**3GPP TSG-RAN WG4 Meeting # 97-e R4-200XXXX**

**Electronic Meeting, 2 – 13 November, 2020**

**Agenda item:** 4.2.3

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [97e][104] NR\_NewRAT\_UE\_RF\_Part\_3

**Document for:** Information

# Introduction

This email discussion handles the contributions submitted to agenda item 4.2.3, 4.2.3.1, 4.2.3.2 and 4.2.3.3. The scope of this email discussion covers Rel-15 UE RF requirements maintenance on TS 38.101-3, which specifies the UE RF requirements for EN-DC operations. There are 4 topics (Simultaneous Rx/Tx UE capability, Rx requirements, Tx requirements and others) in this email discussion and multiple sub-topics within each of them. Note that since this discussion is mainly maintenance work we will start to agree on CRs and mirror CRs in the first round. In the second round only the contentious issues are discussed. There is no GTW time slot planned so far for this email discussion.

# Topic #1: Simultaneous Rx/Tx UE capability

Topic #1 handles the issue identified upon UE capability of simultaneous Rx/Tx operation under NR CA, SUL, EN-DC and NR-DC combinations. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2016469 | Huawei, HiSilicon | Discussion on simultaneous RxTx UE capability:  Observation 1: For TDD-FDD CA/EN-DC combinations, besides the combinations with mandatory simultaneous Rx/Tx operation, for combinations without any note indication, UE shall signals the capability if the UE does support simultaneous Rx/Tx based on its implementation, otherwise, if capability is not reported or absent, it means that the band combination does not support simultaneous Rx/Tx.  Observation 2: simultaneous Rx/Tx capability is not consistent for the band combinations in the spec for inter-band CA.  Observation 3: According to RAN2 spec, if the capability of the fallback mode is different from that of the higher order combination, the capability of fallback mode should be reported additionally. From the RAN2 spec, if the network considers the fallback mode simultaneous Rx/Tx capability as well to decide the UL/DL scheduling for the higher order band combination, this issue can be solved.  Observation 4: there is no obvious judgement that simultaneous Rx/Tx cannot be supported for the FDD-TDD band combination, which means UE shall report simultaneous Rx/Tx capability for all FDD-TDD two-band combinations by default unless otherwise indicated.  Observation 5: Indications of mandatory capability for a higher order band combination are not specified in a consistent and generic method.  **Proposal 1: If the simultaneous capability of the fallback mode is different from that of the higher order combination, the network shall also refer to the fallback mode capability to decide the UL/DL scheduling for the band combination. Some clarification may be needed in RAN2 specification. Draft LS should be sent to RAN2 for the clarification.**  **Proposal 2: For FDD-TDD CA/EN-DC band combinations, remove the indication of mandatory simultaneous Rx/Tx operation condition in the spec, instead, only indicate non-simultaneous Rx/Tx for the band combination if identified, and by default UE shall report simultaneous Rx/Tx capability for two-band FDD-TDD band combinations.**  **Proposal 3: The restriction note similar to non-simultaneous Tx/Rx operation should also be considered for fall back mode to support mandatory simultaneous Tx/Rx operation.**  **Proposal 4: Revise the Notes in the spec to make the capability consistent for all of the fall back and higher order combinations for TDD-TDD and TDD-FDD CA/EN-DC combinations.** |
| R4-2016472 | Huawei, HiSilicon | CR for TS 38.101-3 correction CR for simultaneous Tx/Rx operation (R15) |
| R4-2016473 | Huawei, HiSilicon | Mirror CR to R4-2016472 |
| R4-2016470 | Huawei, HiSilicon | CR for TS 38.101-1: correction CR for simultaneous Tx/Rx operation (R15)  Submitted to 4.2.1.1 |
| R4-2016471 | Huawei, HiSilicon | Mirror CR to R4-2016470  Submitted to 4.2.1.1 |
| R4-2015337 | OPPO | CR on simultaneous Tx-Rx for EN-DC  CatF R15  Coversheet error |
| R4-2015338 | OPPO | CR on simultaneous Tx-Rx for EN-DC (R16 mirror CR)  CatF R16 submitted to 7.19.3  Coversheet error |
| R4-2015016 | NTT DOCOMO | CR to TS 38.101-1[R15]: Clarification of non-simultaneous Rx/Tx operation for CA\_n77-n79 and CA\_n78-n79 in TS 38.101-1  Submitted to 4.2.1.2 |
| R4-2015017 | NTT DOCOMO | Mirror CR to R4-2015016  Submitted to 4.2.1.2 |
| R4-2016238 | Skyworks | CR 38101-3 R15 Band 10 protection and DC\_42\_n79 |
| R4-2016241 | Skyworks | Mirror CR to R4-2016238 |
| R4-2014917 | Apple | LS response on simultaneous Rx/Tx for inter-band NR-DC  Submitted to 16.2 |
| R4-2016001 | ZTE | Draft reply LS on simultaneous Rx/Tx for inter-band NR-DC  Submitted to 4.1 |

## Open issues summary

### Sub-topic 1-1

For certain Two-Band combos, specs specify that it is mandatory to support simultaneous Rx/Tx for the UE. It is ambiguous whether the UE is mandatory to support simultaneous Tx/Rx for the Two-Band combos with neither any specification of *simultaneous* nor *non-simultaneous* in the specs. It might be different between TDD-TDD and FDD-TDD combos but it is general for all CA, SUL and EN-DC.

**Issue 1-1: Whether the UE is mandatory to support simultaneous Rx/Tx on the Two-Band combos without any indication in the specs, generally for CA, SUL and EN-DC**

* For FDD-TDD combos
  + Option 1.1: If not indicated otherwise, the UE is mandatory to support simultaneous Rx/Tx on all FDD-TDD. This means that the UE needs to report simultaneous capability by default.
  + Option 1.2: if not indicated otherwise, no restrictions. This means that the UE is allowed to not report on any of the combos without case-by-case mandatory indication in the spec.
* For TDD-TDD combos
  + Option 2.1: if not indicated otherwise, no restrictions. This means that the UE is allowed to not report on any of the combos without case-by-case mandatory indication in the spec.
* Recommended WF
  + Discuss the above two issues; Agree on option 2.1 if no other voice is heard

### Sub-topic 1-2

It is ambiguous whether the fallback and higher-order combos have the same characteristics in terms of UE capability of simultaneous Rx/Tx. This is in general the case for all CA, SUL and EN-DC combos. Under the cases that the UE has different characteristics of supporting simultaneous Rx/Tx on the fallback and the higher-order combos (e.g., support under two-band combo but not support under higher-order), it has to report differently for both combos respectively. The network has to schedule/configure correspondingly. This may need RAN2 clarifications in the spec.

**Issue 1-2: How to consider whether the UE is mandatory to support simultaneous Rx/Tx for higher-order combos?**

* The UE is allowed to not report supporting simultaneous Rx/Tx for higher-order combos unless otherwise specified
  + Option 1.1: Yes. Under the cases that the UE has different characteristics of supporting simultaneous Rx/Tx on the fallback and the higher-order combos (e.g., support under two-band combo but not support under higher-order), it has to report differently for both combos respectively.
* Whether an LS is needed to RAN2?
  + Option 2.1: Yes. RAN2 may need to clarify that the network needs to be aware of the possible differences between fallback and higher-order combos in terms of UE supporting simultaneous Rx/Tx operation.
* Recommended WF
  + Discuss and agree on the issue; send LS to RAN2 if needed

### Sub-topic 1-3

Following sub-topic 1-2, the issues for CA\_n77-n79 and CA\_n78-n79 are that: it is not clear whether the higher-order combos also have the same restrictions.

**Issue 1-3: the issues of CA\_n77-n79 and CA\_n78-n79 higher-order combos**

* Higher-order combos of CA\_n78-n79 also have the restriction that simultaneous Rx/Tx capability is not reported if UE is using n77 implementation for n78
  + Option 1.1: Yes
  + Option 1.2: No. case by case discussion is needed
* CA\_n77-n79 and its higher-order combos have the restriction that the minimum requirements apply only when there is non-simultaneous Rx/Tx between n77 and n79
  + Option 1.1: Yes
  + Option 1.2: No. case by case discussion is needed
* Recommended WF
  + Discuss on the above issues considering the outcome of sub-topic 1-2

### Sub-topic 1-4

R4-2016238 from skyworks proposes two corrections: 1) remove EUTRA band 10 protection; 2) clarify that it is not feasible for n77 implementation to support simultaneous Rx/Tx on DC\_42\_n79.

**Issue 1-4: Whether the CR can be agreed**

* Band 10 correction
  + Option 1.1: agreeable
* Simultaneous Rx/Tx on DC\_42\_n79 correction
  + Option 2.1: agreeable
  + Option 2.2: not agreeable
* Recommended WF
  + Discuss if the CR is agreeable

### Sub-topic 1-5

Ran2 sent an LS in R4-2014159 asking for guideline on whether simultaneous RxTx UE capability is needed for inter-band NR-DC. We understand that the Rx/Tx simultaneous capability issue discussed for CA, SUL and EN-DC combos also applies for NR DC.

**Issue 1-5: An reply LS needs to be sent to RAN2 about RAN4 consensus on UE capability of Rx/Tx simultaneous operation on NR DC combos**

* NR DC UE capability follows any specifications for the corresponding combo of NR CA
  + Option 1.1: Yes
* Recommended WF
  + Agree on the above proposal and send LS to RAN2; One LS can cover conclusions from both sub-topic 1-2 and 1-5

## Companies views’ collection for 1st round

### Open issues

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| **Sub-topics** | **Comments** |
| Issue 1-1:  Whether the UE is mandatory to support simultaneous Rx/Tx on the Two-Band combos without any indication in the specs, generally for CA, SUL and EN-DC? | Company 1:  Company 2:  ….  [OPPO] Option 1.2 for FDD-TDD, Option 2.1 for TDD-TDD, i.e. should be optional support simultaneous Rx/Tx if no mandatory indication in the spec.  According to 38.306, the capability ***simultaneousRxTxInterBandENDC*** is defined to indicate whether UE supports simultaneous transmission and reception in TDD-TDD and TDD-FDD, and it further clarified that the mandatory combinations are clearly specified in 38.101-3. We can see that if one band combination is mandatory then it should be specified explicitly in the spec, if no explicit indication then this band combination can report whether it supports simultaneousRxTx via this capability report.   |  | | --- | | ***simultaneousRxTxInterBandENDC***  Indicates whether the UE supports simultaneous transmission and reception in TDD-TDD and TDD-FDD inter-band (NG)EN-DC/NE-DC. It is mandatory for certain TDD-FDD and TDD-TDD band combinations defined in TS 38.101-3 [4]. |   ZTE: In 38.306, there are three capability signaling introduced simultaneousRxTxInterBandCA, simultaneousRxTxSUL, simultaneousRxTxInterBandENDC for CA, SUL and EN-DC respectively.  *simultaneousRxTxInterBandCA*  *Indicates whether the UE supports simultaneous transmission and reception in TDD-TDD and TDD-FDD inter-band NR CA. It is mandatory for certain TDD-FDD and TDD-TDD band combinations defined in TS 38.101-1 [2], TS 38.101-2 [3] and TS 38.101-3 [4].*  *simultaneousRxTxSUL*  *Indicates whether the UE supports simultaneous reception and transmission for a NR band combination including SUL. Mandatory/Optional support depends on band combination and captured in TS 38.101-1 [2].*  So for FDD-TDD combos, Option 1.2 looks more aligned with 38.306. And similarly for TDD-TDD combos, Option 2.1.  Ericsson:  For FDD-TDD combinations, Option 1.1. If simultaneousRxTx is supported for a BC this shall be reported for the BC regardless if requirement is mandatory for the said BC. If the requirements for a particular BC do not apply for simultaneousRxTx, then this is noted in the RAN4 tables.  For TDD-TDD combinations, the same should apply.  The most important thing is that the network must be able to understand what UE can and cannot do for a BC by looking at the capability IEs itself. The network should be not be forced to implement any RAN4 tables with information about capabilities (including information in footnotes).  Skyworks: regarding TDD-TDD there are case without specific note on supporting simultaneous Tx/Rx like for DC\_42\_n42. Even if it is agree that it means that the support is optional or mandatory it must have a complete requirement: i.e. all issue generated by simultaneous Tx/Rx should be specified especially interference due to UL. In our CR we add the missing MSD for this case. also it cannot be supported for implementation using a n77 filter for B42. This is to explain that one should very carefully check all possible issues before choosing to allow simultaneous Tx/Rx whether mandatory or optional. This is also the case for FDD-TDD.For TDD-TDD we are OK with no indication means optional whether simultaneous Tx/Rx is supported but other notes may be needed and all requirements related to simultaneous Tx/Rx should be in place.  Qualcomm:  Choose option 1.2 for FDD+TDD and option 2.1 for TDD+TDD. Optional by default unless explicitly stated case by case. Release 15 UEs already in field may not have mandatory support indicated for some combos, so those UEs in the field already will not be able to indicate optional for some combinations  [SoftBank]: Looking back to REL-15, the issues of simultaneous Rx/Tx were discussed in final meetings (#86B and #87) and some agreements were made (such as in R4-185928, R4-188090/8091). But in REL-16, it was not so clear on how the issue is addressed, no specific item on TR37.716-11-11 TP template for example, then it is likely that the requirements largely remain unaddressed. Thus it is desirable to understand the situation before considering the proposed CRs.  As an operator, we prefer to set mandatory for combos without specific issues identified.  **Apple**: Option 1.2 and 2.1  Huawei: Since there are more FDD-TDD band combinations than TDD-TDD, and obviously the treatment of FDD-TDD is not consistent with some inputs before from operators, we see a better way is not identify the band combo which cannot support simultaneous Rx/Tx, which does not change the applicability of RAN2 existing signaling just make the RAN4 spec is more readable and can be easily interpreted by network implementation. For TDD-TDD, as synchronization usually needs to be considered for the close bands, we can still treat it by the current manner, i.e. some band combos are mandatory to support simultaneous Rx/Tx and some are explicitly identified not supporting, for those without note marks, it depends on UE implementation. But the principle is that if UE support simultaneous Rx/Tx, the capability shall be reported, otherwise absent or not reporting means the capability is not supported.  CHTTL:  For FDD-TDD combinations, Option 1.1.  BTW, how to interpret when an FDD-TDD combo is not supporting simultaneous Rx/Tx? as the FDD part is already simultaneous Rx/Tx, or I have some misunderstanding here… |
| Issue 1-2:  How to consider whether the UE is mandatory to support simultaneous Rx/Tx for higher-order combos? | [OPPO] Agree with option 1.1. The *simultaneousRxTxInterBandENDC* capability is a per-band combination capability that means UE can report different simultaneous Rx/Tx capability between higher or lower band combinations.  No strong view whether an LS is sent to RAN2, but actually RAN2 current signaling is enough and no more thing needs to be done in RAN2.  ZTE: Currently, for FR1+FR1 UL inter-band NR CA, CC is only for 2, which is each CC for each band. So if the ‘high order’ is in terms of number of DL CC, then high order configuration share the same characteristics with lower order configuration. If “higher order” is in terms of number of bands, not CCs, we still think high order configuration share the same characteristics with lower order configuration on the same bands.  For LS to RAN2, this can be included in the same reply LS.  Ericsson:  Option 1.1. If the fallback BC supports simultaneousRxTx but not the higher order “parent” BC does not, then both BC *can* be reported. The specification does not mandate the UE to include capabilities for optional features, i.e. list fallback BCs explicitly to advertise some additional features of the fallbacks. The spec only defines the BC/FS the UE shall not signal explicitly.  RAN2 is aware of the above, but an LS could be sent to RAN2 if changes or clarifications are needed in the RAN2 specifications, e.g. that absence of the field simultaneousRxTx means that the capability is not supported for a BC.  Skyworks: if simultaneous Tx/Rx is not supported in fallback it should not be supported for the higher order when using the corresponding UL configuration. Again the key is that the simultaneous Tx/Rx operation is clear including with additional TDD bands and potential requirements are in place and signaling is done accordingly  Qualcomm:  Mandatory or optional for higher order combinations must be looked at case by case.  [SoftBank] As mentioned above, we’d like to clarify the situation firstly.  NTT DOCOMO, INC:  For clarification, is the following description a correct understanding on option 1.1?  NOTE: band number is a just example.   * If a UE reports simultaneous Rx/Tx capability for DC\_1A-2A\_n77A, it means simultaneous Rx/Tx is enabled among all bands, i.e., bands 1, 2, and n77. * If a UE does not support simultaneous Rx/Tx capability for DC\_1A-2A-3A\_n77A and 2A-3A\_n77A, but can support for DC\_1A-2A\_n77A and DC\_1A-3A\_n77A, then UE shall report DC\_1A-2A\_3A\_n77A without simultaneous Rx/Tx capability and also report DC\_1A-3A\_n77A and DC\_2A-3A\_n77A with simultaneous Rx/Tx capability.   **Apple**: We are fine with Option 1.1 and have no strong view on Option 2.1.  Huawei: simultaneousRx/Tx especially when UE does not support it would determine the high order band combo’s capability. For a band combination, if one of the fall back combo does not support it, it doesn’t mean other fallback combos also not support it, but since the capability is per BC reported, in this case, the higher order combo will not support simultaneousRx/Tx. In our understanding, according to RAN2 spec, if the fallback capability is different from the higher order combination, the different capability should be reported. But it’s not clear for simultaneousRx/Tx, whether network will refer to the fallback capability as well to determine the scheduling. That’s should be clarified by RAN2.  CHTTL:  Would like to clarify whether the proposal is targeting when not all of the two band fallback combos indicating support simultaneous Rx/Tx, the higher order (there band) is allowed to not indicating simultaneous Rx/Tx support?  If all of the two band fallback combos indicate support of simultaneous Rx/Tx already, then will the higher order (there band) be not simultaneous Rx/Tx support? |
| Issue 1-3:  the issues of CA\_n77-n79 and CA\_n78-n79 higher-order combos | [OPPO] Clarification is needed what is the “higher-order combinations”, is it only these two bands with more intra-band CC or is it inter-band combinations with other bands. In general, our understanding is case by case discussion is needed if UE is required to mandatory support.  ZTE: Option 1.1. yes. We think high order configuration share the same characteristics with lower order configuration. Also In TS38.101-1, there is a note for CA\_n78-n79, which is : Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.  Ericsson: the issue is somewhat unclear, possibly Option 1.1. The RAN4 requirements should not be conditioned on implementations, but a mandatory simultaneousRxTx requirement (if relevant for DC\_42-n78) could be waived for a UE also supporting Band n77. The UE shall report the simultaneousRxTx according to its capability for each BC indicated (in the lists of supported band combinations)  Skyworks: CA\_n77-n79 cannot support simulataneous Tx/Rx due to small band separation (at least without a massive MSD that is not specified). For CA\_n78-n79 simultaneous Tx/Rx is possible with MSD (specified) but under the assumption that a dedicated n78 filter is used. Thus simultaneous Tx/Rx should not be allowed for CA\_n78-n79 using a band n77 implementation to support n78 and this is valid for higher order combinations (whether intra and/or inter) when this UL configuration is used. Whatever is signalled or not the UE behavior is not specified in this particular case.  So CA\_n77-n79 requirements only apply for non-simultaneous Tx/Rx (ie the MSD for simultaneous Tx/Rx is not part of the minimum requirement). Answer is yes to both questions.  Qualcomm:  Yes, to apply restriction for CA\_n77\_n79 and CA\_n78\_n79 to higher order combinations.  NTT DOCOMO, INC:  For OPPO, our understanding on “higher-order combinations” also includes “inter-band combinations with other bands”. The characteristics of n77-n79 and n78-n79 also apply for these carriers(n77-n79 and n78-n79) in higher order combinations such as 1A\_n77-n79.  **Apple**:  CA\_n78\_n79 Option 1.1: Yes  CA\_n77\_n79 Option 1.1: Yes |
| Issue 1-4:  Whether the CR can be agreed | [OPPO] CR is ok.  ZTE: For simultaneous Rx/Tx on DC\_42\_n79 correction, isn’t need to define the MSD for band 41 -> band n79 due to the cross band isolation?  Ericsson: for 2) the specification should not state what is feasible or not with a particular UE implementation. A requirement for CA\_42-n79 could apply for non-simultaneousRxTx in case the UE also supports n77.  Skyworks: For DC\_42\_n79 the minimum requirement for simultaneous Tx/RX was completely missing or based on implementation using a dedicated Band 42 filter. Even in LTE this is not the assumption for the minimum requirement. we added the MSD for crossband isolation based on a implementation using a n78 dedicated filter. Which is the only way to diplex the bands because an n77 filter would not even reduce n79 UL to a level acceptable to the band 42 receiver.  To ZTE: DC\_42\_n79 has an extra note that there is no UL in band 42 and that this combination is only used for higher order combinations (see Note 9). Thus only n79 UL should be considered  Qualcomm:  Option 1.1 remove Band 10- agreeable. DC\_42\_n79 Agreeable but revise note to include requirement if 2 band combination is part of higher order band combination.  **Apple**: CR is agreeable  Huawei: Based on the analysis in R4-2015555, we prefer to use MSD value 2.9dB.  Skyworks: we are open to revise the CR to accommodate Qualcomm and Huawei’s comments if agreeable to the proponent |
| Issue 1-5:  NR DC UE capability follows any specifications for the corresponding combo of NR CA? | [OPPO] Option 1.1, yes.  ZTE: Yes, same view as in our draft reply LS.  Ericsson: Option 1.1.  Skyworks: agree capability is needed for NR DC too.  **Apple**: In our view, NR DC UE capability does not necessarily follow the corresponding combination of NR CA. Therefore, UE capability for NR DC simultaneous Tx/Rx support is needed We prefer the wording we have proposed in R4-2014917, as follows:  Similarly to the justification for the capabilities of Simultaneous Rx/Tx for NR CA and EN-DC, as captured in the RAN4 LS R4-1808093, simultaneous Rx/Tx for inter-band NR-DC isa band combination specific capability (for both TDD-TDD and TDD-FDD combinations). By default, it is an optional capability for the UE to support, and it can be mandatory to support for specific configurations, which are designated in the specification.RAN4 will agree band combinations for which the capability is mandatory, for all other band combinations the capability is optional.  Huawei: The content should be combined with the clarification LS. For NR-DC, we don’t want to have the ambiguity anymore in the spec, and the capability at least for FDD-TDD should be carefully considered. |
| Others: |  |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2016472  R4-2016473 | [OPPO] Regarding “*Unless otherwise indicated, all two-band TDD-FDD inter-band NR CA, SUL or inter-band EN-DC configurations shall report the simultaneousRxTx capability*”, our understanding is that unless otherwise indicated the simultaneousRxTx is optionally support.  Regarding mandatory report the simultaneousRxTx capability if the band combination is a mandatory simultaneous RxTx band combination or UE support simultaneous RxTx, for clarification is there a UE support simultaneous RxTx but do not report the capability?  ZTE: For the new added sentence, we think what is reported depends on RAN2, it dosen't belong to the minimum requirement in RAN4 |
| Ericsson: this CR should be revised.  This effort to clarify the simultaneousRXTx applicability and capability reporting is good and appreciated. We agree with the gist of the changes.  General clause: the new item e) should state that the "requirements apply for simultaneousRxTx unless otherwise stated" or similar. The reporting behavior belong to RAN2 specifications, not in RAN4 specifications. Clause 5.5B: the statement "This capability applies also for these carriers when applicable EN-DC configuration is part of a higher order EN-DC configuration." suggests the UE should also report the lower-order BC if its capability is different. This is not mandated but the UE can do it. It is essential that the UE report the simultaneousRxTx capability for each BC indicated (fallback and parent if both are reported in the supported band combinations). Absence of the capability/field for the BC indicated should mean that simultaneousRxTx is not supported. |
| Qualcomm: Cannot agree to CR |
| **Apple**: The CR is not agreeable. The added text in clause 4.2 states that all TDD+FDD band combinations are mandatory to support simultaneous Tx/Rx. Support for such combinations needs to be checked for each combination separately, as it may be needed to specify MSD due to too low isolation between the bands. It is also not agreeable to change the note 7 saying that all higher order combinations of a lower order combination supporting simultaneous RX/TX are also mandatory to support simultaneous RX/TX. |
| Huawei: understand the concern from ZTE and Ericsson on the reporting behavior. Wording can be further revised. To QC, what’s the specific concern? To OPPO’s question, if the spec has ambiguity, it does not exclude the possibility the UE supports the capability but not report it. |
| R4-2016470  R4-2016471 | [OPPO] Same comment as R4-2016472.  ZTE: Same comments as above. |
| Ericsson: this CR should be revised, see comments to R4-2016472. |
| **Apple**: Same comments as for R4-2016472 |
| R4-2015337  R4-2015338 | ZTE: see issue 1-1. |
| Ericsson: not agreed, requirements for simultaneousRxTX should be mandatory unless otherwise stated. If mandatory for a BC, then the UE must report simultaneousRxTX for the said BC |
| To Ericsson: this CR is exactly doing this: it states for which case the simultaneous Tx/RX can be supported with the associated requirements. This exactly what has been agreed for CA\_n78-n79 and unless agreed then this combination should not be allowed for simultaneous Tx/Rx at all |
| Huawei: The changes still does not solve the ambiguity of the spec whether to report simultaneous Tx/RX for the band combinations. We need to consider improvement of the applicability as well as capability relation between fallback and higher order combinations. |
| R4-2015016  R4-2015017 | ZTE: Currently, MSD due to cross band isolation are defined for CA\_n78-n79 for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. we are not sure why such requirements were not defined for CA\_n77-n78 due to same as CA\_n78-n79 |
| Ericsson: not agreed. NOTE 3 is odd, the requirements could apply for non-simultaneousRxTx if the UE also supports n77 (then n78 is possibly implemented by n77). |
| Skyworks: We support the CR as it is only was is supported by the current specification and need for the operators deployment  Note that for all this discussion it is not possible to even operate collocated n77 and n79 networks with simultaneous Tx/Rx in Japan and only in regions/locations where only n78 portion of n77 is in operation then n78 and n79 can be operated with simultaneous Tx/Rx provided the the use of dedicated filter which is not the baseline or WW implementation.  To ZTE CA\_n77-n78 is intra band since the two band overlap. |
| NTT DOCOMO, INC:  For ZTE, CA\_n77-n78 uses the bands n77 and n78 which frequency ranges are overlapping with each other. So, the situation is different from CA\_n78-n79. If your question is about CA\_n77-n79, the frequency gap between n77 and n79 is small, then it seems difficult to support simultaneous Rx/Tx for CA\_n77-n79 based on the input from venders so far.  For Ericsson, the description you pointed out has already specified in TS 38.101-3, so the discussion should be separated from this CR. |
| R4-2016238  R4-2016241 | Qualcomm: Need to revise CR to account for higher order combinations |
| Huawei: Based on the analysis in R4-2015555, we prefer to use MSD value 2.9dB. |
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| R4-2014917 | Huawei: see comments to issue 1.5. |
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| R4-2016001 |  |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#1-1** | *Tentative agreements:*  *Candidate options:*  Fixing the **Rel-15** spec on UE simultaneous Rx/Tx capability to understand better (in general for all CA, SUL and EN-DC combos):  **For TDD-TDD combos,**  Option A.1:   * unless explicitly indicated in the spec, the UE is **not** required to support simultaneous Rx/Tx capability; and, * the UE is seen as **not supporting** simultaneous Rx/Tx capability if the capability is not reported (absent IE).   **For FDD-TDD combos,**  Option B.1:   * same principles with TDD-TDD combos   Option B.2:   * unless explicitly indicated in the spec, the UE **is required** to support simultaneous Rx/Tx capability; and, * the UE is **seen as supporting** simultaneous Rx/Tx capability if the capability is not reported (absent IE)   *Recommendations for 2nd round: Further discussion and try to agree on option A.1 and option B.1.* |
| **Sub-topic#1-2** | *Background clarification:*  In most cases, the UE does not support simultaneous Rx/Tx operations in higher-order combos (more than two bands DL). But for a certain high-order combo, the UE tends to support simultaneous operation under some of its two-band fall-back combos. In this case, the UE has to report to the network the FeatureSet per BC for all the two-band combos where the UE supports simultaneous operation. If the UE reports not supporting for the high-order combo, the network perceives that the UE is not supporting simultaneous operation on any of the fall-backs when the reporting is absent on them.  *Tentative agreements:*  For higher-order combos,   * unless explicitly indicated in the spec, the UE is **not** required to support simultaneous Rx/Tx capability; and, * the UE is seen as **not supporting** simultaneous Rx/Tx capability for any of its fall-backs if the capability is not reported per fall-back BC (absent IE); and, * the characteristics for a UE in terms of supporting Rx/Tx simultaneous operation are by default decoupled between a fall-back combo and its higher-order one.   Send an LS to RAN2 on all the agreements from topic#1-1 and topic#1-2 and others if necessary.  *Candidate options:*  *Recommendations for 2nd round: Agree on the above tentative agreements.* |
| **Sub-topic#1-3** | *Tentative agreements:*  Higher-order combos of CA\_n78-n79 also have the restriction that simultaneous Rx/Tx capability is not reported if UE is using n77 implementation for n78.  CA\_n77-n79 and its higher-order combos have the restriction that the minimum requirements apply only when there is non-simultaneous Rx/Tx between n77 and n79.  *Candidate options:*  *Recommendations for 2nd round: Agree on the above tentative agreements and try to agree on the CRs.* |
| **Sub-topic#1-4** | *Tentative agreements:*  Revise the CR.  *Candidate options:*  *Recommendations for 2nd round: Revise the CR.* |
| **Sub-topic#1-5** | *Tentative agreements:*  NR DC UE capability follows any specifications for the corresponding combo of NR CA.  *Candidate options:*  *Recommendations for 2nd round: Further discussion is needed.* |
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*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | LS to RAN2 on UE simultaneous Rx/Tx capability | Huawei |

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2016472  R4-2016473 | *Return to* |
| R4-2016470  R4-2016471 | *Return to* |
| R4-2015337  R4-2015338 | *Return to* |
| R4-2015016  R4-2015017 | *Cat F CR Revised*  *Cat A CR return to* |
| R4-2016238  R4-2016241 | *Cat F CR Revised*  *Cat A CR return to* |
| R4-2014917 | *Return to* |
| R4-2016001 | *Return to* |

## Discussion on 2nd round (if applicable)

### Sub-topic 1-1

**Issue 1-1a: Fixing the Rel-15 spec on UE simultaneous Rx/Tx capability to understand better (in general for all CA, SUL and EN-DC combos):**

**For TDD-TDD combos,**

Option A.1:

* unless explicitly indicated in the spec, the UE is **not** required to support simultaneous Rx/Tx capability; and,
* the UE is seen as **not supporting** simultaneous Rx/Tx capability if the capability is not reported (absent IE).

**For FDD-TDD combos,**

Option B.1:

* same principles with TDD-TDD combos

Option B.2:

* unless explicitly indicated in the spec, the UE **is required** to support simultaneous Rx/Tx capability; and,
* the UE is **seen as supporting** simultaneous Rx/Tx capability if the capability is not reported (absent IE)

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| **Sub-topics** | **Comments** |
| Issue 1-1a: | [OPPO] support Option A.1 and Option B.1.  Ericsson: we prefer option B.2 but it should be “the UE is **seen as *not* supporting** simultaneous Rx/Tx capability if the capability is not reported (absent IE)”. The same principle for FDD-TDD and TDD-TDD:   1. if simultaneous RX/TX is mandatory for a BC (i.e. the UE shall meet the requirements for simultaneous RX/TX) simultaneousRxTx *shall* be indicated for the BC 2. if simultaneous RX/TX is not mandatory for a BC (i.e. requirements for simultaneous RX/TX may not even be specified for the said BC), indication of simultaneousRxTx for the BC is optional. Absence of indication should mean that simultaneous RX/TX is *not* supported.   We recognize that for some band combinations, simultaneous RX/TX is not feasible and requirements for simultaneous RX/TX are not specified – but a UE should not be *prohibited* to indicate support in the capability for a BC even if a requirement is not specified for the said BC? The UE may still be functional.   1. Regarding the ‘default’ we can accept both B.1 and B.2, but it should be the same rule for FDD-TDD and TDD-TDD. However, since simultaneousRxTx is mandatory for FDD-FDD and therefore no conditions stated for FDD-FDD combinations, use of B.2 for FDD-TDD would be more consistent with FDD-FDD even if the support is not indicated for combinations without any TDD band(s).   Skyworks: Support Option A.1 and B.1. There are TDD-TDD cases where simultaneous Tx/Rx support depend on the implementation and notes in the spec are needed to explain when simultaneous Tx/Rx may apply. It is Ok to make FDD-TDD the same although less critical so we could have a default Simultaneous Tx/Rx opration. Especially we have provided a CR for DC\_42\_n79. Also the simultaneous Tx/Rx cannot be expected if there are REFSENS exceptions or AMPR aspects that are not specified.  CHTTL: support Ericsson’s comment  Qualcomm: Option A.1 and B.1.  Huawei: similar view with Ericsson  For TDD-TDD, unless explicitly indicated in the spec, the UE is not required to support simultaneous Rx/Tx capability mandatorily.  For FDD-TDD, unless explicitly indicated in the spec, the UE **is required** to support simultaneous Rx/Tx capability.  The absent interpretation should be the same the for both TDD-TDD and FDD-TDD.  **Apple**: We support Option A.1 and B.1.  We also have a question for Ericsson on their comment for Option B.2. Does that mean if UE did not report the capability, the UE could not support such combinations at all as network would never schedule non-simultaneous Tx/Rx operation for these combinations?  **MediaTek**: We support Option A.1 and B.1 |

### Sub-topic 1-2

In most cases, the UE does not support simultaneous Rx/Tx operations in higher-order combos (more than two bands DL). But for a certain high-order combo, the UE tends to support simultaneous operation under some of its two-band fall-back combos. In this case, the UE has to report to the network the FeatureSet per BC for all the two-band combos where the UE supports simultaneous operation. If the UE reports not supporting for the high-order combo, the network perceives that the UE is not supporting simultaneous operation on any of the fall-backs when the reporting is absent on them.

**Issue 1-2: How to consider whether the UE is mandatory to support simultaneous Rx/Tx for higher-order combos?**

*Tentative agreements:*

For higher-order combos,

* unless explicitly indicated in the spec, the UE is **not** required to support simultaneous Rx/Tx capability; and,
* the UE is seen as **not supporting** simultaneous Rx/Tx capability for any of its fall-backs if the capability is not reported per fall-back BC (absent IE); and,
* the characteristics for a UE in terms of supporting Rx/Tx simultaneous operation are by default decoupled between a fall-back combo and its higher-order one.

Send an LS to RAN2 on all the agreements from topic#1-1 and topic#1-2 and others if necessary.

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| **Sub-topics** | **Comments** |
| Issue 1-2: | [OPPO] ok with the 1st and 3rd bullet, but the 2nd bullet is not needed. As the 3rd bullet already mentioned the higher order and fall-back are decoupled then there is no need to say the relation between them, this makes the 2nd bullet is redundant. What can be inform to RAN2 instead is that if no simultaneous RxTx is reported then UE is considered as not supporting simultaneous RxTx.  BTW, the “absent IE” here is misleading, which might be interpreted mistakenly as new IE is needed in RAN2.  Ericsson: If a fallback BC supports simultaneousRxTx but not the reported higher order “parent” BC does not, then both BC *can* be reported. The specification does not mandate the UE to include capabilities for optional features, i.e. list fallback BCs explicitly to advertise some additional features of the fallbacks. The spec only defines the BC/FS the UE shall exclude.  No RAN2 changes or clarification are needed to this end, but for Issue 1-1 it should be clarified (in 38.331) that absence of the simultaneousRxTx field for a EN-DC, CA or SUL BC means that simultaneous RX/TX is not supported (not clear at present).  Huawei: If the fallback capability is different from the higher order BC capability，the capability of fallback and higher order should be distinguished clearly by signaling and for the network scheduling, all these different capabilities should be referred. This aspect as well as other ambiguities if any should be clarified by RAN2 spec.  **Apple**: We share the same view as with OPPO that we are fine with 1st and 3rd bullets, but not 2nd bullet 2.  **MediaTek**: A question for clarification, not sure whether 3rd bullet is common understanding that UE in terms of supporting Rx/Tx simultaneous operation are by default decoupled? If the fallback BC does not support Rx/Tx simultaneous operation, all its higher order combos shall not be able to support the operation. The higher order combos shall align simultaneous TX/RX capability (support or not support) to its fallback combos. This shall be the baseline and clarified in the specs. |

### Sub-topic 1-3

Following sub-topic 1-2, the issues for CA\_n77-n79 and CA\_n78-n79 are that: it is not clear whether the higher-order combos also have the same restrictions.

**Issue 1-3: the issues of CA\_n77-n79 and CA\_n78-n79 higher-order combos**

*Tentative agreements:*

Higher-order combos of CA\_n78-n79 also have the restriction that simultaneous Rx/Tx capability is not reported if UE is using n77 implementation for n78.

CA\_n77-n79 and its higher-order combos have the restriction that the minimum requirements apply only when there is non-simultaneous Rx/Tx between n77 and n79.

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| **Sub-topics** | **Comments** |
| Issue 1-3: | [OPPO]: Ok with the 2nd sentence, maybe the 1st sentence can be modified as “simultaneous Rx/Tx capability is not required to be reported if…” since this depends on UE implementation whether this capability will be reported.  Ericsson: the specifications should allow exceptions for particular “implementations” (difficult to verify), in the above case requirement for simultaneous RX/TX for CA\_n78-n79 could be waived if the UE also supports n77. The higher order combinations are reported in the list of supported band combinations, the fallbacks are not reported but can be reported if they support a different (optional) capability. We assume that support of simultaneous RX/TX for a reported “parent” BC implies that all fallbacks also support it. Conversely, if a band combination does not support simultaneous RX/TX, we assume that it is not supported for a higher-order combination of the same bands.  Huawei: The 2nd proposed wording may not reflect the meaning of 1st proposal directly. If the meaning is identical, the 2nd one is better for the specification.  Apple: We share the same view as with OPPO.  MediaTek: Share same view with OPPO.  DOCOMO: From the perspective of draft R4-2016789 (Rev-1 of R4-2015016\_CR);  For OPPO, Apple and MediaTek, we have same view with you. CR has already been revised.  For Ericsson, we expect to improve with the following changes. We change 1st sentence from “~ if UE is using n77 implementation for n78.” to “~ if UE supports band n77”. CR has already been revised. Regarding reporting fallback combinations, we will not include in CR because this is a general discussion. But, I have the same understanding about this method.  For Huawei, in my understanding, the essential meaning is the same. The 2nd proposal focus on the requirement applicability itself rather than capability report. We also feel that 2nd one is better for the specification. CR has already been revised. |

### Sub-topic 1-5

Ran2 sent an LS in R4-2014159 asking for guideline on whether simultaneous RxTx UE capability is needed for inter-band NR-DC. We understand that the Rx/Tx simultaneous capability issue discussed for CA, SUL and EN-DC combos also applies for NR DC.

**Issue 1-5: An reply LS needs to be sent to RAN2 about RAN4 consensus on UE capability of Rx/Tx simultaneous operation on NR DC combos**

*Tentative agreements:*

NR DC UE capability follows any specifications for the corresponding combo of NR CA.

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| **Sub-topics** | **Comments** |
| Issue 1-5: | [OPPO] Suggest to only focus on the simultaneous RxTx capability in the LS to RAN2 rather than broaden it.  Ericsson: should be sent; simultaneous RX/TX capability is not a part of the NRDC-parameters. Then RAN2 can take a decision whether this needs a specific field (or refer to the corresponding NR CA).  In general, the gNB must be able to understand what UE can and cannot do for a BC by looking at the capability IEs for the type of BC supported, no implicit signaling.  Huawei: In general the capability principles are the same for both NR CA and NR DC. Since some clarification is needed for existing capability, it would be better to consider the reply together with other clarifications.  **Apple**: Despite there is certain commonality between NR DC and the corresponding combo of NR CA, it does not imply the NR DC UE capability would always follow the specifications for the corresponding combo of NR CA. |

### Sub-topic 1-6 (new in 2nd round)

Companies raise the idea that in the future, every single new two-band combo has to be specified with explicit indication of whether the UE is required to support simultaneous Rx/Tx operation when configured with such combo.

**Issue 1-6: A new rule is applied to every new two-band combo introduced in the future: explicit indication of whether the UE is required to support simultaneous Rx/Tx operation is specified**

*Tentative agreements:*

Agree on the above statement.

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| **Sub-topics** | **Comments** |
| Issue 1-6: | [OPPO] Ok with the rule, if the combination is mandatory for UE to support simultaneous RxTx then it should be clear in spec.  Ericsson: this rule would not be needed if Issue 1-1 is agreed, new combinations should follow the same rules. The current specification should be modified such that support of requirements for simultaneous RX/TX is clear. The current versions of RAN4 and RAN2 specifications are unclear, which is a problem in capability parsing for current deployments.  CHTTL: Share the same view as Ericsson. And current indications of whether the UE is required to support simultaneous Rx/Tx operation are not clear and hard to maintain in the specs.  Huawei: Some simple principles in issue 1-1 can save lots of effort to indicate the capability for every new band combinations, e.g. for FDD-TDD, only pick up the combos which cannot support simultaneous Rx/Tx capability.  Apple: Is the new rule any different from what we currently have in the specifications? |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| Draft of R4-20016790 | **MediaTek**: Sorry for missed comment during 1st round. It needs to have MSD due to cross band isolation in n79 due to B42 uplink since while analyzing MSD for CA\_n78\_n79, this MSD was mainly result from insufficient isolation of n79 filter to n78. So same MSD on n79 shall be applied for DC\_42\_n79. Further, The higher order combos shall align simultaneous TX/RX capability (support or not support) to its fallback combos. This shall be the baseline and clarified in the specs.  NTT DOCOMO, INC:  To MediaTek  UL\_B42 is still not allowed for DC\_B42\_n79 and the higher band combinations including DC\_B42\_n79. That is why MSD for DL victim n79 with UL aggressor B42 is not introduced |

# Topic #2: Receiver requirements

Receiver requirements corrections are covered in Topic #2. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014165 | Qualcomm | CR CatF Cross Band Noise DC\_1\_n40\_highBW |
| R4-2014166 | Qualcomm | CR CatA Cross Band Noise DC\_1\_n40\_hignBW  Uploaded |
| R4-2014682 | Anritsu, Apple | UL output power for spurious response and general Rx |
| R4-2014683 | Anritsu, Apple | Mirror CR to R4-2014682 |
| R4-2015796 | KDDI | CR to correct MSD of DC\_1A-41A\_n77A&n78A  CatF R15 |
| R4-2015797 | KDDI | CR to correct MSD of DC\_1A-41A\_n77A&n78A  CatF R16 submitted to 7.19.3 |
| R4-2016085 | VODAFONE | CR to 38.101-3 DC\_1A-20A\_n28A Missing MSD  CatF R15 |
| R4-2016087 | VODAFONE | CR to 38.101-3 DC\_1A-20A\_n28A Missing MSD (Rel-16)  CatA R16 submitted to 7.5.1 |
| R4-2016225 | vivo | CR to TS38.101-3[R15] Applicability of 2Rx requirements |
| R4-2016226 | vivo | Mirror CR to R4-2016226 |

## Open issues summary

Mainly maintenance CRs.

### Sub-topic 2-1

R4-2014165 and its mirror CR add a NOTE 4 in uplink config table for REFSENS exception due to cross band isolation. The note says for 80MHz UL bandwidth on band n40, the RBs are located at position 15.

**Issue 2-1: Agree on R4-2014165?**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Discussion is needed

### Sub-topic 2-2

R4-2014682 corrects the UL power levels for spurious responses. The same corrections were agreed for OOBB in the last meeting. It also corrects a few errors in referring section numbers.

**Issue 2-2: Agree on R4-2014682?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2014682 and its mirror CR

### Sub-topic 2-3

R4-2015796 and its mirror CR correct the testing points for DC\_1A-41A\_n77A and DC\_1A-41A\_n78A.

**Issue 2-3: Agree on** **R4-2015796?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2015796 and its mirror CR

### Sub-topic 2-4

R4-2016085 adds IMD5 test points for DC\_1A-20A\_n28A for DC\_20A\_n28A interfering band 1 DL. The value is proposed as 8.9dB MSD.

**Issue 2-4: Agree on R4-2016085?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2016085 and ask for a tdoc mirror CR

### Sub-topic 2-5

R4-2016225 clarifies in EN-DC spec that for the Rx requirements the UE is only tested with 4 antenna ports when it claims 4 antenna port on a certain band. Similar corrections were agreed for NR CA in the last meeting.

**Issue 2-5: Agree on R4-2016225?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2016225 and its mirror CR

## Companies views’ collection for 1st round

### Open issues

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| **Sub-topics** | **Comments** |
| Issue 2-1:  Agree on R4-2014165 | ZTE: We support this approach. However,it seems the note is not clear. what does 'RB position' mean? is it located from low egde or upper edge? Also is the note 2 still available?  Ericsson: is this 15 RB shift needed for a particular filter implementation? Another note: Note 1, Note 3 and Note 4 do not seem to be compatible, by Note 1 the TDD allocation should be within the BW (the maximum transmission bandwidth configuration per CBW), by Note 3 the 100 PRB for 80 MHz should be configured within a 20 MHz carrier -- where within the 80 MHz block? By Note 4 the 100 PRB shall be shifted by 15 PRB, but then does not fit within a 20 MHz bandwidth.  Skyworks: we understand the concept and the note but we assume the UL channel in B40 is still placed at the closest edge to band 1 and thus this shift changes the IMD order falling in band 1.  Qualcomm: This paper should be moved to thread [116] sub-topic 3.2.1.  This is actually RB start = 15 for SCS=30KHz. The syntax is duplicated from TS36.101. so Note 3 says you use minimum supported SCS for the UL configuration and for 80MHz, it is 30KHz SCS. The RB start is modified from 0 to 15.  Huawei: The RB shift does not change the fact that the MSD could be larger than specified in the real application if the observation is correct. Thus our preference is to revise the MSD values and keep the general principle for RB placement for UL configuration. Before we handle this CR, RAN4 need to conclude the way forward for the MSD due to CIM issue in agenda 7.19.3. |
| Issue 2-2:  Agree on R4-2014682? | Skyworks: we have followed the discussion since last meeting and agree this CR represents the consensus  Huawei: For the other requirements, if NR carrier is tested, the output power will be set as 29dB below Pcmax,L. However, the correction for intra-band cases didn’t follow this principle. Could you further clarify the reason? |
| Issue 2-3:  Agree on R4-2015796? | ZTE:No strong view. But we would like to ask a question, why N/A is defined in MSD table for this configuration in Rel-15? (N/A means no MSD need to be defined)  Skyworks: Support introduction of MSD  KDDI: Reply to ZTE, we just recognized the MSD missed for this combination during internal review and consider it should be corrected. About the reason, we do not have the answer and maybe interested companies can clarify. |
| Issue 2-4:  Agree on R4-2016085? | Skyworks: we recognize the missing MSD and support the proposed CR  Huawei: For DC\_20\_n28, the only 28A filter (703~733) is assumed due to the overlap between band 20 and n28. The frequency point for n28 which is set as 745.5 MHz isn’t suitable for this band combination. |
| Issue 2-5:  Agree on R4-2016225? | Ericsson: this change was apparently agreed for SA, but is this statement relevant in a RAN4 specifications? (The scope of conformance verification belongs to the conformance test specification.)  vivo: response to Ericsson, thanks for the comments. yes, this is the applicability of RAN4 core requirements, which should be stated in the RAN4 spec. Besides, as you said, this is aligned with SA 2Rx requirements applicability rule. Aligned conclusions captured in 101-1 and 101-3 would be beneficial to develop high quality RAN4 specs. |
| Others: |  |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2014165  R4-2014166 | Ericsson: see comments to issue 2-1. |
| Huawei: see comment to issue 2-1. |
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| R4-2014682  R4-2014683 | Huawei: See comments to issue 2-2. |
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| R4-2015796  R4-2015797 |  |
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| R4-2016085  R4-2016087 | Huawei: see comments to issue 2-4. |
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| R4-2016225  R4-2015226 | **Apple**: Thank you for this CR. Since the new sentence in this CR comes from the TS 38.801-1, we would suggest using the complete statement in order to avoid any misunderstanding. In that case, “otherwise, the UE shall be verified with two Rx antenna ports.” should be added at the end of the new sentence in the CR. |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#2-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Discuss further in accordance to the discussion on MSD due to CIM in Rel-16. |
| **Sub-topic#2-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  The proponent replies to Huawei comment and the group tries to agree on the CRs. |
| **Sub-topic#2-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Agree on the CRs. |
| **Sub-topic#2-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Revise the CR to correct the test point for n28.  *Note: please do not upload catA CR before catF CR is agreed.* |
| **Sub-topic#2-5** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Revise the CRs to address comments from companies. |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
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### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2014165  R4-2014166 | *Return to* |
| R4-2014682  R4-2014683 | *Return to* |
| R4-2015796  R4-2015797 | *Agreeable* |
| R4-2016085  R4-2016087 | *Not pursued* |
| R4-2016225  R4-2016226 | *Cat F CR Revised*  *Cat A CR return to* |

## Discussion on 2nd round (if applicable)

### Sub-topic 2-1

R4-2014165 and its mirror CR add a NOTE 4 in uplink config table for REFSENS exception due to cross band isolation. The note says for 80MHz UL bandwidth on band n40, the RBs are located at position 15.

**Issue 2-1: Agree on R4-2014165?**

Discuss further in accordance to the discussion on MSD due to CIM in Rel-16.

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| **Sub-topics** | **Comments** |
| Issue 2-1: | Skyworks: we support but since there is also 90MHz and 100MHz Ch BW discussed we may need a similar solution for those BW.  Qualcomm: We can add the provision for 90MHz and 100MHz in the WF discussed in thread [116]  Huawei: The 90MHz and 100MHz for n40 can be discussed in Rel-17 WI separately. |

### Sub-topic 2-2

R4-2014682 corrects the UL power levels for spurious responses. The same corrections were agreed for OOBB in the last meeting. It also corrects a few errors in referring section numbers.

**Issue 2-2: Agree on R4-2014682?**

The proponent replies to below comment and the group tries to agree on the CRs.

the correction for intra-band cases didn’t follow this principle. Could you further clarify the reason?

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| **Sub-topics** | **Comments** |
| Issue 2-2: | Anritsu: To our understanding, the main purpose for EN-DC Rx tests is to verify NR single band Rx requirements. However, this would not be achievable for NSA UEs without E-UTRA as anchor. Also, the NR requirements shall be anchor agnostic. This is basically what is described in the “General” clause 7.1 in TS 38.101-3 as shown below.  "Unless otherwise stated, requirements for NR receiver written in TS 38.101-1 [2] and TS 38.101-2 [3] apply and are assumed anchor agnostic. Requirements are verified under conditions where anchor resources do not interfere NR operation."  Therefore, for intra-band non-contiguous EN-DC (in particular for FDD bands), we should change Rx requirements test configuration to ensure anchor resources do not interfere NR operation.  Perhaps the reason for change 3) was not explaining our intention correctly. I apologize for giving a confusion.  Huawei: It looks fine to me after offline clarifications.  **Apple**: Thanks to Huawei’s questions in offline discussions. The following captures our offline clarifications.  The UL configurations for intra-band non-contiguous EN-DC and inter-band EN-DC for OOB/Spurious Response should be defined differently. For Intra-band non-contiguous EN-DC, the UL configuration is set up to avoid the cross-band Tx aggressor impacting the DL CC to be tested with other RX requirements other than REFSENS, as illustrated below,    In this case, the NR DL would be desensed by the E-UTRA UL. As a result, the Rx tests other than REFSENS would be obscured by the impact from E-UTRA UL.  So for intra-band non-contiguous Rx requirements, the UL configurations are set up as shown below,      This way we can cleanly test the NR Rx requirements under EN-DC configuration.  For inter-band EN-DC OOB/Spurious Response, we will not only test the NR requirement mimicking the stand-alone operation, but also test the requirements under the influence of cross-band UL. The UL configuration should be set up such that the 2UL IMD does not have any impact to DL CCs, but also that when NR stand-alone like is tested, NR UL is set to 4dB below Pcmax (2nd paragraph) and when cross-band UL influence is tested for NR, E-UTRA is set at 4dB below Pcmax (1st paragraph). |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: Transmitter requirements

Transmitter requirements corrections are covered in Topic #3. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014309 | SoftBank | Clarification of additional spurious emission requirements on Inter-band EN-DC(R15)  CatF |
| R4-2014310 | SoftBank | Clarification of additional spurious emission requirements on Inter-band EN-DC(R16)  CatA uploaded |
| R4-2014900 | Apple | Coexistence cleanup for 38.101-3 Rel15  CatF |
| R4-2014901 | Apple | Coexistence cleanup for 38.101-3 Rel16  CatF submitted to 7.19.3 |
| R4-2016496 | Huawei, HiSilicon | CR for TS 38.101-3: correction of spurious emission band UE co-existence (R15)  CatF |
| R4-2016497 | Huawei, HiSilicon | CR for TS 38.101-3: correction of spurious emission band UE co-existence (R16)  CatF |
| R4-2015805 | ETSI MCC | Correction of CR0325 implementation |
| R4-2016054 | Ericsson | Correction of p-Max I.E and corresponding references  R16 CatA uploaded  Coversheet error |
| R4-2016055 | Ericsson | Correction of p-Max I.E and corresponding references  R15 CatF  Coversheet error |
| R4-2016485 | Huawei, HiSilicon | CR for 38.101-3 Correction on EN-DC synchronous carriers (R15) |
| R4-2016486 | Huawei, HiSilicon | Mirror CR to R4-2016485 |
| R4-2016492 | Huawei, HiSilicon | CR for TS 38.101-3: correction of delta Tib for UE supporting multiple band combinations (R15) |
| R4-2016493 | Huawei, HiSilicon | Mirror CR to R4-2016492 |
| R4-2016482 | Huawei, HiSilicon | CR for TS 38.101-3: correction of power class for EN-DC  Moved to [115] |
| R4-2016498 | Huawei, HiSilicon | CR for TS 38.101-3: Adding delta TIB requirement for DC\_2-7-7-13\_n66 (R16)  Moved to [116] |
| R4-2016595 | Huawei, HiSilicon | Withdrawn? |
| R4-2015992 | CHTTL | CR to TS 38.101-3 clarifications on indication of Single Uplink allowed for intra-band EN-DC and NE-DC  Moved to topic #4 |
| R4-2015999 | CHTTL | Mirror CR to R4-2015992  Moved to topic #4 |

## Open issues summary

Mainly maintenance CRs.

### Sub-topic 3-1

It is proposed in R4-2014309 that *Unless otherwise stated, for inter-band EN-DC with uplink assigned to one LTE band and one NR band, the requirements for additional spurious emissions apply when one of the bands in a combination is subject to an additional spurious emission requirement (i.e. in clause 6.6.3.3 of TS36.101[4] or clause 6.5.3.3 of TS38.101-1[2]) and the other band shall also protect the same band or range in the spurious emission for UE co-existence requirement (i.e. in clause 6.6.3.2 of TS36.101[4] or clause 6.5.3.2 of TS38.101-1[2]), with the indication of the relevant network signalling(NS) in the former band.*

**Issue 3-1: EN-DC UE has to meet additional single band spurious emission requirements (signalled by NS\_X) on both ULs?**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Discussion is needed

### Sub-topic 3-2

Coexistence cleanup CRs are submitted in 4900 4901 6496 6497.

**Issue 3-2: How to handle the CRs?**

* Check the contents in all CRs and agree on only one sets: one for R15 and one for R16
  + Option 1: Yes
* Recommended WF
  + Merge all into one set.

### Sub-topic 3-3

R4-2015805 is from MCC.

**Issue 3-3: Agree on R4-2015805?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2015805

### Sub-topic 3-4

R4-2016055 corrects reference number errors.

**Issue 3-4: Agree on R4-2016055?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2016055 and its mirror CR

### ~~Sub-topic 3-5~~

~~R4-2016482 corrects configured powers by adding clarifications on deltaPpowerclass,nr. Only Rel-15 needs to be corrected since UE is not able to report the corresponding capability.~~

**~~Issue 3-5: Agree on R4-2016225?~~**

* ~~Proposals~~
  + ~~Option 1: Yes~~
* ~~Recommended WF~~
  + ~~Agree on R4-2016482~~

### Sub-topic 3-6

R4-2016485 further clarifies that the requirements specified for DC\_20A\_n28A apply when the two bands are collocated-deployed.

**Issue 3-6: Agree on R4-2016485?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2016485 and its mirror CR

### Sub-topic 3-7

For UE supporting multiple band combinations, ∆TIB,c could be different for these combinations. Unlike ∆RIB,c , how to use ∆TIB,c in this case is not clearly specified. R4-2016492 proposes to clarify this issue. When the operating band frequency range is ≤ 1 GHz, the applicable additional ∆TIB,c shall be the average value for all band combinations; When the operating band frequency range is > 1 GHz, the applicable additional ∆TIB,c shall be the maximum value for all band combinations.

**Issue 3-7: Agree on R4-2016492?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2016492 and its mirror CR

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 3-1:  EN-DC UE has to meet additional single band spurious emission requirements (signalled by NS\_X) on both ULs? | Company 1:  Company 2:  ….  [OPPO] Option 1: Yes  Ericsson: yes, additional requirements are often regulatory.  Skyworks: agree  Qualcomm: The NS should be signaled in both cell groups. Why wouldn’t that be the case? The UE should not assume it applies to both cell groups if only signaled in one  [SoftBank]: To Qualcomm: The question was answered in [102]. So it Is better to discuss in [102] and result is reflected to the CRs in this thread.  NTT DOCOMO, INC: Yes, such clarification on additional spurious emission for 2UL case is needed.  **Apple**: We think that a discussion is required with introducing this general rule. There could be scenarios for inter-band EN-DC where IMDs (created from both ULs) could violate additional spurious emissions. In this case the UE can only keep emission requirements if additional power backoff is used for both bands. Therefore, increased A-MPR might have to be defined for certain EN-DC combinations with NS\_X. This issue has to be checked for all EN-DC combinations.  For example, if NS\_48 is signaled for DC\_1-n77 then IMDs could fall into protected regions. Whether MPR is sufficient has to be checked. Another problem can occur with DC\_2\_n48 if NS\_27 is signaled for n48. The spurious emission requirements -40dBm/MHz would be applicable directly outside the channel of band 2. This requirement is not possible to be satisfied with MPR alone.  The proposal from the CR raises further questions. What if NS\_X is signaled for LTE and NS\_Y is signaled for NR. What happens in the case of contradicting requirements? How are the additional spurious requirements merged if overlapping? |
| Issue 3-2:  How to handle the CRs? |  |
| Issue 3-3:  Agree on R4-2015805? | Skyworks: should be agreeable  Qualcomm: Yes, agree CR |
| Issue 3-4:  Agree on R4-2016055? | vivo: The Rel-16 mirror CR R4-2016054 cannot be agreed. This Rel-16 CR is contradicting with R4-2015324 which is re-submitted in this meeting based on last meeting’s agreed CR R4-2010855 (CRNum: 0344) and also approved in RP-201504. Unfortunately, the original CR was incorrectly implemented in the latest spec and has to be resubmitted.  For Rel-15 CR, it can be regraded as no direct controversy and we are fine to accept, but no mirror CR should be introduced since Rel-16 HPUE scheme already have different scheme.  Ericsson: This (Ericsson) CR has a cover page issue and therefor needs a new Tdoc # |
| ~~Issue 3-5:~~  ~~Agree on R4-2016055?~~ |  |
| Issue 3-6:  Agree on R4-2016485? | [OPPO] No strong view. The note content itself is ok, but not sure whether this kind of note is necessary or not in the spec.  [Nokia] This issue has been discussed already and has not been agreeable. UE specification should not have network deployment aspects.  Ericsson: not agreed. However, the issue of supporting requirements relevant for non-collocated deployment in similar cases with overlapping DLs should be addressed.  Skyworks: at least the UE behavior in non-co-located scenario is unknown as some or all of the receive AGC may not have the proper setting for both carriers but existing notes should be sufficient  Qualcomm: Note 10 and 11 are sufficient to define requirements for this band combination. It is unnecessary and redundant to add Note 12 as there is no added clarification. Also, deployment scenario should not be stated in the RF specification. Specific requirements are already defined.  Huawei: to Nokia, if the UE spec should not have deployment aspects, what’s the meaning of Note 10 with “The maximum power spectral density imbalance between downlink carriers is within [6] dB.” Who will guarantee the PSD condition? As commented by Ericsson, this issue of overlapping spectrum shall be addressed and we are ok to further discuss it, however, at least the wording of Note 10 needs some revisions, the proposed changes are:  NOTE 10: The minimum requirements apply for DL carriers with maximum power spectral density imbalance of [6] dB. The power spectral density imbalance condition also applies for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration |
| Issue 3-7:  Agree on R4-2016492? | ZTE: We feel a bit confusion for this new added sentence, maybe some examples can be further clarified. In addition, why different approach are used for <=1GHz and >1 GHz?  Qualcomm: The original motivation to distinguish <1 GHz and >1 GHz was because the relaxation applies to the corresponding UTRA band. If that’s no longer the case, then the distinction may not be needed either.  Huawei: The method proposed for delta Tib is aligned with delta Rib in 7.3B.3.0. The methodology was agreed from E-UTRA after a long debating. We don't think the NR UE implementation has been changed dramatically compared to that of LTE. |
| Others: |  |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2014309  R4-2014310 | Company A |
| Company B |
|  |
| R4-2014900  R4-2014901 | [Nokia] for DC\_12\_n66 can E-UTRA bands 42 and 43 be moved to first row as there is no note? |
|  |
|  |
| R4-2016496  R4-2016497 |  |
|  |
|  |
| R4-2015805 |  |
|  |
|  |
| R4-2016054  R4-2016055 | Vivo: Cannot agree with Rel-16 CR R4-2016054. This Rel-16 CR is contradicting with R4-2015324 which is re-submitted in this meeting based on last meeting’s agreed CR R4-2010855 (CRNum: 0344) and also approved in RP-201504. Unfortunately, the original CR was incorrectly implemented in the latest spec and has to be resubmitted.  For Rel-15 CR, it can be regraded as no direct controversy and we are fine to accept, but no mirror CR should be introduced since Rel-16 HPUE scheme already have different scheme. |
| Ericsson: CR R4-2016054 will most probably be withdrawn if R4-2015324 is agreed. |
|  |
| ~~R4-2016482~~ |  |
|  |
|  |
| R4-2016485  R4-2016486 | [Nokia] This issue has been discussed already and has not been agreeable. UE specification should not have network deployment aspects. |
| Ericsson: not agree (but see comment on issue 3-6) |
| Qualcomm: Cannot agree to CR |
| Huawei: We can further discuss the issue for overlapping spectrum as commented by Ericsson. However, the wording of Note 10 is not the correct manner to specify the requirements in the spec, which should be revised at least the description should be consistent between Note 10 and Note 11. |
| R4-2016492  R4-2016493 | ZTE: We feel a bit confusion for this new added sentence, maybe some examples can be further clarified. In addition, why different approach are used for <=1GHz and >1 GHz? |
| Huawei: See similar comments for Issue 3-7 above. |
|  |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#3-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  It needs more discussion. [102] discusses this issue in parallel. The CR can capture agreement if there is any. |
| **Sub-topic#3-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Revise R4-2016496 and R4-2016597 to merge the other CRs at the same time remember to address Nokia comments if needed. |
| **Sub-topic#3-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Agree on the CR. |
| **Sub-topic#3-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Revise the Rel-15 CR R4-2016055 cat F to correct coversheet.  Revise the Rel-16 CR R4-2016054 cat A to cat F and at the same time remove change that conflicts agreed CR R4-2010855.  *Note: please do not upload catA CR before catF CR is agreed.* |
| **Sub-topic#3-6** | *Tentative agreements:*  Reword the note proposed:  NOTE 10: The minimum requirements apply for DL carriers with maximum power spectral density imbalance of [6] dB. The power spectral density imbalance condition also applies for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration.  *Candidate options:*  *Recommendations for 2nd round:*  Discuss further and try to agree on the compromise from the proponent. |
| **Sub-topic#3-7** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Try to agree on the CR if all comments are addressed. |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2014309  R4-2014310 | *Return to* |
| R4-2014900  R4-2014901 | *Merged* |
| R4-2016496  R4-2016497 | *Cat F CR Revised*  *Cat A CR return to* |
| R4-2015805 | *Agreeable* |
| R4-2016054  R4-2016055 | *Revise the Rel-15 CR R4-2016055 cat F to correct coversheet.*  *Revise the Rel-16 CR R4-2016054 cat A to cat F and at the same time remove change that conflicts agreed CR R4-2010855.* |
| R4-2016485  R4-2016486 | *Cat F CR Revised*  *Cat A CR return to* |
| R4-2016492  R4-2016493 | *Return to* |

## Discussion on 2nd round (if applicable)

### Sub-topic 3-1

It is proposed in R4-2014309 that *Unless otherwise stated, for inter-band EN-DC with uplink assigned to one LTE band and one NR band, the requirements for additional spurious emissions apply when one of the bands in a combination is subject to an additional spurious emission requirement (i.e. in clause 6.6.3.3 of TS36.101[4] or clause 6.5.3.3 of TS38.101-1[2]) and the other band shall also protect the same band or range in the spurious emission for UE co-existence requirement (i.e. in clause 6.6.3.2 of TS36.101[4] or clause 6.5.3.2 of TS38.101-1[2]), with the indication of the relevant network signalling(NS) in the former band.*

**Issue 3-1: EN-DC UE has to meet additional single band spurious emission requirements (signalled by NS\_X) on both ULs?**

* Proposals
  + Option 1: Yes
  + Option 2: No

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 3-1: | [OPPO] As commented in 1st round, ok with this Option 1.  Skyworks: option1  **Apple**: As suggested by SoftBank we agree to continue the discussion on issues and challenges in [102] to avoid duplicate discussion threads. |

### Sub-topic 3-6

R4-2016485 further clarifies that the requirements specified for DC\_20A\_n28A apply when the two bands are collocated-deployed.

**Issue 3-6: Agree on R4-2016485?**

Reword the note proposed:

NOTE 10: The minimum requirements apply for DL carriers with maximum power spectral density imbalance of [6] dB. The power spectral density imbalance condition also applies for these carriers when applicable EN-DC configuration is a subset of a higher

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 3-6: | Skyworks: seems the sentence above is not finished. As of now we believe this PSD balance has to be the default for the minimum requirement.  Qualcomm: You may reword note as follows:  NOTE 10: The minimum requirements apply for DL carriers with a maximum power spectral density imbalance of [6] dB. The power spectral density imbalance condition also applies for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration.  Nokia: Ok to have this note as it is intended for UE testing not deployment topologies.  Huawei: CR will be revised to make the wording suitable for the specification. |

### Sub-topic 3-7

For UE supporting multiple band combinations, ∆TIB,c could be different for these combinations. Unlike ∆RIB,c , how to use ∆TIB,c in this case is not clearly specified. R4-2016492 proposes to clarify this issue. When the operating band frequency range is ≤ 1 GHz, the applicable additional ∆TIB,c shall be the average value for all band combinations; When the operating band frequency range is > 1 GHz, the applicable additional ∆TIB,c shall be the maximum value for all band combinations.

**Issue 3-7: Agree on R4-2016492?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2016492 and its mirror CR

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| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 3-7: | [OPPO] Ok with option 1.  Skyworks: it is not clear why the average is used <1GHz and max for >1GHz. Should it max in both case?  ZTE: We have similar comments with SKW in the 1st round discussion. As explained by QC in 1st round, “ original motivation to distinguish <1 GHz and >1 GHz was because the relaxation applies to the corresponding UTRA band. If that’s no longer the case, then the distinction may not be needed either.”, do we need to consider UTRA band for NR band combination?  Qualcomm: Please see my explanation for a similar proposal in thread 102 on R4-2016490. Is it the intention to apply NR relaxations to UTRA? If not, then the use of average for <1 GHz is not needed.  Nokia: To Skyworks, this text comes from LTE agreement and is outcome of about year or more discussion between UE vendors and operators.  Huawei: Agree with Nokia, and it is the agreement for LTE combinations initially. Same principles should be applied for NR as well, and it should include both Rx and Tx parts. |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #4: Others

Several other issues are covered in Topic #4. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014914 | Apple | CR for TS 38.101-3: Corrections for intra-band contiguous EN-DC configurations  CatF R15 |
| R4-2014915 | Apple | CR for TS 38.101-3: Corrections for intra-band contiguous EN-DC configurations  CatF R16 submitted to 7.19.3 |
| R4-2015034 | ZTE | CR to TS 38.101-3: Some corrections on the ENDC |
| R4-2015035 | ZTE | Mirror CR to R4-2015034 |
| R4-2015992 | CHTTL | CR to TS 38.101-3 clarifications on indication of Single Uplink allowed for intra-band EN-DC and NE-DC |
| R4-2015999 | CHTTL | Mirror CR to R4-2015992 |

## Open issues summary

Mainly maintenance CRs.

### Sub-topic 4-1

Correct intra-band EN-DC configurations*.*

**Issue 4-1: Agree on R4-2014914?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2014914

### Sub-topic 4-2

R4-2015034 proposes mainly to clarify that for EN-DC with FR2, suffix D requirements do not apply. Also it proposes to change each CC to individual sub-block for intraband NC EN-DC SEM.

**Issue 4-2: Agree on the changes in R4-2015034?**

* Agree on removal of suffix D references in TS 38101-2.
  + Option 1.1: Yes
* Agree on the wording changes on SEM intraband NC EN-DC
  + Option 2.1: Yes
  + Option 2.2: No. needs discussion.
* Recommended WF
  + Discuss and revise if needed

### Sub-topic 4-3

For the intra-band EN-DC and NE-DC combinations, as the indication of single UL allowed is due to potential emission issues, there is no need to check whether the IM2 or IM3 falls into own primary downlink channel bandwidth or not when determining dual uplink is mandatory support or not. The description for the equation of the self IM interference includes the intra-band configuration tables in the current specification, which might cause confusion.

**Issue 4-3: Agree on R4-2015992?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on R4-2015992 and its mirror CR

### Sub-topic 4-4

As the proponent sees some ambiguity in the definition of *intraBandENDC-Support*, it is proposed in R4-2015089 to have some clarifications in RAN4 and ask RAN2 to incorporate the RAN4 consensus.

**Issue 4-4: clarify this ambiguity spotted in R4-2015089?**

* RAN4 clarifies the ambiguity raised in the paper in Rel-16
  + Option 1: Yes
  + Option 2: No
* If yes, in which way?
  + Option 1: Contiguous EN-DC or non-contiguous EN-DC is based on whether the configuration is included the Table 5.3B.1.2-1 or Table 5.3B.1.3-1.
    - Although non-contiguous uplink is included in Table 5.3B.1.2-1, they shall be supported by UE capable only of intra-band contiguous EN-DC.
  + Option 2: Clarify the definition of intraBandENDC-Support such that this is only related the adjacent LTE and NR carriers
    - This option is the first interpretation described above. If the adjacent LTE and NR carriers are contiguous according to the channel spacing criteria in TS 38.101-3, UE support such configuration, even if LTE part or NR part includes non-contiguous sub-blocks.
    - UE can support the configuration of contiguous downlink and non-contiguous uplink, only if UE signals the support of both contiguous EN-DC and non-contiguous EN-DC.
  + Option 3: Clarify the definition of intraBandENDC-Support such that all the carriers shall be contiguously spaced to be a contiguous EN-DC, otherwise, its non-contiguous.
    - This option is the second interpretation described above. Only if all the LTE and NR carriers are contiguously spaced according to the channel spacing criteria in TS 36.101, TS 38.101-1, and TS 38.101-3, then, UE capable of contiguous EN-DC can supports such configuration.
    - UE can support the configuration of contiguous downlink and non-contiguous uplink, only if UE signals the support of both contiguous EN-DC and non-contiguous EN-DC.
  + Option 4: Restructure UE capability signaling.
    - If none of the solutions (option 1-3) works well, revision of UE capability signaling structure can be further discussed.
  + Option 5: other options.
* Recommended WF
  + Discussion is needed

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 4-1:  Agree on R4-2014914? | Huawei: disagree with the CR. No need to remove the NC UL configuration as they are the valid configuration according to DL.  CHTTL: Since some of the configurations are added by the 1 band LTE + 1 band NR basket WID, I think I have some resposibility to comment on this CR. As these configurations are already in the spec for a while, it might not be a good approach to directly remove them. Could the proponent provide more information on why they need to be removed? and is there any alternative way instead of removing them?  Charter Communications, Inc.: We have a question for clarification. What has prompted this CR? What problem are we trying to address? We believe the NC UL configuration is valid not only for en-dc but other configurations as well.  Google: For R4-2014915, we cannot accept removing DC\_48A\_n48A in the UL configuration. Take DC\_(n)48CA for example, the uplink carrier in LTE can be CC1 or CC2. Assume LTE CC1 frequency < LTE CC2 frequency < NR CC1 frequency. So it is flexible for the network that the intra-band EN-DC UL configuration can be LTE\_UL(CC1)-GAP-NR\_UL(CC1) or LTE\_UL(CC2)-NR\_UL(CC1). Both the contiguous and non-contiguous UL configurations should be applied to the intra-band EN-DC configuration. |
| Issue 4-2:  Agree on the changes in R4-2015034? | ZTE: Agree.  Qualcomm:  (On D-suffix removal)  For Rel-15: It would be better to add wording ‘…and for NR single carrier, ~~and~~ CA operation *and UL MIMO* operation specified in clause 6.3 of…’ Removal, as proposed, means precluding UL MIMO operation in ENDC.  For Rel-16 and newer: It is better to take out references to specific sub-clauses to allow for graceful growth in the future to include NRU, etc. If not removed, it would become necessary to string all the subclauses of applicable requirements.  NTT DOCOMO, INC: We have a question. If we remove the reference to suffix D, we are not sure how UL MIMO requirements apply to UE supporting EN-DC band combinations including FR2 bands with UL MIMO?  Huawei: Disagree with the changes. Any conclusion in RAN4 that CA band combination does not need to support UL MIMO? For SEM correction, there is no such case for UL intra-band non-contiguous ENDC with sub-block in both Rel-15 and Rel-16. |
| Issue 4-3:  Agree on R4-2015992? | [OPPO] ok with the clarification.  Ericsson: not agreed, the IMD requirements are only waived for UEs actually indicating "singleUL-transmissions" (otherwise the requirements apply).  Qualcomm: Listing out the tables is a good change. But the wording about the reason for single UL allowed doesn’t seem to be needed. Maybe instead a note could be added to the table, similar to the Note 3 and Note 4 for the intra-band table?  Huawei: it's not clear whether intra-band EN-DC can be scheduled with dual UL with the potential emission issue with the proposed changes, if the requirement is ambiguous for 2UL, clear requirement of MPR should be specified to meet the emission requirements.  The concept of “single UL allowed” seems different between intra-band ENDC and inter-band ENDC.  Currently, there are some cases as below for intra-band ENDC:  1) It’s mandatory to support dual Tx: DC\_(n)71AA  2) It’s optional to support single/dual Tx: DC\_(n)41AA, DC\_41A\_n41A, DC\_3A\_n3A (Rel-16)  3) The minimum requirements apply only for single switched UL: the other combinations, such as DC\_(n)5AA/ DC\_(n)12AA/ DC\_2A\_n2A / DC\_3A\_n3A (Rel-15)  Clarification and understanding alignment is needed in RAN4.  CHTTL: Thank you all of the above for the discussions. We would like to provide some clarification below.  If my understanding is correct, at that time the formula in the Annex I is discussed for the inter-band only. For the difficult inter-band EN-DC combination, the UE is allowed to indicate not supporting dual UL operation, but still the UE is mandatory to support dual UL operation with the easy transmission channel bandwidth locations under this difficult inter-band EN-DC combination. So clearly it is not applicable to the intra-band EN-DC, since the reasons for single UL allowed are not only the DL interference but also the potential emission issues, as stated in the NOTE 3 of Table 5.5B.2-1, the CR is propose to fix this.  To Ericsson: we are not touching the IMD requirements, please see the clarification above.  To Huawei: We are not changing something to encourage intra-band EN-DC can be scheduled with dual UL with the potential emission issue, please see the clarification above.  To Qualcomm: the intention of the wording about the reason is to make it general to intra-band EN-DC cases. We are also fine with your suggestion, in this CR, we just list the intra-band related table out, and for rel.15 no additional NOTE is needed to the table. |
| Issue 4-4:  clarify this ambiguity spotted in R4-2015089? | Huawei: Option 1, RAN4 clarifies the ambiguity raised in the paper in Rel-16  If yes, in which way?  Option 4: Restructure UE capability signaling.  For each ENDC band combination, actually LTE CA part and NR CA part can be indicated separately, and the CBW, SCS and MIMO can be indicated per CC. So we think there is no problem on whether UE can support LTE contiguous CA or NC CA on LTE side or whether UE can support NR contiguous CA or NC CA on NR side.  The only problem is: how to differentiate contiguous ENDC support in UL and DL.!! Because *intraBandENDC-Support* IE do not differentiate UL and DL indication. So, if UE indicate non-contiguous support, then non-contiguous ENDC should be supported for both UL and DL. So when RAN4 introduce the band combination like downlink DC\_48A\_(n)48AA and uplink DC\_(n)48AA, UE is impossible to indicate on UL and DL support separately.  So the *intraBandENDC-Support* IE need to be restructured. |
| Others: |  |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2014914  R4-2014915 | Huawei: Disagree with the CR, see comments to Issue 4-1. |
| Charter Communications, Inc.: We have asked for further clarification for these CR’s as we don’t understand what is this CR is trying to correct as mentioned above, the UL non cont configuration is valid for en-dc and other configurations.  Google: Disagree with the CR, see comments to Issue 4-1. |
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| R4-2015034  R4-2015035 | NTT DOCOMO, INC: (Same comments on issue 4-2)We have a question. If we remove the reference to suffix D, we are not sure how UL MIMO requirements apply to UE supporting EN-DC band combinations including FR2 bands with UL MIMO? |
| Huawei: disagree with the CR, see comments to Issue 4-2. |
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| R4-2015992  R4-2015999 | Ericsson: not agreed, see comment to issue 2-3. |
| Huawei: See comments to Issue 4-3. |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#4-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  More discussion is needed. Let’s first focus on sub-topic 4-4.  R4-2014915 is moved to thread [116]. |
| **Sub-topic#4-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  More discussion is needed. |
| **Sub-topic#4-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Try to agree on the CRs. |
| **Sub-topic#4-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  More discussion is needed. Please interested companies provide your views. |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2014914 | *Return to* |
| R4-2014915 | *Moved to thread [116]* |
| R4-2015034  R4-2015035 | *Cat F CR revised*  *Cat A CR return to* |
| R4-2015992  R4-2015999 | *Return to* |

## Discussion on 2nd round (if applicable)

### Sub-topic 4-2

R4-2015034 proposes mainly to clarify that for EN-DC with FR2, suffix D requirements do not apply. Also it proposes to change each CC to individual sub-block for intraband NC EN-DC SEM.

**Issue 4-2: Agree on the changes in R4-2015034?**

* Agree on removal of suffix D references in TS 38101-2.
  + Option 1.1: Yes
* Agree on the wording changes on SEM intraband NC EN-DC
  + Option 2.1: Yes
  + Option 2.2: No. needs discussion.

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| **Sub-topics** | **Comments** |
| Issue 4-2: | ZTE: We accept most of the comments in 1st round discussion. The revision have been uploaded in the #104 folder.  [Revision of R4-2015034\_CR to TS38.101-3[R15] Some corrections on the ENDC.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_97_e/Inbox/Drafts/[97e][104] NR_NewRAT_UE_RF_Part_3/Revision of R4-2015034_CR to TS38.101-3[R15] Some corrections on the ENDC.docx)  https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_97\_e/Inbox/Drafts/%5B97e%5D%5B104%5D%20NR\_NewRAT\_UE\_RF\_Part\_3/Revision%20of%20R4-2015034\_CR%20to%20TS38.101-3%5BR15%5D%20Some%20corrections%20on%20the%20ENDC.docx |
|  | Qualcomm: (To ZTE) Thank you for CR and corrections. Draft looks ok.  Huawei: Disagree with the changes. As we comment in the 1st round, there is no such case for UL intra-band non-contiguous ENDC with sub-block in both Rel-15 and Rel-16 for SEM correction. There is no need to replace CC by sub-block. |

### Sub-topic 4-3

For the intra-band EN-DC and NE-DC combinations, as the indication of single UL allowed is due to potential emission issues, there is no need to check whether the IM2 or IM3 falls into own primary downlink channel bandwidth or not when determining dual uplink is mandatory support or not. The description for the equation of the self IM interference includes the intra-band configuration tables in the current specification, which might cause confusion.

**Issue 4-3: Agree on R4-2015992?**

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| **Sub-topics** | **Comments** |
| Issue 4-3: | [OPPO] ok with the CR.  [CHTTL] As suggested by Qualcomm, we revised the CR in the following link: [[Rev 1 of R4-2015992 - CR for clarification of SUO for intraband EN-DC.docx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_97_e/Inbox/Drafts/%5B97e%5D%5B104%5D%20NR_NewRAT_UE_RF_Part_3/Rev%201%20of%20R4-2015992%20-%20CR%20for%20clarification%20of%20SUO%20for%20intraband%20EN-DC.docx)]  https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_97\_e/Inbox/Drafts/%5B97e%5D%5B104%5D%20NR\_NewRAT\_UE\_RF\_Part\_3/Rev%201%20of%20R4-2015992%20-%20CR%20for%20clarification%20of%20SUO%20for%20intraband%20EN-DC.docx  In the revision, we just make the intra-band table out of the description for determining the UE is mandatory support dual uplink based on the self IM interference. No further sentence is added. How about this one?  Skyworks: agree about IMD2/3 of dual UL but it should still be checked whether MSD can occur from single UL (cross-band isolation) in both LTE and NR UL configurations.  ZTE: General ok with the CR, but the CR cover needs to be updated accordingly. To Skyworks, is your intention to introduce some principles/fomulations for the cross-band isolation in the spec?  Qualcomm: I’m not sure that removing intra-band tables is the right way. In some of those tables, there may not be “Single UL allowed”, but if the table is removed, then is dual UL mandatory anymore?  CHTTL: we sligntly update the CR according to the ZTE’s comment. In [Rev 2 of R4-2015992 - CR for clarification of SUO for intraband EN-DC]  https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_97\_e/Inbox/Drafts/%5B97e%5D%5B104%5D%20NR\_NewRAT\_UE\_RF\_Part\_3/Rev%202%20of%20R4-2015992%20-%20CR%20for%20clarification%20of%20SUO%20for%20intraband%20EN-DC.docx  To Qualcomm: Thank you for question, currently the description is :〝the UE is mandated to support dual uplink for EN-DC configuration in xxx table and indicated by column single uplink allowed if the IM does not interfere with its own primary DL transmission channel bandwidth〞🡨 it seems this sentence does not mention about the combination with “not” single UL allowed, so if the combo is not single UL allowed, it can only operate in dual uplink mode, so that it shall be dual UL mandatory no matter the table is liseted here or not. And note that for DC\_(n)71AA (with No in single UL allowed column), there is already a note about the condition of dual uplink in the configuration table. The description here is to mandate dual uplink for the combo is single uplink allowed but IM does not fall into DL channel BW. |

### Sub-topic 4-4

As the proponent sees some ambiguity in the definition of *intraBandENDC-Support*, it is proposed in R4-2015089 to have some clarifications in RAN4 and ask RAN2 to incorporate the RAN4 consensus.

**Issue 4-4: clarify this ambiguity spotted in R4-2015089?**

* RAN4 clarifies the ambiguity raised in the paper in Rel-16
  + Option 1: Yes
  + Option 2: No
* If yes, in which way?
  + Option 1: Contiguous EN-DC or non-contiguous EN-DC is based on whether the configuration is included the Table 5.3B.1.2-1 or Table 5.3B.1.3-1.
    - Although non-contiguous uplink is included in Table 5.3B.1.2-1, they shall be supported by UE capable only of intra-band contiguous EN-DC.
  + Option 2: Clarify the definition of intraBandENDC-Support such that this is only related the adjacent LTE and NR carriers
    - This option is the first interpretation described above. If the adjacent LTE and NR carriers are contiguous according to the channel spacing criteria in TS 38.101-3, UE support such configuration, even if LTE part or NR part includes non-contiguous sub-blocks.
    - UE can support the configuration of contiguous downlink and non-contiguous uplink, only if UE signals the support of both contiguous EN-DC and non-contiguous EN-DC.
  + Option 3: Clarify the definition of intraBandENDC-Support such that all the carriers shall be contiguously spaced to be a contiguous EN-DC, otherwise, its non-contiguous.
    - This option is the second interpretation described above. Only if all the LTE and NR carriers are contiguously spaced according to the channel spacing criteria in TS 36.101, TS 38.101-1, and TS 38.101-3, then, UE capable of contiguous EN-DC can supports such configuration.
    - UE can support the configuration of contiguous downlink and non-contiguous uplink, only if UE signals the support of both contiguous EN-DC and non-contiguous EN-DC.
  + Option 4: Restructure UE capability signaling.
    - If none of the solutions (option 1-3) works well, revision of UE capability signaling structure can be further discussed.
  + Option 5: other options.

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| **Sub-topics** | **Comments** |
| Issue 4-4: | [OPPO] Generally our understanding is Option 2, i.e. it indicates the adjacent LTE and NR CCs whether they are contiguous or non-contiguous. And this IE now is only for UL, regarding the differentiation of UL/DL, maybe a new IE is needed or more clarifications in RAN2.  Skyworks: option 3 seems the right way to remove ambiguity as it clarify that there is no gaps between any LTE and NR DL channels ENDC. If UE does not support non-contiguous LTE and NR UL channels (and MPR/AMPR requirements) then only contiguous UL LTE and NR channels is supported). But may be this can be decided by combinations and have a specific note.  [Google]: The option 3 is preferred. It clarifies the spectrum allocation should be all contiguous among LTE and NR carriers. The contiguous and non-contiguous UL EN-DC configuration can be left to the UE reporting. Perhaps the description or a note can be captured in the specification.  Huawei: Option 4. For LTE CA side and NR CA side of an ENDC configuration, it can be clearly indicated by the current RAN2 signal whether they are contiguous or not supported by UE. For intra-band EN-DC, The only problem is: how to differentiate contiguous ENDC support in UL and DL. Because intraBandENDC-Support IE do not differentiate UL and DL indication. We need to inform RAN2 to restructure the UE capability, we need intraBandENDC-Support IE to be indicated separately in UL and DL.  T-Mobile USA: We prefer Option 4. This is our understanding of the initial intention in Rel-15. We would recommend changing the wording slightly:   * Option 3: Clarify the definition of intraBandENDC-Support such that all the downlink carriers shall be contiguously spaced to be a contiguous EN-DC, otherwise, its non-contiguous.   **Apple**: Option 3 is more in line with our view. However, in current RAN4 specifications, contiguous and non-contiguous configurations seemed to be indicated only by DL configuration which has resulted in ambiguity on categorizing the EN-DC configurations. In our view, when an EN-DC configuration is specified as contiguous combination, both DL and UL should be contiguous, otherwise, they should be specified as non-contiguous combinations. That is the reason why we raised CR R4-2014914 and R4-2014915 to try to fix this issue. Besides our CRs, we also encourage companies to bring in ideas on how to fix this ambiguity issue in RAN4 specifications as we are not sure any of the options above would really address the issue on how to categorize EN-DC configurations without separating the DL and UL. |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |