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

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
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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.

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Email:	yoon@pegasuswi.com
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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: 閔燦皓.

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
		KR Issue	10-2114096	2020.05.18
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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
	P20170866	Provisional Application	10-2017-0101169	2017.08.09
	P20170935	KR Application	10-2018-0014576	2018.02.06
		KR Issue	10-2043996	2019.11.06
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		KR Issue(DA)	10-2206761	2021.01.19
	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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	P20170479	Provisional Application	10-2017-0082920	2017.06.29
	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
		CN Issue	CN 108633072 B	8/26/2022
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
	P20180018	KR Application	10-2018-0035572	2018.03.28
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	P20170318US	US Application	15/990,895	2018.05.29
		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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	P20170531CN	CN Application	201810756991.4	2018.07.11
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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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33	P20170764	Provisional Application	10-2017-0128188	2017.09.29
	P20170916	Provisional Application	10-2017-0162728	2017.11.30
	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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		CN Issue	CN 109586883 B	2021.11.05

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	P20180507	KR Application	10-2018-0132306	2018.10.31
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	P20180014US	US Application	16/241,086	2019.01.07
		US Issue	11,258,532	2022.02.22
	P20180014USC1	US Application(CA)	17/565,353	2021.12.29
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	P20180014CN	CN Application	201910011509.9	2019.01.07
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		US Issue	11,330,573	2022.05.10
	P20150004CN	CN Application	201680004054.2	2017.06.08
		CN Issue	CN 107005903 B	2021.01.15
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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		US Issue	10,334,657	2019.06.25

	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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		KR Issue	10-1866619	2018.06.04
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		US Issue	10,237,084	2019.03.19
	P20150003CN	CN Application	201580066326.7	2017.06.06
		CN Issue	CN 107005820 B	2020.11.03
38	P20130110	Provisional Application	10-2013-0034603	2013.03.29
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		KR Issue	10-1632277	2016.06.15
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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
	P20130843	Provisional Application	10-2013-0130502	2013.10.30
	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
	P20170232CN	CN Application	201810384302.1	2018.04.26
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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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46	P20170654	Provisional Application	10-2017-0107962	2017.08.25
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		KR Issue	10-2115233	2020.05.20
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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
	P20140785	KR Application	10-2014-0175182	2014.12.08
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	P20140175CN	CN Application	201580006949.5	2016.08.02
		CN Issue	CN 106464647 B	2019.09.13
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	P20170314CN	CN Application	201810531289.8	2018.05.29
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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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		KR Issue	10-2114940	2020.05.19
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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
57	P20160835	Provisional Application	10-2016-0152845	2016.11.16
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		US Issue	10,897,720	2021.01.19

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	P20170622	Provisional Application	10-2017-0101782	2017.08.10
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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
	P20170451	Provisional Application	10-2017-0081411	2017.06.27
	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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		KR Issue	10-2114919	2020.05.19
	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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61	P20170741	Provisional Application	10-2017-0118757	2017.09.15
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		KR Issue	10-2198015	2020.12.28
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		US Issue	10,616,834	2020.04.07
	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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	P20180532	Provisional Application	10-2018-0084727	2018.07.20
	P20180540	KR Application	10-2018-0092635	2018.08.08
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64	P20170795	Provisional Application	10-2017-0128513	2017.10.02
	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

		KR Issue	10-1814248	2017.12.26
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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

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United States Patent and Trademark Office
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/826,482	01/04/2022	11219000	KT21-0115D1	6363

126667 7590 12/15/2021

INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121

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.

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

Kyujin PARK, Seoul, KOREA, REPUBLIC OF;

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

KT CORPORATION, Gyeonggi-do, 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.

PART B – FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22314-1450
or Fax **(571)-273-2885**

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

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

INVENSTONE PATENT, LLC.
14291-A Brushwood way
Centreville, VA 20121

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, EFS-Web transmitted, or facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's Name)
(S-signature)
(Date)

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
16/826,482	03/23/2020	Kyujin PARK	KT21-0115D1	6363

TITLE OF INVENTION: APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

APPLN: TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0	$0	$1200	12/08/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
HO, CHUONG T	2412	370-329000

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

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

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

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

1. INVENSTONE Patent, 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 has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

1a. NAME OF ASSIGNEE: KT CORPORATION

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Gyeonggi-do, KOREA

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

4a. The following fee(s) are submitted:
☑ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

4b. Payment of Fees(s): **(Please first reapply and previously paid fee shown above)**
☐ A check is enclosed
☐ Payment be credit card. Form PTO-2038 is attached
☑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 60-2040 (enclose an extra copy of this form)

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29
NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be 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 /Daniel CHUNG/ Date November 25, 2021

Typed or printed name Daniel CHUNG Registration No. 57,889

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 39 of 595

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.

Electronic Patent Application Fee Transmittal

Application Number:	16826482
Filing Date:	23-Mar-2020
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Filer:	Daniel Chung/judy Kim
Attorney Docket Number:	KT21-0115D1

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:				
UTILITY APPL ISSUE FEE	1501	1	1200	1200

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1200**

Electronic Acknowledgement Receipt	
EFS ID:	44370286
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	126667
Filer:	Daniel Chung/judy Kim
Filer Authorized By:	Daniel Chung
Attorney Docket Number:	KT21-0115D1
Receipt Date:	25-NOV-2021
Filing Date:	23-MAR-2020
Time Stamp:	00:15:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1200
RAM confirmation Number	E2021AO116153909
Deposit Account	602040
Authorized User	judy Kim
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)	KT21-0115D1-PTOL85b.pdf	156962 a1d131babdf45ebf7d3fd41740a6c09c02610768	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	37728 e4a630b8b687ff5e7369fed448a47e23d399bfe3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	194690		

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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.
16/826,482	03/23/2020	Kyujin PARK	KT21-0115D1	6363

7590 11/03/2021

INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121

EXAMINER
HO, CHUONG T

ART UNIT	PAPER NUMBER
2412	

NOTIFICATION DATE	DELIVERY MODE
11/03/2021	ELECTRONIC

NOTICE OF NON-COMPLIANT INFORMATION DISCLOSURE STATEMENT

An Information Disclosure Statement (IDS) filed 10/14/2021 in the above-identified application fails to meet the requirements of 37 CFR 1.97(d) for the reason(s) specified below. Accordingly, the IDS will be placed in the file, but the information referred to therein has not been considered.

The IDS is not compliant with 37 CFR 1.97(d) because:

☐ The IDS lacks a statement as specified in 37 CFR 1.97(e).

☑ The IDS lacks the fee set forth in 37 CFR 1.17(p).

☐ The IDS was filed after the issue fee was paid. Applicant may wish to consider filing a petition to withdraw the application from issue under 37 CFR 1.313(c) to have the IDS considered. See MPEP 1308.

C. Garner, for

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

FORM PTOM327-B (Rev. 02/08)

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 45 of 595

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Attorney Docket Number	KT21-0115D1

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 46 of 595

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Attorney Docket Number	KT21-0115D1

	1	《2017 11th International Conference on Signal Processing and Communication Systems (ICSPCS)》 Lihui Wang 等 "Uplink control channel for 5G new RAT"	
	2	《2018 IEEE 5G World Forum (5GWF)》 Lopamudra Kundu;Gang Xiong;Joonyoung Cho "Physical Uplink Control Channel Design for 5G New Radio"	

If you wish to add additional non-patent literature document citation information please click the Add button Add

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	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Attorney Docket Number	KT21-0115D1

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	/Daniel CHUNG/	Date (YYYY-MM-DD)	2021-10-14
Name/Print	Daniel CHUNG	Registration Number	57889

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.**

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 record s.

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:	44025809
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	126667
Filer:	Daniel Chung/judy Kim
Filer Authorized By:	Daniel Chung
Attorney Docket Number:	KT21-0115D1
Receipt Date:	14-OCT-2021
Filing Date:	23-MAR-2020
Time Stamp:	02:14:35
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)	IDS_SB08.pdf	1037566 921a374136da0b9308660ed523fead40560e27dc	no	4

Warnings:

Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Non Patent Literature	Physical_Uplink_Control_Channel_Design_for_5G_New_Radio.pdf	5684298 7aa28afb3c27acfaf35a23752b92ff9be3b6749f	no	6
Warnings:					
Information:					
3	Non Patent Literature	Uplink_control_channel_for_5G_new_RAT.pdf	329791 bcff3ed12070d6e97bbb4ea2aaad9b3f2fa899c3	no	7
Warnings:					
Information:					
4	Non Patent Literature	CN_OA.pdf	418970 c35390aa0100cbf2234713c3c5d0e7d5dbd3919a	no	7
Warnings:					
Information:					
			Total Files Size (in bytes):	7470625	

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

126667 7590 09/08/2021
INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121

EXAMINER	
HO, CHUONG T	
ART UNIT	PAPER NUMBER
2412	

DATE MAILED: 09/08/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/826,482	03/23/2020	Kyujin PARK	KT21-0115D1	6363

TITLE OF INVENTION: APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	12/08/2021

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.

PTOL-85 (Rev. 02/11)

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 52 of 595

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)

126667 7590 09/08/2021
INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121

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.
16/826,482	03/23/2020	Kyujin PARK	KT21-0115D1	6363

TITLE OF INVENTION: APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	12/08/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
HO, CHUONG T	2412	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. _____

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 53 of 595

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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/826,482	03/23/2020	Kyujin PARK	KT21-0115D1	6363

126667 7590 09/08/2021

INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121

EXAMINER	
HO, CHUONG T	

ART UNIT	PAPER NUMBER
2412	

DATE MAILED: 09/08/2021

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.

PTOL-85 (Rev. 02/11)

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 54 of 595

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. 16/826,482	Applicant(s) PARK, Kyujin	
	Examiner CHUONG T HO	Art Unit 2412	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 06/21/2021.
   ☐ 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 16-27 . 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. 1020170128 .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

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

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

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

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

Attachment(s)

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

/CHUONG T HO/
Primary Examiner, Art Unit 2412

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 56 of 595

Notice of Pre-AIA or AIA Status

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

This office action is in response to the amendment filed 06/21/2021.

Claims 16-19, 20-23, 24-27 are pending.

Priority

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. REPUBLIC OF KOREA 10-2017-0128188, filed on 09/29/2017.

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. REPUBLIC OF KOREA 10-2017-0162728, filed on 11/30/2017.

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. REPUBLIC OF KOREA 10-2018-0077270, filed on 07/03/2018.

Allowable Subject Matter

1. Claims 16-19, 20-23, 24-27 are allowed.

2. The following is a statement of reasons for the indication of allowable subject matter:

Claim 16 is allowed over the prior art or record since the cited reference taken individually or in combination fails to particular disclose the following limitations: " wherein the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling " and in combination with other limitations recited as specified in claim 16.

Claim 20 is allowed over the prior art or record since the cited reference taken individually or in combination fails to particular disclose the following limitations: " wherein the UL control channel resource set configuration information is transmitted through UE specific radio resource control (RRC) signaling " and in combination with other limitations recited as specified in claim 20.

Claim 24 is allowed over the prior art or record since the cited reference taken individually or in combination fails to particular disclose the following limitations: " wherein the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling " and in combination with other limitations recited as specified in claim 24.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHUONG T HO whose telephone number is (571)272-3133. The examiner can normally be reached on 7:30-4:00.

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, Charles C Jiang can be reached on 571-270-7191. 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.

/CHUONG T HO/
Primary Examiner, Art Unit 2412

Notice of References Cited	Application/Control No. 16/826,482	Applicant(s)/Patent Under Reexamination PARK, Kyujin	
	Examiner CHUONG T HO	Art Unit 2412	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-20200059327-A1	02-2020	Kini; Ananth	H04W72/042	1/1
*	B	US-20200221444-A1	07-2020	Tiirola; Esa Tapani	H04L1/1812	1/1
*	C	US-20150195063-A1	07-2015	Ro; Sangmin	H04L5/005	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.

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 60 of 595

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

✓	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	11/01/2020	04/12/2021	08/28/2021						
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
	6	-	-							
	7	-	-							
	8	-	-							
	9	-	-							
	10	-	-							
	11	-	-							
	12	-	-							
	13	-	-							
	14	-	-							
	15	-	-							
1	16	✓	✓	=						
2	17	✓	✓	=						
3	18	✓	O	=						
4	19	✓	O	=						
5	20	✓	✓	=						
6	21	✓	✓	=						
7	22	✓	O	=						
8	23	✓	O	=						
9	24	✓	✓	=						
10	25	✓	✓	=						
11	26	✓	O	=						
12	27	✓	O	=						
	28									
	29									
	30									

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 61 of 595

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	**Art Unit**
	CHUONG T HO	2412

CPC								
Symbol							**Type**	**Version**
H04W	/	72	/	0413			F	2013-01-01
H04W	/	72	/	042			A	2013-01-01

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

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/CHUONG T HO/ Primary Examiner, Art Unit 2412	28 August 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	16	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210828

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 62 of 595

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H04J	/	4	/	00	
	/		/		

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
370	329

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					
370	330					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/CHUONG T HO/ Primary Examiner, Art Unit 2412	28 August 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	16	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210828

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 63 of 595

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/CHUONG T HO/ Primary Examiner, Art Unit 2412	28 August 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	16	1

U.S. Patent and Trademark Office Part of Paper No.: 20210828

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 64 of 595

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

CPC - Searched*		
Symbol	Date	Examiner
(H04W72/0413 or H04W72/042 or H04L5/0053 or H04W72/0453	08/28/2021	CH

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
370	329,330	08/28/2021	CH

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

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 65 of 595

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

Search Notes		
Search Notes	**Date**	**Examiner**
(H04W72/0413 or H04W72/042 or H04L5/0053 or H04W72/0453 (Text search only - see search history printout)	08/28/2021	CH
370/329,330 (Text search only - see search history printout)	08/28/2021	CH
Claims search - see search history printout	08/28/2021	CH
Interference search - see search history printout.	08/28/2021	CH
Inventor and Assignee search in EAST and PALM - see search history printout.	08/28/2021	CH
IEEE search - see search history printout.	08/28/2021	CH
EAST search (USPAT, USPGPUB, EPO, USOCR, FERS, JPO, DERWENT, IBM_TDB) see search history printout.	08/28/2021	CH

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
	Interference search - see search history printout	08/28/2021	CH
370	329, 330	08/28/2021	CH
H04W	72/0413, 72/042, 72/0453	08/28/2021	CH
H04L	5/0053	08/28/2021	CH

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 66 of 595

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

BIB DATA SHEET

CONFIRMATION NO. 6363

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
16/826,482	03/23/2020	370	2412	KT21-0115D1

APPLICANTS
KT CORPORATION, Gyeonggi-do, KOREA, REPUBLIC OF;

INVENTORS
Kyujin PARK, Seoul, KOREA, REPUBLIC OF;

**** CONTINUING DATA ***************************
This application is a DIV of 16/147,530 09/28/2018 PAT 10638463

**** FOREIGN APPLICATIONS *************************
REPUBLIC OF KOREA 10-2017-0128188 09/29/2017
REPUBLIC OF KOREA 10-2017-0162728 11/30/2017
REPUBLIC OF KOREA 10-2018-0077270 07/03/2018

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
04/01/2020

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☑ Yes ☐ No	☑ Yes ☐ No	Examiner's Signature	KOREA, REPUBLIC OF	9	12	3

☑ Met after Allowance
CH
Initials

ADDRESS
INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121
UNITED STATES

TITLE
APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
1720	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Doc Code: ECOMM.AUTH/ECOMM.WTDW
Doc Description: Internet Communications Authorized/Internet Communications Authorization Withdrawn

PTO/SB/439 (11-15)

AUTHORIZATION FOR INTERNET COMMUNICATIONS IN A PATENT APPLICATION OR REQUEST TO WITHDRAW AUTHORIZATION FOR INTERNET COMMUNICATIONS		
	Application No.	16/826,482
	Filing Date	03-23-2020
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Practitioner Docket No.	KT21-0115D1

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

I. To authorize permission for Internet Communications.

☑ Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. I understand that a copy of these communications will be made of record in the application file. (MPEP 502.03)

II. To withdraw authorization for Internet Communications.

☐ The authorization given on _____, to the USPTO to communicate with the undersigned and any practitioner in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via Internet communications such as video conferencing, instant messaging, or electronic mail is hereby withdrawn. I understand that the withdrawal is effective when approved rather than when received.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 57,889.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Daniel J. Chung/ — Signature

AUG. 29, 2021 — Date

Daniel J. Chung — Typed or printed name

703-879-5205 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Juristic entities must be represented by a patent practitioner (see 37 CFR 1.31, which is applicable to any paper filed on or after September 16, 2012, that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below*.

☐ * Total of _____ forms are submitted.

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.

Electronic Acknowledgement Receipt

EFS ID:	43630375
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	126667
Filer:	Daniel Chung
Filer Authorized By:	
Attorney Docket Number:	KT21-0115D1
Receipt Date:	29-AUG-2021
Filing Date:	23-MAR-2020
Time Stamp:	14:24:41
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	Internet Communications Authorized	16826482_sb0439.pdf	74944 bf4d0f3875ff7ecfbb9f0def98d9c66ccddbefe0	no	2

Warnings:

Information:	
Total Files Size (in bytes):	74944

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/826,482	Filing Date 03/23/2020	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $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	

APPLICATION AS AMENDED - PART II

AMENDMENT	06/21/2021	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $480 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $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".	/TAMMY D MCBETH BROWN/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Attorney Docket No.: KT21-0115D1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Kyujin PARK	Examiner: HO, CHUONG T
Application No.:	16/826,482	Group Art Unit: 2412
Filing Date:	03-23-2020	Confirmation No.: 6363
For:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO	

Via Mail Stop Amendment

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

AMENDMENT UNDER 37 C.F.R. 1.111

In response to the Office Action dated April 16, 2021, please consider the following:

Amendments to the Claims begin on page 2.

Remarks begin on page 6.

AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1-15. (Canceled)

16. (Currently Amended) A method of transmitting uplink (UL) control information by a user equipment (UE), the method comprising:

receiving, from a base station, UL control channel resource set configuration information for UL control information transmission;

determining one of UL control channel resource sets contained in the received UL control channel resource set configuration information;

determining one of UL control channel resources contained in the determined UL control channel resource set; and

transmitting UL control information through the determined UL control channel resource,

wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information, and

wherein the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling.

17. (Currently Amended) The method according to claim 16, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the UE ~~user equipment~~.

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18. (Currently Amended) The method according to claim 17, wherein the each UL BWP is activated through downlink (DL) control information.

19. (Currently Amended) The method according to claim 16, further comprising:

receiving, from the base station, downlink (DL) control information containing information indicating the one of the UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated from the base station through the DL control information.

20. (Currently Amended) A method of receiving uplink (UL) control information by a base station, the method comprising:

transmitting, to a user equipment (UE), UL control channel resource set configuration information for ~~transmitting~~ UL control information ~~to a user equipment~~; and

receiving the UL control information through one of UL control channel resources ~~configuring~~ in one of UL control channel resource sets contained in the transmitted UL control channel resource set configuration information,

wherein the one of the UL control channel resource sets for the UL control information transmission is determined based on a size of the UL control information, and

wherein the UL control channel resource set configuration information is transmitted through UE specific radio resource control (RRC) signaling.

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21. (Currently Amended) The method according to claim 20, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the UE ~~user equipment~~.

22. (Previously Presented) The method according to claim 21, wherein the each UL BWP is activated through downlink (DL) control information.

23. (Currently Amended) The method according to claim 20, further comprising:

transmitting, to the user equipment, downlink (DL) control information containing information that indicates the one of the UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated to the UE ~~user equipment~~ through the DL control information.

24. (Currently Amended) A user equipment (UE) for transmitting uplink (UL) control information, comprising:

a receiver configured to receive, from a base station, UL control channel resource set configuration information for UL control information transmission;

a controller configured to determine one of UL control channel resource sets contained in the received UL control channel resource set configuration information, and determine one of UL control channel resources configuring the determined one UL control channel resource set; and

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a transmitter configured to transmit the UL control information through the determined UL control channel resource,

wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information, and

wherein the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling.

25. (Currently Amended) The UE ~~user equipment~~ according to claim 24, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the UE ~~user equipment~~.

26. (Currently Amended) The UE ~~user equipment~~ according to claim 25, wherein the each UL BWP is activated through downlink (DL) control information.

27. (Currently Amended) The UE ~~user equipment~~ according to claim 24, wherein the receiver receives, from the base station, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated from the base station through the DL control information.

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REMARKS

Applicant wish to thank the Examiner for the thoroughness of examination and for the issues pointed out in the Office Action. Applicant respectfully requests reconsideration of this application in view of the foregoing amendments and following remarks.

Status of the Claims

Claims 16-17, 20-21 and 24-25 are rejected, and claims 18-19, 22-23 and 26-27 are objected. By this Response, claims 16-21 and 23-27 are amended. The amendments are supported by page. 10, lines 3-4, and page. 33, lines 5-13, and do not add new matter.

Rejection under 35 U.S.C. §103

On pages 4-9 of the Office Action, claims 16-17, and 24-25 were rejected under 35 U.S.C §103 as allegedly being unpatentable over Hooli et al. (U.S. Publication No. US 2018/0324786) (hereinafter "*Hooli*") in view of Yiu et al (U.S. Publication No. US 2019/0044689) (hereinafter "*Yiu*"), and further in view of AHN et al (U.S. Publication No. US 2019/0268123) (hereinafter "*AHN*").

On pages 9-11 of the Office Action, claims 20-21 were rejected under 35 U.S.C §103 as allegedly being unpatentable over *Hooli* in view of *Yiu*, and further in view of *AHN*.

In order to clarify and emphasize certain technical features, independent claim 16 is herewith amended as follows:

> *16. A method of transmitting uplink (UL) control information by a user equipment (UE), the method comprising:*

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receiving, *from a base station,* ***UL control channel resource set configuration information*** *for UL control information transmission;*

determining one of UL control channel resource sets contained in the received UL control channel resource set configuration information*;*

determining one of UL control channel resources contained in the determined UL control channel resource set; and

transmitting UL control information through the determined UL control channel resource,

wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information, and

wherein ***the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling****. (Emphasis added)*

Independent claim 20 is basically directed to a method of receiving uplink (UL) control information by a base station and amended claim 20 now includes certain corresponding limitations of amended independent claim 21.

Independent claim 24 is basically directed to a user equipment (UE) for transmitting uplink (UL) control information and now includes corresponding limitations of amended independent claim 21.

Applicant respectfully submits that independent claim 16 (as amended) is patentable because the cited reference, does not disclose or suggest each and every element of the claim. For example, Applicant respectfully submits that the cited reference does not disclose or suggest at least the above-emphasized features, in combination with other elements of the claim.

The Applicant's amended claim 16 now recites the above-emphasized features, i) "receiving, from a base station, UL control channel resource set configuration information for UL control information transmission", ii) "determining one of UL control channel resource sets

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contained in the received UL control channel resource set configuration information", and iii) "the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling".

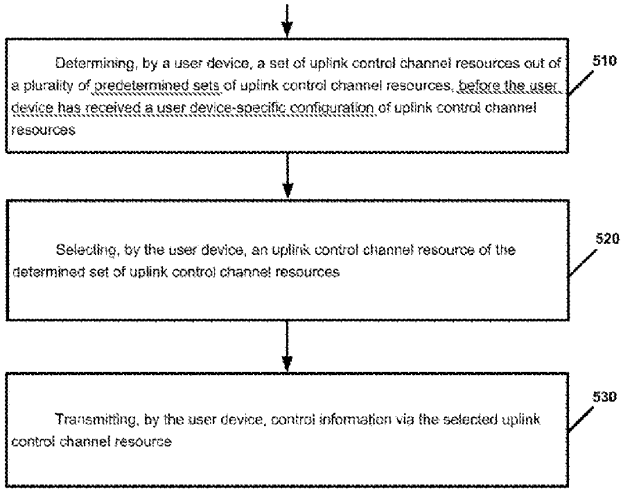
On page. 5 of the Office Action, the Examiner admitted that *Hooli* does not explicitly teach UL control channel resource set configuration. That is, there is no specific teaching in *Hooli* regarding to the above-emphasized applicant's novel feature i), which is "receiving, from a base station, UL control channel resource set configuration information for UL control information transmission". In order to cover such lack of teaching by *Hooli*, in the outstanding Office Action, Examiner relied on *Yiu*. Specifically, the Examiner asserted that *Yiu* teaches the above-emphasized feature i). However, Applicant respectfully disagrees.

In particular, Examiner's relied portions of *Yiu* merely disclose that a plurality of BWPs, BWP transitions, and RRC signals used to set or transition states for BWPs. (See paragraphs [0138], [0142] and [0146] from Examiner's indicated paragraphs [0137]-[0152]).

> **[0138]** As stated above, there can be a plurality of BWPs for the UE **401**. In one example, there are a total of 4 BWPs. In another example, there are more than four BWPs. The BWPs can be set or configured as initial, active or default, in one example.
>
> **[0142]** The UE **401** transitions **516** from the initial BWP **502** to the active BWP **504** when radio resource control (RRC) indicates the UE **401** is in a connected mode with data. This is the RRC connected mode with data.
>
> **[0146]** Generally, RRC signals can be used to set or transition states for BWPs.

From the paragraphs [0138] and [0142] of *Yiu*, people in the ordinary skilled in the art may deduce that certain (RRC) information can be signaled to set or configure BWPs. However, applicant strongly believes that *Yiu* still fails to teach or suggest Applicant's novel features of "receiving, from a base station, UL control channel resource set configuration information for UL control" of the above-emphasized feature i).

Furthermore, the combination of *Hooli* and *Yiu* is not possible, because *Hooli* basically performs determination of a set of uplink control channel resources out of a plurality of predetermined sets of uplink control channel resources, before receiving a user device-specific configuration from FIG. 5 as follows.



Namely, *Hooli* performs the determination of a set of uplink control channel resources with predetermined sets, and without receiving configuration information, and *Yiu* performs signaling to set or configure BWPs. Therefore, the signaling of *Yiu* is not applicable to *Hooli* because the performing of the determination of *Hooli* does not need to receive configuration information.

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Further, regarding the above-emphasized feature ii), which is "determining one of UL control channel resource sets contained in the received UL control channel resource set configuration information", Applicant wishes to point out that *Hooli* fails to teach or suggest the above-emphasized feature ii). That is, *Hooli* does not disclose the determination of one (i.e., a UL control channel resource set) in the received UL control channel resource set configuration information.

Moreover, in order to emphasize and clarify the reception of the UL control channel resource set configuration information, the above-emphasized feature iii), which is "the UL control channel resource set configuration information is received through UE specific radio resource control (RRC) signaling" has been added into the independent claim 16. This newly added feature is also not explicitly taught by the combination of *Hooli* and *Yiu*.

Accordingly, Applicant respectfully submits that independent claim 16 is patentable over the combination of *Hooli* and *Yiu* because it does not teach or suggest all of the features of the amended claim 16. Also, Applicant respectfully submits that independent claim 16 is patentable over the combination of *Hooli, Yiu* and *AHN* as well, because it does not teach or suggest all of the features of the amended claim 16.

Independent claims 20 and 24 contain similar features as amended claim 16. Therefore, Applicant respectfully submits that independent claims 16, 20 and 24 are all patentable over the cited reference for the above reason set forth above with regards to amended claim 16.

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Regarding claims 17, 21 and 25, Applicant respectfully submits that these claims are patentable for at least the reasons set forth above due to their respective dependencies.

Allowable subject matter

Applicant thanks Examiner for indicating that dependent claims 18, 19, 22, 23, 26, and 27 contain allowable subject matter.

Conclusion

In view of the present amendment and the above discussion, Applicant respectfully submits that the present application is in condition for allowance, and an early issuance of a Notice of Allowance is respectfully requested.

No additional fees are believed to be necessitated by this response. If any other fees are determined to be due with this filing, the Director is authorized to charge any such fees, or credit any overpayment, to our Deposit Account No. 602040, referencing the Docket No. stated above.

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Respectfully Submitted,

Date: June 21, 2021

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Electronic Acknowledgement Receipt

EFS ID:	43034205
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	126667
Filer:	Daniel Chung/judy Kim
Filer Authorized By:	Daniel Chung
Attorney Docket Number:	KT21-0115D1
Receipt Date:	21-JUN-2021
Filing Date:	23-MAR-2020
Time Stamp:	03:25:19
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		P20170764USD1_KT21-0115D1_NFOA_response.pdf	96510 ee5352245530ae151c5f2585116d890d9aaaa8b6	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	12
Warnings:			
Information:			
	Total Files Size (in bytes):	96510	

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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/826,482	03/23/2020	Kyujin PARK	KT21-0115D1	6363

126667 7590 04/16/2021

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EXAMINER
HO, CHUONG T

ART UNIT	PAPER NUMBER
2412	

NOTIFICATION DATE	DELIVERY MODE
04/16/2021	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):

dan@invenstonepat.com
mail@invenstonepat.com

Office Action Summary	Application No. 16/826,482	Applicant(s) PARK, Kyujin	
	Examiner CHUONG T HO	Art Unit 2412	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 02/03/2021.

☐ 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) 16-27 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) 16-17,20-21 and 24-25 is/are rejected.

8) ☑ Claim(s) 18-19,22-23 and 26-27 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 03/23/2020 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. 1020170128.

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: _____.

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Notice of Pre-AIA or AIA Status

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

This office action is in response to the Terminal Disclaimer and the amendment filed on 02/03/2021.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 01/19/2021 was filed after the mailing date of the Non Final Rejection on 11/05/2020. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Priority

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. REPUBLIC OF KOREA 10-2017-0128188, filed on 09/29/2017.

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. REPUBLIC OF KOREA 10-2017-0162728, filed on 11/30/2017.

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. REPUBLIC OF KOREA 10-2018-0077270, filed on 07/03/2018.

Response to Arguments

Applicant's arguments with respect to claim(s) 16-27 have been considered but are moot because the new ground of rejection does not rely on any reference applied in the prior rejection of record for any teaching or matter specifically challenged in the argument.

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 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.

Claims 16, 17, 24, 25 is/are rejected under 35 U.S.C. 103 as being unpatentable over 20180324786 (6250255) in view of 20190044689 (62564787), and further in view of 20190268123.

Regarding to claim 16, 20180324786 teaches a method of transmitting uplink (UL) control information by a user equipment, the method comprising:

Receiving, from a base station, UL control channel resource set information for UL control information transmission (determining or selecting, by a user device, a set of uplink control channel resources out of a plurality of predetermined sets of uplink control channel resources) [see Figure 5, step 510 and Paragraphs 0006 & 0007 & 0028 & 0029 & 0036 & 0045 & 0055 & 0057] ;

determining one of UL control channel resource sets contained in the UL control channel resource set information (determines or select a set of uplink control channel resources out of a plurality of predetermined sets of uplink control channel resources) [see Paragraph 0055] (select uplink control channel (e.g., PUCCH) resource set out a plurality of predetermined uplink control channel resource sets) [see Paragraph 0057];

determining one of UL control channel resources contained in the determined UL control channel resource set (select a resource within a resource set) [see Paragraph 0058] [see Figure 5, step 520, selecting, by the user device, an uplink control channel resource of the determined set of uplink control channel resources];

transmitting UL control information through the determined UL control channel resource (transmitting, by the user device, control information via the selected uplink control channel resource) [see Figure 5, step 530].

However, 20180324786 does not explicitly teach UL control channel resource set configuration.

20190044689, from the same or similar fields of endeavor, teaches the user equipment (UE) receives, from the base station, UL BWP configurations, RRC configuration of BWP) [see Figure 5 and Figure 6 and Paragraphs 137-152].

Thus, it would have been obvious to one of ordinary skill in the art before the effective filing data of the claimed invention to modify the system of 20180324786 in view of 20190044689 because 20190044689 suggests that what are needed are techniques to facilitate the allocation and use of bandwidth for wireless communication systems.

However, 20180324786 (6250255) and 20190044689 (62564787) do not explicitly teach wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

20190268123, from the same or similar fields of endeavor, teaches wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information (selecting one of a plurality of sets of PUCCH resources based on a payload size of uplink control information (UCI)) [see Abstract and claim 1 and claim 6].

Thus, it would have been obvious to one of ordinary skill in the art before the effective filing data of the claimed invention to modify the combined system (20180324786 (6250255) and 20190044689 (62564787)) and further in view of 20190268123 because 20190268123 suggests that With an increase in the number of serving cells supported in the CA environment, a greater number of PUCCH formats

with different payload sizes are required. In addition, how the terminal selects and uses the various PUCCH formats is an issue to be considered.

Regarding to claim 17, 20180324786 and 20190044689 and 20190268123 teach the limitations of claim 16 above.

However, 20180324786 does not explicitly teach wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.

20190044689, from the same or similar fields of endeavor, teaches wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment (UL bandwidth part) [see Figure 5 and Figure 6 and Paragraphs 137-152].

Thus, it would have been obvious to one of ordinary skill in the art before the effective filing data of the claimed invention to modify the system of 20180324786 in view of 20190044689 because 20190044689 suggests that what are needed are techniques to facilitate the allocation and use of bandwidth for wireless communication systems.

Regarding to claim 24, 20180324786 teaches a user equipment for transmitting uplink (UL) control information, comprising:

A receiver configured to receive, from a base station, UL control channel resource set information for UL control information transmission (determining or selecting, by a user device, a set of uplink control channel resources out of a plurality of predetermined sets of uplink control channel resources) [see Figure 5, step 510 and Paragraphs 0006 & 0007 & 0028 & 0029 & 0036 & 0045 & 0055 & 0057] ;

A controller configured to determine one of UL control channel resource sets contained in the UL control channel resource set information (determines or select a set of uplink control channel resources out of a plurality of predetermined sets of uplink control channel resources) [see Paragraph 0055] (select uplink control channel (e.g., PUCCH) resource set out a plurality of predetermined uplink control channel resource sets) [see Paragraph 0057];

determine one of UL control channel resources contained in the determined UL control channel resource set (select a resource within a resource set) [see Paragraph 0058] [see Figure 5, step 520, selecting, by the user device, an uplink control channel resource of the determined set of uplink control channel resources];

a transmitter configured to transmit UL control information through the determined UL control channel resource (transmitting, by the user device, control information via the selected uplink control channel resource) [see Figure 5, step 530].

However, 20180324786 does not explicitly teach UL control channel resource set configuration.

20190044689, from the same or similar fields of endeavor, teaches the user equipment (UE) receives, from the base station, UL BWP configurations, RRC configuration of BWP) [see Figure 5 and Figure 6 and Paragraphs 137-152].

Thus, it would have been obvious to one of ordinary skill in the art before the effective filing data of the claimed invention to modify the system of 20180324786 in view of 20190044689 because 20190044689 suggests that what are needed are techniques to facilitate the allocation and use of bandwidth for wireless communication systems.

However, 20180324786 (6250255) and 20190044689 (62564787) do not explicitly teach wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

20190268123, from the same or similar fields of endeavor, teaches wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information (selecting one of a plurality of sets of PUCCH resources based on a payload size of uplink control information (UCI)) [see Abstract and claim 1 and claim 6].

Thus, it would have been obvious to one of ordinary skill in the art before the effective filing data of the claimed invention to modify the combined system (20180324786 (6250255) and 20190044689 (62564787)) and further in view of 20190268123 because 20190268123 suggests that With an increase in the number of serving cells supported in the CA environment, a greater number of PUCCH formats

with different payload sizes are required. In addition, how the terminal selects and uses the various PUCCH formats is an issue to be considered.

Regarding to claim 25, claim 25 is rejected the same limitations of claim 17 above.

Claims 20, 21 is/are rejected under 35 U.S.C. 103 as being unpatentable over 20180324786 (6250255) in view of 20190044689 (62564787), and further in view of 20190268123.

Regarding to claim 20, 20180324786 teaches a method of receiving uplink (UL) control information by a base station, the method comprising:
Determining, by a user device, UL control channel resource set (determines or selects a set of uplink control channel resource out of a plurality of predetermined sets of uplink control channel resources) [see Paragraphs 0055 and Figure 5, steps 510, 520]
information for transmitting UL control information to a user equipment; and
receiving the UL control information through one of UL control channel resources of one of UL control channel resource sets contained in UL control channel resource set information (transmitting, by the user device, control information via the selected uplink control channel resource) [see Paragraph 0055 and Figure 5, step 530].

However, 20180324786 does not explicitly teach transmitting UL control channel resource set configuration information for transmitting UL control information to a user equipment.

20190044689, from the same or similar fields of endeavor, teaches transmitting UL control channel resource set configuration information for transmitting UL control information to a user equipment (a base station transmits PUCCH resource set configuration information to a user equipment) [see Figure 5 and Figure 6 and Paragraphs 137-152].

Thus, it would have been obvious to one of ordinary skill in the art before the effective filing data of the claimed invention to modify the system of 20180324786 in view of 20190044689 because 20190044689 suggests that what are needed are techniques to facilitate the allocation and use of bandwidth for wireless communication systems.

However, 20180324786 (6250255) and 20190044689 (62564787) do not explicitly teach wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

20190268123, from the same or similar fields of endeavor, teaches wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information (selecting one of a plurality of sets of PUCCH resources based on a payload size of uplink control information (UCI)) [see Abstract and claim 1 and claim 6].

Thus, it would have been obvious to one of ordinary skill in the art before the effective filing data of the claimed invention to modify the combined system (20180324786 (6250255) and 20190044689 (62564787)) and further in view of 20190268123 because 20190268123 suggests that With an increase in the number of serving cells supported in the CA environment, a greater number of PUCCH formats

with different payload sizes are required. In addition, how the terminal selects and uses the various PUCCH formats is an issue to be considered.

Regarding to claim 21, 20180324786 and 20190044689 teach the limitations of claim 20 above.

However, 20180324786 does not explicitly teach wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.

20190044689, from the same or similar fields of endeavor, teaches wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment (UL bandwidth part) [see Figure 5 and Figure 6 and Paragraphs 137-152].

Thus, it would have been obvious to one of ordinary skill in the art before the effective filing data of the claimed invention to modify the system of 20180324786 in view of 20190044689 because 20190044689 suggests that what are needed are techniques to facilitate the allocation and use of bandwidth for wireless communication systems.

Allowable Subject Matter

Claims 18, 19, 22, 23, 26, 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHUONG T HO whose telephone number is (571)272-3133. The examiner can normally be reached on 7:30-4:00.

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, Charles C Jiang can be reached on 571-270-7191. 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.

/CHUONG T HO/
Examiner, Art Unit 2412

Notice of References Cited	Application/Control No. 16/826,482	Applicant(s)/Patent Under Reexamination PARK, Kyujin	
	Examiner CHUONG T HO	Art Unit 2412	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-20190268123-A1	08-2019	AHN; Joonkui	H04L5/0053	1/1
	B					
	C					
	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					
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	P					
	Q					
	R					
	S					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 101 of 595

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

CPC - Searched*		
Symbol	Date	Examiner
(H04W72/0413 or H04W72/042 or H04L5/0053 or H04W72/0453	04/12/2021	CH

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
370	329,330	04/12/2021	CH

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

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 102 of 595

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

Search Notes		
Search Notes	**Date**	**Examiner**
(H04W72/0413 or H04W72/042 or H04L5/0053 or H04W72/0453 (Text search only - see search history printout)	04/12/2021	CH
370/329,330 (Text search only - see search history printout)	04/12/2021	CH
Claims search - see search history printout	04/12/2021	CH
Interference search - see search history printout.	04/12/2021	CH
Inventor and Assignee search in EAST and PALM - see search history printout.	04/12/2021	CH
IEEE search - see search history printout.	04/12/2021	CH
EAST search (USPAT, USPGPUB, EPO, USOCR, FERS, JPO, DERWENT, IBM_TDB) see search history printout.	04/12/2021	CH

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
	Interference search - see search history printout	04/12/2021	CH
370	329, 330	04/12/2021	CH

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 103 of 595

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

✓	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	11/01/2020	04/12/2021							
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
	6	-	-							
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	12	-	-							
	13	-	-							
	14	-	-							
	15	-	-							
1	16	✓	✓							
2	17	✓	✓							
3	18	✓	O							
4	19	✓	O							
5	20	✓	✓							
6	21	✓	✓							
7	22	✓	O							
8	23	✓	O							
9	24	✓	✓							
10	25	✓	✓							
11	26	✓	O							
12	27	✓	O							
	28									
	29									
	30									

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 104 of 595

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BIB DATA SHEET

CONFIRMATION NO. 6363

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
16/826,482	03/23/2020 **RULE**	370	2412	KT21-0115D1

APPLICANTS
KT CORPORATION, Gyeonggi-do, KOREA, REPUBLIC OF;

INVENTORS
Kyujin PARK, Seoul, KOREA, REPUBLIC OF;

** **CONTINUING DATA** *************************
This application is a DIV of 16/147,530 09/28/2018 PAT 10638463

** **FOREIGN APPLICATIONS** *************************
REPUBLIC OF KOREA 10-2017-0128188 09/29/2017
REPUBLIC OF KOREA 10-2017-0162728 11/30/2017
REPUBLIC OF KOREA 10-2018-0077270 07/03/2018

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
04/01/2020

	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No ☑ Met after Allowance Verified and Acknowledged ______ Examiner's Signature CH Initials	KOREA, REPUBLIC OF	9	12	3

ADDRESS

INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121
UNITED STATES

TITLE

APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

FILING FEE RECEIVED	FEES	
1720	FEES: Authority has been given in Paper No.___________ to charge/credit DEPOSIT ACCOUNT No.___________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ______________ ☐ Credit

BIB (Rev. 05/07).

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16826482
Filing Date	2020-03-23
First Named Inventor	Kyujin PARK
Art Unit	2412
Examiner Name	HO, CHUONG T
Attorney Docket Number	811.0206

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/CH/	1	20160338041	A1	2016-11-17	Yingyang LI et al.	
/CH/	2	20130128826	A1	2013-05-23	Yanan Lin et al.	

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/CH/	1	106301720	CN	A	2017-01-04	BEIJING SAMSUNG TELECOM R&D CT et al.		☒
/CH/	2	2017/075787	WO	A1	2017-05-11	HUAWEI TECHNOLOGIES CO., LTD.		☒

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CH/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Attorney Docket Number	811.0206

/CH/	3	102014510	CN	A	2011-04-13	DATANG MOBILE COMMUNICATIONS EQUIPMENT CO., LTD.		☒
/CH/	4	102088341	CN	A	2011-06-08	DATANG MOBILE COMMUNICATIONS EQUIPMENT...		☒
/CH/	5	102438319	CN	A	2012-05-02	TELECOM SCIENCE AND TECHNOLOGY INSTITUTE		☒
/CH/	6	102014505	CN	A	2011-04-13	DATANG MOBILE COMMUNICATIONS EQUIPMENT CO., LTD.		☒

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/CH/	1	SAMSUNG, "PUCCH resource configuration for bandwidth restricted UE", R1-1714539, 3GPP TSG RAN WG1 Meeting #90, Prague, Czechia 21st – 25th August 2017, pp. 1-14	☒
/CH/	2	STATE INTELLECTUAL PROPERTY OFFICE OF PEOPLE'S REPUBLIC OF CHINA, Office Action of corresponding CN Patent Application No. 201811148762.0, December 17, 2020	☒

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EXAMINER SIGNATURE

Examiner Signature	/CHUONG T HO/	Date Considered	04/13/2021

*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.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Attorney Docket Number	811.0206

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	/Linus Park/	Date (YYYY-MM-DD)	2021-01-19
Name/Print	Linus Park	Registration Number	45261

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.

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 record s.

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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.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/826,482	03/23/2020	Kyujin PARK	KT21-0115D1

CONFIRMATION NO. 6363

126667
INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121

POA ACCEPTANCE LETTER

OC000000123460512

Date Mailed: 02/22/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/16/2021.

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

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

/ggasgedom/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/826,482	03/23/2020	Kyujin PARK	811.0206

CONFIRMATION NO. 6363

POWER OF ATTORNEY NOTICE

76277
IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

OC000000123460465

Date Mailed: 02/22/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/16/2021.

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

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

/ggasgedom/

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 111 of 595

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Kyujin PARK

Application No./Patent No.: 16/826,482 Filed/Issue Date: 03-23-2020

Titled: APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

KT CORPORATION, a corporation

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

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

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

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

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

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

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

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

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 052192, Frame 0276, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

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

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

PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

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4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

/Daniel CHUNG/	February 17, 2021
Signature	Date
Daniel CHUNG	57889
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

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

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

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

Electronic Acknowledgement Receipt

EFS ID:	41951134
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	126667
Filer:	Daniel Chung/judy Kim
Filer Authorized By:	Daniel Chung
Attorney Docket Number:	KT21-0115D1
Receipt Date:	17-FEB-2021
Filing Date:	23-MAR-2020
Time Stamp:	20:49:12
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	Assignee showing of ownership per 37 CFR 3.73	aia0096-KT21-0115D1.pdf	112789 286308fe887c64e63478038d6d028e252bb ebb3c	no	3
Warnings:					

Information:	
Total Files Size (in bytes):	112789

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.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/826,482
Filing Date	March 23, 2020
First Named Inventor	Kyujin PARK
Title	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
Art Unit	2412
Examiner Name	HO, CHUONG T
Attorney Docket Number	KT21-0115D1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Daniel CHUNG/	Date (Optional)	
Name	Daniel CHUNG	Registration Number	57889
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

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

☐ *Total of _____ forms are submitted.

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

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

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY BY APPLICANT

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

Application Number	Filing Date

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

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 126667

OR

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

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

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

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

KT CORPORATION

☐ Inventor or Joint Inventor (title not required below)

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

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

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

SIGNATURE of Applicant for Patent

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

Signature	[signature]	Date (Optional)	
Name	Sung-Ryul Yeo		
Title	Team leader, 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. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

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

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

Electronic Acknowledgement Receipt

EFS ID:	41928400
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	76277
Filer:	Daniel Chung/judy Kim
Filer Authorized By:	Daniel Chung
Attorney Docket Number:	811.0206
Receipt Date:	16-FEB-2021
Filing Date:	23-MAR-2020
Time Stamp:	11:11:15
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	Power of Attorney	210216-KT21-0115D1_POA.pdf	579144 a1fd93e04229beaeee8e54ce06fe55d518f0c144	no	2
Warnings:					

Information:	
Total Files Size (in bytes):	579144

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/826,482	03/23/2020	Kyujin PARK	811.0206

CONFIRMATION NO. 6363

IMPROPER CFR REQUEST

76277
IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

OC000000123328004

Date Mailed: 02/12/2021

RESPONSE TO REQUEST FOR CORRECTED FILING RECEIPT

Power of Attorney, Claims, Fees, System Limitations, and Miscellaneous

In response to your request for a corrected Filing Receipt, the Office is unable to comply with your request because:

- Any request to correct or update the name of the applicant must include an application data sheet (ADS) in compliance with 37 CFR 1.76 specifying the correct or updated name of the applicant in the applicant information section. Any request to change the applicant after an original applicant has been specified under 37 CFR 1.46(b) must include a new ADS in compliance with 37 CFR 1.76 specifying the applicant in the applicant information section and comply with 37 CFR 3.71 and 3.73. See 37 CFR 1.46(c).

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

/yteferra/

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 121 of 595

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/826,482	03/23/2020	Kyujin PARK	811.0206

CONFIRMATION NO. 6363
IMPROPER CPOA LETTER

76277
IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

OC00000012332788

Date Mailed: 02/12/2021

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 02/10/2021. The power of attorney in this application is not accepted for the reason(s) listed below:

- The power of attorney has not been accepted because the party who is giving power has not been identified. Power of attorney may only be signed by the applicant for patent (37 CFR 1.42) or the patent owner. A party who is not the applicant must become the applicant in accordance with 37 CFR 1.46(c) and appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. For a reissue application, reexamination proceeding, or supplemental examination proceeding, a patent owner who was not the applicant under 37 CFR 1.46 must appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. See 37 CFR 1.32(b)(4).

/yteferra/

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

126667
INVENSTONE PATENT, LLC
14291-A Brushwood way
Centreville, VA 20121
UNITED STATES

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 122 of 595

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/826,482
Filing Date	March 23, 2020
First Named Inventor	Kyujin PARK
Title	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
Art Unit	2412
Examiner Name	HO, CHUONG T
Attorney Docket Number	KT21-0115D1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Daniel CHUNG/	Date (Optional)	
Name	Daniel CHUNG	Registration Number	57889
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

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

☐ *Total of _____ forms are submitted.

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

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

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY BY APPLICANT

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

Application Number	Filing Date

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

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 126667

OR

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

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

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

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

☐ Inventor or Joint Inventor (title not required below)

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

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

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

SIGNATURE of Applicant for Patent

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

Signature		Date (Optional)	
Name	Sung-Ryul Yun		
Title	Team leader		

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

☐ Total of forms are submitted.

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

Electronic Acknowledgement Receipt

EFS ID:	41883970
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Customer Number:	76277
Filer:	Daniel Chung/judy Kim
Filer Authorized By:	Daniel Chung
Attorney Docket Number:	811.0206
Receipt Date:	10-FEB-2021
Filing Date:	23-MAR-2020
Time Stamp:	02:07:27
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	Power of Attorney	210210-KT21-0115D1_POA.pdf	564276 f0e4262393ef06a5427374c864b55b7a288cd328	no	2
Warnings:					

Information:	
Total Files Size (in bytes):	564276

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/826,482	Filing Date 03/23/2020	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $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	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	02/03/2021	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 $480 =	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".	/JACQUELYN L WILLIAMS/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Kyujin PARK		Re: Attorney Docket No.: 811.0206	
Serial No.:	16/826,482	Group Art Unit:	2412
Filed:	03/23/2020	Examiner:	HO, CHUONG T
Matter No.:	811.0206	Conf. No.:	6363

For: APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

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 11/05/2020, Applicant respectfully submits that eTerminal Disclaimer is submitted and approved on 02/03/2021. Therefore, withdrawal of the nonstatutory double patenting rejection is respectfully requested.

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.

Respectfully submitted,

Date: 3 February 2021

/Joung Kook Park/

Customer No. 76277
IP Legal Services, LLC
P.O. Box 651325
Sterling, VA 20165

Joung Kook Park, Reg. No. 69,192
Agent for Applicant
(571) 267-7183 (phone)

Electronic Acknowledgement Receipt

EFS ID:	41822920
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
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:	811.0206
Receipt Date:	03-FEB-2021
Filing Date:	23-MAR-2020
Time Stamp:	12:11:52
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	8110206ReplytoNFOA.pdf	88022 fb54e8f5a78bddb5c619dce4caf17b232ecb d1dd	no	1

Warnings:

Information:	
Total Files Size (in bytes):	88022

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.

Doc Code: DIST.E.FILE **Document Description: Electronic Terminal Disclaimer - Filed**	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	16826482
Filing Date	23-Mar-2020
First Named Inventor	Kyujin PARK
Attorney Docket Number	811.0206
Title of Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
KT CORPORATION	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

10638463

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ○ Small Entity ○ Micro Entity ◉ Regular Undiscounted I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number 69192 ○ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ○ A joint inventor; all of whom are signing this request	
Signature	/Joung Kook Park/
Name	Joung Kook Park

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	16826482
Filing Date:	23-Mar-2020
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Filer:	Kyung Hee Kim/yujin Chun
Attorney Docket Number:	811.0206

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	170	170
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		170

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16826482

Filing Date: 23-Mar-2020

Applicant/Patent under Reexamination: PARK

Electronic Terminal Disclaimer filed on February 3, 2021

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	41822727
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
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:	811.0206
Receipt Date:	03-FEB-2021
Filing Date:	23-MAR-2020
Time Stamp:	12:09:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$170
RAM confirmation Number	E202123C09482043
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	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	33453 d56692a048ddfcdf125886be2b386432bb6314ac	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30133 15d0d1280e13014368bd05fbaa4850c49c9d5033	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	63586		

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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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Attorney Docket Number	811.0206

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20160338041	A1	2016-11-17	Yingyang LI et al.	
	2	20130128826	A1	2013-05-23	Yanan Lin et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	106301720	CN	A	2017-01-04	BEIJING SAMSUNG TELECOM R&D CT et al.		☒
	2	2017/075787	WO	A1	2017-05-11	HUAWEI TECHNOLOGIES CO., LTD.		☒

EFS Web 2.1.17

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Attorney Docket Number	811.0206

	3	102014510	CN	A	2011-04-13	DATANG MOBILE COMMUNICATIONS EQUIPMENT CO., LTD.		☒
	4	102088341	CN	A	2011-06-08	DATANG MOBILE COMMUNICATIONS EQUIPMENT...		☒
	5	102438319	CN	A	2012-05-02	TELECOM SCIENCE AND TECHNOLOGY INSTITUTE		☒
	6	102014505	CN	A	2011-04-13	DATANG MOBILE COMMUNICATIONS EQUIPMENT CO., LTD.		☒

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	SAMSUNG, "PUCCH resource configuration for bandwidth restricted UE", R1-1714539, 3GPP TSG RAN WG1 Meeting #90, Prague, Czechia 21st – 25th August 2017, pp. 1-14	☒
	2	STATE INTELLECTUAL PROPERTY OFFICE OF PEOPLE'S REPUBLIC OF CHINA, Office Action of corresponding CN Patent Application No. 201811148762.0, December 17, 2020	☒

If you wish to add additional non-patent literature document citation information please click the Add button Add

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	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2412
	Examiner Name	HO, CHUONG T
	Attorney Docket Number	811.0206

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	/Linus Park/	Date (YYYY-MM-DD)	2021-01-19
Name/Print	Linus Park	Registration Number	45261

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.**

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 record s.

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.

Espacenet

Bibliographic data: CN106301720 (A) — 2017-01-04

Method and apparatus for transmitting uplink control information

Inventor(s): LI YINGYANG; WANG YI; FU JINGXING; ZHANG SHICHANG ± (李迎阳, ; 王轶, ; 付景兴, ; 张世昌)

Applicant(s): BEIJING SAMSUNG TELECOM R&D CT; SAMSUNG ELECTRONICS CO LTD ± (北京三星通信技术研究有限公司, ; 三星电子株式会社)

Classification: - international: *H04L1/00; H04L5/00*
- cooperative: **H04L1/0027 (CN); H04L1/0031 (CN); H04L1/1671 (EP, US); H04L1/1861 (EP, US); H04L1/1864 (EP, US); H04L5/001 (EP, US); H04L5/0016 (EP, US); H04L5/0055 (EP, US); H04L5/0057 (CN); H04L5/0064 (CN); H04L5/0087 (EP, US); H04W52/143 (US);** H04L1/0026 (CN); H04L5/0055 (CN); H04L5/006 (CN); H04L5/14 (EP, US); H04W52/545 (EP, US); H04W72/0413 (CN); H04W72/0446 (CN)

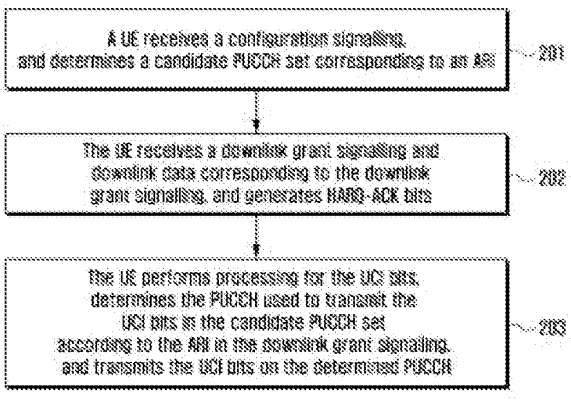
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Abstract of CN106301720 (A)

The application discloses a method and apparatus for transmitting uplink control information (UCI). The method is characterized in that the method includes steps: user equipment (UE) receives and configures a signaling of an alternative PUCCH channel set corresponding to an ACK/NACK resource indication (ARI); the UE receives a downlink authorization signaling and corresponding downlink data and generates HARQ-ACK bits; and the UE processes UCI bits including the HARQ-ACK bits and performs transmission on a PUCCH channel indicated by the ARI. The application also discloses



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a method for transmitting aperiodic CSI information (A-CSI). The method is characterized in that the method includes steps: the user equipment (UE) receives an uplink authorization signaling; the UE determines whether an A-CSI report is currently triggered according to a CSI request domain in the uplink authorization signaling; and the UE determines the to-be-updated CSI process and transmits the A-CSI information on an uplink CC for bearing the A-CSI report.

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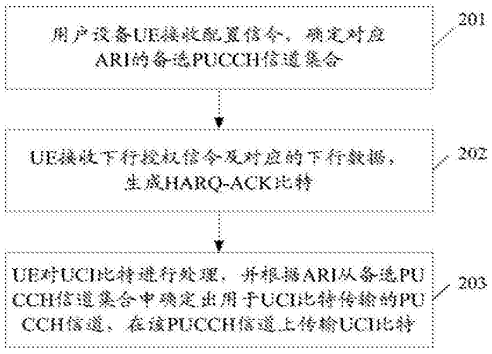
权利要求书3页 说明书14页 附图3页

(54)发明名称

传输上行控制信息的方法和设备

(57)摘要

本申请公开了一种传输上行控制信息UCI的方法，其特征在于，包括：用户设备UE接收配置对应ACK/NACK资源指示(ARI)的备选PUCCH信道集合的信令；UE接收下行授权信令及对应的下行数据，生成HARQ-ACK比特；UE对包括HARQ-ACK在内的UCI比特进行处理，并在ARI指示的PUCCH信道上传输。本申请还公开了一种传输非周期CSI信息(A-CSI)的方法，其特征在于，包括：用户设备UE接收上行授权信令；UE根据上行授权信令中的CSI请求域确定当前是否触发A-CSI报告；UE确定要更新的CSI过程并在承载A-CSI报告的上行CC上传输A-CSI信息。



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1.一种传输上行控制信息UCI的方法,其特征在于,包括:

用户设备UE接收配置信令,确定对应应答ACK/NACK资源指示ARI的备选PUCCH信道集合;

UE接收下行授权信令及对应的下行数据,生成混合自动请求重传应答HARQ-ACK比特;

UE对包括HARQ-ACK在内的UCI比特进行处理,并根据所述下行授权信令中包括的ARI从所述备选物理上行控制信道PUCCH信道集合中确定出用于UCI比特传输的PUCCH信道,在确定出的PUCCH信道上传输所述UCI比特。

2.根据权利要求1所述的方法,其特征在于,当所述UCI比特在PUCCH格式X的信道上传输时,所述UE对UCI比特进行处理并在PUCCH信道上传输包括:

对UCI比特经编码、速率匹配RM、加扰后,写入($R_{mux}\times C_{mux}$)矩阵,然后逐列读出,并在读出时将前$C_{mux,0}$列映射到所述PUCCH格式X信道的第一个时隙,后$C_{mux,1}$列映射到所述PUCCH格式X信道的第二个时隙;然后,对每一个时隙,经正交扩展码OCC扩展后映射到单载波频分多址接入SCFDMA符号上;

其中,根据PUCCH格式X的SCFDMA符号数和OCC长度,确定($R_{mux}\times C_{mux}$)矩阵的列数C_{mux},并根据PUCCH格式X信道支持传输的调制符号数目和每个调制符号允许携带的物理比特个数确定行数R_{mux},$C_{mux,0}+C_{mux,1}=C_{mux}$。

3.根据权利要求1所述的方法,其特征在于,当在所述UCI比特中包括P-CSI时,在所述ARI指示的PUCCH信道上传输包括所述P-CSI的UCI比特。

4.根据权利要求1所述的方法,其特征在于,所述根据ARI确定PUCCH信道包括:将所述ARI信息和其他控制信息一起处理后,映射到除了Pcell的仍然用于功率控制的下行授权信令的传输功率控制TPC域以外的其他下行授权信令的TPC域上;根据相应TPC域上映射的ARI信息确定所述PUCCH信道。

5.根据权利要求4所述的方法,其特征在于,所述ARI信息和其他控制信息的映射包括:除Pcell上的一个下行授权信令的TPC域仍然用于功率控制以外的其他下行授权信令中,基站发送的前N个连续下行授权信令中的TPC域用于映射ARI信息,剩余下行授权信令中的TPC域用于映射所述其他控制信息;其中N为大于等于4的整数。

6.根据权利要求5所述的方法,其特征在于,所述剩余下行授权信令中的TPC域用于映射所述其他控制信息包括:

利用所述剩余下行授权信令中的TPC域承载基站当前调度的下行授权信令的总数;

或者,利用所述剩余下行授权信令中的TPC域承载基站当前调度的TB的总数。

7.根据权利要求6所述的方法,其特征在于,所述下行授权信令的总数或TB的总数为时域计数的、频域计数的或时域和频域联合计数的。

8.根据权利要求1所述的方法,其特征在于,所述根据ARI确定PUCCH信道包括:

所述UE根据所述ARI信息确定PUCCH信道,并根据UCI的比特数选择PUCCH格式;或者,

所述UE根据所述ARI的取值确定当前使用的PUCCH格式和相应的PUCCH信道;其中,所述备选PUCCH信道集合中不同备选PUCCH信道的格式为相同或不同。

9.一种传输上行控制信息UCI的设备,其特征在于,包括:备选PUCCH信道集合确定单元、HARQ-ACK比特生成单元、UCI比特处理单元、PUCCH信道确定单元和发送单元;

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所述备选 PUCCH 信道集合确定单元，用于接收配置信令，确定对应 ACK/NACK 资源指示（ARI）的备选 PUCCH 信道集合；

所述 HARQ-ACK 比特生成单元，用于接收下行授权信令及对应的下行数据，生成 HARQ-ACK 比特；

所述 UCI 比特处理单元，用于对包括 HARQ-ACK 在内的 UCI 比特进行处理；

所述 PUCCH 信道确定单元，用于根据所述下行授权信令中包括的 ARI 从所述备选 PUCCH 信道集合中确定出用于 UCI 比特传输的 PUCCH 信道；

所述发送单元，用于在确定出的 PUCCH 信道上传输所述 UCI 比特。

10. 一种传输非周期 CSI 信息 A-CSI 的方法，其特征在于，包括：

用户设备 UE 接收上行授权信令；

UE 根据上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告；

在确定触发 A-CSI 报告后，UE 确定要更新的 CSI 过程并在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息。

11. 根据权利要求 10 所述的方法，其特征在于，所述根据上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告包括：对只配置了下行传输的 CC，UE 通过检测 DCI 格式 0 确定是否触发 A-CSI 报告；其中，所述 DCI 格式 0 的所述 CSI 请求域，用于触发 UE 对只配置下行传输的 CC 的 A-CSI 报告。

12. 根据权利要求 11 所述的方法，其特征在于，对于只配置下行传输的 CC，当根据所述 DCI 格式 0 确定触发 A-CSI 报告时，所述承载 A-CSI 报告的上行 CC 为：PCell、PScell 或者所述 DCI 格式 0 中指定比特所指示的上行 CC。

13. 根据权利要求 11 所述的方法，其特征在于，对于只配置下行传输的 CC：

利用独立高层信令配置所述 DCI 格式 0 的每个 CSI 请求域的值触发的 CSI 过程；

和 / 或，将所述 DCI 格式 0 中大于 2 比特的信息作为所述 CSI 请求域；

和 / 或，所述在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息包括：当 UE 在承载 A-CSI 报告的上行 CC 上没有调度上行数据传输时，按照所述 DCI 格式 0 确定所述上行 CC 的 PUSCH 信道的参数并传输 A-CSI；当 UE 在所述上行 CC 上调度了上行数据传输，且未触发其他 A-CSI 报告，按照所述上行 CC 的上行授权信令发送 PUSCH 并传输 A-CSI；当 UE 在所述上行 CC 上检测到上行授权信令并触发另一 A-CSI 时，所述 UE 仅传输所述上行 CC 的上行授权信令触发的 A-CSI，或者，UE 同时反馈两个 A-CSI 报告。

14. 根据权利要求 10 所述的方法，其特征在于，所述确定要更新的 CSI 过程包括：

当在一个子帧内触发多个 CG 的 A-CSI、且触发的 CSI 过程的总数 N 大于 UE 更新和报告 A-CSI 的能力 K 时，所述 UE 从 N 个 CSI 过程中选择 K 个优先级最高的 CSI 过程进行更新 CSI 并报告。

15. 根据权利要求 14 所述的方法，其特征在于，对应不同的 CSI 过程确定优先级的方式包括：

同时反馈 RI 和 CQI/PMI 的 CSI 过程的优先级高于采用默认 RI 只反馈 CQI/PMI 的 CSI 过程的优先级；和 / 或，

按照预先定义的各种用于 A-CSI 的 CSI 汇报模式的优先级，确定相应 CSI 过程的优先级；和 / 或，

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按照预先定义的各种下行传输模式的优先级，确定相应 CSI 过程的优先级；和 / 或，

根据 CSI 过程 ID 确定 CSI 过程的优先级；和 / 或，

对配置给所述 UE 的所有 CC 分别配置唯一的小区 ID，根据该小区 ID 确定 CSI 过程的优先级；和 / 或，

对配置给所述 UE 的所有 CC 配置小区 ID，该小区 ID 是在一个 CG 内的小区的索引，根据所述小区 ID 确定 CSI 过程的优先级；和 / 或，

根据 CG 索引确定 CSI 过程的优先级；和 / 或，

当一个 CG 被划分为多个反馈 A-CSI 的子组时，根据 A-CSI 子组的索引确定 CSI 过程的优先级；和 / 或，

根据小区是否承载 UCI 信息确定优先级，其中 Pcell 的优先级高于 PScell 的优先级，PScell 的优先级高于其他 Scell 的优先级；和 / 或，

许可频段小区的 CSI 过程的优先级高于免许可频段小区的 CSI 过程的优先级，或者，免许可频段小区的 CSI 过程的优先级高于许可频段小区的 CSI 过程的优先级；

16. 根据权利要求 14 所述的方法，其特征在于，在所述选择 K 个优先级最高的 CSI 过程时，对应一个 CG 的一个 A-CSI 报告，仅保留属于所述 K 个最高优先级的 CSI 过程的 CSI 信息，并据此确定 A-CSI 信息的总比特数。

17. 一种传输非周期 CSI 信息 A-CSI 的设备，其特征在于，包括：接收单元、A-CSI 报告触发单元和传输单元；

所述接收单元，用于接收上行授权信令；

所述 A-CSI 报告触发单元，用于根据所述上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告，并在确定触发 A-CSI 报告时通知所述传输单元；

所述传输单元，用于在接收到所述 A-CSI 报告触发单元的触发通知后，确定要更新的 CSI 过程并在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息。

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传输上行控制信息的方法和设备

技术领域

[0001] 本发明涉及无线通信系统，更具体的说涉及LTE载波聚合系统，在一个上行信道上传输上行控制信息(UCI)的方法和设备。

背景技术

[0002] 在长期演进(LTE)系统中，通过组合多个单元载波(CC)来得到更大的工作带宽，构成通信系统的下行链路和上行链路，即载波聚合(CA)技术，从而支持更高的传输速率。到目前为止，已经支持各种类型的CA，即：被聚合的小区可以都是FDD小区，也可以都是TDD小区且这些TDD小区的TDD上下行配置相同，还可以都是TDD小区但是这些TDD小区的TDD上下行配置不同，此外，还支持FDD小区和TDD小区的聚合，并且TDD小区的上下行配置可以是半静态配置的或者动态变化。

[0003] 对一个UE，在配置了CA模式时，一个小区是主小区(Pcell)，而其他小区称为次小区(Scell)。按照LTE的方法，对Pcell和Scell基于混合自动重传请求(HARQ)机制来传输下行数据，相应地，UE需要反馈多个小区的HARQ-ACK信息。对FDD系统的一个小区，在一个上行子帧内只需要反馈一个下行子帧内的数据的HARQ-ACK信息；对TDD系统的一个小区，当其帧结构中的下行子帧数据多于上行子帧时，一般在一个上行子帧内需要反馈多个下行子帧内的数据的HARQ-ACK信息，所述多个下行子帧称为对应这个上行子帧的绑定窗口。例如，LTE TDD小区的绑定窗口的大小可以是1、2、3、4或者9。按照LTE的方法，是在Pcell的一个PUCCH信道上反馈所有配置的小区的HARQ-ACK信息。另外，各个小区的周期信道状态指示(P-CSI)也是映射到Pcell上传输，而非周期CSI(A-CSI)是映射到物理上行共享信道(PUSCH)上传输。

[0004] 按照LTE的方法，目前支持物理上行控制信道(PUCCH)格式3，其基本思想是对多个UCI比特信息，例如来自多个配置的小区的HARQ-ACK比特、调度请求(SR)和/或P-CSI信息进行联合编码，并映射到物理信道传输。PUCCH格式3最多可以支持传输22个比特。如图1所示，这里假设采用RM编码，UCI比特经RM信道编码后和加扰后，调制得到24个QPSK符号，并映射到一个PRB的上行资源上传输。其中，前12个QPSK符号映射到PUCCH格式3的第一个时隙中传输，而后12个QPSK符号映射到PUCCH格式3的第二个时隙中传输。这里，一个PUCCH格式3信道在两个时隙内映射的PRB位置相对于中心频率是镜像关系，从而获得频率分集增益。以第一个时隙为例，所述12个QPSK符号映射乘以长度为5的正交扩展码(OCC)的每一个元素后，分别映射到第一个时隙的5个符号上。

[0005] 目前3GPP标准化组织正在对聚合更多的小区的增强CA技术进行标准化工作，例如，聚合的小区数目可以达到32个。这时，对一个UE来说，可以是把所有配置的小区分成多个小区组(CG，Cell Group)，或者，也可以只有一个CG；并对每个CG，分别在一个小区的PUCCH上反馈UCI信息，这个反馈UCI的小区类似于现有CA技术中的Pcell。这里，每个CG的小区数目仍然可以超过现有CA技术支持的最大聚合小区个数。这里，当配置的小区个数较多，或者绑定窗的大小较大时，UE需要反馈的HARQ-ACK比特比较多，例如，大于22比特。

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另外，当配置的小区个数较多时，UE 需要反馈的 CSI 信息也相应地增加了。另外，UE 在上行方向还可能需要发送调度请求 (SR)。例如，大于 22 比特。相应地，为了支持超过 22 比特的 UCI 传输，需要定义一种新的 PUCCH 格式。因为引入了 PUCCH 格式 X，必然带来一系列的影响，相应地需要设计对 UCI 的具体的传输方法。

发明内容

[0006] 本申请提供一种传输 UCI 的方法和设备，能够支持超过 22 比特的 UCI 传输，并实现更高效的 A-CSI 信息的传输。

[0007] 为实现上述目的，本申请采用如下技术方案：

[0008] 一种传输上行控制信息 UCI 的方法，包括：

[0009] 用户设备 UE 接收配置信令，确定对应 ACK/NACK 资源指示 (ARI) 的备选 PUCCH 信道集合；

[0010] UE 接收下行授权信令及对应的下行数据，生成 HARQ-ACK 比特；

[0011] UE 对包括 HARQ-ACK 在内的 UCI 比特进行处理，并根据所述下行授权信令中包括的 ARI 从所述备选 PUCCH 信道集合中确定出用于 UCI 比特传输的 PUCCH 信道，在确定出的 PUCCH 信道上传输所述 UCI 比特。

[0012] 较佳地，当所述 UCI 比特在 PUCCH 格式 X 的信道上传输时，所述 UE 对 UCI 比特进行处理并在 PUCCH 信道上传输包括：

[0013] 对 UCI 比特经编码、速率匹配 (RM)、加扰后，写入 ($R_{mux} \times C_{mux}$) 矩阵，然后逐列读出，并在读出时将前 $C_{mux,0}$ 列映射到所述 PUCCH 格式 X 信道的第一个时隙，后 $C_{mux,1}$ 列映射到所述 PUCCH 格式 X 信道的第二个时隙；然后，对每一个时隙，经 OCC 扩展后映射到 SCFDMA 符号上；

[0014] 其中，根据 PUCCH 格式 X 的 SCFDMA 符号数和 OCC 长度，确定 ($R_{mux} \times C_{mux}$) 矩阵的列数 C_{mux}，并根据 PUCCH 格式 X 信道支持传输的调制符号数目和每个调制符号允许携带的物理比特个数确定行数 R_{mux}，$C_{mux,0}+C_{mux,1} = C_{mux}$。

[0015] 较佳地，当在所述 UCI 比特中包括 P-CSI 时，在所述 ARI 指示的 PUCCH 信道上传输包括所述 P-CSI 的 UCI 比特。

[0016] 较佳地，所述根据 ARI 确定 PUCCH 信道包括：将所述 ARI 信息和其他控制信息一起处理后，映射到除了 Pcell 的仍然用于功率控制的下行授权信令的 TPC 域以外的其他下行授权信令的 TPC 域上；根据相应 TPC 域上映射的 ARI 信息确定所述 PUCCH 信道。

[0017] 较佳地，所述 ARI 信息和其他控制信息的映射包括：除 Pcell 上的一个下行授权信令的 TPC 域仍然用于功率控制以外的其他下行授权信令中，基站发送的前 N 个连续下行授权信令中的 TPC 域用于映射 ARI 信息，剩余下行授权信令中的 TPC 域用于映射所述其他控制信息；其中 N 为大于等于 4 的整数。

[0018] 较佳地，所述剩余下行授权信令中的 TPC 域用于映射所述其他控制信息包括：

[0019] 利用所述剩余下行授权信令中的 TPC 域承载基站当前调度的下行授权信令的总数；

[0020] 或者，利用所述剩余下行授权信令中的 TPC 域承载基站当前调度的 TB 的总数。

[0021] 较佳地，所述下行授权信令的总数或 TB 的总数为时域计数的、频域计数的或时域

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和频域联合计数的。

[0022] 较佳地，所述根据 ARI 确定 PUCCH 信道包括：

[0023] 所述 UE 根据所述 ARI 信息确定 PUCCH 信道，并根据 UCI 的比特数选择 PUCCH 格式；或者，

[0024] 所述 UE 根据所述 ARI 的取值确定当前使用的 PUCCH 格式和相应的 PUCCH 信道；其中，所述备选 PUCCH 信道集合中不同备选 PUCCH 信道的格式为相同或不同。

[0025] 一种传输上行控制信息 UCI 的设备，包括：备选 PUCCH 信道集合确定单元、HARQ-ACK 比特生成单元、UCI 比特处理单元、PUCCH 信道确定单元和发送单元；

[0026] 所述备选 PUCCH 信道集合确定单元，用于接收配置信令，确定对应 ACK/NACK 资源指示（ARI）的备选 PUCCH 信道集合；

[0027] 所述 HARQ-ACK 比特生成单元，用于接收下行授权信令及对应的下行数据，生成 HARQ-ACK 比特；

[0028] 所述 UCI 比特处理单元，用于对包括 HARQ-ACK 在内的 UCI 比特进行处理；

[0029] 所述 PUCCH 信道确定单元，用于根据所述下行授权信令中包括的 ARI 从所述备选 PUCCH 信道集合中确定出用于 UCI 比特传输的 PUCCH 信道；

[0030] 所述发送单元，用于在确定出的 PUCCH 信道上传输所述 UCI 比特。

[0031] 一种传输非周期 CSI 信息（A-CSI）的方法，包括：

[0032] 用户设备 UE 接收上行授权信令；

[0033] UE 根据上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告；

[0034] 在确定触发 A-CSI 报告后，UE 确定要更新的 CSI 过程并在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息。

[0035] 较佳地，所述根据上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告包括：对只配置了下行传输的 CC，UE 通过检测 DCI 格式 0 确定是否触发 A-CSI 报告；其中，所述 DCI 格式 0 的所述 CSI 请求域，用于触发 UE 对只配置下行传输的 CC 的 A-CSI 报告。

[0036] 较佳地，对于只配置下行传输的 CC，当根据所述 DCI 格式 0 确定触发 A-CSI 报告时，所述承载 A-CSI 报告的上行 CC 为：PCell、PScell 或者所述 DCI 格式 0 中指定比特所指示的上行 CC。

[0037] 较佳地，对于只配置下行传输的 CC：

[0038] 利用独立高层信令配置所述 DCI 格式 0 的每个 CSI 请求域的值触发的 CSI 过程；

[0039] 和 / 或，将所述 DCI 格式 0 中大于 2 比特的信息作为所述 CSI 请求域；

[0040] 和 / 或，所述在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息包括：当 UE 在承载 A-CSI 报告的上行 CC 上没有调度上行数据传输时，按照所述 DCI 格式 0 确定所述上行 CC 的 PUSCH 信道的参数并传输 A-CSI；当 UE 在所述上行 CC 上调度了上行数据传输，且未触发其他 A-CSI 报告，按照所述上行 CC 的上行授权信令发送 PUSCH 并传输 A-CSI；当 UE 在所述上行 CC 上检测到上行授权信令并触发另一 A-CSI 时，所述 UE 仅传输所述上行 CC 的上行授权信令触发的 A-CSI，或者，UE 同时反馈两个 A-CSI 报告。

[0041] 较佳地，所述确定要更新的 CSI 过程包括：

[0042] 当在一个子帧内触发多个 CG 的 A-CSI、且触发的 CSI 过程的总数 N 大于 UE 更新和报告 A-CSI 的能力 K 时，所述 UE 从 N 个 CSI 过程中选择 K 个优先级最高的 CSI 过程进行更

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新 CSI 并报告。

[0043] 较佳地，对应不同的 CSI 过程确定优先级的方式包括：

[0044] 同时反馈 RI 和 CQI/PMI 的 CSI 过程的优先级高于采用默认 RI 只反馈 CQI/PMI 的 CSI 过程的优先级；和 / 或，

[0045] 按照预先定义的各种用于 A-CSI 的 CSI 汇报模式的优先级，确定相应 CSI 过程的优先级；和 / 或，

[0046] 按照预先定义的各种下行传输模式的优先级，确定相应 CSI 过程的优先级；和 / 或，

[0047] 根据 CSI 过程 ID 确定 CSI 过程的优先级；和 / 或，

[0048] 对配置给所述 UE 的所有 CC 分别配置唯一的小区 ID，根据该小区 ID 确定 CSI 过程的优先级；和 / 或，

[0049] 对配置给所述 UE 的所有 CC 配置小区 ID，该小区 ID 是在一个 CG 内的小区的索引，根据所述小区 ID 确定 CSI 过程的优先级；和 / 或，

[0050] 根据 CG 索引确定 CSI 过程的优先级；和 / 或，

[0051] 当一个 CG 被划分为多个反馈 A-CSI 的子组时，根据 A-CSI 子组的索引确定 CSI 过程的优先级；和 / 或，

[0052] 根据小区是否承载 UCI 信息确定优先级，其中 Pcell 的优先级高于 PScell 的优先级，PScell 的优先级高于其他 Scell 的优先级；和 / 或，

[0053] 许可频段小区的 CSI 过程的优先级高于免许可频段小区的 CSI 过程的优先级，或者，免许可频段小区的 CSI 过程的优先级高于许可频段小区的 CSI 过程的优先级；

[0054] 较佳地，在所述选择 K 个优先级最高的 CSI 过程时，对应一个 CG 的一个 A-CSI 报告，仅保留属于所述 K 个最高优先级的 CSI 过程的 CSI 信息，并据此确定 A-CSI 信息的总比特数。

[0055] 一种传输非周期 CSI 信息 (A-CSI) 的设备，包括：接收单元、A-CSI 报告触发单元和传输单元；

[0056] 所述接收单元，用于接收上行授权信令；

[0057] 所述 A-CSI 报告触发单元，用于根据所述上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告，并在确定触发 A-CSI 报告时通知所述传输单元；

[0058] 所述传输单元，用于在接收到所述 A-CSI 报告触发单元的触发通知后，确定要更新的 CSI 过程并在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息。

[0059] 由上述技术方案可见，本申请中，UE 接收配置信令，确定对应 ACK/NACK 资源指示 (ARI) 的备选 PUCCH 信道集合；UE 接收下行授权信令及对应的下行数据，生成 HARQ-ACK 比特；UE 对包括 HARQ-ACK 在内的 UCI 比特进行处理，并在 ARI 指示的 PUCCH 信道上传输。通过上述处理，能够支持超过 22 比特的 UCI 传输。

[0060] 本申请中还给出了一种传输非周期 CSI 信息 (A-CSI) 的方法，UE 接收上行授权信令；UE 根据上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告；当确定触发 A-CSI 报告后，UE 确定要更新的 CSI 过程并在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息。通过上述处理，能够实现更高效的 A-CSI 信息的传输。

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附图说明

[0061] 图 1 为 PUCCH 格式 3 的示意图。

[0062] 图 2 为本申请中 UCI 传输方法的基本流程示意图；

[0063] 图 3 为本申请中 PUCCH 格式 X 的示意图；

[0064] 图 4 为本申请中 UCI 传输设备的基本结构示意图；

[0065] 图 5 为本申请中 A-CSI 传输方法的基本流程示意图；

[0066] 图 6 为本申请中 A-CSI 传输设备的基本结构示意图。

具体实施方式

[0067] 为了使本申请的目的、技术手段和优点更加清楚明白，以下结合附图对本申请做进一步详细说明。

[0068] 本申请中给出了 UCI 的传输方法，下面分别进行介绍。首先给出本申请中 UCI 传输方法的具体实现。图 2 为本申请中 UCI 传输方法的基本流程示意图。如图 2 所示，该方法包括：

[0069] 步骤 201，用户设备 UE 接收配置信令，确定对应 ACK/NACK 资源指示（ARI）的备选 PUCCH 信道集合。

[0070] 具体地，预先通过 RRC 等信令半静态配置备选 PUCCH 信道集合，该信道集合对应于 ARI。当在一个子帧内需要反馈 HARQ-ACK 信息时，根据下行授权信令中的 2 比特 ARI 信息可以动态指示备选 PUCCH 信道集合中的一个 PUCCH 信道用于 HARQ-ACK 和其他 UCI 传输。

[0071] 步骤 202，UE 接收下行授权信令及对应的下行数据，生成 HARQ-ACK 比特。

[0072] 在 UE 接收的下行授权信令中包括用于指示 PUCCH 信道的 ARI。

[0073] 步骤 203，UE 对包括 HARQ-ACK 在内的 UCI 比特进行处理，并根据下行授权信令中包括的 ARI 从备选 PUCCH 信道集合中确定出用于 UCI 比特传输的 PUCCH 信道，在确定出的 PUCCH 信道上传输 UCI 比特。

[0074] 以下描述本发明的实施例。

[0075] 实施例一

[0076] 在 CA 系统中，PUCCH 格式 3 只能支持最多 22 比特的 UCI 信息传输。为了支持在 PUCCH 上反馈更多比特的 UCI 信息，需要定义新的 PUCCH 格式，以下称为 PUCCH 格式 X。本实施例中给出采用 PUCCH 格式 X 进行 UCI 信息传输时的具体方式，也就是上述图 2 所示流程中采用 PUCCH 格式 X 时步骤 203 的一种实现方法。

[0077] PUCCH 格式 X 信道可以是基于 PUCCH 格式 3 扩展得到的。一种可能的方法是仍然保持 PUCCH 格式 3 的 OCC 扩展结构不变，即 OCC 的长度不变，通过增加在频域占用的 PRB 个数来支持更多的比特，例如，假设扩展之后的信道占用 N 个 PRB，则它可以承载大约 22N 个 UCI 比特。另一种扩展方法是保持频域仍然占用一个 PRB，而是减少 OCC 的长度，例如，采用 OCC 长度为 2 来支持更多的 UCI 比特。或者，也可以是同时增加占用的 PRB 个数和减小 OCC 长度，从而支持更多的 UCI 比特。采用上述三种方法的共同特点是对 UCI 比特经编码、速率匹配（RM）、加扰和调制以后，调制符号都是经过 OCC 扩展之后才映射到上行单载波频分多址接入（SCFDMA）符号上。

[0078] 如图 3 所示，假设 UCI 比特经信道编码、RM、加扰之后，等分成 C_{mux} 部分，可以表示为

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C_{mux}列。其中，$C_{mux,0}$列经调制和OCC扩展后映射到第一个时隙的上行SCFDMA符号上，$C_{mux,1}$列经调制和OCC扩展后映射到第二个时隙的上行SCFDMA符号上，$C_{mux,0}+C_{mux,1}=C_{mux}$。通常$C_{mux,0}$和$C_{mux,1}$相等或者相差1，从而最大化频率分集增益。假设OCC的长度和一个时隙内用于承载调制符号的SCFDMA符号个数相等，则$C_{mux,0}=C_{mux,1}=1$。假设OCC长度小于一个时隙内用于承载调制符号的SCFDMA符号个数，则$C_{mux,0}$和$C_{mux,1}$可以大于1。在图3中，只表示出对一个UCI的编码、RM和加扰的流程，它可以是代表对多种不同类型的UCI进行联合编码；或者，通过简单扩展，可以支持对多种UCI分别编码、RM和加扰，然后一起映射为C_{mux}列。在图3中，划分C_{mux}列是在调制模块之前，或者，划分C_{mux}列的操作也可以位于调制模块之后。

[0079] 基于LTE的PUCCH信道结构，一个PUCCH格式X信道在子帧的两个时隙内映射的PRB位置相对于中心频率是镜像关系。这样，综合在两个时隙内传输的信号可以获得频率分集增益。但是，如果只观察一个时隙内的信号，因为是局限在一个PRB内，所以基本没有频率分集效果。另一方面，记UCI信息为c_k，$k=0,1,\ldots,K-1$，K是UCI比特数，采用LTE的卷积编码方法，对应其三个生成多项式的输出比特分别记为$d_k^{(0)}$、$d_k^{(1)}$和$d_k^{(2)}$。采用LTE的速率匹配(RM)方法，对比特序列$d_k^{(0)}$、$d_k^{(1)}$和$d_k^{(2)}$分别进行交织，然后级联得到RM的循环缓存。即，循环缓存的前K个比特对应$d_k^{(0)}$，然后K个比特对应$d_k^{(1)}$，最后的K个比特对应$d_k^{(2)}$。这样，RM操作之后的输出比特也保持类似的结构，即连续的K个是对应$d_k^{(0)}$、$d_k^{(1)}$或者$d_k^{(2)}$之一。为了使对应每个生成多项式的K个比特，即$d_k^{(0)}$、$d_k^{(1)}$或者$d_k^{(2)}$，都能够均匀的获得频率分集增益，应该把这K个比特均匀的映射到两个时隙的资源上。根据图3所示的PUCCH格式X的结构，一种处理方法是把加扰之后的比特序列q_k写入($R_{mux}\times C_{mux}$)矩阵，然后逐列读出，前$C_{mux,0}$列映射到第一个时隙，后$C_{mux,1}$列映射到第二个时隙；然后，对每一个时隙，经OCC扩展后映射到SCFDMA符号上。这里，根据PUCCH格式X的SCFDMA符号数和OCC长度，可以得到($R_{mux}\times C_{mux}$)矩阵的列数C_{mux}，记根据PUCCH格式X信道支持传输的调制符号数目为H，每个调制符号能够携带Q_m个物理比特，则($R_{mux}\times C_{mux}$)矩阵的行数$R_{mux}=(H\cdot Q_m)/C_{mux}$，并记$R'_{mux}=R_{mux}/Q_m$。在图3中，只显示了$R'_{mux}$行，其中每个元素$y_k$实际上代表包含$Q_m$行的列向量。假设$q_k$逐行写入($R_{mux}\times C_{mux}$)矩阵，则$\underline{y}_k=[q_{p_0},q_{p_0+C_{mux}}\cdots q_{p_0+C_{mux}(Q_m-1)}]^T$，$p_0=Q_m\cdot C_{mux}\cdot\lfloor k/C_{mux}\rfloor+k \bmod C_{mux}$；或者，假设$q_k$以$Q_m$行为一组按组写入($R_{mux}\times C_{mux}$)矩阵，则$\underline{y}_k=[q_{Q_m k},q_{Q_m k+1}\cdots q_{Q_m k+Q_m-1}]^T$。采用这个方法，保证了对应每个生成多项式的K个比特，即$d_k^{(0)}$、$d_k^{(1)}$或者$d_k^{(2)}$，均匀映射到前$C_{mux,0}$列和后$C_{mux,1}$列，进而映射到PUCCH格式X信道的两个时隙，从而获得均匀的频率分集增益，提高PUCCH格式X信道的链路性能。

[0080] 实施例二

[0081] 本实施例中，给出当UCI比特同时包括HARQ-ACK和P-CSI信息时，也就是需要同时传输HARQ-ACK和P-CSI信息时，本申请中的处理方式。

[0082] 在LTE系统中，当UE在上行子帧需要发送多种类型的信号，相应地分配了多个上行信道。例如，假设在一个子帧内需要传输P-CSI，则基站半静态为UE配置一个用于P-CSI信道。当P-CSI小于等于M比特时，例如M等于11，可以仍然是利用PUCCH格式2来反馈

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P-CSI。当P-CSI信息的比特数目较大时，P-CSI信道可以是PUCCH格式X信道。或者，当P-CSI比特总数小于等于N个比特时，例如，N等于22，可以配置PUCCH格式3信道用于P-CSI；而当P-CSI比特总数大于N个比特时，才采用PUCCH格式X信道。

[0083] 另外，当在一个子帧内需要反馈HARQ-ACK信息时，根据下行授权信令中的2比特ACK/NACK资源指示（ARI）信息可以动态指示一个PUCCH信道用于HARQ-ACK和其他UCI传输。这里，是通过RRC信令半静态配置4个备选PUCCH信道，从而用2比特ARI动态指示使用哪个PUCCH信道用于UCI传输。这个PUCCH信道可以是PUCCH格式3信道，从而支持最多22比特的UCI传输；或者，这个PUCCH信道也可以是PUCCH格式X信道，从而承载更大的UCI净荷。

[0084] 根据上面的分析，基站半静态配置的用于P-CSI的PUCCH信道，只需要考虑P-CSI的比特总数，所以比特数目较少。而对用ARI指示的PUCCH信道，这个信道可以是考虑了在一个CG的一个子帧内的所有需要反馈的UCI比特（包括HARQ-ACK和P-CSI，还可以包括SR），所以ARI指示的PUCCH信道需要承载更多的比特。这样，当在一个子帧内，需要反馈P-CSI也需要反馈HARQ-ACK时，分配用于P-CSI的PUCCH信道不一定可以承载所有UCI比特（包括HARQ-ACK和P-CSI，还可以包括SR），但是ARI指示的PUCCH信道一定可用。

[0085] 为了在各种不同的UCI反馈信息组合的情况下，保持一致的UE操作，本发明提出当需要在一个子帧内同时反馈P-CSI和HARQ-ACK时（还可以进一步包括SR），UE使用ARI动态指示的PUCCH信道来反馈上述UCI信息。

[0086] 采用这种方法，不管半静态配置的P-CSI信道是PUCCH格式2、PUCCH格式3或者PUCCH格式X，UE的操作都是使用ARI动态指示的PUCCH信道来反馈上述UCI信息，保持UE操作的一致性。当不存在ARI动态指示的PUCCH信道时，才使用半静态配置的P-CSI信道反馈上行信息。另外，当配置P-CSI的信道和ARI动态指示的信道是同一个类型的时候，因为ARI可以有多个取值，从而允许基站根据调度的UE的情况，动态调整PUCCH信道的分配，提供了基站分配PUCCH信道的灵活性。这里，基站实现上可以使半静态配置P-CSI的PUCCH信道是半静态配置的对应n比特ARI的备选PUCCH信道之一，例如n等于2，从而基站可以灵活地通过ARI选择PUCCH信道用于UCI传输，而且也避免造成额外的PUCCH开销。

[0087] 实施例三

[0088] 为进一步降低ARI信息的冗余比特，提高资源利用率，本申请中给出新的ARI信息的承载方式，继而UE根据该承载方式在下行授权信令中对应提取ARI，以确定用于传输UCI比特的PUCCH信道。通过本实施例的方式，还能够有效识别连续丢失绑定窗口中最后若干个下行授权信令的情况。

[0089] 在LTE系统中，需要在一个上行子帧内反馈多个CC的多个下行子帧的下行传输的HARQ-ACK信息。这里，把上述多个CC的多个下行子帧称为对应这个上行子帧的绑定窗口。为了帮助UE识别是否丢失了其绑定窗口内的一个或者多个下行传输，在LTE系统引入了下行分配索引（DAI）技术。具体的说，DAI是两比特信息，是一种纯计数器，用于指示到当前子帧位置，一共发送了多少个下行授权信令。但是，2比特DAI信息不能发现丢失连续的4个下行授权信令的情况，或者连续丢失最后的若干个下行授权信令的情况。上述两比特DAI是一种对检测性能和信令开销的折中。换句话说，在LTE系统中，认为丢失连续4个子帧的概率非常低，不需要去优化处理。

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[0090] 另外，在LTE系统中，当在一个子帧内需要反馈HARQ-ACK信息时，是根据下行授权信令中的2比特ACK/NACK资源指示(ARI)信息可以动态指示一个PUCCH信道用于HARQ-ACK传输。这里，是通过RRC信令半静态配置4个备选PUCCH信道，从而用2比特ARI动态指示使用哪个PUCCH信道用于HARQ-ACK传输。

[0091] 根据现有LTE系统中的方法，只有Pcell的DAI等于1的下行授权信令的传输功率控制(TPC)域仍然用于功率控制，而Pcell的其他下行授权信令和Scell的下行授权信令的TPC域都是用作ARI。当考虑为UE配置最多32载波，特别是对TDD系统时，导致有更多的下行授权信令中的TPC域被用作ARI信息。但是，实际上，所有的ARI信息都是相同的2比特信息，这造成大量的冗余比特。

[0092] 本发明提出，可以把ARI信息和其他控制信息（例如新定义的控制信息）一起处理后，映射到上述除了Pcell的仍然用于功率控制的下行授权信令的TPC域以外的其他下行授权信令的TPC域上。上述其他控制信息可以是指示当前分配那种PUCCH格式的信道、指示发送的下行授权信令总数、指示传输的TB总数或者作为DAI的扩展信息等。只要UE能够收到一定数目的上述其他下行授权信令，UE就有可能完成恢复出ARI信息和上述其他控制信息。

[0093] 根据上面的分析，LTE系统的DAI的设计不能发现丢失连续4个下行授权信令的情况，换句话说，丢失连续4个下行授权信令的情况不在LTE系统的优化范围之内。基于这个性质，有可能利用下行授权信令的TPC域承载更多的信息。这里DAI可以仍然是时域的，即对一个CC的各个子帧的下行授权信令的计数；或者，DAI可以是频域的，即对同一个子帧内的各个CC的下行授权信令的计数；或者，DAI可以是联合用于频域和时域的，即首先对一个子帧内的各个CC的下行授权信令的计数，然后对下一个子帧内的各个CC的下行授权信令继续计数。或者，DAI可以是频域的，即对同一个子帧内的各个CC的下行授权信令调度的TB个数进行计数；或者，DAI可以是联合用于频域和时域的，即首先对一个子帧内的各个CC的下行授权信令的调度的TB个数进行计数，然后对下一个子帧内的各个CC的下行授权信令的TB个数进行继续计数。

[0094] 一种可能的方法是，除Pcell上的一个下行授权信令的TPC域仍然用于功率控制以外，基站发送的前N个其他连续下行授权信令中的TPC域仍然指示ARI信息，N大于N_{min}，例如N_{min}等于4；而后续其他下行授权信令中的TPC域用于指示其他控制信息。这里，只有当UE丢失上述前N个连续的下行授权信令时，UE才没有可用的ARI信息，这样的概率非常小，不需要进行优化处理。以下描述处理第N个指示ARI的下行授权信令以后的其他下行授权信令的TPC域的处理方法。

[0095] 第一种处理方法是利用这些TPC域承载基站当前调度的下行授权信令的总数。进一步地，可以是对下行授权信令的个数模N_{min}，从而可以用$\log_2(N_{min})$比特来传输。例如N_{min}等于4，是用2个比特来传输当前调度的下行授权信令的总数。根据对下行授权信令中计数的DAI，UE已经可以发现除丢失最后若干个下行授权信令以外的丢失小于N_{min}个连续下行授权信令的情况。进一步地，基于这个方法，根据在TPC域中传输的这个下行授权信令的总数，UE可以判断他是否丢失了基站调度的最后1～N_{min}-1个下行授权信令。这样，综合DAI和TPC域传输的下行授权信令的总数，UE可以发现所有丢失大于等于N_{min}个连续下行授权信令以外的丢失情况。根据上面的分析，当N_{min}大于等于4时，不需要优化丢失连续N_{min}个

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下行授权信令的情况，所以 UE 可以推断出基站共计发送了多少个下行授权信令，并相应地设置 HARQ-ACK 的比特数。UE 可以根据当前子帧承载的 UCI 比特数目进一步确定 ARI 指示的是哪种 PUCCH 格式的 PUCCH 信道。上述 UCI 可以包括 HARQ-ACK、P-CSI 和 / 或 SR。

[0096] 采用这个方法，除 Pcell 的 TPC 域仍然用于功率控制的下行授权信令外，假设 UE 收到前 N 个指示 ARI 的下行授权信令以外的至少一个下行授权信令，即 UE 收到了在 TPC 域承载的当前调度的下行授权信令的总数，从而 UE 可以准确得到 HARQ-ACK 的比特总数，并按照这个比特总数在 ARI 指示的 PUCCH 信道上传输 HARQ-ACK 信息，这里，在 ARI 指示的 PUCCH 信道上可以同时反馈其他 UCI 信息。或者，除 Pcell 的 TPC 域仍然用于功率控制的下行授权信令外，假设 UE 仅收到前 N 个指示 ARI 的下行授权信令中的至少一个，UE 仍然获得了 ARI 信息，从而确定 PUCCH 信道，但是不能确切知道基站调度下行授权信令数目。UE 可以按照其能够检测到或者分析得到的下行授权信令的数目确定 HARQ-ACK 比特总数。或者，在这种情况下，UE 也可以是固定按照基站调度了 N 个下行授权信令来计算 HARQ-ACK 的比特数，例如 UE 固定反馈 2N 个 HARQ-ACK 比特。

[0097] 在基站侧，当基站实际调度至少 $N+N_{min}$ 个下行授权信令时，在不优化丢失连续 N_{min} 个下行授权信令的前提下，UE 一定收到了在 TPC 域承载的当前调度的下行授权信令的总数，基站可以假设 UE 准确知道 HARQ-ACK 比特总数，从而不需要盲检测。当基站实际调度大于 N 个但是小于 $N+N_{min}$ 个下行授权信令时，因为 UE 可能丢失最后面的最多 $N_{min}-1$ 个下行授权信令，导致 UE 未能收到在 TPC 域承载的当前调度的下行授权信令的总数，从而 UE 有可能不知道准确的 HARQ-ACK 数目；或者，当基站实际调度小于等于 N 个下行授权信令时，即基站未能利用 TPC 域承载的当前调度的下行授权信令的总数，导致 UE 不知道准确的 HARQ-ACK 数目。这时，如果 UE 的操作是按照其能够检测到或者分析得到的下行授权信令的数目确定 HARQ-ACK 比特总数，基站可以是盲检测多种可能的 HARQ-ACK 比特总数来完成 HARQ-ACK 的接收；或者，基站仅按照其实际调度的下行数据传输对应的 HARQ-ACK 比特数来进行 HARQ-ACK 的接收。或者，如果 UE 在没有收到 TPC 域承载的当前调度的下行授权信令的总数的情况下，是固定按照基站调度了 N 个下行授权信令来计算 HARQ-ACK 的比特数，例如 UE 固定反馈 2N 个 HARQ-ACK 比特。基站可能需要盲检测两个净荷大小，即基站实际调度对应的 HARQ-ACK 比特数和 2N 比特。

[0098] 第二种处理方法是利用这些 TPC 域承载基站当前调度的 TB 的总数。进一步地，可以是对 TB 总数模 B_{min}，从而可以用 $\log_2(B_{min})$ 比特来传输。例如 B_{min} 等于 8，上述 $\log_2(B_{min})$ 比特信息经处理后需要映射到多个下行授权信令的 TPC 域上。根据下行授权信令中的对 TB 进行计数的 DAI，UE 已经可以发现除丢失最后若干个 TB 以外的丢失连续小于 B_{min} 个 TB 的情况。进一步地，基于这个方法，根据在 TPC 域中传输的这个 TB 总数，UE 可以判断他是否丢失了基站调度的最后 1 ～ $B_{min}-1$ 个 TB。这样，综合 DAI 和 TPC 域传输的 TB 总数，UE 可以发现所有丢失大于等于 B_{min} 个连续 TB 以外的丢失情况。根据上面的分析，不需要优化丢失连续 4 个下行授权信令的情况，当 B_{min} 等于 8 时，丢失 B_{min} 个连续 TB 相当于丢失连续大于等于 4 个下行授权信令，即不需要优化，所以 UE 可以推断出基站共计发送了多少个 TB，并相应地设置 HARQ-ACK 的比特数。UE 可以根据当前子帧承载的 UCI 比特数目进一步确定 ARI 指示的是哪种 PUCCH 格式的 PUCCH 信道。上述 UCI 可以包括 HARQ-ACK、P-CSI 和 / 或 SR。

[0099] 采用这个方法，除 Pcell 的 TPC 域仍然用于功率控制的下行授权信令外，假设 UE

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收到前 N 个指示 ARI 的下行授权信令以外的至少一个下行授权信令，即 UE 收到了在 TPC 域承载的当前调度的 TB 总数，从而 UE 可以准确得到 HARQ-ACK 的比特总数，并按照这个比特总数在 ARI 指示的 PUCCH 信道上进行 HARQ-ACK 传输，这里，在 ARI 指示的 PUCCH 信道上可以同时反馈其他 UCI 信息。或者，除 Pcell 的 TPC 域仍然用于功率控制的下行授权信令外，假设 UE 仅收到前 N 个指示 ARI 的下行授权信令中的至少一个，UE 仍然获得了 ARI 信息，从而确定 PUCCH 信道，但是不能确切知道基站调度下行授权信令数目。UE 可以按照其能够检测到或者分析得到的 TB 数目确定 HARQ-ACK 比特总数。或者，在这种情况下，UE 也固定按照基站调度了 B 个 TB 来计算 HARQ-ACK 的比特数，例如 UE 固定反馈 B 个 HARQ-ACK 比特。

[0100] 在基站侧，当基站实际调度至少 $N+N_{min}$ 个下行授权信令时，在不优化丢失连续 N_{min} 个下行授权信令的前提下，UE 一定收到了在 TPC 域承载的当前调度的 TB 的总数，基站可以假设 UE 准确知道 HARQ-ACK 比特总数，从而不需要盲检测。当基站实际调度大于 N 个但是小于 $N+N_{min}$ 个下行授权信令时，因为 UE 可能丢失最后面的最多 $N_{min}-1$ 个下行授权信令，导致 UE 未能收到在 TPC 域承载的当前调度的 TB 总数，从而 UE 有可能不知道准确的 HARQ-ACK 数目；或者，当基站实际调度小于等于 N 个下行授权信令时，即基站未能利用 TPC 域承载的当前调度的 TB 总数，导致 UE 不知道准确的 HARQ-ACK 数目。这时，如果 UE 的操作是按照其能够检测到或者分析得到的 TB 数目确定 HARQ-ACK 比特总数，基站可以是盲检测多种可能的 HARQ-ACK 比特总数才能完成 HARQ-ACK 的接收；或者，基站仅按照其实际调度的下行数据传输对应的 HARQ-ACK 比特数来接收 HARQ-ACK 的接收。或者，如果 UE 在没有收到 TPC 域承载的当前调度的 TB 总数的情况下，是固定按照基站调度了 B 个下行授权信令来计算 HARQ-ACK 的比特数，即 UE 固定反馈 B 个 HARQ-ACK 比特。基站可能需要盲检测两个净荷大小，即基站实际调度对应的 HARQ-ACK 比特数和 B 比特。

[0101] 实施例四

[0102] 在本实施例中，给出根据 ARI 信息确定 PUCCH 信道和相应的 PUCCH 格式的具体方式。

[0103] 在 LTE 系统中，需要在一个上行子帧内反馈多个 CC 的多个下行子帧的下行传输的 HARQ-ACK 信息。这里，把上述多个 CC 的多个下行子帧称为对应这个上行子帧的绑定窗口。对参考 HARQ 定时是 FDD 定时的情况，绑定窗口包括一个子帧内的多个 CC 的资源；对参考 HARQ 定时 TDD 定时的情况，则绑定窗口包括多个 CC 的多个子帧内的资源。当可以配置 UE 的 CC 数目很多时，相应地 HARQ-ACK 的比特数目也越多。例如，假设配置了 32CC，每个 CC 的绑定窗口都包括 4 个子帧，则即使在考虑了空间绑定 (spatial bundling) 的情况下，HARQ-ACK 的比特数也达到 128。

[0104] 但是，通常情况下，基站不会调度绑定窗口内所有配置的 CC 的所有子帧给同一个 UE。有些情况下，基站可能仅在绑定窗口内调度了很少的下行数据，有效的 HARQ-ACK 比特数小于等于 N1 比特，例如 N1 等于 22，则在考虑资源利用率时，应该分配 PUCCH 格式 3 信道给 UE。在另一些情况下，基站调度了较多的下行数据，导致有效的 HARQ-ACK 比特数大于 N1，则需要分配 PUCCH 格式 X 信道给 UE。进一步的，PUCCH 格式 X 信道还可以是支持多种净荷比特数，例如，当需要反馈的 HARQ-ACK 比特数大于 N1 但是小于等于 N2 比特时，例如 N2 等于 66，UE 可以按照承载 N2 比特的情况处理 PUCCH 格式 X 信道；当需要反馈的 HARQ-ACK 比特数大于 N2 比特时，UE 可以按照承载 N3 比特的情况处理 PUCCH 格式 X 信道，例如 N3 等于

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130。为了在保证基站调度灵活性的前提下，尽可能优化 PUCCH 的传输性能，提高上行资源利用率，UE 需要动态转换采用的 PUCCH 信道。例如，以 N1 比特为界，转换 PUCCH 格式 3 信道和 PUCCH 格式 X 信道；或者，以 N1 比特和 N2 比特为界，转换 PUCCH 格式 3 信道、净荷较小的 PUCCH 格式 X 信道和净荷较大的 PUCCH 格式 X 信道。

[0105] 另外，在 LTE 系统中，当在一个子帧内需要反馈 HARQ-ACK 信息时，是根据下行授权信令中的 2 比特 ACK/NACK 资源指示（ARI）信息可以动态指示一个 PUCCH 信道用于 HARQ-ACK 传输。这里，是通过 RRC 信令半静态配置 4 个备选 PUCCH 信道，从而用 2 比特 ARI 动态指示使用哪个 PUCCH 信道用于 HARQ-ACK 传输。

[0106] 这里，本发明提出 ARI 的一个值动态指示用于 UCI 传输的 PUCCH 信道格式，并进一步动态指示出 UE 当前使用的 PUCCH 信道。具体的说，记 ARI 是 N 比特信息，例如 N 等于 2，通过 RRC 信令半静态配置 2^N 个备选，并分别配置这 2^N 个备选的 PUCCH 信道格式和对应的 PUCCH 信道。不同备选 PUCCH 信道的格式可以是相同的或者不同的。然后，可以用下行授权信令中的 N 比特 ARI 动态指示用于 UCI 传输的 PUCCH 信道格式和 PUCCH 信道。UE 根据检测到的 ARI 信息确定 PUCCH 信道格式以及使用的 PUCCH 信道。采用这种方法，提供基站动态指示 PUCCH 格式的灵活性，但是，在不增加 ARI 比特数目的情况下，它也意味着对应一种特定 PUCCH 格式的备选信道数目减少了。

[0107] 上述即为本申请中传输 UCI 方法的具体实现。本申请还提供一种传输 UCI 的设备，可以用于实施上述本申请的 UCI 传输方法。图 4 为该设备的基本结构示意图，如图 4 所示，该设备包括：备选 PUCCH 信道集合确定单元、HARQ-ACK 比特生成单元、UCI 比特处理单元、PUCCH 信道确定单元和发送单元。

[0108] 其中，备选 PUCCH 信道集合确定单元，用于接收配置信令，确定对应 ACK/NACK 资源指示（ARI）的备选 PUCCH 信道集合。HARQ-ACK 比特生成单元，用于接收下行授权信令及对应的下行数据，生成 HARQ-ACK 比特。UCI 比特处理单元，用于对包括 HARQ-ACK 在内的 UCI 比特进行处理。PUCCH 信道确定单元，用于根据下行授权信令中包括的 ARI 从备选 PUCCH 信道集合中确定出用于 UCI 比特传输的 PUCCH 信道。发送单元，用于在确定出的 PUCCH 信道上传输包括 HARQ-ACK 在内的 UCI 比特。

[0109] 下面针对 UCI 信息中的 A-CSI 传输方法和设备进行介绍。图 5 为本申请中传输 A-CSI 信息的方法基本流程图。如图 5 所示，该方法包括：

[0110] 步骤 501，UE 接收上行授权信令。

[0111] 步骤 502，UE 根据上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告。

[0112] 步骤 503，在确定触发 A-CSI 报告后，UE 确定要更新的 CSI 过程，并在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息。

[0113] 下面通过两个具体实施例说明 A-CSI 的具体传输方式。

[0114] 实施例五

[0115] 在 LTE 系统中，可以触发 A-CSI 报告，并且是映射到 PUSCH 信道上传输。在上行授权信令中包含 1 比特或者 2 比特的 CSI 请求域，它用于触发 UE 的 A-CSI 报告。以 2 比特 CSI 请求域为例，值“0,0”指示不触发 A-CSI；值“0,1”指示上行授权信令调度的上行 CC 对应的下行 CC 的 A-CSI，这里的对应关系是根据系统信息块 SIB2 确定的；值“1,0”和“1,1”具体触发那些 CSI 报告是用 RRC 信令配置的，所以可以是配置触发任何一个 CC 的 A-CSI，具

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有最大的灵活性。但是，对值“0,1”，因为典型的CA配置都是非对称的，只有配置了对应的上行CC的那些下行CC才能用值“0,1”来触发A-CSI。特别地，UE可以是配置了32个下行CC，而只配置1个上行CC，这在很大程度上限制了值“0,1”的可用性。

[0116] 为了充分利用值“0,1”，本实施例提出对只配置了下行传输的CC，仍然要求UE检测DCI格式0，从而利用DCI格式0来触发UE对这样的只配置下行传输的CC的A-CSI报告。这里，UE检测DCI格式0并不增加盲检测次数，这时因为DCI格式0和DCI格式1A的比特数目相等，并且UE在盲检测调度下行传输的下行授权信令时一定会检测DCI格式。

[0117] 这里，因为只配置了下行传输的CC实际上不能进行上行传输，触发的A-CSI信息只能在其他配置了上行带宽的CC上。这个CC可以固定是Pcell；或者，这个CC可以是对应这个只配置下行传输的CC的反馈UCI的CC，即PScell；或者，可以是对DCI格式0的一些比特进行重新定义，从而指示UE从多个配置的上行CC中选择一个用于A-CSI反馈。

[0118] 这种对应只配置下行传输的CC的DCI格式0可以是仅用于触发A-CSI，或者也可以同时触发对只配置下行传输的CC的A-CSI和调度反馈A-CSI的CC上的上行数据传输。

[0119] 这种对应只配置下行传输的CC的DCI格式0可以是只有值“0,1”用于触发A-CSI，或者也可以是值“0,1”、“1,0”和“1,1”都可以用于触发A-CSI。对值“0,1”、“1,0”和“1,1”，其触发的A-CSI对应的CSI过程是用高层信令配置的，可以与其他支持上行传输的CC的配置相同，或者，也可以是不同的。

[0120] 这种对应只配置下行传输的CC的DCI格式0可以仍然是只有两个比特用于CSI请求，或者也可以是把更多的比特用于CSI请求，从而可以用RRC信令配置更多的不同的A-CSI信息的集合。例如，假设只配置下行传输的CC的DCI格式0不调度上行数据，则DCI格式中的一些域是无用的，可以用来增加CSI请求的比特数。

[0121] 当用只配置下行传输的CC的DCI格式0触发了A-CSI，并且UE在反馈A-CSI的CC上没有调度上行数据传输时，按照这个DCI格式0确定反馈A-CSI的CC的PUSCH信道的相关参数并传输A-CSI。当用只配置下行传输的CC的DCI格式0触发了A-CSI，并且UE在反馈A-CSI的CC上也调度了上行数据传输时，但是在反馈A-CSI的CC上没有额外触发A-CSI报告，则按照反馈A-CSI的CC的上行授权信令来确定PUSCH信道的相关参数，然后在这个PUSCH信道上传输只配置下行传输的CC的DCI格式0触发的A-CSI。当用只配置下行传输的CC的DCI格式0触发了A-CSI，并且UE在反馈A-CSI的CC检测到上行授权信令并额外触发了A-CSI时，即UE同时在一个子帧内收到至少两个A-CSI触发，UE可以认为这种情况是配置错误；或者，UE可以仅传输反馈A-CSI的CC的上行授权信令触发的A-CSI，即丢掉只配置下行传输的CC的DCI格式0触发的A-CSI；或者，UE可以对同时反馈两个A-CSI报告，特别地，UE可以是反馈两个A-CSI的并集，即对两个A-CSI的重复的CSI过程，仅需要传输一次。

[0122] 实施例六

[0123] 在LTE系统中，可以触发A-CSI报告，并且是映射到PUSCH信道上传输。在上行授权信令中包含1比特或者2比特的CSI请求域，它用于触发UE的A-CSI报告。以2比特CSI请求域为例，值“0,0”指示不触发A-CSI；值“0,1”指示上行授权信令调度的上行CC对应的下行CC的A-CSI，这里的对应关系是根据SIB2确定的；值“1,0”和“1,1”具体触发那些CSI报告是用RRC信令配置的，所以可以是配置触发任何一个CC的A-CSI，具有最大的灵

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活性。

[0124] 另外，在 LTE 系统中，可以为 UE 配置了多个小区组 (CG，Cell Group)，并且对一个 CG，在这个 CG 的一个小区上反馈这个 CG 的各个小区的 UCI 信息。特别地，可以是对每个 CG 分别用 RRC 信令配置 A-CSI 报告的 CSI 过程集合，并用上行授权信令来分别触发 UE 的 A-CSI 报告。但是，从 UE 能力上讲，不管是否配置了多个 CG，UE 在一个子帧内能够更新和反馈 A-CSI 的 CSI 过程数目是不变的，记为 K 个 CSI 过程。对各个 CG，CSI 请求域所触发的 A-CSI 报告是独立配置的，即，对一个 CG，允许对应 CSI 请求域的一个码字配置包含最多 K 个 CSI 过程的 A-CSI 报告。这可能会导致在同一个子帧内，当基站在多个 CG 内都触发了 A-CSI 报告时，多个 CG 触发的 CSI 过程的总数可以超过 UE 更新和反馈 A-CSI 的能力。这时，一种处理方法是让 UE 认为这是一种配置错误，但是这造成对基站触发 A-CSI 的限制。另一个处理方法是依赖于 UE 实现来处理这种情况。因为不同的制造商可能有不同的实现方法，这导致基站不确定 UE 到底报告的哪 K 个 CSI 过程是最新的，这也不利于基站调度。实际上，在一些情况下，基站可以是故意使一个子帧内在多个 CG 触发的 A-CSI 过程总数大于 K，仅需要定义一定的优先级规则，就可以控制 UE 只更新一部分高优先级的 CG 的 A-CSI ；或者，控制 UE 只更新各个 CG 的优先级较高的 CSI 过程，这样的可以更新的 CSI 过程的集合不是通过 RRC 信令配置的，从而在不变化 RRC 信令的情况下，增加了触发 A-CSI 的集合数目。

[0125] 本实施例提出，当基站在一个子帧内触发多个 CG 的 A-CSI，并且触发的 CSI 过程的总数大于 UE 更新和报告 A-CSI 的能力 K 时，记触发的 CSI 过程的总数为 N，则 UE 从上述 N 个 CSI 过程中选择 K 个优先级最高的 CSI 过程进行更新 CSI 并报告。

[0126] 对 CSI 信息，可以从以下几个方面来处理优先级。

[0127] 对 A-CSI，其设计原则是一次反馈完成的 CSI 信息，即，在 RI 信息是默认为特定值的情况下，例如 RI 等于 1，报告所有相关的 CQI/PMI 信息 ；或者，UE 需要在一个 PUSCH 上报告 RI 信息和所有 CQI/PMI 信息。这样，区分 RI 和 CQI/PMI 两种 CSI 报告类型的方法不能直接适用于 A-CSI。一种简单的方法是不在使用 CSI 报告类型作为 A-CSI 优先级的依据。或者，定义同时反馈 RI 和 CQI/PMI 的 CSI 过程的优先级高于采用默认 RI 从而只反馈 CQI/PMI 的 CSI 过程。或者，可以是定义各种用于 A-CSI 的 CSI 汇报模式的优先级。或者，可以是定义各种下行传输模式的优先级。

[0128] CSI 过程 ID 仍然可以作为判断 A-CSI 优先级的一个依据。例如，CSI 过程 ID 较小的 CSI 过程优先。对 TM1 ～ 9，LTE 系统没有定义 CSI 过程，但是可以按照只配置一个 CSI 过程并且 CSI 过程 ID 为 0 来处理。

[0129] 对小区 ID，可以有两种定义方法。第一种方法是 UE 的所有配置的 CC 分别配置唯一的小区 ID，这样，可以根据小区 ID 来判断不同 CG 的 CSI 过程的优先级，并且因为不同 CG 的小区 ID 不同，一定可以选出优先级更高的 CSI 过程，从而也就不需要再比较其他参数。或者，第二种方法是配置小区 ID 是在一个 CG 内的小区的索引，即不同的 CG 内的小区可以有相同的用于 A-CSI 优先级的小区 ID，这样，当两个 CG 内的 CSI 过程的小区 ID 都相同时，可以进一步比较 CSI 子帧集索引，例如，CSI 子帧集索引较小的 CSI 过程优先 ；或者，当两个 CG 内的 CSI 过程的小区 ID 相同时，可以进一步比较 CG 的索引，例如，CG 索引较小的 CSI 过程优先 ；或者也可以进一步把 CSI 子帧集索引和 CG 索引都作为优先级准则。

[0130] CG 索引可以作为判断 A-CSI 优先级的一个依据。例如，CG 索引较小的 CSI 过程优

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先。采用这个方法，可以实现 Pcell 所在的 CG 优先级最高，从而保护 Pcell 所在的 CG 的下行传输性能。

[0131] 假设一个 CG 可以进一步划分多个反馈 A-CSI 的子组，即一个 A-CSI 触发的 A-CSI 是局限在一个子组内的 CC 上，则可以把 A-CSI 子组的索引可以作为判断 A-CSI 优先级的一个依据。例如，A-CSI 子组的索引较小的 CSI 过程优先。这里可以是跨越 CG，对所有 A-CSI 子组一起排序，从而一定可以按照 A-CSI 子组索引区分优先级。这里，一般需要保证 Pcell 所在 CG 内的 A-CSI 子组具有更低的索引。或者 A-CSI 子组的索引是在每个 CG 内部定义的，即多个 CG 内的 A-CSI 子帧的索引可以是相等的。

[0132] 为了尽可能保证用于承载 UCI 信息的 CC 的下行传输性能，可以是定义下面的优先级顺序，即 Pcell 的优先级 >PScell 的优先级 > 其他 Scell 的优先级。这里，如果有多个 PScell，认为其优先级相同，如果有多个其他 SCell，也认为其优先级相同；或者，如果有多个 PScell，可进一步按照其索引排序；如果有多个其他 Scell，是按照其索引排序。

[0133] 可以把小区所在的许可频段或者免许可频段作为一个准则，例如，许可频段的小区优先级高于免许可频段的小区，这时因为许可频段的小区的 CSI 测量肯定是可用的，但是对免许可频段的小区，即使触发了 A-CSI 报告，但是如果这个小区已经长时间没有占有信道，其 A-CSI 的有效性很低。或者，也可以定义免许可频段的小区优先级高于许可频段的小区，这时因为免许可频段的一次 CSI 汇报如果不能及时报告并利用，可能导致基站在很长时间内没有 CSI 信息可用，而许可频段上的 CSI 报告则经常可以报告，即汇报的机会更多。

[0134] 采用本发明上面的方法，当基站在多个 CG 触发的 A-CSI 的 CSI 过程数大于 K 时，UE 根据上述优先级规则确定更新其中的 K 个 CSI 过程的 CSI 信息。因为这种优先级规则同时作用于基站和 UE，没有不确定性，UE 可以在上行方向只传输对应上述 K 个 CSI 过程的 A-CSI 信息，即，对应一个 CG 的一个 A-CSI 报告，仅保留属于上述 K 个最高优先级的 CSI 过程的 CSI 信息，并据此确定 A-CSI 信息的总比特数，并相应地在对应这个 CG 的这个 A-CSI 报告的上行信道上传输。采用这个方法，因为去除了未更新的 A-CSI 的无效比特，减小对一般上行数据传输的影响，提高上行资源利用率。

[0135] 以上描述了分别多种处理 A-CSI 优先级的参数，实际的优先级准则可以是联合使用上述优先级的一种或者多种参数。例如，采用四种参数并且按照优先级别从高到低的顺序依次为，CSI 报告类型 >CSI 过程 ID> 小区 ID>CSI 子帧集索引。在联合采用了多种参数的情况下，只有当高级别的参数不能判断优先级的情况下，才进一步比较低一级的参数。

[0136] 上述即为本申请中 A-CSI 的传输方法的具体实现。本申请还提供了一种 A-CSI 的传输设备。图 6 为该设备的基本结构示意图，如图 6 所示，该设备包括：接收单元、A-CSI 报告触发单元和传输单元。

[0137] 其中，接收单元，用于接收上行授权信令。A-CSI 报告触发单元，用于根据上行授权信令中的 CSI 请求域确定当前是否触发 A-CSI 报告，并在确定触发 A-CSI 报告时通知传输单元。传输单元，用于在接收到 A-CSI 报告触发单元的触发通知后，确定要更新的 CSI 过程并在承载 A-CSI 报告的上行 CC 上传输 A-CSI 信息。

[0138] 以上所述仅为本发明的较佳实施例而已，并不用以限制本发明，凡在本发明的精神和原则之内，所做的任何修改、等同替换、改进等，均应包含在本发明保护的范围之内。

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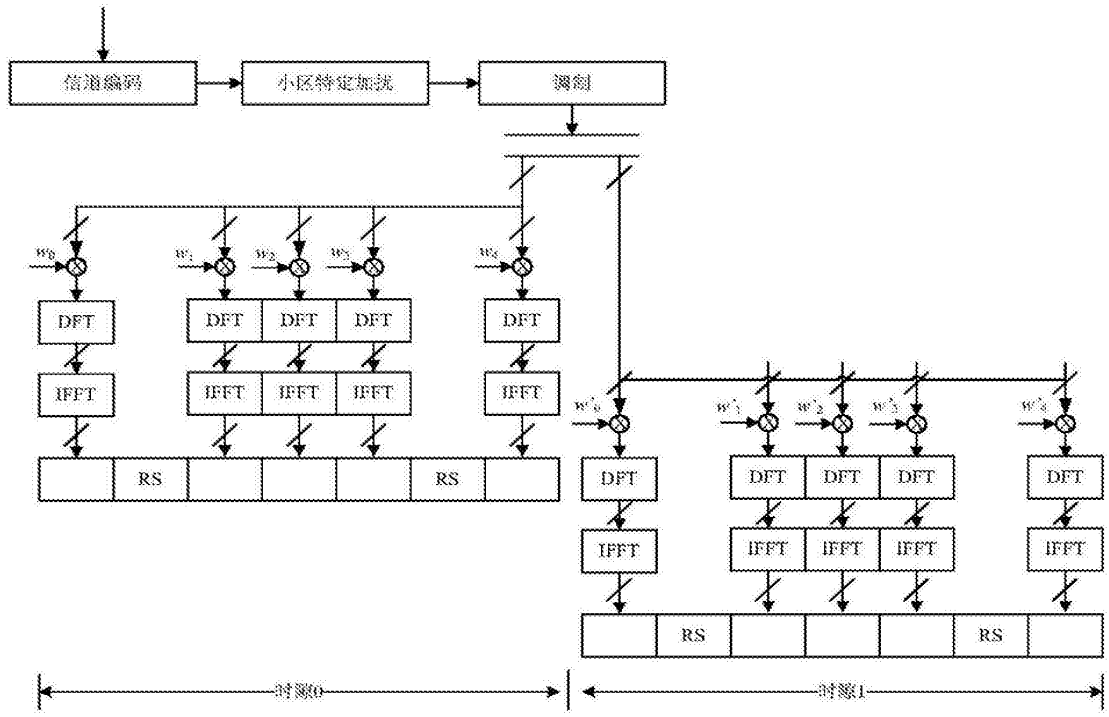


图 1

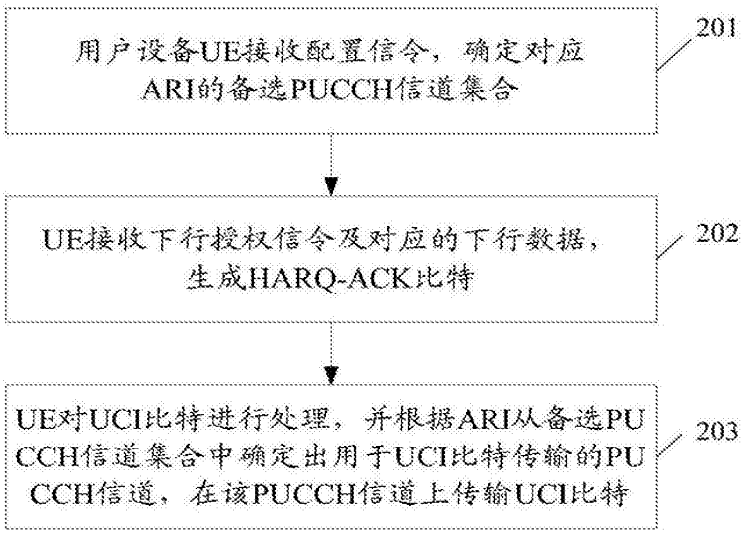


图 2

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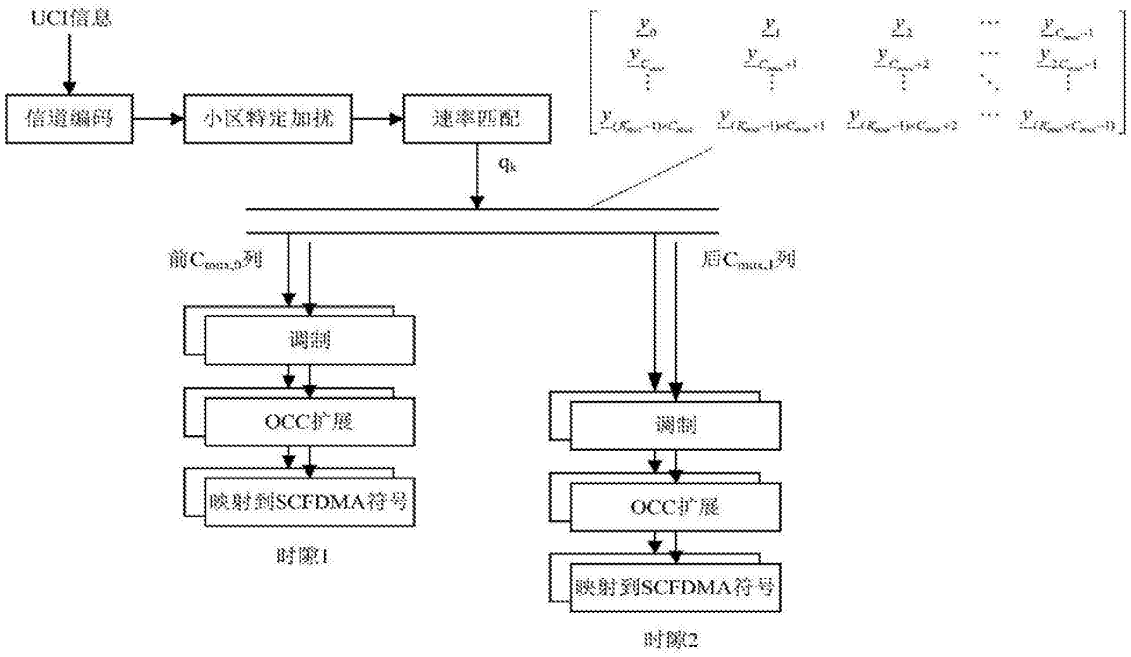


图 3

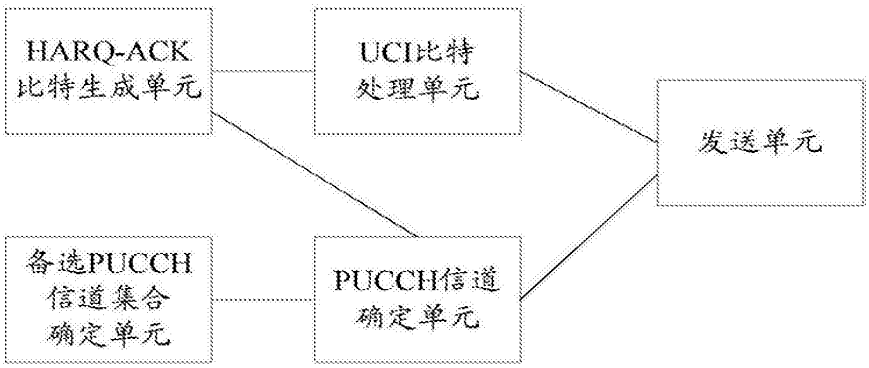


图 4

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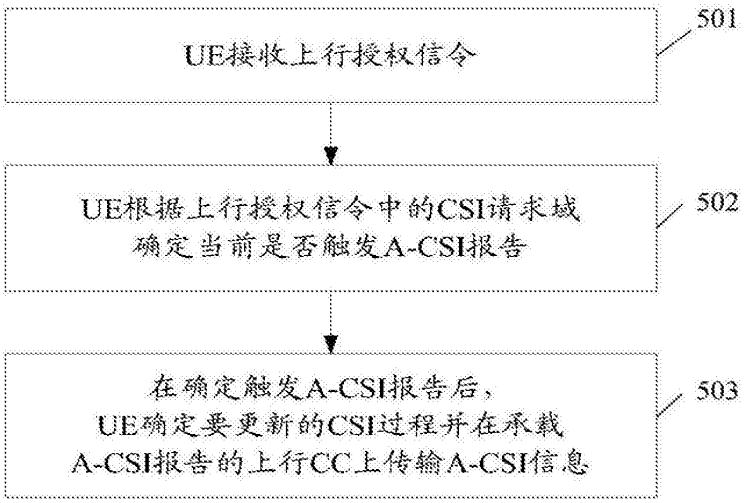


图 5

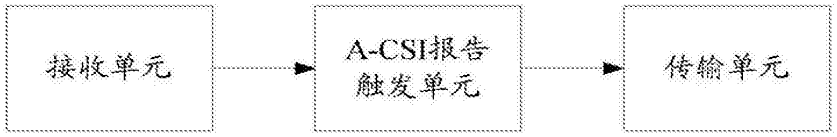


图 6

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根据细则 4.17 的声明:
— 关于申请人有权申请并被授予专利(细则 4.17(ii))

本国际公布:
— 包括国际检索报告(条约第 21 条(3))。

(54) **Title**: USER EQUIPMENT, ACCESS NETWORK DEVICE, METHOD AND DEVICE FOR TRANSMITTING AND RECEIVING UPLINK CONTROL INFORMATION

(54) **发明名称** : 用户设备、接入网设备、上行控制信息的收发方法及装置

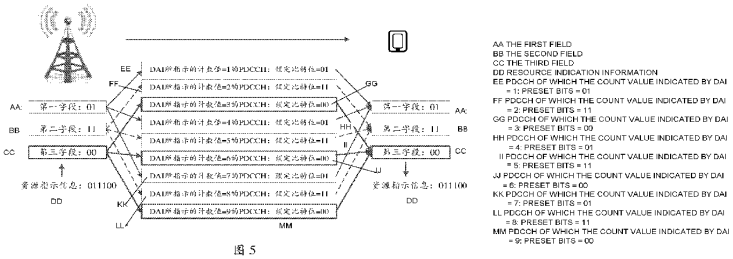


图 5

(57) **Abstract**: Embodiments of the present invention provide a user equipment, an access network device, and a method and device for transmitting and receiving uplink control information, relating to the field of communications. The method comprises: an access network device divides resource indication information into at least two fields, wherein each field is carried by downlink control information of a physical downlink control channel set, each physical downlink control channel set comprises multiple physical downlink control channels corresponding to downlink data received in secondary carriers; a user equipment determines the resource indication information according to the at least two fields. The present invention solves the problem that an access network device can indicate to a user equipment the uplink channel resource used in this application only after the number of bits occupied by predetermined bits in downlink control information is increased, and achieves the effect of determining an uplink channel resource used for transmitting uplink control information in the manner that the access network device respectively indicates one field to the user equipment by means of the downlink control information in each of multiple physical downlink control channel sets and the user equipment obtains resource indication information by determining the various fields of the resource indication information.

(57) **摘要**:

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本发明实施例提供了一种用户设备、接入网设备、上行控制信息的收发方法及装置，涉及通信领域，所述方法包括：接入网设备通过将资源指示信息划分为至少两个字段，每个字段由一个物理下行控制信道集合中的下行控制信息携带，每个物理下行控制信道集合包括在辅载波中接收的下行数据对应的若干个物理下行控制信道，用户设备根据至少两个字段确定出资源指示信息；解决了接入网设备需要增加下行控制信息中预定比特位所占用的比特位后，才能向用户设备指示本次使用的上行信道资源的问题；达到了接入网设备通过多个物理下行控制信道集合中每一个集合的下行控制信息向用户设备分别指示一个字段，用户设备通过确定资源指示信息的各个字段得到资源指示信息，从而确定出用于发送上行控制信息的上行信道资源的效果。

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用户设备、接入网设备、上行控制信息的收发方法及装置

技术领域

本发明实施例涉及通信领域，特别涉及一种用户设备、接入网设备、上行控制信息的收发方法及装置。

背景技术

在通信系统中，用户设备（User Equipment，UE）需要向接入网设备发送上行控制信息（Uplink Control Information，UCI）。UE 通过接入网设备指示的上行信道资源发送 UCI。

在载波聚合（Carrier Aggregation，CA）场景中，接入网设备通过多个载波同时向 UE 发送下行数据，该多个载波包括一个主载波和多个辅载波。同时，UE 需要针对该多个载波向接入网设备反馈 UCI。在 UE 反馈 UCI 时，UE 需要从预配置的四个上行信道资源中，选择出本次使用的上行信道资源。UE 选择上行信道资源的方法包括：UE 从多个辅载波的物理下行控制信道（Physical Downlink Control Channel，PDCCH）中的下行控制信息（Downlink Control Information，DCI）中读取预定比特位上所携带的信息，根据预定比特位上所携带的信息确定出本次使用的上行信道资源。该预定比特位可以是物理上行控制信道发送功率控制命令（Transmisson Power Contral Command for Physical Uplink Control Channel，TPC Command for PUCCH）所对应的比特位。多个辅载波中的下行控制信息中的该预定比特位上携带有相同的信息，该预定比特位通常采用 2 个比特来表示。

比如，预定比特位上携带的信息为 00 时，则 UE 采用第一个上行信道资源发送 UCI；预定比特位上携带的信息为 01 时，则 UE 采用第二个上行信道资源发送 UCI；预定比特位上携带的信息为 10 时，则 UE 采用第三个上行信道资源发送 UCI；预定比特位上携带的信息为 11 时，则 UE 采用第四个上行信道资源发送 UCI。

在实现本发明实施例的过程中，发明人发现现有技术至少存在如下问题：在载波聚合场景下，接入网设备向 UE 预配置的用于发送 UCI 的上行信道资源

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可能为很多个，比如 16 个或 32 个。以预配置的上行信道资源是 16 个为例，接入网设备需要将预定比特位由 2 个比特位修改为 $\log_2 16=4$ 个比特位后，才能向 UE 指示本次使用的上行信道资源，将会对 PDCCH 信道造成较大的传输负担。

发明内容

为了解决在预配置的上行信道资源为很多个时，接入网设备需要增加 DCI 中预定比特位所占用的比特位后，才能向 UE 指示本次使用的上行信道资源的问题，本发明实施例提供了一种用户设备、接入网设备、上行控制信息的收发方法及装置。所述技术方案如下：

根据本发明实施例的第一方面，提供了一种上行控制信息的发送方法，该方法可由 UE 执行，该方法包括：

UE 确定资源指示信息，所述资源指示信息包括至少两个字段，每个所述字段分别由一个物理下行控制信道集合中的下行控制信息确定，每个所述物理下行控制信道集合包括辅载波中的下行数据所对应的若干个物理下行控制信道；

所述 UE 确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源；

所述 UE 在与所述资源指示信息的上行信道资源上发送 UCI。

本发明实施例通过将资源指示信息划分为至少两个字段，每个字段由一个物理下行控制信道集合中的下行控制信息携带，每个物理下行控制信道集合包括在辅载波中接收的下行数据对应的若干个物理下行控制信道；解决了预配置的上行信道资源为很多个时，接入网设备需要增加 DCI 中预定比特位所占用的比特位后，才能向 UE 指示本次使用的上行信道资源的问题；达到了接入网设备不需要增加 DCI 中预定比特位所占用的比特位，通过多个物理下行控制信道集合中每一个集合的下行控制信息向 UE 分别指示一个字段，在 UE 侧通过确定资源指示信息的各字段得到资源指示信息，从而准确确定出用于发送 UCI 的上行信道资源的效果。

在第一方面的第一种可能的实施方式中，所述 UE 确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源，包括：

根据第一对应关系在所述预配置的上行信道资源集合中，确定出与所述资

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源指示信息对应的上行信道资源，所述第一对应关系为预设的资源指示信息和所述上行信道资源集合中每个上行信道资源之间的对应关系。

本发明实施例通过第一对应关系来确定与资源指示信息对应的上行信道资源，具有对应关系简洁、计算量小、计算速度快的优点。

在第一方面的第二种可能的实施方式中，所述资源指示信息包括：第一指示信息和第二指示信息；

所述 UE 确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源，包括：

根据第二对应关系在若干个所述预配置的上行信道资源集合中，确定出与所述第一指示信息对应的上行信道资源集合作为第一上行信道资源集合，每个所述预配置的上行信道资源集合中的上行信道资源对应各自的最大发送比特数；

根据第三对应关系在所述第一上行信道资源集合中，确定出与所述第二指示信息对应的上行信道资源；

其中，所述第二对应关系为预设的第一指示信息和所述预配置的上行信道资源集合之间的对应关系，所述第三对应关系为预设的第二指示信息和所述第一上行信道资源集合中每个上行信道资源之间的对应关系。

本发明实施例中预配置的上行信道资源集合为多个集合，每个集合中的上行信道资源支持发送 UCI 的最大发送比特数不同，UE 可以根据待反馈的 UCI 的数据量大小，选择合适大小的上行信道资源集合中的上行信道资源发送 UCI，从而提高上行信道资源的利用效率。

结合第一方面的第一种可能的实施方式或第二种可能的实施方式，在第一方面的第三种可能的实施方式中，若所述 UE 在所述资源指示信息中的第 L 个字段对应的第 R 个物理下行控制信道集合中的所有物理下行控制信道上都没有检测到所述下行控制信息，则所述资源指示信息中的第 L 个字段由预定规则确定；

其中，所述预定规则包括：所述第 L 个字段为预定取值，或者，所述第 L 个字段为第 R'个物理下行控制信道集合中的所述物理下行控制信道上接收的所述下行控制信息中预定比特位上所指示的信息，$1 \leqslant L \leqslant M$，$1 \leqslant R \neq R' \leqslant M$，R 和 R'之间存在预设的对应关系。

本发明实施例还针对向 UE 发送的部分下行控制信息传输失败的场景，提

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供出一种资源指示信息的确定方式，使得即便部分下行控制信息传输失败，UE依然能够确定出资源指示信息，从而确定出用于发送UCI的上行信道资源的效果。

根据本发明实施例的第二方面，提供了一种上行控制信息的接收方法，该方法可由接入网设备执行，所述方法包括：

接入网设备确定资源指示信息，所述资源指示信息包括至少两个字段，所述资源指示信息用于指示用户设备UE在预配置的上行信道资源集合中确定出反馈上行控制信息时采用的上行信道资源；

所述接入网设备将每个所述字段通过一个物理下行控制信道集合中的下行控制信息向用户设备UE发送，每个所述物理下行控制信道集合包括辅载波中的下行数据所对应的若干个物理下行控制信道；

所述接入网设备接收所述UE根据所述资源指示信息确定的上行信道资源上发送的所述UCI。

在第二方面的第一种可能的实施方式中，所述接入网设备接收所述UE根据所述资源指示信息确定的上行信道资源上发送的所述上行控制信息，包括：

在所述资源指示信息所对应的上行信道资源上接收所述上行控制信息。

在结合第一方面或第二方面的一些可能的实施方式中，所述资源指示信息包括M个字段，M≥2；所述物理下行控制信道集合为M个；

所述资源指示信息中的第i个字段由M个所述物理下行控制信道集合中的第j个所述物理下行控制信道集合中的下行控制信息中的预定比特位上携带的信息所确定；

所述i和所述j之间存在预设对应关系。

在结合第一方面或第二方面的一些可能的实施方式中，每个所述物理下行控制信道集合中的所述物理下行控制信道中的DAI所指示的计数值相对于所述M的余数相同。

本发明实施例通过将每个物理下行控制信道集合中的物理下行控制信道中的DAI所指示的计数值相对于所述M的余数相同，能够使UE对每个物理下行控制信道所属的物理下行控制信道集合进行正确的划分。

在结合第一方面或第二方面的一些可能的实施方式中，每个所述物理下行控制信道集合中的所述物理下行控制信道中的所述预定比特位上所携带的信息相同。

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在结合第一方面或第二方面的一些可能的实施方式中，所述预定比特位是PUCCH 发送功率命令所对应的比特位。

根据本发明实施例的第三方面，提供了一种上行控制信息的发送方法，该方法可由 UE 执行，所述方法包括：

UE 确定第一上行子帧的 UCI，所述 UCI 包括混合自动重传请求反馈 HARQ-ACK 和周期性信道状态信息 CSI；

所述 UE 确定预配置的若干个上行信道资源组成的第二上行信道资源集合；

所述 UE 确定资源指示信息；

所述 UE 确定第三上行信道资源集合中与所述资源指示信息对应的信道资源为第一上行信道资源，所述第三上行信道资源集合为所述第二上行信道资源集合的子集，且所述第三上行信道资源集合与所述 HARQ-ACK 的码本大小匹配；

所述 UE 在所述第一上行子帧的所述第一上行信道资源上发送所述 UCI 中的部分或全部信息。

根据本发明实施例的第四方面，提供了一种上行控制信息的接收方法，该方法可由接入网设备执行，所述方法包括：

接入网设备确定用户设备 UE 在第一上行子帧上的上行控制信息 UCI 的自动重传请求反馈 HARQ-ACK 的码本大小，所述 UCI 包括所述 HARQ-ACK 和周期性信道状态信息 CSI；

所述接入网设备向所述 UE 发送资源指示信息；

所述接入网设备确定向所述 UE 预配置的若干个上行信道资源组成的第二上行信道资源集合；

所述接入网设备确定第三上行信道资源集合中与所述资源指示信息对应的信道资源为第一上行信道资源，所述第三上行信道资源集合为所述第二上行信道资源集合的子集，且所述第三上行信道资源集合与所述 HARQ-ACK 的码本大小匹配；

所述接入网设备接收所述 UE 在所述第一上行子帧的所述第一上行信道资源上发送的所述 UCI 中的部分或全部信息。

本发明实施例中预配置的上行信道资源集合为多个，每个上行信道资源支持发送 UCI 的最大发送比特数相同或不同，UE 和接入网设备通过确定出与

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HARQ-ACK 的码本大小相匹配的一个上行信道集合集合作为第三上行信道资源集合，再在第三上行信道资源集合中确定出与资源指示信息对应的上行信道资源，使得 UE 可以根据待反馈的 UCI 的数据量大小，选择合适大小的上行信道资源集合中的上行信道资源发送 UCI，从而提高上行信道资源的利用效率。

在结合第三方面或第四方面的可选实施方式中，所述第三上行信道资源集合中的所述上行信道资源支持发送 UCI 的最大发送比特数和所述 HARQ-ACK 的码本大小匹配；或，所述第二上行信道资源集合中的各个子集集合和所述 HARQ-ACK 的码本大小之间存在预设的匹配关系。

本发明实施例中通过 UCI 中的 HARQ-ACK 的码本大小，选择出具有合适的最大发送比特数的上行信道资源集合作为第三上行信道资源集合，提高了上行信道资源的利用效率。

根据本发明实施例的第五方面，提供了一种上行控制信息的发送方法，该方法可由 UE 执行，所述方法包括：

UE 确定第二上行子帧的 UCI；

所述 UE 确定预配置的若干个上行信道资源组成的第四上行信道资源集合，所述第四上行信道资源集合中的上行信道资源支持发送 UCI 的最大发送比特数相同；

所述 UE 确定所述第四上行信道资源集合中的第二上行信道资源；

所述 UE 在所述第二上行信道资源上发送所述 UCI。

根据本发明实施例的第六方面，提供了一种上行控制信息的接收方法，该方法可由接入网设备执行，所述方法包括：

接入网设备确定向用户设备 UE 预配置的若干个上行信道资源组成的第四上行信道资源集合，所述第四上行信道资源集合中的上行信道资源支持发送 UCI 的最大发送比特数相同；

所述接入网设备确定所述第四上行信道资源集合中的第二上行信道资源；

所述接入网设备在所述第二上行信道资源上接收所述 UE 发送的 UCI。

在本发明实施例中，UE 或接入网设备通过事先约定的确定方式，从预配置的第四上行信道资源集合中确定出第二上行信道资源作为发送 UCI 的上行信道资源，不需要接入网设备向 UE 发送资源指示信息，节约了 UE 和接入网设备之间的信令资源。

在一些可能的实施方式中，所述第二上行信道资源包括以下任意一种：

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所述第四上行信道资源集合中资源索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中资源索引号最大的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最大的上行信道资源。

根据本发明实施例的第七方面，提供了一种 UE，所述 UE 包括：处理器和发射器；所述处理器被配置为执行指令，所述发射器被配置为由所述处理器控制；所述处理器通过执行指令来实现上述第一方面或第三方面或第五方面中所提供的上行控制信息的发送方法。

根据本发明实施例的第八方面，提供了一种接入网设备，所述接入网设备包括：处理器、与处理器相连的发射器和与处理器相连的接收器；所述处理器被配置为执行指令，所述处理器通过执行指令来实现上述第二方面或第四方面或第六方面中所提供的上行控制信息的接收方法。

根据本发明实施例的第九方面，提供了一种 UE，所述 UE 包括至少一个单元，该至少一个单元用于实现上述第一方面或第三方面或第五方面中所提供的上行控制信息的发送方法。

根据本发明实施例的第十方面，提供了一种接入网设备，所述接入网设备包括至少一个单元，该至少一个单元用于实现上述第二方面或第四方面或第六方面中所提供的上行控制信息的接收方法。

根据本发明实施例的第十一方面，提供了一种通信系统，所述通信系统包括如第七方面提供的 UE 和第八方面提供的接入网设备。或者，所述通信系统包括如第九方面提供的 UE 和第十方面提供的接入网设备。

第十二方面，本发明实施例还提供了一种计算机可读介质，该计算机可读介质存储有用于实现第一方面或第三方面或第四方面所提供的上行控制信息的发送方法的指令，或者，该计算机可读介质存储有用于实现第二方面或第五方面所提供的上行控制信息的接收方法的指令。

附图说明

为了更清楚地说明本发明实施例中的技术方案，下面将对实施例描述中所需要使用的附图作简单地介绍，显而易见地，下面描述中的附图仅仅是本发明

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的一些实施例，对于本领域普通技术人员来讲，在不付出创造性劳动的前提下，还可以根据这些附图获得其他的附图。

图 1 是本发明一个示例性实施例提供的通信系统的结构示意图；

图 2 是本发明一个示例性实施例提供的 UE 的结构示意图；

图 3 是本发明一个示例性实施例提供的接入网设备的结构示意图；

图 4 是本发明一个示例性实施例提供的上行控制信息的收发方法的流程图；

图 5 是本发明一个示例性实施例提供的上行控制信息的收发方法的实施示意图；

图 6 是本发明另一个示例性实施例提供的上行控制信息的收发方法的流程图；

图 7 是本发明另一个示例性实施例提供的上行控制信息的收发方法的流程图；

图 8 是本发明另一个示例性实施例提供的上行控制信息的收发方法的流程图；

图 9 是本发明另一个示例性实施例提供的上行控制信息的收发方法的流程图；

图 10 是本发明另一个示例性实施例提供的上行控制信息的收发方法的流程图；

图 11 是本发明另一个示例性实施例提供的上行控制信息的发送装置的结构示意图；

图 12 是本发明另一个示例性实施例提供的上行控制信息的接收装置的结构示意图。

具体实施方式

为使本发明的目的、技术方案和优点更加清楚，下面将结合附图对本发明实施方式作进一步地详细描述。

在 CA 场景下，接入网设备可以通过一个主载波和多个辅载波来向 UE 发送下行数据。对于每个向 UE 发送下行数据的载波，接入网设备通过 PDCCH 向 UE 发送该下行数据对应的 DCI。该 DCI 中携带的信息包括：物理下行共享

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信道（Physical Downlink Shared Channel，PDSCH）的资源指示信息、下行分配索引（Downlink Assignment Index，DAI）和 TPC command for PUCCH 等。

其中，PDSCH 的资源指示信息用于告知 UE 在该载波的 PDSCH 中的哪些资源中接收下行数据。而 DAI 用于告知 UE 该 PDSCH 在向该 UE 发送的所有 PDSCH 中的计数值。例如向该 UE 发送的所有 PDSCH 共有 X 个，则该计数值为当前 PDSCH 为该 X 个 PDSCH 中的第几个 PDSCH。

比如，在频分双工（Frequency Division Dual，FDD）系统中，在一个传输时间间隔（Transmission Time Interval，TTI）内存在 M 个载波上有对 UE 发送的下行数据，假设该 M 个载波各自对应的载波序号从小到大分别为 N_0、N_1、……N_{M-1}，则该 M 个载波上发送的下行数据各自对应的 PDCCH 信道中的 DCI 的 DAI 所指示的计数值依次按照载波序号进行排序。例如：载波序号为 N_1 的载波上发送的下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 0，载波序号为 N_1 的载波上发送的下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 1，……载波序号为 N_{M-1} 的载波上发送的下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 M-1。

又比如，在时分双工（Time Division Duplexing，TDD）系统中，在一个上行反馈的 TTI 上对应的 L 个下行子帧中的每一个下行子帧都有多个载波对 UE 发送下行数据，则这些 L 个下行子帧的多个载波上发送的下行数据各自对应的 PDCCH 信道中的 DCI 的 DAI 所指示的计数值首先按照载波序号进行排序，然后按照子帧序号排序。以 L=2 为例，假设在第一个子帧的 M 个载波上存在对 UE 发送的下行数据、在第二个子帧的 K 个载波上存在对 UE 发送的下行数据。则第一个子帧的载波序号为 N_1 的载波上发送的下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 0，第一个子帧的载波序号为 N_1 的载波上下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 1，……第一个子帧的载波序号为 N_{M-1} 的载波上发送的下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 M-1、第二个子帧的载波序号为 N_1 的载波上发送的下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 M，第二个子帧的载波序号为 N_2 的载波上发送的下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 M+1，……第二个子帧的载波序号为 N_{K-1} 的载波上发送的下行数据对应的 PDCCH 信道中的 DCI 中的 DAI 所指示的计数值为 M+K-1。

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UE 可以根据 PDSCH 的资源指示信息接收下行数据。UE 还可以根据 DAI 的指示判断是否存在未接收到接入网设备发送的下行数据的情况。对于每个下行数据，若 UE 成功接收到该下行数据，则生成确认（ACK）信息，若 UE 未能成功接收到该下行数据，则生成非确认（NACK）信息，也即混合自动重传请求（Hybrid Automatic Repeat Request，HARQ）机制。其中，ACK 信息和 NACK 信息可统称为 HARQ-ACK，也即，混合自动重传请求反馈。

另外，UE 还需要向接入网设备上报各个处于激活状态的下行载波的周期性信道状态信息（Channel State Informtion，CSI）。UE 需要发送各个载波的周期 CSI 信息的时间是根据接入网设备对每个载波的周期性 CSI 的预配置信息确定的。

UCI 包括：HARQ-ACK 和周期性 CSI。为支持 UE 在特定的上行子帧上发送 UCI，接入网设备为 UE 预配置四个上行信道资源。在当前子帧上，UE 需要从这四个上行信道资源中确定出当前子帧中用于发送上行控制信息的上行信道资源，可选地，该上行信道资源是 PUCCH 资源。

需要说明的是，UE 通过与当前子帧对应的下行子帧中用于对该 UE 发送 PDSCH 的所有辅载波的 PDCCH 信道的 DCI 携带的信息“TPC command for PUCCH”控制位在预配置的四个上行信道资源中确定出在当前子帧上所使用的上行信道资源。这些 PDCCH 信道的 DCI 中“TPC command for PUCCH”均携带相同的信息。同时，UE 通过主载波上 PDSCH 对应的的 PDCCH 信道的 DCI 携带的的“TPC command for PUCCH”确定出发送 UCI 的 PUCCH 信道所使用的发送功率。

但在本发明实施例所涉及的一些 CA 场景下，接入网设备可以为 UE 配置更多的载波来向 UE 发送下行数据，比如：最多 16 个载波或 32 个载波。此时，由于在当前子帧上 UE 需要反馈的 HARQ-ACK 信息由与该当前子帧对应的下行子帧上为 UE 发送下行数据的载波个数确定。由于在各个下行子帧为 UE 发送下行数据的载波个数在很多个载波之间变化，所以在不同的上行子帧，该 UE 发送的 HARQ-ACK 信息的数据量的变化范围比较大。同时，根据接入网设备对每个载波的周期性 CSI 的预配置信息也决定了 UE 在不同的上行子帧中需要发送不同数目的周期性 CSI，所以在不同的上行子帧，该 UE 发送的周期 CSI 信息的数据量的变化范围也比较大。简而言之，UE 在不同的上行子帧中需要发送的 UCI 的数据量的变化范围比较大。

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为适应不同数据量的UCI反馈需求，接入网设备向UE预配置更多的上行信道资源，例如16个或32个。而PDCCH中DCI的“TPC command for PUCCH”控制位只有2个比特，不足以向UE指示用于在预配置的多个上行信道资源中确定出当前子帧中本次使用的上行信道资源。若接入网设备增加“TPC command for PUCCH”控制位所占用的比特数，又会给PDCCH带来较大的负担。为此，请参考本申请提供的如下实施例：

请参考图1，其示出了本发明一个示例性实施例提供的通信系统的结构示意图。该通信系统可以是长期演进（Long Term Evolution, LTE）系统。该通信系统是支持CA技术的通信系统。该通信系统包括：UE120和接入网设备140。

UE120可以是智能手机、平板电脑、电子书阅读器、MP3（英文：Moving Picture Experts Group Audio Layer III，简称：MP3）播放器、MP4（英文：Moving Picture Experts Group Audio Layer IV，简称：MP4）播放器和膝上型便携计算机等等。UE120能够接入通信系统所提供的移动通信网络。

UE120通过移动通信网络与接入网设备140相连。

接入网设备140是通信系统中用于与UE120进行交互的核心网网元。可选地，接入网设备140可以是基站（Node B）或者演进型基站（eVolution Node B， eNB）。

请参考图2，其示出了本发明一个示例性实施例提供的UE的结构示意图。该UE可以是图1中所示出的UE，该UE可以包括：处理器220和发射器240。本领域技术人员可以理解，图2中示出的UE结构并不构成对UE的限定，可以包括比图示更多或更少的部件，或者组合某些部件，或者不同的部件布置。比如，UE还包括存储器260和接收器280等。其中：

处理器220是UE的控制中心，利用各种接口和线路连接整个UE的各个部分，通过运行或执行存储在存储器260内的软件程序和/或模块，以及调用存储在存储器260内的数据，执行UE的各种功能和处理数据，从而对UE进行整体控制。可选的，处理器220可包括一个或多个处理核心；可选的，处理器220可集成应用处理器和调制解调处理器，其中，应用处理器主要处理操作系统、用户界面和应用程序等，调制解调处理器主要处理无线通信。可以理解的

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是，上述调制解调处理器也可以不集成到处理器 220 中，上述调制解调处理器可以单独实现成为一个基带芯片。

存储器 260 可用于软件程序以及模块。处理器 220 通过运行存储在存储器 260 的软件程序以及模块，从而执行各种功能应用以及数据处理。存储器 260 可主要包括存储程序区和存储数据区，其中，存储程序区可存储操作系统 261、确定模块 262、发送模块 263 和至少一个其它功能所需的应用程序 264 等；存储数据区可存储根据 UE 的使用所创建的数据（比如音频数据、电话本等）等。此外，存储器 260 可以由任何类型的易失性或非易失性存储设备或者它们的组合实现，如静态随机存取存储器（英文：Static Random Access Memory，简称：SRAM），电可擦除可编程只读存储器（英文：Electrically Erasable Programmable Read-Only Memory，简称：EEPROM），可擦除可编程只读存储器（英文：Erasable Programmable Read Only Memory，简称：EPROM），可编程只读存储器（英文：Programmable Read-Only Memory，简称：PROM），只读存储器（英文：Read Only Memory，简称：ROM），磁存储器，快闪存储器，磁盘或光盘。

发射器 240 可以包括射频发射组件，比如天线。发射器 240 用于将数据或信息承载在无线信号中进行发送。该无线信号可以是移动通信系统中的时频资源。

接收器 280 可以包括射频接收组件，比如天线。接收器 280 用于接收承载在无线信号中的数据或信息。该无线信号可以是移动通信系统中的时频资源。

尽管未示出，UE 还可选包括供电电源、摄像头、蓝牙模块等，在此不再赘述。

请参考图 3，其示出了本发明另一个示例性实施例示出的接入网设备的结构示意图。该接入网设备可以是图 1 中所示出的接入网设备，该接入网设备包括：处理器 320、与处理器 320 相连的发射器 340 和与处理器 320 相连的接收器 360。本领域技术人员可以理解，图 3 中示出的接入网设备结构并不构成对接入网设备的限定，可以包括比图示更多或更少的部件，或者组合某些部件，或者不同的部件布置。比如，接入网设备还包括存储器 380 和供电电源等。其中：

处理器 320 是接入网设备的控制中心，利用各种接口和线路连接整个接入网设备的各个部分，通过运行或执行存储在存储器 380 内的软件程序和/或模块，以及调用存储在存储器 380 内的数据，执行接入网设备的各种功能和处理

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数据，从而对接入网设备进行整体控制。可选的，处理器 320 可包括一个或多个处理核心；可选的，处理器 320 可集成应用处理器和调制解调处理器，其中，应用处理器主要处理操作系统、用户界面和应用程序等，调制解调处理器主要处理无线通信。可以理解的是，上述调制解调处理器也可以不集成到处理器 320 中，上述调制解调处理器可以单独实现成为一个芯片。

存储器 380 可用于软件程序以及模块。处理器 320 通过运行存储在存储器 380 的软件程序以及模块，从而执行各种功能应用以及数据处理。存储器 380 可主要包括存储程序区和存储数据区，其中，存储程序区可存储操作系统 381、确定模块 382、发送模块 383、接收模块 384 和至少一个其它功能所需的应用程序 385 等；存储数据区可存储根据接入网设备的使用所创建的数据（比如音频数据、电话本等）等。此外，存储器 380 可以由任何类型的易失性或非易失性存储设备或者它们的组合实现。

发射器 340 可以包括射频发射组件，比如天线。发射器 340 用于将数据或信息承载在无线信号中进行发送。该无线信号可以是移动通信系统中的时频资源。

接收器 360 可以包括射频接收组件，比如天线。接收器 360 用于接收承载在无线信号中的数据或信息。该无线信号可以是移动通信系统中的时频资源。

请参考图 4，其示出了本发明一个示例性实施例提供的上行控制信息的收发方法的流程图。本实施例以该方法应用于图 1 所示的通信系统中，该方法包括：

步骤 401，接入网设备确定资源指示信息，资源指示信息包括至少两个字段；

资源指示信息用于指示 UE 在预配置的上行信道资源集合中确定出用于发送上行控制信息的上行信道资源。在 LTE 系统中，该上行信道资源指的是 PUCCH 资源，该 PUCCH 资源具有特定的 PUCCH 格式和特定的时频位置。可选地，全部或部分预配置的上行信道资源还包括：支持发送 UCI 的最大发送比特数、发送 UCI 时可使用的最大编码速率之类的属性信息。

可选地，资源指示信息还可能被称之为其它名称，比如信道指示信息、信道标识信息或资源标识信息等，本实施例对此不加以限定。

资源指示信息包括 M 个字段，每个字段包括相同的比特位数或不同的比

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特位数，M≥2。比如，资源指示信息包括 3 个字段，每个字段包括 2 个比特，也即资源指示信息包括共 6 个比特。

步骤 402，接入网设备将每个字段通过一个 PDCCH 集合中的 DCI 向 UE 发送，每个 PDCCH 集合包括用于调度 UE 在辅载波中接收下行数据的若干个 PDCCH；

在 CA 场景中，接入网设备为 UE 配置多个下行载波，例如，为 UE 配置 16 个、32 个、或者更多个下行载波。这些下行载波包括一个主载波和多个辅载波。

接入网设备将用于调度 UE 在多个辅载波中接收下行数据的 PDCCH 分为 M 个 PDCCH 集合，每个 PDCCH 集合用于发送资源指示信息中的一个字段。

以辅载波为 9 个、资源指示信息包括 3 个字段为例，接入网设备将 DAI 所指示的计数值相对于 3 的余数为 1 的 3 个 PDCCH 划分为第一 PDCCH 集合，用于传输资源指示信息中第一个字段；将 DAI 所指示的计数值相对于 3 的余数为 2 的 3 个 PDCCH 划分为第二 PDCCH 集合，用于传输资源指示信息中的第二个字段；将 DAI 所指示的计数值相对于 3 的余数为 0 的 3 个 PDCCH 划分为第三 PDCCH 集合，用于传输资源指示信息中的第三个字段，如图 5 所示。

需要说明的是，同一个 PDCCH 集合中的每个 PDCCH 的 DCI 中携带的资源指示信息的字段相同。比如，DAI 所指示的计数值相对于 3 的余数为 0 的 3 个 PDCCH 中的 3 个 DCI 中均携带资源指示信息中第一个字段。

步骤 403， UE 确定资源指示信息，资源指示信息包括至少两个字段，每个字段分别由一个 PDCCH 集合中的 DCI 确定，每个 PDCCH 集合包括在辅载波中接收的下行数据所对应的若干个 PDCCH；

UE 接收接入网设备通过多个 PDCCH 集合发送的多个 DCI，UE 从每个 PDCCH 集合中的 DCI 中确定出资源指示信息中的各个字段，最终可确定出资源指示信息。

步骤 404，UE 确定预配置的上行信道资源集合中与资源指示信息对应的上行信道资源；

预配置的上行信道资源集合包括了至少两个 PUCCH 资源，UE 使用其中一个 PUCCH 资源向接入网设备发送 UCI。

UE 从预配置的上行信道资源集合中，确定出与资源指示信息对应的上行信道资源。

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步骤 405，UE 在与资源指示信息对应的上行信道资源上发送 UCI；

步骤 406，接入网设备接收 UE 在资源指示信息对应的上行信道资源上发送的 UCI。

综上所述，本实施例提供的上行控制信息的收发方法，通过将资源指示信息划分为至少两个字段，每个字段由一个 PDCCH 集合中的 DCI 携带，每个 PDCCH 集合包括 UE 的辅载波中接收的数据对应的若干个 PDCCH；解决了预配置的上行信道资源为很多个时，接入网设备需要增加预定比特位所占用的比特位才能向 UE 指示在当前子帧中用于发送 UCI 信息的上行信道资源的问题；达到了接入网设备不需要增加预定比特位所占用的比特位，通过多个 PDCCH 集合中每一个集合中的 DCI 分别向 UE 指示资源指示信息的一个字段，在 UE 侧，UE 通过确定将资源指示信息的各字段得到资源指示信息，然后准确确定在当前子帧发送 UCI 所使用的上行信道资源的效果。

在基于图 4 实施例提供的可选实施例中，资源指示信息包括 M 个字段，M ≥2，也即 M 为大于等于 2 的整数，物理下行控制信道集合为 M 个。资源指示信息中的第 i 个字段由 M 个物理下行控制信道集合中的第 j 个物理下行控制信道集合中的下行控制信息中的预定比特位上携带的信息所确定，其中，i 和 j 之间存在预设对应关系。

比如，资源指示信息包括 4 个字段，每个字段包含 2 个比特。PDCCH 集合也为 4 个，资源指示信息中的第 1 个字段由第 1 个 PDCCH 集合中的 DCI 中的预定比特位上携带的信息所确定；资源指示信息中的第 2 个字段由第 2 个 PDCCH 集合中的 DCI 中的预定比特位上携带的信息所确定；资源指示信息中的第 3 个字段由第 3 个 PDCCH 集合中的 DCI 中的预定比特位上携带的信息所确定；资源指示信息中的第 4 个字段由第 4 个 PDCCH 集合中的 DCI 中的预定比特位上携带的信息所确定。

又比如，资源指示信息包括 3 个字段，每个字段包含 2 个比特。PDCCH 集合也为 3 个，资源指示信息中的第 1 个字段由第 2 个 PDCCH 集合中的 DCI 中的预定比特位上携带的信息所确定；资源指示信息中的第 2 个字段由第 3 个 PDCCH 集合中的 DCI 中的预定比特位上携带的信息所确定；资源指示信息中的第 3 个字段由第 1 个 PDCCH 集合中的 DCI 中的预定比特位上携带的信息所确定。

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在基于图 4 实施例提供的可选实施例中，假设接入网设备为 UE 配置了 1 个主载波和 N 个辅载波。接入网设备和 UE 需要按照预定的划分策略对 N 个辅载波对应的 N 个 PDCCH 进行划分，以得到 M 个 PDCCH 集合，1≤M≤N。可选地，预定的划分策略为：根据每个 PDCCH 中携带的 DCI 中的 DAI 所指示的计数值相对于 M 的余数，将余数相同的 PDCCH 划分至同一 PDCCH 集合。

比如，第 1 个 PDCCH 中的 DAI 所指示的计数值为 0，第 2 个 PDCCH 中的 DAI 所指示的计数值为 1，第 3 个 PDCCH 中的 DAI 所指示的计数值为 2，第 4 个 PDCCH 中的 DAI 所指示的计数值为 3，第 5 个 PDCCH 中的 DAI 所指示的计数值为 4。若 M=2，则第 1 个 PDCCH、第 3 个 PDCCH 和第 5 个 PDCCH 中的 DAI 所指示的计数值相对于 2 的余数均为 0，划分至第一 PDCCH 集合；第 2 个 PDCCH 和第 4 个 PDCCH 中的 DAI 所指示的计数值相对于 2 的余数为 1，划分至第二 PDCCH 集合。

需要说明的一点是，划分策略不局限于上述的一种划分方式，只要接入网设备和 UE 采用相同的划分策略即可。

需要说明的另一点是，每个 PDCCH 集合中的 PDCCH 为至少 1 个，不同的 PDCCH 集合中的 PDCCH 数量相同或者不同，本实施例对此不加以限定。

需要说明的再一点是，每个 PDCCH 集合中的 PDCCH 中 DCI 的预定比特位中所携带的信息均相同，不同的 PDCCH 集合中的 PDCCH 中 DCI 的预定比特位所携带的信息相同或者不同，本实施例对此不加以限定。

可选地，该预定比特位是 PDCCH 中 DCI 中的“TPC Command for PUCCH”所占用的比特位，通常占用 2 个比特。

在基于图 4 实施例提供的可选实施例中，对于用于确定资源指示信息的每一个字段所对应的 PDCCH 集合，UE 都接收到该 PUCCH 集合中至少一个 PDCCH 信道中的 DCI，则上述实施例中的步骤 404 可被替代实现成为步骤 404a。如图 6 所示：

步骤 404a，UE 根据第一对应关系在预配置的上行信道资源集合中，确定出与资源指示信息对应的上行信道资源，第一对应关系为预设的资源指示信息和上行信道资源集合中每个上行信道资源之间的对应关系；

以资源指示信息包括 2 个字段，共 4 个比特，接入网设备为 UE 预配置了

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16 个 PUCCH 资源为例，表一示例性地示出了第一对应关系：

资源指示信息	上行信道资源
0000	第 1 个上行信道资源
0001	第 2 个上行信道资源
0010	第 3 个上行信道资源
…	…
1111	第 16 个上行信道资源

表一

对于接入网设备为 UE 预配置的每一个 PUCCH 资源，预配置信息中包含有该 PUCCH 资源的资源格式和时频位置等属性信息。可选地，预配置信息中还包含有该 PUCCH 资源的最大发送比特数和/或发送 UCI 可使用的最大编码速率等属性信息。最大发送比特数是指支持发送 UCI 的最大发送比特数。

若 UE 确定的资源指示信息为 0001，则与 0001 对应的上行信道资源为第 2 个上行信道资源，同时可以确定该上行信道资源对应的资源格式和时频位置。可选地，还可以确定该上行信道资源支持发送 UCI 的最大发送比特数，和/或，发送 UCI 时可使用的最大编码速率。

对应地，UE 在与该资源指示信息所对应的上行信道资源上发送 UCI。

综上所述，本发明实施例通过第一对应关系来确定与资源指示信息对应的上行信道资源，具有对应关系简洁、计算量小、计算速度快的优点。

在基于图 4 实施例提供的可选实施例中，预配置的上行信道资源集合包括两个或者两个以上的集合，UE 可以确定预配置的上行信道资源集合中的每个上行信道资源集合中的上行信道资源支持发送 UCI 的最大比特数。每个预配置的上行信道资源集合各自对应的支持发送 UCI 的最大比特数可以通过高层信令配置给 UE，也可以由 UE 通过每个上行信道资源集合中的资源格式所确定。例如：对于上行信道资源集合中的上行信道资源都是 PUCCH 格式 3 的集合，支持发送 UCI 的最大比特数为 22。本实施例对 UE 确定预配置的上行信道资源集合中的上行信道资源支持发送 UCI 的最大比特数的方式不做限定。

对应地，资源指示信息包括：第一指示信息和第二指示信息。第一指示信息用于确定预配置的上行信道资源集合中的两个或者两个以上的集合中的第一上行信道资源集合，第二指示信息用于确定第一上行信道资源集合中一个上

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行信道资源为用于发送 UCI 的上行信道资源，对应所述资源指示信息中的 R_1 个字段，$R_1 \geq 1$；第二指示信息对应所述资源指示信息中的 R_2 个字段，$R_2 \geq 1$。若资源指示信息包括 K 个比特，则第一指示信息由 A 个比特组成，第二指示信息由 K-A 个比特组成。此时，上述实施例中的步骤 404 可被替代实现成为步骤 404b 和步骤 404c。如图 7 所示：

步骤 404b，UE 根据第二对应关系在若干个预配置的上行信道资源集合中，确定出与第一指示信息对应的上行信道资源集合作为第一上行信道资源集合；

第二对应关系为预设的第一指示信息和预配置的至少两个上行信道资源集合之间的对应关系。以第一指示信息包括 2 个比特为例，表二示例性地示出了第二对应关系：

第一指示信息	上行信道资源集合
00	预配置的上行信道资源集合中的第 1 个上行信道资源集合
01	预配置的上行信道资源集合中的第 2 个上行信道资源集合
10	预配置的上行信道资源集合中的第 3 个上行信道资源集合
11	预配置的上行信道资源集合中的第 4 个上行信道资源集合

表二

其中，PUCCH 格式 X 可以是任何可能的 PUCCH 格式，比如将来出现的 PUCCH 格式 6。

可选地，第 1 个上行信道资源集合、第 2 个上行信道资源集合、第 3 个上行信道资源集合、第 4 个上行信道资源集合中的上行信道资源的资源格式分别是 PUCCH 格式 3、PUCCH 格式 4、PUCCH 格式 5、PUCCH 格式 X。其中，PUCCH 格式 X 可以是任何可能的 PUCCH 格式，比如将来出现的 PUCCH 格式 6。

若 UE 确定的资源指示信息为 0100，其中第一指示信息包含一个字段，为资源指示信息中的前两个比特位，则与第一指示信息 01 对应的上行信道资源集合为第 2 个上行信道资源集合，也即第一上行信道资源集合为第 2 个上行信道资源集合。

步骤 404c，UE 根据第三对应关系在第一上行信道资源集合中，确定出与第二指示信息对应的上行信道资源；

第三对应关系为预设的第二指示信息和第一上行信道资源集合中每个上行信道资源之间的对应关系。以第二指示信息包括 2 个比特为例，表三示例性

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地示出了第三对应关系：

第二指示信息	第一上行信道资源集合
00	第 1 个上行信道资源
01	第 2 个上行信道资源
10	第 3 个上行信道资源
11	第 4 个上行信道资源

表三

若 UE 确定的资源指示信息为 0100，其中第二指示信息包含一个字段，为资源指示信息中的后 2 个比特位，则与第二指示信息 00 对应的上行信道资源为第一上行信道资源集合中的第 1 个上行信道资源，也即资源指示信息对应的上行信道资源为第 2 个上行信道资源集合中的第 1 个上行信道资源。

综上所述，本发明实施例中预配置的上行信道资源集合由至少两个集合组成，所述至少两个集合中每个集合中上行信道资源各自对应的支持发送 UCI 的最大比特数不同，UE 可以根据第一指示信息和第二指示信息确定上行信道资源集合中的上行信道资源发送 UCI，从而提高上行信道资源的利用效率。

由于接入网设备发送的 PDCCH 中的 DCI 在 UE 侧存在接收失败的可能性，可能存在 UE 成功接收到了用于调度部分辅载波上的下行数据所对应的 PDCCH，而未成功接收到用于调度另一部分辅载波上的下行数据所对应的 PDCCH 的场景。在此场景下，若 UE 在资源指示信息中的第 L 个字段对应的第 R 个物理下行控制信道集合中的所有物理下行控制信道上都没有检测到下行控制信息，则资源指示信息中的第 L 个字段由预定规则确定。其中，预定规则包括：第 L 个字段的信息为预定取值，或者，将第 L 个字段的信息为第 R' 个物理下行控制信道集合中的物理下行控制信道上接收的下行控制信息中预定比特位上所指示的信息，$1 \leqslant L \leqslant M$，$1 \leqslant R \neq R' \leqslant M$，R 与 R'存在预定的对应关系。

也即，上述实施例中的步骤 403 可被替代实现成为步骤 403a 和步骤 403b。如图 8 所示：

步骤 403a，UE 确定资源指示信息信息中的至少一个字段，所述至少一个字段中的每个字段由和该字段对应的 PDCCH 集合中的 DCI 确定，所述每个 PDCCH 集合包括辅载波中接收的数据对应的若干个 PDCCH；

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比如,资源指示信息包括2个字段,UE根据第一PDCCH集合中的PDCCH中的下行控制信息中的预定比特位 01 确定资源指示信息的第一字段，但 UE 在资源指示信息中的第二字段对应的第二 PDCCH 集合中的所有 PDCCH 上都没有检测到下行控制信息。

步骤 403b, UE 确定资源指示信息信息中的第 L 个字段的信息，UE 在第 L 个字段对应的 PDCCH 集合中的所有 PDCCH 上都没有检测到 DCI， UE 确定其他字段的信息为预设值，或者，UE 确定第 L 个字段的信息为第 R'个 PDCCH 集合中的 PDCCH 上接收的 DCI 中预定比特位上所指示的信息，R 和 R'之间存在预设的对应关系。

比如，UE 确定第二个字段的信息为预定取值，预定取值为 01。

又比如，UE 确定第二个字段的信息为 UE 在第一 PDCCH 集合中的 PDCCH 中的下行控制信息中的预定比特位接收的信息 01，最终 UE 确定出资源指示信息为 0101。

综上所述，本发明实施例还针对 UE 没有正确接收所述资源指示信息的部分字段所对应的 PDCCH 集合中的所有 PDCCH 的场景，提供出一种资源指示信息的确定方式，使得即便部分字段所对应的 PDCCH 集合中的所有 PDCCH 都没有被 UE 正确接收，UE 依然能够确定出资源指示信息的这些字段，从而确定出所述资源指示信息，然后用于确定发送 UCI 的上行信道资源的效果。

可选地，在辅载波中有下行数据的载波总数较少时，与辅载波中的下行数据对应的 PDCCH 的总数较少，UE 没有正确接收资源指示信息的部分字段所对应的 PDCCH 集合中的所有 PDCCH 的可能性更大。此时，接入网设备确定的资源指示信息中的各个字段均相同，以便 UE 基于预定规则确定出部分字段后的资源指示信息与接入网设备发送的资源指示信息是相同的。

可选地，步骤 404a 示出的第一对应关系中，对于各个字段上的信息均相同的资源指示信息,其对应的上行信道资源为具有 PUCCH 格式 3 的信道资源，或者，步骤 404c 示出的第三对应关系中，对于各个字段的信息均相同的第二指示信息，其对应的上行信道资源为具有 PUCCH 格式 3 的信道资源。

需要说明的是，本申请中所述的 PUCCH 格式 3、格式 4、格式 5 具体为：

PUCCH 格式 3：将原始比特信道编码和调制后的符号，分别放到一个子帧的两个时隙中。这样，每个时隙上有 12 个调制符号，并且这 12 个调制符号放在一个时隙的一个时域符号上的 12 个连续子载波上，即占用一个资源块

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（Resource Block，RB）中的一个时域符号上的 12 个子载波。然后，针对每个时隙，在时域用序列 w 进行长度为 5 的正交掩码(Orthogonal Cover Code，OCC)扩频，一个时隙占一个 RB 内的 5 个时域符号，不同的 UE 可以在一个 RB 上通过不同的正交码进行码分复用，其余两个符号用来承载参考信号（Reference Signal，RS）。然后，对扩频后的进行离散傅里叶变换(Discrete Fourier Transform，DFT）预编码以及快速傅里叶逆变换（Inverse Fast Fourier Transform，IFFT）。另外，在配置了探测参考信号的子帧的第二个时隙使用一个长为 4 的正交码进行码分复用，即至多支持 4 个 UE 复用(此时的 PUCCH 格式为缩短 PUCCH 格式 3，和非缩短的 PUCCH 格式 3 统称为 PUCCH 格式 3)。

PUCCH 格式 4：PUCCH 信道占用一个 RB 或者多个 RB，且在正常循环前缀（Normal Cyclic Prefix，正常 CP）的情况下，PUCCH 信道对应的每个时隙中只有中间一个时域符号承载解调参考信号，在扩展循环前缀（Extended Cyclic Prefix，扩展 CP）的情况下，每个时隙的第三个时域符号承载解调参考信号；依据卷积码编码的方式对上行控制信息进行编码并在 PUCCH 信道中发送；或者 PUCCH 信道可承载的上行控制信息的最大比特数大于 22 比特。

PUCCH 格式 5：PUCCH 信道占用一个 RB，且在正常循环前缀的情况下，PUCCH 信道对应的每个时隙中只有中间一个时域符号承载解调参考信号，在扩展循环前缀的情况下，每个时隙的第三个时域符号承载解调参考信号，PUCCH 信道中可以通过码分方式发送至少两个 UE 的上行控制信息；依据卷积码编码的方式对上行控制信息进行编码并在 PUCCH 信道中发送；或者 PUCCH 信道可承载的上行控制信息的最大比特数大于 22 比特。

请参考图 9，其示出了本发明另一实施例提供的上行控制信息的收发方法的流程图。本实施例以该上行控制信息的收发方法应用于图 1 所示出的通信系统中来举例说明。本实施例也以接入网设备采用多个载波向 UE 发送下行数据的场景来进行举例说明。该方法包括：

步骤 901，接入网设备向 UE 发送资源指示信息；

该资源指示信息用于指示 UE 在预配置的上行信道资源集合中确定出用于发送 UCI 的上行信道资源。在 LTE 系统中，该上行信道资源指的是 PUCCH 资源，该 PUCCH 资源具有特定的 PUCCH 格式和特定的时频位置。可选地，全部或部分预配置的上行信道资源还包括：支持发送 UCI 的最大发送比特数、发

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送 UCI 时可使用的最大编码速率之类的属性信息。

可选地，资源指示信息还可能被称之为其它名称，比如信道指示信息、信道标识信息或资源标识信息等，本实施例对此不加以限定。

该资源指示信息可以仅包括一个字段，或者，该资源指示信息包括两个或两个以上的字段。当该资源指示信息仅包括一个字段时，接入网设备可以采用如背景技术所示出的发送方法向 UE 发送该资源指示信息；当该资源指示信息包括两个或两个以上的字段时，接入网设备可以采用如图 4 所示实施例提供的发送方法向 UE 发送该资源指示信息，本实施例对此不加以限定。

对应地，UE 根据接收的物理下行控制信道中的预设字段确定该资源指示信息或者确定该资源指示信息中的各个字段。

步骤 902， UE 确定第一上行子帧的 UCI，UCI 包括 HARQ-ACK 和周期性 CSI；

UE 根据接收的多个下行数据、以及多个下行数据和对应的 HARQ-ACK 之间的时序关系，可以确定在第一上行子帧是否需要发送 HARQ-ACK，以及 HARQ-ACK 的码本大小。

UE 还根据被配置的每个载波的周期性 CSI 反馈的时间信息、以及每个载波的激活和去激活状态确定在第一上行子帧是否需要发送周期性 CSI，以及发送周期性 CSI 信息的比特数或者个数。如果 UE 确定第一上行子帧需要发送的 UCI 包括 HARQ-ACK 和周期性 CSI，则执行以下步骤。

步骤 903，UE 确定预配置的若干个上行信道资源组成的第二上行信道资源集合；

接入网设备为 UE 预配置有若干个上行信道资源。UE 确定预配置的若干个上行信道资源组成的第二上行信道资源集合。

步骤 904，UE 确定资源指示信息；

当资源指示信息仅包括一个字段时，UE 根据所有辅载波中的下行数据所对应的 PDCCH 中的 DCI 中的预定比特位上所指示的信息，确定出资源指示信息。

当资源指示信息包括两个或两个以上的字段时，UE 接收接入网设备通过辅载波中的下行数据所对应多个 PDCCH 集合发送的多个 DCI，UE 从每个 PDCCH 集合中的 DCI 中确定出资源指示信息中的各个字段，最终确定出资源指示信息。

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步骤 905，UE 确定第三上行信道资源集合中与资源指示信息对应的信道资源为第一上行信道资源，第三上行信道资源集合为第二上行信道资源集合的子集，且第三上行信道资源集合与 HARQ-ACK 的码本大小匹配；

所述第二上行信道资源集合包括至少两个上行信道资源集合，UE 首先确定其中的一个上行信道资源为第三上行信道资源集合，第三上行信道资源集合与待发送的 UCI 中的 HARQ-ACK 的码本大小匹配。

以第二上行信道资源集合包括两个上行信道资源集合：上行信道资源集合 A 和上行信道资源集合 B 为例，如果上行信道资源集合 A 中的上行信道资源中支持发送的 UCI 的比特数的范围为 $[P_{A1}, P_{A2}]$，上行信道资源集合 B 中的上行信道资源的中支持发送的 UCI 的比特数的范围为 $[P_{B1}, P_{B2}]$，待发送的 HARQ-ACK 的码本大小为 Q。如果 Q 在 $[P_{A1}, P_{A2}]$ 的范围内，则第三上行信道资源集合为上行信道资源集合 A；如果 Q 在 $[P_{B1}, P_{B2}]$ 的范围内，则第三上行信道资源集合为上行信道资源集合 B。简而言之，第三上行信道资源集合中的上行信道资源支持发送的 UCI 的比特数的范围或者比特数的最大值和 HARQ-ACK 的码本大小匹配。

或者，

HARQ-ACK 的码本大小和第二上行信道资源集合中的各个上行信道资源集合之间存在预设的匹配关系，例如 HARQ-ACK 的码本大小为 Q 在第一取值范围内时，和其匹配的上行信道资源集合是第二上行信道资源集合中的第一个上行信道资源集合；HARQ-ACK 的码本大小为 Q 在第二取值范围内时，和其匹配的上行信道资源集合是第二上行信道资源集合中的第二个上行信道资源集合等。所述第一取值范围和第二取值范围不重叠。

优选地，对于第二上行信道资源集合包括的至少两个上行信道资源集合中的每一个集合来说，该集合中的上行信道资源具有相同的资源格式，例如该集合中的上行信道资源都是 PUCCH 格式 3 的资源，或者该集合中的上行信道资源都是 PUCCH 格式 4 的资源。这样，UE 可以根据 HARQ-ACK 信息的码本大小确定与其对应的 PUCCH 格式，然后根据确定的 PUCCH 格式确定第二上行信道资源集合中的第三上行信道资源集合。例如，上行信道资源都是 PUCCH 格式 3 的上行信道资源集合和 HARQ-ACK 信息的码本不大于 22 的 UCI 对应，上行信道资源都是 PUCCH 格式 4 的上行信道资源集合和 HARQ-ACK 信息的码本大于 22 的 UCI 对应。

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步骤 906，UE 在第一上行子帧的第一上行信道资源上发送 UCI 中的部分或全部信息。

UE 确定第一上行信道资源后，UE 在第一上行子帧的第一上行信道资源上发送 UCI。如果第一上行信道资源支持发送的上行控制信息的最大比特数小于待发送的 UCI 的总比特数，则 UE 按照预设的优先级规则丢弃其中的部分周期性 CSI 信息，使得在第一上行信道资源中发送的 UCI 信息不大于第一上行信道资源支持发送的上行控制信息的最大比特数；如果第一上行信道资源支持发送的上行控制信息的最大比特数不小于待发送的 UCI 信息的总比特数，则 UE 在第一上行信道资源中发送的 UCI 的全部信息。

步骤 907，接入网设备确定 UE 在第一上行子帧上的 UCI 的 HARQ-ACK 的码本大小；

UCI 包括 HARQ-ACK 和周期性 CSI。

接入网设备根据向 UE 发送的多个下行数据、以及多个下行数据和对应的 HARQ-ACK 之间的时序关系，确定出 UE 在第一上行子帧上的 UCI 的 HARQ-ACK 的码本大小。

步骤 908，接入网设备确定向 UE 预配置的若干个上行信道资源组成的第二上行信道资源集合；

本步骤与步骤 903 类似。

步骤 909，接入网设备确定第三上行信道资源集合中与资源指示信息对应的信道资源为第一上行信道资源，第三上行信道资源集合为第二上行信道资源集合的子集，且第三上行信道资源集合与 HARQ-ACK 的码本大小匹配；

本步骤与步骤 905 类似；

步骤 910，接入网设备接收 UE 在第一上行子帧的第一上行信道资源上发送的 UCI 中的部分或全部信息。

需要说明的是，本实施例对步骤 907 至步骤 909 的执行顺序不加以限定，步骤 907 至步骤 909 中的全部或部分可以在步骤 906 之前执行。

综上所述，本发明实施例中通过 UCI 中的 HARQ-ACK 的码本大小，选择出具有合适的最大发送比特数的上行信道资源集合作为第三上行信道资源集合，再从第三上行信道资源集合中确定出与资源指示信息对应的信道资源为第一上行信道资源，提高了上行信道资源的利用效率。

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请参考图 10，其示出了本发明再一个实施例提供的上行控制信息的收发方法的流程图。本实施例以该方法应用于图 1 所示出的通信系统中来举例说明。该方法包括：

步骤 1001，UE 确定第二上行子帧的 UCI；

UE 根据接收的多个下行数据、以及多个下行数据和对应的 HARQ-ACK 之间的时序关系，可以确定在第二上行子帧是否需要发送 HARQ-ACK，以及 HARQ-ACK 的码本大小。

UE 还根据被配置的每个载波的周期性 CSI 反馈的时间信息、以及每个载波的激活和去激活状态确定在第二上行子帧是否需要发送周期性 CSI，以及发送周期性 CSI 信息的比特数或者个数。

步骤 1002，UE 确定预配置的若干个上行信道资源组成的第四上行信道资源集合，第四上行信道资源集合中的上行信道资源支持发送的 UCI 的最大比特数相同；

接入网设备为 UE 预配置有若干个上行信道资源。在 LTE 系统中，该上行信道资源指的是 PUCCH 资源，该 PUCCH 资源具有特定的 PUCCH 格式和特定的时频位置。可选地，全部或部分预配置的上行信道资源还包括：支持发送 UCI 的最大发送比特数、发送 UCI 时可使用的最大编码速率之类的属性信息。

例如，接入网设备通过高层信令配置用于发送 UE 的各个服务小区的周期性 CSI 的 PUCCH 格式 2 的上行信道资源。对于发送每个服务小区的周期性 CSI 的 PUCCH 格式 2 的上行信道资源，其配置信息中包括有 PUCCH 资源的索引号“*cqi-PUCCH-ResourceIndex*”，对于主载波来说，该索引号取值范围为 0~1185，对于辅载波来说，该索引号取值范围为 0~1184。根据该索引号和 PUCCH 的其它配置信息，可以确定出 PUCCH 资源所对应的时频位置、以及所使用的序列资源。这些 PUCCH 格式 2 的资源上最大可以发送的 UCI 的最大比特数为 11。或者对于其它格式的 PUCCH 资源，在对 PUCCH 资源的配置信息中还可选包括：支持发送 UCI 的最大比特数、发送 UCI 时可使用的最大编码速率的信息等。

步骤 1003，UE 确定第四上行信道资源集合中的第二上行信道资源；

UE 需要确定第四上行信道资源集合中的第二上行信道资源，该第二上行信道资源用于发送第二上行子帧的 UCI。如果第四上行信道资源集合中的上行信道资源支持发送的 UCI 的最大比特数相同，则第二上行信道资源为以下任意

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一种：

第一，第四上行信道资源集合中资源索引号最小的上行信道资源，或者，

第二，第四上行信道资源集合中资源索引号最大的上行信道资源，或者，

以第四上行信道资源集合中的信道资源为 PUCCH 格式 2 的资源为例。如果第二上行子帧的 UCI 包括至少两个服务小区的周期性 CSI 信息，则第二上行信道资源是为至少两个服务小区配置的各个 PUCCH 资源中，“*cqi-PUCCH-ResourceIndex*”索引号取值范围最小的上行信道资源，或者为“*cqi-PUCCH-ResourceIndex*”索引号取值范围最大的上行信道资源。

第三，第四上行信道资源集合中上行信道资源的资源块低位索引最小的上行信道资源，或者，

第四，第四上行信道资源集合中上行信道资源的资源块低位索引最大的上行信道资源。

以第四上行信道资源集合中的信道资源为 PUCCH 格式 2 的资源为例。如果第二上行子帧的 UCI 信息包括至少两个服务小区的周期性 CSI 信息，则第二上行信道资源是为至少两个服务小区配置的各个 PUCCH 资源中，资源块低位索引最小的上行信道资源，或者资源块低位索引最大的上行信道资源。举例来说，为至少两个服务小区中第一个服务小区配置的 PUCCH 资源所在的资源块索引是 $Q_1 \sim Q_2$，其中 $Q_2 \geq Q_1$，为至少两个服务小区中第二个服务小区配置的 PUCCH 资源所在的资源块索引是 $Q_3 \sim Q_4$，其中 $Q_4 \geq Q_3$，如果 $Q_3 > Q_1$ 则上行信道资源的资源块索引最小的上行信道资源是为第一个服务小区配置的 PUCCH 资源，上行信道资源的资源块索引最大的上行信道资源是为第二个服务小区配置的 PUCCH 资源。

步骤 1004，UE 在第二上行信道资源上发送 UCI。

步骤 1005，接入网设备确定向 UE 预配置的若干个上行信道资源组成的第四上行信道资源集合，第四上行信道资源集合中的上行信道资源支持发送 UCI 的最大发送比特数相同；

本步骤与步骤 1002 类似。

步骤 1006，接入网设备确定第四上行信道资源集合中的第二上行信道资源；

本步骤与步骤 1003 类似。

步骤 1007，接入网设备在第二上行信道资源上接收 UE 发送的 UCI。

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需要说明的是，本实施例对步骤 1004 与步骤 1005 之间的先后顺序不加以限定，步骤 1005 可以在步骤 1004 之前执行；本实施例对步骤 1004 与步骤 1006 之间的先后顺序不加以限定，步骤 1006 可以在步骤 1004 之前执行。

综上所述，在本发明实施例中，UE 或接入网设备通过事先约定的确定方式，从预配置的第四上行信道资源集合中确定出第二上行信道资源为本次使用的上行信道资源，不需要接入网设备向 UE 发送资源指示信息，节约了 UE 和接入网设备之间的信令资源。

需要说明的是，上述各个方法实施例中有关 UE 的步骤，可以由 UE 的处理器调用 UE 的存储器中的对应模块来实现。同时，由 UE 执行的步骤可以单独实现成为 UE 一侧的上行控制信息的发送方法。

还需要说明的是，上述各个方法实施例中有关接入网设备的步骤，可以由接入网设备的处理器调用接入网设备的存储器中的对应模块来实现。同时，由接入网设备执行的步骤可以单独实现成为接入网设备一侧的上行控制信息的接收方法。

请参考图 11，其示出了本发明一个实施例示出的上行控制信息的发送装置的结构示意图。该上行控制信息的发送装置可由硬件或者软硬件的集合实现成为上述 UE 的全部或一部分。所述装置包括：

确定单元 1120 用于实现上述方法实施例中的步骤 403、步骤 404、步骤 404a、步骤 404b 和步骤 404c 中至少一个步骤的功能。

发送单元 1140 用于实现上述步骤 405 的功能，相关细节可结合参考上述方法实施例。

请参考图 12，其示出了本发明一个实施例示出的上行控制信息的接收装置的结构示意图。该上行控制信息的接收装置可由硬件或者软硬件的集合实现成为上述接入网设备的全部或一部分。所述装置包括：

确定单元 1220，用于实现上述步骤 401 的功能；

发送单元 1240，用于实现上述步骤 402 的功能；

接收单元 1260，用于实现上述步骤 406 的功能，相关细节可结合参考上述方法实施例。

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在另一个可选的实施例中，上述确定单元 1120 用于实现步骤 902、步骤 903、步骤 904 和步骤 905 中至少一个步骤的功能；

上述发送单元 1140 用于实现步骤 906 的功能，相关细节可结合参考上述方法实施例。

在另一个可选的实施例中，上述确定单元 1220 用于实现步骤 907、步骤 908 和步骤 909 的功能；

上述发送单元 1240 用于实现步骤 901 的功能；

上述接收单元 1260 用于实现步骤 910 的功能，相关细节可结合参考上述方法实施例。

在再一个可选的实施例中，上述确定单元 1120 用于实现步骤 1001、步骤 1002 和步骤 1003 的功能；

上述发送单元 1140 用于实现步骤 1004 的功能，相关细节可结合参考上述方法实施例。

在再一个可选的实施例中，上述确定单元 1220 用于实现步骤 1005 和步骤 1006 中至少一个步骤的功能；

上述接收单元 1260 用于实现步骤 1007 的功能，相关细节可结合参考上述方法实施例。

需要说明的是，上述的确定单元 1120 可以通过 UE 的处理器执行存储器中的确定模块来实现；上述的发送单元 1140 可以通过 UE 的处理器执行存储器中的发送模块来实现；上述确定单元 1220 可以通过接入网设备的处理器执行存储器中的确定模块来实现；上述发送单元 1240 可以通过接入网设备的处理器执行存储器中的发送模块来实现；上述接收单元 1260 可以通过接入网设备的处理器执行存储器中的接收模块来实现。

本领域普通技术人员可以理解实现上述实施例的全部或部分步骤可以通过硬件来完成，也可以通过程序来指令相关的硬件完成，所述的程序可以存储于一种计算机可读存储介质中，上述提到的存储介质可以是只读存储器，磁盘或光盘等。

以上所述仅为本发明的较佳实施例，并不用以限制本发明，凡在本发明的精神和原则之内，所作的任何修改、等同替换、改进等，均应包含在本发明的保护范围之内。

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权 利 要 求 书

1、一种用户设备 UE，其特征在于，所述 UE 包括：处理器和发射器；

所述处理器，用于确定资源指示信息，所述资源指示信息包括至少两个字段，每个所述字段分别由一个物理下行控制信道集合中的下行控制信息确定，每个所述物理下行控制信道集合包括辅载波中的下行数据所对应的若干个物理下行控制信道；

所述处理器，用于确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源；

所述处理器，还用于通过所述发射器在与所述资源指示信息对应的上行信道资源上发送上行控制信息 UCI。

2、根据权利要求 1 所述的 UE，其特征在于，所述资源指示信息包括 M 个字段，M≥2；所述物理下行控制信道集合为 M 个；

所述资源指示信息中的第 i 个字段由 M 个所述物理下行控制信道集合中的第 j 个所述物理下行控制信道集合中的下行控制信息中的预定比特位上携带的信息所确定；

所述 i 和所述 j 之间存在预设对应关系。

3、根据权利要求 1 或 2 所述的 UE，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的下行分配索引 DAI 所指示的计数值相对于所述 M 的余数相同。

4、根据权利要求 1 至 3 任一所述的 UE，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的所述下行控制信息中的预定比特位上所携带的信息相同。

5、根据权利要求 1 至 4 任一所述的 UE，其特征在于，

所述处理器，还用于若在所述资源指示信息中的第 L 个字段对应的第 R 个物理下行控制信道集合中的所有物理下行控制信道上都没有检测到下行控制信息，则所述资源指示信息中的第 L 个字段由预定规则确定；

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其中，所述预定规则包括：所述第 L 个字段为预定取值，或者，所述第 L 个字段为第 R'个物理下行控制信道集合中的所述物理下行控制信道上接收的所述下行控制信息中预定比特位上所指示的信息，1≤L≤M，1≤R≠R' ≤M， R 和 R'之间的关系是预设的。

6、根据权利要求 1 至 5 任一所述的 UE，其特征在于，在所述处理器用于确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源的方面：

所述处理器，用于根据第一对应关系在所述预配置的上行信道资源集合中，确定出与所述资源指示信息对应的上行信道资源，所述第一对应关系为预设的资源指示信息和所述上行信道资源集合中每个上行信道资源之间的对应关系。

7、根据权利要求 1 至 5 任一所述的 UE，其特征在于，所述资源指示信息包括：第一指示信息和第二指示信息；

在所述处理器用于确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源的方面：

所述处理器，用于：

根据第二对应关系在若干个所述预配置的上行信道资源集合中，确定与所述第一指示信息对应的上行信道资源集合作为第一上行信道资源集合，每个所述预配置的上行信道资源集合中的上行信道资源对应各自的最大发送比特数，所述最大发送比特数是支持发送所述 UCI 的最大发送比特数；

根据第三对应关系确定所述第一上行信道资源集合中与所述第二指示信息对应的上行信道资源；

其中，所述第二对应关系为预设的第一指示信息和所述预配置的上行信道资源集合之间的对应关系，所述第三对应关系为预设的第二指示信息和所述第一上行信道资源集合中每个上行信道资源之间的对应关系。

8、根据权利要求 2 或 4 或 5 所述的 UE，其特征在于，所述预定比特位是物理上行控制信道 PUCCH 发送功率命令所对应的比特位。

9、一种接入网设备，其特征在于，所述接入网设备包括：处理器、与所述

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处理器相连的发射器、与所述处理器相连的接收器；

所述处理器，用于确定资源指示信息，所述资源指示信息包括至少两个字段，所述资源指示信息用于指示用户设备 UE 在预配置的上行信道资源集合中确定用于发送上行控制信息 UCI 的上行信道资源；

所述处理器，还用于通过所述发射器将每个所述字段通过一个物理下行控制信道集合中的下行控制信息向所述 UE 发送，每个所述物理下行控制信道集合包括辅载波中的下行数据所对应的若干个物理下行控制信道；

所述处理器，还用于通过所述接收器接收所述 UE 在所述资源指示信息对应的上行信道资源中发送的所述 UCI。

10、根据权利要求 9 所述的接入网设备，其特征在于，所述资源指示信息包括 M 个字段，M≥2；所述物理下行控制信道集合为 M 个；

所述资源指示信息中的第 i 个字段由 M 个所述物理下行控制信道集合中的第 j 个所述物理下行控制信道集合中的下行控制信息中的预定比特位携带；

所述 i 和所述 j 之间存在预设对应关系。

11、根据权利要求 9 或 10 所述的接入网设备，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的下行分配索引 DAI 所指示的计数值相对于所述 M 的余数相同。

12、根据权利要求 9 至 11 任一所述的接入网设备，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的预定比特位上所携带的信息相同。

13、根据权利要求 10 或 12 所述的接入网设备，其特征在于，所述预定比特位是物理上行控制信道 PUCCH 发送功率命令所对应的比特位。

14、一种用户设备 UE，其特征在于，所述 UE 包括：处理器和发射器；

所述处理器，用于确定第一上行子帧的上行控制信息 UCI，所述 UCI 包括混合自动重传请求反馈 HARQ-ACK 和周期性信道状态信息 CSI；

所述处理器，用于确定预配置的若干个上行信道资源组成的第二上行信道

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资源集合；

所述处理器，用于确定资源指示信息；

所述处理器，用于确定第三上行信道资源集合中与所述资源指示信息对应的信道资源为第一上行信道资源，所述第三上行信道资源集合为所述第二上行信道资源集合的子集，且所述第三上行信道资源集合与所述 HARQ-ACK 的码本大小匹配；

所述处理器，用于通过所述发射器在所述第一上行子帧的所述第一上行信道资源上发送所述 UCI 中的部分或全部信息。

15、根据权利要求 14 所述的 UE，其特征在于，

所述第三上行信道资源集合中的所述上行信道资源支持发送 UCI 的最大发送比特数和所述 HARQ-ACK 的码本大小匹配；

或，

所述第二上行信道资源集合中的各个子集集合和所述 HARQ-ACK 的码本大小之间存在预设的匹配关系。

16、一种接入网设备，其特征在于，所述接入网设备包括：处理器、与所述处理器相连的发射器和与所述处理器相连的接收器；

所述处理器，用于确定用户设备 UE 在第一上行子帧上的上行控制信息 UCI 的自动重传请求反馈 HARQ-ACK 的码本大小，所述 UCI 包括所述 HARQ-ACK 和周期性信道状态信息 CSI；

所述处理器，用于通过所述发射器向所述 UE 发送资源指示信息；

所述处理器，用于确定向所述 UE 预配置的若干个上行信道资源组成的第二上行信道资源集合；

所述处理器，用于确定第三上行信道资源集合中与所述资源指示信息对应的信道资源为第一上行信道资源，所述第三上行信道资源集合为所述第二上行信道资源集合的子集，且所述第三上行信道资源集合与所述 HARQ-ACK 的码本大小匹配；

所述处理器，用于通过所述接收器接收所述 UE 在所述第一上行子帧的所述第一上行信道资源上发送的所述 UCI 中的部分或全部信息。

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17、根据权利要求 16 所述的接入网设备，其特征在于，

所述第三上行信道资源集合中的所述上行信道资源支持发送 UCI 的最大发送比特数和所述 HARQ-ACK 的码本大小匹配；

或，

所述第二上行信道资源集合中的各个子集集合和所述 HARQ-ACK 的码本大小之间存在预设的匹配关系。

18、一种用户设备 UE，其特征在于，所述 UE 包括：处理器和发射器；

所述处理器，用于确定第二上行子帧的上行控制信息 UCI；

所述处理器，用于确定预配置的若干个上行信道资源组成的第四上行信道资源集合，所述第四上行信道资源集合中的上行信道资源支持发送 UCI 的最大发送比特数相同；

所述处理器，用于确定所述第四上行信道资源集合中的第二上行信道资源；

所述处理器，用于通过所述发射器在所述第二上行信道资源上发送所述 UCI。

19、根据权利要求 18 所述的 UE，其特征在于，所述第二上行信道资源包括以下任意一种：

所述第四上行信道资源集合中资源索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中资源索引号最大的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最大的上行信道资源。

20、一种接入网设备，其特征在于，所述接入网设备包括：处理器、与所述处理器相连的发射器和与所述处理器相连的接收器；

所述处理器，用于确定向用户设备 UE 预配置的若干个上行信道资源组成的第四上行信道资源集合，所述第四上行信道资源集合中的上行信道资源的支持发送上行控制信息 UCI 的最大发送比特数相同；

所述处理器，用于确定所述第四上行信道资源集合中的第二上行信道资源；

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所述处理器，用于通过所述接收器在所述第二上行信道资源上接收所述 UE 发送的 UCI。

21、根据权利要求 20 所述的接入网设备，其特征在于，所述第二上行信道资源包括以下任意一种：

所述第四上行信道资源集合中资源索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中资源索引号最大的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最大的上行信道资源。

22、一种上行控制信息的发送方法，其特征在于，所述方法包括：

用户设备 UE 确定资源指示信息，所述资源指示信息包括至少两个字段，每个所述字段分别由一个物理下行控制信道集合中的下行控制信息确定，每个所述物理下行控制信道集合包括辅载波中的下行数据所对应的若干个物理下行控制信道；

所述 UE 确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源；

所述 UE 在与所述资源指示信息对应的上行信道资源上发送上行控制信息 UCI。

23、根据权利要求 22 所述的方法，其特征在于，所述资源指示信息包括 M 个字段，M≥2；所述物理下行控制信道集合为 M 个；

所述资源指示信息中的第 i 个字段由 M 个所述物理下行控制信道集合中的第 j 个所述物理下行控制信道集合中的下行控制信息中的预定比特位上携带的信息所确定；

所述 i 和所述 j 之间存在预设对应关系。

24、根据权利要求 22 或 23 所述的方法，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的下行分配索引 DAI 所指示的计数

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值相对于所述 M 的余数相同。

25、根据权利要求 22 至 24 任一所述的方法，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的所述下行控制信息中的预定比特位上所携带的信息相同。

26、根据权利要求 22 至 25 任一所述的方法，其特征在于，

若所述 UE 在所述资源指示信息中的第 L 个字段对应的第 R 个物理下行控制信道集合中的所有物理下行控制信道上都没有检测到所述下行控制信息，则所述资源指示信息中的第 L 个字段由预定规则确定；

其中，所述预定规则包括：所述第 L 个字段为预定取值，或者，所述第 L 个字段为第 R'个物理下行控制信道集合中的所述物理下行控制信道上接收的所述下行控制信息中预定比特位上所指示的信息，$1 \leqslant L \leqslant M$，$1 \leqslant R \neq R' \leqslant M$，R 和 R'之间存在预设的对应关系。

27、根据权利要求 22 至 26 任一所述的方法，其特征在于，所述 UE 确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源，包括：

根据第一对应关系在所述预配置的上行信道资源集合中，确定出与所述资源指示信息对应的上行信道资源，所述第一对应关系为预设的资源指示信息和所述上行信道资源集合中每个上行信道资源之间的对应关系。

28、根据权利要求 22 至 26 任一所述的方法，其特征在于，所述资源指示信息包括：第一指示信息和第二指示信息；

所述 UE 确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源，包括：

根据第二对应关系在若干个所述预配置的上行信道资源集合中，确定出与所述第一指示信息对应的上行信道资源集合作为第一上行信道资源集合，每个所述预配置的上行信道资源集合中的上行信道资源对应各自的最大发送比特数，所述最大发送比特数是支持发送所述 UCI 的最大发送比特数；

根据第三对应关系在所述第一上行信道资源集合中，确定出与所述第二指示信息对应的上行信道资源；

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其中，所述第二对应关系为预设的第一指示信息和所述预配置的上行信道资源集合之间的对应关系，所述第三对应关系为预设的第二指示信息和所述第一上行信道资源集合中每个上行信道资源之间的对应关系。

29、根据权利要求 23 或 25 或 26 所述的方法，其特征在于，所述预定比特位是物理上行控制信道 PUCCH 发送功率命令所对应的比特位。

30、一种上行控制信息的接收方法，其特征在于，所述方法包括：

接入网设备确定资源指示信息，所述资源指示信息包括至少两个字段，所述资源指示信息用于指示用户设备 UE 在预配置的上行信道资源集合中确定出用于发送上行控制信息 UCI 的上行信道资源；

所述接入网设备将每个所述字段通过一个物理下行控制信道集合中的下行控制信息向 UE 发送，每个所述物理下行控制信道集合包括辅载波中的下行数据所对应的若干个物理下行控制信道；

所述接入网设备接收所述 UE 在所述资源指示信息对应的上行信道资源上发送的所述 UCI。

31、根据权利要求 30 所述的方法，其特征在于，所述资源指示信息包括 M 个字段，M≥2；所述物理下行控制信道集合为 M 个；

所述资源指示信息中的第 i 个字段由 M 个所述物理下行控制信道集合中的第 j 个所述物理下行控制信道集合中的下行控制信息中的预定比特位携带；

所述 i 和所述 j 之间存在预设对应关系。

32、根据权利要求 30 或 31 所述的方法，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的下行分配索引 DAI 所指示的计数值相对于所述 M 的余数相同。

33、根据权利要求 30 至 32 任一所述的方法，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的预定比特位上所携带的信息相同。

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34、根据权利要求 31 或 33 所述的方法，其特征在于，所述预定比特位是物理上行控制信道 PUCCH 发送功率命令所对应的比特位。

35、一种上行控制信息的发送方法，其特征在于，所述方法包括：

用户设备 UE 确定第一上行子帧的上行控制信息 UCI，所述 UCI 包括混合自动重传请求反馈 HARQ-ACK 和周期性信道状态信息 CSI；

所述 UE 确定预配置的若干个上行信道资源组成的第二上行信道资源集合；

所述 UE 确定资源指示信息；

所述 UE 确定第三上行信道资源集合中与所述资源指示信息对应的信道资源为第一上行信道资源，所述第三上行信道资源集合为所述第二上行信道资源集合的子集，且所述第三上行信道资源集合与所述 HARQ-ACK 的码本大小匹配；

所述 UE 在所述第一上行子帧的所述第一上行信道资源上发送所述 UCI 中的部分或全部信息。

36、根据权利要求 35 所述的方法，其特征在于，

所述第三上行信道资源集合中的上行信道资源支持发送的 UCI 的比特数的范围或者最大值和所述 HARQ-ACK 的码本大小匹配；

或，

所述第二上行信道资源集合中的各个子集集合和所述 HARQ-ACK 的码本大小之间存在预设的匹配关系。

37、一种上行控制信息的接收方法，其特征在于，所述方法包括：

接入网设备确定用户设备 UE 在第一上行子帧上的上行控制信息 UCI 的自动重传请求反馈 HARQ-ACK 的码本大小，所述 UCI 包括所述 HARQ-ACK 和周期性信道状态信息 CSI；

所述接入网设备向所述 UE 发送资源指示信息；

所述接入网设备确定向所述 UE 预配置的若干个上行信道资源组成的第二上行信道资源集合；

所述接入网设备确定第三上行信道资源集合中与所述资源指示信息对应的信道资源为第一上行信道资源，所述第三上行信道资源集合为所述第二上行信

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道资源集合的子集，且所述第三上行信道资源集合与所述 HARQ-ACK 的码本大小匹配；

所述接入网设备接收所述 UE 在所述第一上行子帧的所述第一上行信道资源上发送的所述 UCI 中的部分或全部信息。

38、根据权利要求 37 所述的方法，其特征在于，

所述第三上行信道资源集合中的上行信道资源支持发送的 UCI 的比特数的范围或者最大值和所述 HARQ-ACK 的码本大小匹配；

或，

所述第二上行信道资源集合中的各个子集集合和所述 HARQ-ACK 的码本大小之间存在预设的匹配关系。

39、一种上行控制信息的发送方法，其特征在于，所述方法包括：

用户设备 UE 确定第二上行子帧的上行控制信息 UCI；

所述 UE 确定预配置的若干个上行信道资源组成的第四上行信道资源集合，所述第四上行信道资源集合中的上行信道资源支持发送的上行控制信息 UCI 的最大比特数相同；

所述 UE 确定所述第四上行信道资源集合中的第二上行信道资源；

所述 UE 在所述第二上行信道资源上发送所述 UCI。

40、根据权利要求 40 所述的方法，其特征在于，所述第二上行信道资源包括以下任意一种：

所述第四上行信道资源集合中资源索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中资源索引号最大的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最大的上行信道资源。

41、一种上行控制信息的接收方法，其特征在于，所述方法包括：

接入网设备确定向用户设备 UE 预配置的若干个上行信道资源组成的第四

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上行信道资源集合，所述第四上行信道资源集合中的上行信道资源支持发送的上行控制信息 UCI 的最大比特数相同；

所述接入网设备确定所述第四上行信道资源集合中的第二上行信道资源；

所述接入网设备在所述第二上行信道资源上接收所述 UE 发送的 UCI。

42、根据权利要求 41 所述的方法，其特征在于，所述第二上行信道资源包括以下任意一种：

所述第四上行信道资源集合中资源索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中资源索引号最大的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最大的上行信道资源。

43、一种上行控制信息的发送装置，其特征在于，所述装置包括：

确定单元，用于确定资源指示信息，所述资源指示信息包括至少两个字段，每个所述字段分别由一个物理下行控制信道集合中的下行控制信息确定，每个所述物理下行控制信道集合包括辅载波中的下行数据所对应的若干个物理下行控制信道；

所述确定单元，还用于确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源；

发送单元，用于在与所述资源指示信息对应的上行信道资源上发送上行控制信息 UCI。

44、根据权利要求 43 所述的装置，其特征在于，所述资源指示信息包括 M 个字段，M≥2；所述物理下行控制信道集合为 M 个；

所述资源指示信息中的第 i 个字段由 M 个所述物理下行控制信道集合中的第 j 个所述物理下行控制信道集合中的下行控制信息中的预定比特位上携带的信息所确定；

所述 i 和所述 j 之间存在预设对应关系。

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45、根据权利要求 43 或 44 所述的装置，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的下行分配索引 DAI 所指示的计数值相对于所述 M 的余数相同。

46、根据权利要求 43 至 45 任一所述的装置，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的所述下行控制信息中的预定比特位上所携带的信息相同。

47、根据权利要求 43 至 46 任一所述的装置，其特征在于，

所述确定单元，还用于若在所述资源指示信息中的第 L 个字段对应的第 R 个物理下行控制信道集合中的所有物理下行控制信道上都没有检测到所述下行控制信息，则所述资源指示信息中的第 L 个字段由预定规则确定；

其中，所述预定规则包括：所述第 L 个字段为预定取值，或者，所述第 L 个字段为第 R'个物理下行控制信道集合中的所述物理下行控制信道上接收的所述下行控制信息中预定比特位上所指示的信息，$1 \leqslant L \leqslant M$，$1 \leqslant R \neq R' \leqslant M$，R 和 R'之间存在预设的对应关系。

48、根据权利要求 43 至 47 任一所述的装置，其特征在于，所述 UE 确定预配置的上行信道资源集合中与所述资源指示信息对应的上行信道资源，包括：

根据第一对应关系在所述预配置的上行信道资源集合中，确定出与所述资源指示信息对应的上行信道资源，所述第一对应关系为预设的资源指示信息和所述上行信道资源集合中每个上行信道资源之间的对应关系。

49、根据权利要求 43 至 47 任一所述的装置，其特征在于，所述资源指示信息包括：第一指示信息和第二指示信息；

所述确定单元，还用于根据第二对应关系在若干个所述预配置的上行信道资源集合中，确定出与所述第一指示信息对应的上行信道资源集合作为第一上行信道资源集合，每个所述预配置的上行信道资源集合中的上行信道资源对应各自的最大发送比特数，所述最大发送比特数是支持发送所述 UCI 的最大发送比特数；

所述确定单元，还用于根据第三对应关系在所述第一上行信道资源集合中，

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确定出与所述第二指示信息对应的上行信道资源；

其中，所述第二对应关系为预设的第一指示信息和所述预配置的上行信道资源集合之间的对应关系，所述第三对应关系为预设的第二指示信息和所述第一上行信道资源集合中每个上行信道资源之间的对应关系。

50、根据权利要求 44 或 46 或 47 所述的装置，其特征在于，所述预定比特位是物理上行控制信道 PUCCH 发送功率命令所对应的比特位。

51、一种上行控制信息的接收装置，其特征在于，所述装置包括：

确定单元，用于确定资源指示信息，所述资源指示信息包括至少两个字段，所述资源指示信息用于指示用户设备 UE 在预配置的上行信道资源集合中确定出用于发送上行控制信息 UCI 的上行信道资源；

发送单元，用于将每个所述字段通过一个物理下行控制信道集合中的下行控制信息向 UE 发送，每个所述物理下行控制信道集合包括辅载波中的下行数据所对应的若干个物理下行控制信道；

接收单元，用于接收所述 UE 在所述资源指示信息对应的上行信道资源上发送的所述 UCI。

52、根据权利要求 51 所述的装置，其特征在于，所述资源指示信息包括 M 个字段，M≥2；所述物理下行控制信道集合为 M 个；

所述资源指示信息中的第 i 个字段由 M 个所述物理下行控制信道集合中的第 j 个所述物理下行控制信道集合中的下行控制信息中的预定比特位携带；

所述 i 和所述 j 之间存在预设对应关系。

53、根据权利要求 51 或 52 所述的装置，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的下行分配索引 DAI 所指示的计数值相对于所述 M 的余数相同。

54、根据权利要求 51 至 53 任一所述的装置，其特征在于，每个所述物理下行控制信道集合中的所述物理下行控制信道中的预定比特位上所携带的信息相同。

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55、根据权利要求 52 或 54 所述的装置，其特征在于，所述预定比特位是物理上行控制信道 PUCCH 发送功率命令所对应的比特位。

56、一种上行控制信息的发送装置，其特征在于，所述装置包括：

确定单元，用于确定第一上行子帧的上行控制信息 UCI，所述 UCI 包括混合自动重传请求反馈 HARQ-ACK 和周期性信道状态信息 CSI；

所述确定单元，还用于确定预配置的若干个上行信道资源组成的第二上行信道资源集合；

所述确定单元，还用于确定资源指示信息；

所述确定单元，还用于确定第三上行信道资源集合中与所述资源指示信息对应的信道资源为第一上行信道资源，所述第三上行信道资源集合为所述第二上行信道资源集合的子集，且所述第三上行信道资源集合与所述 HARQ-ACK 的码本大小匹配；

发送单元，用于在所述第一上行子帧的所述第一上行信道资源上发送所述 UCI 中的部分或全部信息。

57、根据权利要求 56 所述的装置，其特征在于，

所述第三上行信道资源集合中的上行信道资源支持发送的 UCI 的比特数的范围或者最大值和所述 HARQ-ACK 的码本大小匹配；

或，

所述第二上行信道资源集合中的各个子集集合和所述 HARQ-ACK 的码本大小之间存在预设的匹配关系。

58、一种上行控制信息的接收装置，其特征在于，所述装置包括：

确定单元，用于确定用户设备 UE 在第一上行子帧上的上行控制信息 UCI 的自动重传请求反馈 HARQ-ACK 的码本大小，所述 UCI 包括所述 HARQ-ACK 和周期性信道状态信息 CSI；

发送单元，用于向所述 UE 发送资源指示信息；

所述确定单元，还用于确定向所述 UE 预配置的若干个上行信道资源组成的第二上行信道资源集合；

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所述确定单元，还用于确定第三上行信道资源集合中与所述资源指示信息对应的信道资源为第一上行信道资源，所述第三上行信道资源集合为所述第二上行信道资源集合的子集，且所述第三上行信道资源集合与所述 HARQ-ACK 的码本大小匹配；

接收单元，还用于接收所述 UE 在所述第一上行子帧的所述第一上行信道资源上发送的所述 UCI 中的部分或全部信息。

59、根据权利要求 58 所述的装置，其特征在于，

所述第三上行信道资源集合中的上行信道资源支持发送的 UCI 的比特数的范围或者最大值和所述 HARQ-ACK 的码本大小匹配；

或，

所述第二上行信道资源集合中的各个子集集合和所述 HARQ-ACK 的码本大小之间存在预设的匹配关系。

60、一种上行控制信息的发送装置，其特征在于，所述装置包括：

确定单元，用于确定第二上行子帧的上行控制信息 UCI；

所述确定单元，还用于确定预配置的若干个上行信道资源组成的第四上行信道资源集合，所述第四上行信道资源集合中的上行信道资源支持发送的上行控制信息 UCI 的最大比特数相同；

所述确定单元，还用于确定所述第四上行信道资源集合中的第二上行信道资源；

发送单元，还用于在所述第二上行信道资源上发送所述 UCI。

61、根据权利要求 60 所述的装置，其特征在于，所述第二上行信道资源包括以下任意一种：

所述第四上行信道资源集合中资源索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中资源索引号最大的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最大的上行信道资源。

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62、一种上行控制信息的接收装置，其特征在于，所述装置包括：

确定单元，用于确定向用户设备 UE 预配置的若干个上行信道资源组成的第四上行信道资源集合，所述第四上行信道资源集合中的上行信道资源支持发送的上行控制信息 UCI 的最大比特数相同；

所述确定单元，用于确定所述第四上行信道资源集合中的第二上行信道资源；

发送单元，用于在所述第二上行信道资源上接收所述 UE 发送的 UCI。

63、根据权利要求 62 所述的装置，其特征在于，所述第二上行信道资源包括以下任意一种：

所述第四上行信道资源集合中资源索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中资源索引号最大的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最小的上行信道资源，或者，

所述第四上行信道资源集合中频率最低的资源块中的索引号最大的上行信道资源。

64、一种通信系统，其特征在于，所述通信系统包括：用户设备 UE 和接入网设备；

所述 UE 是如权利要求 1 至 8 任一所述的 UE；所述接入网设备是如权利要求 9 至 13 任一所述的接入网设备；

或，

所述 UE 是如权利要求 14 或 15 所述的 UE；所述接入网设备是如权利要求 16 或 17 所述的接入网设备；

或，

所述 UE 是如权利要求 18 或 19 所述的 UE；所述接入网设备是如权利要求 20 或 21 所述的接入网设备。

65、一种通信系统，其特征在于，所述通信系统包括：用户设备 UE 和接入网设备；

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所述 UE 包括如权利要求 43 至 50 任一所述的装置；所述接入网设备是如权利要求 51 至 55 任一所述的装置；

或，

所述 UE 是如权利要求 56 或 57 所述的装置；所述接入网设备是如权利要求 58 或 59 所述的装置；

或，

所述 UE 是如权利要求 60 或 61 所述的装置；所述接入网设备是如权利要求 62 或 63 所述的装置。

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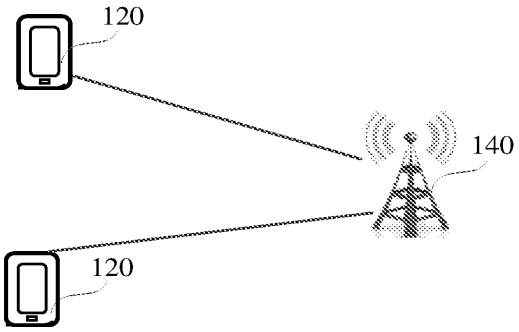

120
140
120

图 1

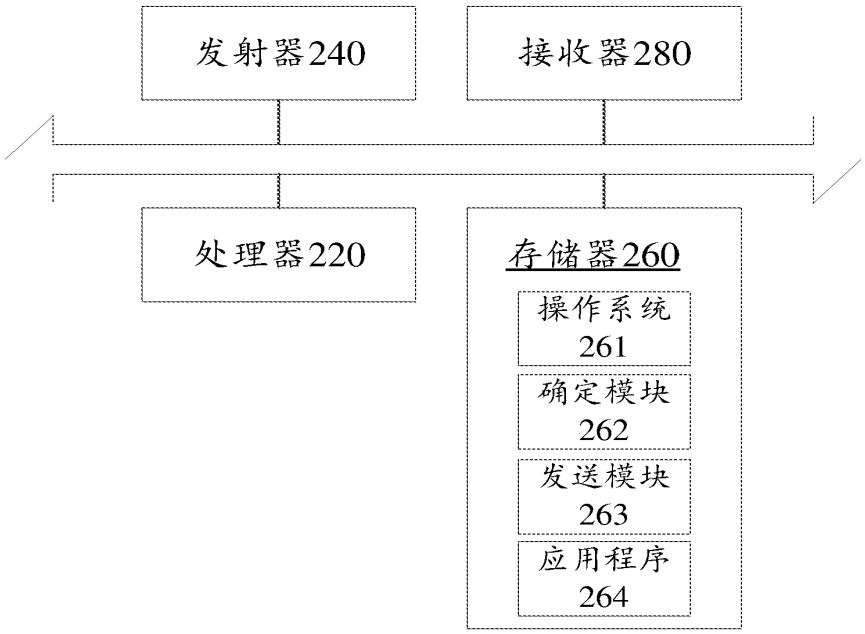

发射器240
接收器280
处理器220
存储器260
操作系统 261
确定模块 262
发送模块 263
应用程序 264

图 2

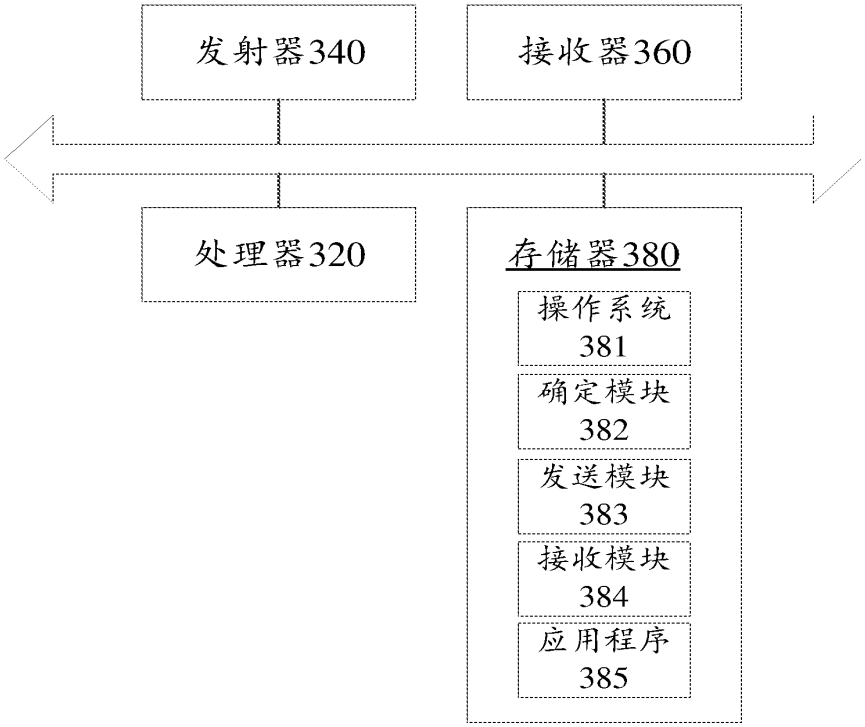

发射器340
接收器360
处理器320
存储器380
操作系统 381
确定模块 382
发送模块 383
接收模块 384
应用程序 385

图 3

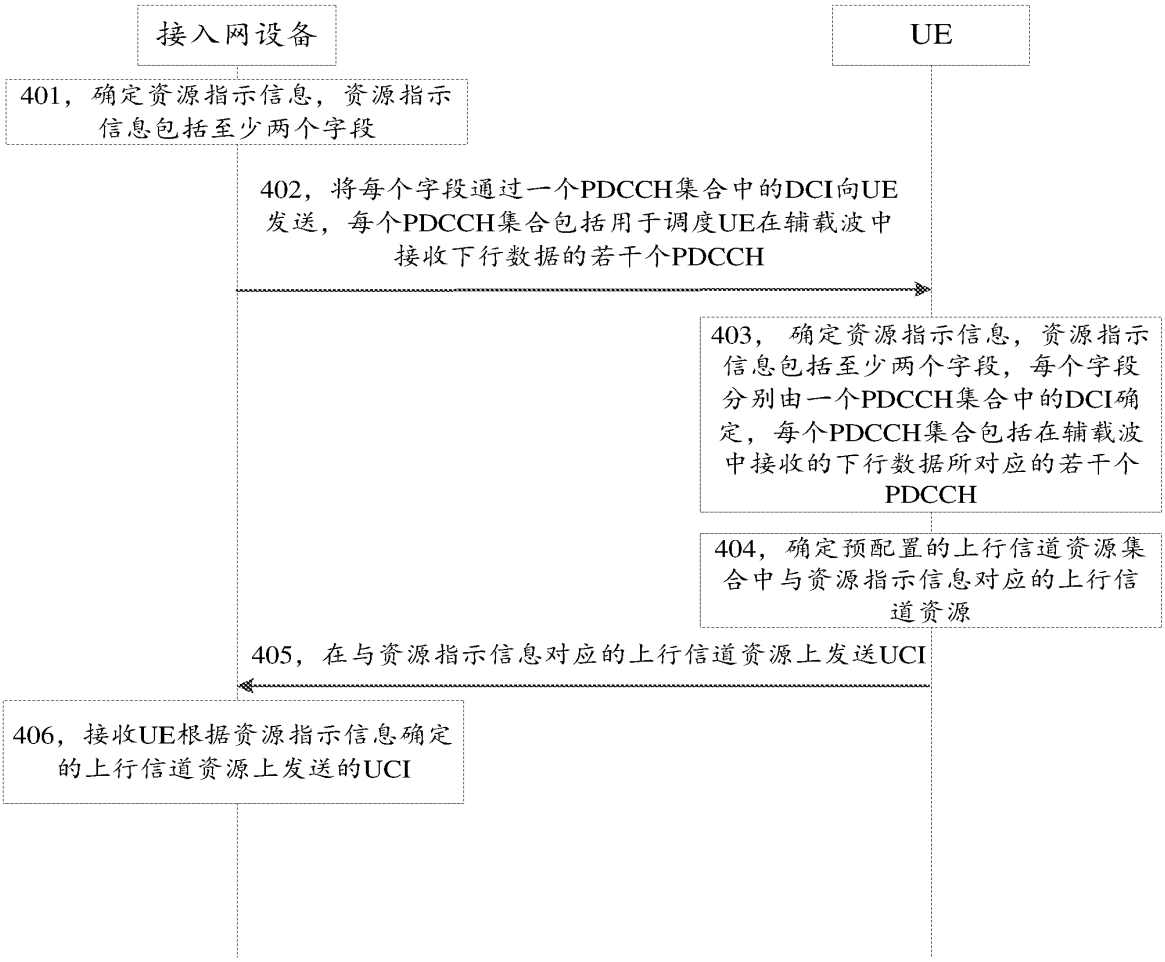

接入网设备
UE
401，确定资源指示信息，资源指示信息包括至少两个字段
402，将每个字段通过一个PDCCH集合中的DCI向UE发送，每个PDCCH集合包括用于调度UE在辅载波中接收下行数据的若干个PDCCH
403，确定资源指示信息，资源指示信息包括至少两个字段，每个字段分别由一个PDCCH集合中的DCI确定，每个PDCCH集合包括在辅载波中接收的下行数据所对应的若干个PDCCH
404，确定预配置的上行信道资源集合中与资源指示信息对应的上行信道资源
405，在与资源指示信息对应的上行信道资源上发送UCI
406，接收UE根据资源指示信息确定的上行信道资源上发送的UCI

图 4

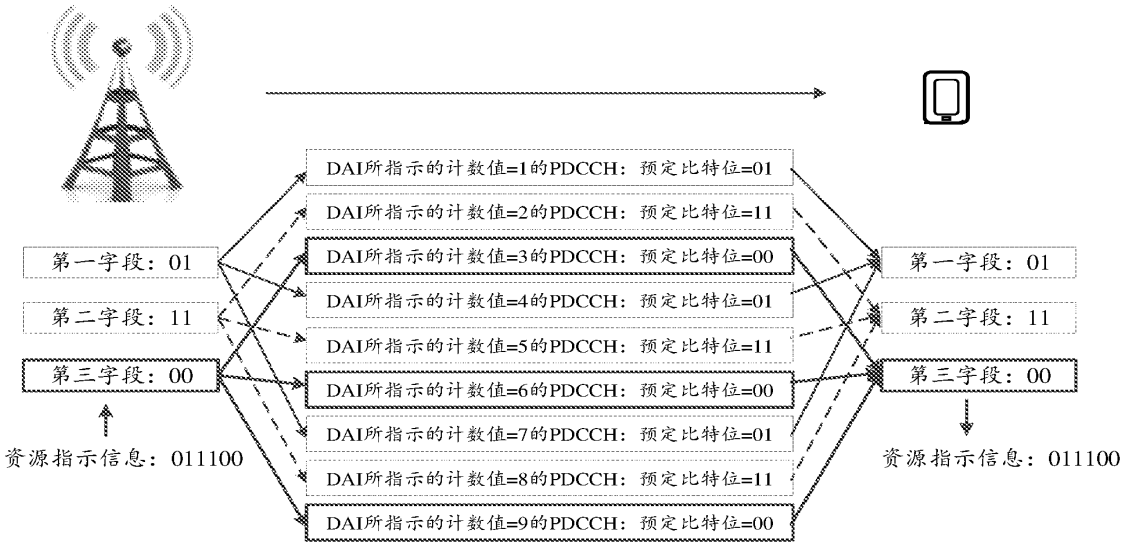

DAI所指示的计数值=1的PDCCH：预定比特位=01
DAI所指示的计数值=2的PDCCH：预定比特位=11
DAI所指示的计数值=3的PDCCH：预定比特位=00
DAI所指示的计数值=4的PDCCH：预定比特位=01
DAI所指示的计数值=5的PDCCH：预定比特位=11
DAI所指示的计数值=6的PDCCH：预定比特位=00
DAI所指示的计数值=7的PDCCH：预定比特位=01
DAI所指示的计数值=8的PDCCH：预定比特位=11
DAI所指示的计数值=9的PDCCH：预定比特位=00
第一字段：01
第二字段：11
第三字段：00
资源指示信息：011100
第一字段：01
第二字段：11
第三字段：00
资源指示信息：011100

图 5

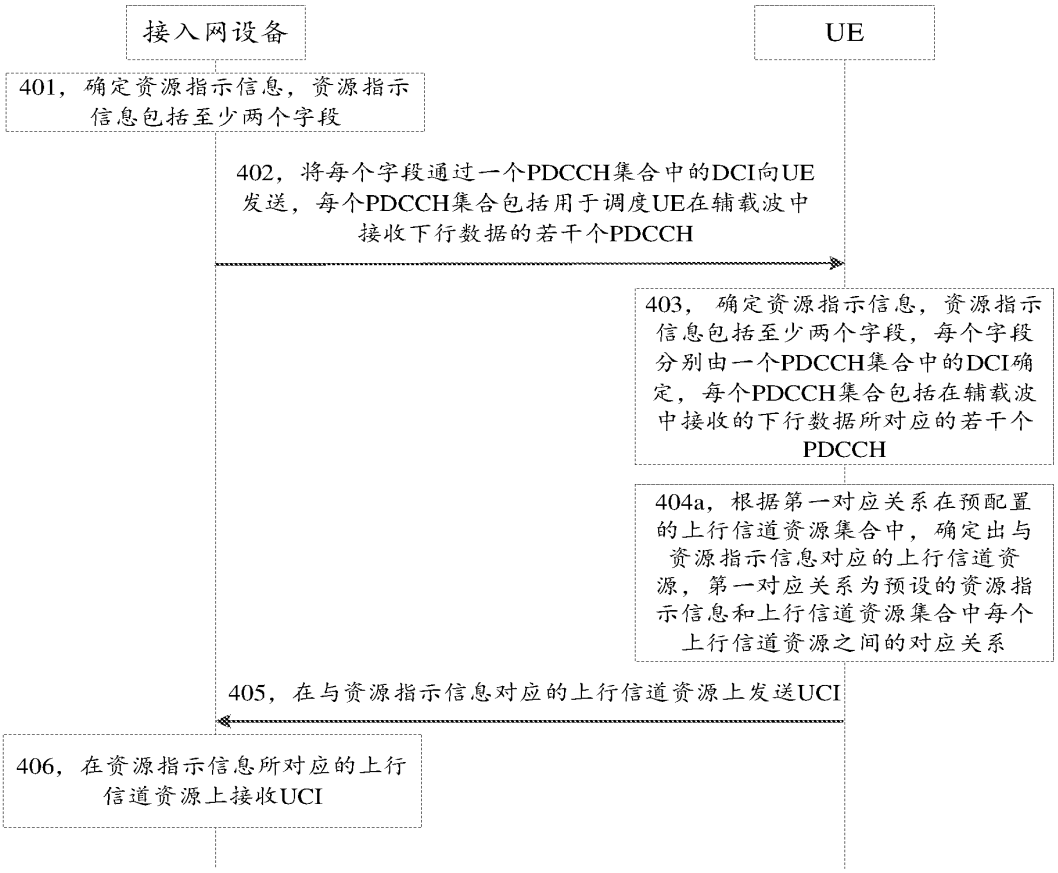

接入网设备
UE
401，确定资源指示信息，资源指示信息包括至少两个字段
402，将每个字段通过一个PDCCH集合中的DCI向UE发送，每个PDCCH集合包括用于调度UE在辅载波中接收下行数据的若干个PDCCH
403，确定资源指示信息，资源指示信息包括至少两个字段，每个字段分别由一个PDCCH集合中的DCI确定，每个PDCCH集合包括在辅载波中接收的下行数据所对应的若干个PDCCH
404a，根据第一对应关系在预配置的上行信道资源集合中，确定出与资源指示信息对应的上行信道资源，第一对应关系为预设的资源指示信息和上行信道资源集合中每个上行信道资源之间的对应关系
405，在与资源指示信息对应的上行信道资源上发送UCI
406，在资源指示信息所对应的上行信道资源上接收UCI

图 6

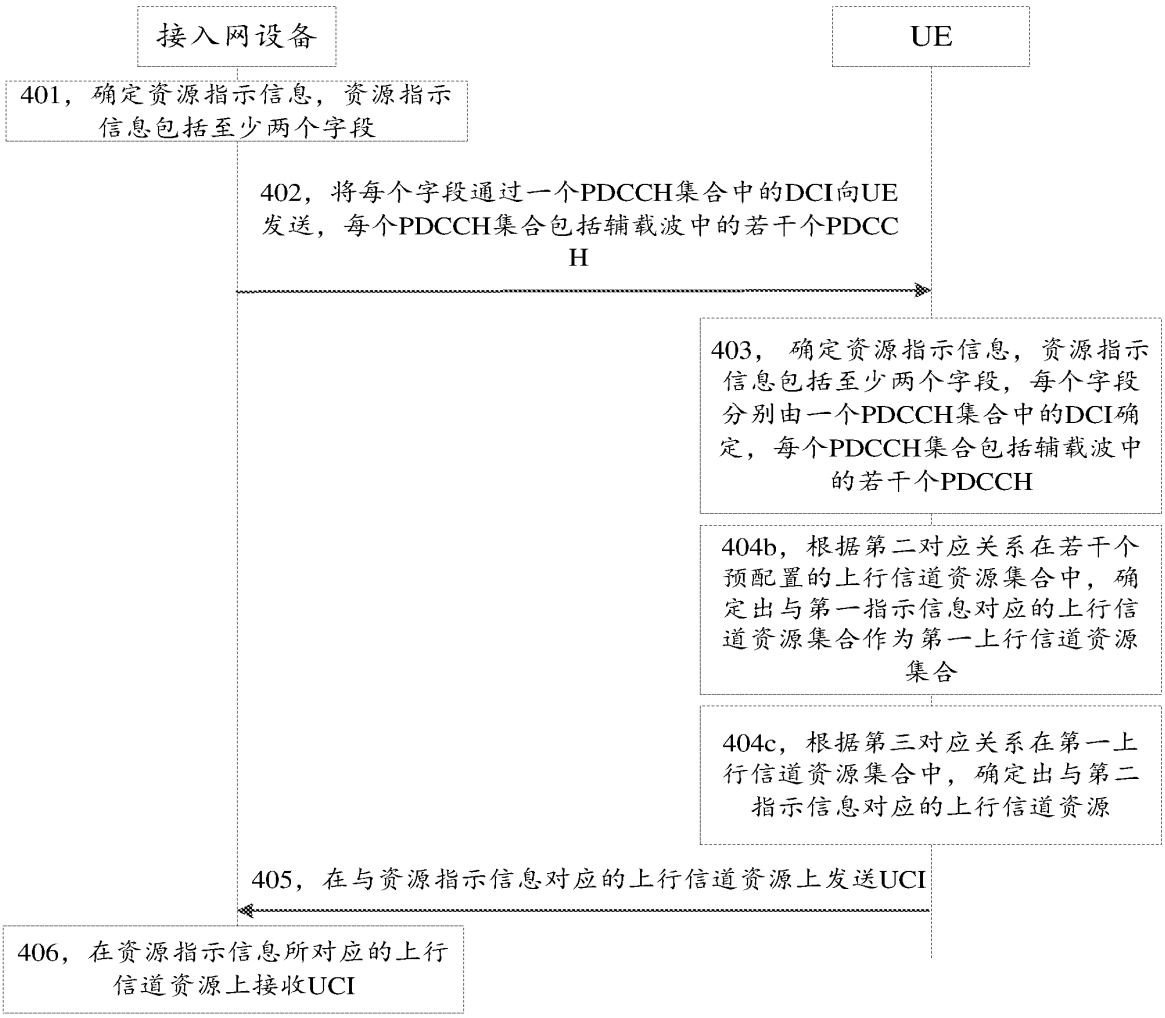

接入网设备
UE
401，确定资源指示信息，资源指示信息包括至少两个字段
402，将每个字段通过一个PDCCH集合中的DCI向UE发送，每个PDCCH集合包括辅载波中的若干个PDCCH
403，确定资源指示信息，资源指示信息包括至少两个字段，每个字段分别由一个PDCCH集合中的DCI确定，每个PDCCH集合包括辅载波中的若干个PDCCH
404b，根据第二对应关系在若干个预配置的上行信道资源集合中，确定出与第一指示信息对应的上行信道资源集合作为第一上行信道资源集合
404c，根据第三对应关系在第一上行信道资源集合中，确定出与第二指示信息对应的上行信道资源
405，在与资源指示信息对应的上行信道资源上发送UCI
406，在资源指示信息所对应的上行信道资源上接收UCI

图 7

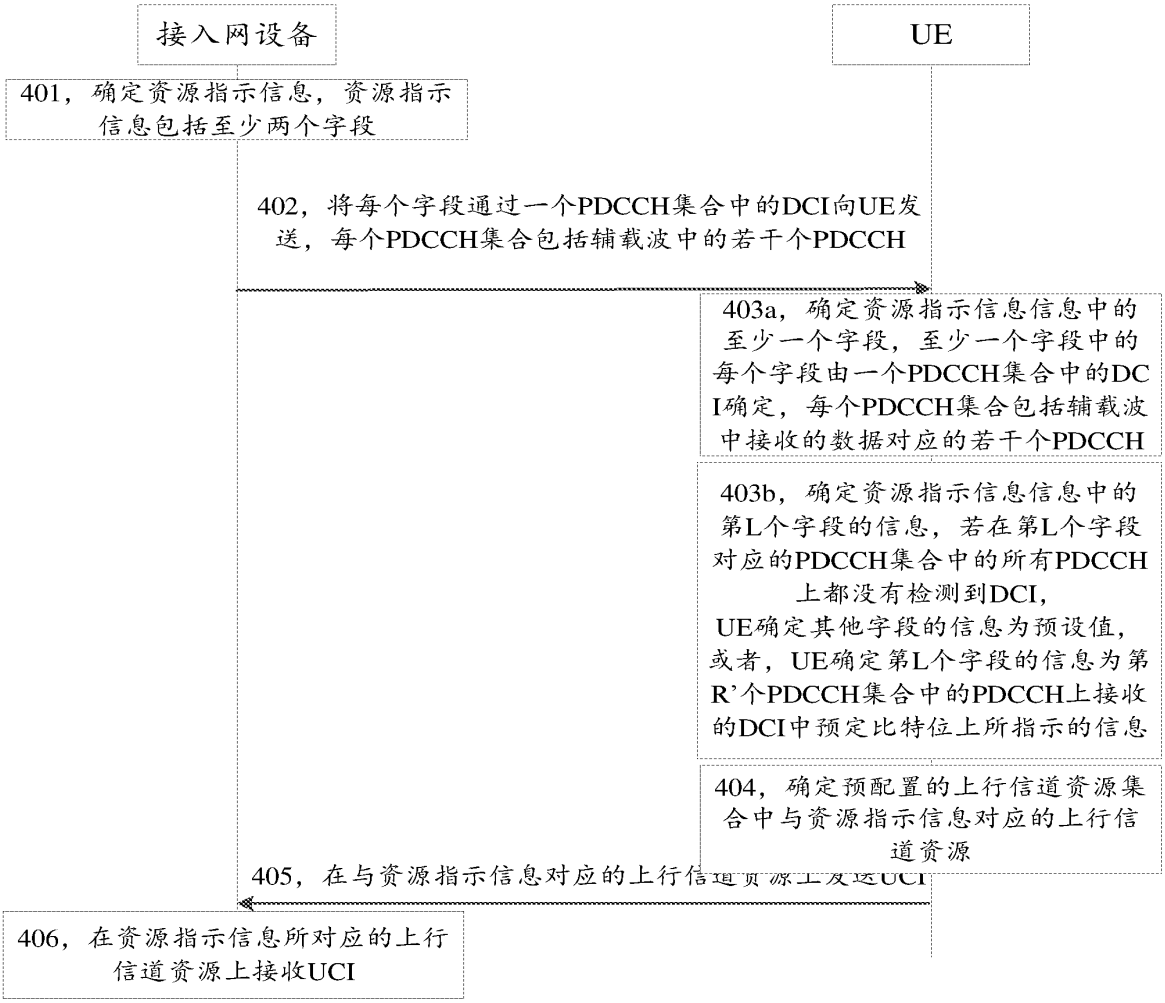

接入网设备
UE
401，确定资源指示信息，资源指示信息包括至少两个字段
402，将每个字段通过一个PDCCH集合中的DCI向UE发送，每个PDCCH集合包括辅载波中的若干个PDCCH
403a，确定资源指示信息信息中的至少一个字段，至少一个字段中的每个字段由一个PDCCH集合中的DCI确定，每个PDCCH集合包括辅载波中接收的数据对应的若干个PDCCH
403b，确定资源指示信息信息中的第L个字段的信息，若在第L个字段对应的PDCCH集合中的所有PDCCH上都没有检测到DCI，
UE确定其他字段的信息为预设值，
或者，UE确定第L个字段的信息为第R'个PDCCH集合中的PDCCH上接收的DCI中预定比特位上所指示的信息
404，确定预配置的上行信道资源集合中与资源指示信息对应的上行信道资源
405，在与资源指示信息对应的上行信道资源上发送UCI
406，在资源指示信息所对应的上行信道资源上接收UCI

图 8

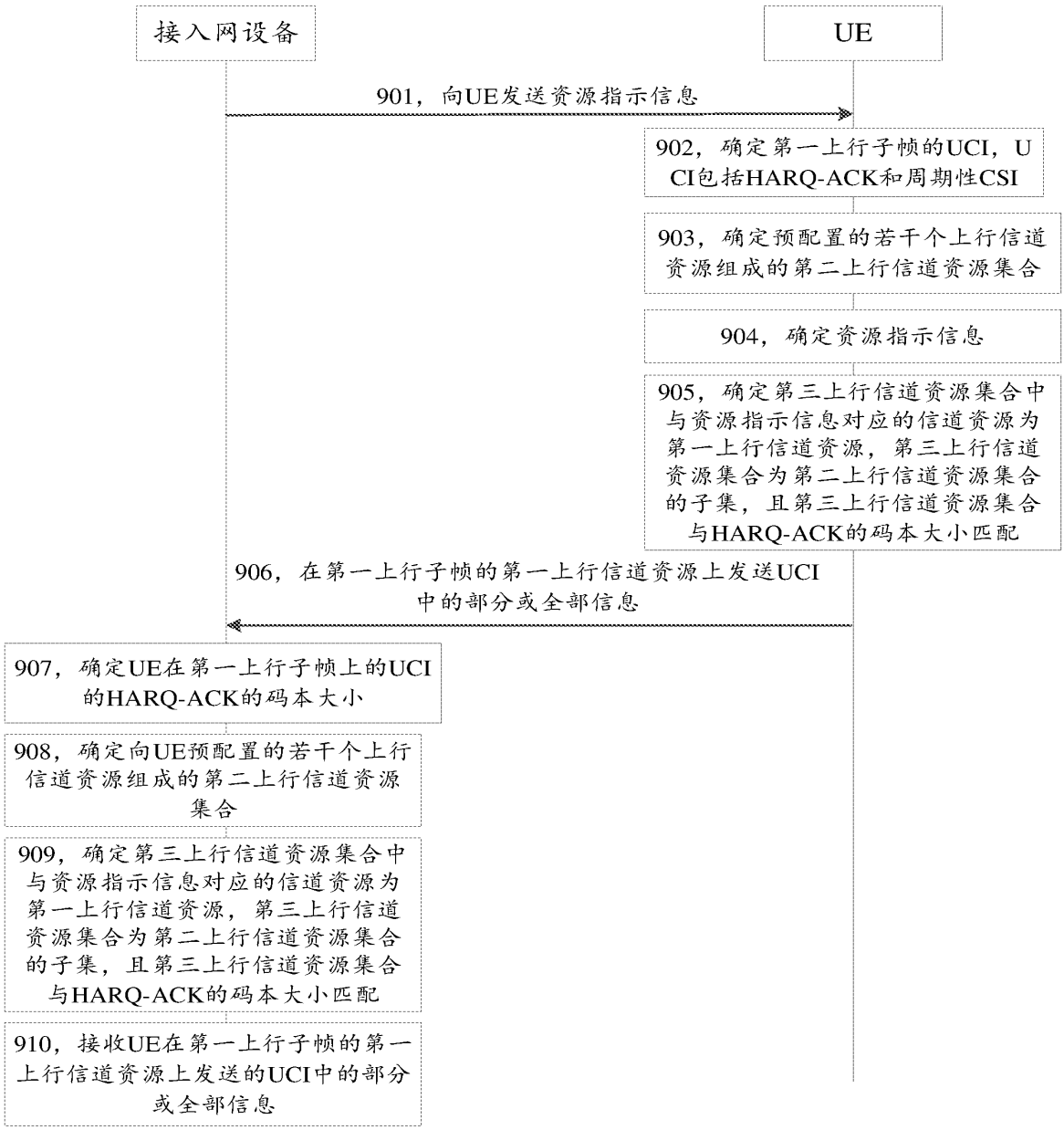

接入网设备
UE
901，向UE发送资源指示信息
902，确定第一上行子帧的UCI，UCI包括HARQ-ACK和周期性CSI
903，确定预配置的若干个上行信道资源组成的第二上行信道资源集合
904，确定资源指示信息
905，确定第三上行信道资源集合中与资源指示信息对应的信道资源为第一上行信道资源，第三上行信道资源集合为第二上行信道资源集合的子集，且第三上行信道资源集合与HARQ-ACK的码本大小匹配
906，在第一上行子帧的第一上行信道资源上发送UCI中的部分或全部信息
907，确定UE在第一上行子帧上的UCI的HARQ-ACK的码本大小
908，确定向UE预配置的若干个上行信道资源组成的第二上行信道资源集合
909，确定第三上行信道资源集合中与资源指示信息对应的信道资源为第一上行信道资源，第三上行信道资源集合为第二上行信道资源集合的子集，且第三上行信道资源集合与HARQ-ACK的码本大小匹配
910，接收UE在第一上行子帧的第一上行信道资源上发送的UCI中的部分或全部信息

图 9

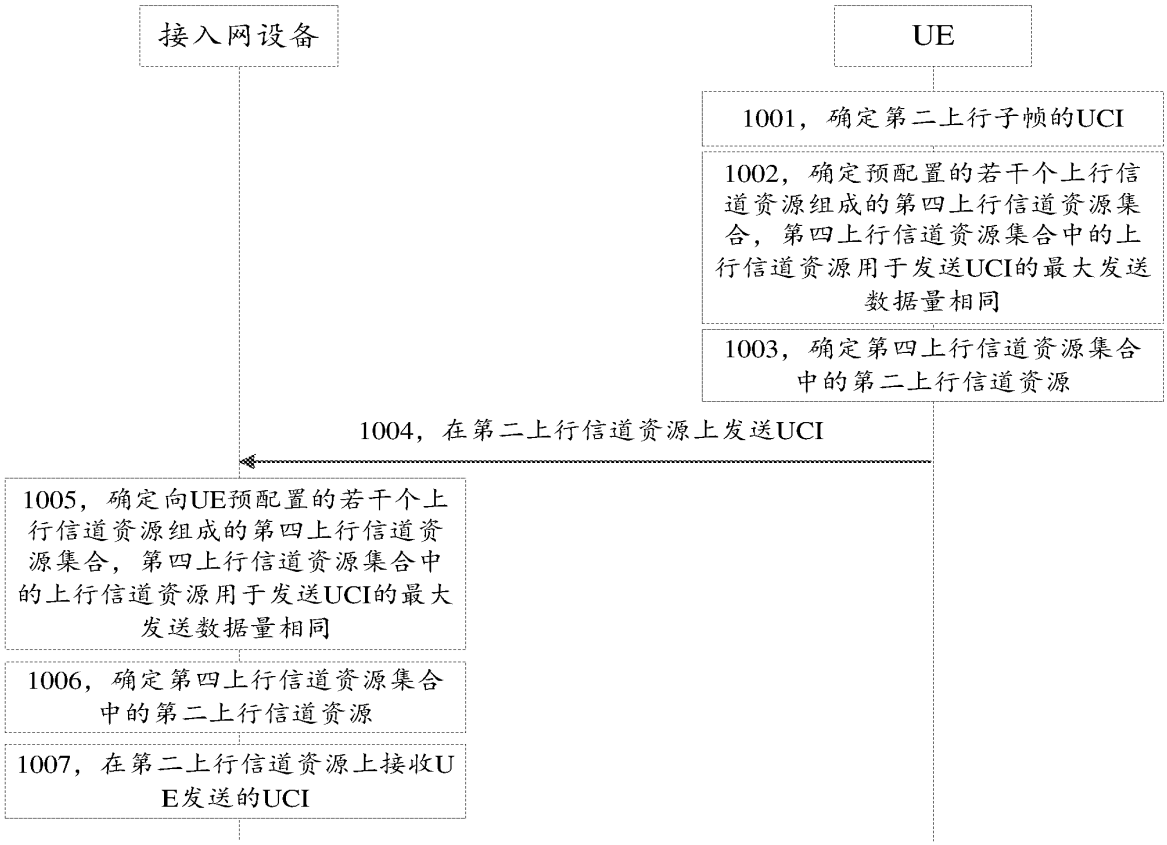

接入网设备
UE
1001，确定第二上行子帧的UCI
1002，确定预配置的若干个上行信道资源组成的第四上行信道资源集合，第四上行信道资源集合中的上行信道资源用于发送UCI的最大发送数据量相同
1003，确定第四上行信道资源集合中的第二上行信道资源
1004，在第二上行信道资源上发送UCI
1005，确定向UE预配置的若干个上行信道资源组成的第四上行信道资源集合，第四上行信道资源集合中的上行信道资源用于发送UCI的最大发送数据量相同
1006，确定第四上行信道资源集合中的第二上行信道资源
1007，在第二上行信道资源上接收UE发送的UCI

图 10

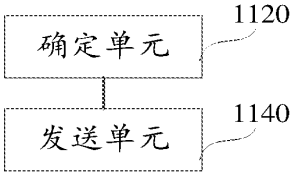


图 11

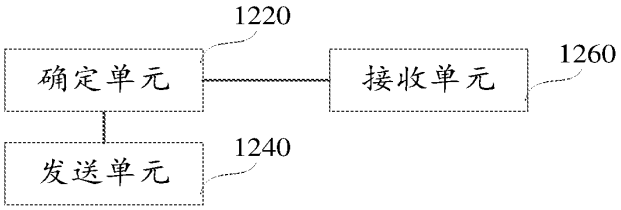


图 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/093920

A. CLASSIFICATION OF SUBJECT MATTER

H04W 72/04 (2009.01) i; H04W 28/06 (2009.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W; H04L; H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, CNTXT, CNKI, VEN, SIPOABS: uplink control information, downlink control information, channel state information, CSI, automatic repeat request, HARQ, physical uplink control channel, PUCCH, carrier aggregation, indication, identifier, UCI, DCI, bit?, HARQ-ACK, TPC command for PUCCH

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 103283292 A (PANASONIC CORPORATION), 04 September 2013 (04.09.2013), description, paragraphs [0058]-[0067] and [0192]-[0233], and figures 9, 17 and 18	1-13, 22-34, 43-55, 64, 65
Y	CN 103283292 A (PANASONIC CORPORATION), 04 September 2013 (04.09.2013), description, paragraphs [0058]-[0067] and [0192]-[0233], and figures 9, 17 and 18	14-21, 35-42, 56-65
Y	CN 104660387 A (BEIJING SAMSUNG COMMUNICATION TECHNOLOGY RESEARCH INSTITUTE et al.), 27 May 2015 (27.05.2015), description, paragraph [0010]	14-17, 35-38, 56-59, 64, 65
Y	US 2015043462 A1 (LG ELECTRONICS INC.), 12 February 2015 (12.02.2015), description, paragraph [0191]	14-17, 35-38, 56-59, 64, 65
Y	CN 103427940 A (ALCATEL-LUCENT SHANGHAI BELL CO., LTD.), 04 December 2013 (04.12.2013), description, paragraph [0083]	18-21, 39-42, 60-63, 64, 65

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 July 2016 (12.07.2016)	**25 July 2016 (25.07.2016)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **HU, Shaoqin** Telephone No.: (86-10) **62089559**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/093920

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 104737471 A (LG ELECTRONICS INC.), 24 June 2015 (24.06.2015), the whole document	1-65

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/093920

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 103283292 A	04 September 2013	RU 2013130668 A	10 February 2015
		US 9077533 B2	07 July 2015
		JP 2015111876 A	18 June 2015
		US 2016165594 A1	09 June 2016
		JP 2014045493 A	13 March 2014
		JP 5684356 B2	11 March 2015
		JP 5878652 B2	08 March 2016
		US 2015016398 A1	15 January 2015
		US 2013250901 A1	26 September 2013
		EP 2663149 A1	13 November 2013
		US 8879497 B2	04 November 2014
		RU 2573639 C2	27 January 2016
		CN 103283292 B	25 May 2016
		KR 20130135275 A	10 December 2013
		US 2015271795 A1	24 September 2015
		US 9295054 B2	22 March 2016
		TW 201240509 A	01 October 2012
		WO 2012093448 A1	12 July 2012
		MX 2013007145 A	29 July 2013
		JP 5398922 B2	29 January 2014
CN 104660387 A	27 May 2015	None	
US 2015043462 A1	12 February 2015	WO 2013125908 A1	29 August 2013
CN 103427940 A	04 December 2013	None	
CN 104737471 A	24 June 2015	US 2015245347 A1	27 August 2015
		WO 2014046457 A1	27 March 2014

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
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国际检索报告

国际申请号
PCT/CN2015/093920

A. 主题的分类

H04W 72/04(2009.01)i; H04W 28/06(2009.01)i

按照国际专利分类(IPC)或者同时按照国家分类和IPC两种分类

B. 检索领域

检索的最低限度文献(标明分类系统和分类号)

H04W; H04L; H04B

包含在检索领域中的除最低限度文献以外的检索文献

在国际检索时查阅的电子数据库(数据库的名称，和使用的检索词（如使用））

CNABS;CNTXT;CNKI;VEN;SIPOABS:载波聚合，指示，标识，上行控制信息，下行控制信息，比特，信道状态信息，CSI，自动请求重传，HARQ，物理上行控制信息，PUCCH，carrier aggregation，indication，identifier，UCI，DCI，bit?，HARQ-ACK，TPC command for PUCCH

C. 相关文件

类 型*	引用文件，必要时，指明相关段落	相关的权利要求
X	CN 103283292 A (松下电器产业株式会社) 2013年 9月 4日 (2013-09-04) 说明书第[0058]-[0067]、[0192]-[0233]，图9、17、18	1-13，22-34，43-55，64，65
Y	CN 103283292 A (松下电器产业株式会社) 2013年 9月 4日 (2013-09-04) 说明书第[0058]-[0067]、[0192]-[0233]，图9、17、18	14-21，35-42，56-65
Y	CN 104660387 A (北京三星通信技术研究有限公司等) 2015年 5月 27日 (2015-05-27) 说明书第[0010]段	14-17，35-38，56-59，64，65
Y	US 2015043462 A1 (LG电子株式会社) 2015年 2月 12日 (2015-02-12) 说明书第[0191]段	14-17，35-38，56-59，64，65
Y	CN 103427940 A (上海贝尔股份有限公司) 2013年 12月 4日 (2013-12-04) 说明书第[0083]段	18-21，39-42，60-63，64，65

☑ 其余文件在C栏的续页中列出。

☑ 见同族专利附件。

* 引用文件的具体类型：

"A" 认为不特别相关的表示了现有技术一般状态的文件

"E" 在国际申请日的当天或之后公布的在先申请或专利

"L" 可能对优先权要求构成怀疑的文件，或为确定另一篇引用文件的公布日而引用的或者因其他特殊理由而引用的文件（如具体说明的）

"O" 涉及口头公开、使用、展览或其他方式公开的文件

"P" 公布日先于国际申请日但迟于所要求的优先权日的文件

"T" 在申请日或优先权日之后公布，与申请不相抵触，但为了理解发明之理论或原理的在后文件

"X" 特别相关的文件，单独考虑该文件，认定要求保护的发明不是新颖的或不具有创造性

"Y" 特别相关的文件，当该文件与另一篇或者多篇该类文件结合并且这种结合对于本领域技术人员为显而易见时，要求保护的发明不具有创造性

"&" 同族专利的文件

国际检索实际完成的日期	国际检索报告邮寄日期
2016年 7月 12日	2016年 7月 25日
ISA/CN的名称和邮寄地址 中华人民共和国国家知识产权局(ISA/CN) 中国北京市海淀区蓟门桥西土城路6号 100088 传真号 (86-10)62019451	受权官员 胡绍芹 电话号码 (86-10)62089559

表 PCT/ISA/210 (第2页) (2009年7月)

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
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C. 相关文件

类 型*	引用文件，必要时，指明相关段落	相关的权利要求
A	CN 104737471 A (LG电子株式会社) 2015年 6月 24日 (2015 - 06 - 24) 全文	1-65

表 PCT/ISA/210 (第2页) (2009年7月)

国际检索报告
关于同族专利的信息

国际申请号
PCT/CN2015/093920

检索报告引用的专利文件			公布日（年/月/日）	同族专利			公布日（年/月/日）
CN	103283292	A	2013年 9月 4日	RU	2013130668	A	2015年 2月 10日
				US	9077533	B2	2015年 7月 7日
				JP	2015111876	A	2015年 6月 18日
				US	2016165594	A1	2016年 6月 9日
				JP	2014045493	A	2014年 3月 13日
				JP	5684356	B2	2015年 3月 11日
				JP	5878652	B2	2016年 3月 8日
				US	2015016398	A1	2015年 1月 15日
				US	2013250901	A1	2013年 9月 26日
				EP	2663149	A1	2013年 11月 13日
				US	8879497	B2	2014年 11月 4日
				RU	2573639	C2	2016年 1月 27日
				CN	103283292	B	2016年 5月 25日
				KR	20130135275	A	2013年 12月 10日
				US	2015271795	A1	2015年 9月 24日
				US	9295054	B2	2016年 3月 22日
				TW	201240509	A	2012年 10月 1日
				WO	2012093448	A1	2012年 7月 12日
				MX	2013007145	A	2013年 7月 29日
				JP	5398922	B2	2014年 1月 29日
CN	104660387	A	2015年 5月 27日		无		
US	2015043462	A1	2015年 2月 12日	WO	2013125908	A1	2013年 8月 29日
CN	103427940	A	2013年 12月 4日		无		
CN	104737471	A	2015年 6月 24日	US	2015245347	A1	2015年 8月 27日
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Method, equipment and system of uplink control channel resource allocation

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Abstract of CN102014510 (A)

The invention discloses a method, equipment and a system of uplink control channel resource allocation. The method comprises the following steps that a base station distributes an uplink control channel resource set which comprises usable channel resource elements fed back by ACK/NACK; the base station sends subsets according the condition of the channel resource elements contained in the uplink control channel resource set and/or the condition whether uplink control channel resources corresponding to a downlink carrier to be fed back or a downlink subframe control region CCE to be fed back can satisfy all antenna ports and sends down an allocation signaling to a user terminal; and two users of the antenna ports are allocated according to the allocation signaling, and ACK/NACK feedback is carried out by using corresponding channel resources. By applying the method, the device and the system, the problems of PDCCH dispatching flexibility influence by feedback channel resources and the blind test complexity of PDCCH with a user terminal.

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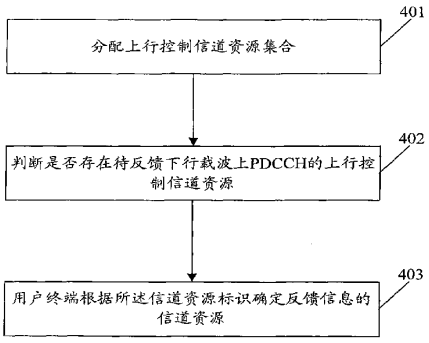
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(54)发明名称

一种上行控制信道资源配置的方法、设备及系统

(57)摘要

本发明公开一种上行控制信道资源配置的方法、装置及系统，该方法包括：基站分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素；基站根据所述上行控制信道资源集合所包含的信道资源元素情况，和/或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令；配置有两个天线端口的用户终端根据所述配置信令，使用相应的信道资源进行 ACK/NACK 反馈。应用本发明提供的方法、装置及系统解决反馈信道资源的受限制影响 PDCCH 调度的灵活性和用户终端对 PDCCH 进行盲检的复杂度的问题。



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1. 一种上行控制信道资源配置的方法，其特征在于，当配置有两个天线端口的用户终端，进行上行控制信道传输时，包括：

基站分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素；

基站根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令；

配置有两个天线端口的用户终端根据所述配置信令，使用相应的信道资源进行 ACK/NACK 反馈。

2. 如权利要求 1 所述的方法，其特征在于，当所述上行控制信道资源集合只包括一个元素时，包括：

所述配置信令包括：上行控制信道资源集合里的全部信道资源元素的信息；

则用户终端读取基站下发的配置信令，检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

3. 如权利要求 2 所述的方法，其特征在于，如果用户终端通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

4. 如权利要求 2 所述的方法，其特征在于，包括：

如果用户终端通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口中预定的一个天线端口使用所述上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

5. 如权利要求 1 所述的方法，其特征在于，当所述上行控制信道资源集合包括至少一个元素时，包括：

所述向用户终端下发配置信令，包括：

基站下发所述上行控制信道资源集合里的全部信道资源元素的信息，并根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，在 PDCCH 中设置可使用资源的标识；该可使用资源的标识用于标示所述用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该信道资源集合中的信道资源元素的使用情况；

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用户终端读取基站下发的配置信令，根据 PDCCH 中的可使用资源的标识，使用相应的信道资源进行 ACK/NACK 反馈。

6. 如权利要求 5 所述的方法，其特征在于，包括 ：

如果基站确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源 ；

UE 检测待反馈的下行载波或者下行子帧的 PDCCH，根据所述可使用资源的标识，确定进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

7. 如权利要求 5 所述的方法，其特征在于，包括 ：

如果基站确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，则所述可使用资源的标识标示所述两个天线端口在进行发送分集的 ACK/NACK 反馈时，其中一个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号 ；

UE 则检测待反馈的下行载波或者下行子帧的 PDCCH，根据所述可使用资源的标识，确定进行发送分集的两个天线端口中预定的一个天线端口使用所述可使用资源的标识所述标示的信道资源编号对应的上行控制信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

8. 如权利要求 1 ～ 7 任一权项所述的方法，其特征在于，多个用户终端共享上行控制信道资源集合中的信道资源元素，基站通过调度限制使用了同一个信道资源的用户终端分时反馈。

9. 如权利要求 5 ～ 7 任一权项所述的方法，其特征在于，如果所述上行控制信道资源集合中的包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1，则所述在物理下行控制信道 PDCCH 中增加可用资源的标识包括 ：

为所有的 PDCCH 上承载的 DCI 格式增加$\lceil \log_2(N+1) \rceil$比特的信令，该信令 N+1 个状态中，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号 ；另外一个状态用于标示用户终端在进行两个天线端口发送分集的 ACK/NACK 反馈时，两个天线端口都不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

10. 如权利要求 5 ～ 7 任一权项所述的方法，其特征在于，如果所述上行控制信道资源集合中的包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1，则所述在物理下行控制信道 PDCCH 中增加可用资源的标识包括 ：

将$\lceil \log_2(N+1) \rceil$比特的信令与 DCI 格式中的其他信令联合编码，实现在物理下行控制信道 PDCCH 中增加可用资源的标识 ；或者

重用 DCI 格式中的信令表示所述 N+1 个状态，实现在物理下行控制信道 PDCCH 中

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增加可用资源的标识；

其中，所述 N+1 个状态，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示所述用户终端在进行两个天线端口发送分集的 ACK/NACK 反馈时，两个天线端口都不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

11. 如权利要求 1 ～ 7 任一权项所述的方法，其特征在于，所述待反馈的下行载波或者下行子帧控制区域 CCE 包括调度所述用户终端物理下行共享信道 PDSCH 的物理下行控制信道 PDCCH 中的 CCE 和 / 或调度所述用户终端物理上行共享信道 PUSCH 的 PDCCH 中的 CCE。

12. 如权利要求 1 ～ 7 任一权项所述的方法，其特征在于，所述上行控制信道资源集合里面的资源性质是半持续调度的，并通过高层信令配置该上行控制信道资源集合中的资源。

13. 一种上行控制信道资源配置的方法，当配置有两个天线端口的用户终端，进行上行控制信道传输时，其特征在于，包括：

基站分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素；

基站根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令，该配置信令指示用户终端使用相应的信道资源进行 ACK/NACK 反馈。

14. 如权利要求 13 所述的方法，其特征在于，当所述上行控制信道资源集合只包括一个元素时，基站向所述用户终端下发的配置信令包括：上行控制信道资源集合里的全部信道资源元素的信息。

15. 如权利要求 13 所述的方法，其特征在于，当所述上行控制信道资源集合包括至少一个元素时，包括：

所述向用户终端下发配置信令，包括：

基站下发所述上行控制信道资源集合里的全部信道资源元素的信息，并根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，在 PDCCH 中设置可使用资源的标识；该可使用资源的标识用于标示所述用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该信道资源集合中的信道资源元素的使用情况。

16. 如权利要求 15 所述的方法，其特征在于，基站如果确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源。

17. 如权利要求 15 所述的方法，其特征在于，基站如果确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，则所述可使用资源的标识

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标示所述两个天线端口在进行发送分集的 ACK/NACK 反馈时，其中一个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号。

18. 如权利要求 13 ～ 17 任一权项所述的方法，其特征在于，多个用户终端共享上行控制信道资源集合中的信道资源元素，基站通过调度限制使用了同一个信道资源的用户终端分时反馈。

19. 如权利要求 13 ～ 17 任一权项所述的方法，其特征在于，所述待反馈的下行载波或者下行子帧控制区域 CCE 包括调度所述用户终端物理下行共享信道 PDSCH 的物理下行控制信道 PDCCH 中的 CCE 和 / 或调度所述用户终端物理上行共享信道 PUSCH 的 PDCCH 中的 CCE。

20. 如权利要求 15 ～ 17 任一权项所述的方法，其特征在于，如果所述上行控制信道资源集合中的包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1，则所述在物理下行控制信道 PDCCH 中增加可用资源的标识包括 ：

为所有的 PDCCH 上承载的 DCI 格式增加$\lceil \log_2(N+1) \rceil$比特的信令，该信令 N+1 个状态中，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号 ；另外一个状态用于标示用户终端在进行两个天线端口发送分集的 ACK/NACK 反馈时，两个天线端口都不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

21. 如权利要求 15 ～ 17 任一权项所述的方法，其特征在于，如果所述上行控制信道资源集合中的包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1，则所述在物理下行控制信道 PDCCH 中增加可用资源的标识包括 ：

将$\lceil \log_2(N+1) \rceil$比特的信令与 DCI 格式中的其他信令联合编码，实现在物理下行控制信道 PDCCH 中增加可用资源的标识 ；或者

重用 DCI 格式中的信令表示所述 N+1 个状态，实现在物理下行控制信道 PDCCH 中增加可用资源的标识 ；

其中，所述 N+1 个状态，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号 ；另外一个状态用于标示所述用户终端在进行两个天线端口发送分集的 ACK/NACK 反馈时，两个天线端口都不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

22. 一种上行控制信道资源配置的方法，当配置有两个天线端口的用户终端，进行上行控制信道传输时，其特征在于，包括 ：

用户终端根据基站下发的配置信令，使用相应的信道资源进行 ACK/NACK 反馈，其中所述配置信令是基站根据所述预先设置的上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集确定的。

23. 如权利要求 22 所述的方法，其特征在于，当所述上行控制信道资源集合只包括一

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个元素时，包括：

所述配置信令包括：上行控制信道资源集合里的全部信道资源元素的信息；

则用户终端读取基站下发的配置信令，检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

24. 如权利要求 23 所述的方法，其特征在于，用户终端如果通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

25. 如权利要求 23 所述的方法，其特征在于，包括：

如果用户终端通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口中预定的一个天线端口使用所述上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

26. 如权利要求 22 所述的方法，其特征在于，当所述上行控制信道资源集合包括至少一个元素时，所述控制信令包括所述上行控制信道资源集合里的全部信道资源元素的信息，以及基站根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，设置在 PDCCH 中的可使用资源的标识；

用户终端读取基站下发的配置信令，以及 PDCCH 中的可使用资源的标识，使用相应的信道资源进行 ACK/NACK 反馈。

27. 如权利要求 26 所述的方法，其特征在于，包括：

如果所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源；

UE 检测待反馈的下行载波或者下行子帧的 PDCCH，根据所述可使用资源的标识，确定进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

28. 如权利要求 26 所述的方法，其特征在于，包括：

如果所述可使用资源的标识标示所述两个天线端口在进行发送分集的 ACK/NACK 反馈时，其中一个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号；

UE 则检测待反馈的下行载波或者下行子帧的 PDCCH，根据所述可使用资源的标

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识，确定进行发送分集的两个天线端口中预定的一个天线端口使用所述可使用资源的标识所述标示的信道资源编号对应的上行控制信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

29. 如权利要求 22 ～ 28 任一权项所述的方法，其特征在于，多个用户终端共享上行控制信道资源集合中的信道资源元素，基站通过调度限制使用了同一个信道资源的用户终端分时反馈。

30. 如权利要求 22 ～ 28 任一权项所述的方法，其特征在于，所述待反馈的下行载波或者下行子帧控制区域 CCE 包括调度所述用户终端物理下行共享信道 PDSCH 的物理下行控制信道 PDCCH 中的 CCE 和 / 或调度所述用户终端物理上行共享信道 PUSCH 的 PDCCH 中的 CCE。

31. 如权利要求 22 ～ 28 任一权项所述的方法，其特征在于，所述上行控制信道资源集合里面的资源性质是半持续调度的，并通过高层信令配置该上行控制信道资源集合中的资源。

32. 一种基站设备，其特征在于，包括 ：

集合资源分配模块，用于分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素 ；

信道资源分配模块，用于根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令，该配置信令指示用户终端使用相应的信道资源进行 ACK/NACK 反馈。

33. 如权利要求 32 所述的基站，其特征在于，所述集合资源分配模块还用于只分配一个 ACK/NACK 反馈可用的信道资源元素到上行控制信道资源集合中。

34. 如权利要求 32 所述的基站，其特征在于，所述集合资源分配模块还用于分配至少一个 ACK/NACK 反馈可用的信道资源元素到上行控制信道资源集合中 ；则

所述信道资源分配模块还用于下发所述上行控制信道资源集合里的全部信道资源元素的信息，并根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，在 PDCCH 中设置可使用资源的标识 ；该可使用资源的标识用于标示所述用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该信道资源集合中的信道资源元素的使用情况。

35. 如权利要求 34 所述的基站，其特征在于，所述信道资源分配模块还用于如果确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源。

36. 如权利要求 34 所述的基站，其特征在于，所述信道资源分配模块还用于如果确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，则所述可使用资源的标识标示所述两个天线端口在进行发送分集的 ACK/NACK 反馈时，其中一

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个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号。

37. 一种用户终端，该用户终端配置有两个天线端口，其特征在于，该用户终端还包括：

读取模块，用于读取基站下发的配置信令，该配置信令是基站根据所述预先设置的上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集确定的；

反馈信道确定模块，用于根据所述配置想信令，使用相应的信道资源进行 ACK/NACK 反馈。

38. 如权利要求 37 所述的用户终端，其特征在于，所述读取模块还用如果确定所述上行控制信道资源集合中只包括一个信道资源元素，所述配置信令包括上行控制信道资源集合里的全部信道资源元素的信息；

则所述反馈信道确定模块还用于检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

39. 如权利要求 38 所述的用户终端，其特征在于，所述反馈信道确定模块还用于如果通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

40. 如权利要求 38 所述的用户终端，其特征在于，所述反馈信道确定模块还用于如果通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口中预定的一个天线端口使用所述上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

41. 如权利要求 37 所述的用户终端，其特征在于，所述读取模块还用如果确定所述上行控制信道资源集合中包括至少一个信道资源元素，所述配置信令包括上行控制信道资源集合里的全部信道资源元素的信息，以及基站根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，设置在 PDCCH 中的可使用资源的标识；

则所述反馈信道确定模块还用于根据 PDCCH 中的可使用资源的标识，使用相应的信道资源进行 ACK/NACK 反馈。

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42. 如权利要求 41 所述的用户终端，其特征在于，所述读取模块如果确定所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源；

则反馈信道确定模块还用于根据所述可使用资源的标识，确定进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

43. 如权利要求 41 所述的用户终端，其特征在于，所述读取模块如果确定所述可使用资源的标识标示所述两个天线端口在进行发送分集的 ACK/NACK 反馈时，其中一个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号；

则反馈信道确定模块还用于根据所述可使用资源的标识，确定进行发送分集的两个天线端口中预定的一个天线端口使用所述可使用资源的标识所述标示的信道资源编号对应的上行控制信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

44. 一种上行控制信道资源配置的系统，该系统包括基站和用户终端，其中该用户终端配置有两个天线端口，其特征在于，包括：

基站，用于分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素，并根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令；

用户终端，用于配置有两个天线端口的用户终端根据所述配置信令，使用相应的信道资源进行 ACK/NACK 反馈。

45. 如权利要求 44 所述的系统，其特征在于，包括：

所述基站还用于只分配一个 ACK/NACK 反馈可用的信道资源元素到上行控制信道资源集合中，并发送上行控制信道资源集合里的全部信道资源元素的信息到用户终端；

用户终端还用于读取基站下发的配置信令，检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

46. 如权利要求 45 所述的系统，其特征在于，包括：

所述用户终端还用于通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

47. 如权利要求 45 所述的系统，其特征在于，包括：

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所述用户终端还用于通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口中预定的一个天线端口使用所述上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

48. 如权利要求 44 所述的系统，其特征在于，包括：

所述基站还用于分配至少一个 ACK/NACK 反馈可用的信道资源元素到上行控制信道资源集合中，则所述配置信令包括上行控制信道资源集合里的全部信道资源元素的信息以及所述可使用资源的标识；以及根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，设置在 PDCCH 中的可使用资源的标识，发送到用户终端；

所述用户终端读取基站下发的配置信令，以及 PDCCH 中的可使用资源的标识，使用相应的信道资源进行 ACK/NACK 反馈。

49. 如权利要求 48 所述的系统，其特征在于，包括：

所述基站还用于确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源；

所述用户终端还用于检测待反馈的下行载波或者下行子帧的 PDCCH，根据所述可使用资源的标识，确定进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

50. 如权利要求 48 所述的系统，其特征在于，包括：

所述基站还用于确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，则所述可使用资源的标识标示所述两个天线端口在进行发送分集的 ACK/NACK 反馈时，其中一个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号；

所述用户终端还用于则检测待反馈的下行载波或者下行子帧的 PDCCH，根据所述可使用资源的标识，确定进行发送分集的两个天线端口中预定的一个天线端口使用所述可使用资源的标识所述标示的信道资源编号对应的上行控制信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

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一种上行控制信道资源配置的方法、设备及系统

技术领域

[0001] 本发明涉及无线通信技术，特别涉及一种上行控制信道资源配置的方法、设备及系统。

背景技术

[0002] 长期演进系统采用 HARQ(Hybrid Automatic Repeat reQuest；混合自动重传请求）来提高数据传输的可靠性，当下行 HARQ 功能开启后，用户终端对接收到的下行数据包进行译码，若译码正确则向基站反馈确认（ACK），若译码失败，则向基站反馈非确认（NACK），要求基站重传该数据包。 当下行持续调度业务结束后，基站向用户终端发送 SPS 资源释放指示，通知用户终端释放分配给该业务的所有资源，用户终端正确接收该指示后将向基站反馈 ACK。 用户终端需要利用上行控制信道资源在上行控制信道上发送上述 ACK/NACK 反馈信息给基站，完成 HARQ 过程。

[0003] 目前标准化工作已经基本完成的长期演进系统（Rel-8）的基本传输方案如下：FDD 系统与 TDD 分别如图 1，2 所示：对于每个工作载波，分别定义了下行信令、下行数据、上行信令和上行数据，以及彼此之间的传输关系。 其中，上行控制信令占用频带的两端，使用跳频方式传输，即在一个子帧内的两个时隙里，上行控制信令将占用不同的频段传输。

[0004] 对于动态调度的下行数据包，其 ACK/NACK 反馈信息所使用的上行控制信道资源编号，将根据承载该数据包调度信息的下行控制信道（PDCCH）所占用的 CCE(Control Channel Element）编号得到，即根据一个 CCE 编号可得到唯一个上行信道资源编号。 在 LTE Rel-8 系统中，由于上行受到单载波传输的限制，因此用户终端在每个子帧内最多只会传输一个上行控制信道，故实际使用的上行控制信道为该用户终端的下行控制信道所占用的第一个 CCE 所对应的上行控制信道。

[0005] 目前对于长期演进系统上行控制信道的研究中，提出了对配置有多个发射天线端口的用户终端，进行上行控制信道传输时，可以使用 ORTD(Orthogonal Resource Transmit Diversity 正交发射分集）的方式实现发射分集，从而提高上行控制信令传输的可靠性或容量。 所谓 ORTD，即每个天线端口对应一个上行控制信道资源，相同的信息经过由不同天线端口上的资源编号选择出的正交序列扩频后，通过相应的天线端口同时发送出去。 接收端将来自不同天线端口的信号分离出来后进行合并检测，从而得到分集增益。 图 3 为两个天线端口时，使用 ORTD 进行发射分集时，其中 s 为反馈的 ACK/NACK 信息，$\mathbf{n}_1^{PUCCH}$和$\mathbf{n}_2^{PUCCH}$分别表示两个天线端口上的两个不同的上行控制信道资源编号。 UE 将在这两个反馈信道上反馈 ACK/NACK 信息，实现 PUCCH 的发送分集。

[0006] 在 LTE Rel-8 系统中，对于一个用户终端，在待反馈的下行载波或者下行子帧上，不但存在调度该用户终端对应的 PDSCH（下行数据包）的 PDCCH，还可能同时存在调度该用户终端对应的 PUSCH（上行数据包）的 PDCCH。而该用户终端进行 ACK/NACK 反馈时可用的上行信道编号仅仅和调度该用户终端 PDSCH 的 PDCCH 的 CCE 产生对应关

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系，而调度该用户终端 PUSCH 的 PDCCH 的 CCE 并没有全部被利用上。

[0007] 在长期演进升级系统 LTE-A 中，对于配置有多个发射天线端口的用户终端，若要支持 PUCCH 的发送分集，则要给两个天线端口都配置一个上行控制信道资源，就需要对待反馈下行载波或下行子帧中该用户终端对应的控制区域 CCE 数量予以限制和 / 或下行控制信道 (PDCCH) 的 CCE 聚合等级予以限制，这将影响到 PDCCH 调度的灵活性和用户终端对 PDCCH 进行盲检的复杂度。

发明内容

[0008] 本发明实施例提供一种上行控制信道资源配置的方法、装置及系统，用于克服长期演进升级系统中，对于配置有多个发射天线端口的用户终端，若要支持 PUCCH 的发送分集，要给两个天线端口都配置一个上行控制信道资源，需要对待反馈下行载波或下行子帧中该用户终端对应的控制区域 CCE 数量予以限制和 / 或下行控制信道 (PDCCH) 的 CCE 聚合等级予以限制，从而影响到 PDCCH 调度的灵活性和用户终端对 PDCCH 进行盲检的复杂度的问题。

[0009] 一种上行控制信道资源配置的方法，当配置有两个天线的用户终端，进行上行控制信道传输时，包括 ：

[0010] 基站分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素 ；

[0011] 基站根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令 ；

[0012] 配置有两个天线端口的用户终端根据所述配置信令，使用相应的信道资源进行 ACK/NACK 反馈。

[0013] 一种上行控制信道资源配置的方法，当配置有两个天线端口的用户终端，进行上行控制信道传输时，包括 ：

[0014] 基站分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素 ；

[0015] 基站根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令，该配置信令指示用户终端使用相应的信道资源进行 ACK/NACK 反馈。

[0016] 一种上行控制信道资源配置的方法，当配置有两个天线端口的用户终端，进行上行控制信道传输时，包括 ：

[0017] 用户终端根据基站下发的配置信令，使用相应的信道资源进行 ACK/NACK 反馈，其中所述配置信令是基站根据所述预先设置的上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集确定的。

[0018] 一种基站设备，包括 ：

[0019] 集合资源分配模块，用于分配上行控制信道资源集合，该资源集合中包含 ACK/

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NACK 反馈可用的信道资源元素；

[0020] 信道资源分配模块，用于根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令，该配置信令指示用户终端使用相应的信道资源进行 ACK/NACK 反馈。

[0021] 一种用户终端，该用户终端配置有两个天线端口，该用户终端还包括：

[0022] 读取模块，用于读取基站下发的配置信令，该配置信令是基站根据所述预先设置的上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集确定的；

[0023] 反馈信道确定模块，用于根据所述配置想信令，使用相应的信道资源进行 ACK/NACK 反馈。

[0024] 一种上行控制信道资源配置的系统，该系统包括基站和用户终端，其中该用户终端配置有两个天线端口，包括：

[0025] 基站，用于分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素，并根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令；

[0026] 用户终端，用于配置有两个天线端口的用户终端根据所述配置信令，使用相应的信道资源进行 ACK/NACK 反馈。

[0027] 对于使用了发送分集的 PUCCH 传输，本发明给出方法也可以取消对用户终端对应的控制区域 CCE 数量的限制和 / 或下行控制信道（PDCCH）的 CCE 聚合等级的限制，在利用发送分集增益提高系统可靠性的同时，保证系统的灵活性并降低复杂度，而且可以很好的与 LTE Release 8 系统兼容。

附图说明

[0028] 图 1 和图 2 为现有技术中长期演进多载波系带宽分配示意图；

[0029] 图 3 和为现有技术中为两个天线端口时，使用 ORTD 进行发射分集的示意图；

[0030] 图 4 为本发明实施例一种上行控制信道资源配置的方法的流程图；

[0031] 图 5 为本发明实施例待反馈的下行载波或者下行子帧的 PDCCH 聚合等级 = 2 时，两个天线端口时使用 ORTD 进行发射分集的示意图；

[0032] 图 6 为本发明实施例待反馈的下行载波或者下行子帧的 PDCCH 聚合等级 = 1 时，两个天线端口时使用 ORTD 进行发射分集的示意图；

[0033] 图 7 为本发明实施例所提供的方法基站端处理过程的流程图；

[0034] 图 8 为本发明实施例所提供的方法终端侧处理过程的流程图；

[0035] 图 9 本发明实施一种基站设备的结构图；

[0036] 图 10 本发明实施一种用户终端设备的结构图；

[0037] 图 11 为本发明实施例一种上行控制信道资源配置的系统的结构图。

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具体实施方式

[0038] 本发明实施例一种上行控制信道资源配置的方法、设备及系统，当配置有两个天线端口的用户终端，进行上行控制信道传输时，该方法包括：基站分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素；基站根据所述上行控制信道资源集合所包含的信道资源元素情况，和/或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令；配置有两个天线端口的用户终端根据所述配置信令，使用相应的信道资源进行 ACK/NACK 反馈。

[0039] 本发明基于兼容 LTE 系统的考虑，给出一种动态指示和半静态指示相结合的上行控制信道资源配置方法。

[0040] 对于使用发送分集下的 PUCCH 传输，需要给两个天线端口分别配置上行控制信道资源，按照在待反馈下行载波或下行子帧中控制区域是否包括调度该用户终端 PUSCH 的 PDCCH，分为两种方法：

[0041] 实施例一、当待反馈下行载波或下行子帧中控制区域不包括调度该用户终端 PUSCH 的 PDCCH 时，且给用户终端分配的上行控制信道资源集合中至少包括一个元素，该方法具体包括，如图 4 所示：

[0042] 步骤 401，系统中，高层半静态的给用户终端固定分配一个上行控制信道资源集合；

[0043] 所述上行控制信道资源集合里面的资源性质是半持续的资源，并可通过信令配置该上行控制信道资源集合中的资源。

[0044] 该集合里有 N ＞＝ 1 个元素，对应 N 个 ACK/NACK 反馈可用的信道资源编号。该集合中的信道资源元素可以被多个用户终端共享，基站通过调度限制使用了同一个信道资源的用户终端分时反馈，从而避免信道资源碰撞问题。

[0045] 步骤 402，基站根据所述上行控制信道资源集合所包含的信道资源元素情况，和待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令；

[0046] 其中，下发配置信令的具体方法，可以是：

[0047] 基站下发所述上行控制信道资源集合里的全部信道资源元素的信息，并根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，在 PDCCH 中设置可使用资源的标识；该可使用资源的标识用于标示所述用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该信道资源集合中的信道资源元素的使用情况。

[0048] 其中，所述可使用资源的标识包括两种情况，其中具体包括：

[0049] 情况一、如果在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集（即待反馈的下行载波或者下行子帧中调度该用户终端 PDSCH 的 PDCCH 的 CCE 聚合等级大于等于 2），则两个天线端口进行 ACK/NACK 反馈所使用的信道资源编号都根据该聚合等级大于等于 2 的 PDCCH 的 CCE 获得。此时不需要利用高层分配的上行控制信道资源集合中的任何一个元素；基站利用 PDCCH 告知用户终端不使用高层

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分配的集合中的信道资源元素（即所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源）。

[0050] 情况二、如果在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，即待反馈的下行载波或者下行子帧中调度该用户终端 PDSCH 的 PDCCH 的 CCE 聚合等级小于 2，这时第一个天线端口使用的反馈信道仍然使用该 PDCCH CCE 对应的信道资源（即重用 Rel-8 的方示），而另一个天线端口所使用的反馈信道则需要在高层分配的上行控制信道资源集合中选择一个反馈信道资源元素。基站利用 PDCCH 告知用户终端在该集合中具体使用的资源元素编号。

[0051] 步骤 403，用户终端读取基站下发的配置信令，并检测待反馈下行载波或者下行子帧的 PDCCH，根据 PDCCH 中的可用资源的标识，确定是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

[0052] 另外，在步骤 402 中，基站利用 PDCCH 告知用户终端在该集合中具体使用的资源元素编号的具体方法包括：

[0053] 在 PDCCH 中增加标示所述用户终端在进行两个天线端口发送分集的 ACK/NACK 反馈时，其中一个天线端口使用上行控制信道资源集合中的信道资源的可用资源的标识。

[0054] 在所述 PDCCH 信令中增加信令标识的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将所述 N+1 个信令状态与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示所述 N+1 个元素的信令状态；

[0055] 上述上行控制信道资源集合里有 N ＞＝ 1 个元素，该 PDCCH 信令通知的方法（即在 PDCCH 中增加可用资源的标识的方法）既可以是为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将所述 N+1 个信令状态与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示所述 N+1 个元素的信令状态。

[0056] 其中，该信令 N+1 个状态中，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示用户终端在进行两个天线端口发送分集的 ACK/NACK 反馈时，两个天线端口都不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

[0057] 如图 5 所示，待反馈的下行载波或者下行子帧的 PDCCH 聚合等级＝ 2，于是存在两个 CCE 分别对应了两个上行控制信道资源n_1^{PUCCH}和n_2^{PUCCH}，这表示待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集。这时基站使用 PDCCH 告知用户终端不使用高层分配的上行控制信道资源集合中的资源作为反馈信道。例如，如果为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，N ＝ 7 时，则可以使用 “000” 来告知用户终端该下行载波上 PDSCH 的 ACK/NACK 反馈不使用高层分配的资源集合中的资源作为承载反馈信息的反馈信道。这时用

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户终端则利用 PDCCH 的两个 CCE 对应的控制信道资源n_1^{PUCCH}和n_2^{PUCCH}作为 ACK/NACK 的反馈信道。

[0058] 如图 6 所示，待反馈的下行载波或者下行子帧的 PDCCH 聚合等级＝ 1，于是只有一个 CCE 对应了一个天线端口上的信道资源n_1^{PUCCH}，这表示待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集。 这时另一个天线端口上的信道资源则需要来自于高层分配给该用户终端的信道资源集合。 基站在该集合的全部元素里分配一个资源编号给该用户终端另一个天线端口，如$n_{X_1}^{PUCCH}$，并且使用 PDCCH 告知用户终端使用了$n_{X_1}^{PUCCH}$。例如，如果为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令， N ＝ 7 时，则可以使用 “001” 来告知用户终端该下行载波上 PDSCH 的 ACK/NACK 反馈使用高层分配的资源集合中的第一个信道资源作为承载反馈信息的反馈信道。

[0059] 根据实施例一所述的方法，当所述上行控制信道资源集合只包括一个元素时，该方法步骤 402 和步骤 403 对应的处理流程为 ：

[0060] 步骤 402，向用户终端下发配置信令基站根据所述上行控制信道资源集合所包含的信道资源元素情况 ；

[0061] 步骤 403，用户终端读取基站下发的配置信令，检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

[0062] 该步骤结构有两种情况，具体包括 ：

[0063] 情况一、用户终端读取基站下发的配置信令，检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

[0064] 情况二、基站侧如果检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则确定从待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源接收用户终端两个天线端口的 ACK/NACK 反馈 ；

[0065] 如果用户终端通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0066] 情况二、基站侧如果检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行

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子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则确定从上行控制信道资源集合中的信道资源和待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源接收用户终端两个天线端口的 ACK/NACK 反馈；

[0067] 如果用户终端通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口中预定的一个天线端口使用所述上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0068] 根据上述方法，具体的基站和用户终端处理过程为：

[0069] 如图 7 所示，应用本发明实施例一所提供的方法，当所述上行控制信道资源集合中包括多个元素时，基站端处理过程具体包括：

[0070] 步骤 701，通过高层 RRC 信令固定给用户终端分配一个上行控制信道资源集合，该集合里有 N ＞＝ 1 个元素，对应 N 个 ACK/NACK 反馈可用的信道资源。 该集合中的元素可以被多个用户终端共享，基站通过调度限制使用了同一个信道资源的用户终端分时反馈，从而避免信道资源碰撞问题。

[0071] 所述上行控制信道资源集合里面的资源性质是半持续的资源，并通过信令配置该上行控制信道资源集合中的资源。

[0072] 步骤 702，判断在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据判定结果在 PDCCH 中增加可用资源的标识，该可用资源的标识用于标示用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及进行 ACK/NACK 反馈时所使用所述信道资源的信道资源编号。

[0073] 其中，设置可使用资源的标识的具体情况包括：

[0074] 情况一、在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，即待反馈的下行载波或者下行子帧中调度该用户终端 PDSCH 的 PDCCH 的 CCE 聚合等级大于等于 2。 这时则基站使用 PDCCH 告知用户终端不使用高层分配的上行控制信道资源集合中的资源作为反馈信道。 该 PDCCH 信令通知的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将所述 N+1 个信令状态与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示所述 N+1 个元素的信令状态。 如果为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，可以将$\lceil \log_2(N+1) \rceil$比特置为全零，表示不使用高层分配的资源集合中的元素。

[0075] 情况二、在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，即待反馈的下行载波或者下行子帧中调度该用户终端 PDSCH 的 PDCCH 的 CCE 聚合等级小于 2。这时则基站在给该用户分配的上行控制信道资源集合中选择一个元

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素作为其中一个天线端口 ACK/NACK 反馈所使用的反馈信道，并且利用 PDCCH 的信令指示给用户终端该资源元素编号。 该 PDCCH 信令通知的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将所述 N+1 个信令状态与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示所述 N+1 个元素的信令状态。 如果为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，则基站利用这$\lceil \log_2(N+1) \rceil$比特指示选用的信道资源元素编号（编号从 1 开始），例如 N = 7 时，则可以使用 “001” 来告知用户终端该下行载波上 PDSCH 的 ACK/NACK 反馈使用高层分配的资源集合中的第一个信道资源作为承载反馈信息的反馈信道。

[0076] 另外，如果所述上行控制信道资源集合只包括一个元素时，基站向所述用户终端下发的配置信令包括：上行控制信道资源集合里的全部信道资源元素的信息。

[0077] 则用户终端自身检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

[0078] 如图 8 所示，应用本发明实施例一所提供的方法，其中当上行控制信道资源集合包括至少一个信道资源元素时，用户终端处理过程具体包括：

[0079] 步骤 801：读取高层配置信令，获知上行控制信道资源集合；

[0080] 步骤 802：检测待反馈下行载波或者下行子帧的 PDCCH，确定是否使用上行控制信道资源集合中的元素；

[0081] 如果为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，当用户终端检测到了全零比特状态，则表示不需要使用高层分配的资源集合中的元素作为反馈信道。 而如果检测到了其他比特状态，则表示需要使用高层分配的资源集合中的元素作为反馈信道。 用户终端根据检测到的 PDCCH，判断以下两种情况：

[0082] 不使用上行控制信道资源集合中的元素。 用户终端则根据该待反馈的下行载波或下行子帧中 PDCCH 的预先约定的两个 CCE 的指示，获取两个天线端口 ACK/NACK 反馈所使用的反馈信道资源编号；

[0083] 使用上行控制信道资源集合中的元素，则根据 PDCCH 的指示，获取其中一个天线端口 ACK/NACK 反馈所使用的信道资源编号（该编号在上行控制信道资源集合的范围内）；而另一个天线端口对应的反馈信道将由该待反馈的下行载波或下行子帧中 PDCCH 预先预定的一个 CCE 来确定。

[0084] 步骤 803：接收 PDSCH，译码后得到 ACK/NACK 反馈信息

[0085] 步骤 804：在步骤 802 中确定的信道资源上利用两个天线端口发送步骤 3 得到的 ACK/NACK 反馈信息。

[0086] 另外，当所述上行控制信道资源集合中只包括一个元素时，该方法的用户终端处理流程包括：

[0087] 当所述上行控制信道资源集合中只包括一个元素时，基站只是将上行控制信道资源集合里的全部信道资源元素的信息下发给用户终端，不需要指示用户终端进行反馈

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的信道资源的具体情况，所示：

[0088] 用户终端读取基站下发的配置信令，检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

[0089] 其中，用户终端自身判定反馈所使用信道资源的具体情况包括：

[0090] 情况一、用户终端如果通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0091] 情况二、如果用户终端通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口中预定的一个天线端口使用所述上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0092] 实施例二、当待反馈下行载波或下行子帧中控制区域包括调度该用户终端 PUSCH 的 PDCCH 时，该方法具体包括：

[0093] 系统中，高层半静态的给用户终端固定分配一个上行控制信道资源集合，该集合里有 N ＞＝ 1 个元素，对应 N 个 ACK/NACK 反馈可用的信道资源编号。该集合中的信道资源元素可以被多个用户终端共享，基站通过调度限制使用了同一个信道资源的用户终端分时反馈，从而避免信道资源碰撞问题。

[0094] 如果在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，即待反馈的下行载波或者下行子帧中该用户终端所对应的 CCE 数量大于等于 2，这些 CCE 不但包括调度该用户终端 PDSCH 的 PDCCH 中的 CCE 还包括调度该用户终端 PUSCH 的 PDCCH 中的 CCE。这时则两个天线端口进行 ACK/NACK 反馈所使用的信道资源编号都根据该用户终端对应的 CCE 获得。此时不需要利用高层分配的上行控制信道资源集合中的任何一个元素；基站利用 PDCCH 告知用户终端不使用高层分配的集合中的信道资源元素。该 PDCCH 信令通知的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新增加 $\lceil \log_2 (N+1) \rceil$ 比特的信令，也可以是将所述 N+1 个信令状态与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示所述 N+1 个元素的信令状态。

[0095] 其中，该信令 N+1 个状态中，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示用户终端在进行两个天线端口发送分集的 ACK/NACK 反馈时，两个天线端口都不使用上行控制信

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道资源集合中的信道资源进行 ACK/NACK 反馈。

[0096] 如果在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，即待反馈的下行载波或者下行子帧中该用户终端所对应的 CCE 数量小于 2，这些 CCE 不但包括调度该用户终端 PDSCH 的 PDCCH 中的 CCE 还包括调度该用户终端 PUSCH 的 PDCCH 中的 CCE，这时第一个天线端口使用的反馈信道仍然根据该用户终端对应的 CCE 获得，而另一个天线端口所使用的反馈信道则需要在高层分配的上行控制信道资源集合中选择一个反馈信道资源元素。 基站利用 PDCCH 告知用户终端在该集合中具体使用的资源元素编号。 该 PDCCH 信令通知的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将所述 N+1 个信令状态与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示所述 N+1 个元素的信令状态。

[0097] 根据实施例二所述的方法，基站端处理过程具体包括 ：

[0098] 步骤 1. 通过高层 RRC 信令固定给用户终端分配一个上行控制信道资源集合，该集合里有 N ＞＝ 1 个元素，对应 N 个 ACK/NACK 反馈可用的信道资源。 该集合中的元素可以被多个用户终端共享，基站通过调度限制使用了同一个信道资源的用户终端分时反馈，从而避免信道资源碰撞问题。

[0099] 步骤 2. 判断在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据判定结果在 PDCCH 中增加可用资源的标识 ；

[0100] 在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，即待反馈的下行载波或者下行子帧中该用户终端所对应的 CCE 数量大于等于 2（这些 CCE 不但包括调度该用户终端 PDSCH 的 PDCCH 中的 CCE 还包括调度该用户终端 PUSCH 的 PDCCH 中的 CCE）。 这时则基站使用 PDCCH 告知用户终端不使用高层分配的上行控制信道资源集合中的资源作为反馈信道。 该 PDCCH 信令通知的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将所述 N+1 个信令状态与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示所述 N+1 个元素的信令状态。 如果为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，可以将$\lceil \log_2(N+1) \rceil$比特置为全零，表示不使用高层分配的资源集合中的元素。

[0101] 在进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，即待反馈的下行载波或者下行子帧中该用户终端所对应的 CCE 数量小于 2（这些 CCE 不但包括调度该用户终端 PDSCH 的 PDCCH 中的 CCE 还包括调度该用户终端 PUSCH 的 PDCCH 中的 CCE）。 这时则基站在给该用户分配的上行控制信道资源集合中选择一个元素作为其中一个天线端口 ACK/NACK 反馈所使用的反馈信道，并且利用 PDCCH 的信令指示给用户终端该资源元素编号。 该 PDCCH 信令通知的方法既可以是为所有的 PDCCH

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上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将所述 N+1 个信令状态与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示所述 N+1 个元素的信令状态。 如果为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，则基站利用这$\lceil \log_2(N+1) \rceil$比特指示选用的信道资源元素编号（编号从 1 开始），例如 N = 7 时，则可以使用“001”来告知用户终端该下行载波上 PDSCH 的 ACK/NACK 反馈使用高层分配的资源集合中的第一个信道资源作为承载反馈信息的反馈信道 .

[0102] 根据实施例二所述的方法，用户终端处理过程具体包括：

[0103] 步骤 1：读取高层配置信令，获知上行控制信道资源集合；

[0104] 步骤 2：检测待反馈下行载波或者下行子帧的 PDCCH，确定是否使用上行控制信道资源集合中的元素；例如：如果为所有的 PDCCH 上承载的 DCI 格式新增加$\lceil \log_2(N+1) \rceil$比特的信令，当用户终端检测到了全零比特状态，则表示不需要使用高层分配的资源集合中的元素作为反馈信道。 而如果检测到了其他比特状态，则表示需要使用高层分配的资源集合中的元素作为反馈信道。 用户终端根据检测到的 PDCCH，判断以下两种情况：

[0105] 情况 1：不使用上行控制信道资源集合中的元素。 这时用户终端则根据该待反馈的下行载波或下行子帧中该用户终端预先约定的两个 CCE（不但包括调度该用户终端 PDSCH 的 PDCCH 中的 CCE 还包括调度该用户终端 PUSCH 的 PDCCH 中的 CCE）的指示，获取两个天线端口 ACK/NACK 反馈所使用的反馈信道资源编号；

[0106] 情况 2：使用上行控制信道资源集合中的元素。 这时则根据 PDCCH 的指示，获取其中一个天线端口 ACK/NACK 反馈所使用的信道资源编号（该编号在上行控制信道资源集合的范围内）；而另一个天线端口对应的反馈信道将由该待反馈的下行载波或下行子帧中该用户终端预先约定的一个 CCE（不但包括调度该用户终端 PDSCH 的 PDCCH 中的 CCE 还包括调度该用户终端 PUSCH 的 PDCCH 中的 CCE）的指示来确定。

[0107] 步骤 3：接收 PDSCH，译码后得到 ACK/NACK 反馈信息

[0108] 步骤 4：在步骤 2 中确定的信道资源上利用两个天线端口发送步骤 3 得到的 ACK/NACK 反馈信息。

[0109] 上述实施例二所述的方法，也存在上行控制信道资源集合的元素个数只有一个和至少一个的两种情况，该实施例中的用户终端和基站的处理流程与实施例一的完全相同，所以在此不再重复描述。

[0110] 如图 9 所示，本发明实施例提供一种基站设备，包括：

[0111] 集合资源分配模块 901，用于分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素；

[0112] 该集合资源分配模块 901，用于根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令，该配置信令指示用户终端使用相应的信道资源进行 ACK/NACK 反馈。

[0113] 情况一、所述集合资源分配模块还用于只分配一个 ACK/NACK 反馈可用的信道资源元素到上行控制信道资源集合中。

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[0114] 情况二、所述集合资源分配模块 901 还用于分配至少一个 ACK/NACK 反馈可用的信道资源元素到上行控制信道资源集合中；则

[0115] 所述信道资源分配模块 902 还用于下发所述下行控制信道资源集合里的全部信道资源元素的信息，并根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，在 PDCCH 中设置可使用资源的标识；该可使用资源的标识用于标示所述用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该信道资源集合中的信道资源元素的使用情况。

[0116] 在该情况下，所述信道资源分配模块 902 还用于如果确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源。

[0117] 该信道资源分配模块 902 还用于如果确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不足够两个天线端口进行发送分集，则所述可使用资源的标识标示所述两个天线端口在进行发送分集的 ACK/NACK 反馈时，其中一个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号

[0118] 如图 10 所示，本发明实施例还提供一种用户终端，该用户终端配置有多个天线端口，包括：

[0119] 读取模块 1001，用于读取基站下发的配置信令，该配置信令是基站根据所述预先设置的上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集确定的；

[0120] 反馈信道确定模块 1002，用于根据所述配置想信令，使用相应的信道资源进行 ACK/NACK 反馈。

[0121] 情况一、当所述上行控制信道资源集合中只包括一个元素时，该装置的读取模块 1001 和反馈信道确定模块 1002 还用于：

[0122] 所述读取模块 1001 还用如果确定所述上行控制信道资源集合中只包括一个信道资源元素，所述配置信令包括上行控制信道资源集合里的全部信道资源元素的信息；

[0123] 则所述反馈信道确定模块 1002 还用于检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈。

[0124] 其中，具体包括：所述反馈信道确定模块 1002 还用于如果通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口都使用所述待反馈下行

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载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0125] 所述反馈信道确定模块 1002 还用于如果通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口中预定的一个天线端口使用所述上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0126] 当所述上行控制信道资源集合中包括多个信道资源元素时，该装置的读取模块 1001 和反馈信道确定模块 1002 还用于 ：

[0127] 所述读取模块 1001 还用如果确定所述上行控制信道资源集合中包括至少一个信道资源元素，所述配置信令包括上行控制信道资源集合里的全部信道资源元素的信息，以及基站根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，设置在 PDCCH 中的可使用资源的标识 ；

[0128] 则所述反馈信道确定模块 1002 还用于根据 PDCCH 中的可使用资源的标识，使用相应的信道资源进行 ACK/NACK 反馈。

[0129] 其中，具体包括所述读取模块 1001 如果确定所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资源 ；

[0130] 则反馈信道确定模块 1002 还用于根据所述可使用资源的标识，确定进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0131] 所述读取模块 1001 如果确定所述可使用资源的标识标示所述两个天线端口在进行发送分集的 ACK/NACK 反馈时，其中一个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号 ；

[0132] 则反馈信道确定模块 1002 还用于根据所述可使用资源的标识，确定进行发送分集的两个天线端口中预定的一个天线端口使用所述可使用资源的标识所述标示的信道资源编号对应的上行控制信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0133] 如图 11 所示，本发明实施例还提供一种上行控制信道资源配置的系统，该系统包括基站 1101 和用户终端 1102，其中该用户终端 1102 配置有多个天线端口，包括 ：

[0134] 基站 1101，用于分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源元素，并根据所述上行控制信道资源集合所包含的信道资源元素情况，和 / 或待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，向用户终端下发配置信令 ；

[0135] 用户终端 1102，用于配置有两个天线端口的用户终端根据所述配置信令，使用

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相应的信道资源进行 ACK/NACK 反馈。

[0136] 其中，所述基站 1101 还用于只分配一个 ACK/NACK 反馈可用的信道资源元素到上行控制信道资源集合中，并发送上行控制信道资源集合里的全部信道资源元素的信息到用户终端；则

[0137] 所述用户终端 1102 还用于读取基站下发的配置信令，检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否足够两个天线端口进行发送分集，并根据检测结果确定是否使用所述上行控制信道资源集合中信道资源进行 ACK/NACK 反馈通过检测下行控制区域，确定待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能够满足两个天线端口进行发送分集，则确定所述预定的天线端口使用上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈的反馈信道。

[0138] 进一步，所述用户终端还用于，包括：

[0139] 所述用户终端 1102 还用于通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0140] 所述用户终端 1102 还用于通过检测待反馈的下行载波或者下行子帧的控制区域，确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源不能足够两个天线端口进行发送分集，则 UE 进行发送分集的两个天线端口中预定的一个天线端口使用所述上行控制信道资源集合中的信道资源作为 ACK/NACK 反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域 CCE 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0141] 另外，当所述上行控制信道资源集合中的元素包括至少一个时，该基站 1101 和用户终端 1102 还用于：

[0142] 所述基站 1101 还用于分配至少一个 ACK/NACK 反馈可用的信道资源元素到上行控制信道资源集合中，则所述配置信令包括上行控制信道资源集合里的全部信道资源元素的信息以及所述可使用资源的标识；以及根据待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源是否能够满足全部天线端口进行发送分集，设置在 PDCCH 中的可使用资源的标识，发送到用户终端；

[0143] 所述用户终端 1102 还用读取基站下发的配置信令，以及 PDCCH 中的可使用资源的标识，使用相应的信道资源进行 ACK/NACK 反馈。

[0144] 进一步，实现包括：

[0145] 其中，所述基站 1101 还用于确定进行发送分集 ACK/NACK 反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域 CCE 对应的上行控制信道资源足够两个天线端口进行发送分集，则所述可使用资源的标识标示用户终端在进行发送分集的 ACK/NACK 反馈时，所述两个天线端口都不使用上行控制信道资源集合中的信道资

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源；

[0146] 则所述用户终端1102还用于检测待反馈的下行载波或者下行子帧的PDCCH，根据所述可使用资源的标识，确定进行发送分集的两个天线端口都使用所述待反馈下行载波上或者下行子帧上控制区域CCE对应的上行控制资源作为ACK/NACK反馈所使用的反馈信道。

[0147] 另外，所述基站1101还用于确定进行发送分集ACK/NACK反馈的上行载波或者上行子帧上，待反馈的下行载波或者下行子帧控制区域CCE对应的上行控制信道资源不足够两个天线端口进行发送分集，则所述可使用资源的标识标示所述两个天线端口在进行发送分集的ACK/NACK反馈时，其中一个预定的天线端口使用上行控制信道资源集合中的信道资源，并且所述可使用资源的标识还用于标示所述那一个预定的天线端口在所述上行控制信道资源集合中使用的信道资源编号；

[0148] 所述用户终端1102还用于则检测待反馈的下行载波或者下行子帧的PDCCH，根据所述可使用资源的标识，确定进行发送分集的两个天线端口中预定的一个天线端口使用所述可使用资源的标识所述标示的信道资源编号对应的上行控制信道资源作为ACK/NACK反馈所使用的反馈信道，另一个天线端口使用所述待反馈下行载波上或者下行子帧上控制区域CCE对应的上行控制资源作为ACK/NACK反馈所使用的反馈信道。

[0149] 本发明给出了一种动态和半静态结合的资源分配方式，方法简单、易于实施，同时适用于FDD及TDD系统。对于使用了发送分集的PUCCH传输，本发明给出方法也可以取消对用户终端对应的控制区域CCE数量的限制和/或下行控制信道(PDCCH)的CCE聚合等级的限制，在利用发送分集增益提高系统可靠性的同时，保证系统的灵活性并降低复杂度，而且可以很好的与LTERelease 8系统兼容。

[0150] 显然，本领域的技术人员可以对本发明进行各种改动和变型而不脱离本发明的精神和范围。这样，倘若本发明的这些修改和变型属于本发明权利要求及其等同技术的范围之内，则本发明也意图包含这些改动和变型在内。

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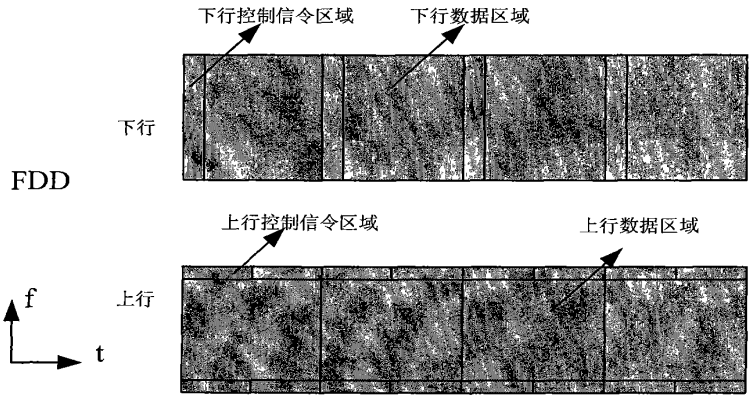


图 1

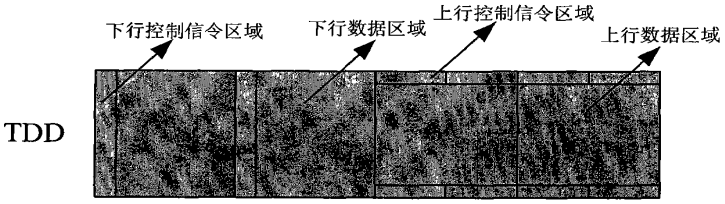


图 2

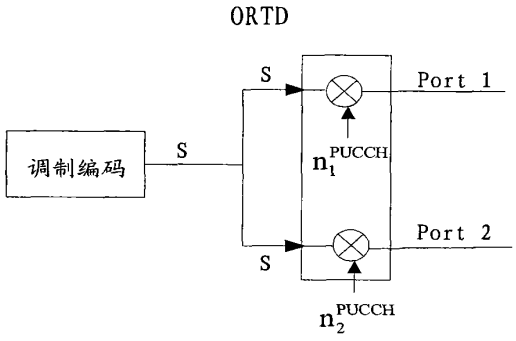


图 3

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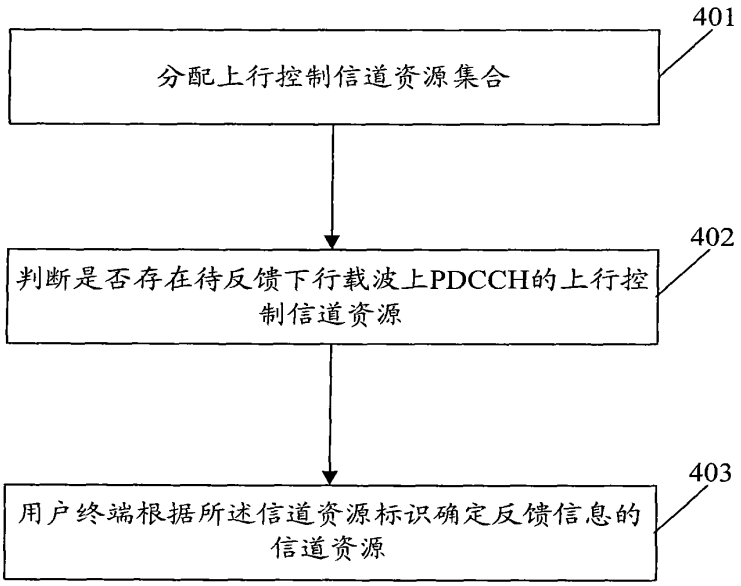


图 4

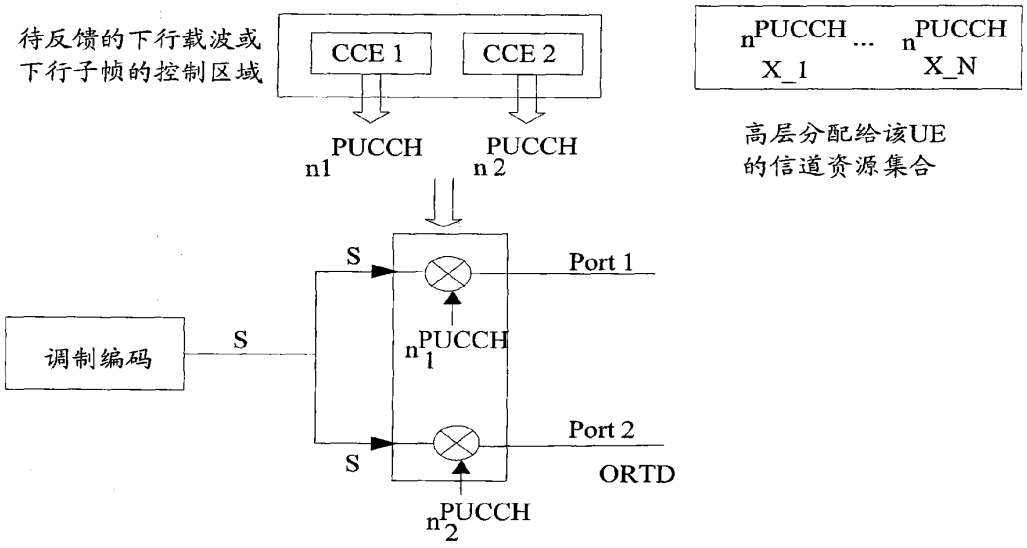


图 5

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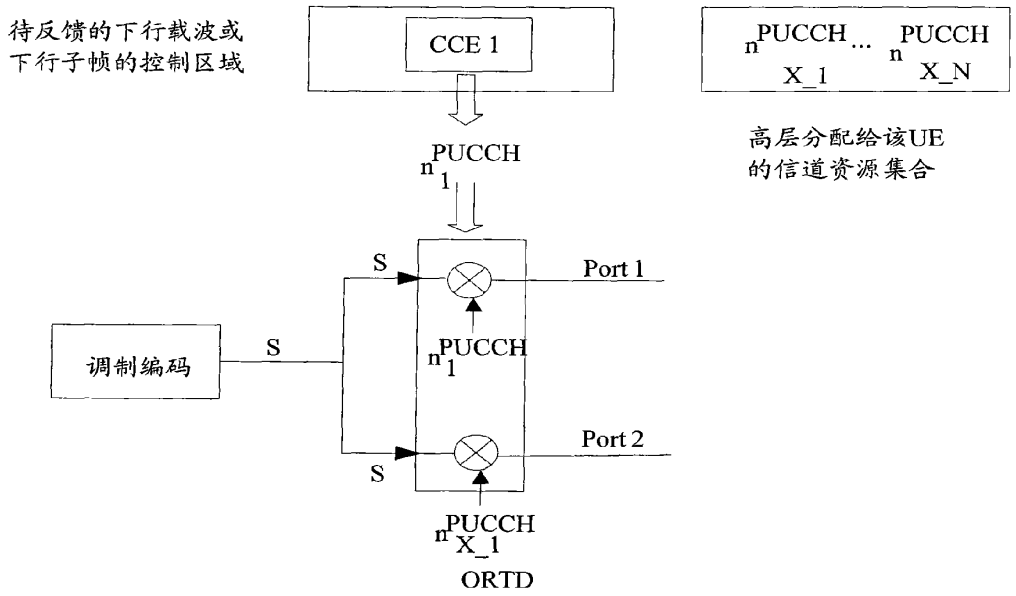


图 6

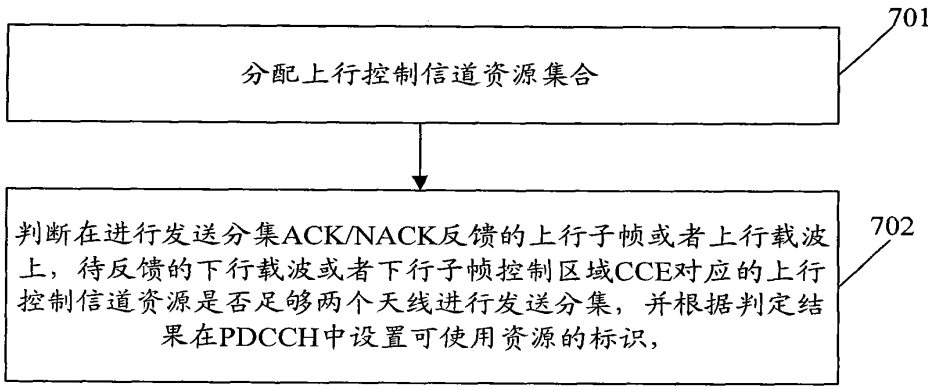


图 7

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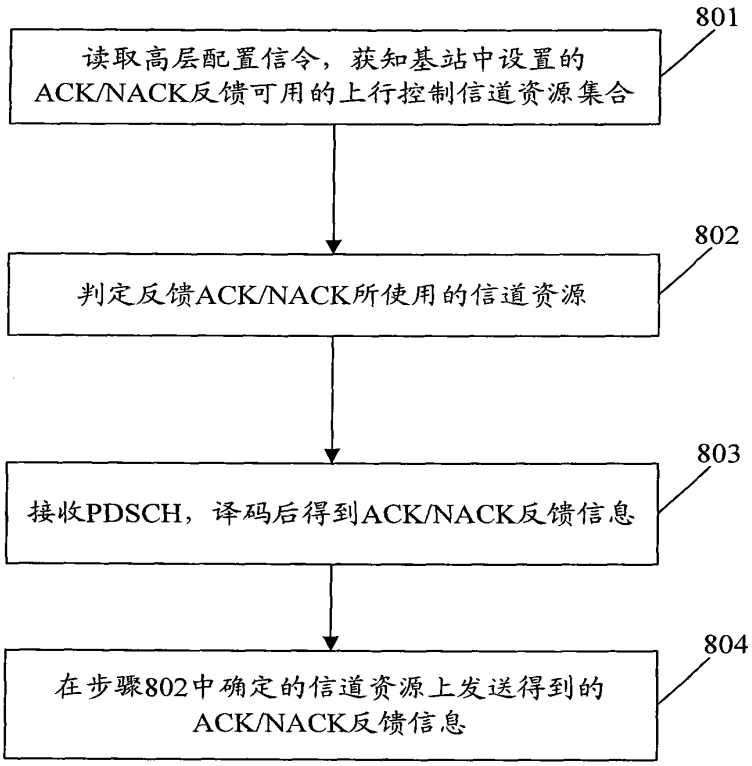


图 8

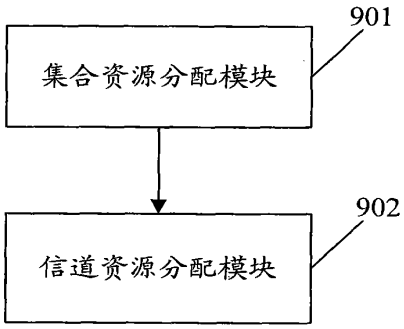


图 9

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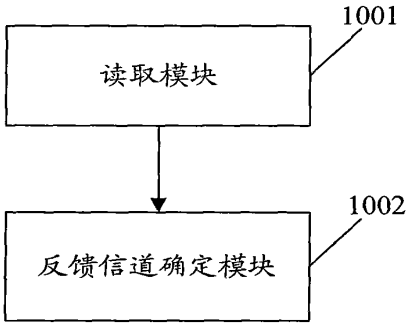


图 10

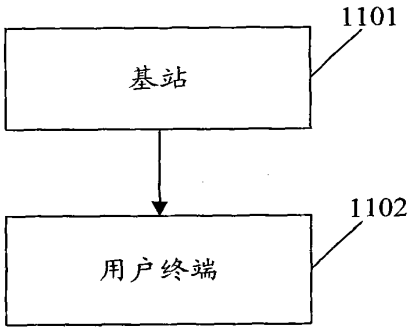


图 11

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Espacenet

Bibliographic data: CN102088341 (A) — 2011-06-08

Transmitting method and transmitting device of feedback information

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Applicant(s): DATANG MOBILE COMM EQUIP CO ± (DATANG MOBILE COMMUNICATIONS EQUIPMENT CO., LTD, ; CHINA ACADEMY OF TELECOMMUNICATIONS TECHNOLOGY)

Classification: **- international:** ***H04L1/16***
- cooperative:

Application number: CN200910242099 20091204

Priority number(s): CN200910242099 20091204

Also published as: CN102088341 (B)

Abstract of CN102088341 (A)

The embodiment of the invention provides a transmitting method of feedback information. The method comprises the following steps that: user equipment (UE) determines that a base station is an uplink control channel resource set configured for the UE in a semi-static state; the UE is used for receiving all uplink control channel resources and downlink data in a feedback window and determining actual feedback information according to a composite feedback state consisting of M pieces of feedback information and a mapping table; and the UE is used for transmitting the actual feedback information to the base station through a selected feedback uplink control channel resource. In the technical scheme provided by the embodiment of the invention, a supportable maximum acknowledgement (ACK)/negative acknowledgement (NACK) feedback volume can be effectively increased, higher data transmission rate can be met, and system utilization ratio is increased. In the scheme provided by the invention, the conventional system is slightly modified, the compatibility of a system cannot be influenced, and the method is implemented easily and efficiently.

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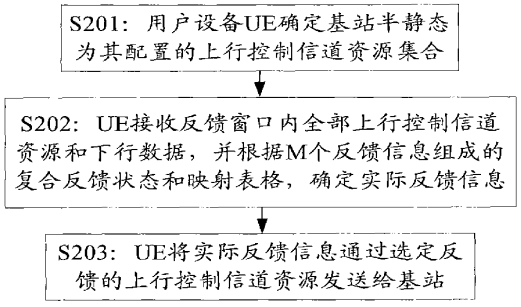
权利要求书 4 页 说明书 20 页 附图 3 页

(54)发明名称

一种反馈信息的传输方法及传输装置

(57)摘要

本发明的实施例提出了一种反馈信息的传输方法，包括：用户设备 UE 确定基站半静态为其配置的上行控制信道资源集合；UE 接收反馈窗口内全部上行控制信道资源和下行数据，并根据 M 个反馈信息组成的复合反馈状态和映射表格，确定实际反馈信息；UE 将实际反馈信息通过选定反馈的上行控制信道资源发送给基站。本发明的实施例提出的技术方案，可支持的最大 ACK/NACK 反馈容量能够有效增大，可以满足更高的数据传输率，提高系统利用率。本发明提出的上述方案，对现有系统的改动很小，不会影响系统的兼容性，而且实现简单、高效。



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1. 一种反馈信息的传输方法，其特征在于，包括以下步骤：

用户设备 UE 接收高层信令，获取基站半静态的给所述用户配置的上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；

所述 UE 接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据，对下行数据译码后得到 M 个反馈信息，并由所述 M 个反馈信息组成一个复合反馈状态，根据映射表格和复合反馈状态，确定实际反馈信息；

当反馈窗口长度 M ＞ L 时，所述 UE 根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限。

2. 如权利要求 1 所述的反馈信息的传输方法，其特征在于，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

3. 如权利要求 2 所述的反馈信息的传输方法，其特征在于，当 M ＞ L 时，所述根据映射表格和复合反馈状态包括：

当反馈窗口内被调度上的下行数据包数量大于预定门限，即复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 的数量大于预定门限时，所述选定反馈的上行控制信道资源为所述 UE 通过接收高层信令获取的半静态配置的上行控制信道资源。

4. 如权利要求 2 所述的反馈信息的传输方法，其特征在于，所述根据映射表格和复合反馈状态包括：

所述选定反馈的上行控制信道资源为复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 对应的上行控制信道资源。

5. 如权利要求 2 所述的反馈信息的传输方法，其特征在于，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系包括：

所述集合 K 的大小由反馈窗口长度 M、L、ACK/NACK 的检测门限、小区内进行 ACK/NACK 反馈的 UE 数量以及实际反馈信息的调制方式决定。

6. 如权利要求 5 所述的反馈信息的传输方法，其特征在于，当 M ＝ 5，且反馈信息的调制方式为 QPSK 调制时，所述 K 取值为 4、3、2 或 1。

7. 一种反馈信息的传输方法，其特征在于，包括以下步骤：

基站半静态的给用户设备 UE 配置一个上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，并通过高层信令通知所述 UE 所述集合内具体的上行控制信道资源，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；

所述基站接收所述 UE 发送的反馈信息，对所有上行控制信道资源进行检测，获取所述 UE 选定反馈的上行控制信道资源，并对所述选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息；

所述基站根据所述 UE 选定反馈的上行控制信道资源和实际反馈信息，根据映射表格，

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获取所述 UE 反馈的具体 M 个反馈信息。

8. 如权利要求 7 所述的反馈信息的传输方法，其特征在于，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

9. 如权利要求 8 所述的反馈信息的传输方法，其特征在于，所述上行控制信道资源集合中的上行控制信道资源元素可以被多个 UE 共享，基站通过调度限制使用了同一个上行控制信道资源的 UE 分时反馈，从而避免信道资源碰撞问题。

10. 如权利要求 8 所述的反馈信息的传输方法，其特征在于，当 M ＞ L 时，所述基站接收所述 UE 发送的反馈信息，对所有上行控制信道资源进行检测，其中所述所有上行控制信道资源包括反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源。

11. 如权利要求 8 所述的反馈信息的传输方法，其特征在于，当 M ＞ L 时，所述映射表格内的映射关系包括：

当反馈窗口内被调度上的下行数据包数量大于预定门限，即复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 的数量大于预定门限时，所述选定反馈的上行控制信道资源为所述 UE 通过接收高层信令获取的半静态配置的上行控制信道资源。

12. 如权利要求 8 所述的反馈信息的传输方法，其特征在于，所述映射表格内的映射关系包括：

所述选定反馈的上行控制信道资源为复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 对应的上行控制信道资源。

13. 如权利要求 8 所述的反馈信息的传输方法，其特征在于，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系包括：

所述集合 K 的大小由反馈窗口长度 M、L、ACK/NACK 的检测门限、小区内进行 ACK/NACK 反馈的 UE 数量以及实际反馈信息的调制方式决定。

14. 如权利要求 13 所述的反馈信息的传输方法，其特征在于，当 M ＝ 5，且反馈信息的调制方式为 QPSK 调制时，所述 K 取值为 4、3、2 或 1。

15. 一种反馈信息的传输系统，其特征在于，包括基站和至少一个用户设备 UE，

所述基站，用于半静态的给用户设备 UE 配置一个上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，并通过高层信令通知所述 UE 所述集合内具体的上行控制信道资源，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；以及用于对所有上行控制信道资源进行检测，获取所述 UE 选定反馈的上行控制信道资源，并对所述选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息；并根据所述 UE 选定反馈的上行控制信道资源和实际反馈信息，根据映射表格，获取所述 UE 反馈的具体 M 个反馈信息；

所述用户设备 UE，用于接收所述基站发送的高层信令，获取基站半静态的给所述用户配置的上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；以及用于接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据，对下行数据译码后得到 M 个反馈信息，并由所述 M 个反馈信息组成一个复合反馈状态；以及用于

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根据映射表格和复合反馈状态，确定实际反馈信息；以及用于当反馈窗口长度 M ＞ L 时，根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限；以及用于将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站。

16. 一种用户设备 UE，其特征在于，包括接收模块、选择模块以及发送模块，

所述接收模块，用于接收高层信令，获取基站半静态的给所述用户配置的上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系，以及用于接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据；对下行数据译码后得到 M 个反馈信息，并由所述 M 个反馈信息组成一个复合反馈状态；

所述选择模块，用于根据映射表格和复合反馈状态，确定实际反馈信息；以及用于当反馈窗口长度 M ＞ L 时，根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限；

所述发送模块，用于将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站。

17. 如权利要求 16 所述的用户设备 UE，其特征在于，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

18. 如权利要求 17 所述的用户设备 UE，其特征在于，当 M ＞ L 时，所述选择模块根据映射表格和复合反馈状态包括：

当反馈窗口内被调度上的下行数据包数量大于预定门限，即复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 的数量大于预定门限时，所述选定反馈的上行控制信道资源为所述 UE 通过接收高层信令获取的半静态配置的上行控制信道资源。

19. 如权利要求 17 所述的用户设备 UE，其特征在于，所述选择模块根据映射表格和复合反馈状态包括：

所述选定反馈的上行控制信道资源为复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 对应的上行控制信道资源。

20. 一种基站，其特征在于，包括资源配置模块、检测模块以及判断模块，

所述资源配置模块，用于半静态的给用户设备 UE 配置一个上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，并通过高层信令通知所述 UE 所述集合内具体的上行控制信道资源，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；

所述检测模块，用于对所有上行控制信道资源进行检测，获取所述 UE 选定反馈的上行控制信道资源，并对所述选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息；

所述判断模块，用于根据所述 UE 选定反馈的上行控制信道资源和实际反馈信息，根据

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映射表格，获取所述 UE 反馈的具体 M 个反馈信息。

21. 如权利要求 20 所述的基站，其特征在于，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

22. 如权利要求 21 所述的基站，其特征在于，所述资源配置模块配置的所述上行控制信道资源集合中的上行控制信道资源元素可以被多个 UE 共享，基站通过调度限制使用了同一个上行控制信道资源的 UE 分时反馈，从而避免信道资源碰撞问题。

23. 如权利要求 21 所述的基站，其特征在于，当 M ＞ L 时，所述检测模块对所有上行控制信道资源进行检测，所述所有上行控制信道资源包括反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源。

24. 如权利要求 21 所述的基站，其特征在于，当 M ＞ L 时，所述映射表格内的映射关系包括：

当反馈窗口内被调度上的下行数据包数量大于预定门限，即复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 的数量大于预定门限时，所述选定反馈的上行控制信道资源为所述 UE 通过接收高层信令获取的半静态配置的上行控制信道资源。

25. 如权利要求 21 所述的基站，其特征在于，所述映射表格内的映射关系包括：

所述选定反馈的上行控制信道资源为复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 对应的上行控制信道资源。

26. 如权利要求 21 所述的基站，其特征在于，所述资源配置模块配置的所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系包括：

所述集合 K 的大小由反馈窗口长度 M、L、ACK/NACK 的检测门限、小区内进行 ACK/NACK 反馈的 UE 数量以及实际反馈信息的调制方式决定。

27. 如权利要求 26 所述的基站，其特征在于，当 M ＝ 5，且反馈信息的调制方式为 QPSK 调制时，所述 K 取值为 4、3、2 或 1。

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一种反馈信息的传输方法及传输装置

技术领域

[0001] 本发明涉及数字通信领域，具体而言，本发明涉及一种反馈信息的传输方法及传输装置。

背景技术

[0002] 移动和宽带成为现代通信技术的发展方向，3GPP(3rd Generation Partnership Project，第三代合作伙伴计划）致力于LTE （Long Term Evolution，长期演进）系统作为3G系统的演进，目标是发展3GPP无线接入技术向着高数据速率、低延迟和优化分组数据应用方向演进。

[0003] LTE系统采用HARQ来提高数据传输的可靠性，当下行HARQ功能开启后，UE对接收到的下行数据包进行译码，若译码正确则向基站反馈ACK，若译码失败，则向基站反馈NACK，要求基站重传该数据包。若UE没有接收到下行数据包，则判断下行数据包丢失，这时UE什么都不反馈，基站则认为此时UE处于DTX状态。因此，下行HARQ的反馈状态有ACK/NACK/DTX三种。

[0004] 在UE使用PUCCH进行ACK/NACK反馈之前，基站会预先为该UE配置一个ACK/NACK反馈可用的上行控制信道资源，该信道资源由一个信道资源编号表示。对于动态调度的下行数据包，其ACK/NACK反馈信息可用的信道资源编号将根据承载该数据包调度信息的下行控制信道（PDCCH）的第一个CCE(Control Channel Element，控制信道单元）编号得到，即根据该PDCCH的第一个CCE可以唯一确定一个上行反馈信道资源编号。对于持续调度的下行数据包所对应的ACK/NACK反馈，由于它们都是周期性反馈的，基站可预先知道各信息传输的具体时间位置，因此持续调度的下行数据包的ACK/NACK反馈信息可用的信道资源编号由基站通过高层信令预先分配给UE。在LTE Rel-8TDD系统中，一个上行子帧可能对应多个下行子帧，因此UE可能需要在一个上行子帧中对多个下行子帧的下行数据包进行ACK/NACK反馈，LTE Rel-8中采用了一种叫做复用及信道选择的方法，下面将对这种方法进行详细描述。

[0005] 在LTE Rel-8TDD系统中，一个上行子帧对应M个下行子帧，UE需要在这个上行子帧上对这M个下行子帧上传输的数据进行ACK/NACK反馈。因此，存在M个ACK/NACK/DTX复合反馈状态。

[0006] LTE Rel-8TDD的复用及信道选择的方法可以适用于单码字和多码字的下行数据包。对于多码字的下行数据包传输，首先将属于同一个用户的不同码字对应的ACK/NACK反馈信息进行逻辑加，之后，根据译码后得到的M个ACK/NACK/DTX反馈信息所组成的复合反馈状态，根据映射表格确定2比特的实际反馈信息，并在反馈窗口内最多M个可供信道选择的上行控制信道资源中选择一个作为实际反馈所使用的上行控制信道资源，之后在选定的上行控制信道资源上传输实际反馈信息。对于单码字的下行数据包传输，则直接根据译码后得到的M个ACK/NACK/DTX反馈信息所组成的复合反馈状态，根据映射表格确定2比特的实际反馈信息，并在反馈窗口内最多M个可供信道选择的上行控制信道资源中选择一个

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作为实际反馈所使用的上行控制信道资源，之后在选定的上行控制信道资源上传输实际反馈信息。具体过程如图 1 所示，实际的反馈信息统一定义为 2 比特，因此需要 QPSK 调制和 PUCCH Format 1b 传送。

[0007] 下面以 M = 4 为例子，给出复用和信道选择的具体过程。首先给出 LTERel-8TDD 系统中，M = 4 的复用和信道选择如表 1 所示：

[0008] 表 1 :LTE Rel-8TDD M = 4 的复用和信道选择表格

[0009]

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HARQ-ACK(0), HARQ-ACK(1), HARQ-ACK (2), HARQ-ACK(3)	$n_{PUCCH}^{(1)}$	$b(0),b(1)$
ACK, ACK, ACK, ACK	$n_{PUCCH,1}^{(1)}$	1, 1
ACK, ACK, ACK, NACK/DTX	$n_{PUCCH,1}^{(1)}$	1, 0
NACK/DTX,NACK/DTX,NACK,DTX	$n_{PUCCH,2}^{(1)}$	1, 1
ACK, ACK, NACK/DTX, ACK	$n_{PUCCH,1}^{(1)}$	1, 0
NACK, DTX, DTX, DTX	$n_{PUCCH,0}^{(1)}$	1, 0
ACK, ACK, NACK/DTX, NACK/DTX	$n_{PUCCH,1}^{(1)}$	1, 0
ACK, NACK/DTX, ACK, ACK	$n_{PUCCH,3}^{(1)}$	0, 1
NACK/DTX, NACK/DTX, NACK/DTX, NACK	$n_{PUCCH,3}^{(1)}$	1, 1
ACK, NACK/DTX, ACK, NACK/DTX	$n_{PUCCH,2}^{(1)}$	0, 1
ACK, NACK/DTX, NACK/DTX, ACK	$n_{PUCCH,0}^{(1)}$	0, 1
ACK, NACK/DTX, NACK/DTX, NACK/DTX	$n_{PUCCH,0}^{(1)}$	1, 1
NACK/DTX, ACK, ACK, ACK	$n_{PUCCH,3}^{(1)}$	0, 1
NACK/DTX, NACK, DTX, DTX	$n_{PUCCH,1}^{(1)}$	0, 0
NACK/DTX, ACK, ACK, NACK/DTX	$n_{PUCCH,2}^{(1)}$	1, 0
NACK/DTX, ACK, NACK/DTX, ACK	$n_{PUCCH,3}^{(1)}$	1, 0
NACK/DTX, ACK, NACK/DTX, NACK/DTX	$n_{PUCCH,1}^{(1)}$	0, 1
NACK/DTX, NACK/DTX, ACK, ACK	$n_{PUCCH,3}^{(1)}$	0, 1
NACK/DTX, NACK/DTX, ACK, NACK/DTX	$n_{PUCCH,2}^{(1)}$	0, 0
NACK/DTX, NACK/DTX, NACK/DTX, ACK	$n_{PUCCH,3}^{(1)}$	0, 0
DTX, DTX, DTX, DTX	N/A	N/A

[0010] 表格的第一列表示全部可能出现的 M 个 ACK/NACK/DTX 反馈信息所组成的复合反馈状态。由于 NACK 和 DTX 状态都需要重传，于是在一些情况下可以共享一种状态。表格的

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第二列为反馈可用的上行控制信道资源，M = 4 时，最多存在 M = 4 个可供信道选择的上行控制信道资源 $:n_{PUCCH,0}^{(1)}$ _ $n_{PUCCH,3}^{(1)}$;而表格的最后一列则表示实际的反馈信息，如果使用 PUCCH format 1b 发送，则支持 2 比特的实际反馈信息。于是选择 QPSK 的调制方式，支持 4 个实际反馈比特状态 :{0,0}, {0,1}, {1,0}, {1,1}。每一个供信道选择的上行控制信道资源和每一个实际反馈比特状态组成一个组合。

[0011] LTE Rel-8TDD 的复用和信道选择方法的本质在于，UE 根据 M 个 ACK/NACK/DTX 反馈信息所组成的复合反馈状态，根据映射表格，在可供信道选择的上行控制信道资源和实际反馈比特状态的全部组合中选择一个组合，即选择出来的上行控制信道资源将作为实际反馈信道资源，而选择出来的实际反馈比特状态将作为实际反馈信息。基站在接收时，也将根据接收到的实际反馈信道资源和实际反馈信息根据映射表格获知具体的复合反馈状态，从而获知 M 个 ACK/NACK/DTX 反馈信息的具体状态。以上所述的映射表格对基站和 UE 都是透明的。

[0012] 如果基站不区分 NACK 和 DTX 状态，则 M = 4 个下行子帧中可能出现的复合反馈状态数量为 4^2 = 16 个，而 M = 4 个可供信道选择的上行控制信道资源和 QPSK 调制对应的 4 个实际反馈比特状态一共可以支持 16 个复合反馈状态，在这种情况下 M = 4 个可供信道选择的上行控制信道资源正好可以支持 M = 4 个下行子帧所对应的反馈状态。但是在很多情况下，NACK 和 DTX 两种状态仍然需要区分，这时，可供信道选择的上行控制信道资源和实际反馈比特状态的组合数量会少于 M = 4 个下行子帧中可能出现的复合反馈状态总数。在 LTE Rel-8TDD 系统中，根据全部可能出现的复合反馈状态发生的概率，还配置了有限个不同的复合反馈状态共用一个可供信道选择的上行控制信道资源和实际反馈比特状态的组合的情况，即多对一的表格映射关系。如表 1 中，一共有两组多对一的映射，每组里有三个不同的复合反馈状态共享了同样的可供信道选择的上行控制信道资源和实际反馈比特状态的组合，这样则避免了可供信道选择的上行控制信道资源和实际反馈比特状态的组合过少的问题。

[0013] 对于 M > 4 的情况，则需要支持更多的复合反馈状态，但是根据现有的系统可供信道选择的上行控制信道资源和实际反馈比特状态的组合远不够支持全部的可能出现的复合反馈状态总数。如果仍然采用多对一的表格映射关系，则会出现很大的错误概率，特别是 M 较大时，于是 LTE Rel-8TDD 的上述复用和信道选择的方法将不再适用。因此，有必要提出一种技术方案，设计出一种兼容 LTE Rel-8 的复用和信道选择的反馈方法，实现多 ACK/NAK 的有效反馈传输。

发明内容

[0014] 本发明的目的旨在至少解决上述技术缺陷之一，特别对 UE 需要向基站反馈的 ACK/NACK 信息超过 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的复合反馈状态的数量的上限时，本发明的实施例提出了一种扩展 LTE Rel-8 复用和信道选择的反馈方法，使用本发明公开的技术方案，可支持的最大 ACK/NACK 反馈容量能够有效增大，可以满足更高的数据传输率，提高系统利用率。

[0015] 为了达到上述目的，本发明的实施例一方面提出了一种反馈信息的传输方法，包括以下步骤 :

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[0016] 用户设备 UE 接收高层信令，获取基站半静态的给所述用户配置的上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；

[0017] 所述 UE 接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据，对下行数据译码后得到 M 个反馈信息，并由所述 M 个反馈信息组成一个复合反馈状态，根据映射表格和复合反馈状态，确定实际反馈信息；

[0018] 当反馈窗口长度 M ＞ L 时，所述 UE 根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限。

[0019] 本发明的实施例另一方面提出了一种反馈信息的传输方法，包括以下步骤：

[0020] 基站半静态的给用户设备 UE 配置一个上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，并通过高层信令通知所述 UE 该集合内具体的上行控制信道资源，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；

[0021] 所述基站接收所述 UE 发送的反馈信息，对所有上行控制信道资源进行检测，获取所述 UE 选定反馈的上行控制信道资源，并对所述选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息；

[0022] 所述基站根据所述 UE 选定反馈的上行控制信道资源和实际反馈信息，根据映射表格，获取所述 UE 反馈的具体 M 个反馈信息。

[0023] 本发明的实施例另一方面还提出一种反馈信息的传输系统，包括基站和至少一个用户设备 UE，

[0024] 所述基站，用于半静态的给用户设备 UE 配置一个上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，并通过高层信令通知所述 UE 该集合内具体的上行控制信道资源，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；以及用于对所有上行控制信道资源进行检测，获取所述 UE 选定反馈的上行控制信道资源，并对所述选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息；并根据所述 UE 选定反馈的上行控制信道资源和实际反馈信息，根据映射表格，获取所述 UE 反馈的具体 M 个反馈信息；

[0025] 所述用户设备 UE，用于接收所述基站发送的高层信令，获取基站半静态的给所述用户配置的上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；以及用于接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据，对下行数据译码后得到 M 个反馈信息，并由所述 M 个反馈信息组成一个复合反馈状态；以及用于根据映射表格和复合反馈状态，确定实际反馈信息；以及用于当反馈窗口长度 M ＞ L 时，根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限；以及用于将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站。

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[0026] 本发明的实施例另一方面还提出一种用户设备 UE，包括接收模块、选择模块以及发送模块，

[0027] 所述接收模块，用于接收高层信令，获取基站半静态的给所述用户配置的上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系，以及用于接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据；对下行数据译码后得到 M 个反馈信息，并由所述 M 个反馈信息组成一个复合反馈状态；

[0028] 所述选择模块，用于根据映射表格和复合反馈状态，确定实际反馈信息；以及用于当反馈窗口长度 M ＞ L 时，根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限；

[0029] 所述发送模块，用于将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站。

[0030] 本发明的实施例另一方面还提出一种基站，包括资源配置模块、检测模块以及判断模块，

[0031] 所述资源配置模块，用于半静态的给用户设备 UE 配置一个上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，并通过高层信令通知所述 UE 该集合内具体的上行控制信道资源，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；

[0032] 所述检测模块，用于对所有上行控制信道资源进行检测，获取所述 UE 选定反馈的上行控制信道资源，并对所述选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息；

[0033] 所述判断模块，用于根据所述 UE 选定反馈的上行控制信道资源和实际反馈信息，根据映射表格，获取所述 UE 反馈的具体 M 个反馈信息。

[0034] 本发明的实施例提出的技术方案，通过高层信令向 UE 配置 K 个半静态配置的上行控制信道资源，实现了扩展 LTE Rel-8 复用和信道选择的反馈方法，上述技术可支持的最大 ACK/NACK 反馈容量能够有效增大，可以满足更高的数据传输率，提高系统利用率。上述技术能很好支持 LTE 和 LTE-A 系统的同时，本发明也可以适用于 LTE-A 多载波聚合系统，也可以适用于别的需要多 ACK/NAK 传输的系统。本发明提出的上述方案，对现有系统的改动很小，不会影响系统的兼容性，而且实现简单、高效。

[0035] 本发明附加的方面和优点将在下面的描述中部分给出，部分将从下面的描述中变得明显，或通过本发明的实践了解到。

附图说明

[0036] 本发明上述的和 / 或附加的方面和优点从下面结合附图对实施例的描述中将变得明显和容易理解，其中：

[0037] 图 1 为 LTE Rel-8TDD 的复用及信道选择的示意图；

[0038] 图 2 为本发明一个实施例反馈信息的传输方法的流程图；

[0039] 图 3 为本发明实施例用户设备 UE 的结构示意图；

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[0040] 图 4 为本发明另一个实施例反馈信息的传输方法的流程图；

[0041] 图 5 为本发明实施例基站的结构示意图。

具体实施方式

[0042] 下面详细描述本发明的实施例，所述实施例的示例在附图中示出，其中自始至终相同或类似的标号表示相同或类似的元件或具有相同或类似功能的元件。下面通过参考附图描述的实施例是示例性的，仅用于解释本发明，而不能解释为对本发明的限制。

[0043] 为了便于理解本发明，下面对本发明的主旨进行详细阐述。

[0044] 本发明基于兼容 LTE 系统的考虑，给出一种利用半静态配置的上行控制信道资源进行复用及信道选择的方法。其主要思想为利用基站半静态的配置的上行控制信道资源，扩展 Rel-8 复用和信道选择的方案，使其可以支持更多的 ACK/NACK 反馈。

[0045] 假设反馈窗口的长度为 M，所述反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。在本发明公开的实施例中，所定义的 M 个反馈状态包括 ACK、NACK 或 DTX 状态。因此，反馈窗口内所有 ACK/NACK/DTX 反馈状态的数量为 M 个，对于多码字的下行数据包传输，可以先将同一个用户的不同码字对应的反馈状态进行逻辑加。反馈窗口内可供信道选择的上行控制信道资源数量的上限也为 M 个，其中所述可供信道选择的上行控制信道资源即包括动态调度下行数据包对应的上行控制信道资源，又包括持续调度下行数据包对应的上行控制信道资源，还包括指示半静态资源释放的 PDCCH 对应的上行控制信道资源。

[0046] LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度存在上限 L。

[0047] 系统中，基站半静态的给 UE 分配一个上行控制信道资源集合，该集合里有 K ＞＝ 1 个元素，对应 K 个 ACK/NACK 反馈可用的上行控制信道资源编号。该集合中的上行控制信道资源元素可以被多个 UE 共享，基站通过调度限制使用了同一上行控制信道资源的 UE 分时反馈，从而避免信道资源碰撞问题。

[0048] 该集合的大小 K 与反馈窗口长度 M 存在一个预先定义的对应关系，该对应关系对基站和 UE 都是透明的。例如如果反馈窗口长度 M ＝ 5，则 K 的取值预先定义为：K ＝ 4，表示基站半静态的为 UE 固定分配 4 个上行控制信道资源。以上所述对应关系可以体现到具体的映射表格上，且该表格对于基站和 UE 都是透明的。需要注意的是，在本发明公开的实施例中，M 和 K 的对应关系会影响映射表格的设计。该映射表格表示不同复合反馈状态与上行控制信道资源编号和实际反馈比特状态的组合之间的映射关系

[0049] 为了实现本发明之目的，本发明公开了一种反馈信息的传输方法，包括以下步骤：用户设备 UE 接收高层信令，获取基站半静态的给所述用户配置的上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；其中，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

[0050] 所述 UE 接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数

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据，对下行数据译码后得到 M 个反馈信息，并由所述 M 个反馈信息组成一个复合反馈状态，根据映射表格和复合反馈状态，确定实际反馈信息；

[0051] 当反馈窗口长度 M ＞ L 时，所述 UE 根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限。。

[0052] 在本发明中，高层信令包括但不限于无线资源管理 RRC 信令。

[0053] 如图 2 所示，为本发明实施例反馈信息的传输方法的流程图，包括以下步骤：

[0054] S201：用户设备 UE 确定基站半静态为其配置的上行控制信道资源集合。

[0055] 在步骤 S201 中，用户设备 UE 接收高层信令，获取基站半静态的给所述用户配置的上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系。

[0056] 其中，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

[0057] S202：UE 接收反馈窗口内全部上行控制信道资源和下行数据，并根据 M 个反馈信息组成的复合反馈状态和映射表格，确定实际反馈信息。

[0058] 在步骤 S202 中，UE 接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据，对下行数据译码后得到 M 个反馈信息，并由所述 M 个反馈信息组成一个复合反馈状态，根据映射表格和复合反馈状态，确定实际反馈信息。

[0059] S203：UE 将实际反馈信息通过选定反馈的上行控制信道资源发送给所述基站。

[0060] 在步骤 S203，当反馈窗口长度 M ＞ L 时，所述 UE 根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限。

[0061] 如果 M 小于等于 L 时，则 UE 不需要利用该上行控制信道资源集合中的上行控制信道资源，此时可以完全重用 LTE Rel-8TDD 系统的复用及信道选择方法。即 UE 根据译码后得到的 M 个反馈信息所组成的复合反馈状态，查映射表格确定实际反馈信息。并在反馈窗口内最多 M 个可供信道选择的上行控制信道资源中选定作为实际反馈所使用的上行控制信道资源，之后在选定的上行控制信道资源上传输实际反馈信息。

[0062] 如果 M 大于 L 时，则需要利用该上行控制信道资源集合中的上行控制信道资源协助信道选择，对可供信道选择的上行控制信道资源和实际反馈比特状态的组合进行扩展，即信道选择的范围除了这最多 M 个信道资源外，还包括上行控制信道资源集合中的 K 个上行控制信道资源，则此时可供信道选择的上行控制信道资源数量的上限扩展为 M+K 个。于是 UE 根据译码后得到的 M 个反馈信息所组成的复合反馈状态，查映射表格确定实际反馈信息。并在反馈窗口内最多 M+K 个可供信道选择的上行控制信道资源中选定作为实际反馈所使用的上行控制信道资源，之后在选定的上行控制信道资源上传输实际反馈信息。

[0063] 具体而言，当 M ＞ L 时，所述根据映射表格和复合反馈状态包括：

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[0064] 当反馈窗口内被调度上的下行数据包数量大于预定门限，即复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 的数量大于预定门限时，所述选定反馈的上行控制信道资源为所述 UE 通过接收高层信令获取的半静态配置的上行控制信道资源。

[0065] 具体而言，所述根据映射表格和复合反馈状态包括：

[0066] 所述选定反馈的上行控制信道资源为复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 对应的上行控制信道资源。

[0067] 具体而言，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系包括：

[0068] 所述集合 K 的大小由反馈窗口长度 M、L、ACK/NACK 的检测门限、小区内进行 ACK/NACK 反馈的 UE 数量以及实际反馈信息的调制方式决定。

[0069] 例如，当 M = 5，且反馈信息的调制方式为 QPSK 调制时，所述 K 取值为 4、3、2 或 1。

[0070] 即该集合的大小 K 与反馈窗口长度 M 存在一个预先定义的对应关系，该对应关系对基站和 UE 都是透明的。例如如果反馈窗口长度 M = 5，则 K 的取值预先定义为：K = 4，表示基站半静态的为 UE 固定分配 4 个上行控制信道资源。

[0071] 为了进一步阐述本发明，下面结合具体的参数，通过一个具体映射表格的实施例说明本发明。

[0072] 首先给出一种不需要多对一映射表格的配置方法，K = 4，即基站半静态的为该 UE 配置 4 个 ACK/NACK 反馈可用的上行控制信道资源。这 4 个上行控制信道资源和反馈窗口内下行数据对应的最多 5 个上行控制信道资源组成了一个可供选择的控制信道资源集合：$n^{(1)}_{PUCCH,0}$ 到 $n^{(1)}_{PUCCH,8}$。其中，所述下行数据对应的上行控制信道资源即包括动态调度下行数据包对应的上行控制信道资源，又包括持续调度下行数据包对应的上行控制信道资源，还包括指示半静态资源释放的 PDCCH 对应的上行控制信道资源。

[0073] 由于可供选择的控制信道资源从 $n^{(1)}_{PUCCH,0}$ 到 $n^{(1)}_{PUCCH,4}$，扩展到了 $n^{(1)}_{PUCCH,0}$ 到 $n^{(1)}_{PUCCH,8}$，于是可以产生一个扩展的映射表格，如表 2 所示，显然，该表格中的不同复合反馈状态与上行控制信道资源编号和 QPSK 调制比特状态的组合之间的映射关系仅仅为一个示例。

[0074] 在本实施例中，由于如果所有数据包都是 DTX 状态，则 UE 什么也不发送，于是除了全部都是 DTX 状态的复合反馈状态外，一共需要区分 36 种可能发生的复合反馈状态。由于基站通过高层信令额外配置了 4 个半静态的上行控制信道资源，从而扩大了可供信道选择的上行控制信道资源数量，如果仍使用 QPSK 的调制方式，则一共有 $(4+5)\times 2^2 = 36$ 个可供信道选择的上行控制信道资源和实际反馈比特状态的组合，正好可以支持 36 种复合反馈状态，达到了对 LTE Rel-8TDD 系统中复用和信道资源方案的扩展要求。

[0075] 表 2：M = 5，K = 4 的复用和信道选择表格

[0076]

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Harq (0)	Harq (1)	Harq (2)	Harq (3)	Harq (4)	n_PUCCH	b(0),b(1)
ACK	ACK	ACK	ACK	ACK	$n^{(1)}_{PUCCH,5}$	1，0
ACK	ACK	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,6}$	1，0
ACK	ACK	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,7}$	1，0
ACK	ACK	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,8}$	1，0
ACK	NACK/DTX	ACK	ACK	ACK	$n^{(1)}_{PUCCH,5}$	0，1
NACK/DTX	ACK	ACK	ACK	ACK	$n^{(1)}_{PUCCH,6}$	0，1
ACK	ACK	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,7}$	0，1
ACK	ACK	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,8}$	0，1
ACK	NACK/DTX	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,5}$	1，1
NACK/DTX	ACK	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,6}$	1，1
ACK	ACK	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,7}$	1，1
ACK	NACK/DTX	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,8}$	1，1

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[0077]

ACK	NACK/DTX	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,5}$	0，0
NACK/DTX	ACK	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,6}$	0，0
NACK/DTX	ACK	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,7}$	0，0
NACK/DTX	NACK/DTX	ACK	ACK	ACK	$n^{(1)}_{PUCCH,8}$	0，0
ACK	ACK	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1，0
ACK	NACK/DTX	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,0}$	1，1
NACK/DTX	NACK/DTX	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,4}$	1，0
ACK	NACK/DTX	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,2}$	1，0
NACK/DTX	ACK	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	1，0
NACK/DTX	ACK	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	1，1
NACK/DTX	ACK	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	1，0
ACK	NACK/DTX	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	1，1
NACK/DTX	NACK/DTX	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,2}$	1，1
NACK/DTX	NACK/DTX	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,4}$	1，1
ACK	NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	0，1
NACK/DTX	ACK	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	0，1
NACK/DTX	NACK/DTX	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,2}$	0，1
NACK/DTX	NACK/DTX	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	0，1
NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,4}$	0，1
NACK	DTX	DTX	DTX	DTX	$n^{(1)}_{PUCCH,0}$	0，0
NACK/DTX	NACK	DTX	DTX	DTX	$n^{(1)}_{PUCCH,1}$	0，0
NACK/DTX	NACK/DTX	NACK	DTX	DTX	$n^{(1)}_{PUCCH,2}$	0，0

[0078]

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NACK/DTX	NACK/DTX	NACK/DTX	NACK	DTX	$n^{(1)}_{PUCCH,3}$	0，0
NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	NACK	$n^{(1)}_{PUCCH,4}$	0，0
DTX	DTX	DTX	DTX	DTX	N/A	N/A

[0079] 以上所述对应关系可以体现到具体的映射表格上，且该表格对于基站和 UE 都是透明的。该映射表格表示不同复合反馈状态与上行控制信道资源编号和实际反馈比特状态的组合之间的映射关系。

[0080] 所述映射表格，即不同复合反馈状态与上行控制信道资源编号和实际反馈比特状态的组合之间的映射关系，其设计应遵循以下两个原则：

[0081] 如果反馈窗口内被调度上的下行数据包数量较多，即复合反馈状态的 M 个 ACK/NACK/DTX 反馈状态中存在较多的确切反馈状态：ACK 或 NACK，则应该把该所述复合反馈状态映射到半静态配置的上行控制信道资源集合中的上行控制信道资源上。例如实施例中的表 2：$n^{(1)}_{PUCCH,5}$到$n^{(1)}_{PUCCH,8}$都是基站半径态配置的上行控制信道资源，而映射表格的前面 16 个复合反馈状态都调度了 3 个及以上的下行数据包，存在 3 个及以上的确切反馈信息 ACK 或 NACK，因此前面 16 个复合反馈状态在实施例中都映射到了基站半径态配置的上行控制信道资源$n^{(1)}_{PUCCH,5}$到$n^{(1)}_{PUCCH,8}$上；

[0082] 复合反馈状态应该映射到反馈窗口内被调度上的下行数据包对应的上行控制信道资源上。例如实施例中的表 2，$n^{(1)}_{PUCCH,0}$到$n^{(1)}_{PUCCH,4}$都是下行数据包对应的上行控制信道资源。复合反馈状态 {ACK，ACK，NACK/DTX，NACK/DTX，NACK/DTX} 中，第一个数据包和第二个数据包是肯定被调度上的，对应着确切的反馈信息 ACK，因此该复合反馈状态映射到第一个数据包对应的上行控制信道资源$n^{(1)}_{PUCCH,0}$上；又例如，复合反馈状态 {NACK/DTX，NACK/DTX，NACK/DTX，NACK/DTX，NACK} 中，最后一个数据包是肯定被调度上的，对应着确切的反馈信息 NACK，因此该复合反馈状态映射到最后一个数据包对应的上行控制信道资源$n^{(1)}_{PUCCH,4}$上。

[0083] 如图 3 所示，为本发明实施例反馈信息的传输装置的结构示意图，用户设备 UE300，包括接收模块 310、选择模块 320 以及发送模块 330。

[0084] 其中，接收模块 310，用于接收高层信令，获取基站半静态的给用户配置的上行控制信道资源集合，其中集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系，以及用于接收基站发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据；对下行数据译码后得到 M 个反馈信息，并由 M 个反馈信息组成一个复合反馈状态。

[0085] 其中，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

[0086] 选择模块 320，用于根据映射表格和复合反馈状态，确定实际反馈信息；以及用于当反馈窗口长度 M ＞ L 时，根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限。

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[0087] 其中，当 M ＞ L 时，选择模块 320 根据映射表格和复合反馈状态包括：

[0088] 当反馈窗口内被调度上的下行数据包数量大于预定门限，即复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 的数量大于预定门限时，选定反馈的上行控制信道资源为 UE 通过接收高层信令获取的半静态配置的上行控制信道资源。

[0089] 其中，选择模块 320 根据映射表格和复合反馈状态包括：

[0090] 选定反馈的上行控制信道资源为复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 对应的上行控制信道资源。

[0091] 发送模块 330，用于将实际反馈信息通过选定反馈的上行控制信道资源发送给基站。

[0092] 因此，可以从上述方法或设备可以概括得到，UE 端需要进行以下相应的处理：

[0093] 对于动态调度的下行数据包检测 PDCCH 和 / 或对于持续调度的下行数据包监测高层信令和 / 或对于指示半静态资源释放的 PDCCH 检测该 PDCCH，获知反馈窗口内全部上行控制信道资源，其上限为 M 个；

[0094] 根据高层信令，获知基站为所述 UE 半静态配置的上行控制信道资源集合中的 K 个上行控制信道资源；

[0095] 接收反馈窗口内的下行数据，译码后得到 M 个 ACK/NACK/DTX 反馈信息，这 M 个 ACK/NACK/DTX 反馈信息组成一个复合反馈状态；

[0096] 如果 M 小于等于 L，则 UE 根据所述 M 个 ACK/NACK/DTX 反馈信息所组成的复合反馈状态，查映射表格确定实际反馈信息。并在反馈窗口内全部最多 M 个上行控制信道资源从中选定反馈的上行控制信道资源；

[0097] 如果 M 大于 L，则 UE 根据所述 M 个 ACK/NACK/DTX 反馈信息所组成的复合反馈状态，查映射表格确定实际反馈信息，并反馈窗口内全部上行控制信道资源（最多 M 个）以及 K 个半静态配置的上行控制信道资源中选定反馈的上行控制信道资源；

[0098] 其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限。

[0099] 将实际反馈信息通过所述选定反馈的上行控制信道资源发送给所述基站。

[0100] 如图 4 所示，为本发明另一实施例反馈信息的传输方法的流程图，包括以下步骤：

[0101] S401：基站给半静态的给 UE 配置上行控制信道资源集合，并通过高层信令通知所述 UE 该集合内具体的上行控制信道资源。

[0102] 在步骤 S401 中，基站半静态的给用户设备 UE 配置一个上行控制信道资源集合，其中所述集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，并通过高层信令通知所述 UE 该集合内具体的上行控制信道资源，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系。

[0103] 其中，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

[0104] 其中，上行控制信道资源集合中的上行控制信道资源元素可以被多个 UE 共享，基站通过调度限制使用了同一个上行控制信道资源的 UE 分时反馈，从而避免信道资源碰撞问题。

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[0105] S402：基站在全部可供信道选择的上行控制信道资源进行检测，获取 UE 选定反馈的上行控制信道资源和实际反馈信息。

[0106] 在步骤 S402 中，基站接收所述 UE 发送的反馈信息，对所有上行控制信道资源进行检测，获取所述 UE 选定反馈的上行控制信道资源，并对所述选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息。

[0107] 其中，当 M ＞ L 时，所述所有上行控制信道资源包括反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源。

[0108] S403：基站根据所述 UE 选定反馈的上行控制信道资源和实际反馈信息查映射表格，获取 UE 反馈的具体信息。

[0109] 在步骤 S403 中，基站根据所述 UE 选定反馈的上行控制信道资源和实际反馈信息，根据映射表格，获取所述 UE 反馈的具体 M 个反馈信息，具体的例子见更进一步的结合映射表的具体实施例。

[0110] 具体而言，当 M ＞ L 时，所述基站接收所述 UE 发送的反馈信息，对所有上行控制信道资源进行检测，其中所述所有上行控制信道资源包括反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源。

[0111] 即如果 M 小于等于 L 时，则 UE 不需要利用该上行控制信道资源集合中的上行控制信道资源，此时可以完全重用 LTE Rel-8TDD 系统的复用及信道选择方法。UE 根据译码后得到的 M 个 ACK/NACK/DTX 反馈信息所组成的复合反馈状态，查映射表格确定实际反馈信息。并在反馈窗口内最多 M 个上行控制信道资源中选定反馈的上行控制信道资源，之后在选定反馈的上行控制信道资源上传输实际反馈信息。

[0112] 如果 M 大于 L 时，则需要利用该上行控制信道资源集合中的上行控制信道资源协助信道选择，对可供信道选择的上行控制信道资源和实际反馈比特状态的组合进行扩展，即信道选择的范围除了这最多 M 个信道资源外，还包括上行控制信道资源集合中的 K 个上行控制信道资源，则此时反馈窗口内可供信道选择的上行控制信道资源数量的上限扩展为 M+K 个。于是 UE 根据译码后得到的 M 个 ACK/NACK/DTX 反馈信息所组成的复合反馈状态，查映射表格确定实际反馈信息。并在反馈窗口内最多 M+K 个可供信道选择的上行控制信道资源中选定反馈的上行控制信道资源，之后在选定反馈的上行控制信道资源上传输实际反馈信息

[0113] 具体而言，当 M ＞ L 时，所述映射表格内的映射关系包括：

[0114] 当反馈窗口内被调度上的下行数据包数量大于预定门限，即复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 的数量大于预定门限时，所述选定反馈的上行控制信道资源为所述 UE 通过接收高层信令获取的半静态配置的上行控制信道资源。

[0115] 具体而言，所述映射表格内的映射关系包括：

[0116] 所述选定反馈的上行控制信道资源为复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 对应的上行控制信道资源。

[0117] 具体而言，所述集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系包括：

[0118] 所述集合 K 的大小由反馈窗口长度 M、L、ACK/NACK 的检测门限、小区内进行 ACK/NACK 反馈的 UE 数量以及实际反馈信息的调制方式决定。

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[0119] 例如，当 M = 5，且反馈信息的调制方式为 QPSK 调制时，所述 K 取值为 4、3、2 或 1。

[0120] 如图 5 所示，为本发明实施例反馈信息的传输装置的结构示意图，基站 500，包括资源配置模块 510、检测模块 530 以及判断模块 520。

[0121] 其中，资源配置模块 510，用于半静态的给用户设备 UE 配置一个上行控制信道资源集合，其中集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K >= 1，并通过高层信令通知 UE 该集合内具体的上行控制信道资源，集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系。

[0122] 其中，反馈窗口长度 M 对于 FDD 系统为进行 ACK/NACK 反馈的上行载波对应的全部下行载波数量；反馈窗口长度 M 对于 TDD 系统为进行 ACK/NACK 反馈的上行子帧对应的全部下行子帧数量，包括在同一载波上和 / 或不同载波上的下行子帧。

[0123] 其中，资源配置模块 510 配置的上行控制信道资源集合中的上行控制信道资源元素可以被多个 UE 共享，基站通过调度限制使用了同一个上行控制信道资源的 UE 分时反馈，从而避免信道资源碰撞问题。

[0124] 其中，资源配置模块 510 配置的集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系包括：

[0125] 集合 K 的大小由反馈窗口长度 M、L、ACK/NACK 的检测门限、小区内进行 ACK/NACK 反馈的 UE 数量以及实际反馈信息的调制方式决定。

[0126] 例如，当 M = 5，且反馈信息的调制方式为 QPSK 调制时，K 取值为 4、3、2 或 1。

[0127] 检测模块 530，用于对所有上行控制信道资源进行检测，获取 UE 选定反馈的上行控制信道资源，并对选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息。

[0128] 其中，当 M > L 时，检测模块 530 对所有上行控制信道资源进行检测，所有上行控制信道资源包括反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源。

[0129] 判断模块 520，用于根据 UE 选定反馈的上行控制信道资源和实际反馈信息，根据映射表格，获取 UE 反馈的具体 M 个反馈信息。

[0130] 其中，当 M > L 时，映射表格内的映射关系包括：

[0131] 当反馈窗口内被调度上的下行数据包数量大于预定门限，即复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 的数量大于预定门限时，选定反馈的上行控制信道资源为 UE 通过接收高层信令获取的半静态配置的上行控制信道资源。

[0132] 此外，映射表格内的映射关系还包括：

[0133] 选定反馈的上行控制信道资源为复合反馈状态的 M 个反馈状态中确切的反馈状态 ACK 或 NACK 对应的上行控制信道资源。

[0134] 为了便于理解上述方法或设备的工作流程，下面结合具体的参数，对本发明的一个具体映射表格的实施例作进一步阐述。

[0135] 本实施例为一种需要多对一映射表格的配置方法，M = 5，K = 3，即基站半静态的为该 UE 配置 3 个 ACK/NACK 反馈可用的上行控制信道资源。

[0136] 在本实施例中，由于 M 仍然为 5，于是仍然需要区分 36 种复合反馈状态。由于基站通过高层信令额外配置了 3 个半静态的上行控制信道资源，如果仍使用 QPSK 的调制方式，则一共有 $(3+5)\times 2^2 = 32$ 个可供信道选择的上行控制信道资源和实际反馈比特状态的组

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合，并不足以支持 36 种复合反馈状态，于是映射表格中不同复合反馈状态与上行控制信道资源编号和 QPSK 调制比特状态的组合之间的映射关系存在着一些多对一的映射关系。但是本实施例中，基站为该 UE 半静态配置的上行控制信道资源数量比表 2 的实施例要少，在保证系统性能的同时，还可以进一步提高上行控制信道资源利用率。

[0137] 在本实施例中，所述 3 个上行控制信道资源和反馈窗口内下行数据包对应的最多 5 个控制控制信道资源组成了一个可供选择的控制信道资源集合 :$n^{(1)}_{PUCCH,0}$到$n^{(1)}_{PUCCH,7}$。于是可以产生一个扩展的映射表格，如表 3 所示，显然，该表格中的不同复合反馈状态与上行控制信道资源编号和 QPSK 调制比特状态的组合之间的映射关系仅仅为一个示例。表 3 中，存在两组多对一的映射关系，每组里有三个不同的复合反馈状态共享了同样的上行控制信道资源编号和 QPSK 调制比特状态的组合。本实施例只给出了一个简单的多对一映射表格，在本方法的实际应用中，为了进一步提高资源利用率，还可以给 UE 配置更少的半静态上行控制信道资源，此时的多对一映射关系以及半静态配置的上行控制信道资源数量 (K) 由基站根据 UE 的数量和上行资源容量进行优化配置。

[0138] 表 3 :M = 5，K = 3 的复用和信道选择表格

[0139]

Harq (0)	Harq (1)	Harq (2)	Harq (3)	Harq (4)	n_PUCCH	b(0),b(1)
ACK	ACK	ACK	ACK	ACK	$n^{(1)}_{PUCCH,5}$	1，0
ACK	ACK	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,6}$	1，0
ACK	ACK	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,6}$	1，0
ACK	ACK	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,5}$	0，1
ACK	NACK/DTX	ACK	ACK	ACK	$n^{(1)}_{PUCCH,7}$	1，0
NACK/DTX	ACK	ACK	ACK	ACK	$n^{(1)}_{PUCCH,7}$	1，0

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[0140]

ACK	ACK	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,6}$	1，0
ACK	ACK	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,5}$	1，1
ACK	NACK/DTX	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,6}$	0，1
NACK/DTX	ACK	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,7}$	0，1
ACK	ACK	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,5}$	0，0
ACK	NACK/DTX	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,6}$	1，1
ACK	NACK/DTX	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,7}$	1，1
NACK/DTX	ACK	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,6}$	0，0
NACK/DTX	ACK	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,7}$	0，0
NACK/DTX	NACK/DTX	ACK	ACK	ACK	$n^{(1)}_{PUCCH,7}$	1，0
ACK	ACK	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1，0
ACK	NACK/DTX	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,0}$	1，1
NACK/DTX	NACK/DTX	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,4}$	1，0
ACK	NACK/DTX	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,2}$	1，0
NACK/DTX	ACK	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	1，0
NACK/DTX	ACK	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	1，1
NACK/DTX	ACK	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	1，0
ACK	NACK/DTX	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	1，1
NACK/DTX	NACK/DTX	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,2}$	1，1
NACK/DTX	NACK/DTX	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,4}$	1，1
ACK	NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	0，1
NACK/DTX	ACK	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	0，1

[0141]

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NACK/DTX	NACK/DTX	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,2}$	0，1
NACK/DTX	NACK/DTX	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	0，1
NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,4}$	0，1
NACK	DTX	DTX	DTX	DTX	$n^{(1)}_{PUCCH,0}$	0，0
NACK/DTX	NACK	DTX	DTX	DTX	$n^{(1)}_{PUCCH,1}$	0，0
NACK/DTX	NACK/DTX	NACK	DTX	DTX	$n^{(1)}_{PUCCH,2}$	0，0
NACK/DTX	NACK/DTX	NACK/DTX	NACK	DTX	$n^{(1)}_{PUCCH,3}$	0，0
NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	NACK	$n^{(1)}_{PUCCH,4}$	0，0
DTX	DTX	DTX	DTX	DTX	N/A	N/A

[0142] 因此，可以从上述方法或设备可以概括得到，基站端需要进行以下相应的处理：

[0143] 基站半静态的给 UE 分配一个上行控制信道资源集合，该集合里有 K ＞＝ 1 个元素，对应 K 个 ACK/NACK 反馈可用的上行控制信道资源编号，该集合的大小 K 与反馈窗口长度 M 存在一个预先定义的对应关系，该对应关系对基站和 UE 都是透明的，以上所述对应关系可以体现到具体的映射表格上，且该表格对于基站和 UE 都是透明的，该映射表格表示不同复合反馈状态与上行控制信道资源编号和实际反馈比特状态的组合之间的映射。

[0144] 所述映射表格，即不同复合反馈状态与上行控制信道资源编号和实际反馈比特状态的组合之间的映射关系，其设计应遵循以下两个原则：

[0145] 如果反馈窗口内被调度上的下行数据包数量较多，即复合反馈状态的 M 个 ACK/NACK/DTX 反馈状态中存在较多的确切反馈状态：ACK 或 NACK，则应该把该所述复合反馈状态映射到半静态配置的上行控制信道资源集合中的上行控制信道资源上；复合反馈状态应该映射到反馈窗口内被调度上的下行数据包对应的上行控制信道资源上；

[0146] 该集合中的上行控制信道资源元素可以被多个 UE 共享，基站通过调度限制使用了同一个上行控制信道资源的 UE 分时反馈，从而避免信道资源碰撞问题；

[0147] 基站通过反馈窗口的长度确定 UE 进行信道选择时是否使用所述上行控制信道资源集合：如果 M 小于等于 L，则基站确定 UE 进行信道选择时不需要使用所述上行控制信道资源集合；如果 M 大于 L，则基站确定 UE 进行信道选择时需要使用所述上行控制信道资源集合；

[0148] 基站端接收过程中，基站对全部可供信道选择的上行控制信道资源进行检测，确定哪个上行控制信道资源上有数据传输，即可获知信道选择过程选定的上行控制信道资源；

[0149] 对选定上行控制信道资源所传输的信号进行检测，获知实际反馈信息；

[0150] 根据检测到的实际反馈信息及选定的上行控制信道资源，查映射表格，获知具体

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的复合反馈状态，从而获知 M 个 ACK/NACK/DTX 反馈信息的具体信息。

[0151] 在上述的两个具体的映射表的示例中，都是针对 M = 5 的反馈窗口长度，但是本发明的方法不仅限于 M = 5 的取值，此外，在两个实施例中，实际反馈比特状态采用 QPSK 调制，即实际反馈比特为 2 比特，显然，但是本发明的方法也适用于其他任意的调制方式。且在上述的两个具体的映射表的示例中，都是以选出一个上行控制信道资源为例，但是本发明的方法不仅限制与选出一个信道资源的系统，实际上本发明也可以适用于在进行信道选择的过程中选出多个信道资源的系统，即在多个信道资源上使用 QPSK 或者其他调制方式发送 ACK/NACK 信息。

[0152] 此外，本发明还提出了一种反馈信息的传输系统，包括如图 5 所示的基站 500 和至少一个如图 3 所示的用户设备 UE300。

[0153] 其中，基站 500 用于半静态的给用户设备 UE300 配置一个上行控制信道资源集合，其中集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，并通过高层信令通知 UE300 该集合内具体的上行控制信道资源，集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；以及用于对所有上行控制信道资源进行检测，获取 UE300 选定反馈的上行控制信道资源，并对选定反馈的上行控制信道资源上的信号进行检测，获取实际反馈信息；并根据 UE300 选定反馈的上行控制信道资源和实际反馈信息，根据映射表格，获取 UE300 反馈的具体 M 个反馈信息。

[0154] UE300 用于接收基站 500 发送的高层信令，获取基站 500 半静态的给用户配置的上行控制信道资源集合，其中集合包含 K 个 ACK/NACK 反馈可用的上行控制信道资源，K ＞＝ 1，集合的大小 K 与 ACK/NACK 反馈窗口长度 M 具有预先定义的对应关系；以及用于接收基站 500 发送的信息，获取反馈窗口内全部上行控制信道资源和下行数据，对下行数据译码后得到 M 个反馈信息，并由 M 个反馈信息组成一个复合反馈状态；以及用于根据映射表格和复合反馈状态，确定实际反馈信息；以及用于当反馈窗口长度 M ＞ L 时，根据映射表格和复合反馈状态，从反馈窗口内全部上行控制信道资源以及 K 个半静态配置的上行控制信道资源中，选定反馈的上行控制信道资源，其中，L 为 LTE Rel-8TDD 系统的复用及信道选择的方法可支持的反馈窗口长度的上限；以及用于将实际反馈信息通过选定反馈的上行控制信道资源发送给基站 500。

[0155] 本发明的实施例提出的上述技术方案，通过高层信令向 UE 配置 K 个半静态配置的上行控制信道资源，实现了扩展 LTE Rel-8 复用和信道选择的反馈方法，上述技术方案可支持的最大 ACK/NACK 反馈容量能够有效增大，可以满足更高的数据传输率，提高系统利用率。上述技术方案能很好支持 LTE-A 系统的同时，本发明也可以适用于 LTE-A 多载波聚合系统，也可以适用于别的需要多 ACK/NAK 传输的系统。本发明提出的上述方案，对现有系统的改动很小，不会影响系统的兼容性，而且实现简单、高效。

[0156] 本领域普通技术人员可以理解实现上述实施例方法携带的全部或部分步骤是可以通过程序来指令相关的硬件完成，所述的程序可以存储于一种计算机可读存储介质中，该程序在执行时，包括方法实施例的步骤之一或其组合。

[0157] 另外，在本发明各个实施例中的各功能单元可以集成在一个处理模块中，也可以是各个单元单独物理存在，也可以两个或两个以上单元集成在一个模块中。上述集成的模块既可以采用硬件的形式实现，也可以采用软件功能模块的形式实现。所述集成的模块如

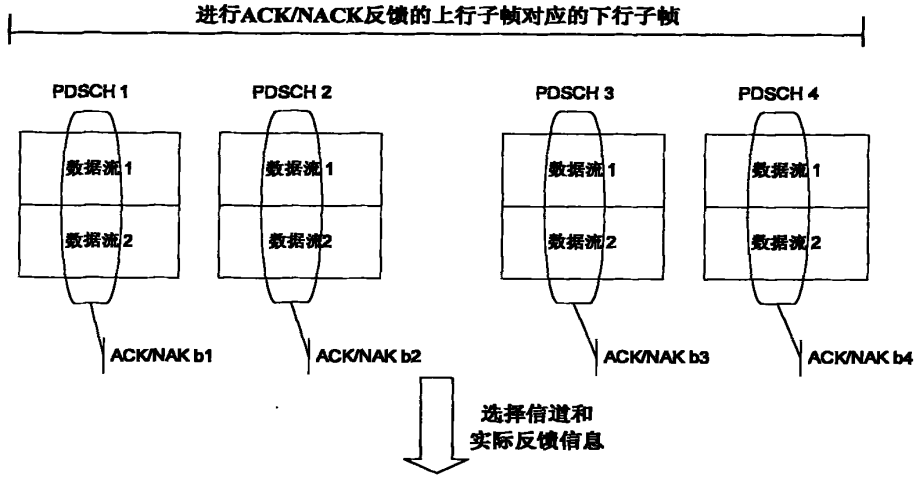
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果以软件功能模块的形式实现并作为独立的产品销售或使用时，也可以存储在一个计算机可读取存储介质中。

[0158] 上述提到的存储介质可以是只读存储器，磁盘或光盘等。

[0159] 以上所述仅是本发明的优选实施方式，应当指出，对于本技术领域的普通技术人员来说，在不脱离本发明原理的前提下，还可以做出若干改进和润饰，这些改进和润饰也应视为本发明的保护范围。

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ACK/NACK b1 b2 b3 b4	上行控制信道资源	实际反馈信息 b(0) b(1)
ACK, ACK, ACK, ACK,	n1	1, 1

图 1

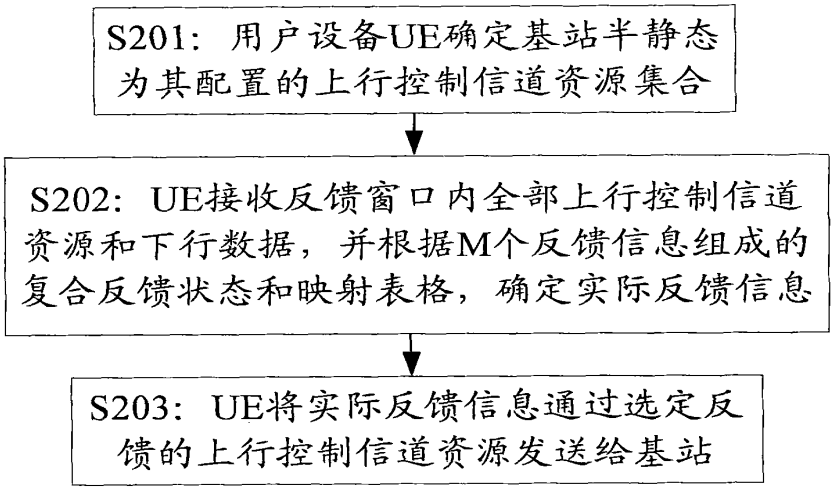


图 2

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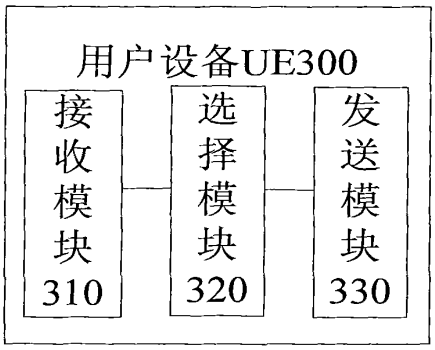


图 3

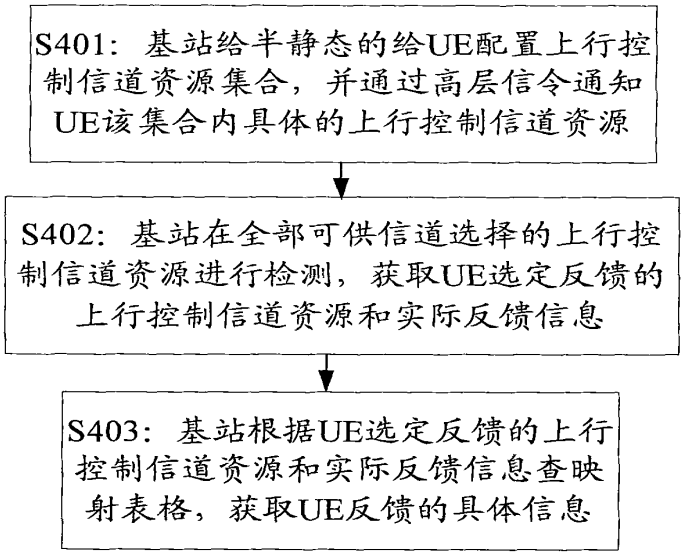


图 4

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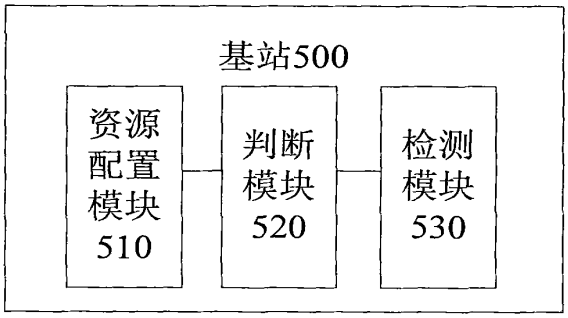


图 5

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Espacenet

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Uplink control channel resource distribution method and device

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Abstract of CN102438319 (A)

The invention discloses an uplink control channel resource distribution method and device. The method comprises the following steps of: establishing a physical uplink control channel (PUCCH) resource table corresponding to uplink control information, wherein a time domain index of a PUCCH resource is set to be the minimum common multiples of various PUCCH repeated cycles supported by the PUCCH resource for transmitting the corresponding uplink control information; and during distribution of the PUCCH resource, finding out an available resource according to the resource table and the PUCCH repeated cycle of a current terminal, finding out an available resource within a range according to the resource table and a smaller PUCCH repeated cycle, and distributing the PUCCH resource to the current terminal according to the search results. Therefore, when the PUCCH resource is distributed to the terminal, the PUCCH repeated cycle of the terminal is considered, and the smaller PUCCH repeated cycle is also considered; under the condition that the uplink control channel resources in different cycles coexist, the transmission requirement of the current terminal can be met and the utilization rate of the uplink control channel resources is increased; and meanwhile, the resources can be selected according to the resource table designed by the embodiment of the invention, so the technology implementation is simplified.

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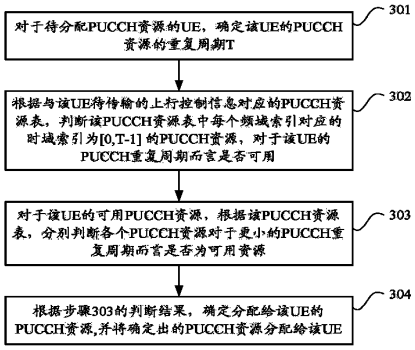
权利要求书 3 页 说明书 10 页 附图 5 页

(54)发明名称

一种上行控制信道资源分配方法及其装置

(57)摘要

本发明公开了一种上行控制信道资源分配方法及其装置。其中，建立对应于上行控制信息的PUCCH资源表，其中的PUCCH资源的时域索引设置为传输相应上行控制信息的PUCCH资源所支持的各种PUCCH重复周期的最小公倍数，在分配PUCCH资源时，首先根据该资源表和当前终端的PUCCH重复周期找出可用资源，再在该范围内根据该资源表和更小的PUCCH重复周期找出可用资源，并根据查找结果为当前终端分配PUCCH资源，从而在为终端分配PUCCH资源时，不仅考虑该终端的PUCCH重复周期，同时还考虑了更小的PUCCH重复周期，从而在不同周期的上行控制信道资源共存的情况下，既能够满足当前终端的传输需求，又提高了上行控制信道资源利用率，同时根据本发明实施例设计的资源表进行上述资源选择，简化了技术实现。



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1. 一种上行控制信道资源分配方法，其特征在于，对应于上行控制信息设置有物理上行控制信道PUCCH资源表，其中的每个PUCCH资源使用时频域索引组合$\langle n_{PUCCH,UCI}, I_{PUCCH,UCI}\rangle$标识，频域索引 $n_{PUCCH,UCI}$ 的取值范围为 [0，$N_{PUCCH,UCI}$-1]，时域索引 $I_{PUCCH,UCI}$ 的取值范围为 [0，$I_{PUCCH,UCI,MAX}$-1]，其中，$N_{PUCCH,UCI}$ 是为传输相应上行控制信息预留的PUCCH频域索引数目，$I_{PUCCH,UCI,MAX}$ 为传输相应上行控制信息的PUCCH资源所支持的各种PUCCH重复周期的最小公倍数，该方法包括：

对于待分配上行控制信道资源的终端，确定所述终端的PUCCH重复周期；

根据与所述终端待传输的上行控制信息对应的PUCCH资源表，判断所述PUCCH资源表中每个频域索引对应的时域索引为 [0，T-1] 的PUCCH资源，对于所述终端的PUCCH重复周期而言是否可用；其中，T为所述终端的PUCCH重复周期；

对于判断为可用的PUCCH资源，根据所述PUCCH资源表，分别判断各个PUCCH资源对于比所述终端的PUCCH重复周期更小的重复周期而言是否可用；

根据所述各个PUCCH资源对于比所述终端的PUCCH重复周期更小的重复周期而言是否可用的判断结果，确定分配给所述终端的PUCCH资源；

将确定出的用于分配给所述终端的PUCCH资源分配给所述终端。

2. 如权利要求1所述的方法，其特征在于，所述分别判断各个PUCCH资源对于比所述终端的PUCCH重复周期更小的重复周期而言是否可用，具体为：

若比所述终端的PUCCH重复周期更小的重复周期有多个，则对于所述多个重复周期中的每个PUCCH重复周期，分别判断所述各个PUCCH资源对于所述更小的重复周期而言是否可用。

3. 如权利要求1或2所述的方法，其特征在于，根据PUCCH资源表，判断PUCCH资源对于PUCCH重复周期而言是否可用，具体为：

对于每个待判断是否可用的PUCCH资源，以当前PUCCH资源为基准，在所述上行控制信息对应的资源表内查找所有与当前PUCCH资源的频域索引相同、时域索引间隔为所述PUCCH重复周期的整数倍的PUCCH资源，如果查找到的所有PUCCH资源均可用，则当前PUCCH资源可用；如果查找到的PUCCH资源中有任何一个资源不可用，则当前PUCCH资源不可用。

4. 如权利要求1所述的方法，其特征在于，所述根据各个PUCCH资源对于比所述终端的PUCCH重复周期更小的重复周期而言是否可用的判断结果，确定分配给所述终端的PUCCH资源，具体为：

如果所述终端的可用PUCCH资源中存在不支持比所述终端的PUCCH重复周期更小的重复周期的资源，则将其中所有不支持更小重复周期的可用资源按照先时域索引递增、后频域索引递增的顺序进行排序，将队列中的第一个PUCCH资源分配给所述终端。

5. 如权利要求1所述的方法，其特征在于，所述根据各个PUCCH资源对于比所述终端的PUCCH重复周期更小的重复周期而言是否可用的判断结果，确定分配给所述终端的PUCCH资源，具体为：

如果所述终端的可用PUCCH资源都可以支持比所述终端的PUCCH重复周期更小的重复周期，则在其中所有可用的PUCCH资源中选择能够支持最少数量的更小重复周期的PUCCH

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资源；

对于选择出来的 PUCCH 资源，按照先时域索引递增、后频域索引递增的顺序进行排序，将队列中的第一个 PUCCH 资源分配给所述终端。

6. 如权利要求 1-2、4-5 之一所述的方法，其特征在于，将 PUCCH 资源分配给所述终端之后，还包括步骤：将相应 PUCCH 资源表中，已分配给所述终端的 PUCCH 资源，以及与该 PUCCH 资源的频域索引相同、时域索引间隔为所述终端的 PUCCH 重复周期的整数倍的 PUCCH 资源，标识为已分配。

7. 如权利要求 1-2、4-5 之一所述的方法，其特征在于，所述终端待传输的上行控制信息包括上行调度请求指示 SRI 或 / 和周期信道质量指示 CQI。

8. 一种上行控制信道资源分配装置，其特征在于，包括：

存储模块，用于存储对应于上行控制信息设置的 PUCCH 资源表，其中的每个 PUCCH 资源使用时频域索引组合$\langle n_{PUCCH,UCI}, I_{PUCCH,UCI}\rangle$标识，频域索引 $n_{PUCCH,UCI}$ 的取值范围为 $[0, N_{PUCCH,UCI}-1]$，时域索引 $I_{PUCCH,UCI}$ 的取值范围为 $[0, I_{PUCCH,UCI,MAX}-1]$，其中，$N_{PUCCH,UCI}$ 是为传输相应上行控制信息预留的 PUCCH 频域索引数目，$I_{PUCCH,UCI,MAX}$ 为传输相应上行控制信息的 PUCCH 资源所支持的各种 PUCCH 重复周期的最小公倍数；

重复周期确定模块，用于对于待分配上行控制信道资源的终端，确定所述终端的 PUCCH 重复周期；

可用资源判断模块，用于根据与所述终端待传输的上行控制信息对应的 PUCCH 资源表，判断所述 PUCCH 资源表中每个频域索引对应的时域索引为 [0,T-1] 的 PUCCH 资源，对于所述终端的 PUCCH 重复周期而言是否可用；以及，对于判断为可用的 PUCCH 资源，根据所述 PUCCH 资源表，分别判断各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用；其中，T 为所述终端的 PUCCH 重复周期；

资源分配模块，用于根据所述各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用的判断结果，确定分配给所述终端的 PUCCH 资源，并将确定出的用于分配给所述终端的 PUCCH 资源分配给所述终端。

9. 如权利要求 8 所述的装置，其特征在于，所述可用资源判断模块具体用于，在分别判断各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用的过程中，若比所述终端的 PUCCH 重复周期更小的重复周期有多个，则对于所述多个重复周期中的每个 PUCCH 重复周期，分别判断所述各个 PUCCH 资源对于所述更小的重复周期而言是否可用。

10. 如权利要求 8 或 9 所述的装置，其特征在于，所述可用资源判断模块具体用于，在判断 PUCCH 资源对于 PUCCH 重复周期而言是否可用的过程中，对于每个待判断是否可用的 PUCCH 资源，以当前 PUCCH 资源为基准，在所述上行控制信息对应的资源表内查找所有与当前 PUCCH 资源的频域索引相同、时域索引间隔为所述 PUCCH 重复周期的整数倍的 PUCCH 资源，如果查找到的所有 PUCCH 资源均可用，则当前 PUCCH 资源可用；如果查找到的 PUCCH 资源中有任何一个资源不可用，则当前 PUCCH 资源不可用。

11. 如权利要求 8 所述的装置，其特征在于，所述资源分配模块具体用于，如果所述终端的可用 PUCCH 资源中存在不支持比所述终端的 PUCCH 重复周期更小的重复周期的资源，

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则将其中所有不支持更小重复周期的可用资源按照先时域索引递增、后频域索引递增的顺序进行排序，将队列中的第一个 PUCCH 资源分配给所述终端。

12. 如权利要求 8 所述的装置，其特征在于，所述资源分配模块具体用于，如果所述终端的可用 PUCCH 资源都可以支持比所述终端的 PUCCH 重复周期更小的重复周期，则在其中所有可用的 PUCCH 资源中选择能够支持最少数量的更小重复周期的 PUCCH 资源；对于选择出来的 PUCCH 资源，按照先时域索引递增、后频域索引递增的顺序进行排序，将队列中的第一个 PUCCH 资源分配给所述终端。

13. 如权利要求 8-9、11-12 之一所述的装置，其特征在于，所述资源分配模块还用于，在将 PUCCH 资源分配给所述终端之后，将相应 PUCCH 资源表中，已分配给所述终端的 PUCCH 资源，以及与该 PUCCH 资源的频域索引相同、时域索引间隔为所述终端的 PUCCH 重复周期的整数倍的 PUCCH 资源，标识为已分配。

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一种上行控制信道资源分配方法及其装置

技术领域

[0001] 本发明涉及无线通信领域，尤其涉及一种上行控制信道资源分配方法及其装置。

背景技术

[0002] 为支持上下行共享信道的正常工作，UE(User Equipment，终端）需要向基站发送某些与上下行数据传输相关的控制信息，即上行控制信息 (Uplink Control Information，UCI)。在 LTE(Long Term Evolution，长期演进）系统中，基站对 UE 的行为进行完全控制，UE 需要接收基站发来的调度信息并按照调度信息的指示进行上下行数据的收发，并反馈相关的控制信息。

[0003] LTE 系统使用 PUCCH(Physical Uplink Control Channel，物理上行控制信道）传输上行控制信息。PUCCH 资源位于上行系统频带的边缘，上下频带的频域宽度是对称的，每一侧的频域宽度为 1 个 PRB(Physical Resource Block，物理资源块）的整数倍。PUCCH 采用跳频方式进行传输，分别位于频带的两侧。系统频带中间部分为 PUSCH(Physical Uplink Shared Channel，物理上行共享信道）资源。每个 PUCCH 资源占用一个 PRB，同一个 PRB 内多个用户之间的 PUCCH 资源通过码分加频分的方式进行区分。

[0004] 在 PUCCH 上传输的上行控制信息主要包括 SRI(Scheduling Request Indicator，上行调度请求指示）、下行 ACK/NACK(Acknowledgement/Negative Acknowledgement) 反馈和周期 CQI(Channel Quality Indicator，信道质量指示）上报信息，除了这些主要的上报信息之外，还可能会携带 PMI(Precoding Matrix Indicator，预编码矩阵指示）、RI(Rank Indication，秩指示）信息。其中，传输 SRI 和周期 CQI 上报的 PUCCH 资源完全由基站的 RRC(Radio Resource Control，无线资源控制）层配置，且具有周期性的特点。按照目前 LTE 标准规定：对于 SRI 传输，可支持的传输周期有 1ms、2ms、5ms、10ms、20ms、40ms 和 80ms；对于周期 CQI 上报，FDD(Frequency Division Duplexing，频分双工）系统可支持的上报周期有：2ms、5ms、10ms、20ms、40ms、80ms、160ms、32ms、64ms 和 128ms，TDD(Time Division Duplexing，时分双工）系统可支持的上报周期有：1ms、5ms、10ms、20ms、40ms、80ms 和 160ms。

[0005] 根据 PUCCH 上承载的信息的不同，PUCCH 支持如下几种 PUCCH format(PUCCH 格式）：

[0006] 表 1：LTE 系统支持的 PUCCH format

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[0007]

PUCCH 格式	调制方式	每个子帧承载比特数M_{bit}	承载信息
1	N/A	N/A	SR
1a	BPSK	1	ACK/NACK; ACK/NACK+SR
1b	QPSK	2	ACK/NACK; ACK/NACK+SR
2	QPSK	20	CQI; CQI+ ACK/NACK (extended cyclic prefix)
2a	QPSK+BPSK	21	CQI+ ACK/NACK(normal cyclic prefix)
2b	QPSK+QPSK	22	CQI+ ACK/NACK(normal cyclic prefix)

[0008] 不同 format 的 PUCCH 资源按照如图 1 所示的原则映射，其中 format 2/2a/2b 占用频带最边缘部分，如果最后一个用于 format 2/2a/2b 的 PRB 上的循环序列资源没有完全使用时，可以在该 PRB 上复用 PUCCH format1/1a/1b。

[0009] PUCCH(1) 和 PUCCH(2) 分开编号。其中，PUCCH(1) 是指 PUCCHformat 1/1a/1b，PUCCH(2) 是指 PUCCH format 2/2a/2b。

[0010] 对于 PUCCH(1)，一个 PRB 可以承载的 PUCCH 资源为c IN_{sc}^{RB} /⇐$_{shift}^{PUCCH}$个，其中：c 的取值等于上行 DMRS(De Modulation Reference Signal，解调参考信号）占用的 SC-FDMA(Single Carrier Frequency Division Multiple Access，单载波频分多址）符号数；⇐$_{shift}^{PUCCH}$表示循环移位序列的循环移位间隔，⇐$_{shift}^{PUCCH}$可选值为 1、2、3；N_{sc}^{RB}表示一个 PRB 包含的子载波的个数，取值为 12。假设 c = 3，⇐$_{shift}^{PUCCH}$ = 2，则 PUCCH(1) 一个 PRB 可承载的 PUCCH 资源个数为 3×12/2 = 18 个，假设系统中 PUCCH(1) 资源包含 M_1 个 PRB，将这些 PRB 按照频域由低到高的顺序进行编号，则对于 PRB i_1(0} i_1 ™M_1)，其对应的 PUCCH(1) 资源索引号为18 Ii_1 ~ 18 Ii_1 J 17。

[0011] 对于 PUCCH(2)，一个 PRB 可以承载的 PUCCH 资源为 12 个，假设系统中 PUCCH(2) 资源包含 M_2 个 PRB，将这些 PRB 按照频域由低到高的顺序进行编号，则对于 PRB i_2(0} i_2™M_2)，其对应的 PUCCH(2) 资源索引号为12 Ii_2 ~ 12 Ii_2 J 11。

[0012] 因此，一个 PUCCH 资源通过时域信息（周期、起始帧号、子帧偏移）、频域信息（所占 PRB 的位置）、码域信息（所使用的循环移位三个要素决定，频域信息、码域信息联合表现为 PUCCH 在一个子帧内的频域索引号。基站为 UE 分配的 PUCCH 资源由一对编号

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$\langle n_{PUCCH}, I_{UCI} \rangle$进行标识，其中 n_{PUCCH} 表示频域索引，I_{UCI} 表示时域索引。

[0013] 目前的 PUCCH 资源分配方法是按照 UE 接入系统的顺序依次为各 UE 分配 PUCCH 资源，在为 UE 分配周期性 PUCCH 资源时，先确定 PUCCH 重复周期，然后按照先时域累加，后频域累加的顺序寻找可用的 PUCCH 资源，即遍历索引组合$\langle n_{PUCCH}, I_{UCI} \rangle$时，先累加索引 I_{UCI}，然后累加索引 n_{PUCCH}，将第 1 个搜索到的可用 PUCCH 资源分配给 UE。

[0014] 目前在确定 UE 的 PUCCH 资源重复周期之后，为 UE 分配 PUCCH 资源的过程中，先从第一个频域索引对应的资源开始，按照时域索引由小到大的顺序搜索可用的 PUCCH 资源，如果找到可用的 PUCCH 资源，则将该 PUCCH 资源分配给当前 UE；如果该频域索引对应的所有 PUCCH 资源都不可用，则在下一个频域索引对应的资源中按照时域索引由小到大的顺序搜索可用的 PUCCH 资源，按照以上的遍历顺序，一旦搜索到可用的 PUCCH 资源，则将该资源分配给当前 UE。由于在实际系统中，对于不同的 UE 可能需要分配不同周期的 PUCCH 资源。

[0015] 在不同周期的 PUCCH 资源共存的情况下，目前的 PUCCH 资源分配方法存在以下问题（如图 2 所示，图中一个小方格代表一个 PUCCH 资源）：在完成对先接入的 UE1、UE2、UE3、UE4、UE5 的 PUCCH 资源分配后，如果这些 UE 的 PUCCH 资源具有较长的重复周期（如图 2 中颜色填充小方格所示，这些 UE 的 PUCCH 资源的重复周期为 10ms），那么在为当前接入的 UE6 分配 PUCCH 资源时，如果 UE6 的 PUCCH 资源重复周期较小（如 5ms），此频域索引 1 对应的尚未分配的 PUCCH 资源对于 UE6 而言都是不可用资源，因此需要在下一个频域索引中寻找可用资源并分配给 UE6，最终分配给 UE6 的资源如图 2 中斜线填充小方格所示。如果后续接入的 UE 中总是 PUCCH 资源重复周期小于 10ms 的 UE，则总是不能分配频域索引 1 对应的未分配资源，这样这些资源就成为了资源碎片。从以上示例可以看出，在不同周期的 PUCCH 资源共存的情况下，按照这种方法分配 PUCCH 资源不利于 PUCCH 资源的高效利用。在 LTE 系统中，PUCCH 资源和 PUSCH 资源共享上行系统带宽，在系统 PUCCH 资源需求一定的情况下，目前的 PUCCH 资源分配方案致使 PUCCH 需要占用更多的频域资源，从而减小了 PUSCH 传输带宽。

发明内容

[0016] 本发明实施例提供了一种上行控制信道资源分配方法及其装置，用以解决现有上行控制信道资源分配机制在不同周期的上行控制信道资源共存的情况下，上行控制信道资源利用率低的问题。

[0017] 本发明实施例提供的上行控制信道资源分配方法中，对应于上行控制信息设置有 PUCCH 资源表，其中的每个 PUCCH 资源使用时频域索引组合$\langle n_{PUCCH,UCI}, I_{PUCCH,UCI} \rangle$标识，频域索引 $n_{PUCCH,UCI}$ 的取值范围为 $[0, N_{PUCCH,UCI}-1]$，时域索引 $I_{PUCCH,UCI}$ 的取值范围为 $[0, I_{PUCCH,UCI,MAX}-1]$，其中，$N_{PUCCH,UCI}$ 是为传输相应上行控制信息预留的 PUCCH 频域索引数目，$I_{PUCCH,UCI,MAX}$ 为传输相应上行控制信息的 PUCCH 资源所支持的各种 PUCCH 重复周期的最小公倍数，该方法包括：

[0018] 对于待分配上行控制信道资源的终端，确定所述终端的 PUCCH 重复周期；

[0019] 根据与所述终端待传输的上行控制信息对应的 PUCCH 资源表，判断所述 PUCCH 资源表中每个频域索引对应的时域索引为 [0, T-1] 的 PUCCH 资源，对于所述终端的 PUCCH 重

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复周期而言是否可用；其中，T 为所述终端的 PUCCH 重复周期；

[0020] 对于判断为可用的 PUCCH 资源，根据所述 PUCCH 资源表，分别判断各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用；

[0021] 根据所述各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用的判断结果，确定分配给所述终端的 PUCCH 资源；

[0022] 将确定出的用于分配给所述终端的 PUCCH 资源分配给所述终端。

[0023] 本发明实施例提供的上行控制信道资源分配装置，包括：

[0024] 存储模块，用于存储对应于上行控制信息设置的 PUCCH 资源表，其中的每个 PUCCH 资源使用时频域索引组合$\langle n_{PUCCH,UCI}, I_{PUCCH,UCI}\rangle$标识，频域索引 $n_{PUCCH,UCI}$ 的取值范围为 $[0, N_{PUCCH,UCI}-1]$，时域索引 $I_{PUCCH,UCI}$ 的取值范围为 $[0, I_{PUCCH,UCI,MAX}-1]$，其中，$N_{PUCCH,UCI}$ 是为传输相应上行控制信息预留的 PUCCH 频域索引数目，$I_{PUCCH,UCI,MAX}$ 为传输相应上行控制信息的 PUCCH 资源所支持的各种 PUCCH 重复周期的最小公倍数；

[0025] 重复周期确定模块，用于对于待分配上行控制信道资源的终端，确定所述终端的 PUCCH 重复周期；

[0026] 可用资源判断模块，用于根据与所述终端待传输的上行控制信息对应的 PUCCH 资源表，判断所述 PUCCH 资源表中每个频域索引对应的时域索引为 [0,T-1] 的 PUCCH 资源，对于所述终端的 PUCCH 重复周期而言是否可用；以及，对于判断为可用的 PUCCH 资源，根据所述 PUCCH 资源表，分别判断各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用；其中，T 为所述终端的 PUCCH 重复周期；

[0027] 资源分配模块，用于根据所述各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用的判断结果，确定分配给所述终端的 PUCCH 资源，并将确定出的用于分配给所述终端的 PUCCH 资源分配给所述终端。

[0028] 本发明的上述实施例中，建立对应于上行控制信息的 PUCCH 资源表，其中的 PUCCH 资源的时域索引设置为传输相应上行控制信息的 PUCCH 资源所支持的各种 PUCCH 重复周期的最小公倍数，在分配 PUCCH 资源时，首先根据该资源表和当前终端的 PUCCH 重复周期找出可用资源，再在该范围内根据该资源表和更小的 PUCCH 重复周期找出可用资源，并根据查找结果为当前终端分配 PUCCH 资源，从而在为终端分配 PUCCH 资源时，不仅考虑该终端的 PUCCH 重复周期，同时还考虑了更小的 PUCCH 重复周期，从而在不同周期的上行控制信道资源共存的情况下，既能够满足当前终端的传输需求，又提高了上行控制信道资源利用率，同时根据本发明实施例设计的资源表进行上述资源选择，简化了技术实现。

附图说明

[0029] 图 1 为现有技术中各种 PUCCH format 共存情况下的物理资源映射示意图；

[0030] 图 2 为现有技术中的 PUCCH 资源分配示意图；

[0031] 图 3 为本发明实施例提供的上行控制信道资源分配流程示意图；

[0032] 图 4 为本发明实施例一中的 PUCCH 资源占用情况示意图；

[0033] 图 5 为本发明实施例一中当前 UE 的可用 PUCCH 资源对其他资源重复周期的支持情况示意图；

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[0034] 图 6 为本发明实施例二中的 PUCCH 资源占用情况示意图；

[0035] 图 7 为本发明实施例二中当前 UE 的可用 PUCCH 资源对其他资源重复周期的支持情况示意图；

[0036] 图 8 为本发明实施例提供的上行控制信道资源分配装置的结构示意图。

具体实施方式

[0037] 针对现有技术存在的上述问题，本发明实施例提出了一种在不同周期的 PUCCH 资源共存的情况下的 PUCCH 资源分配方法，利用一种上行控制信息（如 SRI 或者周期 CQI 上报）支持的多种传输周期之间具有整数倍的特点，在进行 PUCCH 资源分配时尽量使不同周期 PUCCH 资源能够更好的兼容，减少资源碎片的产生，提高 PUCCH 资源利用率。

[0038] 下面结合附图对本发明实施例进行详细描述。

[0039] 本发明实施例中，首先根据所传输的 UCI 的种类，建立对应的 PUCCH 资源表，即每一种 UCI 对应一个 PUCCH 资源表，PUCCH 资源表中的每个 PUCCH 资源使用时频域索引组合 $\langle n_{PUCCH,UCI}, I_{PUCCH,UCI} \rangle$ 进行标识，其中：

[0040] 频域索引 $n_{PUCCH,UCI}$ 取值范围为 0 ～ $N_{PUCCH,UCI}-1$，$N_{PUCCH,UCI}$ 为传输该 UCI 预留的 PUCCH 频域索引数目；时域索引 $I_{PUCCH,UCI}$ 的取值范围为 0 ～ $I_{PUCCH,UCI,MAX}-1$，$I_{PUCCH,UCI,MAX}$ 为系统中传输该 UCI 的 PUCCH 资源支持的各种重复周期的最小公倍数。

[0041] 当需要为 UE 分配传输上行控制信息的 PUCCH 资源时，如图 3 所示，其 PUCCH 资源分配流程可包括：

[0042] 步骤 301，网络设备（如基站）对于待分配 PUCCH 资源的 UE，确定该 UE 的 PUCCH 资源的重复周期 T（单位：ms）。

[0043] 具体的，网络设备可根据现有方式确定 UE 的 PUCCH 重复周期，如，基站在为 UE 配置 SRI 资源重复周期时会考虑业务的 QoS（Quality of Service，业务服务质量）（如业务类型，时延要求等）；在为 UE 配置周期 CQI 上报的资源重复周期时会考虑 UE 的移动速度、信道变化快慢等因素。对于不同 UE 可能配置不同的 SRI 资源周期或者不同的 CQI 上报周期。

[0044] 步骤 302，网络设备根据与该 UE 待传输的上行控制信息对应的 PUCCH 资源表，判断该 PUCCH 资源表中每个频域索引对应的时域索引为 [0，T-1] 的 PUCCH 资源，对于该 UE 的 PUCCH 重复周期而言是否可用。

[0045] 具体的，网络设备可通过以下方式进行判断：以当前考察的 PUCCH 资源为基准，在资源表内找出所有与当前 PUCCH 资源的频域索引相同、时域索引间隔为 T 的整数倍的 PUCCH 资源，同时考察这 $I_{PUCCH,UCI,MAX}/T$ 个 PUCCH 资源，如果所有这 $I_{PUCCH,UCI,MAX}/T$ 个 PUCCH 资源均可用，则当前 PUCCH 资源可用；如果这 $I_{PUCCH,UCI,MAX}/T$ 个 PUCCH 资源中有任何一个资源不可用，则当前 PUCCH 资源不可用。

[0046] 步骤 303，网络设备对于该 UE 的可用 PUCCH 资源，根据该 PUCCH 资源表，分别判断各个 PUCCH 资源对于更小的 PUCCH 重复周期而言是否为可用资源。

[0047] 假设系统中传输该 UCI 的 PUCCH 资源支持的各种重复周期中，取值小于 T 的重复周期有 N 个，对于每个 PUCCH 资源重复周期 $T_i (T_i \neq T, 0 < i \leq N)$，以当前考察的 PUCCH 资源为基准，在资源表内找出所有与当前 PUCCH 资源的频域索引相同、时域索引间隔为 T_i

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的整数倍的 PUCCH 资源，同时考察这 $I_{PUCCH,UCI,MAX}/T_i$ 个 PUCCH 资源，如果所有这 $I_{PUCCH,UCI,MAX}/T_i$ 个 PUCCH 资源均可用，则当前 PUCCH 资源对于 PUCCH 重复周期 T_i 而言是否为可用资源；如果这 $I_{PUCCH,UCI,MAX}/T_i$ 个 PUCCH 资源中有任何一个资源不可用，则当前 PUCCH 资源对于 PUCCH 重复周期 T_i 而言是否为不可用资源。对于可以支持更小重复周期的 PUCCH 资源，进一步确定其可以支持的更小的 PUCCH 重复周期取值的个数。

[0048] 步骤 304，网络设备根据步骤 303 的判断结果，确定分配给该 UE 的 PUCCH 资源，并将确定出的 PUCCH 资源分配给该 UE。

[0049] 具体的，如果该 UE 的可用 PUCCH 资源中存在不支持更小 PUCCH 重复周期的资源，则将所有这些不支持更小 PUCCH 重复周期的可用资源按照先时域索引递增、后频域索引递增的顺序进行排序，将队列中的第一个 PUCCH 资源分配给该 UE。进一步的，将资源表中对应的 $I_{PUCCH,UCI,MAX}/T$ 个 PUCCH 资源标识为“已分配”；

[0050] 如果该 UE 的可用 PUCCH 资源都可以支持更小 PUCCH 重复周期，则在所有这些可用的 PUCCH 资源中选择其中能够支持的更小 PUCCH 重复周期取值个数最少的 PUCCH 资源，对于挑选出来的这些 PUCCH 资源按照先时域索引递增、后频域索引递增的顺序进行排序，将队列中的第一个 PUCCH 资源分配给该 UE，同时将资源表中对应的 $I_{PUCCH,UCI,MAX}/T$ 个 PUCCH 资源标识为“已分配”。

[0051] 若当前待分配 PUCCH 资源的 UE 有多个，则对于其中的每个 UE，均采用上述方法进行 PUCCH 资源分配。

[0052] 为了更清楚的说明本发明实施例，下面给出 2 个实施例，说明 PUCCH 资源分配的具体过程。

[0053] 实施例一

[0054] 假设在一个 LTE 上行系统中，预留出来用于传输 SRI 的 PUCCH 资源的索引数目为 $N_{PUCCH,SRI}$，该系统中用于传输 SRI 的 PUCCH 资源的重复周期有 1ms、2ms、5ms、10ms、20ms 和 40ms 几种。

[0055] 首先建立用于传输 SRI 的 PUCCH 资源表集合，PUCCH 资源表中的每个 PUCCH 资源使用时频域索引组合 $\langle n_{PUCCH,SRI}, I_{PUCCH,SRI} \rangle$ 进行标识，根据为传输 SRI 预留的 PUCCH 资源数目确定频域索引 $n_{PUCCH,SRI}$ 的取值范围为 0 ～ $N_{PUCCH,SRI}-1$；根据该系统中用于传输 SRI 的 PUCCH 资源重复周期确定时域索引 $I_{PUCCH,SRI}$ 的最大取值为该系统中用于传输 SRI 的 PUCCH 资源的各种重复周期的最小公倍数 40，因此 $I_{PUCCH,SRI}$ 的取值范围为 0 ～ 39。

[0056] 假设当前有一个 UE 接入该系统，需要为该 UE 分配用于传输 SRI 的 PUCCH 资源。

[0057] 在步骤 301 中，首先按照已知方法确定该 UE 的 PUCCH 资源的重复周期 T 为 20ms。

[0058] 在步骤 302 中，对于 PUCCH 资源表中每个频域索引对应的时域索引范围在 0 ～ 19 内的 PUCCH 资源，判断该资源对于当前 UE 而言是否为可用资源。具体判断方法为：以当前考察的 PUCCH 资源为基准，在资源表内找到与当前 PUCCH 资源的频域索引相同，时域索引间隔为 20ms 的 PUCCH 资源，即需要同时考察 PUCCH 资源表的时域索引 $I_{PUCCH,SRI}$ 范围内的，满足前述条件的 PUCCH 资源，本实例中需要考察 2 个 PUCCH 资源是否可用，如果这 2 个 PUCCH 资源均可用，则当前 PUCCH 资源可用；如果这 2 个 PUCCH 资源中有任何一个资源不可用，则当

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前 PUCCH 资源不可用。假设当前系统 PUCCH 资源占用情况如图 4 所示，图中一个小方格代表一个 PUCCH 资源。按照以上方法确定当前系统所有未分配的资源对于当前 UE 而言均为可用的 PUCCH 资源，这些资源分别为（如图 4 中未填充的小方块所示）：

[0059] 频域索引 2 对应的可用资源：(2,4)、(2,6)、(2,9)、(2,11)、(2,14)、(2,16)、(2,19)；

[0060] 频域索引 3 对应的可用资源：(3,1)、(3,3)、(3,5)、(3,7) (3,9)、(3,11)、(3,13)、(3,15)、(3,17) (3,19)；

[0061] 频域索引 4 ～ $N_{PUCCH,SRI}-1$ 对应的可用资源为 $(n_{\hat{}PUCCH,SRI}, I_{\hat{}PUCCH,SRI})$，其中 $4 \} n_{\hat{}PUCCH,SRI} \} N_{PUCCH,SRI} \ulcorner 1 \ ,0 \} I_{\hat{}PUCCH,SRI} \} 19$。

[0062] 在步骤 303 中，对于步骤 302 确定的当前 UE 可用的 PUCCH 资源，分别判断每个可用 PUCCH 资源对于更小的 PUCCH 重复周期而言是否为可用资源，对于可以支持更小重复周期的 PUCCH 资源，并确定其可以支持的更小的 PUCCH 重复周期取值的个数，判断结果为：

[0063] 频域索引 2 对应的可用资源中：

[0064] 资源 (2,4)、(2,9)、(2,14) 和 (2,19)（如图 5 中交叉线填充小方格所示）除了可以支持 20ms 的重复周期外，还可以支持 10ms 和 5ms 的重复周期；

[0065] 资源 (2,6) 和 (2,16)（如图 5 中竖线填充小方格所示）除了可以支持 20ms 的重复周期外，还可以支持 10ms 的重复周期；

[0066] 资源 (2,11)（如图 5 中横线填充小方格所示）除了可以支持 20ms 的重复周期外，不能够支持其他更小的重复周期。

[0067] 频域索引 3 对应的所有可用资源除了可以支持 20ms 的重复周期外，还可以支持 10ms 和 2ms 的重复周期。

[0068] 频域索引 4 ～ $N_{PUCCH,SRI}-1$ 对应的所有可用资源除了可以支持 20ms 的重复周期外，还可以支持 10ms、5ms、2ms 和 1ms 的重复周期。

[0069] 在步骤 304 中，确定分配给当前 UE 的 PUCCH 资源：根据步骤 303 的判断结果，当前 UE 的可用 PUCCH 资源中有 1 个不支持重复周期小于 20ms 的 PUCCH 资源 (2,11)（如图 5 中横线填充小方格代表的资源），因此将 PUCCH 资源 (2,11) 分配给当前 UE，并将 PUCCH 资源 (2,11) 和 (2,31) 标识为“已分配”。

[0070] 实施例二

[0071] 假设在一个 LTE 上行系统中，预留出来用于传输 SRI 的 PUCCH 资源的索引数目为 $N_{PUCCH,SRI}$，该系统中用于传输 SRI 的 PUCCH 资源的重复周期有 1ms、2ms、5ms、10ms、20ms 和 40ms 几种。

[0072] 首先建立用于传输 SRI 的 PUCCH 资源表集合，PUCCH 资源表中的每个 PUCCH 资源使用时频域索引组合 $\propto n_{PUCCH,SRI}, I_{PUCCH,SRI} \leq$ 进行标识，根据为传输 SRI 预留的 PUCCH 资源数目确定频域索引 $n_{PUCCH,SRI}$ 的取值范围为 0 ～ $N_{PUCCH,SRI}-1$；根据该系统中用于传输 SRI 的 PUCCH 资源重复周期确定时域索引 $I_{PUCCH,SRI}$ 的最大取值为该系统中用于传输 SRI 的 PUCCH 资源的各种重复周期的最小公倍数 40，因此 $I_{PUCCH,SRI}$ 的取值范围为 0 ～ 39。

[0073] 假设当前有一个 UE 接入该系统，需要为该 UE 分配用于传输 SRI 的 PUCCH 资源。

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[0074] 在步骤 301 中，首先按照已知方法确定该 UE 的 PUCCH 资源的重复周期 T 为 20ms.

[0075] 在步骤 302 中，对于 PUCCH 资源表中每个频域索引对应的时域索引范围在 0 ～ 19 内的 PUCCH 资源，判断该资源对于当前 UE 而言是否为可用资源。具体判断方法为：以当前考察的 PUCCH 资源为基准，在资源表内找到与当前 PUCCH 资源的频域索引相同，时域索引间隔为 20ms 的 PUCCH 资源，即需要同时考察 PUCCH 资源表的时域索引 $I_{PUCCH,SRI}$ 范围内的，满足前述条件的 PUCCH 资源，本实例中需要考察 2 个 PUCCH 资源是否可用，如果这 2 个 PUCCH 资源均可用，则当前 PUCCH 资源可用；如果这 2 个 PUCCH 资源中有任何一个资源不可用，则当前 PUCCH 资源不可用。假设当前系统 PUCCH 资源占用情况如图 6 所示，图中一个小方格代表一个 PUCCH 资源。按照以上方法确定当前系统所有未分配的资源对于当前 UE 而言均为可用的 PUCCH 资源，这些资源分别为（如图 6 中未填充的小方块所示）：

[0076] 频域索引 2 对应的可用资源：(2,4)、(2,6)、(2,9)、(2,14)、(2,16)、(2,19)；

[0077] 频域索引 3 对应的可用资源：(3,1)、(3,3)、(3,5)、(3,7) (3,9)、(3,11)、(3,13)、(3,15)、(3,17) (3,19)；

[0078] 频域索引 4 ～ $N_{PUCCH,SRI}-1$ 对应的可用资源为 $(n_{\hat{}PUCCH,SRI}, I_{\hat{}PUCCH,SRI})$，其中 $4 \} n_{\hat{}PUCCH,SRI} \} N_{PUCCH,SRI}$ 〔1 ,0 $\} I_{\hat{}PUCCH,SRI} \} 19$。

[0079] 在步骤 303 中，对于步骤 302 确定的当前 UE 可用的 PUCCH 资源，分别判断每个可用 PUCCH 资源对于更小的 PUCCH 重复周期而言是否为可用资源，对于可以支持更小重复周期的 PUCCH 资源，同时确定其可以支持的更小的 PUCCH 重复周期取值的个数，判断结果如图 7 所示：

[0080] 频域索引 2 对应的可用资源中：

[0081] 资源 (2,4)、(2,9)、(2,14) 和 (2,19)（如图 7 中竖线填充小方格所示）除了可以支持 20ms 的重复周期外，还可以支持 10ms 和 5ms 的重复周期；

[0082] 资源 (2,6) 和 (2,16)（如图 7 中横线填充小方格所示）除了可以支持 20ms 的重复周期外，还可以支持 10ms 的重复周期；

[0083] 频域索引 3 对应的所有可用资源除了可以支持 20ms 的重复周期外，还可以支持 10ms 和 2ms 的重复周期；

[0084] 频域索引 4 ～ $N_{PUCCH,SRI}-1$ 对应的所有可用资源除了可以支持 20ms 的重复周期外，还可以支持 10ms、5ms、2ms 和 1ms 的重复周期。

[0085] 在步骤 304 中，确定分配给当前 UE 的 PUCCH 资源：根据步骤 303 的判断结果，当前 UE 的可用 PUCCH 资源都可以支持更小的 PUCCH 重复周期，在这些可用 PUCCH 资源中：资源 (2,6) 和 (2,16)（图 7 中横线填充小方块所示）除了可以支持 20ms 重复周期外，还可以支持 1 个更小的 PUCCH 重复周期，其余的可用 PUCCH 资源除了可以支持 20ms 的重复周期外，还可以支持 2 个以上更小的 PUCCH 重复周期。经比较，资源 (2,6) 和 (2,16) 能够支持的更小 PUCCH 重复周期取值个数最少，将这 2 个 PUCCH 资源按照先时域索引递增，后频域索引递增的顺序进行排序，将排在前面的 PUCCH 资源 (2,6) 分配给当前 UE，并将 PUCCH 资源 (2,6) 和 (2,26) 标识为“已分配”。

[0086] 通过以上描述可以看出，本发明实施例实现了在不同周期的 PUCCH 资源共存的情况下的 PUCCH 资源分配，其利用一种上行控制信息（如 SRI 或者周期 CQI 上报）支持的多

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种传输周期之间具有整数倍的特点，在进行 PUCCH 资源分配时尽量使不同周期 PUCCH 资源能够更好的兼容。使用本发明实施例，能够有效地降低 PUCCH 资源碎片出现的概率，提高 PUCCH 资源利用率。

[0087] 通过以上描述可以看出，本发明实施例实现了在不同周期的 PUCCH 资源共存情况下的 PUCCH 资源分配，其对于待分配 PUCCH 资源的 UE，在该 UE 的可用 PUCCH 资源中通过判断每个资源能否支持更小的重复周期，以及可以支持的更小的重复周期取值的个数确定分配给当前 UE 的 PUCCH 资源，可以看出，对于待分配 PUCCH 资源的 UE，在寻找可用资源时，只需在时域上对该 UE 的一个 PUCCH 重复周期范围的 PUCCH 资源进行判决，从而为了避免重复操作，降低实现复杂度。本发明实施例适用于传输 SRI 和周期 CQI 上报的 PUCCH 资源的分配。

[0088] 基于相同的技术构思，本发明实施例还提供了一种上行控制信道资源分配装置，该装置通常设置于基站设备。

[0089] 参见图 8，为本发明实施例提供的上行控制信道资源分配装置的结构示意图，该装置可包括：

[0090] 存储模块 801，用于存储对应于上行控制信息设置的 PUCCH 资源表，其中的每个 PUCCH 资源使用时频域索引组合$\left\{n_{PUCCH,UCI}, I_{PUCCH,UCI}\right\}$标识，频域索引 $n_{PUCCH,UCI}$ 的取值范围为 $[0, N_{PUCCH,UCI}-1]$，时域索引 $I_{PUCCH,UCI}$ 的取值范围为 $[0, I_{PUCCH,UCI,MAX}-1]$，其中，$N_{PUCCH,UCI}$ 是为传输相应上行控制信息预留的 PUCCH 频域索引数目，$I_{PUCCH,UCI,MAX}$ 为传输相应上行控制信息的 PUCCH 资源所支持的各种 PUCCH 重复周期的最小公倍数；

[0091] 重复周期确定模块 802，用于对于待分配上行控制信道资源的终端，确定所述终端的 PUCCH 重复周期；

[0092] 可用资源判断模块 803，用于根据与所述终端待传输的上行控制信息对应的 PUCCH 资源表，判断所述 PUCCH 资源表中每个频域索引对应的时域索引为 [0，T-1] 的 PUCCH 资源，对于所述终端的 PUCCH 重复周期而言是否可用；以及，对于判断为可用的 PUCCH 资源，根据所述 PUCCH 资源表，分别判断各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用；其中，T 为所述终端的 PUCCH 重复周期；

[0093] 资源分配模块 804，用于根据所述各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用的判断结果，确定分配给所述终端的 PUCCH 资源，并将确定出的用于分配给所述终端的 PUCCH 资源分配给所述终端。

[0094] 具体的，可用资源判断模块 803 在分别判断各个 PUCCH 资源对于比所述终端的 PUCCH 重复周期更小的重复周期而言是否可用的过程中，若比所述终端的 PUCCH 重复周期更小的重复周期有多个，则对于所述多个重复周期中的每个 PUCCH 重复周期，分别判断所述各个 PUCCH 资源对于所述更小的重复周期而言是否可用。

[0095] 具体的，可用资源判断模块 803 在判断 PUCCH 资源对于 PUCCH 重复周期而言是否可用的过程中，对于每个待判断是否可用的 PUCCH 资源，以当前 PUCCH 资源为基准，在所述上行控制信息对应的资源表内查找所有与当前 PUCCH 资源的频域索引相同、时域索引间隔为所述 PUCCH 重复周期的整数倍的 PUCCH 资源，如果查找到的所有 PUCCH 资源均可用，则当前 PUCCH 资源可用；如果查找到的 PUCCH 资源中有任何一个资源不可用，则当前 PUCCH 资源

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不可用。

[0096] 具体的，资源分配模块 804 在进行资源分配时，如果所述终端的可用 PUCCH 资源中存在不支持比所述终端的 PUCCH 重复周期更小的重复周期的资源，则将其中所有不支持更小重复周期的可用资源按照先时域索引递增、后频域索引递增的顺序进行排序，将队列中的第一个 PUCCH 资源分配给所述终端。如果所述终端的可用 PUCCH 资源都可以支持比所述终端的 PUCCH 重复周期更小的重复周期，则在其中所有可用的 PUCCH 资源中选择能够支持最少数量的更小重复周期的 PUCCH 资源；对于选择出来的 PUCCH 资源，按照先时域索引递增、后频域索引递增的顺序进行排序，将队列中的第一个 PUCCH 资源分配给所述终端。

[0097] 进一步的，资源分配模块 804 在将 PUCCH 资源分配给所述终端之后，还将相应 PUCCH 资源表中，已分配给所述终端的 PUCCH 资源，以及与该 PUCCH 资源的频域索引相同、时域索引间隔为所述终端的 PUCCH 重复周期的整数倍的 PUCCH 资源，标识为已分配。

[0098] 本领域技术人员可以理解实施例中的装置中的模块可以按照实施例描述进行分布于实施例的装置中，也可以进行相应变化位于不同于本实施例的一个或多个装置中。上述实施例的模块可以合并为一个模块，也可以进一步拆分成多个子模块。

[0099] 通过以上的实施方式的描述，本领域的技术人员可以清楚地了解到本发明可借助软件加必需的通用硬件平台的方式来实现，当然也可以通过硬件，但很多情况下前者是更佳的实施方式。基于这样的理解，本发明的技术方案本质上或者说对现有技术做出贡献的部分可以以软件产品的形式体现出来，该计算机软件产品存储在一个存储介质中，包括若干指令用以使得一台终端设备（可以是手机，个人计算机，服务器，或者网络设备等）执行本发明各个实施例所述的方法。

[0100] 以上所述仅是本发明的优选实施方式，应当指出，对于本技术领域的普通技术人员来说，在不脱离本发明原理的前提下，还可以做出若干改进和润饰，这些改进和润饰也应视本发明的保护范围。

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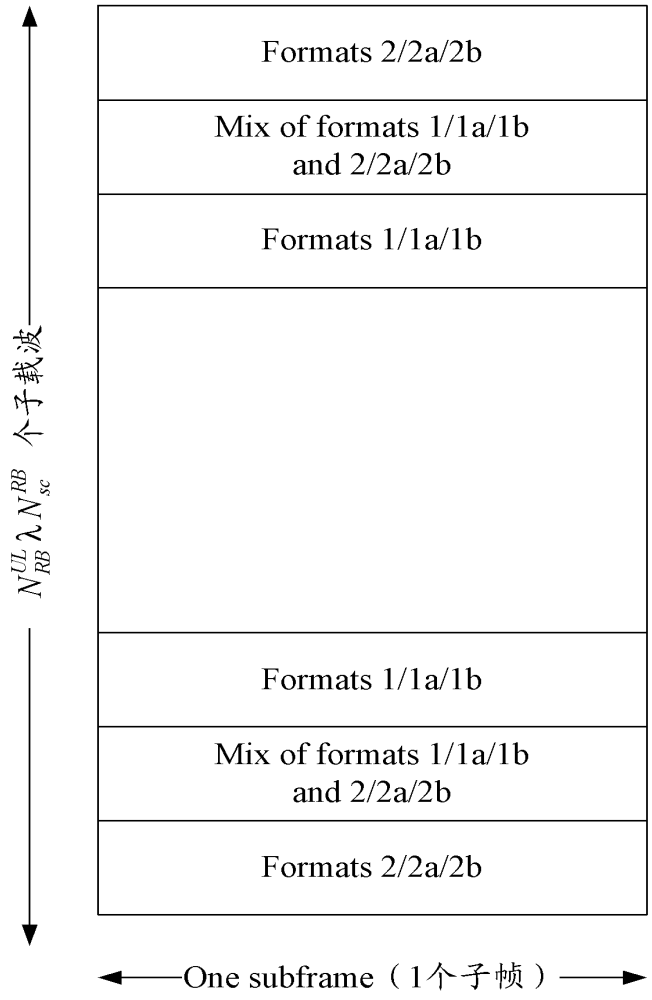


图 1

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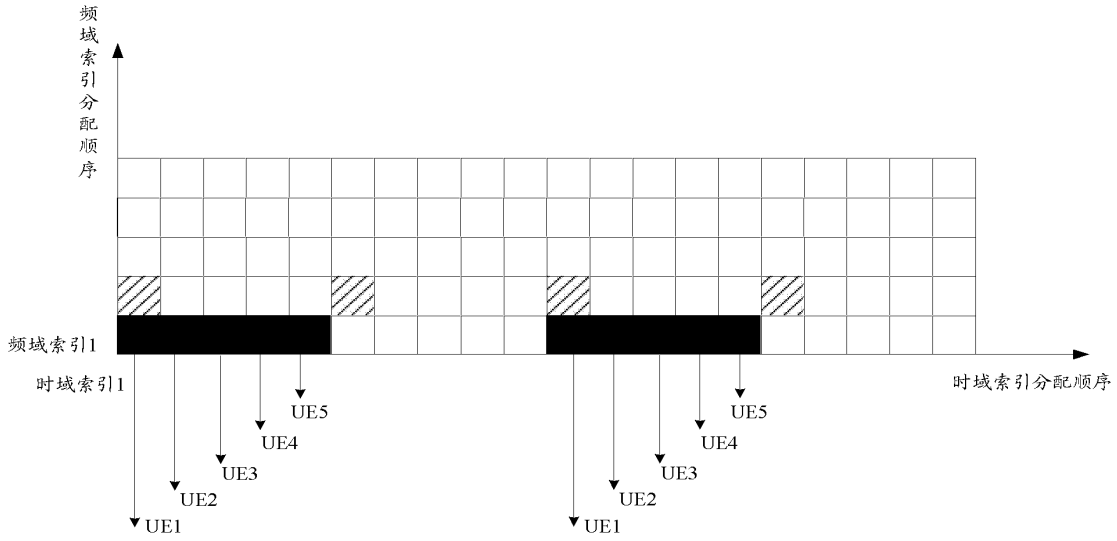


图 2

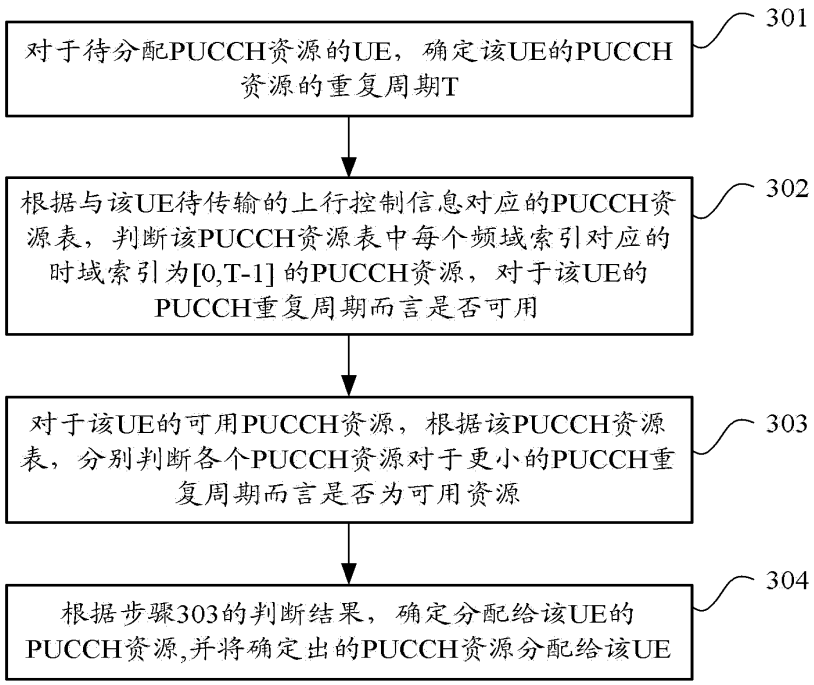


图 3

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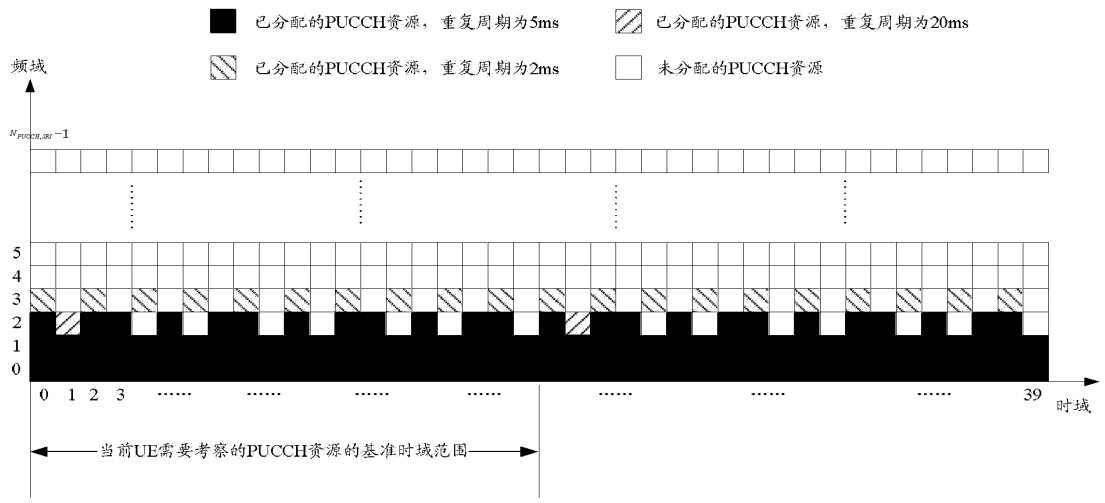


图 4

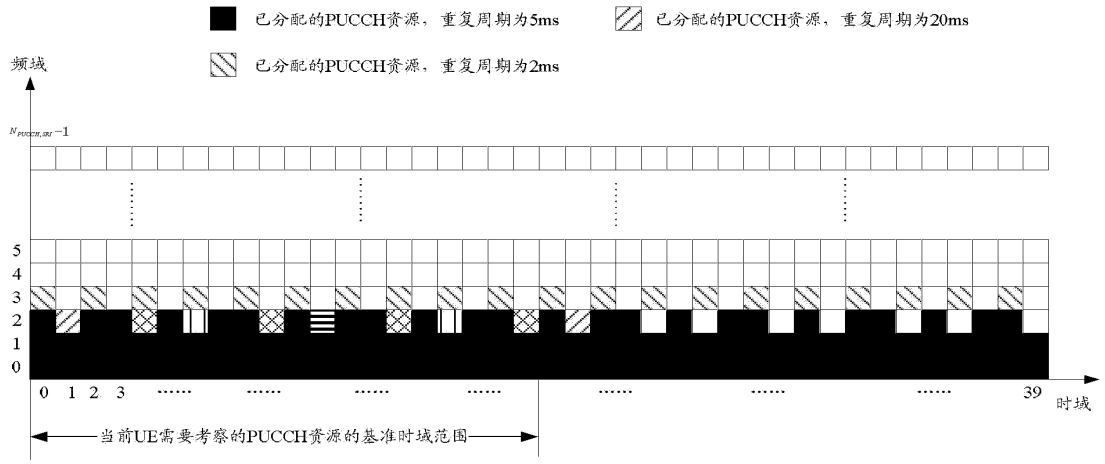


图 5

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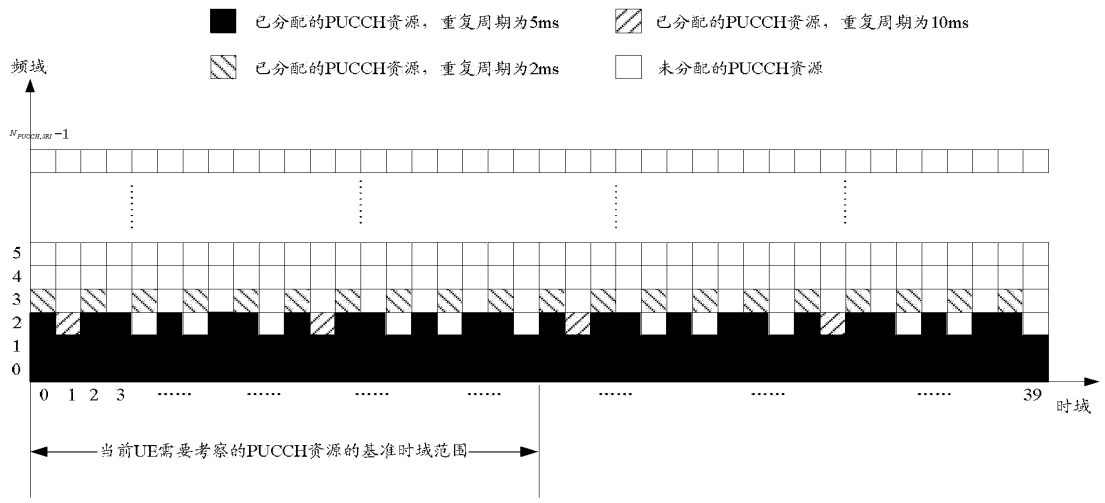


图 6

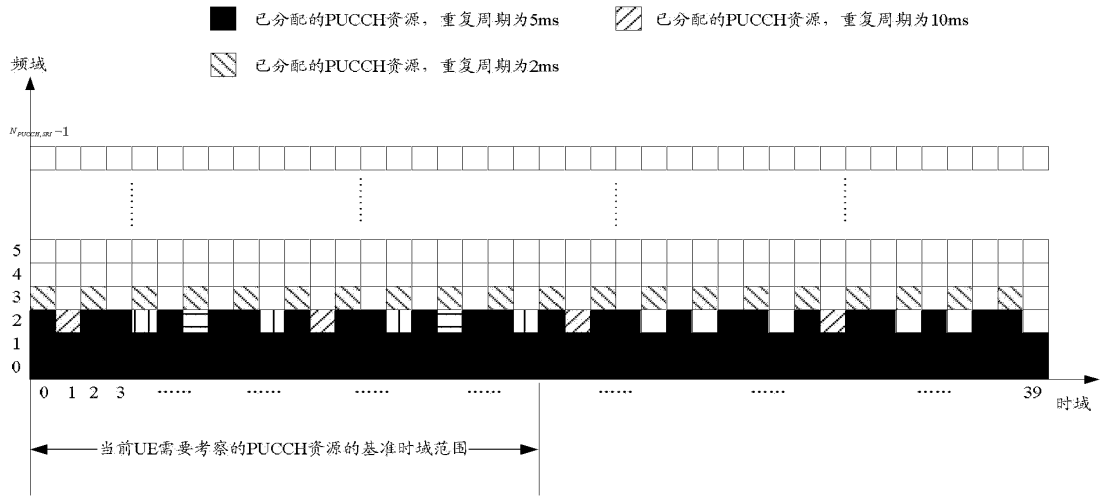


图 7

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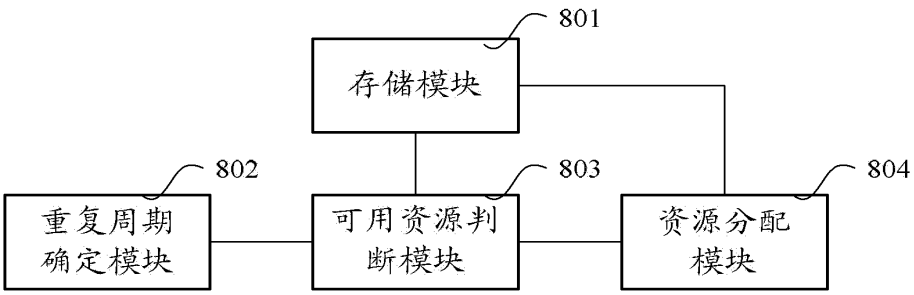


图 8

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Espacenet

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Method, equipment and system for resource allocation of upstream control channel

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Applicant(s): DATANG MOBILE COMM EQUIP CO ± (DATANG MOBILE COMMUNICATIONS EQUIPMENT CO., LTD)

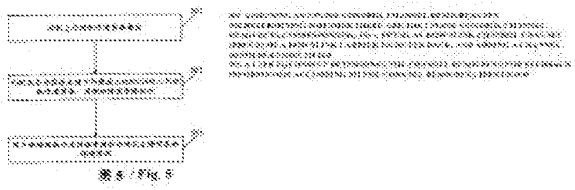
Classification: - international: ***H04L1/16; H04W72/08; H04W72/12***
- cooperative: **H04L1/1861 (EP)**

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Abstract of CN102014505 (A)



The invention discloses a method, equipment and a system for resource allocation of an upstream control channel, wherein the method comprises the following steps: a base station determines whether resources of the upstream control channel corresponding to a feedback physical downstream control channel (PDCCH) exist on an upstream carrier carrying out ACK/NACK (Acknowledgement/Negative Acknowledgement) feedback, and sets identifications of usable resources in the PDCCH according to judging results; and a user terminal detects the PDCCH of a downstream carrier, and uses the corresponding resources to carry out ACK/NACK feedback according to the usable resources in the PDCCH. The invention can solve the problem of resource waste caused by the expense of an upstream feedback channel.

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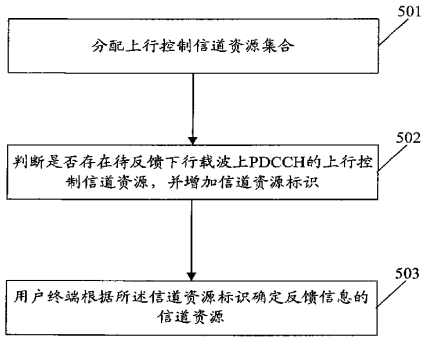
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(54)发明名称

一种上行控制信道资源配置的方法、设备及系统

(57)摘要

本发明公开一种上行控制信道资源配置的方法、设备及系统，该方法包括：基站确定在进行 ACK/NACK 反馈的上行载波上，是否存在反馈物理下行控制信道 PDCCH 对应的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识；用户终端检测下行载波的 PDCCH，根据 PDCCH 中的可使用资源的标识使用相应的资源进行 ACK/NACK 反馈。本发明实例提供的方法、设备和系统可以降低系统中上行反馈信道开销导致资源浪费的问题。



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1. 一种上行控制信道资源配置的方法，其特征在于，包括：

基站确定在进行 ACK/NACK 反馈的上行载波上，是否存在反馈物理下行控制信道 PDCCH 对应的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识；

用户终端检测下行载波的 PDCCH，根据 PDCCH 中的可使用资源的标识使用相应的资源进行 ACK/NACK 反馈。

2. 如权利要求 1 所述的方法，其特征在于，如果确定不存在所述上行控制信道资源，则所述可使用资源的标识用于标示基站预先设置的上行控制信道资源集合中的信道资源；

所述用户终端使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，并使用所述可使用资源的标识所标示的信道资源编号对应的上行控制信道资源作为 ACK/NACK 反馈所使用的反馈信道。

3. 如权利要求 2 所述的方法，其特征在于，多个用户终端共享所述上行控制信道资源集合中的信道资源元素；所述基站通过调度限制使用了同一个信道资源的用户终端分时反馈。

4. 如权利要求 2 或 3 任一权项所述的方法，其特征在于，如果所述上行控制信道资源集合中的包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1，则所述在物理下行控制信道 PDCCH 中设置可使用资源的标识包括：

为所有的 PDCCH 上承载的下行控制信息 DCI 格式设置$\lceil \log_2(N+1) \rceil$比特的信令，该信令 N+1 个状态中，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示所述用户终端不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

5. 如权利要求 2 或 3 任一权项所述的方法，其特征在于，如果所述上行控制信道资源集合中包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1，则所述在物理下行控制信道 PDCCH 中设置可使用资源的标识包括：

将$\lceil \log_2(N+1) \rceil$比特的信令与 DCI 格式中的其他信令联合编码，实现在物理下行控制信道 PDCCH 中设置可使用资源的标识；或者

重用 DCI 格式中的信令表示所述 N+1 个状态，实现在物理下行控制信道 PDCCH 中设置可使用资源的标识；

其中，所述 N+1 个状态，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示所述用户终端不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

6. 如权利要求 2 ～ 3 任一权项所述的方法，其特征在于，所述上行控制信道资源集合里面的资源性质是半持续调度的，并且基站通过高层信令配置该上行控制信道资源集合中的资源。

7. 一种上行控制信道资源配置的方法，其特征在于，包括：

基站分配上行控制信道资源集合，该资源集合中包含 ACK/NACK 反馈可用的信道资源编号，并向用户终端发送该上行控制信道资源集合相关信息的信令；

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基站判断在进行 ACK/NACK 反馈的上行载波上，是否存在反馈物理下行控制信道 PDCCH 对应的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识，该可使用资源的标识用于标示所述用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

8. 如权利要求 7 所述的方法，其特征在于，包括：

如果确定在进行 ACK/NACK 反馈的上行载波上，不存在反馈 PDCCH 对应的上行控制信道资源，则在 PDCCH 中设置标示所述用户终端进行 ACK/NACK 反馈时使用上行控制信道资源集合中的信道资源编号的可使用资源的标识，并且该可使用资源的标识还用于标示所述用户终端进行 ACK/NACK 反馈时在所述上行控制信道资源集合中使用的信道资源编号。

9. 如权利要求 7 ～ 8 任一权项所述的方法，其特征在于，如果所述上行控制信道资源集合中的包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1，则所述在物理下行控制信道 PDCCH 中设置可使用资源的标识包括：

为所有的 PDCCH 上承载的 DCI 格式设置$\lceil \log_2(N+1) \rceil$比特的信令，该信令 N+1 个状态中，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示所述用户终端不使用的上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

10. 如权利要求 7 ～ 8 任一权项所述的方法，其特征在于，如果所述上行控制信道资源集合中的包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1，则所述在物理下行控制信道 PDCCH 中设置可使用资源的标识包括：

将$\lceil \log_2(N+1) \rceil$比特的信令与 DCI 格式中的其他信令联合编码，实现在物理下行控制信道 PDCCH 中设置可使用资源的标识；或者

重用 DCI 格式中的信令表示这 N+1 个状态，实现在物理下行控制信道 PDCCH 中设置可使用资源的标识；

其中，所述 N+1 个状态，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示所述用户终端不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

11. 如权利要求 7 ～ 8 任一权项所述的方法，其特征在于，所述上行控制信道资源集合里面的资源性质是半持续调度的，并且基站通过高层信令配置该上行控制信道资源集合中的资源。

12. 一种上行控制信道资源配置的方法，其特征在于，包括：

用户终端读取基站下发的配置信令，获取基站中设置的所述用户终端进行 ACK/NACK 反馈可用的上行控制信道资源集合的相关信息；

检测待反馈下行载波的 PDCCH，根据该 PDCCH 中设置的可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及进行 ACK/NACK 反馈所使用的信道资源编号。

13. 如权利要求 12 所述的方法，其特征在于，包括：

用户终端检测待反馈下行载波的 PDCCH，如果在进行 ACK/NACK 反馈的上行载波

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上，不存在待反馈下行载波上 PDCCH 对应的上行控制信道资源，则根据所述 PDCCH 中的可使用资源的标识，确定使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，其中所述可使用资源的标识标示所述用户终端进行 ACK/NACK 反馈时在所述上行控制信道资源集合中使用的信道资源编号。

14. 一种基站设备，其特征在于，包括：

分配模块，用于预先分配上行控制信道资源集合，该资源集合中包含至少 1 个 ACK/NACK 反馈可用的信道资源编号；

判定模块，用于确定在进行 ACK/NACK 反馈的上行载波上，是否存在反馈物理下行控制信道 PDCCH 对应的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识，该可使用资源的标识用于标示所述用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

15. 如权利要求 14 所述的基站，其特征在于，所述判定模块还用于如果确定在进行 ACK/NACK 反馈的上行载波上，不存在待反馈下行载波上 PDCCH 对应的上行控制信道资源，则在 PDCCH 中设置标示所述用户终端进行 ACK/NACK 反馈时使用上行控制信道资源集合中的信道资源编号的可使用资源的标识，并且所述可使用资源的标识标示所述用户终端进行 ACK/NACK 反馈时在所述上行控制信道资源集合中使用的信道资源编号。

16. 如权利要求 14 ～ 15 任一权项所述的基站，其特征在于，如果所述分配模块中上行控制信道资源集合中的包括 N 个元素，对应 N 个用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1；则

所述判定模块还用于为所有的 PDCCH 上承载的 DCI 格式设置$\lceil \log_2(N+1) \rceil$比特的信令，该信令 N+1 个状态中，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示所述用户终端不使用的上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

17. 如权利要求 14 ～ 15 任一权项所述的基站，其特征在于，如果所述分配模块中上行控制信道资源集合中的包括 N 个元素，对应 N 个所述用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1；则

所述判定模块还用于将$\lceil \log_2(N+1) \rceil$比特的信令与 DCI 格式中的其他信令联合编码，实现在物理下行控制信道 PDCCH 中设置可使用资源的标识；或者

重用 DCI 格式中的信令表示这 N+1 个状态，实现在物理下行控制信道 PDCCH 中设置可使用资源的标识；

其中，所述 N+1 个状态，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号；另外一个状态用于标示所述用户终端不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

18. 如权利要求 14 ～ 15 任一权项所述的方法，其特征在于，所述分配模块还用于通过高层信令配置所述上行控制信道资源集合中的资源，并且该上行控制信道资源集合里面的资源性质是半持续调度的资源。

19. 一种用户终端，其特征在于，包括：

读取模块，用于读取基站下发的配置信令，获取基站中设置的所述用户终端进行 ACK/NACK 反馈可用的上行控制信道资源集合的相关信息；

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信道资源确定模块，用于检测待反馈下行载波的 PDCCH，根据该 PDCCH 中设置的可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及进行 ACK/NACK 反馈所使用的信道资源编号。

20. 如权利要求 19 所述的用户终端，其特征在于，包括：

所述信道资源确定模块还用于如果确定在进行 ACK/NACK 反馈的上行载波上，不存在待反馈下行载波上 PDCCH 对应的上行控制信道资源，则根据所述 PDCCH 中的可使用资源的标识，确定使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，其中所述可使用资源的标识标示所述用户终端进行 ACK/NACK 反馈时在所述上行控制信道资源集合中使用的信道资源编号。

21. 一种上行控制信道资源配置的系统，其特征在于，包括：

基站，用于确定在进行 ACK/NACK 反馈的上行载波上，是否存在反馈物理下行控制信道 PDCCH 对应的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识；

用户终端，用于检测下行载波的 PDCCH，根据 PDCCH 中的可使用资源的标识使用相应的资源进行 ACK/NACK 反馈。

22. 如权利要求 21 所述的系统，其特征在于，包括：

所述基站还用于如果确定在进行 ACK/NACK 反馈的上行载波上，不存在待反馈下行载波上 PDCCH 对应的上行控制信道资源，则在 PDCCH 中设置标示所述用户终端进行 ACK/NACK 反馈时使用上行控制信道资源集合中的信道资源编号的可使用资源的标识；则

用户终端还用于检测待反馈下行载波的 PDCCH，根据所述可使用资源的标识，确定使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，并使用所述可使用资源的标识所述标示的信道资源编号对应的上行控制信道资源作为 ACK/NACK 反馈所使用的反馈信道。

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一种上行控制信道资源配置的方法、设备及系统

技术领域

[0001] 本发明涉及无线通信技术，特别涉及一种上行控制信道资源配置的方法、设备及系统。

背景技术

[0002] 长期演进系统采用 HARQ(Hybrid Automatic Repeat Request；混合自动重传请求）来提高数据传输的可靠性，当下行 HARQ 功能开启后，用户终端对接收到的下行数据包进行译码，若译码正确则向基站反馈 ACK，若译码失败，则向基站反馈 NACK，要求基站重传该数据包。 当下行持续调度业务结束后，基站向用户终端发送 SPS(Semi-persistent Scheduling 半持续调度）资源释放指示，通知用户终端释放分配给该业务的所有资源，用户终端正确接收该指示后将向基站反馈 ACK。

[0003] 对于长期演进多载波系统，为支持比 LTE 系统更宽的系统带宽，比如 100MHz，具体的实现方式包括：A、直接分配 100M 带宽的频谱（如图 1 所示）；B、将分配给现有系统的一些频谱聚合起来，凑成大带宽提供给长期演进多载波系统使用，此时系统中上下行载波可以不对称配置，即用户可能会占用 N(N ＞＝ 1）个载波进行下行传输， M(M ＞＝ 1）个载波进行上行传输（如图 2 所示）。

[0004] 目前标准化工作已经基本完成的 LTE 系统 (Rel-8) 的基本传输方案如下：频分双工 FDD 系统与时分双工 TDD 分别如图 3 和 4 所示。 对于每个工作载波，分别定义了下行信令、下行数据、上行信令和上行数据，以及彼此之间的传输关系。 上行控制信令占用频带的两端，使用跳频方式传输，即在一个子帧内的两个时隙里，上行控制信令将占用不同的频段传输。 由于无法动态获知上行子帧中需要承载的控制信道的数量，系统将在上行子帧中预留出一定的资源用于上行控制信道传输。

[0005] 对于非持续调度的 ACK/NACK 反馈传输，进行反馈的用户终端将根据其接收到的物理下行控制信道 (PDCCH) 所占用的 CCE(Control Channel Element) 编号 (n_{CCE})，算出其进行 ACK/NACK 反馈所使用的资源（即信道）编号 (n_{AN})，即每个 PDCCH 都对应着一个可用的上行控制信道资源。

[0006] 在长期演进多载波系统中，使用载波聚合时，若每个上行载波内都为各下行载波预留相应的反馈资源，则上行载波中将存在严重的资源浪费，甚至会造成没有可用的上行资源进行数据传输，这将严重影响系统的传输效率。

发明内容

[0007] 本发明实施例提供一种上行控制信道资源配置的方法、设备及系统，用于解决在长期演进多载波系统中，使用载波聚合时，若每个上行载波内都为各下行载波预留相应的反馈资源，从而导致上行载波中将存在严重的资源浪费的问题。

[0008] 一种上行控制信道资源配置的方法，包括：

[0009] 基站分配上行控制信道资源集合，该资源集合中包含多个 ACK/NACK 反馈可用

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的信道资源编号，判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 对应的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识；

[0010] 用户终端读取基站下发的配置信令，检测待反馈下行载波的 PDCCH，根据 PDCCH 中的可使用资源的标识，确定是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

[0011] 一种上行控制信道资源配置的方法，包括：

[0012] 基站分配上行控制信道资源集合，该资源集合中包含多个 ACK/NACK 反馈可用的信道资源编号；

[0013] 判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 对应的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识，该可使用资源的标识用于标示所述用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该信道资源集合中的信道资源元素的使用情况。

[0014] 一种上行控制信道资源配置的方法，包括：

[0015] 用户终端读取基站下发的配置信令，获取基站中设置的所述用户终端进行 ACK/NACK 反馈可用的上行控制信道资源集合的相关信息；

[0016] 检测待反馈下行载波的 PDCCH，根据该 PDCCH 中设置的可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及进行 ACK/NACK 反馈所使用的信道资源编号。

[0017] 一种基站设备，包括：

[0018] 分配模块，用于分配上行控制信道资源集合，该资源集合中包含至少 1 个 ACK/NACK 反馈可用的信道资源编号；

[0019] 判定模块，用于判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 对应的上行控制信道资源，并在 PDCCH 中设置可使用资源的标识，该可使用资源的标识用于标示用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该信道资源集合中的信道资源元素的使用情况。

[0020] 一种用户终端，包括：

[0021] 读取模块，用于读取基站下发的配置信令，获取基站中设置的所述用户终端进行 ACK/NACK 反馈可用的上行控制信道资源集合的相关信息；

[0022] 信道资源确定模块，用于检测待反馈下行载波的 PDCCH，根据该 PDCCH 中设置的可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及进行 ACK/NACK 反馈所使用的信道资源编号。

[0023] 一种上行控制信道资源配置的系统包括：

[0024] 基站，用于分配上行控制信道资源集合，该资源集合中包含多个 ACK/NACK 反馈可用的信道资源编号，判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 对应的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识；

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[0025] 用户终端，用于读取基站下发的配置信令，检测待反馈下行载波的 PDCCH，根据可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源，以及进行 ACK/NACK 反馈所使用的信道资源编号。

[0026] 由于本方法是一种动态指示和半静态指示相结合的方式，对于长期演进载波聚合系统，本发明实例可以降低系统中上行反馈信道开销的资源预留及配置，不仅可以提高长期演进多载波升级系统的系统性能，而且可以很好的与 LTE Release 8 系统兼容。

附图说明

[0027] 图 1 和图 2 为现有技术中长期演进多载波系带宽分配示意图；

[0028] 图 3 和图 4 为现有技术中 LTE 系统 (Rel-8) 中频分双工 FDD 系统与时分双工 TDD 载波示意图；

[0029] 图 5 为本发明实施例一种上行控制信道资源配置的方法的流程图；

[0030] 图 6 为具体应用环境中信号传输的载波应用示意图；

[0031] 图 7 为本发明实施例所提供的方法基站端处理过程的流程图；

[0032] 图 8 为本发明实施例所提供的方法终端侧处理过程的流程图；

[0033] 图 9 本发明实施一种基站设备的结构图；

[0034] 图 10 本发明实施一种用户终端设备的结构图；

[0035] 图 11 为本发明实施例一种上行控制信道资源配置的系统的结构图。

具体实施方式

[0036] 本发明实施例一种上行控制信道资源配置的方法、设备及系统，该方法包括：分配上行控制信道资源集合，该资源集合中包含多个 ACK/NACK 反馈可用的信道资源编号，判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识，该可使用资源的标识用于标示用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该集合中信道资源元素的使用情况；用户终端读取基站下发的配置信令，获知所述上行控制信道资源集合，检测待反馈下行载波的 PDCCH，根据可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源，以及该集合中信道资源元素的使用情况。

[0037] 如图 5 所示，本实施例基于兼容 LTE 系统的考虑，给出一种上行控制信道资源配置方法。

[0038] 对于 LTE-A 载波聚合系统，需要在一个上行载波的 PUCCH 上反馈多个下行载波上 PDSCH 对应的 ACK/NACK 信息和 / 或多个指示 SPS 资源释放的 PDCCH 的 ACK/NACK 信息，于是用户终端需要多个上行控制信道资源来进行 ACK/NACK 反馈。

[0039] 步骤 501，高层给用户终端固定分配一个上行控制信道资源集合，该资源集合中包含多个 ACK/NACK 反馈可用的信道资源编号。

[0040] 该上行控制信道资源集合里有 N ＞＝ 1 个元素，对应 N 个 ACK/NACK 反馈可用的信道资源编号。 该集合中的信道资源元素可以被多个用户终端共享，基站通过调度限制使用了同一个信道资源的用户终端分时反馈，从而避免信道资源碰撞问题。

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[0041] 所述上行控制信道资源集合里面的资源性质是半持续调度的，并且基站通过高层信令配置该上行控制信道资源集合中的资源。

[0042] 步骤 502，判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识，该可使用资源的标识用于标示用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该集合中信道资源元素的使用情况；

[0043] 其中，如果在进行 ACK/NACK 反馈的上行载波上，存在待反馈下行载波止 PDCCH 的 CCE 对应的上行控制信道资源，即在进行 ACK/NACK 反馈的上行载波上预留了待反馈的下行载波上 PDCCH 的 CCE 对应的上行控制信道资源，则使用该资源作为 ACK/NACK 反馈所使用的反馈信道。此时不需要利用高层分配的上行控制信道资源集合中的任何一个元素；基站利用 PDCCH 告知用户终端不使用高层分配的集合中的信道资源元素。

[0044] 该 PDCCH 信令通知的方法（即在 PDCCH 中设置可使用资源的标识的方法）既可以是为所有的 PDCCH 上承载的 DCI（downlink control information，下行控制信息）格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，也可以将$\lceil \log_2(N+1) \rceil$比特的信令与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示这 N+1 个状态。

[0045] 但是如果在进行 ACK/NACK 反馈的上行载波上，不存在待反馈下行载波上 PDCCH 的 CCE 对应的上行控制信道资源，即没有预留待反馈的下行载波上 PDCCH 的 CCE 对应的上行控制信道资源，则需要利用高层分配的上行控制信道资源集合中的一个元素作为 ACK/NACK 反馈所使用的反馈信道。基站利用 PDCCH 告知用户终端在该集合中具体使用的资源元素编号。该 PDCCH 信令通知的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，也可以将$\lceil \log_2(N+1) \rceil$比特的信令与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示这 N+1 个状态。

[0046] 步骤 503、用户终端读取基站下发的配置信令，获知所述上行控制信道资源集合，检测待反馈下行载波的 PDCCH，根据可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源，以及进行 ACK/NACK 反馈所使用的信道资源编号。。

[0047] 如图 6 所示一个实施例，用户终端在上行载波 1 上反馈下行载波 1、2、3、4 上 PDSCH 对应的 ACK/NACK 信息和 / 或指示 SPS 资源释放的 PDCCH 的 ACK/NACK 信息。基站通过 RRC 信令半静态的给该用户终端固定分配 N ＞＝ 1 个上行控制信道资源，在本实施例中设 N ＝ 7，表示高层分配的信道资源集合中有 7 个信道资源元素。如果为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，则 N ＝ 7 时，则需要在所有 PDCCH 的 DCI 格式上新设置 3 比特的信令。

[0048] 在上行载波 1 中，预留了下行载波 1 和下行载波 2 上 PDCCH 的 CCE 对应的上行控制信道资源，即存在待反馈下行载波上 PDCCH 的 CCE 对应的上行控制信道资源。于是，下行载波 1 和下行载波 2 上 PDSCH 的 ACK/NACK 反馈就在这两个下行载波上 PDCCH 的 CCE 对应的上行控制信道资源上传输。基站需要分别在下行载波 1 和下行载

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波 2 上使用 PDCCH 告知用户终端不使用高层分配的上行控制信道资源集合中的资源作为反馈信道。 例如，如果为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，N = 7 时，则可以使用“000”来告知用户终端该下行载波上 PDSCH 的 ACK/NACK 反馈不使用高层分配的资源集合中的资源作为承载反馈信息的反馈信道。

[0049] 但是在上行载波 1 中，并没有预留下行载波 3 和下行载波 4 的上行控制信道资源，即不存在待反馈下行载波上 PDCCH 的 CCE 对应的上行控制信道资源。 于是对于下行载波 3 和下行载波 4 的 ACK/NACK 反馈传输，需要使用高层配置的上行控制信道资源集合中的资源编号。 对于下行载波 3，基站使用下行载波 3 的 PDCCH 来告知用户终端反馈该载波承载的 PDSCH 的 ACK/NACK 信息到底使用了集合中的哪一个元素。 如果为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令， N = 7 时，则可以使用“001”来告知用户终端该下行载波上 PDSCH 的 ACK/NACK 反馈使用高层分配的资源集合中的第一个信道资源作为承载反馈信息的反馈信道。

[0050] 如图 7 所示，在本发明实施例所提供的方法中，基站端处理过程：

[0051] 步骤 701. 通过高层 RRC 信令固定给用户终端分配一个上行控制信道资源集合，该集合里有 N ＞＝ 1 个元素，对应 N 个 ACK/NACK 反馈可用的信道资源。 该集合中的元素可以被多个用户终端共享，基站通过调度限制使用了同一个信道资源的用户终端分时反馈，从而避免信道资源碰撞问题。

[0052] 所述上行控制信道资源集合里面的资源性质是半持续调度的，并且基站通过高层信令配置该上行控制信道资源集合中的资源。

[0053] 步骤 702. 判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识，该可使用资源的标识用于标示用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该集合中信道资源元素的使用情况。

[0054] 情况 1：在进行 ACK/NACK 反馈的上行载波上，存在待反馈下行载波上 PDCCH 的 CCE 对应的上行控制信道资源，即在进行 ACK/NACK 反馈的上行载波上预留了待反馈的下行载波上 PDCCH 的 CCE 对应的上行控制信道资源。 这时则基站使用 PDCCH 告知用户终端不使用高层分配的上行控制信道资源集合中的资源作为反馈信道。 该 PDCCH 信令通知的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将$\lceil \log_2(N+1) \rceil$比特的信令与 Rel-8 现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示这 N+1 个状态。 如果为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，可以将$\lceil \log_2(N+1) \rceil$比特置为全零，表示不使用高层分配的资源集合中的元素。

[0055] 情况 2：在进行 ACK/NACK 反馈的上行载波上，不存在待反馈下行载波上 PDCCH 的 CCE 对应的上行控制信道资源，即没有预留待反馈的下行载波上 PDCCH 的 CCE 对应的上行控制信道资源。 这时则基站在给该用户分配的上行控制信道资源集合中选择一个元素作为 ACK/NACK 反馈所使用的反馈信道，并且利用 PDCCH 的信令指示给用户终端该资源元素编号。 该 PDCCH 信令通知的方法既可以是为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，也可以是将$\lceil \log_2(N+1) \rceil$比特的信令与 Rel-8

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现有的 DCI 格式中的其他信令联合编码，甚至重用现有的 DCI 格式中的信令表示这 N+1 个状态。 如果为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，则基站利用这$\lceil \log_2(N+1) \rceil$比特指示选用的信道资源元素编号（编号从 1 开始），例如 N = 7 时，则可以使用 “001” 来告知用户终端该下行载波上 PDSCH 的 ACK/NACK 反馈使用高层分配的资源集合中的第一个信道资源作为承载反馈信息的反馈信道。

[0056] 如图 8 所示，在本发明实施例所提供的方法中，用户终端处理过程 ：

[0057] 步骤 801 ：读取高层配置信令，获知基站中设置的 ACK/NACK 反馈可用的上行控制信道资源集合 ；

[0058] 步骤 802 ：检测待反馈下行载波的 PDCCH，确定是否使用上行控制信道资源集合中的元素 ；例如 ：如果为所有的 PDCCH 上承载的 DCI 格式新设置$\lceil \log_2(N+1) \rceil$比特的信令，当用户终端检测到了全零比特状态，则表示不需要使用高层分配的资源集合中的元素作为反馈信道。 而如果检测到了其他比特状态，则表示需要使用高层分配的资源集合中的元素作为反馈信道。 用户终端根据检测到的 PDCCH，判断以下两种情况 ：

[0059] 情况 1 ：不使用上行控制信道资源集合中的元素。 这时则根据待反馈下行载波上 PDCCH 预先约定的 CCE 的指示，获取 ACK/NACK 反馈所使用的信道资源编号 ；

[0060] 情况 2 ：使用上行控制信道资源集合中的元素。 这时则根据 PDCCH 的指示，获取 ACK/NACK 反馈所使用的信道资源编号（该编号在上行控制信道资源集合的范围内）；

[0061] 步骤 803 ：接收 PDSCH，译码后得到 ACK/NACK 反馈信息。

[0062] 步骤 804 ：在步骤 802 中确定的信道资源上发送得到的 ACK/NACK 反馈信息。

[0063] 如图 9 所示，本发明实施还提供一种基站设备，包括 ：

[0064] 分配模块 901，用于分配上行控制信道资源集合，该资源集合中包含至少 1 个 ACK/NACK 反馈可用的信道资源编号 ；

[0065] 所述分配模块 901 还用于通过高层信令配置所述上行控制信道资源集合中的资源，并且该上行控制信道资源集合里面的资源性质是半持续调度的资源。

[0066] 判定模块 902，用于判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 对应的上行控制信道资源，并在 PDCCH 中设置可使用资源的标识，该可使用资源的标识用于标示用户终端是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及该信道资源集合中的信道资源元素的使用情况。

[0067] 其中，所述判定模块 902 还用于如果确定在进行 ACK/NACK 反馈的上行载波上，存在待反馈下行载波上 PDCCH 对应的上行控制信道资源，则在 PDCCH 中设置标示用户终端不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈的可使用资源的标识。

[0068] 另外，所述判定模块 902 还用于如果确定在进行 ACK/NACK 反馈的上行载波上，不存在待反馈下行载波上 PDCCH 对应的上行控制信道资源，则在 PDCCH 中设置标示用户终端进行 ACK/NACK 反馈时使用上行控制信道资源集合中的信道资源编号的可使用资源的标识，并且所述可使用资源的标识标示所述用户终端进行 ACK/NACK 反馈时在所述上行控制信道资源集合中使用的信道资源编号。

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[0069] 如果所述分配模块 901 中上行控制信道资源集合中的包括 N 个元素，对应 N 个用户终端进行 ACK/NACK 反馈可用的信道资源编号，其中 N ＞＝ 1 ；则

[0070] 所述判定模块 902 还用于为所有的 PDCCH 上承载的 DCI 格式设置 $\lceil \log_2 (N+1) \rceil$ 比特的信令，该信令 N+1 个状态中，有 N 个状态标示所述上行控制信道资源集合中所速用户终端进行 ACK/NACK 反馈可用的信道资源编号 ；另外一个状态用于标示所述用户终端不使用的上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

[0071] 另外，除上述为所有的 PDCCH 上承载的 DCI 格式设置 $\lceil \log_2 (N+1) \rceil$ 比特的信令的方法外，所述判定模块 902 还用于将 $\lceil \log_2 (N+1) \rceil$ 比特的信令与 DCI 格式中的其他信令联合编码，实现在物理下行控制信道 PDCCH 中设置可使用资源的标识 ；或者

[0072] 重用 DCI 格式中的信令表示这 N+1 个状态，实现在物理下行控制信道 PDCCH 中设置可使用资源的标识 ；

[0073] 其中，所述 N+1 个状态，有 N 个状态标示所述上行控制信道资源集合中所述用户终端进行 ACK/NACK 反馈可用的信道资源编号 ；另外一个状态用于标示所述用户终端不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈。

[0074] 如图 10 所示，本发明实施例还提供一种用户终端，包括 ：

[0075] 读取模块 1001，用于读取基站下发的配置信令，获取基站中设置的所述用户终端进行 ACK/NACK 反馈可用的上行控制信道资源集合的相关信息 ；

[0076] 信道资源确定模块 1002，用于检测待反馈下行载波的 PDCCH，根据该 PDCCH 中设置的可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，以及进行 ACK/NACK 反馈所使用的信道资源编号。

[0077] 其中，所述信道资源确定模块 1002 还用于如果确定在进行 ACK/NACK 反馈的上行载波上，不存在待反馈下行载波上 PDCCH 对应的上行控制信道资源，则根据所述 PDCCH 中的可使用资源的标识，确定使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，其中所述可使用资源的标识标示所述用户终端进行 ACK/NACK 反馈时在所述上行控制信道资源集合中使用的信道资源编号。

[0078] 另外，所述信道资源确定模块 1002 还用于如果确定在进行 ACK/NACK 反馈的上行载波上，存在待反馈下行载波上 PDCCH 对应的上行控制信道资源，则使用所述待反馈下行载波上 PDCCH 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0079] 如图 11 所示，本发明实施例还提供一种上行控制信道资源配置的系统，包括 ：

[0080] 基站 1101，用于分配上行控制信道资源集合，该资源集合中包含多个 ACK/NACK 反馈可用的信道资源编号，判断在进行 ACK/NACK 反馈的上行载波上，是否存在待反馈下行载波上物理下行控制信道 PDCCH 的上行控制信道资源，并根据判定结果在 PDCCH 中设置可使用资源的标识 ；

[0081] 用户终端 1102，用于读取基站 1101 下发的配置信令，获知所述上行控制信道资源集合，检测待反馈下行载波的 PDCCH，根据可使用资源的标识确定是否使用所述上行控制信道资源集合中的信道资源，以及进行 ACK/NACK 反馈所使用的信道资源的信道资源元素。

[0082] 其中，所述基站 1101 还用于如果确定在进行 ACK/NACK 反馈的上行载波上，

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存在待反馈下行载波上 PDCCH 的上行控制信道资源，则在 PDCCH 中设置标示用户终端不使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈的可使用资源的标识；则

[0083] 所述用户终端 1102 还用于使用所述待反馈下行载波上 PDCCH 对应的上行控制资源作为 ACK/NACK 反馈所使用的反馈信道。

[0084] 另外，所述基站 1101 还用于如果确定在进行 ACK/NACK 反馈的上行载波上，不存在待反馈下行载波上 PDCCH 的上行控制信道资源，则在 PDCCH 中设置标示用户终端进行 ACK/NACK 反馈时使用上行控制信道资源集合中的信道资源编号的可使用资源的标识；则

[0085] 用户终端 1102 还用于检测待反馈下行载波的 PDCCH，根据所述可使用资源的标识，确定使用上行控制信道资源集合中的信道资源进行 ACK/NACK 反馈，并使用所述可使用资源的标识所述标示的信道资源编号对应的上行控制信道资源作为 ACK/NACK 反馈所使用的反馈信道。

[0086] 本方法是一种动态指示和半静态指示相结合的方式。 系统中，高层半静态的给用户终端固定分配一个上行控制信道资源集合。在进行 ACK/NACK 反馈的时候，当用户终端需要多个上行控制信道资源时，如果在进行 ACK/NACK 反馈的上行载波上，存在待反馈下行载波上 PDCCH 的 CCE 对应的上行控制信道资源，则不需要利用高层分配的上行控制信道资源集合中的元素；如果不存在待反馈下行载波上 PDCCH 的 CCE 对应的上行控制信道资源，则需要利用高层分配的上行控制信道资源集合中的一个元素作为 ACK/NACK 反馈所使用的反馈信道。

[0087] 显然，本领域的技术人员可以对本发明进行各种改动和变型而不脱离本发明的精神和范围。 这样，倘若本发明的这些修改和变型属于本发明权利要求及其等同技术的范围之内，则本发明也意图包含这些改动和变型在内。

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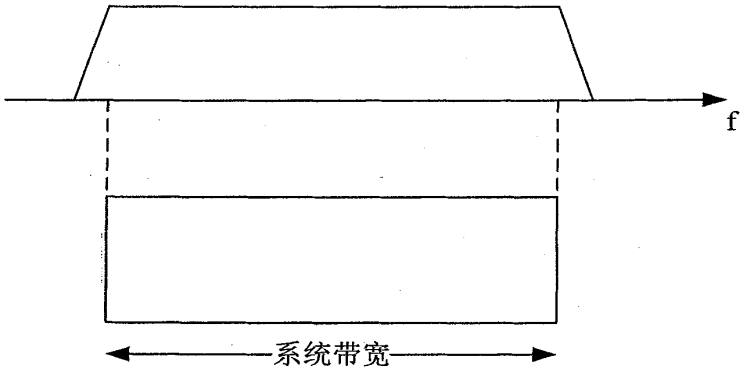


图 1

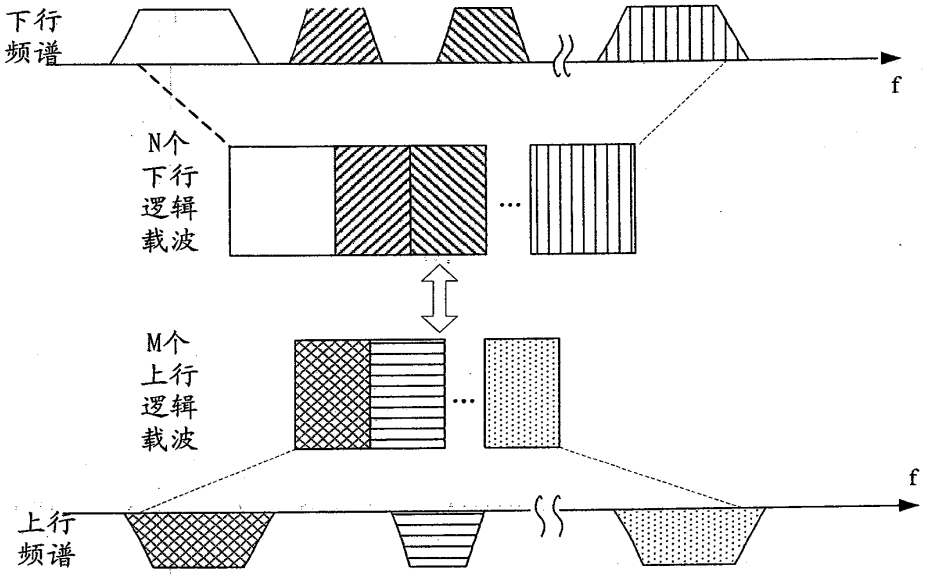


图 2

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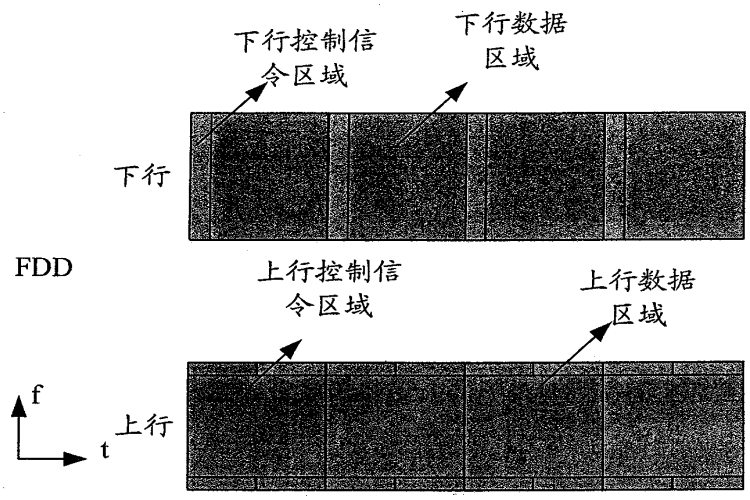


图 3

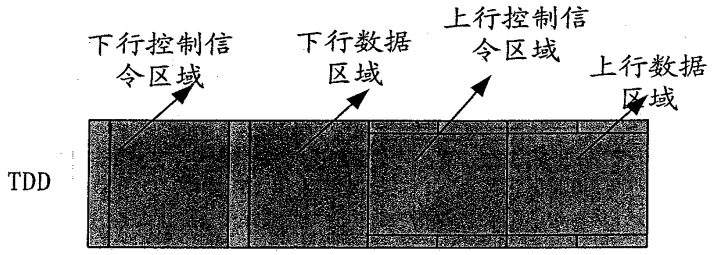


图 4

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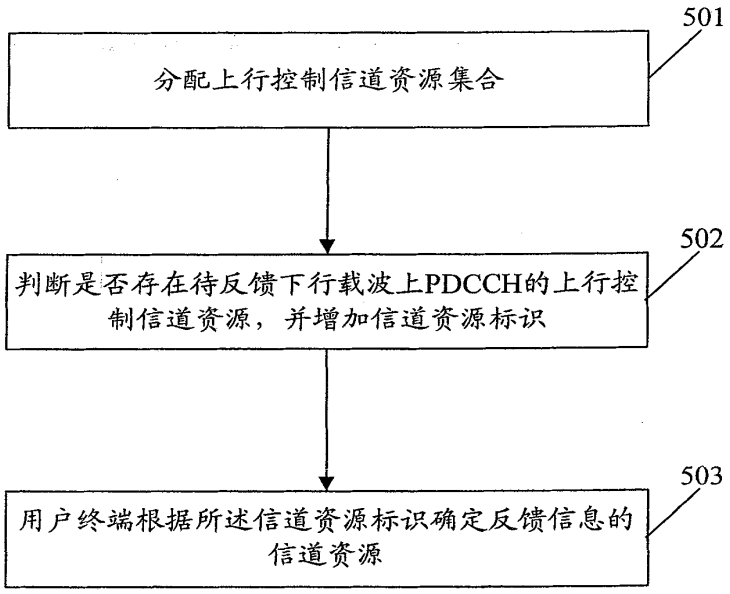


图 5

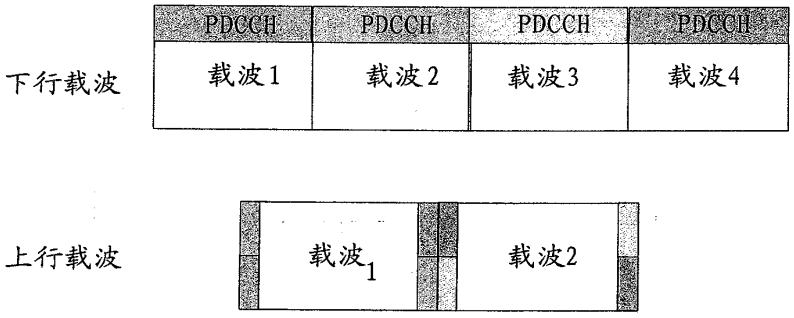


图 6

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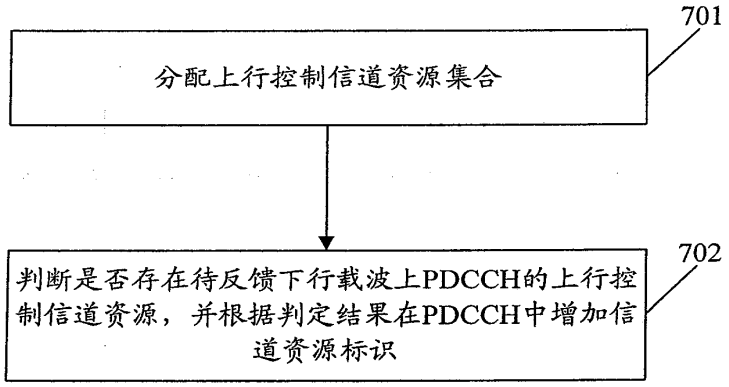


图 7

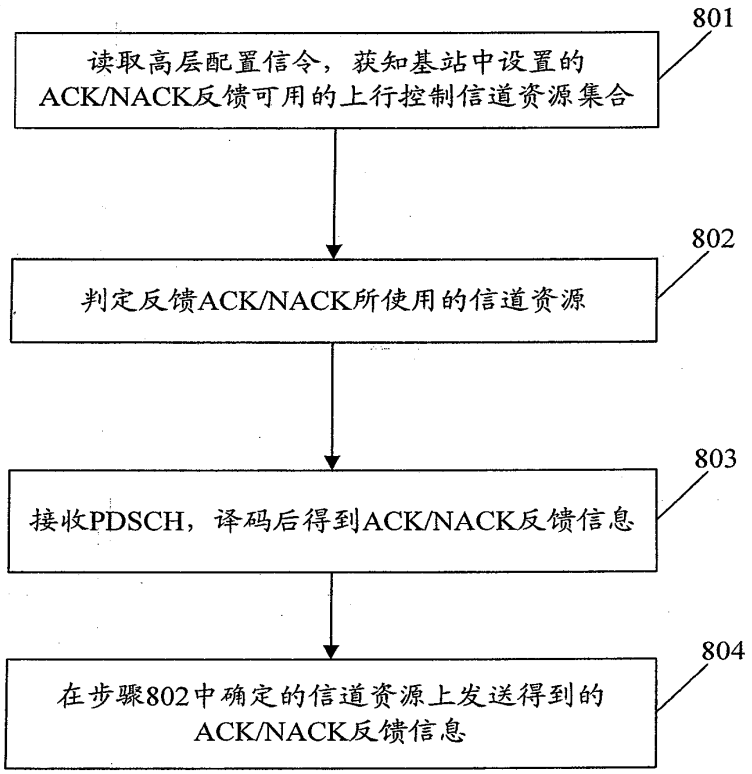


图 8

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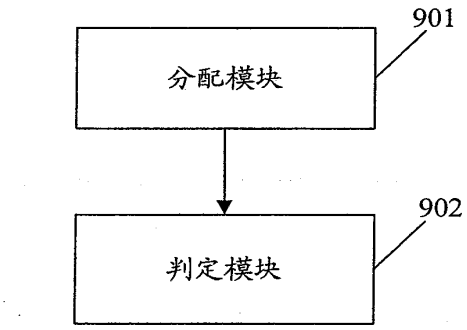


图 9

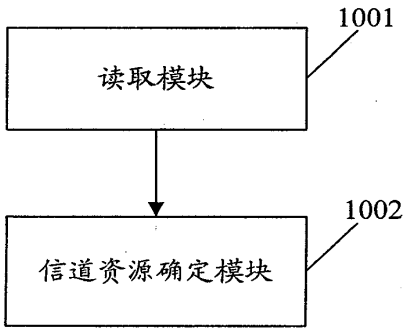


图 10

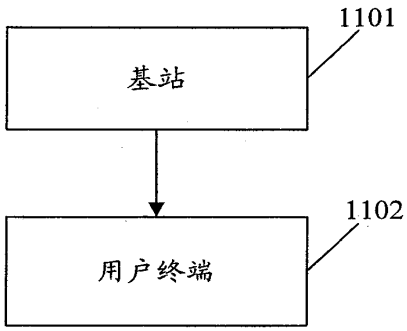


图 11

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Electronic Acknowledgement Receipt

EFS ID:	41677677
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
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:	811.0206
Receipt Date:	19-JAN-2021
Filing Date:	23-MAR-2020
Time Stamp:	12:25:12
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)	8110206IDSForm.pdf	612970 ff41a7a517d623abc5503eeaa4aebfe728bdf93d	no	4

Warnings:

Information:					
2	Foreign Reference	Ref1.pdf	2281479 7fa887d5001bd4312ec5ace76f9a8eee5162a304	no	23
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Information:					
3	Foreign Reference	Ref2.pdf	3337911 1ea2901404a86e461fa3eedb418e4025b09ae9f2	no	63
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4	Foreign Reference	Ref3.pdf	2714702 1408addd6df912c67eb69a500edba2eb3a3306cb	no	31
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9	Non Patent Literature	Ref8nonpatent2.pdf	5855898 bbff39db9fce685bec86b9ad0855eedd3b0506a8	no	15
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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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/826,482	03/23/2020	Kyujin PARK	811.0206	6363

76277 7590 11/05/2020

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

EXAMINER	
HO, CHUONG T	

ART UNIT	PAPER NUMBER
2412	

NOTIFICATION DATE	DELIVERY MODE
11/05/2020	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. 16/826,482	Applicant(s) PARK, Kyujin	
	Examiner CHUONG T HO	Art Unit 2412	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 the Preliminary amendment filed 03/23/2020.

☐ 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) 16-27 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) 16-27 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 03/23/2020 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. 1020170128.

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: _____.

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Ericsson Inc., et al. v. KT Corporation, et al.
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Notice of Pre-AIA or AIA Status

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

This office action is in response to the Preliminary amendment filed 03/23/2020.

Claims 16-19, 20-23, 24-27 are pending.

Priority

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. Republic of Korea 10-2017-0128188, filed on 09/29/2017.

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. Republic of Korea 10-2017-0162728, filed on 11/30/2017.

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119 (a)-(d). The certified copy has been filed in parent Application No. Republic of Korea 10-2018-0077270, filed on 07/03/2018.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 03/23/2020, 04/22/2020 was filed. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claim 16 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 and claim 2 of U.S. Patent No. : US 10,638,463 B2. Although the claims at issue are not identical, they are not patentably distinct from each other because

Claim 16 of the application serial number 16/826,482	Claim 1 of U.S. Patent No. : US 10,638,463 B2
A method of transmitting uplink (UL) control information by a user equipment, the method comprising:	A method of transmitting uplink (UL) control information by a user equipment, the method comprising:
receiving, from a base station, UL control channel resource set configuration information for UL control information transmission;	receiving, from a base station, UL control channel resource set configuration information for UL control information transmission;

determining one of UL control channel resource sets contained in the UL control channel resource set configuration information;	determining one of UL control channel resource sets contained in the UL control channel resource set configuration information;
determining one of UL control channel resources contained in the determined UL control channel resource set;	determining one of UL control channel resources contained in the determined UL control channel resource set;
transmitting UL control information through the determined UL control channel resource,	transmitting UL control information through the determined UL control channel resource,

Claim 16 of the application serial number 16/826,482	Claim 2 of U.S. Patent No. : US 10,638,463 B2
wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.	wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

Claim 17 of the application serial number 16/826,482	Claim 1 of U.S. Patent No. : US 10,638,463 B2
wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.	wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment,

Claim 18 of the application serial number 16/826,482	Claim 1 of U.S. Patent No. : US 10,638,463 B2
wherein the each UL BWP is activated through DL control information.	wherein the each UL BWP is activated through downlink (DL) control information.

Claim 19 of the application serial number 16/826,482	Claim 3 of U.S. Patent No. : US 10,638,463 B2
receiving, from the base station, downlink (DL) control information containing information indicating the one of the UL control channel resources for the UL control information transmission, wherein the one of the UL control channel	receiving, from the base station, downlink (DL) control information containing information indicating the one of the UL control channel resources for the UL control information transmission, wherein the one of the UL control channel

resources is indicated from the base station through the DL control information.	resources is indicated from the base station through the DL control information.

Claim 20 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 4 and claim 5 of U.S. Patent No. : US 10,638,463 B2. Although the claims at issue are not identical, they are not patentably distinct from each other because

Claim 20 of the application serial number 16/826,482	Claim 4 of U.S. Patent No. : US 10,638,463 B2
A method of receiving uplink (UL) control information by a base station, the method comprising:	A method of receiving uplink (UL) control information by a base station, the method comprising:
transmitting UL control channel resource set configuration information for transmitting UL control information to a user equipment;	transmitting UL control channel resource set configuration information for transmitting UL control information to a user equipment;
receiving the UL control information through one of UL control channel	receiving the UL control information through one of UL control channel

resources configuring one of UL control channel resource sets contained in UL control channel resource set configuration information,	resources configuring one of UL control channel resource sets contained in UL control channel resource set configuration information,

Claim 20 of the application serial number 16/826,482	Claim 5 of U.S. Patent No. : US 10,638,463 B2
wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.	wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

Claim 21 of the application serial number 16/826,482	Claim 4 of U.S. Patent No. : US 10,638,463 B2
wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information. wherein the UL control channel resource sets are	wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment,

configured for each UL bandwidth part (BWP) configured for the user equipment.	

Claim 22 of the application serial number 16/826,482	Claim 4 of U.S. Patent No. : US 10,638,463 B2
wherein the each UL BWP is activated through downlink (DL) control information.	wherein the each UL BWP is activated through downlink (DL) control information.

Claim 23 of the application serial number 16/826,482	Claim 6 of U.S. Patent No. : US 10,638,463 B2
transmitting, to the user equipment, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission, wherein the one of the UL control channel resources is indicated to the user equipment through	transmitting, to the user equipment, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission, wherein the one of the UL control channel resources is

the DL control information.	indicated to the user equipment through the DL control information.

Claim 24 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 7 and claim 8 of U.S. Patent No. : US 10,638,463 B2. Although the claims at issue are not identical, they are not patentably distinct from each other because

Claim 24 of the application serial number 16/826,482	Claim 7 of U.S. Patent No. : US 10,638,463 B2
A user equipment for transmitting uplink (UL) control information, comprising:	A user equipment for transmitting uplink (UL) control information, comprising:
a receiver configured to receive, from a base station, UL control channel resource set configuration information for UL control information transmission;	a receiver configured to receive, from a base station, UL control channel resource set configuration information for UL control information transmission;
a controller configured to determine one of UL control channel resource sets contained in the UL control channel resource set configuration information, and determine one of UL control channel	a controller configured to determine one of UL control channel resource sets contained in the UL control channel resource set configuration information, and determine one of UL control channel resources configuring the determined one UL control channel resource set;

resources configuring the determined one UL control channel resource set;	
a transmitter configured to transmit the UL control information through the determined UL control channel resource,	a transmitter configured to transmit the UL control information through the determined UL control channel resource,

Claim 24 of the application serial number 16/826,482	Claim 8 of U.S. Patent No. : US 10,638,463 B2
wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.	wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

Claim 25 of the application serial number 16/826,482	Claim 7 of U.S. Patent No. : US 10,638,463 B2
wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.	wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment,

Claim 26 of the application serial number 16/826,482	Claim 7 of U.S. Patent No. : US 10,638,463 B2
wherein the each UL BWP is activated through downlink (DL) control information.	wherein the each UL BWP is activated through downlink (DL) control information.

Claim 27 of the application serial number 16/826,482	Claim 9 of U.S. Patent No. : US 10,638,463 B2
wherein the receiver receives, from the base station, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission, wherein the one of the UL control channel resources is indicated from the base station through the DL control information.	wherein the receiver receives, from the base station, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission, wherein the one of the UL control channel resources is indicated from the base station through the DL control information

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHUONG T HO whose telephone number is (571)272-3133. The examiner can normally be reached on 7:30-4:00.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles C Jiang can be reached on 571-270-7191. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/CHUONG T HO/
Primary Examiner, Art Unit 2412

Notice of References Cited	Application/Control No. 16/826,482	Applicant(s)/Patent Under Reexamination PARK, Kyujin	
	Examiner CHUONG T HO	Art Unit 2412	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-20200221444-A1	07-2020	Tiirola; Esa Tapani	H04L1/1812	1/1
*	B	US-20190230685-A1	07-2019	PARK; Hanjun	H04W72/0453	1/1
*	C	US-10638463-B2	04-2020	Park; Kyujin	H04W72/0413	1/1
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Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 345 of 595

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

✓	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	11/01/2020								
	1	-								
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Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 346 of 595

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

CPC - Searched*		
Symbol	Date	Examiner
(H04W72/0413 or H04W72/042 or H04L5/0053 or H04W72/0453	11/01/2020	CH

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
370	329,330	11/01/2020	CH

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Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 347 of 595

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/826,482	PARK, Kyujin
	Examiner	Art Unit
	CHUONG T HO	2412

Search Notes		
Search Notes	**Date**	**Examiner**
(H04W72/0413 or H04W72/042 or H04L5/0053 or H04W72/0453 (Text search only - see search history printout)	11/01/2020	CH
370/329,330 (Text search only - see search history printout)	11/01/2020	CH
Claims search - see search history printout	11/01/2020	CH
Interference search - see search history printout.	11/01/2020	CH
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Interference Search			
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	Interference search - see search history printout	11/01/2020	CH
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Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 348 of 595

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16826482
Filing Date	2020-03-23
First Named Inventor	Kyujin PARK
Art Unit	2412
Examiner Name	HO, CHUONG
Attorney Docket Number	811.0206

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/CH/	1	10356761	B2	2019-07-16	Srinivas Yerramalli et al.	

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/CH/	5	20180279353	A1	2018-09-27	Kamel M. Shaheen et al.	

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	Filing Date	2020-03-23
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	Art Unit	2412
	Examiner Name	HO, CHUONG
	Attorney Docket Number	811.0206

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	Art Unit	2412
	Examiner Name	HO, CHUONG
	Attorney Docket Number	811.0206

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/CH/	1	LG ELECTRONICS, "Consideration on PUCCH resource allocation for NR", R1-1715883, 3GPP TSG RAN WG1 Meeting NR#3, Nagoya, Japan, 18th – 21th September 2017	☒
/CH/	2	MEDIATEK INC., "Summary of Offline Discussion on Bandwidth Part Operation", R1-1716832, 3GPP TSG RAN WG1 Meeting NR#3, Nagoya, Japan, 18th – 21th September 2017	☒
/CH/	3	3GPP TS 36.211 V14.3.0, June 2017, pp. 8-75	☒
/CH/	4	U.S. Provisional Application No. 62/502,550 filed on May 5, 2017	☒
/CH/	5	U.S. Provisional Application No. 62/564,787 filed on September 28, 2017	☒

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	Examiner Name	HO, CHUONG
	Attorney Docket Number	811.0206

[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.

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	Art Unit	2412
	Examiner Name	HO, CHUONG
	Attorney Docket Number	811.0206

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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

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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)	2020-03-23
Name/Print	Ian M. Hughes	Registration Number	41083

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(Not for submission under 37 CFR 1.99)

Application Number	16826482
Filing Date	2020-03-23
First Named Inventor	Kyujin PARK
Art Unit	2464 2412
Examiner Name	NGO, RICKY QUOC Chuong
Attorney Docket Number	811.0206

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	~~2412~~ 2464
	Examiner Name	NGO, RICKY QUOC, Chuong
	Attorney Docket Number	811.0206

/CH/	1	QUALCOMM INCORPORATED, "Resource allocation and transmit diversity for PUCCH", R1-1716426, TSG-RAN WG1 Meeting #90, Prague, CZ, 21th - 25th Aug. 2017, pp. 1-14	X

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Examiner Signature	/CHUONG T HO/	Date Considered	10/27/2020

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	~~2412~~ 2464
	Examiner Name	~~NGO, RICKY QUOC~~ HO, CHUONG
	Attorney Docket Number	811.0206

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).

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☐ 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)	2020-04-22
Name/Print	Ian M. Hughes	Registration Number	41083

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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.

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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.

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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.

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BIB DATA SHEET

CONFIRMATION NO. 6363

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
16/826,482	03/23/2020 **RULE**	370	2412	811.0206

APPLICANTS
KT CORPORATION, Gyeonggi-do, KOREA, REPUBLIC OF;

INVENTORS
Kyujin PARK, Seoul, KOREA, REPUBLIC OF;

** **CONTINUING DATA** *************************
This application is a DIV of 16/147,530 09/28/2018 PAT 10638463

** **FOREIGN APPLICATIONS** *************************
REPUBLIC OF KOREA 10-2017-0128188 09/29/2017
REPUBLIC OF KOREA 10-2017-0162728 11/30/2017
REPUBLIC OF KOREA 10-2018-0077270 07/03/2018

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04/01/2020

	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No ☑ Met after Allowance Verified and Acknowledged /CHUONG T HO/ Examiner's Signature CH Initials	KOREA, REPUBLIC OF	9	12	3

ADDRESS

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

TITLE

APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

FILING FEE RECEIVED		
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/826,482	03/23/2020	Kyujin PARK	811.0206

CONFIRMATION NO. 6363

PUBLICATION NOTICE

76277
IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

OC000000118339046

Title:APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

Publication No.US-2020-0221453-A1
Publication Date:07/09/2020

NOTICE OF PUBLICATION OF APPLICATION

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

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Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 360 of 595

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	2464
	Examiner Name	NGO, RICKY QUOC
	Attorney Docket Number	811.0206

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Signature	/Ian M. Hughes/	Date (YYYY-MM-DD)	2020-04-22
Name/Print	Ian M. Hughes	Registration Number	41083

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Electronic Acknowledgement Receipt

EFS ID:	39229939
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
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:	811.0206
Receipt Date:	22-APR-2020
Filing Date:	23-MAR-2020
Time Stamp:	12:38:32
Application Type:	Utility under 35 USC 111(a)

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Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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			Total Files Size (in bytes):	3234799	

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/826,482	03/23/2020	2414	1720	811.0206	12	3

CONFIRMATION NO. 6363

76277
IP LEGAL SERVICES, LLC
P.O. Box 651325
Sterling, VA 20165

FILING RECEIPT

OC000000115904287

Date Mailed: 04/03/2020

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

Kyujin PARK, 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 Priority data as claimed by applicant

This application is a DIV of 16/147,530 09/28/2018

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 10-2017-0128188 09/29/2017 Access Code Provided
REPUBLIC OF KOREA 10-2017-0162728 11/30/2017 Access Code Provided
REPUBLIC OF KOREA 10-2018-0077270 07/03/2018 Access Code Provided

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If Required, Foreign Filing License Granted: 04/01/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/826,482**

Projected Publication Date: 07/09/2020

Non-Publication Request: No

Early Publication Request: No
Title

APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

Preliminary Class

370

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

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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.

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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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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/826,482

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))	12 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

AMENDMENT A

	(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($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
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	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
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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This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office.

출 원 번 호 : 10-2017-0128188
Application Number

출 원 년 월 일 : 2017년 09월 29일
Filing Date Sep. 29, 2017

출 원 인 : 주식회사 케이티
Applicant(s) KT Corporation

2020년 04월 03일

특 허 청
COMMISSIONER

제출 일자 : 2017-09-29

【서지사항】

【서류명】 특허출원서

【출원구분】 특허출원

【출원인】

【명칭】 주식회사 케이티

【특허고객번호】 2-1998-005456-3

【대리인】

【성명】 김은구

【대리인번호】 9-1999-000318-1

【포괄위임등록번호】 2011-023059-1

【대리인】

【성명】 송해모

【대리인번호】 9-2002-000179-4

【포괄위임등록번호】 2011-023060-3

【발명의 국문명칭】 차세대 무선망을 위한 상향 링크 제어 채널 자원 할당 방법 및 장치

【발명의 영문명칭】 Apparatus and method of PUCCH resource allocation for new radio

【발명자】

【성명】 박규진

【성명의 영문표기】 PARK, Kyu Jin

【주민등록번호】 811018-1XXXXXX

【우편번호】 137-140

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【주소】 서울특별시 서초구 우면동 17 KT연구개발센터

【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】	30 면	0 원
【우선권주장료】	0 건	0 원
【심사청구료】	0 항	0 원
【합계】	46,000 원	

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【발명의 설명】

【발명의 명칭】

차세대 무선망을 위한 상향 링크 제어 채널 자원 할당 방법 및 장치 {Apparatus and method of PUCCH resource allocation for new radio}

【기술분야】

【0001】 본 발명은 차세대/5G 무선 액세스망(이하 본 발명에서는 NR[New Radio]라 지칭하도록 함.)에서 상향 링크 제어 채널 자원 할당 방법에 대해 제안한다.

【발명의 내용】

【과제의 해결 수단】

【0002】 본 발명의 일 실시예는 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서, 상기 단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 방법을 제공한다.

【도면의 간단한 설명】

【0003】 도 1은 Example of symbol level alignment among different SCS를 도시한 도면이다.

도 2는 Bandwidth part에 대한 개념적 예시를 도시한 도면이다.

도 3은 임의의 단말을 위해 설정된 하나의 serving cell에서 N개의 BWP 설정

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예를 도시한 도면이다.

도 4는 또 다른 실시예에 의한 기지국의 구성을 보여주는 도면이다.

도 5는 또 다른 실시예에 의한 사용자 단말의 구성을 보여주는 도면이다.

【발명을 실시하기 위한 구체적인 내용】

【0004】 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.

【0005】 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.

【0006】 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.

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【0007】 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.

【0008】 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.

【0009】 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.

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【0010】 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.

【0011】 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.

【0012】 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.

【0013】 또한, 무선 통신 시스템에서는 하나의 반송파 또는 반송파 쌍을 기준으로 상향링크와 하향링크를 구성하여 규격을 구성한다.

【0014】 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.

【0015】 하향링크(downlink)는 다중 송수신 포인트에서 단말로의 통신 또는 통신 경로를 의미할 수 있으며, 상향링크(uplink)는 단말에서 다중 송수신 포인트

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로의 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.

【0016】 이하에서는 PUCCH, PUSCH, PDCCH 및 PDSCH 등과 같은 채널을 통해 신호가 송수신되는 상황을 'PUCCH, PUSCH, PDCCH 및 PDSCH를 전송, 수신한다'는 형태로 표기하기도 한다.

【0017】 한편, 이하에서 기재하는 상위계층 시그널링(High Layer Signaling)은 RRC 파라미터를 포함하는 RRC 정보를 전송하는 RRC 시그널링을 포함한다.

【0018】 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.

【0019】 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,

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NOMA는 SCMA(Sparse Code Multiple Access)와 LDS(Low Density Spreading) 등을 포함한다.

【0020】 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.

【0021】 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.

【0022】 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.

【0023】 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,

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초저가 단말 비용, 낮은 전력 소모, 그리고 최적화된 네트워크 구조를 포함한다.

【0024】 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.

【0025】 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.

【0026】 NR(New Radio)

【0027】 3GPP는 최근 차세대 무선 액세스 기술(i.e. 5G 무선 액세스 기술)에 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 설계가 진행 중이다. 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

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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.

【0028】 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/하향링크 데이터 스케줄링의 기반의 되는 time unit으로서 slot 및 mini-slot이 정의될 수 있다. 이 경우, 해당 slot을 구성하는 OFDM 심볼의 개수, y값은 normal CP의 경우, SCS값에 관계 없이 y=14의 값을 갖도록 결정되었다.

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【0029】 이에 따라 임의의 slot은 14개의 심볼로 구성되며, 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.

【0030】 또한 임의의 numerology(혹은 SCS)에서 상기 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 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.

【0031】 또는 상기에서 서술한 바와 같이 하나의 NR Carrier 내에서 서로 다른 SCS값을 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 1/4정도

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로 줄어들기 때문에 동일하게 14개의 OFDM 심볼로 하나의 slot을 구성할 경우, 해당 15kHz 기반의 slot length는 1ms이 되는 반면, 60kHz 기반의 slot length는 약 0.25ms으로 줄어들게 된다.

【0032】 이처럼 NR에서는 서로 다른 SCS 혹은 서로 다른 TTI length를 정의함으로써, URLLC와 eMBB 각각의 requirement를 만족시키는 방법에 대한 논의가 진행되고 있다.

【0033】 Wider bandwidth operations

【0034】 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, normal LTE 단말은 하나의 LTE CC에 대해 20 MHz bandwidth의 송수신 capability를 지원하였다.

【0035】 하지만, NR의 경우, 하나의 wideband NR CC를 통해 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.

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【0036】 구체적으로 NR에서는 단말 관점에서 구성된 하나의 serving cell을 통해 하나 이상의 bandwidth part를 구성할 수 있으며, 해당 단말은 해당 serving cell에서 하나의 DL bandwidth part와 하나의 UL bandwidth part를 activation하여 상/하향 링크 데이터 송수신을 위해 사용하도록 정의되었다. 또한 해당 단말에서 복수의 serving cell이 설정된 경우, 즉 CA이 적용된 단말에 대해서도 각각의 serving cell 별로 하나의 DL bandwidth part 그리고/혹은 UL bandwidth part를 activation하여 해당 serving cell의 무선 자원을 이용하여 상/하향 링크 데이터 송수신을 위해 사용하도록 정의되었다.

【0037】 구체적으로 임의의 serving cell에서 단말의 initial access procedure를 위한 initial bandwidth part가 정의되며, 각각의 단말 별로 dedicated RRC signaling을 통해 하나 이상의 UE-specific bandwidth part(s)가 구성되고, 또한 각각의 단말 별로 fallback operation을 위한 default bandwidth part가 정의될 수 있다.

【0038】 단, 임의의 serving cell에서 단말의 capability 및 bandwidth part(s) 구성에 따라 동시에 복수의 DL and/or UL bandwidth parts를 activation하여 사용하도록 정의할 수 있으나, NR rel-15에서는 임의의 단말에서 임의의 시간에 하나의 DL bandwidth part 및 UL bandwidth part만을 activation하여 사용하도록 정의되었다.

【0039】 NR PUCCH

【0040】 기존의 LTE 시스템의 경우, 단말의 UCI(Uplink Control

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Information) 전송을 위한 상향 링크 제어 채널인 PUCCH 전송은 단일한 subframe 단위로 이루어졌다. 즉, time-domain에서 하나의 subframe을 구성하는 14개의 SC-FDMA 심볼을 하나의 PUCCH 전송이 이루어졌다. 단, 마지막 심볼이 SRS 전송을 위해 사용될 경우, 마지막 심볼을 제외한 13개의 심볼을 통해 PUCCH 전송이 이루어졌다.

【0041】 또한 UCI의 payload size에 따라 서로 다른 PUCCH format이 정의되었다. 구체적으로 SR(Scheduling Request)와 HARQ ACK과 같은 1 or 2 bits의 UCI 전송은 PUCCH format 1 계열(PUCCH format 1/1a/1b)을 통해 전송되었고, CQI/CSI 피드백과 같이 moderate한 payload size를 갖는 UCI의 경우 PUCCH format 2(PUCCH format 2a/2b) 계열, CA 상황에서 large payload size의 UCI 피드백의 경우 PUCCH format 3 이상을 사용하도록 정의되었다.

【0042】 하지만 NR의 경우, 14개의 심볼로 이루어진 slot 내에서 다양한 duration을 갖는 PUCCH 구조가 정의되었다. 구체적으로 하나의 slot 내에서 단일한 PUCCH 전송이 이루어지는 심볼의 수, N값에 따라 long-PUCCH와 short-PUCCH로 구분되며, long-PUCCH는 하나의 slot 내에서 4~14개의 심볼을 통해 전송될 수 있고, short-PUCCH의 경우 1~2개의 심볼을 통해 전송될 수 있다. 또한 각각의 long-PUCCH와 short-PUCCH에 대해 UCI payload size에 따라 LTE와 유사하게 서로 다른 PUCCH format이 정의될 수 있다. 예를 들어, short-PUCCH에 대해 up to 2 bits의 UCI 전송을 위한 PUCCH format 및 그 이상의 payload size를 갖는 UCI 전송을 위한 PUCCH format이 각각 정의되고, 또한 long-PUCCH에 대해서도 up to 2 bits의 UCI 전송을 위한 PUCCH format 및 그 이상의 payload size를 갖는 UCI 전송을 위한 PUCCH

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format이 각각 정의될 수 있다.

【0043】 즉, NR에서 UCI 전송을 위한 PUCCH structure를 정의함에 있어서 PUCCH duration과 PUCCH format에 대한 정의가 각각 요구될 수 있다.

【0044】 본 발명은 NR에서 단말의 HARQ ACK/NACK 피드백 혹은 aperiodic CSI reporting을 위한 PUCCH 자원 할당 방법에 대해 제안한다.

【0045】 상기에서 서술한 바와 같이 NR에서는 단말 관점에서 구성된 하나의 serving cell을 통해 하나 이상의 bandwidth part(s)를 구성할 수 있다. 구체적으로 해당 serving cell에서 지원하는 transmission direction에 따라, unpaired(i.e. TDD) 혹은 paired(i.e. FDD) spectrum으로 구성된 serving cell의 경우, 적어도 하나 이상의 DL bandwidth part(s)와 UL bandwidth part(s)가 각각 구성될 수 있으며, 기지국은 각각의 단말 별로 주어진 시간에 하나의 DL bandwidth part 및 UL bandwidth part만을 activation하여 각각 상/하향 링크 무선 채널 및 신호(e.g. PDCCH/PDSCH, PUSCH/PUCCH, etc.)의 송수신을 위해 사용하도록 정의되었다. 단, DL-only 혹은 UL-only serving cell의 경우, 각각 DL bandwidth part(s) 혹은 UL bandwidth part(s)만이 구성 및 활성화될 수 있다.

【0046】 이에 따라, 단말은 initial access가 이루어진 Pcell 외에 CA를 통해 구성된 Scell에 대해서도 각각 독립적으로 bandwidth part(s)가 구성되고 활성화될 수 있다.

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【0047】 이처럼 임의의 단말을 위해 구성된 임의의 serving cell에서 하나 이상의 bandwidth part(s)가 구성될 경우, 단말은 임의의 시간에 하나의 bandwidth part를 activation하여 사용할 수 있다. 구체적으로 DL 송수신을 위해서 해당 serving cell에서 해당 단말을 위해 구성된 하나 이상의 DL bandwidth part(s) 중 임의의 DL subframe/slot/mini-slot에서 하나의 DL bandwidth part를 activation하여 사용한다. 마찬가지로 UL 송수신을 위해서 해당 serving cell에서 해당 단말을 위해 구성된 하나 이상의 UL bandwidth part(s) 중 임의의 UL subframe/slot/mini-slot에서 하나의 UL bandwidth part를 activation하여 사용한다.

【0048】 임의의 단말에 대한 상기 DL bandwidth part 및 UL bandwidth part의 activation/deactivation 지시는 PDCCH를 통해 전송되는 DCI(Downlink Control Information)을 통해 이루어질 수 있다. 구체적으로 PDSCH에 대한 자원 할당 정보를 포함하는 DL assignment DCI를 통해 DL bandwidth part에 대한 activation 및 deactivation이 이루어질 수 있다. 또한 PUSCH에 대한 자원 할당 정보를 포함하는 UL grant를 통해 UL bandwidth part에 대한 activation 및 deactivation이 이루어질 수 있다.

【0049】 본 발명에서는 이와 같이 UE-specific한 bandwidth part(이하에서는 설명의 편의를 위해 bandwidth part를 BWP로 지칭하도록 한다.) 기반 동작으로 고려한 PUCCH 자원 할당 방법 및 그와 관련한 구체적인 기지국과 단말의 동작에 대해 제안한다. 특히 UL BWP activation/deactivation, 즉, UL BWP switching에 따른 기지국과 단말의 PUCCH 송수신 자원 지시 및 해석 간 ambiguity를 방지하기 위한 구

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체적인 PUCCH 자원 할당 방법에 대해 제안한다.

【0050】 NR에서는 기지국/네트워크에서 각각의 단말 별로 HARQ ACK/NACK 피드백을 위한 하나 이상의 PUCCH resource(s)로 구성된 단일한 PUCCH resource set 혹은 각각 하나 이상의 PUCCH resource(s)로 구성된 복수의 PUCCH resource sets을 구성하여, 이를 UE-specific higher layer signaling을 통해 각각의 단말에 전송할 수 있다. 이처럼 UE-specific higher layer signaling을 통해 임의의 단말을 위한 단일한 혹은 복수의 PUCCH resource set(s)이 구성된 경우, 기지국에서 PDCCH를 통해 임의의 단말을 위한 PDSCH scheduling 제어 정보 전송 시, 해당 DL assignment DCI(Downlink Control Information)을 해당 PDSCH 수신에 대한 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH resource indication 정보를 포함하여 전송할 수 있다. 즉, 기지국은 임의의 단말을 위한 PDSCH transmission 별로, 해당 단말을 위해 설정된 단일한 PUCCH resource set을 구성하는 PUCCH resources 중 하나의 PUCCH resource를 선택하여, 혹은 해당 단말을 위해 설정된 복수의 PUCCH resource sets 중 하나의 PUCCH resource set 및 해당 PUCCH resource set을 구성하는 PUCCH resources 중 하나의 PUCCH resource를 선택하여, 이를 DL assignment DCI를 통해 전송함으로써, 해당 단말에서 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource를 dynamic하게 할당하도록 정의할 수 있다.

【0051】 본 발명에서는 이를 위한 구체적인 PUCCH resource set 설정 방법 및 해당 PUCCH resource indication 방법을 제안한다.

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【0052】 먼저 임의의 단말을 위한 상기 PUCCH resource set(s)을 구성하는 한 방법으로서, 단말의 HARQ ACK/NACK 피드백을 위한 단말 별 PUCCH resource set(s)을 구성함에 있어서, 해당 단말을 위해 설정된 UL BWP 별로 각각 별도의 PUCCH resource set(s)을 설정하도록 정의할 수 있다. 예를 들어, 임의의 단말을 위해 아래의 그림 3과 같이 N개의 UL BWPs가 설정된 경우(단, 아래의 도 3은 각각의 BWP 간 주파수 축에서 overlapping되지 않도록 구성되었으나, 임의의 BWP 간 주파수 축에서 partially 혹은 fully overlapping되도록 BWP 구성이 이루어질 수도 있으며, 구체적인 UL BWP 설정에 의해 본 발명이 제약되지 않음), 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH resource indication을 위해 각각의 UL BWP 별로 별도의 단일한 혹은 복수의 PUCCH resource set(s)를 설정하여 이를 UE-specific higher layer signaling을 통해 해당 단말에 전송하도록 정의할 수 있다.

【0053】 즉, 기지국은 해당 단말을 위해 BWP #1을 위한 하나의 혹은 복수의 PUCCH resource set(s), BWP #2를 위한 또 다른 하나의 혹은 복수의 PUCCH resource set(s),…, BWP #N을 위한 또 다른 하나의 혹은 복수의 PUCCH resource set(s)까지 각각의 BWP 별로 총 N개의 group of one or more PUCCH resource set(s)를 설정하도록 정의할 수 있다. 이 경우, 각각의 UL BWP 별로 higher layer signaling을 통해 설정된 하나의 혹은 복수의 PUCCH resource set을 구성하는 각각의 PUCCH resource는 PUCCH format 설정 정보, 해당 UL BWP 내의 time/frequency domain PUCCH 자원 설정 정보(혹은 추가적으로 code-domain 자원 설정 정보) 등으로서 정의될 수 있다.

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【0054】 이처럼 higher layer signaling에 의해 각각의 BWP별로 하나 혹은 복수의 PUCCH resource set(s)이 구성된 경우, 상기의 DL assignment DCI를 통한 PUCCH resource indication 정보 영역을 구성함에 있어서 기지국은 PUCCH 전송을 위한 UL BWP indication 정보를 명시적으로 포함하도록 정의할 수 있다. 구체적으로 상기의 DL assignment DCI를 통한 PUCCH resource indication 정보는 UL BWP indication 정보(e.g. BWP index 정보) + 해당 UL BWP 내의 PUCCH resource set indication 정보(e.g. PUCCH resource set index 정보) + 해당 PUCCH resource set 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보(e.g. PUCCH resource index within the PUCCH resource set)으로 구성될 수 있다. 단, 임의의 BWP 내에서 PUCCH resource set을 구성함에 있어서, 특정한 classification 기반의 PUCCH resource set 구성이 이루어질 경우, 해당 특정 classification 정보가 상기 PUCCH resource set indication 정보를 대신할 수 있다. 예를 들어, PUCCH format 혹은 PUCCH duration 혹은 PUCCH payload size 등에 따라 각각 PUCCH resource set이 별도로 구성될 경우, 각각 해당 PUCCH format 정보 혹은 PUCCH duration 정보 혹은 PUCCH payload size 정보 등이 각각 상기의 PUCCH resource set indication 정보 대신 사용될 수 있다. 또는 해당 PUCCH resource set 정보(또는, 상기 PUCCH classification에 따른 지시 정보 포함)와 해당 PUCCH resource set 내의 PUCCH resource index 정보는 joint coding 방식으로 encoding되어 하나의 정보 영역을 통해 송수신될 수 있다. 단, 상기의 PUCCH resource set indication 관련 정보는 해당 정보는 하나의 UL BWP 내에서 복

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수의 PUCCH resource sets 설정이 지원되는 경우에만 필요할 수 있으며, 하나의 UL BWP 당 하나의 PUCCH resource set 구성만 지원되는 경우, 상기의 PUCCH resource set indication 정보는 제외될 수 있다. 이처럼 DL assignment DCI를 통해 PUCCH 전송을 위한 UL BWP indication 정보가 포함될 경우, 해당 UL BWP indication 정보는 추가적으로 해당 단말의 UL BWP activation 정보 및 그에 따른 UL BWP switching 지시 정보로 사용될 수 있다. 구체적으로 해당 UL BWP indication 정보에 따라 해당 단말은 해당 DL assignment DCI 수신 slot으로부터 일정 slot 이후(e.g. k slots 이후)에 해당 UL BWP indication 정보에 따라 UL BWP switching(즉, 현재의 active UL BWP를 deactivation하고 해당 지시 정보에 따라 새로운 UL BWP를 activation 하는 동작)을 수행하도록 정의할 수 있다. 또는 해당 PUCCH 전송 slot으로부터 일정 slot 이전(e.g. j slots 이전)에 UL BWP indication 정보에 따라 UL BWP switching(즉, 현재의 active UL BWP를 deactivation하고 해당 지시 정보에 따라 새로운 UL BWP를 activation 하는 동작)을 수행하도록 정의할 수 있다. 단, 상기 k 혹은 j 값은 0 이상의 임의의 정수값으로서, 임의의 고정된 값을 갖거나, 기지국에 의해 설정되어 higher layer signaling을 통해 전송되거나, 혹은 단말의 capability에 따라 결정될 수 있다. 또한 상기 UL BWP indication 정보가 현재의 active UL BWP를 지시하는 경우, 해당 단말은 상기 BWP switching 동작을 수행하지 않는다.

【0055】 상기의 DL assignment DCI를 통한 PUCCH resource indication 정보 영역을 구성하는 또 다른 방법으로서, 상기 UL BWP는 암묵적으로 결정될 수

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있으며, 이에 따라 해당 DL assignment DCI의 PUCCH resource indication 정보는 해당 UL BWP indication 정보를 제외한 PUCCH resource set indication 정보 + 해당 PUCCH resource set 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보로 구성될 수 있다. 단, 이 때 해당 PUCCH resource set indication 정보 + 해당 PUCCH resource set 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보 상기와 동일한 방법으로 구성될 수 있다. 이처럼 UL BWP가 암묵적으로 결정될 경우, 해당 PUCCH 전송을 위한 UL BWP는 해당 DL assignment DCI 전송 slot에서 해당 단말의 active UL BWP로 결정되도록 정의할 수 있다. UL BWP를 암묵적으로 결정하는 또 다른 방법으로서, 해당 PUCCH 전송을 위한 UL BWP는 해당 단말의 PUCCH 전송 시점, 즉 PUCCH 전송이 이루어지는 slot(혹은 복수의 slot을 통해 PUCCH 전송이 이루어질 경우, PUCCH 전송이 시작되는 slot)에서의 active UL BWP로 결정되도록 정의할 수 있다. 상기 PUCCH 전송을 위한 UL BWP를 암묵적으로 결정하는 또 다른 방법으로서, PDSCH 자원 할당이 이루어지는 DL assignment DCI가 전송된 DL BWP 별로 PUCCH 전송을 위해 association된 UL BWP를 정의할 수 있다. 혹은 해당 DL assignment DCI에 따른 PDSCH 전송이 이루어지는 DL BWP 별로 PUCCH 전송을 위해 association된 UL BWP를 정의할 수 있다. 이 경우, 임의의 단말을 위해 설정된 각각의 DL BWP 별 PUCCH 전송을 위해 association된 UL BWP를 기지국에서 설정하여 UE-specific higher layer signalling 혹은 L1 control signaling을 통해 해당 단말에 전송하거나, 혹은 implicit한 DL BWP - UL BWP association rule을 정

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의할 수 있다. 예를 들어, TDD 셀에서 각각 DL과 UL에 대해 동일한 BWP 설정이 이루어진 경우 혹은 TDD/FDD 셀에서 DL과 UL에 대해 동일한 개수의 BWP 설정이 이루어진 경우, 각각 동일한 index의 DL BWP와 UL BWP를 association하도록 정의할 수 있다.

【0056】 또는 상기 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH resource set(s)을 설정하는 또 다 다른 방법으로서, 해당 PUCCH resource set(s)은 UL BWP common하게 설정될 수 있다. 즉, 임의의 단말을 위해 설정된 하나의 PUCCH resource set을 구성하는 PUCCH resources를 정의함에 있어서, 해당 PUCCH resource set을 구성하는 각각의 PUCCH resource는 해당 단말을 위해 설정된 모든 UL BWP에서 정의된 PUCCH resource들로 구성될 수 있다. 즉, 기지국에서 임의의 단말을 위한 PUCCH resource set(s)을 구성하는 각각의 PUCCH resource를 설정함에 있어서, 해당 PUCCH resource가 구성되는 UL BWP 정보도 포함하도록 할 수 있다. 이에 따라 임의의 단말을 위해 상기의 higher layer signaling을 통해 설정된 하나의 혹은 복수의 PUCCH resource set(s)을 구성하는 각각의 PUCCH resource는 PUCCH format 설정 정보, UL BWP 설정 정보 및 해당 UL BWP 내의 time/frequency domain PUCCH 자원 설정 정보(혹은 추가적으로 code-domain 자원 설정 정보) 등으로서 정의될 수 있다. 이 경우, 상기의 DL assignment DCI를 통해 전송되는 PUCCH resource indication 정보는 상기의 implicit UL BWP indication의 경우와 동일하게 PUCCH resource set indication 정보(e.g. PUCCH resource set index 정보) + 해당 PUCCH resource set 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드

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백을 위해 사용할 PUCCH resource indication 정보(e.g. PUCCH resource index within the PUCCH resource set)으로 구성되거나, 혹은 PUCCH resource set(s) 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보(e.g. PUCCH resource index within the PUCCH resource set)만으로 구성될 수 있다. 상기와 마찬가지로 PUCCH resource set을 구성함에 있어서, 특정한 classification 기반의 PUCCH resource set 구성이 이루어질 경우, 해당 특정 classification 정보가 상기 PUCCH resource set indication 정보를 대신할 수 있다. 예를 들어, PUCCH format 혹은 PUCCH duration 혹은 PUCCH payload size 등에 따라 각각 PUCCH resource set이 별도로 구성될 경우, 각각 해당 PUCCH format 정보 혹은 PUCCH duration 정보 혹은 PUCCH payload size 정보 등이 각각 상기의 PUCCH resource set indication 정보 대신 사용될 수 있다. 또는 해당 PUCCH resource set 정보(또는, 상기 PUCCH classification에 따른 지시 정보 포함)와 해당 PUCCH resource set 내의 PUCCH resource index 정보는 joint coding 방식으로 encoding되어 하나의 정보 영역을 통해 송수신될 수 있다. 단, 상기의 PUCCH resource set indication 관련 정보는 단말 당 복수의 PUCCH resource sets 설정이 지원되는 경우에만 필요할 수 있으며, 단말 당 하나의 PUCCH resource set 구성만 지원되는 경우, 상기의 PUCCH resource set indication 정보는 제외될 수 있다.

【0057】추가적으로 higher layer signaling을 통해 설정되는 PUCCH resource set을 구성하는 PUCCH resource 설정 정보가 각각 UL BWP 설정 정보를 포

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함하는 경우, DL assignment DCI의 PUCCH resource indication 정보에 의해 지시된 PUCCH resource 할당에 따라 상기의 명시적 UL BWP indication의 case와 마찬가지로 해당 단말에서 해당 PUCCH resource가 구성되는 UL BWP로 UL BWP activation 혹은 UL BWP switching 동작을 수행하도록 정의할 수 있다.

【0058】추가적으로 상기에서 서술한 바와 같이 UL BWP별로 단말의 HARQ ACK/NACK 피드백을 위해 하나의 혹은 복수의 PUCCH resource set(s)이 설정된 경우, 또는 UL BWP common하게 하나의 혹은 복수의 PUCCH resource set(s)이 설정된 경우, 해당 PUCCH resource set(s)을 구성하는 각각의 PUCCH resource들은 단말의 aperiodic CSI 피드백을 위해서도 할당될 수 있도록 정의할 수 있다. 구체적으로 기지국에 의해 임의의 단말의 aperiodic CSI reporting이 DL assignment DCI를 통해 triggering될 수 있다. 이를 위해 임의의 단말을 위한 DL assignment DCI format을 정의함에 있어서, 단말의 aperiodic CSI reporting을 triggering하기 위한 정보 영역을 포함하도록 할 수 있으며, 해당 aperiodic CSI reporting 지시 정보 영역을 통해 단말의 aperiodic CSI reporting이 triggering된 경우, 해당 DL assignment DCI를 통해 지시되는 상기의 PUCCH resource 할당 정보에 따라 해당 PUCCH resource를 통해 PDSCH에 대한 HARQ ACK/NACK 피드백 정보와 함께 aperiodic CSI reporting 정보도 multiplexing하여 전송하도록 정의할 수 있다. 즉, 상기의 PUCCH resource set 설정은 HARQ ACK/NACK 피드백과 aperiodic CSI reporting을 위한 common한 PUCCH resource set 설정일 수 있다.

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【0059】또는 기지국/네트워크에서 상기의 HARQ ACK/NACK 피드백을 위한 PUCCH resource set(s) 설정과 별도로 aperiodic CSI reporting을 위한 PUCCH resource set(s)을 구성하여 이를 UE-specific higher layer signaling을 통해 각각의 단말로 전송하도록 정의할 수 있다. 즉, 각각의 단말 별로 aperiodic CSI 피드백만을 위한 하나의 혹은 복수의 PUCCH resource set(s)을 구성하여 이를 UE-specific higher layer signaling을 통해 각각의 단말로 전송하도록 정의할 수 있다. 이 경우, 해당 aperiodic CSI 피드백을 위한 PUCCH resource set은 상기의 HARQ ACK/NACK 피드백을 위한 PUCCH resource set 구성 방법과 동일하게 각각 PUCCH format 별로 혹은 PUCCH duration 별로 별도로 구성될 수도 있고, 그와 관계없이 구성될 수 있다. 또한 aperiodic CSI reporting을 위한 별도의 PUCCH resource set(s)을 설정함에 있어서, 상기에 서술한 바와 같이 UL BWP 별로 aperiodic CSI reporting을 위한 PUCCH resource set(s)을 설정하도록 정의하거나, 혹은 UL BWP common하게 aperiodic CSI reporting을 위한 PUCCH resource set(s)을 설정하도록 정의할 수 있다. 이처럼 별도의 aperiodic CSI reporting을 위한 PUCCH resource set(s)이 설정될 경우, aperiodic CSI reporting을 위한 PUCCH resource 할당은 상기에서 기술한 DL assignment DCI를 통한 HARQ ACK/NACK 피드백을 위한 PUCCH resource 할당 방법을 따르도록 정의할 수 있으며, 추가적으로 UL BWP activation 혹은 switching과 관련한 단말 동작도 상기에서 기술한 동작을 따르도록 정의할 수 있다.

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【0060】 추가적으로 UL grant를 통한 aperiodic CSI reporting이 triggering 될 경우, 단말에서 aperiodic CSI reporting 정보를 전송할 무선 채널 지시 정보(즉, PUSCH or PUCCH)를 포함하도록 정의할 수 있다.

【0061】 도 4는 또 다른 실시예에 의한 기지국(1000)의 구성을 보여주는 도면이다.

【0062】 도 4를 참조하면, 또 다른 실시예에 의한 기지국(1000)은 제어부(1010)과 송신부(1020), 수신부(1030)를 포함한다.

【0063】 제어부(1010)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서,단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 데에 따른 전반적인 기지국(1000)의 동작을 제어한다.

【0064】 송신부(1020)와 수신부(1030)는 전술한 본 발명을 수행하기에 필요한 신호나 메시지, 데이터를 단말과 송수신하는데 사용된다.

【0065】 도 5는 또 다른 실시예에 의한 사용자 단말(1100)의 구성을 보여주는 도면이다.

【0066】 도 5를 참조하면, 또 다른 실시예에 의한 사용자 단말(1100)은 수신부(1110) 및 제어부(1120), 송신부(1130)를 포함한다.

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【0067】 수신부(1110)는 기지국으로부터 하향링크 제어 정보 및 데이터, 메시지를 해당 채널을 통해 수신한다.

【0068】 또한 제어부(1120)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서, 단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 데에 따른 전반적인 사용자 단말(1100)의 동작을 제어한다.

【0069】 송신부(1130)는 기지국에 상향링크 제어 정보 및 데이터, 메시지를 해당 채널을 통해 전송한다.

【0070】 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.

【0071】 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

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해석되어야 하며, 그와 동등한 범위 내에 있는 모든 기술 사상은 본 발명의 권리범위에 포함되는 것으로 해석되어야 할 것이다.

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【특허청구범위】

【청구항 1】

차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서,

상기 단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 방법.

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제출 일자 : 2017-09-29

【요약서】

【요약】

본 발명은 차세대/5G 무선 액세스망에서 상향 링크 제어 채널 자원 할당 방법에 대한 것으로서, 일 실시예는 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서, 상기 단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 방법을 제공한다.

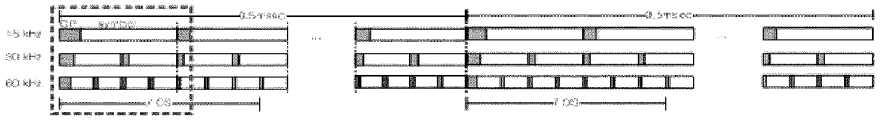
【대표도】

도 2

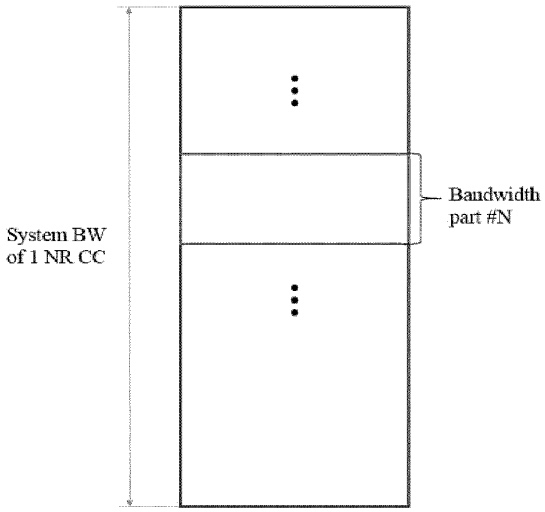
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【도면】

【도 1】

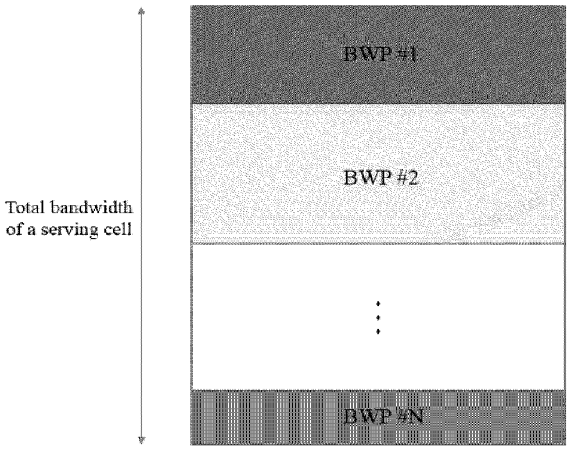


【도 2】

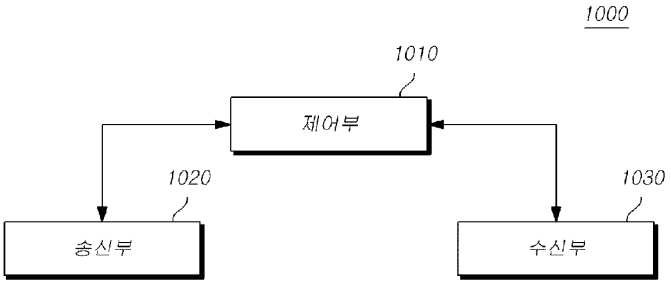


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【도 3】

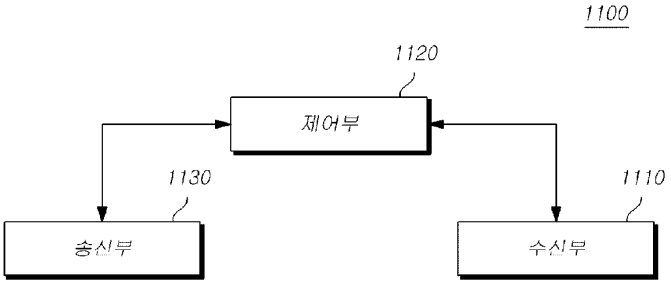


【도 4】



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【도 5】



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출 원 번 호 : 10-2017-0162728
Application Number

출 원 년 월 일 : 2017년 11월 30일
Filing Date Nov. 30, 2017

출 원 인 : 주식회사 케이티
Applicant(s) KT Corporation

2020년 04월 03일

특 허 청
COMMISSIONER

제출 일자 : 2017-11-30

【서지사항】

【서류명】	특허출원서
【출원구분】	특허출원
【출원인】	
【명칭】	주식회사 케이티
【특허고객번호】	2-1998-005456-3
【대리인】	
【명칭】	특허법인(유한)유일하이스트
【대리인번호】	9-2017-100261-6
【지정된변리사】	송해모,김은구
【포괄위임등록번호】	2017-079044-3
【발명의 국문명칭】	차세대 무선망을 위한 상향 링크 제어 채널 자원 할당 방법 및 장치
【발명의 영문명칭】	Apparatus and method of PUCCH resource allocation for new radio
【발명자】	
【성명】	박규진
【성명의 영문표기】	PARK, Kyu Jin
【주민등록번호】	811018-1XXXXXX
【우편번호】	137-140
【주소】	서울특별시 서초구 우면동 17 KT연구개발센터
【출원언어】	국어
【우선권 주장】	

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제출 일자 : 2017-11-30

【출원국명】 KR

【출원번호】 10-2017-0128188

【출원일자】 2017.09.29

【증명서류】 첨부

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 특허법인(유한)유일하이스트 (서명 또는 인)

【수수료】

【출원료】	0 면	46,000 원
【가산출원료】	30 면	0 원
【우선권주장료】	1 건	18,000 원
【심사청구료】	0 항	0 원
【합계】	64,000 원	

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【발명의 설명】

【발명의 명칭】

차세대 무선망을 위한 상향 링크 제어 채널 자원 할당 방법 및 장치 {Apparatus and method of PUCCH resource allocation for new radio}

【기술분야】

【0001】 본 발명은 차세대/5G 무선 액세스망(이하 본 발명에서는 NR[New Radio]라 지칭하도록 함.)에서 상향 링크 제어 채널 자원 할당 방법에 대해 제안한다.

【발명의 내용】

【과제의 해결 수단】

【0002】 본 발명의 일 실시예는 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서, 상기 단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 방법을 제공한다.

【도면의 간단한 설명】

【0003】 도 1은 Example of symbol level alignment among different SCS를 도시한 도면이다.

도 2는 Bandwidth part에 대한 개념적 예시를 도시한 도면이다.

도 3은 임의의 단말을 위해 설정된 하나의 serving cell에서 N개의 BWP 설정

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예를 도시한 도면이다.

도 4는 또 다른 실시예에 의한 기지국의 구성을 보여주는 도면이다.

도 5는 또 다른 실시예에 의한 사용자 단말의 구성을 보여주는 도면이다.

【발명을 실시하기 위한 구체적인 내용】

【0004】 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.

【0005】 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.

【0006】 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.

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【0007】 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.

【0008】 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.

【0009】 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.

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【0010】 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.

【0011】 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.

【0012】 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.

【0013】 또한, 무선 통신 시스템에서는 하나의 반송파 또는 반송파 쌍을 기준으로 상향링크와 하향링크를 구성하여 규격을 구성한다.

【0014】 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.

【0015】 하향링크(downlink)는 다중 송수신 포인트에서 단말로의 통신 또는 통신 경로를 의미할 수 있으며, 상향링크(uplink)는 단말에서 다중 송수신 포인트

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로의 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.

【0016】 이하에서는 PUCCH, PUSCH, PDCCH 및 PDSCH 등과 같은 채널을 통해 신호가 송수신되는 상황을 'PUCCH, PUSCH, PDCCH 및 PDSCH를 전송, 수신한다'는 형태로 표기하기도 한다.

【0017】 한편, 이하에서 기재하는 상위계층 시그널링(High Layer Signaling)은 RRC 파라미터를 포함하는 RRC 정보를 전송하는 RRC 시그널링을 포함한다.

【0018】 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.

【0019】 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,

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NOMA는 SCMA(Sparse Code Multiple Access)와 LDS(Low Density Spreading) 등을 포함한다.

【0020】 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.

【0021】 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.

【0022】 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.

【0023】 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,

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초저가 단말 비용, 낮은 전력 소모, 그리고 최적화된 네트워크 구조를 포함한다.

【0024】 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.

【0025】 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.

【0026】 NR(New Radio)

【0027】 3GPP는 최근 차세대 무선 액세스 기술(i.e. 5G 무선 액세스 기술)에 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 설계가 진행 중이다. 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

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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.

【0028】 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/하향링크 데이터 스케줄링의 기반의 되는 time unit으로서 slot 및 mini-slot이 정의될 수 있다. 이 경우, 해당 slot을 구성하는 OFDM 심볼의 개수, y값은 normal CP의 경우, SCS값에 관계 없이 y=14의 값을 갖도록 결정되었다.

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【0029】 이에 따라 임의의 slot은 14개의 심볼로 구성되며, 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.

【0030】 또한 임의의 numerology(혹은 SCS)에서 상기 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 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.

【0031】 또는 상기에서 서술한 바와 같이 하나의 NR Carrier 내에서 서로 다른 SCS값을 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 1/4정도

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로 줄어들기 때문에 동일하게 14개의 OFDM 심볼로 하나의 slot을 구성할 경우, 해당 15kHz 기반의 slot length는 1ms이 되는 반면, 60kHz 기반의 slot length는 약 0.25ms으로 줄어들게 된다.

【0032】 이처럼 NR에서는 서로 다른 SCS 혹은 서로 다른 TTI length를 정의함으로써, URLLC와 eMBB 각각의 requirement를 만족시키는 방법에 대한 논의가 진행되고 있다.

【0033】 Wider bandwidth operations

【0034】 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, normal LTE 단말은 하나의 LTE CC에 대해 20 MHz bandwidth의 송수신 capability를 지원하였다.

【0035】 하지만, NR의 경우, 하나의 wideband NR CC를 통해 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.

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【0036】 구체적으로 NR에서는 단말 관점에서 구성된 하나의 serving cell을 통해 하나 이상의 bandwidth part를 구성할 수 있으며, 해당 단말은 해당 serving cell에서 하나의 DL bandwidth part와 하나의 UL bandwidth part를 activation하여 상/하향 링크 데이터 송수신을 위해 사용하도록 정의되었다. 또한 해당 단말에서 복수의 serving cell이 설정된 경우, 즉 CA이 적용된 단말에 대해서도 각각의 serving cell 별로 하나의 DL bandwidth part 그리고/혹은 UL bandwidth part를 activation하여 해당 serving cell의 무선 자원을 이용하여 상/하향 링크 데이터 송수신을 위해 사용하도록 정의되었다.

【0037】 구체적으로 임의의 serving cell에서 단말의 initial access procedure를 위한 initial bandwidth part가 정의되며, 각각의 단말 별로 dedicated RRC signaling을 통해 하나 이상의 UE-specific bandwidth part(s)가 구성되고, 또한 각각의 단말 별로 fallback operation을 위한 default bandwidth part가 정의될 수 있다.

【0038】 단, 임의의 serving cell에서 단말의 capability 및 bandwidth part(s) 구성에 따라 동시에 복수의 DL and/or UL bandwidth parts를 activation하여 사용하도록 정의할 수 있으나, NR rel-15에서는 임의의 단말에서 임의의 시간에 하나의 DL bandwidth part 및 UL bandwidth part만을 activation하여 사용하도록 정의되었다.

【0039】 NR PUCCH

【0040】 기존의 LTE 시스템의 경우, 단말의 UCI(Uplink Control

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Information) 전송을 위한 상향 링크 제어 채널인 PUCCH 전송은 단일한 subframe 단위로 이루어졌다. 즉, time-domain에서 하나의 subframe을 구성하는 14개의 SC-FDMA 심볼을 하나의 PUCCH 전송이 이루어졌다. 단, 마지막 심볼이 SRS 전송을 위해 사용될 경우, 마지막 심볼을 제외한 13개의 심볼을 통해 PUCCH 전송이 이루어졌다.

【0041】 또한 UCI의 payload size에 따라 서로 다른 PUCCH format이 정의되었다. 구체적으로 SR(Scheduling Request)와 HARQ ACK과 같은 1 or 2 bits의 UCI 전송은 PUCCH format 1 계열(PUCCH format 1/1a/1b)을 통해 전송되었고, CQI/CSI 피드백과 같이 moderate한 payload size를 갖는 UCI의 경우 PUCCH format 2(PUCCH format 2a/2b) 계열, CA 상황에서 large payload size의 UCI 피드백의 경우 PUCCH format 3 이상을 사용하도록 정의되었다.

【0042】 하지만 NR의 경우, 14개의 심볼로 이루어진 slot 내에서 다양한 duration을 갖는 PUCCH 구조가 정의되었다. 구체적으로 하나의 slot 내에서 단일한 PUCCH 전송이 이루어지는 심볼의 수, N값에 따라 long-PUCCH와 short-PUCCH로 구분되며, long-PUCCH는 하나의 slot 내에서 4~14개의 심볼을 통해 전송될 수 있고, short-PUCCH의 경우 1~2개의 심볼을 통해 전송될 수 있다. 또한 각각의 long-PUCCH와 short-PUCCH에 대해 UCI payload size에 따라 LTE와 유사하게 서로 다른 PUCCH format이 정의될 수 있다. 예를 들어, short-PUCCH에 대해 up to 2 bits의 UCI 전송을 위한 PUCCH format 및 그 이상의 payload size를 갖는 UCI 전송을 위한 PUCCH format이 각각 정의되고, 또한 long-PUCCH에 대해서도 up to 2 bits의 UCI 전송을 위한 PUCCH format 및 그 이상의 payload size를 갖는 UCI 전송을 위한 PUCCH

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format이 각각 정의될 수 있다.

【0043】 즉, NR에서 UCI 전송을 위한 PUCCH structure를 정의함에 있어서 PUCCH duration과 PUCCH format에 대한 정의가 각각 요구될 수 있다.

【0044】 본 발명은 NR에서 단말의 HARQ ACK/NACK 피드백 혹은 aperiodic CSI reporting을 위한 PUCCH 자원 할당 방법에 대해 제안한다.

【0045】 상기에서 서술한 바와 같이 NR에서는 단말 관점에서 구성된 하나의 serving cell을 통해 하나 이상의 bandwidth part(s)를 구성할 수 있다. 구체적으로 해당 serving cell에서 지원하는 transmission direction에 따라, unpaired(i.e. TDD) 혹은 paired(i.e. FDD) spectrum으로 구성된 serving cell의 경우, 적어도 하나 이상의 DL bandwidth part(s)와 UL bandwidth part(s)가 각각 구성될 수 있으며, 기지국은 각각의 단말 별로 주어진 시간에 하나의 DL bandwidth part 및 UL bandwidth part만을 activation하여 각각 상/하향 링크 무선 채널 및 신호(e.g. PDCCH/PDSCH, PUSCH/PUCCH, etc.)의 송수신을 위해 사용하도록 정의되었다. 단, DL-only 혹은 UL-only serving cell의 경우, 각각 DL bandwidth part(s) 혹은 UL bandwidth part(s)만이 구성 및 활성화될 수 있다.

【0046】 이에 따라, 단말은 initial access가 이루어진 Pcell 외에 CA를 통해 구성된 Scell에 대해서도 각각 독립적으로 bandwidth part(s)가 구성되고 활성화될 수 있다.

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【0047】 이처럼 임의의 단말을 위해 구성된 임의의 serving cell에서 하나 이상의 bandwidth part(s)가 구성될 경우, 단말은 임의의 시간에 하나의 bandwidth part를 activation하여 사용할 수 있다. 구체적으로 DL 송수신을 위해서 해당 serving cell에서 해당 단말을 위해 구성된 하나 이상의 DL bandwidth part(s) 중 임의의 DL subframe/slot/mini-slot에서 하나의 DL bandwidth part를 activation하여 사용한다. 마찬가지로 UL 송수신을 위해서 해당 serving cell에서 해당 단말을 위해 구성된 하나 이상의 UL bandwidth part(s) 중 임의의 UL subframe/slot/mini-slot에서 하나의 UL bandwidth part를 activation하여 사용한다.

【0048】 임의의 단말에 대한 상기 DL bandwidth part 및 UL bandwidth part의 activation/deactivation 지시는 PDCCH를 통해 전송되는 DCI(Downlink Control Information)을 통해 이루어질 수 있다. 구체적으로 PDSCH에 대한 자원 할당 정보를 포함하는 DL assignment DCI를 통해 DL bandwidth part에 대한 activation 및 deactivation이 이루어질 수 있다. 또한 PUSCH에 대한 자원 할당 정보를 포함하는 UL grant를 통해 UL bandwidth part에 대한 activation 및 deactivation이 이루어질 수 있다.

【0049】 본 발명에서는 이와 같이 UE-specific한 bandwidth part(이하에서는 설명의 편의를 위해 bandwidth part를 BWP로 지칭하도록 한다.) 기반 동작으로 고려한 PUCCH 자원 할당 방법 및 그와 관련한 구체적인 기지국과 단말의 동작에 대해 제안한다. 특히 UL BWP activation/deactivation, 즉, UL BWP switching에 따른 기지국과 단말의 PUCCH 송수신 자원 지시 및 해석 간 ambiguity를 방지하기 위한 구

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체적인 PUCCH 자원 할당 방법에 대해 제안한다.

【0050】 NR에서는 기지국/네트워크에서 각각의 단말 별로 HARQ ACK/NACK 피드백을 위한 하나 이상의 PUCCH resource(s)로 구성된 단일한 PUCCH resource set 혹은 각각 하나 이상의 PUCCH resource(s)로 구성된 복수의 PUCCH resource sets을 구성하여, 이를 UE-specific higher layer signaling을 통해 각각의 단말에 전송할 수 있다. 이처럼 UE-specific higher layer signaling을 통해 임의의 단말을 위한 단일한 혹은 복수의 PUCCH resource set(s)이 구성된 경우, 기지국에서 PDCCH를 통해 임의의 단말을 위한 PDSCH scheduling 제어 정보 전송 시, 해당 DL assignment DCI(Downlink Control Information)을 해당 PDSCH 수신에 대한 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH resource indication 정보를 포함하여 전송할 수 있다. 즉, 기지국은 임의의 단말을 위한 PDSCH transmission 별로, 해당 단말을 위해 설정된 단일한 PUCCH resource set을 구성하는 PUCCH resources 중 하나의 PUCCH resource를 선택하여, 혹은 해당 단말을 위해 설정된 복수의 PUCCH resource sets 중 하나의 PUCCH resource set 및 해당 PUCCH resource set을 구성하는 PUCCH resources 중 하나의 PUCCH resource를 선택하여, 이를 DL assignment DCI를 통해 전송함으로써, 해당 단말에서 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource를 dynamic하게 할당하도록 정의할 수 있다.

【0051】 본 발명에서는 이를 위한 구체적인 PUCCH resource set 설정 방법 및 해당 PUCCH resource indication 방법을 제안한다.

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【0052】 먼저 임의의 단말을 위한 상기 PUCCH resource set(s)을 구성하는 한 방법으로서, 단말의 HARQ ACK/NACK 피드백을 위한 단말 별 PUCCH resource set(s)을 구성함에 있어서, 해당 단말을 위해 설정된 UL BWP 별로 각각 별도의 PUCCH resource set(s)을 설정하도록 정의할 수 있다. 예를 들어, 임의의 단말을 위해 아래의 그림 3과 같이 N개의 UL BWPs가 설정된 경우(단, 아래의 도 3은 각각의 BWP 간 주파수 축에서 overlapping되지 않도록 구성되었으나, 임의의 BWP 간 주파수 축에서 partially 혹은 fully overlapping되도록 BWP 구성이 이루어질 수도 있으며, 구체적인 UL BWP 설정에 의해 본 발명이 제약되지 않음), 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH resource indication을 위해 각각의 UL BWP 별로 별도의 단일한 혹은 복수의 PUCCH resource set(s)를 설정하여 이를 UE-specific higher layer signaling을 통해 해당 단말에 전송하도록 정의할 수 있다.

【0053】 즉, 기지국은 해당 단말을 위해 BWP #1을 위한 하나의 혹은 복수의 PUCCH resource set(s), BWP #2를 위한 또 다른 하나의 혹은 복수의 PUCCH resource set(s),…, BWP #N을 위한 또 다른 하나의 혹은 복수의 PUCCH resource set(s)까지 각각의 BWP 별로 총 N개의 group of one or more PUCCH resource set(s)를 설정하도록 정의할 수 있다. 이 경우, 각각의 UL BWP 별로 higher layer signaling을 통해 설정된 하나의 혹은 복수의 PUCCH resource set을 구성하는 각각의 PUCCH resource는 PUCCH format 설정 정보, 해당 UL BWP 내의 time/frequency domain PUCCH 자원 설정 정보(혹은 추가적으로 code-domain 자원 설정 정보) 등으로서 정의될 수 있다.

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【0054】 이처럼 higher layer signaling에 의해 각각의 BWP별로 하나 혹은 복수의 PUCCH resource set(s)이 구성된 경우, 상기의 DL assignment DCI를 통한 PUCCH resource indication 정보 영역을 구성함에 있어서 기지국은 PUCCH 전송을 위한 UL BWP indication 정보를 명시적으로 포함하도록 정의할 수 있다. 구체적으로 상기의 DL assignment DCI를 통한 PUCCH resource indication 정보는 UL BWP indication 정보(e.g. BWP index 정보) + 해당 UL BWP 내의 PUCCH resource set indication 정보(e.g. PUCCH resource set index 정보) + 해당 PUCCH resource set 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보(e.g. PUCCH resource index within the PUCCH resource set)으로 구성될 수 있다. 단, 임의의 BWP 내에서 PUCCH resource set을 구성함에 있어서, 특정한 classification 기반의 PUCCH resource set 구성이 이루어질 경우, 해당 특정 classification 정보가 상기 PUCCH resource set indication 정보를 대신할 수 있다. 예를 들어, PUCCH format 혹은 PUCCH duration 혹은 PUCCH payload size 등에 따라 각각 PUCCH resource set이 별도로 구성될 경우, 각각 해당 PUCCH format 정보 혹은 PUCCH duration 정보 혹은 PUCCH payload size 정보 등이 각각 상기의 PUCCH resource set indication 정보 대신 사용될 수 있다. 예를 들어, 상기에서 서술한 바와 같이 RRC signalling을 통해 PUCCH resource set을 구성함에 있어서, PUCCH format 별로 별도의 PUCCH resource set을 구성하도록 정의하고, 상기의 DL assignment DCI를 통해 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH format 지시 정보를 전송함으로써, 이를 통해 해당 단말의 PUCCH resource 할당을 위한

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PUCCH resource set이 도출되도록 정의할 수 있다. 또 다른 예로서, 해당 단말에서 전송해야 하는 PUCCH payload size 즉, UCI의 payload size에 따라 별도의 PUCCH resource set을 구성하도록 정의하고, 단말이 전송해야 하는 UCI payload size에 따라 상기 PUCCH resource 할당을 위한 PUCCH resource set이 결정되도록 정의할 수 있다. 즉, DL assignment DCI를 통해 상기의 PUCCH resource indication 정보(e.g. ARI, ACK/NACK Resource Indication)만이 전송되도록 정의하고, 단말에서 이를 해석하기 위한 PUCCH resource set을 결정함에 있어서, 해당 DL assignment DCI를 통해 할당되는 PUCCH resource를 통해 해당 단말이 전송해야 하는 UCI payload size에 따라 해당 PUCCH resource set이 도출되도록 정의할 수 있다. 또는 해당 PUCCH resource set 정보(또는, 상기 PUCCH classification에 따른 지시 정보 포함)와 해당 PUCCH resource set 내의 PUCCH resource index 정보는 joint coding 방식으로 encoding되어 하나의 정보 영역을 통해 송수신될 수 있다. 단, 상기의 PUCCH resource set indication 관련 정보는 해당 정보는 하나의 UL BWP 내에서 복수의 PUCCH resource sets 설정이 지원되는 경우에만 필요할 수 있으며, 하나의 UL BWP 당 하나의 PUCCH resource set 구성만 지원되는 경우, 상기의 PUCCH resource set indication 정보는 제외될 수 있다. 이처럼 DL assignment DCI를 통해 PUCCH 전송을 위한 UL BWP indication 정보가 포함될 경우, 해당 UL BWP indication 정보는 추가적으로 해당 단말의 UL BWP activation 정보 및 그에 따른 UL BWP switching 지시 정보로 사용될 수 있다. 구체적으로 해당 UL BWP indication 정보에 따라 해당 단말은 해당 DL assignment DCI 수신 slot으로부터 일정 slot 이후

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(e.g. k slots 이후)에 해당 UL BWP indication 정보에 따라 UL BWP switching(즉, 현재의 active UL BWP를 deactivation하고 해당 지시 정보에 따라 새로운 UL BWP를 activation 하는 동작)을 수행하도록 정의할 수 있다. 또는 해당 PUCCH 전송 slot으로부터 일정 slot 이전(e.g. j slots 이전)에 UL BWP indication 정보에 따라 UL BWP switching(즉, 현재의 active UL BWP를 deactivation하고 해당 지시 정보에 따라 새로운 UL BWP를 activation 하는 동작)을 수행하도록 정의할 수 있다. 단, 상기 k 혹은 j 값은 0 이상의 임의의 정수값으로서, 임의의 고정된 값을 갖거나, 기지국에 의해 설정되어 higher layer signaling을 통해 전송되거나, 혹은 단말의 capability에 따라 결정될 수 있다. 또한 상기 UL BWP indication 정보가 현재의 active UL BWP를 지시하는 경우, 해당 단말은 상기 BWP switching 동작을 수행하지 않는다.

【0055】 상기의 DL assignment DCI를 통한 PUCCH resource indication 정보 영역을 구성하는 또 다른 방법으로서, 상기 UL BWP는 암묵적으로 결정될 수 있으며, 이에 따라 해당 DL assignment DCI의 PUCCH resource indication 정보는 해당 UL BWP indication 정보를 제외한 PUCCH resource set indication 정보 + 해당 PUCCH resource set 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보로 구성될 수 있다. 단, 이 때 해당 PUCCH resource set indication 정보 + 해당 PUCCH resource set 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보 상기와 동일한 방법으로 구성될 수 있다. 이처럼 UL BWP가 암묵적

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으로 결정될 경우, 해당 PUCCH 전송을 위한 UL BWP는 해당 DL assignment DCI 전송 slot에서 해당 단말의 active UL BWP로 결정되도록 정의할 수 있다. UL BWP를 암묵적으로 결정하는 또 다른 방법으로서, 해당 PUCCH 전송을 위한 UL BWP는 해당 단말의 PUCCH 전송 시점, 즉 PUCCH 전송이 이루어지는 slot(혹은 복수의 slot을 통해 PUCCH 전송이 이루어질 경우, PUCCH 전송이 시작되는 slot)에서의 active UL BWP로 결정되도록 정의할 수 있다. 상기 PUCCH 전송을 위한 UL BWP를 암묵적으로 결정하는 또 다른 방법으로서, PDSCH 자원 할당이 이루어지는 DL assignment DCI가 전송된 DL BWP 별로 PUCCH 전송을 위해 association된 UL BWP를 정의할 수 있다. 혹은 해당 DL assignment DCI에 따른 PDSCH 전송이 이루어지는 DL BWP 별로 PUCCH 전송을 위해 association된 UL BWP를 정의할 수 있다. 이 경우, 임의의 단말을 위해 설정된 각각의 DL BWP 별 PUCCH 전송을 위해 association된 UL BWP를 기지국에서 설정하여 UE-specific higher layer signalling 혹은 L1 control signaling을 통해 해당 단말에 전송하거나, 혹은 implicit한 DL BWP - UL BWP association rule을 정의할 수 있다. 예를 들어, TDD 셀에서 각각 DL과 UL에 대해 동일한 BWP 설정이 이루어진 경우 혹은 TDD/FDD 셀에서 DL과 UL에 대해 동일한 개수의 BWP 설정이 이루어진 경우, 각각 동일한 index의 DL BWP와 UL BWP를 association하도록 정의할 수 있다.

【0056】 또는 상기 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH resource set(s)을 설정하는 또 다 다른 방법으로서, 해당 PUCCH resource set(s)은 UL BWP common하게 설정될 수 있다. 즉, 임의의 단말을 위해 설정된 하나의 PUCCH

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resource set을 구성하는 PUCCH resources를 정의함에 있어서, 해당 PUCCH resource set을 구성하는 각각의 PUCCH resource는 해당 단말을 위해 설정된 모든 UL BWP에서 정의된 PUCCH resource들로 구성될 수 있다. 즉, 기지국에서 임의의 단말을 위한 PUCCH resource set(s)을 구성하는 각각의 PUCCH resource를 설정함에 있어서, 해당 PUCCH resource가 구성되는 UL BWP 정보도 포함하도록 할 수 있다. 이에 따라 임의의 단말을 위해 상기의 higher layer signaling을 통해 설정된 하나의 혹은 복수의 PUCCH resource set(s)을 구성하는 각각의 PUCCH resource는 PUCCH format 설정 정보, UL BWP 설정 정보 및 해당 UL BWP 내의 time/frequency domain PUCCH 자원 설정 정보(혹은 추가적으로 code-domain 자원 설정 정보) 등으로서 정의될 수 있다. 이 경우, 상기의 DL assignment DCI를 통해 전송되는 PUCCH resource indication 정보는 상기의 implicit UL BWP indication의 경우와 동일하게 PUCCH resource set indication 정보(e.g. PUCCH resource set index 정보) + 해당 PUCCH resource set 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보(e.g. PUCCH resource index within the PUCCH resource set)으로 구성되거나, 혹은 PUCCH resource set(s) 구성하는 PUCCH resources 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH resource indication 정보(e.g. PUCCH resource index within the PUCCH resource set)만으로 구성될 수 있다. 상기와 마찬가지로 PUCCH resource set을 구성함에 있어서, 특정한 classification 기반의 PUCCH resource set 구성이 이루어질 경우, 해당 특정 classification 정보가 상기 PUCCH resource set indication 정보를 대

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신할 수 있다. 예를 들어, PUCCH format 혹은 PUCCH duration 혹은 PUCCH payload size 등에 따라 각각 PUCCH resource set이 별도로 구성될 경우, 각각 해당 PUCCH format 정보 혹은 PUCCH duration 정보 혹은 PUCCH payload size 정보 등이 각각 상기의 PUCCH resource set indication 정보 대신 사용될 수 있다. 또는 해당 PUCCH resource set 정보(또는, 상기 PUCCH classification에 따른 지시 정보 포함)와 해당 PUCCH resource set 내의 PUCCH resource index 정보는 joint coding 방식으로 encoding되어 하나의 정보 영역을 통해 송수신될 수 있다. 단, 상기의 PUCCH resource set indication 관련 정보는 단말 당 복수의 PUCCH resource sets 설정이 지원되는 경우에만 필요할 수 있으며, 단말 당 하나의 PUCCH resource set 구성만 지원되는 경우, 상기의 PUCCH resource set indication 정보는 제외될 수 있다.

【0057】 추가적으로 higher layer signaling을 통해 설정되는 PUCCH resource set을 구성하는 PUCCH resource 설정 정보가 각각 UL BWP 설정 정보를 포함하는 경우, DL assignment DCI의 PUCCH resource indication 정보에 의해 지시된 PUCCH resource 할당에 따라 상기의 명시적 UL BWP indication의 case와 마찬가지로 해당 단말에서 해당 PUCCH resource가 구성되는 UL BWP로 UL BWP activation 혹은 UL BWP switching 동작을 수행하도록 정의할 수 있다.

【0058】 추가적으로 상기에서 서술한 바와 같이 UL BWP별로 단말의 HARQ ACK/NACK 피드백을 위해 하나의 혹은 복수의 PUCCH resource set(s)이 설정된 경우, 또는 UL BWP common하게 하나의 혹은 복수의 PUCCH resource set(s)이 설정

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된 경우, 해당 PUCCH resource set(s)을 구성하는 각각의 PUCCH resource들은 단말의 aperiodic CSI 피드백을 위해서도 할당될 수 있도록 정의할 수 있다. 구체적으로 기지국에 의해 임의의 단말의 aperiodic CSI reporting이 DL assignment DCI를 통해 triggering될 수 있다. 이를 위해 임의의 단말을 위한 DL assignment DCI format을 정의함에 있어서, 단말의 aperiodic CSI reporting을 triggering하기 위한 정보 영역을 포함하도록 할 수 있으며, 해당 aperiodic CSI reporting 지시 정보 영역을 통해 단말의 aperiodic CSI reporting이 triggering된 경우, 해당 DL assignment DCI를 통해 지시되는 상기의 PUCCH resource 할당 정보에 따라 해당 PUCCH resource를 통해 PDSCH에 대한 HARQ ACK/NACK 피드백 정보와 함께 aperiodic CSI reporting 정보도 multiplexing하여 전송하도록 정의할 수 있다. 즉, 상기의 PUCCH resource set 설정은 HARQ ACK/NACK 피드백과 aperiodic CSI reporting을 위한 common한 PUCCH resource set 설정일 수 있다.

【0059】또는 기지국/네트워크에서 상기의 HARQ ACK/NACK 피드백을 위한 PUCCH resource set(s) 설정과 별도로 aperiodic CSI reporting을 위한 PUCCH resource set(s)을 구성하여 이를 UE-specific higher layer signaling을 통해 각각의 단말로 전송하도록 정의할 수 있다. 즉, 각각의 단말 별로 aperiodic CSI 피드백만을 위한 하나의 혹은 복수의 PUCCH resource set(s)을 구성하여 이를 UE-specific higher layer signaling을 통해 각각의 단말로 전송하도록 정의할 수 있다. 이 경우, 해당 aperiodic CSI 피드백을 위한 PUCCH resource set은 상기의 HARQ ACK/NACK 피드백을 위한 PUCCH resource set 구성 방법과 동일하게 각각

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PUCCH format 별로 혹은 PUCCH duration 별로 별도로 구성될 수도 있고, 그와 관계 없이 구성될 수 있다. 또한 aperiodic CSI reporting을 위한 별도의 PUCCH resource set(s)을 설정함에 있어서, 상기에 서술한 바와 같이 UL BWP 별로 aperiodic CSI reporting을 위한 PUCCH resource set(s)을 설정하도록 정의하거나, 혹은 UL BWP common하게 aperiodic CSI reporting을 위한 PUCCH resource set(s)을 설정하도록 정의할 수 있다. 이처럼 별도의 aperiodic CSI reporting을 위한 PUCCH resource set(s)이 설정될 경우, aperiodic CSI reporting을 위한 PUCCH resource 할당은 상기에서 기술한 DL assignment DCI를 통한 HARQ ACK/NACK 피드백을 위한 PUCCH resource 할당 방법을 따르도록 정의할 수 있으며, 추가적으로 UL BWP activation 혹은 switching과 관련한 단말 동작도 상기에서 기술한 동작을 따르도록 정의할 수 있다.

【0060】 추가적으로 UL grant를 통한 aperiodic CSI reporting이 triggering 될 경우, 단말에서 aperiodic CSI reporting 정보를 전송할 무선 채널 지시 정보(즉, PUSCH or PUCCH)를 포함하도록 정의할 수 있다.

【0061】 도 4는 또 다른 실시예에 의한 기지국(1000)의 구성을 보여주는 도면이다.

【0062】 도 4를 참조하면, 또 다른 실시예에 의한 기지국(1000)은 제어부(1010)과 송신부(1020), 수신부(1030)를 포함한다.

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【0063】 제어부(1010)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서,단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 데에 따른 전반적인 기지국(1000)의 동작을 제어한다.

【0064】 송신부(1020)와 수신부(1030)는 전술한 본 발명을 수행하기에 필요한 신호나 메시지, 데이터를 단말과 송수신하는데 사용된다.

【0065】 도 5는 또 다른 실시예에 의한 사용자 단말(1100)의 구성을 보여주는 도면이다.

【0066】 도 5를 참조하면, 또 다른 실시예에 의한 사용자 단말(1100)은 수신부(1110) 및 제어부(1120), 송신부(1130)를 포함한다.

【0067】 수신부(1110)는 기지국으로부터 하향링크 제어 정보 및 데이터, 메시지를 해당 채널을 통해 수신한다.

【0068】 또한 제어부(1120)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서, 단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 데에 따른 전반적인 사용자 단말(1100)의 동작을 제어한다.

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【0069】 송신부(1130)는 기지국에 상향링크 제어 정보 및 데이터, 메시지를 해당 채널을 통해 전송한다.

【0070】 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.

【0071】 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.

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【특허청구범위】

【청구항 1】

차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서,

상기 단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 방법.

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제출 일자 : 2017-11-30

【요약서】

【요약】

본 발명은 차세대/5G 무선 액세스망에서 상향 링크 제어 채널 자원 할당 방법에 대한 것으로서, 일 실시예는 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어 채널 자원을 할당하는 방법에 있어서, 상기 단말을 위해 설정된 상향 링크 BWP(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 방법을 제공한다.

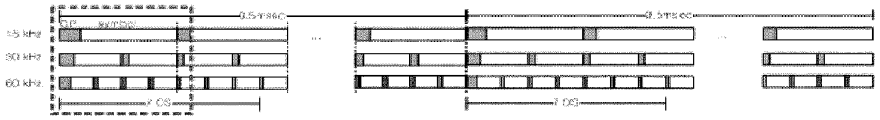
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도 2

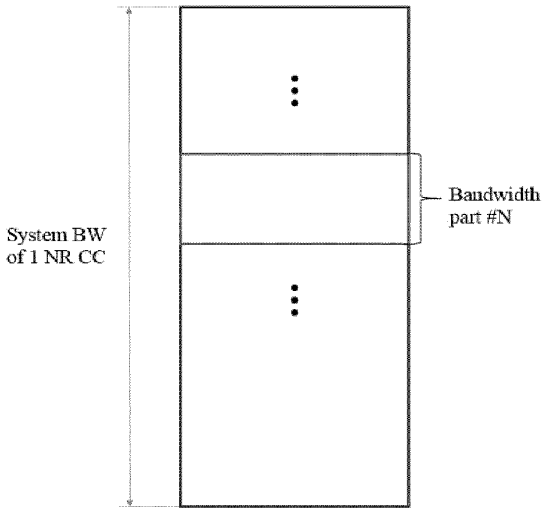
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【도면】

【도 1】

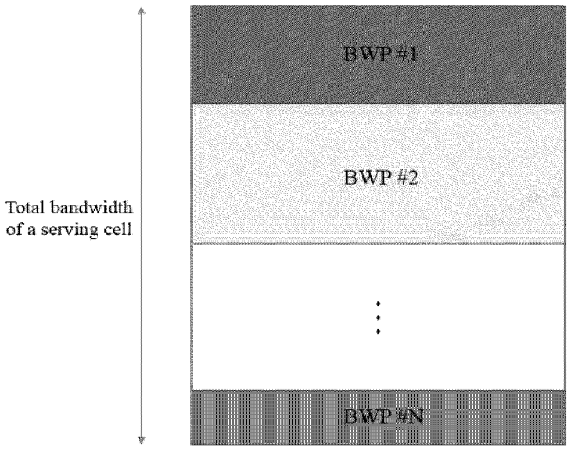


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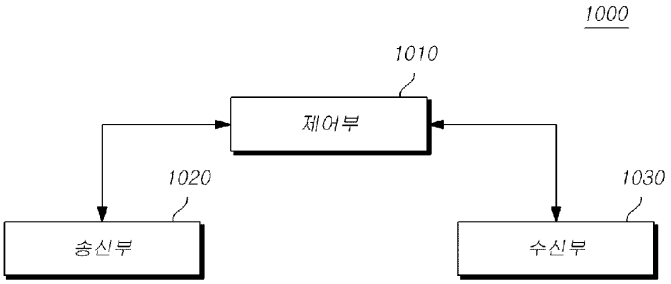


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【도 3】

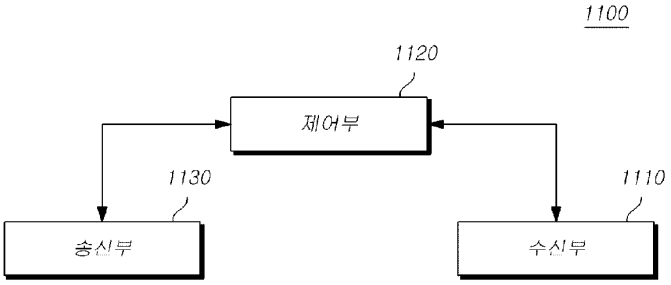


【도 4】



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【도 5】



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【발명의 영문명칭】 Apparatus and method of PUCCH resource allocation for new radio

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【수수료】

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【발명의 설명】

【발명의 명칭】

차세대 무선망을 위한 상향 링크 제어채널 자원 할당 방법 및 장치 {Apparatus and method of PUCCH resource allocation for new radio}

【기술분야】

【0001】 본 실시예는 차세대/5G 무선 액세스망(이하 본 발명에서는 NR[New Radio]라 지칭하도록 함.)에서 상향 링크 제어채널 자원 할당 방법에 대해 제안한다.

【발명의 배경이 되는 기술】

【0002】 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.

【0003】 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

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있다.

【0004】 특히, NR의 단말이 다양한 대역폭 파트(BWP, bandwidth part)를 사용하는 경우에 전술한 대역폭 파트를 기초로 단말이 상향 링크 채널, 즉 상향 링크 제어 채널 및 상향 링크 데이터 채널을 기지국으로 전송하기 위한 구체적이고 효율적인 방법을 설정해야 할 필요성이 증대되고 있다.

【발명의 내용】

【해결하고자 하는 과제】

【0005】 본 실시예들의 목적은 차세대 무선망에서 상향 링크 대역폭 파트 스위칭에 따른 기지국과 단말의 상향 링크 제어채널 송수신 자원 지시 및 해석 간 모호성(ambiguity)를 방지하는 방법 및 장치를 제공하는 것이다.

【과제의 해결 수단】

【0006】 전술한 과제를 해결하기 위해서 안출된 일 실시예는 단말이 상향 링크 제어정보를 전송하는 방법에 있어서, 기지국으로부터 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 수신하는 단계, 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정하는 단계, 결정된 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 결정하는 단계 및 결정된 상향 링크 제어채널 자원을 통해 상기 상향 링크 제어정보를 전송하는 단계를 포함하는 방법을 제공한다.

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【0007】 또한, 다른 실시예는 기지국이 상향 링크 제어정보를 수신하는 방법에 있어서, 단말에 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 전송하는 단계, 및 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 통해 상향 링크 제어정보를 수신하는 단계를 포함하는 방법을 제공한다.

【0008】 또다른 실시예는 상향 링크 제어정보를 전송하는 단말에 있어서, 기지국으로부터 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 수신하는 수신부, 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정하고 결정된 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 결정하는 제어부, 및 결정된 상향 링크 제어채널 자원을 통해 상기 상향 링크 제어정보를 전송하는 송신부를 포함하는 단말을 제공한다.

【0009】 또다른 실시예는 상향 링크 제어정보를 수신하는 기지국에 있어서, 단말에 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 전송하는 송신부, 및 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 통해 상향 링크 제어정보를 수신하는 수신부를 포함하는 기지국을 제공한다.

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【발명의 효과】

【0010】 본 실시예들을 통해 차세대 무선망에서 상향 링크 대역폭 파트 스위칭에 따른 기지국과 단말의 상향 링크 제어채널 송수신 자원 지시 및 해석 간 모호성(ambiguity)를 방지할 수 있다.

【도면의 간단한 설명】

【0011】 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 3a은 임의의 단말을 위해 설정된 하나의 서빙 셀에서 N개의 대역폭 파트 설정 예를 도시한 도면이다.

도 3b는 도 3a의 N개의 대역폭 파트들을 각각 구성하는 PUCCH 자원 셋들과 각 PUCCH 자원 셋들을 구성하는 PUCCH 자원들의 구성을 예시적으로 도시한 도면이다.

도 3c는 PUCCH 자원 지시 정보를 포함하는 하향링크 제어정보를 도시한 도면이다.

도 4는 본 실시예에서 단말이 상향 링크 제어정보를 절차를 도시한 도면이다.

도 5는 본 실시에에서 기지국이 상향 링크 제어정보를 수신하는 절차를 도시

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한 도면이다.

도 6은 본 실시예들에 따른 기지국의 구성을 보여주는 도면이다.

도 7은 본 실시예들에 따른 단말의 구성을 보여주는 도면이다.

【발명을 실시하기 위한 구체적인 내용】

【0012】 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.

【0013】 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.

【0014】 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.

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【0015】 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.

【0016】 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.

【0017】 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.

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【0018】 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.

【0019】 여기서, 상향 링크(Uplink, UL, 또는 업링크)는 사용자 단말에 의해 기지국으로 데이터를 송수신하는 방식을 의미하며, 하향 링크(Downlink, DL, 또는 다운링크)는 기지국에 의해 사용자 단말로 데이터를 송수신하는 방식을 의미한다.

【0020】 상향 링크 전송 및 하향 링크 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.

【0021】 또한, 무선 통신 시스템에서는 하나의 반송파 또는 반송파 쌍을 기준으로 상향 링크와 하향 링크를 구성하여 규격을 구성한다.

【0022】 상향 링크와 하향 링크는, 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.

【0023】 하향 링크(downlink)는 다중 송수신 포인트에서 단말로의 통신 또는 통신 경로를 의미할 수 있으며, 상향 링크(uplink)는 단말에서 다중 송수신 포인트

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로의 통신 또는 통신 경로를 의미할 수 있다. 이때, 하향 링크에서 송신기는 다중 송수신 포인트의 일부분일 수 있고, 수신기는 단말의 일부분일 수 있다. 또한, 상향 링크에서 송신기는 단말의 일부분일 수 있고, 수신기는 다중 송수신 포인트의 일부분일 수 있다.

【0024】 이하에서는 PUCCH, PUSCH, PDCCH 및 PDSCH 등과 같은 채널을 통해 신호가 송수신되는 상황을 'PUCCH, PUSCH, PDCCH 및 PDSCH를 전송, 수신한다'는 형태로 표기하기도 한다.

【0025】 한편, 이하에서 기재하는 상위계층 시그널링(High Layer Signaling)은 RRC 파라미터를 포함하는 RRC 정보를 전송하는 RRC 시그널링을 포함한다.

【0026】 기지국은 단말들로 하향 링크 전송을 수행한다. 기지국은 유니캐스트 전송(unicast transmission)을 위한 주 물리 채널인 하향 링크 데이터 채널의 수신에 필요한 스케줄링 등의 하향 링크 제어 정보 및 상향 링크 데이터 채널에서의 전송을 위한 스케줄링 승인 정보를 전송하기 위한 물리 하향 링크 제어 채널을 전송할 수 있다. 이하에서는, 각 채널을 통해 신호가 송수신 되는 것을 해당 채널이 송수신되는 형태로 기재하기로 한다.

【0027】 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,

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NOMA는 SCMA(Sparse Code Multiple Access)와 LDS(Low Density Spreading) 등을 포함한다.

【0028】 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.

【0029】 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.

【0030】 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, 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.

【0031】 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,

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초저가 단말 비용, 낮은 전력 소모, 그리고 최적화된 네트워크 구조를 포함한다.

【0032】 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.

【0033】 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.

【0034】 NR(New Radio)

【0035】 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.

【0036】 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

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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.

【0037】 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), 지연시간 또는 레이턴시(latency), 커버리지(coverage) 등에 대한 요구사항(requirements)이 서로 상이하기 때문에 임의의 NR 시스템을 구성하는 주파수 대역을 통해 각각의 사용 시나리오(usage scenario)별 요구사항(requirements)을 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.

【0038】 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.

【0039】 이와 관련하여 NR에서는 시간 도메인 구조(time domain structure)의 한 종류로서 서브프레임(subframe)에 대한 정의가 이루어졌으며, 해당 서브프레

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임 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 결정되었으나 이에 제한되지 않는다.

【0040】 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.

【0041】 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.

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【0042】 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)을 만족시키기 힘들 수 있다. 이 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.

【0043】 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 1/4정도로 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.

【0044】 이처럼 NR에서는 서로 다른 SCS 또는 서로 다른 TTI 길이를 정의함으로써, URLLC와 eMBB 각각의 요구사항을 만족시키는 방법에 대한 논의가 진행되고 있다.

【0045】 보다 넓은 대역폭 동작(Wider bandwidth operations)

【0046】 기존 LTE system의 경우, 임의의 LTE 컴포넌트 캐리어(CC,

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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 있었다. 이에 따라 임의의 노멀 LTE 단말은 하나의 LTE 컴포넌트 캐리어에 대해 20 MHz 대역폭의 송수신 캐퍼빌리티를 지원하였다.

【0047】 하지만, NR의 경우, 하나의 광대역 NR 컴포넌트 캐리어에서 서로 다른 송수신 대역폭 캐퍼빌리티(bandwidth capability)를 갖는 NR 단말에 대한 지원이 가능하도록 그 설계가 이루어지고 있다. 이에 따라 아래의 도 2와 같이 임의의 NR CC에 대해 세분화된 대역폭으로 구성된 하나 이상의 대역폭 파트(BWP, bandwidth part)를 구성하여, 단말 별로 서로 다른 대역폭 파트(bandwidth part)의 설정 및 활성화를 통해 플렉서블(flexible)한 보다 넓은 대역폭 동작(wider bandwidth operation)을 지원하도록 요구되고 있다.

【0048】 구체적으로 NR에서는 단말 관점에서 구성된 하나의 서빙 셀을 통해 하나 이상의 대역폭 파트를 구성할 수 있다. 해당 단말은 해당 서빙 셀에서 하나의 하향 링크 대역폭 파트와 하나의 상향 링크 대역폭 파트를 활성화(activation)하여 상/하향 링크 데이터 송수신을 위해 사용할 수 있다. 또한 해당 단말에서 복수의 서빙 셀이 설정된 경우, 즉 캐리어 병합(CA, Carrier Aggregation)이 적용된 단말에 대해서도 각각의 서빙 셀 별로 하나의 하향 링크 대역폭 파트 그리고/혹은 상향 링크 대역폭 파트를 활성화하여 해당 서빙 셀의 무선 자원을 이용하여 상/하향 링크 데이터 송수신을 위해 사용할 수 있다.

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【0049】구체적으로 임의의 서빙 셀에서 단말의 초기 접속 절차(initial access procedure)를 위한 초기 대역폭 파트(initial bandwidth part)가 정의되며, 각각의 단말 별로 지정된(dedicated) RRC 시그널링을 통해 하나 이상의 단말-특정한 대역폭 파트(들)이 구성되고, 또한 각각의 단말 별로 폴백 동작(fallback operation)을 위한 디폴트 대역폭 파트(default bandwidth part)가 정의될 수 있다.

【0050】단, 임의의 서빙 셀에서 단말의 캐퍼빌리티 및 대역폭 파트(들) 구성에 따라 동시에 복수의 하향 링크 및/또는 상향 링크 대역폭 파트들을 활성화하여 사용하도록 정의할 수 있으나, NR rel-15에서는 임의의 단말에서 임의의 시간에 하나의 하향 링크 대역폭 파트 및 상향 링크 대역폭 파트만을 활성화하여 사용하도록 정의되었다.

【0051】NR PUCCH

【0052】기존의 LTE 시스템의 경우, 단말의 상향 링크 제어 정보(UCI, uplink control information) 전송을 위한 상향 링크 제어채널인 PUCCH 전송은 단일한 서브프레임 단위로 이루어졌다. 즉, 시간 도메인에서 하나의 서브프레임을 구성하는 14개의 SC-FDMA 심볼을 하나의 PUCCH 전송이 이루어졌다. 단, 마지막 심볼이 SRS 전송을 위해 사용될 경우, 마지막 심볼을 제외한 13개의 심볼을 통해 PUCCH 전송이 이루어졌다.

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【0053】또한 상향 링크 제어 정보의 페이로드 사이즈에 따라 서로 다른 PUCCH 포맷이 정의되었다. 구체적으로 SR(Scheduling Request)와 HARQ ACK과 같은 1 또는 2 비트들의 상향 링크 제어 정보 전송은 PUCCH 포맷 1 계열(PUCCH 포맷 1/1a/1b)을 통해 전송되었고, CQI/CSI 피드백과 같이 중간의(moderate) 페이로드 사이즈를 갖는 상향 링크 제어 정보의 경우 PUCCH 포맷 2(PUCCH 포맷 2a/2b) 계열, CA 상황에서 큰 페이로드 사이즈의 상향 링크 제어 정보 피드백의 경우 PUCCH 포맷 3 이상을 사용하도록 정의되었다.

【0054】하지만 NR의 경우, 14개의 심볼로 이루어진 슬롯 내에서 다양한 지속시간을 갖는 PUCCH 구조가 정의되었다. 구체적으로 NR에서는 단말의 상향 링크 제어 정보(UCI, uplink control information) 전송을 위해 하나의 슬롯(slot)에서 단일한 PUCCH 전송이 이루어지는 심볼의 수, N값에 따라 긴 지속기간(long duration) PUCCH와 짧은 지속기간(short duration) PUCCH로 구분될 수 있다. NR에서는 단말의 상향 링크 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.

【0055】이하에서 짧은 지속기간(short duration) PUCCH는 숏 PUCCH(short PUCCH)로도 호칭될 수 있고, 긴 지속기간(long duration) PUCCH는 롱 PUCCH(long PUCCH)로도 호칭될 수 있다. 즉 짧은 지속기간(short duration) PUCCH의 경우 1~2개의 심볼을 통해 전송될 수 있고, 긴 지속기간(long duration) PUCCH는 하나의 슬

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롯 내에서 4~14개의 심볼을 통해 전송될 수 있다.

【0056】 또한 각각의 긴 지속기간(long duration) PUCCH와 짧은 지속기간(short duration) PUCCH에 대해 상향 링크 제어 정보 페이로드 사이즈에 따라 LTE와 유사하게 서로 다른 PUCCH 포맷이 정의될 수 있다. 예를 들어, 짧은 지속기간(short duration) PUCCH에 대해 최대 2 비트들의 상향 링크 제어 정보 전송을 위한 PUCCH 포맷 및 그 이상의 페이로드 사이즈를 갖는 상향 링크 제어 정보 전송을 위한 PUCCH 포맷이 각각 정의될 수 있다. 또한 긴 지속기간(long duration) PUCCH에 대해서도 최대 2 비트들의 상향 링크 제어 정보 전송을 위한 PUCCH 포맷 및 그 이상의 페이로드 사이즈를 갖는 상향 링크 제어 정보 전송을 위한 PUCCH 포맷이 각각 정의될 수 있다.

【0057】 즉, NR에서 상향 링크 제어 정보 전송을 위한 PUCCH 구조를 정의함에 있어서 PUCCH 지속시간(duration)과 PUCCH 포맷에 대한 정의가 각각 요구될 수 있다.

【0058】 본 실시예는 NR에서 단말의 HARQ ACK/NACK 피드백 혹은 비주기적 CSI 리포팅을 위한 PUCCH 자원 할당 방법에 대해 제안한다. 본 실시예는 PUCCH가 단말의 HARQ ACK/NACK 피드백 혹은 비주기적 CSI 리포팅을 위한 것으로 예시적으로 설명하나 본 발명은 이에 제한되지 않고 서비스 요청(Service Request(SR))이나 주기적 CSI 리포팅을 위한 PUCCH 자원 할당에서 적용할 수 있다.

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【0059】 상기에서 서술한 바와 같이 NR에서는 단말 관점에서 구성된 하나의 서빙 셀을 통해 하나 이상의 대역폭 파트(들)를 구성할 수 있다. 구체적으로 해당 서빙 셀에서 지원하는 전송 방향(transmission direction)에 따라, 페어링되지 않은 (unpaired) 스펙트럼(i.e. TDD) 혹은 페어링된(paired) 스펙트럼(i.e. FDD)으로 구성된 서빙 셀의 경우, 적어도 하나 이상의 하향 링크 대역폭 파트(들)와 상향 링크 대역폭 파트(들)가 각각 구성될 수 있다.

【0060】 기지국은 각각의 단말 별로 주어진 시간에 하나의 하향 링크 대역폭 파트 및 상향 링크 대역폭 파트만을 활성화하여 각각 상/하향 링크 무선 채널 및 신호(e.g. PDCCH/PDSCH, PUSCH/PUCCH 등)의 송수신을 위해 사용하도록 정의되었다. 단, 하향 링크만(DL-only) 혹은 상향 링크만(UL-only)의 서빙 셀의 경우, 각각 하향 링크 대역폭 파트(들) 혹은 상향 링크 대역폭 파트(들)만이 구성 및 활성화될 수 있다.

【0061】 이에 따라, 단말은 최초 접속(initial access)이 이루어진 Pcell(Primary cell) 외에 캐리어 병합을 통해 구성된 Scell(Secondary cell)에 대해서도 각각 독립적으로 대역폭 파트(들)가 구성되고 활성화될 수 있다.

【0062】 이처럼 임의의 단말을 위해 구성된 임의의 서빙 셀에서 하나 이상의 대역폭 파트(들)가 구성될 경우, 단말은 임의의 시간에 하나의 대역폭 파트를 활성화하여 사용할 수 있다.

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【0063】 구체적으로 하향 링크 송수신을 위해서 해당 서빙 셀에서 해당 단말을 위해 구성된 하나 이상의 하향 링크 대역폭 파트(들) 중 임의의 하향 링크 서브프레임/슬롯/미니-슬롯(mini-slot)에서 하나의 하향 링크 대역폭 파트를 활성화하여 사용한다. 마찬가지로 상향 링크 송수신을 위해서 해당 서빙 셀에서 해당 단말을 위해 구성된 하나 이상의 상향 링크 대역폭 파트(들) 중 임의의 상향 링크 서브프레임/슬롯/미니-슬롯(mini-slot)에서 하나의 상향 링크 대역폭 파트를 활성화하여 사용한다.

【0064】 임의의 단말에 대한 상기 하향 링크 대역폭 파트 및 상향 링크 대역폭 파트의 활성화/비활성화(activation/deactivation) 지시는 PDCCH를 통해 전송되는 하향 링크 제어 정보(DCI, Downlink Control Information)를 통해 이루어질 수 있다. 구체적으로 PDSCH에 대한 자원 할당 정보를 포함하는 하향 링크 할당(DL assignment) 하향 링크 제어 정보를 통해 하향 링크 대역폭 파트에 대한 활성화 및 비활성화가 이루어질 수 있다. 또한 PUSCH에 대한 자원 할당 정보를 포함하는 상향 링크 그랜트(grant)를 통해 상향 링크 대역폭 파트에 대한 활성화 및 비활성화가 이루어질 수 있다.

【0065】 예를 들어, 단말은, 기지국으로부터 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신할 수 있다. 다음으로, 단말은, 대역폭 파트 설정 정보에 의해 설정된 대역폭 파트 셋에 포함된 하나 이상의 대역폭 파트들 중 하나를 지시하는 정보를 포함하는 하향 링크 제어 정보를 기지국으로부터 수신할 수 있다. 단

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말은, 하향 링크 제어 정보에서 지시하는 하나의 대역폭 파트를 통해 하향링크 데이터 채널(PDSCH)을 수신하거나 또는 상향링크 데이터 채널(PUSCH)/상향링크 제어 채널(PUCCH)을 전송할 수 있다.

【0066】 이때 대역폭 파트 설정 정보는, 상위 계층 시그널링(예를 들어 RRC 시그널링)을 통해 기지국으로부터 수신될 수 있다.

【0067】 본 실시예에서는 이와 같이 단말-특정(UE-specific)한 대역폭 파트(이하에서는 설명의 편의를 위해 bandwidth part를 BWP로 지칭할 수 있음) 기반 동작으로 고려한 PUCCH 자원 할당 방법 및 그와 관련한 구체적인 기지국과 단말의 동작에 대해 제안한다. 특히 상향 링크 대역폭 파트 활성화/비활성화, 즉, 상향 링크 대역폭 파트 스위칭에 따른 기지국과 단말의 PUCCH 송수신 자원 지시 및 해석 간 모호성(ambiguity)를 방지하기 위한 구체적인 PUCCH 자원 할당 방법에 대해 제안한다.

【0068】 NR에서는 기지국/네트워크에서 각각의 단말 별로 HARQ ACK/NACK 피드백을 위한 하나 이상의 PUCCH 자원(들)로 구성된 단일한 PUCCH 자원 셋 혹은 각각 하나 이상의 PUCCH 자원(들)로 구성된 복수의 PUCCH 자원 셋들을 구성하여, 이를 단말-특정(UE-specific)한 상위 계층 시그널링(higher layer signaling)을 통해 각각의 단말에 전송할 수 있다.

【0069】 이처럼 단말-특정(UE-specific)한 상위 계층 시그널링(higher layer signaling)을 통해 임의의 단말을 위한 단일한 혹은 복수의 PUCCH 자원 셋(들)이 구성된 경우, 기지국에서 PDCCH를 통해 임의의 단말을 위한 PDSCH 스케줄링 제어정

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보 전송 시, 해당 하향 링크 할당 하향 링크 제어 정보(Downlink Control Information)을 해당 PDSCH 수신에 대한 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 지시 정보를 포함하여 전송할 수 있다.

【0070】 즉, 기지국은 임의의 단말을 위한 PDSCH 전송 별로, 해당 단말을 위해 설정된 단일한 PUCCH 자원 셋을 구성하는 PUCCH 자원들 중 하나의 PUCCH 자원을 선택하거나, 해당 단말을 위해 설정된 복수의 PUCCH 자원 셋들 중 하나의 PUCCH 자원 셋 및 해당 PUCCH 자원 셋을 구성하는 PUCCH 자원들 중 하나의 PUCCH 자원을 선택하여, 이를 하향 링크 할당 하향 링크 제어 정보를 통해 전송함으로써, 해당 단말에서 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH 자원을 동적으로 할당하도록 정의할 수 있다.

【0071】 본 실시예에서는 이를 위한 구체적인 PUCCH 자원 셋 설정 방법 및 해당 PUCCH 자원 지시(resource indication) 방법을 제안한다.

【0072】 먼저 임의의 단말을 위한 상기 PUCCH 자원 셋(들)을 구성하는 한 방법으로서, 단말의 HARQ ACK/NACK 피드백을 위한 단말 별 PUCCH 자원 셋(들)을 구성함에 있어서, 해당 단말을 위해 설정된 상향 링크 대역폭 파트 별로 각각 별도의 자원 셋(들)을 설정하도록 정의할 수 있다.

【0073】 예를 들어, 임의의 단말을 위해 도 3a와 같이 N개(N은 1보다 큰 자연수)의 상향 링크 대역폭 파트들이 설정된 경우 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 지시를 위해 각각의 상향 링크 대역폭 파트 별로 별도의 단일한 혹은 복수의 PUCCH 자원 셋(들)을 설정하여 이를 단말-특정(UE-specific)한

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상위 계층 시그널링(higher layer signaling)을 통해 해당 단말에 전송하도록 정의할 수 있다. 단, 도 3a은 각각의 대역폭 파트 간 주파수 축에서 오버래핑(overlapping)되지 않도록 구성되었으나, 임의의 대역폭 파트 간 주파수 축에서 부분적으로(partially) 혹은 전체적으로(fully) 오버래핑되도록 대역폭 파트 구성이 이루어질 수도 있다. 본 실시예는 구체적인 상향 링크 대역폭 파트 설정에 의해 제약되지 않는다.

【0074】 도 3b를 참조하면, 기지국은 해당 단말을 위해 대역폭 파트 #1을 위한 하나의 혹은 복수의 PUCCH resource 셋(들), BWP #2를 위한 또 다른 하나의 혹은 복수의 PUCCH 자원 셋(들),…, BWP #N을 위한 또 다른 하나의 혹은 복수의 PUCCH 자원 셋(들)까지 각각의 대역폭 파트 별로 총 N개의 하나 이상의 PUCCH 자원 셋(들) 그룹을 설정하도록 정의할 수 있다. 예를 들어 도 3b에 도시한 바와 같이, 특정 대역폭 파트, 예를 들어 BWP #2에 포함된 PUCCH 자원 셋들이, 예를 들어 제1 내지 제4 PUCCH 자원 셋들로 구성될 수 있다.

【0075】 이 경우, 각각의 상향 링크 대역폭 파트 별로 상위 계층 시그널링(higher layer signaling)을 통해 설정된 하나의 혹은 복수의 PUCCH 자원 셋을 구성하는 각각의 PUCCH 자원은 PUCCH 포맷 설정 정보, 해당 상향 링크 대역폭 파트 내의 시간/주파수 도메인 PUCCH 자원 설정 정보(혹은 추가적으로 코드 도메인(code-domain) 자원 설정 정보) 등으로서 정의될 수 있다. 예를 들어 도 3b에 도시한 바와 같이 특정 PUCCH 자원 셋, 예를 들어 제2PUCCH 자원 셋은 제1 내지 제 4 PUCCH 자원들로 구성될 수 있다.

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【0076】 이처럼 상위 계층 시그널링에 의해 각각의 대역폭 파트별로 하나 혹은 복수의 PUCCH 자원 셋(들)이 구성된 경우, 상기의 하향 링크 할당 하향 링크 제어 정보를 통한 PUCCH 자원 지시 정보 영역을 구성함에 있어서 기지국은 PUCCH 전송을 위한 상향 링크 대역폭 파트 지시 정보를 명시적으로 포함하도록 정의할 수 있다.

【0077】 구체적으로 상기의 하향 링크 할당 하향 링크 제어 정보를 통한 PUCCH 자원 지시 정보는 상향 링크 대역폭 파트 지시 정보(e.g. 대역폭 파트 인덱스 정보) + 해당 상향 링크 대역폭 파트 내의 PUCCH 자원 셋 지시 정보(e.g. PUCCH 자원 셋 인덱스 정보) + 해당 PUCCH 자원 셋을 구성하는 PUCCH 자원들 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH 자원 지시 정보(예를 들어, PUCCH 자원 셋 내에서 PUCCH 자원 인덱스)으로 구성될 수 있다.

【0078】 단, 임의의 대역폭 파트 내에서 PUCCH 자원 셋을 구성함에 있어서, 특정한 분류(classification) 기반의 PUCCH 자원 셋 구성이 이루어질 경우, 해당 특정 분류 정보가 상기 PUCCH 자원 셋 지시 정보를 대신할 수 있다. 예를 들어, PUCCH 포맷 혹은 PUCCH 지속시간 혹은 PUCCH 페이로드 사이즈 등에 따라 각각 PUCCH 자원 셋이 별도로 구성될 경우, 각각 해당 PUCCH 포맷 정보 혹은 PUCCH 지속시간 정보 혹은 PUCCH 페이로드 사이즈 정보 등이 각각 상기의 PUCCH 자원 셋 지시 정보 대신 사용될 수 있다.

【0079】 예를 들어, 상기에서 서술한 바와 같이 RRC 시그널링을 통해 PUCCH 자원 셋을 구성함에 있어서, PUCCH 포맷 별로 별도의 PUCCH 자원 셋을 구성하도록

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정의하고, 상기의 하향 링크 할당 하향 링크 제어 정보를 통해 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH 포맷 지시 정보를 전송함으로써, 이를 통해 해당 단말의 PUCCH 자원 할당을 위한 PUCCH 자원 셋이 도출되도록 정의할 수 있다.

【0080】 또 다른 예로서, 해당 단말에서 전송해야 하는 PUCCH 페이로드 사이즈 즉, 상향 링크 제어 정보의 페이로드 사이즈에 따라 별도의 PUCCH 자원 셋을 구성하도록 정의하고, 단말이 전송해야 하는 상향 링크 제어 정보 페이로드 사이즈에 따라 상기 PUCCH 자원 할당을 위한 PUCCH 자원 셋이 결정되도록 정의할 수 있다. 도 3b에 도시된 바와 같이, 하향 링크 할당 하향 링크 제어 정보를 통해 상기의 PUCCH 자원 지시 정보(e.g. ARI, ACK/NACK 자원 지시)만이 전송되도록 정의하고, 단말에서 이를 해석하기 위한 PUCCH 자원 셋을 결정함에 있어서, 해당 하향 링크 할당 하향 링크 제어 정보를 통해 할당되는 PUCCH 자원을 통해 해당 단말이 전송해야 하는 상향 링크 제어 정보 페이로드 사이즈(UCI payload size)에 따라 해당 PUCCH 자원 셋이 도출되도록 정의할 수 있다.

【0081】 예를 들어, 상향 링크 제어 정보 페이로드 사이즈를 비트수에 따라 4개의 영역들로 구분하고, 상향 링크 제어 정보의 비트수에 따라 도 3b에 도시한 바와 같이 제1 내지 제4PUCCH 자원 셋들 중 하나가 돌출되도록 정의할 수 있다.

【0082】 도 3c에 도시한 바와 같이, 하향 링크 할당 하향 링크 제어 정보가 PUCCH 자원 지시 정보(PUCCH resource information 또는 PUCCH resource indicator)를 포함할 수 있다. PUCCH 자원 지시 정보는 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하

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나의 상향 링크 제어채널 자원을 지시한다. 예를 들어 도 3b에 도시한 바와 같이 상향 링크 제어채널 자원 셋이 제1 내지 제4PUCCH 자원들로 구성된 경우, 도 3c에 도시한 PUCCH 자원 지시 정보는 4개의 PUCCH 자원들 중 하나를 지시할 수 있다.

【0083】 또는 해당 PUCCH 자원 셋 정보(또는, 상기 PUCCH 분류에 따른 지시 정보 포함)와 해당 PUCCH 자원 셋 내의 PUCCH 자원 인덱스 정보는 조인트 코딩(joint coding) 방식으로 인코딩되어 하나의 정보 영역을 통해 송수신될 수 있다. 단, 상기의 PUCCH 자원 셋 지시 관련 정보는 해당 정보는 하나의 상향 링크 대역폭 파트 내에서 복수의 PUCCH 자원 셋들 설정이 지원되는 경우에만 필요할 수 있으며, 하나의 상향 링크 대역폭 파트 당 하나의 PUCCH 자원 셋 구성만 지원되는 경우, 상기의 PUCCH 자원 셋 지시 정보는 제외될 수 있다.

【0084】 이처럼 하향 링크 할당 하향 링크 제어 정보를 통해 PUCCH 전송을 위한 상향 링크 대역폭 파트 지시 정보가 포함될 경우, 해당 상향 링크 대역폭 파트 지시 정보는 추가적으로 해당 단말의 상향 링크 대역폭 파트 활성화 정보 및 그에 따른 상향 링크 대역폭 파트 스위칭 지시 정보(uplink bandwidth part switching indication information)로 사용될 수 있다.

【0085】 구체적으로 해당 상향 링크 대역폭 파트 지시 정보에 따라 해당 단말은 해당 하향 링크 할당 하향 링크 제어 정보 수신 슬롯으로부터 일정 슬롯 이후(예를 들어 k개 슬롯들 이후)에 해당 상향 링크 대역폭 파트 지시 정보에 따라 상향 링크 대역폭 파트 스위칭을 수행하도록 정의할 수 있다. 여기서 상향 링크 대역폭 파트 스위칭은 현재의 액티브(active) 상향 링크 대역폭 파트를 비활성화하고

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해당 지시 정보에 따라 새로운 상향 링크 대역폭 파트를 활성화하는 동작을 의미한다.

【0086】 또는 해당 PUCCH 전송 슬롯으로부터 일정 슬롯 이전(e.g. j개 슬롯들 이전)에 상향 링크 대역폭 파트 지시 정보에 따라 상향 링크 대역폭 파트 스위칭(즉, 현재의 액티브 상향 링크 대역폭 파트를 비활성화하고 해당 지시 정보에 따라 새로운 상향 링크 대역폭 파트를 활성화하는 동작)을 수행하도록 정의할 수 있다. 단, 상기 k 혹은 j 값은 0 이상의 임의의 정수값으로서, 임의의 고정된 값을 갖거나, 기지국에 의해 설정되어 상위 계층 시그널링을 통해 전송되거나, 단말의 캐퍼빌리티에 따라 결정될 수 있다. 또한 상기 상향 링크 대역폭 파트 지시 정보가 현재의 액티브 상향 링크 대역폭 파트를 지시하는 경우, 해당 단말은 상기 대역폭 파트 스위칭 동작을 수행하지 않는다.

【0087】 상기의 하향 링크 할당 하향 링크 제어 정보를 통한 PUCCH 자원 지시 정보 영역을 구성하는 또 다른 방법으로서, 상기 상향 링크 대역폭 파트는 암묵적으로 결정될 수 있으며, 이에 따라 해당 하향 링크 할당 하향 링크 제어 정보의 PUCCH 자원 지시 정보는 해당 상향 링크 대역폭 파트 지시 정보를 제외한 PUCCH 자원 셋 지시 정보 + 해당 PUCCH 자원 셋 구성하는 PUCCH 자원들 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH 자원 지시 정보로 구성될 수 있다.

【0088】 단, 이 때 해당 PUCCH 자원 셋 지시 정보 + 해당 PUCCH 자원 셋 구성하는 PUCCH 자원들 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH 자원 지시 정보 상기와 동일한 방법으로 구성될 수 있다. 이처럼 상향 링크 대역폭 파트

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가 암묵적으로(implicit) 결정될 경우, 해당 PUCCH 전송을 위한 상향 링크 대역폭 파트는 해당 하향 링크 할당 하향 링크 제어 정보 전송 슬롯에서 해당 단말의 액티브 상향 링크 대역폭 파트로 결정되도록 정의할 수 있다.

【0089】 상향 링크 대역폭 파트를 암묵적으로 결정하는 또 다른 방법으로서, 해당 PUCCH 전송을 위한 상향 링크 대역폭 파트는 해당 단말의 PUCCH 전송 시점, 즉 PUCCH 전송이 이루어지는 슬롯(혹은 복수의 슬롯을 통해 PUCCH 전송이 이루어질 경우, PUCCH 전송이 시작되는 슬롯)에서의 액티브 상향 링크 대역폭 파트로 결정되도록 정의할 수 있다. 상기 PUCCH 전송을 위한 상향 링크 대역폭 파트를 암묵적으로 결정하는 또 다른 방법으로서, PDSCH 자원 할당이 이루어지는 하향 링크 할당 하향 링크 제어 정보가 전송된 하향 링크 대역폭 파트 별로 PUCCH 전송을 위해 연결(association)된 상향 링크 대역폭 파트를 정의할 수 있다.

【0090】 혹은 해당 하향 링크 할당 하향 링크 제어 정보에 따른 PDSCH 전송이 이루어지는 하향 링크 대역폭 파트 별로 PUCCH 전송을 위해 연결된 상향 링크 대역폭 파트를 정의할 수 있다. 이 경우, 임의의 단말을 위해 설정된 각각의 하향 링크 대역폭 파트 별 PUCCH 전송을 위해 연결된 상향 링크 대역폭 파트를 기지국에서 설정하여 단말-특정한 상위 계층 시그널링 혹은 L1 제어 시그널링을 통해 해당 단말에 전송하거나, 혹은 암묵적으로(implicit) 하향 링크 대역폭 파트 - 상향 링크 대역폭 파트 연결 규칙(downlink bandwidth part-uplink bandwidth part association rule)을 정의할 수 있다.

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【0091】 예를 들어, TDD 셀에서 각각 하향 링크와 상향 링크에 대해 동일한 대역폭 파트 설정이 이루어진 경우 혹은 TDD/FDD 셀에서 하향 링크와 상향 링크에 대해 동일한 개수의 대역폭 파트 설정이 이루어진 경우, 각각 동일한 인덱스의 하향 링크 대역폭 파트와 상향 링크 대역폭 파트를 연결하도록 정의할 수 있다.

【0092】 또는 상기 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 셋(들)을 설정하는 또 다른 방법으로서, 해당 PUCCH 자원 셋(들)은 상향 링크 대역폭 파트에 공통으로(common) 설정될 수 있다. 즉, 임의의 단말을 위해 설정된 하나의 PUCCH 자원 셋을 구성하는 PUCCH 자원들을 정의함에 있어서, 해당 PUCCH 자원 셋을 구성하는 각각의 PUCCH 자원은 해당 단말을 위해 설정된 모든 상향 링크 대역폭 파트에서 정의된 PUCCH 자원들로 구성될 수 있다.

【0093】 즉, 기지국에서 임의의 단말을 위한 PUCCH 자원 셋(들)을 구성하는 각각의 PUCCH 자원을 설정함에 있어서, 해당 PUCCH 자원이 구성되는 상향 링크 대역폭 파트 정보도 포함하도록 할 수 있다.

【0094】 이에 따라 임의의 단말을 위해 상기의 상위 계층 시그널링을 통해 설정된 하나의 혹은 복수의 PUCCH 자원 셋(들)을 구성하는 각각의 PUCCH 자원은 PUCCH 포맷 설정 정보, 상향 링크 대역폭 파트 설정 정보 및 해당 상향 링크 대역폭 파트 내의 시간/주파수 도메인 PUCCH 자원 설정 정보(혹은 추가적으로 코드-도메인 자원 설정 정보) 등으로서 정의될 수 있다.

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【0095】 이 경우, 상기의 하향 링크 할당 하향 링크 제어 정보를 통해 전송되는 PUCCH 자원 지시 정보는 상기의 묵시적 상향 링크 대역폭 파트 지시의 경우와 동일하게 PUCCH 자원 셋 지시 정보(예를 들어 PUCCH 자원 셋 인덱스 정보) + 해당 PUCCH 자원 셋 구성하는 PUCCH 자원들 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH 자원 지시 정보(예를 들어 PUCCH 자원 셋 내에 PUCCH 자원 인덱스)으로 구성되거나, 혹은 PUCCH 자원 셋(들) 구성하는 PUCCH 자원들 중 단말이 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH 자원 지시 정보(예를 들어 PUCCH 자원 셋 내에 PUCCH 자원 인덱스)만으로 구성될 수 있다.

【0096】 상기와 마찬가지로 PUCCH 자원 셋을 구성함에 있어서, 특정한 분류(classification) 기반의 PUCCH 자원 셋 구성이 이루어질 경우, 해당 특정 분류 정보가 상기 PUCCH 자원 셋 지시 정보를 대신할 수 있다.

【0097】 예를 들어, PUCCH 포맷 혹은 PUCCH 지속시간 혹은 PUCCH 페이로드 사이즈 등에 따라 각각 PUCCH 자원 셋이 별도로 구성될 경우, 각각 해당 PUCCH 포맷 정보 혹은 PUCCH 지속시간 정보 혹은 PUCCH 페이로드 사이즈 정보 등이 각각 상기의 PUCCH 자원 셋 지시 정보 대신 사용될 수 있다.

【0098】 또는 해당 PUCCH 자원 셋 정보(또는, 상기 PUCCH 분류에 따른 지시 정보 포함)와 해당 PUCCH 자원 셋 내의 PUCCH 자원 인덱스 정보는 조인트 코딩(joint coding) 방식으로 인코딩되어 하나의 정보 영역을 통해 송수신될 수 있다. 단, 상기의 PUCCH 자원 셋 지시 관련 정보는 단말 당 복수의 PUCCH 자원 셋들 설정이 지원되는 경우에만 필요할 수 있다. 단말 당 하나의 PUCCH 자원 셋 구성만 지

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원되는 경우, 상기의 PUCCH 자원 셋 지시 정보는 제외될 수 있다.

【0099】추가적으로 상위 계층 시그널링을 통해 설정되는 PUCCH 자원 셋을 구성하는 PUCCH 자원 설정 정보가 각각 상향 링크 대역폭 파트 설정 정보를 포함하는 경우, 하향 링크 할당 하향 링크 제어 정보의 PUCCH 자원 지시 정보에 의해 지시된 PUCCH 자원 할당에 따라 상기의 명시적 상향 링크 대역폭 파트 지시의 경우 마찬가지로 해당 단말에서 해당 PUCCH 자원이 구성되는 상향 링크 대역폭 파트로 상향 링크 대역폭 파트 활성화 혹은 상향 링크 대역폭 파트 스위칭 동작을 수행하도록 정의할 수 있다.

【0100】추가적으로 상기에서 서술한 바와 같이 상향 링크 대역폭 파트별로 단말의 HARQ ACK/NACK 피드백을 위해 하나의 혹은 복수의 PUCCH 자원 셋(들)이 설정된 경우, 또는 상향 링크 대역폭 파트에 공통으로 하나의 혹은 복수의 PUCCH 자원 셋(들)이 설정된 경우, 해당 PUCCH 자원 셋(들)을 구성하는 각각의 PUCCH 자원들은 단말의 비주기적 CSI 피드백을 위해서도 할당될 수 있도록 정의할 수 있다.

【0101】구체적으로 기지국에 의해 임의의 단말의 비주기적 CSI 리포팅이 하향 링크 할당 하향 링크 제어 정보를 통해 트리거될 수 있다. 이를 위해 임의의 단말을 위한 하향 링크 할당 하향 링크 제어 정보 포맷을 정의함에 있어서, 단말의 비주기적 CSI 리포팅을 트리거링하기 위한 정보 영역을 포함하도록 할 수 있다. 해당 비주기적 CSI 리포팅 지시 정보 영역을 통해 단말의 비주기적 CSI 리포팅이 트리거링된 경우, 해당 하향 링크 할당 하향 링크 제어 정보를 통해 지시되는 상기의 PUCCH 자원 할당 정보에 따라 해당 PUCCH 자원을 통해 PDSCH에 대한 HARQ ACK/NACK

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피드백 정보와 함께 비주기적 CSI 리포팅 정보도 다중화하여 전송하도록 정의할 수 있다. 즉, 상기의 PUCCH 자원 셋 설정은 HARQ ACK/NACK 피드백과 비주기적 CSI 리포팅을 위한 공통의 PUCCH 자원 셋 설정일 수 있다.

【0102】 또는 기지국/네트워크에서 상기의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 셋(들) 설정과 별도로 비주기적 CSI 리포팅을 위한 PUCCH 자원 셋(들)을 구성하여 이를 단말-특정한 상위 계층 시그널링을 통해 각각의 단말로 전송하도록 정의할 수 있다. 즉, 각각의 단말 별로 비주기적 CSI 피드백만을 위한 하나의 혹은 복수의 PUCCH 자원 셋(들)을 구성하여 이를 단말-특정한 상위 계층 시그널링을 통해 각각의 단말로 전송하도록 정의할 수 있다.

【0103】 이 경우, 해당 비주기적 CSI 피드백을 위한 PUCCH 자원 셋은 상기의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 셋 구성 방법과 동일하게 각각 PUCCH 포맷 별로 혹은 PUCCH 지속시간 별로 별도로 구성될 수도 있고, 그와 관계 없이 구성될 수 있다.

【0104】 또한 비주기적 CSI 리포팅을 위한 별도의 PUCCH 자원 셋(들)을 설정함에 있어서, 상기에 서술한 바와 같이 상향 링크 대역폭 파트 별로 비주기적 CSI 리포팅을 위한 PUCCH 자원 셋(들)을 설정하도록 정의하거나, 혹은 상향 링크 대역폭 파트 공통으로 비주기적 CSI 리포팅을 위한 PUCCH 자원 셋(들)을 설정하도록 정의할 수 있다.

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【0105】 이처럼 별도의 비주기적 CSI 리포팅을 위한 PUCCH 자원 셋(들)이 설정될 경우, 비주기적 CSI 리포팅을 위한 PUCCH 자원 할당은 상기에서 기술한 하향 링크 할당 하향 링크 제어 정보를 통한 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 할당 방법을 따르도록 정의할 수 있으다. 추가적으로 상향 링크 대역폭 파트 활성화 혹은 스위칭과 관련한 단말 동작도 상기에서 기술한 동작을 따르도록 정의할 수 있다.

【0106】 추가적으로 상향 링크 그랜트를 통한 비주기적 CSI 리포팅이 트리거링될 경우, 단말에서 비주기적 CSI 리포팅 정보를 전송할 무선 채널 지시 정보(즉, PUSCH 또는 PUCCH)를 포함하도록 정의할 수 있다.

【0107】 이상, 도 2 내지 도 3c를 참조하여 PUCCH 자원 셋 설정 방법 및 해당 PUCCH 자원 지시(resource indication) 방법을 설명하였다. 이하에서 도 4 내지 도 7을 참조하여 단말과 기지국에서 상향 링크 제어정보를 전송하고 수신하는 방법들 및 그 단말, 기지국을 상세히 설명한다.

【0108】 도 4는 본 실시예에서 단말이 상향 링크 제어정보를 절차를 도시한 도면이다.

【0109】 도 4를 참조하면, 단말은 기지국으로부터 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 수신한다(S400).

【0110】 상향 링크 제어채널 자원 셋들은 단말을 위해 구성된 상향 링크 대역폭 파트 별로 설정될 수 있다. 상향 링크 대역폭 파트는 하향 링크 제어정보를

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통해 활성화할 수 있다.

【0111】 구체적으로 하향 링크 송수신을 위해서 해당 서빙 셀에서 해당 단말을 위해 구성된 하나 이상의 하향 링크 대역폭 파트(들) 중 임의의 하향 링크 서브프레임/슬롯/미니-슬롯(mini-slot)에서 하나의 하향 링크 대역폭 파트를 활성화하여 사용한다. 마찬가지로 상향 링크 송수신을 위해서 해당 서빙 셀에서 해당 단말을 위해 구성된 하나 이상의 상향 링크 대역폭 파트(들) 중 임의의 상향 링크 서브프레임/슬롯/미니-슬롯(mini-slot)에서 하나의 상향 링크 대역폭 파트를 활성화하여 사용한다.

【0112】 임의의 단말에 대한 상기 하향 링크 대역폭 파트 및 상향 링크 대역폭 파트의 활성화/비활성화(activation/deactivation) 지시는 PDCCH를 통해 전송되는 하향 링크 제어 정보(DCI, Downlink Control Information)를 통해 이루어질 수 있다. 구체적으로 PDSCH에 대한 자원 할당 정보를 포함하는 하향 링크 할당(DL assignment) 하향 링크 제어 정보를 통해 하향 링크 대역폭 파트에 대한 활성화 및 비활성화가 이루어질 수 있다. 또한 PUSCH에 대한 자원 할당 정보를 포함하는 상향 링크 그랜트(grant)를 통해 상향 링크 대역폭 파트에 대한 활성화 및 비활성화가 이루어질 수 있다.

【0113】 예를 들어, 단말은, 기지국으로부터 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신할 수 있다. 다음으로, 단말은, 대역폭 파트 설정 정보에 의해 설정된 대역폭 파트 셋에 포함된 하나 이상의 대역폭 파트들 중 하나를 지시

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하는 정보를 포함하는 하향 링크 제어 정보를 기지국으로부터 수신할 수 있다. 단말은, 하향 링크 제어 정보에서 지시하는 하나의 대역폭 파트를 통해 하향링크 데이터 채널(PDSCH)을 수신하거나 또는 상향링크 데이터 채널(PUSCH)/상향링크 제어 채널(PUCCH)을 전송할 수 있다.

【0114】 이때 대역폭 파트 설정 정보는, 상위 계층 시그널링(예를 들어 RRC 시그널링)을 통해 기지국으로부터 수신될 수 있다.

【0115】 NR에서는 기지국/네트워크에서 각각의 단말 별로 HARQ ACK/NACK 피드백을 위한 하나 이상의 PUCCH 자원(들)로 구성된 단일한 PUCCH 자원 셋 혹은 각각 하나 이상의 PUCCH 자원(들)로 구성된 복수의 PUCCH 자원 셋들을 구성하여, 이를 단말-특정(UE-specific)한 상위 계층 시그널링(higher layer signaling)을 통해 각각의 단말에 전송할 수 있다.

【0116】 이처럼 단말-특정(UE-specific)한 상위 계층 시그널링(higher layer signaling)을 통해 임의의 단말을 위한 단일한 혹은 복수의 PUCCH 자원 셋(들)이 구성된 경우, 기지국에서 PDCCH를 통해 임의의 단말을 위한 PDSCH 스케줄링 제어정보 전송 시, 해당 하향 링크 할당 하향 링크 제어 정보(Downlink Control Information)을 해당 PDSCH 수신에 대한 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 지시 정보를 포함하여 전송할 수 있다.

【0117】 또한, 단말은 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정한다(S410).

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【0118】 S410단계에서 상향 링크 제어정보를 전송을 위한 상향 링크 제어채널 자원 셋을 결정할 때, 상향 링크 제어정보의 사이즈에 의해 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정할 수 있다.

【0119】 또한, 단말은 결정된 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 결정한다(S420).

【0120】 추가로, 단말은, 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시하는 정보를 포함하는 하향 링크 제어 정보를 기지국으로부터 수신할 수 있다.

【0121】 이때, 결정된 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원은 기지국으로부터 상기 하향 링크 제어정보를 통해 지시될 수 있다.

【0122】 전술한 바와 같이, 단말은 PDSCH 전송 별로, 해당 단말을 위해 설정된 단일한 PUCCH 자원 셋을 구성하는 PUCCH 자원들 중 하나의 PUCCH 자원을 결정하거나, 혹은 해당 단말을 위해 설정된 복수의 PUCCH 자원 셋들 중 하나의 PUCCH 자원 셋 및 해당 PUCCH 자원 셋을 구성하는 PUCCH 자원들 중 하나의 PUCCH 자원을 결정하여, 해당 단말은 PUCCH 자원을 동적으로 할당할 수 있다.

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【0123】 구체적으로, 임의의 단말을 위한 상기 PUCCH 자원 셋(들)을 구성하는 한 방법으로서, 단말의 HARQ ACK/NACK 피드백을 위한 단말 별 PUCCH 자원 셋(들)을 구성함에 있어서, 해당 단말을 위해 설정된 상향 링크 대역폭 파트 별로 각각 별도의 자원 셋(들)을 설정하도록 정의할 수 있다.

【0124】 예를 들어, 임의의 단말을 위해 도 3a와 같이 N개(N은 1보다 큰 자연수)의 상향 링크 대역폭 파트들이 설정된 경우 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 지시를 위해 각각의 상향 링크 대역폭 파트 별로 별도의 단일한 혹은 복수의 PUCCH 자원 셋(들)을 설정하여 이를 단말-특정(UE-specific)한 상위 계층 시그널링(higher layer signaling)을 통해 해당 단말에 전송하도록 정의할 수 있다.

【0125】 도 3b를 참조하면, 기지국은 해당 단말을 위해 대역폭 파트 #1을 위한 하나의 혹은 복수의 PUCCH resource 셋(들), BWP #2를 위한 또 다른 하나의 혹은 복수의 PUCCH 자원 셋(들),…, BWP #N을 위한 또 다른 하나의 혹은 복수의 PUCCH 자원 셋(들)까지 각각의 대역폭 파트 별로 총 N개의 하나 이상의 PUCCH 자원 셋(들) 그룹을 설정하도록 정의할 수 있다. 예를 들어 도 3b에 도시한 바와 같이, 특정 대역폭 파트, 예를 들어 BWP #2에 포함된 PUCCH 자원 셋들이 예를 들어 제1 내지 제4 PUCCH 자원 셋들로 구성될 수 있다.

【0126】 이 경우, 각각의 상향 링크 대역폭 파트 별로 상위 계층 시그널링(higher layer signaling)을 통해 설정된 하나의 혹은 복수의 PUCCH 자원 셋을 구성하는 각각의 PUCCH 자원은 PUCCH 포맷 설정 정보, 해당 상향 링크 대역폭 파트

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내의 시간/주파수 도메인 PUCCH 자원 설정 정보(혹은 추가적으로 코드 도메인(code-domain) 자원 설정 정보) 등으로서 정의될 수 있다. 예를 들어 도 3b에 도시한 바와 같이 특정 PUCCH 자원 셋, 예를 들어 제2PUCCH 자원 셋은 제1 내지 제 4 PUCCH 자원들로 구성될 수 있다.

【0127】또한, 임의의 대역폭 파트 내에서 PUCCH 자원 셋을 구성함에 있어서, 특정한 분류(classification) 기반의 PUCCH 자원 셋 구성이 이루어질 경우, 해당 특정 분류 정보가 상기 PUCCH 자원 셋 지시 정보를 대신할 수 있다. 예를 들어, PUCCH 포맷 혹은 PUCCH 지속시간 혹은 PUCCH 페이로드 사이즈 등에 따라 각각 PUCCH 자원 셋이 별도로 구성될 경우, 각각 해당 PUCCH 포맷 정보 혹은 PUCCH 지속시간 정보 혹은 PUCCH 페이로드 사이즈 정보 등이 각각 상기의 PUCCH 자원 셋 지시 정보 대신 사용될 수 있다.

【0128】즉, 해당 단말에서 전송해야 하는 PUCCH 페이로드 사이즈 즉, 상향 링크 제어 정보의 페이로드 사이즈에 따라 별도의 PUCCH 자원 셋을 구성하도록 정의하고, 단말이 전송해야 하는 상향 링크 제어 정보 페이로드 사이즈에 따라 상기 PUCCH 자원 할당을 위한 PUCCH 자원 셋이 결정되도록 정의할 수 있다. 도 3b에 도시된 바와 같이, 하향 링크 할당 하향 링크 제어 정보를 통해 상기의 PUCCH 자원 지시 정보(e.g. ARI, ACK/NACK 자원 지시)만이 전송되도록 정의하고, 단말에서 이를 해석하기 위한 PUCCH 자원 셋을 결정함에 있어서, 해당 하향 링크 할당 하향 링크 제어 정보를 통해 할당되는 PUCCH 자원을 통해 해당 단말이 전송해야 하는 상향 링크 제어 정보 페이로드 사이즈(UCI payload size)에 따라 해당 PUCCH 자원 셋이

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도출되도록 정의할 수 있다.

【0129】 예를 들어, 상향 링크 제어 정보 페이로드 사이즈를 비트수에 따라 4개의 영역들로 구분하고, 상향 링크 제어 정보의 비트수에 따라 도 3b에 도시한 바와 같이 제1 내지 제4PUCCH 자원 셋들 중 하나가 돌출되도록 정의할 수 있다.

【0130】 도 3c에 도시한 바와 같이, 하향 링크 할당 하향 링크 제어 정보가 PUCCH 자원 지시 정보(PUCCH resource information 또는 PUCCH resource indicator)를 포함할 수 있다. PUCCH 자원 지시 정보는 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시한다. 예를 들어 도 3b에 도시한 바와 같이 상향 링크 제어채널 자원 셋이 제1 내지 제4PUCCH 자원들로 구성된 경우, 도 3c에 도시한 PUCCH 자원 지시 정보는 4개의 PUCCH 자원들 중 하나를 지시할 수 있다.

【0131】 본 실시예에서 이를 위한 구체적인 PUCCH 자원 셋 설정 방법 및 해당 PUCCH 자원 지시(resource indication)는 도 2 내지 도 3c를 참조하여 전술한 다양한 방법들을 적용할 수 있다.

【0132】 또한, 단말은 결정된 상향 링크 제어채널 자원을 통해 상향 링크 제어정보를 전송한다(S430).

【0133】 도 5는 본 실시예에서 기지국이 상향 링크 제어정보를 수신하는 절차를 도시한 도면이다.

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【0134】 도 5를 참조하면, 기지국은 단말에 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 전송한다(S500).

【0135】 전술한 바와 같이, 상향 링크 제어채널 자원 셋들은 단말을 위해 구성된 상향 링크 대역폭 파트 별로 설정될 수 있다. 상향 링크 대역폭 파트는 하향 링크 제어정보를 통해 활성화될 수 있다.

【0136】 구체적으로 하향 링크 송수신을 위해서 해당 서빙 셀에서 해당 단말을 위해 구성된 하나 이상의 하향 링크 대역폭 파트(들) 중 임의의 하향 링크 서브프레임/슬롯/미니-슬롯(mini-slot)에서 하나의 하향 링크 대역폭 파트를 활성화하여 사용한다. 마찬가지로 상향 링크 송수신을 위해서 해당 서빙 셀에서 해당 단말을 위해 구성된 하나 이상의 상향 링크 대역폭 파트(들) 중 임의의 상향 링크 서브프레임/슬롯/미니-슬롯(mini-slot)에서 하나의 상향 링크 대역폭 파트를 활성화하여 사용한다.

【0137】 임의의 단말에 대한 상기 하향 링크 대역폭 파트 및 상향 링크 대역폭 파트의 활성화/비활성화(activation/deactivation) 지시는 PDCCH를 통해 전송되는 하향 링크 제어 정보(DCI, Downlink Control Information)를 통해 이루어질 수 있다. 구체적으로 PDSCH에 대한 자원 할당 정보를 포함하는 하향 링크 할당(DL assignment) 하향 링크 제어 정보를 통해 하향 링크 대역폭 파트에 대한 활성화 및 비활성화가 이루어질 수 있다. 또한 PUSCH에 대한 자원 할당 정보를 포함하는 상향 링크 그랜트(grant)를 통해 상향 링크 대역폭 파트에 대한 활성화 및 비활성화가 이루어질 수 있다.

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【0138】 예를 들어, 단말은, 기지국으로부터 단말에 대해 설정된 하나 이상의 대역폭 파트로 구성된 대역폭 파트 셋에 대한 대역폭 파트(BWP, bandwidth part) 설정 정보를 수신할 수 있다. 다음으로, 단말은, 대역폭 파트 설정 정보에 의해 설정된 대역폭 파트 셋에 포함된 하나 이상의 대역폭 파트들 중 하나를 지시하는 정보를 포함하는 하향 링크 제어 정보를 기지국으로부터 수신할 수 있다. 단말은, 하향 링크 제어 정보에서 지시하는 하나의 대역폭 파트를 통해 하향링크 데이터 채널(PDSCH)을 수신하거나 또는 상향링크 데이터 채널(PUSCH)/상향링크 제어 채널(PUCCH)을 전송할 수 있다.

【0139】 이때 대역폭 파트 설정 정보는, 상위 계층 시그널링(예를 들어 RRC 시그널링)을 통해 기지국으로부터 수신될 수 있다.

【0140】 NR에서는 기지국/네트워크에서 각각의 단말 별로 HARQ ACK/NACK 피드백을 위한 하나 이상의 PUCCH 자원(들)로 구성된 단일한 PUCCH 자원 셋 혹은 각각 하나 이상의 PUCCH 자원(들)로 구성된 복수의 PUCCH 자원 셋들을 구성하여, 이를 단말-특정(UE-specific)한 상위 계층 시그널링(higher layer signaling)을 통해 각각의 단말에 전송할 수 있다. 이처럼 단말-특정(UE-specific)한 상위 계층 시그널링(higher layer signaling)을 통해 임의의 단말을 위한 단일한 혹은 복수의 PUCCH 자원 셋(들)이 구성된 경우, 기지국에서 PDCCH를 통해 임의의 단말을 위한 PDSCH 스케줄링 제어정보 전송 시, 해당 하향 링크 할당 하향 링크 제어 정보(Downlink Control Information)을 해당 PDSCH 수신에 대한 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 지시 정보를 포함하여 전송할 수 있다.

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【0141】 또한, 기지국은 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 통해 상향 링크 제어정보를 수신한다(S510).

【0142】 전술한 바와 같이, 상향 링크 제어정보를 전송을 위한 상향 링크 제어채널 자원 셋은 상향 링크 제어정보의 사이즈에 의해 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정될 수 있다.

【0143】 전술한 바와 같이, 기지국은 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시하는 정보를 포함하는 하향 링크 제어 정보를 단말에 전송할 수 있다.

【0144】 이때, 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원은 단말에 상기 하향 링크 제어정보를 통해 지시될 수 있다.

【0145】 즉, 기지국은 임의의 단말을 위한 PDSCH 전송 별로, 해당 단말을 위해 설정된 단일한 PUCCH 자원 셋을 구성하는 PUCCH 자원들 중 하나의 PUCCH 자원을 선택하거나, 해당 단말을 위해 설정된 복수의 PUCCH 자원 셋들 중 하나의 PUCCH 자원 셋 및 해당 PUCCH 자원 셋을 구성하는 PUCCH 자원들 중 하나의 PUCCH 자원을 선택하여, 이를 하향 링크 할당 하향 링크 제어 정보를 통해 전송함으로써, 해당 단

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말에서 HARQ ACK/NACK 피드백을 위해 사용할 PUCCH 자원을 동적으로 할당하도록 정의할 수 있다.

【0146】본 실시예에서는 이를 위한 구체적인 PUCCH 자원 셋 설정 방법 및 해당 PUCCH 자원 지시(resource indication) 방법을 제안한다.

【0147】먼저 임의의 단말을 위한 상기 PUCCH 자원 셋(들)을 구성하는 한 방법으로서, 단말의 HARQ ACK/NACK 피드백을 위한 단말 별 PUCCH 자원 셋(들)을 구성함에 있어서, 해당 단말을 위해 설정된 상향 링크 대역폭 파트 별로 각각 별도의 자원 셋(들)을 설정하도록 정의할 수 있다.

【0148】예를 들어, 임의의 단말을 위해 도 3a와 같이 N개(N은 1보다 큰 자연수)의 상향 링크 대역폭 파트들이 설정된 경우 해당 단말의 HARQ ACK/NACK 피드백을 위한 PUCCH 자원 지시를 위해 각각의 상향 링크 대역폭 파트 별로 별도의 단일한 혹은 복수의 PUCCH 자원 셋(들)을 설정하여 이를 단말-특정(UE-specific)한 상위 계층 시그널링(higher layer signaling)을 통해 해당 단말에 전송하도록 정의할 수 있다.

【0149】도 3b를 참조하면, 기지국은 해당 단말을 위해 대역폭 파트 #1을 위한 하나의 혹은 복수의 PUCCH resource 셋(들), BWP #2를 위한 또 다른 하나의 혹은 복수의 PUCCH 자원 셋(들),…, BWP #N을 위한 또 다른 하나의 혹은 복수의 PUCCH 자원 셋(들)까지 각각의 대역폭 파트 별로 총 N개의 하나 이상의 PUCCH 자원 셋(들) 그룹을 설정하도록 정의할 수 있다. 예를 들어 도 3b에 도시한 바와 같이, 특정 대역폭 파트, 예를 들어 BWP #2에 포함된 PUCCH 자원 셋들이, 예를 들어 제1

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내지 제4 PUCCH 자원 셋들로 구성될 수 있다.

【0150】 이 경우, 각각의 상향 링크 대역폭 파트 별로 상위 계층 시그널링(higher layer signaling)을 통해 설정된 하나의 혹은 복수의 PUCCH 자원 셋을 구성하는 각각의 PUCCH 자원은 PUCCH 포맷 설정 정보, 해당 상향 링크 대역폭 파트 내의 시간/주파수 도메인 PUCCH 자원 설정 정보(혹은 추가적으로 코드 도메인(code-domain) 자원 설정 정보) 등으로서 정의될 수 있다. 예를 들어 도 3b에 도시한 바와 같이 특정 PUCCH 자원 셋, 예를 들어 제2PUCCH 자원 셋은 제1 내지 제 4 PUCCH 자원들로 구성될 수 있다.

【0151】 단, 임의의 대역폭 파트 내에서 PUCCH 자원 셋을 구성함에 있어서, 특정한 분류(classification) 기반의 PUCCH 자원 셋 구성이 이루어질 경우, 해당 특정 분류 정보가 상기 PUCCH 자원 셋 지시 정보를 대신할 수 있다. 예를 들어, PUCCH 포맷 혹은 PUCCH 지속시간 혹은 PUCCH 페이로드 사이즈 등에 따라 각각 PUCCH 자원 셋이 별도로 구성될 경우, 각각 해당 PUCCH 포맷 정보 혹은 PUCCH 지속시간 정보 혹은 PUCCH 페이로드 사이즈 정보 등이 각각 상기의 PUCCH 자원 셋 지시 정보 대신 사용될 수 있다.

【0152】 즉, 해당 단말에서 전송해야 하는 PUCCH 페이로드 사이즈 즉, 상향 링크 제어 정보의 페이로드 사이즈에 따라 별도의 PUCCH 자원 셋을 구성하도록 정의하고, 단말이 전송해야 하는 상향 링크 제어 정보 페이로드 사이즈에 따라 상기 PUCCH 자원 할당을 위한 PUCCH 자원 셋이 결정되도록 정의할 수 있다. 도 3b에 도시된 바와 같이, 하향 링크 할당 하향 링크 제어 정보를 통해 상기의 PUCCH 자원

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지시 정보(e.g. ARI, ACK/NACK 자원 지시)만이 전송되도록 정의하고, 단말에서 이를 해석하기 위한 PUCCH 자원 셋을 결정함에 있어서, 해당 하향 링크 할당 하향 링크 제어 정보를 통해 할당되는 PUCCH 자원을 통해 해당 단말이 전송해야 하는 상향 링크 제어 정보 페이로드 사이즈(UCI payload size)에 따라 해당 PUCCH 자원 셋이 도출되도록 정의할 수 있다.

【0153】 예를 들어, 상향 링크 제어 정보 페이로드 사이즈를 비트수에 따라 4개의 영역들로 구분하고, 상향 링크 제어 정보의 비트수에 따라 도 3b에 도시한 바와 같이 제1 내지 제4PUCCH 자원 셋들 중 하나가 돌출되도록 정의할 수 있다.

【0154】 도 3c에 도시한 바와 같이, 하향 링크 할당 하향 링크 제어 정보가 PUCCH 자원 지시 정보(PUCCH resource information 또는 PUCCH resource indicator)를 포함할 수 있다. PUCCH 자원 지시 정보는 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시한다. 예를 들어 도 3b에 도시한 바와 같이 상향 링크 제어채널 자원 셋이 제1 내지 제4PUCCH 자원들로 구성된 경우, 도 3c에 도시한 PUCCH 자원 지시 정보는 4개의 PUCCH 자원들 중 하나를 지시할 수 있다.

【0155】 본 실시예에서 이를 위한 구체적인 PUCCH 자원 셋 설정 방법 및 해당 PUCCH 자원 지시(resource indication)는 도 2 내지 도 3c를 참조하여 전술한 다양한 방법들을 적용할 수 있다.

【0156】 도 6은 본 실시예들에 따른 기지국의 구성을 보여주는 도면이다.

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【0157】 도 6을 참조하면, 기지국(600)은 제어부(610)와 송신부(620), 수신부(630)를 포함한다.

【0158】 제어부(610)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어채널 자원을 할당하는 방법에 있어서, 단말을 위해 설정된 상향 링크 대역폭 파트(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 데에 따른 전반적인 제어부(610)의 동작을 제어한다.

【0159】 송신부(620)와 수신부(630)는 전술한 본 발명을 수행하기에 필요한 신호나 메시지, 데이터를 단말과 송수신하는데 사용된다.

【0160】 송신부(620)는 단말에 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 전송한다.

【0161】 상향 링크 제어채널 자원 셋들은 단말을 위해 구성된 상향 링크 대역폭 파트 별로 설정될 수 있다.

【0162】 상향 링크 대역폭 파트는 하향 링크 제어정보를 통해 활성화될 수 있다.

【0163】 수신부(630)는 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 통해 상향 링크 제어정보를 수신한다.

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【0164】 상향 링크 제어정보를 전송을 위한 상기 상향 링크 제어채널 자원 셋은 상향 링크 제어정보의 사이즈에 의해 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정될 수 있다.

【0165】 기지국은 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시하는 정보를 포함하는 하향 링크 제어 정보를 단말에 전송할 수 있다.

【0166】 이때, 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원은 단말에 상기 하향 링크 제어정보를 통해 지시될 수 있다.

【0167】 도 7은 본 실시예들에 따른 단말의 구성을 보여주는 도면이다.

【0168】 도 7을 참조하면, 단말(700)은 수신부(710), 제어부(720) 및 송신부(730)를 포함한다.

【0169】 수신부(710)는 기지국으로부터 하향 링크 제어정보 및 데이터, 메시지를 해당 채널을 통해 수신한다.

【0170】 또한 제어부(720)는 전술한 본 발명을 수행하기에 필요한 차세대/5G 무선 액세스망에서 임의의 단말을 위한 상향 링크 제어채널 자원을 할당하는 방법에 있어서, 단말을 위해 설정된 상향 링크 대역폭 파트(Bandwidth part)별로 별도의 PUCCH 자원 셋을 설정하는 것을 특징으로 하는 데에 따른 전반적인 사용자 단말(700)의 동작을 제어한다.

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【0171】 송신부(730)는 기지국에 상향 링크 제어정보 및 데이터, 메시지를 해당 채널을 통해 전송한다.

【0172】 제어부(720)는 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정하고, 결정된 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 결정한다.

【0173】 상향 링크 제어채널 자원 셋들은 상기 단말을 위해 구성된 상향 링크 대역폭 파트 별로 설정될 수 있다.

【0174】 상기 상향 링크 대역폭 파트는 상기 하향 링크 제어정보를 통해 활성화될 수 있다.

【0175】 제어부(720)는, 상향 링크 제어정보를 전송을 위한 상향 링크 제어채널 자원 셋을 결정할 때 상향 링크 제어정보의 사이즈에 의해 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정할 수 있다.

【0176】 수신부(710)는 기지국으로부터 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 수신한다.

【0177】 수신부(710)는 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시하는 정보를 포함하는 하향 링크 제어 정보를 기지국으로부터 수신한다. 이때 결정된 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채

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널 자원들 중 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원은 기지국으로부터 상기 하향 링크 제어정보를 통해 지시될 수 있다.

【0178】 송신부(730)는 결정된 상향 링크 제어채널 자원을 통해 상기 상향 링크 제어정보를 전송한다.

【0179】 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.

【0180】 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.

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【특허청구범위】

【청구항 1】

단말이 상향 링크 제어정보를 전송하는 방법에 있어서,

기지국으로부터 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 수신하는 단계;

상기 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정하는 단계;

상기 결정된 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 결정하는 단계; 및

상기 결정된 상향 링크 제어채널 자원을 통해 상기 상향 링크 제어정보를 전송하는 단계를 포함하는 방법.

【청구항 2】

제 1항에 있어서,

상기 상향 링크 제어채널 자원 셋들은 상기 단말을 위해 구성된 상향 링크 대역폭 파트 별로 설정되는 것을 특징으로 하는 방법.

【청구항 3】

제2항에 있어서,

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상기 상향 링크 대역폭 파트는 상기 하향 링크 제어정보를 통해 활성화되는 것을 특징으로 하는 방법.

【청구항 4】

제 1항에 있어서,

상기 상향 링크 제어정보를 전송을 위한 상기 상향 링크 제어채널 자원 셋을 결정하는 단계에서,

상기 상향 링크 제어정보의 사이즈에 의해 상기 상향 링크 제어채널 자원 셋들 중 상기 하나의 상향 링크 제어채널 자원 셋을 결정하는 것을 특징으로 하는 방법.

【청구항 5】

제 1항에 있어서,

상기 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시하는 정보를 포함하는 하향 링크 제어 정보를 기지국으로부터 수신하는 단계를 추가로 포함하며,

상기 결정된 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원은 상기

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기지국으로부터 상기 하향 링크 제어정보를 통해 지시되는 것을 특징으로 하는 방법.

【청구항 6】

기지국이 상향 링크 제어정보를 수신하는 방법에 있어서,

단말에 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 전송하는 단계; 및

상기 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 통해 상기 상향 링크 제어정보를 수신하는 단계를 포함하는 방법.

【청구항 7】

제 6항에 있어서,

상기 상향 링크 제어채널 자원 셋들은 상기 단말을 위해 구성된 상향 링크 대역폭 파트 별로 설정되는 것을 특징으로 하는 방법.

【청구항 8】

제7항에 있어서,

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상기 상향 링크 대역폭 파트는 상기 하향 링크 제어정보를 통해 활성화되는 것을 특징으로 하는 방법.

【청구항 9】

제 6항에 있어서,

상기 상향 링크 제어정보를 전송을 위한 상기 상향 링크 제어채널 자원 셋은 상기 상향 링크 제어정보의 사이즈에 의해 상기 상향 링크 제어채널 자원 셋들 중 상기 하나의 상향 링크 제어채널 자원 셋을 결정되는 것을 특징으로 하는 방법.

【청구항 10】

제 6항에 있어서,

상기 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시하는 정보를 포함하는 하향 링크 제어 정보를 상기 단말에 전송하는 단계를 추가로 포함하며,

상기 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원은 상기 단말에 상기 하향 링크 제어정보를 통해 지시되는 것을 특징으로 하는 방법.

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【청구항 11】

상향 링크 제어정보를 전송하는 단말에 있어서,

기지국으로부터 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 수신하는 수신부;

상기 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정하고, 상기 결정된 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 결정하는 제어부; 및

상기 결정된 상향 링크 제어채널 자원을 통해 상기 상향 링크 제어정보를 전송하는 송신부를 포함하는 단말.

【청구항 12】

제 11항에 있어서,

상기 상향 링크 제어채널 자원 셋들은 상기 단말을 위해 구성된 상향 링크 대역폭 파트 별로 설정되는 것을 특징으로 하는 단말.

【청구항 13】

제12항에 있어서,

상기 상향 링크 대역폭 파트는 상기 하향 링크 제어정보를 통해 활성화되는

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것을 특징으로 하는 단말.

【청구항 14】

제 11항에 있어서,

상기 제어부는, 상기 상향 링크 제어정보를 전송을 위한 상기 상향 링크 제어채널 자원 셋을 결정할 때

상기 상향 링크 제어정보의 사이즈에 의해 상기 상향 링크 제어채널 자원 셋들 중 상기 하나의 상향 링크 제어채널 자원 셋을 결정하는 것을 특징으로 하는 단말.

【청구항 15】

제 11항에 있어서,

상기 수신부는, 상기 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시하는 정보를 포함하는 하향 링크 제어 정보를 기지국으로부터 수신하고,

상기 결정된 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원은 상기 기지국으로부터 상기 하향 링크 제어정보를 통해 지시되는 것을 특징으로 하는 단말.

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【청구항 16】

상향 링크 제어정보를 수신하는 기지국에 있어서,

단말에 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 전송하는 송신부; 및

상기 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 통해 상기 상향 링크 제어정보를 수신하는 수신부를 포함하는 기지국.

【청구항 17】

제 16항에 있어서,

상기 상향 링크 제어채널 자원 셋들은 상기 단말을 위해 구성된 상향 링크 대역폭 파트 별로 설정되는 것을 특징으로 하는 기지국.

【청구항 18】

제 17항에 있어서,

상기 상향 링크 대역폭 파트는 상기 하향 링크 제어정보를 통해 활성화되는 것을 특징으로 하는 기지국.

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【청구항 19】

제 16항에 있어서,

상기 상향 링크 제어정보를 전송을 위한 상기 상향 링크 제어채널 자원 셋은 상기 상향 링크 제어정보의 사이즈에 의해 상기 상향 링크 제어채널 자원 셋들 중 상기 하나의 상향 링크 제어채널 자원 셋을 결정되는 것을 특징으로 하는 기지국.

【청구항 20】

제 16항에 있어서,

상기 송신부는, 상기 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원을 지시하는 정보를 포함하는 하향 링크 제어 정보를 상기 단말에 전송하고,

상기 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 상향 링크 제어정보 전송을 위한 하나의 상향 링크 제어채널 자원은 상기 단말에 상기 하향 링크 제어정보를 통해 지시되는 것을 특징으로 하는 기지국.

Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 501 of 595

【요약서】

【요약】

본 실시예들은 차세대/5G 무선 액세스망에서 상향 링크 제어채널 자원 할당 방법에 대한 것으로서, 기지국으로부터 상기 상향 링크 제어정보 전송을 위한 상향 링크 제어채널 자원 셋 구성 정보를 수신하는 단계, 상향 링크 제어채널 자원 셋 구성 정보에 포함된 상향 링크 제어채널 자원 셋들 중 하나의 상향 링크 제어채널 자원 셋을 결정하는 단계, 결정된 하나의 상향 링크 제어채널 자원 셋을 구성하는 상향 링크 제어채널 자원들 중 하나의 상향 링크 제어채널 자원을 결정하는 단계 및 결정된 상향 링크 제어채널 자원을 통해 상기 상향 링크 제어정보를 전송하는 단계를 포함하는 방법 및 그 장치를 제공한다.

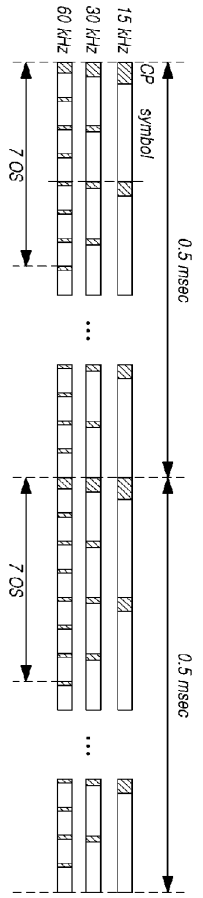
【대표도】

도 4

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Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 502 of 595

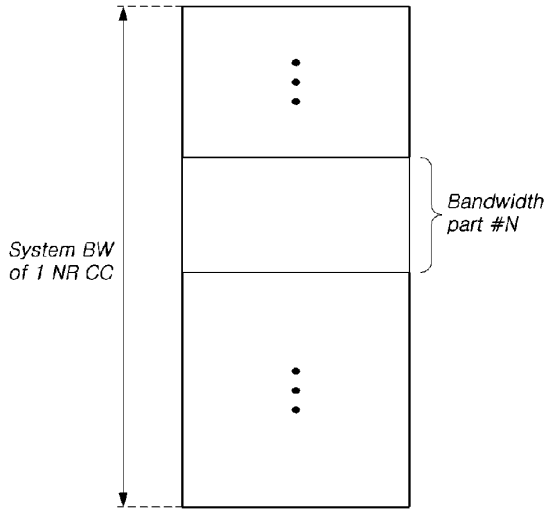
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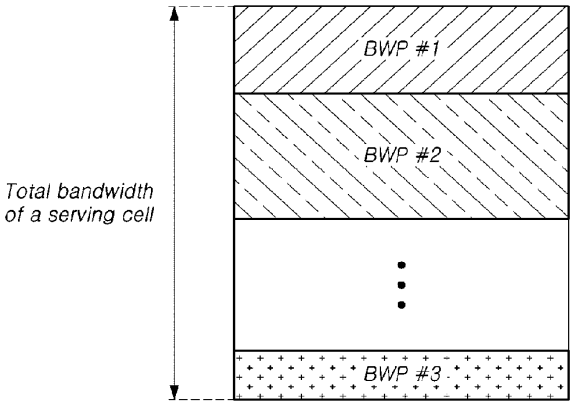


Petitioners' Exhibit 1004
Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 503 of 595

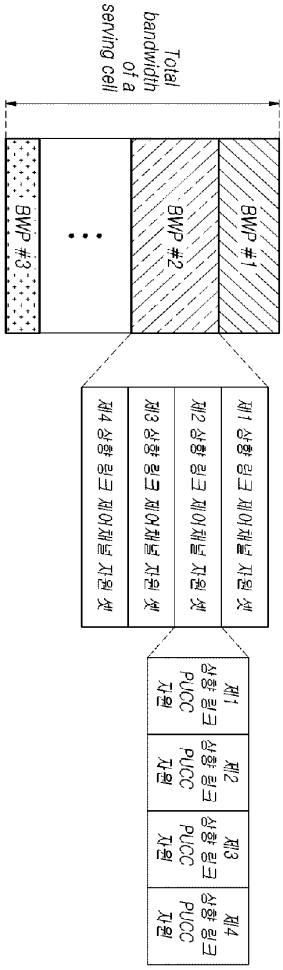
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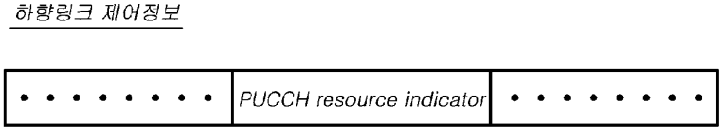

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BWP #3

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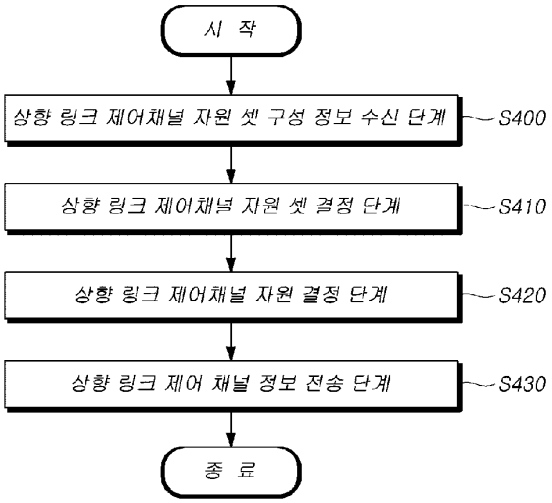


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Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
Page 505 of 595

【도 3c】

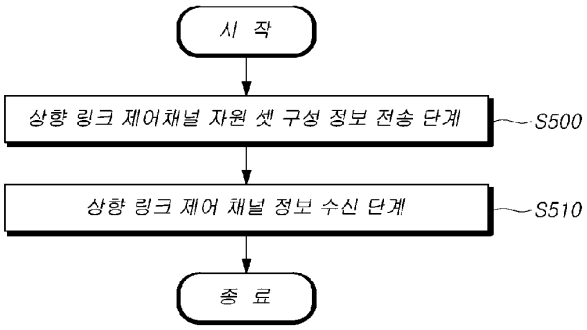


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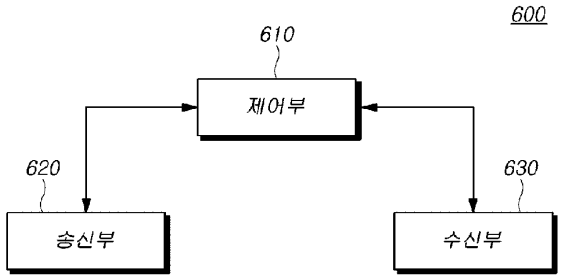


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Case No. IPR2025-00084; U.S. Patent No. 11,219,000
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【도 5】

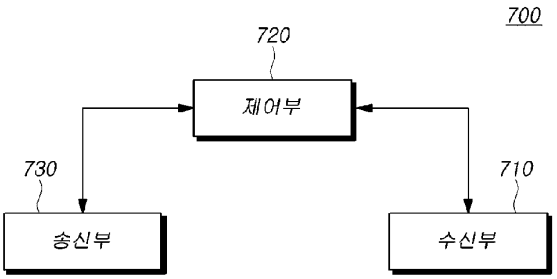


【도 6】



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【도 7】



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Ericsson Inc., et al. v. KT Corporation, et al.
Case No. IPR2025-00084; U.S. Patent No. 11,219,000
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16826482
Filing Date	2020-03-23
First Named Inventor	Kyujin PARK
Art Unit	
Examiner Name	
Attorney Docket Number	811.0206

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	10356761	B2	2019-07-16	Srinivas Yerramalli et al.	

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	1	20180324786	A1	2018-11-08	Kari Hooli et al.	
	2	20190044689	A1	2019-02-07	Candy Yiu et al.	
	3	20180279331	A1	2018-09-27	Kamel M. Shaheen et al.	
	4	20190098580	A1	2019-03-28	Alireza Babaei et al.	
	5	20180279353	A1	2018-09-27	Kamel M. Shaheen et al.	

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	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	811.0206

	6	20180279262	A1	2018-09-27	Alireza Babaei et al.	
	7	20180324678	A1	2018-11-08	Hao Chen et al.	
	8	20180270698	A1	2018-09-20	Alireza Babaei et al.	
	9	20180270700	A1	2018-09-20	Alireza Babaei et al.	
	10	20180279229	A1	2018-09-27	Esmael Dinan et al.	
	11	20190132834	A1	2019-05-02	Zhiyu Yan et al.	
	12	20170289993	A1	2017-10-05	Srinivas Yerramalli et al.	
	13	20190230685	A1	2019-07-25	Hanjun PARK et al.	
	14	20190059112	A1	2019-02-21	Meng-Hui Ou et al.	
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	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	811.0206

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	1	LG ELECTRONICS, "Consideration on PUCCH resource allocation for NR", R1-1715883, 3GPP TSG RAN WG1 Meeting NR#3, Nagoya, Japan, 18th – 21th September 2017	☒
	2	MEDIATEK INC., "Summary of Offline Discussion on Bandwidth Part Operation", R1-1716832, 3GPP TSG RAN WG1 Meeting NR#3, Nagoya, Japan, 18th – 21th September 2017	☒
	3	3GPP TS 36.211 V14.3.0, June 2017, pp. 8-75	☒
	4	U.S. Provisional Application No. 62/502,550 filed on May 5, 2017	☒
	5	U.S. Provisional Application No. 62/564,787 filed on September 28, 2017	☒

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	Application Number	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	811.0206

[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	16826482
	Filing Date	2020-03-23
	First Named Inventor	Kyujin PARK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	811.0206

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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.

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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)	2020-03-23
Name/Print	Ian M. Hughes	Registration Number	41083

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EFS ID:	38936837
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
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:	811.0206
Receipt Date:	23-MAR-2020
Filing Date:	
Time Stamp:	12:10:29
Application Type:	Utility under 35 USC 111(a)

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2	Non Patent Literature	078110206Ref1nonpatent1.pdf	2383236 afcebbf3909f19ad1fc526a9d1ea2fe98a8e8f7f	no	13
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3	Non Patent Literature	078110206Ref2nonpatent2.pdf	1625941 d961f9c172d7f170207b047561718a6a5427ef33	no	7
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Application Number	TBD
Filing Date	March 23, 2020
First Named Inventor	Kyujin PARK
Title	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	811.0206

SIGNATURE of Applicant or Patent Practitioner

Signature	/Ian M. Hughes/	Date	03/23/2020
Name	Ian M. Hughes	Telephone	571-267-7183
Registration Number	41,083		

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

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

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
First Named Inventor/Applicant Name:	Kyujin PARK
Filer:	Kyung Hee Kim/yujin Chun
Attorney Docket Number:	811.0206

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:	38936560
Application Number:	16826482
International Application Number:	
Confirmation Number:	6363
Title of Invention:	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO
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:	811.0206
Receipt Date:	23-MAR-2020
Filing Date:	
Time Stamp:	11:55:53
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	E20203MB56358469
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 1.21 (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	018110206Transmittal1.pdf	236722 8f5aa00bd77513ed7ee8563a5401922f46fc7648	no	2
Warnings:					
Information:					
2		028110206ParentEnglishSpecification.pdf	678384 d82150d0878d91d1f5f504e4ccb1e4cd541058df	yes	54

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	40
Claims	41	44
Abstract	45	45
Drawings-only black and white line drawings	46	54

Warnings:					
Information:					
3	Oath or Declaration filed	038110206ParentExecutedDeclaration.pdf	86010 ea5961135416b37de0f533bca19e8f99ae5dab47	no	1
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	048110206NewADS.pdf	1831838 619893ffed467367aa8eb07eae9df3ca4e58862a	no	8
Warnings:					
Information:					

5	Power of Attorney	058110206PoATransmittal.pdf	191552 b2ee663b67bd303cf57c0a0ceff7d0ef794721c3	no	3
Warnings:					
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Information:					
6	Preliminary Amendment	068110206PreliminaryAmendment.pdf	121844 3149f2a9a56684e88dcefef4a62f57ad805ed3d5	no	5
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	34821 2000ddece2337ed60ed34d04e42346ef8cdc44d1	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	3181171		

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.

Customer No.: 76277 *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Kyujin PARK	Re: Attorney Docket No.: 811.0206
Serial No.:	Group Art Unit:
Filed: 03/23/2020	Examiner:
Matter No.: 811.0206	Conf. No.:

For: APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

PRELIMINARY AMENDMENT

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

Dear Sir:

Prior to examination on the merits, please amend the above-identified application as follows.

Amendments to the Specification begin on page 2.

Amendments to the Claims begin on page 3.

Remarks begin on page 5.

AMENDMENTS TO THE SPECIFICATION

In the Specification

Please **AMEND** the following paragraph under the title of the invention on page 1 as follows.

-- CROSS-REFERENCE TO RELATED APPLICATION

~~This application claims the priority benefit of Korean Patent Application No. 10-2017-0128188, filed on September 29, 2017, No. 10-2017-0162728, filed on November 30, 2017 and No. 10-2018-0077270, filed on July 03, 2018 in the Korean Intellectual Property Office, the disclosures of which are incorporated herein by reference in their entirety.~~ The present application is a divisional of pending U.S. Patent Application No. 16/147,530 (filed on September 28, 2018), which claims priority under 35 U.S.C. §119 to Korean Patent Application Nos. 10-2017-0128188 (filed on September 29, 2017), 10-2017-0162728 (filed on November 30, 2017) and 10-2018-0077270 (filed on July 3, 2018), which are hereby incorporated by reference in their entirety.--

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AMENDMENTS TO THE CLAIMS

1-15. **(Canceled)**

16. **(New)** A method of transmitting uplink (UL) control information by a user equipment, the method comprising:

receiving, from a base station, UL control channel resource set configuration information for UL control information transmission;

determining one of UL control channel resource sets contained in the UL control channel resource set configuration information;

determining one of UL control channel resources contained in the determined UL control channel resource set; and

transmitting UL control information through the determined UL control channel resource,

wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

17. **(New)** The method according to claim 16, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.

18. **(New)** The method according to claim 17, wherein the each UL BWP is activated through DL control information.

19. **(New)** The method according to claim 16, further comprising receiving, from the base station, downlink (DL) control information containing information indicating the one of the UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated from the base station through the DL control information.

20. **(New)** A method of receiving uplink (UL) control information by a base station, the method comprising:

transmitting UL control channel resource set configuration information for transmitting UL control information to a user equipment; and

receiving the UL control information through one of UL control channel resources configuring one of UL control channel resource sets contained in UL control channel resource set configuration information,

wherein the one of the UL control channel resource sets for the UL control information transmission is determined based on a size of the UL control information.

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Case No. IPR2025-00084; U.S. Patent No. 11,219,000
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21. **(New)** The method according to claim 20, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.

22. **(New)** The method according to claim 21, wherein the each UL BWP is activated through downlink (DL) control information.

23. **(New)** The method according to claim 20, further comprising transmitting, to the user equipment, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated to the user equipment through the DL control information.

24. **(New)** A user equipment for transmitting uplink (UL) control information, comprising:

a receiver configured to receive, from a base station, UL control channel resource set configuration information for UL control information transmission;

a controller configured to determine one of UL control channel resource sets contained in the UL control channel resource set configuration information, and determine one of UL control channel resources configuring the determined one UL control channel resource set; and

a transmitter configured to transmit the UL control information through the determined UL control channel resource,

wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

25. **(New)** The user equipment according to claim 24, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.

26. **(New)** The user equipment according to claim 25, wherein the each UL BWP is activated through downlink (DL) control information.

27. **(New)** The user equipment according to claim 24, wherein the receiver receives, from the base station, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated from the base station through the DL control information.

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Case No. IPR2025-00084; U.S. Patent No. 11,219,000
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REMARKS

Claims 1-15 were previously pending in the application. By this amendment, the specification is amended to claim priority, claims 1-15 are cancelled without prejudice or disclaimer and claims 16-27 are added. Assuming the entry of this amendment, claims 16-27 are now pending in the application. Applicant respectfully submits that no new matter is added and the support for the amendments may be found throughout the specification as originally filed.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided. Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully submitted,

Date: 23 March 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)

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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.	811.0206
First Named Inventor	Kyujin PARK
Title	Apparatus and Method of Uplink Control...
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* 45] 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* 9]
6. **Inventor's Oath or Declaration** [*Total Pages* 1] *(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	03/23/2020
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.**

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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.
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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.

APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Korean Patent Application No. 10-2017-0128188, filed on September 29, 2017, No. 10-2017-0162728, filed on November 30, 2017 and No. 10-2018-0077270, filed on July 03, 2018 in the Korean Intellectual Property Office, the disclosures of which are incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present disclosure relates to a method of allocating an uplink control channel resource in a next-generation/5G radio access network (hereinafter, referred to as a new radio (NR)).

2. DESCRIPTION OF THE RELATED ART

Recently, the 3rd generation partnership project (3GPP) has approved the "Study on New Radio Access Technology", which is a study item for research on next-generation/5G radio access technology. On the basis of the Study on New Radio Access Technology, Radio Access Network Working Group 1 (RAN WG1) has been discussing frame structures, channel coding and modulation, waveforms, multiple access methods, and the like for a new radio (NR). It is required to design the NR not only to provide an improved data transmission rate as compared with the long term evolution (LTE)/LTE-Advanced, but also to meet various requirements in detailed and specific usage scenarios.

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An enhanced mobile broadband (eMBB), massive machine-type communication (mMTC), and ultra reliable and low latency communication (URLLC) are proposed as representative usage scenarios of the NR. In order to meet the requirements of the individual scenarios, it is required to design NR to have flexible frame structures, compared with the LTE/LTE-Advanced.

In particular, there is a need to develop a method for enabling a user device to transmit an uplink channel, such as an uplink control channel and an uplink data channel, to a base station based on a bandwidth part (BWP) when the user device uses various BWPs in NR.

SUMMARY OF THE INVENTION

An object of the present disclosure is to provide an apparatus and method of preventing ambiguity between indication and interpretation of an uplink control channel transceiving resource of a base station and a user equipment, resulted from uplink bandwidth part (hereinafter, referred to as BWP) switching in the NR.

In accordance with an aspect of the present disclosure, a method of a user equipment is provided for transmitting uplink control information. The method may include receiving uplink control channel resource set configuration information for the transmission of the uplink control information from a base station, determining one of uplink control channel resource sets contained in the uplink control channel resource set configuration information, determining one of uplink control channel resources configuring the determined uplink control channel resource set, and transmitting the uplink control information through the determined uplink control channel resource.

In accordance with a further aspect of the present disclosure, a method of a base

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Case No. IPR2025-00084; U.S. Patent No. 11,219,000
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station may be provided for receiving uplink control information. The method may include transmitting uplink control channel resource set configuration information for the transmission of the uplink control information to a user equipment, and receiving the uplink control information through one of uplink control channel resources configuring one of uplink control channel resource sets contained in the uplink control channel resource set configuration information.

In accordance with another aspect of the present disclosure, a user equipment may be provided for transmitting uplink control information. Theuser equipment may include a receiver configured to receive uplink control channel resource set configuration information for the transmission of the uplink control information from a base station, a controller configured to determine one of uplink control channel resource sets contained in the uplink control channel resource set configuration information and determine one of uplink control channel resources configuring the determined uplink control channel resource set, and a transmitter configured to transmit the uplink control information through the determined uplink control channel resource.

In accordance with a further aspect of the present disclosure, a base station may be provided for receiving uplink control information. The base station may include a transmitter configured to transmit uplink control channel resource set configuration information for the transmission of the uplink control information to a user equipment, and a receiver configured to receive the uplink control information through one of uplink control channel resources configuring one of uplink control channel resource sets contained in the uplink control channel resource set configuration information.

In accordance with yet another aspect of the present disclosure, it may prevent

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ambiguity between indication and interpretation of an uplink control channel transceiving resource of a base station and a user equipment, resulted from UL BWP switching in the NR.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the disclosure and are incorporated in and constitute a part of the disclosure, illustrate aspects of the disclosure and together with the description serve to explain the principle of the disclosure.

FIG. 1 is a diagram illustrating arrangements of orthogonal frequency division multiple (OFDM) symbols in case of using different subcarrier spacings from each other according to embodiments of the present disclosure;

FIG. 2 is a conceptual view of a bandwidth part (BWP) according t embodiments of the present disclosure;

FIG. 3A is a diagram illustrating an example of configuring N BWPs in one serving cell for an user equipment;

FIG. 3B is a diagram illustrating i) PUCCH resource sets configuring each of N BWPs and ii) PUCCH resources configuring each PUCCH resource set;

FIG. 3C is a diagram illustrating downlink control information including PUCCH resource indication information;

FIG. 4 is a flowchart illustrating a method of a user equipment for transmitting uplink control information according to embodiments of the present disclosure;

FIG. 5 is a flowchart illustrating a method of a base station for receiving uplink control information according to embodiments of the present disclosure;

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FIG. 6 is a diagram illustrating a base station according to embodiments of the present disclosure; and

FIG. 7 is a diagram illustrating a user equipment according to embodiments of the present disclosure.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODYMENTS

Hereinafter, the present preferred embodiments of the disclosure will be described in detail with reference to the accompanying drawings. In denoting elements of the drawings by reference numerals, the same elements will be referenced by the same reference numerals although the elements are illustrated in different drawings. In the following description of the disclosure, detailed description of known functions and configurations incorporated herein may be omitted when it may make the subject matter of the disclosure rather unclear.

In the present disclosure, a wireless communication system refers to a system for providing various communication services such as a voice communication service, a packet data service, etc. The wireless communication system includes a user equipment (UE) and a base station (BS).

In the present disclosure, the UE is defined as a generic term including devices using in wireless communication, such as a UE supporting wideband code division multiple access (WCDMA), long term evolution (LTE), high speed packet access (HSPA), international mobile telecommunications (IMT)-2020 (5G or new radio), or the like, or a mobile station (MS) supporting a global system for mobile communications (GSM), a user terminal (UT), a subscriber station (SS), a wireless device, or the like.

The BS or a cell generally refers to a station communicating with the UE. The BS or cell of the present disclosure is defined as a generic term including, but not limited to, all

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of various coverage areas such as a Node-B, an evolved Node-B (eNB), a gNode-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 transmitting point, a receiving point, or a transceiving point), a relay node, a megacell, a macrocell, a microcell, a picocell, a femtocell, a remote radio head (RRH), a radio unit (RU), and a small cell.

The BS provides radio coverage and is necessary in each of the above-described various cells. The BS may be classified into two categories. 1) The BS may be an apparatus that covers a megacell, a macrocell, a microcell, a picocell, a femtocell, and a small cell, in association with a wireless area, or 2) the BS may indicate a radio coverage area itself. In case of 1), the BS may be apparatuses providing any radio coverage area and controlled by an identical entity, or apparatuses interacting with each other to cooperatively establish the radio coverage area. According to a method of establishing the radio coverage area, the BS may be a point, a transmission/reception point, a transmission point, a reception point, or the like. In case of 2), the BS may be a radio coverage area itself to transmit or receive a signal from a UE or neighboring BS perspective.

The cell of the present disclosure may refer to a coverage of a signal transmitted from a transmission point or a transmission/reception point, a component carrier having the coverage of the signal transmitted from the transmission point or the transmission/reception point, or the transmission/reception point itself.

The user equipment and the BS of the present disclosure are entities of performing uplink and downlink communications used to embody the technology and technical conceptions described in the present disclosure. The user equipment and the BS are defined as a generic term and not limited to a specific term or word.

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The uplink (UL) refers to data transmission and reception from a user equipment to a base station, and the downlink (DL) refers to data transmission and reception from a base station to a user equipment.

The uplink/downlink transmission may be performed using one of i) a time division duplex (TDD) technique that performs transmission by the allocation of different time slots, ii) a frequency division duplex (FDD) technique that performs transmission by the allocation of different frequencies, and iii) both the frequency division duplex (FDD) and the time division duplex (TDD).

Furthermore, according to the related standard, the UL/DL is configured based on a signal carrier or a pair of carriers in the wireless communication system.

UL/DL may transmit control information through a control channel of an uplink or downlink channel, such as a physical DL control channel (PDCCH), a physical UL control channel (PUCCH), and the like. Further, UL/DL may transmit data through a data channel of the uplink or downlink channel, such as a physical DL shared channel (PDSCH), a physical UL shared channel (PUSCH), and the like.

The DL may refer to communication or a communication path from multiple transmission/reception points to a device, or the UL may refer to communication or a communication path from the device to the multiple transmission/reception points. In the DL, a transmitter may be a part of multiple transmission/reception points and a receiver may be a part of the device. In the UL, a transmitter may be a part of the device and a receiver may be a part of multiple transmission/reception points.

Hereinafter, transmission and reception of a signal through a channel such as the PUCCH, the PUSCH, the PDCCH, or the PDSCH, may be described as the transmission and

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reception of the PUCCH, the PUSCH, the PDCCH, or the PDSCH.

Meanwhile, higher layer signaling includes radio resource control (RRC) signaling for transmitting RRC information containing an RRC parameter.

The BS performs a DL transmission to a UE. The BS may transmit i) downlink control information that includes information on scheduling for receiving a physical DL data channel which is a primary channel for unicast transmission and ii) a physical DL control channel for transmitting DL control information which is for transmitting scheduling approval information for transmission on an UL data channel. Hereinafter, transmission and reception of a signal through each channel may be described as transmission and reception of a corresponding channel.

Any of multiple access techniques may be applied to wireless communication systems of the present disclosure, and therefore no limitation is imposed on them. The multiple access techniques that can be used in wireless communication systems of the present disclosure may include 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, OFDM-CDMA, or the like. The NOMA includes sparse code multiple access (SCMA), low cost spreading (LDS), and the like.

Embodiments according to the present disclosure may be applicable to resource allocation in an asynchronous wireless communication evolving into LTE/LTE-advanced and IMT-2020 from GSM, WCDMA, and HSPA. Furthermore, the embodiments may be applicable to resource allocation in a synchronous wireless communication evolving into CDMA, CDMA-2000, and UMB.

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A machine type communication (MTC) device of the present disclosure may refer to a device that is low cost (or low complexity), a user equipment that supports coverage enhancement, or the like. The MTC device of the present disclosure may refer to a device defined as a predetermined category for supporting low costs (or low complexity) and/or coverage enhancement.

In other words, the MTC device of the present disclosure may refer to a low cost (or low complexity) device category/type newly defined in 3GPP Release-13 and performing LTE-based MTC related operations. The MTC device of the present disclosure may refer to a device category/type that is defined in or before 3GPP Release-12 that supports enhanced coverage in comparison with the typical LTE coverage or supports low power consumption, or may refer to a low cost (or low complexity) device category/type newly defined in Release-13. The MTC device may refer to a further enhanced MTC device defined in Release-14.

A narrowband Internet of Things (NB-IoT) device of the present disclosure refers to a device supporting radio access for cellular IoT. NB-IoT technology is aimed at indoor coverage improvement, support for large-scale low-speed devices, low latency sensitivity, very low device costs, low power consumption, and optimized network architecture.

An enhanced mobile broadband (eMBB), massive machine-type communication (mMTC), and ultra reliable and low latency communication (URLLC) are proposed as representative usage scenarios for NR having been discussed in the 3GPP recently.

A frequency, a frame, a subframe, a resource, a resource block (RB), a region, a band, a sub-band, a control channel, a data channel, a synchronization signal, various reference signals, various signals, and various messages associated with NR of the present disclosure

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may be interpreted as being used in the past or present or as various meanings to be used in the future.

NR (New Radio)

Recently, the 3GPP has approved the "Study on New Radio Access Technology", which is a study item for research on next-generation/5G radio access technology. On the basis of such a study item, the 3GPP have started discussions about frame structure, channel coding & modulation, waveform, multiple access scheme, etc.

It is required to design the NR not only to provide a data transmission rate enhanced as compared with that of LTE/LTE-Advanced, but also to meet various requirements for detailed and specific usage scenarios. In particular, an eMBB, mMTC, and URLLC have been discussed as representative usage scenarios of the NR, and it has been required to design more flexible frame structures as compared with those for LTE/LTE-Advanced in order to meet the requirements of each usage scenario.

Specifically, the eMBB, mMTC, URLLC are considered as representative usage scenarios of the NR. Since each usage scenario imposes a different requirement of data rates, latency, coverage, etc., many discussions have conducted for a technique of efficiently multiplexing radio resource units based on different types of numerology (e.g., a subcarrier spacing (SCS), a subframe, a transmission time interval (TTI), etc.) in order to efficiently satisfy requirements according to usage scenarios through a frequency band of any NR system.

To this end, there also have been many discussions conducted for developing i) a technique of multiplexing numerology having different SCS values based on TDM, FDM or TDM/FDM through one NR carrier and ii) a technique of supporting one or more time units

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in configuring scheduling units in a time domain.

In this regard, in the NR, a subframe has been defined as one type of time domain structure. As reference numerology to define a subframe duration, a single subframe duration is defined as having 14 OFDM symbols of 15 kHz SCS-based normal CP overhead, like the LTE. Therefore, the subframe in the NR may have a time duration of 1 ms. Unlike the LTE, since the subframe of the NR is an absolute reference time duration, a slot and a mini-slot may be defined as a time unit used for an actual UL/DL data scheduling. In this case, the number of OFDM symbols constituting a corresponding slot, a value of y, has been defined as y = 14 regardless of the numerology, but not limited thereto.

Therefore, any slot may have 14 symbols. In accordance with a transmission direction for a slot, all of the symbols may be used for DL transmission or UL transmission, or the symbols may be used in the configuration of a DL portion + a gap + a UL portion.

Further, a mini-slot having fewer symbols than the slot has been defined in any numerologies (or SCS), and, as a result, a short time domain scheduling interval for the transmission and reception of UL/DL data may be configured based on the mini-slot. Also, a long time domain scheduling interval for the transmission and reception of UL/DL data may be configured by slot aggregation.

In particular, in case of transmission and reception of latency-critical data, such as Ultra-reliable low-latency communication (URLLC), when scheduling is performed on a slot basis according to 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 having fewer OFDM symbols than the slot may be defined so that scheduling for latency-critical data, such as the URLLC,

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may be performed based on the mini-slot.

Further, as described above, there has been discussions on a technique of scheduling data in accordance with latency requirements based on the length of the slot (or mini-slot) defined in each numerology, by multiplexing and supporting the numerologies using the TDM or FDM technique, which have different SCS values within one NR carrier. For example, as illustrated in FIG. 1, the length of a symbol for 60 kHz SCS is shortened by a fourth of that for 15 kHz SCS, and thus a 60 kHz-based slot is shortened to have a length of about 0.125 ms as compared with a 15 kHz-based slot having a length of 0.5 ms under the same condition that seven OFDM symbols constitute one slot.

As described above, techniques of satisfying each requirement of URLLC and eMBB has been discussed by defining different SCSs or different TTI lengths in the NR.

Wider bandwidth operations

A typical LTE system supports a scalable bandwidth operation for an LTE component carrier (CC). An LTE service provider may use a bandwidth of at least 1.4 MHz up to 20 MHz according to a frequency deployment scenario when configuring one LTE CC. Accordingly, an LTE UE supports transmission/reception capabilities of 20 MHz bandwidth for one LTE CC.

However, the NR has been designed to support UEs each having different transmission/reception bandwidth capability from another in one broadband NR component carrier. Accordingly, as illustrated in FIG. 2, it is required to configure one or more bandwidth parts (BWPs) constituting bandwidths obtained by subdividing an NR CC and to support a wider and flexible bandwidth operation by configuring and activating different BWPs from each other to each UE.

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Specifically, in the NR, one or more BWPs may be configured through one serving cell from a view of a UE. The UE may transmit and/or receive UP/DL data by activating one DL BWP and one UP BWP, in the serving cell. Furthermore, in a case where the UE are connected to a plurality of serving cells(e.g., when the UE performs carrier aggregation (CA)) , the UE may transmit and/or receive UP/DL data by activating one DL BWP and/or one UL BWP for each serving cell and using a radio resource of each serving cell.

Specifically, an initial bandwidth part (BWP) may be defined for an initial access procedure in any serving cell, and one or more UE-specific BWPs may be configured through RRC signaling dedicated for each UE, and a default bandwidth part (BWP) may be defined for a fallback operation for each UE.

It is possible to define A plurality of downlink and/or uplink BWPs to be simultaneously activated and used according to the configurations of BWPs and the capability of a UE in any serving cell. However, the NR rel-15 defines that only one DL BWP and one UL BWP are activated and used in an UE at any time.

NR PUCCH

In the typical LTE system, a PUCCH is transmitted on a single subframe basis, where the PUCCH is an UL control channel for the transmission of uplink control information (UCI) by a UE. That is, one PUCCH is transmitted through 14 SC-FDMA symbols constituting one subframe in a time domain. In a case where the last symbol is used for an SRS transmission, the PUCCH is transmitted through 13 symbols except for the last symbol.

Furthermore, different PUCCH formats are defined according to payload sizes of UL control information. For example, the different PUCCH formats are defined as follows: i)

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PUCCH format 1/1a/1b is used to transmit UL control information of one or two bits (e.g., a scheduling request (SR) and a HARQ ACK); ii) PUCCH format 2a/2b is used to transmit an UL control information having a moderate payload size (e.g., CQI/CSI feedback); and PUCCH format 3 or more is used to transmit the feedback of the UL control information having a large payload size when carrier aggregation (CA) is used.

However, the NR defines a PUCCH structure to have various durations in a slot having 14 symbols. For example, the NR defines a long duration PUCCH and a short duration PUCCH according to the number of symbols required to transmit a single PUCCH, N values, in a single slot for the transmission of uplink control information (UCI) by a UE. For the UE to transmit the UCI, the NR defines two types of PUCCHs which are i) a short duration PUCCH transmitted using one to two symbols and ii) a long duration PUCCH transmitted using four to fourteen symbols in a single slot.

Hereinafter, the short and long duration PUCCHs may be refer to as short and long PUCCHs respectively. That is, the short duration PUCCH may be transmitted using one or two symbols, and the long duration PUCCH may be transmitted using four to fourteen symbols in one symbol.

Furthermore, similar to the typical LTE, the NR defines different PUCCH formats according to payload sizes of uplink control information for each of the long duration PUCCH and the short duration PUCCH. For example, for the short duration PUCCH, the NR defines i) a PUCCH format for the transmission of UL control information with a payload size of up to two bits and ii) a PUCCH format for the transmission of UL control information with a payload size exceeding 2 bits. Furthermore, for the long duration PUCCH, the NR defines i) a PUCCH format for the transmission of UL control information

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with a payload size of up to two bits and ii) a PUCCH format for the transmission of UL control information with a payload size exceeding 2 bits.

As described, for defining a PUCCH structure to transmit UL control information in the NR, it may be required to define a PUCCH duration and a PUCCH format.

In accordance with an embodiment of the present disclosure, a method may be provided for allocating a PUCCH resource for HARQ ACK/NACK feedback or aperiodic CSI reporting by a UE in the NR. In some embodiments of the present disclosure, the PUCCH resource allocation method is described as being applied for HARQ ACK/NACK feedback and aperiodic CSI reporting by a UE, but it is not limited thereto. For example, the PUCCH resource allocation method according to embodiments may be applied for a service request (SR) or periodic CSI reporting.

As described above, in the NR, one or more BWPs may be configured through one serving cell from a UE perspective. For example, at least one DL BWP and at least one UL BWP may be configured according to a transmission direction supported by the serving cell that usesunpaired spectrum (i.e. TDD) or paired spectrum (i.e. FDD),.

The NR defines a BS to activate and use only one DL BWP and one UL BWP at a predetermined time for each UE in order for transmitting and receiving each of DL/UL radio channel and signal (e.g. PDCCH/PDSCH, PUSCH/PUCCH etc.) When the serving cell is a DL-only cell or an UL-only cell, the serving cell may activate and use only one or more DL BWPs or only one or more UL BWPs.

Accordingly, in a UE perspective, one or more UL BWPs and/or DL BWPs may be independently provided and activated for a secondary cell (Scell) configured for carrier aggregation, in addition to a primary cell (Pcell) to which the UE is connected first.

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As described, when one or more BWPs are configured in an serving cell of an UE, the UE can activate and use one BWP at any time.

Specifically, for a DL transmission and/or reception, the serving cell activates and uses one DL BWP in any DL subframe/slot/mini-slot of one or more DL BWPs configured for a corresponding UE. Likewise, for an UL transmission and/or reception, the serving cell activates and uses one UL BWP in any UL subframe/slot/mini-slot of one or more UL BWPs configured for the UE.

Activation/deactivation indications of the DL BWP and the UL BWP to an UE may be performed through DL control information (DCI) transmitted through a PDCCH. For example, the activation/deactivation of the DL BWP may be performed through DL assignment DL control information containing resource allocation information on a PDSCH. Furthermore, the activation/deactivation of the UL BWP may be performed through anUL grant containing resource allocation information on a PUSCH.

For example, a UE may receive, from a BS, BWP configuration information on one or more BWP sets constituted by one or more BWPs configured for the UE. Next, the UE may receive, from the BS, DL control information containing information that indicates one of one or more BWPs contained in the one or more BWP sets configured by the BWP configuration information. The UE may receive the PDSCH or transmit the PUSCH or PUCCH through the one BWP indicated in the DL control information.

At this time, the BWP configuration information may be receive from the BS through high layer signaling, such as RRC signaling.

In accordance with an embodiment of the present disclosure, provided are a PUCCH resource allocation method considering a UE-specific BWP based operation and detailed

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operations of a UE and a BE related thereto. In particular, in connection with the activation/deactivation of the UL BWP, provided is a specific method of allocating a PUCCH resource to prevent ambiguity between indication and interpretation of a PUCCH transceiving resource of a BS and a UE, resulted from UL BWP switching.

In the NR, a BS/network may configure a single PUCCH resource set configured by one or more PUCCH resources for HARQ ACK/NACK feedback or a plurality of PUCCH resource sets, each of which is configured by one or more PUCCH resources, for each UE, and then transmit the configured one or more PUCCH resource sets to each UE through UE-specific higher layer signaling.

As described, when one or multiple PUCCH resource sets are configured for an UE through the UE-specific higher layer signaling, the BS may include PUCCH resource indication information as HARQ ACK/NACK feedback in response to a PDSCH reception at a corresponding UE in DL allocation DL control information and transmit the DL allocation DL control information containing the PUCCH resource indication information when transmitting PDSCH scheduling control information for the UE through a PDCCH,.

That is, for each PDSCH transmission for an UE, the BS selects i) one of i) PUCCH resources configuring a single PUCCH resource set configured for the UE or ii) one of PUCCH resources configuring one of multiple PUCCH resource sets and a PUCCH resource set. Then, the BS transmits the selected one PUCCH resource through DL allocation DL control information. Accordingly, the UE may be defined to dynamically allocate a PUCCH resource to be used for HARQ ACK/NACK feedback.

In accordance with an embodiment of the present disclosure, proposed are a method of configuring a PUCCH resource set and a method of indicating the corresponding PUCCH

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resource.

As a method of configuring one or more PUCCH resource sets for an UE, in configuring one or more PUCCH resource sets for each UE for HARQ ACK/NACK feedback of the UE, it may be defined that one or more separate resource sets are configured for each UL BWP configured for the UE.

For example, as illustrated in FIG. 3A, when N (e.g, N is a natural number greater than 1) UL BWPs for any UE are configured, it may be defined that separate one or multiple PUCCH resource sets are configured for each UL BWP to indicate a PUCCH resource for HARQ ACK/NACK feedback of the UE and then transmitted to the UE through UE-specific higher layer signaling. Although FIG. 3A shows that overlapping between the BWPs in each frequency axis does not occur, one or more BWPs may be configured to overlap with another BWP partially or fully in any frequency axis. However, the present embodiment is not limited to a specific UL BWP configuration.

Referring to FIG. 3B, the BS may configure total N groups of one or multiple PUCCH resource sets per each BWP for a UE, for example, from one or multiple PUCCH resource sets for a BWP #1, one or multiple PUCCH resource sets for a BWP #2,…, up to one or multiple PUCCH resource sets for a BWP #N, where N is an integer number equal to and greater than 1. For example, as illustrated in FIG. 3B, the BWP #2 including one or multiple PUCCH resource sets may be formed of a first to fourth PUCCH resource sets.

As described, each PUCCH resource includes one or multiple PUCCH resource sets configured for each UL BWP through higher layer signaling. Such each PUCCH resource may be defined as PUCCH format configuration information, time/frequency domain PUCCH resource configuration information (or additionally code domain resource

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configuration information) in the UL BWP, or the like. For example, as illustrated in FIG. 3B, a specific PUCCH resource set, such as a second PUCCH resource set, may be configured by a first to fourth PUCCH resources.

As described above, when one or multiple PUCCH resource sets configure each BWP through the higher layer signaling, in configuring an area of PUCCH resource indication information through the DL allocation DL control information, the BS may incluide explicitly UL BWP indication information for the transmission of a PUCCH therein.

For example, the PUCCH resource indication information through the DL allocation DL control information may include UL BWP indication information (e.g. BWP index information) + PUCCH resource set indication information (e.g. PUCCH resource set index information) in the corresponding UL BWP + PUCCH resource indication information (e.g. a PUCCH resource index in the PUCCH resource set) to be used by the UE for HARQ ACK/NACK feedback of PUCCH resources configuring the corresponding PUCCH resource set.

In this regard, when a BWP is configured with specific classes of PUCCH resource sets , the PUCCH resource set indication information may be replaced by the specific classification information. For example, when a separate PUCCH resource set is configured for each of a PUCCH format, the PUCCH resource set indication information may include a PUCCH duration, a PUCCH payload size, and the like, each of the corresponding PUCCH format information, PUCCH duration information, PUCCH payload size information, and the like.

For example, as described above, when a PUCCH resource set is configured through

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RRC signaling, a separate PUCCH resource set for each PUCCH format may be configured, and the PUCCH format indication information for the HARQ ACK/NACK feedback of the UE may be transmitted through the DL allocation DL control information, and thus a resource set for PUCCH resource allocation of the UE may be derived.

For another example, a separate PUCCH resource set may be configured according to a PUCCH payload size to be transmitted by the UE, i.e. the payload size of UL control information, and the PUCCH resource set for the PUCCH resource allocation may be determined according to the UL control information payload size to be transmitted by the UE. As illustrated in FIG. 3B, only the PUCCH resource indication information (e.g. an ACK/NACK resource indication (ARI)) may be transmitted through DL allocation DL control information, and, when the UE determines one or more PUCCH resource sets to interpret it, derived may be a corresponding PUCCH resource set according to an UL control information payload size (UCI payload size) to be transmitted by the UE through a PUCCH resource allocated through the corresponding DL allocation DL control.

For example, the UL control information payload size may be divided into four areas according to the number of bits, and one of a first to fourth PUCCH resource sets may be derived according to the number of bits of the UL control information, as illustrated in FIG. 3B.

As illustrated in FIG. 3C, DL allocation DL control information may contain PUCCH resource indication information (PUCCH resource information or a PUCCH resource indicator). The PUCCH resource indication information indicates one UL control channel resource, for the transmission of UL control information, of UL control channel resources configuring an UL control channel resource set. For example, as

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illustrated in FIG. 3B, in a case where the UL control channel resource set is formed of the first to fourth PUCCH resources, PUCCH resource indication information illustrated in FIG. 3C may indicate one of the four PUCCH resources.

The PUCCH resource set information (or including indication information according to the classification of the PUCCH) and the PUCCH resource index information in the corresponding PUCCH resource set may be encoded in a joint coding scheme and transmitted or received through one information area. The information related to the PUCCH resource set indication may be required only in a case that supports to configure a plurality of PUCCH resource sets in one UL BWP, and when the configuration of only one UCCH resource set per one UL BWP is supported, the PUCCH resource set indication information may be excluded.

As described, when the UL BWP indication information for the transmission of the PUCCH is included in the DL allocation DL control information, the UL BWP indication information may be additionally used as UL BWP activation information of the UE and UL BWP switching indication information resulted therefrom.

For example, the UE may perform UL BWP switching, according to the UL BWP indication information, after a predetermined slot, for example, k slots, from a slot to receive the UE the DL allocation DL control information. In this case, the UL BWP switching means an operation of deactivating a currently-active UL BWP and activating a new UL BWP according to the indication information.

Furthermore, the UE may perform the UL BWP switching (that is, an operation of deactivating a currently-active UL BWP and activating a new UL BWP according to the indication information) according to UL BWP indication information before a

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predetermined slot, for example, j slots, from a PUCCH transmission slot. In this case, the k value or the j value is an arbitrary integer value of 0 or more and has a certain fixed value. The k value or the j value may be configured by a BS and transmitted through higher layer signaling, or the k value or the j value may be determined according to the capability of the UE. When the UL BWP indication information indicates a currently-active UL BWP, the UE does not perform the operation of the UL BWP switching.

As another method of configuring a PUCCH resource indication information area through DL allocation DL control information, the UL BWP may be determined implicitly. As a result, the PUCCH resource indication information of the DL allocation DL control information may be configured by a PUCCH resource set indication information + PUCCH resource indication information, to be used for HARQ ACK/NACK feedback by the UE, of PUCCH resources configuring the PUCCH resource set, except for the UL BWP indication information.

The PUCCH resource set indication information + the PUCCH resource indication information, to be used for HARQ ACK/NACK feedback by the UE, of PUCCH resources configuring the PUCCH resource set may be configured in the same manner as described above. In a case where the UL BWP is determined implicitly as described above, an UL BWP for the PUCCH transmission may be determined as an active UL BWP of the corresponding UE in a slot for the transmission of the DL allocation DL control information.

As another method of implicitly determining an UL BWP, an UL BWP for the transmission of the PUCCH may be determined as an active UL BWP in a time point to transmit the PUCCH of the corresponding UE, that is, a slot through which the PUCCH is transmitted (or in a case where the PUCCH is transmitted through a plurality of slots, a slot

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through which the transmission of the PUCCH is started.) As another method of implicitly determining an UL BWP for the PUCCH transmission, UL BWPs associated with each other for the PUCCH transmission for each DL BWP to which DL allocation DL control information for PDSCH resource allocation may be transmitted.

Also, the UL BWPs associated with each other for the PUCCH transmission for each DL BWP through which PDSCH transmission may be performed according to DL allocation DL control information. In this case, the BS may configure UL BWPs associated with each other for the PUCCH transmission for each DL BWP configured for an UE and transmitthem to the corresponding UE through a UE-specific high layer signaling or L1 control signaling, or define implicitly a DL BWP-UL BWP association rule.

For example, in a case where the same BWP configuration is performed for both a DL and an UL in a TDD cell, or in a case where the same number of BWP configurations is performed for both a DL and an UL in a TDD/FDD cell, the DL BWP and the UL BWP of the same index may be associated with each other.

As another method of configuring one or more PUCCH resource sets for HARQ ACK/NACK feedback of the UE, the one or more PUCCH resource sets may be commonly configured to one or more UL BWP. That is, when PUCCH resources configuring one PUCCH resource set configured for a UE is defined, each of the PUCCH resources configuring the PUCCH resource set may be configured with one or more PUCCH resources defined in all UL BWPs configured for the UE.

When a BS configures each of one or more PUCCH resources configuring one or more PUCCH resource sets for an UE, information on an UL BWP configured by the one or more PUCCH resources may be contained in each PUCCH resource.

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Accordingly, each PUCCH resource configuring one or multiple PUCCH resource sets configured through the higher layer signaling for an UE may be defined as PUCCH format configuration information, UL BWP configuration information, and time/frequency domain PUCCH resource configuration information in the UL BWP (or additionally code-domain resource configuration information), or the like.

In this case, PUCCH resource indication information transmitted through the DL allocation DL control information, as in the case of the implicit UL BWP indication, may be configured by PUCCH resource set indication information (for example, PUCCH resource set index information) + PUCCH resource indication information to be used for HARQ ACK/NACK feedback by the UE among PUCCH resources configuring the PUCCH resource set (for example, a PUCCH resource index in a PUCCH resource set), or only PUCCH resource indication information to be used for HARQ ACK/NACK feedback by the UE among PUCCH resources configuring one or more PUCCH resource sets (for example, a PUCCH resource index in a PUCCH resource set.)

Likewise, when a BWP is configured with specific classes of PUCCH resource sets, the PUCCH resource set indication information may be replaced by the specific classification information.

For example, when a separate PUCCH resource set is configured for each of a PUCCH format, a PUCCH duration, a PUCCH payload size, and the like, each of the corresponding PUCCH format information, PUCCH duration information, PUCCH payload size information, and the like may be used in place of each of the PUCCH resource set indication information.

The PUCCH resource set information (or, including indication information according

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to the classification of the PUCCH) and the PUCCH resource index information in the corresponding PUCCH resource set may be encoded in a joint coding scheme and transmitted or received through one information area. The information related to the PUCCH resource set indication may be necessary only in a case of supporting the configuration of a plurality of PUCCH resource sets for each UE. The PUCCH resource set indication information may be excluded in a case of supporting the configuration of only one UCCH resource for each UE.

Additionally, when configuration information on PUCCH resources configuring PUCCH resource sets configured through high layer signaling contains UL BWP configuration information, according to PUCCH resource allocation indicated by PUCCH resource indication information of DL allocation DL control information, as in the case of the explicit UL BWP indication, the UE may perform an UL BWP activation or an UL BWP switching operation to an UL BWP configured by the one or more PUCCH resources.

Additionally, as described above, when PUCCH resource sets for HARQ ACK/NACK feedback of the UE for each UL BWP are configured, or when one or more PUCCH resource sets are commonly configured in one or more UL BWPs, each PUCCH resource configuring the one or more PUCCH resource sets may be allocated for aperiodic CSI feedback of the UE.

Specifically, aperiodic CSI reporting of any UE may be triggered by the BS through DL allocation DL control information. For this purpose, when a DL allocation DL control information format for an UE is defined, an information area for triggering aperiodic CSI reporting of the UE may be defined to be included therein. In a case where the aperiodic CSI reporting of the UE is triggered through the aperiodic CSI reporting indication

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information area, the aperiodic CSI reporting information may be multiplexed and then transmitted, along with HARQ ACK/NACK feedback information on a PDSCH through the one or more PUCCH resources according to the PUCCH resource allocation information indicated through the DL allocation DL control information. That is, the PUCCH resource set configuration may be a common PUCCH resource set configuration for HARQ ACK/NACK feedback and aperiodic CSI reporting.

In addition, apart from the configuration of one or more PUCCH resource sets for the HARQ ACK/NACK feedback, a BE/network may configure one or more PUCCH resource sets for aperiodic CSI reporting and transmit the configured one or more PUCCH resource sets to each UE through UE-specific High layer signaling. That is, one or multiple PUCCH resource sets for only aperiodic CSI feedback for each UE may be configured and transmitted to each UE through UE-specific High layer signaling.

In this case, one or more PUCCH resource sets for the aperiodic CSI feedback may be separately configured for each PUCCH format or for each PUCCH duration, in the same manner as the PUCCH resource set configuration method for the HARQ ACK/NACK feedback, or be configured regardless of that.

When one or more separate PUCCH resource sets for aperiodic CSI reporting are configured, as described above, one or more PUCCH resource sets for the aperiodic CSI reporting may be configured for each UL BWP, or one or more PUCCH resource sets for the aperiodic CSI reporting may be commonly configured in one or more UL BWPs.

In this regard, in a case where one or more PUCCH resource sets for separate aperiodic CSI reporting are configured, the PUCCH resource allocation for the HARQ ACK/NACK feedback through the DL allocation DL control information described above

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may be applied to PUCCH resource allocation for the aperiodic CSI reporting. Additionally, an operation described above may be applied to an UL BWP activation or a UE operation related to an UL BWP switching.

Additionally, when aperiodic CSI reporting through an UL grant is triggered, radio channel indication information (i.e., a PUSCH or PUCCH) for the transmission of aperiodic CSI reporting information by a UE may be included.

As described above, the method of the PUCCH resource set configuration and the method of the corresponding PUCCH resource indication have been discussed, referring to FIGs. 2 to 3C. Hereinafter, referring to FIGs. 4 to 7, methods of transmitting and receiving UL control information by a UE and/or a BS, and the related UE and BS will be described in detail.

FIG. 4 is a flowchart showing a method of a UE for transmitting UL control information b according to embodiments of the present disclosure.

Referring to FIG. 4, a UE receives, from a BS, UL control channel resource set configuration information for transmitting the UL control information S400.

One or more UL control channel resource sets may be configured for each UL BWP configured for a UE. The UL BWP may be activated through DL control information.

Specifically, a corresponding serving cell for a DL transmission and/or reception activates and uses one DL BWP contained in any DL subframe/slot/mini-slot of one or more DL BWPs configured for a corresponding UE. Likewise, a corresponding serving cell for an UL transmission and/or reception activates and uses one UL BWP contained in an UL subframe/slot/mini-slot of one or more UL BWPs configured for a corresponding UE.

Activation/deactivation indications of the DL BWP and the UL BWP to an UE may

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be performed through DL control information (DCI) transmitted through a PDCCH. Specifically, the activation/deactivation of the DL BWP may be performed through DL assignment DL control information containing resource allocation information on a PDSCH. Furthermore, the activation/deactivation of the UL BWP may be performed through an UL grant including resource allocation information on a PUSCH.

For example, a UE may receive BWP configuration information on one or more BWP sets configured by one or more BWPs configured for the UE from a BS. Next, the UE may receive, from the BS, DL control information containing information for indicating one of one or more BWPs contained in the one or more BWP sets configured by the BWP configuration information. The UE may receive the PDSCH or transmit the PUSCH or PUCCH through the one BWP indicated in the DL control information.

At this time, the BWP configuration information may be receive from the BS through high layer signaling, such as RRC signaling.

In the NR, a BS/network may configure a single PUCCH resource set configured by one or more PUCCH resources for HARQ ACK/NACK feedback or a plurality of PUCCH resource sets, each of which is configured by one or more PUCCH resources, for each UE, and then transmit the configured one or more PUCCH resource sets to each UE through UE-specific higher layer signaling.

In a case where one or multiple PUCCH resource sets for an UE through the UE-specific higher layer signaling are configured, the BS may transmit corresponding DL allocation DL control information including PUCCH resource indication information for HARQ ACK/NACK feedback by the UE in response to a corresponding PDSCH reception when transmitting PDSCH scheduling control information for the UE through a PDCCH.

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Furthermore, the UE determines one of UL control channel resource sets contained in UL control channel resource set configuration information S410.

In step S410, when the UL control channel resource sets to transmit the UL control information are determined, the UE may determine one of the UL control channel resource sets according to the size of the UL control information.

Furthermore, the UE determines one of UL control channel resources contained in the determined one UL control channel resource setS420.

Additionally, the UE may receive from the BS DL control information containing information indicating one, for the transmission of the UL control information, of UL control channel resources configuring UL control channel resource sets.

At this time, the one UL control channel resource for the UL control information transmission of the UL control channel resources contained in the determined UL control channel resource set may be indicated from the BS through the DL control information.

As described above, the UE may determine, for each PDSCH transmission, one of PUCCH resources contained in a single PUCCH resource set configured for the UE, or determine one of a plurality of PUCCH resource sets configured for the UE and one of PUCCH resources contained in the corresponding PUCCH resource set, and then dynamically allocate a PUCCH resource.

Specifically, as a method of configuring PUCCH resource sets for an UE, in configuring PUCCH resource sets for each UE for HARQ ACK/NACK feedback of the UE, separate resource sets may be configured for each UL BWP configured for the UE.

For example, as illustrated in FIG. 3A, in a case where N (N is a natural number greater than 1) UL BWPs for an UE are configured, separate PUCCH resource sets to each

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UL BWP for a PUCCH resource indication for HARQ ACK/NACK feedback of the UE may be configured and transmitted to the UE through UE-specific higher layer signaling.

Referring to FIG. 3B, the BS may configure, for each BWP for a UE, total N PUCCH resource sets, for example, from PUCCH resource sets for a BWP #1, PUCCH resource sets for a BWP #2,…, up to PUCCH resource sets for a BWP #N. For example, as illustrated in FIG. 3B, the BWP #2including PUCCH resource sets may be configured by a first to fourth PUCCH resource sets.

In this case, each PUCCH resource configuring PUCCH resource sets configured for each UL BWP through higher layer signaling may be defined as PUCCH format configuration information, time/frequency domain PUCCH resource configuration information (or additionally code domain resource configuration information) in the UL BWP, or the like. For example, as illustrated in FIG. 3B, a second PUCCH resource set may be configured by a first to fourth PUCCH resources.

Furthermore, when a BWP is configured with specific classes of PUCCH resource sets, the PUCCH resource set indication information may be replaced by the specific classification information. For examplewhen a separate PUCCH resource set is configured for each of a PUCCH format, a PUCCH duration, a PUCCH payload size, and the like, each of the corresponding PUCCH format information, PUCCH duration information, PUCCH payload size information, and the like may be used in place of each of the PUCCH resource set indication information.

That is, a separate PUCCH resource set may be configured according to a PUCCH payload size to be transmitted by the UE, i.e. the payload size of UL control information, and the PUCCH resource set for the PUCCH resource allocation may be determined

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according to the UL control information payload size to be transmitted by the UE. As illustrated in FIG. 3B, only the PUCCH resource indication information (e.g. an ACK/NACK resource indication (ARI) may be transmitted through DL allocation DL control information, and, when the UE determines one or more PUCCH resource sets to interpret it, derived may be a corresponding PUCCH resource set according to an UL control information payload size (UCI payload size) to be transmitted by the UE through a PUCCH resource allocated through the corresponding DL allocation DL control.

For example, the UL control information payload size may be divided into four areas according to the number of bits, and one of a first to fourth PUCCH resource sets may be derived according to the number of bits of the UL control information, as illustrated in FIG. 3B.

As illustrated in FIG. 3C, DL allocation DL control information may contain PUCCH resource indication information (PUCCH resource information or a PUCCH resource indicator). The PUCCH resource indication information indicates one UL control channel resource, for the transmission of UL control information, of UL control channel resources configuringan UL control channel resource set. For example, as illustrated in FIG. 3B, in a case where the UL control channel resource set is configured by the first to fourth PUCCH resources, PUCCH resource indication information illustrated in FIG. 3C may indicate one of the four PUCCH resources.

The various methods described above referring to FIGs. 2 to 3C may be applied to a specific PUCCH resource set configuration method and a corresponding PUCCH resource indication in some embodiments of the present disclosure.

The UE transmits the UL control information through the determined the UL control

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channel resource S430.

FIG. 5 is a flowchart of a BS for receiving UL control information according to some embodiments of the present disclosure.

Referring to FIG. 5, a BS transmits to a UE UL control channel resource set configuration information for the transmission of the UL control information S500.

As described above, one or more UL control channel resource sets may be configured for each UL BWP configured for a UE. The UL BWP may be activated through DL control information.

Specifically, a corresponding serving cell for a DL transmission and/or reception activates to use one DL BWP contained in any DL subframe/slot/mini-slot of one or more DL BWPs configured for a corresponding UE. Likewise, the corresponding serving cell for an UL transmission and/or reception activates to use one UL BWP contained in any UL subframe/slot/mini-slot of one or more UL BWPs configured for the corresponding UE.

Activation/deactivation indications of the DL BWP and the UL BWP to an UE may be performed through DL control information (DCI) transmitted through a PDCCH. Specifically, the activation/deactivation of the DL BWP may be performed through DL assignment DL control information containing resource allocation information on a PDSCH. Furthermore, the activation/deactivation of the UL BWP may be performed through an UL grant containing resource allocation information on a PUSCH.

For example, the UE may receive BWP configuration information on BWP sets configured by BWPs configured for the UE from the BS. Next, the UE may receive DL control information containing information indicating one of BWPs contained in the BWP sets configured by the BWP configuration information from the BS. The UE may receive

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the PDSCH, or transmit the PUSCH or PUCCH through the one BWP indicated in the DL control information.

At this time, the BWP configuration information may be receive from the BS through high layer signaling, such as RRC signaling.

In the NR, a BS/network may configure a single PUCCH resource set configured by PUCCH resources for HARQ ACK/NACK feedback or a plurality of PUCCH resource sets, each of which is configured by PUCCH resources, for each UE, and then transmit the configured PUCCH resource sets to each UE through UE-specific higher layer signaling. In a case where PUCCH resource sets for an UE through the UE-specific higher layer signaling are configured, when transmitting PDSCH scheduling control information for the UE through a PDCCH, the BS may transmit corresponding DL allocation DL control information including PUCCH resource indication information for HARQ ACK/NACK feedback by the UE in response to a corresponding PDSCH reception.

Furthermore, the BS receives UL control information through one of UL control channel resources configuring one of UL control channel resources contained in UL control channel resource set configuration information S510.

As described above, the UL control channel resource sets for transmitting the UL control information may be determined as one of the UL control channel resource sets according to the size of the UL control information.

As described above, the BS may transmit to the UE DL control information containing information indicating one, for the transmission of the UL control information, of UL control channel resources configuring UL control channel resource sets.

At this time, for the UL control information transmission, the one of the UL control

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channel resources configuring the UL control channel resource sets may be indicated to the UE through the DL control information.

That is, the BS selects, for each PDSCH transmission for an UE, one of PUCCH resources configuring a single PUCCH resource set configured for the UE, or one of PUCCH resources configuring one of PUCCH resource sets and a PUCCH resource set, configured for the UE. Then, the BS transmits the selected PUCCH resource through DL allocation DL control information. Accordingly, the UE dynamically may allocate a PUCCH resource to be used for HARQ ACK/NACK feedback.

In accordance with an embodiment of the present disclosure, proposed are a method of configuring a PUCCH resource set and a method of indicating the corresponding PUCCH resource.

As a method of configuring one or more PUCCH resource sets for an UE, in configuring PUCCH resource sets for each UE for HARQ ACK/NACK feedback of the UE, one or more separate resource sets may be configured for each UL BWP configured for the UE.

For example, as illustrated in FIG. 3A, in a case where N (N is a natural number greater than 1) UL BWPs for an UE are configured, separate PUCCH resource sets to each UL BWP for a PUCCH resource indication for HARQ ACK/NACK feedback of the UE may be configured and transmitted to the UE through UE-specific higher layer signaling.

Referring to FIG. 3B, the BS may set, for each BWP for a UE, total N PUCCH resource sets, for example, from PUCCH resource sets for a BWP #1, PUCCH resource sets for a BWP #2,…, up to one or multiple PUCCH resource sets for a BWP #N. For example, as illustrated in FIG. 3B, the BWP#2 including PUCCH resource sets, may be

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configured by a first to fourth PUCCH resource sets.

In this case, each PUCCH resource configuring PUCCH resource sets configured for each UL BWP through higher layer signaling may be defined as PUCCH format configuration information, time/frequency domain PUCCH resource configuration information (or additionally code domain resource configuration information) in the UL BWP, or the like. For example, as illustrated in FIG. 3B, a second PUCCH resource set may be configured by a first to fourth PUCCH resources.

In this regard, when a BWP is configured with specific classes of PUCCH resource sets, the PUCCH resource set indication information may be replaced by the specific classification information. For example, when a separate PUCCH resource set is configured to each of a PUCCH format, a PUCCH duration, a PUCCH payload size, and the like, each of the corresponding PUCCH format information, PUCCH duration information, PUCCH payload size information, and the like may be used in place of each of the PUCCH resource set indication information.

That is, a separate PUCCH resource set may be configured according to a PUCCH payload size to be transmitted by the UE, i.e. the payload size of UL control information, and the PUCCH resource set for the PUCCH resource allocation may be determined according to the UL control information payload size to be transmitted by the UE. As illustrated in FIG. 3B, only the PUCCH resource indication information (e.g. an ACK/NACK resource indication (ARI) may be transmitted through DL allocation DL control information, and, when the UE determines one or more PUCCH resource sets to interpret it, derived may be a corresponding PUCCH resource set according to an UL control information payload size (UCI payload size) to be transmitted by the UE through a PUCCH

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resource allocated through the corresponding DL allocation DL control.

For example, the UL control information payload size may be divided into four areas according to the number of bits, and one of a first to fourth PUCCH resource sets may be derived according to the number of bits of the UL control information, as illustrated in FIG. 3B.

As illustrated in FIG. 3C, DL allocation DL control information may contain PUCCH resource indication information (PUCCH resource information or a PUCCH resource indicator). The PUCCH resource indication information indicates one UL control channel resource, for the transmission of UL control information, of UL control channel resources configuring an UL control channel resource set. For example, as illustrated in FIG. 3B, in a case where the UL control channel resource set is configured by the first to fourth PUCCH resources, PUCCH resource indication information illustrated in FIG. 3C may indicate one of the four PUCCH resources.

The various methods described above referring to FIGs. 2 to 3C may be applied to a specific PUCCH resource set configuration method and a corresponding PUCCH resource indication in some embodiments of the present disclosure.

FIG. 6 is a diagram illustrating a BS according to embodiments of the present disclosure.

Referring to FIG. 6, a BS 600 includes a controller 610, a transmitter 620, and a receiver 630.

In a method of allocating UL control channel resources for an UE in the NR, , the controller 610 is configured to control overall operations so that separate PUCCH resource sets are configured for each UL BWP configured for the UE.

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The transmitter 620 and the receiver 630 are used to transmit and receive signals, messages, and data necessary for carrying out some embodiments as described above, to and from the UE.

The transmitter 620 transmits to the UE UL control channel resource set configuration information for the transmission of UL control information.

One or more UL control channel resource sets may be configured for each UL BWP configured for the UE.

The UL BWP may be activated through DL control information.

The receiver 630 receives UL control information through one of one or more UL control channel resources configuring one of UL control channel resources contained in UL control channel resource set configuration information.

The one or more UL control channel resource sets for transmitting the UL control information may be determined as one of the UL control channel resource sets according to the size of the UL control information.

The BS may transmit to the UE DL control information containing information indicating one, for the transmission of the UL control information, of UL control channel resources configuring one or more UL control channel resource sets.

At this time, the one, for the UL control information transmission, of the UL control channel resources configuring the UL control channel resource sets may be indicated to the UE through the DL control information.

FIG. 7 is a diagram illustrating a UE according to embodiments of the present disclosure.

Referring to FIG. 7, a UE 700 includes a receiver 710, a controller 720 and a

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transmitter 730.

The receiver 710 receives DL control information and data, messages through a corresponding channel from a BS.

Furthermore, in a method of allocating one or more UL control channel resources for any UE in the NR, the controller 720 is configured to control overall operations of the UE so that separate one or more PUCCH resource sets are configured for each UL BWP configured for the UE.

The transmitter 730 transmits UL control information and data, messages through a corresponding channel to the BS.

The controller 720 determines one of one of UL control channel resource sets contained in UL control channel resource set configuration information, and determines one of UL control channel resources configuring the determined one UL control channel resource set.

The UL control channel resource set(s) may be configured for each UL BWP configured for the UE.

The UL BWP may be activated through the DL control information.

When the one or more UL control channel resource sets for transmitting the UL control information are determined, the controller 720 may determine one of the UL control channel resource sets according to the size of the UL control information.

The receiver 710 receives from the BS UL control channel resource set configuration information for the transmission of UL control information.

The receiver 710 receives from the BS DL control information containing information indicating one, for the transmission of the UL control information, of UL

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control channel resources configuring UL control channel resource sets. At this time, one UL control channel resource, for the UL control information transmission, of UL control channel resources configuring the determined UL control channel resource set may be indicated from the BS through the DL control information.

The transmitter 730 transmits the UL control information through the determined UL control channel resource.

The standardized specifications or standard documents related to the embodiments described above have been omitted in order to simplify the description but constitute a part of the present disclosure. Accordingly, it should be construed that the incorporation of the content of the standardized specifications and part of the standard documents into the detailed description and claims is included within the scope of the present disclosure.

The features, structures, configurations, and effects described in the present disclosure are included in at least one embodiment but are not necessarily limited to a particular embodiment. A person skilled in the art can apply the features, structures, configurations, and effects illustrated in the particular embodiment embodiments to another one or more additional embodiment embodiments by combining or modifying such features, structures, configurations, and effects. It should be understood that all such combinations and modifications are included within the scope of the present disclosure Although the exemplary embodiments have been described for illustrative purposes, a person skilled in the art will appreciate that various modifications and applications are possible without departing from the essential characteristics of the present disclosure. For example, the specific components of the exemplary embodiments may be variously modified. The various embodiments described above can be combined to provide further embodiments. These and

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other changes can be made to the embodiments in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the 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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WHAT IS CLAIMED IS:

1. A method of transmitting uplink (UL) control information by a user equipment, the method comprising:

Receiving, from a base station, UL control channel resource set configurationinformation for UL control information transmission;

determining one of UL control channel resource sets contained in the UL control channel resource set configuration information;

determining one of UL control channel resources contained in the determined UL control channel resource set; and

transmitting UL control information through the determined UL control channel resource.

2. The method according to claim 1, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.

3. The method according to claim 2, wherein the each UL BWP is activated through DL control information.

4. The method according to claim 1, wherein the determining of the one of the UL control channel resource sets is performed based on a size of the UL control information.

5. The method according to claim 1, further comprising receiving, from the base station, downlink (DL) control information containing information indicating the one of the

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UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated from the base station through the DL control information.

6. A method of receiving uplink (UL) control information by a base station, the method comprising:

transmitting UL control channel resource set configuration information for transmitting UL control information to a user equipment; and

receiving the UL control information through one of UL control channel resources configuring one of UL control channel resource sets contained in UL control channel resource set configuration information.

7. The method according to claim 6, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.

8. The method according to claim 7, wherein the each UL BWP is activated through downlink (DL) control information.

9. The method according to claim 6, wherein the one of the UL control channel resource sets for the UL control information transmission is determined based on a size of the UL control information.

10. The method according to claim 6, further comprising transmitting, to the user

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equipment, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated to the user equipment through the DL control information.

11. A user equipment for transmitting uplink (UL) control information, comprising:

a receiver configured to receive, from a base station, UL control channel resource set configuration information for UL control information transmission;

a controller configured to determine one of UL control channel resource sets contained in the UL control channel resource set configuration information, and determine one of UL control channel resources configuring the determined one UL control channel resource set; and

a transmitter configured to transmit the UL control information through the determined UL control channel resource.

12. The user equipment according to claim 11, wherein the UL control channel resource sets are configured for each UL bandwidth part (BWP) configured for the user equipment.

13. The user equipment according to claim 12, wherein the each UL BWP is activated through downlink (DL) control information.

14. The user equipment according to claim 11, wherein the determining of the one of

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the UL control channel resource sets is performed based on a size of the UL control information.

15. The user equipment according to claim 11, wherein the receiver receives, from the base station, DL control information containing information that indicates the one of the UL control channel resources for the UL control information transmission,

wherein the one of the UL control channel resources is indicated from the base station through the DL control information.

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ABSTRACT OF THE DISCLOSURE

Provided are a method of transmitting an uplink control information in a next-generation/5G radio access network. The method may include receiving uplink control channel resource set configuration information to transmit the uplink control information from a base station, determining one of uplink control channel resource sets contained in the uplink control channel resource set configuration information, determining one of uplink control channel resources configuring the determined uplink control channel resource set, and transmitting the uplink control information through the determined uplink control channel resource.

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FIG.1

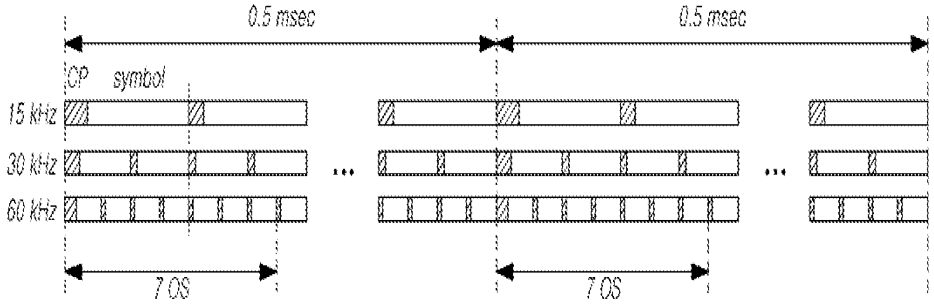
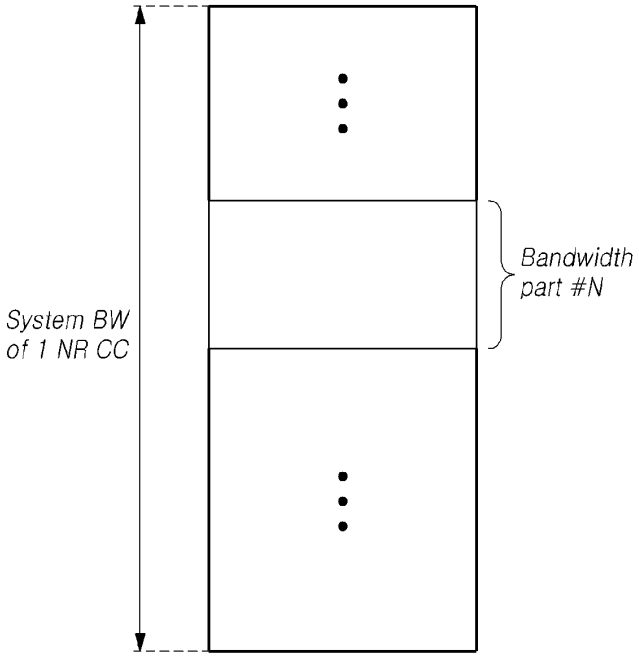
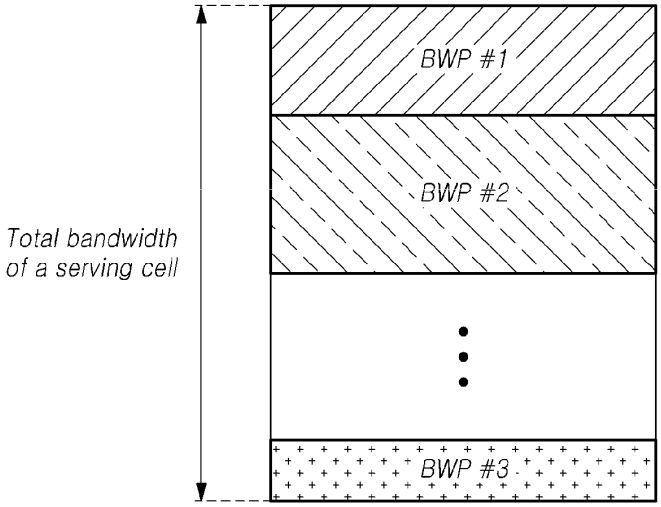


FIG.2



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FIG.3A



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FIG.3B

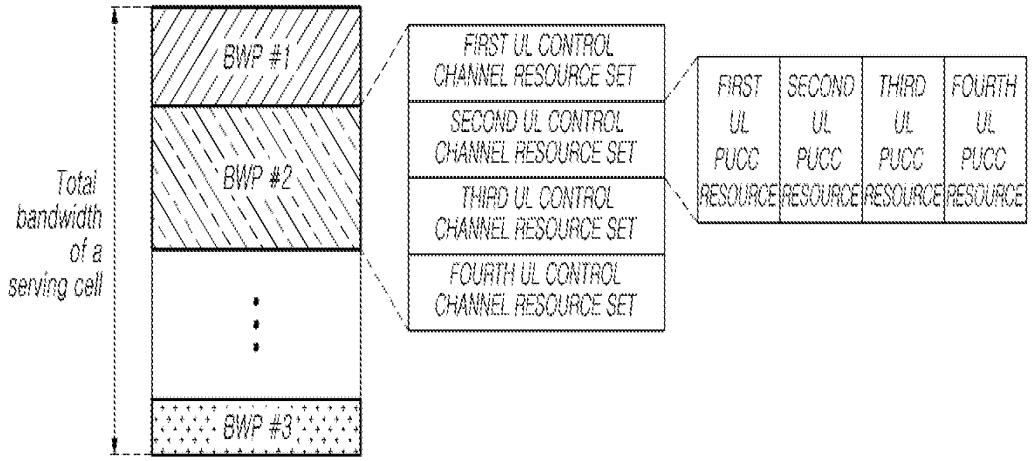
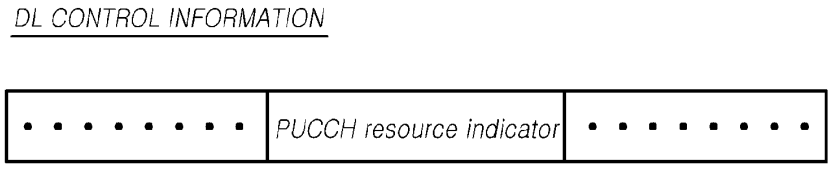
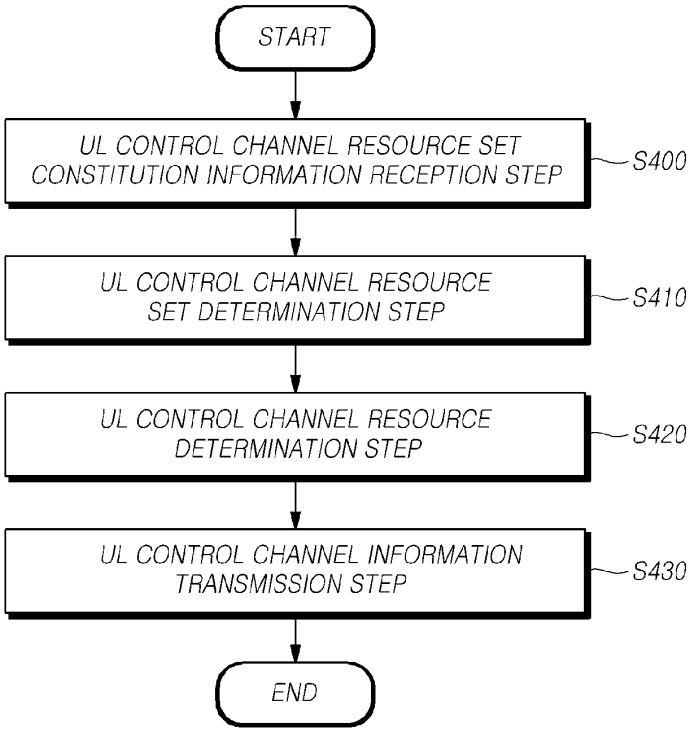

Total bandwidth of a serving cell
BWP #1
BWP #2
BWP #3
FIRST UL CONTROL CHANNEL RESOURCE SET
SECOND UL CONTROL CHANNEL RESOURCE SET
THIRD UL CONTROL CHANNEL RESOURCE SET
FOURTH UL CONTROL CHANNEL RESOURCE SET
FIRST UL PUCC RESOURCE
SECOND UL PUCC RESOURCE
THIRD UL PUCC RESOURCE
FOURTH UL PUCC RESOURCE

FIG.3C



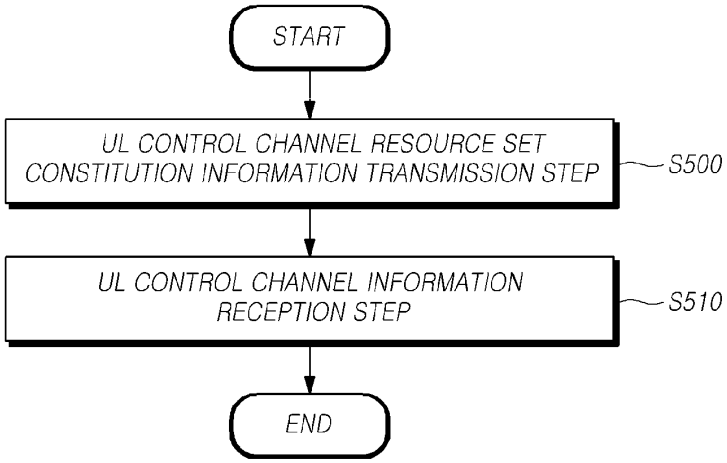
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FIG.4



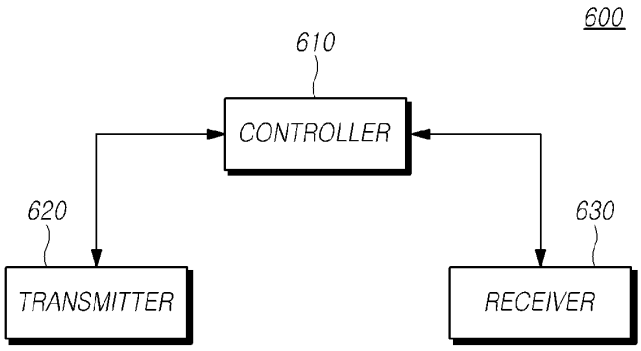
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FIG.5



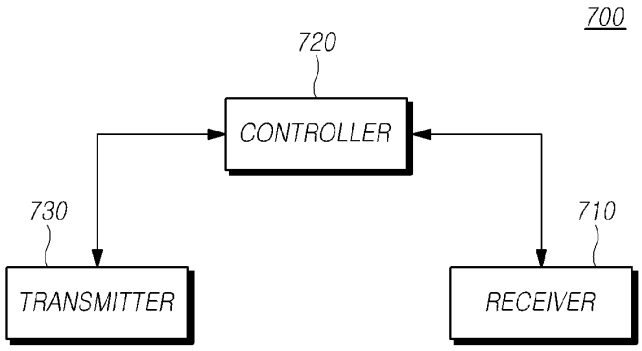
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FIG.6



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FIG. 7



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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 OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO

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.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: PARK, Kyujin Date (Optional): Sep. 3, 2018

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.**

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0206
	Application Number	
Title of Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

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

Inventor Information:

Inventor 1 — Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Kyujin		PARK	

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

City	Seoul	Country of Residence [i]	KR

Mailing Address of Inventor:

Address 1	(Korea Telecom Research Center, Umyeon-dong) 151		
Address 2	Taebong-ro, Seocho-gu		
City	Seoul	**State/Province**	
Postal Code	137-140	**Country** [i]	KR

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

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	76277		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO		
Attorney Docket Number	811.0206	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	9	**Suggested Figure for Publication (if any)**	

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0206
	Application Number	
Title of Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO	

Filing By Reference:

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

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

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

Publication Information:

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

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

Representative Information:

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

Please Select One:	● Customer Number	US Patent Practitioner	◯ Limited Recognition (37 CFR 11.9)
Customer Number	76277		

Domestic Benefit/National Stage Information:

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

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Division of	16/147530	2018-09-28

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0206
	Application Number	
Title of Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO	

Foreign Priority Information:

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

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2017-0128188	KR	2017-09-29	B34C

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2017-0162728	KR	2017-11-30	CBE5

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Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2018-0077270	KR	2018-07-03	9AA3

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

☐ 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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0206
	Application Number	
Title of Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO	

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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0206
	Application Number	
Title of Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO	

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			

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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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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	811.0206
	Application Number	
Title of Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO	

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)	2020-03-23
First Name	Ian	Last Name	Hughes	Registration Number	41083

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	811.0206
		Application Number	
Title of Invention	APPARATUS AND METHOD OF UPLINK CONTROL CHANNEL RESOURCE ALLOCATION FOR NEW RADIO		

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