**3GPP TSG-RAN WG2 Meeting #113-e R2-210xxxx**

**Online, January 25th – February 5th 2021**

**Agenda Item: 5.4.3**

**Source: Huawei, HiSilicon**

**Title: Summary of [012][NR15] UE Capabilites IV (Huawei)**

**Document for: Discussion and decision**

# Introduction

This document summarizes the following offline discussion.

* [AT113-e][012][NR15] UE Capabilites IV (Huawei)

 Scope: Treat [R2-2100056](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2100056.zip), [R2-2101662](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101662.zip), [R2-2101663](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101663.zip), [R2-2101843](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101843.zip), [R2-2101844](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101844.zip), [R2-2101845](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101845.zip), [R2-2101435](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101435.zip), [R2-2101731](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101731.zip), [R2-2101558](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101558.zip), [R2-2100970](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2100970.zip), [R2-2100971](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2100971.zip), [R2-2100972](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2100972.zip),

 Phase 1, determine agreeable parts, Phase 2, for agreeable parts Work on CRs.

 Intended outcome: Report and Agreed CRs.

 Deadline: Schedule A

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# Discussion (Phase 1)

## Simultaneous Rx/Tx

[R2-2100056](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2100056.zip) LS on simultaneous Rx/Tx capability (R4-2016988; contact: Huawei) RAN4 LS in Rel-15 NR\_newRAT-Core To:RAN2

[R2-2101662](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101662.zip) Discussion on simultaneous RxTx capability (LS contact) Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core

[R2-2101663](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101663.zip) Draft reply LS on simultaneous RxTx capability Huawei, HiSilicon LS out Rel-15 NR\_newRAT-Core To:RAN4

[R2-2101843](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101843.zip) Discussion on simultaneous Rx/Tx capability MediaTek Inc. discussion

[R2-2101844](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101844.zip) Clarification on the simultaneousRxTxInterBandCA capability in NR-DC MediaTek Inc. CR Rel-15 38.306 15.12.0 0395 1 F NR\_newRAT-Core R2-2007885

[R2-2101845](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101845.zip) Clarification on the simultaneousRxTxInterBandCA capability in NR-DC MediaTek Inc. CR Rel-16 38.306 16.3.0 0396 1 A NR\_newRAT-Core R2-2007887

[R2-2101435](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101435.zip) On the use of UE simultaneous Rx/Tx capability Ericsson discussion

### 3.1.1 Discussion on fallback capability

The content of RAN4 LS R4-2016988/R2-2100056:

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| --- |
| Simultaneous Rx/Tx capability for TDD-TDD and TDD-FDD inter-band CA, SUL and EN-DC band combinations has been discussed in RAN4. It is identified that there are some ambiguity on the applicability of simultaneous Rx/Tx condition for an inter-band combination, especially for the combination having more than two bands. As an example, for CA\_n39-n41-n79, if UE supports simultaneous Rx/Tx capability for CA\_n41-n79 but not for CA\_n39-n41, the simultaneous Rx/Tx capability shall not be reported for CA\_n39-n41-n79. However, since the capability of the fallback mode is different from the higher order band combination, simultaneous Rx/Tx capability for CA\_n41-n79 shall be reported additionally. For a band combination with different simultaneous Rx/Tx capability for the fallback mode, RAN4’s understanding is that the network shall also consider the fallback mode capability to decide the UL/DL scheduling among all bands for this band combination. It’s not clear whether the current RAN2 specification supports this kind of understanding. If not or if it can only be derived implicitly, RAN4 would like to see some explicit clarification in the RAN2 specification.  |

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| The relevant proposals from R2-2101662 (Huawei):**Proposal 1: RAN2 to confirm that with the legacy RAN2 signalling, the UE can advertise fallback band combinations with different capabilities compared to the corresponding superset band combination.****Proposal 2: Clarify in RAN2 specification that the network also considers the fallback capability to decide the UL/DL scheduling among all bands for this band combination.**The proposals from R2-2101843 (MediaTek):**Proposal 1: RAN2 confirm that *simultaneousRxTxInterBandCA* capability applies to any of the two bands (if applicable) in a BC, and UE shall only include this capability if it supports simultaneous Rx/Tx on all applicable band pairs. The UE could additionally include subset BC in the capability information to report the support of simultaneous RxTx on subset band combination.**The proposals from R2-2101435 (Ericsson):[**Proposal 1 RAN2 confirms RAN4 understanding that the UE may report a fallback band combination for which it supports additional functionality compared to its corresponding superset band combination.**](#_Toc61513959)[**Proposal 2 Inform RAN4 that the UE capability signaling does not account for the indication of support of a feature that needs to be derived from multiple band combinations. If the current design of simultaneous Rx/Tx capability is not enough, RAN4 can clarify which further cases need to be covered so that RAN2 can design the according signaling for such cases.**](#_Toc61513960) |

Based on contributions, rapporteur understands that companies share the same view that the legacy RAN2 signalling already supports advertising fallback band combinations with different simultaneous Rx/Tx capabilities compared to the corresponding superset band combination.

**Q1-1 Do companies agree:**

**RAN2 confirms that *simultaneousRxTxInterBandCA* capability applies to any of the two bands (if applicable) in a BC, and UE shall only include this capability if it supports simultaneous Rx/Tx capability on all applicable band pairs. The UE can additionally include fallback BC with different simultaneous RxTx capability compared to the corresponding superset band combination?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | No | Issue 1)In EN-DC, the UE can signal three UE capabilities, 1) simultaneousRx-Tx in CA-ParametersEUTRA, 2) simultaneousRxTxInterBandCA in CA-ParametersNR and 3) simultaneousRxTxInterBandENDC in MRDC-Parameters. Our understanding is that they are applicable within EUTTRA-CG, within NR-CG and across CGs respectively.So it is not true “*simultaneousRxTxInterBandCA capability applies to any of the two bands (if applicable) in a BC*”.Issue 2)It is our understanding that in NR-DC there is no specified inter-node resource coordination to facilitate non-simultaneous Rx-Tx across CGs. Such coordination is supported between gNB and eNB in RAN3 specifications.We see that those aspects have not been discussed in release-15, because NR-DC is simply limited to FR1-MCG and FR2-SCG. |
| Ericsson | Yes, but | On the excerpt mentioned in the comment above, we think the intention is to clarify that “simultaneousRxTxInterBandCA capability applies to any of the NR bands in a BC”, with that clarification we think the assessment is correct. For the second issue raised above, we think it is beyond the scope of the *simultaneousRxTxInterBandCA* capability. As this feature is applied within a CG. |
| Nokia | Yes | Agree that the 1st paragraph of the LS is how RAN2 signalling works today for NR bands in the BC.We are aligned to P1 and P2 in R2-2101435 from Ericsson. |
| MediaTek | Yes | Our intention on this proposal is only for NR CA within the CG in particular to response RAN4’s question on BC CA\_n39-n41-n79. We do not intent to cover NR-DC or EN-DC with this proposal. |
| Apple | Yes, but | We have same view as Qualcomm. For the second statement, we agree that the UE can reports fallback BC with different capability, although it only makes sense if UE reports no support for higher order and support of simutaeousTxRx for the fallback. And all of this is limited to a CG. |
| OPPO | Yes | As long as the question is checking the meaning of *simultaneousRxTxInterBandCA* specifically |
| Huawei, HiSilicon | Yes, but | For the issue 1) from Qualcomm, we could clarify that “*simultaneousRxTxInterBandCA capability applies to any of the two NR bands (if applicable) in a BC*”. Or we could further add “except for NR-DC” for the time being due to issue raised by Qualcomm and Apple.For the issue 2) from Qualcomm, We understand the issue is if *simultaneousRxTxInterBandCA* is reported for NR-DC, how the MN and SN to coordinate the resource. For some companies mention it is only for one CG, does it means if *simultaneousRxTxInterBandCA* is reported for NR-DC, it indicates capability within one CG instead of cross CGs? We need more time to further check it.  |
| Intel | Yes | According to UE capability procedure, the UE reports fallback band combination if it has different capabilities from the superset.  |
| ZTE | Yes | We are OK with this proposal for the NR CA. |
| Samsung | Yes | We have same view with Ericsson and Nokia. Main question from RAN4 is already supported in RAN2 signalling. |
| CATT | Yes | Now simultaneousRxTxInterBandCA ‎is for NR CA. And we agree with the understanding outlined by the Rapporteur.  |
| LG | Yes | We agree that simultaneousRxTxInterBandCA capability applies to any of the two bands (if applicable) in a BC within a CG. We also agree that UE can indicate fallback BC capabilities that are different from the corresponding superset capabilities |

Companies also discussed how to understand “RAN4’s understanding is that the network shall also consider the fallback mode capability to decide the UL/DL scheduling among all bands for this band combination” in RAN4 LS. There are two understandings/potential ways:

1. Clarify in RAN2 specification that the network also considers the fallback capability to decide the UL/DL scheduling among all bands for this band combination.
2. Inform RAN4 that the UE capability signaling does not account for the indication of support of a feature that needs to be derived from multiple band combinations. If the current design of simultaneous Rx/Tx capability is not enough, RAN4 can clarify which further cases need to be covered so that RAN2 can design the according signaling for such cases.

**Q1-2 Please companies provide your comments on the above two understandings/potential ways or any other comments.**

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| **Company** | **Comments** |
| Qualcomm Incorporated | It is clearly stated in 38.331 that the UE can signal fallback band combination if the UE capability is “different”. Usually such UE capability is an “improved” UE capability that can only be achieved in the fallback combination, e.g. thanks to reduced number of CCs. It does not make sense for the network to look at and apply such “different” capability from a fallback band combination when the UE is configured with a superset band combination. |
| Ericsson | Our understanding is in line with (2). But for what to include in an LS to RAN4, it is sufficient to indicate how the signalling currently works i.e. “Inform RAN4 that the UE capability signaling does not account for the indication of support of a feature that needs to be derived from multiple band combinations.”. |
| Nokia | For the 2nd paragraph of the question in the LS, the network does not look capabilities across BC’s. |
| MediaTek | We are more aligned with understanding (2). NW does not check the “fallback” BC to determine the capability of superset BC. In this case, this may be sub-optimized. But it would be a safe approach. |
| Apple | Well, the NW should consider the capabilities of a BC (if provided by the UE) for capabilities. Otherwise, the capabilities are derived from the higher order BC. For (1) it’s upto the NW to also look at fallback, but as Qualcomm mentioned, we have a clear UE behaviour of reporting BCs. For (2), we partly agree with Ericsson in providing how the current signalging works and ask RAN4 ti clarify what needs to be addressed based on this. |
| OPPO | We share Ericsson’s view |
| Huawei, HiSilicon | We agree that there is no such logic of combining the super BC capability and fallback BC capability for the NW and such default combination may not be supported by the UE. If the majority prefer (2), we are fine and we think we need to inform RAN4 about RAN2 understanding, we can further ask if there is any cases from RAN4 needs to be supported then to further discussion the signalling design if needed. |
| Intel | Similar to Apple, the above two understandings/potential ways are reasonable. We are ok to provide them to RAN4.  |
| ZTE | We share Ericsson and Nokia’s view that the network does not look capabilities across BCs. |
| Samsung | Our understanding is (2) and RAN2 could inform the RAN2 understanding in the reply LS. |
| CATT | We also think (2) is more aligned with the current R2 spec.  |
| LG | Our understanding is more in line with (2) |

### 3.1.2 Discussion on legacy simultaneous Rx/Tx capability field

The content of RAN4 LS R4-2016988/R2-2100056:

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| In addition, it is RAN4 understanding that absence of the simultaneous Rx/Tx capability for TDD-TDD and TDD-FDD inter-band CA, SUL and EN-DC band combinations C means that simultaneous RX/TX is not supported for the band combination, otherwise, if simultaneous Rx/Tx capability is supported, the capability indication must be set to “supported”. |

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| The relevant proposals from R2-2101662 (Huawei):**Proposal 3: RAN2 to discuss if any clarification on “mandatory to report” for simultaneous Rx/Tx capability is needed.**The proposals from R2-2101843 (MediaTek):**Proposal 2: Confirm RAN4 understanding that absent of the field *simultaneousRxTxInterBandCA* implies that simultaneous RX/TX is not supported for the band combination.** |

**Q1-3 Do companies agree:**

**RAN2 to confirm RAN4 understanding that absent of the field *simultaneousRxTxInterBandCA* implies that simultaneous RX/TX is not supported for the band combination?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes |  |
| MediaTek | Yes |  |
| Apple | Yes |  |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Intel | Yes |  |
| ZTE | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| LG | Yes |  |

**Q1-4 Please companies provide your comments on whether any clarification on “mandatory to report” for simultaneous Rx/Tx capability is needed. If yes, please also provide your comments on the proposed changes for TP in R2-2101662.**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | No | Looking at 38.101-1/3, for selected band combinations, it is said that they are “applicable for UE supporting inter-band carrier aggregation / EN-DC with mandatory simultaneous Rx/Tx capability”. It might be clearer if RAN4 says it is mandatory for the UE to support simultaneous Rx/Tx capability for those band combinations. |
| Ericsson | Yes | We think it is beneficial to clarify that it is mandatory to report such capability. Hence, we would need only the change below:“It is mandatory to report for certain TDD-FDD and TDD-TDD band combinations defined in TS 38.101-3 [4].”The note and change in introduction section (4.2.1) seem not essential. |
| Nokia | No | Existing sentence already seems to capture the RAN4 intention. “Mandatory/Optional support depends on band combination and captured in TS 38.101-1 [2].” Obviously, if UE supports then it is forced to report, isn’t it? |
| MediaTek | No | We think it is already conditional mandatory according to RAN4 SPEC (as pointed out by Nokia). Adding the “to report” does not change anything. |
| Apple | No | RAN4 spec is already clear |
| OPPO | No | We also think RAN4 spec is clear enough |
| Huawei, HiSilicon | Yes | Based on the RAN LS “otherwise, if simultaneous Rx/Tx capability is supported, the capability indication must be set to “supported””, we understand the intention is to state in RAN2 that such capability should be reported if UE supported as it is signaling aspects and discussed in RAN2 rather than RAN4. RAN4 only specifies that simultaneousRxTx is mandatory for some combination but if UE does not report such capability, there is a mis-match in the NW side. |
| Intel | No | It is based on RAN4 FG list. Generally, this capability is to indicate the support. And then “mandatory” means that the UE shall report “support”. We don’t see strong need to clarify.  |
| ZTE | Yes | We think it is beneficial to clarify that it is mandatory to report such capability. |
| Samsung | No | We think that further clarification seems not really needed i.e. it is already clear when UE report this capability. |
| CATT | Seems not | If it is already clear in R4 spec, we tend to think no need for further changes to R2 part. |
| LG | No | If UE supports the feature, it surely reports. |

### 3.1.3 Discussion on simultaneous RxTx UE capability for NR-DC

The content of RAN4 LS R4-2016988/R2-2100056:

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| For the question raised by RAN2 on whether the simultaneous RxTx UE capability is needed for inter-band NR-DC (for TDD-TDD and TDD-FDD band combinations), RAN4 thinks that the capability is needed, and same principles used for *simultaneousRxTxInterBandCA* as well as clarification consideration above shall also be applied for NR-DC. |

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| The relevant proposals from R2-2101662 (Huawei):**Proposal 4: RAN2 to confirm that with the legacy RAN2 signalling, it is feasible to indicate simultaneous RxTx UE capability for inter-band NR-DC (for TDD-TDD and TDD-FDD band combinations).**The proposals from R2-2101843 (MediaTek):**Proposal 3: RAN2 to adopt the CRs in R2-2101844 and R2-2101845.**The proposals from R2-2101435 (Ericsson):**Proposal 3 Inform RAN4 that the UE capability signaling already allows the simultaneous Rx/Tx capability to be reported differently for NR CA and NR-DC.** |

Based on contributions, rapporteur understands that companies share the same view that the legacy RAN2 signalling already supports reporting simultaneous RxTx UE capability for NR-DC which can be different with the simultaneous RxTx UE capability for NR CA. The relevant clarifications are provided in CRs R2-2101844/R2-2101845.

**Q1-5 Do companies agree:**

**RAN2 to confirm that with the legacy RAN2 signalling, it is feasible to indicate simultaneous RxTx UE capability differently for NR CA and NR-DC?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | No | We suggest RAN2 be more careful and look at the entire system design of NR-DC. It is too early to conclude single UE capability is sufficient.Issue 1)In EN-DC, the UE can signal three UE capabilities, 1) simultaneousRx-Tx in CA-ParametersEUTRA, 2) simultaneousRxTxInterBandCA in CA-ParametersNR and 3) simultaneousRxTxInterBandENDC in MRDC-Parameters. Our understanding is that they are applicable within EUTTRA-CG, within NR-CG and across CGs respectively.Issue 2)It is our understanding that in NR-DC there is no specified inter-node resource coordination to facilitate non-simultaneous Rx-Tx across CGs. Such coordination is supported between gNB and eNB in RAN3 specifications.We see that those aspects have not been discussed in release-15, because NR-DC is simply limited to FR1-MCG and FR2-SCG. |
| Ericsson | Yes | If there are further cases that RAN4 sees a need, those can be discussed in RAN4. But the capability *simultaneousRxTxInterBandCA* can already be signalled differently between CA-ParametersNR and CA-ParametersNRDC, so we anyway need to clarify what it means in case it is included in CA-ParametersNRDC.  |
| Nokia | Yes | We agree the capabilities can be signalled separately for NR CA and NR-DC band combinations. We can indicate this aspect to RAN4 at least. |
| MediaTek | Yes |  |
| Apple | Yes,but | It is feasible as we have *simultaneousRxTxInterBandCA* in CA-ParametersNRDC. But we also have similar views as Qualcomm, and just because we have a field we should not think everything is already covered. Either we clarify how the field is to be interpreted clearly, or create a new field if there is an NBC issue. |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes | We understand Qualcomm indicates another issue on how to use this simultaneousRxTx capability in NR-DC case and we are fine to further discuss it. But at least, we agree that it is feasible to indicate simultaneous RxTx UE capability differently for NR CA and NR-DC from the UE to the NW. |
| Intel | Yes | The existing *simultaneousRxTxInterBandCA* can be used to indicate simultaneous RxTX for NR-DC. |
| ZTE | Yes | We think the current signalling structure has support to report for NR CA and NR-DC separately |
| Samsung | Yes | Same view with Ericsson and Nokia. |
| CATT | Yes | We think it is better to signal this capability separately for CA and DC. This can be informed to R4. Detailed signalling is up to R2 and can be further discussed.  |
| LG | Yes | From signalling perspective, we think it is allowed. However, we may need to elaborate what QC indicates.  |

**Q1-6 Do companies agree the CRs R2-2101844/R2-2101845?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | No | We suggest RAN2 be more careful and look at the entire system design of NR-DC. |
| Ericsson | Yes |  |
| Nokia | Yes | Could Qualcomm clarify what they mean by system design of NR-DC, which aspect specifically are they referring to? |
| MediaTek | Yes |  |
| Apple | No | We would like to understand what it means that UE supports or not support simultaneousTxRx for NR-DC… across the cell-group or within cell-group.. etc… the CR needs to be discussed. Also we have a paper in RAN4 to discuss this. Might need input from RAN4 as well. |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Intel | Not sure | We don’t disagree with the clarification. But we are wondering if we need more general description for all capabilities that can be reported in *ca-ParametersNR-ForDC* |
| ZTE | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| LG |  | More time to think is needed.  |

### 3.1.4 Others

**Q1-7 Regarding the above understandings, for the consensus reached in RAN2, do companies agree to capture it in the meeting minutes and inform it to RAN4?**

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| **Company** | **Yes/No for capturing it in meeting minutes** | **Yes/No for informing it to RAN4** | **Comments** |
| Ericsson | Probably not | Yes | It is a bit unclear at the moment whether we need to capture anything in the meeting minutes, but we think that we should clarify to RAN4 what the UE capability signalling supports (see comments to Q2). |
| Nokia |  | Yes | RAN2 should summarize the understanding to RAN4 as normal LS response is required. |
| MediaTek | Depends | Yes | LS content could be discussed once we have some RAN2 conclusions. |
| Apple |  | Yes | Informing RAN4 is useful, and maybe asking for clarification as well. |
| OPPO |  | Yes |  |
| Huawei, HiSilicon | Depends | Yes |  |
| Intel | Yes | Yes |  |
| ZTE | Yes | Yes |  |
| Samsung | No strong view | Yes |  |
| CATT |  | Yes | A reply LS is business as usual. What to capture or what CR to approve is R2 discussion.  |
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**Q1-8 Please provide other comments here if any.**

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| **Company** | **Comments** |
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##  Support K0 > 0 in paging

Continuation from last meeting

[R2-2101731](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101731.zip) DL scheduling slot offset capability Ericsson, Qualcomm discussion Rel-15 NR\_newRAT-Core R2-2009944

The observations and proposals are listed as below:

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| **Observation 1**: The UE is required to support K0>0, but it may not have IOT-tested the feature, in which case the UE may set the support to false. **Observation 2**: To avoid potential IOT problems the network can use K0=0 in a paging occasion where both UEs supporting K0>0 and UEs not supporting K0>0 are paged.**Proposal 1**: *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* capability are added to the *UERadioPagingInformation* in REL-15.**Proposal 2**: RAN2 to confirm that a UE that does not support *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* capability does support *pdsch-TimeDomainAllocationList* configuration including K0 values larger than 0. |

**Q2-1 Do companies agree with the Observation 1&2 and Proposal 1? If yes, please also provide your comments on the proposed changes for Appendix in R2-2101731.**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes | Proponent |
| Ericsson2 (proponent) | Yes | In last meeting we discussed whether UE supports K0=0 and 1 for paging. But in the end the “problem” is that UE can indicate that it has not IOT tested K0>0 and NW has to test/check that there is no problem with legacy UE. In our understanding the NW can only use K0>0 when UE indicates that it has IOT tested the feature, and therefore these IOT bits needs to be added to the radio paging capabilities. @HW and Intel: We need to distinguish “support” and “IOT-tested” here. We agree that the UE is required to “support” K0=0 and 1, but the UE can set the IOT capability to FALSE, indicating that it has not IOT-tested K0>0. By including the K0 capabilities in the paging message the gNB can know whether the UE has IOT-tested K0>0. We think this was forgotten in Rel-15. The NW can otherwise not use K0>0 without potential impact on legacy UEs. |
| Nokia | Yes |  |
| MediaTek | Yes |  |
| Apple | Yes |  |
| OPPO | Yes |  |
| Huawei, HiSilicon | Not sure | We understand the issue for paging reception can be addressed by adding new IOT capability in radio paging capabilities. However, the basic feature in RAN1 feature list includes both SI and paging,11) DL scheduling slot offset K0=1 for type 1 CSS without dedicated RRC configuration and for type 0, 0A, and 2 CSSUE still needs to support k0=1 for SI reception, in this case, there seems no problem for supporting k0=1 for paging reception. If anyway the UE needs to support k0=1, the IOT capability may not be very useful. Or both SI and paging can be controlled by IOT capability? But we are not sure how it works, as it is added in radio paging capabilities, how it impacts the SI transmission in NW? |
| Intel | Not sure | According to the R1 feature list 5-1, UE shall support K0 = 1 for Paging (for both FR1 and FR2). It is clear that it is a mandatory feature without UE capability signalling. |
| ZTE | Yes |  |
| Samsung | Not sure |  |
| LG | Yes | We think it is safer to introduce IOT bits for those |

**Q2-2 If companies agree Q2-1, do companies agree with the Proposal 2? If yes, please also provide your comments on whether any clarification is needed, e.g. capturing it in the meeting minutes.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes | Proponent |
| Ericsson2 (proponent) | Yes | To capture this understanding in the chairman notes seems an appropriate solution. @MDTK/Apple: It is our understanding that the NW configures the TDRA table, where each entry contains a possible setting the NW can use when transmitting the PDCCH and scheduling the subsequent PDSCH, i.e. the TDRA table may contains entries with different K0 values. See pdsch-TimeDomainAllocationList in 38.331. |
| Nokia | Yes | Okay to capture this in the meeting minutes. |
| MediaTek | Not sure | Proposal 2: RAN2 to confirm that a UE that does not support *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* capability does support *pdsch-TimeDomainAllocationList* configuration including K0 values larger than 0.Not sure we understand the intention. Does it mean that for UE does not support K0 > 0 the NW may still configure K0 > 0 in system information as it is just **possible** value? The real K0 is provided in DCI and NW will carefully schedule real paging location (e.g. as specific in O2) |
| Apple | Not sure | Same view as Mediatek. Need clarification. |
| OPPO | No | We think UE not supporting these two capability can only support either K0=0(FR1) or K0=0,1 (FR2). So it not correct to say UE can support those configured K0 value in SIB by default. |
| Huawei, HiSilicon | No | Please see our comments on Q2-1. |
| Intel | Not sure | Please see our comments on Q2-1. |
| ZTE | Yes | We understand this proposal only focus on whether the UE can support pdsch-TimeDomainAllocationList configuration including K0 values larger than 0, it doesn’t mean that the UE must support Paging detection with K0>1, (For the K0 >1, it still depends on the *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* capability ) |
| Samsung | Not sure |  |
| LG | Yes | We think the proposal is only about UE capability, not network signaling.  |

## Configuration Limitation per BWP

[R2-2101558](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2101558.zip) Clarification on the BWP Configuration Capabilities ZTE Corporation, Sanechips discussion Rel-15 NR\_newRAT-Core

The proposals are listed as below:

|  |
| --- |
| Proposal 1: Ran2 to clarify which understanding is preferred.1. All of the possible combinations of active BWPs on the different bands shall satisfy the FeatureSetCombination requirement.
2. All of the possible combinations of the configured BWPs on the different bands shall satisfy the FeatureSetCombination requirement.

Proposal 2: The first understanding that “All of the possible combinations of active BWPs on the different bands shall satisfy the FeatureSetCombination requirement” is preferred from the system performance perspective.Proposal 3: RAN2 to confirm the current implementation and understanding of both UE and network vendors and confirm whether any spec clarification is needed.  |

**Q3-1 Which option listed in above Proposal 1 do companies support?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| Qualcomm Incorporated | 2 | The network does not necessarily have full control on the combinations of active BWPs due to:1. UE autonomous BWP switching.
2. Lack of inter-node coordination in DC.

Also from the view point of backward compatibility, option2 is safer. |
| Ericsson | (2) | The UE capabilities are compliant with a single “row” in FeatureSetCombination (which is also captured in 38.331, see below), hence such handling described in understanding 1 in this paper is not possible.“Each FeatureSetsPerBand contains a list of feature sets applicable to the carrier(s) of one band entry of the associated band combination. Across the associated bands, the UE shall support the combination of FeatureSets at the same position in the FeatureSetsPerBand. All FeatureSetsPerBand in one FeatureSetCombination must have the same number of entries.” |
| Nokia | (2) | Agree with Ericsson. The configuration across different rows in FeatureSetCombination is simply invalid and this is the network role to ensure it doesn’t do it. |
| MediaTek | (2) | We agree that option 1 may have better performance but option 2 is more aligned with legacy concept on the capability (it is also safer). |
| Apple | 2 | We think this was brought up in Athens in 2018 and we decided to go with opt-2 then knowing the impact. Also there is no way for the UE to report a mis-configuration if we go with opt-1. We think opt-2 should continue be the way. |
| OPPO | 2 | We also think option2 is safer for UE. But once more than one BWP is configured per band, in fact the combination not aligned with UE feastureset capability does exist. So how would it work?  |
| Huawei, HiSilicon | 2 | We had discussed and clarified it in 38.331:NOTE 3: The Network configures serving cell(s) and BWP(s) configuration to comply with capabilities derived from the combination of FeatureSets at the same position in the FeatureSetsPerBand, regardless of activated/deactivated serving cell(s) and BWP(s). |
| Intel | 2 |  |
| ZTE |  | We can following the majorities’ view for that this paper is mainly for clarification. |
| Samsung | 2 |  |
| CATT | 2 |  |
| LG | 2 | We think that is CR is for clarification as ZTE mentioned |

**Q3-2 Please companies provide your comments on whether/what** **confirmation or spec clarification is needed.**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm Incorporated | We do not see the need of further clarifying. It has always been the case that RRC “configuration” should not exceed the UE capability.  |
| Ericsson | Agree with Qualcomm. |
| Nokia | Agree with Qualcomm and Ericsson. |
| MediaTek | Agree with Qualcomm. |
| Apple | No additional comments, same view as other above. |
| OPPO | No |
| Huawei, HiSilicon | No |
| Intel | No |
| ZTE | We can following the majorities’ view  |
| Samsung | No further clarification is needed. |
| CATT | No |
| LG | Agree with QC |

## V2X Capability

[R2-2100970](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2100970.zip) Dummy the capability bit v2x-EUTRA Ericsson discussion Rel-15 NR\_newRAT-Core

[R2-2100971](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2100971.zip) Dummy the capability bit v2x-EUTRA Ericsson CR Rel-15 38.331 15.12.0 2370 - F NR\_newRAT-Core

[R2-2100972](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113-e%5CDocs%5CR2-2100972.zip) Dummy the capability bit v2x-EUTRA Ericsson CR Rel-15 38.306 15.12.0 0499 - F NR\_newRAT-Core

The observations and proposals are listed as below:

|  |
| --- |
| [Observation 1 RAN2 agreed in Rel-16 that the UE does not report any PC5 capability when this is configured with MR-DC.](#_Toc61536520)[Observation 2 According to the RAN2 agreements in Rel-16, the capability bit v2x-EUTRA introduced in Rel-15 has not meaning and is not used.](#_Toc61536521)[Proposal 1 RAN2 to dummy the capability bit *v2x-EUTRA* in TS 38.331 and TS 38.306.](#_Toc61536522)[Proposal 2 RAN2 to agree on the CRs in [1] and [2].](#_Toc61536523)  |

**Q4-1 Do companies agree to dummy the capability bit *v2x-EUTRA* in TS 38.331 and TS 38.306?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes |  |
| Ericsson (proponent) | Yes |  |
| Nokia | Yes |  |
| MediaTek | Yes |  |
| Apple | Yes |  |
| OPPO | Yes | This bit is neither compatible with the R16 assumption nor future proof. |
| Huawei, HiSilicon | Yes |  |
| Intel | Yes | No strong view. This is basically related to discussion in RAN2#112-e in relation to LS from RAN4 won’t define requirements for MR-DC + LTE/NR PC5 in Rel-16 and hence this capability is also not needed in Rel-15. |
| ZTE | Yes |  |
| Samsung | Yes | No strong view. |
| CATT | Yes |  |

**Q4-2 If companies agree Q4-1, do companies agree the CRs R2-2100971/R2-2100972?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes |  |
| Ericsson (proponent) | Yes |  |
| Nokia | Yes |  |
| MediaTek | Yes |  |
| Apple  | Yes |  |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Intel | Yes |  |
| ZTE | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |

## Summary of Phase 1

### 3.5.1 Simultaneous Rx/Tx

For Q1-1, 12 companies joined the discussion, 11 companies agree with the understanding, 1 company does not agree and indicates that *simultaneousRxTxInterBandCA* is applicable within NR-CG and BC may include EUTTRA and NR. Thus, it is suggested to re-word the sentence to fix/avoid the problem above.

**Proposal 1: RAN2 confirms that *simultaneousRxTxInterBandCA* capability applies to any of the two NR bands (if applicable) in a BC (except for NR-DC), and UE shall only include this capability if it supports simultaneous Rx/Tx capability on all applicable NR band pairs. The UE can additionally include fallback BC with different simultaneous RxTx capability compared to the corresponding superset band combination.**

For Q1-2, 12 companies joined the discussion, 8 companies are aligned or more aligned with understanding (2), 3 companies think two understandings/potential ways are reasonable and can provide them to RAN4. Thus, it is suggested to inform RAN4 that the UE capability signalling does not account for the indication of support of a feature that needs to be derived from multiple band combinations and which further cases need to be covered from RAN4 perspective.

**Proposal 2: RAN2 informs RAN4 that the UE capability signalling does not account for the indication of support of a feature that needs to be derived from multiple band combinations and which further cases need to be covered from RAN4 perspective.**

For Q1-3, 12 companies joined the discussion, all companies agree with the understanding. Thus, it is suggested to confirm RAN4 understanding that absent of the field *simultaneousRxTxInterBandCA* implies that simultaneous RX/TX is not supported for the band combination.

**Proposal 3: RAN2 confirms that absent of the field *simultaneousRxTxInterBandCA* implies that simultaneous RX/TX is not supported for the band combination.**

For Q1-4, 12 companies joined the discussion, 9 companies does not think the clarification on “mandatory to report” for simultaneous Rx/Tx capability is needed, and 3 companies think such clarification is needed. Thus, it is suggested to not pursue such clarification.

**Proposal 4: The clarification on “mandatory to report” for simultaneous Rx/Tx capability is not pursued.**

For Q1-5, 12 companies joined the discussion, 11 companies agree with the understanding, 1 company indicates that there is no specified inter-node resource coordination to facilitate non-simultaneous Rx-Tx across CGs in NR-DC. Rapporteur understands the raised issue is about the interface between gNBs, however for Uu interface, no companies doubt that it is not feasible to indicate simultaneous RxTx UE capability differently for NR CA and NR-DC from the UE to the NW. Thus, it is suggested to confirm that with the legacy RAN2 signalling, it is feasible to indicate simultaneous RxTx UE capability differently for NR CA and NR-DC and continue the discussion on MN-SN coordination in NR-DC.

**Proposal 5: RAN2 confirms that with the legacy RAN2 signalling, it is feasible to indicate simultaneous RxTx UE capability differently for NR CA and NR-DC.**

**Proposal 6: Continue the discussion on the interpretation of simultaneous RxTx UE capability in NR-DC (e.g. within a CG or across the CGs) and MN-SN coordination in NR-DC in Phase 2.**

For Q1-6, 12 companies joined the discussion, 8 companies agree with the CRs R2-2101844/R2-2101845, 2 companies answer “No”, 1 company answering “Not sure” wonders if we need more general description for all capabilities that can be reported in *ca-ParametersNR-ForDC* and 1 company needs more time to think. Rapporteur understands no companies think this clarification is not needed, but the details need further discussion. Thus, it is suggested to pursue the CRs and continue the discussion on these CRs.

**Proposal 7: The CRs R2-2101844 and R2-2101845 can be pursued, the details are discussed in Phase 2.**

For Q1-7, 10 companies joined the discussion, 2 companies think the consensus reached in RAN2 can be captured in the meeting minutes and 3 companies have no strong views. All companies agree that consensus understanding reached in RAN2 should be informed to RAN4. Thus, it is suggested to send reply LS to RAN4 to inform RAN2 understanding which are concluded in RAN2.

**Proposal 8: RAN2 sends reply LS to RAN4 to inform RAN2 understanding, the details are discussed in Phase 2.**

### 3.5.2 Support K0 > 0 in paging

11 companies joined the discussion, 8 companies agree with the Proposal 1 and 3 companies are not sure about the Proposal 1. One company thinks only the issue for paging reception can be addressed and not sure how to impact SI reception, one company thinks UE shall support K0 = 1 for Paging (for both FR1 and FR2) according to R1 feature list 5-1. 5 companies agree with the Proposal 2, 6 companies answer “No” or “Not sure” for Proposal 2. Thus, it is suggested to continue the discussion on whether IOT capability for paging is needed and the relation between IOT capability for paging and SI configuration.

**Proposal 9: Continue the discussion on** **whether the existing IOT capability for K0 should be included in radio paging capabilities, and the relation between IOT capability for paging and *pdsch-TimeDomainAllocationLis*t configuration in Phase 2.**

### 3.5.3 Configuration Limitation per BWP

12 companies joined the discussion, 10 companies support understanding (2) in the contribution [R2-2101558](file:///D%3A%5C%5CDocuments%5C%5C3GPP%5C%5Ctsg_ran%5C%5CWG2%5C%5CTSGR2_113-e%5C%5CDocs%5C%5CR2-2101558.zip%22%20%5Co%20%22D%3ADocuments3GPPtsg_ranWG2TSGR2_113-eDocsR2-2101558.zip) and do not see the need of further clarification. Thus, it is consensus in RAN2 that all of the possible combinations of the configured BWPs on the different bands shall satisfy the *FeatureSetCombination* requirement, and it is suggested that any spec clarification is not pursued.

**Proposal 10: RAN2 understands that all of the possible combinations of the configured BWPs on the different bands shall satisfy the *FeatureSetCombination* requirement, any spec clarification is not pursued.**

### 3.5.4 V2X Capability

11 companies joined the discussion, all companies agree to dummify the capability bit v2x-EUTRA and agree the CRs R2-2100971/R2-2100972. Rapporteur understands that the CRs R2-2100971/R2-2100972 can be agreed based on Phase 1 discussion and do not need to be further discussed in Phase 2. Thus, it is suggested to agree the CRs R2-2100971 and R2-2100972.

**Proposal 11: The CRs R2-2100971 and R2-2100972 are agreed.**

# Discussion (Phase 2)

## Simultaneous Rx/Tx

In phase 1 discussion, one company indicated that there is no specified inter-node resource coordination to facilitate non-simultaneous Rx-Tx across CGs in NR-DC. Such coordination is supported between gNB and eNB in RAN3 specifications in EN-DC. Rapporteur understands that if the *simultaneousRxTxInterBandCA* can apply to any of the two NR bands within a CG or across the CGs when such capability is reported for NR-DC combinations, the resource coordination between the MN and the SN may be needed.

**Q5-1 Which understanding do companies support: the *simultaneousRxTxInterBandCA* applies to any of the two NR bands (1) within a CG or (2) across the CGs when such capability is reported for NR-DC combinations?**

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| --- | --- | --- |
| **Company** | **(1) or (2)** | **Comments** |
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**Q5-2 If companies support (2) for Q5-1, do companies agree resource coordination between the MN and the SN is needed? If yes, please also provide your comments on whether such resource coordination can be supported or not by existing signaling, or anything needs to be informed to RAN3.**

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| **Company** | **Yes/No** | **Comments** |
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**Q5-3 Please companies provide your comments on the contents of CRs R2-2101844/R2-2101845.**

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| --- | --- |
| **Company** | **Comments** |
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The contact company of this RAN4 LS will provide the draft reply LS based on the Phase 1&2 discussion, please companies provide your comments directly to the draft reply LS in Phase 2.

## Support K0 > 0 in paging

According to RAN1 feature list FG 5-1, type 0 and 0A are for SI reception, type 2 is for paging reception.

11) DL scheduling slot offset K0=1 for type 1 CSS without dedicated RRC configuration and for type 0, 0A, and 2 CSS

As explained by proponent, the intention is to distinguish “support” and “IOT-tested”, the UE can set the IOT capability to FALSE, indicating that it has not IOT-tested K0>0. The IOT capability (*dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB*) for paging was proposed to be added to *UERadioPagingInformation*.

But for *pdsch-TimeDomainAllocationList* in SIB1, it gives the possible K0 values that can be used for paging, system information and random access in each entry of the list. If K0>0 is configured in some entries in *TimeDomainAllocationList*, UE needs to support such configuration but the network cannot use such entry when scheduling PDCCH to a UE that did not indicate support of the IOT capability to avoid potential IOT issues. This works for paging, but there still exist IOT issues for SI and RA as there is no IOT capability for SI and RA.

**Q6-1 Do companies agree that the existing IOT capability, i.e. *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB*, should be included in *UERadioPagingInformation* in REL-15. If yes, companies are encouraged to provide your understanding on how to use this IOT capability.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
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**Q6-2 Do companies agree that a UE that does not support *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* capability should support *pdsch-TimeDomainAllocationList* configuration including K0>0 in some entries of the list.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
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**Q6-3 If companies do not agree Q6-2, how the companies understand the relation between *dl-SchedulingOffset-PDSCH-TypeA*/*dl-SchedulingOffset-PDSCH-TypeB* capability and *pdsch-TimeDomainAllocationList* configuration for paging, SI and RA.**

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| --- | --- |
| **Company** | **Comments** |
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# Conclusions

*To be added…*

# References

1. R2-2100056 LS on simultaneous Rx/Tx capability (R4-2016988; contact: Huawei) RAN4
2. R2-2101662 Discussion on simultaneous RxTx capability (LS contact) Huawei, HiSilicon
3. R2-2101663 Draft reply LS on simultaneous RxTx capability Huawei, HiSilicon
4. R2-2101843 Discussion on simultaneous Rx/Tx capability MediaTek Inc.
5. R2-2101844 Clarification on the simultaneousRxTxInterBandCA capability in NR-DC MediaTek Inc.
6. R2-2101845 Clarification on the simultaneousRxTxInterBandCA capability in NR-DC MediaTek Inc.
7. R2-2101435 On the use of UE simultaneous Rx/Tx capability Ericsson
8. R2-2101731 DL scheduling slot offset capability Ericsson, Qualcomm
9. R2-2101558 Clarification on the BWP Configuration Capabilities ZTE Corporation, Sanechips
10. R2-2100970 Dummy the capability bit v2x-EUTRA Ericsson
11. R2-2100971 Dummy the capability bit v2x-EUTRA Ericsson
12. R2-2100972 Dummy the capability bit v2x-EUTRA Ericsson