3GPP TSG-RAN WG4 Meeting # 98-e R4-210xxxx

**Electronic Meeting, 25th January– 5th Febuary, 2021**

**Agenda item:** 4.2.3

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [98e][104] NR\_NewRAT\_UE\_RF\_Part\_3

**Document for:** Information

# Introduction

This email discussion handles the contributions submitted to agenda item 4.2.3. 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 (Reply LS on BCS reporting and support for intra-band EN-DC band combinations, Simultaneous Rx/Tx UE capability, UE capability on *intraBandENDC-Support* 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.

**Note:**

1. **The RAN4’s understanding on A) and B) in LS RP-202935 should be indicated to RAN2 by the end of the first meeting week of RAN4#98e.**
2. **R4-2102937 has been uploaded into the ftp as revision of** **R4-2101111.**
3. **R4-2101144 and SUO part of R4-2101718 were moved to thread [108].**
4. **R4-2102148 was moved into this thread [104].**

# Topic #1: Reply LS on BCS for intra-band EN-DC band combinations

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2102937  (revision of R4-2101111) | Xiaomi | **Question A:**  **Answer: If the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A, the higher order EN-DC band combinations with a common band on the LTE and NR side such as DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A doesn’t need to report a BCS for intra-band EN-DC (as defined in 38.101-3, section 5.3B.1), and in this case,** **the network shall assume that the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A.**  **Question B:**  **Answer: If the UE doesn't support UL on intra-band EN-DC part of a band combination, the band combination can’t be classified as "intra-band EN-DC band combination"** |
| R4-2101143 | MediaTek inc. | **Observation 1: Mandating the reporting of supportedBandwidthCombinationSetIntraENDC helps network to know how to configure DL channel BW on that co-band LTE CC and NR CC according to UE’s capability.**  **Observation 2: Reporting of supportedBandwidthCombinationSetIntraENDC does not mandate UE to support the corresponding intra-band UL configurations.**  **Proposal 1:** **For an EN-DC band combinations with a common band on the LTE and NR sides, UE is mandated to report the BCS for the intra-band EN-DC even if UE does not support intra-band UL configurations.**  **Proposal 2: If the UE doesn't support UL on intra-band EN-DC part of a band combination, the band combination is still classified as "intra-band EN-DC band combination".** |
| R4-2101750 | OPPO | Observation 1: RAN4 BCS defined actually is based on the DL EN-DC rather than UL.  Observation 2: There is note to clarify the UL and DL bandwidth relations in 36.101, i.e. “For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal”.  Observation 3: In LTE the UL bandwidth will follow DL BCS in the same CC. This important information is missing in NR specifications.  Proposal 1: It is proposed to specify LTE notes “For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal” in NR specifications to clarify the relation between UL and DL BCS.  Observation 4: Intra-band EN-DC band combination is the case that UL and DL are both configured with intra-band EN-DC.  Proposal 2: It is proposed to reply RAN2/RAN as below:   * A) Clarify if higher order (i.e. those band combinations which the UE indicates support for explicitly in UE capability signaling) EN-DC band combinations with a common band on the LTE and NR side such as DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A need to report a BCS for intra-band EN-DC (as defined in 38.101-3, section 5.3B.1), even if the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A respectively. If the UE does not report the EN-DC BCS for such a combination, what can the network assume about the configuration limitations for the common bands (e.g. LTE band 71 and NR band n71) in the combination?   **Proposed Answer:**   * **Yes, UE needs to report BCS supported for DL intra-band EN-DC even it doesn’t support intra-band UL configurations.** * B) Resolve the general question of classification of intra-band EN-DC band combinations according to UL support. If the UE doesn't support UL on intra-band EN-DC part of a band combination, is band combination classified as "intra-band EN-DC band combination"?   **Proposed Answer:**   * **Intra-band EN-DC band combination is the case that UL and DL both are configured with intra-band EN-DC, but as reply to question A), the intra-band BCS needs to be reported even intra-band EN-DC is only supported by DL.** |
| R4-2101853 | ZTE Wistron Telecom AB | **It’s proposed:**  **In RAN4’s understanding, for an EN-DC band combination with a common band on the LTE and NR side, if a UE supports the UL configuration with both LTE and NR on the common band, then it is regarded as an intra-band EN-DC band combination with additional inter-band CA component of the LTE and NR”, otherwise, it is interpreted as “inter-band EN-DC”. Even though the EN-DC notation itself does not differentiate these two cases, the UL configuration on the common band is the key to understand which of the case a higher order EN-DC band combination belongs to. With such understanding, the answers to question A) and B) are clarified as:**  **Answer to A): A UE has to report the intra-band UL configuration for the common band for a higher EN-DC band combination consisting of the common band if it intends for the network to be aware that it does not support intra-band EN-DC on the common band, otherwise, the network interprets the higher EN-DC band combination as an intra-band EN-DC band combination. In this way, the legacy UE is not impacted.**  **Answer to B): If a UE does not support UL on intra-band EN-DC part of a band combination, the band combination is not classified as “intra-band EN-DC band combination”.** |
| R4-2102504 | Qualcomm Incorporated | **Proposal 1: RAN4 to agree that UE should not signal intra-band EN-DC BCSs if UE doesn’t support it in the intra-band UL configurations.**  **Proposal 2: For an EN-DC band combination that UE does not report the EN-DC BCS, the UE shall support any combinations of bandwidths as signalled in E-UTRA UE capability and NR UE capability separately.**  **Proposal 3: RAN4 to agree above change for applicability of minimum requirements in TS38.101-3. The corresponding CR is in R4-2102505.**  **Proposal 4:** **A high order/superset inter-band EN-DC band combination containing a fallback intra-band combination where EN-DC is not supported in UL EN-DC configuration should be considered as “inter-band (NG)EN-DC without intra-band (NG)EN-DC component”.** |
| R4-2102505  R4-2102506  R4-2102507 | Qualcomm Incorporated | **CR for 38.101-3 on applicability of minimum requirements for EN-DC.** |
| R4-2102388 | Huawei, HiSilicon | **Proposal 1: If the UE doesn’t support the intra-band UL configurations, e.g. DC\_66A\_n66A or DC\_71A\_n71A inside DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A respectively, then the intra-band configurations should not be considered as intra-band EN-DC.**  **Proposal 2:** **For intra-band configuration(s) not support intra-band EN-DC, the supported BCS or CBW are determined by available reported E-UTRA bandwidth combination sets/CBW and NR bandwidth combination sets/CBW for the inter-band EN-DC configuration.**  **Proposal 3: Clarification on support of intra-band EN-DC and BCS for intra-configurations which not support EN-DC shall be made in RAN4 specification.**  **Proposal 4: LS with clarification on case A) and B) based on proposal 1 and proposal 2 shall be sent to RAN2. If clarification is made in RAN4 spec, there is no need to make changes in RAN2 specification.** |
| R4-2102148 | T-Mobile USA, Bell Mobility, TELUS, Nokia, Nokia Shanghai Bell | **Proposal 1: If a UE supports a higher order (i.e. those band combinations which the UE indicates support for explicitly in UE capability signalling) EN-DC band combinations with a common band on the LTE and NR side such as DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A the UE needs to report supported BCS(s) for intra-band EN-DC (as defined in 38.101-3, section 5.3B.1), even if the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A respectively.**  **Proposal 2: If a UE does not report intra-band EN-DC BCS(s) for a higher order (i.e. those band combinations which the UE indicates support for explicitly in UE capability signalling) EN-DC band combinations with a common band on the LTE and NR side such as DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A, the network may assume the configuration limitations for the common bands (e.g. LTE band 71 and NR band n71) in the combination are based on BCS0 for the equivalent intra-band EN-DC combination.**  **Proposal 3: If a UE doesn't support UL on intra-band EN-DC part of a band combination, the band combination is not classified as an "intra-band EN-DC band combination." However, as noted in response to A) above, the UE should still report the supported intra-band EN-DC BCS(s) if the EN-DC band combination contains a common band on both the LTE and NR side even if the UE does not support UL intra-band EN-DC with the common bands.**  **Proposal 4: In order to help resolve this issue as quickly as possible, RAN4 should politely offer the following change in red as a possible change to 38.306:**  ***supportedBandwidthCombinationSetIntraENDC***  Defines the supported bandwidth combination for the band combination set as defined in the TS 38.101-3 [4]. For intra-band (NG)EN-DC with additional inter-band CA component(s) of LTE and/or NR, or for inter-band (NG)EN-DC with downlink intra-band (NG)EN-DC components, the field defines the bandwidth combinations for the intra-band (NG)EN-DC component. Field encoded as a bit map, where bit N is set to "1" if UE support Bandwidth Combination Set N for this band combination as defined in the TS 38.101-3 [4]. The leading / leftmost bit (bit 0) corresponds to the Bandwidth Combination Set 0, the next bit corresponds to the Bandwidth Combination Set 1 and so on. It is mandatory if the band combination is an intra-band (NG)EN-DC combination with additional inter-band NR/LTE CA component. When not present for intra-band (NG)EN-DC with additional inter-band CA component(s) of LTE and/or NR, or for inter-band (NG)EN-DC with downlink intra-band (NG)EN-DC components, the network may assume support for BCS0 for the relevant intra-band (NG)EN-DC components.  **Proposal 5: RAN4 to send an LS to RAN2 conveying the information above.**  **Proposal 6: RAN4 to discuss if any CRs are needed to clarify the relevance of intra-band EN-DC BCSs for higher order EN-DC combinations.** |

## Open issues summary

RAN has discussed the topic of BCS reporting of intra-band part of inter-band EN-DC as per the document [RP-202805](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_90e/Docs/RP-202805.zip), with the resulting discussion being documented in [RP-202865](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_90e/Docs/RP-202865.zip).

As results, RAN has recognized that both RAN2 and RAN4 require some actions to clarify the BCS reporting for band combinations involving intra-band EN-DC parts. For this reason, RAN would request that, for RAN#91e, the following clarifications are done in RAN2 and RAN4:

* For RAN4:
  + A) Clarify if higher order (i.e. those band combinations which the UE indicates support for explicitly in UE capability signalling) EN-DC band combinations with a common band on the LTE and NR side such as DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A need to report a BCS for intra-band EN-DC (as defined in 38.101-3, section 5.3B.1), even if the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A respectively. If the UE does not report the EN-DC BCS for such a combination, what can the network assume about the configuration limitations for the common bands (e.g. LTE band 71 and NR band n71) in the combination?
  + B) Resolve the general question of classification of intra-band EN-DC band combinations according to UL support. If the UE doesn't support UL on intra-band EN-DC part of a band combination, is band combination classified as "intra-band EN-DC band combination"?
  + C) Indicate the RAN4 understanding on A) and B) to RAN2 by the end of the first meeting week of RAN4#98e (to allow RAN2 to finalize their work).
  + D) Agree (if necessary) CRs taking the conclusions of A) and B) into account.

### Sub-topic 1-1

*Sub-topic description: To clarify and reply to RAN plenary* *LS RP-202935. It’s noted that* *the RAN4 understanding on A) and B) should be indicated to RAN2 by the end of the first meeting week of RAN4#98e****.***

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

**Issue 1-1-1: If the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A respectively, do these higher order EN-DC band combinations with a common band on the LTE and NR side such as DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A need to report a BCS for intra-band EN-DC (as defined in 38.101-3, section 5.3B.1)?**

* Proposals
  + Option 1: Yes, they need to report a BCS. (MTK, OPPO, T-Mobile USA, Bell Mobility, TELUS, Nokia)
  + Option 2: No, they don’t need to report a BCS. (Xiaomi, Huawei, QC)
* Recommended WF
  + TBA

**Issue 1-1-2: If the UE does not report the intra-band EN-DC BCS(s) for such a combination, what can the network assume about the configuration limitations for the common bands (e.g. LTE band 71 and NR band n71) in the combination?**

* Proposals
  + Option 1: For intra-band configuration(s) not support intra-band EN-DC, the supported BCS or CBW are determined by available reported E-UTRA bandwidth combination sets/CBW and NR bandwidth combination sets/CBW for the inter-band EN-DC configuration.
  + Option 2: the network may assume the configuration limitations for the common bands (e.g. LTE band 71 and NR band n71) in the combination are based on BCS0 for the equivalent intra-band EN-DC combination.
  + Option 3: Other solutions.
* Recommended WF
  + TBA

**Issue 1-1-3: If the UE doesn't support UL on intra-band EN-DC part of a band combination, is band combination classified as** **"intra-band EN-DC band combination"?**

* Proposals
  + Option 1: Yes, the band combination is classified as "intra-band EN-DC band combination". (MTK)
  + Option 2: No, the band combination is not classified as "intra-band EN-DC band combination". (Xiaomi, ZTE, Huawei, T-Mobile USA, Bell Mobility, TELUS, Nokia)
  + Option 2A: A high order/superset inter-band EN-DC band combination containing a fallback intra-band combination where EN-DC is not supported in UL EN-DC configuration should be considered as “inter-band (NG)EN-DC without intra-band (NG)EN-DC component”. (QC)
  + Option 2B: Intra-band EN-DC band combination is the case that UL and DL both are configured with intra-band EN-DC. (OPPO)
* Recommended WF
  + TBA

**Issue 1-1-4: Should RAN4 politely offer the following change in red as a possible change to 38.306?**

***supportedBandwidthCombinationSetIntraENDC***

Defines the supported bandwidth combination for the band combination set as defined in the TS 38.101-3 [4]. For intra-band (NG)EN-DC with additional inter-band CA component(s) of LTE and/or NR, or for inter-band (NG)EN-DC with downlink intra-band (NG)EN-DC components, the field defines the bandwidth combinations for the intra-band (NG)EN-DC component. Field encoded as a bit map, where bit N is set to "1" if UE support Bandwidth Combination Set N for this band combination as defined in the TS 38.101-3 [4]. The leading / leftmost bit (bit 0) corresponds to the Bandwidth Combination Set 0, the next bit corresponds to the Bandwidth Combination Set 1 and so on. It is mandatory if the band combination is an intra-band (NG)EN-DC combination with additional inter-band NR/LTE CA component. When not present for intra-band (NG)EN-DC with additional inter-band CA component(s) of LTE and/or NR, or for inter-band (NG)EN-DC with downlink intra-band (NG)EN-DC components, the network may assume support for BCS0 for the relevant intra-band (NG)EN-DC components.

* Proposals
  + Option 1: Yes.
  + Option 2: Yes, but with some modifications.
  + Option 3: No, it depends on RAN2’s decision.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

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| **Sub-topics** | **Comments** |
| Issue 1-1-1 | Ericsson:  Possibly both options.  Option 1: the current 38.306 requires that a BCS is included for the intra-band EN-DC part since the configuration contains an E-UTRA CA part. The UE can indicate for the higher-order band combination or in the Feature Set for this higher-order band combination that UL operation is not supported in B66/B71. Then the intra-band EN-DC BCS only applies for the DL, and the network cannot configure the UE with a fallback to DC\_66A-n66A or DC\_71A-n71A.  Option 2: but the UE should also be able to omit the intra-band EN-DC, then the respective CA BCS for the E-UTRA and NR CG should apply. However, this might not solve all legacy problems for UEs in the field, see answer to 1-1-2.  T-Mobile USA: Option 1: Yes. We believe that UEs that support downlink combinations like DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A need to report a BCS for intra-band EN-DC for DC\_66A\_n66A or DC\_71A\_n71A respectively even if they do not support uplink intra-band EN-DC. The reason is some UEs have implementation restrictions that limit the combinations of channel BWs they support on the common band, even on the downlink. For example, we have deployed UEs that have a split duplex filter for Band 71/n71. These UEs cannot support all of the possible combinations of Band 71+n71 on the downlink in DC\_2A-71A\_n71A. therefore, it is necessary to send the intra-band EN-DC BCS, even though these UEs do not support uplink intra-band EN-DC. If there are UEs that do support all of the possible channel Bandwidths for B71+n71 on the downlink, then they need to report a new BCS or BCS4.  Intel: Option 1  UE may support different UL and DL BCs. The UE may not support all the uplink EN-DC configurations in each EN-DC configuration. However, UE still needs to report BCS for intra-band EN-DC for the DL part. i.e. UE needs to report BCS for DC\_2A-7A-7A-66A-n66A and DC\_2A-71A\_n71A even if the UE doesn’t support the intra-band UL configurations DC\_66A\_n66A or DC\_71A\_n71A respectively.  Apple: Option 2  Let’s suppose we have two scenarios, such that:  **Scenario 1**: UE supports mixed inter-band and intra-band EN-DC DC\_A-B\_nB and/or DC\_A\_(n)B, where bands A and B are LTE bands, and nB is an NR band. UE also supports the UL configuration DC\_A\_nB and also supports DC\_(n)B and/or DC\_nB\_nB;  **Scenario 2**: UE supports mixed inter-band and intra-band EN-DC DC\_A-B\_nB and/or DC\_A\_(n)B, where bands A and B are LTE bands, and nB is an NR band. UE also supports the UL configuration DC\_A\_nB but does not support DC\_(n)B or DC\_B\_nB.  In Scenario 1 the network should interpret the UE’s BCS signaling as applicable to both the UL and DL intra-band parts of the configuration, and the UE should still report the EN-DC BCS defined in 38.101-3, section 5.3B.1.  In Scenario 2 the network still needs to know the UE’s capabilities for the DL intra-band part of the configuration. The network should consider this as an inter-band configuration, where:  - the CBW per LTE band or LTE band combination are taken from LTE single carrier or LTE CA requirements, as applicable;  - and the CBW per NR band or NR band combination are taken from NR single carrier or NR CA requirements, as applicable;  - and there is no need to report EN-DC BCS in this case.  Based on the above explanation, we prefer Option 2  Samsung: Option 2  BCS is specified for both UL and DL. In the case that UE does not support UL configuration, asking UE to report BCS will confuse network especially considering UE may support UL configurations in the future.  Huawei: BCS is a per BC capability, it does not distinguish the UL and DL for current signaling design. Though feature set can be reported for UL and DL separately, however, the BCS has nothing to do with feature set. Option 2 is a simpler solution for both network and UE side, and it will not change the current RAN4 signaling design as the supported channel BW info can be get from the reported LTE and NR BCS or CBW. Some clarification in RAN4 spec would be enough. |
| Issue 1-1-2 | Ericsson:  Option 1 (assuming that “For intra-band configuration(s) not support intra-band EN-DC” means “For intra-band configuration(s) not reporting intra-band EN-DC BCS”).  If the UE does not include an intra-band EN-DC BCS for a supported EN-DC configuration including an intra-band EN-DC part (e.g. 66A-n66A), the respective CA BCS for the E-UTRA and NR CG should apply (e.g. the BW for the respective CA parts containing B66 for E-UTRA and n66 for NR).  Any UL restrictions are indicated in the Feature Set for the band combination. For e.g. DC\_2A-7A-66A-n66 without any BCS indication for the intra-band EN-DC part, the UE can indicate in the FS that it does not support an UL in B66 (but has to support and UL in n66 to make EN-DC possible). The supported bandwidth combinations in the intra-band EN-DC part are given by the BCS for CA\_2A-7A-66A and supported bandwidth for n66.  If the UE includes a BCS for the intra-band EN-DC part, this applies for both the DL and the UL unless the UE indicates a restriction in the UL configuration (e.g. not support UL in B66 for CA\_2A-7A-66A). Then the said BCS would only apply for the DL.  The above is not possible following the latest 38.306, an intra-band EN-DC BCS must be included. RAN4 should inform RAN2 that  “If the UE does not include an intra-band EN-DC BCS for a supported EN-DC configuration including an intra-band EN-DC part, the respective CA BCS for the E-UTRA and NR CG should apply.”  Alternatively, the proposed BCS0 default for the intra-band EN-DC BCS could be considered in view of the new BCS4 in case the above would be NBC.  The UE should follow the general rule in sub-clause 4.2 of 38.101-3. This rule may need some clarification.  T-Mobile USA: Option 2. If the UE does not report an intra-band BCS for DC\_2A-71A\_n71A, the network will not know if the UE supports all combinations of Band 71 and n71, or if it only supports a subset. As mentioned above, there are legacy UEs that use a split duplex filter which cannot support all of the possible combinations of rB71 and n71 even on the downlink. Since there is only one BCS defined for DC\_71A\_n71A the safe approach is to assume that a legacy UE that does not report the relatively new intra-band EN-DC supportedBandwidthCombinationSetIntraENDC IE supports BCS0. This is also the case that a UE that supports DC\_7A-7A-66A\_n66A will support BCS0 for DC\_66A\_n66A on the downlink.  Intel: Option 3 (UE is mandatory to report)  We are not sure RAN4 really needs to discuss this and it is our understanding that UE mandates to report.  Apple: Option 1  Based on the reasoning summarized in our comments to Issue 1-1-1, we prefer Option 1  Samsung: Option 1  If UE does not report BCS for intra-band EN-DC due to capability of supporting UL configurations, Network shall interpret the UE capability based on existing signaling as in option 1  Huawei: Option 1. From network perspective, it would be natural to assume the supported CBW for the intra-band EN-DC part (though UL is not supported) from the reported information, and this kind of BCS/BW are available from capability reported for LTE and NR side. Assume a BCS in the RAN4 spec may not reflect the real deployment demand of the operator, also it burdens the NW implementation to refer different specs with ambiguity. |
| Issue 1-1-3 | Ericsson: Option 1. An intra-band EN-DC part of a higher order configuration is still an “intra-band EN-DC” even if EN-DC is only supported in the DL, restrictions in the UL configuration indicated in e.g. the Feature Set associated with the band combination.  T-Mobile USA: Option 1. We support the proposal from MediaTek. We had an alternative proposal but think that MediaTek’s proposal is more straightforward. We should also add a note to the intra-band EN-DC band tables 5.3B.1.2-1 and 5.3B.1.3-1 to say that the intra-band EN-DC BCSs also apply to higher order combinations that only have intra-band EN-DC in the downlink. Intel: Option 1-a  We would like to clarify that UL can be classified as an inter-band EN-DC, but DL can still be classified as DL-Only intra-band EN-DC combination.  Apple: We prefer a new Option 2C: “the band combination is classified as an inter-band EN-DC configuration”  Samsung: Option 2 is clear solution which is preferred but as long as both network and UE has clear understanding about the UE capability via other capability signaling, classification may not be a big issue.  Huawei: Option 2. Assume the band combination without UL supporting would make the case more complicated when the UE later on supports UL configuration. The impact to RAN2 existing signaling design should be as minimum as possible. |
| Issue 1-1-4 | Ericsson: Option 3. RAN4 should only answer the questions in the LS and possibly describe the use of the BCS for different cases if further clarification is needed.  T-Mobile USA: We proposed Option 1, but would support Option 2 With alternative wording aligned with R4-2101143 from MediaTek. We would also be OK with Option 3 if companies feel that we RAN4 should not be proposing alternative wording.  Intel: It should be clarified the issue 1-1-2 first before discussing this issue.  Apple: Option 3  We prefer Option 3. This field is only reported by the UE which supports intra-band UL within the mixed inter/intra band EN-DC configuration. If the UE does not support intra-band UL (i.e. we are considering Scenario 2, as shown in our comment to Issue 1-1-1), then the UE does not report this field. Thus, no change to the field description is necessary.  Samsung: Option 3. RAN2 signaling design for future proof shall be decided first before RAN4 take any actions on changes on RAN4 spec.  Huawei: Our preference is have a clear conclusion in RAN4 based on the GTW discussion on Tuesday rather than to leave the issue back to RAN2. |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2102505  R4-2102506  R4-2102507 | Ericsson: further clarifications are needed, e.g. what is a subset and product set in the context of BCS? |
| We think further discussion is needed, following the outcome of the discussions above. |
| Apple: We agree to include single CC in both constituent E-UTRA and NR configurations. We think using “or” is sufficient and there is no need to have “and”. |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

## 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”* |

# Topic #2: Simultaneous Rx/Tx UE capability

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

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2101718  R4-2101719 | Ericsson | ***Correction to applicability of simultaneous RX/TX and single-UL transmission***  *Moderator’s note: Rel-17 mirror CR is missing.* |
| R4-2101742 | OPPO | ***Observation 1: It was agreed TDD-FDD EN-DC band combination will follow LTE UL CA simultaneous Rx-Tx capability.***  ***Observation 2: Mandatory simultaneous Rx-Tx band combinations are defined in RAN4 specifications.***  ***Observation 3: UE capability simultaneousRxTxInterBandENDC is defined to indicate whether the UE supports simultaneous Rx-Tx in TDD-TDD and TDD-FDD EN-DC/NE-DC.***  ***Observation 4: Current RAN4 specification defines mandatory simultaneous or non-simultaneous Rx-Tx only for certain band combinations. And no information about other band combinations.***  ***Proposal 1: It is proposed to align the understanding of simultaneous Rx-Tx capability and specify in RAN4 specification for the band combinations which don’t include the mandatory information.***  ***Observation 5: It is straight forward to consider the band combinations without explicit simultaneousRx-Tx information in RAN4 NR specification as they are optionally supported.***  ***Observation 6: LTE simultaneousRx-Tx capability is only defined for TDD+TDD band combinations and no information for TDD+FDD cases.***  ***Observation 7: If simultaneous Rx-Tx is mandatory for LTE TDD+FDD UL CA then the corresponding EN-DC should also be mandatory, but this information is missing in RAN4 specs.***  ***Proposal 2: It is proposed to implement the agreed information “For LTE combinations with both UL for which this capability was supported, the same will be adopted in LTE-NR NSA combinations” into RAN4 spec (wording can be different).***  ***Proposal 3: For Rel-15, generally state simultaneous Rx-Tx is optional for the band combinations that don’t include mandatary information.***  ***Proposal 4: For Rel-16, specify the mandatory simultaneous Rx-Tx for TDD+FDD band combinations included in LTE UL CA from Rel-16.***  ***Proposal 5: For Rel-16, specify the simultaneous Rx-Tx as optional for TDD+FDD band combinations which are not included in LTE UL CA.***  ***Proposal 6: Same logic should be also applied to NR CA.*** |
| R4-2101746  R4-2101747  R4-2101748 | OPPO | ***CR on simultaneous Tx-Rx for EN-DC***  *Moderator’s note:* *Rel-16 mirror CR has been uploaded.* |
| R4-2102375 | Huawei, HiSilicon | ***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: 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 3: Indications of mandatory capability for a higher order band combination are not specified in a consistent and generic method.***  ***Proposal 1: 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 2: 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 3: 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.*** |
| R4-2102378  R4-2102379  R4-2102717 | Huawei, HiSilicon | ***CR for TS 38.101-3 correction CR for simultaneous TxRx operation*** |

## Open issues summary

*Open issue:* *Simultaneous Rx-Tx discussion was re-triggered in last meetings by several papers. Some of agreements were reached and a LS was sent to RAN2 in last meeting. However, it’s necessary to further clarify the specification and remove ambiguity based on RAN4’s common understanding.*

### Sub-topic 2-1

*Sub-topic description:*

1. *For UE supports a band combination without any indicated notes, some clarification in the specification is needed.*
2. *There is a capability inconsistency for the fall back two-band combinations and high order combinations in the spec.*

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

**Issue 2-1-1: How does RAN4 clarify the simultaneous Rx-Tx capability for the FDD-TDD CA/ENDC band combinations?**

* Proposals
  + Option 1: UE shall report simultaneous Rx-Tx capability for all FDD-TDD two-band combinations by default unless otherwise indicated
  + Option 2:
    - For Rel-15, generally state simultaneous Rx-Tx is optional for the band combinations that don’t include mandatary information
    - For Rel-16, specify the mandatory simultaneous Rx-Tx for TDD+FDD band combinations included in LTE UL CA from Rel-16
    - For Rel-16, specify the simultaneous Rx-Tx as optional for TDD+FDD band combinations which are not included in LTE UL CA
* Recommended WF
  + TBA

**Issue 2-1-2: Does RAN4 need to clarify that mandatory capability of simultaneous Rx/Tx also applies for these carriers when applicable EN-DC configuration is part of a higher order EN-DC configuration since the capability should be a per band pair indicated capability?**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

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| **Sub-topics** | **Comments** |
| Issue 2-1-1: | Ericsson:  Closer to Option 2. Option 1 was not agreed at the last meeting. Using the non-simultaneous RxTx as default is also more consistent with the capability indication (support of simultaneous RxTx is a capability).  It should be made clear that the *requirements* for FDD-TDD or TDD-TDD EN-DC band combinations apply for non-simultaneous RxTx between cell groups unless otherwise stated. If the requirements for such a BC also apply for simultaneous RxTx (in addition) for an EN-DC, then the UE includes the *simultaneousRxTxInterBandENDC* if this band combination is supported. For the E-UTRA part of the said band combination, the UE includes the *simultaneousRx-Tx* if this if supported within the MCG, and for the NR part the UE includes the *simultaneousRxTxInterBandENDC* if supported within the SCG  That the *simultaneousRx-Tx* also applies for E-UTRA FDD-TDD should be made clear in the earliest possible release (both RAN2 and RAN4).  Apple:  Option 2 but Rel-16 should also follow Rel-15 where mandatory simultaneous Tx/Rx needs to be explicitly specified, otherwise the support of simultaneous Tx/Rx is considered optional for TDD-FDD CA/EN-DC combinations.  Huawei: Option 1 is not to change the capability to be mandatory for FDD-TDD band combinations. If some restrictions are identified for a specific band combination, which can be reflected in the specification. Otherwise, even the signaling design supports the UE to report the capability based the implementation, actually the use of the capability in some cases is still ambiguous. Open to have further discussion for Option 2. |
| Issue 2-1-2: | Ericsson: Option 2.  Option 1 would violate the existing capability signaling specified in 38.331. The UE may include a fallback band combination if this has different capability than the indicated top-level combination, but the capability of the top-level combination should not be inferred from the capability indicated for a fallback combination if present.  Similar to the above, any restriction for a band combination, e.g. DC\_42-n79, that apply for a two-band combination must be repeated in all tables of higher-order combinations containing the said two-band combination in 38.101-3. In terms of capability indication: the capability of the DC\_42-n79 part of the higher-order combination must follow from the capability indication of the higher-order combination alone (not dependent on a capability indicated for a fallback if included).  Apple: Option 2  The capability of simultaneous Tx/Rx for a lower order EN-DC configuration does not automatically apply for the same configuration when operating as part of a higher order configuration.  Huawei: Option 2  The capability for the fallback mode could be different from the higher order band combination. |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2101718  R4-2101719  Moderator’s note: Rel-17 mirror CR is missing. | Ericsson:  Clarification to the simultaneous RxTx part: it is assumed that the *simultaneousRxTxInterBandENDC* applies between *cell groups.* It is also assumed that the support of simultaneous RxTx capability for the E-UTRA and NR parts (SUL for Rel-15) of an EN-DC FDD-TDD or TDD-TDD combination are as specified for E-UTRA and NR, respectively (recognising that the E-UTRA part does not include FDD-TDD combinations at present). This might not always be the case when the UE is configured with EN-DC, an “unless otherwise stated” is needed for cases in which simultaneous RxTx of the LTE/NR part is no longer supported when the UE is configured with EN-DC. |
| Apple:  In general we are fine with this CR except that it is not clear why NOTE 3 in Table 5.5B.4.1-1 was voided as NOTE 4 does not imply the requirements only apply for non-simultaneous RxTx unless a general statement “requirements for TDD band intra-band EN-DC only apply for non-simultaneous RxTx operation between all carriers” is stated in clause 5.5B.1. |
| Huawei: Further discuss with views collected in 1st round. |
|  |
| R4-2101746  R4-2101747  R4-2101748  Moderator’s note: Rel-16 mirror CR has been uploaded. | Ericsson: not agreed. Requires revision if used as a baseline. It should be made clear that compliance with *requirements* with simultaneous RxTx is optional (scope of RAN4 specifications) unless otherwise stated, and that the simultaneous RxTx capability for EN-DC applies between cell groups. |
| Apple: We agree with the concept on the support of simultaneous RxTx for both TDD-TDD and TDD-FDD inter-band EN-DC. But the suggested wordings from Ericsson look better to us. |
| Huawei: Further discuss with views collected in 1st round. |
|  |
| R4-2102378  R4-2102379  R4-2102717 | Ericsson: not agreed. The EN-DC simultaneous RxTx applies per band combination (BC), between cell groups, not per band pair. This would violate the BC indication as specified in 38.331; capability for an indicated BC does not depend on the capability for fallbacks, e.g. two-band combinations part of a supported higher-order, if included. |
| Apple: CR is not agreed. Simultaneous RxTx for TDD-FDD combinations should not be the baseline without explicit indication per combination in the specifications. |
| Huawei: should focus on the applicability part. |
|  |

## Summary for 1st round

### Open issues

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

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

*Recommendations 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

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

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

## Discussion on 2nd round (if applicable)

## 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”* |

# Topic #3: UE capability on *intraBandENDC-Support*

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

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2102559 | Nokia, Nokia Shanghai Bell | **Proposal: Intra-band EN-DC is considered contiguous only if the two adjacent NR and LTE carriers in downlink are contiguous each other, regardless of uplink configuration. Otherwise it is considered non-contiguous.** |
| R4-2102628 | Huawei, HiSilicon | ***Observation 2: The key problem is: From the current TS 38.331, UE is not allowed to indicate intra-band EN-DC contiguous/non-contiguous capability in UL or DL separately.***  ***Proposal 1: IntraBandENDC-Support IE should be indicated in UL and DL separately per band combination. Send LS to RAN2 to introduce new UE capability on distinguish intra-band ENDC UL and DL contiguous/non-contiguous support.***  ***Proposal 2: For intra-band ENDC, If LTE sub block is contiguous with NR sub block, it is contiguous EN-DC. Otherwise, it is non-contiguous.*** |

## Open issues summary

As the proponent sees some ambiguity in the definition of *intraBandENDC-Support,* which have been discussed since RAN4#97, it is proposed in R4-2102559 and R4-2102628 to have some clarifications in RAN4 and ask RAN2 to incorporate the RAN4 consensus.

### Sub-topic 3-1

*Sub-topic description: There are two interpretations on the definition of intra-band EN-DC contiguous and non-contiguous band combinations. RAN4 need to clarify it, i.e. downlink DC\_48A\_(n)48AA is contiguous or non-contiguous*

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

**Issue 3-1: Clarifications and interpretations on the definition of intra-band EN-DC contiguous and non-contiguous band combinations**

* Proposals
  + Option 1: For intra-band ENDC, If LTE sub block is contiguous with NR sub block, it is contiguous EN-DC. Otherwise, it is non-contiguous. (If the channel spacing between LTE carrier and adjacent NR carrier are contiguous, i.e., the channel spacing is equal to or less than the nominal channel spacing of EN-DC channel spacing specified in TS 38.101-3)
    - => downlink DC\_48A\_(n)48AA is an intra-band contiguous EN-DC band combination
  + Option 2: The entire LTE and NR spectrum are contiguous, i.e., all carriers are contiguously spaced. In other word, all the adjacent carriers including intra LTE carriers and intra NR carriers are contiguously spaced
    - => downlink DC\_48A\_(n)48AA is an intra-band non-contiguous EN-DC band combination
* Recommended WF
  + TBA

### Sub-topic 3-2

*Sub-topic description: From the current TS 38.331, UE is not allowed to indicate intra-band EN-DC contiguous/non-contiguous capability in UL or DL separately or IntraBandENDC-Support* IE doesn’t distinguish DL and UL configuration. RAN4 need to address this issue.

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

**Issue 3-2: How to address this ambiguity** **in the definition of *intraBandENDC-Support* for DL and UL configuration**

* Proposals
  + Option 1: Intra-band EN-DC is considered contiguous only if the two adjacent NR and LTE carriers in downlink are contiguous each other, regardless of uplink configuration. Otherwise it is considered non-contiguous.
  + Option 2: *IntraBandENDC-Support* IE should be indicated in UL and DL separately per band combination. Send LS to RAN2 to introduce new UE capability on distinguish intra-band ENDC UL and DL contiguous/non-contiguous support
  + Option 3: Other solutions
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

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| **Sub-topics** | **Comments** |
| Issue 3-1: | Ericsson:  Option 2: contiguous/non-contiguous w r t carriers, not cell groups. The latter would violate other specifications of contiguous/non-contiguous that refer to sub-blocks.  For the example combination DC\_48A\_(n)48AA, the UE can include the *IntraBandENDC-Support* set to “both”. The UE should also support fallback to the (strictly) non-contiguous DC\_48A\_(n)48A in the DL if the UE supports this for the UL.  Apple:  Option 2. The UL configuration also needs to be considered together. For example, DL DC\_(n)41CA with UL DC\_41A\_n41A should be considered as intra-band non-contiguous EN-DC as the DL fallback is non-contiguous.  Huawei:  Option1. For ENDC contiguous or non-contiguous, UE only need to justify whether LTE and NR part are complied with the nominal channel space definition in 101-3. For LTE SA part or NR SA part, contiguous CA is defined in 36.101 and 38.101-1 respectively. |
| Issue 3-2: | Ericsson:  Is a change needed (Option 3)?  Can a UE supporting e.g. a non-contiguous DC 48A-n48 in the UL be restricted to a strictly contiguous DC\_(n)48BA in the DL? This UE must support all DL fallbacks related to this UL configuration, i.e. is this UE allowed not to support DC 48A-n48 in the DL? Hence *IntraBandENDC-Support* should be set to “both”. If set to “both” but not supported in the UL this can be indicated in the capability for the band combination.  Conversely, for a UE supporting a strictly contiguous DC\_(n)48BA in the DL, then this UE would not necessarily support a fallback to DC 48A-n48 in the DL (corresponding to a DC 48A-n48 in the UL) since this is non-contiguous (unless support of this is explicitly indicated).  Changes acceptable if needed.  Apple: In our view there would be no ambiguity if only both DL and UL including its fallback are contiguous, then the combination is contiguous. Otherwise, the combination is non-contiguous.  Huawei: Option2. This case only happened when there is more than 2CC for intra-band ENDC.  UE need to clearly convey its capability to network in UL and DL. For ENDC, UE may support UL and DL in different RF chain or RF components. It is possible that UE support DL contiguous ENDC, but not support UL non-contiguous ENDC. But currently, ENDC contiguous or non-contiguous can not differentiate UL and DL. |

### CRs/TPs comments collection

*Moderator’s note: It’s suggested to focus on open issues discussion on* *1st round. No CR discussion on 1st round.*

## Summary for 1st round

### Open issues

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

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

*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

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

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

## Discussion on 2nd round (if applicable)

## 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”* |

# Topic #4: Others

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2102094  R4-2102095  R4-2102096 | Huawei, HiSilicon | CR for 38.101-3 to introduce a new MSD due to the counter intermodulation interference |
| R4-2102594  R4-2102593 | Apple | CR for bug fixing of band combination tables for 38101-3  *Moderator’s note: There is no Rel-15 CR.* |

## Open issues summary

*Moderator’s note: In order to improve the efficiency, companies are encouraged to comment the CRs directly in the first round.*

## Companies views’ collection for 1st round

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2102094  R4-2102095  R4-2102096 | Company A |
| Company B |
|  |
| R4-2102594  R4-2102593 | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

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

*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

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

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

## Discussion on 2nd round (if applicable)

## 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”* |