**3GPP TSG-RAN WG4 Meeting #109 R4-2318130**

**Chicago, USA, November 13th – 17th, 2023**

**Agenda item:** 8.3.4

**Source:** Moderator (Huawei, HiSilicon)

**Title:** Topic summary for [109][124] FR1\_enh2\_part1

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

Thread [124] includes following topics:

1. Topic #1: Reply LS on power class indication in lower MSD capability
2. Topic #2: Information & approaches for lower MSD signalling design
3. Topic #3: Requirements for lower MSD capability

# Topic #1: Reply LS on power class indication in lower MSD capability

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

## Companies’ contributions summary

|  |  |  |  |
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| **T-doc number** | **T-doc name** | **Company** | **Proposals / Observations** |
| [**R4-2318777**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318777.zip) | Signalling for low MSD | Qualcomm Technologies Int | ***Answer 1)***  ***For impairments such as harmonics, harmonic mixing and cross band isolation there is only one aggressor band therefore the highest per band power class of the aggressor should be signalled. For IMDs there are two aggressor bands therefore, in this case the highest per band combination power class should be signalled. In both above cases the UE may also report lower power classes if requested by the network/regulator.***  ***Answer2)***  ***For impairments such as harmonics, harmonic mixing and cross band isolation where there is only one aggressor band the highest per band power class should be used. For IMDs where there are two aggressor bands the highest per band combination power class should be signalled. In both above cases the UE may also report lower power classes if requested by the network/regulator.***  ***Answer 3)***  ***Based on the MSD type the highest per band or per band combination power class is reported. Additionally, lower power classes may also be reported for the various MSD types if requested by the network/regulator.*** |
| [**R4-2318893**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318893.zip) | Discussion on reply LS on lower MSD signaling for inter-band CA or DC | Xiaomi | ***Answer 1:***  ***The power class for lower MSD refers to the aggressor band(s).***  ***Answer 2:***  ***The choice of power class type can be dependent on the MSD type, the details could be shown in the following table.***  ***Answer 3:***  ***If UE reports only a single power class per frequency band, per band combination and per band per band combination respectively, the reported power class is the “highest supported power class”, and other lower power class could be as the “other power classes”. E.g. if the reported power class is PC1.5 (29 dBm), other power class could be PC2 (26 dBm), or PC3 (23 dBm).*** |
| [**R4-2318949**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318949.zip) | [Draft] Reply LS on power class indication in lower MSD capability | vivo | ***Answer 1: The power class that is supposed to signalled in the new MSD capability signalling is the power class of aggressor band(s).***  ***Answer 2: All the listed power class types may be relevant in the MSD capability signalling, and the choice of power class type can be dependent on the MSD type, such as whether the aggressor is a single band or two bands. To be more specific:***  *** For the interfere type that consists only one single band as aggressor,***  *** The three per frequency band capability (i.e. ue-PowerClass, ue-PowerClass-v1610, ue-PowerClass-v1700) for the aggressor band would be relevant, with the following exception:***  ***- If the capability ue-PowerClassPerBandPerBC-r17 is used in NR inter-band UL CA case, this capability would be relevant and other per band capability would not be considered:***  *** For the interfere type that consists two bands as aggressor, such as IMD***  *** The two Per band combination capability (powerClass, powerClass-v1610) would be relevant.***  ***Answer 3: RAN4 confirms that the UE have only a single power class per frequency band, per band combination and per band per band combination respectively.***  ***However, for the power classes higher than default, there exist schemes to reduce the nominal maximum output power by means PEMAX, ΔPPowerClass and relating parameters. Though conceptually this is not the “reduction of power classes”, the effect is similar to a reduced power class.***  ***Based on this situation, the “highest supported power class” means the nominal power class which is indicated by the signalling, and the “other power classes” are for the case when certain PEMAX (e.g. 23dBm which is same to PC3 nominal maximum output power) and/or non-zero ΔPPowerClass (e.g. 3 or 6dB) applied.*** |
| [**R4-2319105**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319105.zip) | [Draft] Reply LS on power class indication in lower MSD capability | Apple | ***RAN4 answer to question 1: The power class to be signalled in the new MSD capability signalling is only for aggressor UL band(s).***  ***RAN4 answer to question 2: The power class type shall be per band combination. Depending on the MSD type, the power class is either for single UL with DL only band combination (for UL harmonic, harmonic mixing, and cross-band interference MSD) or for 2-band UL (for 2UL IMD MSD).***  ***RAN4 answer to question 3: The “highest supported power class” shall be the power class as indicated by UE for the band combination. The “other power classes” would be requested by network in consideration that the UE maximum output power could be limited by P-max (PEMAX) which is lower than the PCMAX of the “highest supported power class”.*** |
| [**R4-2319408**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319408.zip) | Reply LS on power class indication in lower MSD capability | Samsung | ***Answer 1: RAN4 confirms that the power class that is supposed to be signalled in the new MSD capability signalling is the power class of the band combination with specific UL and DL configuration. Further, the power class of the band combination with either 1 or 2 aggressor band(s) relies on UE itself to correctly report, along with other information included in lower MSD capability, in other words from UE capability signaling framework perspective it does not require the power class included in lower MSD capability to refer to the field indicated by powerClass and its variations in BandCombination.***  ***Answer 2: Please refer to Answer1. One example provided for reference, DL\_nX-nY\_UL\_nY suffers harmonic interference from nY UL to nX DL, the reported Lower MSD capability class should correspond to the power class for DL\_nX-nY with one aggressor band nY which relies on UE itself to correctly report as mentioned in Answer 1.***  ***Answer 3: RAN4 clarifies that “highest supported power class” is intended for the highest power class a UE supports, while “other power classes” is intended for the lower power class(es). For example, if UE supports PC2 (the highest power class) for a band combination, “other power classes” means PC3. Additionally, more information RAN4 would like to share is that in current RAN4 specs, MSD is captured in different tables for different power classes in terms of each MSD mechanism, which makes it possible for UE to report different lower MSD capability classes according to different power classes.*** |
| [**R4-2319446**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319446.zip) | [NR\_ENDC\_RF\_FR1\_enh2-Core]Discussion on reply LS to LS R2-2311586 on power class indication in lower MSD capability | MediaTek Inc. | ***Proposal 1: Proposed answer to RAN2 LS R2-2311586 on power class indication in lower MSD capability***  ***Proposal 2: For lower-MSD capability reporting, there is no need to report it for different power classes simultaneously. We propose to remove the word “additionally” and update in the LS to RAN2***  ***MSD for different power classes***  ***▪ UE reports the lower MSD capability class per MSD type for the highest supported power class for the band combination***  ***▪ UE can ~~additionally~~ report lower MSD capability class per MSD type for other power classes if requested by the network/regulator***  ***Proposal 3: Update RAN4 CR if proposal 2, remove the word “additionally” is agreed*** |
| [**R4-2319905**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319905.zip) | R18 reply LS on power class reporting in low MSD | OPPO | ***Answer 1: For harmonics, harmonic mixing, and cross band isolation, the power class is the aggressor band power class. For IMD, the power class is the band combination total power class.***  ***Answer 2:***   * ***For harmonics, harmonic mixing, and cross band isolation,***    + ***when only single CC is configured in UL and is configured in the aggressor band, the power class is the aggressor band power class reported by UE capability parameters ue-PowerClass/ ue-PowerClass-v1610/ ue-PowerClass-v1700.***   + ***when only intra-band UL CA is configured and the UL CCs are all configured in the aggressor band, the power class is the aggressor band power class reported by UE capability parameters powerClass / powerClass-v1610.***   + ***when inter-band UL CA/EN-DC is configured, the power class reported in low MSD is the aggressor band power capability in UL band combination which is reported via UE capability parameters ue-PowerClassPerBandPerBC-r17 if exists, or ue-PowerClass/ ue-PowerClass-v1610/ ue-PowerClass-v1700 and powerClass / powerClass-v1610 whichever the Tx power is smaller on the aggressor band.*** * ***For IMD, the power class is the band combination total power class which is reported by powerClass / powerClass-v1610.***   ***Answer 3: Reply as following: It is also RAN4 understanding that UE can only report one power class per frequency band, per band combination, and per band per band combination respectively. The “highest supported power class” means the UE reported power class to network. And the “other power classes” means the max Tx power capability of other power classes that is lower than the reported power class. In RAN4 specification there are MSD requirements defined for different power class capabilities. RAN4 thinks it might be useful if UE can report the MSD capabilities for “other power classes” based on network request when its Tx power is lower than the reported power class.*** |
| [**R4-2320674**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320674.zip) | Discussion on the power class indication in lower-MSD capability | Huawei, HiSilicon | ***Observation 1: Based on RAN4 agreements, a UE supporting lowerMSD capability shall be able to report the lower-MSD class for the highest supported power class for the band combination. The reporting for lower power classes is optional and only executed upon receiving the request from NW/regulator.***  ***Observation 2: RAN2 confirms in the LS that power class is included in the lower MSD capability signalling. And it is under consideration that lower-MSD classes for different power classes for the band combination are reported in response to the network enquiry, for which RAN4’s clarification is requested.*** |
| [**R4-2320675**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320675.zip) | Reply LS on the power class indication in lower-MSD capability | Huawei, HiSilicon | ***Answer 1: RAN4 confirms that the power class used in the new MSD capability signalling is the power class of the band combination consisting of the victim band and the aggressor band(s) with 1 or 2 bands in the UL. The aggressor can be the one UL band for MSD type of harmonic, harmonic mixing and cross-band isolation, or the 2 UL bands for MSD type of IMD for lower-MSD reporting in Rel-18.***  ***Answer 2: The power class used in the new MSD capability signaling shall be determined by the power class of the underlying 2/3-band combination. More explicitly,***   * ***For MSD type of harmonic, harmonic mixing and cross-band isolation, the power class is that for the band combination with the following DL/UL component(s):***   + ***DL\_bandA(victim)-bandB, UL\_bandB(aggressor).*** * ***For MSD type of IMD, the power class is that for the band combination with the following DL/UL components:***   + ***DL\_bandA(victim)-bandB, UL\_bandA(aggressor)-bandB(aggressor) or***   + ***DL\_bandA(victim)-bandB-bandC, UL\_bandB(aggressor)-bandC(aggressor).***   ***Such band combinations may not be signaled via BandCombination IE by the UE. To avoid potential ambiguity, a UE shall include the necessary power class information in the lower-MSD capability reporting, which is in line with the essential information for lower-MSD capability as previously communicated to RAN2.***  ***Answer 3: RAN4 clarifies that both “highest supported power class” and “other power classes” are the power classes which a UE can support for the band combinations as explained in answer#2. Relative to the “highest supported power class”, “other power classes” are intended for the lower power class(es) that the UE may fall back to. For example, if a UE supports PC2 for a band combination, “other power classes” means PC3.*** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1: RAN4 answer for Q1 in LS R2-2311586

***Question 1) in RAN2 LS***

*It is not completely clear to RAN2 whether the power class that is supposed to signalled in the new MSD capability signalling is the power class of aggressor band(s) and/or victim band.*

* Proposals
  + Option 1: power class used in the new MSD capability signalling is the power class of the band combination consisting of the victim band and the aggressor band(s) with specific UL and DL configuration.
    - The aggressor can be the one UL band for MSD type of harmonic, harmonic mixing and cross-band isolation, or the 2 UL bands for MSD type of IMD for lower-MSD reporting in Rel-18 (Huawei).
    - the power class of the band combination with either 1 or 2 aggressor band(s) relies on UE itself to correctly report, along with other information included in lower MSD capability, and does not require the power class included in lower MSD capability to refer to the field indicated by *powerClass* and its variations in *BandCombination* (Samsung).
  + Option 2: per band combination power class for CA configuration with aggressor band(s) and victim band(s)
    - The power class to be signalled is *powerClass-v1530* or *powerClass-v1610* for an associated CA configuration including aggressor band(s) and victim band. (Nokia)
  + Option 3: per band/per band per BC power class for MSD types with single aggressor band and per BC power class for two aggressor bands, refers to the power classes in the table of Q2.
    - The power class to be signalled in the new MSD capability signalling is only for aggressor UL band(s). (Apple, Xiaomi, vivo)
    - For harmonics, harmonic mixing, and cross band isolation, the power class is the aggressor band power class. For IMD, the power class is the band combination total power class. (OPPO, MTK)
* Moderator’s observation

It was agreed by RAN2 that MSD combinations per MSD type are outside the *BandCombination* list, which means the power classes indicated in the *BandCombination* cannot be referred directly by the power class to be indicated in the BC in terms of MSD type. Now the MSD BC structure designed by RAN2 includes MSD type, victim band, aggressor band(s) and power class. That’s the reason RAN2 asked the question 1.

To the moderator’s understanding, all companies agree that MSD types can be categorized to two cases, i.e. one aggressor band for harmonics, harmonic mixing, cross band isolation, and two aggressor bands for IMD, in other words, power class(s) are relevant to the aggressor band(s). But regarding the question itself, it seems answer option 1 is more pertinent to the RAN2 question.

* Recommended WF
  + Check if option 1 can be considered as baseline for Q1.

### Sub-topic 2-2: RAN4 answer for Q2 in LS R2-2311586

***Question 2) in RAN2 LS***

*RAN2 would like to point out that under the current UE capability signalling, the UE reports a power class per frequency band, per band combination and per band per band combination respectively (see the table below).*

|  |  |
| --- | --- |
| ***UE capability parameter*** | ***Applicability*** |
| *ue-PowerClass*  *ue-PowerClass-v1610*  *ue-PowerClass-v1700* | *per frequency band* |
| *powerClass*  *powerClass-v1610* | *Per band combination* |
| *ue-PowerClassPerBandPerBC-r17* | *Per band per band combination* |

*It was not clear to RAN2 which of the above power class types is relevant in the MSD capability signalling, and whether the choice of power class type can be dependent on the MSD type (e.g. whether the aggressor is a single band or two bands).*

* Proposals
  + Option 1: The power classes in the Table of Q2 could be used to determine the power class in the MSD capability signalling in terms of MSD type, but the power class is not necessarily the same as that for the band combination signalled via *BandCombination* IE. It relies on UE itself to correctly report the power class as mentioned in option 1 for Answer 1 (Samsung, Huawei)
    - For MSD type of harmonic, harmonic mixing and cross-band isolation, the power class is that for the band combination with the following DL/UL component(s):
      * DL\_bandA(victim)-bandB, UL\_bandB(aggressor).
    - For MSD type of IMD, the power class is that for the band combination with the following DL/UL components:
      * DL\_bandA(victim)-bandB, UL\_bandA(aggressor)-bandB(aggressor) or
      * DL\_bandA(victim)-bandB-bandC, UL\_bandB(aggressor)-bandC(aggressor).
  + Option 2: the relevant Power Class capability is *powerClass-v1530* or *powerClass-v1610*. (Nokia)
  + Option 3: All the listed power class types could be relevant in the MSD capability signalling, and the choice of power class type is dependent on the MSD type, such as whether the aggressor is a single band or two bands (vivo, OPPO, MTK, Xiaomi, QC, [Apple])
    - Example (not all similar proposals are listed):

|  |  |  |
| --- | --- | --- |
| * MSD type | Number of Aggressor bands for one victim band | UE capability signalling refer to |
| 2 bands combination:  UL harmonic, harmonic mixing and crossband isolation MSD | 1 | If per band combination power class is higher than per band power class  ue-PowerClass; ue-PowerClass-v1610; ue-PowerClass-v1700  If per band combination power class is not higher than per band power class  powerClass; powerClass-v1610  If ue-PowerClassPerBandPerBC-r17 is not absent.  ue-PowerClassPerBandPerBC-r17 |
| 2 bands combination:  IMD with order=2/3/4/5 | 2 | powerClass  powerClass-v1610 |
| 3 bands combination:  IMD with order=2/3/4/5 | 2 | powerClass  powerClass-v1610 |

* Moderator’s observation

From above discussion for Q1, the lower MSD capability reporting for a combination is composed with MSD type, victim band, aggressor band(s) and power class. The power class, e.g. powerClass or ue-PowerClassPerBandPerBC-r17 indicated in *BandCombination* cannot be referred directly. Also, the power class for single aggressor band could be different from that indicated by *ue-PowerClass*. For instance, the indicated power class (by *ue-PowerClass*) for the aggressor band is PC2, and the PC indicated by powerClass for the combination with victim band and aggressor band in *BandCombination* is PC2, but for the lower MSD capability reporting, the PC for the aggressor band could be PC3. Thus, the power class of the band combination consisting of the victim band and the aggressor band(s) with specific UL and DL configuration would be determined by the UE itself rather than by the so called relevant power class(es).

* Recommended WF
  + Check whether option 1 is agreeable.

### Sub-topic 2-3: RAN4 answer for Q3 in LS R2-2311586

***Question 3) in RAN2 LS***

*RAN2 would also like to point out that under the current UE capability signalling, the UE reports only a single power class per frequency band, per band combination and per band per band combination respectively. RAN2 therefore needs a clarification from RAN4 regarding the RAN4 text, what the “highest supported power class” and “other power classes” refer to.*

#### **Issue 2-3-1: “highest supported power class”**

* Proposals
  + Option 1: The highest power class UE supported and indicated for the band combination in terms of MSD type (Nokia, Apple, Xiaomi, vivo, Samsung, QC, OPPO, Huawei)
    - the highest power class is the highest msdPowerClass-r18 in R2-2310735 among lower MSD capabilities (if multiple lower MSD with different msdPowerClass-r18 is supported by a UE) for the same per MSD type per aggressor(s) per victim (Nokia).
    - Based on the MSD type the highest per band or per band combination power class is reported. (QC).
  + Option 2: The “highest supported power class” is the power class a UE is capable to support in a CA/DC configuration in the lower MSD discussion (MTK)
* Moderator’s observation

From the proposals it’s not clear whether all companies share the same view that the highest power class is PC indicated for the band combination consisting of the victim band and the aggressor band(s) with specific UL and DL configuration, i.e. the band combination in terms of MSD type, rather than referring the combination listed by *BandCombination.* If the answer is yes that the understanding is the same, then there would be no difference for option 1 and option 2.

* Recommended WF
  + check whether option 1 is agreeable

#### **Issue 2-3-1: “other power classes”**

* Proposals
  + Option 1: Relative to the “highest supported power class”, “other power classes” are intended for the lower power class(es) (Samsung, Huawei, OPPO, QC, MTK, Xiaomi)
    - For example, if UE supports PC2 (the highest power class) for a band combination, “other power classes” means PC3. Additionally, more information RAN4 would like to share is that in current RAN4 specs, MSD is captured in different tables for different power classes in terms of each MSD mechanism, which makes it possible for UE to report different lower MSD capability classes according to different power classes. (Samsung)
    - The UE may fall back to. For example, if a UE supports PC2 for a band combination, “other power classes” means PC3. (Huawei).
    - the regulatory body may only allow a power class which is lower than the highest supported power class one UE can support, and power class criteria of conformance test was set accordingly, the “other power classes” applies in this case. (MTK)
  + Option 2: The “other power classes” are for the case when certain PEMAX (e.g. 23dBm which is same to PC3 nominal maximum output power) and/or non-zero ΔPPowerClass (e.g. 3 or 6dB) applied (vivo)
  + Option 3: The “other power classes” would be requested by network in consideration that the UE maximum output power could be limited by P-max (PEMAX) which is lower than the PCMAX of the “highest supported power class”. (Apple)
* Recommended WF
  + The options are not mutually exclusive. Check whether option 1 can be considered as baseline, and add some clarification and example for the lower power class(es).

# Topic #2: Information & approaches for lower MSD signalling design

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

## Companies’ contributions summary

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| **T-doc number** | **T-doc name** | **Company** | **Proposals / Observations** |
| [**R4-2320602**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320602.zip) | Discussion on the remaining issues for the lower MSD capability | CHTTL | ***Proposal 1: The lower MSD report type “ALL” should not be used when there is only one MSD among the harmonic/harmonic mixing/cross band isolation/IMD2,3,4,5 for the victim band of a BC.***  ***Proposal 2: RAN4 to further discuss the condition for reporting type “ALL”.***  ***Option 1: The Maximum allowed actual MSD of the reported MSD class for type ALL shall be smaller than the smallest non-zero MSD among the minimum requirements of the harmonic/harmonic mixing/cross band isolation/IMD2,3,4,5 if any.***  ***Option 2: Consider a smaller maximum allowed actual MSD threshold for the “ALL” type, only MSD class I, II is allowed.*** |
| [**R4-2320897**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320897.zip) | On MSD type all for future lower MSD capability | Skyworks Solutions Inc. | ***Proposal: In release 18 MSD type all applies to all specified MSD test points for:***   * ***UL harmonic, harmonic mixing and cross band MSD types for 1UL/1CC case*** * ***IMD MSD type for to 2UL/2CC*** * ***This does not result in additional test for MSD type all versus a UE signalling specific MSD types or a UE not signalling lower MSD capability*** * ***It only applies to MSD test points that are specified.***   ***Proposal on MSD type all signalling:***   * ***It is allowed to signal a lower MSD class higher than one or more specified MSDs. In that case these MSDs are tested with the specified values and the remaining MSDs use the type all declared lower MSD class*** * ***It is allowed to signal a lower MSD class for one specific MSD type and order on top of the MSD type all.***   ***Proposal on lower MSD signalling for forward compatibility: MSD types signalling should be tagged per release to resolve issues due to new MSD types, reduced specified MSD values or updated worst case MSD due to a new larger channel bandwidth.*** |
| [**R4-2319445**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319445.zip) | [NR\_ENDC\_RF\_FR1\_enh2-Core]Discussion on the UE feature list for lowerMSD | MediaTek Inc. | ***Network query filter***  ***UE support network query filter such as band(s), MSD types, power class, frequency range, minimum lower-MSD class, top-K largest MSD class and etc for lower-MSD reporting*** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1: Clarificatrion for ”ALL” MSD type

**Background**

*Agreement in RAN4#108:*

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| --- |
| *“ALL” is defined per victim band per BC*  *Type “ALL” denotes the actual MSD values for harmonic/harmonic mixing/cross band isolation/IMD2,3,4,5 if any are all under the reported lower MSD capability threshold for a victim band with a band combination.* |

*Agreement in RAN4#108bis:*

|  |
| --- |
| **Issue 1-2-3: MSD type “ALL”**  *Keep previous agreement for “ALL” type*   * *“ALL” should not introduce additional test cases compared to UE not declaring lower MSD or relax MSD*   *If UE reports ALL, it does not mean UE always suffer from all MSD types* |

#### **Issue 2-1-1: The definition of MSD type ”ALL”**

* Proposals
  + Option 1: The Maximum allowed actual MSD of the reported MSD class for type ALL shall be smaller than the smallest non-zero MSD among the minimum requirements of the harmonic/harmonic mixing/cross band isolation/IMD2,3,4,5 if any.
  + Option 2: Consider a smaller maximum allowed actual MSD threshold for the “ALL” type, only MSD class I, II is allowed.
  + Option 3: It is allowed to signal a lower MSD class higher than one or more specified MSDs. In that case these MSDs are tested with the specified values and the remaining MSDs use the type all declared lower MSD class
    - It is allowed to signal a lower MSD class for one specific MSD type and order on top of the MSD type all
* Recommended WF
  + Given the agreement in RAN4#108, check whether option 1 is the common understanding by companies

#### **Issue 2-1-2: Condition for reporting ”ALL”**

* Proposals
  + The lower MSD report type “ALL” should not be used when there is only one MSD among the harmonic/harmonic mixing/cross band isolation/IMD2,3,4,5 for the victim band of a BC.
* Recommended WF
  + Check whether the issue can be left to RAN2, as now “ALL” is considered as a separate MSD type by RAN2 just like harmonic or IMD MSD for a MSD band combination.

#### **Issue 2-1-3: Lower MSD signalling for forward compatibility**

* Proposals
  + MSD types signalling should be tagged per release to resolve issues due to new MSD types, reduced specified MSD values or updated worst case MSD due to a new larger channel bandwidth.
* Recommended WF
  + TBA

### Sub-topic 2-2: Lower MSD report for different power classes

**Background**

*Agreements in RAN4#107*

* + *The UE reports the MSD class per MSD types for the highest supported power class for the band combination*
* *UE can additionally report lower MSD for other PCs if NW/regulator requested*
* *Conformance test is only performed for the highest supported power class*
  + *Lower MSD reported for lower power class does not need to be tested*

*Agreements in RAN4#108*

* + *Lower MSD conformance test reuses the RAN4 MSD test point parameters and only changes the MSD value by the upper bound of the declared lower MSD class. And, similar to the specified MSD, the highest supported power class or power class required by certification/regulation body per UL configuration is verified*

#### **Issue 2-2-1: Lower MSD report for different power classes**

* Proposals
  + For lower-MSD capability reporting, there is no need to report it for different power classes simultaneously. We propose to remove the word “additionally” and update in the LS to RAN2
    - MSD for different power classes

- UE reports the lower MSD capability class per MSD type for the highest supported power class for the band combination

- UE can additionally report lower MSD capability class per MSD type for other power classes if requested by the network/regulator

* Recommended WF
  + Check if the previous agreement needs to be changed. If yes, inform RAN2 about the changes.

# Topic #3: Requirements for lower MSD capability

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **T-doc name** | **Company** | **Proposals / Observations** |
| [**R4-2320672**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320672.zip) | DraftCR for introduction of lower-MSD requirements for inter-band CA | Huawei, HiSilicon, Samsung, Skyworks, MediaTek, NTT DOCOMO Inc., OPPO, Xiaomi | ***Draft CR for lower MSD capability for inter-band CA.*** |
| [**R4-2320673**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320673.zip) | DraftCR for introduction of lower-MSD requirements for inter-band EN-DC | Huawei, HiSilicon, Samsung, Skyworks, MediaTek, NTT DOCOMO Inc., OPPO, Xiaomi | ***Draft CR for lower MSD capability for inter-band EN-DC.*** |
| [**R4-2320602**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320602.zip) | Discussion on the remaining issues for the lower MSD capability | CHTTL | ***Proposal 3: If the UE is equipped with four or eight Rx antenna ports for the victim band of the BC, the lower MSD capability is verified with four or eight Rx antenna ports.***  ***Proposal 4: Discuss to include an additional description in the specifications for the aspects in proposal 3.*** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1: draft CRs for lower MSD

*Sub-topic description:*

* Recommended WF
  + Return to

### Sub-topic 3-2: Applicability of more than 2Rx for lower MSD

* Proposals
  + Proposal 1: If the UE is equipped with four or eight Rx antenna ports for the victim band of the BC, the lower MSD capability is verified with four or eight Rx antenna ports.
  + Proposal 2: Discuss to include an additional description in the specifications for the aspects in proposal 3.
    - NOTE 2: If the UE is equipped with four or eight Rx antenna ports for the victim band of the BC, the lower MSD capability is verified with four or eight Rx antenna ports with the increased MSD values of the minimum requirement based on the description in 7.3A.1.
* Recommended WF
  + Check if the verification of lower-MSD introduces additional test conditions than the verification of the minimum MSD requirements
  + Check if the proposed NOTE is agreeable