3GPP TSG-RAN WG2 Meeting #116-e R2-21xxxxx

E-Meeting, 1st – 12th November 2021

**Agenda item: 8.9.3**

**Source: Apple**

**Title: Summary of agenda 8.9.3: Other aspects RAN2 impacts - TRS CSI-RS for RRC-IDLE and RRC-INACTIVE**

**WID/SID: NR\_UE\_pow\_sav\_enh-Core**

**Document for: Discussion and Decision**

# **Introduction**

This document summarizes the contributions related to TRS/CSI-RS for RRC-IDLE and RRC-INACTIVE UEs for enhanced NR UE Power Saving.

* [AT116-e][035][ePowSav] TRS CSI-RS for RRC-IDLE and RRC-INACTIVE (Apple)

 Scope: Progress the topics of TRS CSI-RS for RRC-IDLE and RRC-INACTIVE based on contributions to this meeting. Identify agreements, and potential discussion points. Converge as much as possible offline. Cb Online if needed.

 Intended outcome: Report with Agreements

 Deadline: Wednesday W2 (Online CB if needed)

Companies are requested to provide their inputs by end of **Monday, November 8, 2021, 11:59 PM UTC.**

Rapporteur will provide an updated summary in time for **Wednesday, November 10, 2021** session**.**

# **Contact Information**

Please enter your company contact information in the table below

Table 1 Contact Information

|  |  |  |
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| Company Name | Contact Name | Contact Email ID |
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# **Discussion**

## **TRS/CSI-RS Signalling Availability Indication**

RAN1 in its 106bis-e meeting [1], had made the following agreements for TRS/CSI-RS availability indication.

*Working Assumption*

*If TRS resource is configured in SIB, L1 based availability indication is always enabled based on the configuration.*

*Agreement*

*For L1 based availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UEs, support availability information for configured RS resources using a bitmap. where each bit indicates whether associated TRS resource(s) are available.*

* *Support L1 availability indication at an occasion can provide availability information RS resources with QCL references not confined to be the same as for the L1 availability indication occasion*
	+ *FFS associated TRS resource(s) per bit, e.g. a bit is associated with a TRS resource set*
	+ *Bitmap size is up to X bits*
		- *X = [6] for paging PDCCH based L1 availability indication.*
		- *FFS X for PEI DCI based L1 availability indication*
		- *FFS details about how to configure the DCI field: e.g. start and length of bitmap (e.g. explicitly/implicitly configured)*
* *for paging PDCCH based L1 availability indication, support L1 availability indication at an occasion can provide availability information for all configured RS resources*
	+ *FFS whether this needs to be supported regardless of the number of beams or for some configured RS resources*
* *FFS: PEI DCI provides L1 availability indication information only for RS resources with QCL references to be the same as for the L1 availability indication occasion*
* *FFS: indication of unavailability*

Based on the current set of RAN1 agreements, atleast PDCCH L1 based availability indication would be supported and that there is no consensus on SIB based availability indication.

In the current RAN2 meeting several companies have submitted contributions on this topic, which can be grouped together as follows

Group 1: Do not pursue any SIB based availability indication for TRS/CSI-RS occasion(s) [2]

Group 2: Availability of TRS/CSI-RS occasions(s) indicated in Paging PDCCH [4]

Group 3: NW configures in SIB whether L1 signalling, or SIB presence is used to indicate TRS availability [9][10]

Group 4: Wait for more RAN1 inputs on this topic [3]

In the light for the latest RAN1 agreements, companies are invited to provide their views on whether,

Option 1: Further availability SIB based availability indication is required over and above the RAN1 working assumption

Option 2: Current RAN1 working assumption (PDCCH L1 based indication) is sufficient and there is no need for any additional SIB based availability indication

Table 2 TRS/CSI-RS Availability Indication

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2** | **Comments** |
| OPPO | Option 2 | We should try to have a workable solution first and avoid introducing any enhancements. |
| Samsung | Option 2 | Option 2 is sufficient unless RAN1 decides that PDCCH L1 based indication is optional. |
| MediaTek | Option 2 | This approach is simple and it works. |
| LGE | Option 2 | Option 2 is sufficient. |
| Xiaomi | Option1 | We prefer to wait for more RAN1 inputs on this topic |
| Interdigital  | Option 2 |  |

## **Area scope of new SIB-X**

RAN2 in its 115-e meeting [12], had agreed that the TRS/CSI-RS configurations would be broadcasted in a new SIB-X. The area scope of this new SIB needs to be specified. Based on the contributions in this ongoing RAN2#116-e, two possible groupings are considered

Group 1: The new SIB-X is cell specific and NOT area specific [3], the argument being that the TRS/CSI-RS configuration across different cell(s) would be different.

Group 2: The new SIB-X can be configured area specific [9], to take advantage of any potential commonalities in the TRS configuration across neighbour cells and prevent frequent re-acquisition from UE perspective.

Based on the above, companies are invited to propose their view on whether,

Option 1: The new SIB-X should be **cell** specific

Option 2: The new SIB-X should be **area** specific

Option 3: No strong views

Table 3 Area Scope of SIB-X

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2 / Option 3** | **Comments** |
| OPPO | Option 1 |  |
| Samsung | See comments | Current SI framework is flexible. Network can indicate (by presence/absence of field *areaScope*) whether the SIB is cell specific or area specific. We do not see any need to deviate from this principle. |
| MediaTek | Option 1 | TRS/CSI-RS configurations across different cells are likely to be different |
| LGE |  | The new SIB should be valid in the cell only, but as mentioned by Samsung, we don’t need to specify this and it can be up to NW configuration issue. |
| Xiaomi | Option1 |  |
| Interdigital | No agreement necessary. | Agree with Samsung. |

## **Dedicated Signalling for TRS/CSI-RS configuration**

RAN2 in its 115-e meeting [12], had agreed for the SIB based broadcast availability of TRS/CSI-RS configuration as a baseline, and decision on further dedicated signalling of this configuration on a per UE basis was postponed, and is to be discussed based on company contributions. In this section, we revisit this discussion based on the current set of company contributions.

Two groups of views have emerged on this topic.

Group 1: RAN2 to consider dedicated signalling of TRS/CSI-RS configuration (in addition to the broadcast based) for IDLE/INACTIVE UEs ([4][5][6][7][10]). The motivation being

* Reduces overhead (OSI) for UE to acquire this information while transitioning from RRC CONNECTED to RRC IDLE / RRC INACTIVE states
* High probability of RRC CONNECTED UE using the same configuration in RRC IDLE/RRC INACTIVE states
* Provides optimal configuration to the UE at the time of RRC Release/Suspend
* NW can only provide the delta configuration required for IDLE/INACTIVE UEs compared to what the UEs used while it was in RRC CONNECTED state
* Dedicated configuration is one shot even for several UEs

Group 2: RAN2 to NOT consider any dedicated signalling of TRS/CSI-RS configuration in Rel-17 and only adopt the previously agreed new SIB-X based approach to provide TRS/CSI-RS configuration for IDLE/INACTIVE UEs ([2][3][9]). The motivation being

* Dedicated configuration will become obsolete after a cell change
* Dedicated configuration does not add any value over and above the SIB provided configuration
* Incurs additional signalling overhead in cases when the configuration needs to be changed
* UE can determine its optimal TRS/CSI-RS resource configuration by beam sweeping
* Additional complexity on NW side to construct UE specific TRS/CSI-RS configuration

Based on the above, and the previous RAN2 agreement of using SIB-X broadcast as a baseline, companies are invited to propose their view on whether,

* Option 1: Additional dedicated signalling could be supported for providing TRS/CSI-RS configuration for IDLE/INACTIVE UEs
* Option 2: Additional dedicated signalling need **NOT** be supported for providing TRS/CSI-RS configuration for IDLE/INACTIVE UEs.

Table 4 Dedicated Signalling for TRS/CSI-RS configuration

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2** | **Comments** |
| OPPO | Option 2 | Availability indication is now per cell. With dedicated signalling, UE-specific TRS/CSI-RS configuration will be added and that will cause trouble for cell-specific availability indication. We see no gain by doing that. |
| Samsung | Option 2 |  |
| MediaTek | Option 2 |  |
| LGE | Option 2 |  |
| Xiaomi | Option 2 | We really do not think we need to specify both since one can work well. |
| Interdigital | Option 2 | No strong need |

## **Sizing, Segmentation and Common/Specific part splitting of new SIB-X**

With the introduction of new SIB-X, the size aspect of this new SIB-X needs to be considered. In the RAN2#115-e meeting [12], it was agreed to postpone the discussion on SIB-X sizing, segmentation of new the SIB-X and splitting of common and RS-specific part pending RAN1 inputs. RAN1 in its 106bis-e meeting [1], had made the following agreements for TRS/CSI-RS configuration in SIB-X

***Agreement***

*Configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs include a list of one or more TRS resource sets, where:*

*        a TRS resource set can be configured to include*

*o   a set of TRS resources up to two consecutive slots,*

*  Note: a TRS resource is same as Rel-15/16, i.e. a CSI-RS in a symbol.*

*o   at least common configuration parameters:*

*  a QCL reference*

*  firstOFDMSymbolInTimeDomain,*

*  ‘frequencyDomainAllocation for row1’, ‘startingRB’ ,‘nrofRBs’,’powerControlOffsetSS’, periodicityAndOffset’*

*  FFS*

*        scramblingID,*

*        a TRS resource set ID, number of slots {1, 2} or number of symbols {2, 4} if supported*

*        Note: the ‘TRS resource set’ configuration is not (necessarily) identical to ‘NZP-CSI-RS-ResourceSet’ configuration for TRS in R15/16.*

In the current RAN2 meeting, companies have proposed views on the sizing of this new SIB-X, segmentation requirements and options to consider splitting the configuration as common and TRS specific part [4][6][8][10].

Based on the current RAN1 agreement there are still some FFS in terms of scrambling ID, TRS resource set ID, number of slot or number of symbols (if supported). Companies are invited to propose their view on the topic of

* SIB-X sizing
* SIB-X need for potential segmentation
* SIB-X splitting with common and TRS specific part

### **SIB-X sizing**

Option 1: SIB-X sizing requirements are complete based on the RAN1 input

Option 2: SIB-X sizing requirements need further inputs based on the FFS, and hence needs to be postponed pending further RAN1 input

Table 5 SIB-X Sizing

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2** | **Comments** |
| OPPO | Option 2 |  |
| Samsung | Option 2 | As rapporteur mentioned, there are still some FFS in terms of scrambling ID, TRS resource set ID, number of slot or number of symbols |
| MediaTek | Option 2 |  |
| LGE | Option 2 |  |
| Xiaomi | Option 2 |  |
| Interdigital | Option 2 |  |

### **SIB-X potential need for segmentation**

Option 1: SIB-X sizing requirements are complete (as indicated in 3.4.1) based on the current RAN1 input and based on the maximum configuration size SIB-X segmentation is needed or not.

Option 2: SIB-X sizing requirements (as indicated in 3.4.1) need further inputs based on the current RAN1 FFS, and hence segmentation aspect of SIB-X to be postponed pending further RAN1 input

Table 6 SIB-X Segmentation

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2**  | **Comments** |
| OPPO | Option 2 |  |
| Samsung | Option 2 |  |
| MediaTek | Option 2 |  |
| LGE | Option 2 |  |
| Xiaomi | Option 2 |  |
| Interdigital | Option 2 |  |

### **SIB-X splitting with common and TRS specific part**

Do companies agree in principle that splitting the TRS/CSI-RS configuration is possible based on the current RAN1 input?

Option 1: Yes

Option 2: No

Table 7 Common-Specific Split

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2**  | **Comments** |
| OPPO | No |  |
| Samsung | Option 2 |  |
| MediaTek | Option 2 |  |
| LGE | Option 2 |  |
| Xiaomi | - | RAN1 is discussing this, e.g., common parameters. |
| Interdigital |  | Wait for RAN1 |

Do companies feel RAN2 has to wait for further inputs from RAN1 (for the FFS items) before finalizing the common and RS specific part?

Option 1: Yes

Option 2: No

Table 8 Common-Specific Split Contents

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2**  | **Comments** |
| OPPO | Option 1 |  |
| Samsung | Option 1 |  |
| MediaTek | Option 1 |  |
| LGE | Option 1 |  |
| Xiaomi | Option 1 |  |
| Interdigital | Option 1. |  |

## **On demand acquisition of new SIB-X**

In the RAN2#115-e meeting [12], it was agreed that on demand acquisition of this new SIB-X should be possible. In the current meeting companies have made contributions outlining some restriction on this on demand acquisition based on NW implementation [9][11].

Companies are invited to present their views on following

* On demand nature of SIB-X
* Additional UE impacts on the indicated NW side restrictions for on-demand SIB-X

### **On demand nature of SIB-X**

Do companies agree that SIB-X should be made on demand?

Option 1: Yes

Option 2: No (Please provide justification)

Table 9 SIB-X On Demand

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2**  | **Comments** |
| OPPO | - | SIB-X can be made on demand. |
| Samsung | See comments | Follow current SI framework. Network can configure whether SIB-X is provided on demand or not. |
| MediaTek | - | Can be configured as on-demand or not |
| LGE |  | NW can decide to broadcast it in on-demand manner or not. |
| Xiaomi | - | SIB-X can be made on demand. |
| Interdigital | No agreement necessary | Agree with Samsung |

### **Additional UE side impacts due to NW side restriction for on demand SIB-X**

Do companies see any additional UE side impacts due to NW side restriction for on demand SIB-X? If yes, any potential impacts to be discussed in RAN2?

Option 1: Yes (Please provide details of such impact)

Option 2: No

Table 10 NW restriction for on demand SIB-X

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2**  | **Comments** |
| OPPO | Option 2 | We can follow legacy on-demand SI scheme. |
| LGE | Option 2 |  |
| Xiaomi | Option 2 |  |
| Interdigital | Option 2 |  |

## **UE reporting of TRS/CSI-RS resource usage**

One company has indicated concerns of potential TRS/CSI-RS resource wastage (due to large configuration size and potentially segmented) and absence of any feedback from UEs to ascertain if indeed IDLE/INACTIVE Ues are using this TRS/CSI-RS configuration in the cell [9].

Companies are invited to share their views on the same. Do companies see this as a real issue and needs to be addressed in RAN2?

Option 1: Yes

Option 2: No

Table 11 TRS/CSI-RS usage reporting

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2**  | **Comments** |
| OPPO | Option 2 |  |
| Samsung | Option 2 |  |
| MediaTek | Option 2  |  |
| LGE | Option 2 |  |
| Xiaomi | Option2 | For idle/inactive UE, UE’s feedback is not desired as UE may need to perform RACH. |
| Interdigital | Option 2 |  |

## **Applicability of TRS/CSI-RS for eDRX UEs**

One company has indicated the need for TRS/CSI-RS for eDRX Ues so that they stand to benefit like normal (non eDRX Ues) from a power save perspective. Companies are invited to share the view on the same. Do companies support this view? If yes, should any special handling need to be considered for such eDRX Ues as outlined in [8].

Option 1: Yes

Option 2: No

Table 12 TRS/CSI-RS for eDRX Ues

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Option 1 / Option 2**  | **Comments** |
| OPPO | See comments | We should not target any special handling for eDRX. If it comes for free for eDRX, then we are ok. |
| Samsung | See comments | e-DRX Ues can use TRS/CSI-RS. Follow same principle as other SI configurations/update for e-DRX Ues. |
| MediaTek | - | No specific handling for eDRX Ues |
| LGE | Option 2: No |  |
| Xiaomi | - | We understand the intention of this paper.But we think for availability part, we had better wait for RAN1’s progress.Currently, RAN1 is discuss the UE reference point for validity duration and gNB’s behaviours. |
| Interdigital | Option 2 |  |

# References

1. RAN1#106bis-e meeting – Chairman Notes
2. [R2-2109492](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109492.zip) Discussion on signaling aspects of TRS/CSI-RS occasion(s) for idle/inactive Ues OPPO discussion Rel-17 NR\_UE\_pow\_sav\_enh-Core
3. [R2-2109648](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109648.zip) Discussion on TRS CSI-RS for RRC-IDLE and RRC-INACTIVE State UE Beijing Xiaomi Mobile Softwar discussion
4. [R2-2109738](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109738.zip) Discussion on TRS CSI-RS in idle inactive mode vivo discussion Rel-17 NR\_UE\_pow\_sav\_enh-Core
5. [R2-2110052](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110052.zip) TRS/CSI-RS Signaling Aspects for IDLE/INACTIVE UEs Apple discussion Rel-17 NR\_UE\_pow\_sav\_enh-Core
6. [R2-2110335](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110335.zip) TRS/CSI-RS configuration for Idle/inactive mode UE Lenovo, Motorola Mobility discussion Rel-17
7. [R2-2110353](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110353.zip) Discussion on dedicated signaling of TRS/CSI-RS configuration Sony discussion Rel-17 NR\_UE\_pow\_sav\_enh-Core
8. [R2-2110403](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110403.zip) TRS/CSI-RS SI update mechanism for DRX and eDRX Ues CATT discussion Rel-17 NR\_UE\_pow\_sav\_enh-Core
9. [R2-2110416](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110416.zip) Provisioning of TRS occasions to Idle and Inactive UEs Ericsson discussion Rel-17 NR\_UE\_pow\_sav\_enh-Core
10. [R2-2110540](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110540.zip) Discussion on potential TRS/CSI-RS Huawei, HiSilicon discussion Rel-17 NR\_UE\_pow\_sav\_enh-Core
11. [R2-2110820](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110820.zip) Potential TRS/CSI-RS occasion(s) Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_UE\_pow\_sav\_enh-Core
12. RAN2#115-e meeting – Chairman Notes