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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
62/544,118	08/11/2017		260	251367-8237		

CONFIRMATION NO. 7862

FILING RECEIPT



0000000093815014

109673
McClure, Qualey & Rodack, LLP
3100 Interstate North Circle
Suite 150
Atlanta, GA 30339

Date Mailed: 09/01/2017

Receipt is acknowledged of this provisional patent application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Pei-Kai LIAO, Hsin-Chu, TAIWAN;

Applicant(s)

MEDIATEK INC., Hsin-Chu, TAIWAN;

Power of Attorney:

Daniel McClure--38962

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

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

If Required, Foreign Filing License Granted: 08/31/2017

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 62/544,118**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

Title

Methods of Power-efficient Operation in Wideband Carrier

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

page 1 of 3

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

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

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

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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

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

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

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	251367-8237
		Application Number	
Title of Invention	Methods of Power-efficient Operation in Wideband Carrier		
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.)
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Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Pei-Kai		LIAO		
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	Hsin-Chu		Country of Residence ⁱ	TW	
Mailing Address of Inventor:					
Address 1		No. 1, Dusing Rd. 1st			
Address 2		Science-Based Industrial Park			
City	Hsin-Chu	State/Province			
Postal Code	300	Country ⁱ	TW		
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	109673		
Email Address	dan.mcclure@mqlaw.com		Add Email Remove Email

Application Information:

Title of the Invention	Methods of Power-efficient Operation in Wideband Carrier		
Attorney Docket Number	251367-8237	Small Entity Status Claimed	☐
Application Type	Provisional		
Subject Matter			
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	251367-8237
		Application Number	
Title of Invention	Methods of Power-efficient Operation in Wideband Carrier		

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	109673		

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			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			

Ex. 1009

APPLE INC. / Page 5 of 39

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	251367-8237
		Application Number	
Title of Invention	Methods of Power-efficient Operation in Wideband Carrier		

Foreign Priority Information:

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

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

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

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	251367-8237
		Application Number	
Title of Invention	Methods of Power-efficient Operation in Wideband Carrier		

Authorization or Opt-Out of Authorization to Permit Access:

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

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

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

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

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

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

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

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

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

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

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	251367-8237
		Application Number	
Title of Invention	Methods of Power-efficient Operation in Wideband Carrier		

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	MEDIATEK INC.	
Mailing Address Information For Applicant:		
Address 1	No. 1, Dusing Rd. 1st	
Address 2	Science-Based Industrial Park	
City	Hsin-Chu	State/Province
Country	TW	Postal Code
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee Information:

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	251367-8237
		Application Number	
Title of Invention	Methods of Power-efficient Operation in Wideband Carrier		

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

Signature:

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

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

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

Signature	/Daniel R. McClure/		Date (YYYY-MM-DD)	2017-08-11
First Name	Daniel	Last Name	McClure	Registration Number
				38,962
Additional Signature may be generated within this form by selecting the Add button. Add				

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	251367-8237
		Application Number	
Title of Invention	Methods of Power-efficient Operation in Wideband Carrier		

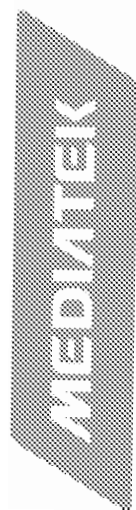
This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes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

Privacy Act Statement

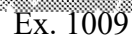
The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection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

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

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



Methods of Power-efficient Operation in Wideband Carrier



Motivation

- * In 3GPP RAN1, 5G base station should be able to support UEs operating with single wideband carrier & UEs operating with intra-band carrier aggregation over the same contiguous spectrum simultaneously
- * In 3GPP RAN1, it was agreed that UE RF bandwidth adaptation is supported at least for DL control for single-carrier operation
- * Till 3GPP RAN1#89, the following has been agreed to enable UE RF bandwidth adaptation
 - One or multiple bandwidth part (BWP) candidates with configurable parameters -- numerology (i.e. subcarrier spacing & cyclic prefix length), frequency location & bandwidth size
 - A DL BWP includes at least one control resource set (CORESET) for the case of single active DL/UL BWP at a given time
 - * CORESET contains the time/frequency radio resources reserved to accommodate the schedulers for DL/UL data
 - A BWP may or may not contain SS block
 - At least one active DL/UL BWP for a UE at a given time
 - Transition gap is needed for BWP switch
 - Measurement gap is supported for the case BWP doesn't include SS block



INTERNAL USE

CTO

Problem Statement

- Design considerations
 - Facilitate 5G base station to support UEs operating with single wideband carrier & UEs operating with intra-band carrier aggregation over the same contiguous spectrum simultaneously
 - Facilitate UE RF bandwidth adaptation in single-carrier operation
 - Facilitate the adaptation of UE Tx/Rx antenna number
- Remaining issues
 - CORESET configuration for system information scheduling in initial access
 - Mechanism to enable the adaptation of UE Tx/Rx antenna number in connected mode
 - Support of broadcast message scheduling for the case of single active DL/UL BWP in connected mode
 - Active BWP switch in connected mode
 - CSI measurement in connected mode
 - RRM measurement in connected mode



INTERNAL USE

CTO

Definition

- * SS block
 - A SS block consists of synchronization signals and physical broadcast channel carrying necessary system information for starting initial access procedure
- * Bandwidth part (BWP)
 - A BWP consists of a group of contiguous PRBs
 - A BWP may or may not contain the SS block
 - Configuration of a BWP includes the following
 - × Numerology, frequency location (e.g. center frequency) and bandwidth (e.g. number of PRBs)
 - A UE can be configured with single or multiple BWPs
 - For a UE, at least one BWP is active at a given time
- * Control resource set (CORESET)
 - CORESET contains the time/frequency radio resources reserved to accommodate the schedulers for DL/UL data
 - A UE can be configured with single or multiple CORESETs
- * Common search space
 - Common search space is defined as a set of candidate locations within a CORESET for the schedulers of system information broadcast, DL broadcast or multi-cast data
- * UE-specific search space
 - UE-specific search space is defined as a set of candidate locations within a CORESET for the schedulers of DL/UL unicast data
- * Radio resource management (RRM) measurement
 - RRM measurement is used for the network to manage the radio resources
 - RRM measurement includes at least reference signal received power (RSRP) & reference signal received quality (RSRQ)



PROPOSALS



INTERNAL USE

cto

Initial Access (1)

- Background
 - Broadcasted system information is partitioned into three parts
 - 1st part of broadcasted system information contains the necessary information for a UE to receive 2nd and 3rd part of broadcasted system information
 - 2nd part of broadcasted system information contains the necessary information for a UE to perform random access procedure to get connected with the network
 - 3rd part of broadcasted system information contains all remaining system information necessary for services the network can provide to UEs
 - 1st part of broadcasted system information is carried in a physical broadcast channel
 - 2nd and 3rd part of broadcasted system information are carried in a physical DL data channel scheduled by a scheduler within a CORESET

Initial Access (2)

- * Proposal #1: The following configurations are carried in the 1st part of broadcasted system information
 - Configuration of 2nd part of broadcasted system information, which includes at least one of the following
 - * Numerology (i.e. subcarrier spacing, cyclic prefix length), frequency location (e.g. center frequency, starting PRB based on the configured numerology) and bandwidth size (e.g. number of PRBs based on the configured numerology)
 - Configuration of a CORESET with common search space for the scheduler of 2nd part of broadcasted system information, which at least includes
 - * The time duration (e.g. the number of contiguous OFDM symbols) of the CORESET within a slot
 - The bandwidth size of the CORESET follows the bandwidth size for 2nd part of broadcasted system information
- * Proposal #2: The following configurations are carried in the 1st part of broadcasted system information
 - Configuration of 2nd and 3rd part of broadcasted system information, which includes at least one of the following
 - * Numerology (i.e. subcarrier spacing, cyclic prefix length), frequency location (e.g. center frequency, starting PRB based on the configured numerology) and bandwidth size (e.g. number of PRBs based on the configured numerology)
 - Configuration of a CORESET with common search space for the scheduler of 2nd and 3rd part of broadcasted system information, which at least includes
 - * The time duration (e.g. the number of contiguous OFDM symbols) of the CORESET within a slot
 - The bandwidth size of the CORESET follows the bandwidth size for 2nd and 3rd part of broadcasted system information



INTERNAL USE

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Initial Access (3)

- * Proposal #3: The following configurations are carried in the 1st part of broadcasted system information
 - Configuration of 2nd part of broadcasted system information, which includes at least one of the following
 - * Numerology (i.e. subcarrier spacing, cyclic prefix length), frequency location (e.g. center frequency, starting PRB based on the configured numerology) and bandwidth size (e.g. number of PRBs based on the configured numerology)
 - Configuration of a CORESET with common search space for the scheduler of 2nd part of broadcasted system information, which includes at least one of the following
 - * The time duration (e.g. the number of contiguous OFDM symbols) of the CORESET within a slot
 - * The number of contiguous slots where the CORESET exists in one periodicity
 - * The periodicity of a CORESET burst
 - The bandwidth size of the CORESET follows the bandwidth size for 2nd part of broadcasted system information
- * Proposal #4: The following configurations are carried in the 1st part of broadcasted system information
 - Configuration of 2nd and 3rd part of broadcasted system information, which includes at least one of the following
 - * Numerology (i.e. subcarrier spacing, cyclic prefix length), frequency location (e.g. center frequency, starting PRB based on the configured numerology) and bandwidth size (e.g. number of PRBs based on the configured numerology)
 - Configuration of a CORESET with common search space for the scheduler of 2nd and 3rd part of broadcasted system information, which includes at least one of the following
 - * The time duration (e.g. the number of contiguous OFDM symbols) of the CORESET within a slot
 - * The number of contiguous slots where the CORESET exists in one periodicity
 - * The periodicity of a CORESET burst
 - The bandwidth size of the CORESET follows the bandwidth size for 2nd and 3rd part of broadcasted system information



EXTERNAL USE

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Initial Access (4)

- ※ DL common BWP is defined as a contiguous bandwidth which can be supported by all served UEs, wherein there are at least synchronization signals, 1st and 2nd part of broadcasted system information & low-rate data
- ※ Proposal #5: DL common BWP configuration includes at least one of the following and is broadcasted in the 1st part of broadcasted system information
 - Configuration of 2nd part of broadcasted system information, which includes at least one of the following
 - ※ Numerology (i.e. subcarrier spacing, cyclic prefix length), frequency location (e.g. center frequency, starting PRB based on the configured numerology) and bandwidth size (e.g. number of PRBs based on the configured numerology)
 - Configuration of a CORESET with common search space for the scheduler of 2nd part of broadcasted system information, which at least includes
 - ※ The time duration (e.g. the number of contiguous OFDM symbols) of the CORESET within a slot
 - The bandwidth size of the CORESET follows the bandwidth size for 2nd part of broadcasted system information
 - The transmission configuration of data service over DL common BWP follows the configuration of 2nd part of broadcasted system information



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Initial Access (5)

- Proposal #6: DL common BWP configuration includes at least one of the following and is broadcasted in the 1st part of broadcasted system information
 - Configuration of 2nd and 3rd part of broadcasted system information, which includes at least one of the following
 - Numerology (i.e. subcarrier spacing, cyclic prefix length), frequency location (e.g. center frequency, starting PRB based on the configured numerology) and bandwidth size (e.g. number of PRBs based on the configured numerology)
 - Configuration of a CORESET with common search space for the scheduler of 2nd and 3rd part of broadcasted system information, which at least includes
 - The time duration (e.g. the number of contiguous OFDM symbols) of the CORESET within a slot
 - The bandwidth size of the CORESET follows the bandwidth size for 2nd and 3rd part of broadcasted system information
 - The transmission configuration of data service over DL common BWP follows the configuration of 2nd and 3rd part of broadcasted system information

Initial Access (6)

- * Proposal #7: DL common BWP configuration includes at least one of the following and is broadcasted in the 1st part of broadcasted system information
 - Configuration of 2nd part of broadcasted system information, which includes at least one of the following
 - * Numerology (i.e. subcarrier spacing, cyclic prefix length), frequency location (e.g. center frequency, starting PRB based on the configured numerology) and bandwidth size (e.g. number of PRBs based on the configured numerology)
 - Configuration of a CORESET with common search space for the scheduler of 2nd part of broadcasted system information, which includes at least one of the following
 - * The time duration (e.g. the number of contiguous OFDM symbols) of the CORESET within a slot
 - * The number of contiguous slots where the CORESET exists in one periodicity
 - * The periodicity of a CORESET burst
 - The bandwidth size of the CORESET follows the bandwidth size for 2nd part of broadcasted system information
 - The transmission configuration of data service over DL common BWP follows the configuration of 2nd part of broadcasted system information



INTERNAL USE

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Initial Access (7)

- Proposal #8: DL common BWP configuration includes at least one of the following and is broadcasted in the 1st part of broadcasted system information
 - Configuration of 2nd and 3rd part of broadcasted system information, which includes at least one of the following
 - * Numerology (i.e. subcarrier spacing, cyclic prefix length), frequency location (e.g. center frequency, starting PRB based on the configured numerology) and bandwidth size (e.g. number of PRBs based on the configured numerology)
 - Configuration of a CORESET with common search space for the scheduler of 2nd and 3rd part of broadcasted system information, which includes at least one of the following
 - * The time duration (e.g. the number of contiguous OFDM symbols) of the CORESET within a slot
 - * The number of contiguous slots where the CORESET exists in one periodicity
 - * The periodicity of a CORESET burst
 - The bandwidth size of the CORESET follows the bandwidth size for 2nd and 3rd part of broadcasted system information
 - The transmission configuration of data service over DL common BWP follows the configuration of 2nd and 3rd part of broadcasted system information



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Adaptation of Tx/Rx Antenna Number

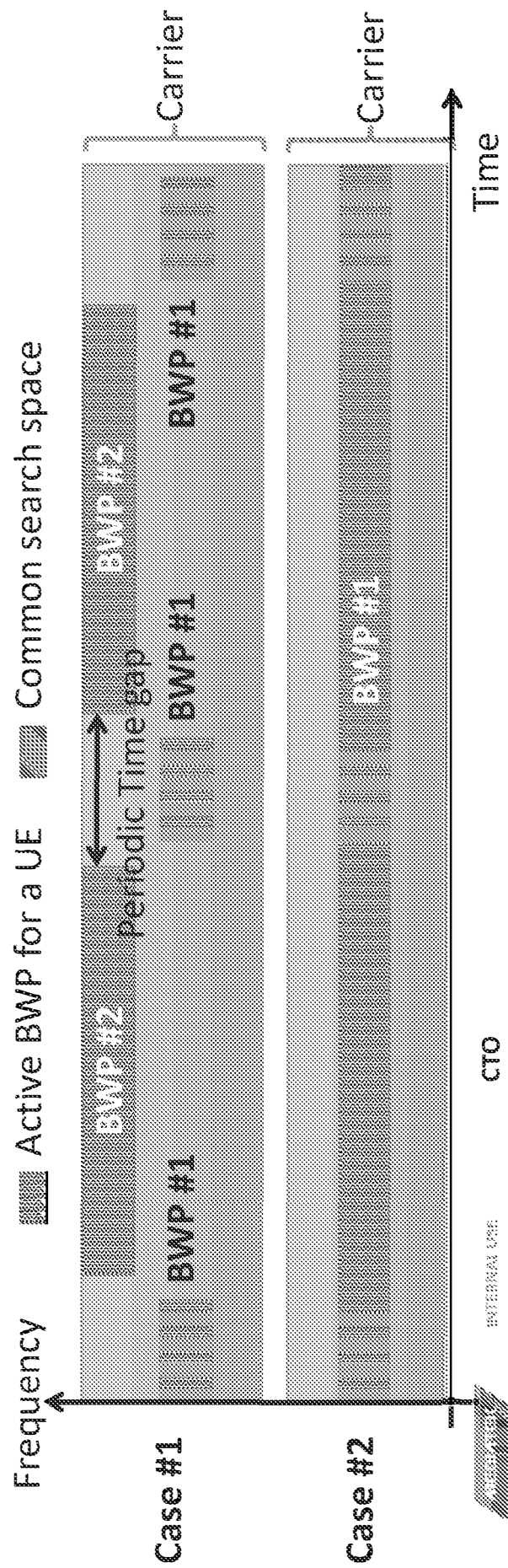
- Proposal #9: In addition to numerology (i.e. subcarrier spacing & CP length), frequency location & bandwidth, bandwidth part configuration further includes the information related to UE Tx/Rx antenna number
 - Example #1: Maximal number of Tx/Rx physical antenna number UE can apply
 - Example #2: Maximal number of Tx/Rx antenna ports UE can assume
 - Example #3: Maximal number of Tx/Rx spatial layers UE can assume
- BWP switch between different BWP configurations enables the adaptation of UE Tx/Rx antenna number
- BWP switch can be based on one of the following or a combination of two or more
 - Higher-layer signaling (e.g. RRC-layer signaling, MAC CE)
 - Physical-layer signaling (e.g. downlink control information)
 - Time pattern

Broadcast/Multi-cast Message Scheduling (1)

- Broadcast/Multi-cast message includes at least the following
 - System information
 - Random access response in random access procedure
 - Paging control for system information updates
 - Group-based uplink transmission power control command
 - Scheduling of multi-cast services
- Proposal #10: For the case of single active BWP at a given time within a cell or carrier,
 - Each configured BWP includes at least one CORESET with UE-specific search space for Pcell & Scell
 - At least one of the configured BWPs includes one CORESET with common search space for Pcell

Broadcast/Multi-cast Message Scheduling (2)

- * Proposal #11: A UE is configured with a periodic time gap for common search space monitoring
 - The configuration of the periodic time gap includes at least one of the following
 - * Periodicity, time gap length and a BWP including CORESET with common search space for monitoring
 - A UE can switch its active BWP to the one including a CORESET with common search space for the monitoring of broadcast message (e.g. system information, random access response, paging control etc.) scheduler during the time gap if its current active BWP doesn't include a CORESET with common search space
 - A UE can monitor both common search space and UE-specific search space in its active BWP without applying the configured time gap if its current active BWP includes a CORESET with common search space



Broadcast/Multi-cast Message Scheduling (3)

- Proposal #10A: For the case of single active BWP at a given time within a cell or carrier,
 - There are two types of common search space
 - Type-1 common search space for broadcasting messages (e.g. system information, paging), which is cell-specific and may require beam sweeping
 - Type-2 common search space for multicasting messages (e.g. random access response in random access procedure, paging control for system information update, group-specific commands or scheduling), which is group-specific (e.g. beam-specific, BWP-specific)
 - At least one of the configured BWPs includes one CORESET with Type-1 common search space for Pcell
 - Each configured BWPs includes one CORESET with Type-2 common search space for both Pcell & Scell
 - Each configured BWP includes at least one CORESET with UE-specific search space for Pcell & Scell



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Active Bandwidth Part Indication (1)

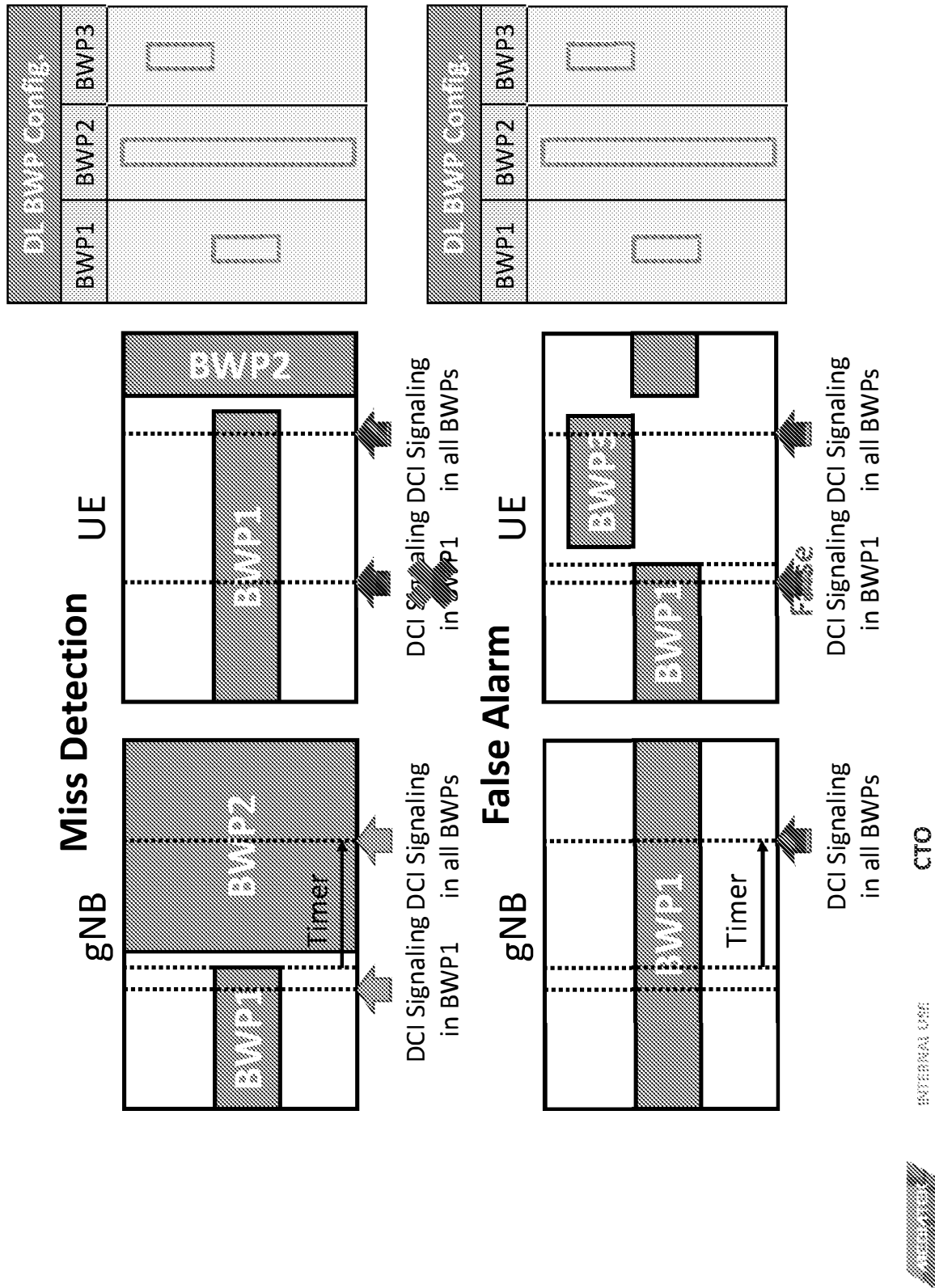
- Proposal #12: The network signals active bandwidth part indication by explicit signaling carried in DCI to a UE
 - The DCI can be either dedicated DCI for active bandwidth part switch or a DL/UL scheduling DCI
 - However, there could be issues on DL/UL active bandwidth part indication if the UE miss-detects or false-alarms the explicit signaling carried in DCI
 - The issue can be resolved by timer-triggered transmission of active DL bandwidth part indication in all DL bandwidth parts configured to the UE
 - * A timer starts when gNB doesn't receive any uplink transmission over the active UL bandwidth part for DL/UL scheduling from the UE and gNB transmits active DL bandwidth part indication in all configured DL bandwidth parts when the timer expires



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Active Bandwidth Part Indication (2)



RRM Measurements

- Background: In NR, two kinds of RRM measurements/reporting are defined
 - SS-block RRM measurement: UE performs it with at least secondary synchronization signal
 - CSI-RS RRM measurement: UE performs it with CSI-RS
- Proposal #12: A method of CSI-RS RRM measurement over BWP
 - UE receives CSI-RS RRM measurement configuration, which includes at least one of the following
 - CSI-RS RRM measurement configurations in a set of configured BWPs, including the active BWP
 - The set of configured BWPs can be a part or a full set of configured BWPs
 - CSI-RS RRM measurement configurations outside the configured BWPs
 - UE performs CSI-RS RRM measurement based on the received configuration

Preliminary Claims (1)

- A method of obtaining DL control resource set configuration, comprising:
 - Receiving configuration of the 2nd part of broadcasted system information in the 1st part of broadcasted system information carried in a DL broadcast channel, wherein the configuration includes at least a DL bandwidth for 2nd part of broadcasted system information;
 - Receiving configuration of a DL control resource set with common search space in the 1st part of broadcasted system information carried in a DL broadcast channel, wherein the configuration at least includes the time duration of the DL control resource set;
 - Determining the time/frequency radio resources of the DL control resource set with common search space based on the DL bandwidth for 2nd part of broadcasted system information and the time duration of the DL control resource set
 - Receiving system information based on the DL scheduler in the common search space of the DL control resource set

Preliminary Claims (2)

- A method of adapting UE Tx/Rx antenna number, comprising:
 - Receiving configuration of a bandwidth part, wherein the configuration includes at least the maximal physical Tx/Rx antenna number, maximal Tx/Rx antenna ports or maximal number of Tx/Rx spatial layers UE can apply for the bandwidth part
 - Switching on a set of physical Tx/Rx antennas and switching off others based on the received configuration
- A method of obtaining common & UE-specific search space configuration, comprising:
 - Receiving configuration of bandwidth parts for Pcell, wherein each configured bandwidth part includes at least one CORESET with UE-specific search space and at least one of the configured bandwidth parts includes one CORESET with common search space
 - Receiving configuration of bandwidth parts for Scell, wherein each configured bandwidth part includes at least one CORESET with UE-specific search space
 - Detecting scheduler(s) in the common search space and UE-specific search space based on the received configuration

Preliminary Claims (3)

- * A method of monitoring common search space, comprising:
 - Receiving configuration of a time gap for common search space monitoring, wherein the configuration includes at least periodicity of the time gap, time gap length and a BWP including a CORESET with common search space for monitoring;
 - Switching active BWP to the BWP including a CORESET with common search space based on the configuration of the time gap if current active BWP doesn't include a CORESET with common search space;
 - Detecting scheduler(s) in the common search space for broadcast/multi-cast data
- * A method of performing RRM measurement, comprising:
 - Receiving configuration of CSI-RS RRM measurement, wherein the configuration includes at least CSI-RS RRM measurement configurations in a set of configured BWPs;
 - Performing CSI-RS RRM measurement based on the received configuration
- * A method of performing RRM measurement, comprising:
 - Receiving configuration of BWPs;
 - Receiving configuration of CSI-RS RRM measurement, wherein the configuration includes at least CSI-RS RRM measurement configurations in a set of the configured BWPs and CSI-RS RRM measurement configurations outside the configured BWPs;
 - Performing CSI-RS RRM measurement based on the received configuration



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Preliminary Claims (4)

- A method of obtaining common & UE-specific search space configuration, comprising:
 - Receiving configuration of bandwidth parts for Pcell, wherein each configured bandwidth part includes at least one CORESET with UE-specific search space, at least one of the configured bandwidth parts includes one CORESET with Type-1 common search space and each configured bandwidth part includes one CORESET with Type-2 common search space
 - Receiving configuration of bandwidth parts for Scell, wherein each configured bandwidth part includes at least one CORESET with UE-specific search space and each configured bandwidth part includes one CORESET with Type-2 common search space
 - Detecting scheduler(s) in Type-1 & Type-2 common search space and UE-specific search space based on the received configuration

Preliminary Claims (5)

- A method of robust active DL bandwidth part indication
 - Transmitting new active DL bandwidth part indication by DCI in current active DL bandwidth part for a UE to the UE
 - Triggering a timer if no uplink transmission is received from the UE for DL/UL scheduling in the active UL bandwidth part
 - Transmitting active DL bandwidth part indication by DCI in all DL bandwidth part configured to the UE when the timer expires



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Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	Methods of Power-efficient Operation in Wideband Carrier			
First Named Inventor/Applicant Name:	Pei-Kai LIAO			
Filer:	Daniel R. McClure/Brooke French			
Attorney Docket Number:	251367-8237			
Filed as Large Entity				
Filing Fees for Provisional				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
PROVISIONAL APPLICATION FILING	1005	1	260	260
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 (\$)				260

Electronic Acknowledgement Receipt

EFS ID:	30053911
Application Number:	62544118
International Application Number:	
Confirmation Number:	7862
Title of Invention:	Methods of Power-efficient Operation in Wideband Carrier
First Named Inventor/Applicant Name:	Pei-Kai LIAO
Customer Number:	109673
Filer:	Daniel R. McClure/Brooke French
Filer Authorized By:	Daniel R. McClure
Attorney Docket Number:	251367-8237
Receipt Date:	11-AUG-2017
Filing Date:	
Time Stamp:	12:35:19
Application Type:	Provisional

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Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$260
RAM confirmation Number	081117INTEFSW12354200
Deposit Account	505954
Authorized User	Brooke French

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

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.21 (Miscellaneous fees and charges)

Ex. 1009

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	00481354.PDF	1822873	no	8
			636443f0cb81294c164eede926c6d566907 efa2c		
Warnings:					
Information:					
2	Specification	00481353.PDF	366993	no	24
			7b17d6056abcc8bd614685f101784bf4602 cbc8b		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30341	no	2
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Warnings:					
Information:					
Total Files Size (in bytes):			2220207		
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