**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.

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| **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. |
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**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. |
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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** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #1-2 Objectives** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #1-3 Specs & timeline** | Tentative agreements:Candidate options:Recommendations for intermediate round: |

## Intermediate round

### Comments & responses

*Based on the status of the intermedaite 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 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. |
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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** |
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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.

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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**

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.

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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 #2-1 General part** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #2-2 Objectives for B34/n34** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #2-3 Objectives for B39/n39** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #2-4 Specs & timeline** | Tentative agreements:Candidate options:Recommendations for intermediate round: |

## Intermediate 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 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. |
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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. |
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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** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #3-2 Objectives** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #3-3 Specs & timeline** | Tentative agreements:Candidate options:Recommendations for intermediate round: |

## Intermediate 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 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. |

## 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.

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| **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. |
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**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 slighly 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 |
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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** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #4-2 General part** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #4-3 Objectives** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #4-4 Specs & timeline** | Tentative agreements:Candidate options:Recommendations for intermediate round: |

## Intermediate round

### Comments & responses

*Based on the status of the initial 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 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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### 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

|  |  |  |
| --- | --- | --- |
| **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.

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| **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. |

**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.

|  |  |
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| **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). |

**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. |

**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 signalled 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 |

### 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 #5-1** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #5-2**  | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #5-3 potential objectives** | Tentative agreements:Candidate options:Recommendations for intermediate round: |
| **Sub-topic #5-4 signaling design** | Tentative agreements:Candidate options:Recommendations for intermediate round: |

## Intermediate 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 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 #5-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 #5-X XXX** | Recommendations: |
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# Summary of Recommendations

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