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| **Program / Project Name:** | CA5G TM |
| **Checklist / Template Completed by:** | TBD |
| **Date Completed:** | Click here to enter a date. |

**3GPP TS 38.141-1**

V15.3.0 (2019-09)

Base Station(BS) coformance testing

Part 1: Conducted conformance testing

(Release 15)

**Detailed Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Editor(s)** | **Description of change** |
| 0.1 | 29-NOV-2019 | Sang-Gu Kang | Initial Draft |
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# Scope

본 문서는 무선 주파수 (RF) 테스트 방법 및 NR 기지국 (BS) Type 1-C 및 Type 1-H에 대한 적합성 요구 사항을 지정합니다. 이는 TS 38.104 [2]에 정의 된 NR BS 사양의 BS Type 1-C 및 BS Type 1-H에 대해 수행 된 요구 사항과 일치합니다.

BS Type 1-C는 전도 요구 사항만 가지고 있으므로 이 규격만 준수하면됩니다.

BS Type 1-H는 전도 및 방사 요구 사항을 모두 가지고 있으므로이 규격 및 TS 38.141-2의 해당 요구 사항을 준수해야합니다 [3].

BS Type 1-O 및 BS Type 2-O는 방사 요구 사항 만 있으므로 TS 38.141-2 [3] 만 준수하면됩니다.

# References

|  |  |
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| [1] | 3GPP TR 21.905: “Vocabulary for 3GPP Specifications” |
| [2] | 3GPP TS 38.104: “NR Base Station (BS) radio transmission and reception” |
| [3] | 3GPP TS 38.141-2: “NR, Base Station (BS) conformance testing, Part 2: Radiated conformance testing” |
| [4] | ITU-R Recommendation M.1545, "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000" |
| [5] | ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain" |
| [6] | IEC 60 721-3-3: "Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations" |
| [7] | IEC 60 721-3-4: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weather protected locations" |
| [8] | IEC 60 721: "Classification of environmental conditions" |
| [9] | IEC 60 068-2-1 (2007): "Environmental testing - Part 2: Tests. Tests A: Cold" |
| [10] | IEC 60 068-2-2: (2007): "Environmental testing - Part 2: Tests. Tests B: Dry heat" |
| [11] | IEC 60 068-2-6: (2007): "Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)" |
| [12] | ITU-R Recommendation SM.328: "Spectra and bandwidth of emissions" |
| [13] | Federal Communications Commission: "Title 47 of the Code of Federal Regulations (CFR)" |
| [14] | ECC/DEC/(17)06: "The harmonised use of the frequency bands 1427-1452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)" |
| [15] | 3GPP TR 25.942: "RF system scenarios" |
| [16] | 3GPP TS 38.212: "NR; Multiplexing and channel coding" |
| [17] | 3GPP TS 38.211: "NR; Physical channels and modulation" |
| [18] | 3GPP TS 38.214: "NR; Physical layer procedures for data" |
| [19] | 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification" |
| [20] | 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz" |
| [21] | 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone" |
| [22] | 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception" |

# Definitions, symbols and abbreviations

## Definitions

**aggregated BS channel bandwidth**: the RF bandwidth in which a Base Station transmits and receives multiple contiguously aggregated carriers. The aggregated BS channel bandwidth is measured in MHz

**antenna connector**: connector at the conducted interface of the BS type 1-C

**active transmitter unit**: transmitter unit which is ON, and has the ability to send modulated data streams that are parallel and distinct to those sent from other transmitter units to a BS type 1-C antenna connector, or to one or more BS type 1-H TAB connectors at the transceiver array boundary

**Base Station RF Bandwidth**: RF bandwidth in which a base station transmits and/or receives single or multiple carrier(s) within a supported operating band  
NOTE: In single carrier operation, the Base Station RF Bandwidth is equal to the BS channel bandwidth.

**Base Station RF Bandwidth edge**: frequency of one of the edges of the Base Station RF Bandwidth

**basic limit**: emissions limit relating to the power supplied by a single transmitter to a single antenna transmission line in ITU-R SM.329 [5] used for the formulation of unwanted emission requirements for FR1

**BS channel bandwidth**: RF bandwidth supporting a single NR RF carrier with the transmission bandwidth configured in the uplink or downlink  
NOTE 1: The BS channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.  
NOTE 2: It is possible for the BS to transmit to and/or receive from one or more UE bandwidth parts that are smaller than or equal to the BS transmission bandwidth configuration, in any part of the BS transmission bandwidth configuration.

**BS type 1-C**: NR base station operating at FR1 with requirements set consisting only of conducted requirements defined at individual antenna connectors

**BS type 1-H**: NR base station operating at FR1 with a requirement set consisting of conducted requirements defined at individual TAB connectors and OTA requirements defined at RIB

**BS type 1-O**: NR base station operating at FR1 with a requirement set consisting only of OTA requirements defined at the RIB  
NOTE: BS type 1-O conformance requirements are captured in TS 38.141-2 [3] and are out of scope of this specification.

**BS type 2-O**: NR base station operating at FR2 with a requirement set consisting only of OTA requirements defined at the RIB  
NOTE: BS type 2-O conformance requirements are captured in TS 38.141-2 [3] and are out of scope of this specification.

**channel edge**: lowest or highest frequency of the NR carrier, separated by the BS channel bandwidth

**carrier aggregation**: aggregation of two or more component carriers in order to support wider transmission bandwidths

**carrier aggregation configuration**: a set of one or more operating bands across which the BS aggregates carriers with a specific set of technical requirements

**contiguous carriers**: set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block

**contiguous spectrum**: spectrum consisting of a contiguous block of spectrum with no sub-block gap(s)

**highest carrier**: The carrier with the highest carrier frequency transmitted/received in a specified frequency band

**inter-band carrier aggregation**: carrier aggregation of component carriers in different operating bands  
NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

**Inter-band gap**: The frequency gap between two supported consecutive operating bands

**intra-band contiguous carrier aggregation**: contiguous carriers aggregated in the same operating band

**intra-band non-contiguous carrier aggregation**: non-contiguous carriers aggregated in the same operating band

**Inter RF Bandwidth gap**: frequency gap between two consecutive Base Station RF Bandwidths that are placed within two supported operating bands

**lowest carrier**: the carrier with the lowest carrier frequency transmitted/received in a specified frequency band

**lower sub-block edge**: frequency at the lower edge of one sub-block  
NOTE: It is used as a frequency reference point for both transmitter and receiver requirements.

**maximum carrier output power**: mean power level measured per carrier at the indicated interface, during the transmitter ON period in a specified reference condition

**maximum total output power**: mean power level measured within the operating band at the indicated interface, during the transmitter ON period in a specified reference condition

**measurement bandwidth**: RF bandwidth in which an emission level is specified

**multi-band connector**: antenna connector of the BS type 1-C or TAB connector of the BS type 1-H associated with a transmitter or receiver that is characterized by the ability to process two or more carriers in common active RF components simultaneously, where at least one carrier is configured at a different operating band than the other carrier(s) and where this different operating band is not a sub-band or superseding-band of another supported operating band

**multi-carrier transmission configuration**: set of one or more contiguous or non-contiguous carriers that a BS is able to transmit simultaneously according to the manufacturer's specification

**non-contiguous spectrum**: spectrum consisting of two or more sub-blocks separated by sub-block gap(s)

**operating band**: frequency range in which NR operates (paired or unpaired), that is defined with a specific set of technical requirements  
NOTE: The operating band(s) for a BS is declared by the manufacturer according to the designations in TS 38.104 [2], tables 5.2-1 and 5.2-2.

**Radio Bandwidth**: frequency difference between the upper edge of the highest used carrier and the lower edge of the lowest used carrier

**rated carrier output power**: mean power level associated with a particular carrier the manufacturer has declared to be available at the indicated interface, during the transmitter ON period in a specified reference condition

**rated total output power**: mean power level associated with a particular operating band the manufacturer has declared to be available at the indicated interface, during the transmitter ON period in a specified reference condition

**requirement set**: one of the NR base station requirement's set as defined for BS type 1-C, BS type 1-H, BS type 1-O, and BS type 2-O

**single-band connector**: antenna connector of the BS type 1-C or TAB connector of the BS type 1-H supporting operation either in a single operating band only, or in multiple operating bands but does not meet the conditions for a multi-band connector

**sub-band**: sub-band of an operating band contains a part of the uplink and downlink frequency range of the operating band

**sub-block**: one contiguous allocated block of spectrum for transmission and reception by the same base station  
NOTE: There may be multiple instances of sub-blocks within a Base Station RF Bandwidth.

**sub-block gap**: frequency gap between two consecutive sub-blocks within a Base Station RF Bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation

**superseding-band**: superseding-band of an operating band includes the whole of the uplink and downlink frequency range of the operating band

**TAB connector**: transceiver array boundary connector

**TAB connector RX min cell group**: operating band specific declared group of TAB connectors to which BS type 1-H conducted RX requirements are applied  
NOTE: Within this definition, the group corresponds to the group of TAB connectors which are responsible for receiving a cell when the BS type 1-H setting corresponding to the declared minimum number of cells with reception on all TAB connectors supporting an operating band, but its existence is not limited to that condition

**TAB connector TX min cell group**: operating band specific declared group of TAB connectors to which BS type 1-H conducted TX requirements are applied  
NOTE: Within this definition, the group corresponds to the group of TAB connectors which are responsible for transmitting a cell when the BS type 1-H setting corresponding to the declared minimum number of cells with transmission on all TAB connectors supporting an operating band, but its existence is not limited to that condition

**total RF bandwidth**: maximum sum of Base Station RF Bandwidths in all supported operating bands

**transceiver array boundary**: conducted interface between the transceiver unit array and the composite antenna

**transmitter OFF period**: time period during which the BS transmitter is not allowed to transmit

**transmitter ON period**: time period during which the BS transmitter is transmitting data and/or reference symbols

**transmitter transient period**: time period during which the transmitter is changing from the OFF period to the ON period or vice versa

**upper sub-block edge**: frequency at the upper edge of one sub-block  
NOTE: It is used as a frequency reference point for both transmitter and receiver requirements.

## Symbols

|  |  |
| --- | --- |
| β | Percentage of the mean transmitted power emitted outside the occupied bandwidth on the assigned channel |
| BWChannel | BS channel bandwidth |
| BWChannel\_CA | Aggregated BS channel bandwidth, expressed in MHz. BWChannel\_CA= Fedge\_high- Fedge\_low |
| BWChannel\_block | Sub-block bandwidth, expressed in MHz. BWChannel\_block = Fedge\_block\_high- Fedge\_block\_low |
| BWConfig | Transmission bandwidth configuration, expressed in MHz, where BWConfig = NRB x SCS x 12kHz |
| BWtot | Total RF bandwidth |
| ∆f | Separation between the channel edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency |
| ∆fmax | f\_offsetmax minus half of the bandwidth of the measuring filter |
| ∆FGlobal | Global frequency raster granularity |
| ∆FOBUE | Maximum offset of the operating band unwanted emissions mask from the downlink operating band edge |
| ∆fOOB | Maximum offset of the out-of-band boundary from the uplink operating band edge |
| ∆FRaster | Channel raster granularity |
| ∆SUL | Channel raster offset for SUL |
| FC | RF reference frequency on the channel raster |
| FC\_block\_high |  |
| FC\_block\_low |  |
| FC\_low |  |
| FC\_high |  |
| Fedge\_low |  |
| Fedge\_high |  |
| Fedge\_block\_low |  |
| Fedge\_block\_high |  |
| Foffset\_high |  |
| Foffset\_low |  |
| FDL\_low |  |
| FDL\_high |  |
| f\_offset |  |
| F\_offsetmax |  |
| FREF |  |
| FREF\_SUL |  |
| FDL\_low |  |
| FDL\_high |  |
| FUL\_low |  |
| FUL\_high |  |
| Iuant |  |
| Ncells |  |
| NRB |  |
| NREF |  |
| NRXU\_active |  |
| NRXU\_counted |  |
| NRXU\_countedpercell |  |
| NTXU\_counted |  |
| NTXU\_countedpercell |  |
| PEM\_n50\_ind |  |
| Pmax\_c\_AC |  |
| Pmax\_c\_cell |  |
| Pmax\_c\_TABC |  |
| Prated\_c\_AC |  |
| Prated\_c\_sys |  |
| Prated\_c\_TABC |  |
| Prated\_t\_AC |  |
| Prated\_t\_TABC |  |
| PREFSENS |  |
| SSREF |  |
| Wgap |  |

## Abbreviations

|  |  |
| --- | --- |
| AAS | Active Antenna System |
| ACLR | Adjacent Channel Leakage Ratio |
| ACS | Adjacent Channel Selectivity |
| AWGN | Additive White Gaussian Noise |
| BS | Base Station |
| BW | Bandwidth |
| CA | Carrier Aggregation |
| CACLR | Cumulative ACLR |
| CW | Continuous Wave |
| DM-RS | Demodulation Reference Signal |
| E-UTRA | Evolved UTRA |
| EVM | Error Vector Manitude |
| FDD | Frequency Division Duplex |
| FR | Frequency Range |
| GSCN | Global Synchronization Channel Number |
| ICS | In-Channel Selectivity |
| LA | Local Area |
| LNA | Low Noise Amplifier |
| MR | Medium Range |
| NR | New Radio |
| NR-ARFCN | NR Absolute Radio Frequency Channel Number |
| OBUE | Operating Band Unwanted Emissions |
| OTA | Over The Air |
| RDN | Radio Distribution Network |
| REFSENS | Reference Sensitivity |
| RF | Radio Frequency |
| RIB | Radiated Interface Boundary |
| RMS | Root Mean Square (value) |
| RS | Reference Signal |
| RX | Receiver |
| SCS | Sub-Carrier Spacing |
| SDL | Supplementary Downlink |
| SSB | Synchronization Signal Block |
| SUL | Supplementary Uplink |
| TAB | Transceiver Array Boundary |
| TAE | Time Alignment Error |
| TDD | Time Division Duplex |
| TX | Transmitter |

# General conducted test conditions and declarations

## Measurement uncertainties and test requirements

### General

이 절의 요구 사항은이 규격의 1 부에 적용되는 모든 시험, 즉 FR1에 대해 정의 된 모든 시험에 적용된다. 주파수 범위 FR1과 FR2는 TS 38.104 [2]의 5.1에 정의되어있다.

최소 요구 사항은 TS 38.104 [2] 및 그 참조에 제시되어있다. 본 문서에 명시 적으로 언급 된 수행 된 시험 요건에 대한 시험 공차는 본 문서의 annex C에 제공된다.

테스트 허용 오차는 각 테스트마다 개별적으로 계산된다. 테스트 허용 오차는 테스트 요구 사항을 작성하기 위해 최소 요구 사항을 완화하는 데 사용된다.

테스트 요구 사항이 해당 최소 요구 사항과 다른 경우 테스트에 적용된 테스트 허용 오차는 0이 아니다. 시험에 대한 시험 공차 및 시험 공차에 의해 최소 요건이 완화 된 방법에 대한 설명은 annex C에 주어져있다.

### Acceptable uncertainty of Test System

#### General

테스트 시스템의 최대 허용 불확도는 적절한 경우 본 명세서에서 명시 적으로 정의 된 각 테스트에 대해 아래에 명시되어있다. 참조로 포함 된 시험 요구 사항에 대한 시험 시스템의 최대 허용 불확도는 각 참조 시험 규격에 정의되어있다.

TAB 커넥터 당 요구 사항이 적용될 때 BS type 1-H의 경우 테스트 불확실성이 측정 된 값에 적용된다. TAB 커넥터 그룹에 대한 요구 사항이 적용되면 그룹의 각 TAB 커넥터에서 측정 된 전력의 합에 테스트 불확실성이 적용된다.

시험 시스템은 시험 케이스의 자극 신호가 규정 된 허용 오차 내에서 조정될 수 있도록하고 시험중인 장비가 규정 값을 초과하지 않는 불확실성으로 측정 될 수 있도록해야한다. 모든 공차 및 불확실성은 절대 값이며, 달리 명시되지 않는 한 신뢰 수준 95 %에 유효하다.

95 %의 신뢰 수준은 테스트 장비 모집단의 성능의 95 %를 포함하는 특정 측정에 대한 측정 불확실성 공차 구간이다.

RF 테스트의 경우 4.1.2의 불확실성이 공칭 50ohm 부하로 작동하는 테스트 시스템에 적용되며 DUT와 테스트 시스템 간의 불일치로 인한 시스템 영향은 포함되지 않는다.

#### Measurement of transmitter

**Table 4.1.2.2-1: Maximum Test System uncertainty for transmitter tests**

|  |  |  |
| --- | --- | --- |
| **Subclause** | **Maximum Test System Uncertainty** | **Derivation of Test System Uncertainty** |
| 6.2 Base Station output power | ±0.7dB, f ≤ 3GHz  ±1.0dB, 3GHz < f ≤ 6GHz (Note) |  |
| 6.3 Output power dynamics | ±0.4dB |  |
| 6.4.1 Transmit OFF power | ±2.0dB, f ≤ 3GHz  ±2.5dB, 3GHz < f ≤ 6GHz (Note) |  |
| 6.4.2 Transmitter transient period | N/A |  |
| 6.5.2 Frequency error | ±12Hz |  |
| 6.5.3 EVM | ±1% |  |
| 6.5.4 Time alignment error | ±25ns |  |
| 6.6.2 Occupied bandwidth | 5MHz, 10MHz BS Channel BW: ±100kHz  15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 50MHz BS Channel BW: ±300kHz  60MHz, 70MHz, 80MHz, 90MHz, 100MHz BS Channel BW: ±600kHz |  |
| 6.6.3 Adjacent Channel Leakage power Ratio (ACLR) |  |  |
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