**3GPP TSG RAN WG1 #108**  **R1-22XXXX**

**e-Meeting, February 21th – March 3rd, 2022**

**Agenda Item:** 8.7.1.2

**Source:** Moderator (Samsung)

**Title:**  3rd round discussion on TRS/CSI-RS occasion(s) for idle/inactive UEs

**Document for:** Discussion/Decision

# Introduction

This document provides summary of contributions [1-20] submitted to agenda item 8.7.1.2 for RAN1#108-e meeting, and corresponding technical discussion in the meeting. According to the proposals in contributions [1-23], the remaining issues for supporting TRS/CSI-RS occasion(s) for idle/inactive UEs can be divided into the following parts, wherein the details are captured in Section 2 to 6, respectively:

* Section 2: TRS availability indication content
  + Issue 1-1: TP for CRs of TS 38.213
  + Issue 1-2: Clarification on default assumption
  + Issue 1-3: Whether/how to restrict consistent TRS availability indication from PEI and paging PDCCH
  + Issue 1-4: Whether to support PEI based TRS availability indication only for RS resources with same QCL references
* Section 3: TRS validity duration
  + Issue 2-1: TP for CRs of TS 38.213
  + Issue 2-2: Clarifications on reference point
* Section 4: TRS resources configuration
  + Issue 3-1: TP for CR of TS 38.214
  + Issue 3-2: Maximum number of TRS resource sets
  + Issue 3-3: Whether/how to reduce configuration overhead
* Section 5: Others

The issues in this document are colour coded with High Priority, Medium Priority, or Low Priority.

Per chairman’s instruction, this document will be used for the following email discussion:

|  |
| --- |
| [108-e-R17-PowSav-02] Email discussion for maintenance on TRS/CSI-RS occasions for idle/inactive UEs – Qiongjie (Samsung)   * 1st check point: February 25 * Final check point: March 3 |

For the first round discussion, please kindly provide your comments on moderator proposals or questions tagged ‘**[1RD]**’ before Feb, 22th, Tuesday, UTC 16:59.

For the second round discussion, please kindly provide your comments on moderator proposals/conclusions tagged ‘**[2RD]**’ before Feb, 24th, Thursday, UTC 23:59.

For the third round discussion, please kindly provide your comments on moderator proposals/conclusions tagged ‘**[3RD]**’ before Feb, 28th, Monday, UTC 23:59.

# TRS availability indication content

The following were agreed regarding TRS availability indication:

|  |
| --- |
| From RAN1#107bis-e:  Agreement  Confirm the following working assumption  If TRS resource is configured in SIB, L1 based availability indication is always enabled based on the configuration.  Agreement  If SIB configures TRS resource, TRS availability indication field is present in DCI format 2\_7 (if configured) with CRC scrambled by PEI-RNTI and DCI format 1\_0 with CRC scrambled by P-RNTI.  Agreement  UE can receive L1 based signaling for TRS availability indication before the expiration/end of validity duration associated with previous L1 based signaling for TRS availability indication   * For each bit indicated as ‘1’ in the availability indication field of the current L1 based signaling, the UE assumes the corresponding TRS resource set(s) are available from the reference point until the end of the validity duration associated with the current L1 based signaling. * For each bit indicated as ‘0’ in the availability indication field of the current L1 based signaling, the UE keeps the existing assumption on the availability or unavailability of the corresponding TRS resource set(s).   Note: the validity duration for different group of TRS resources sets correspond to different bits in the availability indication field can be different and are maintained independently. |

In contributions [1-20], proposals regarding remaining issues for TRS availability indication content are captured in table below:

|  |  |
| --- | --- |
| Huawei, HiSilicon |  |
| ZTE,  Sanechips | 1. A UE does not expect to receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle.   ...................................... Text Proposal for TS38.214.............................................................  **5.1.6.1.1 CSI-RS for tracking**  ...  For each [TRS-ResourceSet] the index of the associated bit in TRS availability indication field [5, TS 38.212], is given by the higher layer parameter [indBitID].  A UE does not expect to receive inconsistent TRS availability indication from DCI format 2-7 and DCI format 1-0 with CRC scrambled by P-RNTI within a default paging cycle.  ................................. End of Text Proposal for TS38.214...............................................................  Proposal 3: The following TP for CR of TS 38.213 should be adopted.  .................................................... Text Proposal for TS38.213...........................................................  **10.4B Indication of TRS resources**  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 or a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2.  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. ~~A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.~~  \*\*\* Unchanged text is omitted \*\*\*  .................................... End of Text Proposal for TS38.213..................................... |
| Vivo |  |
| TCL |  |
| Spreadtrum | ***Proposal 1: For PEI PDCCH based availability indication, the bitmap can have small bit size, e.g. L1 availability indication at an occasion can provide availability information only for RS resources with QCL references to be the same as for the L1 availability indication occasion.*** |
| CATT | ***Proposal 1:*** ***If DCI format 2\_7 is configured,*** ***the size and association between bitmap and TRS resources sets of TRS availability indication field of DCI format 2\_7 should be same as that of the paging DCI.***  **Proposed TP for TS 38.213**   |  | | --- | | 10.4B Indication of TRS resources ------------------------- Unchanged text is Omitted ---------------------------------------------------------  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 and ~~or~~ a DCI format 1\_0 with CRC scrambled by P-RNTI includes the ~~a~~ TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap, if DCI format 2\_7 is configured.  ------------------------- Unchanged text is Omitted --------------------------------------------------------- |   ***Proposal 3:*** ***The flowing TP should be adopted to clarify the meaning of value of '0' for a bit of the bitmap.***  **Proposed TP for TS 38.213**   |  | | --- | | 10.4B Indication of TRS resources ---------------------------------------------------- Unchanged text is Omitted ---------------------------------------------------------  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*.  A value of '0' for a bit of the bitmap ~~is ignored by~~ indicates that the UE keeps the existing assumption of the availability or unavailability of the corresponding TRS resource set(s).  ---------------------------------------------------- Unchanged text is Omitted ---------------------------------------------------------- | |
| OPPO | \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of text Proposal\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 10.4B Indication of TRS resources A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 with CRC scrambled by PEI-RNTI or a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an Id i which indicate the association to the ith bit within the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, of a number of frames provided by *defaultPagingCycle*; if *validityDuration* is not provided, the multiple is equal to 2. A value of ‘1’ for the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] which is the first frame within the default DRX cycle that a PDCCH providing the DCI format 2\_7 or the DCI format 1\_0 with the TRS availability indication field indicating the TRS resource sets is received, where is provided by *defaultPagingCycle*.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End of text Proposal\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |
| Sony |  |
| Intel | **Proposal 1: The default assumption, i.e., before UE receives L1 availability indication after camping on a cell, is that the configured group(s) of TRS resource set(s) are unavailable.** |
| Xiaomi | ***Proposal 1: If L1 indication is configured, before UE receive a first L1 indication after entering a cell, UE should assume the TRS/CSI-RS for idle is not available.***  And related TP text can be as follows:  **TP#1 for TS 38.214 Clause 5.1.6.1.1**  ============================= Unchanged part omitted =========================================  5.1.6.1.1 CSI-RS for tracking  A UE in RRC connected mode is expected to receive the higher layer UE specific configuration of a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*.  <omitted text>  A UE in RRC\_IDLE or RRC\_INACTIVE can receive a higher layer configuration of TRS occasions via a [*TRS-ResourceSetConfig*].  - For frequency range 1, the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a [*TRS-ResourceSet*] consists of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  - For frequency range 2 the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a [*TRS-ResourceSet*] consists of two periodic NZP CSI-RS resources in one slot or by a [*TRS-ResourceSet*] of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter [*TRS-Resource*] in a [*TRS-REsourceSet*] with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  - the time-domain locations of the two CSI-RS resources in a slot, or of the four CSI-RS resources in two consecutive slots (which are the same across two consecutive slots), is one of  - , , or for frequency range 1 and frequency range 2,  - , , , , ,  or  for frequency range 2.  - where the first symbol location in a slot is indicated by *firstOFDMSymbolInTimeDomain* in the [*TRS-ResourceSet*] and the second symbol location in a slot is *firstOFDMSymbolInTimeDomain +* 4  - a single port CSI-RS resource with density  given by Table 7.4.1.5.3-1 from [4, TS 38.211]*.*  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter [*nrofRBs*], [*startingRB*] and [*frequencyDomainAllocation*] in a [*TRS-ResourceSet*] and applies to all resources in a [*TRS-ResourceSet*]. The [frequencyDomainAllocation] configuration is not restricted by initial DL BWP.  - [UE is not expected to receive TRS occasions outside the initial DL BWP.]  - the periodicity and slot offset for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a [*TRS-ResourceSet*], is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a [*TRS-ResourceSet*].  - the UE does not expect the [*TRS-ResourceSet*] to be configured with the periodicity of  slots if the bandwidth of NZP CSI-RS resource is larger than 52 resource blocks.  - the UE may assume the sub-carrier spacing of the NZP CSI-RS resources configured by [*TRS-ResourceSet*] to be same as the sub-carrier spacing of the initial DL BWP.  - *powerControlOffsetSS* given bya [*TRS-ResourceSet*] applies to all resources in a [*TRS-ResourceSet*].  - the QCL information for periodic NZP CSI-RS resources, is given by the higher layer parameter *ssb-Index* configured by a [*TRS-ResourceSet*], is a SS/PBCH block, applies to all resources in a [*TRS-ResourceSet*].  - the UE may assume the following quasi co-location type(s):  - 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block.  Immediately after UE camped on the serving cell, if L1 TRS availability indication is configured via a [*TRS-ResourceSetConfig*], UE assumes no TRS resource is available before detecting the first L1 TRS availability indication on the serving cell.  ============================= Unchanged part omitted =========================================  ***Proposal 2: If L1 TRS availability indication is configured both in paging DCI and PEI, for UE monitoring PEI, UE would acquire L1 indication in PEI and ignore L1 indication in paging DCI.***  And related TP text can be as follows:  **TP#2 for TS 38.214 Clause 5.1.6.1.1**  ============================= Unchanged part omitted =========================================  5.1.6.1.1 CSI-RS for tracking  A UE in RRC connected mode is expected to receive the higher layer UE specific configuration of a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*.  <omitted text>  A UE in RRC\_IDLE or RRC\_INACTIVE can receive a higher layer configuration of TRS occasions via a [*TRS-ResourceSetConfig*].  - For frequency range 1, the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a [*TRS-ResourceSet*] consists of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  - For frequency range 2 the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a [*TRS-ResourceSet*] consists of two periodic NZP CSI-RS resources in one slot or by a [*TRS-ResourceSet*] of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter [*TRS-Resource*] in a [*TRS-REsourceSet*] with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  - the time-domain locations of the two CSI-RS resources in a slot, or of the four CSI-RS resources in two consecutive slots (which are the same across two consecutive slots), is one of  - , , or for frequency range 1 and frequency range 2,  - , , , , ,  or  for frequency range 2.  - where the first symbol location in a slot is indicated by *firstOFDMSymbolInTimeDomain* in the [*TRS-ResourceSet*] and the second symbol location in a slot is *firstOFDMSymbolInTimeDomain +* 4  - a single port CSI-RS resource with density  given by Table 7.4.1.5.3-1 from [4, TS 38.211]*.*  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter [*nrofRBs*], [*startingRB*] and [*frequencyDomainAllocation*] in a [*TRS-ResourceSet*] and applies to all resources in a [*TRS-ResourceSet*]. The [frequencyDomainAllocation] configuration is not restricted by initial DL BWP.  - [UE is not expected to receive TRS occasions outside the initial DL BWP.]  - the periodicity and slot offset for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a [*TRS-ResourceSet*], is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a [*TRS-ResourceSet*].  - the UE does not expect the [*TRS-ResourceSet*] to be configured with the periodicity of  slots if the bandwidth of NZP CSI-RS resource is larger than 52 resource blocks.  - the UE may assume the sub-carrier spacing of the NZP CSI-RS resources configured by [*TRS-ResourceSet*] to be same as the sub-carrier spacing of the initial DL BWP.  - *powerControlOffsetSS* given bya [*TRS-ResourceSet*] applies to all resources in a [*TRS-ResourceSet*].  - the QCL information for periodic NZP CSI-RS resources, is given by the higher layer parameter *ssb-Index* configured by a [*TRS-ResourceSet*], is a SS/PBCH block, applies to all resources in a [*TRS-ResourceSet*].  - the UE may assume the following quasi co-location type(s):  - 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block.  If L1 TRS availability indication is configured both in paging DCI and PEI, for UE monitoring PEI, UE would acquire L1 indication in PEI and ignore L1 indication in paging DCI.  ============================= Unchanged part omitted =========================================  ***Proposal 3: If L1 TRS availability indication is configured, and during the validity time, the TRS resource configuration is changed by SI update procedure, before UE detects a following L1 TRS availability indication, all TRS resources are assumed as unavailable.***  And related TP text can be as follows:  **TP#3 for TS 38.214 Clause 5.1.6.1.1**  ============================= Unchanged part omitted =========================================  5.1.6.1.1 CSI-RS for tracking  A UE in RRC connected mode is expected to receive the higher layer UE specific configuration of a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*.  <omitted text>  A UE in RRC\_IDLE or RRC\_INACTIVE can receive a higher layer configuration of TRS occasions via a [*TRS-ResourceSetConfig*].  - For frequency range 1, the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a [*TRS-ResourceSet*] consists of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  - For frequency range 2 the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a [*TRS-ResourceSet*] consists of two periodic NZP CSI-RS resources in one slot or by a [*TRS-ResourceSet*] of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter [*TRS-Resource*] in a [*TRS-REsourceSet*] with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  - the time-domain locations of the two CSI-RS resources in a slot, or of the four CSI-RS resources in two consecutive slots (which are the same across two consecutive slots), is one of  - , , or for frequency range 1 and frequency range 2,  - , , , , ,  or  for frequency range 2.  - where the first symbol location in a slot is indicated by *firstOFDMSymbolInTimeDomain* in the [*TRS-ResourceSet*] and the second symbol location in a slot is *firstOFDMSymbolInTimeDomain +* 4  - a single port CSI-RS resource with density  given by Table 7.4.1.5.3-1 from [4, TS 38.211]*.*  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter [*nrofRBs*], [*startingRB*] and [*frequencyDomainAllocation*] in a [*TRS-ResourceSet*] and applies to all resources in a [*TRS-ResourceSet*]. The [frequencyDomainAllocation] configuration is not restricted by initial DL BWP.  - [UE is not expected to receive TRS occasions outside the initial DL BWP.]  - the periodicity and slot offset for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a [*TRS-ResourceSet*], is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a [*TRS-ResourceSet*].  - the UE does not expect the [*TRS-ResourceSet*] to be configured with the periodicity of  slots if the bandwidth of NZP CSI-RS resource is larger than 52 resource blocks.  - the UE may assume the sub-carrier spacing of the NZP CSI-RS resources configured by [*TRS-ResourceSet*] to be same as the sub-carrier spacing of the initial DL BWP.  - *powerControlOffsetSS* given bya [*TRS-ResourceSet*] applies to all resources in a [*TRS-ResourceSet*].  - the QCL information for periodic NZP CSI-RS resources, is given by the higher layer parameter *ssb-Index* configured by a [*TRS-ResourceSet*], is a SS/PBCH block, applies to all resources in a [*TRS-ResourceSet*].  - the UE may assume the following quasi co-location type(s):  - 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block.  If L1 TRS availability indication is configured via [SIB], and during the validity time, the TRS resource configuration is changed by SI update procedure, before UE detects a following L1 TRS availability indication, all TRS resources are assumed as unavailable.  ============================= Unchanged part omitted ========================================= |
| CMCC |  |
| Panasonic | **Proposal 1: UE default assumption of TRS availability should be described as "may" instaed of "shall", if either of SIB configuration or L1 indication is temporarily absent or unreliable in below cases:**   * **A UE just camps on a cell or received an updated TRS configuration, before the UE receives a L1 TRS availability indication.** * **During the system modification period and before the new SIBs become valid, a UE can not acquire the up to date TRS configuration but still stores previous TRS configuration.**   **Proposal 4: UE assumes the TRS availability indication consistent between PEI and associated paging DCI. If UE detects inconsistent indication, this is treated as error case and no need to specify.** |
| Samsung |  |
| Apple |  |
| InterDigital | **Conclusion 2: If L1 TRS availability indication is enabled, before UE receives a L1 availability indication after camping on a cell or after receiving an updated TRS configuration, the UE can assume the configured group(s) of TRS resource set(s) are unavailable.** |
| Sharp | **Proposal 2: TRS availability indications in PEI-DCI can be inconsistent with the indication in paging DCI**  **Proposal 3:** **Support providing availability indication via PEI for TRS resources with the same QCL references** |
| LG | **Proposal 2: UE assumes the indicated validity durations are temporally unavailable from the start of modification period where SI acquisition procedure is applied until it acquires a SIB1 message**   * **If a value tag of the SI for TRS configuration is changed from the stored version**    + **the validity durations indicated before the current modification period are unavailable**   + **UE acquires SIB-X to update TRS configuration**   + **UE can apply L1 based availability indication based on updated TRS configuration from the current modification period** * **Otherwise, if a value tag of the SI for TRS configuration is not changed from the stored version**   + **UE can use stored version of SI for TRS configuration**   + **UE can re-assume TRS for the indicated validity durations, if available** |
| Ericsson |  |
| Qualcomm |  |
| MediaTek |  |
| Nokia | **Observation:** *If PO and associated PEI fall to different default paging cycles, the L1 availability indication could be different in the paging DCI and PEI.*  **Observation:** *Having different L1 indication value in paging DCI and associated PEI would not cause any UE ambiquity as UE can determine the availability assumption based on the latest L1 availabilty indication with value ‘1’.* |
| Nordic |  |
| Lenovo |  |

According to the above proposals, the remaining issues regarding TRS availability indication include:

* Issue 1-1: TP for CRs of TS 38.213
* Issue 1-2: Clarification on default assumption
* Issue 1-3: Whether/how to restrict consistent TRS availability indication from PEI and paging PDCCH
* Issue 1-4: Whether to support PEI based TRS availability indication only for RS resources with same QCL references

## 2.1 <1st round discussion>

**Issue 1-1: TP for CR of TS 38.213**

The proposed TPs for CRs of TS 38.213 regarding TRS availability indication based on existing agreements are collected in the table below.

|  |  |  |
| --- | --- | --- |
| **Index** | **Proposed TP** | **From** |
| 1 | ............................. Text Proposal for TS38.213..................................  **10.4B Indication of TRS resources**  (text omitted)  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. ~~A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.~~  \*\*\* Unchanged text is omitted \*\*\*  ................ End of Text Proposal for TS38.213..................................... | ZTE |
| 2 | 10.4B Indication of TRS resources -------------- Unchanged text is Omitted --------------------------------  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 and ~~or~~ a DCI format 1\_0 with CRC scrambled by P-RNTI includes the ~~a~~ TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap, if DCI format 2\_7 is configured.  --------------- Unchanged text is Omitted ------------------------- | CATT |
| 3 | 10.4B Indication of TRS resources --------------------------------- Unchanged text is Omitted ---------------------------------------------------------  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*.  A value of '0' for a bit of the bitmap ~~is ignored by~~ indicates that the UE keeps the existing assumption of the availability or unavailability of the corresponding TRS resource set(s).  ---------------------------------------------------- Unchanged text is Omitted ---------------------------------------------------------- | CATT |
| 4 | \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of text Proposal\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  10.4B Indication of TRS resources  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 with CRC scrambled by PEI-RNTI or a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an Id i which indicate the association to the ith bit within the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, of a number of frames provided by *defaultPagingCycle*; if *validityDuration* is not provided, the multiple is equal to 2. A value of ‘1’ for the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] which is the first frame within the default DRX cycle that a PDCCH providing the DCI format 2\_7 or the DCI format 1\_0 with the TRS availability indication field indicating the TRS resource sets is received, where is provided by *defaultPagingCycle*.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End of text Proposal\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  Proposal\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* | OPPO |

**[1RD]**

**Please a) provide your views on whether or not to support any of the TPs above.**

|  |  |
| --- | --- |
| **TP** | **Companies** |
| #1 | * **Yes:** Nokia, Nordic, vivo (partially), LGE,Sharp,ZTE,Sanechips, intel (with update), MediaTek, , Ericsson1, IDCC * **No: CATT,** Samsung,Xiaomi |
| #2 | * **Yes: CATT, Nordic, Qualcomm, Apple,** vivo (partially), LGE,ZTE,Sanechips(partially), intel, CMCC, Panasonic * **No:** ,Xiaomi, MediaTek (support Xiaomi’s revision) |
| #3 | * **Yes:** CATT, Qualcomm,Xiaomi, intel, Huawei, HiSilicon, CMCC, Ericsson1 (with updates), IDCC * **No: Nordic, vivo** |
| #4 | * **Yes:** Nokia, Nordic, Apple (only PEI-RNTI part) ,Xiaomi, LGE, intel, Huawei/HiSilicon(Only PEI-RNTI part), CMCC, IDCC * **No: CATT, vivo** |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | For #2; no strong view as such, but isn’t this covered in 38.212 (by ” - TRS availability indication – 1, 2, 3, 4, 5, or 6 bitsif *TRS-ResourceSetConfig* is configured; 0 bits otherwise.” |
| CATT | For TP#1, the texts of associated TRS validity should remain.  For TP#4, most of changes are not necessary. |
| Nordic | For #3 if “ignored” is not liked, we could say “is discarded by the UE” |
| Apple | For #1 and #3, we think the TPs are not essential. Either way is correct and there is no ambiguity. But we can go with the majority view.  For #4, we think only “PEI-RNTI” change is needed, and all the other parts do not seem necessary. |
| Samsung | For TP#1, we think the texts should not be removed. Otherwise it’s ambiguous whether or not UE can be indicated with new TRS availability indication before the expiration/end of validity duration associated with previous L1 based signalling for TRS availability indication.  For TP#4, we don’t agree with the first two modifications. 1) RNTI for DCI format 38.213 is removed in latest CR by editor with justification. 2) The description of the association between each bit and TRS resource set is clear in the original CR. For the last modification on reference point for validity duration, we are generally OK. It’s also under discussion for Issue 2-1. |
| vivo | For the text removed by TP#1, the intention seems to capture the following agreements.  Agreement  If SIB configures TRS resource, TRS availability indication field is present in DCI format 2\_7 (if configured) with CRC scrambled by PEI-RNTI and DCI format 1\_0 with CRC scrambled by P-RNTI.  And TP#2 seems also trying to capture the above agreements.  In our understanding, the above agreements should be captured properly. Hence, we suggest the following TP based on TP#1 and TP#2.   |  | | --- | | **10.4B Indication of TRS resources** A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 if configured ~~or~~ ,and a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2.  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from C:\Users\11057001\AppData\Local\Temp\ksohtml\wps740F.tmp.jpg [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where *T* is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. ~~A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.~~ | |
| Xiaomi | For TP #1,  Form our view, the deleted part is a common understanding and it would good to have it to make the spec more clear. but if majority think it is redundant and want to delete it, we can also accept it.  For TP #2,  We understand the intention is to say that if DCI 2-7 is not configured, than TRS availability indication would not be configured in DCI 2-7. And we can agree with the intention, but the current wording in TP #2 seems saying that, if DCI 2-7 is not confogured, than TRS availability indication would not be provided in DCI 1-0 as well. We prefer a different wording as the following,  -------------- Unchanged text is Omitted --------------------------------  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, ~~a DCI format 2\_7 or~~ a DCI format 1\_0 with CRC scrambled by P-RNTI and a DCI format 2-7, if DCI format 2\_7 is configured, includes the ~~a~~ TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap.  --------------- Unchanged text is Omitted -------------------------  For TP #4,  TP #2 and TP #4 should be merged. |
| LGE | For TP#3, we don’t have strong view, but it seem like TP is not essential.  For TP#4, we tend to agree with Apple’s view. Especially we have concern with “within the default DRX cycle” . |
| ZTE, Sanechips | For #1, in our understanding, we think the description that “A value of '0' for a bit of the bitmap is ignored by the UE/” is sufficient, and the last sentence can be removed. Because even without the last sentence, the following can be inferred.  1) No matter whether there is an on-going validity time duration or not, if UE receives an indication of “1”, the associated resource set is valid from the SFN determined by the formula till the multiple of the number of frames;  2) If the TRS resources are not valid, it is still invalid after reception of “0”. If there is an on-going validity time duration, the duration will not change if the indication of “0” is ignored by UE.  Moreover, with the last sentence,  it is unclear whether it refers to each bit or a whole L1 signaling.  the possibility of indicating “0” during the on-going validity time duration is precluded.  For #2, the version provided by vivo is preferred. For the current TP#2, it may imply that the indication can be carried by DCI format 1-0 and PEI, only when PEI is configured. Which is not aligned with the previous agreements.  For #3, okay to clarify the implication of“A value of '0' for a bit of the bitmap is ignored by the UE” or the proposed update.  For #4, in our opinion, the ‘PEI-RNTI’ is removed by the editor in the latest CR. Other revisions seem not needed. For example, description of the TRS availability indication filed is clear in TS 38.331 CR shown as following.   |  | | --- | | ***indBitID***  The index of the associated bit in TRS availability indication field in DCI. Each TRS resource set is configured with an ID i for the association with i-th indication bit in TRS availability indication field in DCI. | |
| Intel | For TP# 1, the intention seems to capture that UE can receive new L1 availability indication before the validity duration triggered by a previous L1 indication expires. However, we are not sure the following part is generally applicable “…….where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames~~. “~~  The “time” gap can be smaller than validity duration. We are not sure whether we had agreement that time between PEI and paging DCI is always smaller than validity duration. Without this part, we think description is clear as follows.  A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames. ~~where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.~~  The proposed change above does not impose any restriction and UE is allowed to receive two L1 indications within an active validity duration. These two L1 indications can be paging DCIs (if PEI is not configured) or PEI followed by paging DCI.  Support TP # 2, 3, 4 |
| Huawei, Hisilicon | TP#2: We can understand the intention of TP#2. But we agree with Nokia that 212 is already clear enough.  TP#3: The updated description seems clearer and is copied&pasted from the agreement. We are fine with it.  For TP#4, the last part we are open to discuss it in issue 2-1. |
| CMCC | TP#1: this TP is also related to issue 1-3.  TP#3: It is better to clarify the UE behavior of receiving value ‘0’. |
| Ericsson1 | #2 : not needed since it is covered by 38.212.  #3 : suggested update “indicates that the UE keeps the existing assumption of the availability or unavailability of **TRS in** the corresponding TRS resource set(s).”  #4 : This has overlap with Issue 2-1 and prefer to discuss together. Some changes are not needed such as adding PEI-RNTI, “which is the first frame”. |
| Moderator1 | On TP#1:   * **[**CATT**,** Samsung, Xiaomi] have concerns to remove the texts. Without the texts it’s ambiguous “whether the availability indication is transmitted [only once] during the validity duration”. * To follow up with Intel’s comment, the text doesn’t consider time between PEI and paging DCI. DCI format 2\_7 **or** DCI format 1\_0 is just a DCI format that can provide the TRS availability indication. The intention of the text is to reflect the following agreement   Agreement  UE can receive L1 based signaling for TRS availability indication before the expiration/end of validity duration associated with previous L1 based signaling for TRS availability indication  On TP#2: vivo and Xiaomi suggested a minor revision to clarify “if configured” only applies to DCI format 2\_7.  On TP#3: no strong objection reason. The wording can be slightly revised to match with indication of “1”.  On TP#4:   * the first two parts are not necessary as commented by [CATT, Samsung, Apple, ZTE, Ericsson]. * For the last part regarding reference point for validity duration determination, it can be discussed in Section 3.   Given above, the TPs are merged as follows:   |  | | --- | | **Proposal 1-1 (v1): Support the following TP for CR of TS 38.213**.  10.4B Indication of TRS resources  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 if configured ~~or~~ and a DCI format 1\_0 with CRC scrambled by P-RNTI includes ~~a~~ the TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2.  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap ~~is ignored by the UE~~ indicates that the UE keeps existing assumption of the availability or unavailability of associated TRS resource sets. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\* | |

### Issue 1-2: Clarification on default assumption

According to the contributions, default assumptions for TRS availability were discussed for the following cases:

* C1: before UE receives L1 availability indication after camping on a cell
* C2: the TRS resource configuration is changed by SI update procedure
* C3: During the system modification period and before the new SIBs become valid

Companies views about default assumptions include

* Alt1: UE assumes all TRS resource set(s) are unavailable
  + Intel(C1), Xiaomi (C1, C2), LG (C3)
* Alt2: UE “may” or “can” assume all TRS resource set(s) are unavailable
  + Panasonic, InterDigital

The issue was discussed in RAN1#107bis-e meeting. The following conclusion based on Alt2 (with majority support in last meeting) is suggested by FL for continuous discussion in this meeting.

|  |
| --- |
| **[1RD]**  **Conclusion 1-2 (v1)**  If L1 TRS availability indication is enabled, before UE receives a L1 availability indication after camping on a cell or after receiving an updated TRS configuration, the UE can assume the configured group(s) of TRS resource set(s) are unavailable.  Note: During the modification period before the new SIBs become valid, stored TRS configurations and the associated availability indication still apply. |

**Please a) provide your views on whether or not to support Conclusion 1-2 (v1) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Nokia, CATT, Qualcomm, Apple, Samsung, vivo, Xiaomi, Sharp, intel, Huawei, HiSilicon, DOCOMO, CMCC, Panasonic(with revision), IDCC |
| No | MediaTek (no need) |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Maybe “can assume are unvailable” 🡪” cannot not assume to be available”? |
| CATT | Agree with Nokia.  If L1 TRS availability indication is enabled, before UE receives a L1 availability indication after camping on a cell or after receiving an updated TRS configuration, the UE can not assume that the configured group(s) of TRS resource set(s) are ~~un~~available. |
| Nordic | CATT wording is OK |
| Qualcomm | We think the original wording is better than Nokia’s update. There is no need to preclude UE blind detection of the TRS although there is no such a requirement for UE either. |
| Xiaomi | In fact we are not sure what does “During the modification period before the new SIBs become valid” refers. Does it refer to the time duration that paging DCI has indicated the SI will be changed in the next modification period and the next modification period is not coming yet? |
| LGE | Before making a decision regarding default assumption on configuration and associated availability, we would like to share our understanding on this issue.  To acquire the updated TRS configuration, UE need to decode SIB1 and SIB-X. In case that the proposed conclusion is accepted, it should be noted that different UE may have different version of TRS configuration since there is possibility that UE fails to decode SIB1 or SIB-X. Hence, different UE may have different understanding on L1 availability indication that received during a modification period where UE performs SI update procedure for the TRS configuration. Is it ok to allow such an inconsistent interpretation for TRS availability between UEs? If it is allowed, it seems like gNB shall support both TRS configurations during the modification period. This means that resource overhead due to the TRS transmission can be doubled |
| ZTE, Sanechips | Not sure why we need to repeat this discussion. I think the same intention is pretty clear based on the previous agreements.  As to the SI update procedure, we think it is a common issue, which does not require special handling for TRS. |
| Intel | Support. Also fine with proposal from Nokia. |
| Huawei, HiSilicon | Agree with Qualcomm and that is the intention of original description.  A bullet should be added to capture that there is no spec impact. |
| MediaTek | The following agreement already clarifies the UE assumption when network doesn’t indicate TRS is available. So we don’t think the repeated conclusion is needed. Note that it is also our understanding current specification doesn’t preclude UE to perform blind detection while it is network that cannot assume UE can always do the blind detection.   |  | | --- | | Agreements: (RAN1#104-e)  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).** | |
| Panasonic | Agree with Qualcomm the current main text is okay and no need to restrict possible UE blind detection. Regarding the note, we think it is better to be revised to “…can/may still apply.” |
| Ericsson1 | Given below agreement, can it be clarified why this conclusion is needed?  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). |
| Moderator1 | [Nokia, CATT, Nordic, Intel] suggested modification “the UE can not assume that the configured group(s) of TRS resource set(s) are ~~un~~available.” But it’s not acceptable to [QC, HW, Panasonic].  The intention of the conclusion is a) to end the discussion on default assumption, and b) not to preclude UE blind detection of the TRS by implementation although there is no such a requirement for UE either. However, MTK and Ericsson pointed out that we have agreement about UE default assumption. No further conclusion is needed. So, we can drop the discussion. |

### Issue 1-3: Whether to restrict consistent TRS availability indication from PEI and paging PDCCH

Proposals about “whether/how to avoid inconsistent availability information in Paging PDCCH and PEI PDCCH” include the following alternatives:

* Alt1: A UE does not expect to receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle
  + ZTE
* Alt2: the UE ignores TRS availability indication in DCI format 1\_0 with CRC scrambled by P-RNTI.
  + Xiaomi
* Alt3: The availability information can be inconsistent. No any UE ambiguity.
  + Sharp, Nokia
* Alt4: If UE detects inconsistent indication, this is treated as error case and no need to specify.
  + Panasonic

The issue was discussed in RAN1#107bis-e meeting. For the first round discussion in this meeting, two options from both sides are provided for continuous discussion.

* Option 1 is a conclusion based on Alt3 and Alt4 without any specific change.
* Option 2 is based on Alt1 and Alt2.

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| --- |
| **[1RD]**  **Option 1:**  **Conclusion 1-3 (v1)**  A UE can receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle.  **Option 2:**  **Proposal 1-3 (v1)**  A UE does not expect to receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle.   * If a UE receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle, the UE ignores TRS availability indication in paging PDCCH. |

**Please a) provide your views on which option to support for resolving issue 1-3 below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| **Option 1:**  **Conclusion 1-3 (v1)** | Nokia, Samsung, LGE, Sharp, DOCOMO, MediaTek, Panasonic, Ericsson1 |
| **Option 2:**  **Proposal 1-3 (v1)** | CATT, Nordic, Qualcomm (with update), vivo (with some modification),Xiaomi, ZTE,Sanechips (with update), intel (without sub-bullet), Huawei, HiSilicon(with update), CMCC |

**and, b) provide additional comments, if any, below:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Discussion for option 1 and 2 has relation to proposal 2-2b. |
| CATT | The UE behavior would be unspecified if they receive different TRS availability indication from DCI format 2\_7 and 1\_0 in the same DRX cycle. |
| Nordic | A UE does not expect to receive inconsistent TRS availability indication from PEI and paging PDCCH received in PO associated with the PEI.   * Note: If a UE receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle, the UE ignores TRS availability indication in paging PDCCH. |
| Qualcomm | The bullet “If a UE receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle, the UE ignores TRS availability indication in paging PDCCH” is unnecessary in proposal 2. Proposal 2 main body should be guaranteed by network. |
| Apple | Before we discuss the two options, the meaning of “inconsistent TRS availability indication” needs to be clarified first. Based on how availability indication is interpreted, we do not think there is any inconsistency between any two indications, because each one is interpreted independently.  It would be helpful if an example of inconsistency can be provided, and why it is considered as inconsistency. |
| Samsung | Our understanding of “inconsistent TRS availability indication” is different bitmap value.  Since we agreed that UE can receive new indication before expiration of validity duration for previous TRS availability indication in last meeting, we don’t see any issue for UE to receive PEI based availability indication and paging PDCCH based availability indication with different value. |
| Vivo | In principle, we agree with the intention of the main-bullet of Option 2. However, we do not see the need for the sub-bullet since the case provided in the sub-bullet has been addressed as an error case by the main-bullet. Additionally, from our understanding, PEI and its associated paging DCI may transmit in different paging cycles, hence we suggest the following revision.  **Option 2:**  **Proposal 1-3 (revised by vivo)**  A UE does not expect to receive inconsistent TRS availability indication from PEI and its associated paging PDCCH ~~within a default paging cycle~~.   * ~~If a UE receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle, the UE ignores TRS availability indication in paging PDCCH.~~ |
| Xiaomi | We support Option2.  Option1 has a very strong negative impact on UE power consumption, and it eliminate all the power saving gain of PEI. If inconsistent TRS availability indication from PEI and paging DCI is allowed, UE does not able to know whether the same or a different TRS availability indication has been indicated in paging DCI or not , so UE has to decode both PEI and paging DCI every DRX cycle. this is basically a huge waste of UE power and we currently see no benefit at all |
| LGE | We have similar view with Samsung. When “1” is indicated by the L1 signal, new validity duration can be started from the reference point, and existing validity durations that UE already has are not impacted. When “0” is indicated by the L1 signal, there is no change for the validity duration. Thus we do not see any issue due to the inconsistency of TRS availability indication between Paging PDDCH and the associated PEI. |
| Sharp | UE can interpret the availability of TRS resources when it receives both or either of two type indications and have no ambiguous regardless of the indications are consistent or inconsistent. we think the restriction is not necessary |
| ZTE, Sanechips | We agree with other companies that the sub-bullet in the option 2 is not needed.  As to the association between paging DCI and PEI, we don’t think it is needed. |
| Huawei, HiSilicon | We are generally fine with the main bullet of option 2. However, we think the indication should be consistent not only within a default paging cycle and also within a validity duration.  And we think the sub-bullet is not needed. For the case of inconsistent (which is actually an error case), it can be up to UE implementation.  **Option 2:**  **Proposal 1-3 (v1)**  A UE does not expect to receive inconsistent TRS availability indication from PEI and paging PDCCH within ~~a default paging cycle~~ a validity duration.   * ~~If a UE receive inconsistent TRS availability indication from PEI and paging PDCCH within a default paging cycle, the UE ignores TRS availability indication in paging PDCCH.~~   Furthermore, if “0” is always ignored and “1” means “available”, can anybody explain in in which case the indication is inconsistent considering this value design? Although we are fine with option2 above, we are wondering whether we need to discuss this proposal in general. |
| DOCOMO | We have similar view with Samsung and LG. We don't think there is a issue with the inconsistency in the TRS availability indication. |
| MediaTek | Based on the current specification, the validity durations of TRS resources will only be prolonged. In our understanding, UE will follow the latest indication as the updated information for TRS validity duration even the latest indication doesn’t provide the same content as the previous one.  To avoid ambiguity, we also suggest to change ‘inconsistent indication’ to ‘different indication content’ |
| CMCC | If Option 1 is adopted, the interpretation of TRS availability indication value ‘0’in paging DCI may be different between UEs supporting PEI and UEs not supporting PEI |
| Ericsson1 | Consistent/inconsistent terminology is not very clear. Since each DCI has its own reference point and validity time duration, we do not see need for linking reception/indication in one DCI with that of another DCI. We do not support Option 2. |
| Moderator1 | On Proposal 1-3,   * [8] companies object it, as they don’t see issue to allow inconsistent or different indication content from PEI and paging PDCCH. * To follow up with Xiaomi’s comment, For UE configured with PEI, UE is not required to monitor paging PDCCH for TRS availability indication in every DRX cycle. Whether or not UE needs to decode paging PDCCH is indicated by PEI.   So, moderator suggests to continue check conclusion 1-3 with the intention to end the discussion for this issue. Conclusion 1-3 is further updated to clarify “inconsistent”, and association between PEI and paging PDCCH.  **Conclusion 1-3 (v2)**  A UE can receive different ~~inconsistent~~ TRS availability indication content from PEI and associated paging PDCCH ~~within a default paging cycle~~ |

### Issue 1-4: Whether to support PEI based TRS availability indication only for RS resources with same QCL reference

[Spreadtrum, Sharp] proposed to support TRS availability indication based on PEI PDCCH in beam-selective manner. The issue was discussed in previous meetings. The majority consider it as non-essential based on the feedbacks in previous discussions.

In the first round discussion in this meeting, two options from both sides are provided for first round discussion. Option 1 is the latest proposal discussed in last meeting to support the additional design, and Option 2 is to conclude no support for the additional design and end of the discussion.

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| --- |
| **[1RD]**  **Option 1:**  **Proposal 1-4 (v1):**  Support to only include one indication bit in TRS availability indication field in DCI for-mat 2\_7, which is associated with the same QCL reference (SSB index) of the monitoring occasion for the DCI format 2\_7, in addition to the support of the same TRS availability indication field size as that in paging DCI.  **Option 2:**  **Conclusion 1-4 (v1)**  No consensus to support   * 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 |

**Please a) provide your views on which option to support for resolving issue 1-4 below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Option 1:  **Proposal 1-4 (v1**) | Apple, Sharp(with modification), Huawei, HiSilicon |
| Option 2:  **Conclusion 1-4 (v1**) | CATT, Qualcomm, Samsung, vivo, Xiaomi,ZTE, Sanechips, intel, DOCOMO, MediaTek, CMCC, Panasonic, IDCC |

**and, b) provide additional comments, if any, below:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Option 1 is not clear if we have multiple resources sharing same QCL source, while the associated L1 availability ID/bit is different |
| Nordic | We have been supporting Option 1, but since we are in maintenance, Option 2 is the way to go. |
| Apple | We have always been supporting Option 1. We would certainly welcome if companies are willing to consider it. |
| Samsung | The additional design for PEI based indication is non-essential. |
| vivo | Not support to introduce new definitions on TRS availability field. The bit filed length in PEI DCI should be same as that in paging DCI to limit spec impact. |
| Xiaomi | Since we have agreed a more flexible way to indicate availability for both TRS with the same and different QCL,we don’t see it is essential to support Option1. |
| LGE | Our preference is option 1, but we can compromise to majority view. |
| Sharp | For Nokia’s question, we can modify the proposal with bits for each resources sharing same QCL:  Support to only include ~~one~~ indication bit(s) in TRS availability indication field in DCI for-mat 2\_7, which is associated with the same QCL reference (SSB index) of the monitoring occasion for the DCI format 2\_7, in addition to the support of the same TRS availability indication field size as that in paging DCI. |
| Huawei, HiSilicon | We support Option 1 which provides technical benefits. |
| Ericsson1 | Not clear what has changed from the last time this was discussed (i.e. RAN1#107-e). |
| Moderator1 | The majority don’t think the additional design is essential. Since we are at the CR phase, moderator suggests to agree on Conclusion 1-4 to end the discussion for this issue.  **Conclusion 1-4 (v1)**  No consensus to support   * 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 |

## 2.2 <2nd round discussion>

**Issue 1-3: Whether to restrict consistent TRS availability indication from PEI and paging PDCCH**

Based on the discussion so far, we didn’t see critical issue that requires a restriction on same indication content from PEI and associated paging PDCCH. So, the purpose of this conclusion is to end the discussion on issue 1-3. The conclusion is the outcome based on the existing agreement without any spec impact.

|  |
| --- |
| **[2RD]**  **Conclusion 1-3 (v2)**  A UE can receive different TRS availability indication content from PEI and associated paging PDCCH. |

**Please a) provide your views on whether or not to support Conclusion 1-3 (v2) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Apple, Sharp, Samsung, Panasonic, LGE, Ericsson2, intel |
| No | Xiaomi, CATT, Qualcomm (further clarification is needed), Huawei, HiSilicon |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Xiaomi | As we have commented earlier, this conclusion would lead to UE monitoring paging DCI every time to get a updated TRS availability indication in paging DCI. It is huge waste of UE power. |
| Vivo | Although we still think the TRS availability indication will not update much frequently and at least it makes less sense to update during the gap between PEI and its associated PO, we can follow the majority view. |
| ZTE, Sanechips | In our opinion, TRS availability indication is introduced for UE power efficiency. If different TRS availability indication is allowed, UE needs to detect both signalings for TRS availability indication, which is not beneficial to UE power saving. Meanwhile, it only consistent indication is allowed, it will increase NW implementation complexity to guarantee the consistency. Therefore, if the group believes there is no critical issue with different indication from PEI and paging DCI, we are fine with the conclusion. |
| Nokia\_2 | As noted, the reference points, and therefore the time covered by validity duration can be different for PEI and paging DCI, thus it would not seem “consistent” to demand these to be “consistent”. Also as commented by other companies, monitoring PEI does not mandate monitoring paging DCI. |
| CATT | UE would decode paging DCI only its successfully decoding of paging DCI in the same DRX cycle. The reference point of TRS validity duration is the beginning of the default DRX cycle. It is not technical correct for UE to receive different TRS availability indication from PEI and paging DCI. |
| Samsung | PEI and paging PDCCH can be supported independently. We don’t agree with the conclusion from Xiaomi that UE needs to UE monitoring paging DCI every time to get a updated TRS availability indication in paging DCI. UE follows PEI indication to wakes up for paging PDCCH.  We also don’t agree with CATT’s comment. UE maintains availability of TRS resources per bit or per group of TRS resource sets. No any technical issue for UE to update TRS resources availability at any time where UE receives a L1 availability indication in paging PDCCH or PEI PDCCH. |
| Qualcomm | We agree with Xiaomi. The issue raised by Xiaomi’s should be clarified together with this conclusion. I.e., if a UE detects the PEI and finds its PO or subgroup is not paged nor short message needs to be received, should the UE process the paging PDCCH just for receiving TRS availability indication or not. |
| Panasonic | As UE only monitors PEI one time during a paging cycle, within which gNB may turn on some TRS resources at any time, some UEs may acquire the availability information with less latency, while some UEs can only acquire it in the next paging cycle, depending on where the monitored PEI-O is. In case a UE is paged and indicated with positive PEI, it is possible that UE receives inconsistent TRS availability information, which is useful to shorten the latency. Even if the UE does not monitor paging due to negative PEI, there is also no issue and it is not mandated to monitor paging and it just needs to wait for the next paging cycle, like many other UEs whose PEI-O is ahead of the changing of TRS transmission. Or if gNB identifies such case, it may choose to page UE and indicate positive bits in PEI then UE will not miss out for this cycle. This is up to gNB implementation. |
| LGE | Even if different availability indication contents is allowed, we can expect that smart gNB will transmit consistent availability indication if there is a validity duration that can be informed at both PEI and paging. It could be a common understanding because gNB would try to help UE power saving. Thus we cannot agree that UE will monitor both PEI and paging DCI to check the TRS availability indication which might be inconsistent between L1 signaling.  Meanwhile as pointed out by some companies, there could be a case that the gNB start new TRS transmission between PEI-O and paging. In this case, if only the consistent indication is allowed, gNB shall transmit undesired TRS from the PEI-O in advance or it shall not indicate TRS availability at the PO for the consistency. This is neither the resource efficient nor power saving efficient way.  Moreover, depends on the outcome of issue 2-2, the reference point between PEI-O and PO could be different from each other. In this case, indicating same contents for the availability indication would not be possible in some cases. |
| Huawei, HiSilicon | We think the PEI DCI and associated paging DCI should have the same indication content for power saving benefit. |
| Intel | They are expected to provide same indication if received within same default DRX cycle, for consistency. If they are in different DRX cycles, indications can be different. Monitoring PEI does not mandate paging DCI. However, even if the indication content is different (for same DRX cycle), it is not expected to impact UE negatively because L1 indication can only indicate availability. So if PEI indicates unavailable and paging DCI indicates available and UE does not monitor paging DCI, UE just misses out on the opportunity to receive TRS until next L1 indication. Other than that, we don’t see much issue. |
| Moderator2 | **Concerns for Conclusion 1-3:**   * C1: the conclusion will lead UE needs to detect both signalings for TRS availability indication.   + Xiaomi, ZTE, HW * C2: will increase NW implementation complexity to guarantee the consistency   + ZTE * C3: It is not technical correct for UE to receive different TRS availability indication from PEI and paging DCI.   + CATT * C4: if a UE detects the PEI and finds its PO or subgroup is not paged nor short message needs to be received, should the UE process the paging PDCCH just for receiving TRS availability indication or not.   + QC   **Responses to the concerns:**   * On C1:   + Monitoring PEI does not mandate monitoring paging DCI. UE follows PEI indication to wake up for paging PDCCH reception.     - Nokia, Samsung, Intel   + There could be a case that the gNB start new TRS transmission between PEI-O and paging. In this case, if only the consistent indication is allowed, gNB shall transmit undesired TRS from the PEI-O in advance or it shall not indicate TRS availability at the PO for the consistency. This is neither the resource efficient nor power saving efficient way.     - LGE, Panasonic, Samsung   + even if the indication content is different (for same DRX cycle), it is not expected to impact UE negatively because L1 indication can only indicate availability. So if PEI indicates unavailable and paging DCI indicates available and UE does not monitor paging DCI, UE just misses out on the opportunity to receive TRS until next L1 indication     - Intel * On C2:   + **Moderator:** NW/UE anyway needs to maintain availability indication per bit or per group of TRS resources sets over time. I don’t think the conclusion will increase NW implementation complexity.   + They are expected to provide same indication if received within same default DRX cycle, for consistency. If they are in different DRX cycles, indications can be different.     - Intel * On C3:   + UE maintains availability of TRS resources per bit or per group of TRS resource sets. No any technical issue for UE to update TRS resources availability at any time where UE receives a L1 availability indication in paging PDCCH or PEI PDCCH.     - Samsung   + The reference point is determined independently for PEI and paging PDCCH based indication according existing agreement. The time covered by validity duration can be different for PEI and paging DCI.     - Nokia * On C4:   + Even if the UE does not monitor paging due to negative PEI, there is also no issue and it is not mandated to monitor paging and it just needs to wait for the next paging cycle, like many other UEs whose PEI-O is ahead of the changing of TRS transmission. Or if gNB identifies such case, it may choose to page UE and indicate positive bits in PEI then UE will not miss out for this cycle. This is up to gNB implementation.     - Panasonic   + **Moderator**: Based on existing agreement, UE is not required to receive Paging PDCCH for TRS availability indication if not paged, i.e. if PEI is “0”. However, UE is not precluded to decode paging PDCCH to get potentially additional TRS availability information by implementation. There is no ambiguity of the availability information between gNB and UE regardless of UE’s implementation.   Given above, no valid/critical issue is identified for the need of additional restriction regarding consistent TRS availability indication from PEI and associated PO. On the other hand, existing design provides allows gNB to transmit new availability information with less latency. So, moderator suggests to further check the conclusion in the email reflector to see if we can reach consensus; otherwise we may drop the discussion in this meeting. |

## 2.3 <3rd round discussion>

**Issue 1-3: Whether to restrict consistent TRS availability indication from PEI and paging PDCCH**

For conclusion 1-3, a note was added based on discussion in email reflector. Let’s further discuss it in the third round.

|  |
| --- |
| **[3RD]**  **Conclusion 1-3 (v3)**  A UE can receive different TRS availability indication content from PEI and associated paging PDCCH.   * Note: UE is not required to receive both PEI and paging PDCCH in the same paging cycle to receive TRS availability indication |

**Please a) provide your views on whether or not to support Conclusion 1-3 (v3) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Qualcomm, LGE, Samsung, intel (with update), Apple |
| No |  |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We still think in real network, it is only reasonable to provide the same TRS availability indication content in PEI and associated paging PDCCH. But to make progress, we are fine with the conclusion with the note. |
| vivo | As we said in the first two round discussions, the consistent TRS availability indication content in PEI DCI and associated paging PDCCH will make sense for UE power saving and complexity reduction. But we can give a compromise on this to follow the majority’s view. |
| Huawei, HiSilicon | The Note looks a bit vague and maybe we should have detailed discussion on this to align the understanding on the note. For us, we have the following understanding.   * If PEI indicates “0” for a bit associated with a group of TRS resource set(s), the same value “zero” is expected in the associated paging DCI for the group of TRS resource set(s). (This is my interpretation of the note.); * If PEI indicates “1” for a bit associated with a group of TRS resource set(s), either value “zero” or value “1” can be received in the associated paging DCI for the group of TRS resource set(s). (This is considering “0” means keeping the existing assumption.)   If the understanding is confirmed as above, we would be OK for the compromised proposal, however we think it would be better to capture them clearly. |
| Nordic | The Note is not really clear.  Is paging cycle (SFN+PF\_offset)modT=0 or (SFN)modT=0 ? |
| ZTE, Sanechips | As we commented before, consistent information is beneficial to UE power saving but at the cost of implementation flexibility. We are okay with the conclusion for the sake of progress. |
| Xiaomi | Share same view as QC and VIVO. And also can compromise to make progress.  And to address Nordic’s comment, we propose the following,  A UE can receive different TRS availability indication content from PEI and associated paging PDCCH.   * Note: UE is not required to receive both PEI and the associated paging PDCCH ~~in the same paging cycle~~ to receive TRS availability indication |
| LGE | We are fine with the proposal, but tend to agree with Nordic’s comment. We prefer Xiomi’s update. |
| Nokia\_3 | I think we should avoid the note as we have already separate rules for triggering (or not) PO monitoring based on PEI.  We could clarify based in Intel comment (quoted below) that that the information can be different if they are in different default DRX cycles.  “They are expected to provide same indication if received within same default DRX cycle, for consistency. If they are in different DRX cycles, indications can be different.” |
| intel | We don’t think the note is necessary. For companies who have concern on main bullet alone, it has been clarified (FL summary after 2nd round) before that different indication does not negatively impact the UE, nor does it mandate monitoring any certain DCI. |
| Ericsson3 | OK with the main proposal, but the note does not seem necessary.  Given both PEI reception and TRS availability indication are up to UE implementation, it is unclear why text like “UE is not required to….” is needed. Also, agree with Nokia comment that information can be different if they are in different default DRX cycles, and this seems to be missing also. Therefore, we suggested below update if the note is to be kept.   * *Note: it is up to UE implementation whether UE ~~is not required to~~ receives both PEI and paging PDCCH in the same paging cycle to receive TRS availability indication* |
| Apple | Just to respond to Huawei/HiSi’s comments, we do not agree with the first bullet:   * If PEI indicates “0” for a bit associated with a group of TRS resource set(s), the same value “zero” is expected in the associated paging DCI for the group of TRS resource set(s). (This is my interpretation of the note.);   What is indicated as ‘0’ in PEI can be indicated as ‘1’ in paging DCI. The note only means that even though the content may be different, the UE is not required to monitor both.  We do not think the note is necessary, but we are fine to keep it if it helps with the convergence/common understanding. |

# TRS validity duration

The following were agreed regarding validity time for L1 based availability indication:

|  |
| --- |
| From RAN1#107-e:  **Agreement**  The reference point for start of the validity duration is SFN of the first PF from the current default DRX cycle where UE receives the availability indication   * FFS: Whether the availability indication is transmitted [only once] during the validity duration |

In contributions [1-20], proposals regarding the validity time for L1 based availability indication are captured in table below:

|  |  |  |
| --- | --- | --- |
| Huawei, HiSilicon | 1. ***The description of “SFN of the first PF from the current default DRX cycle where UE receives the availability indication” in the agreement may cause different referent point of validity durations for different UEs sharing the same PO/PEI-occasion, and needs further clarification to avoid ambiguity between gNB and UE.*** 2. ***It violates the motivation to introduce validity duration of TRS availability if the ambiguity of the reference point caused by detected MOs on UE is left to gNB implementation handling.*** 3. ***It is beneficial to further reduce the maximum number of configurable TRS resource sets for FR1 to reduce UE memory size for low cost and power consumption, especially for RedCap UEs.*** 4. ***Clarify that “the current default DRX cycle where UE receives the availability indication” in RAN1#107 refers to the default DRX cycle that includes the first MO of a PO where UE receives the availability indication, at least for the case when L1 availability indication signaling is received in paging DCI.*** 5. ***Adopt text proposal 1 in section 2.1***  |  | | --- | | ------------------------------------------ Start of Text Proposal 1------------------------------------------  < Unchanged parts are omitted > 10.4B Indication of TRS resources A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 with CRC scrambled by RNTI or a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2. A value of ‘1’ for the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from (SFN+PF\_offset)modT=0 [17, TS 38.304] that corresponds to the frame that includes the first MO of a paging occasion, where the paging occasion includes a PDCCH providing the DCI format 2\_7 or the DCI format 1\_0 with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*.  < Unchanged parts are omitted >  -------------------------------------------- End of Text Proposal 1----------------------------------------- |   ***Proposal 3: Select one of the alternative to align the validity duration for PEI DCI and paging DCI in RAN1#108:***   * + ***Alt.1: The validity duration(s) of L1 availability indication field in a PEI DCI refer to the validity duration(s) of L1 availability indication field in the associated paging occasions of the PEI DCI.***   + ***Alt.2: The validity duration(s) of L1 availability indication field in a PEI DCI refers to the validity duration starts from the SFN of default DRX cycle that includes the first MO of the PEI occasion where UE receives the availability indication.*** |
| ZTE,  Sanechips | 1. For PEI based availability indication, the reference time of the start of validity duration has no ambiguity issue according to current specification and observation. |
| Vivo | **Observation 1: PO for a UE can be located in the first frame of a DRX cycle, and PEI is offset to PO in frame level, which lead to the frame for PEI may be in previous DRX cycle of the associated paging PDCCH.**  **Proposal 1: For PEI based availability indication, the reference time of the start of validity duration follows the reference time for the associated monitoring occasion for the paging DCI, i.e., UE assumes the L1 availability is detected in the associated paging DCI when determine the starting time of validity duration.** |
| TCL |  |
| Spreadtrum |  |
| CATT | ***Proposal 2: The validity duration should be a number of paging cycles provided by defaultPagingCycle.***  **Proposed TP for TS 38.213**   |  | | --- | | 10.4B Indication of TRS resources ---------------------------------------------------- Unchanged text is Omitted ---------------------------------------------------------  … The UE can be additionally provided a multiple, by *validityDuration*, for a number of paging cycles ~~frames~~ provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2.  ---------------------------------------------------- Unchanged text is Omitted --------------------------------------------------------- |   ***Proposal 4: PEI based availability indication should have same reference point with that of its associated paging DCI.***  **Proposed TP for TS 38.213**   |  | | --- | | 10.4B Indication of TRS resources ---------------------------------------------------- Unchanged text is Omitted ---------------------------------------------------------  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing ~~the DCI format 2\_7, or~~ the DCI format 1\_0 with CRC scrambled by P-RNTI, or its associated DCI format 2\_7, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*.  ---------------------------------------------------- Unchanged text is Omitted ---------------------------------------------------------- | |
| DOCOMO | **Proposal 1: Regarding the reference point, Option1 or Option3 should be supported.** |
| OPPO |  |
| Sony |  |
| Intel | **Observation 1: There is no critical need to change the existing agreement regarding reference point definition.** |
| Xiaomi |  |
| CMCC |  |
| Panasonic | **Observation 1: In the case that PEI and associated POs locate in different paging cycle, if reference point is not aligned for the L1 availability indications in the PEI and paging DCI, below issues happen:**   * **gNB may skip the PEI transmission, which is harmful for UE power saving gain.** * **Inconsistency between paging DCI and associated PEI based TRS availability indication may be required, which needs additional standardization efforts and potential specification impact.** * **The UEs whose POs are within the first POnumPerPEI POs may lose power saving gain due to not being able to utilize the TRS.**   **Proposal 3: For both PEI and associated paging based TRS availability indication, the reference point for start of the validity duration is SFN of the first PF of the current default DRX cycle corresponding to the first MO of PO.** |
| Samsung | **Proposal 1: support the following TP#1 for TS 38.213.**  **Proposed TP # 1 for TS 38.213**   |  | | --- | | 10.4B Indication of TRS resources  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 or a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2.  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the first frame of the DRX cycle that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. | |
| Apple |  |
| InterDigital |  |
| Sharp |  |
| LG |  |
| Ericsson | 1. For PEI based availability indication of TRS in TRS occasions, the reference point is the SFN of the first PF associated with the default paging cycle for which UE receives PEI. 2. Adopt TP1 related to 38.213 subclause indication of TRS resources (updated text in blue).   <begin TP1>  10.4B Indication of TRS resources  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 or a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2. A value of '1' for a bit of the bitmap indicates presence of TRS in associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the ~~frame~~ default DRX cycle that includes a PDCCH providing the DCI format 2\_7 or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*.  <end TP1> |
| Qualcomm | **Observation 1: The validity duration of TRS availability indication with current agreement has the following inconsistency problems**   * **TRS availability indication received on different beams may result in different validity durations for same TRS** * **UEs of different POs associated with same PEI-O may have different understanding of validity duration depending on whether the UE receives the availability indication from PEI or from paging PDCCH** * **If a UE receives both PEI and paging PDCCH in same PF, it may have to unnecessarily extend the validity duration by one default paging cycle**   **Proposal 1: Clarify in the agreement that “the current default DRX cycle” is the one that overlaps with the DRX cycle logically associated with the UE’s PEI or PO.**   |  | | --- | | **Agreement**  **The reference point for start of the validity duration is SFN of the first PF from the current default DRX cycle where UE receives the availability indication**   * **FFS: Whether the availability indication is transmitted [only once] during the validity duration**   **Note: Qualcomm and Huawei have concern on Alt a** | |
| MediaTek |  |
| Nokia |  |
| Nordic |  |

According to the above proposals, the remaining issues regarding validity duration for L1 based TRS availability indication include:

* Issue 2-1: TP for CRs of TS 38.213
* Issue 2-2: Clarifications on reference point

## 3.1 <1st round discussion>

### Issue 2-1: TP for CRs of TS 38.213

The proposed TPs for CRs of TS 38.213 regarding TRS validity duration based on existing agreements are collected in the table below.

|  |  |  |
| --- | --- | --- |
| **Index** | **Proposed TP** | **From** |
| 1 | 10.4B Indication of TRS resources ---------------------------------------------------- Unchanged text is Omitted ---------------------------------------------------------  … The UE can be additionally provided a multiple, by *validityDuration*, for a number of paging cycles ~~frames~~ provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2.  ---------------------------------------------------- Unchanged text is Omitted --------------------------------------------------------- | CATT |
| 2 | |  | | --- | | 10.4B Indication of TRS resources  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 or a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2.  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the first frame of the DRX cycle that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. | | Samsung |
| 3 | <begin TP1>  10.4B Indication of TRS resources  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 or a DCI format 1\_0 with CRC scrambled by P-RNTI includes a TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2. A value of '1' for a bit of the bitmap indicates presence of TRS in associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the ~~frame~~ default DRX cycle that includes a PDCCH providing the DCI format 2\_7 or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*.  <end TP1> | Ericsson |

**[1RD]**

**Please a) provide your views on whether or not to support any of the TPs above.**

|  |  |
| --- | --- |
| **TP** | **Companies** |
| #1 | * **Yes:** Nokia, CATT, Nokia, Qualcomm,Xiaomi, LGE,Sharp, CMCC * **No:** Samsung, vivo |
| #2 | * **Yes:** Qualcomm, Samsung, vivo (with some modification), intel * **No:**Nokia (see comment), CATT, Nordic, LGE, , Ericsson1(see comment) |
| #3 | * **Yes:** Qualcomm, ZTE, Sanechips, intel, Ericsson1, IDCC * **No:** Nokia (see comment), CATT, Nordic, vivo, LGE |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Both #2 and #3 seem to have a partial overlap with TP#4 in Issue 1-1“which is the first frame within the default DRX cycle”. |
| Nordic | each PEI belongs to PO, and the default DRX cycle is the one where PO is. This is related also to PEI AI, where it is discussed that PEI should not be associated with PFs in different paging cycles. |
| Qualcomm | For #1, it should be “for a number of default paging cycles ~~frames~~ provided by *defaultPagingCycle*”  #2 and #3 together are good. I.e., both “first” and “default” should be added to the spec text. |
| Apple | For #1, we are fine either way, and also fine with QC’s suggestion.  #2 and #3 overlaps with the a previous TP, and it is better to discuss together. It may be good to have a consolidated TP that includes all the necessary clarifications. |
| Samsung | For #1, *defaultPagingCycle* indicates a number of radio frames according to 38.331 as below:  defaultPagingCycle Default paging cycle, used to derive 'T' in TS 38.304 [20]. Value rf32 corresponds to 32 radio frames, value rf64 corresponds to 64 radio frames and so on  So, we think the original CR is correct. |
| vivo | The TP#2 is reasonable, and we try to add a ‘default’ in the following based on our agreement to avoid ambiguity.  10.4B Indication of TRS resources  <Unchanged text is Omitted>  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the first frame of the default DRX cycle that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE.  <Unchanged text is Omitted> |
| Xiaomi | TP #2/#3 should be discussed together with Issue 1-1. |
| LGE | For #1, we prefer QC’s revision.  For #2, as we commented in Issue 1-1, we have concern on “within the default DRX cycle” |
| Sharp | TP#2/3 can be suspended waiting for the conclusion for other issues |
| ZTE, Sanechips | For #1, we are okay with or without the revisions.  TP #2,3, and the TP is issue 1-1 and be discussed together.  For TP #2,3, we think updating it as ‘the frame of the default DRX cycle’ as it is suggested in TP#3 is clear. The reference point of the frame is clearly clarified by the formula. |
| Intel | For TP # 1, we think it has relation to the description of TP # 1 in issue 1 -1, where validity duration is expressed in multiple number of frames. Hence, these TPs should be consistent in terms of definition and reference to validity duration. |
| Huawei, HiSilicon | For #1, we are fine with it. However, if we decides to change something, it should be “default paging cycles.”.  For #2 and #3, in our understanding, the motivation of the two TPs are the same, i.e. change from ‘a frame including L1 indication’ to ‘a DRX cycle including L1 indication’. However, we think the reason why the description in the spec is not clear is that the agreement itself is not clear enough. Specifically, the word “**where**” in the agreement (“**where** UE receives the availability indication”) is not clearly defined. So we suggest to first discuss issue 2-2. |
| CMCC | TP#2 and TP#3 are related to the discussion of issue 2-2. |
| Ericsson1 | #1: defaultPagingCycle provides a number of frames.  #2 : Given the agreement reflects default DRX cycle, using simply “DRX cycle” can become ambiguous.  #3 : Support, below is the agreement from RAN1#107-e.  ***Agreement***  *The reference point for start of the validity duration is SFN of the first PF from the current default DRX cycle where UE receives the availability indication*   * *FFS: Whether the availability indication is transmitted [only once] during the validity duration* |
| Moderator1 | On TP#1:   * In current CR, “a number of frames provided by *defaultPagingCycle* “corresponds to the time unit of one default paging cycle. *validityDuration* is a multiple of default paging cycle. However, the TP indicates *validityDuration* is a multiple of **a number of paging cycles**, which seems to be wrong.   On TP#2 and #3:   * both “first” and “default paging cycle” are supported by the majority to clarify the reference point is the SFN of the first PF of the default paging cycle where UE receives the indication based on existing agreement.   Given above, the TPs are merged as follows:   |  | | --- | | **Proposal 1-1 (v1): Support the following TP for CR of TS 38.213**.  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the first frame of the default DRX cycle that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\* | |

### Issue 2-2: Clarification on reference point

The proposals regarding clarification on reference point for validity duration can be summarized into the following options as discussed in last meeting. In this meeting, we resume the discussion.

|  |
| --- |
| **[1RD]**  **Option 1**  **Proposal 2-2a (v1)**  The reference point for start of the validity duration is SFN of the first PF from the current default DRX cycle corresponding the first PDCCH MO of the PO/PEI-O where UE receives the availability indication.  **Option 2**  **Proposal 2-2b (v1)**  For paging PDCCH based TRS availability indication, the reference point for start of the validity duration is SFN of the first PF from the current default DRX cycle corresponding the first PDCCH MO of the PO~~/PEI-O~~ where UE receives the availability indication.  For PEI based availability indication, the reference time of the start of validity duration follows the reference time for the associated monitoring occasion for the paging DCI  **Option 3**  No change for the following agreement  **Agreement**  The reference point for start of the validity duration is SFN of the first PF from the current default DRX cycle where UE receives the availability indication |

**Please a) provide/update your views on which option you support for resolving issue 2-2 below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| **Option 1**  **Proposal 2-2a (v1)** | Huawei/HiSilicon, DOCOMO, ~~QC~~, Nokia(alt), Apple (can accept), LGE, MediaTek |
| **Option 2**  **Proposal 2-2b (v1)** | Vivo (with some modification), CATT, Panasonic, Qualcomm (with modification), LGE, Ericsson1(with modification), IDCC |
| **Option 3** | ZTE, DOCOMO, Intel, Nokia(alt), Apple, Samsung,Xiaomi, CMCC |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Would be OK with option 1 or 3. |
| CATT | The abnormal condition is that large PEI frame offset might have the results of PEI in different DRX cycle to that of PO at DRX cycle N. However, PEI is defined as the association of PO. Even PEI is received in DRX cycle N-1 for the early indication of PO at DRX cycle N, the TRS availability received from PEI should also be assumed is for the DRX cycle N (not DRX cycle N-1). |
| Nordic | I am not the English speaker, but to me the wordings are still ambiguous.  Option 1 should be “first frame is the first frame of a DRX cycle in which paging PDCCH is received  Option 2 should be “first frame is the frame containing the first paging PDCCH MO of the default paging cycle in which paging PDCCH is received  PEI location should not impact the reference frame. |
| Qualcomm | We made the following modification to proposal 2-2b for the same reasons as mentioned by CATT for paging PDCCH. I.e., even paging PDCCH is received within the duration of DRX cycle N+1 for PO associated with DRX cycle N, the TRS availability received from paging PDCCH should also be assumed is for the DRX cycle N (not DRX cycle N+1).  Please note in TS 38.304, there is spec text “NOTE 1: A PO associated with a PF may start in the PF or after the PF.”  **Proposal 2-2b (v1)**  For paging PDCCH based TRS availability indication, the reference point for start of the validity duration is SFN of the first PF from the current default DRX cycle ~~corresponding the first PDCCH MO of the PO/PEI-O where UE receives the availability indication~~ for which the UE receives the paging PDCCH.  For PEI based availability indication, the reference time of the start of validity duration follows the reference time for the associated monitoring occasion for the paging DCI |
| Apple | For PEI-based availability indication, we think it is critical that the availability indicaiton applies to the time duration between PEI and PO, so that the available TRS can be used for the current PO reception. |
| Samsung | Similar as Issue 1-2, since we agreed that UE can receive new indication before expiration of validity duration for previous TRS availability indication in last meeting, we think PEI based availability indication and paging PDCCH based availability indication can be processed independently by UE. No need to align the reference point for them. |
| vivo | We think there is some redundancy in the description of the current proposal 2-2b. Our original intention is to clarify the case that when TRS availability indication presents in both PEI DCI and paging DCI, the reference time of the start of validity duration follows the reference time for the associated monitoring occasion for the paging DCI.  Hence, we think the first paragraph in proposal 2-2b belongs to option-1, **and we suggest to discuss these two issues separately.**  **Option 2**  **Proposal 2-2b (revised by vivo)**  **When TRS availability indication presents in both PEI DCI and paging DCI, the reference time of the start of validity duration follows the reference time for the associated monitoring occasion for the paging DCI.** |
| Xiaomi | Current agreement can work, no need to revert previous agreement. |
| LGE | We are fine with either Option 1 or Option 2. |
| ZTE, Sanechips | According to the current agreement/CR, there is no ambiguity of reference point for the TRS indication between gNB and UE . |
| Intel | Current agreement works, so no need to change it. |
| Huawei, HiSilicon | Our first preference is Option 1. As we explained under Issue 2-1, the previous agreement is not clear enough. It should be clarified.  We understand the motivation of the second bullet of proposal 2-2b (v1) is to make the L1 indication more useful in some cases. Though it does not resolve all the problematic scenarios, the reasonable enhancement is acceptable for us.  If it is hard to get the companies’ views converged, we suggest the moderator to discuss the reference point for paging DCI and PEI separately. According to our observation, majority view on paging DCI is easier to be converged. |
| Ericsson1 | Support revised proposal from Qualcomm. For example, it could so happen that PEI-O is in an SFN between last PF of DRX cycle N and first PF of DRX cycle N+1 – then a bit unclear which cycle it belongs to. NW may be able to handle such cases (e.g. consider both N/N+1 assumption for reference point when indicating availability, or simply set the bitmap to all zeros), however reducing ambiguity could be beneficial for UE. |
| IDCC | Support revised proposal from Qualcomm. |
| Moderator1 | One the first debating point is about the default DRX cycle used to determine the reference point   * Alt1: the default DRX cycle is associated with the PDCCH MO whether UE receives the availability indication, i.e. previous agreement. * Alt2: the default DRX cycle is associated with the first PDCCH MO of the PO/PEI-O where UE receives the availability indication.   Another debating point is whether or not to support different reference point for PEI:   * For PEI based availability indication, the reference time of the start of validity duration follows the reference time for the associated PO.   For the second debating point, the majority (Option 1 + Option 3) don’t support the new design of reference point for PEI based availability indication. Also, Apple points out the new design precludes the use case, where PEI indicates TRS resources that can be used for associated PO reception. Since current design still work for PEI, moderator suggests to conclude no consensus to support the new design, and end the discussion.  **Conclusion 2-2(v1)**  No consensus to support   * For PEI based availability indication, the reference time of the start of validity duration follows the reference time for associated monitoring occasion for the paging DCI.   For the first debating point, the majority (Option 1 + Option 2) prefer Alt2. However, several companies think current spec works fine without ambiguity of reference point between gNB and UE. So, moderator suggests to further check the issue of current spec before modifying the existing agreement.  **Proposal 2-2 (v2)**  The current default DRX cycle used for determining the reference point for start of validity duration for an availability indication is down-selected from the following in RAN1#108-e:   * Alt1: the current default DRX cycle is associated with the PDCCH MO whether UE receives the availability indication * Alt2: the current default DRX cycle is associated with the first PDCCH MO of the PO/PEI-O where UE receives the availability indication. |

## 3.2 <2nd round discussion>

### Issue 2-2: Clarification on reference point

As suggested by Ericsson in the email reflector, corresponding TP can be discussed together with the down-selection.

|  |
| --- |
| **[2RD]**  **Proposal 2-2 (v2)**  The current default DRX cycle used for determining the reference point for start of validity duration for an availability indication is down-selected from the following in RAN1#108-e:   * Alt1: the current default DRX cycle is associated with the PDCCH MO where UE receives the availability indication, i.e. previous agreement.   + Adopt TP#1 if Alt1 is down-selected * Alt2: the current default DRX cycle is associated with the first PDCCH MO of the PO/PEI-O where UE receives the availability indication.   + Adopt TP#2 if Alt1 is down-selected   ============================= start of TP#1==========================================  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the first frame of the default DRX cycle that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#1==========================================  ============================= start of TP#2==========================================  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the first frame of the default DRX cycle associated with the first PDCCH MO of the PEI-O or PO that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#2========================================== |

**Please a) provide your views on whether or not to support Proposal 2-2 (v2) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | * **w/ Alt1: Apple, vivo，CMCC, ZTE, Sanechips(with update), CATT , Samsung, intel** * **w/ Alt2: Apple, Qualcomm,** , Ericsson2 (with update), **Huawei, HiSilicon** |
| No  (no new agreement or TP needed) |  |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Even though the existing agreement (Alt 1) works, we are willing to be flexible here to make it slightly easier for the gNB to do the tracking.  We would like to suggest one minor editorial change at least for TP1:” includes ~~a~~ the PDCCH providing the DCI format 2\_7”. It is important to emphasize that we are referring to the particular PDCCH that is being received.  For TP2, it seems that we do not have PEI-O or PO defined in 213, so the terminology needs to be spelt out. |
| vivo | We prefer to follow the previous agreement. |
| CMCC | The previous agreement is clear enough. |
| ZTE, Sanechips | According to the current agreement/CR, there is no ambiguity of reference point for the TRS indication between gNB and UE , therefore, the update in alt2 is not needed.  As to the update in alt1, we think the current CR may not clear about the frame determination, it is not a frame that contains L1 indication, but a reference point for the validity time duration if L1 signaling is received. Therefore, revision is needed. However, we think there is no need to define the “first” frame within a paging cycle, we think the starting point is clear with the formula. Hence, “first” needs to be removed in alt 1. |
| CATT | We are general OK with the default DRX cycle based on existing agreements. We don’t agree to have further modification in TP2. |
| Qualcomm | We prefer to determine the current default DRX cycle as the one that UE receives PEI and paging PDCCH for, which is neither alt 1 nor alt 2. But we can accept to down select from alt 1 and alt 2 for progress.  Among alt 1 and 2, we support alt 2 because otherwise there is new issue if UE changes its best beam during the validity duration. I.e., UE must memorize its validity duration determined by its older beam and the associated PMO location. While with alt 2, UE only needs to memorize the common validity duration for any beam it tracks. This is a major concern for UE implementation, maybe also for network implementation. |
| Panasonic | For Alt2, it is still not clear by “first PDCCH MO of the PO/PEI-O”. For a UE receiving only PEI, it is the first PDCCH MO of the PEI. For a UE receiving both, it is the first PDCCH MO of the PEI. For a UE receiving only paging PDCCH, is it the first PDCCH MO of the PO? Or it is still the first PDCCH MO of the PEI? From the CR, it seems the later case. But for UEs choosing not to monitor DCI format 2\_7, not sure this is the intention. |
| LGE | We are fine with further clarification if majority companies feel it is necessary. However, we still have strong concern on using “the first frame of the default DRX cycle”. As we commented several times, definition of the DRX cycle by the specification is a distance between POs from a UE perspective, and no starting/ending frame is defined. If I missed something from the spec, please let me know. |
| Ericsson2 | No need for “the first PDCCH MO of the” since all MOs of a PO or PEI-O will be associated to the same DRX cycle. |
| Huawei, HiSilicon | We support Alt2 since it makes gNB easier to handle different validity durations for different indication bit.  We have concerns on using “the default DRX cycle” in the specification, which is not correct based on the current specification. If we do not use very accurate description in the agreement, we should use accurate description in the specification. I think this is also why we have TP review rather than just copy & paste agreements into the spec.  If we lack progress on the proposal 2-2 (v2), we suggest to can discuss paging DCI first, since the design of PEI may still be controversial. |
| Moderator2 | On question from Panasonic   * Moderator: Paging PDCCH and PEI PDCCH based TRS avaiablity indicaiton are processed independently. If UE receives both, each of the PDCCHs will trigger a reference point. For a UE receiving only paging PDCCH, it is the first PDCCH MO of the PO. For   On concern from LGE   * Moderator: According to the text in 7.1 of TS 38.304 below.   - *The UE may use Discontinuous Reception (DRX) in RRC\_IDLE and RRC\_INACTIVE state in order to reduce power consumption. The UE monitors one paging occasion (PO)* ***per DRX cycle****.*  The common understanding is that DRX cycle can indicate both a) a periodicity, and b) a period from multiple periods according to the periodicity. So, the majority see the need to clarify in the spec it’s the DRX cycle where UE receives the PEI/paging PDCCH that includes the TRS availability indication.    On the down-selection between Alt1 and Alt2   * Reasons for supporting Alt1:   + Moderator: In general, MOs of a PO/PEI-O will to be associated with two DRX cycles is a corner case. Even it happens, gNB should expect that UE may receive PDCCH in in any configured MO, so gNB can extend TRS transmission for one more DRX cycle in worst case. * Reasons for supporting Alt2:   + HW: It makes gNB easier to handle different validity durations for different indication bit.   + QC: otherwise there is new issue if UE changes its best beam during the validity duration   TPs are updated as follows:   * “first” is removed based on the comment from ZTE. It’s clear that the frame will be associated with the first PF according to the formula. * “a” is replaced by “the” based on comment from Apple. * “default” is removed based on comment from HW. The spec clarified that T corresponds to *defaultPagingCycle.*   Moderator forgot to include Conclusion 2-2(v) for 2nd round discussion. For PEI-O based indication, conclusion 2-2 reflects the majority view to keep the independent reference point, no more spec impact.  Since either of the alternatives works, moderator suggests to select Alt1 based on the majority view and with less spec change.   |  | | --- | | **Conclusion 2-2(v1)**  No consensus to support   * For PEI based availability indication, the reference time of the start of validity duration follows the reference time for associated monitoring occasion for the paging DCI.   **Proposal 2-2a (v3)**  The current default DRX cycle used for determining the reference point for start of validity duration for an availability indication is down-selected from the following in RAN1#108-e:   * Alt1: the current default DRX cycle is associated with the PDCCH MO where UE receives the availability indication, i.e. previous agreement.   + Adopt TP#1 if Alt1 is down-selected * Alt2: the current default DRX cycle is associated with the first PDCCH MO of the PO/PEI-O where UE receives the availability indication.   + Adopt TP#2 if Alt1 is down-selected   ============================= start of TP#1==========================================  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame of the DRX cycle that includes ~~a~~ the PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#1==========================================  ============================= start of TP#2==========================================  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame of the DRX cycle associated with the first PDCCH MO of the [PEI-O] or PO that includes ~~a~~ the PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#2==========================================  **Proposal 2-2b (v1)**  Down-select Alt1. | |

## 3.3 <3rd round discussion>

**Issue 2-2: Clarification on reference point**

Some clarifications based on the discussion in the email reflector:

1. Clarification of existing agreement:

The previous agreement says the current default DRX cycle is where UE receives the availability indication, and UE receives the availability indication in a PDCCH MO in NR system. That’s why the majority think that Alt1 is based on the existing agreement. However, HW/Nordic have different understanding of the current DRX cycle, they seem to assume Alt2 is also based on current agreement. In any case, that’s not really the intention of this discussion. The key is to reach consensus of any TP needed. So in the updated proposal, let’s keep checking necessary TP only.

1. The difference between Alt1 and Alt2.

In most cases, no different between Alt1 and Alt2 as a PO/PEI-O (consists of multiple PDCCH MOs) is within a single DRX cycle. However, for the corner case, when a PO/PEI-O is configured across the boundary of a DRX cycle, the effective validity duration can be different for Alt1 and Alt2. Let’s clarify the behaviors on both gNB and UEs for the two alternatives.

* For Alt1:
  + If UE receives TRS availability indication in a PDCCH MO(e.g. the first PDCCH MO associated QCLed with SSB#1) in DRX cycle n, the UE assumes validity duration starts in DRX cycle n, …, n+ validityDuration-1.
  + If UE receives TRS availability indication in a PDCCH MO(e.g. the last PDCCH MO) in DRX cycle n + 1 , the UE assumes validity duration starts in DRX cycle n + 1, …, n+ validityDuration.
  + Since gNB has to send the same DCI payload in all PDCCH MOs, gNB needs to make sure indicated available TRS resources are available in DRX cycle n, n +1, .., n + validityDuration.
* For Alt2:
  + If UE receives TRS availability indication in a PDCCH MO(e.g. the first PDCCH MO associated QCLed with SSB#1) in DRX cycle n, the UE assumes validity duration starts in DRX cycle n, …, n+ validityDuration-1.
  + If UE receives TRS availability indication in a PDCCH MO(e.g. the last PDCCH MO) in DRX cycle n + 1 , the UE assumes validity duration starts in DRX cycle n, …, n+ validityDuration-1.
  + gNB needs to make sure indicated available TRS resources are available in DRX cycle n, n +1, .., n + validityDuration -1.

So, there is no ambiguity between gNB and UE for any alternative. Let’s focus on the necessary TP in the discussion. Alt3 is added as suggested by LGE.

|  |
| --- |
| **[3RD]**  **Conclusion 2-2(v1)**  No consensus to support   * For PEI based availability indication, the reference time of the start of validity duration follows the reference time for associated monitoring occasion for the paging DCI.   **Proposal 2-2a (v3)**  Down-select one of the TPs to clarify the current default DRX cycle used for determining the reference point for start of validity duration for an availability indication ~~is down-selected from the following in RAN1#108-e:~~   * Alt1: ~~the current default DRX cycle is associated with the PDCCH MO where UE receives the availability indication, i.e. previous agreement~~. Adopt TP#1 ~~if Alt1 is down-selected~~ * Alt2: ~~the current default DRX cycle is associated with the first PDCCH MO of the PO/PEI-O where UE receives the availability indication.~~ Adopt TP#2 ~~if Alt1 is down-selected~~ * Alt3: Adopt TP#3.   ============================= start of TP#1==========================================  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame of the DRX cycle that includes ~~a~~ the PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#1==========================================  ============================= start of TP#2==========================================  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame of the DRX cycle associated with the first PDCCH MO of the PEI-O or PO that includes ~~a~~ the PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#2==========================================  ============================= start of TP#3==========================================  10.4B   Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from cid:image003.png@01D82A6B.FB1D5360 [17, TS 38.304] that corresponds to the first frame before the PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication fieldindicating the TRS resource sets, where cid:image004.png@01D82A6B.FB1D5360 is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#3========================================== |

**Please a) provide your views on whether or not to support Conclusion 2-2 (v1) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | ZTE, Sanechips, Xiaomi, intel, Apple |
| No | Qualcomm (this should be left after 2-2a), vivo, Huawei, HiSilicon, Nordic |

**b) provide your views on whether or not to support Proposal 2-2 (v2) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | * **w/ Alt1: vivo, Nordic (with editorial change),** ZTE, Sanechips**,Xiaomi(second priority), Samsung, intel, Apple** * **w/ Alt2: Qualcomm, Huawei, HiSilicon,Xiaomi(first priority), LGE(in principle), Apple** * **w/ Alt3: Nordic** |
| No |  |

**and, c) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | It looks Alt 3 is changing previous agreement.  For Alt 1, we can compromise if a note is added   * Note: UE expects the same TRS availability information transmitted in all PMOs of the same PEI-O or PO |
| vivo | We think the decision on conclusion 2-2(v1) should be left after that of conclusion 1-3(v3). |
| Huawei, HiSilicon | Unfortunately, the moderator summary was written in a biased way. However, we need finally decide a TP here.  In our view, Alt.1 reverts the following agreement, where validity duration is {1, 2, 4, 8, 16, 32, [64], [128], [256],[512]} default DRX cycle length. Except value 1, the validity duration is an even umber of DRX cycles. However, according to the interpretation above for Alt.1, network shall have an odd number of DRX cycles for validity duration. This can also prove our view that existing agreement didn’t consider the issue discussed here.   |  | | --- | | **Agreement**  For the validity duration configured by higher layer at least for paging PDCCH based L1 availability indication, support   * time unit is one default paging cycle, * applicable values: {1, 2, 4, 8, 16, 32, [64], [128], [256],[512]}   When the validity duration is not configured, UE assumes a default time duration to be 2 default paging cycle(s): |   We think the issues regarding conclusion 2-2 needs to be discussed. Anyway, RAN1 needs to provide a mechanism there.  We are open to directly discuss the two issues together. |
| Nordic | Alt 1: OK, but small change  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame within the DRX cycle that includes ~~a~~ the PDCCH providing the DCI format 2\_7  Alt 2 is technically broken, because  frame SFN determined from , and  frame of the DRX cycle associated with the first PDCCH MO of the PEI-O  maybe not be the same frame.  Alt 3 aligns with previous agreement, but wording modified by FL from Nordic wording, excludes (intentionally?) the case when frame and frame of PO is the the same. |
| ZTE, Sanechips | Conclusion 2-2: support. We think the reference point is clear for NW and UE.  TP: Support Alt-2  For alt-3, the indication carried by paging DCI and DCI format 2-7 can be in the same frame as the frame determined by the formula, the term “before” is not correct. And “first” is not needed.  For alt-2, we think the reference point is clear for NW and UE. Additional TP is not needed. |
| LGE | Between Alt 1 and Alt 2, our preference is Alt 2 in principle. According to the TS38.304 spec, UE assume that the same paging message and the short message are repeated in all transmitted beams. This assumption allows UE could select beam for reception of paging. We prefer to adopt same mechanism for TRS availability indication since we believe it would be useful for UE implementation and power saving.  On the other hand, we are worried about using “the DRX cycle” for determining the time domain location. In my opinion, meaning of “corresponds to the frame of the DRX cycle” is not clear enough to describe the intention of the agreement. I can understand the intention and mechanism since I have been involved in Rel-17 power saving discussion, but not sure it can be correctly interpreted by others in general.  We don’t have strong preference on Alt 3. If our concern on the DRX cycle could be solved, we are fine with the TP with any wording. |
| Nokia\_3 | If companies feel that something is needed, we would support Alt-1. |
| Samsung | We don’t agree with HW’s interpretation of Alt1 that network shall have an odd number of DRX cycles for validity duration. NW has the flexibility to indicate any of the configured applicable values for validity duration. For the example when PEI-O/PO extends a default DRX cycle boundary, gNB can handle it by extending the transmission of available TRS resources for one more DRX cycle as well.  We are OK with the note suggested by QC, we think that’s the common understanding or legacy behavior of data transmission with multi-beam operation in idle/inactive mode. |
| intel | We do not agree with HW comment. FL nicely summarized that no issue exists with any of the proposals. So our view is to adopt TP # 1 which is aligned with existing agreement without introducing a new procedure. We can agree to Note from QC, although we are not sure this is really needed. UE only monitors PMOs QCLed with its SSB(s). Note makes sense, but why does the UE need to have such assumption, regarding PMOs that it is not even monitoring. |
| Ericsson3 | Our understanding of the discussion regarding terminology of default DRX cycle or DRX cycle is that with either option, the reference point in a transmitted DCI is identical for all UEs regardless of any UE specific DRX value. If this is a common understanding, if below note is added to the proposal, we could also be OK with Alt 1 or Alt 3 without “the first PDCCH MO of”.  *Note : Reference point for TRS availability indication in a given DCI is identical for all UEs regardless of UE specific DRX value.* |
| Apple | We are fine with either Alt 1 or 2, prefer Alt 1. It is not exactly clear to us which option Alt 3 intends to cover, same as Alt 1 just a different TP? |

# TRS resources configuration

The following were agreed in RAN#107bis-e regarding configuration of TRS resources for idle/inactive UEs:

|  |
| --- |
| From RAN1#107bis-e:  **Agreement**  Support a configuration parameter for the number of, X, TRS resources for a TRS resource set at least for FR2   * Applicable values for X: {2, 4} * For FR1, X is based on configburation parameter with applicable value {2, 4}   Note: Configuration follows restriction specified in sub-clause 5.1.6.1.1 in TS38.214 for connected mode TRS  Agreement  The parameter of *periodicityAndOffset* is used to determine the location of the first slot of TRS resource set. |

In contributions [1-20], proposals regarding the TRS resources configuration are captured in table below:

|  |  |
| --- | --- |
| Huawei, HiSilicon | ***Observation 3: It is beneficial to further reduce the maximum number of configurable TRS resource sets for FR1 to reduce UE memory size for low cost and power consumption, especially for RedCap UEs.***  ***Proposal 5: Number of configured TRS resource sets in SIB for idle/inactive UEs is not larger than 16 for FR1*** |
| ZTE,  Sanechips | 1. The number of configured TRS resource sets can be larger than the number of actual transmitted SSB.   Proposal 4: The following TP for CR of TS 38.214 should be adopted.  ...................... Text Proposal for TS38.214..............................................................................  **5.1.6.1.1 CSI-RS for tracking**  \*\*\* Unchanged text is omitted \*\*\*  - the periodicity for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet*, is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a *TRS-ResourceSet*. The slot offset given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet* provides the location of the first slot containing the periodic NZP CSI-RS resources configured by b*y* a *TRS-ResourceSet.*  \*\*\* Unchanged text is omitted \*\*\*  .................... End of Text Proposal for TS38.214....................................................................... |
| Vivo |  |
| TCL |  |
| Spreadtrum | ***Proposal 2: A dedicated SIBx can be used for TRS reconfiguration.*** |
| CATT | ***Proposal 5: The following TRS resource set configuration parameters: startingRB, nrofRBs, periodicity and TRS resources number could be common for all the TRS resources sets.*** |
| DOCOMO | **Proposal 2: The common configuration parameter among all TRS resource sets should be supported to reduce the SIB overhead for TRS/CSI-RS for idle/inactive mode UE.** |
| OPPO |  |
| Sony |  |
| Intel | **Proposal 2: The number of configured TRS resource sets can be larger than the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in SIB1.** |
| Xiaomi |  |
| CMCC |  |
| Panasonic | **Proposal 2: The maximum number of configured TRS resource sets is 64 and no need to limit by the number of actual transmitted SSBs in ssb-PositionsInBurst.** |
| Samsung |  |
| Apple | **Proposal 1: The maximum number of configure TRS resource sets is 16 for FR1.**  **Proposal 2: Introduce common parameters *startingRB* and *nrofRBs* for all configured TRS resource sets to reduce the signaling overhead.**   * **Note: *startingRB* and *nrofRBs* can still be separately configured per TRS resource set if needed.** |
| InterDigital | **Conclusion 1: The number of configured TRS resource sets can be larger than the number of actual transmitted SSBs determined according to ssb-PositionsInBurst in SIB1.** |
| Sharp | **Proposal 1: Adopt TP1 for TS 38.214**  ---------------------<begin TP1 for TS 38.214>--------------------------------------------------------------------  5.1.6.1.1 CSI-RS for tracking  <omit unchanged text>  A UE in RRC\_IDLE or RRC\_INACTIVE can receive a higher layer configuration of TRS occasions via a *TRS-ResourceSetConfig*.  - For frequency range 1, the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a *TRS-ResourceSet* consists of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot. If no two consecutive slots are indicated as downlink slots by *tdd-UL-DL-ConfigurationCommon*, then the UE may be configured with one or more NZP CSI-RS set(s), where a *~~TRS-ResourceSet~~* NZP CSI-RS set consists of two periodic NZP CSI-RS resources in one slot.  - For frequency range 2 the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a *TRS-ResourceSet* consists of two periodic NZP CSI-RS resources in one slot or by a *TRS-ResourceSet* of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter *TRS-ResourceSet* with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  - the number of periodic NZP CSI-RS resources configured by a *TRS-ResourceSet* is given by *numberOfresources.*The UE does not expect to receive a configuration with four resources when the TRS symbols in the second slot are indicated as uplink by *tdd-UL-DLConfigurationCommon*.  - the time-domain locations of the two CSI-RS resources in a slot, or of the four CSI-RS resources in two consecutive slots (which are the same across two consecutive slots), is one of  - , , or for frequency range 1 and frequency range 2,  - , , , , ,  or  for frequency range 2.  - where the first symbol location in a slot is indicated by *firstOFDMSymbolInTimeDomain* in the *TRS-ResourceSet* and the second symbol location in a slot is *firstOFDMSymbolInTimeDomain +* 4  - a single port CSI-RS resource with density  given by Table 7.4.1.5.3-1 from [4, TS 38.211]*.*  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter *nrofRBs*, *startingRB* and *frequencyDomainAllocation* in a *TRS-ResourceSet* and applies to all resources in a *TRS-ResourceSet*. The frequencyDomainAllocation configuration is not restricted by initial DL BWP.  - UE is not required to receive TRS occasions outside the initial DL BWP.  - the periodicity for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet*, is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a *TRS-ResourceSet*. The slot offset given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet* provides the location of the first slot containing the periodic NZP CSI-RS resources configured by ~~b~~*~~y~~*a *TRS-ResourceSet.*  -----------------<end TP1>------------------------------------------------------------------------------- |
| LG |  |
| Ericsson | 1. **The following parameters are configured as ‘optional’ for one or more TRS resource set(s).**     1. **startingRB’, nrofRBs’, *frequencyDomainAllocation,* ’powerControlOffsetSS’, ‘scramblingID’, *firstOFDMSymbolInTimeDomain***    2. **For a TRS resource set, when the parameter value is explicitly configured, follow the configured parameter value, otherwise follow the parameter value from the first configured TRS resource set.** 2. Adopt TP2 related to 38.214 subclause CSI-RS for Tracking.   <begin TP2> 5.1.6.1.1 CSI-RS for tracking <omitted unchanged text>  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter *TRS-ResourceSet* with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  <omitted unchanged text>  - the QCL information for periodic NZP CSI-RS resources, is given by the higher layer parameter *ssb-Index* configured by a *TRS-ResourceSet*, is a SS/PBCH block, applies to all resources in a *TRS-ResourceSet*.  - One or more *scramblingIDs* where if a single *scramblingID* is configured, it applies to all NZP-CSI-RS resources in the resource set, otherwise, each NZP-CSI-RS resource is provided with a *scramblingID*.  - the UE may assume the following quasi co-location type(s):  - 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block.  <omitted unchanged text>  <end TP2> |
| Qualcomm |  |
| MediaTek |  |
| Nokia | **Observation:** RAN1#104bis-e agreement on initial BWP not restrictin *TRS-ResourceSet* configuration is not correctly captured in TS38.214  **Proposal: Adopt following TP to 38.214 Section 5.1.6.1.1:**   |  | | --- | | 5.1.6.1.1 CSI-RS for tracking  [text omitted]  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter [*nrofRBs*], [*startingRB*] and [*frequencyDomainAllocation*] in a [*TRS-ResourceSet*] and applies to all resources in a [*TRS-ResourceSet*]. ~~The [frequencyDomainAllocation] configuration is~~ Bandwidth, *nrofRBs*, and the initial CRB index, *startingRB*, of the NZP CSI-RS resource configured by *TRS-ResourceSet* are not restricted by initial DL BWP. | |
| Nordic | ***Proposal-1:*** *The maximum number of TRS resource sets per cell within a band is function of and upper-bounded by 64.* |
| Lenovo |  |

According to the above proposals, the remaining issues regarding TRS resources configuration include:

* Issue 3-1: TP for CR of TS 38.214
* Issue 3-2: Maximum number of TRS resource sets
* Issue 3-3: Whether/how to reduce configuration overhead

4.1 <1st round discussion>

**Issue 3-1: TP for CR of TS 38.214**

The proposed TPs for CRs of TS 38.214 regarding configuration of TRS resources based on existing agreements are collected in the table below.

|  |  |  |
| --- | --- | --- |
| **Index** | **Proposed TP** | **From** |
| 1 | ...................... Text Proposal for TS38.214..............................................................................  **5.1.6.1.1 CSI-RS for tracking**  \*\*\* Unchanged text is omitted \*\*\*  - the periodicity for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet*, is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a *TRS-ResourceSet*. The slot offset given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet* provides the location of the first slot containing the periodic NZP CSI-RS resources configured by b*y* a *TRS-ResourceSet.*  \*\*\* Unchanged text is omitted \*\*\*  .................... End of Text Proposal for TS38.214....................................................................... | ZTE |
| 2 | ---------------------<begin TP1 for TS 38.214>--------------------------------------------------------------------  5.1.6.1.1 CSI-RS for tracking  <omit unchanged text>  A UE in RRC\_IDLE or RRC\_INACTIVE can receive a higher layer configuration of TRS occasions via a *TRS-ResourceSetConfig*.  - For frequency range 1, the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a *TRS-ResourceSet* consists of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot. If no two consecutive slots are indicated as downlink slots by *tdd-UL-DL-ConfigurationCommon*, then the UE may be configured with one or more NZP CSI-RS set(s), where a *~~TRS-ResourceSet~~* NZP CSI-RS set consists of two periodic NZP CSI-RS resources in one slot.  - For frequency range 2 the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a *TRS-ResourceSet* consists of two periodic NZP CSI-RS resources in one slot or by a *TRS-ResourceSet* of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter *TRS-ResourceSet* with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  - the number of periodic NZP CSI-RS resources configured by a *TRS-ResourceSet* is given by *numberOfresources.*The UE does not expect to receive a configuration with four resources when the TRS symbols in the second slot are indicated as uplink by *tdd-UL-DLConfigurationCommon*.  - the time-domain locations of the two CSI-RS resources in a slot, or of the four CSI-RS resources in two consecutive slots (which are the same across two consecutive slots), is one of  - , , or for frequency range 1 and frequency range 2,  - , , , , ,  or  for frequency range 2.  - where the first symbol location in a slot is indicated by *firstOFDMSymbolInTimeDomain* in the *TRS-ResourceSet* and the second symbol location in a slot is *firstOFDMSymbolInTimeDomain +* 4  - a single port CSI-RS resource with density  given by Table 7.4.1.5.3-1 from [4, TS 38.211]*.*  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter *nrofRBs*, *startingRB* and *frequencyDomainAllocation* in a *TRS-ResourceSet* and applies to all resources in a *TRS-ResourceSet*. The frequencyDomainAllocation configuration is not restricted by initial DL BWP.  - UE is not required to receive TRS occasions outside the initial DL BWP.  - the periodicity for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet*, is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a *TRS-ResourceSet*. The slot offset given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet* provides the location of the first slot containing the periodic NZP CSI-RS resources configured by ~~b~~*~~y~~*a *TRS-ResourceSet.*  -----------------<end TP1>------------------------------------------------------------------------------- | Sharp |
| 3 | 5.1.6.1.1 CSI-RS for tracking <omitted unchanged text>  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter *TRS-ResourceSet* with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  <omitted unchanged text>  - the QCL information for periodic NZP CSI-RS resources, is given by the higher layer parameter *ssb-Index* configured by a *TRS-ResourceSet*, is a SS/PBCH block, applies to all resources in a *TRS-ResourceSet*.  - One or more *scramblingIDs* where if a single *scramblingID* is configured, it applies to all NZP-CSI-RS resources in the resource set, otherwise, each NZP-CSI-RS resource is provided with a *scramblingID*.  - the UE may assume the following quasi co-location type(s):  - 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block.  <omitted unchanged text>  <end TP2> | Ericsson |
| 4 | 5.1.6.1.1 CSI-RS for tracking  [text omitted]  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter [*nrofRBs*], [*startingRB*] and [*frequencyDomainAllocation*] in a [*TRS-ResourceSet*] and applies to all resources in a [*TRS-ResourceSet*]. ~~The [frequencyDomainAllocation] configuration is~~ Bandwidth, *nrofRBs*, and the initial CRB index, *startingRB*, of the NZP CSI-RS resource configured by *TRS-ResourceSet* are not restricted by initial DL BWP. | Nokia |

**[1RD]**

**Please a) provide your views on whether or not to support any of the TPs above.**

|  |  |
| --- | --- |
| **TP** | **Companies** |
| #1 | * **Yes:** Nokia, Nordic, Qualcomm, Apple, Samsung,Xiaomi, LGE, ZTE,Sanechips, intel, Huawei, HiSilicon, MediaTek, CMCC, Ericsson1, IDCC * **No: CATT** |
| #2 | * **Yes:** Qualcomm, Apple (2nd part) ,Xiaomi,Sharp * **No:** Nokia (please see comment), CATT, Nordic, Ericsson1 |
| #3 | * **Yes:** Nokia, Nordic, Qualcomm, Apple, Samsung,Xiaomi, LGE,Sharp, ZTE,Sanechips, intel, Huawei, HiSilicon, MediaTek, CMCC, Ericsson1, IDCC * **No:** |
| #4 | * **Yes:** Nokia (proponent), CATT, Nordic, Qualcomm (with modification), Apple (support QC’s modification), Samsung,Xiaomi, LGE, ZTE,Sanechips, intel, Huawei, HiSilicon, MediaTek(support QC’s modification), CMCC, Ericsson1, IDCC * **No:** |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | For #2,  - the text seems to be aligned with earlier text for CONNECTED mode: “with one or more NZP CSI-RS set(s), where a NZP-CSI-RS-ResourceSet consists of two periodic NZP CSI-RS resources in one slot.”  - For the second change proposal for the UL, need to check if this is already captured somewhere. |
| Qualcomm | Update the text of #4 to:  Bandwidth of the NZP CSI-RS resource configured by *TRS-ResourceSet* is not restricted by initial DL BWP. |
| Huawei, HiSilicon | For #2, we think we should use ‘TRS resource set(s)’ to replace “NZP CSI-RS set(s)” instead. |
| Ericsson1 | #2: First change is not needed since TRS resource set is correct usage. 2nd change : similar comment as Nokia. |
| Moderator1 | For TP#2, several companies think the following aligned with connected mode, should be already captured by spec.   * The UE does not expect to receive a configuration with four resources when the TRS symbols in the second slot are indicated as uplink by *tdd-UL-DLConfigurationCommon*.   No objection for TP#1, TP#3 and TP#4 with justification. So the TP#1, #3, #4 are merged for further check.   |  | | --- | | 5.1.6.1.1 CSI-RS for tracking  <omitted text>  A UE in RRC\_IDLE or RRC\_INACTIVE can receive a higher layer configuration of TRS occasions via a *TRS-ResourceSetConfig*.  - For frequency range 1, the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a *TRS-ResourceSet* consists of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot. If no two consecutive slots are indicated as downlink slots by *tdd-UL-DL-ConfigurationCommon*, then the UE may be configured with one or more NZP CSI-RS set(s), where a *TRS-ResourceSet* consists of two periodic NZP CSI-RS resources in one slot.  - For frequency range 2 the UE may be configured with one or more TRS resource set(s), where each TRS resource set configured by a *TRS-ResourceSet* consists of two periodic NZP CSI-RS resources in one slot or by a *TRS-ResourceSet* of four periodic NZP CSI-RS resources in two consecutive slots with two periodic NZP CSI-RS resources in each slot.  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter *TRS-ResourceSet* with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  - the number of periodic NZP CSI-RS resources configured by a *TRS-ResourceSet* is given by *numberOfresources*  - the time-domain locations of the two CSI-RS resources in a slot, or of the four CSI-RS resources in two consecutive slots (which are the same across two consecutive slots), is one of  - , , or for frequency range 1 and frequency range 2,  - , , , , ,  or  for frequency range 2.  - where the first symbol location in a slot is indicated by *firstOFDMSymbolInTimeDomain* in the *TRS-ResourceSet* and the second symbol location in a slot is *firstOFDMSymbolInTimeDomain +* 4  - a single port CSI-RS resource with density  given by Table 7.4.1.5.3-1 from [4, TS 38.211]*.*  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter *nrofRBs*, *startingRB* and *frequencyDomainAllocation* in a *TRS-ResourceSet* and applies to all resources in a *TRS-ResourceSet*. ~~The frequencyDomainAllocation configuration is~~ Bandwidth, *nrofRBs*, and the initial CRB index, *startingRB*, of the NZP CSI-RS resource configured by *TRS-ResourceSet* are not restricted by initial DL BWP.  - UE is not required to receive TRS occasions outside the initial DL BWP.  - the periodicity for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet*, is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a *TRS-ResourceSet*. The slot offset given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet* provides the location of the first slot containing the periodic NZP CSI-RS resources configured by b*y* a *TRS-ResourceSet.*  - the UE does not expect the *TRS-ResourceSet* to be configured with the periodicity of  slots if the bandwidth of NZP CSI-RS resource is larger than 52 resource blocks.  - the UE may assume the sub-carrier spacing of the NZP CSI-RS resources configured by *TRS-ResourceSet* to be same as the sub-carrier spacing of the initial DL BWP.  - *powerControlOffsetSS* given bya *TRS-ResourceSet* applies to all resources in a *TRS-ResourceSet*.  - the QCL information for periodic NZP CSI-RS resources, is given by the higher layer parameter *ssb-Index* configured by a *TRS-ResourceSet*, is a SS/PBCH block, applies to all resources in a *TRS-ResourceSet*.  - One or more *scramblingIDs* where if a single *scramblingID* is configured, it applies to all NZP-CSI-RS resources in the resource set, otherwise, each NZP-CSI-RS resource is provided with a *scramblingID*.  - the UE may assume the following quasi co-location type(s):  - 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block.  For each *TRS-ResourceSet* the index of the associated bit in TRS availability indication field [5, TS 38.212], is given by the higher layer parameter *indBitID*.  <omitted text> | |

**Issue 3-2: Maximum number of TRS resource sets**

Proposals on “whether to reduce maximum number of TRS resources sets” include the following alternatives:

* **Alt 1:** The number of configured TRS resource sets can be larger than the number of actual transmitted SSBs determined according to ssb-PositionsInBurst in SIB1.
* ZTE, Intel, Panasonic, InterDigital
* **Alt 2:** The maximum number of configure TRS resource sets is 16 for FR1
* Apple
* **Alt 3:** The maximum number of TRS resource sets per cell within a band is function of and upper-bounded by 64.
* Nordic

In the first round, FL suggests to check all the alternatives.

|  |
| --- |
| **[1RD]**  **Option 1:**  **Conclusion 3-1 (v1)**  The number of configured TRS resource sets can be larger than the number of actual transmitted SSBs determined according to ssb-PositionsInBurst in SIB1.  **Option 2:**  **Proposal 3-1a(v1)**  The maximum number of configure TRS resource sets is 16 for FR1  **Proposal 3-1b(v1)**  The maximum number of TRS resource sets per cell within a band is function of and upper-bounded by 64. |

**Please a) provide your views on which option to support for resolving issue 3-1 below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| **Option 1**  **Conclusion 3-1 (v1)** | vivo,Xiaomi, Sharp, ZTE,Sanechips, Panasonic |
| **Option 2**  **Proposal 3-1a (v1)** | Xiaomi, Huawei, HiSilicon |
| **Option 2**  **Proposal 3-1b (v1)** |  |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Don’t support any of the proposals. There are no requirements for the UE in relation to the said TRS occasions, thus it would not seem appropriate restrict the configuration either. |
| CATT | We don’t need further agrements |
| Nordic | As commented in our contribution   * UE must be able to comprehend all 64 configurations in order to pick the best TRS * given that TRS availability is dynamic, the best TRS may be made unavailable, and UE may want to go for 2nd best.   Nokia says UE can pick subset of 16, but how should UE know at the time of configuration which TRS resource sets gNB will make available?  We can compromise for any of above proposals. |
| Apple | We need to be reasonable when we set the upper bound. Having an unrealistic upper bound only increases UE complexity without any gain. We would appreciate if any company can provide a realistic use case of 64 TRS configurations for FR1, instead of just saying any further discussion is not needed.  With this said, we would be fine with any proposals that address the concern to some extent. |
| LGE | We don’t need further discussion. |
| Huawei, HiSilicon | Our proposal is categorized to Issue 3-3. Actually we have the same proposal with Apple in our Tdoc. Restricting the maximum number of TRS resource sets to 16 is beneficial for reducing the memory requirement for UE. |
| Panasonic | We are also okay with no consensus. |
| Ericsson1 | Do not see need for any of the proposals. |
| Moderator1 | The majority don’t support either P3-1a or P3-1b.  To end the discussion, the following conclusion is provided for further check.  **Conclusion 3-2 (v2):**  No consensus to support:   * Reduced maximum number of configured TRS resource sets for FR1. |

**Issue 3-3: Whether/how to reduce configuration overhead**

The following were proposed to reduce TRS resources configuration overhead in SIBx:

**P1: Number of configured TRS resource sets in SIB for idle/inactive UEs is not larger than 16 for FR1**

* HW

**P2: The common configuration parameter among all TRS resource sets should be supported to reduce the SIB overhead for TRS/CSI-RS for idle/inactive mode UE.**

* DOCOMO
* CATT: startingRB, nrofRBs, periodicity and TRS resources number
* Apple: startingRB and nrofRBs
* Ericsson1 : startingRB’, nrofRBs’, frequencyDomainAllocation, ’powerControlOffsetSS’, ‘scramblingID’, firstOFDMSymbolInTimeDomain

**[1RD]**

**Please a) Provide your views on whether to support or further discuss the proposals above:**

|  |  |
| --- | --- |
| **Proposals** | **Companies** |
| P1 | * **Yes:** Nordic, Apple,Xiaomi, Huawei, HiSilicon * **No:** Nokia, LGE, Ericsson1 |
| P2 | * **Yes:** CATT, Nordic, Apple,Sharp, DOCOMO, CMCC, Panasonic, Ericsson1 * **No:** |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Neither of the proposed solutions limits the total/max configuration overhead. P1 is a configuration issue and it is up to network to choose the number of resources. As I read P2, it would still allow configuring e.g. startingRB also per TRS resource set, thus it would offer opportunity to reduce the overhead if configuration allows. |
| Nordic | Any of parameters could be common for all TRS resource sets. If configured common, it should not be configured in the TRS resource set. |
| Apple | P1 should be discussed in issue 3-1, right? |
| Samsung | In general, we don’t see any need to continue RRC related design. Whether or how to reduce configuration overhead can be up to RAN2 decision. |
| Huawei, HiSilicon | P1 can be discussed under Issue 3-2. |
| Ericsson1 | RAN2 cannot judge without RAN1 input which parameters could be made common across TRS resource sets to reduce SIB overhead (while still allowing the flexibility to allow different values per TRS resource set as per current framework). |
| Moderator1 | [8] companies support P2 for configuration overhead reduction. Since no objection, a proposal is drafted accordingly for further discussion in next round.  **Proposal 3-3 (v1)**  Support common configuration parameter(s) among all TRS resource sets for idle/inactive mode UE   * The common configuration parameters include startingRB, nrofRBs, frequencyDomainAllocation, powerControlOffsetSS, scramblingID, firstOFDMSymbolInTimeDomain, periodicity, numberOfresources |

## 4.2 <2nd round discussion>

**Issue 3-2: Maximum number of TRS resource sets**

|  |
| --- |
| **[2RD]**  **Conclusion 3-2 (v2):**  No consensus to support:   * Reduced maximum number of configured TRS resource sets for FR1. |

**Please a) provide your views on whether or not to support Conclusion 3-2 (v2) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Xiaomi, vivo,ZTE,Sanechips, CATT, Samsung, LGE, Ericsson2, intel |
| No | Apple, Qualcomm, Huawei, HiSilicon |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | We have asked multiple times if any company could provide a real use case where a gNB wants to configure 64 TRS configurations for idle/inactive UEs (or for connected UEs). We haven’t seen any response so far. I don’t think we should argue that UE can have different ways to handle up to 64 TRS configurations (of course UEs can do all sorts of things to handle it). Instead, we should ask ourselves, if unnecessary, why should we burden the UE to take additional step to do these handling?? We would really appreciate a direct response on at least one practical use case here. |
| Nokia\_2 | I assume the UE capability to store the configuration would be upper bound by the CONNECTED mode capability *maxConfiguredResourceSetsAllCC* (per band). This is lower bound to 16 for FR1 and 32 (per band, if two CCs 2\*[min(*maxConfiguredResourceSetsPerCC*)]). If UE supports CA over different bands, the baseband processing capability needs in my understanding be able to handle higher number. This capability would not be needed in IDLE mode for CA purposes. So I would not think that in typical case the number of configurations does not present a problem.  The number of simultaneous TRS UE can track in CONNECTED mode is set by *maxSimultaneousResourceSetsPerCC*, which is lower bound to one. I would expect that this capability is the limiting factor, which would require UE to adapt the applied ‘active’ configuration, but this we cannot address by limiting the total number of configurations (unless going to very low numbers). Hence the concern and way to address it are not fully clear to me, but I’m certainly more than interested to understand better. |
| CATT | It is gNB implementation on the number of TRS resource in FR1 (one or more TRS resource per beam). In particular, we have L1 signaling for dynamic indication of TRS resources. There is no reason to set the limit. |
| Qualcomm | We agree with other companies that for FR1 a maximum number of 64 TRS resource sets is an over provisioning. Maximum 16 TRS resource sets for FR1 is good for us. |
| Panasonic | Agree with Nokia. |
| Ericsson2 | We prefer to not have any further reduction. Foe example, for UEs in connected mode, TRS configuration (e.g. BW/periodicity, resources, etc), could be changed via RRC, but then to reflect this change to idle/inactive UEs will need an expensive SI update, which would not be preferred. |
| Huawei, Hisilicon | We e should firstly clarify whether the scenario where more than 16 TRS resource sets need to be configured exists in FR1. |
| Moderator2 | For the question from Apple, no companies provide a practical use case for 64 TRS resources sets in FR1. It seems the majority assume the limit doesn’t matter and prefer to keep the implementation flexibility to gNB. Based on the comment from Nokia, it’s possible that the total TRS resource sets configured to connected UEs is 16\*N\_CC in CA mode. Then, gNB could share the larger number of TRS resources sets from connected UEs to idle/inactive UEs.  Since no critical issue to keep the same maximum number of TRS resource sets for FR1 and FR2 based on existing agreement, moderator suggests to further discuss the conclusion in next round or skip the discussion in this meeting. |

**Issue 3-3: Whether/how to reduce configuration overhead**

[8] companies support P2 for configuration overhead reduction. Since no objection, a proposal is drafted accordingly for further discussion in the second round.

For the applicable common configuration parameters, all the parameters mentioned by companies in the 1st round are copied in the proposal as a starting point to discuss. Companies support the proposal, please carefully check whether or not to support all or partial of them.

|  |
| --- |
| **[2RD]**  **Proposal 3-3 (v1)**  Support common configuration parameter(s) among all TRS resource sets for idle/inactive mode UE   * The common configuration parameters include:   + startingRB, nrofRBs, frequencyDomainAllocation, powerControlOffsetSS, scramblingID, firstOFDMSymbolInTimeDomain, periodicity, numberOfresources |

**Please a) provide your views on whether or not to support Proposal 3-3 (v1) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Apple (mostly), CATT, Ericsson2 (with updates), Huawei, HiSilicon(more discussion can be made for the details parameters), intel |
| No | Samsung |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | We are supportive the idea in general.  Can we clarify which one of the following we are trying to agree here?  Alt 1: If a common parameter is configured, the parameter is not included in the configuration of each TRS resource set.  Alt 2: Even if a common parameter is configured, the parameter can still be included in the configuration of each TRS resource set to override the value of the common parameter.  If it is Alt 1, we are fine with the list of parameters.  If it is Alt 2, we think it would not save overhead to include e.g. numberOfresources (1 bit), because when the common parameter is configured, we still need 1 bit to indicate the presence of this parameter in the configuration of each TRS resource set.  We are fine either way, but just want to be clear. |
| Nokia\_2 | We agree with Apple that it should be clarified what is the intent. Also, like expressed earlier, we should maintain the flexibility to provide these parameters per TRS resource set, even if common parameter(s) are optionally supported. |
| CATT | In order to minimize the SIB-X size, our proposal of TRS resource set configuration parameters: startingRB, nrofRBs, periodicity and TRS resources number could be common for all the TRS resources sets. |
| Samsung | We think the proposal is not essential. It’s optimization that is good to have. We have concern about the spec efforts needed, as Apple pointed out so many details needs to be clarified if we open the discussion. |
| LGE | We are fine with the intention of the proposal. But, we would like to clarify whether the configuring the common parameter(s) is optional or not. If it is optional configuration, we are fine with this proposal, and prefer to capture the intention more clearly. |
| Ericsson2 | Support the proposal (with updates). Our preference is to avoid adding new RRC parameters or restructuring the existing RRC parameter list for this (from RAN1 point of view). Therefore, we suggest updating as follows.  Proposed update-E//  Support common value for each of the following ~~configuration~~ parameter(s) among ~~all~~ one or more TRS resource sets for idle/inactive mode UE   * ~~The common configuration parameters include:~~   + startingRB, nrofRBs, frequencyDomainAllocation, powerControlOffsetSS, scramblingID, firstOFDMSymbolInTimeDomain, periodicity, numberOfresources   + These parameter(s) can be configured as ‘optional’ for TRS resource set(s). For a TRS resource set, when the parameter value is explicitly configured, follow the configured parameter value, otherwise follow the parameter value from the first configured TRS resource set   + Remaining details are left to RAN2 |
| Huawei, HiSilicon | We are OK with the main bullet common parameter for all TRS resource sets. But we may need more time to discuss the subbullets on which parameter can be the common one. |
| Intel | Ok with the intention, however, which set of parameters can be common needs more discussion. |
| Moderator2 | No much feedback so far. It seems more time is needed. Moderator suggests to further discuss in next round to see if there are more interests. The proposal is updated to incorporate the comments from Apple and LGE.  **Proposal 3-3 (v2)**  Support common configuration parameter(s) among all TRS resource sets for idle/inactive mode UE   * The common configuration parameters include:   + [startingRB, nrofRBs, frequencyDomainAllocation, powerControlOffsetSS, scramblingID, firstOFDMSymbolInTimeDomain, periodicity, numberOfresources] * Down-select one from:   + Alt 1: If a common parameter is configured, the parameter is not included in the configuration of each TRS resource set.   + Alt 2: Even if a common parameter is configured, the parameter can still be included in the configuration of each TRS resource set to override the value of the common parameter. * The common configuration parameter(s) is optional |

## 4.3 <3nd round discussion>

**Issue 3-2: Maximum number of TRS resource sets**

As summarized in moderator2, let’s further discuss the conclusion in the third round.

|  |
| --- |
| **[3RD]**  **Conclusion 3-2 (v2):**  No consensus to support:   * Reduced maximum number of configured TRS resource sets for FR1. |

**Please a) provide/update your views on whether or not to support Conclusion 3-2 (v2) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Xiaomi, vivo, ZTE, Sanechips, CATT, Samsung, LGE, Ericsson2, intel |
| No | Apple, Qualcomm, Huawei, HiSilicon, Nordic |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | A maximum number of 16 TRS resource sets for FR1 should be sufficient. This can reduce signaling overhead for FR1 cells and save UE memory accordingly. |
| Huawei, HiSilicon | 16 TRS resource sets are sufficient for FR1. With a maximum 16 TRS resources, the configuration information could be controlled with a SIB payload, and can avoid SIB segments to save power consumption and signaling overhead in FR1.  There are some mentioning of comments that connected mode UE can have the capability to store many TRS RS resource. “*maxConfiguredResourceSetsAllCC* (per band). This is lower bound to 16 for FR1 and 32 (per band, if two CCs 2\*[min(*maxConfiguredResourceSetsPerCC*)]). If UE supports CA over different bands, the baseband processing capability needs in my understanding be able to handle higher number.”. However, it is mentioned that for FR1 the minimum value of *maxConfiguredResourceSetsAllCC* is 16. IDLE UE should not be required to keep the same memory size at that for a connected UE with multiple carriers and potential TRS occasions are only present in PCell. Based on these, we think this parameter is a strong justification that maximum of TRS resources in IDLE mode should not be larger than 16.  Before a conclusion on this no consensus, it is appreciated if the companies can give solid justification or some example for scenarios where more than 16 TRS resource sets needs to be configured. |
| Nokia\_3 | Firstly, in my understanding “*maxConfiguredResourceSetsAllCC*” is per band, and my example was related to the case when UE supports CA over different bands. Apologizes if this was not clearly stated. Total configuration size in the maximum case (64) is <1kbyte, which does not sound very large for IDLE mode operation when the need is otherwise limited.  Like pointed out by Ericsson, network may be prepared to serve UE with different capabilities, and thereby have TRS configurations that have different bandwidth. In order to avoid SI updates, and to provide these to UE, it would be beneficial to have these configured. Also digital beam forming in Connected mode could increase the number of applied TRS resources. |
| Apple | We still do not see why we need anything more than 16 for FR1. For the use cases mentioned by Ericsson/Nokia, our understanding is that UEs with different bandwidth can share the same TRS configuration, and UEs within a narrow BW can just use TRS from the corresponding BW.  One thing I would also like to point out is that we have defined a mechanism that supports up to 6 TRS resource set group, and the indication is per group. E.g. if we have 64 TRS resource sets, each group would have 10~11 TRS resource sets. A group can be indicated as available only if all the 10~11 resource sets within the group is available. So configuring too many resource sets in the end may hurt the power saving gain, because the probability of being able to indicate ‘1’ becomes smaller as the number of resource sets per group increases. |

**Issue 3-3: Whether/how to reduce configuration overhead**

As summarized in moderator2, let’s further discuss the updated proposal 3-3(v2) in the third round.

|  |
| --- |
| **[3RD]**  **Proposal 3-3 (v2)**  Support common configuration parameter(s) among all TRS resource sets for idle/inactive mode UE   * The common configuration parameters include:   + [startingRB, nrofRBs, frequencyDomainAllocation, powerControlOffsetSS, scramblingID, firstOFDMSymbolInTimeDomain, periodicity, numberOfresources] * Down-select one from:   + Alt 1: If a common parameter is configured, the parameter is not included in the configuration of each TRS resource set.   + Alt 2: Even if a common parameter is configured, the parameter can still be included in the configuration of each TRS resource set to override the value of the common parameter. * The common configuration parameter(s) is optional |

**Please a) provide your views on whether or not to support Proposal 3-3 (v2) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Huawei, HiSilicon, Nordic, LGE, Apple |
| No | ZTE, Sanechips |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | We think further consideration to reduce the signaling overhead in SIB is essential, considering the configuration information is still larger than the payload of SIB. We prefer Alt.1 to reduce the signaling overhead. |
| Nordic | Alt 1 and Alt 2 can be left up to RAN2. |
| ZTE, Sanechips | For alt 2, we agree with Huawei that alt 2 doesn’t reduce signaling overhead.  For the last bullet, if the common configuration is optional, the signaling overhead doesn’t reduce at all if the the common configuration is not configured. It seems this solution doesn’t resolve the overhead issue for SIB, RAN2 may also need to discuss SIB segmentation in the case the common parameter is not configured. In this sense, this proposal doesn’t help at all. |
| Xiaomi | Share Nordic’s view. should be left to RAN2.  But we still have a comment on P 3-3, the common configuration parameter(s) does not necessarily has to be for all TRS resource set, instead, can be only for some TRS resourse sets. and the multiple TRS resource sets with common parameters can be configured with a configset ID. |
| LGE | From scheduling flexibility point of view, Alt 2 is preferable but we also fine to leave it to RAN2.  We think the last bullet shall be maintained. If not, gNB may lost configuration flexibility of TRS resource, or only restricted set of TRS resource sets that shares common parameter configuration can be configured for idle/inactive UEs. |
| Nokia\_3 | Just to clarify we would not be fine to mandate the TRS configurations to be always identical based on the suggested common parameters, hence if RAN1 goes ahead with this proposal, the parameter(s) should be in minimum optionally configurable either to TRS resource set or ‘common set’. This should be kept clear even if this is left to RAN2. It is good to note that there will be additional hierarchy introduced to the signaling, so not sure if this would actually increase the size (in certain cases) of ASN.1 |
| Samsung | We don’t think the additional design of configuration structure is essential. The feature is complete without the proposal. We prefer to skip optimization during the maintenance phase. |
| Ericsson3 | It seems the listed alternatives is missing our suggested option to avoid introducing new RRC parameter changes impacting ASN1. |

# Others

In addition to the main topics in Section 2-4, some other issues or design aspects have been discussed by a few companies, and the corresponding proposals are captured below.

|  |  |  |
| --- | --- | --- |
| HW | ***Proposal 2: Adopt the following TP2 not to impact connected mode UE’s rate matching behavior due to TRS resource set(s) configured in SIB.***   |  | | --- | | ------------------------------------------ Start of Text Proposal 2------------------------------------------  < Unchanged parts are omitted >  **7.3.1.5 Mapping to virtual resource blocks**  The UE shall, for each of the antenna ports used for transmission of the physical channel, assume the block of complex-valued symbols conform to the downlink power allocation specified in [6, TS 38.214] and are mapped in sequence starting with to resource elements in the virtual resource blocks assigned for transmission which meet all of the following criteria:  - they are in the virtual resource blocks assigned for transmission;  - the corresponding physical resource blocks are declared as available for PDSCH according to clause 5.1.4 of [6, TS 38.214];  - the corresponding resource elements in the corresponding physical resource blocks are  - not used for transmission of the associated DM-RS or DM-RS intended for other co-scheduled UEs as described in clause 7.4.1.1.2;  - not used for non-zero-power CSI-RS according to clause 7.4.1.5 if the corresponding physical resource blocks are for a PDSCH scheduled by a PDCCH with the CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI, or a PDSCH with SPS, except if the non-zero-power CSI-RS is a CSI-RS configured by the higher-layer parameter *CSI-RS-Resource-Mobility* in the *MeasObjectNR* IE or except if the non-zero-power CSI-RS is an aperiodic non-zero-power CSI-RS resource or except if the non-zero-power CSI-RS is TRS resources configured via [*TRS-ResourceSetConfig*];  - not used for PT-RS according to clause 7.4.1.2;  - not declared as 'not available for PDSCH according to clause 5.1.4 of [6, TS 38.214].  The mapping to resource elements allocated for PDSCH according to [6, TS 38.214] and not reserved for other purposes shall be in increasing order of first the index over the assigned virtual resource blocks, where is the first subcarrier in the lowest-numbered virtual resource block assigned for transmission, and then the index .  ------------------------------------------ End of Text Proposal 2------------------------------------------  < Unchanged parts are omitted > |   ***Proposal 4: Conclude that it is RAN1 understanding that Idle/inactive mode UE is not required to monitor all the TRS resource set(s) configured in SIBx by gNB.***  ***Proposal 7: Conclude that it is up to UE implementation whether to utilize TRS resources for time/frequency tracking configured in SIB when UE is in CONNECTED mode.*** |
| CMCC | **Proposal 1. TRS availability indication field is treated as scheduling information for Paging when interpreting the Short Message indicator field in DCI format 1\_0 with P-RNTI.**  **The TP suggestion for TS 38.212 section 7.3.1.2.1 is as the following:**  **<**Unchanged text is omitted>  **Table 7.3.1.2.1-1: Short Message indicator**   |  |  | | --- | --- | | **Bit field** | **Short Message indicator** | | 00 | Reserved | | 01 | Only scheduling information for Paging and TRS availability indication (if any) is present in the DCI | | 10 | Only short message is present in the DCI | | 11 | Both scheduling information for Paging, TRS availability indication (if any) and short message are present in the DCI |   **<**Unchanged text is omitted> |
| MediaTek | Observation 1: For TRS availability indication by PEI for upcoming PO in current paging cycle, a proper time gap should be accommodated for UE to warm up for TRS processing.  Observation 2: Connected mode UE can report requirement of a 3-ms time gap between DCP and the start of the associated DRX on-duration. It is reasonable a longer time gap is reserved for idle/inactive mode UE to realize lower power consumption.  Proposal 1: For PEI-based TRS availability indication, an application delay of [5]-ms is introduced.  Proposal 2: Adopt the following text proposal to Section 10.4B of TS 38.213:   |  | | --- | | <Unchanged parts are omitted>  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. The UE is not expected to receive the indicated TRS resources set within application delay of 5 ms after TRS availability indication provided by DCI format 2\_7.  <Unchanged parts are omitted> | |
| CATT |  |
| Sharp | **Proposal 4:** **Support zero-power PDSCH punching for REs overlapping with TRS resources configured in SIB** |
| LG | **Observation 1: According to the section 5.1.6.1 in the TS 38.214, idle/inactive UE can assume that it is not expected to receive TRS and SIB1 message in the overlapping PRB in the OFDM symbols where SIB1 is transmitted.**  **Observation 2: Rel-15/16 UE in idle/inactive state does not have prior information on TRS. Therefore, the Rel-15/16 UE is not able to deal with the overlap between indicated TRS and broadcast PDSCH which occurs in the idle/inactive state.**  **Observation 3: Rel-17 UE in idle/inactive state can have prior information on TRS. Therefore, it is necessary to deal with the overlap between indicated TRS and broadcast PDSCH for the Rel-17 idle/inactive UEs.**  **Proposal 1: For REs that are configured for a TRS occasion(s) for idle/inactive UEs and indicated actual TRS transmission via L1 signaling**   * **The UE expects TRS transmission in the REs even if they are overlapped with scheduled PDSCH** * **The UE expects PDSCH REs, which overlap with actual TRS transmission, are punctured after PDSCH RE mapping (i.e. zero power PDSCH RE)**   **Proposal 3: Consider following options for the TRS configuration validation and associated availabilities for the eDRX UE:**   * **Opt 1: UE shall monitor SIB1 to check the value tag of SI for TRS configuration before the PTW every eDRX cycles** * **Opt 2: UE cannot assume any validity duration before it monitors the first PO within a PTW** * **Opt 3: L1 signal (i.e. paging DCI and PEI) conveys bit field for indicating SI update for TRS configuration** |

5.1 <1st round discussion>

**Issue 4-1: Others**

Proposals for other issues with need of spec change are collected in the table below.

|  |  |  |
| --- | --- | --- |
| **Index** | **Proposals** | **From** |
| 1 | **Proposal: Adopt the following TP2 not to impact connected mode UE’s rate matching behavior due to TRS resource set(s) configured in SIB.**  ------------------------------------------ Start of Text Proposal 2-----------------------------------------  < Unchanged parts are omitted >  **7.3.1.5 Mapping to virtual resource blocks**  The UE shall, for each of the antenna ports used for transmission of the physical channel, assume the block of complex-valued symbols conform to the downlink power allocation specified in [6, TS 38.214] and are mapped in sequence starting with to resource elements in the virtual resource blocks assigned for transmission which meet all of the following criteria:  - they are in the virtual resource blocks assigned for transmission;  - the corresponding physical resource blocks are declared as available for PDSCH according to clause 5.1.4 of [6, TS 38.214];  - the corresponding resource elements in the corresponding physical resource blocks are  - not used for transmission of the associated DM-RS or DM-RS intended for other co-scheduled UEs as described in clause 7.4.1.1.2;  - not used for non-zero-power CSI-RS according to clause 7.4.1.5 if the corresponding physical resource blocks are for a PDSCH scheduled by a PDCCH with the CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI, or a PDSCH with SPS, except if the non-zero-power CSI-RS is a CSI-RS configured by the higher-layer parameter *CSI-RS-Resource-Mobility* in the *MeasObjectNR* IE or except if the non-zero-power CSI-RS is an aperiodic non-zero-power CSI-RS resource or except if the non-zero-power CSI-RS is TRS resources configured via [*TRS-ResourceSetConfig*];  - not used for PT-RS according to clause 7.4.1.2;  - not declared as 'not available for PDSCH according to clause 5.1.4 of [6, TS 38.214].  The mapping to resource elements allocated for PDSCH according to [6, TS 38.214] and not reserved for other purposes shall be in increasing order of first the index over the assigned virtual resource blocks, where is the first subcarrier in the lowest-numbered virtual resource block assigned for transmission, and then the index .  ------------------------------------------ End of Text Proposal 2------------------------------------------  < Unchanged parts are omitted > | HW |
| 2 | **Proposal: TRS availability indication field is treated as scheduling information for Paging when interpreting the Short Message indicator field in DCI format 1\_0 with P-RNTI.**  **The TP suggestion for TS 38.212 section 7.3.1.2.1 is as the following:**  **<**Unchanged text is omitted>  **Table 7.3.1.2.1-1: Short Message indicator**   |  |  | | --- | --- | | **Bit field** | **Short Message indicator** | | 00 | Reserved | | 01 | Only scheduling information for Paging and TRS availability indication (if any) is present in the DCI | | 10 | Only short message is present in the DCI | | 11 | Both scheduling information for Paging, TRS availability indication (if any) and short message are present in the DCI |   **<**Unchanged text is omitted> | CMCC |
| 3 | **Proposal: The UE is not expected to receive the indicated TRS resources set within application delay of 5 ms after TRS availability indication provided by DCI format 2\_7.** | MTK |
| 4 | **Proposal: For REs that are configured for a TRS occasion(s) for idle/inactive UEs and indicated actual TRS transmission via L1 signaling**   * **The UE expects TRS transmission in the REs even if they are overlapped with scheduled PDSCH** * **The UE expects PDSCH REs, which overlap with actual TRS transmission, are punctured after PDSCH RE mapping (i.e. zero power PDSCH RE)** | LG, sharp |
| 5 | **Proposal: Consider following options for the TRS configuration validation and associated availabilities for the eDRX UE:**   * **Opt 1: UE shall monitor SIB1 to check the value tag of SI for TRS configuration before the PTW every eDRX cycles** * **Opt 2: UE cannot assume any validity duration before it monitors the first PO within a PTW** * **Opt 3: L1 signal (i.e. paging DCI and PEI) conveys bit field for indicating SI update for TRS configuration** | LG |

**[1RD]**

**Please a) provide your views on whether or not to support any of proposals above.**

|  |  |
| --- | --- |
| **Proposals** | **Companies** |
| #1 | * **Yes:** Nokia, Nordic, Qualcomm (with modification), vivo, LGE, Huawei, HiSilicon, CMCC * **No: CATT**, intel, Ericsson1 |
| #2 | * **Yes:** Nokia, Qualcomm (with modification), Huawei, HiSilicon(needs further modification), CMCC * **No: CATT, Nordic, Apple,** LGE, intel |
| #3 | * **Yes:** MediaTek * **No:** Nokia, CATT, Nordic, Qualcomm, Apple, LGE, ZTE,Sanechips, intel, CMCC, Ericsson1 |
| #4 | * **Yes:** LGE,Sharp * **No:** Nokia, CATT, Nordic, Qualcomm, Apple, ZTE,Sanechips, intel, Huawei, HiSilicon, Ericsson1 |
| #5 | * **Yes:** LGE * **No:** Nokia, CATT, Nordic, Qualcomm,, ZTE,Sanechips, intel, CMCC, Ericsson1 |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | For #4, to IDLE/Inactive mode UEs, this would be different behavior than for legacy i.e. for paging message no NZP-CSI related rate matching is assumed.  For #5, not sure if additional changes are needed. I.e. SI update could have also been related to paging configuration, thus SI change procedure should account the eDRX. |
| Qualcomm | For #1, it is necessary to make similar clarification to that for measurement object. It should be clarified that this only applies to   * if the non-zero-power CSI-RS is an aperiodic non-zero-power CSI-RS resource or except if the non-zero-power CSI-RS is TRS resources configured via [*TRS-ResourceSetConfig*] in SIBx (for idle and inactive mode UE);   For #2, we think the proposal should be updated to “restrict TRS availability indication in paging PDCCH to only when short message indicator is not ‘00’” This is to avoid legacy UE that does not support idle/inactive TRS unnecessarily decoding paging PDCCH. It is reasonable to assume that if no UE is paged, there is no need for any UE to receive additional TRS for paging PDSCH decoding or short message decoding. Since UE can use TRS for short message reception, we think CMCC proposal should be extended to also indicate TRS availability when short message is to be received.  For #3, the application delay is functionally unnecessary but will force UE to do additional handling of the delay gap.  For #4, the issue either does not exist or has been handled by network already because the TRS is a configured to some connected mode UE already. No additional clarification or design is needed.  For #5, RAN1 is not officially aware of eDRX. RAN1 should require RAN2 to judge whether specific design is needed. |
| Apple | For #1, we think the main clarification point is whether connected UEs even need to monitor these TRS configurations or not. If not, then we do not need to worry about it.  For #2, it is not clear why this is necessary. TRS availability indication can be present in any paging DCI message.  For #3, it is not necessary. If needed, UE can apply application delay by itself, but there is no need to specify.  For #4, we agree with the 1st sub-bullet in principle but we don’t see the need to agree on anything. The 2nd sub-bullet is new UE behavior, and such scenario should be avoided by the network.  For #5, it is not entirely clear to us the impact of eDRX. This needs further discussion and/or guidance from RAN2. |
| LGE | For #4, our point is to clarify the UE assumption when overlap is occurred. It is obvious that UE could not receive PDSCH data and TRS element simultaneously at the same RE, so UE assumption when overlap is occurred shall be clearly described in the spec. So far, this issue has not been discussed enough due to the priority. But we would like to emphasize again that, 1) overlaps between reference signals and other physical signals/channels should be handled by the spec to avoid ambiguity problem and 2) overlap between broadcast PDSCH and TRS resource would not be avoided by the network when PO is densely deployed.  For #5, recall that in issue 1-2, it is common understanding that the validity duration associated with the previous TRS configuration would be expired when TRS configuration is changed. Also, according to the agreement in a previous RAN1 meeting, length of the validity duration could be configured up to 22 minutes. Let’s consider the case that configured eDRX cycle is shorter than the configured validity duration, and TRS configuration has been changed after a PTW where UE received the L1 availability indication. In general, UE cannot know whether the SI has been updated before it checks short message in paging DCI, SIB1, or SIB-X for TRS configuration, and so far we have been assumed that TRS can be used for time/frequency synchronization before PO. Our suggestion is to avoid undesired UE behavior that eDRX UE uses unavailable TRS resources for t/f synchronization. |
| Sharp | For #4, we think the second bullet is necessary to provide TRS signal without interference for idle/inactive UEs |
| ZTE,Sanechips | For issue #2, if the indication needs to be carried by short message indicator, “00” is better.  For issue#1, we tend to agree with Apple that we need to first discuss whether RRC\_connected UE read SIB for TRS. |
| intel | Agree with Apple comment above for # 1 |
| Huawei, HiSilicon | For#1, the intention is to avoid rate matching of the TRS resource set configured in SIB. It should be captured somewhere. Regarding apple’s and intel’s comments, we think whether connected mode UE can use TRS occasions of IDLE mode UE is UE implementation. Regardless whether connected UE can use it, it should be clear on rate matching behavior of connected mode UEs.  For#2, we agree that except the reserved state, TRS availability field can be in paging DCI. So, TRS availability should be also added for “01” bit field. If we do this change, it seems the description in 212 needs to be also updated.  For#3, we are flexible on it.  For#4, it is gNB implementation.  For#5, we can wait RAN2 for more details for eDRX. |
| CMCC | For #2, From our perspective, we think the TRS availability indication should be treated as scheduling information for Paging, because the TRS availability indication field uses the reserved bits in DCI format 1\_0 not the short message field.  For #4, we are ok to discuss it. |
| Ericsson1 | #1 : proposal is not needed i.e. even without the TP, spec seems to be clear.  #2 : It seems that in all cases, the TRS availability bitfield would be present in the DCI and hence could be used for indicating availability. |

5.2 <2nd round discussion>

According to the discussion in 1st round, proposal #1 and #2 have significant support, while the majority object proposal #3 and #4. Therefore, moderator suggest to further discuss issues and potential solutions for proposal #1 and #2 in the second round.

**Issue 4-1: Impact to connected UE’s rate matching behaviour**

The majority support the proposal, the intention and concerns in first round discussion were addressed by HW in first round discussion.

|  |
| --- |
| **[2RD]**  **Proposal 4-1 (v1):**  Connected mode UE’s rate matching behavior is not impacted by TRS-ResourceSetConfig configured in SIB.   * Adopt the following TP for TS 38.211   ------------------------------------------ Start of Text Proposal 2-----------------------------------------  < Unchanged parts are omitted >  **7.3.1.5 Mapping to virtual resource blocks**  The UE shall, for each of the antenna ports used for transmission of the physical channel, assume the block of complex-valued symbols conform to the downlink power allocation specified in [6, TS 38.214] and are mapped in sequence starting with to resource elements in the virtual resource blocks assigned for transmission which meet all of the following criteria:  - they are in the virtual resource blocks assigned for transmission;  - the corresponding physical resource blocks are declared as available for PDSCH according to clause 5.1.4 of [6, TS 38.214];  - the corresponding resource elements in the corresponding physical resource blocks are  - not used for transmission of the associated DM-RS or DM-RS intended for other co-scheduled UEs as described in clause 7.4.1.1.2;  - not used for non-zero-power CSI-RS according to clause 7.4.1.5 if the corresponding physical resource blocks are for a PDSCH scheduled by a PDCCH with the CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI, or a PDSCH with SPS, except if the non-zero-power CSI-RS is a CSI-RS configured by the higher-layer parameter *CSI-RS-Resource-Mobility* in the *MeasObjectNR* IE or except if the non-zero-power CSI-RS is an aperiodic non-zero-power CSI-RS resource or except if the non-zero-power CSI-RS is TRS resources configured via *TRS-ResourceSetConfig* in SIB;  - not used for PT-RS according to clause 7.4.1.2;  - not declared as 'not available for PDSCH according to clause 5.1.4 of [6, TS 38.214].  The mapping to resource elements allocated for PDSCH according to [6, TS 38.214] and not reserved for other purposes shall be in increasing order of first the index over the assigned virtual resource blocks, where is the first subcarrier in the lowest-numbered virtual resource block assigned for transmission, and then the index .  ------------------------------------------ End of Text Proposal 2------------------------------------------  < Unchanged parts are omitted > |

**Please a) provide your views on whether or not to support Proposal 4-1 (v1) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Vivo, ZTE, Sanechips, Samsung, Huawei, HiSilicon |
| No | Sharp, LGE, Ericsson2 |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Just want to clarify: if we agree to this TP, does it mean like what Huawei suggested: “whether connected mode UE can use TRS occasions of IDLE mode UE is UE implementation”? |
| Sharp | The idle/inactive also apply these criteria for PDSCH mapping. The PDSCH RE overlapped with TRS should be ratematched or punctured at least for idle/inactive UE when the TRS is indicated to be available. |
| Nokia\_2 | Actually one additional question for my clarification; if we have CSI-RS for tracking configured for the UE that is also provided as a part of TRS occasion configuration (for IDLE), what is the expected behavior?  Should we just simplify that the “*TRS-ResourceSetConfig IE is not accounted in determination of available resource elements*”?  In this context Section 7.4.1.5.1 refers currently to:  “for a non-zero-power CSI-RS configured by the NZP-CSI-RS-Resource IE or by the CSI-RS-Resource-Mobility field in the CSI-RS-ResourceConfigMobility IE,”,  thus TRS-ResourceSetConfig IE is not accounted for. It is a good question if TRS-ResourceSetConfig IE should be accounted in 7.4.1.5.1.  For IDLE/Inactive, legacy UEs account only the SSB (expect for SIB1), not NZP-CSI-RS, and don’t see need to change this. |
| Qualcomm | For Rel-17, the idle/inactive TRS is supposed to be a reused resource from TRS configured for connected mode UE. Then network should have already taken care of this TRS by rate matching or avoiding collision with PDSCH for connected and idle/inactive mode UEs, and network should have already configured this TRS resource set to connected mode UEs for T/F tracking purpose if it is useful. So we object to further discuss/conclude anything related to connected mode UE or overlapping with PDSCH. |
| LGE | We have same view with sharp. This criteria shall be apply to idle/inactive TRS as well, and we should take care of potential overlapping issue in idle/inactive state.  First, it should be noted that Rel-15/16 idle/inactive UEs are not aware of TRS configuration. Thus it was impossible to consider a potential overlap case since UE does not have any information. However, Rel-17 UEs who can acquire *TRS-ResourceSetConfig* in SIB can have information regarding TRS transmission. So we should take account potential overlapping problem.  Also, we cannot agree that gNB will handle avoiding collision by the implementation. According to the agreement we made, up to 22 min validity duration could be indicated and it cannot be disabled dynamically. It means, for example, TRS transmission will have higher priority than paging transmission within a long period if gNB schedule paging transmission to avoid collision with TRS. It would impact paging latency or degrade PDSCH reception performance due to the restricted PDSCH resource mapping flexibility. Note that every frame can have PO(s) by the configuration and beam sweeping manner should be supported for idle/inactive UEs. Hence, it seems almost impossible that gNB schedules TRS resources to avoid collision with dense deployed PDSCH transmission |
| Ericsson2 | Proposal is not needed i.e. even without the TP, spec seems to be clear. Can it be clarified which part of current specification would imply rate-matching is affected by *TRS-ResourceSetConfig IE* ?  It seems sufficient to consider the suggestion from Nokia (with small update in red, as shown below)  *TRS-ResourceSetConfig IE is not accounted in determination of available resource elements* for PDSCH. |
| Huawei, HiSilicon | Some replies to Sharp. If we do rate matching on PDSCH for IDLE mode UE, there shall be compatibility issue because existing IDLE mode UE cannot understand potential TRS for Rel-17 IDLE mode UE.  For Nokia’s and Ericsson’s question, we see the following description in 214. By reading it, we understand that TRS-resourceSet belongs to the NZP-CSI-RS defined in 7.4.1.5nthat would be rate matched in 38.211.  “Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter [*TRS-ResourceSet*] with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:”  Therefore, we think a TP is needed to resolve the issue. However, we are fine to discuss Nokia’s proposed change, but it needs to be captured in the spec to avoid any confusion.  *TRS-ResourceSetConfig IE is not accounted in determination of available resource elements* for PDSCH. |
| Intel | We have similar comment as Nokia |
| Moderator2 | There are the following concerns:  For idle/inactive UEs:   * **C1**: legacy UEs account only the SSB (expect for SIB1), not NZP-CSI-RS, and don’t see need to change this.   + Nokia, Intel * **C2**: The idle/inactive also apply these criteria for PDSCH mapping. The PDSCH RE overlapped with TRS should be ratematched or punctured at least for idle/inactive UE when the TRS is indicated to be available.   + Sharp, LGE   For connected UEs:   * **C3**: whether connected mode UE can use TRS occasions of IDLE mode UE is UE implementation?   + Apple * **C4**: Whether TRS-ResourceSetConfig IE should be accounted in 7.4.1.5.1.   + Nokia, Ericsson, Intel * **C5**: Then network should have already taken care of this TRS by rate matching or avoiding collision with PDSCH for connected and idle/inactive mode UEs, and network should have already configured this TRS resource set to connected mode UEs for T/F tracking purpose if it is useful. So we object to further discuss/conclude anything related to connected mode UE or overlapping with PDSCH.   + QC   HW provides replies to C2 and C4. Since proponents of the proposal are OK with the Nokia’s change, moderator suggests to further discuss updated proposal in next round, and companies are encouraged to provide replies to address C3 and C5.  **Proposal 4-1 (v2):**  *TRS-ResourceSetConfig* IE is not accounted in determination of available resource elements for PDSCH. |

**Issue 4-2: Condition for transmit TRS availability indication in paging PDCCH reception**

The open problem is whether or not to restrict transmission of TRS availability indication by Short Message indicator field, i.e. whether to restrict that gNB can transmit TRS availability indication based on paging PDCCH only if paging PDCCH also carries scheduling information and/or short message.

The main motivation is to avoid impact to R15/16 UE or UEs that don’t support idle mode TRS resources, i.e. to avoid the case where the UEs decode paging PDCCH successfully but not receive any useful information.

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| **[2RD]**  **Proposal 4-2 (v1):**  TRS availability indication is provided in paging PDCCH only when   * Alt1: short message indicator is not ‘00’ * Alt2: short message indicator is ‘01’ or ‘11’ |

**Please a) provide your views on whether or not to support Proposal 4-2 (v1) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | * w/ Alt1: Qualcomm, Huawei, HiSilicon * w/ Alt2: CMCC |
| No | Apple, ZTE, Sanechips, Panasonic, LGE, intel |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Maybe we miss something here, but the motivation is still not clear to us. For UEs not support TRS indication, why does it even matter when TRS indication is included in the paging DCI? Those UEs would decode paging PDCCH in any case. What is the harm if the UE does not receive any useful information in the paging DCI? The only additional work for the UE is parsing the DCI, which should be minimum.  Even though we think it is not very likely that the network would transmit a paging DCI just for the purpose of TRS availability indication, it does not seem necessary to have such restriction in the specs. |
| vivo | We agree with the intention that we should to avoid impact to legacy UE. But this restriction will cause that TRS availability indication based on paging PDCCH can only be carried and informed to UE when paging message and/or short message need to be transmitted. **It will undoubtedly give rise to the potential inflexible for UE to apply the idle mode TRS resources, then do harm to UE power saving. Hence, a flexible TRS feature without such restriction is preferred by us.** Or, maybe we may consider another alternative to address the concerns from both sides if the reserved code-pint of short message indicator is touchable i.e., Alt3: when the short message indicator is ‘00’, it means the update of TRS availability indication. |
| CMCC | The intention of this proposal is to avoid impact on legacy UE. Regarding Apple’s comments, although legacy UE will monitor paging PDCCH at its PO, UE will not detect a paging PDCCH with short message indicator value “00” in Rel-15/16, since gNB will not transmit the paging PDCCH with short message indicator value “00”. But if it is allowed that “TRS availability indication” provided in paging PDCCH with short message indicator value “00”, legacy UE may successfully decode the paging PDCCH which causes unnecessary power consumption. In addition, there may be spec impact on how to interpret the reserved short message indicator value “00”.  Regarding the selection between Alt 1 and Alt 2, we prefer Alt 2, since the “TRS availability indication” uses reserved bits in scheduling information not short message. In addition, considering the content of short message is defined in TS 38.331, if should be discussed in RAN2 if companies want to support it. |
| ZTE, Sanechips | (1)It should be first clarified that with the proposal whether it implies that  ①.NW has to indicate “TRS availability indication” of “1” when short message indicator is not “00”, or is “01”, or “11”.  ②gNB can transmit either “0” or “1” for “TRS availability indication” when short message indicator is not “00”, or is “01”.  (2)The TRS is aimed to be used by all the idle./inactive state UEs in the cell, while the paging DCI is transmitted per-PO. With the current proposal, it seems if the UEs of the PO#1 is paged, NW can indicate TRS presence for these UEs in PO#0. However, for the UEs in the PO#2 which are not paged, NW cannot indicate TRS availability indication, therefore, these UE can not use TRS for sync to detect the potential paging DCI in the following paging cycles.  (3)The paging PDSCH is located within the same slot with paging DCI, if UE receives indication of TRS availability via paging DCI, there is not time for UE to use TRS for sync for paging PDSCH detection.  Therefore, we think the restriction is not needed. |
| Nokia\_2 | It might simplest not to imply TRS availability indication in short message indication. As noted, TRS availability field would be present in any case when paging DCI is sent. |
| Samsung | We see the motivation that legacy UE may be confused if decodes a paging PDCCH successfully, but it doesn’t provide short message or scheduling information. If the group confirms that’s a critical issue, we are open to Alt1. |
| Qualcomm | There is a major implementation difference between the following cases   * Network does not send any paging PDCCH in paging PMO * Network sends paging PDCCH in paging PMO only with short message indicator “00”   For the second case, the UE not only decodes the PDCCH according to BD/CCE limit but also has to call software to parse the content of decoded PDCCH. For legacy UE, this causes additional operational overhead and processing delay (up to UE implementation but can be even longer than hardware PDCCH blind decoding) ending up discarding the decoded PDCCH after parsing the payload. We want to minimize the impact to legacy UE and hence Alt 1 or 2 should be adopted.  Regarding the consistency problem between paging PDCCH and PEI based TRS availability indication, the majority view looks there is no problem if inconsistent TRS indication is transmitted in paging PDCCH and PEI. Then the same thing applies here. I.e., no problem if TRS availability indication is not transmitted in both paging PDCCH and PEI in the same paging cycle.  Among Alt 1 and 2, we think it is clearly Alt 1 should be the choice because if network is already sending paging PDCCH to UE with short message indicator value equal to “10”, why this paging PDCCH can not carry TRS availability indication. The worst thing is this paging PDCCH only carries 0’s for the TRS availability indication field. Again, from the consistency discussion for PEI and paging PDCCH based TRS availability indication, major view thinks there is no problem for network to do that. Moreover, UE should be allowed to use the TRS to receive short message/SIB if such a TRS can be indicated available by the paging PDCCH. |
| LGE | We have similar understanding with Apple. We fail to understand the impact to legacy UEs by the TRS availability indication.  Also, it seems like Alt 1 cannot be a solution for the motivation. Current spec does not preclude paging DCI transmission with short message indicator of ‘00’ state. So paging DCI transmission with ‘00’ sate is not an error case.  For Alt 2, we believe that TRS availability indication can be conveyed by paging DCI with PDSCH scheduling and/or short message. Even when gNB transmit paging DCI with short message only indication but neither the SI update nor the ETWS/CMAS is indicated, the legacy UE can assume that reserved bits, where it does not have capability, might be used and no useful information for it is conveyed by the paging DCI. |
| Ericsson2 | OK with the proposal. |
| Intel | We suggest not to couple the features and keep them independent. |
| Moderator2 | To reply ZTE’s question, the proposal implies ②gNB can transmit either “0” or “1” for “TRS availability indication” when short message indicator is not “00”, or is “01” or ‘11’. The proposal indicates only, it’s meaningful for UE to parse the TRS availability indication field only if the condition of Alt1 or Alt2 is satisfied. The value of the TRS availability indication field depends on the actual availability information gNB wants to indicate.  **Motivation for the proposal:**   * To avoid impact on legacy UE. If “TRS availability indication” provided in paging PDCCH with short message indicator value “00”, legacy UE may successfully decode the paging PDCCH which causes unnecessary power consumption. For legacy UE, this causes additional operational overhead and processing delay (up to UE implementation but can be even longer than hardware PDCCH blind decoding) ending up discarding the decoded PDCCH after parsing the payload.   + CMCC, Vivo, QC * No problem if TRS availability indication is not transmitted in both paging PDCCH and PEI in the same paging cycle.   + QC * There may be spec impact on how to interpret the reserved short message indicator value “00”.   + CMCC   **Concerns for the proposal:**   * It will undoubtedly give rise to the potential inflexible for UE to apply the idle mode TRS resources, then do harm to UE power saving.   + Vivo, ZTE * if UE receives indication of TRS availability via paging DCI, there is not time for UE to use TRS for sync for paging PDSCH detection.   + ZTE * it is not very likely that the network would transmit a paging DCI just for the purpose of TRS availability indication, it does not seem necessary to have such restriction in the specs.   + Apple * TRS availability field would be present in any case when paging DCI is sent.   + Nokia   **Selection between Alt1 and Alt2:**   * Reasons to support Alt1:   + if network is already sending paging PDCCH to UE with short message indicator value equal to “10”, why this paging PDCCH can not carry TRS availability indication.     - QC * Reasons to support Alt2:   + since the “TRS availability indication” uses reserved bits in scheduling information not short message. In addition, considering the content of short message is defined in TS 38.331, if should be discussed in RAN2 if companies want to support it.     - CMCC   It seems more discussion is needed. Moderator suggests companies to check the summary above and further discuss the proposal in next round. |

5.3 <3rd round discussion>

**Issue 4-1: Impact to connected UE’s rate matching behaviour**

As summarized in moderator2, let’s further discuss the updated proposal 4-1(v2) in the third round.

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| **[3RD]**  **Proposal 4-1 (v2):**  *TRS-ResourceSetConfig* IE is not accounted in determination of available resource elements for PDSCH. |

**Please a) provide your views on whether or not to support Proposal 4-1 (v2) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Qualcomm, vivo, Huawei, HiSilicon, Nordic, ZTE, Sanechips, Samsung, Apple |
| No |  |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | The idle/inactive TRS is supposed to correspond to a connected mode UE’s TRS for Rel-17. If anything needs to be done for this TRS (e.g., rate matching, no PDSCH resource allocation in the TRS resource REs or configuring of the TRS), it should have been done when the TRS is configured to the connected mode UE. Then there is no need to repeatedly handle the idle/inactive TRS.  We think the following should be clarified.   * This proposal should be a conclusion * This means *TRS-ResourceSetConfig* IE for TRS configured for idle/inactive UEs has no spec impact to connected mode UE |
| Huawei, HiSilicon | Firstly, we support the proposal. I think the concern from Nokia is whether the original TP shall impact UE rate matching behavior if the same TRS resource is also configured for connected UE in RRC dedicated signaling. Therefore, we are fine to firstly agree the proposed proposal.  Regarding Qualcomm’s comments, if the group agrees that *TRS-ResourceSetConfig* does not impact connected mode UE’s rate matching, we prefer to capture it in the specification. The reason, which was also replied in our last round comment, is the existing 38.214 captures following description thinks [TRS-ResourceSet] belongs to the NZP CSI-RS resource defined in clause 7.4.1.5.3 TS 38.211, which is rate matched according to the following 211 description. Based on this we think a TP is any needed to resolve the issue.   |  | | --- | | In TS 38.214:  “Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter [*TRS-ResourceSet*] with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:” | | In TS38.211  - the corresponding resource elements in the corresponding physical resource blocks are  - not used for transmission of the associated DM-RS or DM-RS intended for other co-scheduled UEs as described in clause 7.4.1.1.2;  - not used for non-zero-power CSI-RS according to clause 7.4.1.5 if the corresponding physical resource blocks are for a PDSCH scheduled by a PDCCH with the CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI, or a PDSCH with SPS, except if the non-zero-power CSI-RS is a CSI-RS configured by the higher-layer parameter *CSI-RS-Resource-Mobility* in the *MeasObjectNR* IE or except if the non-zero-power CSI-RS is an aperiodic non-zero-power CSI-RS resource |   Some replies to the discussion in the last round:   |  | | --- | | * **C3**: whether connected mode UE can use TRS occasions of IDLE mode UE is UE implementation?   + Apple   HW&HiSi: our understanding is like this. And we proposed to add a note to capture this in the proposal by moderator. |   It seems more discussion is needed. Moderator suggests companies to check the summary above and further discuss the proposal in next round.   |  |  | | --- | --- | | * **C5**: Then network should have already taken care of this TRS by rate matching or avoiding collision with PDSCH for connected and idle/inactive mode UEs, and network should have already configured this TRS resource set to connected mode UEs for T/F tracking purpose if it is useful. So we object to further discuss/conclude anything related to connected mode UE or overlapping with PDSCH.   + QC   HW&HiSi: As we commented above, there needs a TP to clarify that TRS-resource for IDLE mode UE should not impact connected UE’s rate matching.  As Qualcomm’s comments that TRS-resource should be configured to connected mode UE anyway for T/F tracking, however, we have the following conclusion agreed in RAN1#102 that it is up to gNB to share or not share the TRS resource for IDLE mode with connected 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).**  ……skipped bullets…… |   Based on the above discussions, we suggest the following update to resolve companies’ concern:  **Proposal 4-1 (v2):**  *TRS-ResourceSetConfig* IE is not accounted in determination of available resource elements for PDSCH.   * Note: It is up to UE implementation on whether connected mode UE can use TRS occasions of IDLE mode UE. |   We are fine to discuss the TP as a next step, however the following update seems can resolve Nokia’s concern. Could we adopt it if there is no issue for the TP.  ------------------------------------------ Start of Text Proposal 2 revised-----------------------------------------  < Unchanged parts are omitted >  **7.3.1.5 Mapping to virtual resource blocks**  The UE shall, for each of the antenna ports used for transmission of the physical channel, assume the block of complex-valued symbols conform to the downlink power allocation specified in [6, TS 38.214] and are mapped in sequence starting with to resource elements in the virtual resource blocks assigned for transmission which meet all of the following criteria:  - they are in the virtual resource blocks assigned for transmission;  - the corresponding physical resource blocks are declared as available for PDSCH according to clause 5.1.4 of [6, TS 38.214];  - the corresponding resource elements in the corresponding physical resource blocks are  - not used for transmission of the associated DM-RS or DM-RS intended for other co-scheduled UEs as described in clause 7.4.1.1.2;  - not used for non-zero-power CSI-RS according to clause 7.4.1.5 if the corresponding physical resource blocks are for a PDSCH scheduled by a PDCCH with the CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI, or a PDSCH with SPS, except if the non-zero-power CSI-RS is a CSI-RS configured by the higher-layer parameter *CSI-RS-Resource-Mobility* in the *MeasObjectNR* IE or except if the non-zero-power CSI-RS is an aperiodic non-zero-power CSI-RS resource or except if the non-zero-power CSI-RS is TRS resources configured via *TRS-ResourceSetConfig* in SIB and not provided in *NZP-CSI-RS-Resource*;  - not used for PT-RS according to clause 7.4.1.2;  - not declared as 'not available for PDSCH according to clause 5.1.4 of [6, TS 38.214].  The mapping to resource elements allocated for PDSCH according to [6, TS 38.214] and not reserved for other purposes shall be in increasing order of first the index over the assigned virtual resource blocks, where is the first subcarrier in the lowest-numbered virtual resource block assigned for transmission, and then the index .  ------------------------------------------ End of Text Proposal 2------------------------------------------ |
| LGE | First, we are fine with the proposal in principle. From connected mode UE perspective, we tend to agree with Huawei that some kind of clarification is required to avoid misunderstanding.  Regarding PDSCH for idle/inactive UEs,  we realized that TP for this clause would not be required for PDSCH of idle/inactive UEs. However, we think the proposal 4-1(v2) shall be applied to PDSCH for idle/inactive mode UE as well. As we mentioned so far, we are not suggesting rate matching on PDSCH for IDLE mode UE. We also think backward compatibility should be considered for UEs that cannot assume TRS availability in idle/inactive mode UEs. Our suggestion is to apply RE level puncturing (or zero-power PDSCH RE). Is seem like there are some companies who think TRS overlap with PDSCH for idle/inactive UE can be avoided by gNB implementation. However we have different understanding. First, when UE gets information on a reference signal and the reference signal can be overlapped with other signals/channels, UE shall have clear assumption on the reception at the overlapped REs. It is very natural specification work and not a kind of matter that can be solved by gNB implementation. Morover, gNB may not avoid potential collision between TRS and paging PDSCH for idle/inactive UEs, especially when PO is deployed with high density. So we hardly believe that the overlapping problem can be avoided by gNB implementation. |
| Nokia\_3 | Fine with the proposed conclusion, and if companies feel that something needs to be captured, maybe the wording could be like:  [lot of text omitted]  … or except if the non-zero-power CSI-RS is TRS resources configured only via *TRS-ResourceSetConfig* in SIB. |
| Ericsson3 | OK with the proposed conclusion, and just to clarify, our understanding is that this applies to all PDSCHs and not just for connected mode (as the issue title seems to suggest). |
| Apple | We agree that PDSCH rate matching should not be affected by TRS-ResourceSetConfigu for both connected and idle/inactive UEs. |

**Issue 4-2: Condition for transmit TRS availability indication in paging PDCCH reception**

Please check the summary in Moderator2 for clarifications based on 2nd round discussion. Let’s further discuss proposal 4-2(v1) in the third round.

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| **[3RD]**  **Proposal 4-2 (v1):**  TRS availability indication is provided in paging PDCCH only when   * Alt1: short message indicator is not ‘00’ * Alt2: short message indicator is ‘01’ or ‘11’ |

**Please a) provide your views on whether or not to support Proposal 4-2 (v1) below:**

|  |  |
| --- | --- |
| **Support** | **Companies** |
| Yes | Qualcomm |
| No | vivo, Nordic, ZTE, Sanechips, LGE, intel |

**and, b) provide additional comments, if any, below**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | First, we support the principle of this proposal to avoid impact to legacy UEs. The impact to legacy UEs is really unpredictable. We have to explicitly avoid dummy paging PDCCH with short message indicator = ‘00’ to be intendedly sent for TRS availability information to the legacy UEs. Because of this, we could compromise to accept the following proposal so that paging PDCCH and PEI based TRS availability indication are not always exactly synchronized.  **Conclusion 1-3 (v3)**  A UE can receive different TRS availability indication content from PEI and associated paging PDCCH.   * Note: UE is not required to receive both PEI and paging PDCCH in the same paging cycle to receive TRS availability indication   Between Alt 1 and Alt 2, Alt 1 should be selected because if network has already sent a paging PDCCH to UE even with short message indicator = ‘10’, there is no reason why network cannot include TRS availability information in the reserved bits. The worst case is the only 0 bits are used for TRS availability information. But if there is TRS newly becomes available, it can help UE to receive the updated SIB, and network should indicate the TRS for UE in the paging PDCCH. |
| vivo | We agree with the intention that we should to avoid impact to legacy UE. However, this restriction will cause that TRS availability indication based on paging PDCCH can only be enabled when PEI indicate UE to wake up (if PEI is configured) or when UE is paged (if PEI is not configured). It will undoubtedly give rise to much inflexibility of paging PDCCH based TRS availability indication, and do harm to UE power saving. Hence, a flexible and independent TRS feature (i.e., without such restriction) is preferred by us. Given that, we suggest to use the code-point ‘00’ of the short message indicator to represent the update of TRS availability indication, which can address the concerns from both sides, despite there may be some spec impact. |
| Huawei, HiSilicon | According the comments in the last round, it seems there are companies think dedicated paging DCI should be allowed, therefore, paging DCI with short message indicator of “00” should be allowed. However, we think even if “00” of short message indicator is not allowed, gNB could still use paging DCI with short message indicator of “10” to be used as dedicated TRS availability indication with short message itself set to “0”s. So, it seems the newly usage of paging DCI with short message indicator of “00” is not needed/justified, and it would be good for the network to keep this reserved DCI for other purpose in future.  Now, for Alt.1 and Alt.2, we think the basic difference is whether paging DCI with short message only could also carry “TRS availability indication”, which seems support and not support dedicated paging DCI for “TRS availability indication”. We don’t agree to use the reserved state of “00”, but we are either fine with Alt.1 and Alt.2. |
| ZTE, Sanechips | As we commented before, the paging PDSCH is located within the same slot with paging DCI, if UE receives indication of TRS availability via paging DCI, there is no time for UE to use TRS for sync for paging PDSCH detection.  Moreover, the TRS is aimed to be used by all the idle./inactive state UEs in the cell, while the paging DCI is transmitted per-PO. With the current proposal, it seems if the UEs of the PO#1 is paged, NW can indicate TRS presence for these UEs in PO#0. However, for the UEs in the PO#2 which are not paged, NW cannot indicate TRS availability indication, therefore, these UEs can not use TRS for sync to detect the potential paging DCI in the following paging cycles.  To this end, we think the proposal is not needed. |
| LGE | According to the TS38.212, UE can assume short message indicator = 00 is defined as “reserved”. When it is indicated, legacy UEs can assume that paging PDCCH does not contain any information for them. So we does not think the legacy UEs will be impacted by the “short message indicator = 00”.  Also, there is no reason to preclude indicating TRS availability when short message indicator = 10. Recall that one of the advantage from using paging DCI for TRS availability indication is resource overhead saving. If there is any paging PDCCH transmission that gNB needs to transmit, it would be worth indicating TRS availability even if only short message is present in the DCI. |
| Nokia\_3 | As noted the L1 availability indication resides in ‘reserved’ bits so not sure if anything specific is needed, but if companies feel strongly that this needs to be accounted, then Alt1 would seem most natural. |
| Samsung | We understand the motivation to avoid impact on legacy UE. But we think it’s not a critical issue. Legacy UE should expect the reserved bits in paging PDCCH can be used for new design in future release.  We don’t support to use “00” to indicate TRS availability indication. TRS availability indication can be transmitted regardless of the value for short message indicator. |
| Ericsson3 | Since PEI DCI can carry TRS availability field always, e.g. to wake up UE for monitoring PO for all three cases (for Paging PDSCH only, for short message only, and both), an option is to let Paging DCI always carry TRS availability field. Otherwise, Alt 1 could be considered. |
| Apple | We still do not quite understand the motivation to introduce such a limitation (either Alt 1 or Alt 2). Without Alt 1 or 2, there may be a DCI message that is dedicated to TRS availability indication (using ‘00’). The impact on legacy UE, as far as we can tell, is that the UE decodes a paging DCI with ‘00’ and the UE would ignore it anyway. So we don’t really see any harm done. |

# Proposals for GTW handling

6.1 <GTW on 02/23>

The following proposals are suggested for GTW handling on Feb, 23th, Wednesday.

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| **Proposal 1-1 (v1): Support the following TP for CR of TS 38.213**.  10.4B Indication of TRS resources  A UE in RRC\_IDLE state or RRC\_INACTIVE state can be provided by *TRS-ResourceSetConfig* a set of TRS occasions [6, TS 38.214]. If *TRS-ResourceSetConfig* is provided, a DCI format 2\_7 if configured ~~or~~ and a DCI format 1\_0 with CRC scrambled by P-RNTI includes ~~a~~ the TRS availability indication field [4, TS 38.212] that provides a bitmap to groups of TRS resource sets where the configuration of each TRS resource set includes an association to a bit of the bitmap. The UE can be additionally provided a multiple, by *validityDuration*, for a number of frames provided by *defaultPagingCycle* for TRS resource sets with indicated presence; if *validityDuration* is not provided, the multiple is equal to 2.  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap ~~is ignored by the UE~~ indicates that the UE keeps existing assumption of the availability or unavailability of associated TRS resource sets. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  **Proposal 3-1 (v1):**  Support the following TP for CR of TS 38.214.  5.1.6.1.1 CSI-RS for tracking  <omitted text>  Each NZP CSI-RS resource, defined in Clause 7.4.1.5.3 of [4, TS 38.211], is configured by the higher layer parameter *TRS-ResourceSet* with the following restrictions for a UE in RRC\_IDLE or RRC\_INACTIVE:  - the number of periodic NZP CSI-RS resources configured by a *TRS-ResourceSet* is given by *numberOfresources*  - the time-domain locations of the two CSI-RS resources in a slot, or of the four CSI-RS resources in two consecutive slots (which are the same across two consecutive slots), is one of  - , , or for frequency range 1 and frequency range 2,  - , , , , ,  or  for frequency range 2.  - where the first symbol location in a slot is indicated by *firstOFDMSymbolInTimeDomain* in the *TRS-ResourceSet* and the second symbol location in a slot is *firstOFDMSymbolInTimeDomain +* 4  - a single port CSI-RS resource with density  given by Table 7.4.1.5.3-1 from [4, TS 38.211]*.*  - the bandwidth and the frequency location of the NZP CSI-RS resource, is given by the higher layer parameter *nrofRBs*, *startingRB* and *frequencyDomainAllocation* in a *TRS-ResourceSet* and applies to all resources in a *TRS-ResourceSet*. ~~The frequencyDomainAllocation configuration is~~ Bandwidth, *nrofRBs*, and the initial CRB index, *startingRB*, of the NZP CSI-RS resource configured by *TRS-ResourceSet* are not restricted by initial DL BWP.  - UE is not required to receive TRS occasions outside the initial DL BWP.  - the periodicity for periodic NZP CSI-RS resources, is given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet*, is one of slots where 10, 20, 40, or 80 and where µ is defined in Clause 4.3 of [4, TS 38.211], applies to all resources in a *TRS-ResourceSet*. The slot offset given by the higher layer parameter *periodicityAndOffset* configured b*y* a *TRS-ResourceSet* provides the location of the first slot containing the periodic NZP CSI-RS resources configured by b*y* a *TRS-ResourceSet.*  - the UE does not expect the *TRS-ResourceSet* to be configured with the periodicity of  slots if the bandwidth of NZP CSI-RS resource is larger than 52 resource blocks.  - the UE may assume the sub-carrier spacing of the NZP CSI-RS resources configured by *TRS-ResourceSet* to be same as the sub-carrier spacing of the initial DL BWP.  - *powerControlOffsetSS* given bya *TRS-ResourceSet* applies to all resources in a *TRS-ResourceSet*.  - the QCL information for periodic NZP CSI-RS resources, is given by the higher layer parameter *ssb-Index* configured by a *TRS-ResourceSet*, is a SS/PBCH block, applies to all resources in a *TRS-ResourceSet*.  - One or more *scramblingIDs* where if a single *scramblingID* is configured, it applies to all NZP-CSI-RS resources in the resource set, otherwise, each NZP-CSI-RS resource is provided with a *scramblingID*.  - the UE may assume the following quasi co-location type(s):  - 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block.  For each *TRS-ResourceSet* the index of the associated bit in TRS availability indication field [5, TS 38.212], is given by the higher layer parameter *indBitID*.  <omitted text>  **Conclusion 1-4 (v1)**  No consensus to support   * 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   **Conclusion 3-2 (v2):**  No consensus to support:   * Reduced maximum number of configured TRS resource sets for FR1.   **Conclusion 2-2(v1)**  No consensus to support   * For PEI based availability indication, the reference time of the start of validity duration follows the reference time for associated monitoring occasion for the paging DCI.   **Proposal 2-2 (v2)**  The current default DRX cycle used for determining the reference point for start of validity duration for an availability indication is down-selected from the following in RAN1#108-e:   * Alt1: the current default DRX cycle is associated with the PDCCH MO where UE receives the availability indication, i.e. previous agreement. * Alt2: the current default DRX cycle is associated with the first PDCCH MO of the PO/PEI-O where UE receives the availability indication.   **Proposal 2-1 (v1): Support the following TP for CR of TS 38.213**.  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the first frame of the default DRX cycle that includes a PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  **Conclusion 1-3 (v2)**  A UE can receive different TRS availability indication content from PEI and associated paging PDCCH. |

6.2 <GTW on 02/25>

The following proposals are suggested for GTW handling on Feb, 53th, Friday.

# Conclusion

The following agreements were made in this meeting.

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| **Conclusion 1-3 (v3)**  A UE can receive different TRS availability indication content from PEI and associated paging PDCCH.   * Note: UE is not required to receive both PEI and paging PDCCH in the same paging cycle to receive TRS availability indication   **Conclusion 2-2(v1)**  No consensus to support   * For PEI based availability indication, the reference time of the start of validity duration follows the reference time for associated monitoring occasion for the paging DCI.   **Proposal 2-2a (v3)**  The current default DRX cycle used for determining the reference point for start of validity duration for an availability indication is down-selected from the following in RAN1#108-e:   * Alt1: the current default DRX cycle is associated with the PDCCH MO where UE receives the availability indication, i.e. previous agreement.   + Adopt TP#1 if Alt1 is down-selected * Alt2: the current default DRX cycle is associated with the first PDCCH MO of the PO/PEI-O where UE receives the availability indication.   + Adopt TP#2 if Alt1 is down-selected   ============================= start of TP#1==========================================  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame of the DRX cycle that includes ~~a~~ the PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#1==========================================  ============================= start of TP#2==========================================  10.4B Indication of TRS resources  \*\*\* Unchanged text is omitted \*\*\*  A value of '1' for a bit of the bitmap indicates presence of associated TRS resource sets for the multiple of the number of frames, starting from a SFN determined from [17, TS 38.304] that corresponds to the frame of the DRX cycle associated with the first PDCCH MO of the PEI-O or PO that includes ~~a~~ the PDCCH providing the DCI format 2\_7, or the DCI format 1\_0 with CRC scrambled by P-RNTI, with the TRS availability indication field indicating the TRS resource sets, where is provided by *defaultPagingCycle*. A value of '0' for a bit of the bitmap is ignored by the UE. A UE can receive first and second PDCCHs that provide DCI format 2\_7 or DCI format 1\_0 with CRC scrambled by P-RNTI that indicate presence of TRS resource sets for the multiple of the number of frames, where the second PDCCH reception after the first PDCCH reception by a time that is smaller than the multiple of the number of frames.  \*\*\* Unchanged text is omitted \*\*\*  ============================= end of TP#2==========================================  **Proposal 2-2b (v1)**  Down-select Alt1. |

# References

[1][R1-2200945](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2200945.zip) Remaining issue on assistance TRS occasions for IDLE/inactive mode Huawei, HiSilicon

[2][R1-2201102](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201102.zip) Remaining issues on TRS/CSI-RS occasion(s) for idle/inactive UEs vivo

[3][R1-2201131](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201131.zip) Remaining issues of TRS for RRC idle and inactive UEs ZTE, Sanechips

[4][R1-2201281](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201281.zip) Further discussion on RS occasion for idle/inactive UEs OPPO

[5][R1-2201371](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201371.zip) Remaining issues of TRS/CSI-RS for paging enhancement CATT

[6][R1-2201485](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201485.zip) Discussion on TRS/CSI-RS occasion for idle/inactive Ues NTT DOCOMO, INC.

[7][R1-2201552](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201552.zip) Discussion on TRS/CSI-RS occasion(s) for idle/inactive UEs Spreadtrum Communications

[8][R1-2201642](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201642.zip) Remaining issues on enhancements for TRS/CSI-RS occasion(s) for idle/inactive UEs Panasonic

[9][R1-2201706](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201706.zip) Discussion on the remaining details of TRS/CSI-RS occasions in idle/inactive time Intel Corporation

[10][R1-2201778](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201778.zip) Remaining issues on indication of TRS configurations for idle/inactive UEs Apple

[11][R1-2201866](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201866.zip) Remaining issues on TRS/CSI-RS occasion(s) for idle/inactive UEs CMCC

[12][R1-2201918](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2201918.zip) Remaining issues on TRS/CSI-RS configuration and indication for idle/inactive UEs Xiaomi

[13][R1-2202023](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202023.zip) Maintenance on TRS/CSI-RS occasion(s) for idle/inactive UEs Samsung

[13][R1-2202069](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202069.zip) Maintenance on TRS/CSI-RS Information for idle/inactive UEs MediaTek Inc.

[14][R1-2202149](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202149.zip) Remaining issues on idle and inactive TRS Qualcomm Incorporated

[15][R1-2202195](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202195.zip) Remaining issues on TRS/CSI-RS occasions for idle/inactive UEs Sharp

[16][R1-2202217](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202217.zip) Maintenance for TRS occasion provisioning for Idle/Inactive UEs Ericsson

[17][R1-2202248](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202248.zip) Remaining issues on TRS/CSI-RS occasions for idle/inactive UEs InterDigital, Inc.

[18][R1-2202329](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202329.zip) Open issues on n TRS information forto IDLE/INACTIVE mode UEs Nokia, Nokia Shanghai Bell

[19][R1-2202347](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202347.zip) Discussion on TRS/CSI-RS occasion(s) for idle/inactive UEs LG Electronics

[20][R1-2202385](file:///C:\Users\qiongjie.l\AppData\Local\Docs\R1-2202385.zip) On TRS design for idle/inactive UEs Nordic Semiconductor ASA

# Appendix: Previous 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. |

## 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. |

## RAN1#104b-e

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| Agreement:  SCS of TRS/CSI-RS occasion(s) for idle/inactive UEs is same as SCS of CORESET#0.  Agreement:  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   Agreement:  IDLE/INACTIVE mode UE is not expected to receive TRS/CSI-RS outside the initial DL BWP.   * Configuration of the frequency location of TRS/CSI-RS occasion(s) for idle/inactive UEs is not restricted by initial BWP.   Working assumption:  Support at least L1 based signaling for the availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UEs.   * FFS details, including paging DCI and/or PEI for L1 based signaling * FFS SIB-based signaling/configuration   + Note: It is RAN1 understanding that existing SI update procedure is used for SIB based signalling   To further check on 4/19  Agreement:  Configuration for TRS/CSI-RS occasion(s) for idle/inactive UEs is based on periodic TRS only, including following limitations   * Configuration parameters that are necessary to provide configuration of periodic TRS for idle/inactive UEs * Applicable values that are necessary to provide configuration of periodic TRS for idle/inactive UEs * If the configuration is provided, idle/inactive UEs can always implicitly assume that trs-info is configured.   + The parameter trs-info does not need to be provided in the configuration   Agreement:  For the information provided by a physical layer availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UEs, one or more alternatives from the following can be supported:   * Alt1: Availability/unavailability information for all or some of configured RS resources using a bitmap or codepoint * e.g. using bitmap, where each bit ~~from a bitmap or a codepoint~~ is associated with at least one resource~~/configuration~~ or a set/group of resources * e.g. a codepoint to indicate a state of availability/unavailability for all or some of configured RS resources * Alt2: value or codepoint to indicate one or more resource/configuration indices that correspond to the available RS resources * FFS whether and how to indicate the ‘availability’ in beam selective manner. * Other alternatives are not precluded |

## RAN1#105-e

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| Agreement:  Confirm the following working assumption:  Support at least L1 based signaling for the availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UEs.   * FFS details, including paging DCI and/or PEI for L1 based signaling * FFS SIB-based signaling/configuration   + Note: It is RAN1 understanding that existing SI update procedure is used for SIB based signalling     Agreement:  For the information provided by a physical layer availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UEs, support availability/unavailability information for configured RS resources using a bitmap or codepoint   * e.g. using bitmap, where each bit is associated with at least one resource/configuration or a set/group of resources * e.g. a codepoint to indicate a state of availability/unavailability for all or some of configured RS resources * FFS maximum number of configured RS resources per physical layer availability indication to support. * FFS whether availability/unavailability information is for all or some of configured RS resources     Agreement:  Support applicable values for the following configuration parameters as below.   * powerControlOffsetSS: {-3, 0, 3, 6}dB * scramblingID: 0 to 1023 * firstOFDMSymbolInTimeDomain: 0 to 9   + firstOFDMSymbolInTimeDomain indicates first symbol in a slot, a second symbol in the same slot can be derived implicitly with symbol index as firstOFDMSymbolInTimeDomain+4 * startingRB: 0 to 274 * nrofRBs: 24 to 276     Agreement:  The QCL information of TRS/CSI-RS occasion(s) for idle/inactive UEs is indicated as a SSB index in range of 0 to 63.   * FFS: how the QCL information can be configured, e.g. per RS resource set or per configuration * FFS: QCL type, which is predetermined   **Working assumption:**  Support paging PDCCH based availability indication of TRS/CSI-RS occasions for idle/inactive UEs.  Support PEI based availability indication of TRS/CSI-RS occasions for idle/inactive UEs at least if PDCCH-based PEI is down-selected.   * FFS ~~whether and~~ how to enable/disable L1 based availability indication configurable by SIB   Agreement:  Configuration of TRS/CSI-RS occasion(s) for idle/inactive UEs include:   * periodicityAndOffset {10, 20, 40, 80} ms * frequencyDomainAllocation for row1 with applicable values from {0, 1, 2, 3} to indicate the offset of the first RE to RE#0 in a RB * FFS Configuration index   + details,     - E.g. Per resource or resource set or group of resource sets     - E.g. explicit or implicit indication based on QCL source   Agreement:  Further study supporting SIB based signaling for availability information of TRS/CSI-RS occasions for idle/inactive UEs at least based on the presence/absence of the configuration of the TRS/CSI-RS occasion in SIB\_X in case L1 based availability indication is not configured.   * FFS whether and how SIB based signaling and L1 based signaling can be configured simultaneously |

## RAN1#106-e

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| Agreement  Support at least one of the following alternatives   * Alt1: L1 availability indication at an occasion provides availability/unavailability information only for RS resources with the same QCL reference as the L1 availability indication occasion. * Alt2: L1 availability indication at an occasion can provide availability/unavailability information for RS resources with QCL references not confined to be the same as for the L1 availability indication occasion   Note:  The occasion mentioned above refers to a signal/channel monitoring occasion (e.g. a paging PDCCH or PEI monitoring occasion) to provide the L1 availability indication.  Note: a RS resource is a RS from configured TRS/CSI-RS occasion(s) for idle/inactive UEs., where the configuration for TRS/CSI-RS occasion(s) for idle/inactive UEs is based on periodic TRS only.  Agreement  L1 based availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UEs is valid for a time duration starting from a reference point, where   * the time duration can be determined based on at least one from the following (to be down-selected):   + Alt-1: configured by higher layer   + Alt-2: a predefined/configured window   + Alt-3: value indicated by the availability indication, where the value is one of multiple configured time duration(s)   + Alt-4: until when the UE receives another availability indication   + A combination of alternatives or other alternatives is not precluded. * the reference point can be determined as at least one from the following (to be down-selected):   + Alt-1: start of next PO or DRX cycle   + Alt-2: time location where UE receives the indication     - Note: the time location is subject to application delay if agreed   + Alt-3: start of current PO or DRX cycle where UE receive the indication   + Alt-4: a time location which is configured by higher layer   + A combination of alternatives or other alternatives is not precluded.   **Agreement**  For a RS resource configured for TRS/CSI-RS occasion(s) for idle/inactive UEs, a quasi co-location type can be determined as   * + ‘typeC’ with an SS/PBCH block and, when applicable, ‘typeD’ with the same SS/PBCH block |

## RAN1#106bis-e

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| Conclusion  No consensus to support SIB based signaling for availability information of TRS/CSI-RS occasions for idle/inactive UEs  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 availabilityinformation 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     **Agreement**  At least for paging PDCCH based L1 availability indication of TRS/CSI-RS at the configured occasion(s) to the idle/inactive UEs, the L1 availability indication is valid for a time duration starting from a reference point, where   * the time duration is a validity duration configured by higher layer,   + FFS applicable values, e.g. # of DRX cycles, or multiple of default paging cycle duration (i.e. modification period)   + FFS UE doesn’t expect inconsistent L1 based indication during the time duration * the reference point for start of the validity duration is one of the following alternatives:   + Alt1: SFN of the first PF from the next DRX cycle   + Alt2: SFN of the first PF from the current DRX cycle where UE receives the indication   + Alt3: based on SFN configured by higher layer, i.e. modification period configured as multiple of default paging cycle duration   + Alt4: start of the PF for the PO where UE receives the indication   + Note: the DRX cycle in Alt1 and Alt2 is the default paging cycle broadcast in SIB   + Note: The SFN for the first PF is ~~for (UE mod N) = 0, and can be~~ calculated by (SFN + PF\_offset) mod T = 0 * the time duration can be optionally configured by gNB   + when the time duration is not configured, one of the following alternatives can be considered:     - Alt1: the availability indication is valid until when the UE receives another availability indication.     - Alt2: the availability indication is valid until L1 availability indication is changed by network     - Alt3: default time duration e.g. default paging cycle * FFS whether and how to handle the miss detection issue of L1 signaling   **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 TRSin R15/16. |

## RAN1#107-e

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| **Agreement**  For the maximum number of TRS resource sets configured by higher layer, X,   * X = 64 * FFS: the number of configured TRS resource sets is not larger than the number of actual transmitted SSBs determined according to ssb-PositionsInBurst in SIB1   **Agreement**  For L1 availability indication using a bitmap, the following is supported:   * Number of bits in the bitmap, N, is up to 6 bits * a bit is associated with a group of TRS resource sets. The associated TRS resource sets for each bit can be based on   + explicit configuration of TRS resource set group, where     - each TRS resource set is configured with a ID i, with value from {0, …, N-1}, for the association with an indication bit in TRS availability indication field.     - the ith bit maps to all the TRS resource set(s) associated with ID *i*. * start of the bitmap is the first bit of the reserved bits in paging PDCCH * Note: It is left to RAN2 decision on whether explicit parameter is used for N or it can be implicitly determined by the TRS resource set configurations.   **Agreement**  The reference point for start of the validity duration is SFN of the first PF from the current default DRX cycle where UE receives the availability indication   * FFS: Whether the availability indication is transmitted [only once] during the validity duration   **Note: Qualcomm and Huawei have concern on Alt a**  **Agreement**  For the validity duration configured by higher layer at least for paging PDCCH based L1 availability indication, support   * time unit is one default paging cycle, * applicable values: {1, 2, 4, 8, 16, 32, [64], [128], [256],[512]}   When the validity duration is not configured, UE assumes a default time duration to be 2 default paging cycle(s):  **Agreement**  Confirm the following working assumption  Working Assumption   * Support paging PDCCH based availability indication of TRS/CSI-RS occasions for idle/inactive UEs. * Support PEI based availability indication of TRS/CSI-RS occasions for idle/inactive UEs at least if PDCCH-based PEI is down-selected. |

## RAN1#107bis-e

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| Agreement  Support a configuration parameter for the number of, X, TRS resources for a TRS resource set at least for FR2   * Applicable values for X: {2, 4} * For FR1, X is based on configuration parameter with applicable value {2, 4}   Note: Configuration follows restriction specified in sub-clause 5.1.6.1.1 in TS38.214 for connected mode TRS  Agreement  One or more scrambling IDs is configured for a TRS resource set.   * If a single scrambling ID is configured, it applies to all the TRS resources. * Otherwise, each TRS resource is provided with a scrambling ID.   Agreement  The applicable values:{64, 128, 256, 512} are supported for the validity duration configured by higher layer.   * Note: If UE is provided a configuration of validity duration longer than 10.24s, and the UE does not support eDRX, it is up to UE implementation whether to assume the validity duration length is no larger than 10.24s   Agreement  UE can receive L1 based signaling for TRS availability indication before the expiration/end of validity duration associated with previous L1 based signaling for TRS availability indication   * For each bit indicated as ‘1’ in the availability indication field of the current L1 based signaling, the UE assumes the corresponding TRS resource set(s) are available from the reference point until the end of the validity duration associated with the current L1 based signaling. * For each bit indicated as ‘0’ in the availability indication field of the current L1 based signaling, the UE keeps the existing assumption on the availability or unavailability of the corresponding TRS resource set(s).   Note: the validity duration for different group of TRS resources sets correspond to different bits in the availability indication field can be different and are maintained independently.  Note: CATT has concern on the power saving gain based on this agreement.  Agreement  Confirm the following working assumption  If TRS resource is configured in SIB, L1 based availability indication is always enabled based on the configuration.  Agreement  The parameter of *periodicityAndOffset* is used to determine the location of the first slot of TRS resource set.  Agreement  If SIB configures TRS resource, TRS availability indication field is present in DCI format 2\_7 (if configured) with CRC scrambled by PEI-RNTI and DCI format 1\_0 with CRC scrambled by P-RNTI. |