**3GPP TSG-RAN WG4 Meeting # 107 R4-23XXXXX**

**Incheon, KR, May 22nd – May 26th, 2023**

**Agenda item:** 7.1

**Source:** Moderator (Skyworks Solutions, Inc.)

**Title:** Draft Topic Summary [107][105] NR\_Baskets\_Part\_1

**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.*

Topic 1: Combinations with Triple beat case

Topic 2: LBLB 1UL combinations

Topic 3: NR-U contiguous ULCA A-MPR

Topic 4: BCS4/5 additions

Topic 5: R18 Corrections to band combinations configurations and MSDs

# Topic #1: Combinations with Triple beat case

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2309088](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309088.zip)** Triple-beat for DC\_3A-8B\_n78A | Apple | **Observation 1:** If the TB product is resulted from the frequency sum of the 2 discrete RBs in the contiguous UL CA mixing with the other band UL carrier, the TB product would be no different from the IMD3 mixed by only 2 UL carriers for the same UL band combination.**Proposal 1:** If TB is resulted from the frequency sum of the 2 discrete RBs in the contiguous UL CA, there is no need to specify the TB test configuration as the requirement can already be verified by the fallback 2UL IMD3.**Observation 2:** If the TB test configuration with 2 discrete RBs in intra-band contiguous UL CA is within an FDD band, the IMDs generated by the 2 RBs could result in more severe REFSENS impact to its own DL band than the TB interference to the 3rd DL band.**Proposal 2:** The TB test configuration should ensure the FDD band self-interference would not interrupt the 3rd DL band MSD verification, if REFSENS or MSD for all DL bands would not be tested simultaneously. |
| [**R4-2309741**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309741.zip) Triple Beat MSD for DC\_3A-8B\_n78A | Skyworks Solutions Inc. | Proposal: Interested companies are invited to study the band 3 MSD for the test point captured in Table 1.**Table 1**: Band 3 TB MSD test point proposal for DC\_3A-8B\_n78A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ENDC band combination | NR/LTE band | UL Fc (MHz) | UL/DL BW (MHz) | UL LCRB | DL Fc (MHz) | MSD (dB) | Duplex mode | IMD order |
|  | 3 | N/A | 5 | N/A | 1845 | **[FFS]** | FDD | IMD3 |
| DC\_3A-8B\_n78A | 8 | 900 | 10 | 1 (RBSTART=20) | 945 | N/A | FDD | N/A |
|  |  | 910 | 10 | 1 (RBSTART=45) | 955 | N/A | FDD | N/A |
|  | n78 | 3660 | 10 | 25 (RBSTART=0) | 3660 | N/A | TDD | N/A |

 |
| [**R4-2309450**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309450.zip)TP for TR 37.718-21-11: updated MSD for DC\_3A\_8B\_n78A with UL DC\_8B\_n78A | CHTTL | TP to capture input on Triple Beat MSD in band 3 for DC\_3A\_8B\_n78A with UL DC\_8B\_n78A |

## Open issues summary

### Sub-topic 1-1

*Sub-topic description:* Discussion on triple beat cases that are equivalent to an IMD case and Triple beat to third band verification

**Issue 1-1: Triple Beat vs IMD3 and verification**

* Proposals
	+ Proposal 1: If TB is resulted from the frequency sum of the 2 discrete RBs in the contiguous UL CA, there is no need to specify the TB test configuration as the requirement can already be verified by the fallback 2UL IMD3.
	+ Proposal 2: The TB test configuration should ensure the FDD band self-interference would not interrupt the 3rd DL band MSD verification, if REFSENS or MSD for all DL bands would not be tested simultaneously.
* Recommended WF
	+ Proposals 1 can simplify triple beat MSD assessment and specification
	+ Proposal 2 may need input to RAN5
	+ Discuss proposals on-line and a WF may be needed to capture agreements

### Sub-topic 1-2

*Sub-topic description:* Triple Beat MSD for DC\_3A\_8B\_n78A with UL DC\_8B\_n78A

*Open issues and candidate options before meeting:*

**Issue 1-2: Triple Beat MSD for DC\_3A\_8B\_n78A with UL DC\_8B\_n78A**

* Proposals
	+ R4-2309088 there is no need to specify the TB test configuration as the requirement can already be verified by the fallback 2UL IMD3
	+ R4-2309741Further study Triple beat MSD
* Recommended WF
	+ Based on outcome in Issue 1-1, capture it in revision of R4-2309450

# Topic #2: LBLB 1UL combinations

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2309290**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309290.zip) DraftCR for TS 38.101-1 to introduce CA\_n12-n71 Requirements | Skyworks Solutions Inc. | To specify the following band combination specific requirements.1) Cross band MSD of n12 UL in n71 DL2) Cross band MSD of n71 UL in n12 DLThese changes are based on agreements from way forward R4-2306479 WF on CA\_n71-n85 and related band 12 and 71 combinations, T Mobile USA, Apple, Murata, Nokia, Skyworks |
| [**R4-2309298**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309298.zip) Input on CA\_n5-n71 cross-band MSD and DeltaT/R | Skyworks Solutions Inc. | Proposal on architecture: CA\_n5-n71 requirement is based on a two-antenna implementation with:* Band n71 and n105 co-banding
* n5DL+n105UL+n105DL triplexer on antenna 1
* n105DL+n5UL+n5DL triplexer on antenna 2
* Support of multiple LBLB combinations.

Proposal on Delta T and Delta R: the values in Table 1 and 2 are used for CA\_n5-n71.**Table 1: ΔTIB,c** **due to NR CA (two bands)**

|  |  |
| --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)9** |
| **Component band in order of bands in configuration10** |
| CA\_n5-n71 | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔTIB,c = 0.NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3 the band order from left to right is n1 and n3. |

**Table 2: ΔRIB,c due to NR CA (two bands)**

|  |  |
| --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)8** |
| **Component band in order of bands in configuration9** |
| CA\_n5-n71 | 0.5 | 0.3 |
| NOTE 8: “-” denotes ΔRIB,c = 0.NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n77 the band order from left to right is n1 and n77. |

Proposal for CA\_n5-n71 1UL cross-band MSD: see Table 4 below.Table 4: CA\_n5-n71 1UL cross-band MSD

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n71 | n5 | 688 | 20 | 15 | 20 (RBstart=86) | 871.5 | 5 | 1.3 | >ACLR2 |
| n5 | n71 | 834 | 20 | 15 | 20 (RBstart=0) | 649.5 | 5 | 1.1 | >ACLR2 |

 |
| [**R4-2309533**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309533.zip)TP for 38.718-02-01 on MSD value due to cross band isolation for CA\_n5A-n71A combination | Ericsson, Rogers | **Table 5.39.1.4-1: ΔTIB,c**

|  |  |
| --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)9** |
| **Component band in order of bands in configuration10** |
| CA\_n5-n71 | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔTIB,c = 0.NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3 the band order from left to right is n1 and n3. |

**Table 5.39.1.4-2: ΔRIB,c**

|  |  |
| --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)8** |
| **Component band in order of bands in configuration9** |
| CA\_n5-n71 | - | - |
| NOTE 8: “-” denotes ΔRIB,c = 0.NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n77 the band order from left to right is n1 and n77. |

based on values for CA\_n3-n7.**Table 5.39.1.5-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC3 aggressor NR UL band for NR CA FR1**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n71 | n5 | 688 | 20 | 15 | 20 (RBstart=86) | 871.5 | 5 | 0.6 | >ACLR2 |
| n5 | n71 | 834 | 20 | 15 | 20 (RBstart=0) | 649.5 | 5 | 0.6 | >ACLR2 |

 |
| [**R4-2309363**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309363.zip)New test point for CA\_n71-n85 cross band MSD | Skyworks Solutions Inc. | **Proposal on baseline CA\_n71-n85 MSD test points in Table 1:** * **This applies to UEs not supporting the R18 newly introduced symmetric UL/DL CBW >20MHz.**

Table 1: MSD test point for R18 mandatory support

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n71 | n85 | 688 | 20 | 15 | 20 (RBstart=86) | 730.5 | 5 | 8.2X | ACLR2 |
| n85 | n71 | 705.5 | 15 | 15 | 20 (Rbstart=59) | 649.5 | 5 | 3.8 | >ACLR2 |
| NOTE X: applicable to UE not supporting n71 symmetrical UL/DL channel bandwidths above 20MHz |

**Proposal on additional largest band n71 UL CBW MSD test point in Table 2 and Table 3 alternatives:** * **This applies to UEs supporting any of the R18 newly introduced symmetric UL/DL CBW >20MHz**
* **Assuming that a 35MHz symmetrical UL/DL for n71 is approved in RAN#100, the following test point in Table 2 is evaluated for the RAN4#108 meeting.**

Table 2: MSD test point for R18 optional support

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n71 | n85 | 680.5 | 35 | 15 | 20 (Rbstart=168) | 730.5 | 5 | TBDX | ACLR1 |
| NOTE X: applicable to UE supporting n71 symmetrical UL/DL channel bandwidths above 20MHz |

* **If 35MHz symmetrical UL/DL for n71 is not approved in RAN#100, then the following test point in Table 3 is evaluated for theRAN4#108 meeting.**

Table 3: MSD test point for R18 optional support

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n71 | n85 | 683 | 30 | 15 | 20 (Rbstart=140) | 730.5 | 5 | TBDX | ACLR2 |
| NOTE X: applicable to UE supporting n71 symmetrical UL/DL channel bandwidths above 20MHz |

* **The proper alternative will be captured in a CR after RAN#100 (earliest is RAN4#108 assuming that the MSD value is agreed).**
 |

## 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

*Sub-topic description:* CA\_n12-n71 requirement

**Issue 2-1: CA\_n12-n71 requirement**

* Proposals
	+ Cross band MSD of n12 UL in n71 DL
	+ Cross band MSD of n71 UL in n12 DL
* Recommended WF
	+ Based on agreed WF, Endorse R4-2309290

### Sub-topic 2-2

*Sub-topic description* CA\_n5-n71 Delta R

**Issue 2-2: CA\_n5-n71 Delta R**

* Proposals
	+ Value already endorsed in R4-2309533
	+ Corrected Delta R values from R4-2309298
* Recommended WF
	+ Discuss on-line and capture agreements in revision R4-2309533 if needed

### Sub-topic 2-3

*Sub-topic description:* CA\_n5-n71 cross-band MSD

**Issue 2-3: CA\_n5-n71 cross-band MSD**

* Proposals
	+ 1.3/1.1dB MSD for n5/n71 in R4-2309533 based on evaluation
	+ 0.6/0.6dB MSD for n5/n71 in R4-2309298 based on CA\_n3-n7
* Recommended WF
	+ Discuss on-line and capture agreements in revision R4-2309533 if needed

### Sub-topic 2-4

*Sub-topic description* CA\_n71-n85 MSD test points

**Issue 2-4: CA\_n71-n85 MSD test points**

* Proposals
	+ Cross band MSD for baseline (UL CBW up to 20MHz). values already agreed in WF. Only note added
	+ Cross band MSD for new maximum UL CBW in n71. 30MHz in RAN99 but 35MHz requested in RAN#100
* Recommended WF
	+ Discuss on-line and agree on handling of CA\_n71-n85 handling of requirement for mandatory vs optional UL CBW support in R18.

# Topic #3: NR-U contiguous ULCA A-MPR

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2309723](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309723.zip)** Discussion of simulation results on UE RF NR-U UL CA A-MPR for PC5 | Charter Communications, Inc | Discussion paper for simulation calibration purposeTable 1: Initial simulation results for UL CA A-MPR PC5 for Band n96B with NS\_54 for calibration purpose.

|  |  |  |
| --- | --- | --- |
| Pre-coding | Modulation | RB Allocation |
|  |  | Full2 (dB) | Partial3(dB) | Exception for Full5 (dB) |
| DFT-s-ODFM | Pi/2 BPSK4 | ≤ [4.0] |  |
|  | QPSK | ≤ [4.0] |  |
|  | 16 QAM | ≤ [4.5] |  |
|  | 64 QAM | ≤ [5.0] |  |
|  | 256 QAM | ≤ [6.0] |  |
| CP-OFDM | QPSK | ≤ [5.0] |  |
|  | 16 QAM | ≤ [5.0] |  |
|  | 64 QAM | ≤ [6.0] |  |
|  | 256 QAM | ≤ [7.0] |  |
| NOTE 1: The MPR shall apply to all SCS in all active 20 MHz sub-bands contiguously allocated in the channel. The MPR applies to interlaced allocations with uplink resource allocation type 2 as specified in TS 38.214 [10].NOTE 2: Full RB allocation MPR applies when all RB’s in a 20 MHz channel or all RB’s in all sub-bands for wideband operation are fully allocated and sub-bands are transmitted according to configuration A in Table 6.2F.2A.2-2.NOTE 3: Partial RB allocation MPR applies when one or more RB’s in one or more sub-bands are not allocated and sub-bands are transmitted according to configuration A in Table 6.2F.2A.2-2.NOTE 4: Applicable to Pi/2-BPSK modulation when IE powerBoostPi2BPSK is set to 0.NOTE 5: Exception for Full RB allocation MPR applies when all RB’s in a 20 MHz channel or all RB’s in all sub-bands for wideband operation are fully allocated and sub-bands are transmitted according to configuration [B] in Table 6.2F.2A.2-2. |

 |

## Open issues summary

### Sub-topic 3-1

*Sub-topic description:* Discussion paper for simulation calibration purpose providing backoff per waveforms for NS\_54 A-MPR

**Issue 3-1: NS\_54 A-MPR**

* Proposals
	+ Simulation results for calibration purpose
* Recommended WF
	+ Data to be considered by other contributing companies
	+ Note R4-2309723

# Topic #4: BCS4/5 additions

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2308562**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308562.zip) Addition of FR1 intra-band BCS 4 and 5 | Huawei, HiSilicon, CATT | Added new FR1 CA\_n48(2A) intra-band BCS 4 and 5 as per the approved WID RP-230067.Some existing FR1 intra-band BCS other than BCS 4 and 5 have no corresponding fallback BCS, significant signalling overhead will be introduced. |
| [**R4-2308563**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308563.zip) Addition of FR1 inter-band BCS 4 and 5 | Huawei, HiSilicon, CATT | Added new FR1 inter-band BCS 4 and 5 as per the approved WID RP-230133. |

## Open issues summary

### Sub-topic 4-1

*Sub-topic description:* FR1 intra-band BCS 4 and 5

**Issue 4-1: CA\_n48(2A) intra-band BCS 4 and 5**

* Proposals
	+ Adding CA\_n48(2A) 1UL BCS4/5
* Recommended WF
	+ Approve R4-2308562
	+ (moderator note: missing “-“ in UL configuration, was missing before the CR)

### Sub-topic 4-2

*Sub-topic description* FR1 inter-band BCS 4 and 5

**Issue 4-2: BCS4/5 inter-band additions**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Recommended WF
	+ Approve R4-2308563
	+ Moderator note: when introducing BCS4/5 there may be new MSD cases to be checked due to new smallest or largest CBW or aggregated BW, it would be useful that some text in cover page provides evidence of the checks
	+ CA\_n2-n77/78 introduces a new largest UL CBW for n2, cross band issue needs to be checked: check OK
	+ CA\_n8-n78 introduces a new largest UL CBW for n8, cross band issue needs to be checked: check OK
	+ CA\_n71-n78 introduces a new largest UL CBW for n71, cross band issue needs to be checked: check OK

# Topic #5: R18 Corrections to band combinations configurations and MSDs

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2308564**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308564.zip) Draft CR for TS 38.101-3 to align the MSD test configurations due to harmonic and harmonic mixing for ENDC | Huawei, HiSilicon | Based on the agreements in WF R4-2306583, the MSD table format should be further evolved.1) MSD table format for harmonic interference exceptions in clause 7.3B.2.3.1 is updated.2) MSD table format for harmonic mixing interference exceptions in clause 7.3B.2.3.2 is updated. |
| [**R4-2309081**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309081.zip) CR for 38.101-1 18.1.0 Bug fixes for CA/DC tables | Apple | Correcting some notation bugs. For four UL combinations the marking “n” is missing and has been added |
| [**R4-2309082**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309082.zip) CR for 38.101-3 18.1.0 Bug fixes and fallback additions for CA/DC tables | Apple | 1. Correcting some notation bugs2. Adding missing Fallback combinationsMany combinations have been added in the Release 18.1.0 spec with R4-2301500, however, there have many bugs introduced by using a wrong notation for the added combinations and also many fallbacks are missing. Some other minor bugs are corrected as well. |

## Open issues summary

### Sub-topic 5-1

*Sub-topic description:* MSD test configurations due to harmonic and harmonic mixing for ENDC

**Issue 5-1: MSD table format for harmonic cases**

* Proposals
	+ Update UL harmonic and harmonic mixing MSD tables to the agreed new format
* Recommended WF
	+ Endorse R4-2308564

### Sub-topic 5-2

*Sub-topic description:* 38.101-1 Bug fixes for CA/DC tables

**Issue 5-2: Issue with band combinations notation**

* Proposals
	+ Simple fix of “n” missing for some bands
* Recommended WF
	+ Approve R4-2309081

### Sub-topic 5-3

*Sub-topic description* 38.101-3 Bug fixes and fallback additions for CA/DC tables

**Issue 5-3: Issue with band combinations notation and fallbacks**

* Proposals
	+ Fixing bugs and fallbacks
* Recommended WF
	+ Approve R4-2309081