**3GPP TSG-RAN Meeting #92-e RP-21XXXX**

**Electronic Meeting, 19th – 27th May 2021**

**Agenda item:** 9.1.4, 9.13

**Source:** Moderator (RAN4 Chair)

**Title:** Email discussion summary for [92-e-05-Spectrum-WIs]

**Document for:** Information

# Introduction

In this document, we capture comments and responses in the email thread of [92-e-05-Spectrum-WIs] for new RAN4-led spectrum related WI proposals. Based on the discussions the recommendations will be provided. The following documents under the agenda 9.1.4 and 9.13 will be covered in this email thread.

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| **TDoc** | **Title** | **Source** | **Type** | **AI** |
| RP-211202 | New WID: High-power UE operation for fixed-wireless/vehicle-mounted use cases in LTE bands 5 and 12 and NR band n71 | Nokia, Nokia Shanghai Bell | WID new | 9.1.4 |
| RP-211283 | New WID on LTE/NR spectrum sharing in Band 34/n34 | CMCC | WID new | 9.1.4 |
| RP-211284 | New WID on LTE/NR spectrum sharing in Band 39/n39 | CMCC | WID new | 9.1.4 |
| RP-211393 | New WID on DC of x bands (x=1,2,3) LTE inter-band CA (xDL/1UL) and 4 bands NR inter-band CA (4DL/1UL) | Huawei, HiSilicon | WID new | 9.1.4 |
| RP-211445 | Motivation for Introduction of the 6GHz unlicensed band in other countries/regions | Apple Inc. | discussion | 9.1.4 |
| RP-211446 | New WID for Introduction of the 6GHz unlicensed band in other countries/regions | Apple Inc. | WID new | 9.1.4 |
| RP-211305 | Improved MSD for CA and DC | Qualcomm Incorporated | other | 9.13 |

# Topic #1: New WI for HPUE on B5, B12 and n71

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Title** | **Sourcing company** |
| RP-211202 | New WID: High-power UE operation for fixed-wireless/vehicle-mounted use cases in LTE bands 5 and 12 and NR band n71 | Nokia, Nokia Shanghai Bell |

## Initial round

### Comments & responses

In this section, we collect the comments and responses for the proposed work item. Based on the comments, we will decide how to move forward in the next step.

**Sub-topic 1-1: Any question or comment on the justification or any other general comment?**

Companies are invited to provide the general comments, including comments on justification part, whether the WI is needed, how to handle the work, in the follow table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | It is unclear how the requirments for PC1 in Band n71 should be derived. While the SI included example “product brief” (not a datasheet) for Band 5 and Band 12 filters, there was none provided for Band n71. Band n71 is challenging due to the small duplex offset. Even for PC3 significant refsens degradation was specified. We suggest that Band n71 is removed from the scope of this WI. |
| T-Mobile USA | We disagree with Qualcomm. As far as we are aware, there has never been a requirement in RAN4 that a datasheet must be provided prior to the start of a Work Item. The Study Item Technical Report concluded that there were no hardware problems, but that for any of the bands UE REFSENS exceptions may be needed and should be studied during the WI phase. From the TR [RP-210985]:  “HPUE operation impacts on Band 12, Band 5, and Band n71 BS and UE performance have been studied in terms of UE transmitter harmonics and UE self-dense, as well as BS receiver blocking. No need has been identified for any additional UE requirements or relaxations due to uplink harmonics, nor any change in the BS receiver blocking requirements. On the other hand, UE REFSENS exception due to self-dense may be needed, and this should be further discussed and agreed during the WI phase.”  “HPUE hardware and software requirements in Band 12, Band 5, and Band n71 as well as implementation feasibility have been studied, and no major implementation issue has been found, given the target form factors for fixed-wireless/vehicle-mounted use cases.”  The proposal to remove n71 is not supported by the conclusion of the SI TR. T-Mobile cannot accept approval of the Work Item if n71 is removed. |
| LGE | In our understanding, the new WI is for PC1 UE operation with NR Uu interface for FWA and Vehicular UE in the candidate bands.  For the n71, we have same view with Qualcomm on that small duplexer gap can have impact on the desense. RAN4 can further discuss on this impacts if current objectives are kept. |
| Nokia | Band n71 filter can be further discussed when relating requirements like MRP are decided in the WI phase. |
| AT&T | Concerning the PC1 requirements for n71, the existing PC1 requirements (MPR, ACLR, etc.) for band n14 should be leveraged where possible. We think that this was the intent when RAN4 decided to add n14 PC1 in Rel-16 with the goal that the general PC1 requirements would align. |
| Skyworks | Regarding PC1 for n71, PC1 has been specified for other bands that have small duplex gaps like 400MHz bands and band 12 also has a small duplex gap. The FWA form factor enables different duplexer technologies to be used and also the PA has much higher linearity. We do see the benefit to use n71 for FWA and RAN4 can study how to mitigate potential MSD based on duplexer isolation and PA linearity assumptions. Note that UL BW is limited to 20MHz and UL allocation can be optimized for good link performance even if the worst case allocation results in MSD. We support to keep n71 in the scope. |
| ZTE | Clarification questions:  For release independence in the performance part, is it from Rel-15 or Rel-16 intended? |
| Verizon | We support and cosign this work item!  We also want to include following bands in scope of this work item,   * band n5 * band 13, and * band n13 |

**Sub-topic 1-2: Comments and responses on proposed objectives**

The following objectives are proposed.

Core part:

*As stated in the conclusion of TR 37.880, the following topics should be further discussed and agreed during the WI phase:*

*1. Coexistence studies between HPUE in Band 5 and adjacent channel public safety operation in the same geographical area.*

*2. UE REFSENS exception due to self-dense.*

*3. UE MOP, MPR, A-MPR, and ACLR, considering the interactions between them (e.g. MRP and ACLR) and other related parameters (e.g. larger NR spectrum utilization for band n71).*

*The corresponding HPUE requirements for each band can be included in the RAN4 specifications independently when the work on this band is complete, i.e. no need to wait for the completion of other bands.*

Performance part:

*Specify, if necessary, the performance requirements such as release independence in TS 36.307 and TS 38.307.*

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
| Qualcomm | In bullet 3, MPR is misspelled as MRP. In the last sentence for the core part, the general requirements i.e., MPR, ACLR, need to be completed first before the HPUE requirements for any band can be included in the specifications. |
| Nokia | Will correct the typo in the revision, thanks. The intention here is that HPUE requirements for a band can be included in the specifications once all requirements for this band are agreed, there is no need to e.g. wait for MRP for other bands to be agreed on first. |
| AT&T | For bullet 3, see our comment on sub-topic 1-1. |
| Skyworks | For band n71 and PC1, MPR needs to be re-assessed for BW > 10MHz due to larger SU of NR and for the ACLR requirement based on the coexistence studies. |
| ZTE | Clarification question:  What is the exact meaning of “larger NR spectrum utilization for band n71” in Objective 3. Do you mean a higher SU dedicated for n71 is targeted? |
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**Sub-topic 1-3: Comments and responses on impacted/new specifications and target completion date**

The proposed impacted specifications as well as target completion date are as follows:

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| --- | --- | --- | --- |
| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
| 36.101 | Introduce core requirements for high-power UE operation for fixed-wireless/vehicle-mounted use cases in Band 12 and Band 5. | RAN#95 | Core part |
| 38.101-1 | Introduce core requirements for high-power UE operation for fixed-wireless/vehicle-mounted use cases in Band n71. | RAN#95 | Core part |
| 36.307 | Define high-power UE operation for fixed-wireless/vehicle-mounted use cases in Band 12 and Band 5 as release independent feature, if necessary. | RAN#96 | Perf. Part |
| 38.307 | Define high-power UE operation for fixed-wireless/vehicle-mounted use cases in Band n71 as release independent feature, if necessary. | RAN#96 | Perf. Part |

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

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|  | **Status summary** |
| **Sub-topic #1-1 General part** | 7 companies commented. The major issue is whether power class 1 UE for n71 should be included in WI or not. One company proposed to remove n71 from WI scope. Three companies including two operators insisted keeping n71 power class 1. Two companies thought that the filter issue and its impact on requirements like MPR can be further discussed in WI.  No comments on the LTE band B5 and B12.  One operator requested to add additional band, i.e., NR band n5 and n13, LTE band B13 into the WID, which seems not be included in SI.  The other question is from which release the requirement should be applied.  **Tentative agreements:**  It is agreeable to include power class 1 on LTE band B12 and B5 in WID.  **Candidate options:**   * Include power class 1 for n71 into WI   + Further discuss the impact of small duplex offset on the RF requirements.   **Recommendations for intermediate round:**  Further discuss the following issues:   * Whether the power class 1 for n71 can be included in WID on the condition that the issue of small duplex will be addressed and its impact on RF requirements will be investigated in the WI. * Whether NR band n5 and n13 and LTE band B13 will be included in WI. * Provide the answer to the question on release independent and discuss from which release the requirements will be applied or decide whether the release independency will be decided in WI. |
| **Sub-topic #1-2 Objectives** | 5 companies made comment. Some issues were raised and companies seemed have different views. Further discussion is needed.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further discuss and answer the following questions related to bullet 3   * Whether the general issues including MPR, ACLR (which seems band agnostic) should be finalized before the band specific requirements are specified.   + Option 1: yes, general requirements need be completed first   + Option 2: no, RAN4 will include HPUE requirements for a band once all the band specific requirements are agreed. There is no need to wait for other bands. * How to introduce the power class 1 requirements for n71   + Option 1: for n71, the existing PC1 requirements (MPR, ACLR, etc.) for band n14 should be leveraged where possible.   + Option 2: For band n71 and PC1, MPR needs to be re-assessed for BW > 10MHz due to larger SU of NR and for the ACLR requirement based on the coexistence studies. * Whether the higher SU dedicated for n71 will be introduced |
| **Sub-topic #1-3 Specs & timeline** | No comments. The table can be checked in the final round when approving the WID |

## Intermediate round

### Comments & responses

In this round, the following issues need be further discussed and addressed.

**Sub-topic 1-1: Any question or comment on the justification or any other general comment?**

Further discuss the following issues:

* Q1: Whether the power class 1 for n71 can be included in WID on the condition that the issue of small duplex will be addressed and its impact on RF requirements will be investigated in the WI.
* Q2: Whether NR band n5 and n13 and LTE band B13 will be included in WI.
* Q3: From which release the requirements will be applied, or whether the release independency should be decided in WI.

Companies are invited to provide comments and responses in the following table.

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**Sub-topic 1-2: Comments and responses on proposed objectives**

Further discuss and answer the following questions related to bullet 3

* Whether the general issues including MPR, ACLR (which seems band agnostic) should be finalized before the band specific requirements are specified.
  + Option 1: yes, general requirements need be completed first
  + Option 2: no, RAN4 will include HPUE requirements for a band once all the band specific requirements are agreed. There is no need to wait for other bands.

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* How to introduce the power class 1 requirements for n71
  + Option 1: for n71, the existing PC1 requirements (MPR, ACLR, etc.) for band n14 should be leveraged where possible.
  + Option 2: For band n71 and PC1, MPR needs to be re-assessed for BW > 10MHz due to larger SU of NR and for the ACLR requirement based on the coexistence studies.

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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* Whether the higher SU dedicated for n71 will be introduced

Companies are invited to provide comments and responses in the following table.

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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

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|  | **Status summary** |
| **Sub-topic #1-X XXX** | Tentative agreements:  Candidate options:  Recommendations for final round: |
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## Final round

### Comments & responses

*Based on the status of the final round, recommendations will be provided.*

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status and provide the recommendation.

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|  | **Status summary** |
| **Sub-topic #1-X XXX** | Recommendations: |
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# Topic #2: LTE/NR spectrum sharing for B34/n34, B39/n39

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Title** | **Sourcing company** |
| RP-211283 | New WID on LTE/NR spectrum sharing in Band 34/n34 | CMCC |
| RP-211284 | New WID on LTE/NR spectrum sharing in Band 39/n39 | CMCC |

## Initial round

### Comments & responses

In this section, we collect the comments and responses for the proposed work item. Based on the comments, we will decide how to move forward in the next step.

**Sub-topic 2-1: Any question or comment on the justification or any other general comment for two WIDs?**

Companies are invited to provide the general comments, including comments on justification part, whether the WI is needed, how to handle the work, in the follow table.

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| **Company** | **Comments** |
| Huawei, HiSilicon | Support the WI proposals. |
| Apple | We have no concerns with the justification for these two WIs. As a relatively minor remark, since the work for introducing requirements to n34 and n39 is minimal and the request for both bands comes from the same operator, we suggest contemplating an approach of having just one WID instead of two to minimize the procedural overhead. |
| Skyworks | We also think that it is simpler to consolidate similar spectrum related work in a single WI |
| ZTE | We are supportive to the two WIDs. |
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**Sub-topic 2-2: Comments and responses on objectives for WI on LTE/NR spectrum sharing in B34/n34**

The following objectives are proposed.

Core part:

*The work item aims to specify spectrum sharing requirements for n34.*

* *Introduce UL 7.5kHz frequency shift for 15kHz SCS operation from Rel-15 [RAN4]*
  + - *Study for backward compatibility*
    - *Study for which release UL shift can be made mandatory*

Performance part:

*None*

Companies are invited to provide comments and responses in the following table.

|  |  |
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| **Company** | **Comments** |
| XXX |  |
| Apple | We agree with the objectives of the WIDs. As commented earlier, since objectives are exactly the same for both bands, we suggest instantiating one WID instead of two separate WIDs. |
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**Sub-topic 2-3: Comments and responses on objectives for WI on LTE/NR spectrum sharing in B39/n39**

The following objectives are proposed.

Core part:

*The work item aims to specify spectrum sharing requirements for n39.*

* *Introduce UL 7.5kHz frequency shift for 15kHz SCS operation from Rel-15 [RAN4]*
  + - *Study for backward compatibility*
    - *Study for which release UL shift can be made mandatory*

Performance part:

*None*

Companies are invited to provide comments and responses in the following table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Apple | We agree with the objectives of the WIDs. As commented earlier, since objectives are exactly the same for both bands, we suggest instantiating one WID instead of two separate WIDs. |
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**Sub-topic 2-4: Comments and responses on impacted/new specifications and target completion date**

The proposed impacted specifications as well as target completion date are as follows:

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| --- | --- | --- | --- |
| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
| 38.101-1 | NR; User Equipment (UE) radio transmission and reception | RAN#92e | Core Part |
| 38.104 | NR; Base Station (BS) radio transmission and reception | RAN#92e | Core Part |
| 38.307 | NR; Requirements on User Equipments (UEs) supporting a release-independent frequency band | RAN#92e | Core Part |

Companies are invited to provide comments and responses in the following table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Apple | Is it possible to have the target completion in the same meeting (RAN #92e) for WID approval? Should not it be RAN#93 or RAN#94? |
| ZTE | As commented offline and similar question to Apple, the target completion date of RAN#92e, i.e., this week, seems not feasible. A new date should be indicated. |
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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

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|  | **Status summary** |
| **Sub-topic #2-1 General part** | 4 companies made comment. There is no objection to approve the WID. But two companies suggested to merge them into one WI.  **Tentative agreements:**  It is agreeable to introduce the requirements for LTE/NR spectrum sharing in Band 34/n34 and Band 39/n39.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further discuss   * Whether to merge two draft WID into one. |
| **Sub-topic #2-2 Objectives for B34/n34** | 1 company commented that one WID is preferable.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  First address the issue under Sub-topic #2-1.  Moderator: there is a typo in the objective of WID for 34/n34. The band number should be 34. |
| **Sub-topic #2-3 Objectives for B39/n39** | 1 company commented that one WID is preferable.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  First address the issue under Sub-topic #2-1. |
| **Sub-topic #2-4 Specs & timeline** | 2 companies commented the target completion date. It seems target completion date needs corrected.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further clarification and revision on target completion date is needed. |

## Intermediate round

### Comments & responses

Based on the initial round discussion, the following issue needs be discussed in the intermediate round.

**Sub-topic 2-1: Any question or comment on the justification or any other general comment for two WIDs?**

Further discuss

* Whether to merge two draft WID into one.

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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**Sub-topic 2-4: Comments and responses on impacted/new specifications and target completion date**

* Further clarification and revision on target completion date is needed.

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

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|  | **Status summary** |
| **Sub-topic #2-X XXX** | Tentative agreements:  Candidate options:  Recommendations for final round: |
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## Final round

### Comments & responses

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status and provide the recommendation.

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|  | **Status summary** |
| **Sub-topic #2-X XXX** | Recommendations: |
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# Topic #3: DC of x-band LTE CA + 4 bands NR CA

## Companies’ contributions summary

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| **T-doc number** | **Title** | **Sourcing company** |
| RP-211393 | New WID on DC of x bands (x=1,2,3) LTE inter-band CA (xDL/1UL) and 4 bands NR inter-band CA (4DL/1UL) | Huawei, HiSilicon |

## Initial round

### Comments & responses

In this section, we collect the comments and responses for the proposed work item. Based on the comments, we will decide how to move forward in the next step.

**Sub-topic 3-1: Any question or comment on the justification or any other general comment?**

Companies are invited to provide the general comments, including comments on justification part, whether the WI is needed, how to handle the work, in the follow table.

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| **Company** | **Comments** |
| Huawei, HiSilicon | Support the WI proposal to consider the operator requested band combinations. |
| Apple | We would like to have more clarifications on a demand for a total of up to 7 aggregated bands (3 LTE bands + 4 NR bands) DC combination as currently only up to 6 aggregated bands combinations have been proposed. Should we consider x = 1, 2 only? |
| Skyworks | The example band combinations all include an FR2 band. is this 7band combination targeting FR1+FR2 combination only or 7 FR1 band only is also targeted? |
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**Sub-topic 3-2: Comments and responses on objectives**

The following objectives are proposed.

Core part:

* *.* *Specify the DC configurations listed in the tables below, including at least*
  + *Applicable frequencies if necessary*
  + *Applicable bandwidths and bandwidth sets if necessary*
* *Specify the band-combination specific RF requirements for these DC configurations, i.e.*
  + *Analyse combinations that have self-desensitization due to following reasons:*
    - *TX Harmonic and/or intermodulation overlap of receive band*
    - *TX signal overlap of receiver harmonic frequency*
    - *TX frequency being in close proximity of one of the receive bands*
    - *Any other identified reasons such that insufficient cross band isolation, harmonic mixing*
  + *For the combination where self-desensitization exists, specify at least needed*
    - *∆TIB, c and ∆RIB, c*
    - *Reference sensitivity exceptions including MSD test cases*

*of all REL-17 DC including EN-DC and NE-DC of LTE CA for up to 3 different bands DL with 1 band UL + NR CA for 4 different bands DL with 1 band UL that fall into the category is defined by the WI title.*

*An overview table of these EN-DC and NE-DC configurations are provided in the EXCEL file zipped together with WORD file WID.*

*Unless stated otherwise, the release independent for EN-DC and NE-DC configurations are from Rel-15.*

Performance part:

*This Perf. Part WI has to standardize the Perf. Part requirements:*

* *Required changes to be added to release independence TS 38.307.*

*of all REL-17 DC combinations including EN-DC and NE-DC that fall into the category is defined by the WI title.*

The band combinations are included:

Refer to attached excel file of RP-211393.

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
| Huawei, HiSilicon | Support the objectives, and they are similar to other basket WIs in terms of band combination specific requirements. |
| Apple | We would like to have further clarifications on whether the NR CA part is always an FR1+FR2 combination or can be a CA within FR1? |
| CHTTL | There are few proposed combinations with uplink configuration “DC\_n3A”, maybe they are typos? |
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**Sub-topic 3-3: Comments and responses on impacted/new specifications and target completion date**

The proposed impacted specifications as well as target completion date are as follows:

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| --- | --- | --- | --- | --- | --- |
| **New specifications** *{One line per specification. Create/delete lines as needed}* | | | | | |
| Type | TS/TR number | Title | For info  at TSG# | For approval at TSG# | Remarks |
| Internal TR | 37.717-11-41 | DC of x bands (x=1,2,3) LTE inter-band CA (xDL/1UL) and 4 bands NR inter-band CA (4DL/1UL) | *TSG#94* | *TSG#95* | *WANG, Zhou,*  *Huawei,*  *research.wangzhou@huawei.com* |

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| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
| 38.101-3 | Add new DC band combinations and related RF core requirements | *TSG#95* | Core part |
| 38.307 | Release independent manner will be applied to all new DC band combinations according to each DC band combination | *TSG#95* | Perf. part |

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

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| --- | --- |
|  | **Status summary** |
| **Sub-topic #3-1 General part** | 3 companies commented. There are questions for clarifications on up to 7 aggregated bands. Further discussion is needed.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further clarifications on the following questions on the scope are needed:   * Should we consider x=1, 2 only? * Is this 7band combination targeting FR1+FR2 combination only or 7 FR1 band only is also targeted? (whether the NR CA part is always an FR1+FR2 combination or can be a CA within FR1) |
| **Sub-topic #3-2 Objectives** | 3 companies commented. Except for the similar questions as above for sub-topic #3-1, the question on uplink configuration”DC\_3A” was raised.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further discuss the following questions   * Are the uplink configurations “DC\_n3A” for proposed band combinations typo? |
| **Sub-topic #3-3 Specs & timeline** | No comment was received. Further review can be done in the final round. |

## Intermediate round

### Comments & responses

Based on the initial round discussion, the following issues/questions need be addressed/answered.

**Sub-topic 3-1: Any question or comment on the justification or any other general comment?**

Further clarifications on the following questions on the scope are needed:

* Should we consider x=1, 2 only?
* Is this 7band combination targeting FR1+FR2 combination only or 7 FR1 band only is also targeted? (whether the NR CA part is always an FR1+FR2 combination or can be a CA within FR1)

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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**Sub-topic 3-2: Comments and responses on objectives**

Further discuss the following questions

* Are the uplink configurations “DC\_n3A” for proposed band combinations typo?

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

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| --- | --- |
|  | **Status summary** |
| **Sub-topic #3-X XXX** | Tentative agreements:  Candidate options:  Recommendations for final round: |
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## Final round

### Comments & responses

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status and provide the recommendation.

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|  | **Status summary** |
| **Sub-topic #3-X XXX** | Recommendations: |
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# Topic #4: 6GHz unlicensed band in other countries/regions

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Title** | **Sourcing company** |
| RP-211445 | Motivation for Introduction of the 6GHz unlicensed band in other countries/regions | Apple Inc. |
| RP-211446 | New WID for Introduction of the 6GHz unlicensed band in other countries/regions | Apple Inc. |

More issue is added according to RAN chair guidance, which is related to the flagged SR for European lower 6GHz bands. The information is provided as below.

|  |  |  |
| --- | --- | --- |
| **Tdoc** | **Title** | **Reason for discussion** |
| RP-211320 | SR for introduction of lower 6GHz NR unlicensed operation for Europe | The SR contains an action to RAN:  “REQUESTED ACTION: RAN plenary shall decide if unlicensed operation in the frequency range 5945 MHz to 6425 MHz in Europe shall be based on available ECC Decision (20)01 or RAN4 shall consider other aspects as well. Further, RAN plenary is requested to decide which of the two listed options RAN4 shall follow to introduce unlicensed operation in the frequency range 5945 MHz to 6425 MHz in Europe.”  Also note that the TR 38.849 is not ready for official presentation to RAN for information, so RP-211321 is withdrawn. |

## Initial round

### Comments & responses

In this section, we collect the comments and responses for the proposed work item. Based on the comments, we will decide how to move forward in the next step.

**Sub-topic 4-1: Can we agree to introduce the support of the 6GHz band in countries/regions that are not covered by the scope of the existing WIs?**

Proposals in RP-211445:

“*…there are a number that either have recently announced support for the 6GHz band or are in the process of public consultations to open the 6GHz band for the license-exempt operation…. As can be seen, quite many countries have somewhat different regulatory requirements for the maximum mean EIRP density and out of band emissions. And since those parameters have direct impact on e.g. A-MPR values, 3GPP RAN WG4 will have to perform analysis on how much A-MPR each country/region will have and how it can be supported with existing or new NS values. Furthermore, since other Administrations have been working on the 6GHz band, even more countries will start publishing the corresponding regulatory requirements. Based on that we anticipate that non-trivial technical discussions will be needed to understand how to support 6GHz in all countries/regions*.”

***Proposal: Introduce support for the 6GHz band in countries/regions that are not covered by the scope of the existing WIs.***

Companies are invited to provide the general comments on the above proposal.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We are generally supportive of the proposal; however, we need to agree on an approach to introduce the specialized requirements for each country. It is not practical for 3GPP to define new emission and A-MPR requirements, for example, on a country-specific basis if each country will have a slightly different regulatory rules. |
| LGE | LGE support to study the regulatory requirements for 6GHz band in each countries/regions that are not covered in the existing WIs.  The current specification only complied with U.S. requirements. EU regulation is ongoing in the existing WI, So need to new WID to support of the 6GHz band in other countries/regions. |
| Deutsche Telekom | We are a bit surprised that we talk about “countries” here …  (I know we a talking here about a particular regulation in a particular country)  Can Apple please explain why there is a need to talk about “countries” ?  Could we find a more 3GPP appropriate language, please. |
| Intel | Overall, we are supportive to extend the work on 6GHz band definition to cover different regions. The work shall be conducted for the regions, where the regulatory work is finalized. Suggest adding an explicit list of regions covered by the work item. |
| Apple | @**Qualcomm**: Yes, we do have the same view that introducing specialized requirements for every new country is not a good approach. Our current understanding is that some countries anyway “share” similar regulatory parameters for some modes.  Referring to Region 2 as an example, Canada and US share same parameters for the SP and LPI operation, but Canada has also VLP. Brazilian LPI is same as US/Canada LPI, but the VLP mode in Brazil is a different when compared to the Canadian VLP. Peru and Chile have only LPI, which is identical to other Region 2 countries.  Referring to Region 3, South Korea VLP mode is identical to EU/CEPT VLP, but LPI has slightly different parameters.  @**DT**: The wording is not perfect and can be changed later. In fact, in the objective part we make it more explicit be referring to TR 37.890. |
| Skyworks | We support this WI as 3GPP cannot ignore some regulation in some countries/regions especially for an unlicensed band. We have done the work for n46 and we should now work on the 6GHz band. So far we have used different NS for different regions and UE types/usages (ie indoor/outdoor or LPI/VLP). We agree that the goal should be to minimize the number of NS used and as far as possible reuse existing band definition. RAN4 should first try to consolidate the different requirements into a manageable set of cases. Note that the available NS mechanism will allow NR-U to be more agile than WiFi in supporting the different regulations as they develop. |
|  |  |

**Sub-topic 4-2: Any question or comment on justification or any other general comment on the proposed WI RP-211446?**

Companies are invited to provide the general comments, including comments on justification part, how to handle the work, in the follow table.

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| **Company** | **Comments** |
| Qualcomm | We are generally supportive of the proposal; however, we would like to understand whether new NS values will be perpetually added to Band n96 as countries make the spectrum available with lightly different rules than already covered by existing NS’s. In this case, legacy devices may not be able to support the new NS. While there has been discussion in the past about new NS values and incompatibility with legacy devices, those previous discussions were somewhat limited to a single new NS or relative few new NS’s. In the case of Band n96, it seems that a much larger number of NS’s could be added over a much longer period of time. |
| Charter Communications Inc. | With regards to this WID, we understand that we need to address regulatory requirements in other regions for 6 GHz. We also understand that such requirements can possibly be handled with existing NS values or new NS values. We have concerns that we could potentially run out of NS values to address other countries and regions while we might still need ns values for the US in n96 to address vlp mode. Therefore, we suggest to add an additional objective to read*, “Depending on the regulatory requirements and if these requirements cannot be handled by existing NS values or whether new NS values are not possible then an introduction to a new band will be needed.”*  This objective will not exclude the possibility of introducing a new band in 6 GHz if handling through NS values is not possible. |
| Huawei, HiSilicon | We also think that to address regulatory requirements in different regions may end up with large number of NS values. And it is expected that the NS related discussion according to update of regional regulatory requirements could last a long period, in that sense, also considering the backward compatibility issues, new NR band(s) could be considered for other regions with different regulatory requirements. |
| CMCC | If the motivation is to study an approach on how to support 6GHz in countries/regions, then this should not belong to a spectrum WI in our view. If there is other requests from countries or regions to support 6GHz that not covered by the existing Wis, they can have their own proposal. This is the business as usual. Don’t understand why we need this WI. |
| LGE | Generally, LGE prefer to define new NS for 6GHz band (n96). If there is some issue to define new NS for the n96, then RAN4 can send LS to RAN2 to increase the number of NS for n96. It is up to RAN4 study outcome.  We prefer this WI is to start in Rel-17 and RAN can make additional WI according to new regulatory requirements in countries in Rel-18. |
| Telecom Italia | We agree with CMCC, this is not a spectrum activity, and at the moment there is no room in RAN4 for new non spectrum activities.  If specific regulations are defined for countries/Regions, a spectrum WI could be approved, with the assumption that a new band is defined |
| Deutsche Telekom | We agree with CMCC and Telecom Italia, but our comment above also applies here … |
| BT | What do we mean by “other countries/regions”? We believe that this wording is far too vague for a WI. If it is considered that there is sufficient support for this WI and it is decided that it should proceed then it will need to clearly specify those countries / regions to which it applies |
| Intel | 1) It is not very clear whether the WI aims to reuse n96 or additional bands can be considered depending on the specific regulatory status. We think that the WID description can be kept generic and both options can be considered in the WI stage.  2) The NS questions raised by companies seem valid and detailed solutions to address this problem can be discussed in the WG-level. |
| Apple | @**Qualcomm**: We agree with the general observation that since we cannot predict the outcome of the regulatory decision in a particular country, we indeed might face a situation when new NS values will be “perpetually” added. However, as we also exemplified in the previous point, the local Administrations usually try to harmonize their requirements with other countries in the same region and thus we do not anticipate a plethora of new NS values. One of the WI goals will be to take a consistent look at all potential NS values and see whether we can minimize them.  @**Charter**: We will be Ok with adding the following statement that “*Depending on the regulatory requirements and if these requirements cannot be handled by existing NS values or whether new NS values are not possible then an introduction to a new band will be needed*.”  @**CMCC, TIM, DT**: This is “business-as-usual” spectrum related WI. As agreed at the September 2020 RAN meeting, once we have the regulatory requirements released by the corresponding countries (refer to TR 37.890), 3GPP can proceed with the normative work on how these requirements can be supported.  @**BT, DT**: The wording in “other countries/regions” is indeed somewhat vague, we are sure that 3GPP can end up with a better name for the WI. Referring to the objective part, there is an explicit reference to TR 37.890 so we are limited by the countries captured there and by the target completion date of this WI.  @**Intel**: Similar to comment from Charter, we can clarify that “the WID description can be kept generic and both options can be considered in the WI stage.” |
| CHTTL | share the view as CMCC. |
| Skyworks | When compared to n46 where we use 4 NS, for the 6GHz cases, we have to treat indoor/outdoor or VLP/LPI cases on top. Part of the work will be to group the different cases in a minimum set of NS, we could develop criterias like how much difference in back-off justifies a different NS (this needs to be discussed amongst RAN4 experts within the WI). Regarding the WI being justified, so far for unlicensed band we have carried the work as soon as regulation was available. This is the case already for n46 and then we did n96 in the scope of NR-U without specific request as the regulation was then available. To avoid the confusion on the term countries/regions the WI could directly refer to the regulatory document. |
| Orange | Same view as CMCC and others, Orange is not supportive of this WI. Regarding EU, a WI is already approved to cover EU specific requirements. By the way, we are supportive of creating a new band corresponding to the targeted European band plan for unlicensed 6 GHz (5925-6425 MHz) once regulatory decisions are finalized. We do not think re-using n96 is the best way forward. |

**Sub-topic 4-2a: Reuse the existing n96 or define a new band for European frequency range of 5945 to 6425 MHz**

In the SR RP-211320 there is one outstanding issue for which the proponent want to further discuss in RAN plenary.

1. *How to introduce the frequency range 5945 to 6425 MHz for unlicensed operation in Europe to the specification by RAN4. As agreed in WF R4-2103229 unlicensed operation in the range 5945-6425 MHz can be introduced by:*
   * *Option 1: Re-using already defined band n96* 
     + *FFS if additional notes and/or clarifications are needed. Regional specific requirements to be included in relevant specifications.*
   * *Option 2: Defining a new band n[xx]* 
     + *On top of specific requirements provided by ECC, the new band shall reuse requirements already defined for n96, where possible.*

Companies are invited to provide comments on which option should be agreed.

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| **Company** | **Comments** |
| Telecom Italia | We cannot accept re-use of band n96 in Europe.  A new band must be defined to take into account the European regulation |
| Charter Communications Inc. | We can compromise with option 1 if Skyworks comment above prevails, “When compared to n46 where we use 4 NS, for the 6GHz cases, we have to treat indoor/outdoor or VLP/LPI cases on top.” If this cannot be assured then a new band can be defined. In general, we should attempt not defining a new band unless is absolutely necessary. We would had prefer the sub-bullet in option 2 to reflect a statement like this. |
| Nokia | Support option 1. From ecosystem point of view, RAN4 shall always strive to use existing bands unless it is not possible. n96 with NS values will take European regulation into account in exactly the same way as a new band. |
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**Sub-topic 4-3: Comments and responses on objectives of the proposed work item in RP-211446**

The following objectives are proposed.

Core part:

*The objectives of the core part work item are:*

*- Analyse regulatory requirements for new countries/regions that have adopted the 6GHz band for the license-exempt operation:*

*NOTE: The list of new countries/regions with the corresponding parameters can be taken from TR 37.890;*

*- Depending on the regulatory requirements, determine whether they can be handled by existing NS values or whether new NS values are needed.*

*- Define or update (if needed) system parameters such as channel bandwidths and channel arrangements.*

*- Define or update (if needed) transmitter and receiver characteristics requirements for the UE.*

*- Define or update (if needed) transmitter and receiver characteristics requirements for the BS*.

Performance part:

*The objective of the performance part work item is to define or update (if needed) conformance requirements for BS testing.*

*Changes are to be made in a release-independent manner.*

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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**Sub-topic 4-4: Comments and responses on impacted/new specifications and target completion date**

The proposed impacted specifications as well as target completion date are as follows:

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| --- | --- | --- | --- | --- | --- |
| **New specifications** *{One line per specification. Create/delete lines as needed}* | | | | | |
| Type | TS/TR number | Title | For info  at TSG# | For approval at TSG# | Remarks |
| *Internal TR* | *TR 38.xxx* | *Introduction of the 6GHz unlicensed band in other countries/regions* |  | *RAN#95* | *Core part* |

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| --- | --- | --- | --- |
| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
| 38.101-1 | NR; UE Radio transmission and reception | RAN#95 | Core UE part |
| 38.104 | NR; BS Radio transmission and reception | RAN#95 | Core BS part |
| 37.104 | E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception | RAN#95 | Core BS part |
| 37.105 | Active Antenna System (AAS) Base Station (BS) transmission and reception | RAN#95 | Core BS part |
| 38.141-1 | NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing | RAN#96 | Perf. BS part |
| 38.141-2 | NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing | RAN#96 | Perf. BS part |
| 37.141 | E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing | RAN#96 | Perf. BS part |
| 37.145-1 | Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: conducted conformance testing | RAN#96 | Perf. BS part |
| 37.145-2 | Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: radiated conformance testing | RAN#96 | Perf. BS part |

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

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|  | **Status summary** |
| **Sub-topic #4-1 Proposal in RP-211445** | 6 companies commented. 5 companies are supportive to study and/or design a solution to meet the regulation requirements in different regions. One company commented that here we should consider a particular regulation rather a “country”. It seems unclear how to introduce the support of more 6GHz spectrum, which needs further discussion.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further discuss and answer the questions:   * Whether it is agreeable to introduce the support of 6GHz unlicensed band to fulfill the regional regulations which are not covered by the scope of the existing WIs. * If the answer to above question is yes, then further discuss how to introduce the support of 6GHz unlicensed spectrum to fulfil the regional regulations which are not covered by the scope of the existing WIs. |
| **Sub-topic #4-2 General part** | 13 companies commented. Companies’ comments are on different level in this sub-topic. 5 operators questioned whether the proposed WID belongs to spectrum related topic and questioned the need of the work. 2 operators thought the wording “country” is vague. 6 companies discussed the detailed approach of using NS based on n96 to fulfil the regional regulation requirements. At least 2 companies expressed the view that the new band needs be specified to fulfil the regional regulation requirements.  From moderator perspective, we need a consensus on whether such WI is agreeable or not before discussing the detailed general solution.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further discuss and answer the following questions:   * How to introduce the support of 6GHz unlicensed spectrum to fulfil the regional regulations which are not covered by the scope of the existing WIs, considering the following options   + Option 1: Depending on the regulatory requirements, determine whether they can be handled by existing NS values or whether new NS values are needed (based on existing NR band n96)     - It will need to clearly specify those countries / regions to which it applies   + Option 1a:     - Depending on the regulatory requirements, determine whether they can be handled by existing NS values or whether new NS values are needed (based on existing NR band n96).     - Depending on the regulatory requirements and if these requirements cannot be handled by existing NS values or whether new NS values are not possible, then an introduction to a new band will be needed.     - It will need to clearly specify those countries / regions to which it applies   + Option 2: New NR band(s) could be considered for other regions with different regulatory requirements. * Whether the proposed WI RP=211446 is spectrum related or non-spectrum related |
| **Sub-topic #4-2a Objectives** | 3 companies commented. 2 companies supported option 1. 1 company disagreed to reuse n96. But this sub-topic was added at the late stage of initial round. More comments are welcome.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further discuss this topics in the next round. |
| **Sub-topic #4-3 Objectives** | No comment |
| **Sub-topic #4-4 Specs & timeline** | No comment. |

## Intermediate round

### Comments & responses

Based on the comments in the initial round, we can merge the discussion. In the intermediate round, we can focus on the following questions. In moderator view, the basic issue under sub-topic 4-2 and sub-topic 4-2a are the same. So we can merge them for the discussion in the intermediate round.

**Sub-topic 4-1, sub-topic 4-2 and sub-topic 4-2a**

Further discuss

* How to introduce the support of 6GHz unlicensed spectrum to fulfil the regional regulations which are not covered by the scope of the existing WIs, considering the following options
  + Option 1: Depending on the regulatory requirements, determine whether they can be handled by existing NS values or whether new NS values are needed (based on existing NR band n96)
    - It will need to clearly specify those countries / regions to which it applies
  + Option 1a:
    - Depending on the regulatory requirements, determine whether they can be handled by existing NS values or whether new NS values are needed (based on existing NR band n96).
    - Depending on the regulatory requirements and if these requirements cannot be handled by existing NS values or whether new NS values are not possible, then an introduction to a new band will be needed.
    - It will need to clearly specify those countries / regions to which it applies
  + Option 2: New NR band(s) could be considered for other regions with different regulatory requirements.

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**Sub-topic 4-2**

Discuss and answer the following questions:

* Whether the proposed WI RP-211446 is spectrum related or non-spectrum related

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

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| --- | --- |
|  | **Status summary** |
| **Sub-topic #4-X XXX** | Tentative agreements:  Candidate options:  Recommendations for final round: |
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## Final round

### Comments & responses

*Based on the status of the intermediatel round, the issues will be provided by moderator and further comments will be collected.*

Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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### Summary

Moderator summarizes discussion status and provide the recommendation.

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|  | **Status summary** |
| **Sub-topic #4-X XXX** | Tentative agreements:  Candidate options:  Recommendations: |
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# Topic #5: Improving MSD for CA and DC

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Title** | **Sourcing company** |
| RP-211305 | Improved MSD for CA and DC | Qualcomm Incorporated, T-Mobile USA, Verizon, AT&T, DISH Network, TELUS, Deutsche Telekom, CMCC, CHTTL, KT Corp, Vodafone, BT plc., Telecom Italia, Bell Mobility |

## Initial round

### Comments & responses

In this section, we collect the comments and responses for the proposed work item. Based on the comments, we will decide how to move forward in the next step.

Background:

The issue was triggered by the proposal to design a solution to improve MSD for power class 2 EN-DC in RAN4. And then the proponents proposed to apply it for all the power classes. The latest discussions were captured in RAN4 email summaries of R4-2107937 and R4-2107926.

Because there is no clear objective for such generic solution to improve MSD in any existing WID, and it seems not proper to treat it under basket work items for band combinations in a band specific manner, it was suggested to discuss how to handle it in RAN.

**Sub-topic 5-1: Comments and questions on proposal#1, i.e., should we introduce a generic UE capability for improving MSD?**

***Proposal 1: RAN4 to introduce a new UE capability bit to allow a UE indicate support for improved MSD***

Companies are invited to provide comments on ***Proposal 1*** in the follow table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We support the proposal to improve MSD. However, we have few comments on the scope of the work:   1. We prefer not to define improved MSD as UE capability. Instead new MSD values identified during the study should replace the existing MSD values in Rel-17. In the past we have reduced margins/improve requirements which replaced the old ones e.g. RF margins in RSRP accuracy. 2. The above proposal is to reduce the MSD when the IMD overlaps with the wanted channel. However, there is also an ongoing discussion in RAN4 on MSD improvement triggered by RAN5 LS (R4-2104470/R5-211609). This concerns requirements for IMD when the IMD falls just outside the wanted DL channel i.e. to verify the UE performance when the channel is assigned to avoid IMD. Both mechanisms should be considered. In summary the scope of “MSD improvement” should include:  * Verification of the MSD when the IMD misses the wanted channel (MSD = 0 dB or a small value) as triggered by RAN5 LS. * Reduction of the MSD when the IMD overlaps with the wanted channel. |
| T-Mobile USA | We support the proposal for an improved MSD capability. We don’t think the right approach is simply new MSD values. The 3GPP minimum requirements allow for a diversity of implementation options, and the current requirements allow for the worst-case assumptions. In certain markets a large percentage of Ues have implementations, for instance integrated rather than discrete RF Front end, that allow the MSD requirements to be greatly exceeded. The problem the operators have is that we cannot distinguish between Ues that only meet the minimum requirements and require close to the allowed MSD and Ues that require very little MSD. Revising the current MSD values as suggested by Ericsson will not rectify the situation, because there will still be a need for architectural flexibility. We support architectural flexibility, but we need to be able to distinguish between Ues that need to allowed MSD, and Ues that require very little MSD. |
| Qualcomm | We (obviously) support this proposal as the specified MSD values are too large to enable operator deployment and we recognize the benefit for the network to be able to distinguish higher performing devices by signaling. We agree with T-Mobile that a greatly improved MSD should be specified with capability signaling in addition to, not instead of, the existing minimum requirement MSD value. |
| SoftBank | We support this proposal. |
| Huawei, HiSilicon | Generally we are open to have further discussion on the issue of MSD improvement, but we are not ready to accept the capability without clear understanding and consensus in the group which assumptions should be considered for the evaluation of improved MSD.  There are still quite a lot issues to be addressed for the MSD topic. In the spec, there are different types of MSD, e.g. harmonic MSD, harmonic mixing MSD, cross band isolation MSD, intermodulation MSD, etc. For a specific band combination, it may have one of them or several MSDs. For example, if the combo has both harmonic MSD and intermodulation MSD, It is possible that harmonic could be improved but IMD cannot, and even for the harmonic, as the current requirement is defined on band basis, which means for a specific frequency configuration, there could be no MSD issue at all for the operator. All the cases mixed together, it would be difficult for the network to distinguish the Ues just by the reported signaling. Replacing the existing MSD values is one way we could consider.  On the other hand, there are many new band combinations proposed in Rel-17, how to define the MSD for some of the band combinations are still undergoing, the alternative way is to define better MSD requirements for combos, certainly it also depends on appropriate component capability assumptions. But without the MSD values specified for the combos, in which place we say the possible improvement? Should we focus on defining the MSD values for the proposed band combinations introduced in Rel-17 firstly?  The workload in RAN4 is extremely heavy, and the discussion of MSD improvement already occupied lots of RAN4 TU, which actually is out of the scope of the WID. We don’t think RAN4 could have additional TU to study MSD improvement in Rel-17, and since there are so many issues related to MSD need to be addressed, a feasibility study in Rel-18 is more practical to proceed. |
| NTT DOCOMO, INC. | We support this proposal to make NW deployment more flexible. Also agree with T-Mobile comment. From operator perspective, the UE who can perform better performance and only meet the minimum requirement should be distinguished to provide good service for all Ues. |
| CMCC | We support improving MSD requirements. Coverage is very important for operators. And it seems common understanding that existing MSD values are too large, and some UE can achieve much better performance. We support to distinguish UE with different capabilities. |
| KDDI | We support this proposal. |
| LGE | RAN4 already discussed why UE vendor had concern to improve MSD value. And LGE really would like to know how we can improve MSD values under the condition that UE should support variable MR-DC, NR CA combinations and other features (e.g. UL-MIMO, TxD). |
| Telecom Italia | As cosigning company we support the proposal |
| DISH Network | We support the proposal. The problem for operators is real; it is very challenging to deploy some combination e.g 30dB 3GPP defined MSD without knowing each UE MSD performance more in detail, as some devices require only few dB and some require significantly more, up to close 30dB. From RF technology perspective, it has been demonstrated by devices in the field that it is fully possible to optimize MSD performance really a lot in typical smartphone type of devices. We don’t understand LGE comment, does that comment mean LGE thinks that 30dB MSD cannot be improved in real device? This would be per band combination anyways, so agreeing the proposal does not mean ALL combinations in device must be optimized. |
| Deutsche Telekom | We support the proposal |
| BT | We support this proposal. |
| Telstra | We support the proposal |
| Intel | We are open to discuss it. For the exact solution, we think that further analysis on the exact capability is required (i.e. whether it should be capability or we simply tighten the MSD values in the specs; what should be the granularity of uplexing; whether uplexing shall be provided per BC or per UE). Overall, we prefer not to have a single MSD values to ensure flexibility of implementation. The exact details can be left up to the WG-level discussion.  Also, RAN4 may need to assess the actual system benefits from the improved MSD. In particular, it is helpful to understand the existing network implementations to handle the MSD and how the network may use the information on the actual MSD values (e.g. whether legacy networks perform or not perform scheduling of Ues in problematic resource allocations and how it is planned to be improved in case improved MSD capabilities are defined). So, we suggest having a discussion in the WG-level to identify the exact impacts on the system performance for the legacy systems and for the new improved MSD scenarios.  This work affects the generic requirements rather than BC-specific and in our view, it may not qualify as purely spectrum item. So, it is preferable to keep the discussion under non-spectrum items.  Finally, further discussion whether it can fit to Rel-17 is required taking into account the TU assessment and RAN4 workload. |
| Apple | Our preference is also not to define improved MSD as UE capability as it would introduce more specifications development works and signaling loading. We would also like to understand how much improvement is expected especially for IMD2 and IMD3 and what are the key mechanism(s) for improvement? |
| CHTTL | We support the proposal and agree with T-mobile’s comment. |
| MTK | One uplexingion question. How could a single bit uplexi different UE implementations. As we know, MSD is also UE FE architecture dependent. Will there be new UE capability bit indicating FE architecture also? (for example: MSD for separate antenna would be different from UE using diplexer) |
| Nokia | We support proposal 1 |
| AT&T | We support this proposal. The existing MSD requirements based on conservative assumptions result in the inability for operators to confidently allocate the very CA/DC combinations intended to improve customer experience and network capacity. In the end, the work done to specify very large MSD values might be wasted if the combinations are never deployed/utilized and results in UE conformance test cases that add very little value. In addition, we also support the Ericsson comment related to concerns about requirements for IMD when the IMD falls just outside the wanted DL channel and we would support adding this analysis to the effort. This issue results in the same situation where certain combinations are limited in deployment. |
| Skyworks | Since it is impossible for RAN4 to revisit every single MSD values we first need to understand which are the MSD that are in scope: are they MSD above a given value? A given MSD type? Only inter-band or also intra-band?  What is then signaled?  -a better value? A new value in a different table?  -if a better MSD value is signaled,is it valid for all MSDs of a given combinations (all harmonics, IMD, cross band related) or one by one?  -if a better MSD value is signaled for a low order combination, is it still realizable for a higher order combination? For example band A and B use a simple uplexing but the band C and D are added in the same range than B and requires an hexaplexer: is the improved MSD still feasible? To the same value?  Unless we have a clear view of how to tackle the above questions the scope is too vague, too large to be handled and may result in lower MSD only for the simple cases but not when higher order combinations needs to be supported. Also it should be considered that RAN4 only look at band combinations one by one where in reality a UE supports a large set of overlapping band combinations.  If we agree that higher integration and state of the art technology have better performance than that of the minimum requirement it shall also be acknowledged that margin is required as real implementations cover a large set of overlapping higher order combinations covering multiple regions and thus must have trade offs between all combinations and not just one as specified in RAN4. |
| ZTE | We appreciate the efforts to improve MSD and consider proposal 1 if TU permitted for the required work. For a specific UL/DL combination, MSD improvement could be different for different configurations, e.g., channel bandwidth, in this case, is the least MSD improvement selected among all possible channel bandwidths if a single value is specified? |
| Vivo | We agree that for certain combinations there could be improvements for MSD value. However, this was also depending on many factors and quite implementation specific, thus may not that easily to be specified. It is probable that only in quite limited cases that noticeable effect can be seen and worthy to be done.  Considering the Rel-17 time frame and the non-urgent nature of this topic, may be Rel-18 is more appropriate, and release independency can also be considered if deemed necessary and applicable. For Rel17 this work is proposed to be put on hold. |
| Orange | We are supportive of this proposal |
| OPPO | This has been discussed in RAN4 before, and no conclusion there, and is not clear of how much commercial UE can improve the MSD and also in which level this can be improved. Many open questions are not been answered in RAN4. Therefore it is premature to discuss introducing new singaling for MSD improvement. |
| Xiaomi | MSD improvement for specific band combination is possible. However, in our view, it is very hard to get a common rule on assumptions to derive the improved MSD for those band combinations having MSD, since the MSD improvement in one band combination may led to MSD deterioration for other band combinations. Thus, the feasibility should be discussed first. |
| Verizon | We support the proposal and do believe this work can enhance the network performance. |
| Bell Mobility | We support the proposal |

**Sub-topic 5-2: If we can agree to do the work for improve MSD, then how can we treat it, i.e., in new WI, adding objectives in the existing WI, or TEI?**

Question: How can we handle the work?

* + Option 1: new work item
  + Option 2: adding the new objectives in the existing work item
  + Option 3: TEI17
  + Other option

Companies are invited to provide answers on the above questions in the follow table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 2. Prefer to add it in one of the existing WIs. It might be difficult to complete in one WG meeting so TEI17 may be unrealistic. |
| T-Mobile USA | Option 2: Prefer to add it in one of the existing WIs. |
| Qualcomm | Also prefer option 2 |
| Huawei, HiSilicon | Other option. The focus of Rel-17 is to specify the MSD requirements for the proposed band combinations rather than to discuss the MSD improvement. As the heavy workload in RAN4, we prefer to have feasibility study of improvement in Rel-18. |
| CMCC | Prefer option2. |
| LGE | Other option. This is not feasible as UE vendor perspective. |
| Telecom Italia | Option 2 or TEI 17 |
| DISH Network | Prefer option 2. Option 1 could also be considered as option 2 might have the challenge to address both PC2 and PC3 on one go (no existing single WI which has both PC2 and PC3). |
| Deutsche Telekom | Preference for Option 2 |
| Telstra | Option 2 preferred |
| Intel | Option 2. The scope is quite big for TEI17. Prefer to add to the non-spectrum WI. |
| Apple | Companies can follow the same exercise for every MSD calculation with increment improvement in RF components performance to develop the MSD requirements for the newly proposed combinations. It may not be necessary to have a new handing on the improved MSD requirements. |
| CHTTL | Prefer option 2. |
| MTK | Give the current RAN4 remaining RF TU is already a negative value, we wonder whether we still have the margin to start a new work? |
| Nokia | Work under TEI is not preferred |
| AT&T | We prefer Option 2. |
| Skyworks | It is unclear which WI it should be attached to since MSD is discussed in basket WI but also in the 35/45MHz, new BW, PC2 TDD, PC2 FDD……we believe this work if pursued cannot be under the block approval process and the signaling aspects have to be discussed specifically. |
| ZTE | Option 2 seems more feasible. |
| vivo | Considering the time frame and workload, if really considered, R18 as part of a WI is preferred. |
| Orange | Option 2 is preferred |
| OPPO | Rel-17 is not a good choice, can be further discussed in Rel-18 maybe. |
| Xiaomi | We prefer to have feasibility study of improvement in Rel-18. |
| Verizon | Option 2 |

**Sub-topic 5-3: Comments and responses on potential objectives**

The following objectives are proposed.

* + *How to determine the improved MSD value [RAN4]*
  + *The details of the signaling need to be decided [RAN2/RAN4?]*
  + *Should this be limited to new combinations being specified, i.e., PC2 CA, or should this also apply (optionally) to existing combinations even PC3? [RAN4?]*
  + *Under what ~~work item and~~ release should this be carried out? [RAN]*

For the last bullet, please focus on “release” here.

Companies are invited to provide comments and responses in the following table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | As commented in 5-1, we prefer not to define improved MSD as UE capability. The scope can also be applied to existing combinations and also PC3. It can be done in Rel-17. |
| T-Mobile USA | We support the proposed objectives. We think the new MSD capability can apply to Rel-17. |
| Qualcomm | Our preference is Rel-17 with release independence to earlier releases if possible |
| Huawei, HiSilicon | Our preference is not to define new UE capability for improved MSD. Feasibility study is needed for MSD improvement, and the work should be done in Rel-18 rather than in Rel-17 due to the heavy workload in RAN4. |
| NTT DOCOMO, INC. | As stated in sub-topic 5-1, we prefer to introduce new MSD capability in Rel-17 and it should also be applied to existing combinations even PC3. |
| CMCC | Support the objetvies and also support to apply to existing combinations including PC3. |
| LGE | RAN4 had many discussion on this issues. So, do not need to define additional capability. |
| DISH Network | This should apply to both PC3 and PC2. Release 17 should be fine, recognizing that not all combinations have to be analyzed during Rel17; this should be release independent. For instance, the highest priority combinations could be chosen based on real spectrum holdings, deployments, and the amount of existing MSD. |
| Deutsche Telekom | Rel-17 is fine |
| Telstra | Rel-17 |
| Apple | Our preference is to limit to new combinations only. Companies should provide justifications on how the improvement is achieved with detailed link budget. If more than one companies provide the analysis and proposed MSDs, average or some middle ground would be considered as has been commonly practiced in RAN4. |
| CHTTL | Share the view as T-mobile, NTT Docomo and CMCC. |
| Nokia | We don’t think the 2nd bullet is necessary if the idea is just for UE to tell NW MSD value with a certain granularity such that 0, 10, 20 or 30dB…  Regarding the 3rd bullet, we haven’t seen the reason not to include PC3.  With respect to the release, the discussion on this improvement is conducted in Rel-17 but from which release this capability is available as release independent should be discussed in parallel. |
| AT&T | This effort should apply to PC3 and PC2. Concerning which release, we prefer Rel-17 with release independence if possible. |
| ZTE | This could be carried out in Rel-17. |
| Vivo | If considered, R18 is preferred. |
| Orange | Rel17 should be targeted |
| Xiaomi | Too early to discuss this. |
| Verizon | It can be done in Rel-17 with release independence to earlier releases if possible |
| Bell Mobility | Rel-17 |

**Sub-topic 5-4: Comments and responses on signalling design, i.e., Proposal #2 and #3 in RP-211445.**

***Proposal 2: RAN4 will choose a (preferably low single digit) improved MSD value that a UE could declare support for a given combination with a new capability bit***

* ***RAN4 could either define a single improved MSD value for all the types of MSD, or it could choose one level for harmonics, one level for harmonic mixing, one level for cross-band isolation and one value for Intermods.***

***Proposal 3: The new capability would be ignaled per UL/DL band combination***

Companies are invited to provide general comments on the above two proposals in the follow table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | The details should be left for RAN4. As commented in previous sub-topics, new requirements should apply to all Rel-17 Ues. |
| T-Mobile USA | We think the details should be left to RAN4. |
| Huawei, HiSilicon | We would like define MSD requirements for the proposed band combinations firstly according to the existing WID objectives in Rel-17. Whether and how to improve the MSD as well as the details can be left for future release. |
| CMCC | The proposal can be used as a starting point for RAN4 discussion. |
| LGE | Based on our comments in sub-topic 5-1, 5-2 and 5-3, it should be discussed based on RAN4 consensus which factor are possible improvement point compare to current MSD study. |
| DISH Network | This is a good starting point |
| Deutsche Telekom | This is RAN4 work |
| Telstra | RAN 4 to decide |
| Apple | Our preference is not to introduce capability for MSD. |
| CHTTL | Though the details can be discussed in RAN4, the proposal can be the starting point, and some guidance can be helpful. |
| MTK | The proposals are too detail. Note sure if this is what should be discussed in plenary.  For P2, there are different cases for MSD due to cross band isolation (case 1~case 3), different orders of intermods, how can a single value represent all these complicated cases.  For P3, MSD due to IMD for 3-bands combination as well as due to triple-bit shall be considered also for the new signaling if new UE capability bit is agreed. In another words, all MSD mechanisms being discussed in RAN4. |
| Nokia | This kind of details should be discussed in RAN4. |
| AT&T | RAN4 can decide. |
| Skyworks | Since it is impossible given the current load to spend a large effort on optimization, we suggest that the scope should be limited or have clear criterias to avoid a flood of contributions with poor quality. Please note that close to 50% of block approval contributions for ½and 3 bands in FR1 have a flag as the proposed MSD has errors (missing case, underestimated issues….). The careful check of block approval contributions for MSD have effectively added an extra week of work in front of the meeting, we simply cannot afford the same for an optimized performance. |
| ZTE | As commented before, more discussions are needed on whether or not to go for a single MSD improvement value if the work is agreed. |
| Vivo | Proposed to not discussed in Rel17 in current condition. |
| Orange | To be left to RAN4 decision |
| OPPO | Too early to discuss signaling. |
| Xiaomi | It shall depend on RAN4 |
| Verizon | Let RAN4 make decision |
| Bell Mobility | Can be left to RAN4 to make the decision |

### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #5-1** | 25 companies commented. Among them, 16 companies including 13 operators supported the work. 4 companies are open to further discussion. 5 companies still had concerns. Companies’ views are quite diverse.  It seems difficult to agree on introduction of a new UE capability signaling. The technique issues are discussed extensively in RAN4 but most vendors still thought that it is not easy to improve MSD and too many factors need be considered.  Since there are widely demands on improving MSD from operators, I wonder if companies can reach a consensus to initialize a work targeting at improving MSD rather than agreeing on introduction of signaling.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Further discuss   * Whether 3GPP can initialize the work targeting at improving MSD.   + FFS whether the capability signaling is feasible   + FFS how to improve MSD and which factors should be taken into account |
| **Sub-topic #5-2** | 22 companies commented. 13 companies supported option 2. It seems that the scope is big if the further evaluation on how to improve MSD is needed. Thus Option 3 is not feasible.  From moderator perspective, I would like to suggest companies to consider to include it in the existing non-spectrum related WID.  Based on current situation, it is difficult to directly agree on introduction of capability signaling. The improved MSD requirements need be studied. So I would like to suggest considering adding an objective with a study phase. But we should also consider that the workload for RF room is very high.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  Down-select to Option 2 and other options, further discuss how to organize the work:   * Option 2: adding the new objectives in the existing work item * Option 2a: adding the new objectives in the existing non-spectrum related work item   + Have a study phase to evaluate     - How to improve MSD     - Feasibility to introduce a capability signaling * Option 3:Defer the work improving MSD to Rel-18 WI |
| **Sub-topic #5-3 potential objectives** | 18 companies commented. 12 companies supported to introduce the capability from Rel-17. 2 companies prefer Rel-18. 3 companies referred not to specify the capability signaling.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  There is no consensus on the capability signaling. We need first address the sub-topic #5-1 and #5-2. Before addressing #5-1 and #5-2, we do not need discuss the detailed objectives in the intermediate round. |
| **Sub-topic #5-4 signaling design** | Most companies agreed that the signaling design should be left to working group. Then we may not need further discuss this topic in the intermediate round.  **Tentative agreements:**  None.  **Candidate options:**  None.  **Recommendations for intermediate round:**  No further discussion on it in the intermediate round. |

## Intermediate round

### Comments & responses

Based on the comments in the initial round, we would like to encourage companies to have further discussion on sub-topic #5-1 and sub-topic #5-2.

**Sub-topic 5-1: Comments and questions on proposal#1, i.e., should we introduce a generic UE capability for improving MSD?**

Further discuss

* Whether 3GPP can initialize the work targeting at improving MSD
  + FFS whether the capability signaling is feasible
  + FFS how to improve MSD and which factors should be taken into account

Companies are invited to provide comments and responses in the following table.

|  |  |
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| **Company** | **Comments** |
| XXX |  |
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**Sub-topic 5-2: If we can agree to do the work for improve MSD, then how can we treat it, i.e., in new WI, adding objectives in the existing WI, or TEI?**

Further discuss how to organize the work:

* Option 2: adding the new objectives in the existing work item
* Option 2a: adding the new objectives in the existing non-spectrum related work item
  + Have a study phase to evaluate
    - How to improve MSD
    - Feasibility to introduce a capability signaling
* Option 3: Defer the work improving MSD to Rel-18 WI

Companies are invited to provide comments and responses in the following table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
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### Summary

Moderator summarizes discussion status for this round, list all the identified open issues and tentative agreements or candidate options and suggestion for next round.

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #5-X XXX** | Tentative agreements:  Candidate options:  Recommendations for final round: |
|  |  |
|  |  |

## Final round

### Comments & responses

Companies are invited to provide comments and responses in the following table.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
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### Summary

Moderator summarizes discussion status and provide the recommendation.

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #5-X XXX** | Recommendations: |
|  |  |
|  |  |

# Summary of Recommendations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| RP-21xxxx | New WI on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |