채널을 통해 수신한다.

<67> 또한 제어부(1120)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서 기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것에 따른 전반적인 사용자 단말(1100)의 동작을 제어한다.

<68> 송신부(1130)는 기지국에 상향링크 제어 정보 및 데이터, 메시지를 해당 채널을 통해 전송한다.

<69> 전술한 실시예에서 언급한 표준내용 또는 표준문서들은 명세서의 설명을 간략하게 하기 위해 생략한 것으로 본 명세서의 일부를 구성한다. 따라서, 위 표준내용 및 표준문서들의 일부의 내용을 본 명세서에 추가하거나 청구범위에 기재하는 것은 본 발명의 범위에 해당하는 것으로 해석되어야 한다.

<70> 이상의 설명은 본 발명의 기술 사상을 예시적으로 설명한 것에 불과한 것으

로서, 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자라면 본 발명의 본질적인 특성에서 벗어나지 않는 범위에서 다양한 수정 및 변형이 가능할 것이다. 따라서, 본 발명에 개시된 실시예들은 본 발명의 기술 사상을 한정하기 위한 것이 아니라 설명하기 위한 것이고, 이러한 실시예에 의하여 본 발명의 기술사상의 범위가 한정되는 것은 아니다. 본 발명의 보호 범위는 아래의 청구범위에 의하여 해석되어야 하며, 그와 동등한 범위 내에 있는 모든 기술 사상은 본 발명의 권리범위에 포함되는 것으로 해석되어야 할 것이다.

【특허청구범위】

【청구항 1】

차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서,

기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것을 특징으로 하는 방법.

제출 일자 : 2017-08-11

【요약서】

【요약】

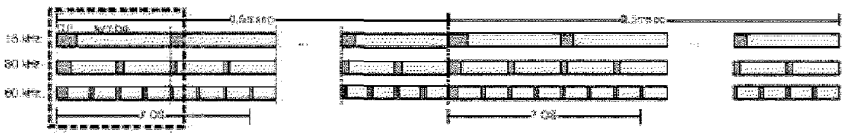
본 발명은 차세대/5G 무선 액세스망에서 상향 링크 제어 채널 송수신을 위한 frequency hopping에 관한 것으로서, 일 실시예는 차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서, 기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것을 특징으로 하는 방법을 제공한다.

【대표도】

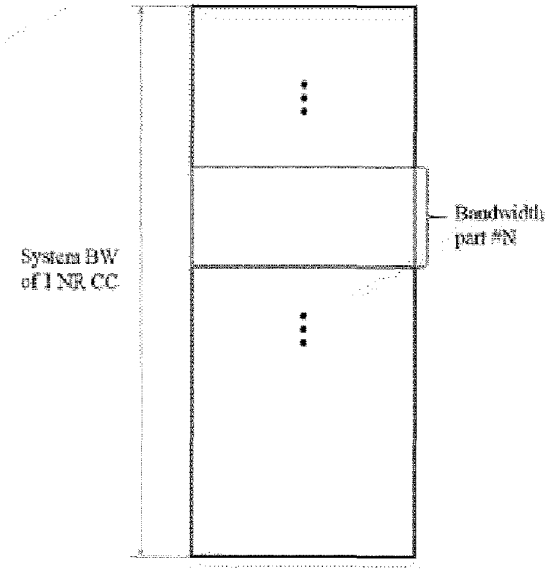
도 3

【도면】

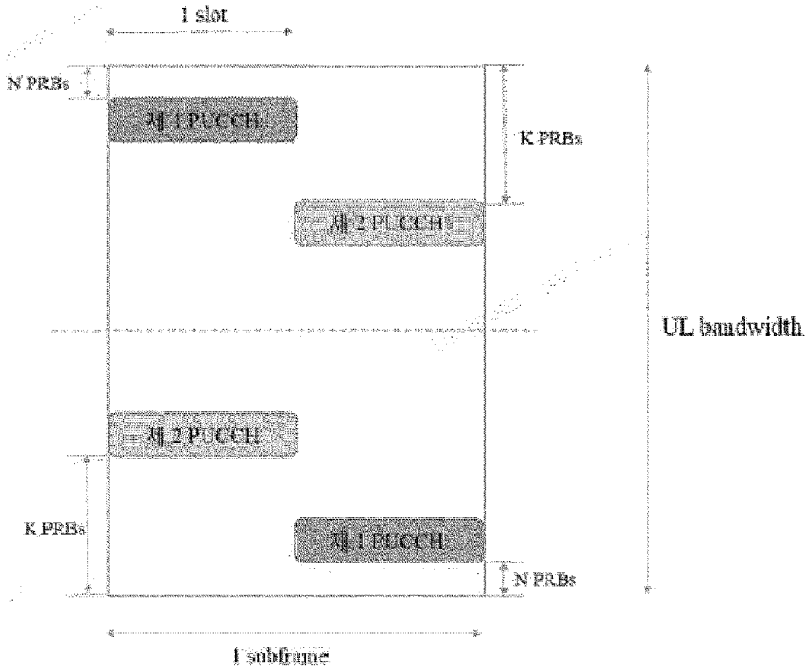
【도 1】



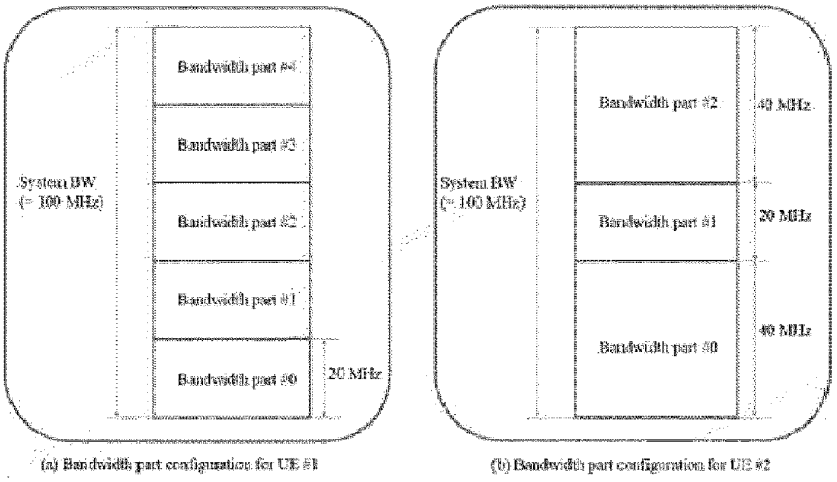
【도 2】



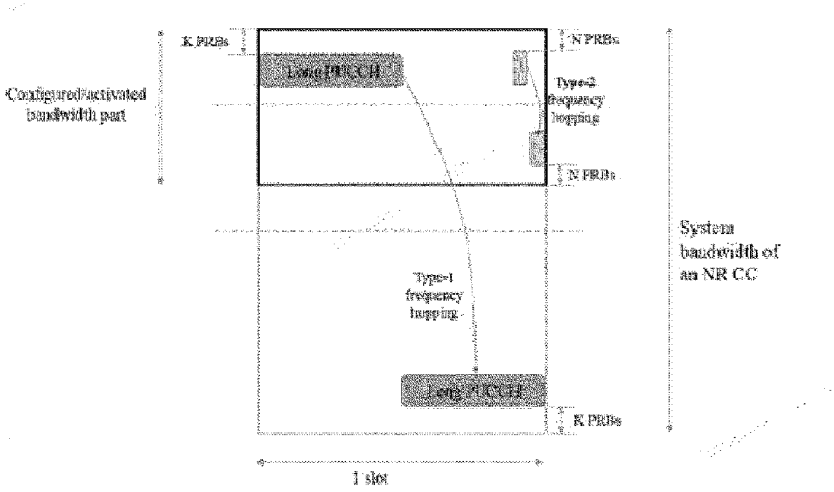
【도 3】


1 slot
N PRBs
제 1 PUCCH
K PRBs
제 2 PUCCH
UL bandwidth
제 2 PUCCH
K PRBs
제 1 PUCCH
N PRBs
1 subframe

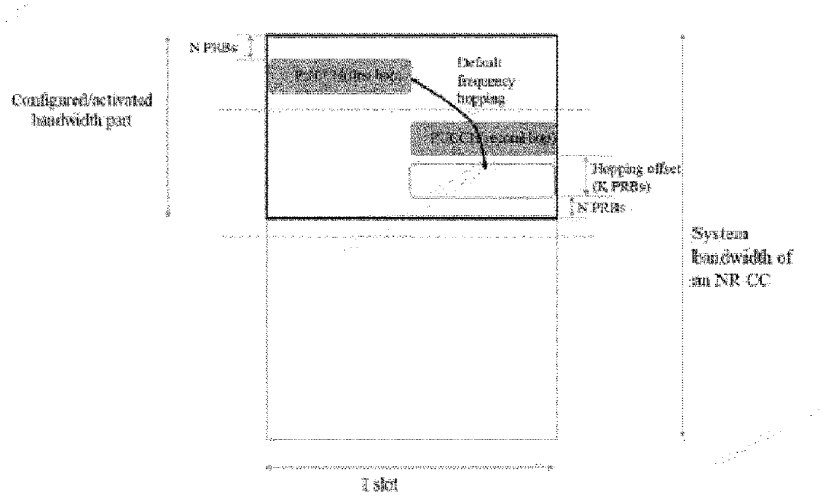
【도 4】


Bandwidth part #4
Bandwidth part #3
Bandwidth part #2
Bandwidth part #1
Bandwidth part #0
System BW
(= 100 MHz)
20 MHz
(a) Bandwidth part configuration for UE #1
Bandwidth part #2
Bandwidth part #1
Bandwidth part #0
System BW
(= 100 MHz)
40 MHz
20 MHz
40 MHz
(b) Bandwidth part configuration for UE #2

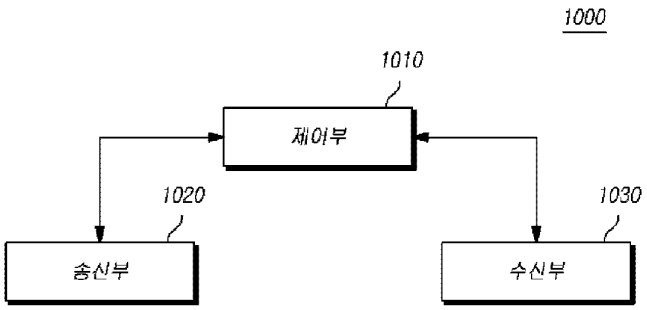
【도 5】


K PRBs
Long PUCCH
N PRBs
Type-2 frequency hopping
N PRBs
Configured/activated bandwidth part
System bandwidth of an NR CC
Type-1 frequency hopping
Long PUCCH
K PRBs
1 slot

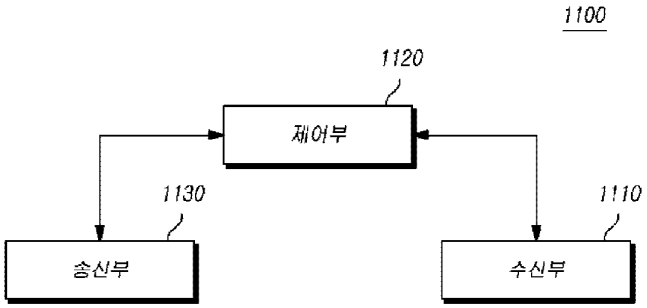
【도 6】


N PRBs
Default frequency hopping
Hopping offset (K PRBs)
N PRBs
Configured/activated bandwidth part
System bandwidth of an NR CC
1 slot

【도 7】


1000
1010
제어부
1020
송신부
1030
수신부

【도 8】


1100
1120
제어부
1130
송신부
1110
수신부

대한민국특허청
KOREAN INTELLECTUAL PROPERTY OFFICE

별첨 사본은 아래 출원의 원본과 동일함을 증명함.

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Applicant(s) KT Corporation

2018년 09월 25일

특 허 청
COMMISSIONER

제출 일자 : 2017-07-28

【서지사항】

【서류명】 특허출원서

【출원구분】 특허출원

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【포괄위임등록번호】 2011-023060-3

【발명의 국문명칭】 차세대 무선망을 위한 주파수 호핑 방법 및 그 장치

【발명의 영문명칭】 Apparatus and method of frequency hopping for new radio

【발명자】

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【국적】 KR

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제출 일자 : 2017-07-28

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【국적】 KR

【출원언어】 국어

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 김은구 (서명 또는 인)

대리인 송해모 (서명 또는 인)

【수수료】

【출원료】	0	면	46,000 원
【가산출원료】	26	면	0 원
【우선권주장료】	0	건	0 원
【심사청구료】	0	항	0 원
【합계】	46,000 원		

【발명의 설명】

【발명의 명칭】

차세대 무선망을 위한 주파수 호핑 방법 및 그 장치{Apparatus and method of frequency hopping for new radio}

【기술분야】

<1> 본 발명은 차세대/5G 무선 액세스망(이하 본 발명에서는 NR[New Radio]라 지칭하도록 함.)에서 상향 링크 제어 채널 송수신을 위한 frequency hopping 방안을 제안한다.

【발명의 내용】

【과제의 해결 수단】

<2> 본 발명의 일 실시예는 차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서, 기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것을 특징으로 하는 방법을 제공한다.

【도면의 간단한 설명】

<3> 도 1은 다른 SCS간의 symbol level alignment의 예를 도시한 도면이다.

도 2는 Bandwidth part에 대한 개념적 예시를 도시한 도면이다.

도 3은 LTE/LTE-A 시스템에서 정의된 PUCCH frequency hopping의 일례를 도시한 도면이다.

도 4는 UE-specific Bandwidth part 설정에 대한 개념적 예시를 도시한 도면이다.

도 5는 PUCCH duration에 기반한 frequency hopping rule의 예를 도시한 도면이다.

도 6은 DCI를 통한 hopping offset indication 방법의 일례를 도시한 도면이다.

도 7은 또 다른 실시예에 의한 기지국의 구성을 보여주는 도면이다.

도 8은 또 다른 실시예에 의한 사용자 단말의 구성을 보여주는 도면이다.

【발명을 실시하기 위한 구체적인 내용】

<4> 이하, 본 발명의 일부 실시예들을 예시적인 도면을 통해 상세하게 설명한다. 각 도면의 구성요소들에 참조부호를 부가함에 있어서, 동일한 구성요소들에 대해서는 비록 다른 도면상에 표시되더라도 가능한 한 동일한 부호를 가지도록 하고 있음에 유의해야 한다. 또한, 본 발명을 설명함에 있어, 관련된 공지 구성 또는 기능에 대한 구체적인 설명이 본 발명의 요지를 흐릴 수 있다고 판단되는 경우에는 그 상세한 설명은 생략한다.

<5> 본 명세서에서 무선 통신 시스템은 음성, 패킷 데이터 등과 같은 다양한 통신 서비스를 제공하기 위한 시스템을 의미한다. 무선 통신 시스템은 사용자 단말(User Equipment, UE) 및 기지국(Base Station, BS)을 포함한다.

<6> 사용자 단말은 무선 통신에서의 단말을 의미하는 포괄적 개념으로서, WCDMA,

LTE, HSPA 및 IMT-2020(5G 또는 New Radio) 등에서의 UE(User Equipment)는 물론, GSM에서의 MS(Mobile Station), UT(User Terminal), SS(Subscriber Station), 무선 기기(wireless device) 등을 모두 포함하는 개념으로 해석되어야 할 것이다.

<7> 기지국 또는 셀(Cell)은 일반적으로 사용자 단말과 통신하는 지점(station)을 말하며, 노드-B(Node-B), eNB(evolved Node-B), gNB(gNode-B), LPN(Low Power Node), 섹터(Sector), 싸이트(Site), 다양한 형태의 안테나, BTS(Base Transceiver System), 액세스 포인트(Access Point), 포인트(예를 들어, 송신포인트, 수신포인트, 송수신포인트), 릴레이 노드(Relay Node), 메가 셀, 매크로 셀, 마이크로 셀, 피코 셀, 펨토 셀, RRH(Remote Radio Head), RU(Radio Unit), 스몰 셀(small cell) 등 다양한 커버리지 영역을 모두 포괄하는 의미이다.

<8> 앞서 나열된 다양한 셀은 각 셀을 제어하는 기지국이 존재하므로 기지국은 두 가지 의미로 해석될 수 있다. 1) 무선 영역과 관련하여 메가 셀, 매크로 셀, 마이크로 셀, 피코 셀, 펨토 셀, 스몰 셀(small cell)을 제공하는 장치 그 자체이거나, 2) 무선 영역 그 자체를 지시할 수 있다. 1)에서 소정의 무선 영역을 제공하는 장치들이 동일한 개체에 의해 제어되거나 무선 영역을 협업으로 구성하도록 상호작용하는 모든 장치들을 모두 기지국으로 지시한다. 무선 영역의 구성 방식에 따라 포인트, 송수신 포인트, 송신 포인트, 수신 포인트 등은 기지국의 일 실시예가 된다. 2)에서 사용자 단말의 관점 또는 이웃하는 기지국의 입장에서 신호를 수신하거나 송신하게 되는 무선 영역 그 자체를 기지국으로 지시할 수 있다.

<9> 본 명세서에서 셀(Cell)은 송수신 포인트로부터 전송되는 신호의 커버리지

또는 송수신 포인트(transmission point 또는 transmission/reception point)로부터 전송되는 신호의 커버리지를 가지는 요소 반송파(component carrier), 그 송수신 포인트 자체를 의미할 수 있다.

<10> 본 명세서에서 사용자 단말과 기지국은, 본 발명에서 기술되는 기술 또는 기술적 사상을 구현하는데 사용되는 두 가지(Uplink 또는 Downlink) 송수신 주체로 포괄적인 의미로 사용되며 특정하게 지칭되는 용어 또는 단어에 의해 한정되지 않는다.

<11> 여기서, 상향링크(Uplink, UL, 또는 업링크)는 사용자 단말에 의해 기지국으로 데이터를 송수신하는 방식을 의미하며, 하향링크(Downlink, DL, 또는 다운링크)는 기지국에 의해 사용자 단말로 데이터를 송수신하는 방식을 의미한다.

<12> 상향링크 전송 및 하향링크 전송은 서로 다른 시간을 사용하여 전송되는 TDD(Time Division Duplex) 방식이 사용될 수 있고, 서로 다른 주파수를 사용하여 전송되는 FDD(Frequency Division Duplex) 방식, TDD 방식과 FDD 방식의 혼용 방식이 사용될 수 있다.

<13> 또한, 무선 통신 시스템에서는 하나의 반송파 또는 반송파 쌍을 기준으로 상향링크와 하향링크를 구성하여 규격을 구성한다.

<14> 상향링크와 하향링크는, PDCCH(Physical Downlink Control CHannel), PUCCH(Physical Uplink Control CHannel) 등과 같은 제어 채널을 통하여 제어 정보를 전송하고, PDSCH(Physical Downlink Shared CHannel), PUSCH(Physical Uplink

Shared CHannel) 등과 같은 데이터 채널로 구성되어 데이터를 전송한다.

<15> 하향링크(downlink)는 다중 송수신 포인트에서 단말로의 통신 또는 통신 경로를 의미할 수 있으며, 상향링크(uplink)는 단말에서 다중 송수신 포인트로의 통신 또는 통신 경로를 의미할 수 있다. 이때, 하향링크에서 송신기는 다중 송수신 포인트의 일부분일 수 있고, 수신기는 단말의 일부분일 수 있다. 또한, 상향링크에서 송신기는 단말의 일부분일 수 있고, 수신기는 다중 송수신 포인트의 일부분일 수 있다.

<16> 이하에서는 PUCCH, PUSCH, PDCCH 및 PDSCH 등과 같은 채널을 통해 신호가 송수신되는 상황을 'PUCCH, PUSCH, PDCCH 및 PDSCH를 전송, 수신한다'는 형태로 표기하기도 한다.

<17> 한편, 이하에서 기재하는 상위계층 시그널링(High Layer Signaling)은 RRC 파라미터를 포함하는 RRC 정보를 전송하는 RRC 시그널링을 포함한다.

<18> 기지국은 단말들로 하향링크 전송을 수행한다. 기지국은 유니캐스트 전송(unicast transmission)을 위한 주 물리 채널인 하향링크 데이터 채널의 수신에 필요한 스케줄링 등의 하향링크 제어 정보 및 상향링크 데이터 채널에서의 전송을 위한 스케줄링 승인 정보를 전송하기 위한 물리 하향링크 제어 채널을 전송할 수 있다. 이하에서는, 각 채널을 통해 신호가 송수신 되는 것을 해당 채널이 송수신되는 형태로 기재하기로 한다.

<19> 무선 통신 시스템에서 적용되는 다중 접속 기법에는 제한이 없다. TDMA(Time

Division Multiple Access), FDMA(Frequency Division Multiple Access), CDMA(Code Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), NOMA(Non-Orthogonal Multiple Access), OFDM-TDMA, OFDM-FDMA, OFDM-CDMA와 같은 다양한 다중 접속 기법을 사용할 수 있다. 여기서, NOMA는 SCMA(Sparse Code Multiple Access)와 LDS(Low Density Spreading) 등을 포함한다.

<20> 본 발명의 일 실시예는 GSM, WCDMA, HSPA를 거쳐 LTE/LTE-Advanced, IMT-2020으로 진화하는 비동기 무선 통신과, CDMA, CDMA-2000 및 UMB로 진화하는 동기식 무선 통신 분야 등의 자원 할당에 적용될 수 있다.

<21> 본 명세서에서 MTC(Machine Type Communication) 단말은 low cost(또는 low complexity)를 지원하는 단말 또는 coverage enhancement를 지원하는 단말 등을 의미할 수 있다. 또는 본 명세서에서 MTC 단말은 low cost(또는 low complexity) 및/또는 coverage enhancement를 지원하기 위한 특정 카테고리로 정의된 단말을 의미할 수 있다.

<22> 다시 말해 본 명세서에서 MTC 단말은 LTE 기반의 MTC 관련 동작을 수행하는 새롭게 정의된 3GPP Release-13 low cost(또는 low complexity) UE category/type을 의미할 수 있다. 또는 본 명세서에서 MTC 단말은 기존의 LTE coverage 대비 향상된 coverage를 지원하거나, 혹은 저전력 소모를 지원하는 기존의 3GPP Release-12 이하에서 정의된 UE category/type, 혹은 새롭게 정의된 Release-13 low cost (또는 low complexity) UE category/type을 의미할 수 있다. 또는, Release-14에서 정의된 further Enhanced MTC 단말을 의미할 수도 있다.

<23> 본 명세서에서 NB-IoT(NarrowBand Internet of Things) 단말은 셀룰러 IoT를 위한 무선 액세스를 지원하는 단말을 의미한다. NB-IoT 기술의 목적은 향상된 인도어(Indoor) 커버리지, 대규모의 저속 단말에 대한 지원, 저지연민감도, 초저가 단말 비용, 낮은 전력 소모, 그리고 최적화된 네트워크 구조를 포함한다.

<24> 3GPP에서 최근 논의 중인 NR(New Radio)에서 대표적인 사용 시나리오(usage scenario)로서, eMBB(enhanced Mobile BroadBand), mMTC(massive Machine Type Communication), URLLC(Ultra Reliable and Low Latency Communication)가 제기되고 있다.

<25> 본 명세서에서 NR(New Radio)과 관련한 주파수, 프레임, 서브프레임, 자원, 자원블럭, 영역(region), 밴드, 서브밴드, 제어채널, 데이터채널, 동기신호, 각종 참조신호, 각종 신호, 각종 메시지는 과거 또는 현재 사용되는 의미 또는 장래 사용되는 다양한 의미로 해석될 수 있다.

<26> NR(New Radio)

<27> 3GPP는 최근 차세대/5G 무선 액세스 기술에 대한 연구를 위한 study item인 "Study on New Radio Access Technology"를 승인하고, 이를 기반으로 RAN WG1에서는 각각 NR(New Radio)를 위한 frame structure, channel coding & modulation, waveform & multiple access scheme 등에 대한 논의가 시작되었다. NR은 LTE 대비 향상된 데이터 전송율 뿐 아니라, 세분화되고 구체화된 usage scenario 별로 요구되는 다양한 QoS requirements를 만족시킬 수 있는 설계가 이루어지도록 요구되고

있다. 특히 NR의 대표적 usage scenario로서 eMBB(enhancement Mobile BroadBand), mMTC(massive MTC) 및 URLLC(Ultra Reliable and Low Latency Communications)가 정의되었으며, 각각의 usage scenario별 requirements를 만족하기 위한 방법으로서 LTE 대비 flexible한 frame structure 설계가 요구되고 있다. 각각의 usage scenario는 data rates, latency, reliability, coverage 등에 대한 requirements가 서로 상이하기 때문에 임의의 NR 시스템을 구성하는 주파수 대역을 통해 각각의 usage scenario 별 requirements를 효율적으로 만족시키기 위한 방법으로서 서로 다른 numerology(e.g. subcarrier spacing, subframe, TTI, etc.) 기반의 무선 자원 유닛(unit)을 효율적으로 multiplexing하는 방안에 대한 필요성이 제기되고 있다.

<28> 이를 위한 한 방법으로서, 서로 다른 subcarrier spacing값을 갖는 numerology에 대해 하나 혹은 복수의 NR component carrier(s)를 통해 TDM, FDM 혹은 TDM/FDM 기반으로 다중화하여 지원하는 방법 및 time domain에서의 스케줄링 단위를 구성함에 있어서 하나 이상의 time unit을 지원하는 방안에 대한 논의가 이루어졌다. 이와 관련하여 NR에서는 time domain structure의 한 종류로서 subframe에 대한 정의가 이루어졌으며, 해당 subframe duration을 정의하기 위한 reference numerology로서 LTE와 동일한 15kHz SCS(Sub-Carrier Spacing) 기반 normal CP overhead의 14개의 OFDM symbols로 구성된 단일한 subframe duration을 정의하기로 결정하였다. 이에 따라 NR에서 subframe은 1ms의 time duration을 가진다. 단, LTE와 달리 NR의 subframe은 절대적인 reference time duration으로서, 실제 상/하향

링크 데이터 스케줄링의 기반의 되는 time unit으로서 slot 및 mini-slot이 정의될 수 있다. 이 경우, 해당 slot을 구성하는 OFDM 심볼의 개수, y값은 up to 60kHz의 SCS값을 갖는 numerology에 대해 y=7 and 14으로 정의되고, 60kHz보다 큰 SCS값을 갖는 numerology의 경우 y=14의 값을 갖도록 결정되었다.

<29> 이에 따라 임의의 slot은 7개 혹은 14개의 심볼로 구성될 수 있으며, 또한 해당 slot의 transmission direction에 따라 모든 심볼이 DL transmission을 위해 이용되거나, 혹은 모든 심볼이 UL transmission을 위해 이용되거나, 혹은 DL portion + (gap) + UL portion의 형태로 이용될 수 있다.

<30> 또한 임의의 numerology(혹은 SCS)에서 해당 slot보다 적은 수의 심볼로 구성된 mini-slot이 정의되어 이를 기반으로 상/하향 링크 데이터 송수신을 위한 짧은 길이의 time-domain scheduling interval이 설정되거나, 혹은 slot aggregation을 통해 상/하향 링크 데이터 송수신을 위한 긴 길이의 time-domain scheduling interval이 구성될 수 있다. 특히 URLLC와 같이 latency critical한 데이터에 대한 송수신의 경우, 15kHz와 같이 SCS값이 작은 numerology 기반의 frame 구조에서 정의된 0.5ms(7 symbols) 혹은 1ms(14 symbols) 기반의 slot 단위로 스케줄링이 이루어질 경우, latency requirement를 만족시키기 힘들 수 있기 때문에 이를 위해서 해당 slot보다 적은 수의 OFDM 심볼로 구성된 mini-slot을 정의하여 이를 기반으로 해당 URLLC와 같은 latency critical한 데이터에 대한 스케줄링이 이루어지도록 정의할 수 있다.

<31> 또는 상기에서 서술한 바와 같이 하나의 NR Carrier 내에서 서로 다른 SCS값

을 갖는 numerology를 TDM and/or FDM 방식으로 다중화하여 지원함으로써, 각각의 numerology 별로 정의된 slot(혹은 mini-slot) length를 기반으로 latency requirement에 맞추어 데이터를 스케줄링하는 방안도 고려되고 있다. 예를 들어 아래의 도 1과 같이 SCS가 60kHz인 경우, SCS 15kHz인 경우보다 심볼 길이가 1/4정도로 줄어들기 때문에 동일하게 7개의 OFDM 심볼로 하나의 slot을 구성할 경우, 해당 15kHz 기반의 slot length는 0.5ms이 되는 반면, 60kHz 기반의 slot length는 약 0.125ms으로 줄어들게 된다.

<32> 이처럼 NR에서는 서로 다른 SCS 혹은 서로 다른 TTI length를 정의함으로써, URLLC와 eMBB 각각의 requirement를 만족시키는 방법에 대한 논의가 진행되고 있다.

<33> Wider bandwidth operations

<34> 기존 LTE system의 경우, 임의의 LTC CC(Component Carrier)에 대한 scalable bandwidth operation을 지원하였다. 즉, 주파수 deployment scenario에 따라 임의의 LTE 사업자는 하나의 LTE CC를 구성함에 있어서, 최소 1.4 MHz부터 최대 20 MHz의 대역폭을 구성할 수 있었고, 이에 따라 임의의 normal LTE 단말은 하나의 LTE CC에 대해 20 MHz bandwidth의 송수신 capability를 지원하였다.

<35> 하지만, NR의 경우, 하나의 NR CC에서 서로 다른 송수신 bandwidth capability를 갖는 NR 단말에 대한 지원이 가능하도록 그 설계가 이루어지고 있으며, 이에 따라 아래의 도 2와 같이 임의의 NR CC에 대해 세분화된 대역폭으로 구성된 하나 이상의 bandwidth part(s)를 구성하여, 단말 별로 서로 다른 bandwidth

part configuration 및 activation을 통해 flexible한 wider bandwidth operation을 지원하도록 요구되고 있다.

<36> 이와 같이 임의의 NR CC는 하나 이상의 bandwidth part로 구분될 수 있으며, 이에 따라 각각의 단말에서는 하나 이상의 bandwidth part가 구성될 수 있으며, 임의의 단말을 위해 구성된 하나 이상의 bandwidth part(s) 중 하나 이상의 bandwidth part(s)에 대한 activation을 통해 해당 단말을 위한 상/하향 링크 무선 신호 및 무선 채널에 대한 송수신을 수행하도록 정의할 수 있다.

<37> 또한 임의의 NR CC에서 복수의 numerology(e.g. SCS, CP length, etc.)가 지원될 경우, 각각의 bandwidth part 별로 송수신을 위한 서로 다른 numerology가 설정될 수 있다.

<38> Frequency hopping for PUCCH in LTE

<39> 3GPP LTE/LTE-A 시스템에서 단말의 상향 링크 제어 정보(UCI, Uplink Control Information)을 전송하기 위한 상향 링크 무선 제어 채널인 PUCCH의 경우, 하나의 서브프레임 내에서 슬롯 단위로 frequency hopping이 이루어졌다. 이 때 해당 PUCCH의 frequency hopping 단위, 즉, hopping이 이루어지는 대역폭은 해당 UL 서브프레임의 시스템 대역폭에 의해 결정되었다. 즉, 아래의 도 3과 같이 임의의 UL 서브프레임에서의 frequency hopping은 각각의 슬롯에서 중심 주파수를 기준으로 대칭적인 형태로 이루어지도록 정의되었다.

<40> 본 발명은 NR에서 임의의 슬롯에서 PUCCH 전송을 위해 서로 다른 bandwidth

part(s) 설정이 이루어지는 단말들 간의 PUCCH 자원 간 collision을 막기 위한 PUCCH frequency hopping 적용 방법에 대해 제안한다.

<41> 상기에서 서술한 바와 같이 임의의 NR CC는 하나 이상의 bandwidth part(s)로 구성될 수 있다. 임의의 NR CC에서 bandwidth part(s)를 구성함에 있어서, 해당 bandwidth part(s)는 UE-specific하게 구성되거나, 혹은 cell-specific하게 구성될 수 있다. 즉, 아래의 도 4와 같이 각각의 단말 별로 서로 다른 bandwidth part 설정이 이루어지거나, 혹은 임의의 NR CC에 대해 모든 단말에서 동일한 bandwidth part 설정이 이루어질 수 있다. 단, 도 4는 하나의 예시일 뿐, NR CC의 구체적인 대역폭 및 bandwidth part 별 대역폭에 의해 본 발명이 제한되지는 않는다.

<42> 임의의 NR CC에 대해 bandwidth part 구성이 이루어지면, 구성된 bandwidth part 중 기지국과 단말 간 PDCCH/PDSCH 송수신을 위한 하향 링크 bandwidth part에 대한 activation 및 PUCCH/PUSCH 송수신을 위한 상향 링크 bandwidth part에 대한 activation을 통해 단말과 기지국 간 통신을 위한 상/하향 링크 bandwidth part가 설정될 수 있다.

<43> 본 발명에서는 이처럼 임의의 NR CC에서 구성된 임의의 slot에서 각각의 단말 별로 PUCCH 전송을 위해 구성되거나, 혹은 activation된 bandwidth part의 크기가 다른 경우를 고려한 PUCCH의 frequency hopping 방법에 대해 제안한다.

<44> 구체적으로 NR에서는 단말의 UCI 전송을 위해 하나의 slot에서 1~2 심볼을 통해 전송되는 short duration PUCCH와 4~14심볼을 통해 전송되는 long duration PUCCH의 2가지 형태의 PUCCH가 정의되었다. 이 때, 임의의 단말에서 UCI 전송을 위

해 하나의 슬롯 내에서 2 symbol로 구성된 short PUCCH를 사용하거나, 혹은 long duration PUCCH를 사용할 경우, frequency diversity gain을 얻기 위해 frequency hopping을 적용할 필요성이 있다. 특히, 2 symbol로 구성된 short PUCCH의 경우, 각각의 symbol 단위로 frequency hopping이 이루어질 수 있으며, long duration PUCCH의 경우에 대해서도 하나의 slot 내에서 최대 1번의 frequency hopping을 지원하도록 정의할 수 있다.

<45> 이처럼 NR에서 단일한 slot 내에서의 PUCCH에 대한 frequency hopping을 지원할 경우, 임의의 단말에서 2 symbols로 구성된 short duration PUCCH 혹은 long duration PUCCH를 통해 UCI를 전송할 때, 해당 PUCCH에 대한 구체적인 frequency hopping 방법을 정의할 필요가 있다.

<46> 구체적으로 NR에서는 UE bandwidth adaption 지원에 따라 임의의 NR CC에서 서로 다른 송수신 대역폭을 갖는 단말에 대한 지원이 이루어짐에 따라 상기에서 서술한 바와 같이 각각의 단말 별로 PUCCH 송수신을 위한 bandwidth part가 별도로 구성 및 활성화될 수 있으며, 그에 따라 LTE와 같이 해당 CC의 시스템 대역폭에 의존하는 단일한 frequency hopping rule을 적용하기 어렵다.

<47> 본 발명에서는 이를 고려한 구체적인 PUCCH frequency hopping 방법에 대해 제안한다.

<48> 방안 1: 암묵적인 호핑 대역폭 결정 방법

<49> 구체적인 frequency hopping 방법에 대한 첫번째 실시예로서, long duration

PUCCH와 short duration PUCCH에 대해 서로 다른 frequency hopping rule을 정의할 수 있다. 또는 임의의 slot 혹은 임의의 단말에서 PUCCH 전송을 위해 할당된 심볼의 수에 따라 서로 다른 frequency hopping rule을 정의할 수 있다. 즉 PUCCH duration(short vs. long) 혹은 PUCCH전송을 위해 할당된 심볼의 수 및 PUCCH 전송을 위해 설정/활성화된 bandwidth part의 대역폭 혹은 NR CC의 시스템 대역폭 등의 함수로서 임의의 단말에서 적용할 PUCCH에 대한 frequency hopping bandwidth가 정의될 수 있다. 이에 대한 한 예로써, long duration PUCCH의 경우, 임의의 단말을 위해 activation된 bandwidth part의 대역폭과 관계 없이, 해당 단말이 접속한 NR CC의 시스템 대역폭에 따라 frequency hopping 대역폭이 결정되고, short duration PUCCH의 경우, 각각의 단말 별로 상향 링크 송수신을 위해 activation된 bandwidth part의 대역폭에 따라 frequency hopping 대역폭이 결정되도록 정의할 수 있다. 또는 이와 유사하게 임의의 slot에서 임의의 단말을 위해 할당된 PUCCH의 심볼 수에 따라 해당 심볼 수가 특정 값 이상일 경우, NR CC의 시스템 대역폭에 따라 frequency hopping 대역폭이 결정되고, 그렇지 않을 경우 activation된 bandwidth part의 대역폭에 따라 frequency hopping 대역폭이 결정되도록 정의할 수 있다.

<50> 이에 대한 구체적인 일례로서, NR CC의 시스템 대역폭에 기반한 frequency hopping rule(i.e. type-1 frequency hopping)과 단말 별로 activation된 bandwidth part의 대역폭에 기반한 frequency hopping rule(i.e. type-2 frequency hopping)을 정의하고, (단, type-1 frequency hopping 및 type-2 frequency hopping과 같은 명칭에 의해 본 발명이 제한되는 것은 아님) 임의의 단말에서 UCI

전송을 위해 적용할 frequency hopping rule이 해당 UCI 전송을 위해 사용할 PUCCH의 duration에 의해 결정되도록 정의할 수 있다. 즉, 상기의 도 5와 같이 임의의 long PUCCH의 경우, type-1 frequency hopping을 적용하고, short PUCCH의 경우 type-2 frequency hopping을 적용하도록 정의하거나, 혹은 PUCCH 전송을 위해 할당된 symbol의 수에 따라 frequency hopping type을 결정하도록 정의할 수 있다. 단, 시스템 대역폭에 기반한 frequency hopping rule(즉, type-1 frequency hopping)이 적용될 경우, 해당 hopping 대역폭이 단말의 송수신 대역폭보다 큰 경우, PUCCH의 frequency hop 간 retuning gap이 정의될 수 있다. 또는 기지국/네트워크에서 UE-specific/cell-specific higher layer signalling 혹은 MAC CE signalling 혹은 L1 control signaling을 통해 각각의 단말 별로 임의의 PUCCH 전송을 위한 frequency hopping type을 설정/지시하도록 정의할 수 있다.

<51> 방안 2: 명시적인 호핑 대역폭 설정 방법

<52> 기지국/네트워크에서 각각의 단말 별로 PUCCH에 대한 frequency hopping 대역폭을 설정/지시하도록 정의할 수 있다. 이에 대한 구체적인 방법으로서, UE-specific 혹은 cell-specific higher layer signalling 각각의 단말 별로 PUCCH에 대한 frequency hopping 대역폭을 기지국/네트워크에서 직접 설정하여 시그널링해 주도록 정의할 수 있다. 단, 추가적으로 해당 PUCCH frequency hopping 설정 전에 임의의 단말에서 적용할 default frequency hopping 대역폭이나 default frequency hopping rule이 정의될 수 있으며, 해당 default frequency hopping 대역폭 혹은 default frequency hopping rule은 상기의 방안 1 및 도 5와 같은 방식으로

bandwidth part의 대역폭이나 혹은 NR CC의 대역폭에 의해 결정될 수 있다. 단, UE-specific/cell-specific higher layer signaling에 의한 PUCCH hopping 대역폭 설정 시, PUCCH duration, UCI의 종류(e.g. SR, CSI feedback or HARQ ACK/NACK feedback 등)나 payload size 등과 관계 없이 단일한 hopping 대역폭을 설정하도록 정의하거나, 혹은 상기의 방안 1과 같이 PUCCH duration이나 혹은 임의의 slot에서 PUCCH 전송을 위해 할당된 심볼 수, 또는 UCI 종류나 payload size 등에 따른 PUCCH format 별로 별도의 frequency hopping 대역폭을 설정하도록 정의할 수 있다.

<53> 기지국/네트워크에서 각각의 단말 별로 PUCCH에 대한 frequency hopping 대역폭을 설정/지시하도록 하는 또 다른 방법으로서, 기지국/네트워크에서 L1 control signaling을 통해 각각의 PUCCH 전송 별로 적용할 frequency hopping 대역폭을 지시하도록 정의할 수 있다. 구체적으로 임의의 단말을 위한 DL assignment DCI 혹은 UL grant와 같은 DCI를 통해 임의의 단말에서 HARQ ACK/NACK 피드백 혹은 CSI 피드백을 위한 PUCCH 전송이 지시될 경우, 해당 DCI를 통해 PUCCH 전송 자원 할당 정보와 함께 frequency hopping 대역폭 지시 정보가 직접 전송되도록 정의할 수 있다. 단, control overhead를 줄이기 위한 방안으로서, 해당 DCI의 PUCCH frequency hopping 대역폭 지시 정보를 통해 기지국/네트워크에서 지시 가능한 candidate value(s)를 정의하고, DCI를 통해 해당 candidate value(s) 중 하나의 값을 지시하도록 정의할 수 있다. 이 때 PUCCH frequency hopping을 위한 candidate value(s)는 bandwidth part의 대역폭 혹은 NR CC의 시스템 대역폭 등에

의해 정의되거나, 혹은 cell-specific/UE-specific higher layer signaling을 통해 기지국/네트워크에 의해 설정될 수 있다.

<54> 또는 임의의 default frequency hopping 대역폭 혹은 default frequency hopping rule을 정의하고, 해당 default frequency hopping 대역폭 혹은 default frequency hopping rule을 적용한 해당 PUCCH second hop의 frequency location(즉, 해당 PUCCH의 second hop의 PRB(s))로부터의 offset값(e.g. PRB offset값)을 해당 DL assignment DCI 혹은 UL grant 등의 L1 control signaling을 통해 기지국/네트워크에서 dynamic하게 indication해주도록 정의할 수 있다. 예를 들어, 도 6과 같이 상기의 방안 1에서 기술한 방법 중 단말 별로 설정/활성화된 bandwidth part의 대역폭에 따른 type-2 frequency hopping이 임의의 단말에서 PUCCH 전송을 위한 default frequency hopping rule로서 정의되고, 기지국/네트워크는 해당 default frequency hopping rule에 따른 해당 PUCCH의 second frequency hop으로부터의 frequency offset값을 L1 control signaling을 통해 indication해주도록 정의할 수 있다. 단, 본 발명은 구체적은 default frequency hopping rule과 관계없이 적용될 수 있다. 예를 들어, default frequency hopping bandwidth의 경우 cell-specific/UE-specific higher layer signaling을 통해 단말 별로 semi-static하게 설정되거나, 상기의 방안 1의 type-2 frequency hopping이 default hopping rule로서 정의되거나, 혹은 상기의 방안 1과 같이 PUCCH duration이나 PUCCH symbol의 수에 따라 서로 다른 default hopping rule이 정의될 수 있다. 또한 control overhead를 줄이기 위해 DCI를 통해 indication할 수 있는 해당

hopping offset값들의 candidate values들이 상기에서 서술한 L1 control signaling을 통한 frequency hopping 대역폭 지시 방법과 동일한 방법으로 정의될 수 있다.

<55> 추가적으로 기지국/네트워크에서 cell-specific/UE-specific higher layer signalling, MAC CE signalling 혹은 L1 control signaling을 통해 PUCCH에 대한 frequency hopping 여부를 enabling하거나, disabling하도록 정의할 수 있다.

<56> 또한 상기에서 서술한 frequency hopping 방법들의 조합으로서 PUCCH에 대한 frequency hopping 방법이 정의되는 경우도 본 발명의 범주에 포함될 수 있으며, PUCCH 외에 PUSCH 혹은 SRS 혹은 PRACH 등 모든 상향 링크 물리 채널/신호에 대해 본 발명에서 제안한 frequency hopping 방법이 적용될 수 있으며, 이는 본 발명의 범주에 포함된다.

<57> 도 7은 또 다른 실시예에 의한 기지국(1000)의 구성을 보여주는 도면이다.

<58> 도 7을 참조하면, 또 다른 실시예에 의한 기지국(1000)은 제어부(1010)과 송신부(1020), 수신부(1030)를 포함한다.

<59> 제어부(1010)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서 기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것에 따른 전반적인 기지국(1000)의 동작을 제어한다.

<60> 송신부(1020)와 수신부(1030)는 전술한 본 발명을 수행하기에 필요한 신호나

메시지, 데이터를 단말과 송수신하는데 사용된다.

<61> 도 8은 또 다른 실시예에 의한 사용자 단말(1100)의 구성을 보여주는 도면이다.

<62> 도 8을 참조하면, 또 다른 실시예에 의한 사용자 단말(1100)은 수신부(1110) 및 제어부(1120), 송신부(1130)를 포함한다.

<63> 수신부(1110)는 기지국으로부터 하향링크 제어 정보 및 데이터, 메시지를 해당 채널을 통해 수신한다.

<64> 또한 제어부(1120)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서 기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것에 따른 전반적인 사용자 단말(1100)의 동작을 제어한다.

<65> 송신부(1130)는 기지국에 상향링크 제어 정보 및 데이터, 메시지를 해당 채널을 통해 전송한다.

<66> 전술한 실시예에서 언급한 표준내용 또는 표준문서들은 명세서의 설명을 간략하게 하기 위해 생략한 것으로 본 명세서의 일부를 구성한다. 따라서, 위 표준내용 및 표준문서들의 일부의 내용을 본 명세서에 추가하거나 청구범위에 기재하는 것은 본 발명의 범위에 해당하는 것으로 해석되어야 한다.

<67> 이상의 설명은 본 발명의 기술 사상을 예시적으로 설명한 것에 불과한 것으

로서, 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자라면 본 발명의 본질적인 특성에서 벗어나지 않는 범위에서 다양한 수정 및 변형이 가능할 것이다. 따라서, 본 발명에 개시된 실시예들은 본 발명의 기술 사상을 한정하기 위한 것이 아니라 설명하기 위한 것이고, 이러한 실시예에 의하여 본 발명의 기술사상의 범위가 한정되는 것은 아니다. 본 발명의 보호 범위는 아래의 청구범위에 의하여 해석되어야 하며, 그와 동등한 범위 내에 있는 모든 기술 사상은 본 발명의 권리범위에 포함되는 것으로 해석되어야 할 것이다.

【특허청구범위】

【청구항 1】

차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서,

기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것을 특징으로 하는 방법.

제출 일자 : 2017-07-28

【요약서】

【요약】

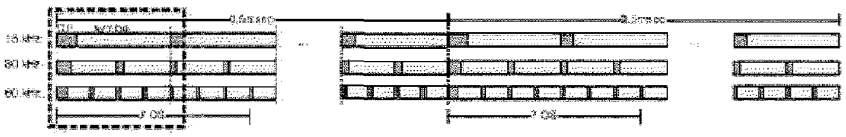
본 발명은 차세대/5G 무선 액세스망에서 상향 링크 제어 채널 송수신을 위한 frequency hopping에 관한 것으로서, 일 실시예는 차세대/5G 무선 액세스 망에서 상향 링크 제어 채널 송수신을 위한 주파수 도약(frequency hopping) 방법에 있어서, 기지국에서 각각의 단말별로 PUCCH에 대한 주파수 도약 대역폭을 설정하도록 지시하는 것을 특징으로 하는 방법을 제공한다.

【대표도】

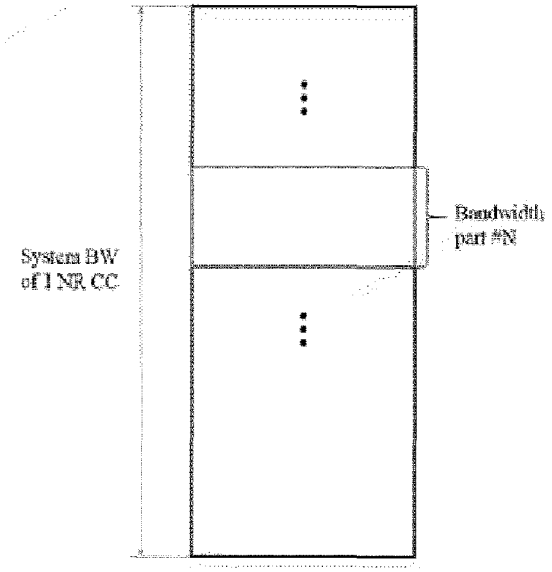
도 3

【도면】

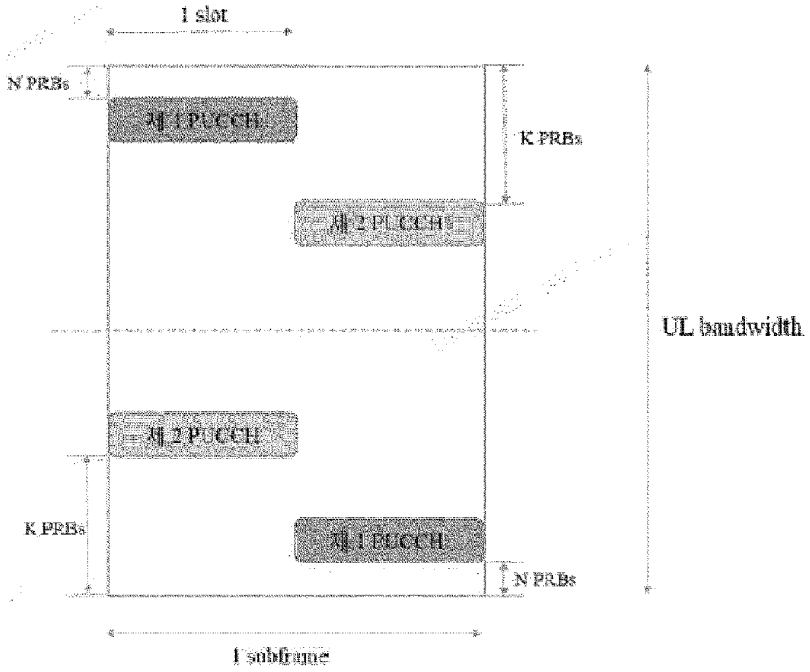
【도 1】



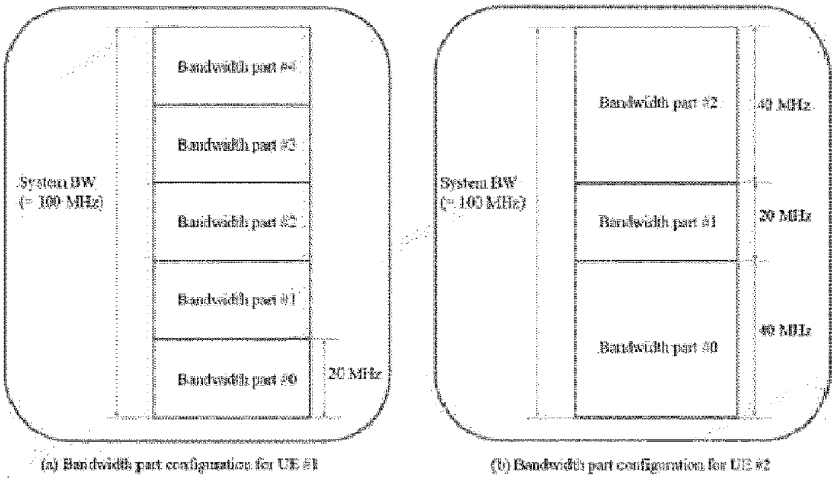
【도 2】



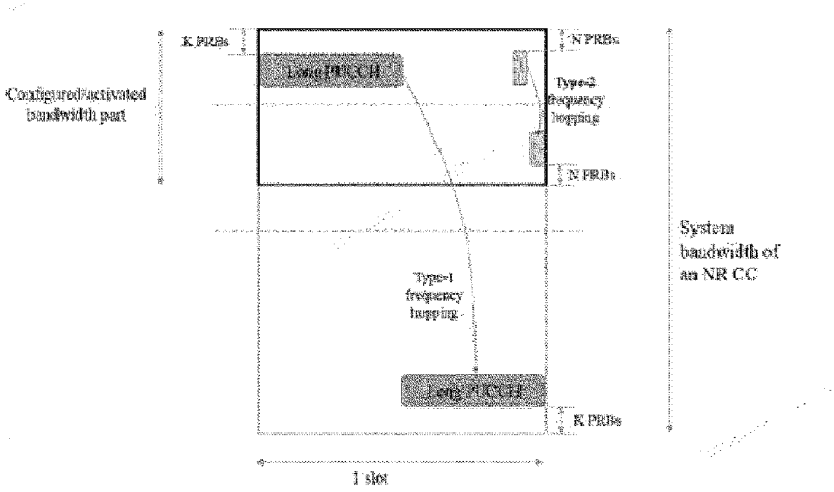
【도 3】


1 slot
N PRBs
제 1 PUCCH
K PRBs
제 2 PUCCH
UL bandwidth
제 2 PUCCH
K PRBs
제 1 PUCCH
N PRBs
1 subframe

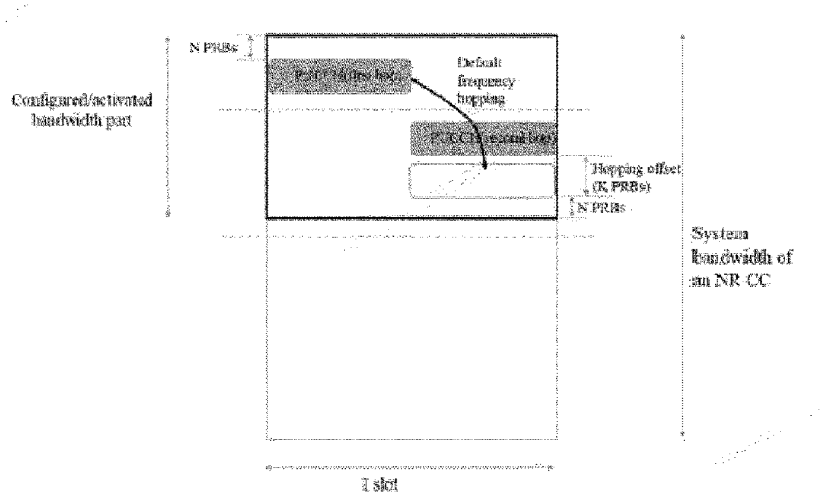
【도 4】


Bandwidth part #4
Bandwidth part #3
Bandwidth part #2
Bandwidth part #1
Bandwidth part #0
System BW
(= 100 MHz)
20 MHz
(a) Bandwidth part configuration for UE #1
Bandwidth part #2
Bandwidth part #1
Bandwidth part #0
System BW
(= 100 MHz)
40 MHz
20 MHz
40 MHz
(b) Bandwidth part configuration for UE #2

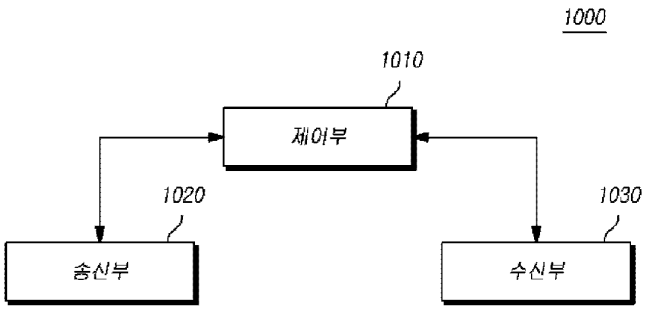
【도 5】


K PRBs
Long PUCCH
N PRBs
Type-2 frequency hopping
N PRBs
Configured/activated bandwidth part
System bandwidth of an NR CC
Type-1 frequency hopping
Long PUCCH
K PRBs
1 slot

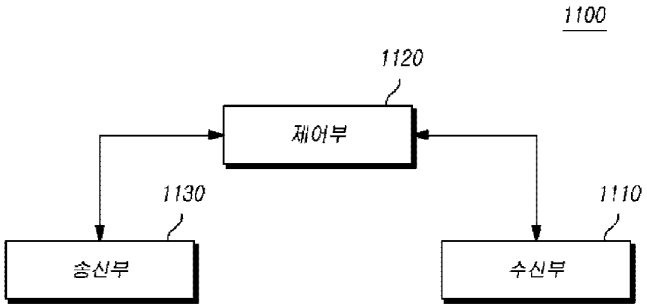
【도 6】


N PRBs
Default frequency hopping
Hopping offset (K PRBs)
N PRBs
Configured/activated bandwidth part
System bandwidth of an NR CC
1 slot

【도 7】


1000
1010
제어부
1020
송신부
1030
수신부

【도 8】


1100
1120
제어부
1130
송신부
1110
수신부

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/048,210

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	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	18 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 460 =	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	1720

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.

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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/048,210	07/27/2018	2414	1720	811.0136	18	3

CONFIRMATION NO. 1073

76277
IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

FILING RECEIPT

OC000000102178609

Date Mailed: 09/11/2018

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

Inventor(s)

Kyujin PARK, Seoul, KOREA, REPUBLIC OF;
Woo-jin CHOI, Seoul, KOREA, REPUBLIC OF;

Applicant(s)

KT CORPORATION, Gyeonggi-do, KOREA, REPUBLIC OF;

Assignment For Published Patent Application

KT CORPORATION, Gyeonggi-do, KOREA, REPUBLIC OF

Power of Attorney: The patent practitioners associated with Customer Number 76277

Domestic Applications for which benefit is claimed - None.
A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

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.)
REPUBLIC OF KOREA 10-2017-0095980 07/28/2017
REPUBLIC OF KOREA 10-2017-0102577 08/11/2017
REPUBLIC OF KOREA 10-2018-0057278 05/18/2018

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

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

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 09/10/2018
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/048,210**
Projected Publication Date: 01/31/2019
Non-Publication Request: No
Early Publication Request: No
Title

APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

Preliminary Class

370

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

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

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

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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

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Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82A (07-12)

Approved for use through 11/30/2014. OMB 0651-0035

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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	TBD
Filing Date	July 27, 2018
First Named Inventor	Kyujin PARK
Title	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	811.0136

SIGNATURE of Applicant or Patent Practitioner

Signature	/Ian M. Hughes/	Date	07/27/2018
Name	Ian M. Hughes	Telephone	571-267-7183
Registration Number	41,083		

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

☐ *Total of _____ forms are submitted.

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.**

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POWER OF ATTORNEY BY APPLICANT

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

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

76277

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

Name	Registration Number		Name	Registration Number

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

☒ The address associated with the above-mentioned Customer Number.

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☐ The address associated with Customer Number:

OR

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Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant:

☐ Inventor or Joint Inventor

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (*e.g.*, a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

Signature		Date	10/29/2012
Name	CHOI, Ji-Myung	Telephone	82-31-727-2661
Title and Company	General Manager of KT CORPORATION		

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

☐ *Total of _____ forms are submitted.

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.**

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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 Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL
First Named Inventor/Applicant Name:	Kyujin PARK
Filer:	Kyung Hee Kim
Attorney Docket Number:	811.0136

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1720**

Electronic Acknowledgement Receipt

EFS ID:	33310397
Application Number:	16048210
International Application Number:	
Confirmation Number:	1073
Title of Invention:	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	76277
Filer:	Kyung Hee Kim
Filer Authorized By:	
Attorney Docket Number:	811.0136
Receipt Date:	27-JUL-2018
Filing Date:	
Time Stamp:	23:01:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1720
RAM confirmation Number	073018INTEFSW23021700
Deposit Account	505881
Authorized User	Kyung Kim

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37 CFR 1.16 (National application filing, search, and examination fees)

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	Transmittal of New Application	018110136Transmittal1.pdf	224991 8eeeda7c03775e8a9d1250951f311f3cf8f46d5b	no	2
Warnings:					
Information:					
2		028110136EnglishSpecification.pdf	251791 ff5395a6db6c460e1c08de7bfd7e149bfe5cb2e4	yes	50

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Drawings-only black and white line drawings	41	50
	Abstract	40	40
	Claims	36	39
	Specification	1	35

Warnings:					
Information:					
3	Oath or Declaration filed	038110136ExecutedDeclarations.pdf	168181 5e39d9d1238e833811f06a071a2b9864e122065b	no	2
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
4	Application Data Sheet	048110136NewADS.pdf	1833805 2ab6fceaaffa014f996701247ee8c12381a26fdd	no	9
Warnings:					
Information:					

5	Power of Attorney	058110136PoATransmittal.pdf	192803 d00a6e8d6c1826d6a9387224b3e7dea7c4593ed4	no	3
Warnings:					
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Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	34600 a6b33eb3468728b37ef3945cb82d4d468bf2eac1	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2706171	

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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/AIA/15 (03-13)
Approved for use through 01/31/2014. OMB 0651-0032
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	811.0136
First Named Inventor	Kyujin PARK
Title	Apparatus and Method for Transmitting...
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [ ] **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [✓] **Specification** [*Total Pages* 40] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. [✓] **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* 10]
6. **Inventor's Oath or Declaration** [*Total Pages* 2] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. [✓] Newly executed (original or copy)
   b. [ ] A copy from a prior application (37 CFR 1.63(d))
7. [✓] **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   [ ] Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. [ ] Computer Readable Form (CRF)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**

ACCOMPANYING APPLICATION PAPERS

10. [✓] **Assignment Papers** (cover sheet & document(s)) Name of Assignee KT CORPORATION
11. [ ] **37 CFR 3.73(c) Statement** (*when there is an assignee*) [✓] **Power of Attorney**
12. [ ] **English Translation Document** (*if applicable*)
13. [ ] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
14. [ ] **Preliminary Amendment**
15. [ ] **Return Receipt Postcard** (*MPEP § 503*) (*Should be specifically itemized*)
16. [ ] **Certified Copy of Priority Document(s)** (*if foreign priority is claimed*)
17. [ ] **Nonpublication Request** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
18. [ ] **Other:**

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

19. CORRESPONDENCE ADDRESS

[✓] The address associated with Customer Number: 76277 **OR** [ ] Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/Ian M. Hughes/	Date	07/27/2018
Name (Print/Type)	Ian M. Hughes	Registration No. (Attorney/Agent)	41,083

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

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 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).
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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.
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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.

FIG.1

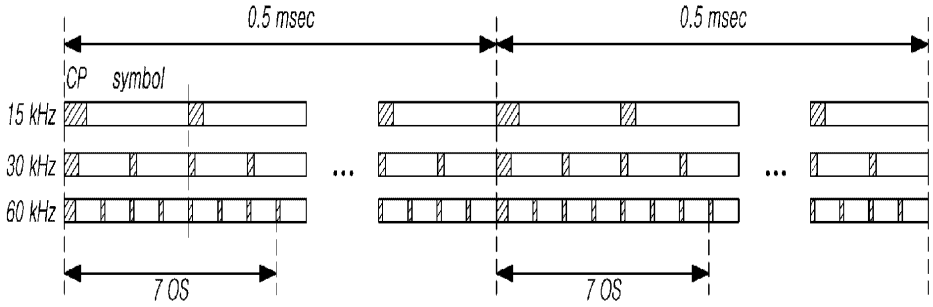


FIG.2

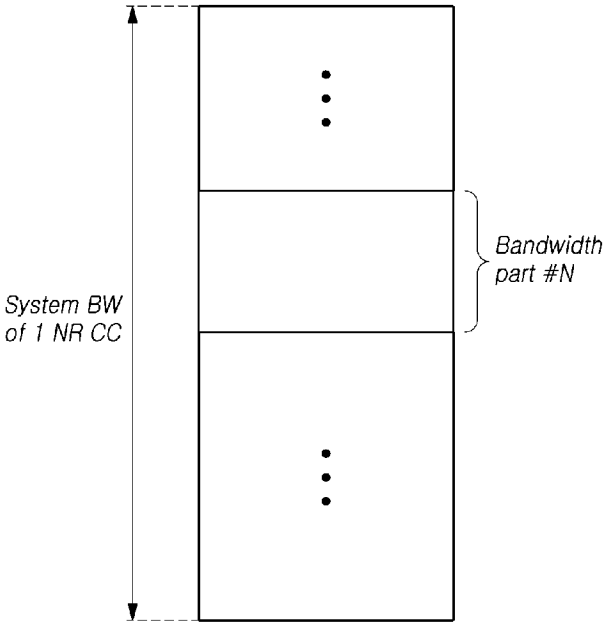


FIG.3

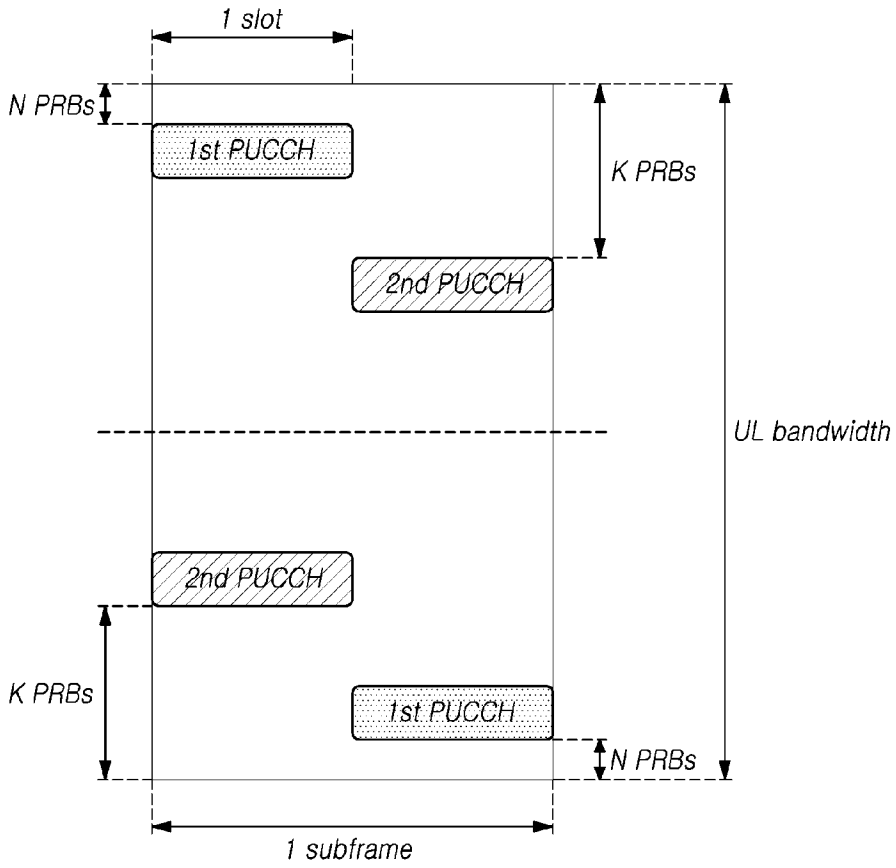
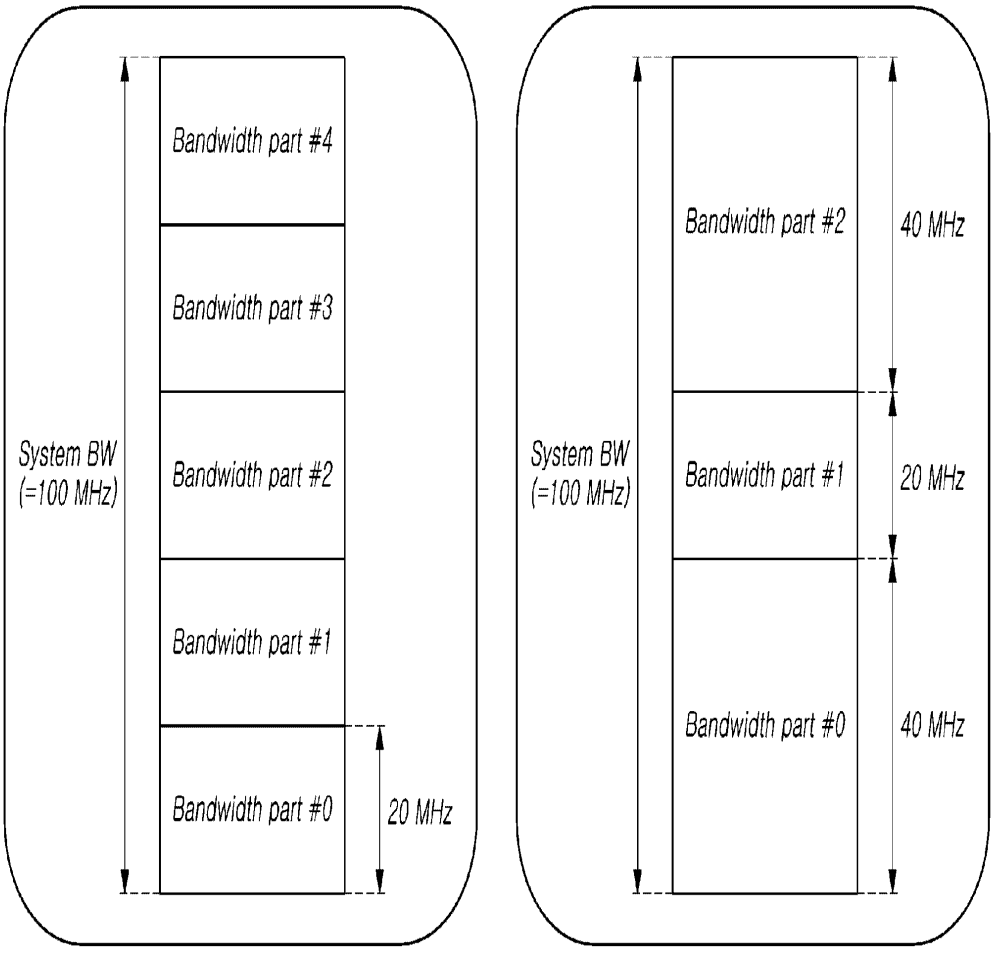

1 slot
N PRBs
1st PUCCH
K PRBs
2nd PUCCH
UL bandwidth
2nd PUCCH
K PRBs
1st PUCCH
N PRBs
1 subframe

FIG.4



(a) Bandwidth part configuration UE #1

(b) Bandwidth part configuration UE #2

FIG.5

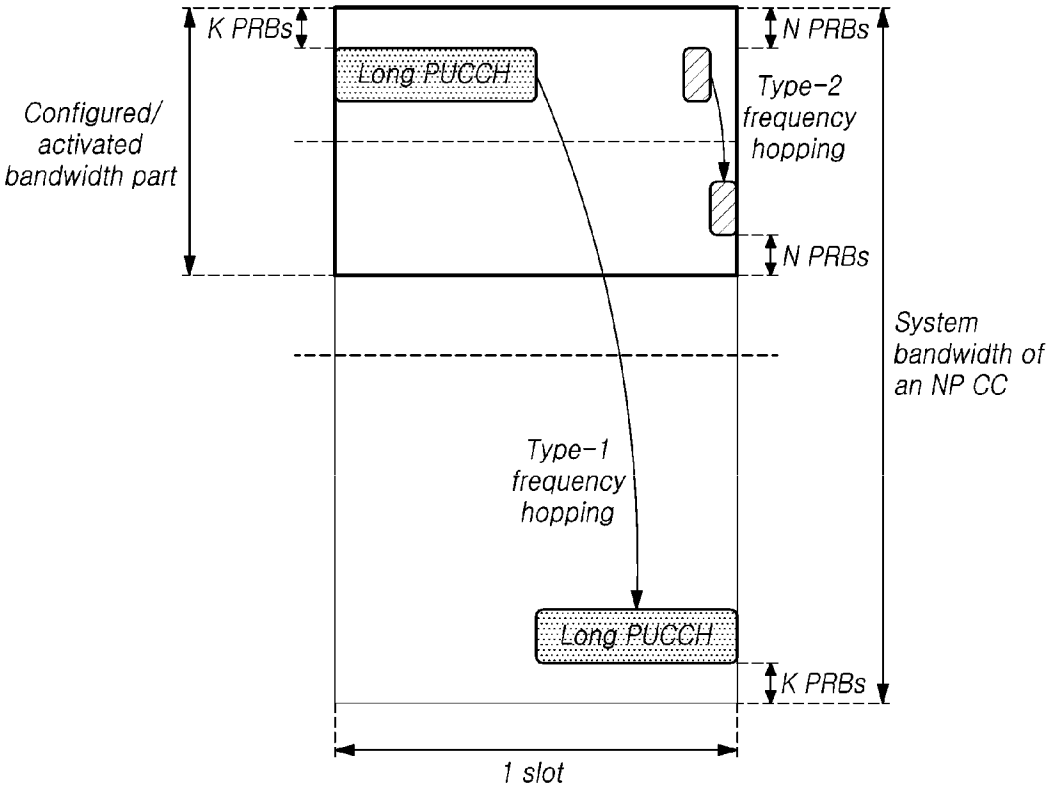

K PRBs
N PRBs
Long PUCCH
Type-2
frequency
hopping
Configured/
activated
bandwidth part
N PRBs
System
bandwidth of
an NP CC
Type-1
frequency
hopping
Long PUCCH
K PRBs
1 slot

FIG.6

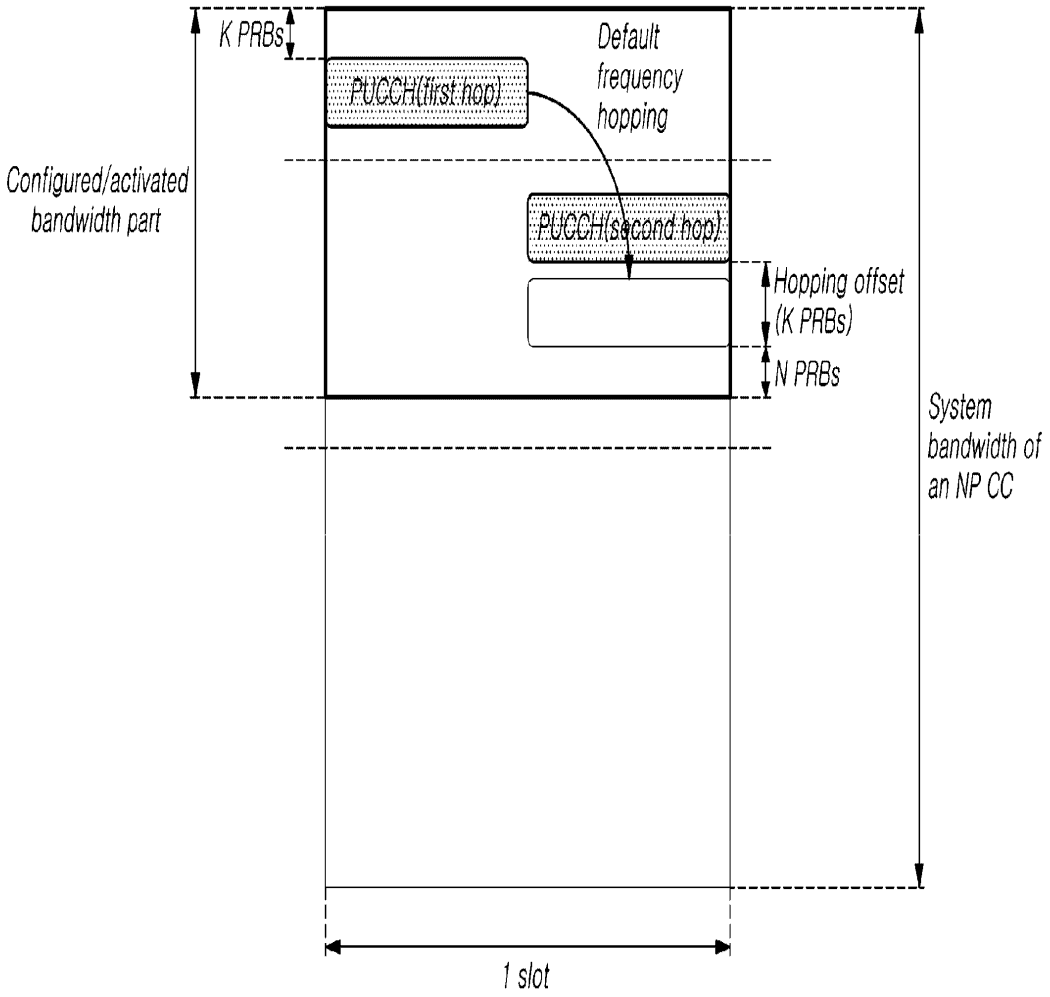

K PRBs
Default frequency hopping
PUCCH(first hop)
Configured/activated bandwidth part
PUCCH(second hop)
Hopping offset (K PRBs)
N PRBs
System bandwidth of an NP CC
1 slot

FIG. 7

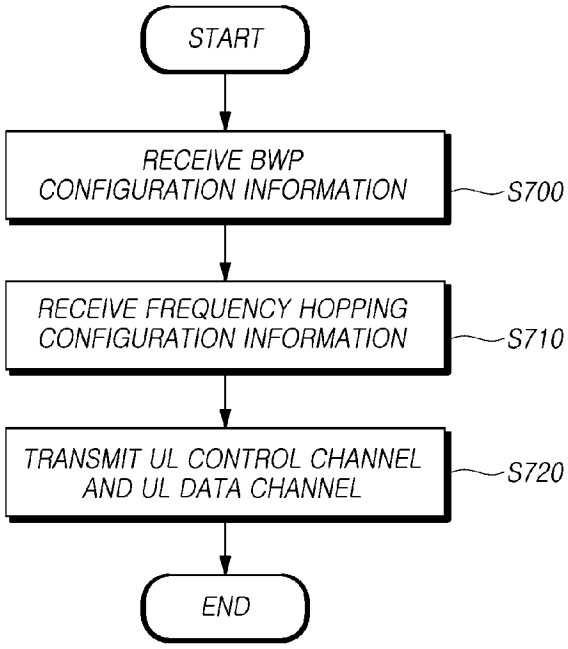

START
RECEIVE BWP CONFIGURATION INFORMATION
S700
RECEIVE FREQUENCY HOPPING CONFIGURATION INFORMATION
S710
TRANSMIT UL CONTROL CHANNEL AND UL DATA CHANNEL
S720
END

FIG. 8

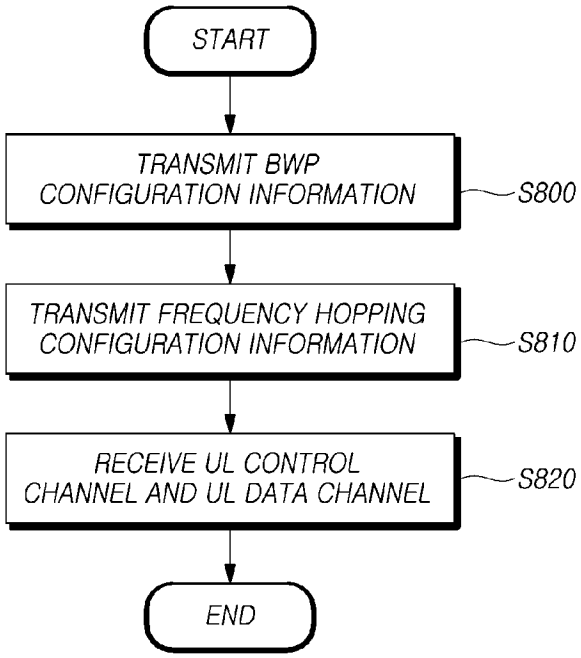

START
TRANSMIT BWP CONFIGURATION INFORMATION
S800
TRANSMIT FREQUENCY HOPPING CONFIGURATION INFORMATION
S810
RECEIVE UL CONTROL CHANNEL AND UL DATA CHANNEL
S820
END

FIG.9

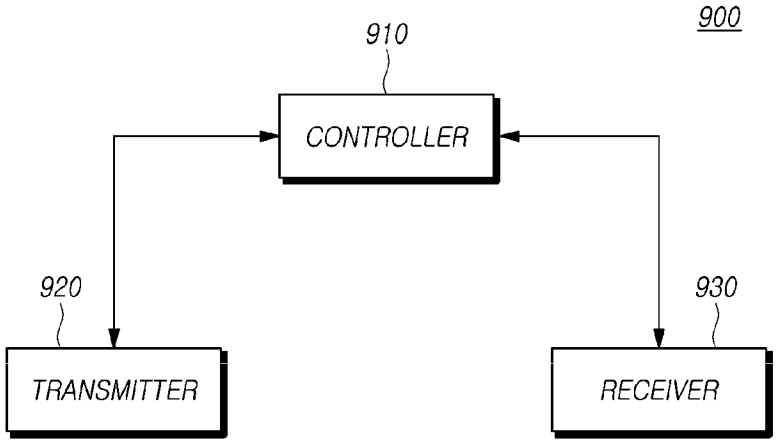
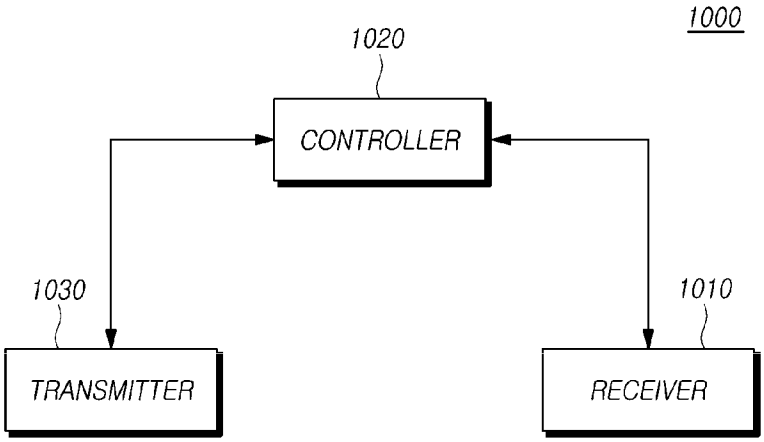


FIG. 10



Abstract of the Disclosure

Provided are an apparatus and method for transmitting and receiving an uplink (UL) channel. A method for a user equipment (UE) to transmit a UL control channel and a UL data channel to a base station (BS) includes receiving bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE from a BS, receiving frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one BWP of the BWP set from the BS, and transmitting a UL control channel and a UL data channel to the BS through the single BWP of the BWP set based on the BWP configuration information and the frequency hopping configuration information.

WHAT IS CLAIMED IS:

1. A method for a user equipment (UE) to transmit an uplink (UL) control channel and a UL data channel to a base station (BS), the method comprising:

receiving, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE;

receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set; and

transmitting a UL control channel and a UL data channel to the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information.

2. The method of claim 1, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

3. The method of claim 1, wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values.

4. The method of claim 3, wherein a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of

physical resource blocks (PRBs) constituting the transmission BWP.

5. The method of claim 4, wherein the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less.

6. The method of claim 3, wherein a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI).

7. A method for a base station (BS) to receive an uplink (UL) control channel and a UL data channel from a user equipment (UE), the method comprising:

transmitting bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE;

transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one reception BWP of the BWP set to the UE; and

receiving the UL control channel and the UL data channel from the UE through the reception BWP based on the BWP configuration information and the frequency hopping configuration information.

8. The method of claim 7, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information

of a second frequency resource region of the UL control channel.

9. The method of claim 7, wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values.

10. The method of claim 9, wherein a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the reception BWP.

11. The method of claim 10, wherein the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the reception BWP is a preset threshold value or less.

12. The method of claim 9, wherein a frequency hopping offset value used to receive the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI).

13. A user equipment (UE) for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS), the UE comprising:

a receiver configured to receive, from a BS, bandwidth part (BWP) configuration information of a BWP set composed of one or more BWPs configured for the UE and receive, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set; and

a transmitter configured to transmit a UL control channel and a UL data channel to

the BS through the transmission BWP based on the BWP configuration information and the frequency hopping configuration information.

14. The UE of claim 13, wherein the frequency hopping configuration information for a UL control channel includes at least one of information indicating whether to perform frequency hopping, physical resource block (PRB) allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

15. The UE of claim 13, wherein the frequency hopping configuration information for a UL data channel includes a frequency hopping offset set composed of one or more frequency hopping offset values.

16. The UE of claim 15, wherein a number of frequency hopping offset values included in the frequency hopping offset set is determined based on a number of physical resource blocks (PRBs) constituting the transmission BWP.

17. The UE of claim 16, wherein the number of frequency hopping offset values included in the frequency hopping offset set is determined depending on whether the number of PRBs constituting the transmission BWP is a preset threshold value or less.

18. The UE of claim 15, wherein a frequency hopping offset value used to transmit the UL data channel among the frequency hopping offset values included in the frequency hopping offset set is indicated by UL grant downlink control information (DCI).

APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority from Korean Patent Application Nos. 10-2017-0095980, 10-2017-0102577, and 10-2018-0057278, filed on July 28, 2017, August 11, 2017, and May 18, 2018, which are hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND OF THE INVENTION

1. Field of the invention

The present disclosure relates to an apparatus and method for transmitting and receiving an uplink (UL) channel, and more particularly, to an apparatus and method for performing frequency hopping for UL channel transmission and reception in a next generation/fifth generation (5G) (will be referred to as New Radio (NR) below) radio access network.

2. Description of the Related Art

Recently, the Third Generation Partnership Project (3GPP) approved "Study on New Radio Access Technology" which is a study item for research on next generation/5G radio access technology, and Radio Access Network (RAN) Working Group 1 (WG1) is separately discussing frame structures, channel coding and modulation, waveforms, multiple-access schemes, etc. for NR on the basis of the technology. It is required to

design an NR to meet not only an improved data transmission rate compared to Long Term Evolution (LTE)/LTE-Advanced but also various demands of subdivided and detailed usage scenarios.

Representative usage scenarios of NR may include enhanced Mobile BroadBand (eMBB), massive Machine Type Communication (mMTC), and Ultra Reliable and Low Latency Communications (URLLC). It is also required to design a frame structure to be flexible in comparison to LTE/LTE-Advanced (LTE-A) as a method for meeting requirements of respective usage scenarios.

In particular, when an NR user equipment (UE) uses various bandwidth parts (BWPs), there is an increasing necessity of setting a detailed and efficient method for the UE to transmit UL channels, that is, a UL control channel and a UL data channel, to a base station (BS) on the basis of the BWPs.

SUMMARY OF THE INVENTION

In this background, the present disclosure is to provide a frequency hopping application method for preventing collision between resources used by user equipments (UEs) which use different bandwidth part (BWP) configurations to transmit uplink (UL) channels in New Radio (NR).

Objects of the present disclosure are not limited thereto, and other objects which have not been mentioned will be apparent to those of ordinary skill in the art from the following descriptions.

To solve the foregoing problem, in accordane with an embodiment, a method may be provided for a UE to transmit a UL control channel and a UL data channel to a base station (BS). The method may include: receiving, from a BS, BWP configuration

information of a BWP set composed of one or more BWPs configured for a UE; receiving, from the BS, frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one BWP of the BWP set; and transmitting a UL control channel or a UL data channel to the BS through the single BWP on the basis of the BWP configuration information and the frequency hopping configuration information.

In accordance with another embodiment, a method may be provided for a BS to receive a UL control channel and a UL data channel from a UE. The method may include: transmitting BWP configuration information of a BWP set composed of one or more BWPs configured for a UE to the UE; transmitting frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one BWP of the BWP set to the UE; and receiving the UL control channel or the UL data channel from the UE through the single BWP on the basis of the BWP configuration information and the frequency hopping configuration information.

In accordance with further another embodiment, a UE may be provided for transmitting a UL control channel and a UL data channel to a BS. The UE may include: a receiver configured to receive BWP configuration information of a BWP set composed of one or more BWPs configured for the UE from a BS and receive frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one BWP of the BWP set from the BS; and a transmitter configured to transmit a UL control channel or a UL data channel to the BS through the single BWP on the basis of the BWP configuration information and the frequency hopping configuration information.

In accordance with still another embodiment, a BS may be provided for receiving a UL control channel and a UL data channel from a UE. The BS may include: a transmitter

configured to transmit BWP configuration information of a BWP set composed of one or more BWPs configured for a UE and transmit frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one BWP of the BWP set; and a receiver configured to receive a UL control channel or a UL data channel from the UE through the single BWP on the basis of the BWP configuration information and the frequency hopping configuration information.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and advantages of the present disclosure will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagram for showing an arrangement of orthogonal frequency-division multiplexing (OFDM) symbols according to an embodiment of the present disclosure when different subcarrier spacing (SCS) values are used;

FIG. 2 is a diagram for showing a conceptual example of a bandwidth part (BWP) according to an embodiment of the present disclosure;

FIG. 3 is a diagram for showing an example of frequency hopping for a physical uplink control channel (PUCCH) defined in a Long Term Evolution (LTE)/Long Term Evolution-Advanced (LTE-A) system;

FIG. 4 is a diagram for showing a conceptual example of user equipment (UE)-specific bandwidth part BWP configurations according to an embodiment of the present disclosure;

FIG. 5 is a diagram for showing an example of a frequency hopping rule based on PUCCH duration according to an embodiment of the present disclosure;

FIG. 6 is a diagram for showing an example of a method of indicating a frequency hopping offset through downlink control information (DCI) according to an embodiment of the present disclosure;

FIG. 7 is a flowchart illustrating a procedure of a UE for transmitting an uplink (UL) control channel and a UL data channel to a base station (BS) according to an embodiment of the present disclosure;

FIG. 8 is a flowchart illustrating a procedure of a BS for receiving a UL control channel and a UL data channel from a UE according to an embodiment of the present disclosure;

FIG. 9 is a diagram for showing a BS according to an embodiment of the present disclosure; and

FIG. 10 is a diagram for showing a UE according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

Hereinafter, embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. In adding reference numerals to elements in each drawing, the same elements will be designated by the same reference numerals if possible, although they may be shown in different drawings. Further, in the following description of the present disclosure, a detailed description of known functions and configurations incorporated herein will be omitted when it is determined that the description may make the subject matter of the present disclosure rather unclear.

In this specification, a wireless communication system denotes a system for providing various communication services, such as voice, packet data, and the like. A wireless communication system includes a user equipment (UE) and a base station (BS).

A UE is a comprehensive concept that refers to a terminal in wireless communication and should be construed as encompassing not only a UE in a wideband code division multiple access (WCDMA) network, a Long Term Evolution (LTE) network, a high speed packet data access (HSPA) network, a network of International Mobile Telecommunications for 2020 (IMT-2020; fifth generation (5G) or New Radio (NR)), etc., but also a mobile station (MS), a user terminal (UT), a subscriber station (SS), a wireless device, etc. in Global System for Mobile communication (GSM).

A BS or cell refers to a station which generally communicates with a UE and encompasses a node-B, an evolved node-B (eNB), a gateway station Node-B (gNB), a low power node (LPN), a sector, a site, various types of antennas, a base transceiver system (BTS), an access point, a point (e.g., a transmission point, a reception point, and a transmission/reception point), a relay node, and various coverage regions, such as a mega-cell, a macro-cell, a micro-cell, a picocell, a femtocell, a remote radio head (RRH), a radio unit (RU), a small cell, and the like.

Since there is a BS for controlling each of the various cells listed above, a BS may be interpreted into two meanings: 1) a device for providing a mega-cell, a macro-cell, a micro-cell, a picocell, a femtocell, or a small cell in relation to a radio region or 2) the radio region itself. According to the first meaning, the BSs may be i) devices which provide certain radio regions under control of the same entity or ii) all devices which interact with each other to cooperatively provide a radio region. A point, a transmission/reception point, a transmission point, a reception point, etc. are embodiments of a BS according to a method of providing a radio region. According to the second

meaning, a BS may be a radio region itself in or from which a signal is received or transmitted from the viewpoint of a UE or a neighboring BS.

In this specification, a cell may refer to the coverage of a signal transmitted from a transmission/reception point, a component carrier having the coverage of a signal transmitted from a transmission point or a transmission/reception point, or a transmission/reception point itself.

In this specification, a UE and a BS are used as comprehensive meanings of two (uplink and downlink) transmitting and receiving entities used to implement the technology or technical spirit described in the present disclosure, but not limited to terms or words that are specifically referred to.

Here, an uplink (UL) refers to a method of transmitting and receiving data to and from a BS by a UE, and a downlink (DL) refers to a method of transmitting and receiving data to and from a UE by a BS.

For UL transmission and DL transmission, it is possible to use one of i) time division duplex (TDD) in which transmission is performed by using different times, ii) frequency division duplex (FDD) in which transmission is performed by using different frequencies, and iii) a mixed scheme of TDD and FDD.

Also, in a wireless communication system, a UL and a DL are configured on the basis of one carrier wave or one pair of carrier waves according to a standard.

In a UL and a DL, control information is transmitted through a control channel, such as a physical downlink control channel (PDCCH), a physical uplink control channel (PUCCH), etc.. The UL and the DL are configured as data channels, such as a physical downlink shared channel (PDSCH), a physical uplink shared channel (PUSCH), etc., such that data is transmitted.

A DL may refer to communication or a communication path from a multi-transmission/reception point to a UE, and a UL may refer to communication or a communication path from the UE to the multi-transmission/reception point. In the DL, a transmitter may be a part of the multi-transmission/reception point, and a receiver may be a part of the UE. Also, in the UL, a transmitter may be a part of the UE, and a receiver may be a part of the multi-transmission/reception point.

"A signal is transmitted and received through a channel, such as a PUCCH, a PUSCH, a PDCCH, or a PDSCH," may have the same meaning of "a PUCCH, a PUSCH, a PDCCH, or a PDSCH is transmitted and received."

Meanwhile, high layer signaling mentioned below includes radio resoucre control (RRC) signaling for transmitting RRC information including an RRC parameter.

A BS performs DL transmission to UEs. A BS may transmit a PDCCH for transmitting DL control information, such as scheduling required to receive a DL data channel, which is a main physical channel for unicast transmission, and scheduling grant information for transmission in an UL data channel. Transmission and reception of a signal through each channel will be referred to as "transmission and reception of a channel."

Any multiple access scheme may be applied to a wireless communication system. It is possible to use various multiple access schemes including time-division multiple access (TDMA), frequency-division multiple access (FDMA), CDMA, orthogonal frequency-division multiple access (OFDMA), non-orthogonal multiple access (NOMA), OFDM-TDMA, OFDM-FDMA, and OFDM-CDMA. Here, NOMA includes sparse code multiple access (SCMA), low density spreading (LDS), and the like.

An embodiment of the present disclosure may be applied to resource allocation in asynchronous wireless communication, which evolves into LTE/LTE-Advanced

(LTE-A)and IMT-2020 through GSM, WCDMA, and HSPA, synchronous wireless communication which evolves into CDMA, CDMA-2000, and Ultra Mobile Broadband (UMB), and the like.

In this specification, a machine-type communication (MTC) UE may refer to a UE which supports low cost (or low complexity), a UE which supports coverage enhancement, or the like. Alternatively, in this specification, an MTC UE may refer to a UE which is defined as a specific category to support low cost (or low complexity) and/or coverage enhancement.

In other words, in this specification, an MTC UE may refer to a Third Generation Partnership Project (3GPP) Release-13 low cost (or low complexity) UE category/type which was newly defined and performs an LTE-based MTC-related operation. Alternatively, in this specification, an MTC UE may support an enhanced coverage which is more extensive than the existing LTE coverage or may refer to a UE category/type defined in 3GPP Release-12 or a lower version which supports low power consumption or a Release-13 low cost (or low complexity) UE category/type which was newly defined. Otherwise, an MTC UE may refer to a further enhanced MTC UE defined in Release-14.

In this specification, a narrowband Internet of things (NB-IoT) UE refers to a UE supporting radio access for cellular IoT. Objects of the NB-IoT technology include enhanced indoor coverage, support for large-scale low-speed UEs, low latency sensitivity, very low cost of UEs, low power consumption, and optimized network architecture.

Representative usge scenarios in NR which is recently under discussion in the 3GPP may includeenhanced Mobile BroadBand (eMBB), massive Machine Type Communication (mMTC), and Ultra Reliable and Low Latency Communications (URLLC).

In this specification, frequencies, frames, subframes, resources, resource blocks, regions, bands, sub-bands, control channels, data channels, synchronization signals, various reference signals, various signals, and various messages related to NR may be interpreted as meanings used in the past or present or various meanings which will be used in the future.

New Radio (NR)

Recently, the 3GPP approved "Study on New Radio Access Technology" which is a study item for research on next generation/5G radio access technology, and separate discussions have begun on frame structures, channel coding and modulation, waveforms, multiple-access schemes, etc. for NR on the basis of the technology.

It is required to design an NR to meet not only an improved data transmission rate compared to LTE/LTE-A but also various demands of subdivided and detailed usage scenarios. In particular, eMBB, mMTC, and URLLC are proposed as representative usage scenarios of NR. It is also required to design a frame structure to be flexible in comparison to LTE/LTE-A as a method for meeting requirements of respective usage scenarios.

Specifically, eMBB, mMTC, and URLLC are considered as representative usge scenarios in NR which is recently under discussion in the 3GPP. The respective usage scenarios have different requirements of data rates, latency, coverage, etc. Accordingly, it is necessary to develop a method of efficiently multiplexing radio resource units on the basis of differet numerologies (e.g., subcarrier spacing (SCS) values, subframes, transmission time intervals (TTIs), etc.) for efficiently meeting usage scenario-specific requirements through a frequency band constituting an arbitrary NR system.

As a method for the purpose, discussions were made on a method of supporting numerologies having different SCS values by multiplexing the numerologies on the basis

of time-division multiplexing (TDM), frequency-division multiplexing (FDM), or TDM/FDM through one NR carrier and a method of supporting one or more time units to set a scheduling unit in a time domain. In relation to this, a subframe was defined as a time domain structure in NR, and it was determined to define a single subframe duration composed of 14 OFDM symbols of a 15kHz SCS-based normal cyclic prefix (CP) overhead, which is the same as that of LTE, as a reference numerology for defining a corresponding subframe duration. Accordingly, a subframe has a time duration of 1 ms in NR. However, unlike LTE, a subframe in NR is an absolute reference time duration, and a slot and a mini-slot may be defined as time units which are bases of actual UL/DL data scheduling. In this case, y which is the number of OFDM symbols constituting a corresponding slot was determined to have a value of 14 regardless of numerology.

Accordingly, any slot may be composed of 14 symbols. According to a transmission direction of the corresponding slot, all the symbols may be used for DL transmission or UL transmission, or used in the form of "DL portion + gap + UL portion."

Also, a mini-slot composed of a smaller number of symbols than that of the corresponding slot may be defined in an arbitrary numerology (or SCS), and on the basis of the mini-slot, a short time-domain scheduling interval for UL/DL data transmission and reception may be set, or a long time-domain scheduling interval for UL/DL data transmission and reception may be set through slot aggregation.

In particular, in the case of transmission and reception of latency-critical data such as URLLC, when scheduling is made in units of slots based on 0.5 ms (7 symbols) or 1 ms (14 symbols) defined in a frame structure based on a numerology having a small SCS value such as 15 kHz, it may be difficult to meet latency requirements. To solve this problem, a mini-slot composed of a smaller number of OFDM symbols than that of the

corresponding slot may be defined so that latency-critical data, such as the URLLC, may be scheduled on the basis of the mini-slot.

Alternatively, as described above, it is possible to consider a method of scheduling data according to latency requirements on the basis of slot (or mini-slot) lengths defined by numerology by supporting numerologies having different SCS values in one NR carrier through multiplexing based on TDM or FDM. For example, as shown in FIG. 1, a symbol length corresponding to an SCS value of 60 kHz is about 1/4 of a symbol length corresponding to an SCS value of 15 kHz. Therefore, when one slot is composed of seven OFDM symbols, the 15kHz-based slot length is 0.5 ms, and the 60kHz-based slot length is reduced to about 0.125 ms.

In this way, in NR, discussions are underway on a method of meeting requirements of each of URLLC and eMBB by defining different SCS values or TTIs.

Wider bandwidth operations

A typical LTE system supports a scalable bandwidth operation for an arbitrary LTE component carrier (CC). In other words, any LTE service provider may set a minimum bandwidth of 1.4 MHz to a maximum bandwidth of 20 MHz according to a frequency deployment scenario when configuring one LTE CC. Accordingly, any normal LTE UE supports a transmission/reception capability of 20 MHz bandwidth for one LTE CC.

However, NR is designed to support NR UEs having different transmission/reception bandwidth capabilities by one NR CC. Accordingly, as shown in FIG. 2, it is required to configure one or more bandwidth parts (BWPs), which are composed of bandwidths obtained by subdividing an arbitrary NR CC, and support a wider and flexible bandwidth operation by setting and activating different BWPs according to UEs.

In this way, any NR CC may be divided into one or more BWPs. Accordingly, one or more BWPs may be configured for each UE, and UL/DL wireless signals and wireless channels for an arbitrary UE may be transmitted and received by activating at least one of one or more BWPs configured for the corresponding UE.

Also, when a plurality of numerologies (e.g., SCS values, CP lengths, etc.) are supported by any NR CC, different numerologies for transmission and reception may be set for respective BWPs.

Frequency hopping for PUCCH in LTE

In the case of a PUCCH which is a UL wireless control channel for transmitting uplink control information (UCI) of a UE in a 3GPP LTE/LTE-A system, frequency hopping is performed in units of slots in one subframe. Here, a frequency hopping unit of the PUCCH is determined by a system bandwidth of a corresponding UL subframe, where the frequency hopping unit is a bandwidth over which a frequency is hopped.

In other words, as shown in FIG. 3, frequency hopping in any UL subframe is defined to be performed in a symmetrical form with respect to a central frequency of each slot.

Embodiments described below may be applied to UEs, BSs, and core network entities (e.g., mobility management entities (MMEs)) which use any mobile communication technolgy. For example, the embodiments may be applied to a next generation mobile communication (e.g., 5G mobile communication, new-radio access technology (RAT)) UE, BS, core network entity (e.g., access and mobility function (AMF)) as well as a mobile communication UE to which LTE technology is applied. For convenience of description, a BS may represent an eNB of an LTE/evolved universal terrestrial radio access network (E-UTRAN), a BS (e.g., a central unit (CU), a distributed

unit (DU), or a logical entity in which a CU and a DU are integrally implemented) in a 5G wireless network in which the CU and the DU are separated, or a gNB.

Also, a numerology described herein denotes numerical characteristics and meanings relating to data transmission and reception and may be determined by an SCS value. Therefore, a difference in numerology may denote that SCS values whereby numerologies are determined are different.

In this specification, a slot length may be represented by the number of OFDM symbols constituting a slot or a time occupied by the slot. For example, when one numerology based on 15kHz SCS is used, the length of one slot may be represented by 14 OFDM symbols or 1 ms.

In this specification, a UL channel is a concept encompassing a PUSCH and a PUCCH that are transmited to a BS by a UE, and transmission and reception of a UL channel between a BS and a UE may denote that the UE transmits the UL channel to the BS or the BS receives the UL channel from the UE.

Various embodiments of a method of performing frequency hopping for UL channel transmission and reception in a next generation/5G radio access network will be described in detail below. Embodiments described below may be applied individually or in combination.

As described above, an NR CC may be composed of one or more BWPs. When BWPs are configured in any NR CC, the BWPs may be configured to be UE-specific or cell-specific.

In other words, a different BWP configuration may be set for each UE as shown in FIG. 4, or the same BWP configuration may be set in all UEs for any NR CC. However, FIG. 4 is a mere example, and the present disclosure is not limited to the detailed bandwidth and BWP-specific bandwidths of the NR CC.

When a BWP configuration is set for any NR CC, UL/DL BWPs for communication between a UE and a BS may be set by activating a DL BWP for transmitting and receiving a PDCCH/PDSCH between the BS and the UE and a UL BWP for transmitting and receiving a PUCCH/PUSCH among the configured BWPs.

In accordance with an embodiment of the present disclosure, a frequency hopping method may be provided for a case in which BWPs configured or activated for PUCCH transmission for each UE in a slot configured in any NR CC have different sizes.

Specifically, in NR, two types of PUCCHs are defined for a UE to transmit UCI. A first type is a short duration PUCCH which is transmitted through one or two symbols in one slot, and a second type is a long duration PUCCH which is transmitted through four to 14 symbols. The short duration PUCCH may also be referred to below as a short PUCCH, and the long duration PUCCH may also be referred to below as a long PUCCH.

When any UE uses a short duration PUCCH composed of two symbols or a long duration PUCCH in one slot to transmit UCI, it is necessary to apply frequency hopping to obtain frequency diversity gain.

In particular, in the case of a short duration PUCCH composed of two symbols, frequency hopping may be performed in units of symbols. Also, in the case of a long duration PUCCH, frequency hopping may be supported at most once in one slot.

According to NR, when frequency hopping is supported for a PUCCH in a single slot as described above, it is necessary to define a detailed frequency hopping method for a corresponding PUCCH so that any UE transmits UCI through a short duration PUCCH composed of two symbols or a long duration PUCCH.

Specifically, as NR supports UE bandwidth adaption, UEs having different transmission/reception bandwidths in an arbitrary NR CC are supported. Therefore, as described above, BWPs for PUCCH transmission and reception may be separately

configured and activated for each UE. Accordingly, it is difficult to use the same single frequency hopping rule, which depends on a system bandwidth of a corresponding CC, unlike LTE.

In accordance with an embodiment of the present disclosure, a detailed frequency hopping method may be provided in consideration of this.

Embodiment 1: Implicit method of determining hopping bandwidth

According to a first embodiment of a detailed frequency hopping method, different frequency hopping rules may be defined for a long duration PUCCH and a short duration PUCCH. Alternatively, different frequency hopping rules may be defined according to the number of symbols assigned for PUCCH transmission in any slot or UE.

In other words, a frequency hopping bandwidth for a PUCCH, which will be applied to any UE, may be defined as a function of a PUCCH duration or the number of symbols assigned for PUCCH transmission, a bandwidth of a BWP configured and activated for PUCCH transmission or a system bandwidth of an NR CC, and the like.

For example, in the case of a long duration PUCCH, a frequency hopping bandwidth may be determined according to a system bandwidth of an NR CC with which an arbitrary UE is connected regardless of a bandwidth of a BWP activated for the UE. In the case of a short duration PUCCH, a frequency hopping bandwidth may be determined according to a bandwidth of a BWP which is UE-specifically activated for UL transmission and reception.

Similarly, when the number of symbols of a PUCCH assigned for an arbitrary UE in an arbitrary slot is a specific value or more, a frequency hopping bandwidth may be determined according to a system bandwidth of an NR CC. Otherwise, a frequency hopping bandwidth may be determined according to a bandwidth of an activated BWP.

As a detailed example, it is possible to define a frequency hopping rule based on a system bandwidth of an NR CC (i.e., type-1 frequency hopping) and a frequency hopping rule based on a bandwidth of a BWP which is activated for each UE (i.e., type-2 frequency hopping) (however, the present disclosure is not limited to the names such as type-1 frequency hopping and type-2 frequency hopping), and a frequency hopping rule which will be used for an arbitrary UE to transmit UCI may be determined according to a duration of a PUCCH to be used for transmitting the UCI.

In other words, as shown in FIG. 5, type-1 frequency hopping may be applied to a long duration PUCCH, and type-2 frequency hopping may be applied to a short duration PUCCH, or a frequency hopping type may be determined according to the number of symbols assigned for PUCCH transmission.

However, when the frequency hopping rule based on a system bandwidth (i.e., type-1 frequency hopping) is applied and a corresponding hopping bandwidth is greater than a transmission/reception bandwidth of a UE, a returning gap may be defined between frequency hops of a PUCCH. Alternatively, a BS/network may set and indicate a frequency hopping type for PUCCH transmission for each UE through UE-specific/cell-specific higher layer signaling, media access control (MAC) control element (CE) signaling, or level-1 (L1) control signaling.

Embodiment 2: Explicit method of determining hopping bandwidth

A BS/network may set/indicate a frequency hopping bandwidth for a PUCCH for each UE. As a detailed method, a BS/network may directly set and signal a frequency hopping bandwidth for a PUCCH for each UE through UE-specific/cell-specific higher layer signaling.

Additionally, before frequency hopping configuration for a corresponding PUCCH, it is possible to define a default frequency hopping bandwidth or a default

frequency hopping rule which will be applied to any UE. The default frequency hopping bandwidth or the default frequency hopping rule may be determined according to a bandwidth of a BWP or a bandwidth of an NR CC in the same way as described in Embodiment 1 with reference to FIG. 5.

However, when a PUCCH hopping bandwidth is set through UE-specific/cell-specific higher layer signaling, the same hopping bandwidth may be set regardless of PUCCH duration, UCI type (e.g., scheduling request (SR), channel state indicator (CSI) feedback, or hybrid automatic request (HARQ) acknowledgement (ACK)/negative acknowledgement (NACK) feedback), payload size, or the like.

Alternatively, as described in Embodiment 1, a frequency hopping bandwidth may be set differently according to a PUCCH duration, the number of symbols assigned for PUCCH transmission in an arbitrary slot, or a PUCCH format dependent on a UCI type, a payload size, or the like.

For another method for a BS/network to set/indicate a frequency hopping bandwidth for a PUCCH for each UE, a BS/network may indicate frequency hopping bandwidths, which will be applied to respective PUCCH transmission operations, through L1 control signaling. Specifically, when an arbitrary UE indicates PUCCH transmission for HARQ ACK/NACK feedback or CSI feedback through downlink control information (DCI), such as DL assignment DCI or UL grant, for the UE, frequency hopping bandwidth indication information may be directly transmitted through the corresponding DCI together with PUCCH transmission resource allocation information.

However, as a method for reducing control overhead, it is possible to define candicate values which may be indicated by the BS/network through the PUCCH frequency hopping bandwidth indication information of the DCI, and indicate one of the candidate values through the DCI.

Here, the candidate values for PUCCH frequency hopping may be defined according to a bandwidth of a BWP or a system bandwidth of an NR CC, or may be set by the BS/network through cell-specific/UE-specific higher layer signaling.

Alternatively, a default frequency hopping bandwidth or a default frequency hopping rule may be defined, and the BS/network may dynamically indicate an offset value (e.g., a physical resource block (PRB) offset value) from a frequency location of a second hop of a corresponding PUCCH (i.e., a PRB of the second hop of the corresponding PUCCH), to which the default frequency hopping bandwidth or the default frequency hopping rule has been applied, through L1 control signaling of corresponding DL assignment DCI or UL grant.

Alternatively, the BS/network may set a corresponding offset value through UE-specific/group common/cell-specific higher layer signaling or MAC CE signaling.

For example, as shown in FIG. 6, type-2 frequency hopping dependent on a bandwidth of a BWP configured and activated for each UE, which is one of the methods described in Embodiment 1, may be defined as a default frequency hopping rule for any UE to transmit a PUCCH, and the BS/network may indicate a frequency hopping offset value from a second frequency hop of the corresponding PUCCH conforming to the default frequency hopping rule through L1 control signaling.

However, this embodiment may be applied regardless of a defailed default frequency hopping rule. For example, a default frequency hopping bandwidth may be semi-statically set for each UE through cell-specific/UE-specific higher layer signaling, type-2 frequency hopping of Embodiment 1 described above may be defined as a default hopping rule, or different default hopping rules may be defined according to a PUCCH duration or the number of PUCCH symbols as described in Embodiment 1.

Also, candidate values for corresponding hopping offset values which may be indicated by DCI to reduce control overhead may be defined in the same way as the above-described method of indicating a frequency hopping bandwidth through L1 control signaling.

Embodiment 3: Method of separately allocating frequency resources (e.g., PRBs) for each frequency hop

When frequency hopping for a PUCCH is applied in a slot or between slots, a BS/network may configure separate frequency resource allocation information (e.g., PRB allocation information) for each frequency hop and directly set/indicate the frequency resource allocation information for a UE.

For example, as shown in FIG. 5 or 6, when an arbitrary UE sets/indicates PUCCH transmission through one UL slot and frequency hopping is applied to the PUCCH transmission, frequency resource allocation information (e.g. PRB allocation information) for a first frequency hop of a corresponding PUCCH and frequency resource allocation information (e.g. PRB allocation information) for a second frequency hop of the corresponding PUCCH may be separately set and signaled to the corresponding UE.

In other words, a method for a BS/network to signal frequency resource allocation information (e.g., PRB allocation information) for PUCCH transmission of a UE may be defined to sepeately set frequency resource allocation information (e.g. PRB allocation information) for a first frequency hop of the corresponding PUCCH transmission and frequency resource allocation information (e.g. PRB allocation information) for a second frequency hop of the corresponding PUCCH transmission and to transmit the same to the corresponding UE through UE-specific/group common/cell-specific higher layer signaling, MAC CE signaling, or L1 control signaling.

Additionally, a BS/network may enable or disable frequency hopping for a PUCCH through cell-specific/UE-specific higher layer signaling, MAC CE signaling, or L1 control signaling.

Also, the scope of the present disclosure encompasses a frequency hopping method for a PUCCH defined to be a combination of the above-described frequency hopping methods. The frequency hopping methods described in the present disclosure may be applied not only to a PUCCH but also to all UL physical channels/signals, such as a PUSCH, a sounding reference signal (SRS), a physical random access channel (PRACH), etc., without departing from the scope of the present disclosure.

FIG. 7 is a flowchart illustrating a method of a UE for transmitting a UL control channel and a UL data channel to a BS according to an embodiment of the present disclosure.

Referring to FIG. 7, a UE may receive BWP configuration information from a BS (S700). The BWP configuration information is information on a BWP set composed of one or more BWPs configured for the UE.

For example, the BWP configuration information may include index information which indicates each BWP included in the BWP set composed of the one or more BWPs configured for the UE.

The UE may receive DL control information which indicates one of the BWPs included in the BWP set on the basis of the BWP configuration information from the BS.

Here, the number of bits of information indicating a BWP in the DL control information may be determined according to a maximum number N (N is a natural number greater than or equal to 1) of BWPs which may be used by the UE. For example, when N is set to four, four different pieces of information may be represented by at most

two bits. Therefore, in the DL control information, information indicating a BWP may be one bit or two bits.

For another example, the BWP configuration information may additionally include SCS information and a CP for each BWP of the BWP set.

Here, each BWP of the BWP set may be configured on the basis of common resource block (RB) indexing information of a CC configured by the BS. The CC may be a narrowband (NB) CC or a wideband (WB) CC, or may refer to one or more CCs for carrier aggregation (CA).

All UEs which use the same CC may share the same common RB indexing information. In other words, it is possible to apply the same RB indexing regardless of whether an arbitrary CC is based on a single numerology or multiple numerologies are multiplexed on the CC.

Specifically, configuration information of each BWP of the BWP set may include a starting RB index, that is, a starting point of the BWP, based on the common RB indexing information. Such a starting PRB index may be represented in units of RB indices based on common RB indexing. Also, the configuration information of each BWP may additionally include starting RB indexing information based on the common RB indexing information and size information of the corresponding BWP. The BS may transmit the BWP configuration information to the UE through higher layer signaling (e.g., RRC signaling).

The UE may receive frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP of the BWP set from the BS (S710).

Here, the frequency hopping configuration information for a UL control channel may include at least one of information indicating whether to perform frequency hopping,

PRB allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

The first frequency resource region and the second frequency resource region which will be described below denote frequency resource regions to which a first PUCCH and a second PUCCH constituting the UL control channel are separately assigned when frequency hopping is performed. The first and second frequency resource regions may also be referred to as a first frequency hop and a second frequency hop, respectively.

The information indicating whether to perform frequency hopping is information which indicates whether to enable or disable frequency hopping for the UL control channel. When the frequency hopping is enabled, the frequency hopping is performed, and when the frequency hopping is disabled, no frequency hopping is performed.

When the frequency hopping is performed, the PRB allocation information of the first frequency resource region of the UL control channel may include starting PRB indexing information of the first frequency resource region.

Likewise, when the frequency hopping is performed, the PRB allocation information of the second frequency resource region of the UL control channel may include starting PRB indexing information of the second frequency resource region.

Also, the frequency hopping configuration information for a UL data channel may include a frequency hopping offset set which is composed of one or more frequency hopping offset values. Here, the frequency hopping offset values may be indicated as the numbers of PRBs.

The number of frequency hopping offset values included in the frequency hopping offset set may be determined on the basis of the number of PRBs constituting the transmission BWP.

As an example of a method of determining the number of frequency hopping offset values included in the frequency hopping offset set, the number of frequency hopping offset values included in the frequency hopping offset set may be determined depending on whether a number K of PRBs constituting the transmission BWP is a preset threshold value T (T is a natural number greater than or equal to 1) or less.

For example, when K is T (e.g., 50 PRBs) or less, the number of frequency hopping offsets may be set to a preset first hopping offset number (e.g., two), and when K exceeds T, the number of frequency hopping offsets may be set to a preset second hopping offset number (e.g., four). Here, the greater the size of the BWP, the greater the frequency hopping offset may be. Therefore, the second hopping offset number may be set to be greater than the first hopping offset number.

The UE may receive information indicating which one of the frequency hopping offset values included in the frequency hopping offset set will be used from the BS. Here, the BS may notify the UE of the corresponding information through UL grant DCI.

The UE may transmit a UL control channel and a UL data channel to the BS through the transmission BWP on the basis of the BWP configuration information and the frequency hopping configuration information (S720).

The BWP configuration information and the frequency hopping configuration information may be indicated by the BS through higher layer signaling (e.g., RRC signaling).

FIG. 8 is a flowchart illustrating a method of a BS for receiving a UL control channel and a UL data channel from a UE according to an embodiment of the present disclosure.

Referring to FIG. 8, a BS may transmit BWP configuration information of a BWP set which is composed of one or more BWPs configured for a UE to the UE

(S800). The BWP configuration information is information on the BWP set composed of the one or more BWPs configured for the UE.

For example, the BWP configuration information may include index information which indicates each BWP included in the BWP set composed of the one or more BWPs configured for the UE.

The BS may transmit DL control information which indicates one of the BWPs included in the BWP set on the basis of the BWP configuration information to the UE.

Here, the number of bits of information indicating a BWP in the DL control information may be determined according to a maximum number N (N is a natural number greater than or equal to 1) of BWPs which may be used by the UE. For example, when N is set to four, four different pieces of information may be represented by at most two bits. Therefore, in the DL control information, information indicating a BWP may be one bit or two bits.

For another example, the BWP configuration information may additionally include SCS information and a CP for each BWP of the BWP set.

Here, each BWP of the BWP set may be configured on the basis of common RB indexing information of a CC configured by the BS. The CC may be an NB CC or a WB CC, or may refer to one or more CCs for CA.

All UEs which use the same CC may share the same common RB indexing information. In other words, it is possible to apply the same RB indexing regardless of whether an arbitrary CC is based on a single numerology or multiple numerologies are multiplexed on the CC.

Specifically, configuration information of each BWP of the BWP set may include a starting RB index, that is, a starting point of the BWP, based on the common RB indexing information. Such a starting PRB index may be represented in units of RB

indices based on common RB indexing. Also, the configuration information of each BWP may additionally include starting RB index information based on the common RB indexing information and size information of the corresponding BWP. The BS may transmit the BWP configuration information to the UE through higher layer signaling (e.g., RRC signaling).

The BS may transmit frequency hopping configuration information for a UL control channel and a UL data channel received through one reception BWP of the BWP set to the UE (S810).

Here, the frequency hopping configuration information for a UL control channel may include at least one of information indicating whether to perform frequency hopping, PRB allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

The information indicating whether to perform frequency hopping is information which indicates whether to enable or disable frequency hopping for the UL control channel. When the frequency hopping is enabled, the frequency hopping is performed, and when the frequency hopping is disabled, no frequency hopping is performed.

When the frequency hopping is performed, the PRB allocation information of the first frequency resource region of the UL control channel may include starting PRB indexing information of the first frequency resource region.

Likewise, when the frequency hopping is performed, the PRB allocation information of the second frequency resource region of the UL control channel may include starting PRB indexing information of the second frequency resource region.

Also, the frequency hopping configuration information for a UL data channel may include a frequency hopping offset set which is composed of one or more frequency

hopping offset values. Here, the frequency hopping offset values may be indicated as the numbers of PRBs.

The number of frequency hopping offset values included in the frequency hopping offset set may be determined on the basis of the number of PRBs constituting the reception BWP.

As an example of a method of determining the number of frequency hopping offset values included in the frequency hopping offset set, the number of frequency hopping offset values included in the frequency hopping offset set may be determined depending on whether a number K of PRBs constituting the reception BWP is a preset threshold value T (T is a natural number greater than or equal to 1) or less.

For example, when K is T (e.g., 50 PRBs) or less, the number of frequency hopping offsets may be set to a preset first hopping offset number (e.g., two), and when K exceeds T, the number of frequency hopping offsets may be set to a preset second hopping offset number (e.g., four). Here, the greater the size of the BWP, the greater the frequency hopping offset may be. Therefore, the second hopping offset number may be set to be greater than the first hopping offset number.

The UE may receive information indicating which one of the frequency hopping offset values included in the frequency hopping offset set will be used from the BS. Here, the BS may notify the UE of the corresponding information through UL grant DCI.

Also, the BS may receive a UL control channel and a UL data channel from the UE through the reception BWP on the basis of the BWP configuration information and the frequency hopping configuration information (S820).

The UE may be notified of the BWP configuration information and the frequency hopping configuration information through higher layer signaling (e.g., RRC signaling).

FIG. 9 is a diagram showing a BS according to an embodiment of the present disclosure.

Referring to FIG. 9, a BS 900 includes a controller 910, a transmitter 920, and a receiver 930.

The transmitter 920 and the receiver 930 are used to transmit and receive signals, messages, and data required to implement the above-described present disclosure.

Specifically, the transmitter 920 may transmit BWP configuration information of a BWP set composed of one or more BWPs configured for a UE and transmit frequency hopping configuration information for a UL control channel and a UL data channel received through one reception BWP included in the BWP set.

Here, the BWP configuration information is information on the BWP set composed of the one or more BWPs configured for the UE.

For example, the BWP configuration information may include index information which indicates each BWP included in the BWP set composed of the one or more BWPs configured for the UE.

The BS may transmit DL control information which indicates one of the BWPs included in the BWP set on the basis of the BWP configuration information to the UE.

Here, the number of bits of information indicating a BWP in the DL control information may be determined according to a maximum number N (N is a natural number greater than or equal to 1) of BWPs which may be used by the UE. For example, when N is set to four, four different pieces of information may be represented by at most two bits. Therefore, in the DL control information, information indicating a BWP may be one bit or two bits.

For another example, the BWP configuration information may additionally include SCS information and a CP for each BWP of the BWP set.

Here, each BWP of the BWP set may be configured on the basis of common RB indexing information of a CC configured by the BS. The CC may be an NB CC or a WB CC, or may refer to one or more CCs for CA.

All UEs which use the same CC may share the same common RB indexing information. In other words, it is possible to apply the same RB indexing regardless of whether an arbitrary CC is based on a single numerology or multiple numerologies are multiplexed on the CC.

Specifically, configuration information of each BWP of the BWP set may include a starting RB index, that is, a starting point of the BWP, based on the common RB indexing information. Such a starting PRB index may be represented in units of RB indices based on common RB indexing. Also, the configuration information of each BWP may additionally include starting RB indexing information based on the common RB indexing information and size information of the corresponding BWP. The BS may transmit the BWP configuration information to the UE through higher layer signaling (e.g., RRC signaling).

Also, the frequency hopping configuration information for a UL control channel may include at least one of information indicating whether to perform frequency hopping, PRB allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

The information indicating whether to perform frequency hopping is information which indicates whether to enable or disable frequency hopping for the UL control channel. When the frequency hopping is enabled, the frequency hopping is performed, and when the frequency hopping is disabled, no frequency hopping is performed.

When the frequency hopping is performed, the PRB allocation information of the first frequency resource region of the UL control channel may include starting PRB indexing information of the first frequency resource region.

Likewise, when the frequency hopping is performed, the PRB allocation information of the second frequency resource region of the UL control channel may include starting PRB indexing information of the second frequency resource region.

Also, the frequency hopping configuration information for a UL data channel may include a frequency hopping offset set which is composed of one or more frequency hopping offset values. Here, the frequency hopping offset values may be indicated as the numbers of PRBs.

The number of frequency hopping offset values included in the frequency hopping offset set may be determined on the basis of the number of PRBs constituting the reception BWP.

As an example of a method of determining the number of frequency hopping offset values included in the frequency hopping offset set, the number of frequency hopping offset values included in the frequency hopping offset set may be determined depending on whether a number K of PRBs constituting the reception BWP is a preset threshold value T (T is a natural number greater than or equal to 1) or less.

For example, when K is T (e.g., 50 PRBs) or less, the number of frequency hopping offsets may be set to a preset first hopping offset number (e.g., two), and when K exceeds T, the number of frequency hopping offsets may be set to a preset second hopping offset number (e.g., four). Here, the greater the size of the BWP, the greater the frequency hopping offset may be. Therefore, the second hopping offset number may be set to be greater than the first hopping offset number.

The UE may receive information indicating which one of the frequency hopping offset values included in the frequency hopping offset set will be used from the BS. Here, the BS may notify the UE of the corresponding information through UL grant DCI.

The receiver 930 may receive a UL control channel and a UL data channel from the UE through the reception BWP on the basis of the BWP configuration information and the frequency hopping configuration information.

The UE may be notified of the BWP configuration information and the frequency hopping configuration information through higher layer signaling (e.g., RRC signaling).

FIG. 10 is a disgram showing a UE according to an embodiment of the present disclosure.

Referring to FIG. 10, a UE 1000 includes a receiver 1010, a controller 1020, and a transmitter 1030.

From a BS, the receiver 1010 may receive BWP configuration information of a BWP set which is composed of one or more BWPs configured for the UE and receive frequency hopping configuration information for a UL control channel and a UL data channel transmitted through one transmission BWP included in the BWP set.

Here, the BWP configuration information is information on the BWP set composed of the one or more BWPs configured for the UE.

For example, the BWP configuration information may include index information which indicates each BWP included in the BWP set composed of the one or more BWPs configured for the UE.

The UE may receive DL control information which indicates one of the BWPs included in the BWP set on the basis of the BWP configuration information from the BS.

Here, the number of bits of information indicating a BWP in the DL control information may be determined according to a maximum number N (N is a natural number greater than or equal to 1) of BWPs which may be used by the UE. For example, when N is set to four, four different pieces of information may be represented by at most two bits. Therefore, in the DL control information, information indicating a BWP may be one bit or two bits.

For another example, the BWP configuration information may additionally include SCS information and a CP for each BWP of the BWP set.

Here, each BWP of the BWP set may be configured on the basis of common RB indexing information of a CC configured by the BS. The CC may be an NB CC or a WB CC, or may refer to one or more CCs for CA.

All UEs which use the same CC may share the same common RB indexing information. In other words, it is possible to apply the same RB indexing regardless of whether an arbitrary CC is based on a single numerology or multiple numerologies are multiplexed on the CC.

Specifically, configuration information of each BWP of the BWP set may include a starting RB index, that is, a starting point of the BWP, based on the common RB indexing information. Such a starting PRB index may be represented in units of RB indices based on common RB indexing. Also, the configuration information of each BWP may additionally include starting RB indexing information based on the common RB indexing information and size information of the corresponding BWP. The BS may transmit the BWP configuration information to the UE through higher layer signaling (e.g., RRC signaling).

Also, the frequency hopping configuration information for a UL control channel may include at least one of information indicating whether to perform frequency hopping,

PRB allocation information of a first frequency resource region of the UL control channel, and PRB allocation information of a second frequency resource region of the UL control channel.

The information indicating whether to perform frequency hopping is information which indicates whether to enable or disable frequency hopping for the UL control channel. When the frequency hopping is enabled, the frequency hopping is performed, and when the frequency hopping is disabled, no frequency hopping is performed.

When the frequency hopping is performed, the PRB allocation information of the first frequency resource region of the UL control channel may include starting PRB indexing information of the first frequency resource region.

Likewise, when the frequency hopping is performed, the PRB allocation information of the second frequency resource region of the UL control channel may include starting PRB indexing information of the second frequency resource region.

Also, the frequency hopping configuration information for a UL data channel may include a frequency hopping offset set composed of one or more frequency hopping offset values. Here, the frequency hopping offset values may be indicated as the numbers of PRBs.

The number of frequency hopping offset values included in the frequency hopping offset set may be determined on the basis of the number of PRBs constituting the transmission BWP.

As an example of a method of determining the number of frequency hopping offset values included in the frequency hopping offset set, the number of frequency hopping offset values included in the frequency hopping offset set may be determined depending on whether a number K of PRBs constituting the transmission BWP is a preset threshold value T (T is a natural number greater than or equal to 1) or less.

For example, when K is T (e.g., 50 PRBs) or less, the number of frequency hopping offsets may be set to a preset first hopping offset number (e.g., two), and when K exceeds T, the number of frequency hopping offsets may be set to a preset second hopping offset number (e.g., four). Here, the greater the size of the BWP, the greater the frequency hopping offset may be. Therefore, the second hopping offset number may be set to be greater than the first hopping offset number.

The UE may receive information indicating which one of the frequency hopping offset values included in the frequency hopping offset set will be used from the BS. Here, the BS may notify the UE of the corresponding information through UL grant DCI.

The transmitter 1030 may transmit a UL control channel and a UL data channel to the BS through the transmission BWP on the basis of the BWP configuration information and the frequency hopping configuration information.

The BS may provide the BWP configuration information and the frequency hopping configuration information through higher layer signaling (e.g., RRC signaling).

According to the embodiments of the present disclosure, it is possible to provide a frequency hopping application method for preventing collision between resources used by UEs which use different BWP configurations to transmit UL channels in NR.

The standard content or standard documents mentioned in the above-described embodiments are omitted to simplify the description of this specification, but form a part of this specification. Therefore, adding a part of the standard content and standard documents to this specification or describing a part of the standard content and standard documents in the claims should be construed as being included in the scope of the present disclosure.

The above embodiments of the present disclosure have been described only for illustrative purposes, and those skilled in the art will appreciate that various modifications

and changes may be made thereto without departing from the essential features of the disclosure. Therefore, the embodiments of the present disclosure are not intended to limit, but are intended to illustrate the technical idea of the present disclosure, and the scope of the technical idea of the present disclosure is not limited by the embodiments. The scope of the present disclosure shall be construed on the basis of the accompanying claims in such a manner that all of the technical ideas included within the scope equivalent to the claims belong to the present disclosure.

Moreover, the terms "system," "processor," "controller," "component," "module," "interface,", "model," "unit" or the like are generally intended to refer to a computer-related entity, either hardware, a combination of hardware and software, software, or software in execution. For example, a component may be, but is not limited to being, a process running on a processor, a processor, a controller, a control processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration, both an application running on a controller or processor and the controller or processor can be a component. One or more components may reside within a process and/or thread of execution and a component may be localized on one computer and/or distributed between two or more computers.

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

Title of Invention	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

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

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

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

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LEGAL NAME OF INVENTOR

Inventor: PARK, Kyujin Date (Optional): 2018. 07. 13

Signature: _____

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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 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Title of Invention	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

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

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

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

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LEGAL NAME OF INVENTOR

Inventor: CHOI, Woo-jin Date (Optional): 2018. 07. 13

Signature: 

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

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 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0136
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

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

Inventor Information:

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0136
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL	

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For further information see 37 CFR 1.33(a).

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Customer Number	76277		
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Application Information:

Title of the Invention	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL		
Attorney Docket Number	811.0136	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	10	**Suggested Figure for Publication (if any)**	

Filing By Reference:

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

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

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

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

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Customer Number	76277		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0136
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL	

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

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

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Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2017-0095980	KR	2017-07-28	

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2017-0102577	KR	2017-08-11	

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Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2018-0057278	KR	2018-05-18	

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0136
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL	

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

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0136
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Authorization or Opt-Out of Authorization to Permit Access:

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

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

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

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

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

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

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

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

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

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

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

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0136
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Title of Invention	APPARATUS AND METHOD FOR TRANSMITTING AND RECEIVING UPLINK CHANNEL	

Applicant Information:

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

Applicant 1 — Remove

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

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

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

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	KT CORPORATION		
Mailing Address Information For Applicant:			
Address 1	206, Jeongja-dong, Bundang-gu, Seongnam-si		
Address 2			
City	Gyeonggi-do	**State/Province**	
Country	KR	Postal Code	463-711
Phone Number		Fax Number	
Email Address			

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

Assignee Information including Non-Applicant Assignee Information:

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

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Assignee 1

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

Remove

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

Organization Name	KT CORPORATION

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	206, Jeongja-dong, Bundang-gu, Seongnam-si		
Address 2			
City	Gyeonggi-do	**State/Province**	
Country i	KR	Postal Code	463-711
Phone Number		Fax Number	
Email Address			

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

Signature:

Remove

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

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

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

Signature	/Ian M. Hughes/			Date (YYYY-MM-DD)	2018-07-27
First Name	Ian	Last Name	Hughes	Registration Number	41083

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

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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 CooperationTreaty.

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.