**3GPP TSG-RAN Meeting #93-e RP-21XXXX**

**Electronic Meeting, September 13 – 17, 2021**

**Agenda item:** 9.1.4

**Source:** Moderator (RAN4 Chair)

**Title:** Email discussion summary for [93e-08-RAN4-R17-Spectrum]

**Document for:** Information

# Introduction

In this email thread we will discussion the following topics:

* New WI proposal for APT 600MHz NR band
* New WID on high power UE (power class 2) for NR FDD band (SI was closed and this is follow-up WI)
* New WID on increasing UE power high limit for CA and DC
* “Improved MSD” and “lifting the restriction on MOP imposed by PC“

The following contributions will be covered.

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| **TDoc** | **Title** | **Source** | **Type** | **AI** |
| [RP‑211744](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-211744.zip" \t "_blank) | APT 600MHz NR band | Spark NZ Ltd | Discussion |  |
| [RP‑211903](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-211903.zip" \t "_blank) | New WID on high power UE (power class 2) for NR FDD band | China Unicom | WID new |  |
| [RP‑212163](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-212163.zip" \t "_blank) | New WID: Increasing UE power high limit for CA and DC | China Telecom | WID new |  |
| [RP‑212364](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-212364.zip" \t "_blank) | Way forward on "Improved MSD" and "Lifting the restriction on MOP imposed by PC" | Nokia, Nokia Shanghai Bell | discussion |  |

In this document, we capture comments and conclusions for this email thread.

# Topic #1: APT 600MHz NR band

## Companies’ contributions summary

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| **T-doc number** | **Title** | **Sourcing company** |
| [RP‑211744](file:///C:\Users\d00375225\AppData\Local\Temp\Rar$EXa6264.33390\docs\RP-211744.zip) | APT 600MHz NR band | Spark NZ Ltd |

## Initial round

### Comments & responses

**Background information**

The SI of Study on extended 600MHz NR band was completed and the LS was sent to AWG. It is expected to get feedback from AWG. The following are the related contributions. Please have discussions taking into account the following contributions.

*A study of the feasibility of various duplex filter arrangements for the extended 600 MHz band has now been completed. The TR 38.860 contains the outcome of the Study item on extended 600MHz. This has been submitted to the RAN for approval in doc RP-211766.*

*RAN 4 has sent a LS to the AWG informing them of the completion of the work. The AWG 28 is currently meeting on line 6- 14 September.*

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| [RP‑211675](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-211675.zip" \t "_blank) | LS on the progress of the study item on extended 600MHz NR band (R4-2114750; to: Asia-Pacific Telecommunity Wireless Group (AWG); cc: RAN; contact: Spark) | RAN4 |
| [RP‑211952](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-211952.zip" \t "_blank) | Status report for SI Study on extended 600MHz NR band; rapporteur: Spark NZ Ltd | RAN4 |
| [RP‑211766](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-211766.zip" \t "_blank) | TR 38.860 v1.0.0 Study on extended 600MHz NR band | Spark NZ Ltd |

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

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** |
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**Sub-topic 1-2: Can we start the work based on options B1 and B2**

The proponent proposed that

* ***The objective of the WI is to request the 3GPP to start normative work on options B1 and B2.***

Can we agree on this proposal? Companies are invited to provide comments and responses in the following table.

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| **Company** | **Comments** |
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**Sub-topic 1-3: Comments and responses on the proposed objectives**

The following objectives are proposed in the WID.

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**Core part:**

The purpose of this work item is to:

Develop a technical specification for the APT 600 MHz band for options B1 and B2 as shown below:

Table 1: NR operating band (option B1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Operating Band | Uplink (UL) operating band BS receive UE transmit | | | Downlink (DL) operating band BS transmit  UE receive | | | Duplex Mode |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
|  | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

Table 6: Duplexer arrangements (option B2 35+25)

|  |  |  |  |
| --- | --- | --- | --- |
| Duplexer type | Uplink (UL) operating band BS receive UE transmit | Downlink (DL) operating band BS transmit  UE receive | Duplex Mode |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| Duplex 1  Duplex 2 | 663 MHz – 698 MHz  678 MHz – 703 MHz | 617MHz – 652 MHz  632MHz – 657 MHz | FDD |
| FDD |
| NOTE: Both duplexers will be part of the same band | | | |

The above specifications should include the following

* Operating band, channel bandwidth and system parameters
* BS and UE RF core requirement taking into account potential coexistence issues
* RRM requirement

**Perf. part**

The objectives are to define:

* Conformance requirements for BS

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

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| **Company** | **Comments** |
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**Sub-topic 1-4: Comments and responses on impacted/new specifications and target completion date & time budget**

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

(Moderator: the Rel-17 target completion date is March 2022 RAN#95 for Core part)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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* | *38.xxx* | APT 600 MHz NR band | *TBD* | *RAN#* |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **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#97 | Core part |
| 38.133 | NR; Requirements for support of radio resource management | RAN#97 | Core part |
| 38.104 | NR; BS Radio transmission and reception | RAN#97 | Core part |
| 38.141-1 | NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing | RAN#97 | Perf. Part |
| 36.104 | E-UTRA; BS Radio transmission and reception | RAN#97 | Core part |
| 36.141 | E-UTRA; BS conformance testing | RAN#97 | Perf. Part |
| 37.104 | E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception | RAN#97 | Core part |
| 37.141 | E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing | RAN#97 | Perf. Part |
| 37.105 | Active Antenna System (AAS) Base Station (BS) transmission and reception | RAN#97 | Core part |
| 37.145-1 | Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: conducted conformance testing | RAN#97 | Perf. Part |
| 37.145-2 | Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: radiated conformance testing | RAN#97 | 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 initial 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** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |
| **Sub-topic #1-2 Options B1 and B2** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |
| **Sub-topic #1-3 Objectives** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |
| **Sub-topic #1-4 Impacted spec and timeline** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |

## Intermediate round

### Comments & responses

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

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: HPUE PC2 for NR FDD band

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Title** | **Sourcing company** |
| [RP‑211903](file:///C:\Users\d00375225\AppData\Local\Temp\Rar$EXa6264.33390\docs\RP-211903.zip) | New WID on high power UE (power class 2) for NR FDD band | China Unicom |

## Initial round

### Comments & responses

**Background information:**

The SI of Study on high power UE (power class 2) for one NR FDD band was completed. The related documents are provide below. This proposed WI is the follow-up work item.

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| --- | --- | --- | --- |
| [RP‑211854](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-211854.zip" \t "_blank) | Status report for SI Study on high power UE (power class 2) for one NR FDD band; rapporteur: China Unicom | RAN4 | WI status report |
| [RP‑212495](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-212495.zip" \t "_blank) | TR 38.861 v2.0.1 Study on high power UE (power class 2) for one NR FDD band | China Unicom | draft TR |

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 WI?**

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

The following objectives are proposed in the WID.

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**Core part:**

The objectives of the core part are as follows:

* Introduction of NR band n1 and n3 to support high power UE (Power class 2)
* Specify RF characteristics for n1 and n3, including:

1. Specify UE maximum output power, Tx power tolerance for band n1 and n3.
2. Specify A-MPR requirements for band n1 and n3 if needed
3. Specify PC2 MSD requirements for NR band n1.
4. Specify PC2 MSD requirements for NR band n3.

**Perf. part**

Specify the necessary performance requirements such as release independence in TS 38.307.

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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 impacted/new specifications and target completion date & time budget**

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 | Add PC2 FDD to User Equipment (UE) radio transmission and reception | TSG#95 | Core part |
| 38.307 | Add PC2 EN-DC Requirements on User Equipment (UEs) supporting a release-independent frequency band | RAN#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 #2-1 General** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |
| **Sub-topic #2-2 Objectives** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |
| **Sub-topic #2-3 Specs & timeline** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |

## Intermediate round

### Comments & responses

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

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: Increasing UE power high limit for CA and DC

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Title** | **Sourcing company** |
| [RP‑212163](file:///C:\Users\d00375225\AppData\Local\Temp\Rar$EXa6264.33390\docs\RP-212163.zip) | New WID: Increasing UE power high limit for CA and DC | China Telecom |
| [RP‑212364](file:///C:\Users\d00375225\AppData\Local\Temp\Rar$EXa6264.33390\docs\RP-212364.zip) | Way forward on "Improved MSD" and "Lifting the restriction on MOP imposed by PC" | Nokia, Nokia Shanghai Bell |

## Initial round

### Comments & responses

**Background information:**

This issue was discussed in RAN4 #100e in agenda for WI NR\_PC2\_SUL\_CA. There was no consensus how to treat this topic since there is no corresponding objective in WI NR\_PC2\_SUL\_CA. The corresponding discussions in RAN4 were summarized in R4-2115021.

Besides, in Rel-18 uplink enhancement discussion, one topic about “power aggregation” was also under discussion.

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: General comments on how to organize the work and in which release the work can be done?**

In RP-212163, the proponents proposed to start the work in Rel-17 to increase the maximum output power limitation for dual PA equipped UE for CA and DC.

In RP-212364, the proponents proposed

* ***Way forward to “Lifting the restriction on MOP limited by the power class”***
  + ***RAN tasks RAN4 to establish objectives for SI or WI where the objective shall be ones to study if the new method, i.e., Option 2 in [3] can achieve similar outcomes as conventional power class method can.***
  + ***This topic is handled under a dedicated SI or WI in Rel-17 or 18 based on the objectives.***

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** |
| Xiaomi | This issue has been discussed for several RAN4 meetings but no consuses. Several open issues have been identified. We support to have a dedicated SI for this issue. Considering the current workload in RAN4, as a R18 item is our preference. |
| Verizon | RAN4 should initiative this work in Rel-17. |
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**Sub-topic 3-2: Comments and responses on objectives for WI proposed in RP 212163**

**Core part**

The objectives of the core part are as follows:

1. Consider the two options and study the feasibility and impacts for option 1.
   * Option 1: Improvement on power high limit
   * Option 2: Definition of a new power class for CA and DC
2. If the consensus for 1) is option 1, then specify higher maximum output power for dual PA equipped UE’s for CA and DC
   * Replace the power class with sum or modified sum in PCMAX\_H in CA/DC
   * All associated core requirements are also to be specified
   * SAR mechanisms are modified, if needed, to allow for higher transmit power
   * Example combination as CA\_n1A-n78A (23dBm+26dBm) is considered when specifying the band-combination specific core requirements.

**Perf. part:** N/A

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

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| **Company** | **Comments** |
| Xiaomi | We are ok with the objectives. |
| Verizon | We support Option 1, and this has considered the significate new possible validations from Option 2.  As this work is to increasing the UE power limit for CA and DC, we believe the scope of this work should cover all of the possible UE power limits defined by RAN4, including PC5, as a package of RAN4 work |
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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:

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | Introduce improvement for power high limit for CA to the spec of NR User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone | RAN#95e | 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 #3-1 General** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |
| **Sub-topic #3-2 Objectives** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |
| **Sub-topic #3-3 Specs & timeline** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |

## Intermediate round

### Comments & responses

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

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: Improved MSD

## Companies’ contributions summary

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| **T-doc number** | **Title** | **Sourcing company** |
| [RP‑212364](file:///C:\\Users\\d00375225\\AppData\\Local\\Temp\\Rar$EXa6264.33390\\docs\\RP-212364.zip" \t "_blank) | Way forward on "Improved MSD" and "Lifting the restriction on MOP imposed by PC" | Nokia, Nokia Shanghai Bell |

## Initial round

### Comments & responses

**Background information:**

RAN#92-e tasked RAN4 to study on “low MSD” and signalling. In RAN4#100e, there was no conclusions on how to address this topic. The discussions were summarized in R4-2115012. And the following observations were provided by the corresponding moderator in RAN4 for this topic.

***Moderator observations:***

* *Current status in RAN4 is mainly related to not agreeing on the “low MSD” objective and basically whether it is to:*
* *Solve identified  network and operators issues due to high MSD, evaluate them and possibly capture “low MSD” (per identified combinations or example combinations) in TR (whether this requires signaling is based on improved MSD values and understanding of how “low MSD” and “minimum requirement MSD” UEs may be treated in the network)*
* *Introduce a “low/improved MSD” capability for UEs to advertise it without consideration of solving identified issues nor how UEs signaling “low MSD” versus minimum requirement UE may be treated differently in the network.*
* *Clear objectives need to be defined in a SI to allow progress in RAN4 and resolve companies split views between assessing “low MSD” for identified issues versus only introducing a signaling mechanism for UE to advertise better MSD.*

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 on to that both feasibility study and signalling can be conducted in parallel?**

* ***Way forward to “low MSD”***
  + ***RAN ensures that both feasibility study on how MSD behaves and study on how the signalling should look should be conducted in parallel.***

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

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| **Company** | **Comments** |
| Xiaomi | We support the view that both the feasibility on MSD improvement and signalling should be studied in parallel. As the intention of this topic is to identify the solution for the high MSD inter-band CA/DC combination for avoiding performance loss due to the network may disable the band combination for all UEs in a conservative way or enable the band combination for UE with high sensitivity degradation, and in the actual network, UE can’t be always expected to transmit with maximum transmission output power, the actual desense (real time MSD) for a UE in a cell can be dynamically changed with different locations and conditions. It is therefore really meaningful and worth to study on how to treat UEs with high MSD dynamically by considering actual Tx power range as well. |
| Verizon | We agree this WF.  Mainly, an objective of work should be clarified in this RAN meeting to allow progress from RAN4. |
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**Sub-topic 4-2: Comments on how to organize the work and in which release the work could be done**

* ***Way forward to “low MSD”***
  + ***RAN tasks RAN4 to establish objectives for SI or WI.***
  + ***This topic is handled under a dedicated SI or WI in Rel-17 or 18 based on the objectives.***

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

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| **Company** | **Comments** |
| Xiaomi | To solve above identified network and operators issues due to high MSD comprehensively, it is better to be handled in R 18 and get RAN2 involved, Thus we think as one objective of In-device coexistence for NR (RP-212032) is a good way to go. |
| Verizon | We agree with Nokia that this work needs to be handled a dedicated item. For the timeline of this work, it could be either in Rel-17 or Rel-18 depending on RAN4 workload although we prefer a solution early. |
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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 212364** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |
| **Sub-topic #4-2 Proposal in RP 212364** | XX companies commented.  **Tentative agreements:**  **Candidate options:**  **Recommendations for intermediate round:**  Further discuss the following issues:   * xx |

## Intermediate round

### Comments & responses

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

### 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 #4-X XXX** | Tentative agreements:  Candidate options:  Recommendations for final round: |
|  |  |
|  |  |

## 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.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

### Summary

Moderator summarizes discussion status and provide the recommendation.

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

# Summary of Recommendations