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| **MINISTRY OF INFORMATION AND COMMUNICATIONS** | **SOCIALIST REPUBLIC OF VIETNAM** Independence - Freedom - Happiness |
|  |  |

Number: 17/2022/TT-BTTTT *Hanoi, November, 29th, 2022*

**CIRCULAR**

## Issue "National technical regulation on E-UTRA NB IoT User Equipment - Radio access"

*Pursuant to the Law on Standards and Technical Regulations dated June 29th, 2006;*

*Pursuant to the Telecommunications Law dated November 23rd, 2009;*

*Pursuant to the Law on Radio Frequency dated November 23rd, 2009;*

*Pursuant to Decree No. 127/2007/ND-CP dated August 1st, 2007 of the Government detailing and guiding the implementation of a number of articles of the Law on Standards and Technical Regulations;*

*Pursuant to Decree No. 78/2018/ND-CP dated May 16th, 2018 of the Government amending and supplementing a number of articles of Decree No. 127/2007/ND-CP dated August 1st, 2007* [*of*](https://thuvienphapluat.vn/van-ban/linh-vuc-khac/nghi-dinh-127-2007-nd-cp-huong-dan-luat-tieu-chuan-va-quy-chuan-ky-thuat-54148.aspx) *the Government regulating the implementation of a number of articles of the Law on Standards and Technical Regulations;*

*Pursuant to Decree No. 48/2022/ND-CP dated July 26th, 2022 of the Government regulating the functions, tasks, powers and organizational structure of the Ministry of Information and Communications;*

*At the request of the Director of the Department of Science and Technology,*

## *The Minister of Information and Communications promulgates a Circular regulating national technical regulation on E-UTRA NB IoT user equipment - Radio access*.

## Article 1. Issued together with this Circular is the National Technical Regulation on E-UTRA NB IoT user equipment - Radio access (QCVN 131:2022/BTTTT).

**Article 2 .** This Circular takes effect from July 1st, 2023 .

**Article 3 .** Chief of Office, Director of the Department of Science and Technology, Heads of agencies and units under the Ministry of Information and Communications, Directors of Departments of Information and Communications of provinces and central cities and organizations, relevant individuals are responsible for implementing this Circular./.

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| ***Recipients:***  - Prime Minister, Deputy Prime Ministers (to report);  - Ministries, ministerial-level agencies, and agencies under the Government;  - People's Committees of provinces and central cities;  - Department of Information and Information of provinces and central cities;  - Department of Legal Document Inspection (Ministry of Justice);  - Official Gazette, Government Electronic Information Portal;  - Ministry of Information and Communications: Minister and Deputy Ministers, agencies and units under the Ministry, the Ministry's Electronic Information Portal;  - Stored: VT, KHCN (250). | **MINISTER**  *(signed and sealed)*  **Nguyen Manh Hung** |



SOCIALIST REPUBLIC OF VIETNAM

**QCVN 131:2022/BTTTT**

**NATIONAL TECHNICAL REGULATION**

**ON E-UTRA NB IoT USER EQUIPMENT**

**RADIO ACCESS**

**HANOI - 2022**

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Preface

QCVN 131:2022/BTTTT compiled by the Institute of Postal Science and Technology, appraised by the Ministry of Science and Technology, approved by the Department of Science and Technology, and issued by the Ministry of Information and Communications together with Circular No.17/TT-BTTTT dated November, 29th, 2022.

**NATIONAL TECHNICAL REGULATION**

**ON E-UTRA NB IoT USER EQUIPMENT**

**- RADIO ACCESS**

# GENERAL RULES

## Scope

This regulation stipulates the technical requirements for the radio access of E-UTRA narrowband IoT user equipment operating on one or more frequencies specified in regulations in Table 1 and Vietnam's planned frequencies.

HS code of E-UTRA narrowband IoT use equipment applies according to Appendix B.

**Table 1 - Operating frequencies of E-UTRA narrowband IoT user equipment**

| **E-UTRA Frequency** | **Transmission direction**  **of UE** | **Operating frequencies of**  **E-UTRA narrowband IoT user equipment** |
| --- | --- | --- |
| 1 | Broadcast | 1 920 MHz - 1 980 MHz |
| Receive | 2 110 MHz - 2 170 MHz |
| 3 | Broadcast | 1 710 MHz - 1 785 MHz |
| Receive | 1 805 MHz - 1 880 MHz |
| 5 | Broadcast | 824 MHz - 835 MHz |
| Receive | 869 MHz - 880 MHz |
| 8 | Broadcast | 880 MHz - 915 MHz |
| Receive | 925 MHz - 960 MHz |
| 28 | Broadcast | 703 MHz - 733 MHz |
| Receive | 758 MHz - 788 MHz |

## Applicable subjects

This regulation applies to Vietnamese and foreign organizations and individuals that produce and trade user equipment within the scope of this regulation in the territory of Vietnam.

## References

ETSI TS 136 521-1 (V16.9.0) (March 2021): “LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing (3GPP TS 36.521-1 version 16.9.0 Release 16)”.

ETSI TS 136 508 (V16.8.0) (March 2021): “LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE) conformance testing (3GPP TS 36.508 version 16.8.0 Release 16)”.

ETSI TS 136 101 (V13.21.0) (March 2021): “LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 13.21.0 Release 13)”.

TCVN 7699-2-1 (IEC 60068-2-1), Environmental testing - Part 2-1: Tests - Test A: Cold.

TCVN 7699-2-2 (IEC 60068-2-2), Environmental testing - Part 2-2: Tests - Test B: Dry heat.

ETSI TS 137 544 (V16.1.0) (03-2021): "Universal Mobile Telecommunications System (UMTS); LTE; Universal Terrestrial Radio Access (UTRA) and Evolved UTRA (E-UTRA); User Equipment (UE) Over The Air (OTA) performance; Conformance testing (3GPP TS 37.544 version 16.1.0 Release 16)".

Recommendation ITU-R SM.329-12 (2012): "Unwanted emissions in the spurious domain".

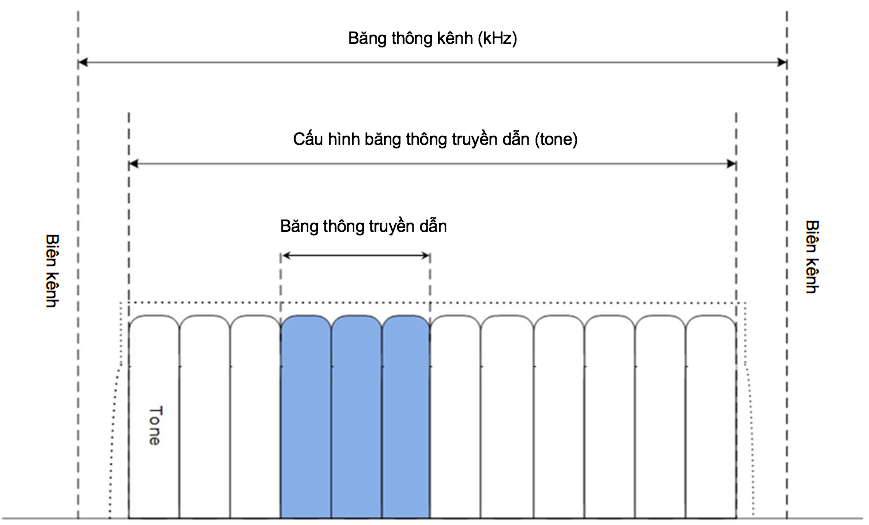
## Explanation of words

**1.4.1. Channel bandwidth**

The radio bandwidth supports E-UTRA radio frequency single carrier (in this regulation referred to as NB) with transmission bandwidth configured in the uplink or downlink of the cell.

NOTE 1: Channel bandwidth has a dimension of MHz and is used as a reference for transmitter and receiver requirements.

NOTE 2: The channel bandwidth and transmission bandwidth configuration for an NB carrier are described in Figure 1 according to ETSI TS 136 101.



**Figure 1- Channel bandwidth and NB transmission bandwidth configuration**

**1.4.2. Channel edge**

The lowest and highest frequency of the carrier, separated by the channel bandwidth.

**1.4.3. Maximum output power**

The average power level of each carrier of the UE measured at the antenna connector under specified reference conditions.

**1.4.4. Mean power**

When applied to NB radio transmission, average power is the power measured within the carrier's operating system bandwidth.

NOTE: The measurement time is assumed to be at least one subframe (1 ms), unless otherwise stated.

**1.4.5. Network signaled value**

Sent from the BS to the UE to indicate additional unwanted emission requests to the UE.

**1.4.6. Occupied bandwidth**

Is the width of the frequency band over which the average power radiated at frequencies lower than the lower bound and higher than the upper bound of that band is equal to a given percentage β/2 of the total average power of the emission.

**1.4.7. Operating band**

The frequency range is defined with a set of technical requirements within which the NB operates.

NOTE: Bands for NB are designated with Arabic numerals, the corresponding operating bands for NB are designated with Roman numerals.

**1.4.8. Output power**

The average power of a UE carrier transmitted to a load whose resistance is equal to the nominal impedance of the transmitter.

**1.4.9. Reference bandwidth**

The bandwidth at which the emission level is determined.

**1.4.10. Resource block**

The physical resource consists of a number of symbols in the time domain and a number of consecutive subcarriers spanning 180 kHz in the frequency domain.

**1.4.11. Sub-block**

Contiguous allocation blocks of frequency bands transmitted and received by the same UE, where there may be multiple instances of sub-blocks within a radio bandwidth.

**1.4.12. Transmission bandwidth**

Instantaneous transmission bandwidth from UE or BS, measured in resource block units.

**1.4.13. Transmission bandwidth configuration**

The highest transmission bandwidth allowed for uplink or downlink within a given channel bandwidth, measured in resource block units.

**1.4.14. Transmit diversity**

Transmit diversity is based on space-frequency block coding techniques along with time-shift-frequency diversity when four transmit antennas are used.

**1.4.15. E-UTRA NB IoT User Equipment**

NB IoT devices are designed to operate in E-UTRA bands.

## Symbol

|  |  |
| --- | --- |
| ΔfOOB | Δ Out-of-band emission frequency |
| BWChannel | Channel bandwidth |
| BWInterferer | Channel bandwidth of the noise source |
| F | Frequency |
| FInterferer (offset) | Frequency deviation of noise |
| FInterferer | Noise frequency |
| FIoffset | Frequency deviation of noise |
| FC | Center carrier frequency |
| FDL\_low | The lowest frequency of the downlink operating band |
| FDL\_high | Highest frequency of the downlink operating band |
| FUL\_low | The lowest frequency of the uplink operating band |
| FUL\_high | Highest frequency of the uplink operating band |
| NRB | Configure transmission bandwidth |
| PInterferer | Average modulation power of noise |
| PUMAX | Maximum Power The UE can reduce its power according to the modulation type, network symbology, and proximity to the band edge |
| Pwanted | NB signal power |

## Abbreviation

|  |  |  |
| --- | --- | --- |
| ACLR |  | Adjacent Channel Leakage Ratio |
| ACS |  | Adjacent Channel Selectivity |
| B.W |  | Band Width |
| CW |  | Continuous Wave |
| DCI |  | Downlink Control Information |
| DL |  | Down Link |
| EARFCN |  | E-UTRA Absolute Radio Frequency Channel Number |
| ERM |  | Electromagnetic compatibility and Radio spectrum Matters |
| EUT |  | Equipment Under Test |
| E-UTRA |  | Evolved UMTS Terrestrial Radio Access |
| GSM |  | Global System for Mobile |
| HARQ |  | Hybrid Acknowledge Request |
| IMT |  | International Mobile Telecommunications |
| MAC |  | Medium Access Control |
| MBW |  | Measurement Bandwidth |
| MOP |  | Maximum Output Power |
| NB IoT |  | Narrowband Internet of Things |
| OOB |  | Out Of Band |
| PDCCH |  | Physical Downlink Control Channel |
| PHICH |  | Physical Hybrid ARQ Indicator Channel |
| PUSCH |  | Physical Uplink Shared Channel |
| RB |  | Resource Block |
| RE |  | Resource Element |
| REFSENS |  | Reference sensitivity power level |
| RMC |  | Reference Measurement Channel |
| RNTI |  | Radio Network Temporary Identifier |
| RRC |  | Radio Resource Control |
| SS |  | System Simulator |
| TH |  | Temperature High |
| TH/VH |  | High extreme Temperature/High extreme Voltage |
| TH/VL |  | High extreme Temperature/Low extreme Voltage |
| TL |  | Temperature Low |
| TL/VH |  | Low extreme Temperature/High extreme Voltage |
| TL/VL |  | Low extreme Temperature/Low extreme Voltage |
| TPC |  | Transmitter Power Control |
| TRP |  | Total Radiated Power |
| UE |  | User Equipment |
| UL |  | Uplink |
| UMTS |  | Universal Mobile Telecommunications System |
| VH |  | Higher extreme Voltage |
| VL |  | Lower extreme Voltage |

# TECHNICAL REGULATIONS

## Environmental conditions

The technical requirements in this regulation apply to the operating environmental conditions of the equipment and must be declared by the manufacturer. The equipment must comply with all technical requirements of this regulation when operating within the boundary limits of published operating environmental conditions.

## Technical requirements

### Maximum output power of the generator

* + - 1. **Definition**

The following UE power classes define the maximum output power for any transmission bandwidth within the NB channel bandwidth.

For a subcarrier spacing of 3.75 kHz, the peak output power is defined as the average power over a period of at least one slot (2 ms) excluding the 2 304 Ts gap when the UE is not transmitting.

For a subcarrier spacing of 15 kHz, the peak output power is defined as the average power over a period of at least one subframe (1 ms).

* + - 1. **Limitation**

The UE's maximum output power must not exceed the values ​​at Table 2.

**Table 2 - UE power types**

| **NB band** | **Class 3 (dBm)** | **Tolerance (dB)** | **Category 5 (dBm)** | **Tolerance (dB)** |
| --- | --- | --- | --- | --- |
| 1 | 23 | ± 2.7 | 20 | ± 2.7 |
| 3 | 23 | ± 2.7 | 20 | ± 2.7 |
| 5 | 23 | ± 2.7 | 20 | ± 2.7 |
| 8 | 23 | ± 2.7 | 20 | ± 2.7 |
| 28 | 23 | ± 2.7 | 20 | ± 2.7 |

### Transmitter emission spectrum mask

* + - 1. **Definition**

The UE emission spectrum mask applies to frequencies ΔfOOB starting from ± the allocated NB channel bandwidth edge.

* + - 1. **Limitation**

The radiated power of any UE must comply according to the requirements at Table 3.

**Table 3 - UE NB emission spectrum mask**

| **ΔfOOB (kHz)** | **Emission spectrum limit (dBm)** | **Measurement bandwidth** |
| --- | --- | --- |
| ±0 | 24.5 | 30 kHz |
| ±100 | -3.5 | 30 kHz |
| ±150 | -6.5 | 30 kHz |
| ±300 | -27.5 | 30 kHz |
| ± 500 – 1 700 | -33.5 | 30 kHz |

### Transmitter spurious emissions

* + - 1. **Definition**

Transmitter spurious emissions are emissions created by unwanted effects of the transmitter such as: harmonic emissions, parasitic emissions, intermodulation components and frequency conversion components but do not include includes out-of-band emissions.

The spurious emission limits are specified in the general requirement clauses in accordance with recommendation ITU-R SM.329-12 and the UE NB operating band requirements.

To improve measurement accuracy, sensitivity, and efficiency, the resolution bandwidth can be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the measurement result must be integrated over the measurement bandwidth to obtain the equivalent noise bandwidth of the measurement bandwidth.

* + - 1. **Limitation**

Subtract the boundary between the outer band NBandfake domain fOOB = 1.7 MHz, when the UE is configured for NB uplink transmission the following limits applied:

Internal spurious emission limits Table 5 Applies to larger frequency rangesΔfOOB (MHz) at Table 4 calculated from the edge of the channel bandwidth.

The average power of measured spurious emissions for the general requirement shall not exceed the values ​​at Table 5.

**Table 4- The boundary ΔfOOB between the NB channel and the spurious emission region**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth** | **5MHz** | **10MHz** | **15 MHz** | **20MHz** |
| ΔfOOB (MHz) | 10 | 15 | 20 | 25 |

NOTE 1: For measurement conditions at the boundary of each frequency band, the lowest frequency of the measurement point in each frequency band is set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measuring point in each frequency range should be located at the highest boundary of the frequency range minus MBW/2. MBW is the symbol for the measurement bandwidth specified for the guard band.

**Table 5 - Limitations of spurious emissions**

| **Frequency range** | **Maximum levels** | **Measurement bandwidth** |
| --- | --- | --- |
| 9 kHz ≤ f < 150 kHz | -36 dBm | 1 kHz |
| 150 kHz ≤ f < 30 MHz | -36 dBm | 10 kHz |
| 30 MHz ≤ f < 1 GHz | -36 dBm | 100 kHz |
| 1 GHz ≤ f < 12.75 GHz | -30 dBm | 1MHz |

### Minimum output power of the generator

* + - 1. **Definition**

For the UE NB, the minimum output power transmits mono and polyphony over the channel bandwidth is -40 dBm.

For a subcarrier spacing of 3.75 kHz, the minimum output power is defined as the average power over a period of at least one slot (2 ms) excluding the 2 304 Ts gap when the UE is not transmitting. For a subcarrier spacing of 15 kHz, the minimum output power is defined as the average power per subframe (1 ms).

* + - 1. **Limitation**

The minimum output power does not exceed a value of -40 dBm for all NB channel bandwidths.

### The receiver's adjacent channel selectivity

* + - 1. **Definition**

The receiver's neighboring channel selectivity is a parameter that evaluates the receiver's ability to receive signals at the allocated frequency channel when there is the presence of neighboring channel signals at a given frequency offset from the frequency of the center of the allocated channel. ACS is the ratio of the receiver filter attenuation on the allocated channel frequency to the receiver filter attenuation on the adjacent channel(s).

* + - 1. **Limitation**

The UE must meet the minimum requirements specified in Table 6 for all values ​​of adjacent channel interference up to -25 dBm. However, it is not possible to measure ACS directly; instead, the lower and upper test parameter ranges are selected internally Table 6 whose throughput must be ≥ 95 % of the maximum throughput of the reference measurement channel defined in A.3.2 of ETSI TS 136 521-1.

**Table 6 - Measurement parameter for adjacent channel selectivity**

|  |  |  |
| --- | --- | --- |
| **Measurement parameter ACS1** | | |
| Interference | **GSM (GMSK)** | **E-UTRA** |
| NB signal power  (Pwanted)/dBm | REFSENS + 14 dB | |
| Noise signal power  (PInterferer)/dBm | REFSENS + 42 dB | REFSENS + 47 dB |
| Noise bandwidth | 200 kHz | 5MHz |
| Noise deviation from NB channel edge | ±200 kHz | ±2.5 MHz |
| **Measurement parameters ACS2** | | |
| Interference | **GSM (GMSK)** | **E-UTRA** |
| NB signal power  (Pwanted)/dBm | -53 dBm | -58 dBm |
| Noise signal power  (PInterferer)/dBm | -25 dBm | |
| Noise bandwidth | 200 kHz | 5MHz |
| Noise deviation from NB channel edge | ±200 kHz | ±2.5 MHz |

### Blocking characteristics of receivers

* + - 1. **Definition**

The blocking characteristic is a parameter that evaluates the ability of the receiver to receive a wanted signal at the allocated channel frequency in the presence of unwanted interference on frequencies other than these spurious response frequencies. or adjacent channel frequencies, without this unwanted input signal causing a decrease in the receiver's performance beyond a specified limit. The blocking criterion applies to all frequencies except those where spurious responses occur.

* + - 1. **Limitation**

With the parameters defined at Table 7, the throughput must be ≥ 95 % of the maximum throughput of the reference test channels as specified in A.2.2, A.2.3 and A.3.2, ETSI, TS 136 521-1 (with one side OCNG Pattern OP .1 FDD/TDD for DL ​​signal as described in A.5.1.1/A.5.2.1, ETSI, TS 136 521-1).

With the parameters defined at Table 8, the throughput must be ≥ 95 % of the maximum throughput of the reference test channels as specified in A.2.2, A.2.3 and A.3.2, ETSI, TS 136 521-1 (with one side OCNG Pattern OP .1 FDD/TDD for DL ​​signal as described in A.5.1.1/A.5.2.1, ETSI, TS 136 521-1), excluding spurious response frequencies.

For Table 8 in frequency bands 1, 2 and 3 up to max (24.6[NRB/6]) exceptions are allowed for spurious response frequencies in each allocated frequency channel when measuring using step size 1 MHz, where NRB is the number of resource blocks in the downlink transmission bandwidth configuration. For exceptions, the requirements specified in 2.2.7 is applicable.

**Table 7- In-band blocking parameters**

|  |  |
| --- | --- |
| **Measurement parameter IBB1** | |
| NB signal power  (Pwanted) / dBm | REFSENS + 6 dB |
| Interference | E-UTRA |
| Noise signal power  (PInterferer)/dBm | - 56 dBm |
| Noise bandwidth | 5MHz |
| Noise deviation from NB channel edge | +7.5 MHz + 0.005 MHz  and  -7.5 MHz - 0.005 MHz |
| **Measurement parameter IBB2** | |
| NB signal power  (Pwanted)/dBm | REFSENS + 6 dB |
| Interference | E-UTRA |
| Noise signal power  (PInterferer)/dBm | - 44 dBm |
| Noise bandwidth | 5MHz |
| Noise deviation from NB channel edge | from +12.5 MHz to FDL\_high + 15 MHz and  from -12.5 MHz to FDL\_low - 15 MHz |

**Table 8- Out-of-band blocking parameters**

| **Parameters** | **Unit** | **Frequency** | | |
| --- | --- | --- | --- | --- |
| **Band 1** | **Band 2** | **Band 3** |
| Pwanted | dBm | REFSENS + 6 dB | | |
| Pinterferer (CW) | dBm | -44 | -30 | -15 |
| F rangeinterferer | MHz | FDL\_low- 15 to FDL\_low - 60 | FDL\_low- 60 to FDL\_low - 85 | FDL\_low - 85 to 1 MHz |
| MHz | FDL\_high+ 15 to FDL\_high + 60 | FDL\_high+ 60 to FDL\_high + 85 | FDL\_high + 85 to 12 750 MHz |
| NOTE 1: For the downlink frequency range 729 MHz < f < 1 GHz in the operating band, the disturbance power level (PInterferer) for band 3 will have to be adjusted to -18 dBm at the frequency range limited by FDL\_low- 150 MHz of the smallest band supported by the UE in the frequency range 729 MHz < f < 1 GHz and FDL\_high+ 150 MHz of the largest frequency band UE supports in the frequency range 729 MHz < f < 1 GHz.  NOTE 2: For the downlink frequency range 1 805 MHz < f < 2 200 MHz in the operating band, the disturbance power level (PInterferer) for band 3 will have to be adjusted to -20 dBm at the frequency range limited by FDL\_low- 200 MHz of the smallest band the UE supports in the frequency range 1 805 MHz < f < 2 200 MHz and FDL\_high+ 200 MHz of the largest frequency band the UE supports in the frequency range 1 805 MHz < f < 2 200 MHz. | | | | |

### Spurious response of the receiver

* + - 1. **Definition**

Spurious response is a parameter that evaluates the ability of a receiver to receive a wanted signal at its assigned channel frequency without exceeding a given attenuation due to the presence of an unwanted CW interfering signal. at any other frequency, at which a response exists, i.e. for those frequencies the out-of-band blocking limit is determined at 2.2.6.2 not satisfied.

* + - 1. **Limitation**

Throughput must be ≥ 95 % of the maximum throughput of reference test channels according to regulations at A.2.2, A.2.3 and A.3.2, ETSI of TS 136 521-1 (with an OCNG Pattern OP.1 FDD/TDD dynamic surface for DL ​​signals as described in A.5.1.1/A .5.2.1, ETSI TS 136 521-1) with parameters at Table 9.

**Table 9 - Spurious response**

| **Parameters** | **Unit** | **Level** |
| --- | --- | --- |
| Psignal | dBm | REFSENS+ 6 |
| (CW) | dBm | -44 |
|  | MHz | Spurious response frequencies |
| Number of spurious response frequencies |  | 24 (in OOB ranges 1, 2, 3) |
| NOTES 1: Reference measurement channel determined in A.3.2, ETSI TS 136 521-1.  NOTE 2: REFSENS is defined in ETSI TS 136 521-1.  NOTE 3: OOB ranges 1, 2, 3 specified in Table 8. | | |

### Intermodulation characteristics of the receiver

* + - 1. **Definition**

Intermodulation response rejection is a parameter that evaluates the ability of a receiver to receive a wanted signal at the allocated channel frequency in the presence of two or more interfering signals with a specific frequency relationship to the signal desired.

* + - 1. **Limitation**

Throughput shall be ≥ 95 % of the maximum throughput of the reference test channels as specified in A.2.2, A.2.3 and A.3.2, ETSI TS 136 521-1 (with one OCNG Pattern OP. 1 FDD/TDD for DL ​​signal as described in A.5.1.1/A.5.2.1, ETSI TS 136 521-1) with parameters defined in Table 10 to the average power of the wanted signal is determined by the presence of two interfering signals.

**Table 10 - Measurement parameters for wideband intermodulation**

|  |  |
| --- | --- |
| **Broadband intermodulation measurement parameters** | |
| NB signal power | REFSENS + 12 dB |
| CW interference signal power | -46 dBm |
| E-UTRA interference signal power 1.4 MHz | -46 dBm |
| CW noise deviation | ±2.2 MHz |
| E-UTRA noise offset 1.4 MHz | ±4.4 MHz |

### Spurious emissions of receivers

* + - 1. **Definition**

Spurious emission power is the power of the emissions generated or amplified in the receiver appearing at the antenna connector of the UE.

* + - 1. **Limitation**

Spurious emission power does not exceed the maximum value specified in Table 11.

**Table 11 - General requirements for receiver’s spurious emissions**

| **Band frequency** | **Measurement bandwidth** | **Maximum levels** |
| --- | --- | --- |
| 30MHz≤f<1 GHz | 100 kHz | -57 dBm |
| 1 GHz≤f≤ 12.75 GHz | 1MHz | -47 dBm |
| NOTE: Unused PDCCH resources are buffered with resource groups with power levels given by PDCCH\_RA/RB as defined in C.3.1, ETSI TS 136 101. | | |

### Transmitter adjacent channel leakage power ratio

* + - 1. **Definition**

The adjacent channel leakage power ratio (ACLR) is the ratio of the filtered average power centered on the allocated channel frequency to the filtered average power centered on the adjacent channel frequency.

* + - 1. **Limitation**

Channel power and allocated NB adjacent channel power measured with filters and measurement bandwidths as specified in Table 12.

If the measured adjacent channel power is greater than -50 dBm, then the measured GSMACLR and W-CDMAACLR must be greater than the limits at Table 12 and meets the protection of GSM, W-CDMA and E-UTRA systems.

**Table 12 – ACLR measurement request for UE NB**

|  |  |  |
| --- | --- | --- |
|  | **GSM**ACLR | **W-CDMA**ACLR |
| **ACLR** | 19.2 dB | 36.2 dB |
| **Adjacent channel center frequency offset from NB channel edge** | ±200 kHz | ±2.5 MHz |
| **Adjacent channel measurement bandwidth** | 180 KHz | 3.84 MHz |
| **Measurement filter** | Rectangular | RRC filter |
| **NB channel measurement bandwidth** | 180 KHz | 180 KHz |
| **NB channel measurement filter** | Rectangular | Rectangular |

### Receiver reference sensitivity

Unless otherwise specified, the receiver characteristics are determined at the UE antenna connectors. For UE(s) with only a single integral antenna, one reference antenna(s) with a gain of 0 dBi is assumed for each antenna port.

* + - 1. **Definition**

Reference sensitivity evaluates the ability of the UE to receive data at a given average throughput for a specified reference test channel, under conditions of low signal level, ideal propagation environment and no there is noise.

A UE that cannot meet the throughput requirements above will effectively reduce the coverage of an e-NodeB.

* + - 1. **Limitation**

Throughput shall be ≥ 95 % of the maximum throughput of the reference test channels as defined in A.3.2.2, ETSI document TS 136 521-1 (with an OCNG Pattern OP.1 FDD/TDD dynamic side for DL signal as described in A.5.1.1/A.5.2.1, ETSI TS 136 521-1) with the parameters defined in Table 13.

**Table 13 – Reference sensitivity**

|  |  |
| --- | --- |
| **Operating frequency band** | **REFSENS (dBm)** |
| 1, 3, 5, 8, 28 | -107.5 |

### Total receiver radiation sensitivity

This technical requirement applies to UEs with dimensions greater than or equal to 56 mm and less than or equal to 72 mm.

* + - 1. **Definition**

The total radiation sensitivity is defined as follows:

Wherein, Effective Isotropic Sensitivity (EIS) is defined as the power at the antenna output, i.e. the sensitivity threshold achieved at each polarization. Ω is the azimuth angle, is the frequency. θ and φ are orthogonal polarization angles.

In which, N and M are the numbers of sampling intervals corresponding to θ and φ. the measuring angles. Sampling intervals are specified in 4.4 of ETSI TS 137 544.

TRS can be calculated from rayleigh fading three-dimensional isotropic medium measurements in an average uniform azimuth and elevation distribution. The calculation of TRS in this case is based on finding the lowest power received by the UE for a finite number of field combinations in the measurement chamber that produces a BER level better than the specified BER. By calibrating the average power transfer function, the absolute value of TRS can be obtained. The following formula is used to calculate TRS.

In which, Pref,n is the reference power conversion function for fixed measurement antenna; n, Rn is the reflection coefficient for fixed measurement antenna; n, Cn is the path loss in the cable connecting from the measurement receiver to the antenna fixed measuring n. These parameters are calculated from calibration measurements and are specified in B.2 of ETSI TS 137 544. is calculated using the following formula:

In which, is the mth value of the transfer function for fixed measuring antenna n, which gives the BER threshold. M is the total measured power value at the BER threshold for each fixed test antenna.

* + - 1. **Limitation**

The average measured total radiated sensitivity value of the low, medium and high channels for the handheld UE shall be less than the average TRS value specified in Table 14. Averaging must be done on a linear scale for the TRS results for the left and right sides of the model head. The average TRS limit is shown in the “Average” column of Table 14.

**Table 14 – Minimum TRS value limitation**

|  |  |  |
| --- | --- | --- |
| **Operating frequency band** | **Unit** | **<REFIor>** |
| **The average value** |
| 1 | dBm/10MHz | -86 |
| 3 | dBm/10MHz | -86 |
| 5 | dBm/10MHz | -86 |
| 8 | dBm/10MHz | -82.5 |
| 28 | dBm/10MHz | -82.5 |
| NOTE: Does not apply to combined waves. | | |

NOTE: TRS minimum requirements apply to equipment with dimensions greater than or equal to 56 mm and less than or equal to 72 mm as defined in ETSI TR 125 914.

### Total radiant power

This technical requirement applies to UEs with dimensions greater than or equal to 56 mm and less than or equal to 72 mm.

* + - 1. **Definition**

Total radiated power (TRP) is a measurement of the actual UE radiated power level. TRP is defined as the integral of the power transmitted in different directions over the entire radiation sphere:

In which: is the azimuth angle, f is the frequency.

θ and φ are orthogonal polarization angles.

and are the actual power level transmitted in the respective polarizations.

Therefore:

In which, N and M are the numbers of sampling intervals corresponding to θ and φ. are the measuring angles. Sampling intervals are specified in 4.4 of ETSI TS 137 544.

The TRP can be calculated from the Rayleigh fading patterns of the total power emitted from the UE. Measurement of transmitter power in an isotropic Rayleigh fading medium is based on sampling the UE's radiated power for a finite number of field combinations in the measurement chamber. The average value of the samples is statistically distributed corresponding to TRP and by adjusting the average power transfer function, from which the absolute value of TRP is calculated.

Therefore:

In which, is the reference power conversion function for fixed measurement antenna n, Rn is the reflection coefficient for fixed measurement antenna n, Cn is the path loss in the cable connecting from the measurement receiver to the antenna fixed measuring name n. These parameters are calculated from calibration measurements and are specified in B.2 of ETSI TS 137 544. are the average power values ​​measured by fixed antenna n and are calculated using the following formula:

In which, is the mth number of samples of the complex number conversion function measured by fixed measuring antenna n and M is the total number of measured samples for each fixed measuring antenna.

NOTE: All averages must be made using linear power values ​​(e.g. measurements in W).

* + - 1. **Limitation**

The average value of the measured total radiated power of the low, medium and high channels at the position next to the head must be greater than the value specified in Table 15. Averaging should be performed on a linear scale for the TRP results for the left and right sides of the prosthetic head.

**Table 15 – Minimum TRP value limit**

|  |  |  |
| --- | --- | --- |
| **Operating frequency band** | **Unit** | **Class 3 capacity** |
| **Average power (dBm)** |
| 1 | dBm/10MHz | 10.9 |
| 3 | dBm/10MHz | 10.9 |
| 5 | dBm/10MHz | 10.9 |
| 8 | dBm/10MHz | 7.6 |
| 28 | dBm/10MHz | 7.6 |
| NOTE: Does not apply to combined waves. | | |

NOTE: The minimum TRS requirement applies to UEs with dimensions greater than or equal to 56 mm and less than or equal to 72 mm as defined in ETSI TR 125 914.

### Emission of radiation

* + - 1. **Definition**

This criterion evaluates the ability to limit unwanted emissions from the housing port of radio communication equipment and auxiliary equipment.

This criterion applies to radio communication equipment and auxiliary equipment.

Measurement of this parameter shall be carried out on the radio communication equipment and/or on the typical configuration of the auxiliary equipment.

* + - 1. **Limitation**

The frequency margins and reference bandwidths for the detailed transitions of the limits between the requirements for out-of-band emissions and the requirements for spurious emissions are based on recommendations SM.329 -12 and SM.1539-1 of ITU-R.

The requirements in Table 16 apply only to frequencies in the spurious emission domain.

**Table 16 - Requirements for radiated spurious emissions**

|  |  |  |
| --- | --- | --- |
| **Frequency** | **Minimum requirements for (e.r.p)/idle reference bandwidth** | **Minimum requirements for (e.r.p)/reference bandwidth in traffic mode** |
| 30 MHz ≤ f < 1 000 MHz | -57 dBm/100 kHz | -36 dBm/100 kHz |
| 1 GHz ≤ f < 12.75 GHz | -47 dBm/1 MHz | -30 dBm/1 MHz |

### Control and monitoring functions

* + - 1. **Definition**

This requirement verifies that the UE's control and monitoring functions prevent the UE from transmitting in the absence of a valid network.

This criterion can be applied to radio communication equipment and auxiliary equipment.

Measurement of this parameter shall be carried out on the radio communication equipment and/or on the typical configuration of the auxiliary equipment.

* + - 1. **Limitation**

The maximum power measured during the test period shall not exceed -30 dBm.

# MEASUREMENT METHODS

## Environmental conditions

Testing is performed at representative limit points in the operating environment disclosed in the file.

Measurements must be performed under a full range of environmental conditions (within the published limits of the device's operating environment) to determine compliance with technical requirements.

Normally, the device should achieve all measurements using the conductivity method under normal conditions, unless otherwise specified. Guidance on the use of other conditions uses reference ETSI TS 136 521-1.

For each UE operating band, measurements are performed with the appropriate frequency defined in ETSI TS 136 508.

## Interpretation of measurement results

The results recorded in the measurement report for the measurements described in this regulation are as follows:

* The measured value is related to the corresponding limit used to decide whether the device meets the requirements of the standard or not;
* The measurement uncertainty value for the measurement of each parameter shall be included in the test report;
* For each measurement, the recorded value of the measurement uncertainty shall be less than or equal to the value given in Table 17 and Table 18. According to this standard, in measurement methods, the values ​​of measurement uncertainty must be calculated and must be equivalent to the expansion factor (coverage factor) k = 1.96 (for a confidence level of 95 % in case the distributions characterizing the actual measurement uncertainty are normal (Gaussian). The principles for calculating measurement uncertainty are presented in TR 100 028, special cases in Annex C of ETSI TR 100 028-2. Guidance on the use of other measuring conditions uses reference ETSI TS 136 521-1.

**Table 17 - Maximum measurement uncertainty of the test system**

| **Parameters** | **Conditions** | **Measurement uncertainty** |
| --- | --- | --- |
| Maximum output power of the generator |  | ±0.7 dB |
| Transmitter emission spectrum mask |  | ±1.5 dB |
| Transmitter spurious emissions | 9 kHz < f ≤ 4 GHz: ±2.0 dB  4 GHz < f ≤ 12.75 GHz: ±4.0 dB | ±2.0 dB  ±4.0 dB |
| Minimum output power of the generator |  | ±1.0 dB |
| Receiver adjacent channel selectivity (ACS) |  | ±1.1 dB |
| Receiver blocking characteristics | 1 MHz < finterferer≤ 3 GHz  3 GHz < finterferer≤ 12.75 GHz | ±1.3 dB  ±3.2 dB |
| Spurious response of the receiver | 1 MHz < finterferer≤ 3 GHz  3 GHz < finterferer≤ 12.75 GHz | ±1.3 dB  ±3.2 dB |
| Intermodulation characteristics of the receiver |  | ±1.4 dB |
| Receiver spurious emissions | 30 MHz ≤ f ≤ 4.0 GHz: ±2.0 dB  4 GHz < f ≤ 12.75 GHz: ±4.0 dB | ±2.0 dB  ±4.0 dB |
| Transmitter adjacent channel leakage power ratio |  | ±0.8 dB |
| Receiver reference sensitivity | f ≤ 4.0 GHz  4 GHz < f ≤ 12.75 GHz | ±0.7 dB  ±1.0 dB |

**Table 18 - Maximum measurement uncertainty for radiated emissions, control and monitoring functions**

| **Parameters** | **Measurement uncertainty** |
| --- | --- |
| Effective RF radiated power between 30 MHz and 180 MHz | ±6 dB |
| Effective RF radiated power between 180 MHz and 12.75 GHz | ±3 dB |
| Conducted RF power | ±1 dB |

NOTE 1: For RF measurements, it must be noted that the internal uncertainty Table 17 Applies to a test system operating with a nominal load of 50 Ω and does not take into account system effects due to mismatch between the EUT and the test system.

NOTE 2: If the test system has a measurement uncertainty greater than the measurement uncertainty specified in Table 17, the equipment may still be used, provided the following adjustments are made: Any additional uncertainties in the Test System beyond those specified in Table 17 can be used to tighten measurement requirements - making the measurement more difficult to pass (for some measurements, e.g. receiver measurements, this may require changing the excitation signals ). This procedure ensures that the measuring system does not meet the internal requirements Table 17, will not increase the likelihood of the EUT passing the measurements in the event that the EUT would be judged to fail if a measurement system that meets the requirements in Table 17.

## Measurement methods

### Maximum output power of the generator

* + - 1. **Initial conditions**

Test environment: Normal, TL/VL, TL/VH, TH/VL, TH/VH (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect the SS to the UE's antenna connector using only the UE's main Tx/Rx antenna.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set according to C.0, C.1 and C.3.0 and the uplink signals according to H.1, C.4.0 of ETSI TS 136 521-1.

4) UL reference measurement channels are established according to 6.2.2F4.1 of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure UE is in 2A-NB state with CIoT CP optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) SS sends uplink schedule information for each UL HARQ process via PDCCH DCI format N0 to C\_RNTI for arrangement to UL RMC according to Table 6.2.2F.1.4.1-1 of ETSI TS 136 521-1. Since the UE has no load and no loopback data to send, the UE sends uplink MAC buffer bits on the UL RMC (UE must be ready to transmit PUMAX after establishing the initial condition).

2) Measure the average power of the UE within the channel bandwidth of the radio access mode. The measurement time must be at least the continuous duration of one subframe (1\_ms) for 15 kHz subcarrier spacing or one slot (2 ms) excluding the 2 304 Ts gap when the UE does not transmit for 3.75 kHz subcarrier spacing. Half-duplex protection subframes are not tested.

NOTE: For configuration IDs applied to the UE depending on the Measurement Configuration Table with different UL subcarrier spacing, the SS releases the connection through the 3A-NB state and responds to the CP CioT optimization system at 2A-NB status according to 8.1.5 of TS 136 508 uses the appropriate UL subcarrier spacing in the Random Access Response message.

See detailed measurement method in 6.2.2F of ETSI TS 136 521-1.

### Transmitter emission spectrum mask

* + - 1. **Initial conditions**

Test environment: Normal (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect the SS to the UE's antenna connector using only the UE's main Tx/Rx antenna.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set according to C.0, C.1 and C.3.0 and the uplink signals according to H.1 and H.4.0 of ETSI TS 136 521-1.

4) UL referenced measurement channels are available Set according to 6.6.2.1F.4.1 of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure UE is in 2A-NB state with CIoT CP optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) SS sends uplink schedule information via NPDCCH DCI format N0 to C\_RNTI for arrangement to UL RMC according to Table 6.6.2.1F.4.1-1 of ETSI TS 136 521-1. Since the UE has no payload to send, the UE sends uplink MAC buffer bits on the UL RMC (UE must be ready to transmit PUMAX after establishing initial conditions).

2) Measure the UE's nominal power at the channel bandwidth in radio access mode according to the measurement configuration specified in Table 6.2.3F.5-1 of ETSI TS 136 521-1. The minimum measurement time is one subframe for 15 kHz channel spacing, andone slot (2 ms) excluding the 2 304 Ts interval when the UE is not transmitting for the 3.75 kHz channel spacing.

3) Measure the power of the transmitted signal with the following bandpass filter in Table 3. The center frequencies of the filter must pass through sequential steps in the same table. The measured power must be recorded for each step. During the measurement process, positive TS must be obtained.

NOTE: For configuration IDs applied to the UE depending on the Measurement Configuration Table with different UL subcarrier spacing, the SS releases the connection through the 3A-NB state and responds to the CP CioT optimization system at 2A-NB status according to 8.1.5 of TS 136 508 uses the appropriate UL subcarrier spacing in the Random Access Response message.

See detailed measurement methods in 6.6.2.1 of ETSI TS 136 521-1.

### Transmitter spurious emissions

* + - 1. **Initial conditions**

Test environment: Normal (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect the SS to the UE's antenna connector using only the UE's main Tx/Rx antenna.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set according to C.0, C.1 and C.3.0 and the uplink signals according to H.1, H.4.0 document ETSI TS 136 521-1.

4) UL reference measurement channels are established according to 6.6.3F.1.4.1 and 6.6.3F.2.4.1 of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure the UE is in 2A-NB state with CP CioT optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) SS sends uplink schedule information via NPDCCH DCI format N0 to C\_RNTI for arrangement to UL RMC according to Table 6.6.3F.1.4.1-1 of ETSI TS 136 521-1 or Table 6.6.3F.2.4 .1-1 (existing simultaneously) and with calendar type according to A.2 of ETSI TS 136 521-1. Since the UE has no payload to send, the UE sends uplink MAC buffer bits on the UL RMC (UE must be ready to transmit PUMAX after establishing the initial condition).

2) Measure the power of the signal with a filter of corresponding bandwidth. The center frequency of the filter must be set at successive steps corresponding to the tables. The measured power must be evaluated at each step. During the measurement, active time slots must be obtained.

NOTE: For configuration IDs applied to the UE depending on the Measurement Configuration Table with different UL subcarrier spacing, the SS releases the connection through the 3A-NB state and responds to the CP CioT optimization system at 2A-NB status according to 8.1.5 of TS 136 508 uses the appropriate UL subcarrier spacing in the Random access response message.

See detailed measurement methods in 6.6.3F.1 and 6.6.3F.2 of ETSI TS 136 521-1.

### Minimum output power of the generator

* + - 1. **Initial conditions**

Test environment: Normal, TL/VL, TL/VH, TH/VL, TH/VH (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect the SS to the UE's antenna connector using only the UE's main Tx/Rx antenna.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set according to C.0, C.1 and C.3.0 and the uplink signals according to H.1, H.3.0 of ETSI TS 136 521-1.

4) UL reference measurement channels are established according to 6.3.2F.4.1 of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure the UE is in 2A-NB state with CP CioT optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) SS sends uplink schedule information for each UL HARQ process via NPDCCH DCI format N0 to C\_RNTI for arrangement to UL RMC according to Table 6.3.2F.4.1-1 of ETSI TS 136 521-1. Since the UE has no load and no loopback data to send, the UE sends uplink MAC padding bits on the UL RMC.

2) Measure the nominal power of the UE at the channel bandwidth in radio access mode. The minimum measurement time is one subframe for 15 kHz channel spacing, andone slot (2 ms) excluding the 2 304 Ts interval when the UE is not transmitting for the 3.75 kHz channel spacing. Half-duplex protection frames are not tested.

NOTE: For configuration IDs applied to the UE depending on the Measurement Configuration Table with different UL subcarrier spacing, the SS releases the connection through the 3A-NB state and responds to the CP CioT optimization system at 2A-NB status according to 8.1.5 of TS 136 508 uses the appropriate UL subcarrier spacing in the Random access response message.

See detailed measurement method in 6.3.2 of ETSI TS 136 521-1.

### The receiver's adjacent channel selectivity

* + - 1. **Initial conditions**

Test environment: Normal (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect the SS to the UE antenna connector using only the UE main Tx/Rx antenna and note that the source of interference may be caused by the GSM or E-UTRA system.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set up according to C.0, C.1 and C.2 and NPUSCH format 2 is used to carry ACK/NACK on the uplink.

4) UL reference measurement channels are established according to 7.5F.4.1-1 of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure the UE is in 2A-NB state with CP CioT optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) SS transmits NPDSCH over NPDCCH DCI format N1 for C\_RNTI to transmit DL RMC specified in Table 7.5F.4.1-1 of ETSI TS 136 521-1. SS sends downlink MAC buffer bits on DL RMC. The UE will send back a HARQ response based on the information contained in the N1 format DCI.

2) Set the downlink signal level to the value specified for ACS1, GSM at Table 6.

3) Set the interference signal level to the value specified for ACS1, GSM at Table 6 with a frequency lower than the desired signal at Table 6 and uses a modulated interference bandwidth according to G.2 of ETSI TS 136 521-1.

4) Measure the average throughput over a period of time large enough to achieve statistical calculations according to G.2 of ETSI TS 136 521-1.

5) Repeat steps 2 to 4, applying the noise signal on the wanted signal in step 3.

6) Set the downlink signal level to the value specified for ACS1, E-UTRA at Table 6.

7) Set the interference signal level to the value specified for ACS1, E-UTRA at Table 6 with a frequency lower than the desired signal at Table 6 and uses a modulated interference bandwidth according to D.2 of ETSI TS 136 521-1.

8) Measure the average throughput over a period of time large enough to achieve statistical calculations according to D.2 of ETSI TS 136 521-1.

9) Repeat steps 6 to 8, applying the noise signal on the wanted signal in step 7.

10) Release the connection through State 3A-NB.

11) Adjust system information elements according to Table 7.5F.4.3-1 of ETSI TS 136 521-1 and notify the UE via a paging message including system information correction.

12) Ensure the UE is in 2A-NB state with the CP CioT optimization system according to 8.1.5 of ETSI TS 136 508, using the new UE power control settings.

13) SS transmits NPDSCH over NPDCCH DCI format N1 for C\_RNTI to transmit DL RMC specified in Table 7.5F.4.1-1 of ETSI TS 136 521-1. SS sends downlink MAC buffer bits on DL RMC. The UE will send back a response based on the information contained in the N1 format DCI.

14) Set the downlink signal level to the value specified for ACS2, GSM at Table 6. For steps 14 to 17 and 18 to 21, use message content for the exceptions specified in Table 7.5F.4.3-1 of ETSI TS 136 521-1.

15) Set the interference signal level to the value specified by ACS2, GSM at Table 6 with a frequency lower than the desired signal at Table 6 and use modulated noise of 5 MHz bandwidth according to D.2 of ETSI TS 136 521-1.

16) Measure the average throughput over a period of time large enough to achieve statistical calculations according to G.2 of ETSI TS 136 521-1.

17) Repeat steps 14 to 16, applying the noise signal on the wanted signal in step 15.

18) Set the downlink signal level to the value specified for ACS2, E-UTRA at Table 6.

19) Set the interference signal level to the value specified for ACS2, E-UTRA at Table 6 with a frequency lower than the desired signal at Table 6 and use modulated noise of 5 MHz bandwidth according to D.2 of ETSI TS 136 521-1.

20) Measure the average throughput over a period of time large enough to achieve statistical calculations according to G.2 of ETSI TS 136 521-1.

21) Repeat steps 18 to 20, using the noise signal on the wanted signal in step 19.

See detailed measurement methods in 7.5F.4 of ETSI TS 136 521-1.

### Receiver blocking characteristics

* + - 1. **Initial conditions**

Test environment: Normal (see Appendix A).

For both cases of in-band blocking and out-of-band blocking, the frequencies tested are: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect the SS to the UE's antenna connector using only the UE's main Tx/Rx antenna.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set up according to C.0, C.1 and C.2 and NPUSCH format 2 is used to carry ACK/NACK on the uplink.

4) Set up the DL reference measurement channels according to Table 7.6.1F.4.1-1 for in-band blocking and Table 7.6.2F.4.1-1 for out-of-band blocking of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure the UE is in 2A-NB state with CP CioT optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure in tape**

1) SS transmits NPDSCH over NPDCCH DCI format N1 for C\_RNTI to transmit DL RMC specified in Table 7.6.1F.4.1-1 of ETSI TS 136 521-1. SS sends downlink MAC buffer bits on DL RMC. The UE will send back a HARQ response based on the information contained in the N1 format DCI.

2) Set the downlink signal level as specified in Table 7.

3) Set the signal generator parameters for the interference signal below the wanted signal in case of IBB1 according to Table 7.

4) Measure the average throughput over a sufficient period of time to achieve statistical calculations according to G.2 document ETSI TS 136 521-1.

5) Repeat steps 3 to 4, using the noise signal above the desired signal level for case IBB1 in step 3.

6) Repeat steps 3 to 5, using the noise signal in case IBB1. The bands of the IBB2 case cover steps equal to the noise bandwidth. The measurement frequencies are selected similar to Table 7.6.1F.4.2-1 of ETSI TS 136 521-1.

See detailed measurement methods in 7.6.1F.4 of ETSI TS 136 521-1.

* + - 1. **Out-of-band measurement procedure**

1) SS transmits NPDSCH over NPDCCH DCI format N1 for C\_RNTI to transmit DL RMC specified in Table 7.6.2F.4.1-1 of ETSI TS 136 521-1. SS sends downlink MAC buffer bits on DL RMC. The UE will send back a HARQ response based on the information contained in the N1 format DCI.

2) Set the downlink signal level as specified in Table 8.

3) Set the signal generator parameters for the interference signal below the wanted signal in case of IBB1 according to Table 7.

2) SS sends uplink schedule information for each UL HARQ process via PDCCH DCI format 0 to C\_RNTI for arrangement to UL RMC according to Table 7.6.2.4.1-1 document ETSI TS 136 521-1. Since the UE has no payload data to send, the UE broadcasts uplink MAC buffer bits on the UL RMC.

3) Set the parameters of the CW signal generator for the interference signal at Table 8. The size of the frequency jump is 1 MHz.

4) Measure the average throughput over a sufficient period of time to achieve statistical calculations according to G.2 of ETSI TS 136 521-1.

5) Record the frequencies at which the measured throughput is unsatisfactory.

6) Repeat steps 3 to 5, using the noise signal above the desired signal level in step 3.

See detailed measurement methods in 7.6.2F.4 of ETSI TS 136 521-1.

### Spurious response of the receiver

* + - 1. **Initial conditions**

The initial conditions will be the same as for the out-of-band blocking characteristic at 3.3.6.2 to test the spurious response obtained at 3.3.6.3 under the same conditions.

* + - 1. **Measurement procedure**

1) SS transmits NPDSCH over NPDCCH DCI format N1 for C\_RNTI to transmit DL RMC specified in Table 7.6.2F.4.1-1 of ETSI TS 136 521-1. SS sends downlink MAC buffer bits on DL RMC. The UE will send back a HARQ response based on the information contained in the N1 format DCI.

2) Set the parameters of the CW signal generator for the following interference signal Table 9. The spurious frequencies are obtained from the results recorded at the last step of the measurement procedure 3.3.6.2.

3) Set the downlink signal level as specified in Table 9.

4) For spurious frequencies, measure the average throughput for a sufficient period of time to achieve statistical calculations according to G.2 of ETSI TS 136 521-1.

See detailed measurement methods in 7.7F.4 of ETSI TS 136 521-1.

### Intermodulation characteristics of the receiver

* + - 1. **Initial conditions**

Test environment: Normal (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect the SS to the UE's antenna connector using only the UE's main Tx/Rx antenna.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set up according to C.0, C.1 and C.2 and NPUSCH format 2 is used to carry ACK/NACK on the uplink.

4) Set up the DL reference measurement channels in Table 7.8.1F.4.1-1 of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure the UE is in 2A-NB state with CP CioT optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) SS transmits NPDSCH over NPDCCH DCI format N1 for C\_RNTI to transmit DL RMC specified in Table 7.8.1F.4.1-1 of ETSI TS 136 521-1. SS sends downlink MAC buffer bits on DL RMC. The UE will send back a HARQ response based on the information contained in the N1 format DCI.

2) Set the downlink signal level as specified in Table 10.

3) Set the parameters of the CW signal generator for the interference signal accordingly Table 10 and frequencies below the wanted signal level, using the modulation interference bandwidth as specified in Annex D of ETSI TS 136 521-1.

4) Measure the average throughput for a sufficient period of time to achieve statistical calculations according to G.2 of ETSI TS 136 521-1.

5) Repeat steps 2 to 4, using a noise signal below the desired signal level in step 3.

See detailed measurement methods in 7.8.1F.4 of ETSI TS 136 521-1.

### Receiver spurious emissions

* + - 1. **Initial conditions**

Test environment: Normal (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect a spectrum analyzer or other suitable device to the UE antenna connector. Use only the main UE Tx/Rx antenna according to Annex A of ETSI TS 136 508.

2) Set the cell parameters according to ETSI TS 136 508. 4.4.3.

3) Set up the initial downlink signals according to ETSI TS 136 521-1. C.0, C.1 and C.3.1.

4) Set up DL reference measurement channels according to ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure the UE is in 2A-NB state with CP CioT optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) Use a spectrum analyzer (or equivalent measuring device) to scan the frequency range from 30\_MHz to 12.75 GHz and measure the average power of spurious emissions.

2) Repeat step 1 for all UE E-UTRA Rx antennas.

3) Repeat for measurement frequencies, channel bandwidths and operating frequency ranges.

See detailed measurement method at 7.9F of ETSI TS 136 521-1.

### Transmitter adjacent channel leakage power ratio

* + - 1. **Initial conditions**

Test environment: Normal (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

Uplink/Downlink configuration: see ETSI TS 136 521-1:

1) Connect the SS to the UE's antenna connector using only the UE's main Tx/Rx antenna.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set according to C.0, C.1 and C.3.0 and the uplink signals according to H.1, H.4.0 of ETSI TS 136 521-1.

4) Set up UL reference measurement channels according to 6.6.2.3F.4.1-1 of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure the UE is in 2A-NB state with CP CioT optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) SS sends uplink schedule information for each UL HARQ process via NPDCCH DCI format N0 to C\_RNTI for arrangement to UL RMC according to Table 6.6.2.3F.4.1-1 of ETSI TS 136 521-1. Since the UE has no data payload to send, the UE broadcasts uplink MAC buffer bits on the UL RMC. (UE must be ready to transmit PUMAX after establishing initial conditions).

2) Measure the average power of the UE in the channel bandwidth of the radio access modes according to the test configurations, which must meet the requirements stated in Table 12. The minimum measurement time is one subframe for 15 kHz channel spacing, andone slot (2 ms) excluding the 2 304 Ts interval when the UE is not transmitting for the 3.75 kHz channel spacing.

3) Measure the average power of the rectangular filter for the UE NB channel.

4) Measure the average power of the rectangular filter for the GSM adjacent channel both upstream and downstream of the corresponding UE NB channel.

5) Measure the average filter power for the UTRA adjacent channel both upstream and downstream of the corresponding UE NB channel.

6) Calculate the power ratio between the values ​​measured in steps 3 and 4 for the upper and lower GSMACLR.

7) Calculate the power ratio between the values ​​measured in steps 3 and 5 for the upper and lower UTRAACLR1.

NOTE: For configuration IDs applied to the UE depending on the Measurement Configuration Table with different UL subcarrier spacing, the SS releases the connection through the 3A-NB state and responds to the CP CioT optimization system at 2A-NB status according to 8.1.5 of TS 136 508 uses the appropriate UL subcarrier spacing in the Random Access Response message.

See detailed measurement method in 6.6.2.3F of ETSI TS 136 521-1.

### Receiver reference sensitivity

* + - 1. **Initial conditions**

Test environment: Normal, TL/VL, TL/VH, TH/VL, TH/VH (see Appendix A).

Tested frequencies: The frequency range is specified in 1.1 of this regulation.

1) Connect the SS to the UE's antenna connector using only the UE's main Tx/Rx antenna.

2) Set the cell parameters according to 8.1.4.3 of ETSI TS 136 508.

3) The downlink signals are initially set up according to C.0, C.1 and C.3.0 and NPUSCH format 2 is used to carry ACK/NACK on the uplink.

4) Set up the DL reference measurement channels according to Table 7.3 F.1.4.1-1 of ETSI TS 136 521-1.

5) Propagation conditions are established according to B.0 of ETSI TS 136 521-1.

6) Ensure the UE is in 2A-NB state with CP CioT optimization system according to 8.1.5 of ETSI TS 136 508.

NOTE: Reference setup instructions for testing modes (setup, call and test) are specified in ETSI TS 136 521-1, ETSI TS 136 508 and ETSI TS 136 509 respectively.

* + - 1. **Measurement procedure**

1) SS transmits NPDSCH over NA format NPDCCH DCI for C\_RNTI to transmit DL RMC specified in Table 7.3F.1.4.1-1. SS sends downlink MAC buffer bits on DL RMC. The UE will send back a HARQ response based on the information contained in the N1 format DCI.

2) Set the downlink signal level to the REFSENS value specified in Table 13.

3) Measure the average throughput over a sufficient period of time to achieve statistical calculations according to G.2 of ETSI TS 136 521-1.

4) Repeat for measurement frequencies, channel bandwidths and operating frequency ranges.

See detailed measurement method in 7.3F.1.4 of ETSI TS 136 521-1.

### Total receiver radiation sensitivity

* + - 1. **Initial conditions**

Initial conditions specified in 7.1.5.4.1 of ETSI TS 137 544.

* + - 1. **Measurement procedure**

Measurement procedure specified in 7.1.5.4.2 of ETSI TS 137 544.

In cases the equipment supports adaptive features that allow dynamic adjustment of the user interaction radio transceiver block and TX power adjustment to achieve optimal performance in the operating area, the measurement sample must be representative to the equipment configuration used by users in that zone (which may include setting the MCC value or another parameter used in that zone).

* + - 1. **Measurement procedures, reflectivity chamber method**

Regulations in 7.1.5.4.3 of ETSI TS 137 544.

### Total radiant power

* + - 1. **Initial conditions**

Initial conditions specified in 6.1.5.4.1 of ETSI TS 137 544.

* + - 1. **Measurement procedure**

Measurement procedure specified in 6.1.5.4.2 of ETSI TS 137 544.

In cases where the device supports adaptive features that allow dynamic adjustment of the user interaction radio transceiver block and TX power adjustment to achieve optimal performance in the operating area, the measurement sample must be representative. represents the device configuration used by users in that zone (which may include setting the MCC value or another parameter used in that zone).

For devices that support transmit antenna switching using a multiple TX antenna system, TRP must be measured for each individual transmit antenna. Antennas with larger TRPs are used for pass/fail evaluation.

* + - 1. **Measurement procedures, reflectivity chamber method**

Regulations in 6.1.5.4.3 of ETSI TS 137 544.

### Radiation spurious emissions

* + - 1. **Measurement methods**

If possible, the test location shall be a completely anechoic chamber to simulate free space conditions. The EUT must be placed on a non-conductive support. The average power of any spurious emissions shall be determined by the test antenna and the measuring receiver (e.g. spectrum analyser).

At each frequency at which a component is determined, the EUT shall be rotated to achieve maximum response, and the effective radiated power (e.r.p) of that component determined by an alternative measurement, the This is the reference method. The measurement shall be repeated with the test antenna in the orthogonal polarization plane.

UNCLEPREFER: Effective radiated power (e.r.p) refers to the radiation of a half-wavelength tuned dipole antenna instead of an isotropic antenna. The constant difference between eirp and e.r.p is 2.15 dB.

e.r.p (dBm) = e.i.r.p (dBm) - 2.15

(Recommendation ITU-R SM.329-12, Annex 1).

Measurements are made with a tuned dipole antenna or a reference antenna with known gain referenced to an isotropic antenna.

It must be clearly stated in the test report if another test location or test method is used. The results must be converted to reference method values ​​and the validity of the conversion must be demonstrated.

* + - 1. **Measurement configuration**

This section specifies the following emission test configurations:

- The device must be tested under normal testing conditions;

- The test configuration must be as close as possible to the normal use configuration;

- If the device is part of a system, or can be connected to ancillary equipment, it is possible to test the device when it is connected to the minimum configuration of the auxiliary device to test the ports acceptable;

- If the device has multiple ports, number of ports must be selected enough to simulate real operating conditions and ensure that all different termination types are tested;

- The testing conditions, configuration and operating mode must be recorded in the test report;

- Connected ports in normal operation must be connected to an auxiliary device or a properly terminated representative cable to simulate the input/output characteristics of the auxiliary device, RF input/output ports must be properly terminated;

- Ports that are not connected to cables during normal operation, e.g. service connectors, programming connectors, temporary connectors... must not be connected to any cables during testing. If cables must be connected to these ports, or interconnect cables need to be extended to run the EUT, care should be taken to ensure that the EUT evaluation is not affected by the addition and extension of these cables.

Emission measurements must be performed in two operating modes:

- With an established communication link (traffic mode); and

- In idle mode.

### Control and monitoring functions

1) When starting the test, the UE must be turned off. The UE antenna connector must be connected to a power measuring device with the following characteristics:

- RF bandwidth must be larger than the total operating frequency range of the UE;

- The response time of the power measuring device must ensure that the measured power is no more than 1 dB compared to the measured power at steady state within 100 μs when a CW signal is applied.

- The device must record the measured peak power.

NOTE: The device may include a visual frequency low-pass filter to minimize the UE response to electrical spikes or to Gaussian noise peaks.

2) Turn on the UE for about 15 min, then turn off the UE.

3) The EUT is maintained off for at least 30 s, then switched on for approximately 1 min.

4) Record the maximum power radiated from the UE during the testing period.

# REGULATIONS ON MANAGEMENT

**4.1.** E-UTRA NB IoT user equipment within the scope of regulation specified in 1.1 must comply with the technical regulations in this Regulation.

**4.2.** Operating frequency of the device: Comply with regulations on management and use of radio frequencies in Vietnam.

**4.3.** Measuring devices and equipment: Comply with legal regulations on measurement.

# RESPONSIBILITIES OF ORGANIZATIONS AND INDIVIDUALS

Relevant organizations and individuals are responsible for implementing regulations on certification of conformity and declaration of conformity for E-UTRA narrowband IoT user equipment and are subject to inspection by state management agencies according to current regulations.

# IMPLEMENTATION ORGANIZATION

**6.1.** The Authority of Telecommunications and the Departments of Information and Communications are responsible for organizing, implementing, guiding and managing E-UTRA NB IoT user equipment according to this standard.

**6.2.** In case the regulations stated in this regulation are changed, supplemented or replaced, the provisions in the new document shall comply.

**6.3.** During the implementation of this Regulation, if any problems or difficulties arise, relevant organizations and individuals should report in writing to the Ministry of Information and Communications (Department of Science and Technology) for guidance and solutions./.

# Appendix A

**(Regulations)**

# Environmental conditions

**A.1. Introduce**

This Annex regulates the environmental conditions of the UE.

**A.2. Temperature**

The UE fully meets the temperature range requirements as shown in Table A.1.

**Table A.1 - Temperature conditions**

|  |  |
| --- | --- |
| **Temperature range** | **Condition** |
| From +15 °C to +35 °C | For normal conditions (with relative humidity up to 75 %) |
| From -10 °C to +55 °C | For critical conditions (see TCVN 7699-2-1 and TCVN 7699-2-2) |

Outside this temperature range, if power is on, the UE must not cause harmful effects to the radio frequency spectrum. In no case shall the UE exceed the transmit power levels as defined in ETSI TS 136 101 for critical conditions.

The reference for this requirement is E.1 of ETSI TS 136 101.

Some tests were performed under critical temperature conditions. These testing conditions are denoted as TL (Lower Critical Temperature, -10° C) and TH (Upper Critical Temperature, +55° C).

**A.3. Voltage**

The UE fully meets the voltage range requirements, i.e. the voltage range within the critical voltage points.

The manufacturer shall declare the lower and upper limit voltages and the approximate shutdown voltage. For equipment that may operate from one or more of the power sources listed below, the lower critical voltage shall not be higher and the upper critical voltage not lower than specified below.

**Table A.2 - Test voltage conditions**

| **Electricity supply** | **Critical voltage**  **lower border** | **Critical voltage**  **upper limit** | **Internal voltage**  **conditions**  **Normal** |
| --- | --- | --- | --- |
| Alternating power (AC) | 0.9 x Nominal | 1.1 x Nominal | Nominal |
| Lead acid batteries according to regulations | 0.9 x Nominal | 1.3 x Nominal | 1.1 x Nominal |
| Batteries not regulated: |  |  |  |
| Leclanché | 0.85 x Nominal | Nominal | Nominal |
| Lithium | 0.95 x Nominal | 1.1 x Nominal | 1.1 x Nominal |
| Mercury/Nickel and Cadmium | 0.90 x Nominal |  | Nominal |

Outside this voltage range, if the power is turned on, the UE must not cause harmful effects on the radio frequency spectrum. In no case shall the UE exceed the transmit power levels as defined in ETSI TS 136 101 for critical conditions. In particular, the UE must block all RF emissions when the supply voltage is below the manufacturer's declared shutdown voltage.

The standard reference for this requirement is E.2 of ETSI TS 136 101.

Some tests are performed under critical voltage conditions. These testing conditions are denoted as VL (Lower Critical Voltage) and VH (Upper Critical Voltage).

**A.4. Testing environment**

When testing under normal environmental conditions is required, the normal conditions in A.2 and A.3 applied.

When testing at extreme conditions is required, the combination of the extreme temperature and extreme voltage conditions in A.2 and A.3 applied. These combinations include:

* Lower Critical Temperature / Lower Critical Voltage (TL/VL);
* Lower Critical Temperature / Upper Critical Voltage (TL/VH);
* Upper Critical Temperature / Lower Critical Voltage (TH/VL);
* Upper Critical Temperature / Upper Critical Voltage (TH/VH).

# **Appendix B**

**(Regulations)**

HS code of E-UTRA NB IoT user equipment

|  |  |  |  |
| --- | --- | --- | --- |
| **TT** | **Name of products and goods according to QCVN** | **HS code** | **Description of products and goods** |
| 01 | E-UTRA NB IoT user equipment | 8517.14.00 | Land mobile user equipment using narrowband IoT technology |

# References

[1] ETSI EN 301 908-13 V13.2.1 (2022-02) - IMT cellular networks; Harmonized Standard covers the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE).

[2] ETSI EN 301 908-1 V15.1.1 (2021-09) - IMT cellular networks; Harmonized Standard covers the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 1: Introduction and common requirements.