**3GPP TSG-RAN WG4 Meeting # 104-e R4-22XXXXX**

**Electronic Meeting, 10 – 19 Octbor 2022**

**Agenda item:** 8.1.1

**Source:** Moderator (Apple)

**Title:** Email discussion summary for [104-bis-e][227]LS\_reply

**Document for:** Information

# Introduction

This email thread treats the following topic in agenda item 8.1.1

1. Time difference for MIMO with two TAs (R1-2205593)

It is appreciated that the delegates for this topic put their contact information in the table below.

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
|  |  |  |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: Title

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc**  | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2215461**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215461.zip) | Further discussion on Maximum uplink timing difference for multi-DCI multi-TRP with two Tas | Xiaomi | **Observation 1: The Rel-16 eMIMO agreement on that no core RRM requirement impact on MRTD and MTTD requirements for m-TRP transmission for intra-band CA is based on the RTD is within CP which is agreed by RAN1.****Observation 2: With the two TA assumption, the within CP assumption should not be kept.****Observation 3: The propagation delay difference has played a large role on the MRTD and corresponding MTTD requirement.****Proposal 1: The propagation difference can be considered for intra-band non-collocated case as the inter-band CA.****Proposal 2: For inter-cell m-TRP case, the current inter-band CA MTTD requirement can be reused.** |
| [**R4-2215614**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215614.zip) | On R18 eFeMIMO - MTTD for multi-DCI mult-TRP with two TAs | Apple | **Observation 1: existing MRTD requirements only apply for cells on different carriers and cannot apply among different TRPs on the same carrier.****Observation 2: existing MTTD requirements only apply for cells on different carriers and cannot apply among different TRPs on the same carrier.****Proposal 1: for both intra-cell and inter-cell multiple TRPs, the maximum uplink transmit timing difference between multiple TRPs can be assumed within a CP length.** |
| [**R4-2216290**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216290.zip) | On maximum uplink timing difference for multi-DCI multi-TRP with two Tas | Huawei, HiSilicon | ***Proposal 1: The existing MRTD/MTTD requirements in section 7.5 and 7.6 of TS38.133 only define the timing difference limitation between different CCs for CA or DC operations, not define the timing difference limitation between different TRPs on the same CC for MIMO case.******Proposal 2: For both intra-cell and inter-cell cases, the UL transmit timing difference value for multiple TRPs can be derived from the DL receive timing difference for multiple TRPs, where TTD = RTD + implementation margin.******Proposal 3: In R18, the maximum uplink transmit timing difference between multiple TRPs can be assumed as (RTD + 1.6us) for FR1 and (RTD + 0.5us) for FR2, where RTD is the maximum DL receive timing difference assumed in R18 multi-Rx chain DL reception WI.*** |
| [**R4-2216368**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216368.zip) | Discussion on maximum uplink timing difference for multi-DCI multi-TRP with two TAs | vivo | **Observation 1 The 2 TA enhancements for TDM based multi-DCI uplink transmission can be applicable to:*** **FR1 UE**
* **FR2 UE, probably with the simultaneous different QCL-D Rx capability, but is only able to Tx from one panel.**

**Observation 2 The 2 TA enhancements for simultaneous multi-DCI uplink transmission can be applicable to:*** **FR2 UE that is capable of Tx from 2 different panels.**

**Observation 3 For simultaneous Rx with different UE panels, the RTD assumption is being discussed in R18 multi-Rx chain WI.****Observation 4 From RAN4 RRM perspective, for TDM based multi-DCI uplink transmission, considering the worst case, the minimal separation between the two UL transmissions associated with two TAs should not be less than the transient period specified in RF specs. Overlapping between UL transmission is not allowed.****Proposal RAN4 to provide RAN1 with the following additional feedback for the LS*** **For FR1 UE, or for FR2 UE which is only able to Tx from one panel at a time, only TDM based multi-DCI uplink transmission can be supported by the UE. Considering the worst case, the Tx timing difference between two UL transmissions associated with different TAs should meet the restriction that the minimal separation between the two UL transmissions at UE side should not be less than the transient period specified in RF specs.**
* **For FR2 UE that is capable of simultaneous Tx from 2 different panels, RAN4 postpone the discussion until the RTD assumption is concluded in R18 multi-Rx chain WI.**
 |
| [**R4-2216410**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216410.zip) | Multiple TA for multi-TRP deployments limits | InterDigital  | ***Observation 1:*** *With the current cell phase accuracy requirement of 3us, the reception within a CP cannot be assumed for the inter-cell mTRP scenario in FR2.****Observation 2:*** *For NR inter-band CA within FR2 the maximum receive time difference defined in 38.133 specification is 8us.****Observation 3:*** *The simultaneous Rx/Tx for mTRP inter-cell or intra-cell along with a specific MRTD/MTTD may be part of UE capabilities.****Observation 4:*** *If TAE for intra-carrier case applicable requirement of 65ns or intra-band contiguous CA with or without MIMO of 260ns, then within CP reception may be feasible as is.****Proposal 1:*** *For inter-cell m-TRP with two TAs Maximum Transmit Time Difference limits adopt NR inter-band CA cases as baseline.****Proposal 2:*** *RAN4 to study if MIMO (OTA) requirements for TAE are applicable and which one is valid for intra-cell mTRP MRTD starting point for determination.****Proposal 3:*** *RAN4 to study if a common intra-cell/inter-cell TAE of 3us between TRPs is acceptable for FR2-1 mTRP.* |
| [**R4-2216605**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216605.zip) | Maximum uplink timing difference for multi-DCI multi-TRP with 2 TAs | Nokia, Nokia Shanghai Bell | 1. Existing MRTD/MTTD requirements do not cover the time difference in the same CC. New requirements are needed.
2. Two simultaneous transmissions are always performed on two different Tx chains. There is no need to restrict the propagation delay difference to the CP length.
3. The inter-band NR CA MRTD/MTTD requirements can be used as baseline for the multi-DCI multi-TRP with two TAs.
 |
| [**R4-2216716**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216716.zip) | Discussion on maximum uplink timing difference for Multi-DCI Multi-TRP with two TAs | Samsung | ***Observation 1:* In RAN4, there is no final decision explicitly to define MRTD requirement from two TRPs, but there is one clarification in TS 38.133:** **“The requirements defined in clause [7.6] are also applicable when UE is configured to receive multiple PDSCH transmission occasions from one or more QCL sources on any one of the aggregated NR carriers.”*****Proposal 1:* The current MRTD/MTTD requirements in RAN4 defines the limitation on time difference only for inter-cell case, but it should be also applied in the case “UE is configured to receive multiple PDSCH transmission occasions from one or more QCL sources on any one of the aggregated NR carriers.”** ***Observation 2:* For NR TDM based PUSCH transmission, UL transmission overlapping happens in the scenario with two TA configured due to the restriction of UE capability, i.e., UE with single Tx.*****Observation 3:* If UE supports two independent RF chains/Tx chains with different TAs, the UL signals can be transmitted simultaneously in a CC and then there is no overlapping problem.*****Proposal 2:* In multi-DCI multi-TRP with two TAs, if UL transmission overlapping is allowed and handled in RAN1, the current single TX UE can be reused. If not, UE supporting two independent RF chains/Tx chains with different TAs is more reasonable.** ***Observation 4: The assumption on time difference within CP may be not feasible for inter-cell multi-DCI multi-TRP with two TAs case.*** ***Observation 5:* For co-located intra-cell multi-DCI multi-TRP with two TAs case, although the assumption on DL timing difference within a CP simplifies UE implementation. However, co-located deployment does not match the targeted scenario for intra-cell multi-DCI multi-TRP with two TAs.*****Observation 6:* For non-collocated intra-cell multi-DCI multi-TRP with two TAs case, where UE has two panels, the MTTD between multiple TRPs cannot be assumed within a CP length (single FFT).*****Proposal 3:* In Rel-18 two TAs multi-DCI multi-TRP scenario, the MTTD between multiple TRPs cannot be assumed within a CP length (single FFT) for both intra- and inter-cell cases, in which multiple panels are used for multiple TRPs respectively.*****Proposal 4:* For inter-cell/intra-cell multi-DCI multi-TRP with two TAs case, MTTD values are depend on the number of UE panels.** **- For single UE panel utilized, timing difference shall be restricted within CP.** **- For multiple UE panels utilized for multi-TRP respectively, the existing MTTD requirement for inter-band sync NR-DC, i.e., 34.6us for all cells in MCG and SCG in FR1, and 8.5us for all cells in MCG and SCG in FR2-1, shall be followed.**  |
| [**R4-2216832**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216832.zip) | Discussion on maximum uplink timing difference for multi-DCI multi-TRP with two TAs | Ericsson | **Proposal 1:** Existing RAN4 requirements for MRTD/MTTD are specified for CA/DC and not MIMO. **Proposal 2:** Inter-band CA deployment scenario to be agreed as deployment scenario for multi-TRP with multi-DCI and multi-TA case too.**Proposal 3:** TAE value for inter-band CA to be reused for intra-cell and inter-cell multi-TRP.**Proposal 4:** MRTD and MTTD values for inter-band CA to be reused for intra and inter-cell multi-TRP.**Proposal 5:** If the proposal 3 and 4 are agreeable, RAN4 to send LS response indicating the same to RAN1. |
| [**R4-2216833**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216833.zip) | Reply LS on maximum uplink timing difference for multi-DCI multi-TRP with two TAs | Ericsson | LS draft. |
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## Open issues summary

In Rel-18 discussions on MIMO Evolution for Downlink and Uplink, RAN1 has agreed to support multi-DCI multi-TRP operation with two TAs. With regards to the maximum uplink timing difference between the two TAs for multi-DCI multi-TRP operation, RAN1 made the following conclusion in RAN1#109-e:

Conclusion: For multi-DCI multi-TRP operation with two TAs, the decision on the maximum uplink timing difference is left up to RAN4.

* send an LS to RAN4 asking them the maximum uplink timing difference RAN1 can assume between the two TAs for multi-DCI multi-TRP operation.

RAN1 would kindly like to ask RAN4 to provide feedback on what maximum uplink timing difference that RAN1 can assume between the two TAs for multi-DCI multi-TRP operation.

The following issues were discussed during RAN4#104-e meeting, however, no consensus has been reached.

|  |
| --- |
| * Sub-topic 1-1: Align views on whether MRTD/MTTD requirements in 38.133 cover intra-cell case.
* Sub-topic 1-2: MTTD for multiple TRPs for intra-cell case
* Sub-topic 1-3: MTTD for multiple TRPs for inter-cell case
 |

### This E-mail thread will further discuss the open issue with regards to the questions raised in RAN1 LS.

### Sub-topic 1-1: MRTD/MTTD requirement in 7.5 and 7.6 of 38.133

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-1-1: Applicability of MRTD/MTTD requirements in 7.5 and 7.6 of 38.133**

* Proposals
	+ Option 1: Existing MRTD/MTTD requirements in 7.5 and 7.6 of 38.133 only define the timing difference limitation between different CCs for CA or DC operations, not define the timing difference limitation between different TRPs on the same CC for MIMO case.
	+ Option 2: Existing MRTD/MTTD requirements in 7.5 and 7.6 of 38.133 only define the timing difference limitation between different CCs for CA or DC operations, but it should be also applied in the case “UE is configured to receive multiple PDSCH transmission occasions from one or more QCL sources on any one of the aggregated NR carriers.”
* Recommended WF
	+ TBA

**Issue 1-1-2: whether clarifications are needed for the following note in 7.6.1 of 38.133**

*“The requirements defined in clause 7.6 are also applicable when UE is configured to receive multiple PDSCH transmission occasions from one or more QCL sources on any one of the aggregated NR carriers.”*

* Proposals
	+ Option 1: Yes, how the MRTD/MTTD requirement is applicable for MIMO need to be clarified.
		- E.g., adding “between CCs” after “applicable”
	+ Option 2: No. it is clear enough for CA/DC with multiple PDSCH reception for MIMO.
	+ Option 3: Other, please specify.

### Sub-topic 1-2: MRTD/MTTD requirement for multi-DCI multi-TRP operation in FR1

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 1-2: MRTD/MTTD requirement for multi-DCI multi-TRP operation in FR1**

* Proposals
	+ Option 1: For both intra-cell and inter-cell multi-TRP, the maximum uplink transmit timing difference between multiple TRPs can be assumed within a CP length.
	+ Option 2: MRTD and MTTD values for inter-band CA (34.6us) to be reused for intra-cell and inter-cell multi-TRP.
	+ Option 3: For both intra-cell and inter-cell multi-TRP, depending on UE capability,
		- For UE with only single Tx chain, MTTD shall be restricted within CP for both intra-cell and inter-cell multi-TRP.
		- For UE with multiple Tx chains, the existing MTTD requirement for inter-band CA (34.6us) is applicable for both intra-cell and inter-cell multi-TRP.
	+ Option 4: For both intra-cell and inter-cell multi-TRP, the UL transmit timing difference can be derived from the DL receive timing difference for multi-TRP, where TTD = RTD + 1.6 us.
	+ Option 5: Only TDM based multi-DCI uplink transmission is supported for both intra-cell and inter-cell multi-TRP. No need for any further MTTD requirements. The Tx timing difference between two UL transmissions associated with different TAs should meet the restriction that the minimal separation between the two UL transmissions at UE side should be no less than the transient period in FR1.
	+ Option 6: For inter-cell multi-TRP case, adopt MRTD/MTTD for NR inter-band CA cases as baseline. FFS for intra-cell multi-TRP case.
* Recommended WF
	+ TBA

### Sub-topic 1-3: MRTD/MTTD requirement for multi-DCI multi-TRP operation in FR2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 1-3: MRTD/MTTD requirement for multi-DCI multi-TRP operation in FR2**

* Proposals
	+ Option 1: For both intra-cell and inter-cell multi-TRP, the maximum uplink transmit timing difference between multiple TRPs can be assumed within a CP length.
	+ Option 2: MRTD and MTTD values for inter-band CA (8.5us) to be reused for both intra-cell and inter-cell multi-TRP.
	+ Option 3: For both intra-cell and inter-cell multi-TRP, depending on UE capability,
		- For UE only capable of single panel, MTTD shall be restricted within CP for both intra-cell and inter-cell multi-TRP.
		- For UE capable of multiple panels, the existing MTTD requirement for inter-band CA (8.5us) is applicable for both intra-cell and inter-cell multi-TRP.
	+ Option 4: For both intra-cell and inter-cell multi-TRP, the UL transmit timing difference can be derived from the DL receive timing difference for multi-TRP, where TTD = RTD + 0.5 us.
		- RTD is the maximum DL receive timing difference assumed in Rel-18 multi-Rx chain DL reception WI.
	+ Option 5: For both intra-cell and inter-cell multi-TRP, depending on UE capability
		- Only TDM based multi-DCI uplink transmission is supported for UE only capable of Tx from one panel. No need for any further MTTD requirements. The Tx timing difference between two UL transmissions associated with different TAs should meet the restriction that the minimal separation between the two UL transmissions at UE side should be no less than the transient period in FR2.
		- For UE capable of simultaneous Tx from 2 different panels, RAN4 postpone the discussion until the RTD assumption is concluded in R18 multi-Rx chain WI.
	+ Option 6: For inter-cell multi-TRP case, adopt MRTD/MTTD for NR inter-band CA cases as baseline. FFS for intra-cell multi-TRP case.
* Recommended WF
	+ TBA

### Sub-topic 1-4: TAE for multi-TRP

* Proposals
	+ Option 1: Same value for inter-band CA to be used for intra-cell and inter-cell multi-TRP
	+ Option 2: Same value for inter-band CA to be used for inter-cell multi-TRP. Further check if MIMO (OTA) requirements for TAE are applicable and which one (65ns or 260ms) is valid for intra-cell mTRP MRTD starting point for determination.
	+ Other, please specify

### LS out

TBD.

Depending on the discussion for Sub-topic 1-1/2/3

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

**Sub-topic 1-1: MRTD/MTTD requirement in 7.5 and 7.6 of 38.133**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | **Sub-topic 1-1-1:** **Sub-topic 1-1-2:**  |

**Sub-topic 1-2: MRTD/MTTD requirement for multi-DCI multi-TRP operation in FR1**

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

**Sub topic 1-3: MRTD/MTTD requirement for multi-DCI multi-TRP operation in FR2**

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

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest focussing on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #2: Title

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-22xxxxx | Company A | Proposal 1:Observation 1: |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-1: TBA**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Recommended WF
	+ TBA

### Sub-topic 2-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-2: TBA**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |

**Example 2**

Sub topic 1-1

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

Sub topic 1-2

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

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents