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(71) Applicant: **MEDIATEK INC.** [CN/CN]; No. 1, Dusing 1st Rd., Hsinchu Science Park, Hsinchu City 30078, Taiwan (CN).

(72) Inventors: **LIN, Hsuan-Li**; No. 1, Dusing 1st Rd., Hsinchu Science Park, Hsinchu City 30078, Taiwan (CN). **TANG, Zhixun**; No. 1, Dusing 1st Rd., Hsinchu Science Park, Hsinchu City 30078, Taiwan (CN). **QU, Wenze**; No. 1, Dusing 1st Rd., Hsinchu Science Park, Hsinchu City 30078, Taiwan (CN). **YU, Tsang-Wei**; No. 1, Dusing 1st Rd., Hsinchu Science Park, Hsinchu City 30078, Taiwan (CN).

(74) Agent: **CHINA WISPRO INTELLECTUAL PROPERTY LLP.**; Room A806, Zhongdi Building, China University of Geosciences Base, No. 8 Yuexing 3rd Road, High-Tech Industrial Estate, Nanshan District, Shenzhen, Guangdong 518057 (CN).

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(54) **Title:** PROCEDURE OF UE CHANNEL STATE INFORMATION (CSI) REPORT AND CHANNEL STATE INFORMATION REFERENCE SIGNAL (CSI-RS) CONFIGURATION UPDATE FOR CSI

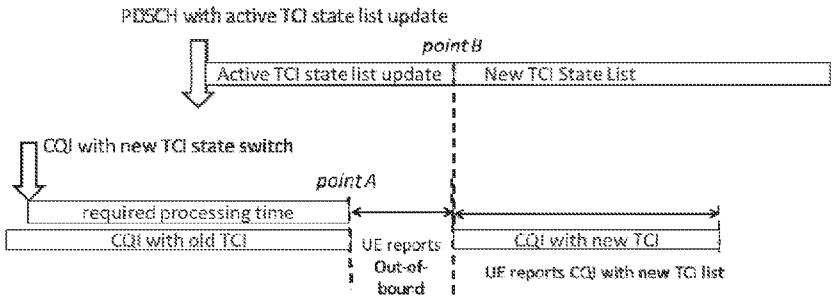

Figure 2

(57) **Abstract:** Apparatus and methods are provided for CSI reporting. In one novel aspect, Channel State Information (CSI) reporting are performed based on timing of completion of Channel State Information Reference Signal (CSI-RS) configuration update for CSI, a timing of new TCI state switch for the CSI-RS for CSI is configured, and a timing of completing the active TCI state list update. In one embodiment, the CSI is reported (before time point A) according to the old TCI state list until UE finished the TCI state switch. In another embodiment, the CSI is reported as out-of-bound in the time durationafter finished the TCI state switch included in the CSI-RS configuration update for CSI and before updating the active TCI state list. In one embodiment, the CSI is reported as out-of-bound in the time durationbefore finished the TCI state switch included in the CSI-RS configuration update for CSI and after updating the active TCI state list.

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PROCEDURE OF UE CHANNEL STATE INFORMATION (CSI) REPORT AND CHANNEL STATE INFORMATION REFERENCE SIGNAL (CSI-RS) CONFIGURATION UPDATE FOR CSI

TECHNICAL FIELD

[0001] The disclosed embodiments relate generally to wireless communication, and, more particularly, to UE channel state information (CSI) report and TCI switch.

BACKGROUND

[0002] In the NR network, with multi-beam technology, Transmission Configuration Indication (TCI) is provided to proceed UE reception.

[0003] TCI state switch requirements for downlink control and data channel has been provided.However, for CSI (Channel State Information) reporting as channel quality indicator, it can also switch its TCI state or the CSI-RS for CSI can also be reconfigured, but its UE behavior and requirements are not provided yet.

[0004] Improvements and enhancements are required for CSI-RS for CSI reporting for the NR network.

SUMMARY

[0005] The following presents a simplified summary of one or more aspects in order to provide a basic understanding of such aspects. This summary is not an extensive overview of all contemplated aspects, and is intended to neither

identify key or critical elements of all aspects nor delineate the scope of any or all aspects. Its sole purpose is to present some concepts of one or more aspects in a simplified form as a prelude to the more detailed description that is presented later.

[0006] In an aspect of the disclosure, a method is provided. The UE reports Channel State Information (CSI) to a new radio (NR) network, according to a timing of completion of CSI-RS configuration update for CSI, a timing of new TCI state switch for the CSI-RS for CSI is configured, and a timing of completing the active TCI state list update.

[0007] In another respect, when the CSI-RS configuration update for CSI is finished at time *point A*after completing the active TCI state list update at time *point B*, the reporting CSI comprises reporting CSI before time *point A*according to an existing TCI state list until UE finished the TCI state switch (included in the CSI-RS configuration update) for the CSI and the active TCI state list update and reporting CSI after time point A according to the active TCI state list update after UE finished TCI state switch.

[0008] To the accomplishment of the foregoing and related ends, the one or more aspects comprise the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail certain illustrative features of the one or more aspects. These features are indicative,

however, of but a few of the various ways in which the principles of various aspects may be employed, and this description is intended to include all such aspects and their equivalents.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The accompanying drawings, where like numerals indicate like components, illustrate embodiments of the invention.

[0010] Figure 1 illustrates an exemplary diagram for the scenario that CSI-RS configuration update for CSI is finished (*point A*) **after** completing the active TCI state list update (*point B*).

[0011] Figure 2 illustrates an exemplary diagram for the scenario that CSI-RS configuration update for CSI is finished (*point A*) **before** completing the active TCI state list update (*point B*).

[0012] Figure 3 illustrates an exemplary diagram for the scenario that CSI-RS configuration update for CSI (for the new TCI state switch for the CSI-RS for CSI) is **configured** (*point A*) **after** completing the active TCI state list update (*point B*).

DETAILED DESCRIPTION

[0013] Reference will now be made in detail to some embodiments of the invention, examples of which are illustrated in the accompanying drawings.

Figure 1 is for the scenario that CSI-RS configuration update, including the TCI update or CSI-RS resource ID update, for CSI is finished (time *point A*) **after** completing the active TCI state list update (time *point B*).The UE shall report the CSI with old TCI state list until UE finished the TCI state switch (included in the CSI-RS configuration update) for the CSI and active TCI state list update. (after time *point A*) the UE shall report CSI with the new TCI state list after UE finished TCI state switch for CSI reporting. The CSI-RS configuration update includes at least an update on a TCI of a CSI-RS resource via RRC configuration or indicated by media access control (MAC-CE) or by downlink control information (DCI), or an update on a CSI-RS resource ID used for CSI reporting.

[0014] Figure 2 is for the scenario thatCSI-RS configuration update for CSI is finished (time *point A*) **before** completing the active TCI state list update (time *point B*).(after *point B*) the UE shall report CSI with the new TCI state list after UE finished the CSI-RS configuration update for CSI (i.e. TCI state switch for the CSI-RS for CSI) and active TCI state list update. (after time *point A* andbefore time *point B*) The UE can report out-of-bound in the timeline after finished the TCI state switch the CSI-RS configuration update for CSI (i.e. TCI state switch for the CSI-RS for CSI) and before updating the active TCI state. After finishing the TCI state switch for CSI, UE has the capability to report the CSI with new

TCI state, but the active TCI state list for data reception is still not updated.

[0015] Figure 3 is for the scenario that CSI-RS configuration update for CSI (for the new TCI state switch for the CSI-RS for CSI) is **configured** (time *point A*) **after** completing the active TCI state list update (time *point B*). (after time*point A*) the UE shall report CSI with the new TCI state list after UE finished the TCI state switch for the CSI-RS for CSI and active TCI state list update. (after time *point B* andbefore time*point A*) The UE can report out-of-bound in the time duration after finished updating the active TCI state list and before finished the TCI state switch for CSI. After finishing the TCI state list update, the UE work on the new TCI state to receive data transmission. However, the CSI reporting is still staying at the old TCI state. Thus, the CSI feedback can also be out-of-bound. Once finishing the TCI state switch for CSI reporting, the UE can report the CSI with the new TCI state list.

CLAIMS

What is claimed is:

1. A method comprising:

reporting CSI by a user equipment (UE) in a new radio (NR) network, according to a timing of completion of channel state information reference signal (CSI-RS) configuration update for channel state information (CSI), a timing of a Transmission Configuration Indication (TCI) state switch for the CSI-RS for CSI is configured, and a timing of completing an active TCI state update.

2. The method of claim 1, wherein when the CSI-RS configuration update for CSI is finished at time *point A***after** completing the active TCI state list update at time *point B*, the reporting CSI comprises:

reporting CSI before time *point A*according to an existing TCI state list until UE finished the TCI state switch (included in the CSI-RS configuration update) for the CSI and the active TCI state list update; and

reporting CSI after time point A according to the active TCI state list update after UE finished TCI state switch.

3. The method of claim 1, wherein the reporting CSI comprises:

reporting CSI before time *point B*according to the new TCI state list after UE finished the CSI-RS configuration update for CSI and an active TCI state list update; and

reporting CSIafter time *point A* andbefore time *point B*as **out-of-bound in the time duration**after finished the CSI-RS configuration update for CSI and before updating the active TCI state list, when the CSI-RS configuration update for CSI is finished at time *point A* and **before** completing the active TCI state list update at time *point B*.

4. The method of claim 3, wherein the CSI-RS configuration update for CSI comprises at least an update on TCI of a CSI-RS resource via RRC configuration or indicated by media access control (MAC-CE) or downlink control information (DCI), or an update on a CSI-RS resource ID used for CSI reporting.

5. The method of claim 1, wherein the reporting CSI comprises:

reporting CSI after time *point A*according to the new TCI state list after UE finished the TCI state switch for the CSI-RS for CSI and the active TCI state list update; and

reporting CSI after time *point B* andbefore time *point A*as **out-of-bound in the time duration**after finished updating the active TCI state list and before finished the TCI state switch for CSI, when the new TCI state switch for the CSI-RS for CSI is **configured** at time *point A***after** completing the active TCI state list update at time *point B*.

6. The method of claim 1, wherein the CSI reporting is CQI reporting, RI (rand indication)reporting, or PMI (precoding matrix indication) reporting.

DRAWINGS

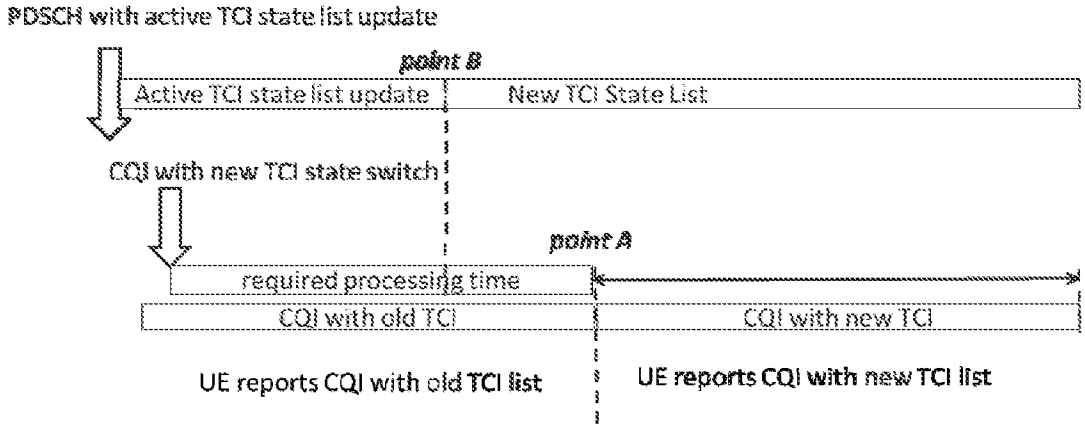

Figure 1

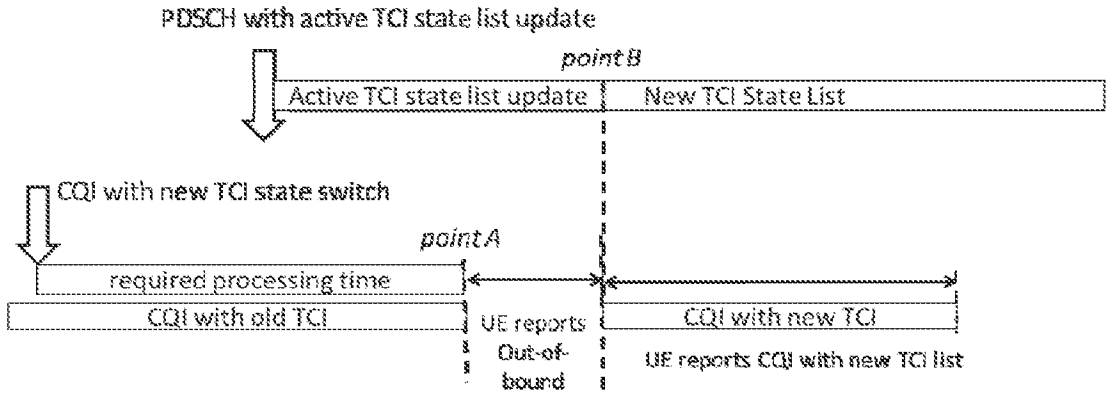

Figure 2

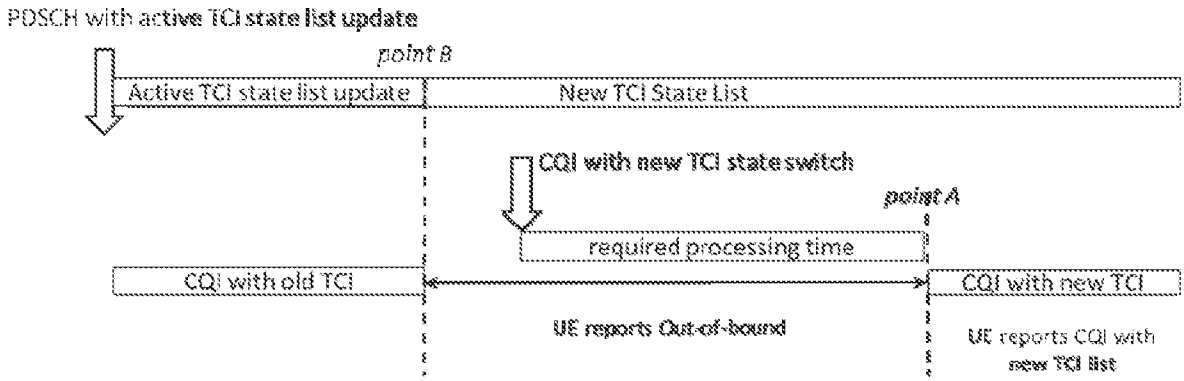
PDSCH with active TCI state list update
point B
Active TCI state list update
New TCI State List
CQI with new TCI state switch
point A
required processing time
CQI with old TCI
CQI with new TCI
UE reports Out-of-bound
UE reports CQI with new TCI list

Figure 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/109797

A. CLASSIFICATION OF SUBJECT MATTER

H04W 72/04(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, H04Q

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, VEN, USTXT, EPTXT, 3GPP: channel state information, CSI, CSI-RS, transmission configuration indication, TCI, report+, updat+, active, configurat+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2019120520 A1 (ERICSSON TELEFON AB L M) 27 June 2019 (2019-06-27) description page 17 line 27 to page 30 line 6 and figures 1-11	1-6
A	WO 2019097478 A1 (ERICSSON TELEFON AB L Met al.) 23 May 2019 (2019-05-23) the whole document	1-6
A	CN 109302272 A (ZTE CORPORATION) 01 February 2019 (2019-02-01) the whole document	1-6

☐ 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
03 June 2020	**22 June 2020**
Name and mailing address of the ISA/CN **National Intellectual Property Administration, PRC** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing** **100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer **XU,Jiaying** Telephone No. **86-(010)-62089446**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/109797

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
WO 2019120520 A1	27 June 2019	US 2019364591 A1	28 November 2019
WO 2019097478 A1	23 May 2019	None	
CN 109302272 A	01 February 2019	WO 2019157958 A1	22 August 2019