**3GPP TSG RAN WG1 #104-e R1-21xxxxx**

**e-Meeting, January 25 – February 5, 2021**

**Source: Moderator (MediaTek)**

**Title: Email discussion on reply LS for TCI state indication at Direct SCell activation**

**Agenda item: 7.2.10**

**Document for:** **Discussion and Decision**

Introduction

In RAN1#104-e meeting, an LS from RAN4 was received on TCI state indication at Direct SCell activation [1] and the following issue description is drawn from RAN4 while the solution to the issue is RAN1/RAN2 aspect:

* Current RRC command for direct SCell activation does not include TCI state activation information to UE. In current framework, network needs to send separate MAC CE to complete direct SCell activation procedure. Due to this both gNB and UE may not realise the full benefit of direction SCell activation feature using existing framework. The above mentioned issue applies to both FR1 and FR2.

Several related contributions on discussion and draft reply LS were submitted in this meeting [2]-[4]. As guided by the Chairman, this contribution provides a summary of the submitted contributions, discussion points and outcomes of email discussion during this meeting:

[104-e-NR-MRDC-CA-03] Email discussion/approval of a potential reply LS to [R1-2100013](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100013.zip) until Jan-29 - James (MediaTek)

Discussion points (phase 1 until 27-Jan)

Based on the submitted inputs [2]-[4], it is mentioned in [2] that a default selection of TCI states according to current 38.213/38.214 spec is enough to tackle RAN4’s issue about direct SCell activation. A separate MAC-CE may not be necessary due the following text in 38.214 5.1.5:

* After a UE receives an initial higher layer configuration of TCI states and before reception of the activation command, the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the SS/PBCH block **determined in the initial access procedure**

or when only a single TCI state is configured.

In [3][4], they empathize with RAN4 that a separate MAC-CE is required to complete direct SCell activation procedure in current framework due to lack of TCI state activation information. In [3], it is elaborated that to further realise the full benefit of direction SCell activation, this would involve

* an RRC command update (RAN2 spec impact) or
* a default TCI state definition for direct SCell activation (RAN1 spec impact)

while [3][4] both prefer not to introduce further direct SCell optimization in RAN1 R16 spec due to the late stage in R16.

To moderator’s understanding, RAN1 should first clarify whether a separate MAC-CE is required to complete direct SCell activation procedure as RAN4 indicated. If it is required, RAN1 can further discuss whether a RAN1-based solution is necessary in R16. For the RAN2-based solution, it should be up to RAN2 to decide whether to develop a solution.

The following questions are devised in order to formulate potential answers to RAN4’s questions. Companies are encouraged to provide their inputs below.

Question 1 (Whether a separate MAC-CE is required to complete direct SCell activation procedure in current framework due to lack of TCI state activation information):

**Do you agree with RAN4 that a separate MAC-CE is required to complete direct SCell activation procedure in current framework?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| MTK | Yes | To our understanding, "TCI determined in the initial access procedure" mentioned in [2] only applies to PCell, not SCell. For “single TCI state configured” mentioned in [2], it is kind of a special case and not a general solution. Therefore, we agree with RAN4 that a separate MAC-CE is required to complete direct SCell activation procedure in current framework. |
| ZTE | Yes | Based on our understanding, considering one specific example, i.e., FR1 (PCell)+FR2 (SCell) CA, “TCI determined in the initial access procedure” may be more appropriate to be applies to PCell only.  From this perspective, a separate MAC-CE is required to complete direct SCell activation procedure. But of course, RAN2 may come up with some other solutions to handle this issue, e.g., introducing RRC IE to configure the TCI state. |
| Nokia, NSB | No | There are quite few cases when the TCI activation does not require a MAC CE   * By default, a serving cell's TCI state points to the SS/PBCH block (without any configuration) * If only a single TCI state is configured for PDCCH, that is always considered activated and no separate MAC CE activation is needed * For QCL type D, the PDSH TCI state in RRC\_CONNECTED is determined according to the CORESET with the smallest *controlResourceSetId* that is configured for active BWP of serving cell |
| Qualcomm | Yes |  |
| vivo | No | Besides the case mentioned by Nokia. There is one additional case.  For a CORESET with index 0, the UE assumes that a DM-RS antenna port for PDCCH receptions in the CORESET is quasi co-located with  - the one or more DL RS configured by a TCI state, where the TCI state is indicated by a MAC CE activation command for the CORESET, if any, or  - a SS/PBCH block the UE identified during a most recent random access procedure not initiated by a PDCCH order that triggers a contention-free random access procedure, if no MAC CE activation command indicating a TCI state for the CORESET is received after the most recent random access procedure. |
| CATT | Yes | Additional MAC message is needed for the SCell TCI state in SCell activation. |

Question 2 (RAN1-based solution in R16):

**RAN4 LS mentioned that the solution to the issue is RAN1/RAN2 aspect. Do you agree that RAN1 should devise a solution for this issue in R16 if the issue is valid?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| MTK | Yes | It may be late in R16, but realizing the full benefit of direction SCell activation feature using existing framework is helpful for system performance enhancement. Companies can discuss proposals in this or next RAN1 meeting to finalize the solution. |
| ZTE | No | From our perspective, it is too late to introduce RAN1 solutions to address this issue. We noticed that companies submitted some layer-2 based solutions in RAN2, it may be better to leave this issue to RAN2 to avoid parallel discussion in RAN1 and RAN2. |
| Nokia | No | From our view, there are cases when the MAC-CE for activating the TCI state as part of SCell activation is not a mandatory pre-requisite, and don’t see the need to device a new solution for the problem that is not really there. |
| Qualcomm | No | RAN2 should define the solution, i.e., adding the TCI state in RRC signalling |
| vivo | No | Too late for Rel-16 enhancement. |
| CATT | No | No additional enhancement for Rel-16 |

Question 3 (RAN2-based solution):

**RAN4 LS mentioned that the solution to the issue is RAN1/RAN2 aspect. Do you agree that it should be up to RAN2 to decide whether a RAN2-based solution is required?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| MTK | Yes | It should be up to RAN2. |
| ZTE | Yes | This topic is led by RAN2, it is better to wait for RAN’s input first. If RAN2 resolves this issue, then no RAN1-based solution is needed. |
| Nokia | Yes | RAN2 can decide if they believe something is needed, but in our view it is important to inform RAN2 in addition to RAN4 of the somewhat misleading understanding conveyed in the RAN4 LS. A suggestion for this with the corresponding RAN1 spec references is in [R1-2100502](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2100502.zip) |
| Qualcomm | Yes | RNA1 can agree that a solution is needed, and it is up to RAN2 to define the solution. |
| Vivo | Yes | It is up to RAN2. |
| CATT | Yes | It is up to RAN2 |

Proposed reply LS answers / outcome (phase 2 until 29-Jan)

TBD, based on outcome of phase 1 discussion.

Summary of contribution inputs

In [2], it quotes the following spec in 38.214 5.1.5:

If *tci-PresentInDCI* is set to "enabled" for the CORESET scheduling the PDSCH, and the time offset between the reception of the DL DCI and the corresponding PDSCH is equal to or greater than *timeDurationForQCL* if applicable, after a UE receives an initial higher layer configuration of TCI states and before reception of the activation command, the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the SS/PBCH block determined in the initial access procedure with respect to 'QCL-TypeA', and when applicable, also with respect to'QCL-TypeD'.

and draws the following observation

**Observation 1:** Before TCI state activation, UE assumes that the TCI state of PDSCH is towards SSB at least for the PCell.

Along with some other observations about default beam association for PDCCH/PDSCH in 38.213/38.214, the following proposal is proposed in [2] to inform RAN4 in the reply LS:

**Proposal 1:** Indicate to RAN4 the default selection of TCI states according [TS38.214](https://www.3gpp.org/DynaReport/38214.htm) and [TS38.213](https://www.3gpp.org/DynaReport/38213.htm) as follows:

* By default, a serving cell's TCI state points to the SS/PBCH block (without any configuration)
* If only a single TCI state is configured for PDCCH, that is always considered activated and no separate MAC CE activation is needed

For QCL type D, the PDSH TCI state in RRC\_CONNECTED is determined according to the CORESET with the smallest *controlResourceSetId* that is configured for active BWP of serving

In [3], three solutions are mentioned for TCI state activation for direct SCell activation:

1. To additionally indicate one TCI state that is to be activated inside the RRC command for direct SCell activation.
2. To define that a default TCI state (e.g., lowest or highest ID) among those included in the RRC command for direct SCell activation is to be activated.
3. (Implementation-based) Network to send regular MAC-CE to activate one TCI state, after sending RRC command for direct SCell activation.

and it is proposed in [3] that **RAN1 reply RAN4, cc RAN2 that RAN1 would not consider further optimizations on TCI state indication for direct SCell activation in R16**.

In [4], it is mentioned that:

* RAN1 understands that in current framework, network must send separate MAC CE commands in addition to the RRC activation command to complete the direct SCell activation procedure.

and the corresponding suggested action is:

* From RAN1 perspective, considering that Rel-16 has already been frozen, **no further enhancement is required to accelerate the SCell activation procedure in Rel-16. Any potential enhancements can be considered in Rel-17 WI of further MR-DC enhancements.**

References

[1] R1-2100013 LS on TCI state indication at Direct SCell activation, RAN4, RAN1 #104e

[2] R1-2100502 On TCI state indication for SCells, Nokia, Nokia Shanghai Bell, RAN1 #104e

[3] R1-2101741 Discussion on TCI state indication at Direct SCell activation, Huawei, HiSilicon, RAN1 #104e

[4] R1-2101147 [DRAFT] Reply LS on TCI state indication at Direct SCell activation, vivo, RAN1 #104e