**3GPP TSG-RAN4 Meeting #111 *R4-2410688***

**Fukuoka, Japan, 20th – 24th May 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  |  | **CR** | **2218** | **rev** | **1** | **Current version:** | **18.5.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:***  | (NR\_ATG-Core) CR for 38101-1 on ATG UE Tx RFrequirement |
|  |  |
| ***Source to WG:*** | Apple |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_ATG-Core |  | ***Date:*** | 2024-03-25 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* *Rel-20 (Release 20)* |
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| ***Reason for change:*** | Some requirements for ATG are unclear and need to be updated. |
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| ***Summary of change:*** | The following symbols are introduced for better description of the requirements.Pmax,c,ACMaximum carrier output power measured per antenna connectorPmax,c,TABC The maximum carrier output power per TAB connectorPrated,c,AC The rated carrier output power per antenna connectorPrated,c,TABC The rated carrier output power per TAB connectorDescription is updated for the following requirements,UE maximum output power for ATGConfigured transmitted power for ATG |
|  |  |
| ***Consequences if not approved:*** | The requirements remain unclear. |
|  |  |
| ***Clauses affected:*** | 3.2; 6.2J; 6.4J |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.521-1 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

## **<<Start of Change>>**

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

ΔFGlobal Granularity of the global frequency raster

ΔFRaster Band dependent channel raster granularity

ΔfOOB Δ Frequency of Out Of Band emission

ΔFTX-RX Maximum deviation to the Tx-Rx carrier center frequency separation for asymmetric uplink/downlink channel bandwidth operation

∆MPRc Allowed Maximum Power Reduction relaxation for serving cell *c*

ΔPPowerClass Adjustment to maximum output power for a given power class

RB The starting frequency offset between the allocated RB and the measured non-allocated RB

ΔRIB,c Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell *c*

ΔRIBC Allowed reference sensitivity relaxation due to support for intra-band contiguous CA operation

ΔRIBNC Allowed reference sensitivity relaxation due to support for intra-band non-contiguous CA operation

ΔRIB,4R Reference sensitivity adjustment due to support for 4 antenna ports

ΔRIB,8R Reference sensitivity adjustment due to support for 8 antenna ports

ΔR1RReference sensitivity adjustment due to support for 1 antenna ports

ΔRXR,2R Reference sensitivity adjustment for two antenna ports XR UEs on bands defined in Table 7.3.2-2b

ΔShift Channel raster offset

TC Allowed operating band edge transmission power relaxation

TC,*c*Allowed operating band edge transmission power relaxation for serving cell *c*

ΔTIB,c Allowed maximum configured output power relaxation due to support for inter-band CA operation, inter-band NR-DC operation and due to support for SUL operations, for serving cell *c*

BWChannel Channel bandwidth

BWChannel,block Sub-block bandwidth, expressed in MHz. BWChannel,block= Fedge,block,high- Fedge,block,low

BWChannel\_CA Aggregated channel bandwidth, expressed in MHz

BWChannel,max Maximum channel bandwidth supported among all bands in a release

BWGB max(GBChannel,low, GBChannel,high)

BWDL Channel bandwidth for DL

BWUL Channel bandwidth for UL

BWinterferer Bandwidth of the interferer

Ceil(x) Rounding upwards; ceil(x) is the smallest integer such that ceil(x) ≥ x

Floor(x) Rounding downwards; floor(x) is the greatest integer such that floor(x) ≤ x

FC Center frequency of a carrier for a numerology defined by the *RF reference frequency* on the channel raster mapped to the carrier according to sub-clause 5.4.2.2FC,block, high Fc of the highest transmitted/received carrier in a *sub-block*

FC,block, low Fc of the lowest transmitted/received carrier in a *sub-block*

FC,low The Fc of the lowest carrier, expressed in MHz

FC,high The Fc of the highest carrier, expressed in MHz

FDL\_low The lowest frequency of the downlink *operating band*

FDL\_high The highest frequency of the downlink *operating band*

FUL\_low The lowest frequency of the uplink *operating band*

FUL\_high The highest frequency of the uplink *operating band*

Fedge,block,low The lower *sub-block* edge, where Fedge,block,low = FC,block,low - Foffset, low.

Fedge,block,high The upper *sub-block* edge, where Fedge,block,high = FC,block,high + Foffset, high.

Fedge , low The *lower edge* of *aggregated channel bandwidth*, expressed in MHz. Fedge,low = FC,low - Foffset,low.

Fedge, high The *higher edge* of *aggregated channel bandwidth*, expressed in MHz. Fedge,high = FC,high + Foffset,high.

FInterferer (offset) Frequency offset of the interferer (between the center frequency of the interferer and the carrier frequency of the carrier measured). For intra-band contiguous CA, the FInterferer (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer

FInterferer Frequency of the interferer

FIoffset Frequency offset of the interferer (between the center frequency of the interferer and the closest edge of the carrier measured)

Foffset Frequency offset from FC\_high to the *higher edge* or FC\_low to the *lower edge.*

Foffset,high Frequency offset from FC,high to the upper *UE RF Bandwidth edge*, or from FC,block, high to the upper sub-block edge

Foffset,low Frequency offset from FC,low to the lower *UE RF Bandwidth edge*, or from FC,block, low to the lower sub-block edge

FOOB The boundary between the NR out of band emission and spurious emission domains

FREF RF reference frequency

FREF-Offs Offset used for calculating FREF

FREF, shift RF reference frequency for Supplementary Uplink (SUL) bands, the uplink of all FDD bands, and TDD bands

Fuw (offset) The frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer

GBChannel Minimum guard band defined in clause 5.3.3, expressed in kHz

GBChannel(i) Minimum guard band defined in clause 5.3.3 of carrier *i*

GBChannel,low Minimum guard band defined in clause 5.3.3 for the lowest assigned component carrier in clause 5.3A.3

GBChannel,high Minimum guard band defined in clause 5.3.3 for the highest assigned component carrier in clause 5.3A.3

LCRB Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resources blocks

Max() The largest of given numbers

Min() The smallest of given numbers

 Physical resource block number

NRACLR NR ACLR

NRB Transmission bandwidth configuration, expressed in units of resource blocks

NRB\_agg The number of the aggregated RBs within the fully allocated aggregated channel bandwidth

$N\_{RB\_{\\_agg}}=\sum\_{1}^{j}N\_{RB\_{j}}\*2^{μ\_{j}}$ for carrier 1 to j, where *μ* is defined in TS 38.211 [6]

NRB,c The transmission bandwidth configuration of component carrier c, expressed in units of resource blocks

$N\_{RB,cj}=N\_{RB\_{j}}\*2^{μ\_{j}}$ for carrier j, where *μ* is defined in TS 38.211 [6]

NRB,largest BW The largest transmission bandwidth configuration of the component carriers in the bandwidth combination, expressed in units of resource blocks

NRB,low The transmission bandwidth configurations according to Table 5.3.2-1 for the lowest assigned component carrier in clause 5.3A.1

NRB,high The transmission bandwidth configurations according to Table 5.3.2-1 for the highest assigned component carrier in clause 5.3A.1

NREF NR Absolute Radio Frequency Channel Number (NR-ARFCN)

NREF-Offs Offset used for calculating NREF

PCMAX The configured maximum UE output power

PCMAX, *c* The configured maximum UE output power for serving cell *c*

PCMAX, *f*, *c* The configured maximum UE output power for carrier *f* of serving cell *c* in each slot

PEMAX Maximum allowed UE output power signalled by higher layers

PEMAX, *c* Maximum allowed UE output power signalled by higher layers for serving cell *c*

PInterferer Modulated mean power of the interferer

Plargest BW Power of the largest transmission bandwidth configuration of the component carriers in the bandwidth combination

PMaxOutputPower The rated maximum ATG UE output power at maximum modulation order and full PRB configurations which is indicated by ATG UE capability [*RatedMOPATG*]

PPowerClass The nominal UE power (i.e., no tolerance)

Pmax,c,ACMaximum carrier output power defined as the sum of measurement of all antenna connectors

Pmax,c,TABC Maximum carrier output power defined as the sum of measurement of all TAB connectors

Prated,c,AC Rated carrier output power defined as the sum of power over all antenna connectors

Prated,c,TABC Rated carrier output power defined as the sum of power over all TAB connectors

P-MPR*c* Power Management Maximum Power Reduction for serving cell *c*

PRB The transmitted power per allocated RB, measured in dBm

PREFSENS\_SL The REFSENS power for Sidelink

PUMAX The measured configured maximum UE output power

Puw Power of an unwanted DL signal

Pw Power of a wanted DL signal

RBstart The lowest RB index of transmitted resource blocks

RBstart\_CA The lowest RB index of transmitted resource blocks for intra-band contiguous CA

SCSc SCS for the component carrier c, expressed in kHz

SCSlargest BW SCS for the largest transmission bandwidth configuration of the component carriers in the bandwidth combination, expressed in kHz

SCSlow SCS for the lowest assigned component carrier in clause 5.3A.1, expressed in kHz

SCShigh SCS for the highest assigned component carrier in clause 5.3A.1, expressed in kHz

*tp* Transient Period value signalled by the UE

*tpstart* Start position of transient period relative to the symbol boundary

T(PCMAX, *f*, *c*) Tolerance for applicable values of PCMAX, *f*, *c* for configured maximum UE output power for carrier *f* of serving cell *c*

TL,c Absolute value of the lower tolerance for the applicable *operating band* as specified in clause 6.2.1

SSREF SS block reference frequency position

UTRAACLR UTRA ACLR

## **<<Next Change>>**

## 6.1J General

Unless otherwise stated, the transmitter characteristics are specified at the antenna connector(s) of the ATG UE with one or multiple omni-directional antenna(s) or at the *transceiver array boundary* (TAB) connectors of the ATG UE with the antenna array. The definition about *transceiver array boundary* (TAB) is specified in clause 4.3.2 of TS 38.104 [16].

## **<<Next Change>>**

## 6.2J Transmitter power for ATG

### 6.2J.1 UE maximum output power for ATG

For the ATG UE, the rated maximum output power is reported via UE capability [*RatedMOPATG*] at maximum modulation order reported by ATG UE and full PRB configurations within the channel bandwidth of NR carrier unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). UE capability [*RatedMOPATG*] is an integer value in the range 23 to 40 dBm.

For ATG UE with multiple omni-directional antennas not indicating the capability *antennaArrayType-r18,* the measured maximum output powerPmax,c,AC shall remain within +2 dB and -2 dB of the rated maximum output power Prated,c,AC reported by the ATG UE.

For ATG UE with antenna array indicating the capability *antennaArrayType-r18,* the measured maximum output powerPmax,c,TABC shall remain within +2 dB and -2 dB of the rated maximum output powerPrated,c,TABC reported by the ATG UE.

### 6.2J.2 Configured transmitted power for ATG

The UE is allowed to set its configured maximum output power PCMAX,f,c for carrier f of serving cell c in each slot. The configured maximum output power PCMAX,f,c is set within the following bounds:

PCMAX\_L,f,c ≤ PCMAX,f,c ≤ PCMAX\_H,f,c with

PCMAX\_L,f,c = MIN {PEMAX,c, Prated,c,AC or Prated,c,TABC}

PCMAX\_H,f,c = PEMAX,c

where

 PEMAX,c is the value given by [either the *p-Max* IE or the field *additionalPmax* of the *NR-NS-PmaxList IE]*, whichever is applicable according to TS 38.331[7];

 Prated,c,AC is the rated maximum output power at maximum modulation order and full PRB configurations which is indicated by ATG UE capability [*RatedMOPATG*] for ATG UE with multiple omni-directional antennas not indicating the capability *antennaArrayType-r18*;

6.2J Transmitter power for ATG

6.2J.1 UE maximum output power for ATG

For the ATG UE, the rated output power is reported via UE capability maxOutputPowerATG-r18 at maximum modulation order reported by ATG UE and full PRB configurations within the channel bandwidth of NR carrier unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). UE capability *maxOutputPowerATG-r18* is an integer value in the range 23 to 40 dBm.

For ATG UE with multiple omni-directional antennas not indicating the capability *antennaArrayType-r18,* the maximum output powerPmax,c,AC shall remain within +2 dB and -2 dB of the rated output powerPrated,c,AC reported by the ATG UE.

For ATG UE with antenna array indicating the capability *antennaArrayType-r18,* the maximum output powerPmax,c,TABC shall remain within +2 dB and -2 dB of the rated output powerPrated,c,TABC reported by the ATG UE.Prated,c,TABC is the rated output power at maximum modulation order and full PRB configurations which is indicated by ATG UE capability *maxOutputPowerATG-r18* for ATG UE with antenna array indicating the capability *antennaArrayType-r18*.

## **<<Next Change>>**

7.1J General for ATG

Unless otherwise stated, the receiver characteristics are specified at the antenna connector(s) of the ATG UE with one or multiple omni-directional antenna(s) or at the *transceiver array boundary* (TAB) connectors of the ATG UE with the antenna array. The definition about *transceiver array boundary* (TAB) is specified in clause 4.3.2 of TS 38.104 [16].

For ATG UE with multiple omni-directional antennas not indicating the capability *antennaArrayType-r18*, the receiver RF requirements are defined on top of each antenna connector.

For ATG UE with antenna array indicating the capability *antennaArrayType-r18*, the receiver RF requirements are defined on top of each TAB connector.

## **<<Next Change>>**

## 7.3J Reference sensitivity for ATG

### 7.3J.1 General

For ATG UE with multiple omni-directional antennas not indicating the capability *antennaArrayType-r18,* the reference sensitivity power level REFSENS is the minimum mean power per polarization at antenna connector, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

For ATG UE with antenna array indicating the capability *antennaArrayType-r18,*the reference sensitivity power level REFSENS is the minimum mean power per polarization at TAB antenna connector, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

### 7.3J.2 Reference sensitivity power level

For a ATG UE(s) equipped with 2 Rx antenna connectors or one phase antenna array with two polarizations, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in Annex A.5.1.1) with parameters specified in Table 7.3.2-1a and Table 7.3.2-1b for the applicable operating bands.

For ATG UE(s) equipped with 4 Rx antenna connectors or two phase antenna arrays and each equipped with two polarizations, reference sensitivity for 2Rx antenna connectors or one phase antenna array with 2 polarizations shall be modified by the amount given in ΔRIB,4R in Table 7.3.2-2 for the applicable operating bands.

The reference sensitivity (REFSENS) requirement for a ATG UE shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2-3.

## **<<End of Change>>**