**3GPP TSG-RAN4 Meeting #114 R4-2502926**

**Athens, Greece, 17th – 21st February 2025**

**Agenda item:** 7.12.4

**Source:** CMCC

**Title:** WF on UE RF requirements for ATG

**Document for:** Approval

# Introduction

This document captures the agreements on Rel-19 ATG UE RF requirements in RAN4#114.

# Topic #1: R18 UE RF requirements maintenance

**Issue 1-1: Tx requirements definition for two types of ATG UE antenna**

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| Proposals from Apple, Keysight, CMCC:* All transmit signal quality requirements should be specified at the antenna connector(s) of the ATG UE with one or multiple omni-directional antennas(s) or at the transceiver array boundary (TAB) connectors of the ATG UE with the antenna array.
 |

WF:

* All transmit signal quality requirements should be specified at the antenna connector(s) of the ATG UE with one or multiple omni-directional antennas(s)
* FFS for the ATG UE with the antenna array.

**Issue 1-2: Rx requirements definition for two types of ATG UE antenna**

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| Agreement during RAN4#113:* Rx antenna port requirements of the ATG UE need to be specified at the antenna connector(s) or TAB connectors.
* The power should be fed to each connector during the test
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WF:

* Companies are encouraged to provide wording on how to capture this agreement in the specification, especially for ATG UEs with antenna arrays.

# Topic #2: R19 UE RF for inter-band CA

**Issue 2-1: Assumed** **parameters when supporting n39 UL for CA\_n3A-n39A with common antenna.**

Agreement:

* Companies are encouraged to provide MSD values based on the following parameters.

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| --- | --- |
| **Parameters** | **Values** |
| Antenna Isolation | 20dB |
| The rejection for band n3 Rx filter at 1885~1915MHz | [35dB] |
| n39 Tx filter rejection at 1805~1830MHz | [50dB] |

* Above parameters are only applicable for ATG UE with dedicated filter design

**Issue 2-2: MSD for CA\_n3A-n39A with n39 UL**

Agreement:

* Companies are encouraged to provide MSD values based on the following Tables.
	+ MSD analysis based on separated antenna are not precluded.
* All of these MSD values are only applicable to ATG UE.
* Further study on how to capture these MSD values to in the specification.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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)** |
| n39 | n3 | 1900 | 30 | 15 | 160 (RBstart=0) | 1817.5 | 25 | MSDTable X | ~~ACLR2 and~~ >ACLR2 |

**Table X CA\_n3-n39 with band n39 UL MSD requirements for different output powers**

|  |  |
| --- | --- |
| **Output power** | **MSD (Based on Antenna Architecture with common antenna)** |
| 23dBm | TBD |
| 24dBm | TBD |
| … | … |
| 39dBm | TBD |
| 40 dBm | TBD |

**Issue 2-3: Assumed parameters for CA\_n3A-n39A with n39 DL**

WF:

* Use the following parameters in the approved Tdoc R4-2410641 with 20dB antenna isolation as baseline to analysis the MSD value for n39 DL.
	+ Other parameters are not precluded.

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| **Parameters** | **Value** |
| Antenna isolation | [20dB] |
| Tx attenuation at 1880~1920MHz for band n3 duplexer | [30dB] |
| Rx attenuation at 1710~1785MHz for band n3+n39 Rx filter | [40dB] |

**Issue 2-4: MSD for CA\_n3A-n39A with n39 DL**

WF:

* Companies are encouraged to provide MSD values based on the following Tables.
	+ Other MSD test configurations are not precluded.
* All of these MSD values are only applicable to ATG UE.
* Further study on how to capture these MSD values to in the specification.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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)** |
| n3 | n39 | [1722.5] | [25] | [15] | [160 (RBstart=0)] | [1900] | [30] | MSDTable Y | [>ACLR2] |

**Table Y CA\_n3-n39 with band n3 UL MSD requirements for different output powers**

|  |  |
| --- | --- |
| **Output power** | **MSD (Based on Antenna Architecture with common antenna)** |
| 23dBm | TBD |
| 24dBm | TBD |
| … | … |
| 39dBm | TBD |
| 40 dBm | TBD |

**Issue 2-5: whether preclude Case 4.**

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| **Issue 1-1-2: UE antenna type for inter-band CA**Agreement:* Refine the agreement from last meeting as:
	+ For intra-band contiguous CA, same antenna type should be applied on a band.
	+ For inter-band CA, either different or same antenna type can be applied on different bands.
	+ For inter-band CA, consider the following cases:
		- 1. ATG UE with omnidirectional antennas on the bands of PCC and SCC.
		- 2. ATG UE with an omnidirectional antenna on the band of PCC and an antenna array on the band of SCC.
		- 3. ATG UE with an antenna array on the band of PCC and an omnidirectional antenna on the band of SCC.
		- [4. ATG UE with an antenna array on the bands of PCC and SCC, and one common Rx beam assumed.]
		- 5. ATG UE with an antenna array on the bands of PCC and SCC, and two simultaneous separate Rx beams assumed.

Further check which understanding is correct:* Understanding #1: Case 4 is excluded in RF session.
* Understanding #2: Case 4 is not explicitly discussed in RF session, since no case 4 specific RF requirement. Case 4 UE implementation is possible.
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Agreement:

* ATG UE with an antenna array on the bands of PCC and SCC, and one common Rx beam is possible for specific band combination.
	+ Antenna array type for inter-band CA is highly depending on frequency range of operating bands and UE implementation.
	+ Option 1: Case 4 UE implementation is possible for CA\_n3-n39 that frequency ranges between two bands are close to each other.
	+ Option 2: Case 4 UE implementation is possible for CA\_n3-n39 that DL frequency separation between two bands are less than [X=FFS, e.g, 500 MHz].

Qualcomm: need calculate based on bands.

ZTE: prefer to option 1.

Ericsson: about common beam measurement, it is implementation issue. There could be other possibility.

LGE: we have requirements to specify the general. In general, we have considered two different separations.

Moderator: This issue is from RRM. RRM wants RF session to clarify whether it is precluded or not. From RF, we think case 4 is feasible. For the detailed frequency between two bands, that is not part of RF discussions. For RRM part, option 1 is enough for guidance.

LGE: It is not enough for RRM. There is no BC. We need specify the number for it.

# Topic #3: R19 UE RF for UL-MIMO

**Issue 3-1: ULFPTx mode for UL-MIMO**

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| * Proposals
	+ Option 1: ULFPTx Mode is not relevant to this feature. (ZTE)
	+ Option 2: ULFPTx mode still applies for ATG UE to support different implementation (CMCC, LGE, Ericsson)
	+ Option 3: Depend on ATG UE implementation whether to leverage the existing ULFPTx mode. (Huawei)
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~~WF:~~

* ~~Since ULFPTx Mode is an optional feature, ULFPTx mode still applies for ATG UE with one or multiple omni-directional antennas(s)~~
* ~~FFS for the ATG UE with the antenna array.~~

ZTE: ATG always have two ports.

Ericsson: that is not always the case.

LGE: Same view as Ericsson.

**Issue 3-2: whether preclude the single antenna port related requirement**

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| * Proposals
	+ Option 1: no (CMCC, LGE, Ericsson, Huawei)
	+ Option 2: not to consider the single antenna port transmission TxD for ATG UE operation. (ZTE)
 |

~~WF:~~

* ~~Single antenna port related requirement should not be precluded.~~

# Topic #4: R19 UE RF for DL-MIMO

**Issue 4-1: ATG UE RF requirements for UL-MIMO**

Agreement:

* Since the WID does not include the UE RF part for DL-MIMO, there is no requirement impact for ATG UE DL MIMO.