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TECHNOLOGY ASPECTS

IAFI¹

UPDATES TO WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW
RECOMMENDATION ITU-R M.[IMT-2020.UNWANT.MS]

Generic unwanted emission characteristics of mobile stations using the terrestrial radio interface of IMT-2020

At the 44th meeting of Working Party (WP) 5D (Geneva, 12-22 June 2023), Sub-Working Group (SWG) OOBE elevated the preliminary draft revision status of Recommendations [ITU-R M.2070](#) to draft revision. The output document is available in Document [5/137](#).

This contribution proposes updates to the working document of preliminary draft new Recommendation ITU-R M.[IMT-2020.UNWANT.MS] to harmonize with text in the draft revision of Recommendation ITU-R M.2070.

To that end, updates are proposed in the following sections of working document towards a preliminary draft new Recommendation ITU-R M.[IMT-2020.UNWANT.MS]:

- scope
- considering
- noting
- recommends
- Table 1.1.1-1 is split into two tables: one table containing frequency bands identified for IMT in the RR and the other table containing frequency bands not identified for IMT in the RR
- Table 2.1.1-1 is also split into two tables in the same manner as how Table 1.1.1-1 is split.

The frequency bands 3 700-3 800 MHz and 6 425-7 125 MHz that are approved by WRC-23 as IMT bands have been taken into account.

The proposed changes are marked in the Attachment below and are highlighted in **grey**.

Attachment: 1

¹ ITU-APT Foundation of India is a sector member of ITU (<https://iafi.in>).

ATTACHMENT

WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW
RECOMMENDATION ITU-R M.[IMT-2020.UNWANT.MS]

**Generic unwanted emission characteristics of mobile stations using the
terrestrial radio interface of IMT-2020**

[Editor's note: This document is a compilation of input received to date. The document has not been reviewed and is not agreed by the Membership of ITU-R Working Party 5D.]

Scope

This Recommendation provides the generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-2020, suitable for establishing the technical basis for global circulation of IMT-2020 terminals. The information about unwanted emissions included in this Recommendation could also be used as guidance by Administrations for cases not specifically covered herein. Implementation of characteristics of mobile stations using the terrestrial radio interfaces of IMT-2020 in any of the bands included in this Recommendation is subject to compliance with the Radio Regulations.

Keywords

IMT-2020, emission characteristics, out-of-band, unwanted, mobile station

The ITU Radiocommunication Assembly,

considering

- a)* that unwanted emissions consist of both spurious and out-of-band (OoB) emissions according to No. **1.146** of the Radio Regulations (RR) and that spurious and OoB emissions are defined in RR Nos. **1.145** and **1.144**, respectively;
- b)* that limitation of the maximum permitted levels of unwanted emissions of IMT-2020 mobile stations (MSs) is necessary to protect other radio systems and services from interference and to enable coexistence between different technologies;
- c)* that too stringent limits may lead to an increase in size or in complexity of IMT-2020 radio equipment;
- d)* that every effort should be made to keep limits for unwanted emissions at the lowest possible values taking account of economic factors and technological limitations;
- e)* that Recommendation ITU-R SM.329 relates to the effects, measurements and limits to be applied to spurious domain emissions;
- f)* that the same spurious emission limits apply equally to MSs of all radio interfaces;
- g)* that Recommendation ITU-R SM.1541 relating to OoB emission specifies generic limits in the OoB domain which generally constitute the least restrictive OoB emission limits and encourages the development of more specific limits for each system;
- h)* that the levels of spurious emissions of IMT-2020 terminals shall comply with the limits specified in RR Appendix **3**;

- i) that Recommendation ITU-R M.1579 establishes the technical basis for global circulation of IMT MSs;
- j) that one of the basic requirements of global circulation is that the MS does not cause harmful interference in any country where it is taken;
- k) that the harmonization of unwanted emission limits will facilitate global use and access to a global market;
- l) that unwanted emission limits are dependent on the transmitter emission characteristics in addition to depending on services operating in other bands;
- m) that the technology used by a system and its conformance with the recommended specifications and standards in Recommendation ITU-R M.2150 defines that system as IMT-2020 regardless of the frequency band of operation,

noting

- a) the work carried out by standardization bodies to define limits to protect other radio systems and services from interference and to enable coexistence between different technologies;
- b) that IMT-2020 mobile stations must comply with local, regional, and international regulations for OoB and spurious emissions relevant to their operations, wherever such regulations apply;
- c) that the notes and annexes of this Recommendation – being based on the ongoing work in standardization bodies – in order to reflect the wide applicability of IMT-2020 technologies and to maintain consistency with the technology specifications, may contain material which reflects information related to the technology applications in bands other than those identified for IMT,

recommends

- 1 that the unwanted emission characteristics of IMT-2020 mobile stations should be based on the limits contained in the technology specific Annexes 1, and 3 which correspond to the terrestrial radio interface specifications referenced in recommends 1 of Recommendation ITU R M.2150;
- 2 that the unwanted emission characteristics of IMT-2020 mobile stations **in Annexes 1, 2 and 3 and X** should apply in Regions and countries in which corresponding bands are identified for IMT in the Radio regulations.

Annex 1: “3GPP 5G-SRIT”²

Annex 2: “3GPP 5G-RIT”³

Annex 3: “5Gi”⁴

Annex X: “DECT-2020 NR - RIT Component”

[Editor’s note: Annexes 1, 2 and 3 are to be provided by GCS proponents for Recommendation ITU-R M.[IMT-2020.SPECS].]

² Developed by 3GPP Proponent as “5G, Release 15 and beyond – LTE+NR SRIT”.

³ Developed by 3GPP Proponent as “5G, Release 15 and beyond – NR RIT”.

⁴ Developed by TSDSI as “5Gi RIT”.

Annex 1

3GPP 5G-SRIT

Source: Document [5D/1530](#)

3GPP 5G

The present Annex includes unwanted emission requirements from long-term evolution (LTE) and new radio (NR) Releases for Mobile Stations. In 3GPP terminology, the term Evolved-UMTS Terrestrial Radio Access (E-UTRA) is also used to signify the LTE radio interface.

This Annex is divided into four parts:

- Chapter 1 contains the E-UTRA MS unwanted emission requirements.
- Chapter 2 contains the NR range 1 standalone unwanted emission requirements.
- Chapter 3 contains the NR range 2 standalone unwanted emission requirements.
- Chapter 4 contains the NR range 1 and range 2 interworking operation with other radios.

Values specified in the present Annex incorporate test tolerances defined in Recommendation ITU R M.1545 [10].

1 Generic unwanted emission characteristics for E-UTRA

1.1 Operating bands and channel arrangements

1.1.1 Operating bands

E-UTRA is designed to operate in the FR1 operating bands defined in Table 1.1.1-1.

[Editor's Note: If a frequency band in the 3GPP NR operating band covers a larger frequency band than what is identified in the RR and Recommendation ITU-R M.1036, then the IMT identified band is listed in the table for IMT frequency band and the sub-bands that are not IMT identified are listed in the table for non-IMT bands. For example: NR band 41: 2 496-2 690 MHz is treated by listing 2 500-2 690 MHz in the table for IMT bands and 2 496-2 500 MHz is listed under NR band 41 in the table for non-IMT band]

TABLE 1.1.1-1

E-UTRA operating bands

E-UTRA Operating Band	Uplink (UL) operating band BS receive / UE transmit $F_{UL_low} - F_{UL_high}$	Downlink (DL) operating band BS transmit / UE receive $F_{DL_low} - F_{DL_high}$	Duplex Mode
1	1 920 MHz – 1 980 MHz	2 110 MHz – 2 170 MHz	FDD
2	1 850 MHz – 1 910 MHz	1 930 MHz – 1 990 MHz	FDD
3	1 710 MHz – 1 785 MHz	1 805 MHz – 1 880 MHz	FDD
4	1 710 MHz – 1 755 MHz	2 110 MHz – 2 155 MHz	FDD
5	824 MHz – 849 MHz	869 MHz – 894 MHz	FDD
6 ¹	830 MHz – 840 MHz	875 MHz – 885 MHz	FDD

E-UTRA Operating Band	Uplink (UL) operating band BS receive / UE transmit $F_{UL_low} - F_{UL_high}$	Downlink (DL) operating band BS transmit / UE receive $F_{DL_low} - F_{DL_high}$	Duplex Mode
7	2 500 MHz – 2 570 MHz	2 620 MHz – 2 690 MHz	FDD
8	880 MHz – 915 MHz	925 MHz – 960 MHz	FDD
9	1 749.9 MHz – 1 784.9 MHz	1 844.9 MHz – 1 879.9 MHz	FDD
10	1 710 MHz – 1 770 MHz	2 110 MHz – 2 170 MHz	FDD
11	1 427.9 MHz – 1 447.9 MHz	1 475.9 MHz – 1 495.9 MHz	FDD
12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD
13	777 MHz – 787 MHz	746 MHz – 756 MHz	FDD
14	788 MHz – 798 MHz	758 MHz – 768 MHz	FDD
15	Reserved	Reserved	FDD
16	Reserved	Reserved	FDD
17	704 MHz – 716 MHz	734 MHz – 746 MHz	FDD
18	815 MHz – 830 MHz	860 MHz – 875 MHz	FDD
19	830 MHz – 845 MHz	875 MHz – 890 MHz	FDD
20	832 MHz – 862 MHz	791 MHz – 821 MHz	FDD
21	1 447.9 MHz – 1 462.9 MHz	1 495.9 MHz – 1 510.9 MHz	FDD
22	3 410 MHz – 3 490 MHz	3 510 MHz – 3 590 MHz	FDD
23 ¹	2 000 MHz – 2 020 MHz	2 180 MHz – 2 200 MHz	FDD
24 ¹⁷	1 626.5 MHz – 1 660.5 MHz	1 525 MHz – 1 559 MHz	FDD
25	1 850 MHz – 1 915 MHz	1930 MHz – 1 995 MHz	FDD
26	814 MHz – 849 MHz	859 MHz – 894 MHz	FDD
27	807 MHz – 824 MHz	852 MHz – 869 MHz	FDD
28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD
29	NA	717 MHz – 728 MHz	FDD ²
30	2 305 MHz – 2 315 MHz	2350 MHz – 2360 MHz	FDD ¹⁵
31	452.5 MHz – 457.5 MHz	462.5 MHz – 467.5 MHz	FDD
32	NA	1 452 MHz – 1 496 MHz	FDD ²
33	1 900 MHz – 1 920 MHz	1 900 MHz – 1 920 MHz	TDD
34	2 010 MHz – 2 025 MHz	2 010 MHz – 2 025 MHz	TDD
35	1 850 MHz – 1 910 MHz	1 850 MHz – 1 910 MHz	TDD
36	1 930 MHz – 1 990 MHz	1 930 MHz – 1 990 MHz	TDD
37	1 910 MHz – 1 930 MHz	1 910 MHz – 1 930 MHz	TDD
38	2 570 MHz – 2 620 MHz	2 570 MHz – 2 620 MHz	TDD
39	1 880 MHz – 1 920 MHz	1 880 MHz – 1 920 MHz	TDD
40	2 300 MHz – 2 400 MHz	2 300 MHz – 2 400 MHz	TDD
41	2 496 MHz – 2 690 MHz	2 496 MHz – 2 690 MHz	TDD
42	3 400 MHz – 3 600 MHz	3 400 MHz – 3 600 MHz	TDD
43	3 600 MHz – 3 800 MHz	3 600 MHz – 3 800 MHz	TDD
44	703 MHz – 803 MHz	703 MHz – 803 MHz	TDD
45	1 447 MHz – 1 467 MHz	1 447 MHz – 1 467 MHz	TDD
46	5 150 MHz – 5 925 MHz	5 150 MHz – 5 925 MHz	TDD ^{8,9}

E-UTRA Operating Band	Uplink (UL) operating band BS receive / UE transmit $F_{UL_low} - F_{UL_high}$	Downlink (DL) operating band BS transmit / UE receive $F_{DL_low} - F_{DL_high}$	Duplex Mode
47	5 855 MHz – 5 925 MHz	5 855 MHz – 5 925 MHz	TDD ¹¹
48	3 550 MHz – 3 700 MHz	3 550 MHz – 3 700 MHz	TDD
50	1 432 MHz - 1 517 MHz	1 432 MHz - 1 517 MHz	TDD ¹³
51	1 427 MHz - 1 432 MHz	1 427 MHz - 1 432 MHz	TDD ¹³
...			
53	2 483.5 MHz - 2 495 MHz	2 483.5 MHz - 2 495 MHz	TDD
...			
64	Reserved	Reserved	FDD
65	1 920 MHz – 2 010 MHz	2 110 MHz – 2 200 MHz	FDD
66	1 710 MHz – 1 780 MHz	2 110 MHz – 2 200 MHz	FDD ⁴
67	NA	738 MHz – 758 MHz	FDD ²
68	698 MHz – 728 MHz	753 MHz – 783 MHz	FDD
69	NA	2570 MHz – 2 620 MHz	FDD ²
70	1695 MHz – 1710 MHz	1995 MHz – 2 020 MHz	FDD ¹⁰
71	663 MHz – 698 MHz	617 MHz – 652 MHz	FDD
72	451 MHz – 456 MHz	461 MHz – 466 MHz	FDD
73	450 MHz – 455 MHz	460 MHz – 465 MHz	FDD
74	1 427 MHz – 1 470 MHz	1 475 MHz – 1 518 MHz	FDD
75	NA	1 432 MHz – 1 517 MHz	FDD ²
76	NA	1 427 MHz – 1 432 MHz	FDD ²
85	698 MHz – 716 MHz	728 MHz – 746 MHz	FDD
87	410 MHz – 415 MHz	420 MHz – 425 MHz	FDD
88	412 MHz – 417 MHz	422 MHz – 427 MHz	FDD

NOTE 1 – Band 6, 23 is not applicable.

NOTE 2 – Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell.

NOTE 3 – A UE that complies with the E-UTRA Band 65 minimum requirements in this specification shall also comply with the E-UTRA Band 1 minimum requirements.

NOTE 4 – The range 2 180-2 200 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured.

NOTE 5 – A UE that supports E-UTRA Band 66 shall receive in the entire DL operating band

NOTE 6 – A UE that supports E-UTRA Band 66 and CA operation in any CA band shall also comply with the minimum requirements specified for the DL CA configurations CA_66B, CA_66C and CA_66A-66A.

NOTE 7 – A UE that complies with the E-UTRA Band 66 minimum requirements in this specification shall also comply with the E-UTRA Band 4 minimum requirements.

NOTE 8 – This band is an unlicensed band restricted to licensed-assisted operation using Frame Structure Type 3

NOTE 9 – In this version of the specification, restricted to E-UTRA DL operation when carrier aggregation is configured.

NOTE 10 – The range 2010-2020 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured and TX-RX separation is 300 MHz The range 2 005-2 020 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured and TX-RX separation is 295 MHz.

NOTE 11 This band is unlicensed band used for V2X communication. There is no expected network deployment in this band so Frame Structure Type 1 is used.

E-UTRA Operating Band	Uplink (UL) operating band BS receive / UE transmit $F_{UL_low} - F_{UL_high}$	Downlink (DL) operating band BS transmit / UE receive $F_{DL_low} - F_{DL_high}$	Duplex Mode
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NOTE 12 – A UE that complies with the E-UTRA Band 74 minimum requirements in this specification shall also comply with the E-UTRA Band 11 and Band 21 minimum requirements.

NOTE 13 – UE that complies with the E-UTRA Band 50 minimum requirements in this specification shall also comply with the E-UTRA Band 51 minimum requirements.

NOTE 14 – A UE that complies with the E-UTRA Band 75 minimum requirements in this specification shall also comply with the E-UTRA Band 76 minimum requirements.

NOTE 15 – Uplink transmission is not allowed at this band for UE with external vehicle-mounted antennas.

NOTE 16 – This band is restricted to licensed-assisted operation using Frame Structure Type 3

NOTE 17 – DL operation in this band is restricted to 1526 – 1536 MHz and UL operation is restricted to 1 627.5 – 1 637.5 MHz and 1 646.5 – 1 656.5 MHz.

The UE operating bands for E-UTRA carrier aggregation are defined in TS 36.101 [1] clause 5.5A.

The UE operating bands for E-UTRA UL-MIMO are defined in TS 36.101 [1] clause 5.5B.

The UE operating bands for E-UTRA dual connectivity are defined in TS 36.101 [1] clause 5.5C.

The UE operating bands for E-UTRA ProSe are defined in TS 36.101 [1] clause 5.5D.

The UE operating bands for UE category 0, UE category M1 and M2 and UE category 1bis are defined in TS 36.101 [1] clause 5.5E.

The UE operating bands for category NB1 and NB2 are defined in TS 36.101 [1] clause 5.5F.

The UE operating bands for V2X Communication are defined in TS 36.101 [1] clause 5.5G.

1.1.2 UE Channel bandwidth

The UE channel bandwidth for different E-UTRA bands are defined in TS 36.101-1 [1] clause 5.6.

The UE CA configurations and bandwidth combination sets are defined in TS 36.101-1 [1] clause 5.6A.

The UE channel bandwidth for UL-MIMO are defined in TS 36.101-1 [1] clause 5.6B.

The UE channel bandwidth for Dual Connectivity are defined in TS 36.101-1 [1] clause 5.6C.

The UE channel bandwidth for ProSe are defined in TS 36.101-1 [1] clause 5.6D.

The UE channel bandwidth for category NB1 and NB2 are defined in TS 36.101-1 [1] clause 5.6F.

The UE V2X configurations and bandwidth combination sets channel bandwidth are defined in TS 36.101-1 [1] clause 5.6G.

1.1.3 Channel arrangement

The UE channel spacing, channel raster, channel number and TX–RX frequency separation are defined in TS 36.101-1 [1] clause 5.7.1, 5.7.2, 5.7.3 and 5.7.4 respectively.

The UE channel spacing for CA, channel raster for CA and TX–RX frequency separation for CA are defined in TS 36.101-1 [1] clause 5.7.1A, 5.7.2A and 5.7.4A respectively.

The UE channel spacing for category NB1 and NB2, channel raster for category NB1 and NB2, channel number for category NB1 and NB2, and TX–RX frequency separation for category NB1 and NB2 are defined in TS 36.101-1 [1] clause 5.7.1F, 5.7.2F, 5.7.3F and 5.7.4A respectively.

The UE TX–RX frequency separation for category M1 and M2 are defined in TS 36.101-1 [1] clause 5.7.4E.

1.1.4 Void

1.1.5 Definitions, symbols and abbreviations

1.1.5.1 Definitions

Carrier aggregation: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

Carrier aggregation configuration: A combination of CA operating band(s) and CA bandwidth class(es) supported by a UE.

Channel bandwidth: The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

Inter-band carrier aggregation: Carrier aggregation of component carriers in different 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.

1.1.5.2 Symbols

F_{DL_low}	The lowest frequency of the downlink <i>operating band</i>
F_{DL_high}	The highest frequency of the downlink <i>operating band</i>
F_{UL_low}	The lowest frequency of the uplink <i>operating band</i>
F_{UL_high}	The highest frequency of the uplink <i>operating band</i>

1.1.5.3 Abbreviations

ACLR	Adjacent Channel Leakage Ratio
CA	Carrier Aggregation
DC	Dual Connectivity
DL	Downlink
E-UTRA	Evolved UTRA
FDD	Frequency division duplex
FR	Frequency Range
NR	New Radio
NS	Network Signalling
TDD	Time division duplex

UE	User equipment
UL	Uplink
UL MIMO	Uplink Multiple Antenna transmission
V2X	Vehicle to Everything

1.2 RF spectrum emissions

1.2.1 Out of band emission

1.2.1.1 Spectrum emission mask

The general E-UTRA spectrum emission mask limits are defined in TS 36.521-1 [5] clause 6.6.2.1.5.

The E-UTRA spectrum emission mask limits for CA are defined in TS 36.521-1 [5] clause 6.6.2.1A.1.5.

The E-UTRA spectrum emission mask limits for UL-MIMO are defined in TS 36.521-1 [5] clause 6.6.2.1B.5.

The E-UTRA spectrum emission mask limits for UE category 0 are defined in TS 36.521-1 [5] clause 6.6.2.1E.5.

The E-UTRA spectrum emission mask limits for UE category M1 are defined in TS 36.521-1 [5] clause 6.6.2.1EA.5.

The E-UTRA spectrum emission mask limits for UE 1bis are defined in TS 36.521-1 [5] clause 6.6.2.1EB.5.

The E-UTRA spectrum emission mask limits for UE M2 are defined in TS 36.521-1 [5] clause 6.6.2.1EC.5.

The E-UTRA spectrum emission mask limits for UE NB1 and NB2 are defined in TS 36.521-1 [5] clause 6.6.2.1EF.5.

The E-UTRA spectrum emission mask limits for V2X are defined in TS 36.521-1 [5] clause 6.6.2.1G.1.5.

The E-UTRA spectrum emission mask limits for V2X Communication /Sidelink simultaneous with E-UTRA uplink transmissions are defined in TS 36.521-1 [5] clause 6.6.2.1G.2.5.

The E-UTRA spectrum emission mask limits for V2X Communication / Intra-band contiguous MCC operation are defined in TS 36.521-1 [5] clause 6.6.2.1G.3.5.

The E-UTRA spectrum emission mask limits for for subslot/slot TTI are defined in TS 36.521-1 [5] clause 6.6.2.1_s.5.

1.2.1.2 Additional spectrum emission mask

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

The additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2.5.

The UL 64-QAM additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2_1.5.

The UL 256-QAM additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2.5.

The PUSCH frequency hopping additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2_3.5.

The CA additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2A.1.5.

The UL-MIMO additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2.5.

The UE category 0 additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2E.5.

The UE category M1 additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2EA.5.

The UE category 1bis additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2EB.5.

The UE category M2 additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2EC.5.

The UE category V2X additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2G.1.5.

The UE category V2X Communication / Sidelink simultaneous with E-UTRA uplink transmissions additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2G.2.5.

The UE subslot/slot TTI additional spectrum emission requirements for different network signalling labels are defined in TS 36.521-1 [5] clause 6.6.2.2_s.5.

1.2.1.3 Adjacent channel leakage ratio

Adjacent channel leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency.

The E-UTRA and UTRA ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3.5.1.

The HPUE ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3_1.5.

The Multi-Cluster PUSCH ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3_2.5.

The UL 64-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3_3.5.

The Multi-Cluster PUSCH with UL 64-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3_4.5.

The UL 256-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3_5.5.

The Multi-Cluster PUSCH with UL 256-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3_6.5.

The CA ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.1.5.

The CA (intra-band contiguous DL CA and UL CA) for UL 64-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.1_1.5.

The CA (intra-band contiguous DL CA and UL CA) for UL 256-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.1_2.5.

The CA (intra-band contiguous DL CA and UL CA) for HPUE ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.1_3.5.

The CA (inter-band DL CA and UL CA) ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.2.5.

The CA (inter-band DL CA and UL CA) for UL 64-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.2_1.5.

The CA (inter-band DL CA and UL CA) for UL 256-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.3_1.5.

The CA (intra-band non-contiguous DL CA and UL CA) ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.3.5.

The CA (intra-band non-contiguous DL CA and UL CA) for UL 64-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.3_1.5.

The CA (intra-band non-contiguous DL CA and UL CA) for UL 256-QAM ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.3_2.5.

The CA (3UL CA) ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.4.5.

The CA (4UL CA) ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3A.5.5.

The UL-MIMO ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3B.5.

The UE category 0 ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3E.5.

The UE category M1 ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3EA.5.

The UE category 1bis ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3EB.5.

The UE category M2 ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3EC.5.

The UE category NB1 and NB2 ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3F.5.

The NB1 and NB2/Power Class 6 ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3FA.5.

The V2X Communication ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3G.1.5.

The V2X Communication / Simultaneous E-UTRA V2X sidelink and E-UTRA uplink transmissions ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3G.2.5.

The V2X Communication / Intra-band contiguous multi-carrier operation ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3G.3.5.

The subslot/slot TTI ACLR requirements are defined in TS 36.521-1 [5]. Clause 6.6.2.3_s.5.

1.2.2 Transmitter spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329 [9] and NR operating band requirement to address UE co-existence.

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

1.2.2.1 Spurious emissions requirements

The general E-UTRA spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1.5.

The Multi-Cluster PUSCH spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1_1.5.

The CA (intra-band contiguous DL CA and UL CA) spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1A.1.5.

The CA (inter-band DL CA and UL CA) spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1A.2.5.

The CA (intra-band non-contiguous DL CA and UL CA) spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1A.3.5.

The CA (3UL CA) spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1A.4.1.5.

The CA (inter-band 3DL CA and 3UL CA) spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1A.4.2.5.

The CA (3UL CA) (intra-band non-contiguous 3DL CA and 3UL CA) spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1A.4.3.5.

The CA (4UL CA) spurious emission limits are defined in TS 36.521-1 [5] clause 6.6.3.1A.5.5.

1.2.2.2 Spurious emissions for UE co-existence

The co-existence requirements for the UE are release specific.

The general co-existence requirements up to Rel-16 can found in TS 36.521-1 [5]. Clause 6.6.3.2.5.

The co-existence requirements for CA (intra-band contiguous DL CA and UL CA) can found in TS 36.521-1 [5]. Clause 6.6.3.2A.1.5.

The co-existence requirements for CA (inter-band DL CA and UL CA) can found in TS 36.521-1 [5]. Clause 6.6.3.2A.2.5.

The co-existence requirements for CA (intra-band non-contiguous DL CA and UL CA) can found in TS 36.521-1 [5]. Clause 6.6.3.2A.3.5.

The co-existence requirements for CA (3UL CA) can found in TS 36.521-1 [5]. Clause 6.6.3.2A.4.5.

The co-existence requirements for CA (4UL CA) can found in TS 36.521-1 [5]. Clause 6.6.3.2A.5.5.

1.2.2.3 Additional spurious emissions

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

The additional spurious emission requirements for network signalling label "NS_04" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.1.

The additional spurious emission requirements for network signalling label "NS_05" are defined in TS 36.521-1 [5] clause 6.6.3.3.5.2.

The additional spurious emission requirements for network signalling label "NS_07" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.3-1.

The additional spurious emission requirements for network signalling label "NS_08" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.4-1.

The additional spurious emission requirements for network signalling label "NS_09" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.5-1.

The additional spurious emission requirements for network signalling label "NS_11" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.6-1.

The additional spurious emission requirements for network signalling label "NS_12" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.7-1.

The additional spurious emission requirements for network signalling label "NS_13" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.8-1.

The additional spurious emission requirements for network signalling label "NS_14" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.9-1.

The additional spurious emission requirements for network signalling label "NS_15" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.10-1.

The additional spurious emission requirements for network signalling label "NS_16" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.11-1.

The additional spurious emission requirements for network signalling label "NS_17" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.12-1.

The additional spurious emission requirements for network signalling label "NS_18" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.13-1.

The additional spurious emission requirements for network signalling label "NS_19" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.14-1.

The additional spurious emission requirements for network signalling label "NS_20" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.15-1.

The additional spurious emission requirements for network signalling label "NS_21" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.16-1.

The additional spurious emission requirements for network signalling label "NS_22" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.17-1.

The additional spurious emission requirements for network signalling label "NS_23" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.18-1.

The additional spurious emission requirements for network signalling label "NS_24" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.19-1.

The additional spurious emission requirements for network signalling label "NS_25" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.20-1.

The additional spurious emission requirements for network signalling label "NS_27" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.21-1.

The additional spurious emission requirements for network signalling label "NS_36" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.22-1.

The additional spurious emission requirements for network signalling label "NS_38" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.23-1.

The additional spurious emission requirements for network signalling label "NS_39" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.24-1.

The additional spurious emission requirements for network signalling label "NS_45" are defined in TS 36.521-1 [5] clause 6.6.3.3.5.25

The additional spurious emission requirements for network signalling label "NS_44" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.26-1.

The additional spurious emission requirements for network signalling label "NS_56" are defined in TS 36.521-1 [5] Table 6.6.3.3.5.27-1.

1.2.2.4 Additional spurious emissions for UL 64-QAM

The additional spurious emission requirements for UL 64-QAM are defined in TS 36.521-1 [5] clause 6.6.3.3_1.5.

1.2.2.5 Additional spurious emissions for UL 256-QAM

The additional spurious emission requirements for UL 256-QAM are defined in TS 36.521-1 [5] clause 6.6.3.3_2.5.

1.2.2.6 Additional spurious emissions for CA

The additional spurious emission requirements for CA (intra-band contiguous DL CA and UL CA) are defined in TS 36.521-1 [5] clause 6.6.3.3A.1.5.

The additional spurious emission requirements for CA (intra-band contiguous DL CA and UL CA) for UL 64-QAM are defined in TS 36.521-1 [5] clause 6.2.4A.1_1.5.

The additional spurious emission requirements for CA (intra-band contiguous DL CA and UL CA) for UL 256-QAM are defined in TS 36.521-1 [5] clause 6.2.4A.1_2.5.

The additional spurious emission requirements for CA (inter-band DL CA and UL CA) are defined in TS 36.521-1 [5] clause 6.6.3.3A.2.5.

The additional spurious emission requirements for CA (inter-band DL CA and UL CA) for UL 64-QAM are defined in TS 36.521-1 [5] clause 6.6.3.3A.2_1.5.

The additional spurious emission requirements for CA (inter-band DL CA and UL CA) for UL 256-QAM are defined in TS 36.521-1 [5] clause 6.6.3.3A.2_2.5.

The additional spurious emission requirements for CA (3UL CA) are defined in TS 36.521-1 [5] clause 6.6.3.3A.4.5.

The additional spurious emission requirements for CA (4UL CA) are defined in TS 36.521-1 [5] clause 6.6.3.3A.5.5.

1.2.3 Transmitter spurious emissions for UL-MIMO

The E-UTRA spurious emissions for UL-MIMO are defined in TS 36.521-1 [5] clause 6.6.3B.1.5.

The co-existence requirements for UL-MIMO are defined in TS 36.521-1 [5]. Clause 6.6.3B.2.5.

The additional spurious emissions requirements for UL-MIMO are defined in TS 36.521-1 [5]. Clause 6.6.3B.3.5.

1.2.4 Transmitter spurious emissions for UE category 0

The E-UTRA spurious emissions for UE category 0 are defined in TS 36.521-1 [5] clause 6.6.3E.1.5.

The co-existence requirements for UE category 0 are defined in TS 36.521-1 [5]. Clause 6.6.3E.2.5.

The additional spurious emissions requirements for UE category 0 are defined in TS 36.521-1 [5]. Clause 6.6.3E.3.5.

1.2.5 Transmitter spurious emissions for UE category M1

The E-UTRA spurious emissions for UE category M1 are defined in TS 36.521-1 [5] clause 6.6.3EA.1.5.

The co-existence requirements for UE category M1 are defined in TS 36.521-1 [5]. Clause 6.6.3EA.2.5.

The additional spurious emissions requirements for UE category M1 are defined in TS 36.521-1 [5]. Clause 6.6.3EA.3.5.

1.2.6 Transmitter spurious emissions for UE category 1bis

The E-UTRA spurious emissions for UE category 1bis are defined in TS 36.521-1 [5] clause 6.6.3EB.1.5.

The co-existence requirements for UE category 1bis are defined in TS 36.521-1 [5]. Clause 6.6.3EB.2.5.

The additional spurious emissions requirements for UE category 1bis are defined in TS 36.521-1 [5]. Clause 6.6.3EB.3.5.

1.2.7 Transmitter spurious emissions for UE category M2

The E-UTRA spurious emissions for UE category M2 are defined in TS 36.521-1 [5] clause 6.6.3EC.1.5.

The co-existence requirements for UE category M2 are defined in TS 36.521-1 [5]. Clause 6.6.3EC.2.5.

The additional spurious emissions requirements for UE category M2 are defined in TS 36.521-1 [5]. Clause 6.6.3EC.3.5.

1.2.8 Transmitter spurious emissions for UE category NB1 and NB2

The E-UTRA spurious emissions for UE category NB1 and NB2 are defined in TS 36.521-1 [5]. Clause 6.6.3EF.1.5.

The co-existence requirements for UE category NB1 and NB2 are defined in TS 36.521-1 [5]. Clause 6.6.3EF.2.5.

1.2.9 Transmitter spurious emissions for V2X

The spurious emissions for V2X Communication / Non-concurrent with E-UTRA uplink transmissions are defined in TS 36.521-1 [5]. Clause 6.6.3G.1.5.

The spurious emission band UE co-existence for V2X Communication / Non-concurrent with E-UTRA uplink are defined in TS 36.521-1 [5]. Clause 6.6.3G.1_1.5.

The spurious emission for V2X Communication / Sidelink simultaneous with E-UTRA uplink transmissions are defined in TS 36.521-1 [5]. Clause 6.6.3G.2.5.

The spurious emission band UE co-existence for V2X Communication / Sidelink simultaneous with E-UTRA uplink transmissions are defined in TS 36.521-1 [5]. Clause 6.6.3G.2_1.5.

The spurious emission for V2X Communication / Intra-band contiguous MCC operation are defined in TS 36.521-1 [5]. Clause 6.6.3G.3.5.

The spurious emission band UE co-existence for V2X Communication / Intra-band contiguous MCC operation are defined in TS 36.521-1 [5]. Clause 6.6.3G.3_1.5.

1.3 Receiver spurious emissions

The general receiver spurious emission requirements are defined in TS 36.521-1 [5]. Clause 7.7.5.

The general receiver spurious emission requirements with 4 Rx antenna ports are defined in TS 36.521-1 [5] clause 7.7_1.5.

The receiver spurious emission requirements for CA (intra-band contiguous DL CA and UL CA) are defined in TS 36.521-1 [5] clause 7.7A.1.5.

The receiver spurious emission requirements for CA (intra-band contiguous DL CA without UL CA) are defined in TS 36.521-1 [5] clause 7.7A.2.5.

The receiver spurious emission requirements for CA (inter-band DL CA without UL CA) are defined in TS 36.521-1 [5] clause 7.7A.3.5.

The receiver spurious emission requirements for CA (intra-band non-contiguous DL CA without UL CA) are defined in TS 36.521-1 [5] clause 7.7A.4.5.

The receiver spurious emission requirements for 3DL CA are defined in TS 36.521-1 [5] clause 7.7A.5.5.

The receiver spurious emission requirements for 4DL CA are defined in TS 36.521-1 [5] clause 7.7A.7.5.

The receiver spurious emission requirements for 5DL CA are defined in TS 36.521-1 [5] clause 7.7A.8.5.

The receiver spurious emission requirements for 6DL CA are defined in TS 36.521-1 [5] clause 7.7A.9.5.

The receiver spurious emission requirements for 7DL CA are defined in TS 36.521-1 [5] clause 7.7A.10.5.

The receiver spurious emission requirements for UL-MIMO are defined in TS 36.521-1 [5] clause 7.7B.5.

The receiver spurious emission requirements for ProSe Direct Discovery are defined in TS 36.521-1 [5] clause 7.7D.1.5.

The receiver spurious emission requirements for ProSe Direct Communication are defined in TS 36.521-1 [5] clause 7.7D.2.5.

The receiver spurious emission requirements for UE category 0 are defined in TS 36.521-1 [5] clause 7.7E.5.

The receiver spurious emission requirements for UE category M1 are defined in TS 36.521-1 [5] clause 7.7EA.5.

The receiver spurious emission requirements for UE category 1bis are defined in TS 36.521-1 [5] clause 7.7EB.5.

The receiver spurious emission requirements for UE category M2 are defined in TS 36.521-1 [5] clause 7.7EC.5.

The receiver spurious emission requirements for NB1 and NB2 are defined in TS 36.521-1 [5] clause 7.7F.5.

The receiver spurious emission requirements for V2X Communication / Non-concurrent with E-UTRA uplink transmissions are defined in TS 36.521-1 [5] clause 7.7G.1.5.

The receiver spurious emission requirements for V2X Communication / Simultaneous E-UTRA V2X sidelink and E-UTRA uplink transmissions are defined in TS 36.521-1 [5] clause 7.7G.2.5.

The receiver spurious emission requirements for V2X Communication / Intra-band contiguous multi-carrier operation are defined in TS 36.521-1 [5] clause 7.7G.3.5.

2 Generic unwanted emission characteristics for NR range 1 standalone

2.1 Operating bands and channel arrangements

Requirements throughout the RF specifications are in many cases defined separately for different frequency ranges (FR). The frequency ranges in which NR can operate according to this version of the specification are identified as described in Table 2.1-1.

TABLE 2.1-1

Definition of frequency ranges

Frequency range designation	Corresponding frequency range
FR1	410 MHz – 7 125 MHz
FR2	24 250 MHz – 52 600 MHz

2.1.1 Operating bands

NR is designed to operate in the FR1 operating bands defined in Table 2.1.1-1.

TABLE 2.1.1-1

NR operating bands in FR1

NR operating band	Uplink (UL) <i>operating band</i> BS receive / UE transmit $F_{UL_low} - F_{UL_high}$	Downlink (DL) <i>operating band</i> BS transmit / UE receive $F_{DL_low} - F_{DL_high}$	Duplex Mode
n1	1 920 MHz – 1 980 MHz	2 110 MHz – 2 170 MHz	FDD
n2	1 850 MHz – 1 910 MHz	1 930 MHz – 1 990 MHz	FDD
n3	1 710 MHz – 1 785 MHz	1 805 MHz – 1 880 MHz	FDD
n5	824 MHz – 849 MHz	869 MHz – 894 MHz	FDD
n7	2 500 MHz – 2 570 MHz	2 620 MHz – 2 690 MHz	FDD
n8	880 MHz – 915 MHz	925 MHz – 960 MHz	FDD
n12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD
n14	788 MHz – 798 MHz	758 MHz – 768 MHz	FDD

NR operating band	Uplink (UL) operating band BS receive / UE transmit $F_{UL_low} - F_{UL_high}$	Downlink (DL) operating band BS transmit / UE receive $F_{DL_low} - F_{DL_high}$	Duplex Mode
n20	832 MHz – 862 MHz	791 MHz – 821 MHz	FDD
n24 ¹⁶	1 626.5 MHz – 1 660.5 MHz	1 525 MHz – 1 559 MHz	FDD
n25	1 850 MHz – 1 915 MHz	1 930 MHz – 1 995 MHz	FDD
n26	814 MHz – 849 MHz	859 MHz – 894 MHz	FDD
n28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD
n29	N/A	717 MHz – 728 MHz	SDL
n30 ³	2 305 MHz – 2 315 MHz	2 350 MHz – 2 360 MHz	FDD
n34	2 010 MHz – 2 025 MHz	2 010 MHz – 2 025 MHz	TDD
n38 ¹⁰	2 570 MHz – 2 620 MHz	2 570 MHz – 2 620 MHz	TDD
n39	1 880 MHz – 1 920 MHz	1 880 MHz – 1 920 MHz	TDD
n40	2 300 MHz – 2 400 MHz	2 300 MHz – 2 400 MHz	TDD
n41	2 496 MHz – 2 690 MHz	2 496 MHz – 2 690 MHz	TDD
n46	5 150 MHz – 5 925 MHz	5 150 MHz – 5 925 MHz	TDD13
n47 ¹¹	5855 MHz – 5925 MHz	5 855 MHz – 5 925 MHz	TDD
n48	3550 MHz – 3700 MHz	3 550 MHz – 3 700 MHz	TDD
n51	1427 MHz – 1432 MHz	1 427 MHz – 1 432 MHz	TDD
n53	2483.5 MHz – 2495 MHz	2 483.5 MHz – 2 495 MHz	TDD
n65	1 920 MHz – 2 010 MHz	2 110 MHz – 2 200 MHz	FDD4
n66	1 710 MHz – 1 780 MHz	2 110 MHz – 2 200 MHz	FDD
n70	1 695 MHz – 1 710 MHz	1995 MHz – 2 020 MHz	FDD
n71	663 MHz – 698 MHz	617 MHz – 652 MHz	FDD
n74	1 427 MHz – 1 470 MHz	1 475 MHz – 1 518 MHz	FDD
n75	N/A	1 432 MHz – 1 517 MHz	SDL
n76	N/A	1 427 MHz – 1 432 MHz	SDL
n77 ¹²	3 300 MHz – 4 200 MHz	3 300 MHz – 4 200 MHz	TDD
n78	3 300 MHz – 3 800 MHz	3 300 MHz – 3 800 MHz	TDD
n79	4 400 MHz – 5 000 MHz	4 400 MHz – 5 000 MHz	TDD
n81	880 MHz – 915 MHz	N/A	SUL
n82	832 MHz – 862 MHz	N/A	SUL
n84	1920 MHz – 1 980 MHz	N/A	SUL
n95 ⁸	2 010 MHz – 2 025 MHz	N/A	SUL
n96 ¹⁴	5 925 MHz – 7 125 MHz	5 925 MHz – 7 125 MHz	TDD ¹³
n97 ¹⁵	2 300 MHz – 2 400 MHz	N/A	SUL
n98 ¹⁵	1 880 MHz – 1 920 MHz	N/A	SUL
n99 ¹⁶	1 626.5 MHz – 1 660.5 MHz	N/A	SUL
n100	874.4 MHz – 880 MHz	919.4 MHz – 925 MHz	FDD
n101	1 900 MHz – 1 910 MHz	1 900 MHz – 1 910 MHz	TDD
n102¹⁴	5 925 MHz – 6 425 MHz	5 925 MHz – 6 425 MHz	FDD¹³
n104 ^{17,18}	6 425 MHz – 7 125 MHz	6 425 MHz – 7 125 MHz	TDD

NR operating band	Uplink (UL) <i>operating band</i> BS receive / UE transmit $F_{UL_low} - F_{UL_high}$	Downlink (DL) <i>operating band</i> BS transmit / UE receive $F_{DL_low} - F_{DL_high}$	Duplex Mode
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NOTE 1 – UE that complies with the NR Band n50 minimum requirements in this specification. Shall also comply with the NR Band n51 minimum requirements.

NOTE 2 – UE that complies with the NR Band n75 minimum requirements in this specification. Shall also comply with the NR Band n76 minimum requirements.

NOTE 3 – Uplink transmission is not allowed at this band for UE with external vehicle-mounted antennas.

NOTE 4 – A UE that complies with the NR Band n65 minimum requirements in this specification shall also comply with the NR Band n1 minimum requirements.

NOTE 5 – FFS.

NOTE 6 – A UE that supports NR Band n66 shall receive in the entire DL operating band.

NOTE 7 – A UE that supports NR Band n66 and CA operation in any CA band shall also comply with the minimum requirements specified for the DL CA configurations CA_n66B and CA_n66(2A) in the current version of the specification.

NOTE 8 – This band is applicable in China only.

NOTE 9 – FFS.

NOTE 10 – When this band is used for V2X SL service, the band is exclusively used for NR V2X in particular regions.

NOTE 11 – This band is unlicensed band used for V2X service. There is no expected network deployment in this band.

NOTE 12 – In the USA this band is restricted to 3 450-3 550 MHz and 3 700-3 980 MHz.

NOTE 13 – This band is restricted to operation with shared spectrum channel access as defined in TS 37.213.

NOTE 14 – This band is applicable in the USA only subject to FCC Report and Order FCC 20-51

NOTE 15 – The requirements for this band are applicable only where no other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area. For scenarios where other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NOTE 16 – DL operation in this band is restricted to 1 526-1 536 MHz and UL operation is restricted to 1 627.5-1 637.5 MHz and 1 646.5-1 656.5 MHz.

NOTE 17 – For this band, CORESET#0 values from Table 13-5 or Table 13-6 in TS 38.213 are applied regardless of the minimum channel bandwidth.

NOTE 18 – [This band is applicable only to RCC countries in accordance with RCC Recommendation 1/21]

The UE operating bands for CA are defined in TS 38.101-1 [1] clause 5.2A.

The UE operating bands for DC are defined in TS 38.101-1 [1] clause 5.2B.

The UE operating band combination for SUL are defined in TS 38.101-1 [1] clause 5.2C.

The UE operating band combination for UL MIMO are defined in TS 38.101-1 [1] clause 5.2D.

The UE operating band combination for V2X are defined in TS 38.101-1 [1] clause 5.2E.

2.1.2 UE Channel bandwidth

The UE channel bandwidth for different NR bands are defined in TS 38.101-1 [1] clause 5.3.

The UE channel bandwidth for CA are defined in TS 38.101-1 [1] clause 5.3A.

The UE channel bandwidth for V2X are defined in TS 38.101-1 [1] clause 5.3E.

2.1.3 Channel arrangement

The UE channel arrangement i.e. channel spacing, channel raster, synchronization raster and TX–RX frequency separation are defined in TS 38.101-1 [1] clause 5.4.

The UE channel arrangement for CA are defined in TS 38.101-1 [1] clause 5.4A.

The UE channel arrangement for V2X are defined in TS 38.101-1 [1] clause 5.4.

2.1.4 Configurations

The UE configurations for CA operating bands are defined in TS 38.101-1 [1] clause 5.5A.

The UE configurations for DC operating bands are defined in TS 38.101-1 [1] clause 5.5B.

The UE configurations for SUL operating bands are defined in TS 38.101-1 [1] clause 5.5C.

2.1.5 Definitions, symbols and abbreviations

2.1.5.1 Definitions

Carrier aggregation: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

Channel bandwidth: The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

2.1.5.2 Symbols

F_{DL_low}	The lowest frequency of the downlink <i>operating band</i>
F_{DL_high}	The highest frequency of the downlink <i>operating band</i>
F_{UL_low}	The lowest frequency of the uplink <i>operating band</i>
F_{UL_high}	The highest frequency of the uplink <i>operating band</i>

2.1.5.3 Abbreviations

ACLR	Adjacent Channel Leakage Ratio
CA	Carrier Aggregation
DC	Dual Connectivity
FDD	Frequency division duplex
FR	Frequency Range
NR	New Radio
NS	Network Signalling
SUL	Supplementary uplink
TDD	Time division duplex
UE	User equipment
V2X	Vehicle to Everything

2.2 RF spectrum emissions

Additional emission requirements can be signalled by the network. Each additional emission requirement is associated with a unique NS label. A list of NS labels and their corresponding NR frequency bands are defined in TS 38.521-1 [1] Table 6.2.3.3.1-1.

2.2.1 Out of band emission

2.2.1.1 Spectrum emission mask

The general NR spectrum emission mask limits are defined in TS 38.521-1 [1] Table 6.5.2.2.5-1 with test tolerances in Table 6.5.2.2.5-2.

2.2.1.2 Additional spectrum emission mask

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

The additional spectrum emission requirements for network signalling label "NS_35" are defined in TS 38.521-1 [1] Table 6.5.2.3.5.1-1 with test tolerances in Table 6.5.2.3.5-1.

The additional spectrum emission requirements for network signalling label "NS_04" are defined in TS 38.521-1 [1] Table 6.5.2.3.5.2-1 with test tolerances in Table 6.5.2.3.5-1.

The additional spectrum emission requirements for network signalling label "NS_03" and "NS_21" are defined in TS 38.521-1 [1] Table 6.5.2.3.5.3-1 with test tolerances in Table 6.5.2.3.5-1.

The additional spectrum emission requirements for network signalling label "NS_06" are defined in TS 38.521-1 [1] Table 6.5.2.3.5.4-1 with test tolerances in Table 6.5.2.3.5-1.

2.2.1.3 Adjacent channel leakage ratio

Adjacent channel leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency.

The NR ACLR requirements are defined in TS 38.521-1 [1] clause 6.5.2.4.1.5.

The UTRA ACLR requirements are defined in TS 38.521-1 [1] clause 6.5.2.4.2.5.

2.2.2 Transmitter spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329 and NR operating band requirement to address UE co-existence.

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

2.2.2.1 Spurious emissions requirements

The general NR spurious emission limits are defined in TS 38.521-1 [1] Table 6.5.3.1.5-1.

2.2.2.2 Spurious emissions for UE co-existence

The co-existence requirements for the UE are release specific. The Rel-15 and Rel-16 requirements can be found in TS 38.521-1 [1] Table 6.5.3.2.5-1.

2.2.2.3 Additional spurious emissions

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

The additional spurious emission requirements for network signalling label "NS_04" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.1-1.

The additional spurious emission requirements for network signalling label "NS_17" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.2-1.

The additional spurious emission requirements for network signalling label "NS_18" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.3-1.

The additional spurious emission requirements for network signalling label "NS_05" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.4-1.

The additional spurious emission requirements for network signalling label "NS_43" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.5-1.

The additional spurious emission requirements for network signalling label "NS_37" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.6-1.

The additional spurious emission requirements for network signalling label "NS_21" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.12-1.

The additional spurious emission requirements for network signalling label "NS_24" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.13-1.

The additional spurious emission requirements for network signalling label "NS_27" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.14-1.

The additional spurious emission requirements for network signalling label "NS_47" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.15-1.

The additional spurious emission requirements for network signalling label "NS_50" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.16-1.

The additional spurious emission requirements for network signalling label "NS_12" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.17-1.

The additional spurious emission requirements for network signalling label "NS_13" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.18-1.

The additional spurious emission requirements for network signalling label "NS_14" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.19-1.

The additional spurious emission requirements for network signalling label "NS_15" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.20-1.

The additional spurious emission requirements for network signalling label "NS_45" are defined in TS 38.521-1 [1] Table 6.5.3.3.5.21-1.

The additional spurious emission requirements for network signalling label "NS_48 are defined in TS 38.521-1 [1] Table 6.5.3.3.5.22-1.

The additional spurious emission requirements for network signalling label "NS_49 are defined in TS 38.521-1 [1] Table 6.5.3.3.5.23-1.

The additional spurious emission requirements for network signalling label "NS_44 are defined in TS 38.521-1 [1] Table 6.5.3.3.5.24-1.

The additional spurious emission requirements for network signalling label "NS_46 are defined in TS 38.521-1 [1] Table 6.5.3.3.5.25-1.

The additional spurious emission requirements for network signalling label "NS_56 are defined in TS 38.521-1 [1] Table 6.5.3.3.5.27-1.

2.2.3 Receiver spurious emissions

The general receiver spurious emission requirements are defined in TS 38.521-1 [1] Table 7.9.5-1.

The receiver spurious emission requirements for CA are defined in TS 38.521-1 [1] Table 7.9.5-1.

2.2A Output RF spectrum emissions for CA

2.2A.1 Out of band emission

For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the output RF spectrum emissions requirements in clause 2.2 apply.

2.2A.1.1 Spectrum emission mask

The general NR spectrum emission mask limits for intra-band CA are defined in TS 38.521-1 [1] clause 6.5A.2.2.1.5.

2.2A.1.2 Void

2.2A.1.3 Adjacent channel leakage ratio

The general NR ACLR limits for CA are defined in TS 38.521-1 [1] clause 6.5A.2.4.1.1.5.

The general UTRA spectrum emission mask limits for CA are defined in TS 38.521-1 [1] clause 6.5A.2.4.2.1.5

2.2A.2 Transmitter spurious emissions for CA

The general spurious emissions limits for CA are defined in TS 38.521-1 [1] clause 6.5A.3.1.1.5.

The surious emissions CA limits for UE co-existence are defined in TS 38.521-1 [1] clause in clause 6.5A.3.2.1.5

2.2B Output RF spectrum emissions for NR-DC

2.2B.1 Spectrum emission mask for NR-DC

For inter-band NR-DC with one uplink carrier assigned per NR band, the output RF spectrum emissions for the corresponding inter-band CA configuration as specified in clause 2.2A.1.1 applies.

2.2B.2 Adjacent channel leakage ratio for NR-DC

For inter-band dual connectivity, the spurious emissions for the corresponding inter-band CA configuration as specified in clause 2.2A.1.3 applies.

2.2C Output RF spectrum emissions for SUL

2.2C.1 Spectrum emissions mask for SUL

The spectrum emission mask limits for SUL are defined in TS 38.521-1 [1] clause 6.5C.2.2.5.

2.2C.2 Additional spectrum emission mask for SUL

The additional spectrum emission mask limits for SUL are defined in TS 38.521-1 [1] clause 6.5C.2.3.5.

2.2C.3 Adjacent channel leakage ratio for SUL

The NR ACLR limits for SUL are defined in TS 38.521-1 [1] clause 6.5C.2.4.1.5.

The UTRA ACLR limits for SUL are defined in TS 38.521-1 [1] clause 6.5C.2.4.2.5.

2.2C.4 Spurious emissions for SUL

2.2C.4.1 General spurious emissions for SUL

The general spurious emission limits for SUL are defined in TS 38.521-1 [1] clause 6.5C.3.1.5.

2.2C.4.2 Spurious emissions co-existence for SUL

The SUL spurious emission co-existence limits are defined in TS 38.521-1 [1] clause 6.5C.3.2.5.

2.2C.4.3 Additional spurious emissions for SUL

The additional spurious emission limits are defined in clause 2.2.2.3.

2.2D RF spectrum emissions for UL MIMO

2.2D.1 Out of band emission for UL MIMO

2.2D.1.1 Spectrum emission mask for UL MIMO

The spectrum emission mask requirements for UL-MIMO are defined in TS 38.521-1 [1] clause 6.5D.2.2.5

2.2D.1.2 Additional spectrum emission mask for UL MIMO

The additional spectrum emission requirements for UL-MIMO are defined in TS 38.521-1 [1] clause 6.5D.2.3.5.

2.2D.1.3 Adjacent channel leakage ratio for UL MIMO

The NR ACLR requirements for UL-MIMO are defined in TS 38.521-1 [1] clause 6.5D.2.4.1.5.

The UTRA ACLR requirements for UL-MIMO are defined in TS 38.521-1 [1] clause 6.5D.2.4.2.5.

2.2D.2 Spurious emissions for UL MIMO

2.2D.2.1 Spurious emissions requirements

The general spurious emission limits for UL MIMO are defined in TS 38.521-1 [1] clause 6.5D.3.1.5.

The general spurious emission limits for UL MIMO Rel-16 onward are defined in TS 38.521-1 [1] clause 6.5D.3_1.1.5.

2.2D.2.2 Spurious emissions for UE co-existence

The UL MIMO co-existence limits are defined in clause 2.2.2.2.

2.2D.2.3 Additional spurious emissions

The UL MIMO additional spurious emission limits are defined in clause 2.2.2.3 for different NS values.

2.2E RF spectrum emissions for V2X

2.2E.1.1 Spectrum emission mask for V2X

The spectrum emission mask requirements for V2X are defined in TS 38.521-1 [1] clauses 6.5E.2.2.1.5 and 6.5E.2.2.1D.5.

2.2E.1.2 Additional spectrum emission mask for V2X

The additional spectrum emission requirements for V2X are defined in TS 38.521-1 [1] clauses 6.5E.2.3.1.5 and 6.5E.2.3.1D.5.

2.2E.1.3 Adjacent channel leakage ratio for V2X

The ACLR requirements for V2X are defined in TS 38.521-1 [1] clauses 6.5E.2.4.1.5 and 6.5E.2.4.1D.5.

2.2E.2 Spurious emissions for V2X

2.2E.2.1 Spurious emissions requirements

The general spurious emission limits for V2X are defined in clause 2.2.2.1.

2.2E.2.2 Spurious emissions for UE co-existence

The V2X co-existence limits are defined in clause 2.2.2.2.

2.2E.2.3 Additional spurious emissions

The V2X additional spurious emission limits are defined in TS 38.521-1 [1] clause 6.5E.3.3.1.5 for different NS values.

2.2F RF spectrum emissions for shared spectrum channel access

2.2F.1.1 Spectrum emission mask for shared spectrum channel access

The spectrum emission mask requirements for UL-MIMO are defined in TS 38.521-1 [1] clause 6.5F.2.2.5.

2.2F.1.2 Adjacent channel leakage ratio for shared spectrum channel access

The ACLR requirements for shared spectrum channel access are defined in TS 38.521-1 [1] clause 6.5F.2.4.1.5.

2.2F.2 Spurious emissions for shared spectrum channel access

2.2F.2.1 Spurious emissions requirements

The general spurious emission limits for shared spectrum channel access are defined in TS 38.521-1 [1] clause 6.5F.3.1.5.

2.2F.2.2 Spurious emissions for UE co-existence

Spurious emissions requirements for UE coexistence are not applicable to bands restricted to stand_alone operation.

2.2G RF spectrum emissions for Tx Diversity

2.2G.1.1 Void

2.2G.1.2 Adjacent channel leakage ratio for Tx Diversity

The ACLR requirements for Tx Diversity are defined in TS 38.521-1 [1] clause 6.5G.2.3.1.5

3 Generic unwanted emission characteristics for NR range 2 standalone

3.1 Operating bands and channel arrangements

Requirements throughout the RF specifications are in many cases defined separately for different frequency ranges (FR). The frequency ranges in which NR can operate according to this version of the specification are identified as described in Table 3.1-1.

TABLE 3.1-1

Definition of frequency ranges

Frequency range designation	Corresponding frequency range
FR1	410 MHz – 7 125 MHz
FR2	24 250 MHz – 52 600 MHz

3.1.1 Operating bands

NR is designed to operate in the FR2 operating bands defined in Table 3.1.1-1.

TABLE 3.1.1-1

NR operating bands in FR2

Operating Band	Uplink (UL) operating band BS receive UE transmit		Downlink (DL) operating band BS transmit UE receive		Duplex Mode
	TABLE I.	TABLE II. $F_{UL_low} - F_{UL_high}$	TABLE III.	TABLE IV. $F_{DL_low} - F_{DL_high}$	
n257		26 500 MHz – 29 500 MHz		26 500 MHz – 29 500 MHz	TDD
n258		24 250 MHz – 27 500 MHz		24 250 MHz – 27 500 MHz	TDD
n259		39 500 MHz – 43 500 MHz		39 500 MHz – 43 500 MHz	TDD
n260		37 000 MHz – 40 000 MHz		37 000 MHz – 4 0000 MHz	TDD
n261		27 500 MHz – 28 350 MHz		27 500 MHz – 28 350 MHz	TDD

The UE operating bands for CA are defined in TS 38.101-2 [3] clause 5.2A.

The UE operating bands for DC are defined in TS 38.101-2 [3] clause 5.2B.

The UE operating band combination for UL MIMO are defined in TS 38.101-2 [3] clause 5.2D.

3.1.2 UE Channel bandwidth

The UE channel bandwidth for different NR bands are defined in TS 38.101-2 [3] clause 5.3.

The UE channel bandwidth for CA are defined in TS 38.101-2 [3] clause 5.3A.

3.1.3 Channel arrangement

The UE channel arrangement i.e. channel spacing, channel raster, synchronization raster and TX–RX frequency separation are defined in TS 38.101-2 [3] clause 5.4.

The UE channel arrangement for CA are defined in TS 38.101-2 [3] clause 5.4A.

3.1.4 Configurations

The UE configurations for CA operating bands are defined in TS 38.101-2 [3] clause 5.5A.

The UE configurations for UL-MIMO operating bands are defined in TS 38.101-2 [3] clause 5.5D.

3.1.5 Definitions, symbols and abbreviations

3.1.5.1 Definitions

Aggregated Channel Bandwidth: The RF bandwidth in which a UE is configured to transmit and receive multiple contiguously aggregated carriers.

Carrier aggregation: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

Channel bandwidth: The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

EIRP(Link=Link angle, Meas=Link angle): measurement of the UE such that the link angle is aligned with the measurement angle. EIRP (indicator to be measured) can be replaced by EIS, Frequency, EVM, carrier Leakage, In-band emission and OBW.

EIRP(Link=TX beam peak direction, Meas=Link angle): measurement of the EIRP of the UE such that the measurement angle is aligned with the beam peak direction within an acceptable measurement error uncertainty. EIRP (indicator to be measured) can be replaced by Frequency, EVM, carrier Leakage, In-band emission and OBW.

EIRP(Link=Spherical coverage grid, Meas=Link angle): measurement of the EIRP spherical coverage of the UE such that the EIRP link and measurement angles are aligned with the directions along the spherical coverage grid within an acceptable measurement error uncertainty. Alternatively, the spherical coverage grid can be replaced by the beam peak search grid as the results from the beam peak search can be re-used for spherical coverage.

EIS (effective isotropic sensitivity): sensitivity for an isotropic directivity device equivalent to the sensitivity of the discussed device exposed to an incoming wave from a defined AoA.

EIS(Link=RX beam peak direction, Meas=Link angle): measurement of the EIS of the UE such that the measurement angle is aligned with the RX beam peak direction within an acceptable measurement error uncertainty.

NOTE 1: The sensitivity is the minimum received power level at which specific requirement is met.

NOTE 2: Isotropic directivity is equal in all directions (i.e. 0 dBi).

Fallback group: Group of carrier aggregation bandwidth classes for which it is mandatory for a UE to be able to fallback to lower order CA bandwidth class configuration. It is not mandatory for a UE to be able to fallback to lower order CA bandwidth class configuration that belong to a different fallback group.

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.

Link angle: a DL-signal AoA from the view point of the UE, as described in Annex J. If the beam lock function is used to lock the UE beam(s), the link angle can become any arbitrary AoA once the beam lock has been activated.

Measurement angle: the angle of measurement of the desired metric from the view point of the UE, as described in Annex J

radiated interface boundary: operating band specific radiated requirements reference point where the radiated requirements apply.

radiated requirements reference point: for the RF measurement setup, the radiated requirements reference point is located at the centre of the quiet zone. From the UE perspective the reference point is the input of the UE antenna array.

RX beam peak direction: direction where the maximum total component of RSRP and thus best total component of EIS is found.

Sub-block: This is one contiguous allocated block of spectrum for transmission and reception by the same UE. There may be multiple instances of sub-blocks within an RF bandwidth.

TX beam peak direction: direction where the maximum total component of EIRP is found.

TRP(Link=TX beam peak direction, Meas=TRP grid): measurement of the TRP of the UE such that the measurement angles are aligned with the directions of the TRP grid points within an acceptable measurement uncertainty while the link angle is aligned with the TX beam peak direction.

3.1.5.2 Symbols

F_{DL_low}	The lowest frequency of the downlink <i>operating band</i>
F_{DL_high}	The highest frequency of the downlink <i>operating band</i>
F_{UL_low}	The lowest frequency of the uplink <i>operating band</i>
F_{UL_high}	The highest frequency of the uplink <i>operating band</i>

3.1.5.3 Abbreviations

ACLR	Adjacent Channel Leakage Ratio
CA	Carrier Aggregation
DC	Dual Connectivity
FDD	Frequency division duplex
FR	Frequency Range
NR	New Radio
NS	Network Signalling
SUL	Supplementary uplink

TDD	Time division duplex
UE	User equipment
EIRP	Effective Isotropic Radiated Power
EIS	Effective Isotropic Sensitivity
UL MIMO	Uplink Multiple Antenna transmission

3.2 RF spectrum emissions

Additional emission requirements can be signalled by the network. Each additional emission requirement is associated with a unique NS label. A list of NS labels and their corresponding NR frequency bands are defined in TS 38.521-2 [6] Table 6.2.3.3.1-1 and Table 6.2.3.3.1-2.

3.2.1 Out of band emission

3.2.1.1 Spectrum emission mask

The general NR spectrum emission mask limits are defined in TS 38.521-2 [6] Table 6.5.2.1.5-1 with test tolerances in Table 6.5.2.1.5-2.

3.2.1.2 Additional spectrum emission mask

Additional spectrum emission requirements are currently not defined in TS 38.521-2 [6]

3.2.1.3 Adjacent channel leakage ratio

Adjacent channel leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency.

The NR FR2 ACLR requirements are defined in TS 38.521-2 [6] clause 6.5.2.4.1.5.

3.2.2 Transmitter spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329 and NR operating band requirement to address UE co-existence.

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

3.2.2.1 Spurious emissions requirements

The general NR spurious emission limits are defined in TS 38.521-2 [6] Table 6.5.3.1.5-1.

3.2.2.2 Spurious emissions for UE co-existence

The co-existence requirements for the UE are found in TS 38.521-2 [6] Table 6.5.3.2.5-1.

3.2.2.3 Additional spurious emissions

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE

shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

The additional spurious emission requirements for network signalling label "NS_202" are defined in TS 38.521-2 [6] Table 6.5.3.3.3-2.

The additional spurious emission requirements for network signalling label "NS_203" are defined in TS 38.521-2 [6] Table 6.5.3.3.3-3.

3.2.3 Receiver spurious emissions

The general receiver spurious emission requirements are currently not defined in TS 38.521-2 [6].

3.2A Output RF spectrum emissions for CA

3.2A.1 Out of band emission

3.2A.1.1 Spectrum emission mask

The general NR spectrum emission mask limits for intra-band contiguous CA are defined in TS 38.521-2 [6] clause 6.5A.2.1.1.5.

3.2A.1.2 Void

3.2A.1.3 Adjacent channel leakage ratio

The general NR ACLR limits for CA are defined in TS 38.521-2 [6] clause 6.5A.2.2.1.5-1.

3.2A.2 Transmitter spurious emissions for CA

The general spurious emissions limits for CA are defined in TS 38.521-2 [6] clause 6.5A.3.1.1.5.

The spurious emissions CA limits for UE co-existence are defined in TS 38.521-2 [6] clause in clause 6.5A.3.2.1.5

3.2D RF spectrum emissions for UL MIMO

3.2D.1 Out of band emission for UL MIMO

3.2D.1.1 Spectrum emission mask for UL MIMO

The spectrum emission mask requirements for UL-MIMO are defined in TS 38.521-2 [6] clause 6.5D.2.1.5

3.2D.1.2 Additional spectrum emission mask for UL MIMO

The additional spectrum emission requirements for UL-MIMO are currently not defined in TS 38.521-2 [6]

3.2D.1.3 Adjacent channel leakage ratio for UL MIMO

The NR ACLR requirements for UL-MIMO are defined in TS 38.521-2 [6] clause 6.5D.3.3.

3.2D.2 Spurious emissions for UL MIMO

3.2D.2.1 Spurious emissions requirements

The general spurious emission limits for UL MIMO are defined in TS 38.521-2 [6] clause 6.5D.3.1.5.

3.2D.2.2 Spurious emissions for UE co-existence

The spurious emission for UE co-existence limits for UL MIMO are defined in TS 38.521-2 [6] clause 6.5D.3.2.

3.2D.2.3 Additional spurious emissions

The spurious emission for UE co-existence limits for UL MIMO are defined in TS 38.521-2 [6] clause 6.5D.3.3.

4 Generic unwanted emission characteristics for NR range 1 and range 2 interworking operation with other radios

4.1 Operating bands and channel arrangements

4.1.1 Operating bands

The UE operating bands for inter-band NR CA between FR1 and FR2 arrangements are defined in TS 38.521-3 [8] Table 5.2A.1-1.

The UE operating bands for DC arrangements are specified in TS 38.521-3 V16.7.0, subclause 5.5B

The UE operating bands for NR V2X operation concurrent with E-UTRA uplink/downlink or sidelink arrangements are defined in TS 38.521-3 V16.7.0, subclause 5.2E

4.1.2 UE Channel bandwidth

The UE channel bandwidth for inter-band NR CA between FR1 and FR2 arrangements are defined in TS 38.521-3 [8] clause 5.3A.

The UE channel bandwidth for EN-DC are defined in TS 38.521-3 [8] clause 5.3B.

The UE channel bandwidth for NR V2X operation concurrent with E-UTRA uplink/downlink or sidelink arrangements are defined in TS 38.521-3 [8] clause 5.3E.

4.1.3 Channel arrangement

The UE channel arrangement for inter-band NR CA between FR1 and FR2 arrangements are defined in TS 38.521-3 [8] clause 5.4A.

The UE channel arrangement for DC arrangements are defined in TS 38.521-3 [8] clause 5.4B.

4.1.4 Configurations

The supported inter-band CA configurations between FR1 and FR2 are specified in TS 38.521-3 [8] Table 5.5A.1-1.

The supported intra-band contiguous EN-DC configurations are specified in TS 38.521-3 [8] Table 5.5B.2-1.

The supported intra-band non-contiguous EN-DC configurations are specified in TS 38.521-3 [8] Table 5.5B.3-1.

The supported inter-band EN-DC configurations within FR1 are specified in TS 38.521-3 [8] Table 5.5B.4.1-1, Table 5.5B.4.2-1, Table 5.5B.4.3-1, Table 5.5B.4.4-1 and Table 5.5B.4.5-1.

The supported inter-band NE-DC configurations within FR1 are specified in TS 38.521-3 [8] Table 5.5B.4a.1-1.

The supported inter-band EN-DC configurations including FR2 are specified in TS 38.521-3 [8] Table 5.5B.5.1-1, Table 5.5B.5.2-1, Table 5.5B.5.3-1 and Table 5.5B.5.4-1.

The supported inter-band EN-DC configurations including FR1 and FR2 are specified in TS 38.521-3 [8] Table 5.5B.6.2-1, Table 5.5B.6.3-1, Table 5.5B.6.4-1 and Table 5.5B.6.5-1.

The supported inter-band NR-DC configurations between FR1 and FR2 are specified in TS 38.521-3 [8] Table 5.5B.7.1-1.

The supported V2X configurations between E-UTRA and NR are specified in TS 38.521-3 [8] Table 5.5E.2-1, Table 5.5E.3-1 and Table 5.5E.4.1-1.

4.1.5 Definitions, symbols and abbreviations

4.1.5.1 Definitions

Con-current operation: The simultaneous transmission and reception of sidelink and Uu interfaces while operation is agnostic of the service used on each interface.

4.1.5.2 Symbols

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

$\Delta R_{IB,c}$	Allowed reference sensitivity relaxation due to support for CA or DC operation, for serving cell c
$\Delta T_{IB,c}$	Allowed maximum configured output power relaxation due to support for CA or DC operation, for serving cell c
$BW_{E-UTRA_Channel}$	Channel bandwidth of E-UTRA carrier
$BW_{E-UTRA_Channel_CA}$	Channel bandwidth of E-UTRA sub-block which is composed of intra-band contiguous CA E-UTRA carriers
$BW_{NR_Channel}$	Channel bandwidth of NR carrier
$BW_{NR_Channel_CA}$	Channel bandwidth of NR sub-block which is composed of intra-band contiguous CA NR carriers
Ceil(x)	Rounding upwards; ceil(x) is the smallest integer such that $ceil(x) \geq x$
$EN-DC_{ACLR}$	The ratio of the filtered mean power centred on the aggregated sub-block bandwidth ENBW to the filtered mean power centred on an adjacent bandwidth of the same size ENBW
$E-UTRA_{ACLR}$	E-UTRA ACLR
F_C	RF reference frequency for the carrier centre on the channel raster
F_{DL_low}	The lowest frequency of the downlink operating band
F_{DL_high}	The highest frequency of the downlink operating band
F_{UL_low}	The lowest frequency of the uplink operating band
F_{UL_high}	The highest frequency of the uplink operating band
F_{OOB}	The boundary between the NR out of band emission and spurious emission domains
L_{CRB}	Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resources blocks
Max()	The largest of given numbers
Min()	The smallest of given numbers

NR_{ACLR}	NR ACLR
N_{RB}	Transmission bandwidth configuration, expressed in units of resource blocks
N_{RB_agg}	The number of the aggregated RBs within the fully allocated aggregated channel bandwidth
P_{CMAX}	The configured maximum UE output power
RB_{start}	Indicates the lowest RB index of transmitted resource blocks
W_{gap}	The sub-block gap between the two sub-blocks.

4.1.5.3 Abbreviations

ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
A-MPR	Additional Maximum Power Reduction
BCS	Bandwidth Combination Set
CA	Carrier Aggregation
CC	Component Carrier
DC	Dual Connectivity
EN-DC	E-UTRA/NR DC
e.i.r.p.	equivalent isotropically radiated power
EVM	Error Vector Magnitude
FR	Frequency Range
ENBW	The aggregated bandwidth of an E-UTRA sub-block and an adjacent NR sub-block
ITS	Intelligent Transportation System
ITU-R	Radio communication Sector of the International Telecommunication Union
MBW	Measurement bandwidth defined for the protected band
MPR	Allowed maximum power reduction
MSD	Maximum Sensitivity Degradation
MCG	Master Cell Group
NR	New Radio
NS	Network Signalling
NSA	Non-Standalone, a mode of operation where operation of a radio is assisted with another radio
OOB	Out-of-band
OOBE	Out-of-band emission
OTA	Over The Air
PRB	Physical Resource Block
PSCCH	Physical Sidelink Control CHannel
PSSCH	Physical Sidelink Shared CHannel

RE	Resource Element
REFSENS	Reference Sensitivity
RF	Radio Frequency
Rx	Receiver
SCG	Secondary Cell Group
SCS	Subcarrier spacing
SEM	Spectrum Emission Mask
SL	Sidelink
SUL	Supplementary uplink
TDM	Time Division Multiplex
Tx	Transmitter
UE	User Equipment
UL	Uplink
UL MIMO	Up Link Multiple Antenna transmission
ULSUP	Uplink sharing from UE perspective
V2X	Vehicle to Everything

4.1.6 Applicability of minimum requirements

- a) In TS 38.101-3 [4] the Minimum Requirements are specified as general requirements and additional requirements. Where the Requirement is specified as a general requirement, the requirement is mandated to be met in all scenarios.
- b) For specific scenarios for which an additional requirement is specified, in addition to meeting the general requirement, the UE is mandated to meet the additional requirements.
- c) The spurious emissions power requirements are for the long-term average of the power. For the purpose of reducing measurement uncertainty, it is acceptable to average the measured power over a period of time sufficient to reduce the uncertainty due to the statistical nature of the signal.
- d) Terminal that supports EN-DC configuration shall meet E-UTRA requirements as specified in TS 36.101 [1] and NR requirements as in TS 38.101-1 [2] and TS 38.101-2 [3] unless otherwise specified in TS 38.101-3 [4].
- e) All the requirements for intra-band contiguous and non-contiguous EN-DC apply under the assumption of the same uplink-downlink and special subframe configurations in the E-UTRA and slot format indicated by UL-DL-configurationCommon and UL-DL-configurationDedicated in the NR for the EN-DC.
- f) For EN-DC combinations with CA configurations for E-UTRA and/or NR, all the requirements for E-UTRA and/or NR all the requirements for E-UTRA and/or NR intra-band contiguous and non-contiguous CA apply under the assumption of the same slot format indicated by UL-DL-configurationCommon and UL-DL-configurationDedicated in the PCell and SCells for NR and the same uplink-downlink and special subframe configurations in PCell and SCells for E-UTRA.

A terminal which supports an EN-DC configuration shall support:

- If any subsets of the EN-DC configuration do not specify its own bandwidth combination sets in TS 38.521-3 [8] clause 5.3B, then the terminal shall support the same E-UTRA bandwidth combination sets it signals the support for in E-UTRA CA configuration part of E-UTRA – NR DC and shall support the same NR bandwidth combination sets it signals the support for in NR CA configuration part of E-UTRA – NR DC.
- Else if one of the subsets of the EN-DC configuration specify its own bandwidth combination sets in TS 38.521-3 [8] clause 5.3B, then the terminal shall support a product set of channel bandwidth for each band specified by E-UTRA bandwidth combination sets, NR bandwidth combination sets, and EN-DC bandwidth combination sets it signals the support.

A terminal which supports an inter-band EN-DC configuration with a certain UL configuration shall support the all lower order DL configurations of the lower order EN-DC combinations, which have this certain UL configuration and the fallbacks of this UL configuration.

A terminal which supports CA or DC configurations, which include FR2 intra-band CA combinations with multiple subblocks, where at least one of the subblocks consists of a contiguous CA combination, is not required to support all possible fallback combinations but can directly fall back to a single FR2 carrier. Deactivating carriers within the CA or DC combination is still possible.

Terminal that supports inter-band NR-DC between FR1 and FR2 configuration shall meet the requirements for corresponding CA configuration (suffix A), unless otherwise specified.

4.1.7 Applicability and test coverage rules

4.1.7.1 General

- (1) The applicability and test coverage rules for Non-Standalone (NSA) only capable devices shall include the following:
 - a) For each NR band in a device; test all the EN-DC exception test requirements as per test procedures in TS 38.521-3 [8].
 - b) Test all the EN-DC FR2 non-exception test requirements in this specification with test procedures which refer appropriately back to clause 3 for each NR band. Test only one EN-DC combination per FR2 band for each EN-DC configuration as defined in clause 4.1.4 using LTE anchor agnostic approach.
 - c) Test all the EN-DC FR1 non-exception test requirements in this specification with test procedures which refer appropriately back to clause 2 for each NR band. Test only one EN-DC combination per FR1 band for each EN-DC configuration as defined in clause 4.1.4 using LTE anchor agnostic approach.
- (2) The applicability and test coverage rules for Standalone (SA) and NSA capable devices shall include the following:
 - a) For each NR band in a device, test all the EN-DC exception test requirements as per test procedures in TS 38.521-3 [8].
 - b) Test all the Standalone FR2 test requirements as per test procedures in clause 3 for each NR band. This also fulfils coverage for all non-exception EN-DC FR2 test requirements for that NR band and need not be retested. If Standalone FR2 cannot be tested (due to test case not being complete), then test in EN-DC mode following (1)(b) above.
 - c) Test all the Standalone FR1 test requirements as per test procedures in clause 2 for each NR band. This also fulfils coverage for all non-exception EN-DC FR1 test requirements

for that NR band and need not be retested. If Standalone FR1 cannot be tested (due to test case not being complete or if the UE does not support the band in SA mode), then test in EN-DC mode following (1)(c) above.

4.1.7.2 Test coverage across 5G NR connectivity options

The test cases in this specification cover both Standalone (FR1+FR2 CA without DC) as well as Non-Standalone FR1 and FR2 (E-UTRA and 5G NR interworking) testing. Below shall be the understanding with respect to coverage across 5G NR architecture options:

- 1) Unless otherwise stated within the test case, it shall be understood that test requirements are agnostic of the NSA architecture option configured within the test. The test coverage across NSA options shall be considered fulfilled by execution of the NSA test case in one NSA option. Subsequently the test execution and test results can be leveraged to other NSA options.
- 2) Only one SA or NSA architecture option type is identified and utilized in the definition of each test case within this test specification. NSA test cases are configured using Connectivity EN-DC i.e. NSA Option 3 and Standalone (SA) test cases are configured using Connectivity NR i.e. SA Option 2 which shall be the default architecture options used for NSA and SA test execution respectively.
- 3) If a UE does not support NSA Option 3, any other supported NSA option can be configured to execute the test. The leverage rule detailed in (1) would apply.

4.2 Output RF spectrum emissions

4.2.1 Output RF spectrum emissions for inter-band CA between FR1 and FR2

For inter-band NR CA between FR1 and FR2, out-of-band emissions specified in clause 2 and clause 3 apply for each frequency range respectively.

4.2.2 Output RF spectrum emissions for EN-DC

4.2.2.1 Out of band emission

4.2.2.1.1 General spectrum emission mask

For intra-band contiguous EN-DC, the general NR spectrum emission mask limits are defined in TS 38.521-3 [8] Table 6.5B.2.1.1.5-1 with test tolerances in Table 6.5B.2.1.1.5-2.

For intra-band non-contiguous EN-DC, the general NR spectrum emission mask limits are defined in TS 38.521-3 [8] clause 6.5B.2.2.1.5.

For inter-band EN-DC within FR1, the general NR spectrum emission mask limits are defined in TS 38.521-3 [8] clause 6.5B.2.3.1.5.

For inter-band EN-DC including FR2, the general NR spectrum emission mask limits are defined in TS 38.521-3 [8] clauses 6.5B.2.4.1.5, 6.5B.2.4.1_1.1.5, 6.5B.2.4.1_1.2.5 and 6.5B.2.4.1_1.3.5.

For inter-band EN-DC including FR2 for UL-MIMO, the general NR spectrum emission mask limits are defined in TS 38.521-3 [8] clause 6.5B.2.4.1D.5.

4.2.2.1.2 Additional spectrum emission mask

For intra-band contiguous EN-DC, the additional spectrum emission mask limits for NS₃₅ are defined in TS 38.521-3 [8] Table Table 6.5B.2.1.2.5.1-1 with test tolerances in Table 6.5B.2.1.2.5-1.

For intra-band contiguous EN-DC, the additional spectrum emission mask limits for NS_04 are defined in TS 38.521-3 [8] Table Table 6.5B.2.1.2.5.2-1 with test tolerances in Table 6.5B.2.1.2.5-1.

For intra-band non-contiguous EN-DC, the additional spectrum emission mask limits are defined in TS 38.521-3 [8] clause 6.5B.2.2.2.5.

For inter-band EN-DC within FR1, the additional spectrum emission mask limits are defined in TS 38.521-3 [8] clause 6.5B.2.3.2.5.

4.2.2.1.3 Adjacent channel leakage ratio

For intra-band contiguous EN-DC, the adjacent channel leakage ratio limits are defined in TS 38.521-3 [8] Table 6.5B.2.1.3.5.1-1 with test tolerances in Table 6.5B.2.1.3.5-2.

For intra-band non-contiguous EN-DC, the adjacent channel leakage ratio limits are defined in TS 38.521-3 [8] clause 6.5B.2.2.3.5.

For inter-band EN-DC within FR1, the adjacent channel leakage ratio limits are defined in TS 38.521-3 [8] clause 6.5B.2.3.3.3.5.

For inter-band EN-DC including FR2, the adjacent channel leakage ratio limits are defined in TS 38.521-3 [8] clauses 6.5B.2.4.3.5 and 6.5B.2.4.3_1.1.5.

For inter-band EN-DC including FR2 for UL-MIMO, the adjacent channel leakage ratio limits are defined in TS 38.521-3 [8] clause 6.5B.2.4D.3.5.

4.2.2.2 Transmitter spurious emissions

4.2.2.2.1 General spurious emissions requirements

For intra-band contiguous EN-DC, the general spurious emissions limits are defined in TS 38.521-3 [8] Table 6.5B.3.1.1.5-1.

For intra-band non-contiguous EN-DC, the general spurious emissions limits are defined in TS 38.521-3 [8] clause 6.5B.3.2.1.5.

For inter-band EN-DC within FR1, the general spurious emissions limits are defined in TS 38.521-3 [8] Table 6.5B.3.3.1.5-1.

For inter-band EN-DC including FR2, the general spurious emissions limits are defined in TS 38.521-3 [8] clauses 6.5B.3.4.1.5 and 6.5B.3.4.1_1.1.5.

For inter-band EN-DC including FR2 for UL-MIMO, the general spurious emissions limits are defined in TS 38.521-3 [8] clause 6.5B.3.4.1D.5.

4.2.2.2.2 Spurious emission band UE co-existence

For intra-band contiguous EN-DC, the general spurious emissions limits are defined in TS 38.521-3 [8] clause 6.5B.3.1.2.5.

For intra-band non-contiguous EN-DC, the general spurious emissions limits are defined in TS 38.521-3 [8] clause 6.5B.3.2.2.5.

For inter-band EN-DC within FR1, the general spurious emissions limits are defined in TS 38.521-3 [8] Tables 6.5B.3.3.2.5-1 and 6.5B.3.3.2.5-2.

For inter-band EN-DC including FR2, the general spurious emissions limits are defined in TS 38.521-3 [8] clause 6.5B.3.4.2.5.

4.2.2.2.3 Additional spurious emissions

For intra-band contiguous EN-DC, the additional spurious emissions limits are defined in TS 38.521-3 [8] clause 6.5B.4.1.5.

For intra-band non-contiguous EN-DC, the additional spurious emissions limits are defined in TS 38.521-3 [8] clause 6.5B.4.2.5.

For inter-band EN-DC within FR1, the additional spurious emissions limits are defined in TS 38.521-3 [8] clause 6.5B.4.3.5.

4.2.2.3 Receiver spurious emissions

For intra-band contiguous EN-DC, the receiver spurious emissions limits are defined in TS 38.521-3 [8] clause 7.9B.1.5.

For intra-band non-contiguous EN-DC, the receiver spurious emissions limits are defined in TS 38.521-3 [8] clause 7.9B.2.5.

For inter-band EN-DC within FR1, the additional receiver emissions limits are defined in TS 38.521-3 [8] clauses 7.9B.3.5 and 7.9B.3_1.1.5.

For inter-band EN-DC including FR2, the receiver spurious emissions limits are defined in TS 38.521-3 [8] clauses 7.9B.4.5, 7.9B.4_1.1.5, 7.9B.4_1.2.5, 7.9B.4_1.3.5 and 7.9B.4_1.4.5.

5 References

- [1] GPP TS 36.101 [1] V17.6.0 (2022-06), “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (Release 17)”
- [2] 3GPP TS 38.101-1 V17.6.0 (2022-06), “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone (Release 17)”
- [3] 3GPP TS 38.101-2 V17.6.0 (2022-06), “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone (Release 17)”
- [4] 3GPP TS 38.101-3 V17.6.0 (2022-06), “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios (Release 17)”
- [5] 3GPP TS 36.521-1 [5] (2022-06), “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance Testing (Release 17)”
- [6] 3GPP 38.521-1 V17.5.0 (2022-06), “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone; (Release 17)”
- [7] 3GPP 38.521-2 V16.12.0 (2022-06), “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; User Equipment (UE) conformance

- specification; Radio transmission and reception; Part 2: Range 2 Standalone (Release 16)”
- [8] 3GPP 38.521-3 V17.5.0 (2022-06), “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios (Release 17)”
- [9] ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain".
- [10] ITU-R Recommendation M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".

Attachment 1 to Annex 1

Definition of test tolerance

Test tolerance

With reference to Recommendation ITU-R M.1545 [10], “test tolerance” is the relaxation value referred to in *recommends 2* of Recommendation ITU-R M.1545 [10], i.e., the difference between the core specification value and the test limit, evaluated applying the shared risk principle as per Figures 2 and 3 of Annex 1 of Recommendation ITU-R M.1545 [10]. In case the core specification value is equal to the test limit (Fig. 3 of Annex 1 of Recommendation ITU-R M.1545 [10]) the “test tolerances” are equal to 0.

Annex 2

3GPP 5G-RIT

Annex 3

5Gi RIT

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Annex X

DECT-2020 NR – RIT Component

Introduction

This Annex provides the generic unwanted emission characteristics of mobile stations (radio equipment in PT-mode) using the DECT-2020 NR radio interface.

2 Transmitter spectrum emission requirements for DECT-2020

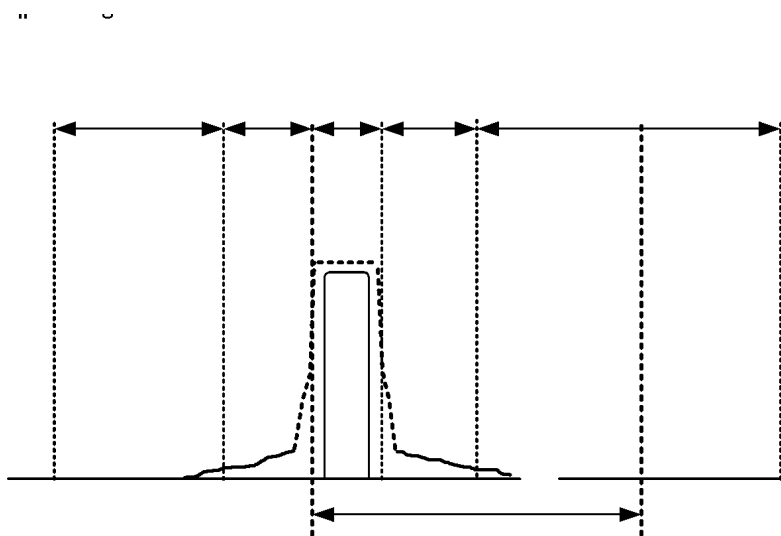
2.1 General

Radio equipment transmitter spectrum emissions are occupied channel emissions, out of band and spurious emissions. The relation of these emission components is illustrated in Figure 2.1-1.

The transmitter characteristics are specified at the antenna connector(s) of the radio equipment. For radio equipment with an integral antenna only, a reference antenna(s) with a gain of 0 dBi should be assumed for each antenna port(s).

[Editors note: Reference point for AAS needs to be clarified. AAS is not used in DECT-2020 currently.]

FIGURE 2.1-1
Transmitter RF spectrum



2.2 Occupied channel BW

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean transmitted power.

The value of $\beta/2$ shall be taken as 0.5%.

The occupied bandwidth shall be less than the nominal channel bandwidth as defined in Table 2.2-1.

TABLE 2.2-1

Channel bandwidth

Parameter	Operating channel bandwidth I	Operating channel bandwidth II	Operating channel bandwidth III
Nominal channel bandwidth (MHz)	1.728	3.456	6.912
Transmission channel bandwidth (MHz)	1.539	3.051	6.075

2.3 Out of band emissions

The out-of-band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions.

The spectrum emission mask of the radio device (RD) applies to frequencies (Δf_{OOB}) starting from the \pm edge of the assigned channel. For frequencies offset greater than Δf_{OOB} as specified in Tables 2.3-1, 2.3-2 and 2.3-3, the spurious requirements in clause 2.4 are applicable.

TABLE 2.3-1

Spectrum emission limit for 1.728 MHz channel bandwidth

Spectrum emission limit (dBm)		
$\Delta f_{OOB} / \text{MHz}$	1.728 MHz channel bandwidth	Measurement bandwidth
± 0 to 0.094 5	-10	30 kHz
$\pm 0.094 5$ to 1.633 5	-10	1 MHz
$\pm 1.633 5$ to 1.822 5	-13	1 MHz
$\pm 1.822 5$ to 3.361 5	-20	1 MHz
$\pm 3.361 5$ to 3.456	-23	1 MHz

TABLE 2.3-2

Spectrum emission limit for 3.456 MHz channel bandwidth

Spectrum emission limit (dBm)		
$\Delta f_{OOB} / \text{MHz}$	3.456 MHz channel bandwidth	Measurement bandwidth
± 0 to 0.202 5	-10	30 kHz
$\pm 0.202 5$ to 3.253 5	-10	1 MHz
$\pm 3.253 5$ to 3.658 5	-13	1 MHz
$\pm 3.658 5$ to 6.709 5	-20	1 MHz
$\pm 6.709 5$ to 6.912	-23	1 MHz

TABLE 2.3-3

Spectrum emission limit for 6.912 MHz channel bandwidth

Spectrum emission limit (dBm)		
$\Delta f_{OOB} / \text{MHz}$	6.912 MHz channel bandwidth	Measurement bandwidth
± 0 to 0.418 5	-10	30 kHz
$\pm 6.493 5$ to 7.330 5	-13	1 MHz
$\pm 7.330 5$ to 13.405 5	-20	1 MHz
$\pm 13.405 5$ to 13.824	-23	1 MHz

2.4 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements in-line with Recommendation ITU-R SM.329.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 2.3-1 from the edge of the channel bandwidth. The spurious emission limits in Table 2.4-1 apply for all transmitter bands and channel bandwidths.

TABLE 2.4-1

Spurious emission limits

Frequency range	Maximum level	Measurement bandwidth
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	-36 dBm	1 kHz
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	-36 dBm	10 kHz
$30 \text{ MHz} \leq f < 1\,000 \text{ MHz}$	-36 dBm	100 kHz
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	-30 dBm	1 MHz
$12,75 \text{ GHz} \leq f < 5^{\text{th}}$ harmonic of the upper frequency edge in GHz	-30 dBm	1 MHz