**3GPP TSG-RAN WG4 Meeting # 101bis-e R4-220xxxx**

**Electronic Meeting, 17 – 25 January 2022**

**Agenda item: 5.37, 5.38, 5.39, 8.7, 8.9**

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [101bis-e][116] LTE\_NR\_Other\_WI

**Document for:** Information

# Introduction

In this email thread, the following agenda items are discussed.

5.37 Additional NR bands for UL-MIMO
5.38 DL interruption for band combo dynamic Tx Switching
5.39 Simultaneous Rx/Tx band combination
8.7 Additional LTE bands for UE Cat M1/2, NB1/2
8.9 R17 Additional enhancements for NB-IoT and LTE-MTC

# Topic #1: Additional NR bands for UL-MIMO

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2201759**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201759.zip) | Ligado Networks | Draft CR for n24 and n99 UL-MIMO PC3Includes n24 and corresponding SUL band n99 as bands supporting UL MIMO, UL MIMO MOP for n24 and n99 |
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## Open issues summary

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

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

## Companies views’ collection for 1st round

### Open issues

No open issues, please comment in the CR section (1.3.2) directly.

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| **Company** | **Comments** |
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### 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.*

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| **CR/TP number** | **Comments collection** |
| [**R4-2201759**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201759.zip)Draft CR for n24 and n99 UL-MIMO PC3 | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
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## 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.*

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|  | **Status summary**  |
| **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*

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| **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”* |

# Topic #2: Downlink interruption for band combinations to conduct dynamic Tx Switching

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2200770 | China Telecom | Draft CR to 38.101-1 Introduce DL interruption clarification for CA conduting Tx Switching<Not available> |

## Companies views’ collection for 1st round

### Open issues

No open issues to be discussed.

### 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 to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
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## Summary for 1st 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.*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
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## Discussion on 2nd round (if applicable)

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| **CR/TP number** | **Comments collection** |
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## Summary for 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”.*

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# Topic #3: Simultaneous Rx/Tx band combination

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2200566**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200566.zip) | NTT DOCOMO INC. | **Observation 1: Simultaneous RxTx capability signalling for per-band-pair per band combination was newly introduced from Rel-15 RAN2 specification TS 38.306 and TS 38.331 according to RAN4 request [2][3].****Observation 2: Based on the current description of TS 38.101-1 and TS 38.101-3, if it is mandatory for UE(s) to support simultaneous RxTx of band combination Band 1+Band 2, it may be unclear whether it is mandatory to support simultaneous RxTx of a band pair Band 1+Band 2 within a higher order band combination such as Band 1+ Band 2+ Band 3.****Observation 3: Applicability rule of mandatory simultaneous RxTx for higher order band combinations is needed only when per-band-pair signalling is indicated in the higher order band combinations in order to align with RAN2 signalling design and avoid the impact on legacy UEs.****Proposal 1: Clarify the applicability of mandatory simultaneous RxTx for band pairs included in higher order band combinations by adding the following description to relevant notes as shown in Table 2.2-2 in this paper:*** *Mandatory simultaneous RxTx capability also apply for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration and the field of simultaneousRxTxInterBandENDCPer-band-pair is included in the higher order EN-DC configuration.*

**Proposal 2: Changes in proposal 1 should apply to TS 38.101-1 and TS 38.101-3 from Rel-15.*** Some wording should be modified such as EN-DC and NR CA, and simultaneousRxTxInterBandENDCPer-band-pair and simultaneousRxTxInterBandCAPer-band-pair.
 |
| [**R4-2200354**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200354.zip) | SoftBank Corp. | **Observation: Some band combinations have already specified as the simultaneous Rx/Tx capability is mandatory support. The maximum MSD value in those band combinations is 29.8(2 antenna ports) / 32.5(4 antenna ports) dBm.** **Proposal: The threshold should be higher than 29.8(2 antenna ports) / 32.5(4 antenna ports) dBm. If there are some difficulties to define those values from the implementation perspective, they should be clarified and considered when defining the threshold.** |
| [**R4-2201067**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201067.zip) | Samsung | ***Observation1: Simultaneous Rx/Tx capability is optional means that for one band combination it depends on UE’s claim supporting simultaneous Rx/Tx, otherwise, the capability is not present******Observation 2: If simultaneous Rx/Tx capability is not present means worse MSD performance than a threshold, it may conflict with potential “Low MSD” capability which will be discussed in Rel-18******Proposal 1: It is proposed to consider specify mandatory simultaneous Rx/Tx capability case by case for FR1 FDD-TDD band combinations at least in Rel-17, i.e. whether a FDD-TDD band combination mandatory support simultaneous Rx/Tx is based on operator’s request.*** |
| [**R4-2201230**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201230.zip) | Xiaomi | **Proposal 1: MSD threshold could be decided from some system level simulation.** |
| [**R4-2201340**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201340.zip) | ZTE Corporation | **Observation 1: For a FDD-TDD inter-band NR CA band combination, inter-band NR CA operation can not workable if simultaneous Rx/Tx operation is not supported.****Observation 2: Due to actual MSD can be 20 dB or more better than the MSD in the specs, actual MSD could be smaller than the threshold in case of the MSD defined in the spec larger than the MSD threshold.****Observation 3: The performance would be affected if changing the simultaneous Rx/Tx capability from mandatory to optional.** **Proposal: The threshold value should be higher than 32.5dB.**  |
| [**R4-2201954**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201954.zip) | Huawei, HiSilicon | ***Observation 1: MSD for FDD-TDD band combination is defined for simultaneous Rx/Tx operation.*** ***Observation 2: Though the MSD for some band combination could be very large, whether to enable a band combination is a choice of deployment decision******Proposal 1: For FDD-TDD band combination for FR1 with specified MSD, simultaneous Rx/Tx is the default capability and no need to further discuss the MSD threshold.*** |
| [**R4-2201955**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201955.zip) | Huawei, HiSilicon | TP for TR 38.839: Principles for simultaneous Rx/Tx capability |
| [**R4-2200567**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200567.zip) | MediaTek Beijing Inc. | Proposal: Add NOTE to clarify the minimum requirements apply only when there is non-simultaneous Rx/Tx operation for CA\_n257-n259 and CA\_n258-n260, as CA\_n260-n261. |
| [**R4-2201341**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201341.zip) | ZTE Corporation | DRAFT CR to TS 38.101-2: On Simultaneous RxTx capability for FR2 inter-band CA (Cat F)A note is added in table 5.2A.2-1 to indicate the information of simultaneous Rx/Tx capability for the existing FR2 band combinations of CA\_n260-n261. |
| [**R4-2201342**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201342.zip) | ZTE Corporation | DRAFT CR to TS 38.101-2: On Simultaneous RxTx capability for FR2 inter-band CA (Cat A) |
| [**R4-2201343**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201343.zip) | ZTE Corporation | DRAFT CR to TS 38.101-2: On Simultaneous RxTx capability for FR2 inter-band CA CA\_n257-n259 and CA\_n258-n260 (Cat F)To indicate same note as in R4-2119950 for simultaneous Rx/Tx capability for the existing FR2 band combinations CA\_n257-n259 and CA\_n258-n260. |
| [**R4-2201956**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201956.zip) | Huawei, HiSilicon | ***Observation 1: Non-simultaneous Rx/Tx operation would have strong limitation for network deployment for FR2 CA inter-band combinations******Observation 2: There are no detailed analysis for the MSD for specific band combinations, especially for the far separated FR2 band combinations******Observation 3: The simultaneous Rx/Tx capability is optionally supported for FR2 TDD-TDD band combinations. If UE does not support simultaneous Rx/Tx operation for the band combination, it does not need to report the capability.*** ***Proposal 1: For FR2 TDD-TDD band combinations, especially those with large frequency separation, leave the capability to UE implementation, and no need to have the note with non-simultaneous Rx/Tx operation to limit the network deployment flexibility.***  |

## 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 3-1 Simultaneous Rx/Tx capability for FR1+FR1 FDD-TDD band combination

*Sub-topic description: The discussion on MSD threshold is continued and a new issue is raised by DoCoMo in R4-2200566.*

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

**Issue 3-1-1: MSD threshold**

**Issue 3-1-2: Applicability of mandatory simultaneous RxTx for band pairs included in higher order band combinations**

### Sub-topic 3-2 Simultaneous Rx/Tx capability for FR2+FR2 TDD-TDD band combination

*Sub-topic description: The same issue as in last meeting is presented in the contribution papers.*

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

**Please comment in the CR/TP section directly.**

## Companies views’ collection for 1st round

### Open issues

**Issue 3-1-1: MSD threshold**

**For FR1+FR1 FDD-TDD band combinations whose MSD is larger than a threshold (value FFS), further discuss whether simultaneous Rx/Tx can be changed to optional, otherwise, the simultaneous Rx/Tx capability is mandatory support.**

* Proposals
	+ Option 1: The threshold should be higher than 29.8(2 antenna ports) / 32.5(4 antenna ports) dBm. If there are some difficulties to define those values from the implementation perspective, they should be clarified and considered when defining the threshold.
	+ Option 2: The threshold value should be higher than 32.5dB.
	+ Option 3: MSD threshold could be decided from some system level simulation.
	+ Option 4: It is proposed to consider specify mandatory simultaneous Rx/Tx capability case by case for FR1 FDD-TDD band combinations at least in Rel-17, i.e. whether a FDD-TDD band combination mandatory support simultaneous Rx/Tx is based on operator’s request.
	+ Option 5: Others (please specify)
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Samsung | Our proposal as option4 is based on our observation that “If simultaneous Rx/Tx capability is not present means worse MSD performance than a threshold, it may conflict with potential “Low MSD” capability which will be discussed in Rel-18”. I would like to hear opinions of experts on this. If indeed there may be a conflict or some relationship, then it would be better to discuss the threshold in Rel-18. |
| ZTE | Either option 1 or option 2. If there were no agreements in the end, we propose not to define the MSD threshold for FDD-TDD band combs, instead mandatory simultaneous Rx/Tx capability to all the FDD-TDD band combs. In addition, it may need discuss how to support FDD-TDD CA if simultaneous Rx/Tx is not supported. |
| SoftBank | Support option 2 but we are fine with option 1 considering the discussion in the last meeting.  |
| CHTTL | Support option 2 but also fine with option 1. |
| Huawei, HiSilicon | Ok with either option 1 or option 2. Alternatively, since FDD-TDD band combination for FR1 with specified MSD, simultaneous Rx/Tx is the default capability, whether to have a MSD threshold may not be that important. If indeed there are some FDD-TDD band combinations with MSD cannot support simultaneous Rx/Tx operation (so far not identified yet), they can be indicated with a NOTE in the spec.  |
| Qualcomm | We prefer Option 5. Field/deployment data from operators or infra-vendors would be very useful to decide on what the threshold should be. Option 3 will be very time consuming and unlikely to lead to any conclusion. Option 1 or 2 seem arbitrary, any technical reason to choose any of these values? |
| Apple | Option 4 seems to be reasonable as it includes case by case study of CA combinations. In the case of very high MSD it could hinder DL demodulation and therefore prevent signal reception. This needs to be checked before mandatory Rx/Tx is defined. |
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**Issue 3-1-2: Applicability of mandatory simultaneous RxTx for band pairs included in higher order band combinations**

* Proposals
* Proposal 1: adding the following description to relevant notes as shown in Table 2.2-2 in R4-2200566:

*Mandatory simultaneous RxTx capability also apply for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration and the field of simultaneousRxTxInterBandENDCPer-band-pair is included in the higher order EN-DC configuration.*

* Proposal 2: Changes in proposal 1 should apply to TS 38.101-1 and TS 38.101-3 from Rel-15
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| SoftBank | Support both proposal 1 and 2.  |
| CHTTL | In the paper, it mentions if it is mandatory to support simultaneous RxTx of band combination Band 1+Band 2, it is also mandatory to support simultaneous RxTx of the band pair Band 1+Band 2 within a higher band combination such as Band 1+ Band 2+ Band 3.So probably there is no need to add the signalling aspect in RAN4? Ex: the following sentence is enough?*Mandatory simultaneous RxTx capability also apply for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration* |
| Huawei, HiSilicon | Support the proposals.Also ok with the suggestion by CHTTL. |
| Qualcomm | We are fine with the proposals |
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### 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.*

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| **CR/TP number** | **Comments collection** |
| R4-2201955TP for TR 38.839: Principles for simultaneous Rx/Tx capability | MediaTek: About Huawei’s proposal “For FR2+FR2 TDD-TDD band combination, the simultaneous Rx/Tx capability should be studied case by case:Currently, we add NOTE to existed band combinations about no support simultaneous Tx/Rx, however, as proposed/commented last meeting, we think it is also fine to make the NOTE as general principle for FR2+FR2.So, we think it’s too early to agree the CR’s proposal. |
| Huawei, HiSilicon: The TP just captures the previous agreements. For FR2 TDD-TDD, even there are some discussion undergoing, it does not break the general principle that the band combinations should be studied case by case, similar to that for FR1 TDD-TDD. Curious to see “too early to agree the proposal”, those proposals were already agreed before actually. |
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| R4-2201341DRAFT CR to TS 38.101-2: On Simultaneous RxTx capability for FR2 inter-band CA (Cat F) | ZTE: This draft CR was endorsed in last RAN4 meeting. Unfortunately, it was not implemented to the specification. Therefore, the draft CR is re-submitted. |
| MediaTek: Support. Thanks for ZTE’s effort. |
| Huawei, HiSilicon: Since this one was endorsed in last meeting, we are ok with it. But this is the bis meeting, re-submission of the draft CR still cannot make it to be implemented in the spec. |
| R4-2201342DRAFT CR to TS 38.101-2: On Simultaneous RxTx capability for FR2 inter-band CA (Cat A) | ZTE: This draft CR was endorsed in last RAN4 meeting. Unfortunately, it was not implemented to the specification. Therefore, the draft CR is re-submitted. |
| MediaTek: Support. Thanks for ZTE’s effort. |
| Huawei, HiSilicon: see above comments. |
| R4-2201343DRAFT CR to TS 38.101-2: On Simultaneous RxTx capability for FR2 inter-band CA CA\_n257-n259 and CA\_n258-n260 (Cat F) | ZTE: Agree. This draft CR is aligned with the previous agreements. |
| Rohde & Schwarz: Agree with the reason for change and support the CR. |
| MediaTek: Support. Thanks for ZTE’s effort. |
| Verizon: agree the draft CR! It is reasonable to have a consistent requirement. Huawei, HiSilicon: We didn’t see technical analysis of possible REFSENS degradation for these band combinations under simultaneous Rx/Tx operation. We are not against the note itself and the applicability for some band combinations, but case by case study means at least some study is needed. We think the RAN4 specification should be built with technical inputs rather than just presenting the proposal. We expect to see some basic analysis on MSD in next meeting and then to close the discussion. |
| Apple: Thanks for drafting the CR. The “Reason for change” mentions that R4-2119950 was endorsed but not implemented. As it was not implemented and note 1 is not provided to CA\_n260-n261 with this CR it might remain missing. We would like to get a clarification on how the note is finally applied to this combination.  |

## 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.*

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|  | **Status summary**  |
| **Sub-topic# 3-1 & 3-2** | *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*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
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## Discussion on 2nd round (if applicable)

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| **Company** | **Comments** |
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| **CR/TP number** | **Comments collection**  |
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## Summary for 2nd round (if applicable)

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

### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
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# Topic #4: Additional LTE bands for UE Cat M1/2, NB1/2

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2201716**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201716.zip) | Ericsson | Table 6.2.4E-x: A-MPR for "NS\_27" for Cat-M1 with sub-PRB allocation

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| --- | --- | --- |
| **Channel BW** | **Parameter** | **Region** |
| 5 MHz | (NB\_index, SCstart) | (0, ≤4) | (0, ≤72) | (3, >=48) | (3, >=60) | (0, ≤14) | (0, ≤72) | (3, >=48) | (3, >=60) |
| Lcsc | 2,3 | 2,3 | 2,3 | 2,3 | 6 | 6 | 6 | 6 |
| A-MPR [dB] | ≤3 | ≤1 | ≤1 | ≤3 | ≤2 | ≤1 | ≤1 | ≤2 |
| Note 1: Lcsc is the length of the continuous subcarrier, SCstart is the subcarrier offset relative to the first subcarrier of the first PRB of NB indicated with NBindex.NOTE 2: Lcsc is the length of the continuous subcarrier, SCstart is the subcarrier offset relative to the first subcarrier of the first PRB of NB indicated with NBindex. |

Proposal: Consider above A-MPR table for the sub-PRB allocation for “NS-27” |
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## 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 4-1 A-MPR for LTE Band 48

*Sub-topic description: A-MPR for LTE band 48 NS\_27 Cat-M1 UE.*

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

**Issue 4-1-1: A-MPR for NS\_27**

## Companies views’ collection for 1st round

### Open issues

**Issue 4-1-1: A-MPR for NS\_27**

**Discuss the A-MPR requirements as proposed in R4-2201716, duplicated below.**

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| **Channel BW** | **Parameter** | **Region** |
| 5 MHz | (NB\_index, SCstart) | (0, ≤4) | (0, ≤72) | (3, >=48) | (3, >=60) | (0, ≤14) | (0, ≤72) | (3, >=48) | (3, >=60) |
| Lcsc | 2,3 | 2,3 | 2,3 | 2,3 | 6 | 6 | 6 | 6 |
| A-MPR [dB] | ≤3 | ≤1 | ≤1 | ≤3 | ≤2 | ≤1 | ≤1 | ≤2 |
| Note 1: Lcsc is the length of the continuous subcarrier, SCstart is the subcarrier offset relative to the first subcarrier of the first PRB of NB indicated with NBindex.NOTE 2: Lcsc is the length of the continuous subcarrier, SCstart is the subcarrier offset relative to the first subcarrier of the first PRB of NB indicated with NBindex. |

* Proposals
	+ Option 1: Agree with the proposal
	+ Option 2: Others (please specify)
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Ericsson | Option 1 |
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### 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.*

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| **CR/TP number** | **Comments collection** |
|  | 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.*

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|  | **Status summary**  |
| **Sub-topic# 4-1** | *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*

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| **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”* |
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# Topic #5: NB-IoT 16QAM

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2200415**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200415.zip) | Nokia, Nokia Shanghai Bell | **Proposal: There is no need to differentiate the NB-IoT carrier power with 16QAM and the NB-IoT carrier with QPSK. One declaration is applied when configured for 16QAM/QPSK transmissions.** |
| [**R4-2201714**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201714.zip) | Ericsson | **Observation#1: There should be no coverage impact on legacy NB-IoT device due to the 16QAM introduction.****Observation#2: new feature will be specified starting from Rel-17 and there is no NBC (non-backward compatibility issue for it.****Observation#3: For new equipment, it is better to have one NB-IoT declared power to support both 16QMA and QPSK.****Observation#4: Declaration on the NB-IoT carrier to support 16QAM would be fine for legacy equipment.**Observation#5: It is not necessary for RAN4 to discuss how to support the 16QAM in legacy BS as it is a NBC feature. |
| [**R4-2201831**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201831.zip) | Huawei,HiSilicon | **Observation 1: When upgrading, legacy equipment may use lower power for 16QAM transmissions.****Observation 2: The coverage of QPSK should be maintained, regardless of the transmission power for 16QAM.****Proposal 1: Further discuss the two options in the WF, and find the best solution that can maintain the QPSK coverage while meet the demand for 16QAM.** |
| [**R4-2201832**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201832.zip) | Huawei,HiSilicon | Draft CR to TS 36.101The EVM requirement for 16QAM NB-IoT DL is added. |
| [**R4-2201833**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201833.zip) | Huawei,HiSilicon | Draft CR to TS 36.141The EVM requirement for 16QAM NB-IoT DL is added. |

## Open issues summary

### Sub-topic 5-1 BS RF Requirements

*Sub-topic description:* The impact to BS RF requirements in support of 16QAM are discussed here.

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

**Issue 5-1-1: Declaration of rated output power for 16QAM DL**

## Companies views’ collection for 1st round

### Open issues

**Issue 5-1-1: Declaration of rated output power for 16QAM DL**

Discuss whether to allow manufacturers to declare different rated output power for NB-IoT 16QAM transmission in standalone mode

* Proposals
	+ Option 1: One declaration is applied when configured for 16QAM/QPSK transmissions.
	+ Option 2: Up to two rated output power declarations may be made.
	+ Option 3: Others (please specify)
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Nokia | Option 1; We see no need for option 2, as we stated in our paper, a suitable design for BS with NB-IoT operation in standalone mode should maintain the QPSK coverage while meet the demand for 16QAM; we also provide some suggestions for legacy BS handling in our paper without the need to have two rated output power declarations. |
| Ericsson | Option 1. Agree with Nokia. If the legacy BS is upgraded to a “Rel-17” and support 16QAM NB-IoT UE, it will not roll-back to legacy node so seems the need of option 2 is not there in practice. |
| Huawei | Thanks Nokia and Ericsson for the good discussions and constructive suggestions. We also share the view that the QPSK coverage should not be affected. Option 1 is acceptable. Hence no spec changes are needed. |
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### 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 to focus on open issues discussion on 1st round.*

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2201832Draft CR to TS 36.101 | Nokia: This draft CR is to TS 36.104 but not TS 36.101. |
| Huawei: Thanks Nokia for pointing out the typo in the moderator’s summary. The CR cover sheet is correct.  |
|  |
| R4-2201833Draft CR to TS 36.141 | Nokia: The number of NPDSCH bits should be double from 304 to 608 and from 200 to 400 for 16QAM in clause 6.1.4.5; we propose to have an agreement to share the CR drafting workload among participating companies in February RAN4#102 meeting, Nokia volunteer to provide the CR to TS 36.141. |
| Huawei: For Tx power or EVM measurement, the coding rate doesn’t really matter. But we’re OK to adopt the changes proposed by Nokia. Since we already prepared the draft CR, we’re happy to continue with the formal CR. Maybe we can co-source? |
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## 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.*

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|  | **Status summary**  |
| **Sub-topic #5-1** | *Tentative agreements:* *Candidate options:**Recommendations for 2nd round:* |
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### 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.*

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
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## Discussion on 2nd round (if applicable)

### Open issues

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| **Company** | **Comments** |
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### 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 to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
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## Summary for 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”.*

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# Topic #6: LTE-MTC Additional Enhancements

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2201287**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201287.zip) | Sony | **Observation A: The power class for NB-IoT is defined for a single-subcarrier transmission.****Observation B: The NB-IoT MPR specification allows the NB-IoT UE to transmit at a lower power level than the power level used for single-subcarrier transmission.****Observation C: eMTC and NB-IoT can be implemented with the same RF front-end. The NB-IoT MPR values for full-PRB transmission relative to sub-PRB transmission are equally applicable to eMTC.****Proposal A: The MPR framework allows a sub-PRB capable UE to apply a power reduction of full-PRB, PRACH, PUCCH and SRS relative to the power of a 2-tone sub-PRB PUSCH transmission.****Proposal B: For an eMTC UE capable of sub-PRB transmission:*** **The eMTC power class is defined for a 2-of-3 sub-PRB transmission**
* **The eMTC MPR specification allows the eMTC UE to transmit at a lower power level than the power level used for a 2-of-3 sub-PRB transmission**
* **The power reduction for eMTC UEs for full-PRB transmissions is the same as the power reduction allowed for NB-IoT UEs for full-PRB transmission**
 |
| [**R4-2201715**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201715.zip) | Ericsson | **Observation#1: Reducing the full-PRB transmission power generally is against the UE rated power definition.****Proposal-1: Follow the framework of NR pi/2 BPSK power boosting if RAN4 decides that there is an overall gain from the subPRB boosting.****Observation#2: If RAN4 decided for the subPRB power boosting, it will be possible to boost power for 2 out 3 tone subPRB transmission thanks to low PAPR characteristic.****Proposal-2: Focus on PC5 CAT-M1 device for the potential power boosting to PC3 on subPRB transmission.****Proposal-3: RAN4 could discuss the feasibility only in Rel-17 in remaining two RAN4 meetings.** |

## 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 6-1 Feasibility study on max power reduction for PRACH, PUCCH, and full-PRB PUSCH

*Sub-topic description: The feasibility study is continued. Effort in two different directions remains.*

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

**Issue 6-1-1: Feasibility study on max power reduction**

## Companies views’ collection for 1st round

### Open issues

**Issue 6-1-1: Feasibility study on max power reduction**

* Proposals
	+ Option 1: Enable power boosting for sub-PRB PUSCH from a lower PC
		- Focus on PC5 CAT-M1 device for the potential power boosting to PC3 on subPRB transmission
	+ Option 2: Define full power transmission for 2-of-3 sub-PRB and allow power reduction for full-PRB PUSCH, PRACH and PUCCH
		- Add supplementary MPR for full PRB transmissions for UE CAT-M1 PC3 and PC5
	+ Option 3: Conclude the feasibility study without specification impact in Rel-17
	+ Option 4: Remove the objective from the WI
	+ Option 5: others (please specify)
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Ericsson | Option 2 seems more complex than option 1. E.g the A-MPR/MPR simulation assumption, how PA calibrated, how to specify the A-MPR for different bands of different NS values for such new UE power class. Whether it will have more impact on other RAN spec as the power class is a parameter used a parameter for S-criteria compensation in 36.304.

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| Pcompensation  | If the UE supports the *additionalPmax* in the *NS-PmaxList*, if present, in SIB1, SIB3 and SIB5:max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);else:if PPowerClass is 14 dBm:max(PEMAX1 –(PPowerClass – Poffset), 0) (dB);else:max(PEMAX1 –PPowerClass, 0) (dB)For IAB-MT, Pcompensation is set to 0. |

Seems option 1 impact less, at least there is no need to re-do all A-MPR simulation for full-RB allocation.Maybe for now focusing the feasibility study as only one meeting left. |
| Sony | Our preference is option 2. Option 2 achieves the work item objective (which states twice that \*power reduction\* of full-PRB channels is the objective rather than power boosting of sub-PRB transmissions). Option 2 is the approach that is taken for NB-IoT in section 6.2.3F of TS36.101. It is clear that this approach works, more so given that there are many implementations that have a common RF for NB-IoT and eMTC.While option 1 seems to achieve a similar goal to the work item objective, we think this would entail more work than option 2. Option 1 is not really consistent with the WID.Option 3 would pre-suppose that power reduction of full-PRB is not feasible, since the work item objective is to “study and if found feasible specify”. If power reduction of full-PRB is feasible (as is evident from the NB-IoT specification), then the work item mandates that it will be specified. The only way that RAN4 would not specify power reduction of full-PRB is if it were found to be unfeasible (and it is clear that full-PRB power reduction is feasible).Option 4 would have to be discussed in RAN plenary rather than RAN4.Summary: Support option 2. Other options are not consistent with the WID. |
| Huawei | Both option 1 and 2 require significant effort. For option 1, new MPR/A-MPR need to be determined for boosted sub-PRB. Simulation/measurement data would be needed. For option 2, it’s effectively asking for a big relaxation on Tx power, since the current spec doesn’t allow MPR for sub-PRB transmissions of Cat-M1 UEs. Again, measurement/simulation data would be needed to support such a request as per the convention in 3GPP. And it’s not clearly how to use the proposed S-MPR.Given that only one meeting is left for the WI, the situation would lead us to option 3, i.e. two options are proposed, but no consensus is reached for the feasibility of either one. |
| Qualcomm | Option 4, this should be brought up to plenary. There has been a lot of discussion on this and so far not much technical discussions. It seems very difficult that we would be able to conclude the discussion on time. |

### 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.*

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

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|  | **Status summary**  |
| **Sub-topic# 6-1** | *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*

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| **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)

### Open issues

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| **Company** | **Comments** |
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## Summary for 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”.*

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# Recommendations for Tdocs

## 1st round

**New tdocs**

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| **Title** | **Source** | **Comments** |
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**Existing tdocs**

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| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| [**R4-2201759**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201759.zip) | Draft CR for n24 and n99 UL-MIMO PC3 | Ligado Networks |  |  |
| R4-2200770 | Draft CR to 38.101-1 Introduce DL interruption clarification for CA conduting Tx Switching | China Telecom |  |  |
| [**R4-2200566**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200566.zip) | Clarification on per-band-pair simultaneous RxTx capability | NTT DOCOMO INC. |  |  |
| [**R4-2200354**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200354.zip) | Discussion on the simultaneous Rx/Tx capability for FR1+FR1 FDD-TDD band combination | SoftBank Corp. |  |  |
| [**R4-2201067**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201067.zip) | Discussion on simultaneous RxTx capability for FR1 FDD-TDD band combination | Samsung |  |  |
| [**R4-2201230**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201230.zip) | Discussion on principle for simultaneous Rx Tx band combinations for CA, SUL, MR-DC and NR-DC | Xiaomi |  |  |
| [**R4-2201340**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201340.zip) | Simultaneous Rx/Tx capability for FR1+FR1 FDD-TDD band combination | ZTE Corporation |  |  |
| [**R4-2201954**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201954.zip) | Further consideration on the MSD principle for FR1 FDD-TDD band combination | Huawei, HiSilicon |  |  |
| [**R4-2201955**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201955.zip) | TP for TR 38.839: Principles for simultaneous RxTx capability | Huawei, HiSilicon |  |  |
| [**R4-2200567**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200567.zip) | View on FR2 simultaneous Tx/Rx discussion | MediaTek Beijing Inc. |  |  |
| [**R4-2201341**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201341.zip) | DRAFT CR to TS 38.101-2: On Simultaneous RxTx capability for FR2 inter-band CA | ZTE Corporation |  |  |
| [**R4-2201342**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201342.zip) | DRAFT CR to TS 38.101-2: On Simultaneous RxTx capability for FR2 inter-band CA | ZTE Corporation |  |  |
| [**R4-2201343**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201343.zip) | Draft CR to TS38.101-2[R17] On Simultaneous RxTx capability for FR2 inter-band CA\_n257-n259 and CA\_n258-n260 | ZTE Corporation |  |  |
| [**R4-2201956**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201956.zip) | Further consideration on the simultaneous Rx/Tx capability for FR2 TDD-TDD band combination | Huawei, HiSilicon |  |  |
| [**R4-2201716**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201716.zip) | AMPR simulation results for Cat-M1 for B48 | Ericsson |  |  |
| [**R4-2200415**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2200415.zip) | Proposals on BS RF requirements for support of 16QAM in NB-IoT | Nokia, Nokia Shanghai Bell |  |  |
| [**R4-2201714**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201714.zip) | BS RF impact analysis on R17 NB\_IoT | Ericsson |  |  |
| [**R4-2201831**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201831.zip) | Remaining issues for NB-IoT 16QAM BS RF requirements | Huawei,HiSilicon |  |  |
| [**R4-2201832**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201832.zip) | Draft CR to TS36104 Addition of NB-IoT 16QAM | Huawei,HiSilicon |  |  |
| [**R4-2201833**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201833.zip) | Draft CR to TS36141 Addition of NB-IoT 16QAM | Huawei,HiSilicon |  |  |
| [**R4-2201287**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201287.zip) | On max power reduction for PRACH, PUCCH, and full-PRB PUSCH | Sony |  |  |
| [**R4-2201715**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-bis-e/Docs/R4-2201715.zip) | RF impact analysis on R17 eMTC WID | Ericsson |  |  |
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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

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| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
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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