**3GPP TSG-RAN WG4 Meeting # 95-e *R4-2006104***

**Electronic Meeting, 25 May – 5 June 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **37.141** | **CR** | **0928** | **rev** | **1** | **Current version:** | **16.5.0** |  |
|  |
| *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 |  | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | CR to TS 37.141: Clarifications on test configurations for NB-IoT operation in NR in-band |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NB\_IOTenh3-Perf |  | ***Date:*** | 2020-05-15 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | 1) The phrase ‘in-band position closest to NR minimum guard band for NB-IoT operation in NR in-band’ may lead to interpretation that there would be ‘NR minimum guard band for NB-IoT operation in NR in-band’.2) The channel bandwidth and SCS of the NR carrier is not clearly specified in one bullet in TC22. |
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| ***Summary of change:*** | 1) Clarify the phrase to ‘RB for NB-IoT operation in NR in-band which is closest to NR minimum guard band GBChannel’.2) Clarify the channel bandwidth and SCS of the NR carrier in that bullet in TC22. |
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| ***Consequences if not approved:*** | Ambiguities remain and would lead to different interpretations. |
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| ***Clauses affected:*** | 4.8.21, 4.8.22, 4.8.23 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**<Start of change>**

4.8.21 TC21: Contiguous operation in CS16, 18, 19

4.8.21.0 General

The purpose of TC21, TC21a and TC21b is to test multi-RAT operations with NR.

Unless otherwise stated, for all test configurations in this clause, the narrowest supported NR channel bandwidth and lowest SCS for that bandwidth for the operating band shall be used in the test configuration.

Unless otherwise stated, the E-UTRA bandwidth shall be 5 MHz unless the BS does not support 5 MHz E-UTRA, in which case the E-UTRA bandwidth shall be the lowest supported bandwidth for the operating band.

4.8.21.1 TC21 generation

TC21 is only applicable for a BS that supports E-UTRA and NR. TC21 is constructed using the following method:

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth.

- Adjacent to the lower Base Station RF Bandwidth edge:

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band. Place the power boosted NB-IoT RB at the lower outermost eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) RB for NB-IoT operation in NR in-band which is closest to NR minimum guard band GBChannel at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported, place an NR carrier. The specified FOffset-RAT shall apply.

- Adjacent to the upper Base Station RF Bandwidth edge:

- If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.

- If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place an E-UTRA carrier. The specified FOffset-RAT shall apply.

- For transmitter tests, alternately add NR carriers at the low end and E-UTRA carriers at the high end adjacent to the already placed carriers until the Base Station RF Bandwidth is filled or the total number of supported carriers is reached. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

4.8.21.1A TC21a generation

TC21a is only applicable for a BS that supports GSM, E-UTRA and NR. TC21a is constructed using the following method:

For transmitter tests, if the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, two instances of TC21a shall be generated using the following values for rated total output power and the total number of supported carriers:

1) The rated total output power and the reduced number of supported carriers at the rated total output power in Multi-RAT operations

2) The reduced rated total output power at the total number of supported carriers in Multi-RAT operations and the total number of supported carriers.

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, tests that use TC21a shall be performed using both instances 1) and 2) of TC21a except tests for modulation accuracy in which only TC21a according to 2) shall be used.

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth.

- Adjacent to the lower Base Station RF Bandwidth edge:

- Place a GSM carrier.

- Adjacent to the upper Base Station RF Bandwidth edge:

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band. Place the power boosted NB-IoT RB at the upper outermost eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) RB for NB-IoT operation in NR in-band which is closest to NR minimum guard band GBChannel at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported:

- If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.

- If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place a GSM carrier. The specified FOffset-RAT shall apply. Place one E-UTRA carrier adjacent to the already placed GSM carrier. The specified FOffset-RAT shall apply.

- Place one NR carrier adjacent to the already placed carrier at the upper Base Station RF bandwidth edge.

- For transmitter tests, add GSM carriers at the lower edge using 600 kHz spacing until no more GSM carriers are supported or no more GSM carriers fit. Add alternately NR carriers and E-UTRA carriers at the high end adjacent to the already placed carriers until the Base Station RF Bandwidth is filled or the total number of supported carriers is reached. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

4.8.21.1B TC21b generation

TC21b is only applicable for a BS that supports UTRA, E-UTRA and NR. TC21b is constructed using the following method:

For transmitter tests, if the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, two instances of TC21b shall be generated using the following values for rated total output power and the total number of supported carriers:

1) The rated total output power and the reduced number of supported carriers at the rated total output power in Multi-RAT operations

2) The reduced rated total output power at the total number of supported carriers in Multi-RAT operations and the total number of supported carriers.

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, tests that use TC21b shall be performed using both instances 1) and 2) of TC21b.

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth.

- Adjacent to the lower Base Station RF Bandwidth edge:

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band. Place the power boosted NB-IoT RB at the lower outermost eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) RB for NB-IoT operation in NR in-band which is closest to NR minimum guard band GBChannel at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported, place an NR carrier. The specified FOffset-RAT shall apply.

- Adjacent to the upper Base Station RF Bandwidth edge:

- If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.

- If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place a E-UTRA carrier. The specified FOffset-RAT shall apply.

- Place UTRA carrier adjacent to the already placed E-UTRA carrier. The UTRA FDD may be shifted maximum 100 kHz towards lower frequencies to align with the channel raster.

- For transmitter tests, alternately add NR carriers at the low end and E-UTRA carriers at the high end adjacent to the already placed carriers until the Base Station RF Bandwidth is filled or the total number of supported carriers is reached. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

4.8.21.2 TC21 power allocation

a) Unless otherwise stated, set each carrier to the same power so that the sum of the carrier powers equals the rated total output power as appropriate for the test configuration according to manufacturer’s declarations in subclause 4.7.2

b) In case that TC21 is configured for testing modulation quality, the power allocated per carrier for the RAT on which modulation quality is measured shall be the highest possible for the given modulation configuration according to the manufacturer’s declarations in subclause 4.7.2, unless that power is higher than the level defined by case a). The power of the remaining carriers from other RAT(s) shall be set to the same level as in case a).

If in the case of b) the power of one RAT needs to be reduced in order to meet the manufacture’s declaration the power in the other RAT(s) does not need to be increased.

4.8.22 NTC21: Non-contiguous operation in CS16, 18, 19

4.8.22.0 General

The purpose of NTC21, NTC21a and NTC21b is to test multi-RAT operations with NR.

Unless otherwise stated, for all test configurations in this clause, the narrowest supported NR channel bandwidth and lowest SCS for that bandwidth shall be used in the test configuration.

Unless otherwise stated, the E-UTRA bandwidth shall be 5 MHz unless the BS does not support 5 MHz E-UTRA, in which case the E-UTRA bandwidth shall be the lowest supported bandwidth.

4.8.22.1 NTC21 generation

NTC21 is only applicable for a BS that supports E-UTRA and NR. NTC21 is constructed using the following method:

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth for non-contiguous operation. The Base Station RF Bandwidth consists of one sub-block gap and two sub-blocks located at the edges of the declared maximum Base Station RF Bandwidth.

- Adjacent to the lower Base Station RF Bandwidth edge:

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band. Place the power boosted NB-IoT RB at the lower outermost eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) RB for NB-IoT operation in NR in-band which is closest to NR minimum guard band GBChannel at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported, place an NR carrier. The specified FOffset-RAT shall apply.

- Adjacent to the upper Base Station RF Bandwidth edge:

- If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.

- If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place an E-UTRA carrier. The specified FOffset-RAT shall apply.

- The sub-block edges adjacent to the sub-block gap shall be determined using the specified FOffset-RAT for the carrier adjacent to the sub-block gap.

4.8.22.1A NTC21a generation

NTC21a is only applicable for a BS that supports GSM, E-UTRA and NR. NTC21a is constructed using the following method:

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, two instances of NTC21a shall be generated using the following values for rated total output power and the total number of supported carriers:

1) The rated total output power and the reduced number of supported carriers at the rated total output power in Multi-RAT operations

2) The reduced rated total output power at the total number of supported carriers in Multi-RAT operations and the total number of supported carriers.

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, tests that use NTC21a shall be performed using both instances 1) and 2) of NTC21a except:

1) Tests for modulation accuracy in which only NTC21a according to 2) shall be used.

2) If the reduced number of supported carriers is 6 or more, only instance 1) of NTC21a shall be used.

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth for non-contiguous operation. The Base Station RF Bandwidth consists of one sub-block gap and two sub-blocks located at the edges of the declared maximum Base Station RF Bandwidth.

- Adjacent to the lower Base Station RF Bandwidth edge:

- Place a GSM carrier at the lower RF Bandwidth edge. The specified FOffset-RAT shall apply. Place one GSM carrier adjacent to the upper sub-block edge of the lower sub-block and:

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band in the middle of the lower sub-block bandwidth and place the power boosted NB-IoT RB at the lower outermost eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) RB for NB-IoT operation in NR in-band which is closest to NR minimum guard band GBChannel.

- If NB-IoT operation in NR in-band is not supported, place NR carrier in the middle of the lower sub-block bandwidth.

- Adjacent to the upper Base Station RF Bandwidth edge:

- If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.

- If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place a GSM carrier. The specified FOffset-RAT shall apply.

- Place a GSM carrier adjacent to the lower sub-block edge of the upper sub-block. Place an E-UTRA carrier in the middle of the upper sub-block bandwidth.

- The nominal carrier spacing defined in subclause 4.5.1 shall apply. The sub-block edges adjacent to the sub-block gap shall be determined using the specified FOffset-RAT for the carrier adjacent to the sub-block gap.

4.8.22.1B NTC21b generation

NTC21b is only applicable for a BS that supports UTRA, E-UTRA and NR. NTC21b is constructed using the following method:

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, two instances of NTC21b shall be generated using the following values for rated total output power and the total number of supported carriers:

1) The rated total output power and the reduced number of supported carriers at the rated total output power in Multi-RAT operations

2) The reduced rated total output power at the total number of supported carriers in Multi-RAT operations and the total number of supported carriers.

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, tests that use NTC21b shall be performed using both instances 1) and 2) of NTC21b except if the reduced number of supported carriers is 4 or more, only instance 1) of NTC21b shall be used.

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth for non-contiguous operation. The Base Station RF Bandwidth consists of one sub-block gap and two sub-blocks located at the edges of the declared maximum Base Station RF Bandwidth.

- Adjacent to the lower Base Station RF Bandwidth edge:

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band. Place the power boosted NB-IoT RB at the lower outermost eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) RB for NB-IoT operation in NR in-band which is closest to NR minimum guard band GBChannel at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported, place an NR carrier. The specified FOffset-RAT shall apply.

- Adjacent to the upper Base Station RF Bandwidth edge:

- If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.

- If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place an E-UTRA carrier. The specified FOffset-RAT shall apply.

- Place a UTRA carrier adjacent to the lower sub-block edge of the upper sub-block.

- For transmitter tests, place one UTRA adjacent to the upper sub-block edge of the lower sub-block. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

- The sub-block edges adjacent to the sub-block gap shall be determined using the specified FOffset-RAT for the carrier adjacent to the sub-block gap. The carrier(s) may be shifted maximum 100 kHz towards higher frequencies to align with the channel raster.

4.8.22.2 NTC21 power allocation

a) Unless otherwise stated, set each carrier to the same power so that the sum of the carrier powers equals the rated total output power appropriate for the test configuration according to manufacturer’s declarations in subclause 4.7.2.

b) In case that NTC21 is configured for testing modulation quality, the power allocated per carrier for the RAT on which modulation quality is measured shall be the highest possible for the given modulation configuration according to the manufacturer’s declarations in subclause 4.7.2, unless that power is higher than the level defined by case a). The power of the remaining carriers from other RAT(s) shall be set to the same level as in case a).

If in the case of b) the power of one RAT needs to be reduced in order to meet the manufacture’s declaration the power in the other RAT(s) does not need to be increased.

4.8.23 TC22: Contiguous operation in CS17

4.8.23.1 TC22 generation

TC22 is constructed using the following method:

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth.

- Adjacent to the upper Base Station RF Bandwidth edge:

- Place a standalone NB-IoT carrier.

* Adjacent to the lower Base Station RF Bandwidth edge:

- If NB-IoT operation in NR in-band is supported, place a 5MHz / 15kHz SCS NR carrier with NB-IoT operation in NR in-band. Place the power boosted NB-IoT RB at the lower outermost eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) RB for NB-IoT operation in NR in-band which is closest to NR minimum guard band GBChannel at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply. Place a 5MHz E-UTRA carrier adjacent to the NR carrier.

- If NB-IoT operation in NR in-band is not supported and:

- If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier. Place the NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the lower Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the lower Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply. Place a 5MHz / 15kHz SCS NR carrier adjacent to the 10 MHz E-UTRA carrier.

- If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier. Place the NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply. Place a 5MHz / 15kHz SCS NR carrier adjacent to the 5 MHz E-UTRA carrier.

- If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place a 5MHz/15kHz SCS NR carrier. The specified FOffset-RAT shall apply. Place a 5 MHz E-UTRA carrier adjacent to the 5MHz / 15kHz SCS NR carrier.

- For transmitter tests, alternately add 5MHz E-UTRA carriers at the low end and NB-IoT standalone carriers at the high end adjacent to the already placed carriers until the Base Station RF Bandwidth is filled or the total number of supported carriers is reached. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

- If NR 5MHz and/or E-UTRA 5/10 MHz channel bandwidth is not supported, the narrowest carrier shall be selected. If 15kHz SCS is not supported for particular NR operating band, the smallest supported SCS declared per operating band shall be selected.

4.8.23.2 TC22 power allocation

Set the power of each carrier to the same power so that the sum of the carrier powers equals the rated total output power according to the manufacturer’s declaration in subclause 4.7.2.

**<End of change>**