

ETSI TS 138 104 V16.14.0 (2023-01)



5G; NR; Base Station (BS) radio transmission and reception (3GPP TS 38.104 version 16.14.0 Release 16)

ETSI TS 138 104 V16.14.0 (2023-01)

<https://standards.iteh.ai/catalog/standards/sist/30180c71-6c76-4bae-825b-43ef95b9ec63/etsi-ts-138-104-v16-14-0-2023-01>



ReferenceRTS/TSGR-0438104vge0

Keywords5G

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>

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>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

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 2023.
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.

Legal Notice

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

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 <i>non-contiguous spectrum</i>	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.....	38
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	44
5.4 Channel arrangement.....	46
5.4.1 Channel spacing.....	46
5.4.1.1 Channel spacing for adjacent NR carriers.....	46
5.4.1.2 Channel spacing for CA	46
5.4.2 Channel raster	47
5.4.2.1 NR-ARFCN and channel raster.....	47
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 <i>operating band</i>	48
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.....	52
6 Conducted transmitter characteristics	56
6.1 General	56
6.2 Base station output power	56
6.2.1 General.....	56
6.2.2 Minimum requirement for BS type 1-C.....	57

6.2.3	Minimum requirement for <i>BS type 1-H</i>	57
6.2.4	Additional requirements (regional).....	57
6.3	Output power dynamics.....	57
6.3.1	General.....	57
6.3.2	RE power control dynamic range	57
6.3.2.1	General	57
6.3.2.2	Minimum requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	58
6.3.3	Total power dynamic range	58
6.3.3.1	General	58
6.3.3.2	Minimum requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	58
6.3.4	NB-IoT RB power dynamic range for NB-IoT operation in NR in-band	59
6.3.4.1	General	59
6.3.4.2	Minimum Requirement	59
6.4	Transmit ON/OFF power	59
6.4.1	Transmitter OFF power	59
6.4.1.1	General	59
6.4.1.2	Minimum requirement for <i>BS type 1-C</i>	59
6.4.1.3	Minimum requirement for <i>BS type 1-H</i>	59
6.4.2	Transmitter transient period	60
6.4.2.1	General	60
6.4.2.2	Minimum requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	60
6.4.2.3	Void.....	61
6.5	Transmitted signal quality	61
6.5.1	Frequency error.....	61
6.5.1.1	General	61
6.5.1.2	Minimum requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	61
6.5.2	Modulation quality.....	61
6.5.2.1	General	61
6.5.2.2	Minimum Requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	61
6.5.2.3	EVM frame structure for measurement.....	62
6.5.3	Time alignment error	62
6.5.3.1	General	62
6.5.3.2	Minimum requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	62
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 <i>BS type 1-C</i> and <i>BS type 1-H</i>	63
6.6.3	Adjacent Channel Leakage Power Ratio	64
6.6.3.1	General	64
6.6.3.2	Limits and <i>Basic limits</i>	64
6.6.3.3	Minimum requirement for <i>BS type 1-C</i>	67
6.6.3.4	Minimum requirement for <i>BS type 1-H</i>	67
6.6.4	Operating band unwanted emissions	68
6.6.4.1	General	68
6.6.4.2	<i>Basic limits</i>	70
6.6.4.2.1	<i>Basic limits</i> for Wide Area BS (Category A)	70
6.6.4.2.2	<i>Basic limits</i> for Wide Area BS (Category B)	70
6.6.4.2.3	<i>Basic limits</i> for Medium Range BS (Category A and B).....	72
6.6.4.2.4	<i>Basic limits</i> for Local Area BS (Category A and B).....	73
6.6.4.2.4A	<i>Basic limits</i> for Local Area and Medium Range BS for band n46 and n96 (Category A and B)	73
6.6.4.2.5	<i>Basic limits</i> for additional requirements	76
6.6.4.3	Minimum requirements for <i>BS type 1-C</i>	77
6.6.4.4	Minimum requirements for <i>BS type 1-H</i>	77
6.6.5	Transmitter spurious emissions.....	78
6.6.5.1	General	78
6.6.5.2	<i>Basic limits</i>	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	79
6.6.5.2.3	Additional spurious emissions requirements	79
6.6.5.2.4	Co-location with other base stations.....	89
6.6.5.3	Minimum requirements for <i>BS type 1-C</i>	94

6.6.5.4	Minimum requirements for <i>BS type 1-H</i>	94
6.7	Transmitter intermodulation	95
6.7.1	General	95
6.7.2	Minimum requirements for <i>BS type 1-C</i>	95
6.7.2.1	Co-location minimum requirements	95
6.7.2.2	Additional requirements	96
6.7.3	Minimum requirements for <i>BS type 1-H</i>	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	97
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 <i>BS type 1-C</i> and <i>BS type 1-H</i>	99
7.3	Dynamic range	103
7.3.1	General	103
7.3.2	Minimum requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	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 <i>BS type 1-C</i> and <i>BS type 1-H</i>	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 <i>BS type 1-C</i> and <i>BS type 1-H</i>	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 <i>BS type 1-C</i> and <i>BS type 1-H</i>	119
7.5.3	Co-location minimum requirements for <i>BS type 1-C</i> and <i>BS type 1-H</i>	121
7.5.4	Void	121
7.6	Receiver spurious emissions	121
7.6.1	General	121
7.6.2	<i>Basic limits</i>	122
7.6.3	Minimum requirement for <i>BS type 1-C</i>	122
7.6.4	Minimum requirement for <i>BS type 1-H</i>	122
7.7	Receiver intermodulation	123
7.7.1	General	123
7.7.2	Minimum requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	123
7.8	In-channel selectivity	129
7.8.1	General	129
7.8.2	Minimum requirement for <i>BS type 1-C</i> and <i>BS type 1-H</i>	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
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	161
8.2.10.1	General	161
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
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 <i>BS type 1-H</i> and <i>BS type 1-O</i>	184
9.2.3	Minimum requirement for <i>BS type 2-O</i>	184
9.3	OTA base station output power	184
9.3.1	General	184
9.3.2	Minimum requirement for <i>BS type 1-O</i>	185
9.3.3	Minimum requirement for <i>BS type 2-O</i>	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 <i>BS type 1-O</i>	185
9.4.3	OTA total power dynamic range	185
9.4.3.1	General	185
9.4.3.2	Minimum requirement for <i>BS type 1-O</i>	186
9.4.3.3	Minimum requirement for <i>BS type 2-O</i>	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 <i>BS type 1-O</i>	186
9.5.2.3	Minimum requirement for <i>BS type 2-O</i>	186
9.5.3	OTA transient period	186
9.5.3.1	General	186
9.5.3.2	Minimum requirement for <i>BS type 1-O</i>	187
9.5.3.3	Minimum requirement for <i>BS type 2-O</i>	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 <i>BS type 1-O</i>	187
9.6.1.3	Minimum requirement for <i>BS type 2-O</i>	187
9.6.2	OTA modulation quality	188
9.6.2.1	General	188
9.6.2.2	Minimum Requirement for <i>BS type 1-O</i>	188
9.6.2.3	Minimum Requirement for <i>BS type 2-O</i>	188
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 <i>BS type 1-O</i>	188
9.6.3.3	Minimum requirement for <i>BS type 2-O</i>	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 <i>BS type 1-O</i> and <i>BS type 2-O</i>	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 <i>BS type 1-O</i>	190
9.7.3.3	Minimum requirement for <i>BS type 2-O</i>	190
9.7.4	OTA operating band unwanted emissions	192
9.7.4.1	General	192
9.7.4.2	Minimum requirement for <i>BS type 1-O</i>	192
9.7.4.2.1	Additional requirements	193
9.7.4.3	Minimum requirement for <i>BS type 2-O</i>	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 <i>BS type 1-O</i>	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 <i>BS type 2-O</i>	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 <i>BS type 1-O</i>	199
10	Radiated receiver characteristics	200
10.1	General	200
10.2	OTA sensitivity	201
10.2.1	<i>BS type 1-H</i> and <i>BS type 1-O</i>	201
10.2.1.1	General	201
10.2.1.2	Minimum requirement	201
10.2.2	<i>BS type 2-O</i>	201
10.3	OTA reference sensitivity level	202
10.3.1	General	202
10.3.2	Minimum requirement for <i>BS type 1-O</i>	202
10.3.3	Minimum requirement for <i>BS type 2-O</i>	203
10.4	OTA dynamic range	204
10.4.1	General	204
10.4.2	Minimum requirement for <i>BS type 1-O</i>	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 <i>BS type 1-O</i>	213
10.5.1.3	Minimum requirement for <i>BS type 2-O</i>	214
10.5.2	OTA in-band blocking	215
10.5.2.1	General	215
10.5.2.2	Minimum requirement for <i>BS type 1-O</i>	215
10.5.2.3	Minimum requirement for <i>BS type 2-O</i>	218
10.6	OTA out-of-band blocking	218
10.6.1	General	218

10.6.2	Minimum requirement for <i>BS type 1-O</i>	218
10.6.2.1	General minimum requirement	218
10.6.2.2	Co-location minimum requirement	219
10.6.3	Minimum requirement for <i>BS type 2-O</i>	220
10.6.3.1	General minimum requirement	220
10.7	OTA receiver spurious emissions.....	220
10.7.1	General.....	220
10.7.2	Minimum requirement for <i>BS type 1-O</i>	220
10.7.3	Minimum requirement for <i>BS type 2-O</i>	221
10.8	OTA receiver intermodulation	222
10.8.1	General.....	222
10.8.2	Minimum requirement for <i>BS type 1-O</i>	222
10.8.3	Minimum requirement for <i>BS type 2-O</i>	226
10.9	OTA in-channel selectivity.....	227
10.9.1	General.....	227
10.9.2	Minimum requirement for <i>BS type 1-O</i>	227
10.9.3	Minimum requirement for <i>BS type 2-O</i>	230
11	Radiated performance requirements.....	231
11.1	General	231
11.1.1	Scope and definitions.....	231
11.1.2	OTA demodulation branches	231
11.1.3	Void	232
11.2	Performance requirements for PUSCH	232
11.2.1	Requirements for <i>BS type 1-O</i>	232
11.2.1.1	Requirements for PUSCH with transform precoding disabled	232
11.2.1.2	Requirements for PUSCH with transform precoding enabled	232
11.2.1.3	Requirements for UCI multiplexed on PUSCH	232
11.2.1.4	Requirements for PUSCH for high speed train	232
11.2.1.5	Requirements for UL timing adjustment.....	232
11.2.1.6	Requirements for PUSCH 0.001% BLER.....	232
11.2.1.7	Requirements for PUSCH repetition Type A.....	232
11.2.1.8	Requirements for PUSCH mapping Type B with non-slot transmission	232
11.2.1.9	Requirements for PUSCH for 2-step RA type	232
11.2.1.10	Requirements for interlaced PUSCH	232
11.2.1.11	Requirements for CG-UCI multiplexed on interlaced PUSCH	232
11.2.2	Requirements for <i>BS type 2-O</i>	233
11.2.2.1	Requirements for PUSCH with transform precoding disabled	233
11.2.2.1.1	General	233
11.2.2.1.2	Minimum requirements	233
11.2.2.2	Requirements for PUSCH with transform precoding enabled	236
11.2.2.2.1	General	236
11.2.2.2.2	Minimum requirements	237
11.2.2.3	Requirements for UCI multiplexed on PUSCH	237
11.2.2.3.1	General	237
11.2.2.3.2	Minimum requirements	239
11.2.2.4	Requirements for PUSCH for 2-step RA type	241
11.2.2.4.1	General	241
11.2.2.4.2	Minimum requirements	241
11.2.2.5	Requirements for PUSCH repetition Type A.....	242
11.2.2.5.1	General	242
11.2.2.5.2	Minimum requirements	242
11.2.2.6	Requirements for PUSCH mapping Type B with non-slot transmission	243
11.2.2.6.1	General	243
11.2.2.6.2	Minimum requirements	244
11.3	Performance requirements for PUCCH.....	245
11.3.1	Requirements for <i>BS type 1-O</i>	245
11.3.1.1	DTX to ACK probability	245
11.3.1.2	Performance requirements for PUCCH format 0	245
11.3.1.3	Performance requirements for PUCCH format 1	245
11.3.1.4	Performance requirements for PUCCH format 2	245
11.3.1.5	Performance requirements for PUCCH format 3	245

11.3.1.6	Performance requirements for PUCCH format 4	245
11.3.2	Requirements for <i>BS type 2-O</i>	245
11.3.2.1	DTX to ACK probability	245
11.3.2.2	Performance requirements for PUCCH format 0	245
11.3.2.2.1	General	245
11.3.2.2.2	Minimum requirements	246
11.3.2.3	Performance requirements for PUCCH format 1	246
11.3.2.3.1	NACK to ACK requirements	246
11.3.2.3.2	ACK missed detection requirements	247
11.3.2.4	Performance requirements for PUCCH format 2	248
11.3.2.4.1	ACK missed detection requirements	248
11.3.2.4.2	UCI BLER performance requirements	249
11.3.2.5	Performance requirements for PUCCH format 3	250
11.3.2.5.1	General	250
11.3.2.5.2	Minimum requirements	250
11.3.2.6	Performance requirements for PUCCH format 4	251
11.3.2.6.1	General	251
11.3.2.6.2	Minimum requirements	251
11.4	Performance requirements for PRACH	252
11.4.1	Requirements for <i>BS type 1-O</i>	252
11.4.1.1	PRACH False alarm probability	252
11.4.1.2	PRACH detection requirements	252
11.4.2	Requirements for <i>BS type 2-O</i>	252
11.4.2.1	PRACH False alarm probability	252
11.4.2.1.1	General	252
11.4.2.1.2	Minimum requirement	252
11.4.2.2	PRACH detection requirements	252
11.4.2.2.1	General	252
11.4.2.2.2	Minimum requirements	252
Annex A (normative):	Reference measurement channels	254
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)	254
A.2	Fixed Reference Channels for dynamic range (16QAM, R=2/3)	256
A.3	Fixed Reference Channels for performance requirements (QPSK, R=193/1024)	258
A.3A	Fixed Reference Channels for performance requirements (QPSK, R=99/1024)	264
A.3B	Fixed Reference Channels for performance requirements (QPSK, R=308/1024)	266
A.4	Fixed Reference Channels for performance requirements (16QAM, R=658/1024)	267
A.5	Fixed Reference Channels for performance requirements (64QAM, R=567/1024)	271
A.6	PRACH Test preambles	274
A.7	Fixed Reference Channels for performance requirements (16QAM, R=434/1024)	275
A.8	Fixed Reference Channels for performance requirements (QPSK, R=157/1024)	276
Annex B (normative):	Error Vector Magnitude (FR1)	278
B.1	Reference point for measurement	278
B.2	Basic unit of measurement	278
B.3	Modified signal under test	279
B.4	Estimation of frequency offset	279
B.5	Estimation of time offset	279
B.5.1	General	279
B.5.2	Window length	280
B.6	Estimation of TX chain amplitude and frequency response parameters	281

B.7	Averaged EVM	282
Annex C (normative):	Error Vector Magnitude (FR2)	284
C.1	Reference point for measurement.....	284
C.2	Basic unit of measurement	284
C.3	Modified signal under test.....	285
C.4	Estimation of frequency offset	285
C.5	Estimation of time offset	285
C.5.1	General	285
C.5.2	Window length	286
C.6	Estimation of TX chain amplitude and frequency response parameters	286
C.7	Averaged EVM	288
Annex D (normative):	Characteristics of the interfering signals.....	290
Annex E:	Void	291
Annex F (normative):	Relationship between EIRP based regulatory requirements and 3GPP requirements.....	292
F.1	General	292
F.2	Relationship between EIRP based regulatory requirements and conducted requirements.....	292
F.3	Relationship between EIRP based regulatory requirements and OTA requirements.....	293
Annex G (Normative):	Propagation conditions.....	294
G.1	Static propagation condition.....	294
G.2	Multi-path fading propagation conditions.....	294
G.2.1	Delay profiles	294
G.2.1.1	Delay profiles for FR1	295
G.2.1.2	Delay profiles for FR2	296
G.2.2	Combinations of channel model parameters	297
G.2.3	MIMO Channel Correlation Matrices	298
G.2.3.1	MIMO Correlation Matrices using Uniform Linear Array (ULA)	298
G.2.3.1.1	Definition of MIMO Correlation Matrices.....	298
G.2.3.1.2	MIMO Correlation Matrices at High, Medium and Low Level	302
G.2.3.2	Multi-Antenna channel models using cross polarized antennas	304
G.2.3.2.1	Definition of MIMO Correlation Matrices using cross polarized antennas	305
G.2.3.2.2	Spatial Correlation Matrices at UE and gNB sides	305
G.2.3.2.2.1	Spatial Correlation Matrices at UE side	305
G.2.3.2.2.2	Spatial Correlation Matrices at gNB side	306
G.2.3.2.3	MIMO Correlation Matrices using cross polarized antennas	306
G.3	High speed train condition	306
G.4	Moving propagation conditions.....	310
Annex H (informative):	Change history	312
History		323

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

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.

- 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 V16.14.0 (2023-01)

<https://standards.iteh.ai/catalog/standards/sist/30180c71-6c76-4bae-825b-43ef95b9ec63/etsi-ts-138-104-v16-14-0-2023-01>

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] <https://standards.iteh.ai/catalog/standards/sist/30180c71-6c76-4bae-825b-43e95b9ec63/etsi-ts-138-104-v16-14-0-2023-01>
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".