



TECHNICAL SPECIFICATION

**LTE;
Evolved Universal Terrestrial Radio Access (E-UTRA);
Base Station (BS) conformance testing
(3GPP TS 36.141 version 17.15.0 Release 17)**

get full document from standards.iteh.ai



ReferenceRTS/TSGR-0436141vhf0

KeywordsLTE

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 the
[ETSI Search & Browse Standards](#) application.

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 on [ETSI deliver](#) repository.

Users should be aware that the present document may be revised or have its status changed, this information is available in the [Milestones listing](#).

If you find errors in the present document, please send your comments to the relevant service listed under [Committee Support Staff](#).

If you find a security vulnerability in the present document, please report it through our [Coordinated Vulnerability Disclosure \(CVD\)](#) program.

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 2026.
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 IPR online database](#).

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™**, **LTE™** and **5G™** logo 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 at [3GPP to ETSI numbering cross-referencing](#).

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.....	16
1 Scope	18
2 References	18
3 Definitions, symbols and abbreviations	19
3.1 Definitions	19
3.2 Symbols.....	22
3.3 Abbreviations	24
4 General test conditions and declarations	25
4.1 Measurement uncertainties and Test Requirements	25
4.1.1 General.....	25
4.1.2 Acceptable uncertainty of Test System.....	26
4.1.2.1 Measurement of transmitter	27
4.1.2.2 Measurement of receiver	28
4.1.2.3 Measurement of performance requirement	35
4.1.3 Interpretation of measurement results.....	41
4.2 Base station classes	41
4.3 Regional requirements.....	41
4.4 Selection of configurations for testing.....	44
4.5 BS Configurations	44
4.5.1 Transmit configurations	44
4.5.1.1 Transmission with multiple transmitter antenna connectors	45
4.5.2 Receive configurations	45
4.5.2.1 Reception with multiple receiver antenna connectors, receiver diversity	45
4.5.3 Duplexers.....	46
4.5.4 Power supply options.....	46
4.5.5 Ancillary RF amplifiers	46
4.5.6 BS with integrated Iuant BS modem	47
4.5.7 BS using antenna arrays.....	47
4.5.7.1 Receiver tests	47
4.5.7.2 Transmitter tests	48
4.6 Manufacturer's declarations of regional and optional requirements	48
4.6.1 Operating band and frequency range	48
4.6.2 Channel bandwidth	49
4.6.3 Base station output power.....	49
4.6.4 Spurious emissions Category.....	49
4.6.5 Additional operating band unwanted emissions	49
4.6.6 Co-existence with other systems.....	50
4.6.7 Co-location with other base stations	50
4.6.8 Manufacturer's declarations of supported RF configurations	50
4.6.9 NB-IoT sub-carrier spacing	52
4.6.10 NB-IoT power dynamic range	52
4.6.11 Sub-PRB allocation.....	52
4.7 Specified frequency range and supported channel bandwidth.....	52
4.7.1 Base Station RF Bandwidth position for multi-carrier and/or CA testing	53
4.7.2 Aggregated Channel Bandwidth position for Contiguous CA occupied bandwidth testing	53
4.7.3 NB-IoT testing.....	54
4.8 Format and interpretation of tests.....	54
4.9 Applicability of requirements.....	55
4.10 Test configurations for multi-carrier and/or CA operation.....	55
4.10.1 ETC1: Contiguous spectrum operation.....	55
4.10.1.1 ETC1 generation	55

4.10.1.2	ETC1 power allocation	56
4.10.2	ETC2: Contiguous CA occupied bandwidth.....	56
4.10.2.1	ETC2 generation	56
4.10.2.2	ETC2 power allocation	57
4.10.3	ETC3: Non-contiguous spectrum operation	57
4.10.3.1	ETC3 generation	57
4.10.3.2	ETC3 power allocation	57
4.10.3.24	VOID.....	57
4.10.4	ETC4: Multi-band test configuration for full carrier allocation.....	57
4.10.4.1	ETC4 generation	57
4.10.4.2	ETC4 power allocation	58
4.10.5	ETC5: Multi-band test configuration with high PSD per carrier	58
4.10.5.1	ETC5 generation	58
4.10.5.2	ETC5 power allocation	59
4.10.6	ETC6: NB-IoT standalone multi-carrier operation	59
4.10.6.1	ETC6 generation	59
4.10.6.2	ETC6 power allocation	59
4.10.7	ETC7: E-UTRA and NB-IoT standalone multi-carrier operation.....	59
4.10.7.1	ETC7 generation	59
4.10.7.2	ETC7 power allocation	60
4.10.8	ETC8: E-UTRA and NB-IoT in-band multi-carrier operation.....	60
4.10.8.1	ETC8 generation	60
4.10.8.2	ETC8 power allocation	60
4.10.9	ETC9: E-UTRA and NB-IoT guard-band multi-carrier operation.....	60
4.10.9.1	ETC9 generation	60
4.10.9.2	ETC9 power allocation	61
4.11	Applicability of test configurations	61
4.12	Requirements for BS capable of multi-band operation	66
4.13	Tests for BS capable of multi-band operation with three or more bands	67
5	Operating bands and channel arrangement.....	67
5.1	General	67
5.2	Void.....	67
5.3	Void.....	67
5.4	Void.....	67
5.5	Operating bands.....	67
5.6	Channel bandwidth.....	71
5.7	Channel arrangement.....	75
5.7.1	Channel spacing.....	75
5.7.1A	CA Channel spacing	75
5.7.2	Channel raster	76
5.7.3	Carrier frequency and EARFCN.....	76
5.8	Requirements for contiguous and non-contiguous spectrum.....	79
6	Transmitter characteristics	80
6.1	General	80
6.1.1	E-UTRA Test Models.....	80
6.1.1.1	E-UTRA Test Model 1.1 (E-TM1.1).....	80
6.1.1.2	E-UTRA Test Model 1.2 (E-TM1.2).....	82
6.1.1.3	E-UTRA Test Model 2 (E-TM2)	84
6.1.1.3a	E-UTRA Test Model 2a (E-TM2a).....	87
6.1.1.3b	E-UTRA Test Model 2b (E-TM2b)	87
6.1.1.3c	E-UTRA subslot TTI Test Model 2-1 (sE-TM2-1).....	87
6.1.1.3d	E-UTRA subslot TTI Test Model 2a (sE-TM2a-1).....	89
6.1.1.3e	E-UTRA slot TTI Test Model 2-2 (sE-TM2-2)	89
6.1.1.3f	E-UTRA slot TTI Test Model 2a (sE-TM2a-2).....	91
6.1.1.4	E-UTRA Test Model 3.1 (E-TM3.1).....	91
6.1.1.4a	E-UTRA Test Model 3.1a (E-TM3.1a).....	92
6.1.1.4b	E-UTRA Test Model 3.1b (E-TM3.1b).....	92
6.1.1.4c	E-UTRA subslot TTI Test Model 3.1 (sE-TM3.1-1)	93
6.1.1.4d	E-UTRA subslot TTI Test Model 3.1a (sE-TM3.1a-1).....	94
6.1.1.4e	E-UTRA slot TTI Test Model 3.1 (sE-TM3.1-2).....	95

6.1.1.4f	E-UTRA slot TTI Test Model 3.1a (sE-TM3.1a-2)	95
6.1.1.5	E-UTRA Test Model 3.2 (E-TM3.2).....	96
6.1.1.5a	E-UTRA subslot TTI Test Model 3.2 (sE-TM3.2-1)	100
6.1.1.5b	E-UTRA slot TTI Test Model 3.2 (sE-TM3.2-2).....	112
6.1.1.6	E-UTRA Test Model 3.3 (E-TM3.3).....	124
6.1.1.6a	E-UTRA subslot TTI Test Model 3.3 (sE-TM3.3-1)	129
6.1.1.6b	E-UTRA slot TTI Test Model 3.3 (sE-TM3.3-2).....	135
6.1.2	Data content of Physical channels and Signals for E-TM.....	142
6.1.2.1	Reference signals	143
6.1.2.2	Primary Synchronization signal	143
6.1.2.3	Secondary Synchronization signal	143
6.1.2.4	PBCH	143
6.1.2.5	PCFICH.....	143
6.1.2.6	PHICH.....	143
6.1.2.7	PDCCH	144
6.1.2.8	PDSCH or sPDSCH	144
6.1.2.9	sPDCCH.....	144
6.1.3	NB-IoT Test Model	145
6.1.4	Data content of Physical channels and Signals for N-TM	145
6.1.4.1	Reference signals	146
6.1.4.2	Synchronization signals	146
6.1.4.3	NPBCH	146
6.1.4.4	NPDCCH	146
6.1.4.5	NPDSCH.....	146
6.1.5	Test Model for NB-IoT guard band operation.....	147
6.1.6	Test Model for NB-IoT in-band operation.....	147
6.2	Base station output power	147
6.2.1	Definition and applicability	147
6.2.2	Minimum Requirement	148
6.2.3	Test purpose.....	148
6.2.4	Method of test	149
6.2.4.1	Initial conditions	149
6.2.4.2	Procedure	149
6.2.5	Test Requirements	149
6.2.6	Home BS output power for adjacent UTRA channel protection.....	150
6.2.6.1	Definition and applicability.....	150
6.2.6.2	Minimum Requirement	151
6.2.6.3	Test purpose	151
6.2.6.4	Method of test	151
6.2.6.4.1	Initial conditions.....	151
6.2.6.4.2	Procedure.....	151
6.2.6.5	Test Requirements.....	152
6.2.7	Home BS output power for adjacent E-UTRA channel protection.....	152
6.2.7.1	Definition and applicability.....	152
6.2.7.2	Minimum Requirement	153
6.2.7.3	Test purpose	153
6.2.7.4	Method of test	153
6.2.7.4.1	Initial conditions	153
6.2.7.4.2	Procedure.....	154
6.2.7.5	Test Requirements.....	154
6.2.8	Home BS output power for co-channel E-UTRA protection.....	155
6.2.8.1	Definition and applicability.....	155
6.2.8.2	Minimum Requirement	156
6.2.8.3	Test purpose	156
6.2.8.4	Method of test	156
6.2.8.4.1	Initial conditions	156
6.2.8.4.2	Procedure.....	156
6.2.8.5	Test Requirements.....	157
6.3	Output power dynamics.....	157
6.3.1	RE Power control dynamic range	157
6.3.1.1	Definition and applicability.....	157
6.3.1.2	Minimum Requirement	158

6.3.1.3	Method of test	158
6.3.2	Total power dynamic range	158
6.3.2.1	Definition and applicability	158
6.3.2.2	Minimum Requirement	158
6.3.2.3	Test purpose	158
6.3.2.4	Method of test	158
6.3.2.4.1	Initial conditions	158
6.3.2.4.2	Procedure	158
6.3.2.5	Test Requirement	159
6.3.3	NB-IoT RB power dynamic range for in-band or guard band operation	159
6.3.3.1	Definition and applicability	159
6.3.3.2	Minimum Requirement	159
6.3.3.3	Test purpose	159
6.3.3.4	Method of test	159
6.3.3.5	Test Requirement	159
6.4	Transmit ON/OFF power	160
6.4.1	Transmitter OFF power	160
6.4.1.1	Definition and applicability	160
6.4.1.2	Minimum Requirement	160
6.4.1.3	Test purpose	160
6.4.1.4	Method of test	160
6.4.1.4.1	Void	160
6.4.1.4.2	Void	160
6.4.1.5	Test requirement	160
6.4.2	Transmitter transient period	160
6.4.2.1	Definition and applicability	160
6.4.2.2	Minimum Requirement	161
6.4.2.3	Test purpose	161
6.4.2.4	Method of test	161
6.4.2.4.1	Initial conditions	161
6.4.2.4.2	Procedure	161
6.4.2.5	Test requirement	162
6.5	Transmitted signal quality	162
6.5.1	Frequency error	162
6.5.1.1	Definition and applicability	162
6.5.1.2	Minimum Requirement	162
6.5.1.3	Test purpose	162
6.5.1.4	Method of test	162
6.5.1.5	Test requirement	162
6.5.2	Error Vector Magnitude	163
6.5.2.1	Definition and applicability	163
6.5.2.2	Minimum Requirement	163
6.5.2.3	Test purpose	163
6.5.2.4	Method of test	163
6.5.2.4.1	Initial conditions	163
6.5.2.4.2	Procedure	163
6.5.2.5	Test requirement	164
6.5.3	Time alignment error	165
6.5.3.1	Definition and applicability	165
6.5.3.2	Minimum Requirement	165
6.5.3.3	Test Purpose	165
6.5.3.4	Method of Test	165
6.5.3.4.1	Initial Conditions	165
6.5.3.4.2	Procedure	166
6.5.3.5	Test Requirement	166
6.5.4	DL RS power	167
6.5.4.1	Definition and applicability	167
6.5.4.2	Minimum Requirement	167
6.5.4.3	Test purpose	167
6.5.4.4	Method of test	167
6.5.4.4.1	Initial conditions	167
6.5.4.4.2	Procedure	167

6.5.4.5	Test requirement	167
6.6	Unwanted emissions.....	168
6.6.1	Occupied bandwidth	168
6.6.1.1	Definition and applicability.....	168
6.6.1.2	Minimum Requirements.....	168
6.6.1.3	Test purpose	168
6.6.1.4	Method of test	168
6.6.1.4.1	Initial conditions	168
6.6.1.4.2	Procedure.....	169
6.6.1.5	Test requirements.....	170
6.6.2	Adjacent Channel Leakage power Ratio (ACLR)	170
6.6.2.1	Definition and applicability.....	170
6.6.2.2	Minimum Requirement	170
6.6.2.3	Test purpose	171
6.6.2.4	Method of test	171
6.6.2.4.1	Initial conditions.....	171
6.6.2.4.2	Procedure.....	171
6.6.2.5	Test Requirement	172
6.6.2.6	Cumulative ACLR test requirement in non-contiguous spectrum	174
6.6.3	Operating band unwanted emissions	176
6.6.3.1	Definition and applicability.....	176
6.6.3.2	Minimum Requirement	177
6.6.3.3	Test purpose	177
6.6.3.4	Method of test	177
6.6.3.4.1	Initial conditions.....	177
6.6.3.4.2	Procedure.....	178
6.6.3.5	Test requirement	178
6.6.3.5.1	Test requirements for Wide Area BS (Category A).....	179
6.6.3.5.2	Test requirements for Wide Area BS (Category B).....	184
6.6.3.5.2.1	Category B test requirements (Option 1).....	184
6.6.3.5.2.2	Category B (Option 2).....	187
6.6.3.5.2A	Test requirements for Local Area BS (Category A and B).....	190
6.6.3.5.2B	Test requirements for Home BS (Category A and B).....	193
6.6.3.5.2C	Test requirements for Medium Range BS (Category A and B).....	194
6.6.3.5.2D	Minimum requirements for Local Area and Medium Range BS in Band 46 (Category A and B).....	199
6.6.3.5.2E	Minimum requirements for stand-alone NB-IoT Wide Area BS.....	200
6.6.3.5.2F	Minimum requirements for stand-alone NB-IoT Local Area BS	201
6.6.3.5.2G	Minimum requirements for stand-alone NB-IoT Home BS	202
6.6.3.5.2H	Minimum requirements for stand-alone NB-IoT Medium Range BS	203
6.6.3.5.3	Additional requirements	204
6.6.4	Transmitter spurious emissions.....	209
6.6.4.1	Definition and applicability.....	209
6.6.4.2	Minimum Requirements.....	209
6.6.4.3	Test Purpose	209
6.6.4.4	Method of Test	209
6.6.4.4.1	Initial conditions	209
6.6.4.4.2	Procedure.....	210
6.6.4.5	Test requirements.....	210
6.6.4.5.1	Spurious emissions (Category A)	211
6.6.4.5.2	Spurious emissions (Category B)	211
6.6.4.5.3	Protection of the BS receiver of own or different BS	211
6.6.4.5.4	Co-existence with other systems in the same geographical area	212
6.6.4.5.5	Co-location with other base stations.....	228
6.7	Transmitter intermodulation.....	243
6.7.1	Definition and applicability	243
6.7.2	Minimum Requirement	244
6.7.2A	Additional requirement for Band 41	244
6.7.3	Test purpose.....	244
6.7.4	Method of test	244
6.7.4.1	Initial conditions	244
6.7.4.2	Procedures.....	244

6.7.5	Test Requirements	245
6.7.6	Additional test requirements for Band 41	246
7	Receiver characteristics	246
7.1	General	246
7.2	Reference sensitivity level.....	247
7.2.1	Definition and applicability	247
7.2.2	Minimum Requirement.....	247
7.2.3	Test purpose.....	247
7.2.4	Method of testing	247
7.2.4.1	Initial conditions	247
7.2.4.2	Procedure	247
7.2.5	Test requirement	248
7.3	Dynamic range	253
7.3.1	Definition and applicability	253
7.3.2	Minimum Requirement.....	253
7.3.3	Test purpose.....	253
7.3.4	Method of testing	253
7.3.4.1	Initial conditions	253
7.3.4.2	Procedure	253
7.3.5	Test Requirements	254
7.4	In-channel selectivity	260
7.4.1	Definition and applicability	260
7.4.2	Minimum Requirement.....	260
7.4.3	Test purpose.....	260
7.4.4	Method of testing.....	260
7.4.4.1	Initial conditions	260
7.4.4.2	Procedure	261
7.4.5	Test Requirements	262
7.5	Adjacent Channel Selectivity (ACS) and narrow-band blocking	268
7.5.1	Definition and applicability	268
7.5.2	Minimum Requirement.....	268
7.5.3	Test purpose.....	268
7.5.4	Method of test	268
7.5.4.1	Initial conditions	268
7.5.4.2	Procedure for Adjacent Channel Selectivity	268
7.5.4.3	Procedure for narrow-band blocking.....	269
7.5.5	Test Requirements	271
7.6	Blocking	280
7.6.1	Definition and applicability	280
7.6.2	Minimum Requirements	281
7.6.3	Test purpose.....	281
7.6.4	Method of test	281
7.6.4.1	Initial conditions	281
7.6.4.2	Procedure	281
7.6.5	Test Requirements	283
7.6.5.1	General requirement.....	283
7.6.5.2	Co-location with other base stations	297
7.7	Receiver spurious emissions.....	310
7.7.1	Definition and applicability	310
7.7.2	Minimum Requirements	310
7.7.3	Test purpose.....	310
7.7.4	Method of test	310
7.7.4.1	Initial conditions	310
7.7.4.2	Procedure	311
7.7.5	Test requirements.....	311
7.8	Receiver intermodulation	312
7.8.1	Definition and applicability	312
7.8.2	Minimum Requirement.....	312
7.8.3	Test purpose.....	312
7.8.4	Method of test	313
7.8.4.1	Initial conditions	313

7.8.4.2	Procedures	313
7.8.5	Test requirements	314
8	Performance requirement	329
8.1	General	329
8.2	Performance requirements for PUSCH	329
8.2.1	Performance requirements of PUSCH in multipath fading propagation conditions transmission on single antenna port	329
8.2.1.1	Definition and applicability	329
8.2.1.2	Minimum Requirement	330
8.2.1.3	Test Purpose	330
8.2.1.4	Method of test	330
8.2.1.4.1	Initial Conditions	330
8.2.1.4.2	Procedure	330
8.2.1.5	Test Requirement	330
8.2.1A	Performance requirements of PUSCH in multipath fading propagation conditions transmission on two antenna ports	348
8.2.1A.1	Definition and applicability	348
8.2.1A.2	Minimum Requirement	348
8.2.1A.3	Test Purpose	348
8.2.1A.4	Method of test	348
8.2.1A.4.1	Initial Conditions	348
8.2.1A.4.2	Procedure	348
8.2.1A.5	Test Requirement	349
8.2.2	Performance requirements for UL timing adjustment	351
8.2.2.1	Definition and applicability	351
8.2.2.2	Minimum Requirement	351
8.2.2.3	Test Purpose	351
8.2.2.4	Method of test	351
8.2.2.4.1	Initial Conditions	351
8.2.2.4.2	Procedure	351
8.2.2.5	Test Requirement	352
8.2.3	Performance requirements for HARQ-ACK multiplexed on PUSCH	353
8.2.3.1	Definition and applicability	353
8.2.3.2	Minimum Requirement	353
8.2.3.3	Test Purpose	354
8.2.3.4	Method of test	354
8.2.3.4.1	Initial Conditions	354
8.2.3.4.2	Procedure	354
8.2.3.5	Test Requirement	354
8.2.4	Performance requirements for High Speed Train conditions	355
8.2.4.1	Definition and applicability	355
8.2.4.2	Minimum Requirement	355
8.2.4.3	Test Purpose	355
8.2.4.4	Method of test	356
8.2.4.4.1	Initial Conditions	356
8.2.4.4.2	Procedure	356
8.2.4.5	Test Requirement	357
8.2.5	Performance requirements for PUSCH with TTI bundling and enhanced HARQ pattern	360
8.2.5.1	Definition and applicability	360
8.2.5.2	Minimum Requirement	360
8.2.5.3	Test Purpose	361
8.2.5.4	Method of test	361
8.2.5.4.1	Initial Conditions	361
8.2.5.4.2	Procedure	361
8.2.5.5	Test Requirement	362
8.2.6	Enhanced performance requirements type A of PUSCH in multipath fading propagation conditions with synchronous interference	362
8.2.6.1	Definition and applicability	362
8.2.6.2	Minimum Requirement	363
8.2.6.3	Test Purpose	363
8.2.6.4	Method of test	363

8.2.6.4.1	Initial Conditions	363
8.2.6.4.2	Procedure	363
8.2.6.5	Test Requirement	364
8.2.6A	Enhanced performance requirements type A of PUSCH in multipath fading propagation conditions with asynchronous interference	366
8.2.6A.1	Definition and applicability	366
8.2.6A.2	Minimum Requirement	367
8.2.6A.3	Test Purpose	367
8.2.6A.4	Method of test	367
8.2.6A.4.1	Initial Conditions	367
8.2.6A.4.2	Procedure	367
8.2.6A.5	Test Requirement	368
8.2.7	Performance requirements of PUSCH in multipath fading propagation conditions transmission on single antenna port for coverage enhancement	370
8.2.7.1	Definition and applicability	370
8.2.7.2	Minimum Requirement	370
8.2.7.3	Test Purpose	370
8.2.7.4	Method of test	370
8.2.7.4.1	Initial Conditions	370
8.2.7.4.2	Procedure	370
8.2.7.5	Test Requirement	371
8.2.8	Performance requirements of PUSCH with Frame structure type 3	372
8.2.8.1	Definition and applicability	372
8.2.8.2	Minimum Requirement	372
8.2.8.3	Test Purpose	372
8.2.8.4	Method of test	372
8.2.8.4.1	Initial Conditions	372
8.2.8.4.2	Procedure	373
8.2.8.5	Test Requirement	373
8.2.9	Enhanced performance requirements type B of PUSCH in multipath fading propagation conditions	374
8.2.9.1	Definition and applicability	374
8.2.9.2	Minimum Requirement	374
8.2.9.3	Test Purpose	374
8.2.9.4	Method of test	374
8.2.9.4.1	Initial Conditions	374
8.2.9.4.2	Procedure	374
8.2.9.5	Test Requirement	376
8.2.10	Performance requirements of PUSCH in multipath fading propagation conditions transmission on single antenna port for subPRB transmission	378
8.2.10.1	Definition and applicability	378
8.2.10.2	Minimum Requirement	378
8.2.10.3	Test Purpose	379
8.2.10.4	Method of test	379
8.2.10.4.1	Initial Conditions	379
8.2.10.4.2	Procedure	379
8.2.10.5	Test Requirement	380
8.3	Performance requirements for PUCCH	380
8.3.1	ACK missed detection for single user PUCCH format 1a transmission on single antenna port	380
8.3.1.1	Definition and applicability	380
8.3.1.2	Minimum Requirement	381
8.3.1.3	Test purpose	381
8.3.1.4	Method of test	381
8.3.1.4.1	Initial Conditions	381
8.3.1.4.2	Procedure	381
8.3.1.5	Test Requirement	381
8.3.2	CQI performance requirements for PUCCH format 2 transmission on single antenna port	382
8.3.2.1	Definition and applicability	382
8.3.2.2	Minimum Requirement	382
8.3.2.3	Test purpose	382
8.3.2.4	Method of test	382
8.3.2.4.1	Initial Conditions	382
8.3.2.4.2	Procedure	383

8.3.2.5	Test Requirement	383
8.3.3	ACK missed detection for multi user PUCCH format 1a	384
8.3.3.1	Definition and applicability	384
8.3.3.2	Minimum Requirement	384
8.3.3.3	Test purpose	384
8.3.3.4	Method of test	384
8.3.3.4.1	Initial Conditions	384
8.3.3.4.2	Procedure	384
8.3.3.5	Test Requirement	385
8.3.4	ACK missed detection for PUCCH format 1b with Channel Selection	385
8.3.4.1	Definition and applicability	385
8.3.4.2	Minimum Requirement	386
8.3.4.3	Test purpose	386
8.3.4.4	Method of test	386
8.3.4.4.1	Initial Conditions	386
8.3.4.4.2	Procedure	386
8.3.4.5	Test Requirement	387
8.3.5	ACK missed detection for PUCCH format 3	387
8.3.5.1	Definition and applicability	387
8.3.5.2	Minimum Requirement	387
8.3.5.3	Test purpose	387
8.3.5.4	Method of test	388
8.3.5.4.1	Initial Conditions	388
8.3.5.4.2	Procedure	388
8.3.5.5	Test Requirement	388
8.3.6	NACK to ACK detection for PUCCH format 3	389
8.3.6.1	Definition and applicability	389
8.3.6.2	Minimum Requirement	389
8.3.6.3	Test purpose	389
8.3.6.4	Method of test	389
8.3.6.4.1	Initial Conditions	389
8.3.6.4.2	Procedure	390
8.3.6.5	Test Requirement	390
8.3.7	ACK missed detection for PUCCH format 1a transmission on two antenna ports	390
8.3.7.1	Definition and applicability	390
8.3.7.2	Minimum Requirement	391
8.3.7.3	Test purpose	391
8.3.7.4	Method of test	391
8.3.7.4.1	Initial Conditions	391
8.3.7.4.2	Procedure	391
8.3.7.5	Test Requirement	392
8.3.8	CQI performance requirements for PUCCH format 2 transmission on two antenna ports	392
8.3.8.1	Definition and applicability	392
8.3.8.2	Minimum Requirement	392
8.3.8.3	Test purpose	392
8.3.8.4	Method of test	392
8.3.8.4.1	Initial Conditions	392
8.3.8.4.2	Procedure	393
8.3.8.5	Test Requirement	393
8.3.9	CQI performance requirements for PUCCH format 2 with DTX detection	394
8.3.9.1	Definition and applicability	394
8.3.9.2	Minimum Requirement	394
8.3.9.3	Test purpose	394
8.3.9.4	Method of test	394
8.3.9.4.1	Initial Conditions	394
8.3.9.4.2	Procedure	394
8.3.9.5	Test Requirement	395
8.3.10	ACK missed detection for PUCCH format 1a transmission on single antenna port for coverage enhancement	395
8.3.10.1	Definition and applicability	395
8.3.10.2	Minimum Requirement	396
8.3.10.3	Test purpose	396

8.3.10.4	Method of test	396
8.3.10.4.1	Initial Conditions	396
8.3.10.4.2	Procedure.....	396
8.3.10.5	Test Requirement	397
8.3.11	CQI performance requirements for PUCCH format 2 transmission on single antenna port for coverage enhancement.....	397
8.3.11.1	Definition and applicability.....	397
8.3.11.2	Minimum Requirement	397
8.3.11.3	Test purpose	397
8.3.11.4	Method of test	397
8.3.11.4.1	Initial Conditions	397
8.3.11.4.2	Procedure.....	397
8.3.11.5	Test Requirement	398
8.3.12	ACK missed detection for PUCCH format 4	398
8.3.12.1	Definition and applicability.....	398
8.3.12.2	Minimum Requirement	399
8.3.12.3	Test purpose	399
8.3.12.4	Method of test	399
8.3.12.4.1	Initial Conditions	399
8.3.12.4.2	Procedure.....	399
8.3.12.5	Test Requirement	400
8.3.13	ACK missed detection for PUCCH format 5	400
8.3.13.1	Definition and applicability.....	400
8.3.13.2	Minimum Requirement	401
8.3.13.3	Test purpose	401
8.3.13.4	Method of test	401
8.3.13.4.1	Initial Conditions	401
8.3.13.4.2	Procedure.....	401
8.3.13.5	Test Requirement	402
8.4	Performance requirements for PRACH	402
8.4.1	PRACH false alarm probability and missed detection.....	402
8.4.1.1	Definition and applicability.....	402
8.4.1.2	Minimum Requirement	402
8.4.1.3	Test purpose	403
8.4.1.4	Method of test	403
8.4.1.4.1	Initial Conditions	403
8.4.1.4.2	Procedure.....	403
8.4.1.5	Test Requirement	404
8.5	Performance requirements for Narrowband IoT.....	406
8.5.1	Performance requirements for NPUSCH format 1	406
8.5.1.1	Definition and applicability.....	406
8.5.1.2	Minimum Requirement	406
8.5.1.3	Test Purpose	406
8.5.1.4	Method of test	407
8.5.1.4.1	Initial Conditions	407
8.5.1.4.2	Procedure.....	407
8.5.1.5	Test Requirement	407
8.5.2	ACK missed detection for NPUSCH format 2	409
8.5.2.1	Definition and applicability.....	409
8.5.2.2	Minimum Requirement	409
8.5.2.3	Test purpose	409
8.5.2.4	Method of test	409
8.5.2.4.1	Initial Conditions	409
8.5.2.4.2	Procedure.....	409
8.5.2.5	Test Requirement	410
8.5.3	Performance requirements for NPRACH	411
8.5.3.1	Definition and applicability.....	411
8.5.3.2	Minimum Requirement	411
8.5.3.3	Test purpose	411
8.5.3.4	Method of test	411
8.5.3.4.1	Initial Conditions	411
8.5.3.4.2	Procedure.....	412

8.5.3.5	Test Requirement	412
8.6	Performance requirements for subslot-PUSCH.....	413
8.6.1	Definition and applicability	413
8.6.2	Minimum Requirement.....	413
8.6.3	Test Purpose.....	413
8.6.4	Method of test	413
8.6.4.1	Initial Conditions.....	413
8.6.4.2	Procedure	413
8.6.5	Test Requirement.....	414
8.7	Performance requirements for SPUCCH.....	415
8.7.1	ACK missed detection for single user SPUCCH format 1a.....	415
8.7.1.1	Definition and applicability.....	415
8.7.1.2	Minimum Requirement	415
8.7.1.3	Test Purpose	415
8.7.1.4	Method of test	416
8.7.1.4.1	Initial Conditions	416
8.7.1.4.2	Procedure.....	416
8.7.1.5	Test Requirement	416
8.7.2	ACK missed detection requirements for SPUCCH format 4.....	417
8.7.2.1	Definition and applicability.....	417
8.7.2.2	Minimum Requirement	417
8.7.2.3	Test Purpose	417
8.7.2.4	Method of test	417
8.7.2.4.1	Initial Conditions	417
8.7.2.4.2	Procedure.....	417
8.7.2.5	Test Requirement	418
9	(Void).....	418
Annex A (normative): Reference Measurement channels.....		419
A.0	General	419
A.1	Fixed Reference Channels for reference sensitivity and in-channel selectivity (QPSK, R=1/3).....	421
A.2	Fixed Reference Channels for dynamic range (16QAM, R=2/3).....	421
A.3	Fixed Reference Channels for performance requirements (QPSK 1/3)	422
A.4	Fixed Reference Channels for performance requirements (16QAM 3/4)	422
A.5	Fixed Reference Channels for performance requirements (64QAM 5/6)	423
A.6	PRACH Test preambles	423
A.7	Fixed Reference Channels for UL timing adjustment (Scenario 1)	424
A.8	Fixed Reference Channels for UL timing adjustment (Scenario 2)	424
A.9	Multi user PUCCH test.....	425
A.10	PUCCH transmission on two antenna ports test.....	425
A.11	Fixed Reference Channel for PUSCH with TTI bundling and enhanced HARQ pattern	425
A.14	Fixed Reference Channels for NB-IOT reference sensitivity ($\pi/2$ BPSK, R=1/3).....	426
A.14.1	Void.....	427
A.15	Fixed Reference Channels for NB-IoT dynamic range ($\pi/4$ QPSK, R=2/3).....	427
A.16	Fixed Reference Channels for NB-IoT NPUSCH format 1	428
A.16.1	One PRB.....	428
A.17	Fixed Reference Channels for performance requirements (256QAM 5/6)	429
A.18	Fixed Reference Channels for PUSCH transmission in UpPTS (16QAM 0.65)	429
A.19	Fixed Reference Channels for PUSCH transmission in UpPTS (256QAM 0.69)	430

A.20	Fixed Reference Channels for PUSCH with Frame structure type 3	430
A.21	Fixed Reference Channels for performance requirements (QPSK 3/5)	431
A.22	Fixed Reference Channels for performance requirements (64QAM 1/2)	431
A.23	Fixed Reference Channel for subslot-PUSCH	432
A.24	Fixed Reference Channels for PUSCH with SubPRB transmission	432
Annex B (normative): Propagation conditions.....		433
B.1	Static propagation condition.....	433
B.2	Multi-path fading propagation conditions.....	433
B.3	High speed train condition	434
B.4	Moving propagation conditions.....	438
B.5	Multi-Antenna channel models	439
B.5.1	Definition of MIMO Correlation Matrices	439
B.5.2	MIMO Correlation Matrices at High, Medium and Low Level	440
B.5A	Multi-Antenna channel models using cross polarized antennas.....	442
B.5A.1	Definition of MIMO Correlation Matrices using cross polarized antennas.....	443
B.5A.2	Spatial Correlation Matrices at UE and eNB sides.....	443
B.5A.2.1	Spatial Correlation Matrices at UE side.....	443
B.5A.2.2	Spatial Correlation Matrices at eNB side.....	444
B.5A.3	MIMO Correlation Matrices using cross polarized antennas	444
B.6	Interference model for enhanced performance requirements type A and type B	445
B.6.1	Dominant interferer proportion	445
B.6.2	Interference model for synchronous scenario.....	445
B.6.3	Interference model for asynchronous scenario	445
Annex C (normative): Characteristics of the interfering signals.....		446
Annex D (normative): Environmental requirements for the BS equipment		447
D.1	General	447
D.2	Normal test environment	447
D.3	Extreme test environment.....	447
D.3.1	Extreme temperature	447
D.4	Vibration.....	448
D.5	Power supply	448
D.6	Measurement of test environments.....	448
Annex E (normative): Void		449
Annex F (normative): Global In-Channel TX-Test		450
F.1	General	450
F.2.1	Basic principle.....	450
F.2.2	Output signal of the TX under test	450
F.2.3	Reference signal	450
F.2.4	Measurement results.....	450
F.2.5	Measurement points	451
F.3.1	Pre FFT minimization process.....	451
F.3.2	Timing of the FFT window	452
F.3.3	Resource Element TX power.....	452
F.3.4	Post FFT equalisation.....	453
F.4.1	EVM.....	454
F.4.2	Averaged EVM	455