ETSI TS 138 104 V17.5.0 (2022-04)

iTeh STANDARD
PREVIEW
(standards.iteh.ai)

5G;
NR;
Base Station (BS) radio transmission and reception
(3GPP TS 38.104 version 17.5.0 Release 17)

ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-16b1-4d4d-a045-5b98cf5886ab/etsi-ts-138-104-v17-5-0-2022-04

Reference
RTS/TSGR-0438104vh50

Keywords
5G

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

iTeh STANDARD PREVIEW

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.
Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

(standards.iteh.ai)

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-16b1-4d4d-a015-5b98cf5886ab/etsi-ts-138-104-v17-5-0-2022-04

If you find a security vulnerability in the present document, please report it through our
Coordinated Vulnerability Disclosure Program:
https://www.etsi.org/standards/coordinated-vulnerability-disclosure

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.
No recommendation as to products and services or vendors is made or should be implied.
No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.
In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.
The content of the PDF version shall not be modified without the written authorization of ETSI.
The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2022.
All rights reserved.

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

iTeh STANDARD
PREVIEW
(standards.iteh.ai)

Legal Notice

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9e0f1fd0-16b1-4d4d-a645-56b8ef5886ab/etsi-ts-138-104-v17-5-0-2022-04

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights 2
Legal Notice 2
Modal verbs terminology 2
Foreword 12
1 Scope 14
2 References 14
3 Definitions, symbols and abbreviations 15
3.1 Definitions 15
3.2 Symbols 19
3.3 Abbreviations 21
4 General 23
4.1 Relationship with other core specifications 23
4.2 Relationship between minimum requirements and test requirements 23
4.3 Conducted and radiated requirement reference points 23
4.3.1 *BS type 1-C* 23
4.3.2 *BS type 1-H* 24
4.3.3 *BS type 1-O* and *BS type 2-O* 25
4.4 Base station classes 25
4.5 Regional requirements 26
4.6 Applicability of requirements 29
4.7 Requirements for contiguous and *non-contiguous spectrum* 29
4.8 Requirements for BS capable of multi-band operation 30
4.9 OTA co-location with other base stations 31
5 *Operating bands* and channel arrangement 33
5.1 General 33
5.2 *Operating bands* 33
5.3 *BS channel bandwidth* 36
5.3.1 General 36
5.3.2 *Transmission bandwidth configuration* 37
5.3.3 Minimum guardband and *transmission bandwidth configuration* 37
5.3.4 RB alignment 39
5.3.5 *BS channel bandwidth* per *operating band* 39
5.3A *BS channel bandwidth* for CA 43
5.3A.1 *Transmission bandwidth configuration* for CA 43
5.3A.2 Minimum guardband and *transmission bandwidth configuration* for CA 43
5.4 Channel arrangement 45
5.4.1 Channel spacing 45
5.4.1.1 Channel spacing for adjacent NR carriers 45
5.4.1.2 Channel spacing for CA 45
5.4.2 Channel raster 46
5.4.2.1 NR-ARFCN and channel raster 46
5.4.2.1A NB-IoT carrier frequency numbering 47
5.4.2.2 Channel raster to resource element mapping 47
5.4.2.3 Channel raster entries for each *operating band* 47
5.4.3 Synchronization raster 51
5.4.3.1 Synchronization raster and numbering 51
5.4.3.3 Synchronization raster entries for each operating band 51
6 Conducted transmitter characteristics 55
6.1 General 55
6.2 Base station output power 55
6.2.1 General 55
6.2.2 Minimum requirement for *BS type 1-C* 56

iTeh STANDARD PREVIEW (standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-1001-4d4d-a045-5b98cf5886ab/etsi-ts-138-104-v17.5.0-2022-04

6.2.3 Minimum requirement for *BS type 1-H* 56
6.2.4 Additional requirements (regional) 56
6.3 Output power dynamics 56
6.3.1 General 56
6.3.2 RE power control dynamic range 56
6.3.2.1 General 56
6.3.2.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 57
6.3.3 Total power dynamic range 57
6.3.3.1 General 57
6.3.3.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 57
6.3.4 NB-IoT RB power dynamic range for NB-IoT operation in NR in-band 58
6.3.4.1 General 58
6.3.4.2 Minimum Requirement 58
6.4 Transmit ON/OFF power 58
6.4.1 Transmitter OFF power 58
6.4.1.1 General 58
6.4.1.2 Minimum requirement for *BS type 1-C* 59
6.4.1.3 Minimum requirement for *BS type 1-H* 59
6.4.2 *Transmitter transient period* 59
6.4.2.1 General 59
6.4.2.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 1-H 60
6.4.2.3 Void 60
6.5 Transmitted signal quality 60
6.5.1 Frequency error 60
6.5.1.1 General 60
6.5.1.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 60
6.5.2 Modulation quality 60
6.5.2.1 General 60
6.5.2.2 Minimum Requirement for *BS type 1-C* and *BS type 1-H* 61
6.5.2.3 EVM frame structure for measurement 61
6.5.3 Time alignment error 61
6.5.3.1 General 61
6.5.3.2 Minimum requirement for *BS type 1-C* and *BS type* 1-H 61
6.6 Unwanted emissions 62
6.6.1 General 62
6.6.2 Occupied bandwidth 63
6.6.2.1 General 63
6.6.2.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 63
6.6.3 Adjacent Channel Leakage Power Ratio 63
6.6.3.1 General 63
6.6.3.2 Limits and *Basic limits* 63
6.6.3.3 Minimum requirement for *BS type 1-C* 67
6.6.3.4 Minimum requirement for *BS type 1-H* 67
6.6.4 Operating band unwanted emissions 67
6.6.4.1 General 67
6.6.4.2 *Basic limits* 69
6.6.4.2.1 *Basic limits* for Wide Area BS (Category A) 69
6.6.4.2.2 Basic limits for Wide Area BS (Category B) 70
6.6.4.2.3 *Basic limits* for Medium Range BS (Category A and B) 71
6.6.4.2.4 *Basic limits* for Local Area BS (Category A and B) 72
6.6.4.2.4A Basic limits for Local Area and Medium Range BS for band n46, n96 and n102 (Category A and B) 72
6.6.4.2.5 *Basic limits* for additional requirements 75
6.6.4.3 Minimum requirements for *BS type 1-C* 77
6.6.4.4 Minimum requirements for *BS type 1-H* 77
6.6.5 Transmitter spurious emissions 77
6.6.5.1 General 77
6.6.5.2 *Basic limits* 78
6.6.5.2.1 General transmitter spurious emissions requirements 78
6.6.5.2.2 Protection of the BS receiver of own or different BS 78
6.6.5.2.3 Additional spurious emissions requirements 79
6.6.5.2.4 Co-location with other base stations 89

iTeh STANDARD PREVIEW (standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-16b1-4d4d-a045-5b98cf5886ab/etsi-ts-138-104-v17-5-0-2022-04

6.6.5.3 Minimum requirements for *BS type 1-C* 94
6.6.5.4 Minimum requirements for *BS type 1-H* 95
6.7 Transmitter intermodulation 95
6.7.1 General 95
6.7.2 Minimum requirements for *BS type 1-C* 95
6.7.2.1 Co-location minimum requirements 95
6.7.2.2 Additional requirements 96
6.7.3 Minimum requirements for *BS type 1-H* 96
6.7.3.1 Co-location minimum requirements 96
6.7.3.2 Intra-system minimum requirements 97
6.7.3.3 Additional requirements 98

7 Conducted receiver characteristics 99
7.1 General 99
7.2 Reference sensitivity level 99
7.2.1 General 99
7.2.2 Minimum requirements for *BS type 1-C* and *BS type 1-H* 99
7.3 Dynamic range 103
7.3.1 General 103
7.3.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 103
7.4 In-band selectivity and blocking 113
7.4.1 Adjacent Channel Selectivity (ACS) 113
7.4.1.1 General 113
7.4.1.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 113
7.4.1.3 Void 115
7.4.1.4 Void 115
7.4.2 In-band blocking 115
7.4.2.1 General 115
7.4.2.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 115
7.4.2.3 Void 119
7.4.2.4 Void 119
7.5 Out-of-band blocking 119
7.5.1 General 119
7.5.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 119
7.5.3 Co-location minimum requirements for *BS type 1-C* and *BS type 1-H* 121
7.5.4 Void 121
7.5.5 Additional out-of-band blocking requirements for the use of RMR bands 121
7.6 Receiver spurious emissions 122
7.6.1 General 122
7.6.2 *Basic limits* 122
7.6.3 Minimum requirement for *BS type 1-C* 123
7.6.4 Minimum requirement for *BS type 1-H* 123
7.7 Receiver intermodulation 124
7.7.1 General 124
7.7.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 124
7.8 In-channel selectivity 129
7.8.1 General 129
7.8.2 Minimum requirement for *BS type 1-C* and *BS type 1-H* 129

8 Conducted performance requirements 137
8.1 General 137
8.1.1 Scope and definitions 137
8.1.2 Void 137
8.2 Performance requirements for PUSCH 137
8.2.1 Requirements for PUSCH with transform precoding disabled 137
8.2.1.1 General 137
8.2.1.2 Minimum requirements 138
8.2.2 Requirements for PUSCH with transform precoding enabled 146
8.2.2.1 General 146
8.2.2.2 Minimum requirements 146
8.2.3 Requirements for UCI multiplexed on PUSCH 147
8.2.3.1 General 147

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/1c1b4febb-16b1-4d4d-a045-5b98ef5886ab/etsi-ts-138-104-v17.5.0-2022-04

8.2.3.2 Minimum requirements 148
8.2.4 Requirements for PUSCH for high speed train 149
8.2.4.1 General 149
8.2.4.2 Minimum requirements 150
8.2.5 Requirements for UL timing adjustment 152
8.2.5.1 Minimum requirements for high speed train 153
8.2.5.2 Minimum requirements for normal mode 154
8.2.6 Requirements for PUSCH 0.001% BLER 155
8.2.6.1 General 155
8.2.6.2 Minimum requirements 155
8.2.7 Requirements for PUSCH repetition Type A 156
8.2.7.1 General 156
8.2.7.2 Minimum requirements 157
8.2.8 Requirements for PUSCH mapping Type B with non-slot transmission 159
8.2.8.1 General 159
8.2.8.2 Minimum requirements 159
8.2.9 Requirements of PUSCH for 2-step RA type 160
8.2.9.1 General 160
8.2.9.2 Minimum requirements 161
8.2.10 Requirements for interlaced PUSCH 162
8.2.10.1 General 162
8.2.10.2 Minimum requirements 162
8.2.11 Performance requirements for CG-UCI multiplexed on interlaced PUSCH 163
8.2.11.1 General 163
8.2.11.2 Minimum requirements 164
8.3 Performance requirements for PUCCH 165
8.3.1 DTX to ACK probability 165
8.3.1.1 General 165
8.3.1.2 Minimum requirement 165
8.3.2 Performance requirements for PUCCH format 0 165
8.3.2.1 General 165
8.3.2.2 Minimum requirements 166
8.3.3 Performance requirements for PUCCH format 1 166
8.3.3.1 NACK to ACK requirements 166
8.3.3.1.1 General 166
8.3.3.1.2 Minimum requirements 167
8.3.3.2 ACK missed detection requirements 168
8.3.3.2.1 General 168
8.3.3.2.2 Minimum requirements 168
8.3.4 Performance requirements for PUCCH format 2 169
8.3.4.1 ACK missed detection requirements 169
8.3.4.1.1 General 169
8.3.4.1.2 Minimum requirements 169
8.3.4.2 UCI BLER performance requirements 170
8.3.4.2.1 General 170
8.3.4.2.2 Minimum requirements 170
8.3.5 Performance requirements for PUCCH format 3 171
8.3.5.1 General 171
8.3.5.2 Minimum requirements 171
8.3.6 Performance requirements for PUCCH format 4 172
8.3.6.1 General 172
8.3.6.2 Minimum requirement 172
8.3.7 Performance requirements for multi-slot PUCCH 173
8.3.7.1 General 173
8.3.7.2 Performance requirements for multi-slot PUCCH format 1 173
8.3.7.2.1 NACK to ACK requirements 173
8.3.7.2.1.1 General 173
8.3.7.2.1.2 Minimum requirements 174
8.3.7.2.2 ACK missed detection requirements 174
8.3.8 Performance requirements for interlaced PUCCH format 0 175
8.3.8.1 General 175
8.3.8.2 Minimum requirements 175

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-16b1-4d4d-a045-5b98cf5886ab/etsi-ts-138-104-v17-5-0-2022-04

8.3.9 Performance requirements for interlaced PUCCH format 1 175
8.3.9.1 NACK to ACK requirements 175
8.3.9.1.1 General 175
8.3.9.1.2 Minimum requirements 176
8.3.9.2 ACK missed detection requirements 176
8.3.9.2.1 General 176
8.3.9.2.2 Minimum requirements 177
8.3.10 Performance requirements for interlaced PUCCH format 2 177
8.3.10.1 General 177
8.3.10.2 Minimum requirements 177
8.3.11 Performance requirements for interlaced PUCCH format 3 178
8.3.11.1 General 178
8.3.11.2 Minimum requirements 178
8.4 Performance requirements for PRACH 179
8.4.1 PRACH False alarm probability 179
8.4.1.1 General 179
8.4.1.2 Minimum requirement 179
8.4.2 PRACH detection requirements 179
8.4.2.1 General 179
8.4.2.2 Minimum requirements for Normal Mode 179
8.4.2.3 Minimum requirements for high speed train 180
8.4.2.4 Minimum requirements for PRACH with L_{RA}=1151 and L_{RA}=571 181

9 Radiated transmitter characteristics 183
9.1 General 183
9.2 Radiated transmit power 183
9.2.1 General 183
9.2.2 Minimum requirement for *BS type 1-H* and *BS type 1-O* 184
9.2.3 Minimum requirement for *BS type 2-O* 184
9.3 OTA base station output power 184
9.3.1 General 184
9.3.2 Minimum requirement for *BS type 1-O* 185
9.3.3 Minimum requirement for *BS type 2-O* 185
9.3.4 Additional requirements (regional) 185
9.4 OTA output power dynamics 185
9.4.1 General 185
9.4.2 OTA RE power control dynamic range 185
9.4.2.1 General 185
9.4.2.2 Minimum requirement for *BS type 1-O* 185
9.4.3 OTA total power dynamic range 185
9.4.3.1 General 185
9.4.3.2 Minimum requirement for *BS type 1-O* 186
9.4.3.3 Minimum requirement for *BS type 2-O* 186
9.5 OTA transmit ON/OFF power 186
9.5.1 General 186
9.5.2 OTA transmitter OFF power 186
9.5.2.1 General 186
9.5.2.2 Minimum requirement for *BS type 1-O* 186
9.5.2.3 Minimum requirement for *BS type 2-O* 186
9.5.3 OTA transient period 186
9.5.3.1 General 186
9.5.3.2 Minimum requirement for *BS type 1-O* 187
9.5.3.3 Minimum requirement for *BS type 2-O* 187
9.6 OTA transmitted signal quality 187
9.6.1 OTA frequency error 187
9.6.1.1 General 187
9.6.1.2 Minimum requirement for *BS type 1-O* 187
9.6.1.3 Minimum requirement for *BS type 2-O* 187
9.6.2 OTA modulation quality 188
9.6.2.1 General 188
9.6.2.2 Minimum Requirement for *BS type 1-O* 188
9.6.2.3 Minimum Requirement for *BS type 2-O* 188

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-16b1-4d4d-a045-5b98ef5886ab/etsi-ts-138-104-v17.5.0-2022-04

9.6.2.3.1 EVM frame structure for measurement 188
9.6.3 OTA time alignment error 188
9.6.3.1 General 188
9.6.3.2 Minimum requirement for *BS type 1-O* 188
9.6.3.3 Minimum requirement for *BS type 2-O* 189
9.7 OTA unwanted emissions 189
9.7.1 General 189
9.7.2 OTA occupied bandwidth 190
9.7.2.1 General 190
9.7.2.2 Minimum requirement for *BS type 1-O* and *BS type* 2-O 190
9.7.3 OTA Adjacent Channel Leakage Power Ratio (ACLR) 190
9.7.3.1 General 190
9.7.3.2 Minimum requirement for *BS type 1-O* 190
9.7.3.3 Minimum requirement for *BS type 2-O* 190
9.7.4 OTA operating band unwanted emissions 192
9.7.4.1 General 192
9.7.4.2 Minimum requirement for *BS type 1-O* 192
9.7.4.2.1 Additional requirements 193
9.7.4.3 Minimum requirement for *BS type 2-O* 193
9.7.4.3.1 General 193
9.7.4.3.2 OTA operating band unwanted emission limits (Category A) 194
9.7.4.3.3 OTA operating band unwanted emission limits (Category B) 195
9.7.4.3.4 Additional OTA operating band unwanted emission requirements 195
9.7.5 OTA transmitter spurious emissions 196
9.7.5.1 General 196
9.7.5.2 Minimum requirement for *BS type 1-O* 196
9.7.5.2.1 General 196
9.7.5.2.2 General OTA transmitter spurious emissions requirements 196
9.7.5.2.3 Protection of the BS receiver of own or different BS 196
9.7.5.2.4 Additional spurious emissions requirements 196
9.7.5.2.5 Co-location with other base stations 197
9.7.5.3 Minimum requirement for *BS type 2-O* 197
9.7.5.3.1 General 197
9.7.5.3.2 General OTA transmitter spurious emissions requirements 197
9.7.5.3.3 Additional OTA transmitter spurious emissions requirements 198
9.8 OTA transmitter intermodulation 199
9.8.1 General 199
9.8.2 Minimum requirement for *BS type 1-O* 199

10 Radiated receiver characteristics 200
10.1 General 200
10.2 OTA sensitivity 201
10.2.1 *BS type 1-H* and *BS type 1-O* 201
10.2.1.1 General 201
10.2.1.2 Minimum requirement 201
10.2.2 *BS type 2-O* 201
10.3 OTA reference sensitivity level 202
10.3.1 General 202
10.3.2 Minimum requirement for *BS type 1-O* 202
10.3.3 Minimum requirement for *BS type 2-O* 203
10.4 OTA dynamic range 204
10.4.1 General 204
10.4.2 Minimum requirement for *BS type 1-O* 204
10.5 OTA in-band selectivity and blocking 213
10.5.1 OTA adjacent channel selectivity 213
10.5.1.1 General 213
10.5.1.2 Minimum requirement for *BS type 1-O* 213
10.5.1.3 Minimum requirement for *BS type 2-O* 214
10.5.2 OTA in-band blocking 215
10.5.2.1 General 215
10.5.2.2 Minimum requirement for *BS type 1-O* 215
10.5.2.3 Minimum requirement for *BS type 2-O* 218

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-16b1-4d4d-a045-5b98cf5886ab/etsi-ts-138-104-v17-5-0-2022-04

10.6 OTA out-of-band blocking 219
10.6.1 General 219
10.6.2 Minimum requirement for *BS type 1-O* 219
10.6.2.1 General minimum requirement 219
10.6.2.2 Co-location minimum requirement 220
10.6.3 Minimum requirement for *BS type 2-O* 220
10.6.3.1 General minimum requirement 220
10.7 OTA receiver spurious emissions 221
10.7.1 General 221
10.7.2 Minimum requirement for *BS type 1-O* 221
10.7.3 Minimum requirement for *BS type 2-O* 222
10.8 OTA receiver intermodulation 223
10.8.1 General 223
10.8.2 Minimum requirement for *BS type 1-O* 223
10.8.3 Minimum requirement for *BS type 2-O* 228
10.9 OTA in-channel selectivity 228
10.9.1 General 228
10.9.2 Minimum requirement for *BS type 1-O* 229
10.9.3 Minimum requirement for *BS type 2-O* 231

11 Radiated performance requirements 232
11.1 General 232
11.1.1 Scope and definitions 232
11.1.2 OTA demodulation branches 232
11.1.3 Void 233
11.2 Performance requirements for PUSCH 233
11.2.1 Requirements for *BS type 1-O* 233
11.2.1.1 Requirements for PUSCH with transform precoding disabled 233
11.2.1.2 Requirements for PUSCH with transform precoding enabled 233
11.2.1.3 Requirements for UCI multiplexed on PUSCH 233
11.2.1.4 Requirements for PUSCH for high speed train 233
11.2.1.5 Requirements for UL timing adjustment 233
11.2.1.6 Requirements for PUSCH 0.001% BLER 233
11.2.1.7 Requirements for PUSCH repetition Type A 233
11.2.1.8 Requirements for PUSCH mapping Type B with non-slot transmission 233
11.2.1.9 Requirements for PUSCH for 2-step RA type 233
11.2.1.10 Requirements for interlaced PUSCH 233
11.2.1.11 Requirements for CG-UCI multiplexed on interlaced PUSCH 233
11.2.2 Requirements for *BS type 2-O* 234
11.2.2.1 Requirements for PUSCH with transform precoding disabled 234
11.2.2.1.1 General 234
11.2.2.1.2 Minimum requirements 234
11.2.2.2 Requirements for PUSCH with transform precoding enabled 237
11.2.2.2.1 General 237
11.2.2.2.2 Minimum requirements 238
11.2.2.3 Requirements for UCI multiplexed on PUSCH 238
11.2.2.3.1 General 238
11.2.2.3.2 Minimum requirements 240
11.2.2.4 Requirements for PUSCH for 2-step RA type 242
11.2.2.4.1 General 242
11.2.2.4.2 Minimum requirements 242
11.2.2.5 Requirements for PUSCH repetition Type A 243
11.2.2.5.1 General 243
11.2.2.5.2 Minimum requirements 243
11.2.2.6 Requirements for PUSCH mapping Type B with non-slot transmission 244
11.2.2.6.1 General 244
11.2.2.6.2 Minimum requirements 245
11.3 Performance requirements for PUCCH 246
11.3.1 Requirements for *BS type 1-O* 246
11.3.1.1 DTX to ACK probability 246
11.3.1.2 Performance requirements for PUCCH format 0 246
11.3.1.3 Performance requirements for PUCCH format 1 246

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9...-ts-138-104-v17.5.0-2022-04

11.3.1.4 Performance requirements for PUCCH format 2 246
11.3.1.5 Performance requirements for PUCCH format 3 246
11.3.1.6 Performance requirements for PUCCH format 4 246
11.3.2 Requirements for *BS type 2-O* 246
11.3.2.1 DTX to ACK probability 246
11.3.2.2 Performance requirements for PUCCH format 0 246
11.3.2.2.1 General 246
11.3.2.2.2 Minimum requirements 247
11.3.2.3 Performance requirements for PUCCH format 1 247
11.3.2.3.1 NACK to ACK requirements 247
11.3.2.3.2 ACK missed detection requirements 248
11.3.2.4 Performance requirements for PUCCH format 2 249
11.3.2.4.1 ACK missed detection requirements 249
11.3.2.4.2 UCI BLER performance requirements 250
11.3.2.5 Performance requirements for PUCCH format 3 251
11.3.2.5.1 General 251
11.3.2.5.2 Minimum requirements 251
11.3.2.6 Performance requirements for PUCCH format 4 252
11.3.2.6.1 General 252
11.3.2.6.2 Minimum requirements 252
11.4 Performance requirements for PRACH 253
11.4.1 Requirements for *BS type 1-O* 253
11.4.1.1 PRACH False alarm probability 253
11.4.1.2 PRACH detection requirements 253
11.4.2 Requirements for *BS type 2-O* 253
11.4.2.1 PRACH False alarm probability 253
11.4.2.1.1 General 253
11.4.2.1.2 Minimum requirement 253
11.4.2.2 PRACH detection requirements 253
11.4.2.2.1 General 253
11.4.2.2.2 Minimum requirements 254

Annex A (normative): Reference measurement channels 255

A.1 Fixed Reference Channels for reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation and in-channel selectivity (QPSK, R=1/3) 255

A.2 Fixed Reference Channels for dynamic range (16QAM, R=2/3) 257

A.3 Fixed Reference Channels for performance requirements (QPSK, R=193/1024) 259

A.3A Fixed Reference Channels for performance requirements (QPSK, R=99/1024) 265

A.3B Fixed Reference Channels for performance requirements (QPSK, R=308/1024) 267

A.4 Fixed Reference Channels for performance requirements (16QAM, R=658/1024) 268

A.5 Fixed Reference Channels for performance requirements (64QAM, R=567/1024) 272

A.6 PRACH Test preambles 275

A.7 Fixed Reference Channels for performance requirements (16QAM, R=434/1024) 276

A.8 Fixed Reference Channels for performance requirements (QPSK, R=157/1024) 277

A.9 Fixed Reference Channels for performance requirements (256QAM, R=682.5/1024) 278

Annex B (normative): Error Vector Magnitude (FR1) 279

B.1 Reference point for measurement 279

B.2 Basic unit of measurement 279

B.3 Modified signal under test 280

B.4 Estimation of frequency offset 280

B.5 Estimation of time offset 280

iTeh STANDARD PREVIEW (standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/...
0-2022-04

B.5.1 General 280
B.5.2 Window length 281
B.6 Estimation of TX chain amplitude and frequency response parameters 282
B.7 Averaged EVM 284
Annex C (normative): Error Vector Magnitude (FR2) 286
C.1 Reference point for measurement 286
C.2 Basic unit of measurement 286
C.3 Modified signal under test 287
C.4 Estimation of frequency offset 287
C.5 Estimation of time offset 287
C.5.1 General 287
C.5.2 Window length 288
C.6 Estimation of TX chain amplitude and frequency response parameters 288
C.7 Averaged EVM 290
Annex D (normative): Characteristics of the interfering signals 292
Annex E: Void 293
Annex F (normative): Relationship between EIRP based regulatory requirements and 3GPP requirements 294
F.1 General 294
F.2 Relationship between EIRP based regulatory requirements and conducted requirements 294
F.3 Relationship between EIRP based regulatory requirements and OTA requirements 295
Annex G (Normative): Propagation conditions 296
G.1 Static propagation condition 296
G.2 Multi-path fading propagation conditions 296
G.2.1 Delay profiles 296
G.2.1.1 Delay profiles for FR1 297
G.2.1.2 Delay profiles for FR2 298
G.2.2 Combinations of channel model parameters 299
G.2.3 MIMO Channel Correlation Matrices 300
G.2.3.1 MIMO Correlation Matrices using Uniform Linear Array (ULA) 300
G.2.3.1.1 Definition of MIMO Correlation Matrices 300
G.2.3.1.2 MIMO Correlation Matrices at High, Medium and Low Level 304
G.2.3.2 Multi-Antenna channel models using cross polarized antennas 306
G.2.3.2.1 Definition of MIMO Correlation Matrices using cross polarized antennas 307
G.2.3.2.2 Spatial Correlation Matrices at UE and gNB sides 307
G.2.3.2.2.1 Spatial Correlation Matrices at UE side 307
G.2.3.2.2.2 Spatial Correlation Matrices at gNB side 308
G.2.3.2.3 MIMO Correlation Matrices using cross polarized antennas 308
G.3 High speed train condition 308
G.4 Moving propagation conditions 312
Annex H (informative): Change history 314
History 325

iTeh STANDARD PREVIEW (standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-1bb1-4d4d-a045-5b98cf5886ab/etsi-ts-138-104-v17.5.0-2022-04

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

iTeh STANDARD PREVIEW (standards.iteh.ai)

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-16b1-4d4d-a045-5b98cf5886ab/etsi-ts-138-104-v17-5-0-2022-04

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

iTeh STANDARD
PREVIEW
(standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)
https://standards.iteh.ai/catalog/standards/sist/9cb4febb-16b1-4d4d-a045-5b98cf5886ab/etsi-ts-138-104-v17-5-0-2022-04

1 Scope

The present document establishes the minimum RF characteristics and minimum performance requirements of NR and NB-IoT operation in NR in-band Base Station (BS).

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain".

[3] Recommendation ITU-R SM.328: "Spectra and bandwidth of emissions".

[4] 3GPP TR 25.942: "RF system scenarios".

[5] 3GPP TS 38.141-1: "NR; Base Station (BS) conformance testing; Part 1: Conducted conformance testing".

[6] 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing".

[7] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".

[8] "Title 47 of the Code of Federal Regulations (CFR)", Federal Communications Commission.

[9] 3GPP TS 38.211: "NR; Physical channels and modulation".

[10] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[11] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[12] ECC/DEC/(17)06: "The harmonised use of the frequency bands 1427-1452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)"

[13] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".

[14] 3GPP TS 37.105: "Active Antenna System (AAS) Base Station (BS) transmission and reception".

[15] 3GPP TS 38.212: "NR; Multiplexing and channel coding".

[16] 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz"

[17] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[18] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone"

[19] ERC Recommendation 74-01, "Unwanted emissions in the spurious domain".

iTeh STANDARD PREVIEW (standards.iteh.ai)
ETSI TS 138 104 V17.5.0 (2022-04)