**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

# Contact from companies

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| Company | Email |
| Qualcomm Incorporated | mkitazoe@qti.qualcomm.com |
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# Discussion

## 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. |
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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. |
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### 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 |  |
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**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. |
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### 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. |
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**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. |
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### 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** |
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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 |
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**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.**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes | Proponent |
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## 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:

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| 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?**

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

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| **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.  |
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## 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:

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| [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?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes |  |
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**Q4-2 If companies agree Q4-1, do companies agree the CRs R2-2100971/R2-2100972?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm Incorporated | Yes |  |
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# 4 Conclusions

*To be added…*

# 5 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