**3GPP TSG RAN WG1 #104b-e** **R1-2103251**

**e-Meeting, April 12th – April 20th, 2021**

**Agenda Item:** 8.7.1.2

**Source:** Moderator (Samsung)

**Title:**  Summary for TRS/CSI-RS occasion(s) for idle/inactive UEs

**Document for:** Discussion/Decision

# Introduction

In RAN1#104 e-meeting for AI 8.7.1.2, it was agreed that UE’s assumption on the availability of TRS/CSI-RS at the configured occasion(s) is informed to the idle/inactive UE based on explicit indication. The details, such as signalling method and detailed information for the TRS/CSI-RS, etc, are FFS. Also, it was concluded to decide in RAN1#104b-e whether or not to support periodic CSI-RS in addition to periodic TRS for TRS/CSI-RS occasion(s) for idle/inactive UEs. Lastly, several configuration aspects and corresponding alternatives were identified in last meeting. Down-selection or determination of applicable values for those agreed configuration parameters are expected to be discussed in RAN1#104b-e.

This document provides a summary of the contributions for TRS/CSI-RS occasion(s) for idle/inactive UEs, where companies’ views/proposes are divided into the following sections/topics:

* Topic #1. Explicit availability indication
* Topic #2. RS types
* Topic #3. Details of configuration
* Topic #4: Others

Some potential proposals based on summarized views are provided for Topic #1, #2, and #3 for further discussion during the first round discussion (before 1st check point on 4/15).

The following email thread for TRS/CSI-RS occasion(s) for idle/inactive UEs is announced by Chairman in RAN1#104 e-meeting:

[104b-e-NR-R17-PowSav-02] Email discussion on TRS/CSI-RS occasions(s) for idle/inactive UEs – Qiongjie (Samsung)

* 1st check point: 4/15
* 2nd check point: 4/19
* 3rd check point: 4/20

# Topic #1: Explicit availability indication

According to the following agreement in RAN1#104-e meeting, it has been agreed that UE’s assumption on the availability of TRS/CSI-RS at the configured occasion(s) is informed to the idle/inactive UE based on explicit indication. The details are open for further disucssion.

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| --- |
| Agreements:For a cell with TRS/CSI-RS occasions configured for IDLE/Inactive UEs, IDLE/Inactive UE’s assumption on the availability of TRS/CSI-RS at the configured occasion(s) is informed to the idle/inactive UE based on explicit indication.* FFS details (e.g., the signalling, detailed information for the TRS/CSI-RS, etc.)
* There is no intended blind detection of the presence/absence of TRS/CSI-RS at the UE side in this feature. That is, the UE assumes TRS/CSI-RS is not present if the network does not indicate it is available (or indicates it is unavailable).
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The following proposals regarding the explicit availability indication are submitted in RAN1#104b-e:

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| HW [1] | 1. ***Support indication of availability of assistance TRS before the start of PO through PEI transmission.***
2. ***An indication period is introduced, which can be configured N paging cycles, during which the availability of assistance TRS is assumed to be the same.***
3. ***Support indication of availability of assistance TRS before the start of PO through legacy paging DCI.***
4. ***The availability of assistance TRS in a window before the PO is indicated.***
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| OPPO[2] | ***Proposal 1: Paging DCI or PEI can be used to indicate the availability of TRS/CSI-RS.*** |
| Spreadtrum [3] | **Proposal 2: The availability indication of TRS/CSI-RS in paging DCI or PEI DCI shall be supported.** |
| TCL[4] | **Proposal 6: Consider shared physical layer signaling to carry both the UE subgroup paging information and TRS/CSI-RS availability indication explicitly.**  |
| Vivo[5] | ***Proposal 4:*** *The availability indication can be delievered at least through paging DCI.** *TRS/CSI-RS availability indication through PEI also depends on the signal/channel design of PEI, and it can be discussed after the details are clear.*

***Proposal 5:*** *UE assumes the TRS/CSI-RS available before receiving signaling indicating the TRS/CSI-RS as NOT available.****Proposal 6:*** *Following the TRS availability update procedure can be considered** *Alt-1: The availability indication is transmitted in a first modification period, during which the availability does not take effect until the next modification period. (preferred for on-to-off switching)*
	+ *The modification period is defined for SI update in current specification.*
* *Alt-2: The availability indication takes effect once it is received. (preferred for off-to-on switching)*
 |
| ZTE[6] | **Proposal 2: The TRS availability indication should be carried by PEI.****Proposal 3: The PEI can be used to indicate the availability/unavailability information for each configured TRS resource, instead of all TRS resources.** |
| CATT[7] | ***Proposal 9:*** ***The availability of TRS/CSI-RS at the configured occasion(s) should be informed to the UE by the present/not present of SIB-X TRS/CSI-RS configuration.*** |
| MediaTek[8] | **Proposal 2: gNB to indicate the TRS/CSI-RS availability information to idle/inactive mode UE(s) through SIB.*** **UE(s) monitors SIB for TRS/CSI-RS configuration/availability information periodically without SI update notification.**

**Proposal 3: If paging early indication (PEI) is configured, gNB can indicate the TRS/CSI-RS availability information to idle/inactive mode UE(s) through PEI.** |
| Panasonic[9] | **Proposal 1: L1 (PEI and paging based) TRS/CSI-RS availability indication is supported.** |
| CMCC[10] | **Proposal 1. PEI can carry the availability information of TRS/CSI-RS, which indicate UE whether the TRS/CSI-RS is available or not before the associated PO.**  |
| Xiaomi[11] | ***Proposal 3: DCI based TRS/CSI-RS availability indication can be supported.*** |
| Intel[12] | **Proposal 3: If L1 indication is to be supported for availability indication, paging DCI is preferred over PEI.** |
| Apple[13] | **Proposal 6: The availability indication of the TRS/CSI-RS occasion(s) can be carried in SIB, paging DCI and/or PEI (if PDCCH is adopted for PEI).****Proposal 7: When the availability indication is carried in a DCI, it only carries the information for TRS/CSI-RS configuration(s) that correspond to the same beam as the DCI.****Proposal 8: When a TRS configuration is indicated as available, the idle/inactive UEs assumes that only a certain number of TRS occasion(s) before a PO is available.** |
| Qualcomm[14] | **Proposal 1: RAN1 down-selects from the candidate solutions for indicating whether the TRS/CSI-RS is avaiable at the configured occasion(s)*** **Paging PDCCH**
	+ **By using unused and/or reserved bits in the DCI**
	+ **This includes cross-slot scheduling paging PDCCH as PEI**
* **PDCCH based PEI**
	+ **By using DCI field bits that are not used by UE sub-grouping indication**
* **Sequence/RS based PEI**
	+ **By using additional sequences**
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| Samsung[15] | **Proposal 1: Support paging PDCCH and/or SIB for availability indication of TRS/CSI-RS occasions for idle/inactive UEs.**  **Proposal 2: Support indication of available TRS/CSI-RS resource set(s) for idle/inactive UEs.** **Proposal 3: Support indication of available duration of TRS/CSI-RS occasions for idle/inactive UEs.**  |
| Sony[16] | **Proposal 1: Availability information of TRS/CSI-RS is signaled in the paging DCI.****Proposal 2: Availability information at least contains an indication whether TRS/CSI-RS for idle/inactive UEs is transmitted or not. Further study on additional availability information (e.g. availability duration, which active TRS/CSI-RS are currently available).** |
| LG[17] | **Proposal 1: The availability of TRS/CSI-RS at the configured occasion(s) is informed to the idle/inactive UE at least by the PEI.****- FFS: whether to support indication using paging DCI**  |
| Nokia[18] | **Proposal: Support as a one option indicating the availability in static manner SI without any dynamic presence/availability indication.** **Proposal: Support providing static availability configuration, e.g. in a form of a time table, in SI without any dynamic presence/availability indication.****Proposal:** **Consider paging mechanism based aperiodic availability indication with validity timer as an additional availability indication**.**Proposal: The availability indication for the TRS occasions should support beam specific availability indication.** |
| InterDigital[19] | **Proposal 1: Explicit signaling is used to indicate to the UE the TRS/CSI-RS availability.****Proposal 2: Paging PDCCH and paging indication channel are considered for explicit signaling of the availability of the TRS/CSI-RS occasions.*** **Downselect between paging PDCCH or the paging indication channel after more progress is achieved in the design of the paging indication channel.**
 |
| Sharp[20] | **Proposal 1: DCI should be used to inform the availability of TRS/CSI-RS** |
| DOCOMO[21] | **Proposal 1: Paging DCI and/or paging early indication should explicitly indicate the availability of TRS/CSI-RS for idle/inactive mode UE.****Proposal 2: If UE has not received the availability indication at least for a certain duration, the UE should assume no TRS/CSI-RS can be obtained.****Proposal 3: When the availability is informed e.g., by paging PDCCH, the timer (re)starts, and then after the timer expires, i.e., the availability indication has not been received for the timer period, the UE assumes no TRS/CSI-RS can be obtained.*** **The time period can be configured, e.g., via SIB.**
 |
| Lenovo[22] | **Proposal 4: Support following TRS/CSI-RS transmission modes:*** **Mode 1: UE may assume that TRS/CSI-RS are present on all configured TRS/CSI-RS occasions**
* **Mode 2: UE shall further check availability of TRS/CSI-RS on configured TRS/CSI-RS occasions**

**Proposal 5: Availability of TRS/CSI-RS transmission is indicated in paging DCI or DCI carrying the PEI (if DCI based PEI is supported).** **Proposal 6: gNB can configure a validity time interval for a TRS/CSI-RS configuration. Upon expiry of the validity time, UE assumes that previous TRS/CSI-RS configuration is unavailable.** |
| Ericsson[23] | 1. TRS availability is indicated via a bitfield in the Paging DCI and with associated validity timer value(s) for the availability. Higher layers configure the validity timer value(s), ranging from 1 to [40] default paging cycles.
	1. When UE detects a Paging DCI with the bitfield indicating TRS as available, the UE can assume TRS is present for a duration given by the validity timer.
 |
| Nordic[24] | ***Proposal-3:*** *iTRS presence for current paging cycle is indicated in paging DCI and PEI of the previous paging cycle, i.e. one DRX cycle before current paging cycle.* |

## First round discussion

Based on the contributions submitted in RAN1#104b-e, there are proposals in five aspects regarding the details of explicit avaiablity indication of TRS/CSI-RS at the configured occasion(s) for idle/inactive UEs:

* Signaling method
* Indication content
* Validity time
* Application delay
* Default mode

### Signalling method

For signaling method, there candidates are proposed. The companies’ views from the contributions are summarized as below:

* + **Option 1: Paging DCI**
	+ HW, OPPO, Spreadtrum, Vivo, Panasonic, xiaomi, Intel, Apple, QC, Samsung, Sony, LG(FFS), Nokia, Sharp, DOCOMO, Lenovo, Ericsson, Nordic
	+ **Option 2: PEI if configured**
	+ HW, OPPO, Spreadtrum, TCL, Vivo(FFS), ZTE, MediaTek, Panasonic, CMCC, xiaomi (DCI based), Apple (DCI based), QC, LG, interdigital (FFS), Sharp (DCI based), DOCOMO, Lenovo(DCI based), Nordic
	+ **Option 3: SIB, e.g. SIB1 or other SIBs**
	+ CATT, MediaTek, Apple, Samsung, Nokia

Therefore, the following proposal with all companies’ views captured is provided for discussion during the first round.

**Moderator proposal #1**

**Discuss and/or down select from the following alternatives as signalling methods for the availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UE.**

* **Alt1: paging DCI**
* **Alt2: PEI**
* **Alt3: SIB**

Please provide the detailed views in the following table.

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| --- | --- | --- |
| **Company**  | **Alternative to support** | **Comments** |
|  |  | .  |
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### Indication content

For indication content, some companies provide views as below:

* + Alt 1: availability in a window before a PO
	+ HW, CMCC
	+ Alt2: availability/unavailability information for each configured resource, e.g. a bitmap
	+ ZTE
	+ Alt3: TRS/CSI-RS configuration(s) that correspond to the available TRS/CSI-RS resources, e.g. configuration index, or TRS/CSI-RS resource set index
	+ CATT, MediaTek, Apple, Samsung
	+ Alt4: available TRS/CSI-RS associated with a specific beam indication
	+ Nokia

Therefore, the following proposal with all companies’ views captured is provided for discussion during the first round.

**Moderator proposal #2**

**Discuss and/or down select from the following alternatives as indication content for the availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UE.**

* **Alt 1: availability in a window before a PO**
* **Alt2: availability/unavailability information for each configured resource, e.g. a bitmap**
* **Alt3: TRS/CSI-RS configuration(s) that correspond to the available TRS/CSI-RS resources, e.g. configuration index, or TRS/CSI-RS resource set index**
* **Alt4: available TRS/CSI-RS associated with a specific beam indication**
* **Other alternatives are not precluded.**

Please provide the detailed views in the following table.

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| --- | --- | --- |
| **Company**  | **Alternative to support** | **Comments** |
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### Validity time

When Idle/inactive UE receives an availability indication, the UEs assume the indicated TRS/CSI-RS occasions are available for a validity time, and unavailable upon expiry of the validity time. The companies’ views from the contributions regarding the validity time are summarized as below:

* + Alt 1: explicit indicated, e.g. configured by SIB or included in the availability indication
	+ HW, Samsung, Sony(FFS), Nokia, DOCOMO, Lenovo, Ericsson
	+ Alt2: before a PO
	+ Apple, Nordic

Therefore, the following proposal with all companies’ views captured is provided for discussion during the first round.

**Moderator proposal #3**

**Discuss whether and how to support validity time for the availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UE, considering the following alternatives**

* **Alt 1: explicit indicated, e.g. configured by SIB or included in the availability indication**
* **Alt2: before a PO**
* **Other alternatives are not precluded**

Please provide the detailed views in the following table.

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| **Company**  | **Alternative to support** | **Comments** |
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### Application delay

An application delay may be necessary to determine when an availability indication can take effect; otherwise UE assumes an availability indication takes effects immediately when transmitted/received. The companies’ views regarding the application delay from the contributions are summarized as below:

* + Option 1: no need, the availability indication becomes effective once received
	+ Vivo (off-to-on)
	+ Option 2: explicit indicated, e.g. configurable
	+ Vivo (on-to-off)
	+ Option 3: explicit indicated, e.g. next DRX cycle
	+ Nordic

Therefore, the following proposal with all companies’ views captured is provided for discussion during the first round.

**Moderator proposal #4**

**Discuss whether and how to support application delay for the availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UE, considering the following alternatives**

* **Alt 1: no need, the availability indication becomes effective once received**
* **Alt 2: explicit indicated, e.g. configured by SIB**
* **Alt 3: implicit indicated, e.g. next DRX cycle**

Please provide the detailed views in the following table.

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| **Company**  | **Alternative to support** | **Comments** |
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### Default mode

Some companies have proposed to support a default mode for configured TRS/CSI-RS occasion(s), when UE has not received the availability indication. The views from the contributions regarding default mode of the configured TRS/CSI-RS occasion(s) are summarized as below:

* + Mode 1: UE may assume that TRS/CSI-RS are present on all configured TRS/CSI-RS occasions
	+ Lenovo
	+ Mode 2: UE should assume no TRS/CSI-RS can be obtained.
	+ Lenovo, Vivo, DOCOMO

Therefore, the following proposal with all companies’ views captured is provided for discussion during the first round.

**Moderator proposal #5**

**Discuss default mode for TRS/CSI-RS at the configured occasion(s) to the idle/inactive UE when idle/inactive UE has not received any availability indication, considering the following alternatives**

* **Alt 1: the idle/inactive UE assumes the TRS/CSI-RS at all the configured TRS/CSI-RS occasions are present/available**
* **Alt2: the idle/inactive UE assumes the TRS/CSI-RS at all the configured TRS/CSI-RS occasions are not available**

Please provide the detailed views in the following table.

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| **Company**  | **Alternative to support** | **Comments** |
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# Topic #2. RS types

In last e-meeting, it has been agreed to determine whether or not to support periodic CSI-RS in addition to periodic TRS for idle/inactive UEs in RAN1#104b-e.

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| **Conclusion:*** **Decide at RAN1#104b-e, whether or not to support periodic CSI-RS in addition to periodic TRS for TRS/CSI-RS occasion(s) for idle/inactive UEs.**
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The following proposals regarding RS types are submitted in RAN1#104b-e

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| --- | --- |
| HW [1] | **Proposal 8: Do not support periodic CSI-RS for TRS/CSI-RS occasion(s) for idle/inactive UEs.** |
| OPPO[2] | **Proposal 5: Supporting periodic CSI-RS for idle/inactive UEs is slighted preferred.** |
| Spreadtrum[3] | **Proposal 1: CSI-RS in addition to periodic TRS are not used as TRS/CSI-RS occasion(s) for idle/inactive UEs.** |
| TCL[4] | **Proposal 4: Support configuration of Multiple RS resources for TRS/CSI-RS occasion of idle/inactive UE, and do not restrict TRS/CSI-RS occasion to be TRS only.** **Propsal 2: Consider slot1280 in PeriodicityAndOffset of CSI-RS to create a longer peridocity for long DRx cycle.**  |
| ZTE[5] | **Proposal 1:** **Only periodic TRS is supported for RRC idle/inactive state UE.** |
| Vivo[6] |  |
| CATT[7] | ***Proposal 1: Periodic CSI-RS in addition to periodic TRS for TRS/CSI-RS occasion(s) can be supported for idle/inactive UEs.*** |
| MediaTek[8] | **Proposal 1: Periodic CSI-RS other than periodic TRS is not used as TRS/CSI-RS occasion(s) for idle/inactive mode UE.** |
| Panasonic[9] |  |
| CMCC[10] | **Proposal 2. Not support periodic CSI-RS in addition to periodic TRS for TRS/CSI-RS occasion(s) for idle/inactive UEs.** |
| Xiaomi[11] | ***Proposal 2: Support both TRS and CSI-RS for idle/inactive UEs in case of multiple RS resources can be considered.*** |
| Intel[12] | **Proposal 4: Periodic TRS is sufficient and Periodic CSI-RS is not supported in idle/inactive mode.** |
| Apple[13] | **Proposal 1: Support only periodic TRS for idle/inactive UEs. Periodic CSI-RS other than TRS is not supported.** |
| Qualcomm[14] | **Proposal 5: For Rel-17, only support the configuration of TRS for idle/inactive mode UEs.** |
| Samsung[15] | **Proposal 4: Support common configuration parameters for RS resource at configured TRS/CSI-RS occasions for idle/inactive UEs regardless of RS type.** **Proposal 5: Support some periodic CSI-RS in addition to periodic TRS for TRS/CSI-RS occasion(s) for idle/inactive UEs, including at least** * **CSI-RS for L1-RSRP report available in RRC connected mode, and**
* **CSI-RS with single antenna port and no CDM type.**
 |
| Sony[16] | **Proposal 8: Rel-17 does not support periodic CSI-RS for idle/inactive UEs** |
| LG[17] | **Proposal 2: Do not consider further on periodic CSI-RS in Rel-17.** |
| Nokia[18] | **Proposal: Do not support other RS types (than TRS).** |
| InterDigital[19] | **Proposal 5: Configuration of periodic CSI-RS is supported.** |
| Sharp[20] |  |
| DOCOMO[21] |  |
| Lenovo[22] |  |
| Ericsson[23] | **[Proposal 5](#_Toc68640565)****[Only TRS/CSI-RS occasion(s) corresponding to periodic TRS can be shared with idle UEs.](#_Toc68640565)** |
| Nordic[24] | ***Proposal-1:*** *Only periodic TRS are used as TRS/CSI-RS occasion(s) for idle/inactive UEs, i.e as iTRS.****Proposal-2:*** *Extend the supported periodicity of iTRS (compared to RRC-connected TRS) by values of 5ms and 160ms.* |

## First round discussion

Based on contributions submitted in RAN1#104b-e, the companies’ views regarding RS types are summarized as below:

* + **Alt 1. Support periodic TRS only**
	+ HW, Spreadtrum, ZTE, MediaTek, CMCC, Intel, Apple, QC, Sony, LG. Nokia, Ericsson, Nordic **(13)**
	+ **Alt 2. Support periodic CSI-RS in addition to periodic TRS**
	+ OPPO, TCL, CATT, Xiaomi, Samsung, interdigital **(6)**
	+ Alt2-1: subset of legacy CSI-RS
		- [TCL]: to support periodicity of slot1280
		- [Nordic]: Extend the supported periodicity (compared to RRC-connected TRS) by values of 5ms and 160ms.
		- [Samsung]: consider periodic CSI-RS with single antenna port and no CDM type, CSI-RS for L1-RSRP

The pros and cons regarding whether or not to consider periodic CSI-RS in addition to periodic TRS are well known by companies. Considering a tradeoff between configuration overhead and availability/configuration flexibility, some companies proposed to consider at least some subset of legacy periodic CSI-RS, such as extended periodicity of TRS, single antenna, no CDM type, etc.

Therefore, it’s worthwhile to further discuss at least subset of legacy periodic CSI-RS in addition to periodic TRS before down-selection.

**Moderator proposal #6**

**Discuss and down-select from the following alternatives for whether or not to support periodic CSI-RS in addition to periodic TRS for TRS/CSI-RS occasion(s) for idle/inactive UEs.**

* **Alt1: Periodic TRS only.**
	+ **Have same configuration restrictions as connected mode TRS.**
* **Alt2: Support some periodic CSI-RS without distinguish RS type in the configuration.**
	+ **Configuration restrictions of connected mode TRS may be relaxed, for example more applicable values for periodicity, BW, etc.**
	+ **Consider only CSI-RS shares common configuration parameters as TRS, such as one antenna port, same density, etc.**

Please provide the detailed views in the following table.

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| **Company**  | **Alternative to support** | **Comments** |
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# Topic #3. Details of Configurations

According to the following agreements in RAN1#104-e meeting, some alternatives for configuration aspects, including SCS, frequency location, and QCL information, are provided for down-section in RAN1#104bis-e. Also, it has been agreed to support configuration of TRS/CSI-RS occasion(s) for idle/inactive Ues include at least powerControlOffsetSS, scramblingID, firstOFDMSymbolInTimeDomain, startingRB, and nrofRBs, But the corresponding applicable values are open for determination.

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| Agreements:The SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs can be discussed and down-selected from following alternatives at RAN1#105-e:* Alt1: same as initial BWP
* Alt2: configurable parameter

Agreements:The configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs are discussed and down-selected from following alternatives at RAN1#104bis-e:* Alt-1: within initial DL BWP
* Alt-2: is not restricted by initial BWP
	+ IDLE/INACTIVE mode UE is not expected to receive TRS/CSI-RS outside the initial DL BWP.

Agreements:To study QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs from following alternatives: * Alt-1: ~~TCI state~~ from higher layer configuration, e.g. qcl-InfoPeriodicCSI-RS
* Alt-2: QCL assumptions associated with transmitted SSBs implicitly, e.g. similar to PDCCH monitoring in PO
	+ ~~FFS details~~
* FFS details

Other alternatives are not precludedAgreements:Configuration of TRS/CSI-RS occasion(s) for idle/inactive Ues include at least:* powerControlOffsetSS,
* scramblingID
* firstOFDMSymbolInTimeDomain,
* startingRB.
* nrofRBs,
* FFS other parameters
* FFS applicable values

Agreements:Multiple RS resources can be configured for TRS/CSI-RS occasion(s) for idle/inactive UEs. * FFS details (including whether or not to restrict the RS to be TRS only)
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The following proposals regarding configureaiton details are submitted in RAN1#104b-e

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| HW [1] | ***Proposal 5: The SCS of TRS/CSI-RS occasion(s) for idle/inactive UEs is the same as the SCS of initial BWP.******Proposal 6: The frequency location of assistance TRS is not restricted by initial BWP.******Proposal 7: The QCL information of assistance TRS is explicitly configured.******Proposal 9: Signaling overhead in SIB due to the configuration of assistance RS occasions needs to be minimized.*** |
| OPPO[2] | ***Proposal 2: The SCS of TRS/CSI-RS occasion(s) for idle/inactive UEs can be configurable.******Proposal 3: The frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs shall be configured within the initial DL BWP.******Proposal 4: QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs is derived from higher layer configuration, e.g. qcl-InfoPeriodicCSI-RS.*** |
| Spreadtrum [3] | ***Proposal 3: The SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs shall be the same as initial BWP.******Proposal 4: The configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs is not restricted by initial BWP.**** ***IDLE/INACTIVE mode UE is not expected to receive TRS/CSI-RS outside the initial DL BWP.***

***Proposal 5:*** ***QCL assumption of TRS/CSI-RS occasion(s) for idle/inactive UEs is from higher layer configuration, e.g. qcl-InfoPeriodicCSI-RS.*** |
| TCL[4] | **Proposal 1: Consider the parameters such as density and PeriodicityAndOffset in TRS/CSI-RS occasion(s) configuration for idle/inactive mode UE.** **Propsal 2: Consider slot1280 in PeriodicityAndOffset of CSI-RS to create a longer peridocity for long DRx cycle.** **Proposal 3: Study the configuration of multiple TRS/CSI-RS SMTC window to reduce the configuration signaling overhead.****Proposal 5: Associate QCL assumption of TRS/CSI-RS occasion(s) for idle/inactive UEs with the transmitted SSBs implicitly, e.g. similar to PDCCH monitoring in PO.**  |
| Vivo[5] | ***Proposal 1:*** *The SCS for TRS/CSI-RS configured for idle/inactive UEs should be the same as that of initial DL BWP.****Proposal 2:*** *The configuration of the frequency location and bandwidth are not restricted by initial DL BWP, and UE is not required to receive the RS resources outside initial DL BWP.****Proposal 3:*** *QCL information of TRS/CSI-RS resources for idle/inactive UEs is explicitly configured.* |
| ZTE[6] | **Proposal 4: The Alt-2 (configuration of the frequency location of TRS occasion(s) for idle/inactive UEs is not restricted by initial BWP) should be adopted.****Proposal 5: The Alt-1 (the SCS of configuration of TRS is the same as initial BWP) is adopted.****Proposal 6: The** **Alt-2 (QCL assumptions associated with transmitted SSBs implicitly, e.g. similar to PDCCH monitoring in PO) is adopted.****Proposal 7: For multiple RS resources for TRS occasion(s), the RS type, RS occasions, and number of RS resources can be limited.** |
| CATT[7] | ***Proposal 2: TRS/CRS-RS resource/resource set configuration should meet the requirement of SIB message size limit.******Proposal 3: TRS/CSI-RS configuration for Idle/Inactive mode should be associated with SSB/paging occasion(s) to achieve good power saving gain with low SIB*** ***signaling overhead***.***Proposal 4: SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs should be same as initial BWP.******Proposal 5:*** ***Rel-15 CSI-RS bandwidth configuration scheme can be reused for IDLE/Inactive UE with additional indication of the starting PRB outside the initial BWP. The resource infrequency location of TRS/CSI-RS occasion(s) for IDLE/Inactive UEs should be within initial DL BWP.******Proposal 6: QCL information configuration of TRS for idle/inactive UE should be configured per CSI-RS resource set.*** ***Proposal 8: The following procedure can be used for TRS/CSI-RS occasion(s) configuration:******Step1) predefined parameters******of TRS/CSI-RS resource grid;******Step 2) SIB indicate parameters details; including QCL assumption with a SSB;******Step 3）To derive TRS occasion(s) according to predefined rule and parameters provided by step1 and step 2.*** |
| MediaTek[8] | **Proposal 4: The SCS of TRS/CSI-RS configuration is configurable.****Proposal 5: The configuration of frequency location for TRS/CSI-RS occasion(s) is not restricted by initial DL BWP.****Proposal 6: The QCL information of TRS/CSI-RS occasion(s) is from higher layer configuration.** |
| Panasonic[9] | **Proposal 2: QCL parameter with SSB index and power offset with SSB should be explicitly indicated in the TRS/CSI-RS configuration in SIB.****Proposal 3: The SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs is same as initial DL BWP.** **Proposal 4: The configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs is not restricted by initial DL BWP. IDLE/INACTIVE mode UE is not expected to receive TRS/CSI-RS outside the initial DL BWP** |
| CMCC[10] | **Proposal 3. The SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs is the same as initial BWP.****Proposal 4. The configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs is not restricted by initial BWP.****Proposal 5. The QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEsis derived from higher layer configuration, e.g. qcl-InfoPeriodicCSI-RS.** |
| Xiaomi[11] | ***Proposal 1: The SCS of TRS/CSI-RS occasion(s) for idle/inactive UEs is configurable parameter, alt2 is preferred.******Proposal 4: QCL*** ***information of TRS/CSI-RS occasion(s) associated with related SSB for idle/inactive UEs should be configured by higher layer signaling*** |
| Intel[12] | **Proposal 1:*** **In addition to the parameters agreed in RAN1-104e, the following parameters can be included in TRS/CSI-RS configuration**
	+ **Repetition**
	+ **periodicityAndOffset**
	+ **qcl-InfoPeriodicCSI-RS**
	+ **frequencyDomainAllocation**
	+ **Availability indication**

**Proposal 2: Same SCS as initial DL BWP is assumed for TRS/CSI-RS occasions.** |
| Apple[13] | **Proposal 2: The SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs is the same as the initial DL BWP.****Proposal 3: The indicated frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs is not restricted to the initial DL BWP.****Proposal 4: The QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs is indicated as a SSB index.****Proposal 5: Use the TRS configuration parameters in Table 1 as the starting point. Further signaling overhead reduction/optimization can be considered.****Table 1 TRS configuration parameters**

|  |  |
| --- | --- |
| **TRS configuration parameters** | **Value Range** |
| TRS configuration index | 0 to (max # of TRS configurations – 1) |
| Frequency domain allocation | {0, 1, 2, 3}For TRS, this can be simplified to the offset for the TRS REs in a RB. |
| firstOFDMSymbolInTimeDomain | 0 to 9 |
| startingRB | Can reuse the existing range: 0 to 274 |
| nrofRBs | Can reuse the existing range: 24 to 276 |
| powerControlOffsetSS | Reuse the existing range: {-3, 0, 3, 6} dB |
| scramblingID | Reuse the existing range: 0 to 1023 |
| periodicityAndOffset | Can reuse the existing structure of CSI-ResourcePeriodicityAndOffset, with periodicity limited to {10, 20, 40, 80} ms. |
| QCL information | 0 to 63, indicating the QCLed SSB index |
| Number of slots for TRS | {1, 2} |

 |
| Qualcomm[14] | **Proposal 2: Support Alt-1 for the configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs:*** **Alt-1: within initial DL BWP**
* **Alt-2: is not restricted by initial BWP**
	+ **IDLE/INACTIVE mode UE is not expected to receive TRS/CSI-RS outside the initial DL BWP.**

**Proposal 3: support Alt 1 for the SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs. SCS of initial BWP is the SCS of CORESET #0 if CORESET #0 and SSBs have different SCS*** **Alt1: same as initial BWP**
* **Alt2: configurable parameter**

**Proposal 4: Support Alt-1 for the QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs in following alternatives:** * **Alt-1: from higher layer configuration, e.g. qcl-InfoPeriodicCSI-RS**
* **Alt-2: QCL assumptions associated with transmitted SSBs implicitly, e.g. similar to PDCCH monitoring in PO**
 |
| Samsung[15] | **Proposal 6: Support applicable values of {db-3, db0, db3, db6} for *powerControlOffsetSS* of TRS/CSI-RS occasion(s) for idle/inactive UEs.****Proposal 7: Support a length of 10bits for *scramblingID* of TRS/CSI-RS occasion(s) for idle/inactive UEs**.**Proposal 8: Support value in range of 0 to 13 for *firstOFDMSymbolInTimeDomain* of TRS/CSI-RS occasion(s) for idle/inactive UEs**.**Proposal 9: Support startingRB and nrofRBs with applicable value in range of (0..*maxNrofPhysicalResourceBlocks*-1), where *maxNrofPhysicalResourceBlocks* can be larger than maximum number of RBs of initial BWP for TRS/CSI-RS occasion(s) for idle/inactive UEs**.**Proposal 10: Support SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs same as initial BWP.****Proposal 11: Support configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs not restricted by initial BWP.** **Proposal 12: Support QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs from higher layer configuration, e.g. qcl-InfoPeriodicCSI-RS.** |
| Sony[16] | **Proposal 3: The SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs is a configurable parameter.****Proposal 4: The configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs is not restricted by the initial BWP.****Proposal 5: QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs should come from From higher layer configuration (e.g. qcl-InfoPeriodicCSI-RS).****Proposal 6: Support providing multiple TRS/CSI-RS configurations to idle/inactive UEs.** |
| LG[17] | **Proposal 3: Support Alt 1 for the SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs****Proposal 4: When SIB signalling is used for the configuration, support Alt 1 for the configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs.** **Proposal 5: Higher layer configuration is used to configure QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs** |
| Nokia[18] | **Proposal: The configuration of TRS occasion-related parameters informed to the IDLE/INACTIVE mode UE(s) should be assumed to support similar flexibility as required by Connected Mode UE(s**).**Proposal: The configuration of TRS to the IDLE/INACTIVE mode UEs needs to support independent configuration for each broadcast/SSB beam.****Proposal:** W**hen informing TRS occasions for the IDLE/INACTIVE mode UEs, parameters ‘nrofPorts’, ‘cdm-Type’ and ‘density’ in ‘CSI-RS-ResourceMapping’ can be omitted from the configuration and values assumed to be same as defined by specification TS38.214 for CSI-RS configured with ‘trs-info’.****Proposal:** **Following parameters can be assume to be same/common for RS resources in TRS resource set, or could be derived from one parameter for a RS resources defined in TRS resource set:*** **For TRS, ‘firstOFDMSymbolInTimeDomain’ would need to be provided only once for a TRS resource set, and location of both of the second symbol in the slot could be derived from it, and in case of two (consecutive) slots are in RS resource set, symbol locations are same in the second slot.**
	+ **Note: number of slots (1 or 2) is indicated separetly, per resource set or for all resource sets.**
* **For TRS, ’row1’, ‘startingRB’ and ‘nrofRBs’are common/same for the RS resources in a RS resource set, thus would be provided only once per RS resource set.**
* **For TRS, ‘CSI-ResourcePeriodicityAndOffset’ would need to be provided only once for TRS resources in same slot.**

**Proposal:** **Configure the QCL information for each RS resource for IDLE/INACTIVE mode explicitely e.g. via SSB index.** **Proposal:** **For sub-carrier spacing configuration for TRS occasions, while being able to explicitely configure the sub-carrier spacing offers some flexibility, assuming that the sub-carrier spacing is aligned with initial BWP (given bysubCarrierSpacingCommon) seems sufficient.****Proposal:** **For IDLE/INACTIVE mode UE(s), the frequency location of the TRS occasions is given by ‘startingRB’ and ‘nrofRBs’ and it is not be restricted by the initial DL BWP.**  |
| InterDigital[19] | **Proposal 3: The configuration of the frequency location of TRS/CSI-RS occasion(s) is within initial DL BWP.****Proposal 4: The SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs is same as initial BWP.****Proposal 7: The QCL information of TRS/CSI-RS occasion(s) for idle/inactive is from higher layer configuration.** |
| Sharp[20] | **Proposal 2: Additional restriction for TRS/CSI-RS configuration should not be introduced****Proposal 3: The TRS/CSI-RS can be configured without considering the bandwidth restrictions of the initial BWP** **Proposal 4: The QCL information of TRS/CSI-RS should be associated with the signal of availability information.**  |
| DOCOMO[21] | **Proposal 5: The SCS of CSI-RS for idle/inactive mode should be same as that with initial DL BWP.** |
| Lenovo[22] | **Proposal 1: Support following methods to reduce the TRS/CSI-RS configuration signalling overhead:*** **Predefine or fix a part of TRS/CSI-RS parameters in specification**
* **Update a subset of parameters of TRS/CSI-RS configuration**
* **Based on configuration parameters of one NZP-CSI-RS resource of an NZP-CSI-RS resource set, a UE derives configuration parameters of remaining NZP-CSI-RS resources of the NZP-CSI-RS resource set**

**Proposal 2: QCL information for TRS/CSI-RS configured for idle/inactive UEs is indicated per TRS/CSI-RS resource set.****Proposal 3: Consider following QCL indication methods for TRS/CSI-RS configured for idle/inactive UEs:** * **Alt 1: based on TRS/CSI-RS resource set ID**
* **Alt 2: based on a bitmap of a length same as the maximum number of SSBs per half frame. Each configured TRS/CSI-RS resource set is sequentially mapped to a bit with value ‘1’ and a corresponding SSB index.**
* **Alt 3: based on a SSB index provided in the configuration.**
 |
| Ericsson[23] | [**Proposal 2** **The frequency location of TRS occasion(s) for idle/inactive UEs is not restricted by the initial BWP.**](#_Toc68640562)[**Proposal 3** **The SCS of TRS transmitted in TRS occasion(s) for idle/inactive UEs is same as the SCS of initial BWP.**](#_Toc68640563)[**Proposal 4** **QCL information of TRS occasions, e.g., in association with SSB indices is informed to the UE explicitly as part of TRS occasion configuration information.**](#_Toc68640564) |
| Nordic[24] | ***Proposal-2:*** *Extend the supported periodicity of iTRS (compared to RRC-connected TRS) by values of 5ms and 160ms.****Proposal-4:*** *iTRS are not associated with a BWP. iTRS shall span* * *All RBs of 24- and 48-RB CORESET#0*
* *52 contiguous RBs of 96-RB CORESET#0*

***Proposal-5:*** *For iTRS, support configuration of row1 of frequencyDomainAllocation****Proposal-6:*** *To reduce configuration overhead for iTRS, define iTRS burst where iTRS of different beams/SSBs are derived from the one reference iTRS configured by iTRS-ResourceSet. Details are for further study.* |

## First round discussion

Based on the contributions submitted in RAN1#104b-e, proposals regarding the details of configuraiton for TRS/CSI-RS at the configured occasion(s) for idle/inactive UEs can be diviced into the follwoing aspects

* SCS
* Frequency location
* QCL information
* Applicable values
* Methods for configuration overhead reduction
* Other configuration parameters

### SCS

Based on the contributions submitted in RAN1#104b-e, comapines’ view on SCS configuraiton of TRS/CSI-RS occasion(s) for idle/inactive UEs are summarized as below:

* + **Alt1: same as initial BWP**
	+ HW, Spreadtrum, Vivo, ZTE, CATT, Panasonic, CMCC, Intel, Apple. QC, LG, Nokia, Interdigital, DOCOMO, Ericsson **(15)**
	+ **Alt2: configurable parameter**
	+ OPPO, MediaTek, Xiaomi, Samsung, Sony **(5)**

Therefore, the following proposoal based on majority view is provided for discussion during the 1st round.

**Moderator proposal #7**

**Support SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs same as initial BWP.**

Please provide the detailed views in the following table.

|  |  |  |
| --- | --- | --- |
| **Company**  | **Support****(Y or N)** | **Comments** |
|  |  | .  |
|  |  |   |

### Frequency location

Based on the contributions submitted in RAN1#104b-e, comapines’ view regarding the configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs are summarized as below:

* + **Alt 1: within initial DL BWP**
	+ OPPO, CATT, QC, LG, interdigital **(5)**
	+ **Alt 2: is not restricted by initial BWP**
	+ HW, Spreadtrum, Vivo, ZTE, MediaTek, Panasonic, CMCC, Apple, Samsung, Sony, Nokia, Sharp, Ericsson, Nordic **(14)**

Therefore, the following proposoal based on majority view is provided for discussion during the 1st round.

**Moderator proposal #8**

**Configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs is not restricted by initial BWP.**

* **IDLE/INACTIVE mode UE is not expected to receive TRS/CSI-RS outside the initial DL BWP.**

Please provide the detailed views in the following table.

|  |  |  |
| --- | --- | --- |
| **Company**  | **Support****(Y or N)** | **Comments** |
|  |  | .  |
|  |  |   |

### QCL information

Based on the contributions submitted in RAN1#104b-e, comapines’ view regarding QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs are summarized as below:

* + **Alt-1: TCI state from higher layer configuration, e.g. qcl-InfoPeriodicCSI-RS**
	+ HW, OPPO, Spreadtrum, Vivo, CATT, MediaTek, Panasonic, CMCC, Xiaomi, Intel, Apple, QC, Samsung, Sony, LG, Nokia, Interdigital, Lenovo, Ericsson **(19)**
	+ QCL information, SSB index only
		- Panasonic, apple, Nokia, Lenovo, Ericsson
	+ **Alt-2: QCL assumptions associated with transmitted SSBs implicitly, e.g. similar to PDCCH monitoring in PO**
	+ TCL, ZTE **(2)**
* **Alt-3: The QCL information of TRS/CSI-RS should be associated with the signal of availability information.**
	+ Sharp **(1)**

The majority think Alt2 is not feasible since the available TRS/CSI-RS for idle/inactive UEs are shared from connected mode based on explicit indication. Therefore, the following proposoal based on majority view is provided for further discussion.

**Moderator proposal #9**

**Support higher layer configuration of the QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs.**

* **FFS details of the QCL information, e.g. associated SSB index**

Please provide the detailed views in the following table.

|  |  |  |
| --- | --- | --- |
| **Company**  | **Support****(Y or N)** | **Comments** |
|  |  | .  |
|  |  |   |

### Applicable values

Only a few companies provide views regarding the applicable values for supported configuraiton parameters. Therefore, the following table can be used to collect compaines’ view regarding the applicable values during the the first round discussion.

**Moderator proposal #10**

**Support applicable values for configurations parameter in Table 1 as below.**

Table 1: Applicable values for supported configuraiton parameter

|  |  |
| --- | --- |
| **parameters** | Applicable values |
| powerControlOffsetSS /dB | Ex. {-3, 0, 3, 6} |
| scramblingID | Ex. 0 to 1023 |
| firstOFDMSymbolInTimeDomain | Ex. 0 to 9 |
| startingRB | Ex. 0 to 274 |

Note: the example of applicable values for reference are from Apple [13].

Please provide applicable values for configuration parameters based on Table 1.

|  |  |
| --- | --- |
| **Company**  | **Comments** |
|  | .  |
|  |   |

### Methods for configuration overhead reduction

Based on the contributions submitted in RAN1#104b-e, there are many proposals to consider the methods for configuraiton overhead reduction for multple RS resources configured for TRS/CSI-RS coccasions for idle/inactive UEs.

* + Alt 1: Configuration associated with PO
	+ CATT, DOCOMO
	+ Alt 2: Configuration per RS resources set, or group of sets
	+ CATT, Samsung, Nokia, Lenovo, Ericsson, Nordic
	+ Alt 3: Predefine some fixed configuration,
	+ Nokia, Lenovo, Ericsson
	+ Alt 4: Number of RS resources can be limited
	+ ZTE
	+ Alt 5: configure TRS/CSI-RS SMTC window
	+ TCL

Therefore, the following proposal with all companies’ views captured is provided for discussion:

**Moderator proposal #11**

**Study how to reduce configuration overhead for TRS/CSI-RS occasion(s) for idle/inactive UEs, including the following alternatives:**

* **Alt 1: Configuration associated with PO**
* **Alt 2: Configuration per RS resources set, or group of sets**
* **Alt 3: Predefine some fixed configuration**
* **Alt 4: Number of RS resources can be limited**
* **Alt 5: configure TRS/CSI-RS SMTC, e.g. similar as SMTC for mobility**

Please provide the detailed views in the following table.

|  |  |  |
| --- | --- | --- |
| **Company**  | **Alternative to support** | **Comments** |
|  |  | .  |
|  |  |   |

### Other configuration parameters

Based on the contributions submitted in RAN1#104b-e, some other configuration parameters are proposed by some companies as follows:

* + Density
	+ TCL
	+ Repetition
	+ Intel
	+ periodicityAndOffset
	+ TCL, Intel, Apple
	+ Frequency domain allocation
	+ Intel, Apple, Nordic
	+ Number of slots for TRS
	+ Apple

Therefore, the following proposal is provided for discussion:

**Moderator proposal #12**

**Discuss whether to support additional configuration parameters of TRS/CSI-RS occasion(s) for idle/inactive UEs, including:**

* **density,**
* **repetition,**
* **periodicityAndOffset,**
* **frequency domain allocation**
* **Number of slots**

Please provide the detailed views in the following table.

|  |  |  |
| --- | --- | --- |
| **Company**  | **Support****(Y or N)** | **Comments** |
|  |  | .  |
|  |  |   |

# Topic #4: Others

The following proposals in addtion to the three topics above are submitted in RAN1#104b-e

|  |  |
| --- | --- |
| HW [1] | ***Proposal 10: Send LS to inform RAN2 about the progress in RAN1 by RAN1 #104bis-e and trigger the discussion in RAN2 on the issues of signaling design for assistance TRS configuration.*** |
| Sony[16] | **Proposal 7: In addition to SIB, support TRS/CSI-RS configuration via other high-layer signalling (e.g. dedicated RRC, RRC release message, etc).** |
| LG[17] | **Proposal 6: Study how to handle PDSCH REs overlap with TRS/CSI-RS occasion(s).** |
| Nokia[18] | **Proposal:** **Focus the RAN1 work on WID objective 1b on designing the mechanism to provide IDLE/INACTIVE mode UEs the information on potential periodic TRS occasions.** |
| NOCOMO[21] | **Proposal 4: It is necessary that we have common understanding on whether or not the UE can replace SSB for RRM measurement with TRS/CSI-RS for idle/inactive mode UE, i.e., the UE can skip SSB.** |

Please provide any suggestions/comments on other topics to be discussed in the following table.

|  |  |
| --- | --- |
| **Company**  | **Comments** |
|  |  |
|  |  |
|  |  |

# Conclusion

In RAN1#104b-e meeting, the following agreements are made. Companies are encouraged to prepare next meeting to resolve FFSs based on agreements so far.

# References

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10. [R1-2102893](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2102893.zip) Discussion on TRS/CSI-RS occasion(s) for IDLE/INACTIVE-mode UEs CMCC
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12. [R1-2103042](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103042.zip) TRS/CSI-RS functionality during idle/inactive mode Intel Corporation
13. [R1-2103116](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103116.zip) Indication of TRS/CSI-RS for idle/inactive-mode UE power saving Apple
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24. [R1-2103654](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103654.zip) On TRS design for idle/inactive UEs Nordic Semiconductor ASA

# Summary of Agreements

## RAN1#102-e

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| Agreements:* New types/patterns of TRS/CSI-RS are not introduced specifically for idle/inactive mode UE.

Agreements:The TRS/CSI-RS occasion(s) that may be for connected mode UEs can be shared to idle/inactive mode UEs. -  Note: It is understood that gNB can potentially share the occasions to idle/inactive (which would just mean it up to NW whether to share or not share).-  Note: It is understood that TRS/CSI-RS in the TRS/CSI-RS occasion(s) may or may not be transmitted.-  Note: Always-on TRS/CSI-RS transmission by gNodeB is not required-  At least TRS/CSI-RS occasion(s) corresponding to periodic TRS is supported - FFS for other RS types-  FFS: Whether UE blind detection is required or not.Agreements:Idle/inactive UE may use the TRS/CSI-RS occasion(s) that are shared to it for functionalities such as: -           **AGC, time/frequency tracking**-           **FFS: RRM measurement for serving cell, RRM measurement for neighbor cell, paging reception indication****Observation:**It is up to gNB implementation whether or not to transmit a TRS/CSI-RS to idle/inactive UEs even when the TRS/CSI-RS is not needed by connected UEs (e.g., when there is a connected mode UE in a cell but the UE is no longer using the TRS/CSI-RS, or when there is no longer connected mode UE in a cell, etc.)Agreements:The configuration of TRS/CSI-RS occasion(s) for idle/inactive mode UE(s) is provided by higher layer signalling-           FFS higher layer signalling candidates (e.g., SIB, dedicated RRC, RRC release message, etc.)-           FFS for other signalling candidates (e.g., pre-configuration, etc.)-           FFS for detailed configuration parameters (e.g., whether and how to reduce the signalling overhead for configuration, etc.)Agreements:Further study whether and how to inform the availability of TRS/CSI-RS to idle/inactive mode UE (implicitly or explicitly).- Note: Availability corresponds to the information for whether TRS/CSI-RS is actually transmitted or not. |

## RAN1#103-e

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| Agreement:* Functionality of RRM measurement for neighbour cell is not supported for TRS/CSI-RS for idle/inactive UE(s).

Agreements:* SIB signalling provides the configuration of TRS/CSI-RS occasion(s) for idle/inactive UE(s).
	+ Up to RAN2 to decide which SIB is to be used.
	+ Whether or not to additionally support other high-layer signalling methods (e.g., dedicated RRC, RRC release message, etc.) is up to RAN2

Send an LS to RAN2 informing the above agreements, and* To further add that RAN1 is working on the detailed physical layer design

Agreement:* Aperiodic TRS and semi-persistent/aperiodic CSI-RS are not used as TRS/CSI-RS occasion(s) for idle/inactive UEs.

Agreements:* Target sending an LS to RAN2 and RAN4 to ask whether it is feasible to allow a UE to use the potential TRS/CSI-RS occasion to enhance the SSB based IDLE/Inactive mode evaluations of the serving cell. (to also include agreements from last meeting)
* Further discussion whether any additional information needs to be included in the LS or not, including potential re-wording of the leading sentence

Agreements:* Discuss further based on the following alternatives and down-select at RAN1#104-e:
	+ Alt 1: The availability of TRS/CSI-RS at the configured occasion(s) is NOT informed to the UE.
	+ Alt 2: The availability of TRS/CSI-RS at the configured occasion(s) is informed to the UE.
	+ Alt 3. The conditional availability of TRS/CSI-RS at the configured occasion(s) is informed to the UE.
		- The condition can be, e.g., existence of paging.
	+ Alt 4. Combination of the above alternatives.
	+ FFS for details
	+ FFS for UE behavior when the availability is not informed.
	+ Other techniques are not precluded.
	+ Companies encourage to provide sufficient information for the proposal, e.g.,
		- how to achieve power saving gain
		- how to minimize impact on NW

how to minimize extra UE implementation complexity* + - feasibility check on sharing the TRS/CSI-RS between connected UEs and idle/inactive UEs
	+ Proposals should be consistent with the WID objective.

**Conclusion:*** TRS/CSI-RS based PEI is discussed in AI 8.7.1.1.
* PEI functionality is not further discussed under AI 8.7.1.2.
* Note: This does not prevent to potentially use PEI to carry the indication for TRS/CSI-RS presence.
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## RAN1#104-e

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| Update on 1/28 email:Agreements:Configuration of TRS/CSI-RS occasion(s) for idle/inactive Ues include at least:* powerControlOffsetSS,
* scramblingID
* firstOFDMSymbolInTimeDomain,
* startingRB.
* nrofRBs,
* FFS other parameters
* FFS applicable values

Agreements:The SCS configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs can be discussed and down-selected from following alternatives at RAN1#105-e:* Alt1: same as initial BWP
* Alt2: configurable parameter

Agreements:Multiple RS resources can be configured for TRS/CSI-RS occasion(s) for idle/inactive UEs. * FFS details (including whether or not to restrict the RS to be TRS only)

Update on 1/31:Agreements:For a cell with TRS/CSI-RS occasions configured for IDLE/Inactive UEs, IDLE/Inactive UE’s assumption on the availability of TRS/CSI-RS at the configured occasion(s) is informed to the idle/inactive UE based on explicit indication.* FFS details (e.g., the signalling, detailed information for the TRS/CSI-RS, etc.)
* There is no intended blind detection of the presence/absence of TRS/CSI-RS at the UE side in this feature. That is, the UE assumes TRS/CSI-RS is not present if the network does not indicate it is available (or indicates it is unavailable).

**Conclusion**From RAN1 perspective, there is no consensus on supporting RRM measurement for serving cell functionality for TRS/CSI-RS occasion(s) for idles/inactive UEs.Agreements:The configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs are discussed and down-selected from following alternatives at RAN1#104bis-e:* Alt-1: within initial DL BWP
* Alt-2: is not restricted by initial BWP
	+ IDLE/INACTIVE mode UE is not expected to receive TRS/CSI-RS outside the initial DL BWP.

Agreements:To study QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs from following alternatives: * Alt-1: ~~TCI state~~ from higher layer configuration, e.g. qcl-InfoPeriodicCSI-RS
* Alt-2: QCL assumptions associated with transmitted SSBs implicitly, e.g. similar to PDCCH monitoring in PO
	+ ~~FFS details~~
* FFS details
* Other alternatives are not precluded

**Conclusion:**Decide at RAN1#104b-e, whether or not to support periodic CSI-RS in addition to periodic TRS for TRS/CSI-RS occasion(s) for idle/inactive UEs. |