3GPP TS 38.141-2 V1.1.0 (2018-11)

Technical Specification

3rd Generation Partnership Project;

Technical Specification Group RAN;

NR;

Base Station (BS) conformance testing

Part 2: Radiated conformance testing

(Release 15)

** 

The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP..  
The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented.  
This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification.  
Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices.

Keywords

Radio, NR

***3GPP***

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis

Valbonne - FRANCE

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

Internet

http://www.3gpp.org

***Copyright Notification***

No part may be reproduced except as authorized by written permission.  
The copyright and the foregoing restriction extend to reproduction in all media.

© 2017, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).

All rights reserved.

UMTS™ is a Trade Mark of ETSI registered for the benefit of its members

3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners  
LTE™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners

GSM® and the GSM logo are registered and owned by the GSM Association

Contents

Foreword 11

1 Scope 12

2 References 12

3 Definitions, symbols and abbreviations 14

3.1 Definitions 14

3.2 Symbols 17

3.3 Abbreviations 18

4 General radiated test conditions and declarations 20

4.1 Measurement uncertainties and test requirements 20

4.1.1 General 20

4.1.2 Acceptable uncertainty of OTA Test System 21

4.1.2.1 General 21

4.1.2.2 Measurement of transmitter 21

4.1.2.3 Measurement of receiver 25

4.1.2.4 Measurement of performance requirement 26

4.1.3 Interpretation of measurement results 26

4.2 Radiated requirement reference points 27

4.3 Base station classes 28

4.4 Regional requirements 29

4.5 BS configurations 29

4.5.1 Transmit configurations 29

4.5.2 Receive configurations 30

4.5.3 Power supply options 31

4.6 Manufacturer’s declarations 31

4.7 Test configurations 39

4.7.1 General 39

4.7.2 Test signal configurations 40

4.7.2.1 Test signal used to build Test Configurations 40

4.7.2.2 NRTC1: Contiguous spectrum operation 40

4.7.2.2.1 NRTC1 generation 40

4.7.2.2.2 NRTC1 power allocation 40

4.7.2.3 NRTC2: Contiguous CA occupied bandwidth 41

4.7.2.3.1 NRTC2 generation 41

4.7.2.3.2 NRTC2 power allocation 41

4.7.2.4 NRTC3: Non-contiguous spectrum operation 41

4.7.2.4.1 NRTC3 generation 41

4.7.2.4.2 NRTC3 power allocation 42

4.7.2.5 NRTC4: Multi-band test configuration for full carrier allocation 42

4.7.2.5.1 NRTC4 generation 42

4.7.2.5.2 NRTC4 power allocation 43

4.7.2.6 NRTC5: Multi-band test configuration with high PSD per carrier 43

4.7.2.6.1 NRTC5 generation 43

4.7.2.6.2 NRTC5 power allocation 43

4.8 Applicability of requirements 44

4.8.1 General 44

4.8.2 Requirement set applicability 44

4.8.3 Applicability of test configurations for *single-band RIB* 44

4.8.4 Applicability of test configurations for *multi-band RIB* 45

4.9 RF channels and test models 46

4.9.1 RF channels 46

4.9.2 Test models 47

4.9.2.1 General 47

4.9.2.2 NR FR2 test models 47

4.9.2.2.1 NR FR2 test model 1.1 (NR- FR2-TM1.1) 48

4.9.2.2.2 NR FR2 test model 2 (NR- FR2-TM2) 49

4.9.2.2.3 NR FR2 test model 3.1 (NR- FR2-TM3.1) 49

4.10 Requirements for contiguous and non-contiguous spectrum 51

4.11 Requirements for BS capable of multi-band operation 51

4.12 Co-location requirements 51

4.12.1 General 51

4.12.2 Co-location test antenna 52

4.12.2.1 General 52

4.12.2.2 Co-location test antenna characteristics 52

4.12.2.3 Co-location test antenna alignment 52

5 Operating bands and channel arrangement 54

6 Radiated transmitter characteristics 55

6.1 General 55

6.2 Radiated transmit power 55

6.2.1 Definition and applicability 55

6.2.2 Minimum requirement 55

6.2.3 Test purpose 55

6.2.4 Method of test 56

6.2.4.1 Initial conditions 56

6.2.4.2 Procedure 56

6.2.5 Test requirement 57

6.3 OTA base station output power 57

6.3.1 Definition and applicability 57

6.3.2 Minimum requirement 57

6.3.3 Test purpose 57

6.3.4 Method of test 57

6.3.4.1 Initial conditions 57

6.3.4.2 Procedure 58

6.3.5 Test requirement 58

6.3.5.1 *BS type 1-O* 58

6.3.5.2 *BS type 2-O* 59

6.4 OTA output power dynamics 59

6.4.1 General 59

6.4.2 OTA RE power control dynamic range 59

6.4.2.1 Definition and applicability 59

6.4.2.2 Minimum requirement 59

6.4.2.4 Method of test 59

6.4.3 OTA total power dynamic range 59

6.4.3.1 Definition and applicability 59

6.4.3.2 Minimum requirement 60

6.4.3.3 Test purpose 60

6.4.3.4 Method of test 60

6.4.3.4.1 Initial conditions 60

6.4.3.4.2 Procedure 60

6.4.3.5 Test requirement 61

6.4.3.5.1 *BS type 1-O* 61

6.4.3.5.2 *BS type 2-O* 61

6.5 OTA transmit ON/OFF power 61

6.5.1 OTA transmitter OFF power 62

6.5.1.1 Definition and applicability 62

6.5.1.2 Minimum requirement 62

6.5.1.3 Test purpose 62

6.5.1.4 Method of test 62

6.5.1.4.1 Initial conditions 62

6.5.1.4.2 Procedure 63

6.5.1.4.2.1 General procedure 63

6.5.1.4.2.2 *BS type 1-O* 63

6.5.1.4.2.3 *BS type 2-O* 63

6.5.1.5 Test requirements 64

6.5.1.5.1 *BS type 1-O* 64

6.5.1.5.2 *BS type 2-O* 64

6.5.2 OTA transmitter transient period 64

6.5.2.1 Definition and applicability 64

6.5.2.2 Minimum requirement 65

6.5.2.3 Test purpose 65

6.5.2.4 Method of test 65

6.5.2.4.1 Initial conditions 65

6.5.2.4.2 Procedure 65

6.5.2.4.2.1 General procedure 65

6.5.2.4.2.2 *BS type 1-O* 66

6.5.2.4.2.3 *BS type 2-O* 66

6.5.2.5 Test requirements 67

6.5.2.5.1 *BS type 1-O* 67

6.5.2.5.2 *BS type 2-O* 67

6.6 OTA transmitted signal quality 67

6.6.1 General 67

6.6.2 OTA frequency error 67

6.6.2.1 Definition and applicability 67

6.6.2.2 Minimum Requirement 67

6.6.2.3 Test purpose 68

6.6.2.4 Method of test 68

6.6.2.4.1 Initial conditions 68

6.6.2.5 Test Requirements 68

6.6.3 OTA modulation quality 68

6.6.3.1 Definition and applicability 68

6.6.3.2 Minimum Requirement 68

6.6.3.3 Test purpose 68

6.6.3.4 Method of test 68

6.6.3.4.1 Initial conditions 68

6.6.3.4.2 Procedure 69

6.6.3.5 Test requirements 69

6.6.3.5.1 *BS type 1-O* 69

6.6.3.5.2 *BS type 2-O* 71

6.6.4 OTA time alignment error 72

6.6.4.1 Definition and applicability 72

6.6.4.2 Minimum requirement 72

6.6.4.3 Test purpose 72

6.6.4.4 Method of test 72

6.6.4.4.1 Initial conditions 72

6.6.4.4.2 Procedure 73

6.6.4.5 Test Requirement 73

6.6.4.5.1 *BS type 1-O* 73

6.6.4.5.2 *BS type 2-O* 73

6.7 OTA unwanted emissions 74

6.7.1 General 74

6.7.2 OTA occupied bandwidth 74

6.7.2.1 Definition and applicability 74

6.7.2.2 Minimum requirement 74

6.7.2.3 Test purpose 74

6.7.2.4 Method of test 75

6.7.2.4.1 Initial conditions 75

6.7.2.4.2 Procedure 75

6.7.2.5 Test requirement 76

6.7.2.5.1 *BS type 1-O* 76

6.7.2.5.2 *BS type 2-O* 76

6.7.3 OTA Adjacent Channel Leakage Power Ratio (ACLR) 76

6.7.3.1 Definition and applicability 76

6.7.3.2 Minimum requirement 77

6.7.3.3 Test purpose 77

6.7.3.4 Method of test 77

6.7.3.4.1 Initial conditions 77

6.7.3.4.2 Procedure 77

6.7.3.5 Test requirements 78

6.7.3.5.1 *BS type 1-O* 78

6.7.3.5.2 *BS type 2-O* 80

6.7.4 OTA operating band unwanted emissions 82

6.7.4.1 Definition and applicability 82

6.7.4.2 Minimum requirement 83

6.7.4.3 Test purpose 83

6.7.4.4 Method of test 83

6.7.4.4.1 Initial conditions 83

6.7.4.4.2 Procedure 83

6.7.4.5 Test requirements 84

6.7.4.5.1 *BS type 1-O* 84

6.7.4.5.2 *BS type 2-O* 92

6.7.5 OTA transmitter spurious emissions 93

6.7.5.1 General 93

6.7.5.2 General OTA transmitter spurious emissions requirements 94

6.7.5.2.1 Definition and applicability 94

6.7.5.2.2 Minimum requirement 94

6.7.5.2.3 Test purpose 94

6.7.5.2.4 Method of test 94

6.7.5.2.4.1 Initial conditions 94

6.7.5.2.4.2 Procedure 95

6.7.5.2.5 Test requirement 95

6.7.5.2.5.1 Test requirement for *BS type 1-O* 95

6.7.5.2.5.2 Test requirement for *BS type 2-O* 96

6.7.5.3 Protection of the BS receiver of own or different BS 96

6.7.5.3.1 Definition and applicability 96

6.7.5.3.2 Minimum requirements 96

6.7.5.3.3 Test purpose 96

6.7.5.3.4 Method of test 97

6.7.5.3.4.1 Initial conditions 97

6.7.5.3.4.2 Procedure 97

6.7.5.3.5 Test requirements 97

6.7.5.4 Additional spurious emissions requirements 98

6.7.5.4.1 Definition and applicability 98

6.7.5.4.2 Minimum Requirement 98

6.7.5.4.3 Test purpose 98

6.7.5.4.4 Method of test 98

6.7.5.4.4.1 Initial conditions 98

6.7.5.4.4.2 Procedure 99

6.7.5.4.5 Test requirement 100

6.7.5.4.5.1 Test requirement for *BS type 1-O* 100

6.7.5.5 Co-location requirements 106

6.7.5.5.1 Definition and applicability 106

6.7.5.5.2 Minimum requirements 106

6.7.5.5.3 Test purpose 106

6.7.5.5.4 Method of test 106

6.7.5.5.4.1 Initial conditions 106

6.7.5.5.4.2 Procedure 107

6.7.5.5.5 Test requirements 107

6.8 OTA transmitter intermodulation 112

6.8.1 Definition and applicability 112

6.8.2 Minimum requirement 112

6.8.3 Test purpose 113

6.8.4 Method of test 113

6.8.4.1 Initial conditions 113

6.8.4.2 Procedure 113

6.8.5 Test requirements 114

6.8.5.1 Requirement for *BS type 1-O* 114

7 Radiated receiver characteristics 116

7.1 General 116

7.2 OTA sensitivity 116

7.2.1 Definition and applicability 116

7.2.2 Minimum requirement 117

7.2.3 Test Purpose 117

7.2.4 Method of test 117

7.2.4.1 Initial conditions 117

7.2.4.2 Procedure 117

7.2.5 Test requirements 118

7.2.5.1 General 118

7.2.5.2 Test requirements for *BS type 1-H* and *BS type 1-O* 118

7.2.5.3 Test requirements for *BS type 2-O* 118

7.3 OTA reference sensitivity level 118

7.3.1 Definition and applicability 118

7.3.2 Minimum requirement 119

7.3.3 Test Purpose 119

7.3.4 Method of test 119

7.3.4.1 Initial conditions 119

7.3.4.2 Procedure 119

7.3.5 Test requirements 120

7.3.5.1 General 120

7.3.5.2 Test requirements for *BS type 1-O* 120

7.3.5.3 Test requirements for *BS type 2-O* 121

7.4 OTA dynamic range 122

7.4.1 Definition and applicability 122

7.4.2 Minimum requirement 122

7.4.3 Test purpose 122

7.4.4 Method of test 122

7.4.4.1 Initial conditions 122

7.4.4.2 Procedure 122

7.4.5 Test requirement 123

7.4.5.1 General 123

7.4.5.2 Test requirements for *BS type 1-O* 123

7.5 OTA in-band selectivity and blocking 132

7.5.1 OTA adjacent channel selectivity 132

7.5.1.1 Definition and applicability 132

7.5.1.2 Minimum requirement 132

7.5.1.3 Test purpose 132

7.5.1.4 Method of test 132

7.5.1.4.1 Initial conditions 132

7.5.1.4.2 Procedure 132

7.5.1.5 Test requirement 133

7.5.1.5.1 General 133

7.5.1.5.2 Test requirements for *BS type 1-O* 133

7.5.1.5.3 Test requirements for *BS type 2-O* 134

7.5.2 OTA in-band blocking 135

7.5.2.1 Definition and applicability 135

7.5.2.2 Minimum requirement 135

7.5.2.3 Test purpose 135

7.5.2.4 Method of test 136

7.5.2.4.1 Initial conditions 136

7.5.2.4.2 Procedure 136

7.5.2.5 Test requirement 136

7.5.2.5.1 General 136

7.5.2.5.2 Test requirements for *BS type 1-O* 137

7.5.2.5.3 Test requirements for *BS type 2-O* 140

7.6 OTA out-of-band blocking 141

7.6.1 Definition and applicability 141

7.6.2 Minimum requirement 141

7.6.3 Test purpose 141

7.6.4 Method of test 141

7.6.4.1 Initial conditions 141

7.6.4.2 Procedure 142

7.6.4.2.1 NR BS type 1-O procedure for out-of-band blocking 142

7.6.4.2.2 NR BS type 1-O procedure for co-location blocking 142

7.6.4.2.3 *BS type 2-O* procedure for out-of-band blocking 143

7.6.5 Test requirements 144

7.6.5.1 Requirement for *BS type 1-O* 144

7.6.5.1.1 General 144

7.6.5.1.2 Co-location requirement 144

7.6.5.2 Requirement for *BS type 2-O* 145

7.6.5.2.1 General requirement 145

7.7 OTA receiver spurious emissions 145

7.7.1 Definition and applicability 145

7.7.2 Minimum requirement 146

7.7.3 Test purpose 146

7.7.4 Method of test 146

7.7.4.1 Initial conditions 146

7.7.4.2 Procedure 147

7.7.5 Test requirement 147

7.7.5.1 Test requirement for *BS type 1-O* 147

7.7.5.2 Test requirement for *BS type 2-O* 148

7.8 OTA receiver intermodulation 148

7.8.1 Definition and applicability 148

7.8.2 Minimum requirement 148

7.8.3 Test purpose 149

7.8.4 Method of test 149

7.8.4.1 Initial conditions 149

7.8.4.2 Procedure 149

7.8.5 Test requirement 150

7.8.5.1 *BS type 1-O* 150

7.8.5.2 *BS type 2-O* 154

7.9 OTA in-channel selectivity 154

7.9.1 Definition and applicability 154

7.9.2 Minimum requirement 154

7.9.3 Test purpose 155

7.9.4 Method of test 155

7.9.4.1 Initial conditions 155

7.9.4.2 Procedure 155

7.9.5 Test requirement 156

7.9.5.1 *BS type 1-O* 156

7.9.5.2 *BS type 2-O* 159

8 Radiated performance requirements 161

8.1 General 161

8.1.1 OTA demodulation branches 161

8.2 OTA performance requirements for PUSCH 162

8.2.1 Requirements for BS type 1-O 162

8.2.2 Requirements for BS type 2-O 162

8.2.2.1 Performance requirements for PUSCH with transmission precoding disabled 162

8.2.2.1.1 Definition and applicability 162

8.2.2.1.2 Minimum Requirement 162

8.2.2.1.3 Test purpose 162

8.2.2.1.4 Method of test 162

8.2.2.1.4.1 Initial conditions 162

8.2.2.1.4.2 Procedure 162

8.2.2.1.5 Test Requirement 163

8.3 OTA performance requirements for PUCCH 165

8.3.1 Requirements for BS type 1-O 165

8.3.2 Requirements for BS type 2-O 165

8.4 OTA performance requirements for PRACH 165

8.4.1 Requirements for *BS type 1-O* 165

8.4.1.1 PRACH false alarm probability and missed detection 165

8.4.1.1.1 Definition and applicability 165

8.4.1.1.2 Minimum requirement 165

8.4.1.1.3 Test purpose 165

8.4.1.1.4 Method of test 165

8.4.1.1.4.1 Initial conditions 165

8.4.1.1.4.2 Procedure 165

8.4.1.1.5 Test requirement 165

8.4.2 Requirements for BS type 2-O 165

Annex A (normative): Reference measurement channels 166

A.1 Fixed Reference Channels for receiver sensitivity and in-channel selectivity (QPSK, R=1/3) 166

A.2 Fixed Reference Channels for dynamic range (16QAM, R=2/3) 167

Annex B (normative): Environmental requirements for the BS equipment 168

B.1 General 168

B.2 Normal test environment 168

B.3 Extreme test environment 168

B.3.1 Extreme temperature 168

B.4 Vibration 169

B.5 Power supply 169

B.6 Measurement of test environments 169

B.7 OTA extreme test methods 170

Annex C (informative): Test tolerances and derivation of test requirements 172

C.1 Measurement of transmitter 173

C.2 Measurement of receiver 176

Annex D (normative): Calibration 178

Annex E (informative): OTA test system set-up 179

E.1 Transmitter 179

E1.1 Radiated transmit power, output power dynamics and transmitter signal quality 179

E.1.2 OTA Base Station output power, ACLR, OTA operating band unwanted emissions 179

E.1.3 OTA spurious emissions 180

E.1.4 OTA Co-location emissions, TX OFF power 180

E.1.5 OTA transmitter Intermodulation 181

E.2 Receiver 182

E.2.1 OTA sensitivity and OTA reference sensitivity 182

E.2.2 OTA dynamic range 182

E.2.3 OTA adjacent channel selectivity, general blocking, and narrowband blocking 183

E.2.4 OTA blocking 184

E.2.4.1 OTA general out-of-band blocking 184

E.2.4.2 OTA co-location blocking 185

E.2.5 OTA receiver spurious emissions 185

E.2.6 OTA receiver intermodulation 186

E.2.7 OTA in-channel selectivity 186

Annex F (normative): Estimation of Measurement Uncertainty 187

Annex G (informative): Transmitter Spatial emissions Declaration 188

G.1 General 188

G.2 Declarations 188

Annex H (informative): Format and interpretation of tests 190

I.1 General 191

I.2 Spherical equal angle grid 191

I.2.1 General 191

I.2.2 Reference angular step criteria 191

I.3 Spherical equal area grid 193

I.4 Spherical Fibonacci grid 193

I.5 Orthogonal cut grid 193

I.6 Wave vector space grid 194

I.7 Orthogonal 2 cuts with pattern multiplication 195

I.8 Orthogonal 2 or 3 cut with dense sampling 195

I.9 Full sphere with sparse sampling 196

I.10 Beam-based directions 196

I.11 Peak method 196

I.12 Equal sector with peak average 197

I.13 Pre-scan 197

Annex J (informative): Change history 198

# 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.

# 1 Scope

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for NR Base Station (BS) *type 1-H*, *BS type 1-O* and *BS* *type 2-O*. These have been derived from, and are consistent with the radiated requirements for *BS type 1-H*, *BS type 1-O* and *BS type 2-O* in NR BS specification defined in TS 38.104 [2].

A *BS type 1-C* only has conducted requirements so it does not require compliance to this specification.

A *BS type 1-H* has both conducted and radiated requirements so it requires compliance to the applicable requirements of this specification and TS 38.141-1 [3].

*BS type 1-O* and *BS type 2-O* have only radiated requirements so they require compliance to this specification only.

# 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] 3GPP TS 38.104: "NR Base Station (BS) radio transmission and reception"

[3] 3GPP TS 38.141-1: “NR, Base Station (BS) conformance testing, Part 1: Conducted conformance testing”

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

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

[6] 3GPP TR 37.842: "E-UTRA and UTRA; Radio Frequency (RF) requirement background for Active Antenna System (AAS) Base Station (BS)"

[7] IEC 60 721-3-3: "Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations"

[8] IEC 60 721-3-4: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weather protected locations"

[9] IEC 60 721: "Classification of environmental conditions"

[10] IEC 60 068-2-1 (2007): "Environmental testing - Part 2: Tests. Tests A: Cold"

[11] IEC 60 068-2-2: (2007): "Environmental testing - Part 2: Tests. Tests B: Dry heat"

[12] IEC 60 068-2-6: (2007): "Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)"

[13] Recommendation ITU-R M.328: "Spectra and bandwidth of emissions"

[14] FCC publication number 662911: "Emissions Testing of Transmitters with Multiple Outputs in the Same Band".

[15] 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)”

[16] 3GPP TR 37.843: " E-UTRA and UTRA; Radio Frequency (RF) requirement background for Active Antenna System (AAS) Base Station (BS) radiated requirements"

[17] 3GPP TR 38.817-02: "NR; General aspects for Base Station (BS) Radio Frequency (RF) for NR"

[18] 3GPP TS 36.104: “E-UTRA; Base Station (BS) radio transmission and reception”

[19] 3GPP TS 38.212: "NR; Multiplexing and channel coding"

[20] 3GPP TS 38.211: "NR; Physical channels and modulation"

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**antenna connector:** connector at the conducted interface of the *BS type 1-C*

**aggregated BS channel bandwidth:** the RF bandwidth in which a Base Station transmits and receives multiple contiguously aggregated carriers. The *aggregated BS channel bandwidth* is measured in MHz

**Base Station RF Bandwidth**: RF bandwidth in which a base station transmits and/or receives single or multiple carrier(s) within a supported operating band

NOTE: In single carrier operation, the *Base Station RF Bandwidth* is equal to the channel bandwidth.

**Base Station RF Bandwidth edge:** frequency of one of the edges of the *Base Station RF Bandwidth*

**basic limit:** emissions limit relating to the power supplied by a single transmitter to a single antenna transmission line in ITU-R SM.329 [5] used for the formulation of unwanted emission requirements for FR1

**beam:** beam (of the antenna) is the main lobe of the radiation pattern of an *antenna array*

NOTE: For certain BS *antenna array*, there may be more than one beam.

**beam centre direction:** direction equal to the geometric centre of the half-power contour of the beam

**beam direction pair:** data set consisting of the *beam centre direction* and the related *beam peak direction*

**beam peak direction:** direction where the maximum EIRP is found

**beamwidth:** beam which has a half-power contour that is essentially elliptical, the half-power beamwidths in the two pattern cuts that respectively contain the major and minor axis of the ellipse

**BS channel bandwidth**: RF bandwidth supporting a single NR RF carrier with the transmission bandwidth configured in the uplink or downlink

NOTE 1: The *BS channel bandwidth* is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

NOTE 2: It is possible for the BS to transmit to and/or receive from one or more UE bandwidth parts that are smaller than or equal to the BS transmission bandwidth configuration, in any part of the BS transmission bandwidth configuration.

**BS receiver:** composite receiver function of a BS receiving in an *operating band*

**BS type 1-C:** NR base station operating at FR1 with requirements set consisting only of conducted requirements defined at individual *antenna connectors*

**BS type 1-H:** NR base station operating at FR1 with a requirement set consisting of conducted requirements defined at individual *TAB connectors* and OTA requirements defined at RIB

**BS type 1-O:** NR base station operating at FR1 with a requirement set consisting only of OTA requirements defined at the RIB

**BS type 2-O:** NR base station operating at FR2 with a requirement set consisting only of OTA requirements defined at the RIB

**channel edge:** lowest or highest frequency of the NR carrier, separated by the *BS channel bandwidth*

**carrier aggregation:** aggregation of two or more component carriers in order to support wider transmission bandwidths

**carrier aggregation configuration:** a set of one or more *operating bands* across which the BS aggregates carriers with a specific set of technical requirements

**co-location reference antenna**: a passive antenna used as reference for base station to base station co-location requirements

**contiguous carriers:** set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block

**contiguous spectrum:** spectrum consisting of a contiguous block of spectrum with no *sub-block gap*(s)

**demodulation branch:** single input of the *BS receiver* to the demodulation algorithms

**directional requirement:** requirement which is applied in a specific direction within the OTA coverage range for the Tx and when the AoA of the incident wave of a received signal is within the *OTA REFSENS RoAoA* or the *minSENS RoAoA* as appropriate for the receiver

Editor’s note: This definition is aligned with the definition of Single directional requirement for AAS BS. The naming should be further aligned between NR and AAS specifications.

**fractional bandwidth:** fractional bandwidth FBW is defined as 

**highest carrier:** the carrier with the highest carrier frequency transmitted/received in a specified frequency band

**inter-band carrier aggregation:** carrier aggregation of component carriers in different operating bands

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

**intra-band contiguous carrier aggregation:** *contiguous carriers* aggregated in the same operating band

**intra-band non-contiguous carrier aggregation:** non-contiguous carriers aggregated in the same operating band

**[Inter RF Bandwidth gap:** frequency gap between two consecutive Base Station RF Bandwidths that are placed within two supported *operating bands*]

**lowest Carrier:** the carrier with the lowest carrier frequency transmitted/received in a specified frequency band

**lower sub-block edge:** frequency at the lower edge of one *sub-block*

NOTE: It is used as a frequency reference point for both transmitter and receiver requirements.

**maximum carrier TRP output power:** mean power level measured perRIB during the *transmitter ON period* for a specific carrier in a specified reference condition and corresponding to the declared *rated carrier TRP output* power (Prated,c,TRP)

**maximum total TRP output power:** mean power level measured perRIB during the *transmitter ON period* in a specified reference condition and corresponding to the declared *rated total TRP output* power (Prated,t,TRP)

**minSENS:** the lowest declared EIS value for the OSDD’s declared for OTA sensitivity requirement.

**minSENS RoAoA:** The reference RoAoA associated with the OSDD with the lowest declared EIS

**multi-band RIB:** *operating band* specific RIB which is paired with one or more additional *operating band* specific RIBs where the multiple bands are supported through common active electronic component(s)

**multi-carrier transmission configuration:** set of one or more contiguous or non-contiguous carriers that a NR BS is able to transmit simultaneously according to the manufacturer’s specification

**non-contiguous spectrum:** spectrum consisting of two or more sub-blocks separated by *sub-block gap*(s)

**NR BS receiver:** composite receiver function of a NR BS receiving in an *operating band*

**operating band:** frequency range in which NR operates (paired or unpaired), that is defined with a specific set of technical requirements

NOTE: The operating band(s) for a BS is declared by the manufacturer according to the designations in TS 38.104 [2].

**OTA coverage range**: a common range of directions within which TX OTA requirements that are neither specified in the *OTA peak directions sets* nor as *TRP requirement* are intended to be met

**OTA peak directions set:** set(s) of *beam peak directions* within which certain TX OTA requirements are intended to be met, where all *OTA peak directions set(s)* are subsets of the *OTA coverage range*

NOTE:     The *beam peak directions* are related to a corresponding contiguous range or discrete list of *beam centre directions*by the *beam direction pairs* included in the set.

**OTA REFSENS RoAoA:** Is the RoAoA determined by the contour defined by the points at which the achieved EIS is 3dB higher than the achieved EIS in the reference direction

NOTE: This contour will be related to the average element/sub-array radiation pattern 3dB beam width.

**OTA sensitivity directions declaration:** set of manufacturer declarations comprising at least one set of declared minimum EIS values (with *BS channel bandwidth*), and related directions over which the EIS applies

NOTE: All the directions apply to all the EIS values in an OSDD.

**polarization match:** condition that exists when a plane wave, incident upon an antenna from a given direction, has a polarization that is the same as the receiving polarization of the antenna in that direction

**radiated interface boundary**: operating band specific reference point for radiated requirements, defined in the near field or in the far field depending on the radiated requirement’s testability feasibility

**Radio Bandwidth:** frequency difference between the upper edge of the highest used carrier and the lower edge of the lowest used carrier

**rated beam EIRP:** For a declared beam and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the base station is declared to radiate at the associated *beam peak direction* during the *transmitter ON period*

**rated carrier TRP output power:** mean power level declared by the manufacturer per carrier, for BS operating in single carrier, multi-carrier, or carrier aggregation configurations that the manufacturer has declared to be available at the RIB during the *transmitter ON period*

**rated total TRP output power:** mean power level declared by the manufacturer, that the manufacturer has declared to be available at the RIB during the *transmitter ON period*

**reference beam direction pair:** declared *beam direction pair*, including reference *beam centre direction* and reference *beam peak direction* where the reference *beam peak direction* is the direction for the intended maximum EIRP within the *OTA peak directions set*

**receiver target:** AoA in which reception is performedby *BS types 1-H*, 1-O and *BS types 2-O*

**receiver target redirection range:** union of all the *sensitivity RoAoA* achievable through redirecting the *receiver target* related to particular OSDD

**receiver target reference direction:** direction inside the *OTA sensitivity directions declaration* declared by the manufacturer for conformance testing. For an OSDD without *receiver target redirection range*, this is a direction inside the *sensitivity RoAoA*

**reference RoAoA**: the sensitivity RoAoA associated with the receiver target reference direction for each OSDD

**requirement set:** one of the NR base station requirement’s set as defined for *BS type 1-C*, *BS type 1-H*, *BS type 1-O*, and *BS type 2-O*

**sensitivity RoAoA:** RoAoA within the *OTA sensitivity directions declaration*, within which the declared EIS(s) of an OSDD is intended to be achieved at any instance of time for a specific BS direction setting

**single-band RIB:** *operating band* specific RIB without any common active electronic component(s) shared with other *operating bands*

**sub-block:** one contiguous allocated block of spectrum for transmission and reception by the same base station

NOTE: There may be multiple instances of sub-blocks within a Base Station RF Bandwidth.

**sub-block gap:** frequency gap between two consecutive sub-blocks within a *Base Station RF Bandwidth*, where the RF requirements in the gap are based on co-existence for un-coordinated operation

**TAB connector:** *transceiver array boundary* connector

**transceiver array boundary:** conducted interface between the transceiver unit array and the composite antenna

**transmission bandwidth:** RF Bandwidth of an instantaneous transmission from a UE or BS, measured in resource block units

**total radiated power:** the total power radiated by the antenna

NOTE: The total radiated power is the power radiating in all direction for two orthogonal polarizations. Total radiated power is defined in both the near-field region and the far-field region.

**upper sub-block edge:** frequency at the upper edge of one *sub-block*

NOTE: It is used as a frequency reference point for both transmitter and receiver requirements.

## 3.2 Symbols

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

 Percentage of the mean transmitted power emitted outside the occupied bandwidth on the assigned channel

BeWθ,REFSENS The beamwidth equivalent to the OTA REFSENS RoAoA in the θ-axis in degrees

BeWφ,REFSENS The beamwidth equivalent to the OTA REFSENS RoAoA in the φ-axis in degrees

BWChannel *BS channel bandwidth*

BWChannel\_CA *Aggregated BS Channel Bandwidth*, expressed in MHz. BWChannel\_CA = Fedge\_high- Fedge\_low

BWConfig Transmission bandwidth configuration, expressed in MHz, where BWConfig = *N*RB x SCS x 12

Δf Separation between the channel edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency

Δfmax f\_offsetmax minus half of the bandwidth of the measuring filter

ΔFGlobal Global frequency raster granularity

ΔfOBUE Maximum offset of the *operating band* unwanted emissions mask from the downlink *operating band* edge

ΔfOOB Maximum offset of the out-of-band boundary from the uplink *operating band* edge

ΔminSENS Difference between conducted reference sensitivity and EISminsens

ΔOTAREFSENS Difference between conducted reference sensitivity and OTA REFSENS

ΔFRaster Channel raster granularity

Δsample                The difference between the nominal and extreme power measurements during extreme EIRP testing, Pmax,sample,nom  - Pmax,sample,ex

ΔSUL Channel raster offset for SUL

EIRPFBWhigh Declared EIRP value for the upper supported frequency within supported operating band, for which *fractional bandwidth* support was declared

EIRPFBWlow Declared EIRP value for the lower supported frequency within supported operating band, for which *fractional bandwidth* support was declared

EISminsens The EIS declared for the *minSENS RoAoA*

EISREFSENS OTA REFSENS EIS value

EISREFSENS\_50M Declared OTA reference sensitivity basis level for FR2 based on a reference measurement channel with 50MHz *BS channel bandwidth*

FFBWhigh Upper supported frequency within supported operating band, for which *fractional bandwidth* support was declared

FFBWlow Lower supported frequency within supported operating band, for which *fractional bandwidth* support was declared

FC *RF reference frequency* on the channel raster

FC,block, high Fc of the highest transmitted/received carrier in a sub-block

FC,block, low Fc of the lowest transmitted/received carrier in a sub-block

FC\_low The Fc of the lowest carrier, expressed in MHz

FC\_high The Fc of the highest carrier, expressed in MHz

Fedge\_low The lower edge of *Aggregated BS Channel Bandwidth*, expressed in MHz. Fedge\_low = FC\_low - Foffset\_low

Fedge\_high The upper edge of *Aggregated BS Channel Bandwidth*, expressed in MHz. Fedge\_high = FC\_high + Foffset\_high

Fedge,block,low The lower sub-block edge, where Fedge,block,low = FC,block,low - Foffset\_low

Fedge,block,high The upper sub-block edge, where Fedge,block,high = FC,block,high + Foffset\_high

Foffset\_high Frequency offset from FC\_high to the upper *Base Station RF Bandwidth edge*, or from F C,block, high to the upper sub-block edge

Foffset\_low Frequency offset from FC\_low to the lower *Base Station RF Bandwidth edge*, or from FC,block, low to the lower sub-block edge

f\_offset Separation between the channel edge frequency and the centre of the measuring filter

f\_offsetmax The offset to the frequency ΔfOBUE outside the downlink *operating band*

FREF RF reference frequency

FREF,SUL  RF reference frequency for Supplementary Uplink (SUL) bands

FDL\_low The lowest frequency of the downlink *operating band*

FDL\_high The highest frequency of the downlink *operating band*

FUL\_low The lowest frequency of the uplink *operating band*

FUL\_high The highest frequency of the uplink *operating band*

Ncells The declared number corresponding to the minimum number of cells that can be transmitted by an *BS type 1-H* in a particular *operating band*

NRB Transmission bandwidth configuration, expressed in resource blocks

NREF NR Absolute Radio Frequency Channel Number (NR-ARFCN)

NRXU,active The number of active receiver units. The same as the number of *demodulation branches* to which compliance is declared for chapter 8 performance requirements

PEM,n50,ind Declared emission level for Band n50 in the band 1518-1559 MHz; ind = a, b

Pmax,c,EIRP The maximum carrier EIRPwhen the NR BS is configured at the maximum rated carrier output TRP (PRated,c,TRP)

Pmax,c,EIRP, extreme The maximum carrier EIRP when the NR BS is configured at the maximum rated carrier output TRP (PRated,c,TRP) under extreme conditions, either measured directly or calculated

Pmax,c**,**TRP*Maximum carrier TRP output power* measuredat the RIB(s), and corresponding to the declared *rated carrier TRP output power* (Prated,c,TRP)

Pmax,sample,nomThe measured sample power in extreme conditionals chamber when the AAS BS is configured at the rated carrier output TRP (PRated,c,TRP), under nominal conditions

Pmax,sample,ext The measured sample power in extreme conditionals chamber when the AAS BS is configured at the rated carrier output TRP (PRated,c,TRP), under extreme conditions

PRated,c,EIRP           The rated carrier output EIRP when the NR BS is configured at the rated carrier output TRP (PRated,c,TRP)

Prated,c,TRP Rated carrier TRP output *power* declaredper RIB

Prated,t,TRP *Rated total TRP output power* declaredper RIB

PREFSENS Conducted reference Sensitivity power levelSSREF SS block reference frequency position

TTOTA Test tolerance for OTA requirements

Wgap Sub-block gap or Inter RF Bandwidth gap size

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

AA Antenna Array

ACLR Adjacent Channel Leakage Ratio

ACS Adjacent Channel Selectivity

CA Carrier Aggregation

CACLR Cumulative ACLR

CLTA Co-Location Test Antenna

DUT Device Under Test

EIRP Equivalent Isotropic Radiated Power

EIS Equivalent Isotropic Sensitivity

FBW Fractional Bandwidth

FR Frequency Range

GSCN Global Synchronization Channel Number

ICS In-Channel Selectivity

NR New Radio

OSDD OTA Sensitivity Directions Declaration

OTA Over The Air

RDN Radio Distribution Network

REFSENS Reference Sensitivity

RIB Radiated Interface Boundary

RoAoA Range of Angles of Arrival

SCS Sub-Carrier Spacing

TAB Transceiver Array Boundary

TAE Time Alignment Error

TRP Total Radiated Power

TT Test Tolerance

# 4 General radiated test conditions and declarations

## 4.1 Measurement uncertainties and test requirements

### 4.1.1 General

The requirements of this clause apply to all applicable tests in 3GPP TS 38.141-2 (the present document), i.e. to all radiated tests defined for *BS type 1-H*, *BS type 1-O* and *BS type 2-O*.

The minimum requirements are given in TS 38.104 [2]. Test Tolerances for the radiated test requirements (TTOTA) explicitly stated in the present document are given in annex C.

Test Tolerances are individually calculated for each test. Test Tolerances are used to relax the minimum requirements to create test requirements.

When a test requirement differs from the corresponding minimum requirement, then the Test Tolerance applied for the test is non-zero. The Test Tolerance for the test and the explanation of how the minimum requirement has been relaxed by the Test Tolerance are given in annex C.

Table 4.1.1-1: Overview of radiated Tx requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tx requirement | | Classification  (Note) | | Notes |
| Radiated transmit power | | Directional – *OTA peak directions set* | | This requirement is based on Rel-13 AAS BS requirement for EIRP accuracy. |
| OTA BS output power | | TRP | |  |
| OTA output power dynamics | | Directional – *OTA peak directions set* | | Conformance testing is carried in the reference direction. |
| OTA transmit ON/OFF power | | FR1 | FR2 |  |
| Co-location | TRP |
| OTA transient period | | Co-location | |  |
| OTA modulation quality | | Directional – *OTA coverage range* | | Conformance testing is carried in the reference direction and the maximum directions of the OTA coverage range on each axis. |
| OTA frequency error | | Directional – *OTA coverage range* | | Conformance testing is carried out in the reference direction. |
| OTA time alignment error | | Directional – *OTA coverage range* | | Conformance testing is carried out in the reference direction. |
| OTA occupied bandwidth | | Directional – *OTA coverage range* | | Conformance testing is carried out in the reference direction. |
| OTA ACLR | | TRP | |  |
| OTA operating band unwanted emission | | TRP | |  |
| OTA transmitter spurious emission | General requirement | TRP | | For FR1 and FR2. |
| Protection of the BS receiver of own or different BS | Co-location | | For FR1 only. |
| Additional spurious emissions | TRP | | For FR1 only. |
| Co-location with other base stations | Co-location | | For FR1 only. |
| OTA transmitter intermodulation | | Co-location | | For FR1 only. |
| NOTE: Directional requirement does not imply one compliance direction only. The directional requirement applies to a single direction at a time. | | | | |

Table 4.1.1-2: Overview of radiated Rx requirements

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Rx requirement | | Classification | Applicability levels | | Coverage range | | **Number of conformance directions** |
| FR1 | FR2 | FR1 | FR2 |
| OTA sensitivity | | Directional | Minimum EIS | N/A | OSDD | N/A | 5 |
| OTA reference sensitivity | | Directional | OTA REFSENS | OTA REFSENS | *OTA REFSENS RoAoA* | | 5 |
| OTA Dynamic range | | Directional | OTA REFSENS | N/A | *OTA REFSENS RoAoA* | N/A | 1 |
| OTA adjacent channel selectivity | | Directional | minSENS | OTA REFSENS | *minSENS RoAoA* | *OTA REFSENS RoAoA* | 1 |
| OTA in-band blocking | | Directional | OTA REFSENS and minSENS | OTA REFSENS | *OTA REFSENS RoAoA and minSENS RoAoA* | *OTA REFSENS RoAoA* | 5 |
| OTA out-of-band blocking | General requirement | Directional | *minSENS* | OTA REFSENS | *minSENS RoAoA* | *OTA REFSENS RoAoA* | 1 |
| Co-location with other base stations | Co-location (Note 2) | *minSENS* | N/A | *minSENS RoAoA* | N/A | 1 |
| OTA receiver spurious emissions | | TRP | N/A | | N/A | | N/A |
| OTA receiver intermodulation | | Directional | OTA REFSENS and minSENS | OTA REFSENS | *OTA REFSENS RoAoA and minSENS RoAoA* | *OTA REFSENS RoAoA* | 1 |
| OTA in-channel selectivity | | Directional | *minSENS* | OTA REFSENS | *minSENS RoAoA* | *OTA REFSENS RoAoA* | 1 |
| NOTE 1: Directional requirement does not imply one compliance direction only. The directional requirement applies to a single direction at a time.  NOTE 2: The compliance direction for co-location blocking is applicable for the wanted signal only but not the interfering signal. | | | | | | | |

### 4.1.2 Acceptable uncertainty of OTA Test System

#### 4.1.2.1 General

The maximum acceptable uncertainty of the OTA Test System is specified below for each radiated test defined explicitly in the present specification, where appropriate.

The OTA Test System shall enable the stimulus signals in the test case to be adjusted to within the specified tolerance and the DUT to be measured with an uncertainty not exceeding the specified values. All tolerances and uncertainties are absolute values, and are valid for a confidence level of 95 %, unless otherwise stated.

A confidence level of 95% is the measurement uncertainty tolerance interval for a specific measurement that contains 95% of the performance of a population of test equipment.

#### 4.1.2.2 Measurement of transmitter

The maximum OTA Test System uncertainty for OTA transmitter tests minimum requirements are given in tables 4.1.2.2-1 and 4.1.2.2-2. Details for derivation of OTA Test System uncertainty are given in corresponding subclauses in TR 38.817-02 [17].

Table 4.1.2.2-1: Maximum OTA Test System uncertainty for FR1 OTA transmitter tests

|  |  |  |
| --- | --- | --- |
| Subclause | Maximum OTA Test System uncertainty |  |
| 6.2 Radiated transmit power | Normal condition:  ±1.1 dB, f ≤ 3 GHz  ±1.3 dB, 3 GHz < f ≤ 6 GHz |  |
| Extreme condition:  ±2.5 dB, f ≤ 3 GHz  ±2.6 dB, 3 GHz < f ≤ 6 GHz |  |
| 6.3 OTA base station output power | ±1.4 dB, f ≤ 3.0 GHz  ±1.5 dB, 3.0 GHz < f ≤ 4.2 GHz  ±1.5, 4.2 GHz < f ≤ 6.0 GHz |  |
| 6.4.2 OTA RE power control dynamic range | N/A |  |
| 6.4.3 OTA total power dynamic range | ±0.4 dB |  |
| 6.5.2 OTA transmitter OFF power | ±3.4 dB, f ≤ 3.0 GHz  ±3.6 dB, 3.0 GHz < f ≤ 6 GHz  (NOTE) |  |
| 6.5.3 OTA transmitter transient period | N/A |  |
| 6.6.1 OTA frequency error | ±12 Hz |  |
| 6.6.2 OTA modulation quality | ±1 % |  |
| 6.6.3 OTA time alignment error | ±25 ns |  |
| 6.7.2 OTA occupied bandwidth | 5 MHz, 10 MHz BS Channel BW: ±100 kHz  15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz BS Channel BW: ±300 kHz  60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz BS Channel BW: ±600 kHz |  |
| 6.7.3 OTA ACLR | ACLR/CACLR  f ≤ 3.0 GHz  BW ≤ 20MHz: ±1 dB  BW > 20MHz: ±1 dB  3.0 GHz < f ≤ 4.2 GHz  BW ≤ 20MHz: ±1.2 dB  BW > 20MHz: ±1.2 dB  4.2 GHz < f ≤ 6.0 GHz  BW ≤ 20MHz: ±1.2 dB  BW > 20MHz: ±1.2 dB  Absolute power ±2.2 dB, f ≤ 3.0 GHz  Absolute power ±2.7 dB, 3.0 GHz < f ≤ 4.2 GHz  Absolute power ±2.7 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| 6.7.4 OTA operating band unwanted emissions | Absolute power ±1.8 dB, f ≤ 3.0 GHz  Absolute power ±2 dB, 3.0 GHz < f ≤ 4.2 GHz  Absolute power ±2 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| 6.7.5.2.2 OTA transmitter spurious emissions, mandatory requirements | ±2.3 dB, 30 MHz < f ≤ 6 GHz  ±4.2 dB, 6 GHz < f ≤ 26 GHz |  |
| 6.7.5.2.3 OTA transmitter spurious emissions, protection of BS receiver | ±3.1 dB, f ≤ 3 GHz  ±3.3 dB, 3 GHz < f ≤ 4.2 GHz  ±3.4, 4.2 GHz < f ≤ 6 GHz |  |
| 6.7.5.2.4 OTA transmitter spurious emissions, additional spurious emissions requirements | ±2.6 dB, f ≤ 3 GHz  ±3.0, 3 GHz < f ≤ 4.2 GHz  ±3.5, 4.2 GHz < f ≤ 6 GHz |  |
| 6.7.5.2.5 OTA transmitter spurious emissions, co-location | ±3.1 dB, f ≤ 3 GHz  ±3.3 dB, 3 GHz < f ≤ 4.2 GHz  ±3.4, 4.2 GHz < f ≤ 6 GHz  (NOTE) |  |
| 6.8 OTA transmitter intermodulation | The value below applies only to the interfering signal and is unrelated to the measurement uncertainty of the tests (6.6.1, 6.6.2 and 6.6.4) which have to be carried out in the presence of the interferer.  ±3.2 dB, f ≤ 3.0 GHz  ±3.4 dB, 3.0 GHz < f ≤ 4.2 GHz  ±3.5 dB, 4.2 GHz < f ≤ 6 GHz  (NOTE) |  |
| NOTE: Fulfilling the criteria for CLTA selection and placement in subclause 4.12 is deemed sufficient for the test purposes. When these criteria are met, the measurement uncertainty related to the selection of the co-location test antenna and its alignment as specified in the appropriate measurement uncertainty budget in TR 37.843 [28], subclause 10.6 shall be used for evaluating the test system uncertainty. | | |

Table 4.1.2.2-2: Maximum OTA Test System uncertainty for FR2 OTA transmitter tests

|  |  |  |
| --- | --- | --- |
| Subclause | Maximum OTA Test System uncertainty |  |
| 6.2 Radiated transmit power | ±1.7 dB (24.25 – 33.4 GHz)  ±2.0 dB (37 – 52.6 GHz) |  |
| 6.3 OTA base station output power | ±2.1 dB (24.25 – 33.4 GHz)  ±2.4 dB (37 – 52.6 GHz) |  |
| 6.4.2 OTA RE power control dynamic range | N/A |  |
| 6.4.3 OTA total power dynamic range | ±0.4 dB |  |
| 6.5.2 OTA transmitter OFF power | FFS |  |
| 6.5.3 OTA transmitter transient period | N/A |  |
| 6.6.1 OTA frequency error | ±12 Hz |  |
| 6.6.2 OTA modulation quality | 1% |  |
| 6.6.3 OTA time alignment error | ±25 ns |  |
| 6.7.2 OTA occupied bandwidth | [600] kHz |  |
| 6.7.3 OTA ACLR | Relative ACLR:  ±2.3dB (24.25 – 33.4 GHz)  ±2.6dB (37 – 52.6 GHz)  Absolute ACLR: ±2.7dB |  |
| 6.7.4 OTA operating band unwanted emissions | ±2.7dB |  |
| 6.7.5.3.2 OTA transmitter spurious emissions, mandatory requirements | FFS |  |
| 6.7.5.3.3 OTA transmitter spurious emissions, additional spurious emissions requirements | FFS |  |

#### 4.1.2.3 Measurement of receiver

The maximum OTA Test System uncertainty for OTA receiver tests minimum requirements are given in tables 4.1.2.3-1 and 4.1.2.3-2. Details for derivation of OTA Test System uncertainty are given in corresponding subclauses in TR 38.817-02 [17].

Table 4.1.2.3-1: Maximum OTA Test System uncertainty for FR1 OTA receiver tests

|  |  |  |
| --- | --- | --- |
| Subclause | Maximum OTA Test System uncertainty |  |
| 7.2 OTA sensitivity | ±1.3 dB, f ≤ 3.0 GHz  ±1.4 dB, 3.0 GHz < f ≤ 4.2 GHz  ±1.6 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| 7.3 OTA reference sensitivity level | ±1.3 dB, f ≤ 3.0 GHz  ±1.4 dB, 3.0 GHz < f ≤ 4.2 GHz  ±1.6 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| 7.4 OTA dynamic range | ±0.3 dB |  |
| 7.5.1 OTA adjacent channel selectivity | ±1.7 dB, f ≤ 3.0 GHz  ±2.1 dB, 3.0 GHz < f ≤ 4.2 GHz  ±2.4 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| 7.5.2 In-band blocking (General) | ±1.9 dB, f ≤ 3.0 GHz  ±2.2 dB, 3.0 GHz < f ≤ 4.2 GHz  ±2.5 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| 7.5.2 In-band blocking (Narrowband) | ±1.7 dB, f ≤ 3.0 GHz  ±2.1 dB, 3.0 GHz < f ≤ 4.2 GHz  ±2.4 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| 7.6 OTA out-of-band blocking | fwanted ≤ 3 GHz  1 MHz < finterferer ≤ 3 GHz: ±2.0 dB  3 GHz < finterferer ≤ 6 GHz: ±2.1 dB  6 GHz < finterferer ≤ 12.75 GHz: ±3.5 dB  3 GHz < fwanted ≤ 4.2GHz:  1 MHz < finterferer ≤ 3 GHz: ±2.0 dB  3 GHz < finterferer ≤ 6 GHz: ±2.1 dB  6 GHz < finterferer ≤ 12.75 GHz: ±3.6 dB  4.2 GHz < fwanted ≤ 6 GHz:  1 MHz < finterferer ≤ 3 GHz: ±2.2 dB  3 GHz < finterferer ≤ 6 GHz: ±2.3 dB  6 GHz < finterferer ≤ 12.75 GHz: ±3.6 dB |  |
| 7.7 OTA receiver spurious emissions | 30 MHz ≤ f ≤ 6 GHz, ±2.5dB  6 GHz < f ≤ 26 GHz, ±4.2dB |  |
| 7.8 OTA receiver intermodulation | ±2.0 dB, f ≤ 3.0 GHz  ±2.6 dB, 3.0 GHz < f ≤ 4.2 GHz  ±3.2 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| 7.9 OTA in-channel selectivity | ±1.7 dB, f ≤ 3.0 GHz  ±2.1 dB, 3.0 GHz < f ≤ 4.2 GHz  ±2.4 dB, 4.2 GHz < f ≤ 6.0 GHz |  |
| NOTE: Fulfilling the criteria for CLTA selection and placement in subclause 4.12 is deemed sufficient for the test purposes. When these criteria are met, the measurement uncertainty related to the selection of the co-location test antenna and its alignment as specified in the appropriate measurement uncertainty budget in TR 37.843 [28], subclause 10.6 shall be used for evaluating the test system uncertainty. | | |

Table 4.1.2.3-2: Maximum OTA Test System uncertainty for FR2 OTA receiver tests

|  |  |  |
| --- | --- | --- |
| Subclause | Maximum OTA Test System uncertainty |  |
| 7.3 OTA reference sensitivity level | ±2.4 dB |  |
| 7.5.1 OTA adjacent channel selectivity | ±3.4 dB |  |
| 7.5.2 In-band blocking (General) | ±3.4 dB |  |
|  |  |  |
| 7.6 OTA out-of-band blocking | ±4.1 dB |  |
| 7.7 OTA receiver spurious emissions | ±2.5 dB, 30 MHz ≤ f ≤ 6 GHz  ±2.7 dB, 6 GHz < f ≤ 40 GHz  ±5.0 dB, 40 GHz < f ≤ 60 GHz |  |
| 7.8 OTA receiver intermodulation | ±3.9 dB |  |
| 7.9 OTA in-channel selectivity | ±3.4 dB |  |

#### 4.1.2.4 Measurement of performance requirement

Table 4.1.2.4-1: Maximum OTA Test System uncertainty for FR1 OTA performance requirements

|  |  |  |
| --- | --- | --- |
| Subclause | Maximum OTA Test System uncertainty | Derivation of OTA Test System uncertainty |
| 8 PUSCH, PUCCH, PRACH with [single antenna port] and fading channel | ± [0.6] dB | [Overall system uncertainty for fading conditions comprises two quantities:  1. Signal-to-noise ratio uncertainty  2. Fading profile power uncertainty  Items 1 and 2 are assumed to be uncorrelated so can be root sum squared:  Test System uncertainty = [SQRT (Signal-to-noise ratio uncertainty 2 + Fading profile power uncertainty 2)]  Signal-to-noise ratio uncertainty ±0.3 dB  Fading profile power uncertainty ±0.5 dB] |
| 8 PRACH with [single antenna port] and AWGN | ± [0.3] dB | [Signal-to-noise ratio uncertainty ±0.3 dB] |
| 8 PUSCH with [two antenna port] and fading channel | ± [0.8] dB | [Overall system uncertainty for fading conditions comprises two quantities:  1. Signal-to-noise ratio uncertainty  2. Fading profile power uncertainty  Items 1 and 2 are assumed to be uncorrelated so can be root sum squared:  Test System uncertainty = [SQRT (Signal-to-noise ratio uncertainty 2 + Fading profile power uncertainty 2)]  Signal-to-noise ratio uncertainty ±0.3 dB  Fading profile power uncertainty ±0.7 dB for MIMO] |

Table 4.1.2.4-2: Maximum OTA Test System uncertainty for FR2 OTA performance requirements

|  |  |  |
| --- | --- | --- |
| Subclause | Maximum OTA Test System uncertainty | Derivation of OTA Test System uncertainty |
| TBD |  |  |

### 4.1.3 Interpretation of measurement results

Editor’s note: Square brackets on the Shared Risk text to be removed or the text to be changed once the OTA test procedures and MU for BS type 1-O and BS type 2-O are stable enough.

[The measurement results returned by the OTA Test System are compared - without any modification - against the test requirements as defined by the Shared Risk principle in Recommendation ITU-R M.1545 [4].]

The actual measurement uncertainty of the OTA Test System for the measurement of each parameter shall be included in the test report.

The recorded value for the OTA Test System uncertainty shall be, for each OTA measurement, equal to or lower than the appropriate figure in subclause 4.1.2 of this specification.

If the OTA Test System for an OTA test is known to have a measurement uncertainty greater than that specified in subclause 4.1.2, it is still permitted to use this apparatus provided that an adjustment is made as follows:

Any additional uncertainty in the OTA Test System over and above that specified in subclause 4.1.2 shall be used to tighten the OTA test requirement, making the test harder to pass. For some tests e.g. receiver tests, this may require modification of stimulus signals. This procedure will ensure that an OTA Test System not compliant with subclause 4.1.2 does not increase the chance of passing a DUT where that device would otherwise have failed the test if an OTA Test System compliant with subclause 4.1.2 had been used.

## 4.2 Radiated requirement reference points

Radiated characteristics for *BS type 1-H*, *BS type 1-O* and *BS type 2-O* are defined over the air (OTA) where the operating band specific radiated interface is referred to as the *Radiated Interface Boundary* (RIB). Radiated requirements are also referred to as OTA requirements. The (spatial) characteristics in which the OTA requirements apply are detailed for each requirement. For *BS type 1-H* the requirements are defined for two points of reference, signified by radiated requirements at the RIB and the conducted requirements at *transceiver array boundary* (TAB). The OTA requirements of *BS type 1-H* are tested in the far field (Fraunhofer) region.

General architecture and reference points of *BS type 1-H*, *BS type 1-O* and *BS type 2-O* are presented on the following figures 4.2-1 – 4.2-2.



Figure 4.2-1: General architecture of *BS type 1-H*

This specification details only radiated test requirements and hence only requires the radiated reference points.



Figure 4.2-2: General architecture of *BS type 1-O* and *BS type 2-O*

The transceiver unit array is part of the composite transceiver functionality generating modulated transmit signal structures and performing receiver combining and demodulation.

The transceiver unit array contains an implementation specific number of transmitter units and an implementation specific number of receiver units. Transmitter units and receiver units may be combined into transceiver units. The transmitter/receiver units have the ability to receive/send parallel independent modulated symbol streams.

The composite antenna contains a *radio distribution network* (RDN) and an antenna array. The RDN is a linear passive network that distributes the RF power between the *transceiver array boundary* and the antenna array, in an implementation specific way.

## 4.3 Base station classes

The requirements in this specification apply to Wide Area Base Stations, Medium Range Base Stations and Local Area Base Stations unless otherwise stated. The associated deployment scenarios and definitions of BS classes are exactly the same for BS with and without connectors.

BS classes for *BS type 1-H* are defined as indicated below:

- Wide Area Base Stations are characterised by requirements derived from Macro Cell scenarios with a BS to UE minimum coupling loss equal to 70 dB.

- Medium Range Base Stations are characterised by requirements derived from Micro Cell scenarios with a BS to UE minimum coupling loss equals to 53 dB.

- Local Area Base Stations are characterised by requirements derived from Pico Cell scenarios with a BS to minimum coupling loss equal to 45 dB.

BS classes for BS *type 1-O* and *BS type 2-O* are defined as indicated below:

- Wide Area Base Stations are characterised by requirements derived from Macro Cell scenarios with a BS to UE minimum distance along the ground equal to 35 m.

- Medium Range Base Stations are characterised by requirements derived from Micro Cell scenarios with a BS to UE minimum distance along the ground equal to 5 m.

- Local Area Base Stations are characterised by requirements derived from Pico Cell scenarios with a BS to UE minimum distance along the ground equal to 2 m.

The manufacturer shall declare the intended class of the BS under test.

## 4.4 Regional requirements

Some requirements in the present document may only apply in certain regions either as optional requirements, or set by local and regional regulation as mandatory requirements. It is normally not stated in the 3GPP specifications under what exact circumstances that the requirements apply, since this is defined by local or regional regulation.

Table 4.4-1 lists all requirements in the present specification that may be applied differently in different regions.

Table 4.4-1: List of regional requirements

|  |  |  |
| --- | --- | --- |
| Subclause | Requirement | Comments |
| 5 | Operating bands | Some NR operating bands may be applied regionally. |
| 6.7.2 | OTA occupied bandwidth | The requirement may be applied regionally. There may also be regional requirements to declare the occupied bandwidth according to the definition in present specification. |
| 6.7.3 | OTA absolute ACLR, | The emission limits specified for OTA absolute ACLR as the *basic limit* + X (dB) are applicable, unless stated differently in regional regulation. |
| 6.7.4 | OTA out-of-band emissions | The emission limits specified for OTA out-of-band emissions as the *basic limit* + X (dB) are applicable, unless stated differently in regional regulation. |
| 6.7.4.5 | OTA out-of-band emissions  Limits in FCC Title 47 | The BS may have to comply with the applicable emission limits established by FCC Title 47, when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer. |
| 6.7.5.2 | General OTA transmitter spurious emissions | Category A or Category B spurious emission limits, as defined in ITU-R Recommendation SM.329 [5], may apply regionally.  The emission limits specified as the *basic limit* + X (dB) are applicable, unless stated differently in regional regulation. |
| 6.7.5.4 | Additional OTA transmitter spurious emissions | These requirements may be applied for the protection of system operating in frequency ranges other than the BS operating band. |
| 7.7 | OTA receiver spurious emissions | The emission limits specified as the *basic limit* + X (dB) are applicable, unless stated differently in regional regulation. |

## 4.5 BS configurations

### 4.5.1 Transmit configurations

Unless otherwise stated, the radiated transmitter characteristics in clause 6 are specified at RIB, with a full complement of transceiver units for the configuration in normal operating conditions.

*Editor’s note: to be aligned with the figures for the RIB interfaces and co-location concept.*



Figure 4.5.1-1: Transmitter test interfaces



Figure 4.5.1-2: Transmitter test interfaces for co-location concept

### 4.5.2 Receive configurations

Unless otherwise stated, the radiated receiver characteristics in clause 7 are specified at RIB, with a full complement of transceiver units for the configuration in normal operating conditions.

*Editor’s note: to be aligned with the figures for the RIB interfaces and co-location concept.*



Figure 4.5.2-1: Receiver test interfaces



Figure 4.5.2-2: Receiver test interfaces for co-location concept

### 4.5.3 Power supply options

If the BS is supplied with a number of different power supply configurations, it may not be necessary to test RF parameters for each of the power supply options, provided that it can be demonstrated that the range of conditions over which the equipment is tested is at least as great as the range of conditions due to any of the power supply configurations.

## 4.6 Manufacturer’s declarations

The following BS manufacturer’s declarations listed in table 4.6-1 are required to be provided by the manufacturer for radiated requirements testing for *BS type 1-H,* *BS type 1-O* and *BS type 2-O*.

For the *BS type 1-H* declarations required for the conducted requirements testing, refer to TS 38.141-1 [3], subclause 4.6.

Table 4.6-1 Manufacturers declarations for *BS type 1-H, BS type 1-O* and *BS type 2-O* radiated test requirements

| Declaration identifier | Declaration | Description | Applicability  (Note 1) | | |
| --- | --- | --- | --- | --- | --- |
| *BS type 1-H*  (Note 2) | *BS type 1-O* | *BS type 2-O* |
| D.1 | Coordinate system reference point | Location of coordinated system reference point in reference to an identifiable physical feature of the BS enclosure. | x | x | x |
| D.2 | Coordinate system orientation | Orientation of the coordinate system in reference to an identifiable physical feature of the BS enclosure. | x | x | x |
| D.3 | Beam identifier | A unique title to identify a beam, e.g. a, b, c or 1, 2, 3.  The vendor may declare any number of beams, the minimum requirement to declare for conformance are the beams with the highest intend EIRP for each of the beams widths below:  1) Narrowest intended BeWθ, narrowest intended BeWϕ (possible when narrowest intended BeWθ) at the reference beam direction.  2) Narrowest intended BeWϕ, narrowest intended BeWθ (possible when narrowest intended BeWϕ) at the reference beam direction.  3) Widest intended BeWθ, widest intended BeWϕ (possible when widest intended BeWθ at the reference beam direction.  4) Widest intended BeWϕ, widest intended BeWθ (possible when widest intended BeWϕ) at the reference beam direction.  5) BeWθ and BeWϕ which provide highest intended EIRP of all possible beams at the reference beam direction.  NOTE 3: Depending on the capability of the system some of these beams may be the same.  When selecting the above five beam widths for declaration, all beams that the BS is intended to produce shall be considered, including beams that during operation may be identified by any kind of cell or UE specific reference signals, with the exception of any type of beam that is created from a group of transmitters that are not all phase synchronised. | x | x | x |
| D.4 | Operating band support | NR *operating band(s)* supported by the BS. Supported bands declared for every beam (D.3).  NOTE 4: These *operating bands* are related to their respective single‑band RIBs. | x | x | x |
| D.5 | BS requirements set | Declaration of one of the NR base station *requirement’s set* as defined for *BS type 1-H*, *BS type 1-O*, *or BS type 2-O*. | c | x | x |
| D.6 | BS class | Declared as Wide Area BS, Medium Range BS, or Local Area BS. | c | x | x |
| D.7 | BS channel band width and SCS support | NR BS channel bandwidth and SCS supported. Declared for each beam (D.3) and each *operating band* (D.4). | c | x | x |
| D.8 | *OTA peak directions set* reference beam direction pair | The beam direction pair, describing the reference beam peak direction and the reference beam centre direction. Declared for every beam (D.3). | x | x | x |
| D.9 | *OTA peak directions set* | The OTA peak directions set for each beam. Declared for every beam (D.3). | x | x | x |
| D.10 | *OTA peak directions set* maximum steering direction(s) | The *beam direction pair(s)* corresponding to the following points:  1) The *beam peak direction* corresponding to the maximum steering from the *reference beam centre direction* in the positive *Φ* direction, while the *θ value being the closest possible to the reference beam centre direction.*  2) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the negative *Φ* direction, while the *θ value being the closest possible to the* reference beam centre direction*.*  3) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the positive *θ* direction, while the *Φ value being the closest possible to the* reference beam centre direction.  4) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the negative *θ* direction, while the *Φ value being the closest possible to the* reference beam centre direction*.*  The maximum steering direction(s) may coincide with *the reference beam centre direction*.  Declared for every beam (D.3). | x | x | x |
| D.11 | Rated beam EIRP | The rated EIRP level per carrier (PRated,c,EIRP) at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.8). Declared for every beam (D.3).  (NOTE Y, Z) | x | x | x |
| D.12 | Beamwidth | The *beamwidth* for the reference *beam direction pair* and the four maximum steering directions. Declared for every beam (D.3). | x | x | x |
| D.13 | Equivalent beams | List of beams which are declared to be equivalent.  Equivalent beams imply that the beams are expected to have identical *OTA peak directions sets* and intended to have identical spatial properties at all steering directions within the *OTA peak directions set* when presented with identical signals. All declarations (D.4 – D.12) made for the beams are identical and the transmitter unit*,* RDN and antenna array responsible for generating the beam are of identical design. | x | x | x |
| D.14 | Parallel beams | List of beams which have been declared equivalent (D.13) and can be generated in parallel using independent RF power resources.  Independent power resources mean that the beams are transmitted from mutually exclusive transmitter units. | x | x | x |
| D.15 | Number of carriers at maximum TRP | The number of carriers per operating band the NR BS is capable of generating at maximum TRP declared for every beam (D.3). | x | x | x |
| D.16 | Multi-band transceiver units | Declared if an *operating band* is generated using transceiver units supporting operation in multiple *operating bands* through common active RF components. | x | x | x |
| D.17 | Operating bands with multi-band dependencies | List of *operating bands* which are generated by multi-band transceiver units. Declared for each *operating band* for which multi-band transceiver units (D.16) have been declared. | c | x | n/a |
| D.18 | Maximum radiated *Base Station RF Bandwidth* | Maximum *Base Station RF Bandwidth* in the *operating band*, declared for each supported operating band (D.4). | c | x | x |
| D.19 | Maximum radiated *Base Station RF Bandwidth* for contiguous operation | Maximum *Base Station RF Bandwidth* for contiguous spectrum operation, declared for each supported *operating band* (D.4). | c | x | x |
| D.20 | Maximum radiated *Base Station RF Bandwidth* for non- contiguous operation | Maximum *Base Station RF Bandwidth* for non-contiguous spectrum operation, declared for each supported *operating band* (D.4). | c | x | x |
| D.21 | Maximum *Radio Bandwidth* of the *operating band* with multi-band dependencies | Largest *Radio Bandwidth* that can be supported by the *operating bands* with multi-band dependencies.  Declared for each supported *operating band* which has multi-band dependencies (D.17). | c | x | n/a |
| D.22 | Total RF bandwidth (BWtot) | Total RF bandwidth BWtot of transmitter and receiver, declared per the band combinations (D.56). | c | x | x |
| D.23 | Inter-band CA bands | Declared inter-band CA bands supported by the beam. Declared per beam (D.3). | c | x | x |
| D.24 | CA-only operation | Declared of CA-only but not multiple carriers operation, declared per *operating band* (D.4) and per beam (D.3). | c | x | x |
| D.25 | Total number of supported carriers for operating bands with multi-band dependencies | Total number of supported carriers for operating bands declared to have multi-band dependencies (D.17). | c | x | x |
| D.26 | Contiguous or non-contiguous spectrum operation support | Ability of BS to support contiguous or non-contiguous (or both) frequency distribution of carriers when operating multi-carrier in an operating band. | c | x | x |
| D.27 | Non-contiguous parameters | If non-contiguous operation is supported in *operating band* (D.26) and parameters (e.g. frequency range, maximum Base Station RF Bandwidth, rated total output power, etc.) differ from the contiguous spectrum operation, then this declaration provided parameters for the non-contiguous operation. Otherwise, parameters for contiguous or non-contiguous spectrum operation in the operating band are assumed to be the same. | c | x | x |
| D.28 | OSDD identifier | A unique identifier for the OSDD. | x | x | n/a |
| D.29 | OSDD operating band support | Operating band supported by the OSDD, declared for every OSDD (D.28).  NOTE 5: As each identified OSDD has a declared minimum EIS value (D.32), multiple operating band can only be declared if they have the same minimum EIS declaration. | x | x | n/a |
| D.30 | OTA sensitivity supported BS channel bandwidth and SCS | The *BS channel bandwidths* and SCS supported by each OSDD. | x | x | n/a |
| D.31 | Redirection of receiver target support | Ability to redirect the receiver target related to the OSDD. | x | x | n/a |
| D.32 | Minimum EIS for FR1 (EISREFSENS) | The minimum EISREFSENS requirement (i.e. maximum allowable EIS value) applicable to all sensitivity RoAoA per OSDD.  Declared per NR supported channel BW for the OSDD (D.30).  The lowest EIS value for all the declared OSDD’s is called minSENS, while its related range of angles of arrival is called *minSENS RoAoA*.  NOTE 6: If the *BS type 1-H* or *BS type 1-O* is not capable of redirecting the receiver target related to the OSDD then there is only one RoAoA applicable to the OSDD. | x | x | n/a |
| D.33 | Minimum EIS for FR2 (EISREFSENS\_50M) | The EISREFSENS\_50M level used for the derivation of the FR2 EISREFSENS for all channel bandwidths supported by *BS type 2-O*. The declared single integer value of EISREFSENS\_50M shall be within the ranges specified in table below:   |  |  | | --- | --- | | BS class | EISREFSENS\_50M range | | Wide Area BS | -119 to -96 dBm | | Medium Range BS | -114 to -91 dBm | | Local Area BS | -109 to -86 dBm |     NOTE 7: Although EISREFSENS\_50M level is based on a reference measurement channel with BWChannel = 50 MHz, it does not imply that BS has to support 50MHz channel bandwidth. | n/a | n/a | x |
| D.34 | Receiver target reference direction Sensitivity Range of Angle of Arrival | The sensitivity RoAoA associated with the receiver target reference direction (D.36) for each OSDD. | x | x | n/a |
| D.35 | Receiver target redirection range | For each OSDD the associated union of all the sensitivity RoAoA achievable through redirecting the receiver target related to the OSDD.  NOTE 8: Not applicable for *BS type 2-O*. | x | x | n/a |
| D.36 | Receiver target reference direction | For each OSDD an associated direction inside the receiver target redirection range (D.35).  NOTE 9: For an OSDD without receiver target redirection range, this is a direction inside the sensitivity RoAoA. | x | x | n/a |
| D.37 | Conformance test directions sensitivity RoAoA | For each OSDD that includes a receiver target redirection range, four sensitivity RoAoA comprising the conformance test directions (D.38). | x | x | n/a |
| D.38 | Conformance test directions | For each OSDD four conformance test directions.  If the OSDD includes a receiver target redirection range the following four directions shall be declared:  1) The direction determined by the maximum φ value achievable inside the receiver target redirection range, while θ value being the closest possible to the receiver target reference direction.  2) The direction determined by the minimum φ value achievable inside the receiver target redirection range, while θ value being the closest possible to the receiver target reference direction.  3) The direction determined by the maximum θ value achievable inside the receiver target redirection range, while φ value being the closest possible to the receiver target reference direction.  4) The direction determined by the minimum θ value achievable inside the receiver target redirection range, while φ value being the closest possible to the receiver target reference direction.  If an OSDD does not include a receiver target redirection range the following 4 directions shall be declared:  1) The direction determined by the maximum φ value achievable inside the sensitivity RoAoA, while θ value being the closest possible to the receiver target reference direction.  2) The direction determined by the minimum φ value achievable inside the sensitivity RoAoA, while θ value being the closest possible to the receiver target reference direction.  3) The direction determined by the maximum θ value achievable inside the sensitivity RoAoA, while φ value being the closest possible to the receiver target reference direction.  4) The direction determined by the minimum θ value achievable inside the sensitivity RoAoA, while φ value being the closest possible to the receiver target reference direction. | x | x | n/a |
| D.39 | *OTA coverage range* | Declared as a single range of directions within which selected TX OTA requirements are intended to be met.  NOTE 10: *OTA coverage range* is used for conformance testing of such TX OTA requirements as occupied bandwidth, frequency error, TAE or EVM. | x | x | x |
| D.40 | *OTA coverage range* reference direction | The direction describing the reference direction of the *OTA converge range* (D.39).  NOTE 11: The *OTA coverage reference* direction may be the same as the Reference beam direction pair (D.8) but does not have to be. | x | x | x |
| D.41 | *OTA coverage range* *maximum directions* | The directions corresponding to the following points:  1) The direction determined by the maximum φ value achievable inside the *OTA coverage range*, while θ value being the closest possible to the *OTA coverage range* reference direction.  2) The direction determined by the minimum φ value achievable inside the *OTA coverage range*, while θ value being the closest possible to the *OTA coverage range* reference direction.  3) The direction determined by the maximum θ value achievable inside the *OTA coverage range*, while φ value being the closest possible to the *OTA coverage range* reference direction.  4) The direction determined by the minimum θ value achievable inside the OTA coverage range, while φ value being the closest possible to the OTA coverage range reference direction. | x | x | x |
| D.42 | The rated carrier OTA BS power, PRated,c,TRP | PRated,c,TRP is declared as TRP OTA power per carrier, declared per supported operating band.  (NOTE Y, Z) | n/a | x | x |
| D.43 | Worst-case side of the BS on which the co-location test antenna is placed | Declare the worst-case side of the BS on which the co-location test antenna is placed and test will be done only on the declared side. | n/a | x | x |
|  |  |  |  |  |  |
| D.45 | Spurious emission category | Declare the BS spurious emission category as either category A or B with respect to the limits for spurious emissions, as defined in Recommendation ITU-R SM.329 [5]. | c | x | x |
| D.46 | Geographic area support | The manufacturer shall declare the regions the BS may operate in. e.g. CEPT. | c | x | x |
| D.47 | Co-existence with other systems | The manufacturer shall declare whether the BS under test is intended to operate in geographic areas where one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA and/or PHS operating in another operating band are deployed. | c | x | x |
| D.48 | Co-location with other base stations | The manufacturer shall declare whether the BS under test is intended to operate co-located with Base Stations of one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD and/or E-UTRA operating in another operating band. | c | x | n/a |
| D.49 | *Single-band RIB or multi-band RIB* | List of *single-band RIB and/or multi-band RIB* resulting from the supported *operating bands* (D.4), and operating bands with multi-band dependencies (D.17). | c | x | x |
| D.50 | Single or multiple carrier | BS capability to operate with a single carrier (only) or multiple carriers. Declared per supported operating band, per RIB. | x | x | x |
| D.51 | Maximum number of supported carriers per *operating band* | Maximum number of supported carriers. Declared per supported operating band, per RIB. | c | x | x |
| D.52 | Total maximum number of supported carriers | Maximum number of supported carriers for all supported operating bands. Declared per RIB. | c | x | x |
| D.53 | Other band combination multi-band restrictions | Declare any other limitation under simultaneous operation in the declared band combinations (D.17), which have any impact on the test configuration generation. | c | x | n/a |
| D.54 | Ncells | Number corresponding to the minimum number of cells that can be transmitted by a BS in a particular *operating band*. Declared per *operating band* (D.4). | c | x | n/a |
| D.55 | Maximum supported power difference between carriers | Maximum supported power difference between carriers in each supported *operating band*. Declared per *operating band* (D.4). | c | x | x |
| D.56 | Maximum supported power difference between carriers is different *operating bands* | Maximum supported power difference between any two carriers in any two different supported *operating bands*. Declared per operating bands combination (D.57). | c | x | n/a |
| D.57 | Operating band combination support | List of *operating bands* combinations supported by BS. | c | x | n/a |
| D.58 | Inter-band CA | Declaration of operating band(s) combinations supporting inter‑band CA. Declared per operating band combination (D.57). | c | x | x |
| D.59 | Intra-band contiguous CA | Declaration of operating band(s) supporting intra-band contiguous CA. Declared per *operating band* with CA support. | c | x | x |
| D.60 | Intra-band non-contiguous CA | Declaration of operating band(s) supporting intra-band non‑contiguous CA. Declared per operating band with CA support. | c | x | x |
| D.61 | OTA REFSENS RoAoA | Range of angles of arrival associated with the OTA REFSENS. | x | x | x |
| D.62 | OTA REFSENS receiver target reference direction | Reference direction inside the OTA REFSENS RoAoA (D.61). | x | x | x |
| D.63 | OTA REFSENS conformance test directions | The following four OTA REFSENS conformance test directions shall be declared:  1) The direction determined by the maximum φ value achievable inside the OTA REFSENS RoAoA, while θ value being the closest possible to the OTA REFSENS receiver target reference direction.  2) The direction determined by the minimum φ value achievable inside the OTA REFSENS RoAoA, while θ value being the closest possible to the OTA REFSENS receiver target reference direction.  3) The direction determined by the maximum θ value achievable inside the OTA REFSENS RoAoA, while φ value being the closest possible to the OTA REFSENS receiver target reference direction.  4) The direction determined by the minimum θ value achievable inside the OTA REFSENS RoAoA, while φ value being the closest possible to the OTA REFSENS receiver target reference direction. | x | x | X |
| D.64 | Band n20 support, operating in geographical areas allocated to broadcasting (DTT) | If the BS has *single band connector(s)* or *multi-band connector(s)* declared to support Band n20 the manufacturer shall declare if the BS may operate in geographical areas allocated to broadcasting (DTT). | c | x | n/a |
| D.65 | Band n20 support, emission level for channel N (PEM,N) | If the BS has *sin single band connector(s)* or *multi-band connector(s)* declared to support Band n20 and has been declared to operate in geographical areas allocated to broadcasting (DTT), the emission level for channel N (annex G of TS 36.104 [11]) shall be declared. | c | x | n/a |
| D.66 | Band n20 support, Maximum output Power in [10] MHz (P10MHz) | If the BS has *single band connector(s)* or *multi-band connector(s)* declared to support Band n20 and has been declared to operate in geographical areas allocated to broadcasting (DTT), the maximum output power in [10] MHz (annex G of TS 36.104 [16]) shall be declared. | c | x | n/a |
| D.67 | Supported frequency range of the NR *operating band* | List of supported frequency ranges representing *fractional bandwidths* (FBW) of *operating bands* with FBW larger than 6%. | x | x | x |
| D.68 | Rated beam EIRP at lower end of the *fractional bandwidth* (EIRPFBWlow) | The rated EIRP level per carrier at lower end of the *fractional bandwidth* (EIRPFBWlow), at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.8).  Declared per beam for all supported frequency ranges (D.67).  NOTE 13: if D.68 is declared for certain frequency range (D.67), there shall be no “Rated beam EIRP” declaration (D.11) for the *operating band* containing that particular frequency range.  (NOTE Y, Z) | x | x | x |
| D.69 | Rated beam EIRP at higher end of the *fractional bandwidth* (EIRPFBWhigh) | The rated EIRP level per carrier at higher end of the *fractional bandwidth* (EIRPFBWhigh), at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.8).  Declared per beam for all supported frequency ranges in (D.67).  NOTE 14: if D.69 is declared for certain frequency range (D.67), there shall be no “Rated beam EIRP” declaration (D.11) for the *operating band* containing that particular frequency range.  (NOTE Y, Z) | x | x | x |
| NOTE 1: Manufacturer declarations applicable per BS *requirement set* were marked as “x”. Manufacturer declarations not applicable per BS *requirement set* were marked as “n/a”.  NOTE 2: For *BS type 1-H*, the only radiated declarations are related to EIRP and EIS requirements. For *BS type 1-H* declarations required for the conducted requirements testing, refer to TS 38.141-1 [3]. For declarations marked as ‘c’, related conducted declarations in TS 38.141-1 [3] apply.  NOTE Y: If a *BS type 2-O* BS is capable of 64QAM DL operation then two rated output power declarations may be made. One declaration is applicable when configured for 64QAM transmissions and the other declaration is applicable when not configured for 64QAM transmissions.  NOTE Z: If a *BS type 1-H* or *BS type 1-O* is capable of 256QAM DL operation then two rated output power declarations may be made. One declaration is applicable when configured for 256QAM transmissions and the other declaration is applicable when not configured for 256QAM transmissions. | | | | | |

## 4.7 Test configurations

*Editor’s note: to capture multi-carrier/CA operation, contiguous/non-contiguous operation. Test models to be captured in this clause. Test models other than those already listed below, are not precluded.*

### 4.7.1 General

*Editor’s note: test configuration aspects to be confirmed once the test models and test configurations discussion is concluded.*

The test configurations shall be constructed using the methods defined below subject to the parameters declared by the manufacturer as listed in subclause 4.6.

[For test contiguous spectrum operation configurations used in receiver tests only the carriers in the outermost frequency positions in the *Base Station RF Bandwidth* need to be generated by the test equipment. For non-contiguous spectrum operation test configurations used in receiver tests, outermost carriers for each sub-block need to be generated by the test equipment.]

The applicable test models for generation of the carrier transmit test signal are defined in subclause [x].

NOTE: In case, carriers are shifted to align with the channel raster Foffset.

### 4.7.2 Test signal configurations

#### 4.7.2.1 Test signal used to build Test Configurations

The signal’s *BS channel bandwidth* and subcarrier spacing used to build NR Test Configurations shall be selected according to tables 4.7.2-1 and 4.7.2-2.

Table 4.7.2-1: Signal to be used to build NR TCs for *BS type 1-H* and *BS type 1-O*

|  |  |  |  |
| --- | --- | --- | --- |
| *Operating band* characteristics | | FDL\_high – FDL\_low < 100 MHz | FDL\_high – FDL\_low ≥ 100 MHz |
| TC signal characteristics | BWchannel | 5 MHz (Note) | 20 MHz (Note) |
| Subcarrier spacing | Smallest supported subcarrier spacing declared per operating band (D.xx) | |
| Note: If this *BS channel bandwidth* is not supported, the narrowest supported *BS channel bandwidth* declared per *operating band* (D.7) shall be used. | | | |

Table 4.7.2-2: Signal to be used to build NR TCs for *BS type 2-O*

|  |  |  |
| --- | --- | --- |
| *Operating band* characteristics | | FDL\_high – FDL\_low ≤ 3250 MHz |
| TC signal characteristics | BWchannel | 100 MHz (Note 1, Note 2) |
| Subcarrier spacing | Smallest supported subcarrier spacing declared per operating band (D.xx) |
| Note 1: BS vendor can decide to test with 50 MHz *BS channel bandwidth* and smallest supported SCS declared per *operating band* (D.xx) instead of 100 MHz *BS channel bandwidth* in certain regions, where spectrum allocation and regulation require testing with 50 MHz.  Note 2: If this *BS channel bandwidth* is not supported, the narrowest supported *BS channel bandwidth* declared per *operating band* (D.7) shall be used. | | |

#### 4.7.2.2 NRTC1: Contiguous spectrum operation

The purpose of test configuration NRTC1 is to test all BS requirements excluding CA occupied bandwidth.

For NRTC1 used in receiver tests only the two outermost carriers within each supported operating band need to be generated by the test equipment.

##### 4.7.2.2.1 NRTC1 generation

NRTC1 shall be constructed on a per band basis using the following method:

- The *Base Station RF Bandwidth* of each supported operating band shall be the declared maximum radiated *Base Station RF Bandwidth* for contiguous operation (D.19).

- Select the carrier to be tested according to 4.7.2.1 and place it adjacent to the lower *Base Station RF Bandwidth edge*. Place same signal adjacent to the upper Base Station RF Bandwidth edge.

- For transmitter tests, select as many carriers (according to 4.7.2.1) that the beam supports within a band and that fit in the rest of the declared maximum *Base Station RF Bandwidth*. Place the carriers adjacent to each other starting from the upper *Base Station RF Bandwidth edge*. The nominal carrier spacing defined in TS 38.104 [2] subclause 5.4.1 shall apply;

The test configuration should be constructed on a per band basis for all component carriers of the inter-band CA bands declared to be supported by the beam (D.23). All configured component carriers are transmitted simultaneously in the tests where the transmitter should be on.

##### 4.7.2.2.2 NRTC1 power allocation

Set the number of carriers to the number of carriers at maximum TRP (D.15).

For EIRP accuracy requirements set each beam to rated beam EIRP (D.11) for the tested *beam direction pair*.

For all other requirements ensure the total radiated power is set to rated carrier OTA BS power PRated,c,TRP (D.42).

For a beamdeclared to support CA-only operation (D.24), set the power spectral density of each carrier to the same level so that the sum of the carrier power equals the same value as above.

#### 4.7.2.3 NRTC2: Contiguous CA occupied bandwidth

NRTC2 in this subclause is used to test CA occupied bandwidth.

##### 4.7.2.3.1 NRTC2 generation

NRTC2 shall be constructed on a per band basis using the following method:

- All component carrier combinations supported by the beam, which have different sum of channel bandwidths of component carrier, shall be tested. For all component carrier combinations which have the same sum of channel bandwidths of component carriers, only one of the component carrier combinations shall be tested.

- Of all component carrier combinations which have same sum of channel bandwidths of component carrier, select those with the narrowest carrier with the smallest supported subcarrier spacing declared per *operating band* (D.xx) at the lower *Base Station RF Bandwidth edge*.

- Of the combinations selected in the previous step, select one with the narrowest carrier with the smallest supported subcarrier spacing declared per *operating band* (D.xx) at the upper *Base Station RF Bandwidth edge*.

- If there are multiple combinations fulfilling previous steps, select the one with the smallest number of component carrier.

- If there are multiple combinations fulfilling previous steps, select the one with the widest carrier with the smallest supported subcarrier spacing declared per *operating band* (D.xx) being adjacent to the lowest carrier.

- If there are multiple combinations fulfilling previous steps, select the one with the widest carrier with the smallest supported subcarrier spacing declared per *operating band* (D.xx) being adjacent to the highest carrier.

- If there are multiple combinations fulfilling previous steps, select the one with the widest carrier with the smallest supported subcarrier spacing declared per *operating band* (D.xx) being adjacent to the carrier which has been selected in the previous step.

- If there are multiple combinations fulfilling previous steps, repeat the previous step until there is only one combination left.

- The nominal channel spacing defined in TS 38.104 [2] subclause 5.4.1 shall apply.

##### 4.7.2.3.2 NRTC2 power allocation

Set the number of carriers to the number of carriers at maximum TRP (D.15).

For EIRP accuracy requirements set each beam to rated beam EIRP (D.11) for the tested *beam direction pair*.

For all other requirements ensure the total radiated power is set to rated carrier OTA BS power PRated,c,TRP (D.42).

For a beamdeclared to support CA-only operation (D.24), set the power spectral density of each carrier to the same level so that the sum of the carrier power equals the same value as above.

#### 4.7.2.4 NRTC3: Non-contiguous spectrum operation

The purpose of NRTC3 is to test NR multicarrier non-contiguous aspects.

For NRTC3 used in receiver tests, outermost carriers for each sub-block need to be generated by the test equipment; other supported carriers are optional to be generated.

##### 4.7.2.4.1 NRTC3 generation

NRTC3 is constructed on a per band basis using the following method:

- The *Base Station RF Bandwidth* of each supported operating band shall be the declared maximum radiated *Base Station RF Bandwidth* for non-contiguous operation (D.20). The *Base Station RF Bandwidth* consists of one sub-block gap and two sub-blocks located at the edges of the declared maximum radiated *Base Station RF Bandwidth* for non-contiguous operation (D.20).

- Select the carrier to be tested according to 4.7.2.1. Place it adjacent to the upper *Base Station RF Bandwidth edge* and another similar carrier adjacent to the lower *Base Station RF Bandwidth edge*.

- For single-band operation receiver tests, if the remaining gap is at least 15 MHz (or 60 MHz if channel bandwidth of the carrier to be tested is 20 MHz) for FR1 or 150 MHz for FR2 plus two times the *channel bandwidth* used in the previous step and the beam supports at least 4 carriers, place a NR carrier of this *channel bandwidth* adjacent to each already placed carrier for each sub-block. The nominal channel spacing defined in TS 38.104 [2] subclause 5.4.1 shall apply.

- The sub-block edges adjacent to the sub-block gap shall be determined using the specified FOffset\_high and FOffset\_low for the carriers adjacent to the sub-block gap.

##### 4.7.2.4.2 NRTC3 power allocation

Set the number of carriers to the number of carriers at maximum TRP (D.15).

For EIRP accuracy requirements set each beam to rated beam EIRP (D.11) for the tested *beam direction pair*.

For all other requirements ensure the total radiated power is set to rated carrier OTA BS power PRated,c,TRP (D.42).

#### 4.7.2.5 NRTC4: Multi-band test configuration for full carrier allocation

The purpose of NRTC4 is to test beams which have been generated using transceiver units supporting operation in multiple operating bands through common active electronic components(s), considering maximum supported number of carriers.

##### 4.7.2.5.1 NRTC4 generation

NRTC4 is based on re-using the existing test configuration applicable per band on beams generated using Multi-band transceiver units and hence have declared multi-band dependencies (D.16, D.17). It is constructed using the following method:

- The *Base Station RF Bandwidth* of each supported operating band shall be the declared maximum radiated *Base Station RF Bandwidth* (D.18).

- The number of carriers of each supported operating band shall be the declared total number of supported carriers for operating bands with multi-band dependencies in each band (D.25). Carriers shall be selected according to 4.7.2.1 and shall first be placed at the outermost edges of the declared maximum radiated *Radio Bandwidth* (D.21). Additional carriers shall next be placed at the edges of *Base Station RF Bandwidth*, if possible.

- The allocated *Base Station RF Bandwidth* of the outermost bands shall be located at the outermost edges of the declared maximum radiated *Radio Bandwidth* (D.21).

- Each concerned band shall be considered as an independent band and the corresponding test configuration shall be generated in each band. The mirror image of the single band test configuration shall be used in the highest band being tested for the beam.

-- If an operating band with multi-band dependencies supports three carriers only, two carriers shall be placed in one band according to the relevant test configuration while the remaining carrier shall be placed at the edge of the maximum *Radio Bandwidth* in the other band.

- If the sum of the *base Station RF bandwidths* of each of the supported operating bands is greater than the declared maximum *Radio Bandwidth* of the operating band with multi-band dependencies (D.21) then repeat the steps above for test configurations where the *Base Station RF Bandwidth* of one of the operating band shall be reduced so that the declared maximum *Radio Bandwidth* is not exceeded and vice versa.

- If the sum of the maximum number of supported carrier of each supported operating bands with multi-band dependencies (D.17) is larger than the declared total number of supported carriers for operating bands with multi-band dependencies (D.25), repeat the steps above for test configurations where in each test configuration the number of carriers of one of the operating band shall be reduced so that the total number of supported carriers is not be exceeded and vice versa.

##### 4.7.2.5.2 NRTC4 power allocation

Set the number of carriers to the total number of supported carriers for *operating bands* with multi-band dependencies (D.25).

For EIRP accuracy requirements set each beam to rated beam EIRP (D.11) for the tested *beam direction pair*.

For all other requirements ensure the total radiated power is set to rated carrier OTA BS power PRated,c,TRP (D.42).

If the allocated number of carriers in an operating band exceeds the declared number of carriers at maximum TRP in an operating band (D.15) the carriers should if possible be allocated to a different operating band.

#### 4.7.2.6 NRTC5: Multi-band test configuration with high PSD per carrier

The purpose of NRTC5 is to test multi-band operation aspects considering higher PSD cases with reduced number of carriers and non-contiguous operation (if supported) in multi-band mode.

##### 4.7.2.6.1 NRTC5 generation

NRTC5 is based on re-using the existing test configuration applicable for operating bands using multi-band transceiver units and hence have declared multi-band dependencies (D.16, D.17)*.* It is constructed using the following method:

- The *Base Station RF Bandwidth* of each supported operating band shall be the declared maximum radiated *Base Station RF Bandwidth* (D.18).

- The allocated *Radio Bandwidth* of the outermost bands shall be located at the outermost edges of the declared maximum *Radio Bandwidth* of the operating band with multi-band dependencies (D.21).

- The maximum number of carriers is limited to two per band. Carriers shall be selected according to 4.7.2.1 and shall be placed at the outermost edges of the declared maximum *Radio Bandwidth* of the operating band with multi-band dependencies (D.21).

- Each concerned band shall be considered as an independent band and the carrier placement in each band shall be according to NRTC3, where the declared parameters for multi-band operation shall apply. Narrowest supported *BS channel bandwidth* with the smallest subcarrier spacing declared per *operating band* (D.xx) shall be used in the test configuration.

- If an *operating band* with multi-band dependencies supports three carriers only, two carriers shall be placed in one band according to the relevant test configuration while the remaining carrier shall be placed at the edge of the maximum *Radio Bandwidth* in the other band.

- If the sum of the *base Station RF bandwidths* of each of the supported *operating bands* is greater than the declared maximum *Radio Bandwidth* of the *operating band* with multi-band dependencies (D.21) then repeat the steps above for test configurations where the *Base Station RF Bandwidth* of one of the *operating band* shall be reduced so that the declared maximum *Radio Bandwidth* of the *operating band* with multi-band dependencies (D.21) is not exceeded and vice versa.

##### 4.7.2.6.2 NRTC5 power allocation

Set the number of carriers to the total number of supported carriers for *operating bands* with multi-band dependencies (D.25).

For EIRP accuracy requirements set each beam to rated beam EIRP (D.11) for the tested *beam direction pair*.

For all other requirements ensure the total radiated power is set to rated carrier OTA BS power PRated,c,TRP (D.42).

If the sum of the TRP for all carriers in an operating band(s) exceeds the sum of the rated carrier OTA BS power PRated,c,TRP (D.42) for the number of carriers at maximum TRP (D.15) in multi-band operation, the exceeded part shall, if possible, be reallocated into the other band(s). If the EIRP allocated for a carrier exceeds the declared rated TRP, the exceeded power shall, if possible, be reallocated into the other carriers.

## 4.8 Applicability of requirements

*Editor’s note: NR BS aspects related to the TS 37.145-2 radiated MSR conformance will be addressed after single RAT specification aspects in the present specification will be settled.*

### 4.8.1 General

### 4.8.2 Requirement set applicability

In table 4.8.2-1, the requirement applicability for each requirement set is defined. For each requirement, the applicable requirement subclause in the specification is identified. Requirements not included in a requirement set is marked not applicable (NA).

Table 4.8.2-1: Requirement set applicability

| Requirement | Requirement set | | |
| --- | --- | --- | --- |
|  | *BS type 1-H* | *BS type 1-O* | *BS type 2-O* |
| Radiated transmit power | 6.2 | 6.2 | 6.2 |
| OTA base station output power | NA | 6.3 | 6.3 |
| OTA output power dynamics | 6.4 | 6.4 |
| OTA transmit ON/OFF power | 6.5 | 6.5 |
| OTA transmitted signal quality | 6.6 | 6.6 |
| OTA occupied bandwidth | 6.7.2 | 6.7.2 |
| OTA ACLR | 6.7.3 | 6.7.3 |
| OTA out-of-band emission | 6.7.4 | 6.7.4 |
| OTA transmitter spurious emission | 6.7.5 | 6.7.5 |
| OTA transmitter intermodulation | 6.8 | NA |
| OTA sensitivity | 7.2 | 7.2 | NA |
| OTA reference sensitivity level | NA | 7.3 | 7.3 |
| OTA dynamic range | 7.4 | NA |
| OTA in-band selectivity and blocking | 7.5 | 7.5 |
| OTA out-of-band blocking | 7.6 | 7.6 |
| OTA receiver spurious emission | 7.7 | 7.7 |
| OTA receiver intermodulation | 7.8 | 7.8 |
| OTA in-channel selectivity | 7.9 | 7.9 |
| Radiated performance requirements | 8 | 8 |

### 4.8.3 Applicability of test configurations for *single-band RIB*

The applicable test configurations are specified in the tables below for each the supported RF configuration, which shall be declared according to subclause 4.6. The generation and power allocation for each test configuration is defined in subclause 4.7. This subclause contains the test configurations for *single-band RIB*.

For a BS declared to be capable of single carrier operation only, a single carrier (SC) shall be used for testing.

For a *single-band RIB* declared to support multi-carrier and/or CA operation in contiguous spectrum operation, the test configurations in the second column of table 4.8.3-1 shall be used for testing.

For a *single-band RIB* declared to support multi-carrier and/or CA operation in contiguous and non-contiguous spectrum and where the parameters in the manufacturer's declaration according to subclause 4.6 are identical for contiguous (C) and non-contiguous (NC) spectrum operation, the test configurations in the third column of table 4.8.3-1 shall be used for testing.

For a *single-band RIB* declared to support multi-carrier and/or CA in contiguous and non-contiguous spectrum and where the parameters in the manufacture's declaration according to subclause 4.6 are not identical for contiguous and non-contiguous spectrum operation, the test configurations in the fourth column of table 4.8.3-1 shall be used for testing.

Unless otherwise stated, single carrier configuration (SC) tests shall be performed using signal with narrowest supported *BS channel bandwidth* with the smallest supported subcarrier spacing declared per *operating band* (D.7).

Table 4.8.3-1: Test configurations for a *single-band RIB*

|  |  |  |  |
| --- | --- | --- | --- |
| BS test case | Contiguous spectrum capable BS | C and NC capable BS with identical parameters | C and NC capable BS with different parameters |
| Radiated transmit power | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| OTA base station maximum output power | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| OTA RE Power control dynamic range | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| OTA total power dynamic range | SC | SC | SC |
| OTA transmit ON/OFF power (only applied for NR TDD BS) | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| OTA frequency error | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| OTA error Vector Magnitude | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| OTA time alignment error | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| OTA Occupied bandwidth | SC, NRTC2 (Note 1) | SC, NRTC2 (Note 1) | SC, NRTC2 (Note 1) |
| OTA ACLR | NRTC1 | NRTC1,NRTC3 | NRTC1, NRTC3 |
| OTA CACLR | - | NRTC3 | NRTC3 |
| OTA operating band unwanted emissions | NRTC1, SC (Note 2) | NRTC1, NRTC3, SC (Note 2) | NRTC1, NRTC3, SC (Note 2) |
| OTA transmitter spurious emissions | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| OTA transmitter intermodulation | NRTC1 | NRTC1, NRTC3 | NRTC1, NRTC3 |
| OTA sensitivity | SC | SC | SC |
| OTA reference sensitivity level | SC | SC | SC |
| OTA dynamic range | SC | SC | SC |
| OTA adjacent channel selectivity | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| In-band blocking | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| OTA out-of-band blocking | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| OTA receiver spurious emissions | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| OTA receiver intermodulation | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| OTA in-channel selectivity | SC | SC | SC |
| Note 1: NRTC2 is only applicable when contiguous CA is supported.  Note 2: OBUE SC shall be tested using the widest supported Channel Bandwidth and the highest supported subcarrier spacing. | | | |

### 4.8.4 Applicability of test configurations for *multi-band RIB*

For a *multi-band RIB*, the test configuration in table 4.8.4-1 shall be used for testing.

Unless otherwise stated, single carrier configuration (SC) tests shall be performed using signal with narrowest supported *BS channel bandwidth* with the smallest supported subcarrier spacing declared per *operating band* (D.xx).

NOTE: The applicability of test configurations in table 4.8.4-1 are not applicable to *BS type 2-O.*

Table 4.8.4-1: Test configuration for a *multi-band RIB*

|  |  |
| --- | --- |
| BS test case | Test configuration |
| Radiated transmit power | NRTC1/3 (Note 1), NRTC4 |
| OTA base station maximum output power | NRTC1/3 (Note 1), NRTC4 |
| OTA RE Power control dynamic range | Tested with Error Vector Magnitude |
| OTA total power dynamic range | SC |
| OTA transmit ON/OFF power (only applied for NR TDD BS) | NRTC4 |
| OTA frequency error | Tested with Error Vector Magnitude |
| OTA error Vector Magnitude | NRTC1/3 (Note 1), NRTC4 |
| OTA time alignment error | NRTC1/3 (Note 1), NRTC5 (Note 2) |
| OTA Occupied bandwidth | SC, NRTC2 (Note 3) |
| OTA ACLR | NRTC1/3 (Note 1), NRTC5 (Note 4) |
| OTA CACLR | NRTC3 (Note 1), NRTC5 (Note 4) |
| OTA operating band unwanted emissions | NRTC1/3 (Note 1), NRTC5,  SC (Note 5) |
| OTA transmitter spurious emissions | NRTC1/3 (Note 1), NRTC5 |
| OTA transmitter intermodulation | NRTC1/3 (Note 1) |
| OTA sensitivity | SC |
| OTA reference sensitivity level | SC |
| OTA dynamic range | SC |
| OTA adjacent channel selectivity | NRTC5 |
| In-band blocking | NRTC5 |
| OTA out-of-band blocking | NRTC5 |
| OTA receiver spurious emissions | NRTC1/3 (Note 1), NRTC5 |
| OTA receiver intermodulation | NRTC5 |
| OTA in-channel selectivity | SC |
| Note 1: NRTC1 and/or NRTC3 shall be applied in each supported operating band.  Note 2: NRTC5 is only applicable when inter-band CA is supported.  Note 3: NRTC2 is only applicable when contiguous CA is supported.  Note 4: NRTC5 may be applied for Inter RF Bandwidth gap only.  Note 5: OBUE SC shall be tested using the widest supported Channel Bandwidth and the highest supported sub-carrier spacing. | |

## 4.9 RF channels and test models

*Editor’s note: RF channels to be confirmed once the test models and test configurations discussion is concluded.*

### 4.9.1 RF channels

For the single carrier testing many tests in this TS are performed with appropriate frequencies in the bottom, middle and top channels of the supported frequency range of the BS. These are denoted as RF channels B (bottom), M (middle) and T (top).

Unless otherwise stated, the test shall be performed with a single carrier at each of the RF channels B, M and T.

Many tests in this TS are performed with the maximum *Base Station RF Bandwidth* located at the bottom, middle and top of the supported frequency range in the operating band. These are denoted as BRFBW (bottom), MRFBW (middle) and TRFBW (top).

Unless otherwise stated, the test shall be performed at BRFBW, MRFBW and TRFBW defined as following:

- BRFBW: maximum *Base Station RF Bandwidth* located at the bottom of the supported frequency range in the operating band.

- MRFBW: maximum *Base Station RF Bandwidth* located in the middle of the supported frequency range in the operating band.

- TRFBW: maximum *Base Station RF Bandwidth* located at the top of the supported frequency range in the operating band.

For a BS capable of multi-band operation and capable of dual-band operation, unless otherwise stated, the test shall be performed at BRFBW\_T'RFBW and B'RFBW\_TRFBW defined as following:

- BRFBW\_ T'RFBW: the *Base Station RF Bandwidths* located at the bottom of the supported frequency range in the lower operating band and at the highest possible simultaneous frequency position, within the maximum *Radio Bandwidth*, in the upper operating band.

- B'RFBW\_TRFBW: the *Base Station RF Bandwidths* located at the top of the supported frequency range in the upper operating band and at the lowest possible simultaneous frequency position, within the maximum *Radio Bandwidth*, in the lower operating band.

NOTE: BRFBW\_T'RFBW = B'RFBW\_TRFBW = BRFBW\_TRFBW when the declared maximum *Radio Bandwidth* (see subclause 4.6) spans both operating bands. BRFBW\_TRFBW means the *Base Station RF Bandwidths* are located at the bottom of the supported frequency range in the lower operating band and at the top of the supported frequency range in the upper operating band.

Occupied bandwidth test in this TS are performed with the Aggregated Channel Bandwidth and sub-block bandwidths located at the bottom, middle and top of the supported frequency range in the operating band. These are denoted as BBW Channel CA(bottom), MBW Channel CA (middle) and TBW Channel CA (top) for contiguous spectrum operation.

Unless otherwise stated, the test for contiguous spectrum operation shall be performed at BBW Channel CA, MBW Channel CA and TBW Channel CA defined as following:

- BBW Channel CA: Aggregated Channel Bandwidth located at the bottom of the supported frequency range in each operating band;

- MBW Channel CA: Aggregated Channel Bandwidth located close in the middle of the supported frequency range in each operating band;

- TBW Channel CA: Aggregated Channel Bandwidth located at the top of the supported frequency range in each operating band.

When a test is performed by a test laboratory, the position of B, M and T for single carrier, BRFBW, MRFBW and TRFBW for single band operation, BBW Channel CA, MBW Channel CA and TBW Channel CA forcontiguous spectrum operation in the operating band, the position of BRFBW\_T'RFBW and B'RFBW\_TRFBW in the supported operating band combinations shall be specified by the laboratory. The laboratory may consult with operators, the manufacturer or other bodies.

### 4.9.2 Test models

#### 4.9.2.1 General

The NR test models described in TS 38.141-1 is also applicable for 1-O. The following sections will describe the NR test models needed for 2-O.

#### 4.9.2.2 NR FR2 test models

The set-up of physical channels for transmitter tests shall be according to one of the NR test models (NR- FR2-TM) below. A reference to the applicable test model is made within each test.

The following general parameters are used by all NR test models:

- Duration is 1 radio frame (10 ms) for FDD and 2 radio frames for TDD (20 ms)

- The slots are numbered 0 to 10×2µ – 1 where µ is the numerology corresponding to the subcarrier space

- NRB is the maximum transmission bandwidth configuration seen in table 5.3.2-2 in TS 38.104 [2].

- Normal CP

- Virtual resource blocks of localized type

For NR FR2 TDD, test models are derived based on the uplink/downlink configuration as showing in the table 4.9.2.2-1 using information element *TDD-UL-DL-ConfigCommon*.

[If the number of downlink symbols in a special slot is less than 7 symbols, no measurements will be performed on that special slot.]

Table 4.9.2.2-1: Configurations of TDD for *BS type 2-O* test models

|  |  |  |
| --- | --- | --- |
| Field name | 60 kHz SCS | 120 kHz SCS |
| referenceSubcarrierSpacing |  |  |
| Periodicity (ms) for dl-UL-TransmissionPeriodicity | 1.25 ms | 1.25 ms |
| nrofDownlinkSlots | 3 | 7 |
| nrofDownlinkSymbols | 10 | 6 |
| nrofUplinkSlots | 1 | 2 |
| nrofUplinkSymbols | 2 | 4 |

Common physical channel parameters for all NR FR2 test models are specified in the following tables: table 4.9.2.2-2 for PDCCH, table 4.9.2.2-3 for PDSCH. Specific physical channel parameters for NR FR2 test models are described in sections 4.9.2.2.1 to 4.9.2.2.3.

**Table 4.9.2.2-2: Common physical channel parameters for PDCCH**

|  |  |
| --- | --- |
| Parameter |  |
| # of symbols used for control channel | 1 |
| # of CCEs allocated to PDCCH | 1 |
| Starting RB location for PDCCH | 0 |
| # of available REGs | 6 |
| Aggregation level(s) | 1 |
| # of RBs not allocated by PDCCH in the each symbol | NRB – 6 |
| DM-RS configuration and density | Comb structure with same frequency density of ¼ (i.e., every 4th subcarrier) on all REGs |
| ratio of PDCCH EPRE to DM-RS EPRS | 0 dB |

**Table 4.9.2.2-3: Common physical channel parameters for PDSCH**

|  |  |
| --- | --- |
| Parameter |  |
| DM-RS configuration and density | Type 1, comb 2 (every other subcarrier) in symbol 3 |
| ratio of PDSCH EPRE to DM-RS EPRE | 0 dB |
| PTRS configuration and density | LPT-RS 4  KPT-RS 2 |
| ratio of PDSCH EPRE to DM-RS EPRE | 0 dB |

##### 4.9.2.2.1 NR FR2 test model 1.1 (NR- FR2-TM1.1)

This model shall be used for tests on:

- BS output power

- Unwanted emissions

- Occupied bandwidth

- ACLR

- Operating band unwanted emissions

- Transmitter spurious emissions

**Table 4.9.2.2.1-1: Physical channel parameters of NR-FR2-TM1.1**

|  |  |
| --- | --- |
| **Parameter** |  |
| # of QPSK PDSCH PRBs | NRB |
| Ratio of PDSCH EPRE to PDCCH EPRE | 0 dB |

##### 4.9.2.2.2 NR FR2 test model 2 (NR- FR2-TM2)

This model shall be used for tests on:

- Total power dynamic range (lower OFDM symbol power limit at min power),

- EVM of single 64QAM PRB allocation (at min power)

- Frequency error (at min power)

**Table 4.9.2.2.2-1: Physical channel parameters of NR-FR2-TM2**

|  |  |
| --- | --- |
| Parameter |  |
| # of 64QAM PDSCH PRBs | 1 |
| Level of boosting (dB) | 0 |
| Location of 64QAM PRB | |  |  |  | | --- | --- | --- | | Slot | RB | n | | 3*n* | 0 |  | | 3*n*+1 |  |  | | 3*n*+2 | -1 |  | |

#### 4.9.2.2.3 NR FR2 test model 3.1 (NR- FR2-TM3.1)

This model shall be used for tests on:

- Output power dynamics

- Total power dynamic range (upper OFDM symbol power limit at max power with all 64QAM PRBs allocated)

- Transmitted signal quality

- Frequency error

- EVM for 64QAM modulation (at max power)

Note: if power back off is declared for 64QAM, EVM shall be tested on highest modulation without power back off

Physical channel parameters are defined in table 4.9.2.2.1-1 with all QPSK PDSCH PRBs replaced by 64QAM PDSCH PRBs.

4.9.2.3 Data content of Physical channels and Signals for NR-TM

Randomisation of the data content is obtained by utilizing the length-31 Gold sequence scrambling of TS 38.211 [x], subclause 5.2 which is invoked by all physical channels prior to modulation and mapping to the RE grid. An appropriate number of ‘0’ bits shall be generated prior to the scrambling.

Initialization of the scrambler and RE-mappers as defined in TS38.211 [xx] use the following additional parameters:

- [ = 1 for the lowest configured carrier,  = 2 for the 2nd lowest configured carrier,…,  = n for the nth configured carrier]

- Antenna ports starting with 1000 for PDSCH

- Antenna ports starting with 2000 for PDCCH

- *q* = 0 (single code word)

- Rank 1 (single layer)

-  = 0

4.9.2.3.1 PDCCH

- PDCCH modulation to be QPSK as described in TS 38.211 [x], subclause 5.1.3

- For each subframe the required amount of bits for all PDCCHs is as follows: (# of PDCCH)\*(# of CCE per PDCCH)\* 6 (REG per CCE)\*12 (RE per REG)\*2(bits per RE) with these parameters according to the NR -TM definitions in subclause 4.4.9.2.2

- Generate this amount of bits according to ‘all 0’ data

-

- 1 CCE shall be according to TS38.211, clause 7.3.2. PDCCH using non-interleaved CCE-to-REG mapping. PDCCH should occupy first symbol for 6 resource-element groups, where a resource element group equals one resource block during one OFDM symbol.

- [Perform PDCCH multiplexing and scrambling according to TS 38.211 [20], subclause 7.3.2.3]

- Perform mapping to REs according to TS 38.211 [20], subclause 7.3.2.5

- NID = 0 in DM-RS sequence generation

4.9.2.3.2 PDSCH

- For each slot generate the required amount of bits for all PRBs according to ‘all 0’ data

- NR-TMs utilize 1 user PDSCH transmissions

- The required amount of PDSCH ‘0’ bits within a slot and allocated PRBs shall be generated

- [Perform user specific scrambling according to TS 38.211 [20], subclause 7.3.1.1.]

- [Perform modulation of the scrambled bits with the modulation scheme defined for each user according to TS 38.211 [20], subclause 6.3.2]

- Perform mapping of the complex-valued symbols to layer according to TS 38.211 [20], subclause 7.3.1.3.   Complex-valued modulation symbols  for codeword  shall be mapped onto the layers ,  where  is equal to 1.

- Perform PDSCH mapping type A according to TS 38.211 [20]

- DM-RS sequence generation according to TS 38.211 [20], subclause 7.4.1.1.1 where *l* is the OFDM symbol number within the slot, using symbol 3 for every other subcarrier

- DM-RS mapping according to TS 38.211 [20], subclause 7.4.1.1.2 where type 1 configuration is considered

- For NR-FR2-TM PT-RS sequence generation according to TS 38.211 [20], subclause 7.4.1.2.1

- For NR-FR2-TM PT-RS mapping according to TS 38.211 [20], subclause 7.4.1.2.2, where *l* = 4, *k =* 2

## 4.10 Requirements for contiguous and non-contiguous spectrum

A spectrum allocation where a BS operates can either be contiguous or non-contiguous. Unless otherwise stated, the requirements in the present specification apply for BS configured for both contiguous spectrum operation and non-contiguous spectrum operation.

For BS operation in non-contiguous spectrum, some requirements apply both at the *Base Station RF Bandwidth* edges and inside the sub-block gaps. For each such requirement, it is stated how the limits apply relative to the Base Station RF Bandwidth edges and the sub-block edges respectively.

## 4.11 Requirements for BS capable of multi-band operation

For *multi-band* *RIB*, the radiated test requirements in clause 6 and 7 apply separately to each supported *operating band*, unless otherwise stated. For some radiated test requirements, it is explicitly stated that specific additions or exclusions to the test requirement apply at *multi-band RIB(s)* as detailed in the requirement subclause.

*BS type 1-O* may be capable of supporting operation in multiple *operating bands* with one of the following implementations at the *radiated interface boundary*:

- All RIBsare *single-band RIBs*.

- All RIBsare *multi-band* *RIBs*.

- A combination of single-band *RIBs* and *multi-band RIBs* provides support of the *BS type 1-O* capability of operation in multiple *operating bands*.

For *multi-band RIBs* supporting the bands for TDD, the radiated test requirements in the present specification assume no simultaneous uplink and downlink occur between the bands.

The radiated test requirements for *multi-band RIBs* supporting bands for both FDD and TDD are FFS and are not covered by the present release of this specification.

## 4.12 Co-location requirements

### 4.12.1 General

Co-location requirements are requirements which are based on assuming the *BS type 1-O* is co-located with another BS of the same base station class. They ensure that both co-located systems can operate with minimal degradation to each other.

The co-location requirements in table 4.12.1-1 rely on a *co-location reference antenna* used to mimic a base station to base station co-location scenario.

Table 4.12.1-1: Co-location requirements

| **Subclause number** | **Requirement** | **Co-location reference antenna operation** | **Type** |
| --- | --- | --- | --- |
| 6.5 | OTA transmit ON/OFF power for FR1 | Measure emission | Mandatory |
| 6.7.6.3  6.7.6.5 | OTA spurious emission: Protection of the BS receiver of own or different BS | Measure emission | Optional based on declaration |
| OTA spurious emission: Co-location with other base stations |
| 6.8 | OTA transmitter intermodulation | Inject the interferer signal | Mandatory |
| 7.6.3 | OTA out-of-band blocking: Co-location with other base stations | Inject the interferer signal | Optional based on declaration |

The OTA transmit ON/OFF power requirement and OTA transmitter intermodulation requirement are mandatory requirements where the test requirement is derived using the *co-location reference antenna*, which represents the worst-case scenario.

The *co-location reference antenna* is defined in TS 38.104 [2].

### 4.12.2 Co-location test antenna

#### 4.12.2.1 General

Co-location requirements are specified as power levels into or out of the conducted interface of the *co-location reference antenna*. For conformance testing the requirements are translated to the input or output of a *co-location test antenna* (CLTA).

A CLTA is a practical antenna which can be used to test conformance to the co-location requirements.

#### 4.12.2.2 Co-location test antenna characteristics

A *co-location test antenna* is a practical passive antenna that is used for conformance testing of the co-location requirements and is based on the definition of the *co-location reference antenna*. A CLTA shall comply to the requirements specified in table 4.12.2.2-1.

Translation of the requirements to other test antennas are not precluded but suitable translations between the co-location reference antenna and test antenna must be provided to demonstrate that the method is within the specified MU.

The currently defined CLTAs are suitable for testing *BS type 1-O* implemented with a planar antenna array. The method for testing AAS BS with other antenna array implementations is FFS.

Table 4.12.2.2-1: CLTA characteristics

|  |  |  |
| --- | --- | --- |
| **Parameter** | **In-band CLTA** | **Out-of-band CLTAs** |
| Vertical radiating dimension (h) | Test object vertical radiating length ±30% | N/A |
| Horizontal beam width | 65° ± 10° | 65° ± 10° |
| Vertical beam width | N/A | The half-power vertical beam width of the CLTA equals the narrowest declared vertical beamwidth ±3° |
| Polarization | Match | Match to in-band |
| Conducted interface return loss | > 10 dB | > 10 dB |
| NOTE: If a multi-column or multi-band antenna is used the column closest to the NR BS shall be selected while other columns are terminated during testing. | | |

#### 4.12.2.3 Co-location test antenna alignment

The alignment between the NR BS under test and the *co-location test antenna* is described in table 4.12.2.3-1 and figure 4.12.2.3-1.

Table 4.12.2.3-1: CLTA alignment tolerances

|  |  |  |
| --- | --- | --- |
| **Parameter** | **In-band** | **Out-of-band** |
| Edge-to-edge separation between the AAS BS and the CLTA, d | 0.1 m ± 0.01 m | 0.1 m ± 0.01 m |
| Vertical alignment | Centre ± 0.01 m | Centre ± 0.01 m |
| Front alignment | Radome front ± 0.01 m | Radome front ± 0.01 m |



Figure 4.12.2.3-1: Alignment of NR BS and CLTA

# 5 Operating bands and channel arrangement

For the NR operating bands specification, their channel bandwidth configurations, channel spacing and raster, as well as synchronization raster specification, refer to TS 38.104 [2], clause 5 and its relevant subclauses.

For radiated testing purposes in this specification, FR1 and FR2 operating bands are considered.

# 6 Radiated transmitter characteristics

## 6.1 General

This subclause describes any general aspects of radiated transmitter characteristics and relations between requirements.

General test conditions for transmitter tests are given in clause 4, including interpretation of measurement results and configurations for testing. BS configurations for the tests are defined in subclause 4.5.

If beams have been declared equivalent and parallel (D.13, D.14), only a representative beam is necessary to demonstrate conformance.

## 6.2 Radiated transmit power

### 6.2.1 Definition and applicability

Radiated transmit power is defined as the EIRP level for a declared beam at a specific *beam peak direction*.

For each declared beam, the requirement is based on declarations captured in subclause 4.6 for a beam identifier (D.3), *reference beam direction pair* (D.8), *rated beam EIRP* (D.11) at the beam's reference direction pair, *OTA peak directions set* (D.9), the *beam direction pairs* at the maximum steering directions (D.10) and their associated *rated beam EIRP* and *beamwidth(s)* for reference *beam direction pair* and maximum steering directions(D.12).

For a declared beam identifier and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the BS is declared to radiate at the associated *beam peak direction* during the *transmitter ON period*.

For each *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a specific *rated beam EIRP* level may be claimed. Any claimed value shall be met within the accuracy requirement as described below. *Rated beam EIRP* is only required to be declared for the *beam direction pairs* subject to conformance testing as detailed in subclause 6.2.4.1.

NOTE 1: The *OTA peak directions set* for a beam is the complete continuous or discrete set of all *beam direction* for which the EIRP accuracy is intended to be achieved for the beam.

NOTE 2: A *beam direction pair* consists of a *beam centre direction* and an associated *beam peak direction*.

NOTE 3: A declared EIRP value is a value provided by the manufacturer for verification according to the conformance specification declaration requirements, whereas a claimed EIRP value is provided by the manufacturer to the equipment user for normal operation of the equipment and is not subject to formal conformance testing.

Radiated transmit power is *directional requirement* applicable to *BS type 1-H*, *BS type 1-O* and *BS type 2-O*.

### 6.2.2 Minimum requirement

Radiated transmit power minimum requirement for *BS type 1-H* and *BS type 1-O* is defined in 3GPP TS 38.104 [2], subclause 9.2.2.

Radiated transmit power minimum requirement for *BS type 2-O* is defined in 3GPP TS 38.104 [2], subclause 9.2.3.

### 6.2.3 Test purpose

The test purpose is to verify the ability to accurately generate and direct radiated power per beam, across the frequency range and under normal conditions, for all declared beamsof the *BS type 1-H*, *BS type 1-O* and *BS type 2-O*.

### 6.2.4 Method of test

#### 6.2.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier: B, M and T; see subclause 4.9.1.

*Base station RF bandwidth* positions to be tested for multi-carrier and/or CA:

* BRFBW, MRFBW and TRFBW in single-band operation, see subclause 4.9.1,
* BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see subclause 4.9.1.

Directions to be tested:

* *OTA peak directions set reference beam direction pair* (D.8), and
* *OTA peak directions set maximum steering directions* (D.10).

In addition for a *BS type 1-O* a single test case shall be performed under extreme test environment as defined in annex B.3. In this case, it is sufficient to test on a single combination of one NR-ARFCN, one RF bandwidth position and with only one applicable test configuration defined in clause 5.

NOTE:   Tests under extreme power supply also test extreme temperature.

#### 6.2.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2. For normal test environment conditions in OTA domain, the test procedure is as follows:

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Move the BS on the positioner in order that the direction to be tested aligns with the test antenna.

4) Configure the *beam peak direction* of the BS according to the declared *beam direction pair*.

5) Set the BS to transmit according to the applicable test configuration in subclause 4.7 using the corresponding test model(s) in subclause 4.9.2.

In addition, for a BS declared to be capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in subclause 4.7.2.

6) Measure EIRP by either a) or b) below:

a) If the OTA test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the BS.

b) If the OTA test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

7) Test steps 3 to 6 are repeated for all declared beams (D.3) and their reference *beam direction pairs* and *maximum steering directions* (D.8 and D.10).

For multi-band capable BS and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carriers activated in the other band.

8)   For extreme conditions tests the methods in annex B.7 may be used where a representative power measurement is taken at both nominal conditions (Pmax,sample,nom) and extreme conditions (Pmax,sample,ext) and the delta (Δsample) is added to the nominal measurement from step 6 such that Pmax,c,EIRP, extreme = Pmax,c,EIRP + Δsample.

### 6.2.5 Test requirement

For each declared conformance *beam direction pair*, the EIRP measurement results in subclause 6.2.4.2 shall remain within the values provided in table 6.2.5-1, relative to the manufacturer's declared rated beam EIRP (D.11) value:

Table 6.2.5-1: Test requirement for radiated transmit power

|  |  |  |
| --- | --- | --- |
|  | Normal test environment | Extreme test environment |
| *BS type 1-H* | f ≤ 3 GHz: ± 3.3 dB | N/A |
| 3 GHz < f ≤ 6 GHz: ± 3.5 dB |
| *BS type 1-O* | f  ≤ 3 GHz: ± 3.3 dB | f  ≤ 3 GHz: ± 5.2 dB |
| 3 GHz < f ≤ 6 GHz: ± 3.5 dB | 3 GHz < f ≤ 4.2 GHz: ± 5.3 dB |
| 4.2 GHz < f ≤ 6 GHz: ± 5.3 dB |
| *BS type 2-O* | 24.15 GHz < f ≤ 29.5 GHz: ± 5.1 dB  37 GHz < f ≤ 40 GHz: ± 5.4 dB  … | fTBD1 < f ≤ fTBD2: ± (EIRPacc\_EXTREME\_FR2+ TTOTA\_FR2) dB  … |

## 6.3 OTA base station output power

### 6.3.1 Definition and applicability

OTA BS output power is declared as the TRP radiated requirement, with the output power accuracy requirement defined at the RIB during the *transmitter ON period* for any specific *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set,* for *BS type 1-O* and *BS type 2-O*.

The BS *rated carrier TRP output power* shall be within limits as specified in table 6.3.1-1.

Table 6.3.1-1: BS rated carrier TRP output powerlimits for *BS type 1-O*

|  |  |
| --- | --- |
| BS class | Prated,c,TRP |
| Wide Area BS | (note) |
| Medium Range BS | ≤ + 47 dBm |
| Local Area BS | ≤ + 33 dBm |
| NOTE: There is no upper limit for the Prated,c,TRP of the Wide Area Base Station. | |

Despite the general requirements for the BS output power described in subclauses 9.3.2 – 9.3.3, additional regional requirements might be applicable.

NOTE: In certain regions, power limits corresponding to BS classes may apply for *BS type 2-O*.

### 6.3.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 9.3.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 9.3.3.

### 6.3.3 Test purpose

The test purpose is to verify the accuracy of the *maximum carrier TRP* (Pmax,c,TRP) across the frequency range for all *RIBs*.

### 6.3.4 Method of test

#### 6.3.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier: B, M, T; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier and/or CA:

* BRFBW, MRFBW and TRFBW in single band operation; see subclause 4.9.1.
* BRFBW\_T'RFBW and B'RFBW in multi-band operation, see subclause 4.9.1.

Beams to be tested: The [narrowest declared beam] (D.3, D.11).

As the requirement is TRP the beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex I) as long as the required TRP output power level is achieved.

#### 6.3.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Set the BS in the direction of the declared *beam peak direction* of the *beam direction pair*, for the beam to be tested.

4) Configure the BS such that the beam peak direction(s) applied during the power measurement step 6 are consistent with the grid and measurement approach for the TRP test.

5) Set the BS to transmit according to the applicable test configuration in clause 5 using the corresponding test model(s) in subclause 4.12.2.

In addition, for a BS declared to be capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in subclause 4.11.

6) Set the BS in the reference direction of the appropriated TRP measurement grid (see annex I).

7) Measure EIRP by either a) or b) below:

a) If the test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the BS.

b) If the test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

8) Repeat step 6-7 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

9) Calculate TRP using the EIRP measurements.

For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

### 6.3.5 Test requirement

#### 6.3.5.1 *BS type 1-O*

The TRP measurement result in step 9 of subclause 6.3.4.2 shall remain:

- within +3.4 dB and -3.4 dB of the manufacturer's declared *rated carrier TRP output power* Prated,c,TRP carrier frequency f  ≤ 3.0 GHz;

- within +3.5 dB and –3.5 dB of the manufacturer's declared *rated carrier TRP output power* Prated,c,TRP for carrier frequency 3.0 GHz < f ≤ 4.2 GHz.

- within +3.5 dB and –3.5 dB of the manufacturer's declared *rated carrier TRP output power* Prated,c,TRP for carrier frequency 4.2 GHz < f ≤ 6.0 GHz.

#### 6.3.5.2 *BS type 2-O*

The TRP measurement result in step 9 of subclause 6.3.4.2 shall remain:

- within +5.1 dB and -5.1 dB of the manufacturer's declared *rated carrier TRP output power* Prated,c,TRP carrier frequency 24.25 GHz < f ≤ 29.5 GHz.

- within +5.4 dB and –5.4 dB of the manufacturer's declared *rated carrier TRP output power* Prated,c,TRP for carrier frequency 37 GHz < f ≤ 40 GHz.

*Editor’s note: more frequency divisions for the measuring accuracy may be introduced.*

## 6.4 OTA output power dynamics

### 6.4.1 General

The requirements in subclause 6.4 apply during the *transmitter ON period*. Transmit signal quality (as specified in subclause 6.6) shall be maintained for the output power dynamics requirements.

The OTA output power requirements are *single direction requirements* and apply to the *beam peak directions* over the *OTA peak directions set*.

### 6.4.2 OTA RE power control dynamic range

#### 6.4.2.1 Definition and applicability

The OTA RE power control dynamic range is the difference between the power of an RE and the average RE power for a BS at maximum output power (Pmax,c,EIRP) for a specified reference condition.

This requirement shall apply at each RIB supporting transmission in the *operating band*.

#### 6.4.2.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 9.4.2.2.

#### 6.4.2.4 Method of test

No specific test or test requirements are defined for RE power control dynamic range. The Error Vector Magnitude test, as described in subclause 6.6 provides sufficient test coverage for this requirement.

### 6.4.3 OTA total power dynamic range

#### 6.4.3.1 Definition and applicability

The OTA total power dynamic range is the difference between the maximum and the minimum transmit power of an OFDM symbol for a specified reference condition.

This requirement shall apply at each RIB supporting transmission in the *operating band*.

NOTE 1: The upper limit of the OTA total power dynamic range is the BS maximum carrier EIRP (Pmax,c,EIRP). The lower limit of the OTA total power dynamic range is the average EIRP for single RB transmission in the same direction using the same beam. The OFDM symbol carries PDSCH and not contain RS, PBCH or synchronization signals.

#### 6.4.3.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 9.4.3.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 9.4.3.3.

#### 6.4.3.3 Test purpose

The test purpose is to verify that the total power dynamic range is within the limits specified by the minimum requirement.

#### 6.4.3.4 Method of test

##### 6.4.3.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

Beams to be tested: The [narrowest declared beam] (D.3, D.11).

Directions to be tested: The *OTA peak directions set reference beam direction pair* (D.8).

##### 6.4.3.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Move the AAS BS on the positioner in order that the direction to be tested aligns with the test antenna.

4) Configure the beam peak direction of the BS according to the declared beam direction pair.

5) Set the BS to transmit using [E-TM 3.1] for *BS type 1-O* or [E-TM x.x] for *BS type 2-O*, in TS 38.141-1 [3] subclause 6.1.1.1 at the manufacturers declared *rated carrier output EIRP* (PRated,c,EIRP).

6) Measure the average OFDM symbol EIRP as defined in annex F in TS 38.141-1 [3] by either a) or b) below:

a) If the test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the BS. Sum the EIRP measured on both polarizations.

b) If the test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

7) Set the BS to transmit using [E-TM 2] for *BS type 1-O* or [E-TM x.x] for *BS type 2-O*, in TS 38.141-1 [3] subclause 6.1.1.1.

8) Measure the average OFDM symbol power as defined in annex F TS 38.141 [xx] by either a) or b) below:

a) If the test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the BS. Sum the EIRP measured on both polarizations.

b) If the test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

The measured OFDM symbols shall not contain RS, PBCH or synchronisation signals.

9) If BS supports 256QAM, set the channel set-up of the transmitted signal according to [E-TM 3.1a] *for BS type 1-O* or [E-TM x.x] *for BS type 2-O* and repeat step 1. Set to transmit a signal according to [E-TM 2a] for *BS type 1-O* or [E-TM x.x] for *BS type 2-O* and repeat step 3.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

10) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

#### 6.4.3.5 Test requirement

##### 6.4.3.5.1 *BS type 1-O*

The downlink (DL) total power dynamic range for each NR carrier shall be larger than or equal to the level in table 6.4.3.5.1-1.

Table 6.4.3.5.1-1: Total power dynamic range

|  |  |  |  |
| --- | --- | --- | --- |
| BS channel bandwidth [MHz] | Total power dynamic range  (dB) | | |
| 15 kHz SCS | 30 kHz SCS | 60 kHz SCS |
| 5 | 13.5 | 10 | N/A |
| 10 | 16.7 | 13.4 | 10 |
| 15 | 18.5 | 15.3 | 12.1 |
| 20 | 19.8 | 16.6 | 13.4 |
| 25 | 20.8 | 17.7 | 14.5 |
| 30 | 21.6 | 18.5 | 15.3 |
| 40 | 22.9 | 19.8 | 16.6 |
| 50 | 23.9 | 20.8 | 17.7 |
| 60 | N/A | 21.8 | 18.5 |
| 70 | N/A | 22.3 | 19.1 |
| 80 | N/A | 22.9 | 19.8 |
| 90 | N/A | 23.4 | 20.4 |
| 100 | N/A | 23.9 | 20.9 |

NOTE: Additional test requirements for the Error Vector Magnitude (EVM) at the lower limit of the dynamic range are defined in subclause 6.6.

##### 6.4.3.5.2 *BS type 2-O*

OTA total power dynamic range minimum requirement for *BS type 2-O* is specified such as for each NR carrier it shall be larger than or equal to the levels specified in table 6.4.3.5.2-1.

Table 6.4.3.5.2-1: Minimum requirement for *BS type 2-O* total power dynamic range

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCS [kHz] | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| OTA total power dynamic range (dB) | | | |
| 60 | 17.7 | 20.8 | 23.8 | N.A |
| 120 | 14.6 | 17.7 | 20.8 | 23.8 |

NOTE: Additional test requirements for the EVM at the lower limit of the dynamic range are defined in subclause 6.6.

## 6.5 OTA transmit ON/OFF power

### 6.5.1 OTA transmitter OFF power

#### 6.5.1.1 Definition and applicability

OTA transmitter OFF power requirements apply only to TDD operation of NR BS.

OTA transmitter OFF power is defined as the mean power measured over 70/Nµs filtered with a square filter of bandwidth equal to the transmission bandwidth configuration of the BS (BWConfig) centred on the assigned channel frequency during the *transmitter OFF period*. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

For BS supporting intra-band contiguous CA, the transmitter OFF power is defined as the mean power measured over 70/N µs filtered with a square filter of bandwidth equal to the *Aggregated BS Channel Bandwidth* BWChannel\_CA centred on (Fedge\_high+Fedge\_low)/2 during the *transmitter OFF period*.

For *BS type 1-O*, the transmitter OFF power is defined as the output power at the *co-location test antenna* conducted output(s). For *BS type 2-O* the transmitter OFF power is defined as TRP.

For *multi-band co-location test antenna* conducted output(s), the requirement is only applicable during the *transmitter OFF period* in all supported operating bands.

For *single band* *co-location test antenna* conducted output(s)supporting multiple operating bands, the requirement is applicable per supported operating band.

For *multi-band* *RIBs*, the requirement is only applicable during the *transmitter OFF period* in all supported *operating bands*.

For *single band* *RIBs* supporting transmission in multiple operating bands, the requirement is applicable per supported operating band.

#### 6.5.1.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 9.5.2.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 9.5.2.3.

#### 6.5.1.3 Test purpose

The purpose of this test is to verify the OTA transmitter OFF power is within the limits of the minimum requirements.

#### 6.5.1.4 Method of test

##### 6.5.1.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for mult-carrier and/or CA:

- MRFBW in single band operation, see subclause 4.9.1;

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation; see subclause 4.9.1.

Directions to be tested:

* The requirement for FR1 is specified as co-location requirement. For general description of co-location requirements, refer to subclause 4.12.
* The requirement for FR2 is specified as TRP requirement. The beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex I) as long as the required TRP output power level is achieved.

##### 6.5.1.4.2 Procedure

##### 6.5.1.4.2.1 General procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

##### 6.5.1.4.2.2 *BS type 1-O*

3) Place the *co-location test antenna* as specified in subclause 4.12.

4) Set the BS to transmit according to the applicable test configuration in subclause 4.7 using the corresponding test models or set of physical channels in subclause 4.9.2.

5) Measure the mean power spectrum density at the output(s) of co-location test antenna as power sum over all supported polarizations over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the NR BS centred on the central frequency of the RF bandwidth. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 10 μs to 35/N μs before start of next transmitter ON period - 10 μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

6) For an NR BS supporting contiguous CA, measure the mean power spectral density at the output(s) of co-location test antenna as power sum over all supported polarizations over 70/N μs filtered with a square filter of bandwidth equal to the Aggregated Channel Bandwidth BWChannel\_CA centred on (Fedge\_high+Fedge\_low)/2. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 10 μs to 35/N μs before start of next transmitter ON period - 10 μs.

In addition, for a *multi-band RIB*, the following steps shall apply:

7) For a *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

##### 6.5.1.4.2.3 *BS type 2-O*

[3) Configure the BS such that the beam peak direction(s) applied during the power measurement step 6 are consistent with the grid and measurement approach for the TRP test.

4) Set the NR BS to transmit according to the applicable test configuration in subclause 4.7 using the corresponding test models or set of physical channels in subclause 4.9.

In addition, for an NR BS declared to be capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in subclause 4.7.3.

5) Set the NR BS in the reference direction of the appropriated TRP measurement grid (see annex I).

6) Measure EIRP by either a) or b) below. EIRP is measured over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the NR BS centred on the central frequency of the RF bandwidth. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 3μs to 35/N μs before start of next transmitter ON period - 3μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

a) If the test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the NR BS.

b) If the test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

7) For an NR BS supporting contiguous CA, measure EIRP by either a) or b) below. EIRP is measured over 70/N μs filtered with a square filter of bandwidth equal to the Aggregated Channel Bandwidth BWChannel\_CA centred on (Fedge\_high+Fedge\_low)/2. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 3 μs to 35/N μs before start of next transmitter ON period - 3 μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

a) If the test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the NR BS.

b) If the test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

8) Repeat step 6-8 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

9) Calculate TRP using the EIRP measurements.

For multi-band capable NR BS and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.]

#### 6.5.1.5 Test requirements

##### 6.5.1.5.1 *BS type 1-O*

The mean power spectral density measured according to subclause 6.5.1.4.2 shall be less than -102.6 dBm/MHz for carrier frequency f ≤ 3.0 GHz.

The mean power spectral density measured according to subclause 6.5.1.4.2 shall be less than -102.4 dBm/MHz for carrier frequency 3.0 GHz < f ≤ 6.0 GHz.

For *multi-band RIB*, the requirement is only applicable during the transmitter OFF period in all supported operating bands.

##### 6.5.1.5.2 *BS type 2-O*

The measured mean power spectral density according to subclause 9.5.1.4.2 shall be less than [-36+XX] dBm/MHz for carrier frequency f ≤ XX GHz.

The measured mean power spectral density according to subclause 9.5.1.4.2 shall be less than [-36+XX] dBm/MHz for carrier frequency XX GHz < f ≤ XX GHz.

The measured mean power spectral density according to subclause 9.5.1.4.2 shall be less than [-36+XX] dBm/MHz for carrier frequency XX GHz < f ≤ XX GHz.

For *multi-band RIBs*, the requirement is only applicable during the transmitter OFF period in all supported operating bands.

### 6.5.2 OTA transmitter transient period

#### 6.5.2.1 Definition and applicability

*The OTA transmitter transient period* requirements apply only to TDD operation of BS.

The OTA *transmitter transient period* is the time period during which the transmitter unit is changing from the OFF period to the ON period or vice versa. The OTA *transmitter transient period* is illustrated in figure 6.5.2.1-1.

Figure 6.5.2.1-1: Illustration of the relations of transmitter ON period,  
transmitter OFF period and transmitter transient period

Transmitter output power

Time

Transmitter ON period

(DL transmission)

Transmitter OFF

period

Transmitter OFF

period

Transmitter transient

period

OFF power level

ON power level

UL transmission

GP or UL transmission

This requirement applies at each *co-location test antenna conducted* output supporting reception in the operating band for *BS type 1-O*, and at each *RIB* supporting transmission in the *operating band* for *BS type 2-O*.

#### 6.5.2.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 9.5.3.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 9.5.3.3.

#### 6.5.2.3 Test purpose

The purpose of this test is to verify the OTA transmitter transient periods are within the limits of the minimum requirements.

#### 6.5.2.4 Method of test

##### 6.5.2.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested: M; see subclause 4.9.1.

Base Station RF Bandwidth positions to be tested:

- MRFBW in single band operation, see subclause 4.9.1;

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation; see subclause 4.9.1.

Directions to be tested: The requirement is specified as co-location requirement. For general description of co-location requirements, refer to subclause 4.12.

##### 6.5.2.4.2 Procedure

###### 6.5.2.4.2.1 General procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

###### 6.5.2.4.2.2 *BS type 1-O*

3) Place the *co-location test antenna* as specified in subclause 4.12.

4) Set the BS to transmit according to the applicable test configuration in subclause 4.7 using the corresponding test models or set of physical channels in subclause 4.9.

5) Measure the mean power spectrum density at the output(s) of co-location test antenna as power sum over all supported polarizations over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the BS centred on the central frequency of the RF bandwidth. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 10 μs to 35/N μs before start of next transmitter ON period - 10 μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

6) For an BS supporting contiguous CA, measure the mean power spectral density at the output(s) of co-location test antenna as power sum over all supported polarizations over 70/N μs filtered with a square filter of bandwidth equal to the Aggregated Channel Bandwidth BWChannel\_CA centred on (Fedge\_high+Fedge\_low)/2. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 10 μs to 35/N μs before start of next transmitter ON period - 10 μs.

In addition, for a *multi-band RIB*, the following steps shall apply:

7) For a *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

###### 6.5.2.4.2.3 *BS type 2-O*

[3) Place the measurement antenna at the transmitter reference direction

4) Configure the BS such that the beam peak direction(s) applied during the power measurement step 6 are consistent with the grid and measurement approach for the TRP test.

5) Set the NR BS to transmit according to the applicable test configuration in subclause 4.7 using the corresponding test models or set of physical channels in subclause 4.9.

In addition, for an NR BS declared to be capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in subclause 4.7.3.

6) Measure EIRP sample when transmitter is ON at maximum rated power, call this P\_EIRP\_ON by either a) or b) below. EIRP is measured over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the NR BS centred on the central frequency of the RF bandwidth. From maximum transmit power measurement also corresponding TRP, P\_TRP\_ON is known.

a) If the test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the NR BS.

b) If the test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

7) Measure EIRP sample when transmitter is OFF, call this P\_EIRP\_OFF by either a) or b) below. EIRP is measured over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the NR BS centred on the central frequency of the RF bandwidth. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 3μs to 35/N μs before start of next transmitter ON period - 3μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz. From maximum transmit power measurement also corresponding TRP, P\_TRP\_ON is known.

8) For an NR BS supporting contiguous CA, measure EIRP by either a) or be below. EIRP is measured over 70/N μs filtered with a square filter of bandwidth equal to the Aggregated Channel Bandwidth BWChannel\_CA centred on (Fedge\_high+Fedge\_low)/2. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 3 μs to 35/N μs before start of next transmitter ON period - 3 μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz, call this P\_EIRP\_OFF.

9) Calculate the difference between EIRP when transmitter is on and off, call this Delta\_EIPR. Delta\_EIRP = P\_EIRP\_ON – P\_EIRP\_OFF

10) Estimate the TRP off power as P\_TRP\_ON – Delta\_EIRP.

For multi-band capable NR BS and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.]

#### 6.5.2.5 Test requirements

##### 6.5.2.5.1 *BS type 1-O*

The mean power spectral density measured according to subclause 6.5.2.4.2 shall be less than -102.6 dBm/MHz for carrier frequency f ≤ 3.0 GHz.

The mean power spectral density measured according to subclause 6.5.2.4.2 shall be less than -102.4 dBm/MHz for carrier frequency 3.0 GHz < f ≤ 6.0 GHz.

For *multi-band RIB*, the requirement is only applicable during the transmitter OFF period in all supported operating bands.

##### 6.5.2.5.2 *BS type 2-O*

[The estimated TRP according to subclause 9.5.2.4.2 shall be less than [-36+XX] dBm/MHz for carrier frequency f ≤ XX GHz.

The estimated TRP according to subclause 9.5.2.4.2 shall be less than [-36+XX] dBm/MHz for carrier frequency XX GHz < f ≤ XX GHz.

The estimated TRP according to subclause 9.5.2.4.2 shall be less than [-36+XX] dBm/MHz for carrier frequency XX GHz < f ≤ XX GHz.

For *multi-band RIBs*, the requirement is only applicable during the *transmitter OFF period* in all supported operating bands.]

## 6.6 OTA transmitted signal quality

### 6.6.1 General

Unless otherwise stated, the requirements in clause 6.6 apply during the *transmitter ON period*.

### 6.6.2 OTA frequency error

#### 6.6.2.1 Definition and applicability

OTA frequency error is the measure of the difference between the actual BS transmit frequency and the assigned frequency. The same source shall be used for RF frequency and data clock generation.

OTA frequency error requirement is defined as a directional requirement at the RIB and shall be met within the OTA coverage range.

#### 6.6.2.2 Minimum Requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 9.6.1.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 9.6.1.3.

#### 6.6.2.3 Test purpose

The test purpose is to verify that OTA frequency error is within the limit specified by the minimum requirement.

#### 6.6.2.4 Method of test

Requirement is tested together with OTA modulation quality test, as described in subclause 6.6.3.

##### 6.6.2.4.1 Initial conditions

Directions to be tested: OTA coverage range reference direction (D.40).

#### 6.6.2.5 Test Requirements

The modulated carrier frequency of each NR carrier configured by the BS shall be accurate to within the accuracy range given in table 6.6.2.5-1 and 6.6.2.5-2 observed over 1 ms.

Table 6.6.2.5-1: OTA frequency error test requirement for *BS type 1-O*

|  |  |
| --- | --- |
| BS class | Accuracy |
| Wide Area BS | ±(0.05 ppm + 12 Hz) |
| Medium Range BS | ±(0.1 ppm + 12 Hz) |
| Local Area BS | ±(0.1 ppm + 12 Hz) |

Table 6.6.2.5-2: OTA frequency error test requirement for *BS type 2-O*

|  |  |
| --- | --- |
| BS class | Accuracy |
| Wide Area BS | ±(0.05 ppm + 12 Hz) |
| Medium Range BS | ±(0.1 ppm + 12 Hz) |
| Local Area BS | ±(0.1 ppm + 12 Hz) |

### 6.6.3 OTA modulation quality

#### 6.6.3.1 Definition and applicability

OTA modulation quality is defined by the difference between the measured carrier signal and a reference signal. Modulation quality can e.g. be expressed as Error Vector Magnitude (EVM). The Error Vector Magnitude is a measure of the difference between the ideal symbols and the measured symbols after the equalization. This difference is called the error vector.

OTA modulation quality requirement is defined as a directional requirement at the RIB and shall be met within the *OTA coverage range*.

#### 6.6.3.2 Minimum Requirement

The minimum requirement for *BS type 1-O*, is in TS 38.104 [2], subclause 9.6.2.2.

The minimum requirement for *BS type 2-O*, is in TS 38.104 [2], subclause 9.6.2.3.

#### 6.6.3.3 Test purpose

The test purpose is to verify that OTA modulation quality is within the limit specified by the minimum requirement.

#### 6.6.3.4 Method of test

##### 6.6.3.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier:

- B and T; see subclause 4.9.1.

*Base station RF bandwidth* positions to be tested for multi-carrier and/or CA:

- BRFBW and TRFBW in single-band operation, see subclause 4.9.1;

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see subclause 4.9.1.

Directions to be tested:

- The OTA coverage range reference direction (D.40).

- The OTA coverage range maximum directions (D.41).

Beams to be tested: The test is performed once using the narrowest beamwidth supported by the BS (D.3, D.11).

Polarizations to be tested: For dual polarized systems the requirement shall be tested and met for both polarizations.

##### 6.6.3.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the NR BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Move the NR BS on the positioner in order that the direction to be tested aligns with the test antenna.

4) Configure the beamforming settings of the NR BS according to the direction to be tested.

5) Set the NR BS to output according to the applicable test configuration in subclause 4.7 using the corresponding test models or set of physical channels in subclause 4.9.2.

For BS declared to be capable of single carrier operation only, set the BS to transmit a signal according to NR-TM 3.1 if 256QAM is not supported by BS or according to NR-TM 3.1a if 256QAM is supported by BS, at manufacturer's declared rated output power (PRated,c,EIRP).

For BS declared to be capable of multi-carrier and/or CA operation, set the BS to transmit according to NR-TM 3.1 if 256QAM is not supported by BS or according to NR-TM 3.1a if 256QAM is supported by BS, on all carriers configured using the applicable test configuration and corresponding power setting specified in subclause 4.7 and 4.x.

For NR-TM 3.1 and NR-TM 3.1a, power back-off shall be applied if it is declared.

6) For each carrier, measure the EVM and frequency error as defined in annex D.

7) Repeat steps 5 and 6 for NR-TM 2 if 256QAM is not supported by BS or for NR-TM 2a if 256QAM is supported by BS. For NR-TM 2 and NR-TM 2a the OFDM symbol power (in the conformance direction) shall be at the lower limit of the dynamic range according to the test procedure in subclause 6.3.2.4 and test requirements in subclause 6.3.2.5.

In addition, for multi-band RIB, the following steps shall apply:

8) For multi-band RIB and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

#### 6.6.3.5 Test requirements

##### 6.6.3.5.1 *BS type 1-O*

For *BS type 1-O*, the EVM of each NR carrier for different modulation schemes on PDSCH shall be less than the limits in table 6.6.3.5.1-1.

Table 6.6.3.5.1-1 EVM requirements for *BS type 1-O*

|  |  |
| --- | --- |
| Modulation scheme for PDSCH | Required EVM (%) |
| QPSK | 18.5 % |
| 16QAM | 13.5 % |
| 64QAM | 9 % |
| 256QAM | 4.5 % |

EVM shall be evaluated for each NR carrier over all allocated resource blocks and downlink subframes and with RS density configuration of DM-RS of comb 2 (every other subcarrier) in symbol 3 and 11. Different modulation schemes listed in table 6.6.3.5.1-1 shall be considered for rank 1.

For NR, for all bandwidths, the EVM measurement shall be performed for each NR carrier over all allocated resource blocks and downlink subframes within 10 ms measurement periods. The boundaries of the EVM measurement periods need not be aligned with radio frame boundaries.

Table 6.6.3.5.1-2, 6.6.3.5.1-3, 6.6.3.5.1-4 below specify the EVM window length (*W*) for normal CP for *BS type 1-O*.

Table 6.6.3.5.1-2 EVM window length for normal CP for NR, FR1, 15 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth (MHz) | FFT size | Cyclic prefix length for symbols 1‑6 and 8-13 in FFT samples | EVM window length *W* | Ratio of *W* to total CP length for symbols 1‑6 and 8-13 (Note 1) (%) |
| 5 | 512 | 36 | 14 | 40 |
| 10 | 1024 | 72 | 28 | 40 |
| 15 | 1536 | 108 | 44 | 40 |
| 20 | 2048 | 144 | 58 | 40 |
| 25 | 2048 | 144 | 72 | 50 |
| 30 | 3072 | 216 | 108 | 50 |
| 40 | 4096 | 288 | 144 | 50 |
| 50 | 4096 | 288 | 144 | 50 |
| Note: These percentages are informative and apply to a slot’s symbols 1 to 6 and 8 to 13. Symbols 0 and 7 have a longer CP and therefore a lower percentage. | | | | |

Table 6.6.3.5.1-3 EVM window length for normal CP for NR, FR1, 30 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth (MHz) | FFT size | Cyclic prefix length for symbols 1‑13 in FFT samples | EVM window length *W* | Ratio of *W* to total CP length for symbols 1‑13(Note 1) (%) |
| 5 | 256 | 18 | 8 | 40 |
| 10 | 512 | 36 | 14 | 40 |
| 15 | 768 | 54 | 22 | 40 |
| 20 | 1024 | 72 | 28 | 40 |
| 25 | 1024 | 72 | 36 | 50 |
| 30 | 1536 | 108 | 54 | 50 |
| 40 | 2048 | 144 | 72 | 50 |
| 50 | 2048 | 144 | 72 | 50 |
| 60 | 3072 | 216 | 130 | 60 |
| 70 | 3072 | 216 | 130 | 60 |
| 80 | 4096 | 288 | 172 | 60 |
| 90 | 4096 | 288 | 172 | 60 |
| 100 | 4096 | 288 | 172 | 60 |
| Note: These percentages are informative and apply to a slot’s symbols 1 through 13. Symbol 0 has a longer CP and therefore a lower percentage. | | | | |

Table 6.6.3.5.1-4 EVM window length for normal CP for NR, FR1, 60 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth MHz | FFT size | Cyclic prefix length for symbols 1‑27 in FFT samples | EVM window length *W* | Ratio of *W* to total CP for symbols 1‑6(Note 1) [%] |
| 10 | 256 | 18 | 8 | 40 |
| 15 | 384 | 27 | 11 | 40 |
| 20 | 512 | 36 | 14 | 40 |
| 25 | 512 | 36 | 18 | 50 |
| 30 | 768 | 54 | 26 | 50 |
| 40 | 1024 | 72 | 36 | 50 |
| 50 | 1024 | 72 | 36 | 50 |
| 60 | 1536 | 108 | 64 | 60 |
| 70 | 1536 | 108 | 64 | 60 |
| 80 | 2048 | 144 | 86 | 60 |
| 90 | 2048 | 144 | 86 | 60 |
| 100 | 2048 | 144 | 86 | 60 |
| Note: These percentages are informative and apply to a slot’s symbols 1 through 13. Symbol 0 may have a longer CP and therefore a lower percentage. | | | | |

##### 6.6.3.5.2 *BS type 2-O*

For *BS type 2-O*, the EVM of each NR carrier for different modulation schemes on PDSCH shall be less than the limits in table 6.4.3.5.2-1.

Table 6.6.3.5.2-1 EVM requirements for *BS type 2-O*

|  |  |
| --- | --- |
| Modulation scheme for PDSCH | Required EVM (%) |
| QPSK | 18.5 % |
| 16QAM | 13.5 % |
| 64QAM | 9 % |

EVM requirements shall apply for each NR carrier over all allocated resource blocks and downlink sub frames and with RS density configuration of DM-RS of comb 2 (every other subcarrier) in symbol 3. PT-RS should be configured for localized setting for every fourth symbol for every second RB. Different modulation schemes listed in table 6.6.3.5.2-1 shall be considered for rank 1.

For NR, for all bandwidths, the EVM measurement shall be performed for each NR carrier over all allocated resource blocks and downlink subframes within 10 ms measurement periods. The boundaries of the EVM measurement periods need not be aligned with radio frame boundaries.

Table 6.6.3.5.2-2 and 6.6.3.5.2-3 below specify the EVM window length (*W*) for normal CP for *BS type 2-O*.

Table 6.6.3.5.2-2 EVM window length for normal CP for NR, FR2, 60 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth (MHz) | FFT size | Cyclic prefix length for symbols 1-13 in FFT samples | EVM window length *W* | Ratio of *W* to total CP length for symbols 1‑13(Note 1) (%) |
| 50 | 1024 | 72 | 36 | 50 |
| 100 | 2048 | 144 | 72 | 50 |
| 200 | 4096 | 288 | 144 | 50 |
| Note: These percentages are informative and apply to a slot’s symbols 1 through 13. Symbol 0 may have a longer CP and therefore a lower percentage. | | | | |

Table 6.6.3.5.2-3 EVM window length for normal CP for NR, FR2, 120 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth (MHz) | FFT size | Cyclic prefix length for symbols 1-13 in FFT samples | EVM window length *W* | Ratio of *W* to total CP length for symbols 1‑13(Note 1) (%) |
| 50 | 512 | 36 | 18 | 50 |
| 100 | 1024 | 72 | 36 | 50 |
| 200 | 2048 | 144 | 72 | 50 |
| 400 | 4096 | 288 | 144 | 50 |
| Note: These percentages are informative and apply to a slot’s symbols 1 through 13. Symbol 0 may have a longer CP and therefore a lower percentage. | | | | |

### 6.6.4 OTA time alignment error

#### 6.6.4.1 Definition and applicability

This requirement shall apply to frame timing in TX diversity, MIMO transmission, carrier aggregation and their combinations.

Frames of the NR signals present in the radiated domain are not perfectly aligned in time. In relation to each other, the RF signals present in the radiated domain may experience certain timing differences.

For a specific set of signals/transmitter configuration/transmission mode, the OTA Time Alignment Error (OTA TAE) is defined as the largest timing difference between any two different NR signals. The OTA time alignment error requirement is defined as a *directional requirement* at the RIB and shall be met within the *OTA coverage range.*

#### 6.6.4.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 9.6.3.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 9.6.3.3.

#### 6.6.4.3 Test purpose

To verify that the OTA time alignment error is within the limit specified by the minimum requirement.

#### 6.6.4.4 Method of test

##### 6.6.4.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- MRFBW in single-band operation, see subclause 4.9.1;

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see subclause 4.9.1.

Directions to be tested: OTA coverage range reference direction (D.40).

Polarizations to be tested: For dual polarized systems the requirement shall be tested and met considering both polarisations. If the measurement antenna does not support dual polarization, time alignment error shall be measured under the condition that measurement antenna is aligned between the AAS BS polarisations such that it receives half the power from each polarisation.

##### 6.6.4.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the NR BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the NR BS with the test system.

3) Move the NR BS on the positioner in order that the direction to be tested aligns with the test antenna.

4) Configure the beamforming settings of the NR BS according to the direction of the testing.

5) Set the NR BS to transmit NR-TM1.1 or any DL signal using TX diversity, MIMO transmission or carrier aggregation, using the configuration with the minimum number of cells and reference signals.

NOTE: For TX diversity and MIMO transmission, different ports may be configured in NR-TM (using *p* = 0 and 1).

For an NR BS declared to be capable of single carrier operation only, set the NR BS to transmit according to manufacturer's declared rated output power, PRated,c,TRP.

If the NR BS supports intra band contiguous or non-contiguous Carrier Aggregation set the NR BS to transmit using the applicable test configuration and corresponding power setting specified in subclauses 4.11.

If the NR BS supports inter band carrier aggregation set the BR BS to transmit, for each band, a single carrier or all carriers, using the applicable test configuration and corresponding power setting specified in subclauses 4.11.

6) Measure the time alignment error between the different reference symbols on different beams on the carrier(s).

In addition, for a multi-band RIB, the following steps shall apply:

7) For a multi-band RIB and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

#### 6.6.4.5 Test Requirement

##### 6.6.4.5.1 *BS type 1-O*

For MIMO or TX diversity transmissions, at each carrier frequency, OTA TAE shall not exceed 90 ns.

For intra-band contiguous carrier aggregation, with or without MIMO or TX diversity, OTA TAE shall not exceed 285 ns.

For intra-band non-contiguous carrier aggregation, with or without MIMO or TX diversity, OTA TAE shall not exceed 3.025 µs.

For inter-band carrier aggregation, with or without MIMO or TX diversity, OTA TAE shall not exceed 3.025 µs.

NOTE: If the above Test Requirement differs from the Minimum Requirement then the Test Tolerance applied for this test is non-zero. The Test Tolerance for this test is defined in subclause 4.1.2 and the explanation of how the Minimum Requirement has been relaxed by the Test Tolerance is given in annex C.

##### 6.6.4.5.2 *BS type 2-O*

For MIMO or TX diversity transmissions, at each carrier frequency, OTA TAE shall not exceed 90 ns.

For intra-band contiguous carrier aggregation, with or without MIMO or TX diversity, OTA TAE shall not exceed 155 ns.

For intra-band non-contiguous carrier aggregation, with or without MIMO or TX diversity, OTA TAE shall not exceed 3.025 µs.

For inter-band carrier aggregation, with or without MIMO or TX diversity, OTA TAE shall not exceed 3.025 µs.

## 6.7 OTA unwanted emissions

### 6.7.1 General

OTA unwanted emissions consist of so-called out-of-band emissions and spurious emissions according to ITU definitions ITU-R SM.329 [5]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the *BS channel bandwidth* resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions.

The OTA out-of-band emissions requirement for the *BS type 1-O* and *BS type 2-O* transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and operating band unwanted emissions (OBUE). The OTA Operating band unwanted emissions define all unwanted emissions in each supported downlink operating band plus the frequency ranges ΔfOBUE above and ΔfOBUE below each band. OTA Unwanted emissions outside of this frequency range are limited by an OTA spurious emissions requirement.

The maximum offset of the operating band unwanted emissions mask from the operating band edge is ΔfOBUE. The value of ΔfOBUE is defined in table 6.7.1-1 for *BS type 1-O* and *BS type 2-O* for the NR operating bands.

Table 6.7.1-1: Maximum offset ΔfOBUE outside the downlink operating band

|  |  |  |
| --- | --- | --- |
| BS type | Operating band characteristics | ΔfOBUE [MHz] |
| *BS type 1-O* | FDL\_high – FDL\_low < 100 MHz | 10 |
| 100 MHz ≤ FDL\_high – FDL\_low ≤ 900 MHz | 40 |
| *BS type 2-O* | FDL\_high – FDL\_low ≤ 3250 MHz | 1500 |

The OTA unwanted emission requirements are applied per cell for all the configurations supported by *BS type 1‑O*. Requirements for OTA unwanted emissions are captured using TRP, *directional requirements* or co-location requirements as described per requirement.

There is in addition a requirement for OTA occupied bandwidth.

### 6.7.2 OTA occupied bandwidth

#### 6.7.2.1 Definition and applicability

The OTA occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage /2 of the total mean transmitted power. See also recommendation ITU-R SM.328 [13].

The value of /2 shall be taken as 0.5%.

The OTA occupied bandwidth requirement applies during the *transmitter ON period* for a single transmitted carrier. The minimum requirement below may be applied regionally. There may also be regional requirements to declare the OTA occupied bandwidth according to the definition in the present clause.

The OTA occupied bandwidth is defined as a *directional requirement* and shall be met in the manufacturer’s declared *OTA coverage range* at the RIB.

#### 6.7.2.2 Minimum requirement

The minimum requirement for *BS type 1-O* and *BS type 2-O* is in 3GPP TS 38.104 [2], subclause 9.7.2.2.

#### 6.7.2.3 Test purpose

The test purpose is to verify that the emission at the *RIB* does not occupy an excessive bandwidth for the service to be provided and is, therefore, not likely to create interference to other users of the spectrum beyond undue limits.

#### 6.7.2.4 Method of test

##### 6.7.2.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

Directions to be tested: *OTA coverage range* *reference direction* (D.40).

Aggregated Channel Bandwidth positions to be tested for contiguous carrier aggregation: MBW Channel CA; see subclause 4.9.1.

For a BS declared to be capable of single carrier operation, start transmission according to NR-FR1-TM1.1 for *BS type 1-O* or NR-FR2-TM1.1 for *BS type 2-O*, subclause 4.9.2 at manufacturers declared rated carrier output EIRP (PRated,c,EIRP, D.11).

For a BS declared to be capable of contiguous carrier aggregation operation, set the base station to transmit according to NR-FR1-TM1.1 for *BS type 1-O* or NR-FR2-TM1.1 for *BS type 2-O* on all carriers configured using the applicable test configuration and corresponding power setting specified in subclause 4.8.2.3.1.

For a BS declared to be capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in subclause 4.8.

##### 6.7.2.4.2 Procedure

The OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Move the AAS BS on the positioner in order that the direction to be tested aligns with the test antenna.

4) Configure the beam peak direction of the BS according to the declared beam direction pair.

5) Set the BS to transmit signal.

6) Measure the spectrum emission of the transmitted signal using at least the number of measurement points, and across a span, as listed in table 6.7.2.4.2-1 and table 6.7.2.4.2-2. The selected resolution bandwidth (RBW) filter of the analyser shall be 30 kHz or less.

NOTE: The detection mode of the spectrum analyzer will not have any effect on the result if the statistical properties of the out-of-OBW power are the same as those of the inside-OBW power. Both are expected to have the Rayleigh distribution of the amplitude of Gaussian noise. In any case where the statistics are not the same, though, the detection mode is power responding. There are at least two ways to be power responding. The spectrum analyser can be set to "sample" detection, with its video bandwidth setting at least three times its RBW setting. Or the analyser may be set to respond to the average of the power (root-mean-square of the voltage) across the measurement cell.

Table 6.7.2.4.2-1: Span and number of measurement points for OBW measurements for NR FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth | *BS channel bandwidth*  BWChannel (MHz) | | | | | *Aggregated BS channel bandwidth* BWChannel\_CA (MHz) |
| 5 | 10 | 15 | 20 | > 20 | > 20 |
| Span (MHz) | 10 | 20 | 30 | 40 |  |  |
| Minimum number of measurement points | 400 | 400 | 400 | 400 |  |  |

Table 6.7.2.4.2-2: Span and number of measurement points for OBW measurements for NR FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bandwidth | *BS channel bandwidth*  BWChannel (MHz) | | | | *Aggregated BS channel bandwidth* BWChannel\_CA (MHz) |
| 50 | 100 | 200 | 400 | > 50 |
| Span (MHz) |  | | | |  |
| Minimum number of measurement points |  | | | |  |

7) Compute the total of the EIRP, P0, (in power units, not decibel units) of all the measurement cells in the measurement span. Compute P1, the EIRP outside the occupied bandwidth on each side. P1 is half of the total EIRP outside the bandwidth. P1 is half of (100 % - (occupied percentage)) of P0. For the occupied percentage of 99 %, P1 is 0.005 times P0. The EIRP calculation depends on whether the test facility supports dual polarization:

a) If the test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the BS. Measure and sum the EIRP on both polarizations to obtain P0 or P1.

b) If the test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power as the sum over both polarizations to obtain P0 or P1

8) Determine the lowest frequency, f1, for which the sum of all EIRP in the measurement cells from the beginning of the span to f1 exceeds P1.

9) Determine the highest frequency, f2, for which the sum of all EIRP in the measurement cells from the end of the span to f2 exceeds P1.

10) Compute the OTA occupied bandwidth as f2 - f1.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

11) For *multi-band RIBs* and single band tests, repeat the steps 6) - 10) above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

#### 6.7.2.5 Test requirement

##### 6.7.2.5.1 *BS type 1-O*

The OTA occupied bandwidth for each NR carrier shall be less than the channel bandwidth as defined in TS 38.104 [2], table 5.3.2-1. For contiguous CA, the occupied bandwidth shall be less than or equal to the Aggregated Channel Bandwidth as defined in TS 38.104 [2], subclause 5.3.2-1.

##### 6.7.2.5.2 *BS type 2-O*

The OTA occupied bandwidth for each NR carrier shall be less than the channel bandwidth as defined in TS 38.104 [2], table 5.3.2-2. For contiguous CA, the occupied bandwidth shall be less than or equal to the Aggregated Channel Bandwidth as defined in TS 38.104 [2], subclause 5.3.2-2.

### 6.7.3 OTA Adjacent Channel Leakage Power Ratio (ACLR)

#### 6.7.3.1 Definition and applicability

OTA Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. The measured power is TRP.

The requirement shall be applied per RIB during the *transmitter ON period*.

#### 6.7.3.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 9.7.3.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 9.7.3.3.

#### 6.7.3.3 Test purpose

To verify that the OTA adjacent channel leakage ratio requirement shall be met as specified by the minimum requirement.

#### 6.7.3.4 Method of test

##### 6.7.3.4.1 Initial conditions

Test environment: normal; see annex B.2.

RF channels to be tested for single carrier: B and T; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- BRFBW and TRFBW in single-band operation, see subclause 4.9.1;

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operaton, see subclause 4.9.1.

Directions to be tested: As the requirement is TRP the beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex I) as long as the required TRP output power level is achieved.

##### 6.7.3.4.2 Procedure

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Configure the BS such that the beam peak direction(s) applied during the power measurement step 6 are consistent with the grid and measurement approach for the TRP test.

The measurement devices characteristics shall be:

- measurement filter bandwidth: defined in subclause 6.7.3.5.

- detection mode: true RMS voltage or true power averaging.

4) For single carrier operation, set the BS to transmit according to the applicable test configuration in clause 5 using the corresponding test model(s) in subclause 4.12.2 at manufacturers declared *rated carrier output power* (PRated,c,TRP).

For a BS declared to be capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in subclause 4.11.

5) Align the BS and the test antenna such that measurements to determine TRP can be performed (see annex I).

6) Measure the absolute power of the assigned channel frequency and the (adjacent channel frequency).

7) Repeat step 5-6 for all directions in the appropriated TRP measurement grid needed for TRPEstimate for each of the assigned channel frequency and the adjacent channel frequency (see annex I).

8) Calculate TRPEstimate for the absolute total radiated power of the wanted channel and the adjacent channel and the ACLR estimate using the measurements made in Step 7.

NOTE: ACLR is calculated by the ratio of the absolute TRP of the assigned channel frequency and the absolute TRP of the adjacent frequency channel.

#### 6.7.3.5 Test requirements

##### 6.7.3.5.1 *BS type 1-O*

For the OTA ACLR requirement either the OTA ACLR limits in tables 6.7.3.5.1-1/2a or the OTA ACLR absolute limits in tables 6.7.3.5.1-2 shall apply, whichever is less stringent. The OTA CACLR limits in table 6.7.3.5.1-3 or the OTA CACLR absolute limits in table 6.7.3.5.1-3a shall apply, whichever is less stringent.

For a RIB operating in non-contiguous spectrum, the OTA ACLR requirement applies inside sub block gaps for the frequency ranges defined in table 6.7.3.5.1-2a, while the CACLR requirement applies inside sub block gaps for the frequency ranges defined in table 6.7.3.5.1-3.

For a *multi-band RIB*, the OTA ACLR test requirement applies inside Inter RF Bandwidth gaps for the frequency ranges defined in table 6.7.3.5.1-2a, while the OTA CACLR requirement applies inside Inter RF Bandwidth gaps for the frequency ranges defined in table 6.7.3.5.1-3.

For operation in paired and unpaired spectrum, the OTA ACLR measurement result shall not be less than the OTA ACLR limit specified in table 6.7.3.5.1-1.

Table 6.7.3.5.1-1: Base station type 1-O ACLR limit

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of lowest/highest NR carrier transmitted BWChannel [MHz] | BS adjacent channel centre frequency offset below the lowest or above the highest carrier centre frequency transmitted | Assumed adjacent channel carrier (informative) | Filter on the adjacent channel frequency and corresponding filter bandwidth | OTA ACLR limit  (0 – 3 GHz) | OTA ACLR limit (3 – 6 GHz) |
| 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90,100 | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| 2 x BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| BWChannel /2 + 2.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 44 dB (Note 3) | 43.8 dB (Note 3) |
| BWChannel /2 + 7.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 44 dB (Note 3) | 43.8 dB (Note 3) |
| NOTE 1: BWChannel and BWConfig are the *BS channel bandwidth* and transmission bandwidth configuration of the lowest/highest NR carrier transmitted on the assigned channel frequency.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: The requirements are applicable when the band is also defined for E-UTRA or UTRA. | | | | | |

The absolute total power measurement shall not exceed the OTA ACLR absolute limit specified in table 6.7.3.5.1-2.

Table 6.7.3.5.1-2: Base station type 1-O ACLR absolutelimit

|  |  |
| --- | --- |
| BS category / BS class | OTA ACLR absolute limit |
| Category A Wide Area BS | -4 dBm/MHz |
| Category B Wide Area BS | -6 dBm/MHz |
| Medium Range BS | -16 dBm/MHz |
| Local Area BS | -23 dBm/MHz |

For operation in non-contiguous spectrum or multiple bands, the OTA ACLR measurement result shall not be less than the OTA ACLR limit specified in table 6.7.3.5.1-2a.

Table 6.7.3.5.1-2a: Base Station type 1-O ACLR limit in non-contiguous spectrum or multiple bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of lowest/highest NR carrier transmitted BWChannel [MHz] | Sub-block or Inter RF Bandwidth gap size (Wgap) where the limit applies [MHz] | BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | OTA ACLR limit  (0-3GHz) | OTA ACLR limit (3-6GHz) |
| 5, 10, 15, 20 | Wgap ≥ 15 (Note 3)  Wgap ≥ 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| Wgap ≥ 20 (Note 3)  Wgap ≥ 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | Wgap ≥ 60 (Note 4)  Wgap ≥ 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| Wgap ≥ 80 (Note 4)  Wgap ≥ 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| NOTE 1: BWConfig is the transmission bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz.  NOTE 4: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz. | | | | | | |

The OTA CACLR measurement result shall not less than the OTA CACLR limit specified in table 6.7.3.5.1-3.

Table 6.7.3.5.1-3: Base Station type 1-O CACLR limit

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of lowest/highest NR carrier transmitted BWChannel [MHz] | Sub-block or Inter RF Bandwidth gap size (Wgap) where the limit applies [MHz] | BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | OTA CACLR limit  (0-3 GHz) | OTA CACLR limit (3-6 GHz) |
| 5, 10, 15, 20 | 5 ≤ Wgap < 15 (Note 3)  5 ≤ Wgap < 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| 10 < Wgap < 20 (Note 3)  10 ≤ Wgap < 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| 25, 30, 40, 50, 60, 70, 80,90, 100 | 20 ≤ Wgap < 60 (Note 4)  20 ≤ Wgap < 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| 40 < Wgap < 80 (Note 4)  40 ≤ Wgap < 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 44 dB | 43.8 dB |
| NOTE 1: BWConfig is the transmission bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz.  NOTE 4: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz. | | | | | | |

The absolute total power measurement shall not exceed the OTA CACLR absolute limit specified in table 6.7.3.5.1-3a.

Table 6.7.3.5.1-3a: Base station type 1-O CACLR absolutelimit

|  |  |
| --- | --- |
| BS category / BS class | OTA CACLR absolutelimit |
| Category A Wide Area BS | -4 dBm/MHz |
| Category B Wide Area BS | -6 dBm/MHz |
| Medium Range BS | -16 dBm/MHz |
| Local Area BS | -23 dBm/MHz |

Table 6.7.3.5.1-4: Filter parameters for the assigned channel

|  |  |
| --- | --- |
| RAT of the carrier adjacent to the sub-block or Inter RF Bandwidth gap | Filter on the assigned channel frequency and corresponding filter bandwidth |
| NR | NR of same BW with SCS that provides largest transmission bandwidth configuration |

##### 6.7.3.5.2 *BS type 2-O*

For the OTA ACLR requirement either the OTA ACLR limits in tables 6.7.3.5.2-1/3 or the OTA ACLR absolute limits in tables 6.7.3.5.2-2 shall apply, whichever is less stringent. The OTA CACLR limits in table 6.7.3.5.2-4 or the OTA CACLR absolute limits in table 6.7.3.5.2-4a shall apply, whichever is less stringent.

For a RIB operating in non-contiguous spectrum, the OTA ACLR requirement in table 6.7.3.5.2-3 shall apply in sub-block gaps for the frequency ranges defined in the table, while the OTA CACLR requirement in table 6.7.3.5.2-4 shall apply in sub-block gaps for the frequency ranges defined in the table.

The CACLR in a sub-block gap is the ratio of:

a) the sum of the filtered mean power centred on the assigned channel frequencies for the two carriers adjacent to each side of the sub-block gap, and

b) the filtered mean power centred on a frequency channel adjacent to one of the respective sub-block edges.

The assumed filter for the adjacent channel frequency is defined in table 6.7.3.5.2-4 and the filters on the assigned channels are defined in table 6.7.3.5.2-5.

The OTA ACLR measurement result shall not be less than the OTA ACLR limit specified in table 6.7.3.5.2-1.

Table 6.7.3.5.2-1: *BS type 2-O* ACLR limit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of lowest/highest NR carrier transmitted  BWChannel (MHz) | BS adjacent channel centre frequency offset below the lowest or above the highest carrier centre frequency transmitted | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | OTA ACLR limit  (dB) |
| 50, 100, 200, 400 | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 25.7 (Note 3)  23.4 (Note 4) |
| NOTE 1: BWChannel and BWConfig are the *BS channel bandwidth* and transmission bandwidth configuration of the lowest/highest NR carrier transmitted on the assigned channel frequency.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz  NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz | | | | |

The absolute total power measurement shall not exceed the OTA ACLR absolute limit specified in table 6.7.3.5.2-2

Table 6.7.3.5.2-2: *BS type 2-O* ACLR absolute limit

|  |  |
| --- | --- |
| BS class | ACLR absolute limit |
| Wide-area BS | -10.3dBm/MHz |
| Medium-range BS | -17.3 dBm/MHz |
| Local-area BS | -17.3 dBm/MHz |

For operation in non-contiguous spectrum, the OTA ACLR measurement result shall not be less than the OTA ACLR limit specified in table 6.7.3.5.2-3.

Table 6.7.3.5.2-3: *BS type 2-O* ACLR limit in non-contiguous spectrum

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of lowest/highest NR carrier transmitted (MHz) | Sub-block gap size (Wgap) where the limit applies (MHz) | BS adjacent channel centre frequency offset below or above the sub-block edge (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | OTA ACLR limit  (MHz) |
| 50, 100 | Wgap ≥ 100 (Note 5)  Wgap ≥ 250 (Note 6) | 25 MHz | 50 MHz NR (Note 2) | Square (BWConfig) | 25.7 (Note 3)  23.4 (Note 4) |
| 200, 400 | Wgap ≥ 400 (Note 6)  Wgap ≥ 250 (Note 5) | 100 MHz | 200 MHz NR (Note 2) | Square (BWConfig) | 25.7 (Note 3)  23.4 (Note 4) |
| NOTE 1: BWConfig is the transmission bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.24 – 33.4 GHz.  NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz.  NOTE 5: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz.  NOTE 6: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz. | | | | | |

For operation in non-contiguous spectrum, the CACLR for NR carriers located on either side of the sub-block gap shall be less than the value specified in table 6.7.3.5.2-4.

Table 6.7.3.5.2-4: *BS type 2-O* CACLR limit in non-contiguous spectrum

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of lowest/highest NR carrier transmitted (MHz) | | Sub-block gap size (Wgap) where the limit applies (MHz) | BS adjacent channel centre frequency offset below or above the sub-block edge (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | OTA CACLR limit  (dB) |
| 50, 100 | | 50 ≤ Wgap < 100 (Note 5)  50 ≤ Wgap < 250 (Note 6) | 25 MHz | 50 MHz NR (Note 2) | Square (BWConfig) | 25.7 (Note 3)  23.4 (Note 4) |
| 200, 400 | | 200 ≤ Wgap < 400 (Note 6)  200 ≤ Wgap < 250 (Note 5) | 100 MHz | 200 MHz NR (Note 2) | Square (BWConfig) | 25.7 (Note 3)  23.4 (Note 4) |
| NOTE 1: BWConfig is the transmission bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.24 – 33.4 GHz.  NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz.  NOTE 5: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz.  NOTE 6: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz. | | | | | | |

The absolute total power measurement shall not exceed the OTA CACLR absolute limit specified in table 6.7.3.5.2-4a.

Table 6.7.3.5.2-4a: *BS type 2-O* CACLR absolutelimit

|  |  |
| --- | --- |
| BS class | CACLR absolute limit |
| Wide-area BS | -10.3 dBm/MHz |
| Medium-range BS | -17.3 dBm/MHz |
| Local-area BS | -17.3 dBm/MHz |

Table 6.7.3.5.2-5: Filter parameters for the assigned channel

|  |  |
| --- | --- |
| RAT of the carrier adjacent to the sub-block or Inter RF Bandwidth gap | Filter on the assigned channel frequency and corresponding filter bandwidth |
| NR | NR of same BW with SCS that provides largest transmission bandwidth configuration |

### 6.7.4 OTA operating band unwanted emissions

#### 6.7.4.1 Definition and applicability

The OTA limits for operating band unwanted emissions are specified as TRP per RIB, unless otherwise stated.

For *BS type 1-O*, for a *RIB* operating in multi-carrier or contiguous CA, the requirements apply to *BS channel bandwidths* of the outermost carrier. In addition, for a *RIB* operating in non-contiguous spectrum, the requirements shall apply inside any sub-block gap. In addition, for a *multi-band RIB*, the requirements shall apply inside any Inter RF Bandwidth gap.

For *BS type 2-O*, for a *RIB* operating in multi-carrier or contiguous CA, the requirements apply to the frequencies (ΔfOBUE) starting from the edge of the *contiguous transmission bandwidth.* In addition, for a *RIB* operating in non-contiguous spectrum, the requirements apply inside any sub-block gap.

#### 6.7.4.2 Minimum requirement

The minimum requirement for *BS type 1-O* is defined in 3GPP TS 38.104 [2], subclause 9.7.4.2.

The minimum requirement for *BS type 2-O* is defined in 3GPP TS 38.104 [2], subclause 9.7.4.3.

#### 6.7.4.3 Test purpose

This test measures the emissions of the NR BS, close to the assigned channel bandwidth of the wanted signal, while the NR BS is in operation.

#### 6.7.4.4 Method of test

##### 6.7.4.4.1 Initial conditions

Test environment: normal; see annex B.2.

RF channels to be tested for single carrier: B, M and T; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- BRFBW, MRFBW and TRFBW in single-band operation, see subclause 4.9.1;

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see subclause 4.9.1.

Directions to be tested: As the requirement is TRP the beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex I) as long as the required TRP output power level is achieved.

##### 6.7.4.4.2 Procedure

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Configure the BS such that the beam peak direction(s) applied during the power measurement step 6 are consistent with the grid and measurement approach for the TRP test.

The measurement devices characteristics shall be:

- measurement filter bandwidth: defined in subclause 6.7.4.5.

- detection mode: true RMS voltage or true power averaging.

4) For single carrier operation, set the BS to transmit according to the applicable test configuration in clause 5 using the corresponding test model(s) in subclause 4.12.2 at manufacturers declared *rated carrier output power* (PRated,c,TRP).

For a BS declared to be capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in subclause 4.11.

5) Align the BS and the test antenna such that measurements to determine TRP can be performed (see annex I).

6) Sweep the centre frequency of the measurement filter in contiguous steps and measure emission power within the specified frequency ranges with the specified measurement bandwidth.

7) Repeat step 5-6 for all directions in the appropriated TRP measurement grid needed for TRPEstimate (see annex I).

8) Calculate TRPEstimate using the measurements made in step 6.

9) For *BS type 1-O* and *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

#### 6.7.4.5 Test requirements

##### 6.7.4.5.1 *BS type 1-O*

The emission measurement result shall not exceed the maximum levels specified in tables 6.7.4.5.1-1 to 6.7.4.5.1-17, where:

- Δf is the separation between the channel edge frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency.

- f\_offset is the separation between the channel edge frequency and the centre of the measuring filter.

- f\_offsetmax is the offset to the frequency ΔfOBUE MHz outside the downlink operating band.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

For a *multi-band RIB* inside any *Inter RF Bandwidth gaps* with Wgap < 2\*ΔfOBUE, emissions shall not exceed the cumulative sum of the test requirements specified at the *Base Station RF Bandwidth edges* on each side of the *Inter RF Bandwidth gap*. The test requirement for *Base Station RF Bandwidth edge* is specified in the tables 6.7.4.5.1-1 to 6.7.4.5.1-17 below, where in this case:

- Δf is the separation between the *Base Station RF Bandwidth edge* frequency and the nominal -3 dB point of the measuring filter closest to the *Base Station RF Bandwidth edge*.

- f\_offset is the separation between the *Base Station RF Bandwidth edge* frequency and the centre of the measuring filter.

- f\_offsetmax is equal to the *Inter RF Bandwidth gap* minus half of the bandwidth of the measuring filter.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

For a *multi-band RIB*, the operating band unwanted emission limits apply also in a supported operating band without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported operating band. In this case, no cumulative limit is applied in the *inter-band gap* between a supported downlink operating band with carrier(s) transmitted and a supported downlink operating band without any carrier transmitted and

- In case the *inter-band gap* between a supported downlink operating band with carrier(s) transmitted and a supported downlink operating band without any carrier transmitted is less than 2\*ΔfOBUE, f\_offsetmax shall be the offset to the frequency ΔfOBUE MHz outside the outermost edges of the two supported downlink operating bands and the operating band unwanted emission limit of the band where there are carriers transmitted, as defined in the tables of the present subclause, shall apply across both downlink bands.

- In other cases, the operating band unwanted emission limit of the band where there are carriers transmitted, as defined in the tables of the present subclause for the largest frequency offset (Δfmax), shall apply from ΔfOBUE MHz below the lowest frequency, up to ΔfOBUE MHz above the highest frequency of the supported downlink operating band without any carrier transmitted.

For a multicarrier *single-band RIB* or a *single-band RIB* configured for intra-band contiguous or non-contiguous carrier aggregation the definitions above apply to the lower edge of the carrier transmitted at the lowest carrier frequency and the upper edge of the carrier transmitted at the highest carrier frequency within a specified frequency band.

In addition inside any sub-block gap for a *single-band RIB* operating in non-contiguous spectrum, emissions shall not exceed the cumulative sum of the test requirements specified for the adjacent sub blocks on each side of the sub block gap. The test requirement for each sub block is specified in the tables 6.7.4.5.1-1 to 6.7.4.5.1-17 below, where in this case:

- Δf is the separation between the sub block edge frequency and the nominal -3 dB point of the measuring filter closest to the sub block edge.

- f\_offset is the separation between the sub block edge frequency and the centre of the measuring filter.

- f\_offsetmax is equal to the sub block gap bandwidth minus half of the bandwidth of the measuring filter.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

Table 6.7.4.5.1-1: Wide Area BS operating band unwanted emission limits   
(NR bands ≤ 1 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz | 3.8 dBm - 7/5(f\_offset/MHz - 0.05) dB | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -3.2 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -4 dBm (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band*, the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be -13 dBm/100 kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-2: Wide Area BS *operating band* unwanted emission limits   
(1 GHz < NR bands ≤ 3 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz | 3.8 dBm-7/5(f\_offset/MHz-0.05)dB | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -3.2 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -4 dBm (Note 3) | 1MHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band*, the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be ‑13 dBm/1 MHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-3: Wide Area BS *operating band* unwanted emission limits   
(3 GHz < NR bands ≤ 4.2 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz | 4 dBm-7/5(f\_offset/MHz-0.05)dB | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -3 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -4 dBm (Note 3) | 1MHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band*, the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be ‑13 dBm/1 MHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-4: Wide Area BS *operating band* unwanted emission limits   
(4.2 GHz < NR bands ≤ 6 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz | 4 dBm-7/5(f\_offset/MHz-0.05)dB | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -3 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -4 dBm (Note 3) | 1MHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band*, the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be ‑13 dBm/1 MHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-5: Wide Area BS operating band unwanted emission limits   
(NR bands ≤ 1 GHz) for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz | 3.8 dBm-7/5(f\_offset/MHz-0.05)dB | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -3.2 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -7 dBm (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band*, the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be ‑16 dBm/100 kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-6: Wide Area BS operating band unwanted emission limits   
(1 GHz < NR bands ≤ 3 GHz) for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz | 3.8 dBm-7/5(f\_offset/MHz-0.05)dB | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -3.2 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -6 dBm (Note 3) | 1MHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band*, the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-7: Wide Area BS operating band unwanted emission limits   
(3 GHz < NR bands ≤ 4.2 GHz) for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz | 4 dBm-7/5(f\_offset/MHz-0.05)dB | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -3 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -6 dBm (Note 3) | 1MHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band*, the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-8: Wide Area BS operating band unwanted emission limits   
(4.2 GHz < NR bands ≤ 6 GHz) for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz | 4 dBm-7/5(f\_offset/MHz-0.05)dB | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -3 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -6 dBm (Note 3) | 1MHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band*, the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-9: Medium Range BS *operating band* unwanted emission limits, 40 < Prated,c,TRP ≤ 47 dBm (NR bands ≤ 3 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | – 67.2 dB | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | Min(Prated,c,TRP - 69 dB, -25 dBm)  (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be Min(Prated,c,TRP – 69 dB, ‑25 dBm)/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-10: Medium Range BS *operating band* unwanted emission limits, 40 < Prated,x ≤ 47 dBm ( 3 GHz < NR bands ≤ 4.2 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | Prated,c,TRP - 67 dB | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | Min(Prated,c,TRP – 69 dB, -25 dBm)  (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be Min(Prated,c,TRP – 69 dB, ‑25 dBm)/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-11: Medium Range BS operating band unwanted emission limits, 40 < Prated,c,TRP ≤ 47 dBm ( 4.2 GHz < NR bands ≤ 6 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | Prated,c,TRP - 67 dB | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | Min(Prated,c,TRP – 69 dB, -25 dBm)  (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be Min(Prated,c,TRP – 69 dB, ‑25 dBm)/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-12: Medium Range BS operating band unwanted emission limits, Prated,c,TRP ≤ 40 dBm

(NR bands ≤ 3 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -27.2 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -29 dBm (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be -29dBm/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-13: Medium Range BS operating band unwanted emission limits, Prated,c,TRP ≤ 40 dBm

(3 GHz < NR bands ≤ 4.2 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -27 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -29 dBm (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be -29dBm/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-14: Medium Range BS operating band unwanted emission limits, Prated,c,TRP ≤ 40 dBm

(4.2 GHz < NR bands ≤ 6 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -27 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -29 dBm (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be -29dBm/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-15: Local Area BS operating band unwanted emission limits (NR bands ≤ 3 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -35.2 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -37 dBm (Note 10) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be -37dBm/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-16: Local Area BS operating band unwanted emission limits (3 GHz < NR bands ≤ 4.2 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -35 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -37 dBm (Note 10) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be -37dBm/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.7.4.5.1-17: Local Area BS operating band unwanted emission limits (4.2 GHz < NR bands ≤ 6 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Test requirement (Note 1, 2) | Measurement bandwidth |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -35 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -37 dBm (Note 10) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any *operating band* the emission limits within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10MHz from both adjacent sub blocks on each side of the sub-block gap, where the emission limits within sub-block gaps shall be -37dBm/100kHz.  NOTE 2: For a *multi-band RIB* with Inter RF Bandwidth gap < 2\*ΔfOBUE the emission limits within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

In addition to the requirements in tables 6.7.4.5.1-1 to 6.7.4.5.1-17, the BS may have to comply with the applicable emission limits established by FCC Title 47 [xx], when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer.

##### 6.7.4.5.2 *BS type 2-O*

The emission measurement result shall not exceed the maximum levels specified in the tables below, where:

- Δf is the separation between the *contiguous transmission bandwidth* edge frequency and the nominal -3dB point of the measuring filter closest to the *contiguous transmission bandwidth* edge.

- f\_offset is the separation between the *contiguous transmission bandwidth* edge frequency and the centre of the measuring filter.

- f\_offsetmax is the offset to the frequency ΔfOBUE outside thedownlink *operating band*, where ΔfOBUE is defined in table 6.7.1-1.

In addition, inside any sub-block gap for a *RIB* operating in non-contiguous spectrum, emissions shall not exceed the cumulative sum of the test requirements specified for the adjacent sub blocks on each side of the sub block gap. The test requirement for each sub-block is specified in the tables 6.7.4.5.2-1 to 6.7.4.5.2-2 below, where in this case:

- Δf is the separation between the sub block edge frequency and the nominal -3 dB point of the measuring filter closest to the sub block edge.

- f\_offset is the separation between the sub block edge frequency and the centre of the measuring filter.

- f\_offsetmax is equal to the sub block gap bandwidth minus half of the bandwidth of the measuring filter.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

Table 6.7.4.5.2-1: OBUE limits applicable in the frequency range 24.25 – 33.4 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | Measurement bandwidth |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-2.3  dBm, Max(Prated,t,TRP – 32.3 dB, -9.3 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13  dBm, Max(Prated,t,TRP – 43 dB, -20 dBm)) | 1 MHz |
| NOTE: For non-contiguous spectrum operation within any operating band the limitwithin sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. | | | |

Table 6.7.4.5.2-2: OBUE limits applicable in the frequency range 37 GHz – 52.6 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | Measurement bandwidth |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-2.3  dBm, Max(Prated,t,TRP – 30.3 dB, -9.3 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13  dBm, Max(Prated,t,TRP – 41 dB, -20 dBm)) | 1 MHz |
| NOTE: For non-contiguous spectrum operation within any operating band the limitwithin sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. | | | |

### 6.7.5 OTA transmitter spurious emissions

#### 6.7.5.1 General

Unless otherwise stated, all requirements are measured as mean power.

The OTA transmitter spurious emissions limits are specified as TRP per RIB, unless otherwise stated.

The OTA transmitter spurious emission limits for FR1 shall apply from 30 MHz to 12.75 GHz, excluding the frequency range from ΔfOBUE below the lowest frequency of each supported downlink *operating band*, up to ΔfOBUE above the highest frequency of each supported downlink *operating band*, where the ΔfOBUE is defined in subclause 6.7.1. For some *operating bands*, the upper limit of the spurious range might be higher than 12.75 GHz in order to comply with the 5th harmonic limit of the downlink *operating band*, as specified in ITU-R recommendation SM.329 [5].

For *multi-band RIB* the above exclusion applies for each supported *operating band*.

The requirements shall apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer’s specification.

*BS type 1-O* requirements consists of OTA transmitter spurious emission requirements based on TRP and co-location requirements not based on TRP.

The OTA transmitter spurious emission limits for FR2 shall apply from 30 MHz to 2nd harmonic of the upper frequency edge of the downlink *operating band*, excluding the frequency range from ΔfOBUE below the lowest frequency of each supported downlink *operating band*, up to ΔfOBUE above the highest frequency of each supported downlink *operating band*, where the ΔfOBUE is defined in subclause 6.7.1.

#### 6.7.5.2 General OTA transmitter spurious emissions requirements

##### 6.7.5.2.1 Definition and applicability

The general OTA transmitter spurious emissions requirements are specified as TRP per RIB, per cell, unless otherwise specified.

##### 6.7.5.2.2 Minimum requirement

The minimum requirement for *BS type 1-O* is specified in TS 38.104 [2], subclause 9.7.5.2.2.

The minimum requirement for *BS type 2-O* is specified in TS 38.104 [2], subclause 9.7.5.3.2.

##### 6.7.5.2.3 Test purpose

The test purpose is to verify if the radiated spurious emissions from the BS at the RIB are within the specified minimum requirements.

##### 6.7.5.2.4 Method of test

###### 6.7.5.2.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier, see subclause 4.9.1:

* For FR1:
  + B when testing from 30 MHz to FDL\_low - ΔfOBUE
  + T when testing from FDL\_high + ΔfOBUE to 12.75 GHz (or to 5th harmonic)
* For FR2:
  + B when testing from 30 MHz to FDL\_low - ΔfOBUE
  + T when testing from FDL\_high + ΔfOBUE to 2nd harmonic (or to 60 GHz)

RF bandwidth positions to be tested in single-band multi-carrier operation, see subclause 4.9.1:

* For FR1:
  + BRFBW when testing from 30 MHz to FDL\_low - ΔfOBUE
  + TRFBW when testing from FDL\_high + ΔfOBUE to 12.75 GHz (or 5th harmonic)
* For FR2:
  + BRFBW when testing from 30 MHz to FDL\_low - ΔfOBUE
  + TRFBW when testing from FDL\_high + ΔfOBUE to 2nd harmonic (or to 60 GHz)

RF bandwidth positions to be tested in multi-band multi-carrier operation, see subclause 4.9.1:

* For FR1:
  + BRFBW\_T'RFBW when testing from 30 MHz to FDL\_Blow\_low - ΔfOBUE
  + B'RFBW\_TRFBW when testing from FDL\_Bhigh\_high + ΔfOBUE to 12.75 GHz (or to 5th harmonic)
  + BRFBW\_T'RFBW and B'RFBW\_TRFBW when testing from FDL\_Blow\_high + ΔfOBUE to FDL\_Bhigh\_low - ΔfOBUE
* For FR2:
  + BRFBW\_T'RFBW when testing from 30 MHz to FDL\_Blow\_low - ΔfOBUE
  + B'RFBW\_TRFBW when testing from FDL\_Bhigh\_high + ΔfOBUE to 2nd harmonic (or to 60 GHz)
  + BRFBW\_T'RFBW and B'RFBW\_TRFBW when testing from FDL\_Blow\_high + ΔfOBUE to FDL\_Bhigh\_low - ΔfOBUE

Directions to be tested: As the requirement is TRP the beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex I) as long as the required TRP output power level is achieved.

###### 6.7.5.2.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the AAS BS with the test system.

3) Measurements shall use a measurement bandwidth in accordance to the conditions in subclause 6.7.5.2.5.

4) The measurement device characteristics shall be:

- Detection mode: True RMS.

5) Set the BS to transmit

- For RIBdeclared to be capable of single carrier operation only, set the RIB to transmit a signal according to E-TM1.1 in subclause 4.12.2, at manufacturer's declared rated output power Prated,c,TRP.

- For a RIB declared to be capable of multi-carrier and/or CA operation, set the set the RIB to transmit according to E-TM1.1 on all carriers configured using the applicable test configuration and corresponding power setting specified in subclause 4.7.

6) Align the BS and the test antenna such that measurements to determine TRP can be performed (see annex I).

7) Measure the emission at the specified frequencies with specified measurement bandwidth.

8) Repeat step 6-7 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

NOTE 1: the TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: the frequency sweep or the TRP measurement grid sweep may be done in any order.

9) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

10) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

##### 6.7.5.2.5 Test requirement

###### 6.7.5.2.5.1 Test requirement for *BS type 1-O*

For a BS meeting category A the TRP of any spurious emission shall not exceed the limits in table 6.7.5.2.5.1-1.

Table 6.7.5.2.5.1-1: General OTA BS transmitter spurious emission limits for *BS type 1-O*, Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | Test limit | Measurement bandwidth | Notes |
| 30 MHz – 1 GHz | -13 + X dBm | 100 kHz | Note 1, Note 4 |
| 1 GHz 12.75 GHz | 1 MHz | Note 1, Note 2, Note 4 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz | 1 MHz | Note 1, Note 2, Note 3, Note 4 |
| NOTE 1: Measurement bandwidths as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: This spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the DL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: X = 9 dB with the exception of operation in Region 2 where the FCC guidance for MIMO systems in [14] is applicable and any other territories where regulation requires, X = 0 dB. | | | |

For a BS meeting category B the TRP of any spurious emission shall not exceed the limits in table 6.7.5.2.5.1-2.

Table 6.7.5.2.5.1-2: General OTA BS transmitter spurious emission limits for *BS type 1-O*, Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | Test limit | Measurement bandwidth | Notes |
| 30 MHz – 1 GHz | -36 + X dBm | 100 kHz | Note 1, Note 4 |
| 1 GHz – 12.75 GHz | -30 + X dBm | 1 MHz | Note 1, Note 2, Note 4 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz | 1 MHz | Note 1, Note 2, Note 3, Note 4 |
| NOTE 1: Measurement bandwidths as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: This spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the DL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: X= 9 dB with the exception of operation in Region 2 where the FCC guidance for MIMO systems in [14] is applicable and any other territories where regulation requires, X = 0 dB. | | | |

###### 6.7.5.2.5.2 Test requirement for *BS type 2-O*

The power of any spurious emission shall not exceed the limits in table 6.7.5.2.5.2-1.

Editor’s note: The spurious emission limits may be updated, pending further input concerning recommended Category B limits.

Table 6.7.5.2.5.2-1: General OTA BS transmitter spurious emission limits for *BS type 2-O*

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | Test limit | Measurement bandwidth | Notes |
| 30 MHz – 1 GHz | -13 dBm | 100 kHz | Note 1 |
| 1 GHz – min(2nd harmonic of the upper frequency edge of the DL operating band in GHz; [60] GHz) | 1 MHz | Note 1, Note 2 |
| NOTE 1: Measurement bandwidth as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1. | | | |

#### 6.7.5.3 Protection of the BS receiver of own or different BS

##### 6.7.5.3.1 Definition and applicability

This requirement shall be applied for NR FDD operation in order to prevent the receivers of own or a different BS of the same band being desensitised by emissions from a type 1-O BS.

This requirement is a co-location requirement as defined in subclause 4.9, in 3GPP TS 38.104 [1], the power levels are specified at the CLTA output.

##### 6.7.5.3.2 Minimum requirements

The minimum requirement for NR BS type 1-O is defined in 3GPP TS 38.104 [1], subclause 9.7.5.2.

##### 6.7.5.3.3 Test purpose

For OTA co-location spurious emission, the test purpose is to verify that the emission is within the specified requirement limits at the CLTA conducted output(s).

##### 6.7.5.3.4 Method of test

###### 6.7.5.3.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier: MRFBW in *single-band RIB*, see subclause 4.9.1; BRFBW\_T'RFBW and B'RFBW\_TRFBW in *multi-band RIB*, see subclause 4.9.1.

In addition, for *multi-band RIB*:

- For BRFBW\_T'RFBW, emission testing above the highest operating band may be omitted.

- For B'RFBW\_TRFBW, emission testing below the lowest operating band may be omitted.

Directions to be tested: The requirement is specified as co-location requirement. For general description of co-location requirements, refer to subclause 4.12.

The co-location spurious emission is measured at the CLTA conducted output(s).

###### 6.7.5.3.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1. Select and place the *NR BS* and CLTA as described in subclause 4.12 with parameters as specified in table 4.12.2.2-1 and table 4.12.2.3-1.
2. Several CLTAs might be required to cover the whole co-location spurious emission frequency ranges.
3. Place test antenna in reference direction at far-field distance, aligned in all supported polarizations (single or dual) with the *NR BS* as depicted in annex E1.3.
4. The test antenna shall be dual (or single) polarized with the same frequency range as the *NR BS* for co-location spurious emission test case.
5. Connect test antenna and CLTA to the measurement equipment as depicted in annex E1.3.
6. OTA co-location spurious emission is measured as the power sum over all supported polarizations at the CLTA conducted output(s).
7. The measurement device (signal analyzer) characteristics shall be:

- Detection mode: True RMS.

1. Set the *BS type 1-O* to transmit:

- Set the *NR BS* to transmit maximum power according to the applicable test configuration in subclause 4.7 using the corresponding test models or set of physical channels in subclause 4.9.2.

9) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the test requirement in subclause 6.7.5.3.5.

In addition, for *multi-band RIB*, the following steps shall apply:

10) For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

##### 6.7.5.3.5 Test requirements

6.7.5.3.5.1 Test requirement for *BS type 1-O*

This requirement shall be applied for NR FDD operation in order to prevent the receivers of own or a different BS of the same band being desensitised by emissions from a *BS type 1-O*.

This requirement is a co-location requirement as defined in subclause 4.9, in TS 38.104 [1], the power levels are specified at the CLTA output.

The total power of any spurious emission from both polarizations of the CLTA connector output shall not exceed the limits in table 6.7.5.3.5.1-1.

Table 6.7.5.3.5.1-1: BS type 1-O OTA spurious emissions limits for protection of the BS receiver

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **BS class** | **Frequency range** | **Maximum Level for bands below 3GHz** | **Maximum Level for bands between 3 and 4.2GHz** | **Maximum Level for bands between 4.2 and 6GHz** | **Measurement bandwidth** | **Note** |
| Wide Area BS | FUL\_low – FUL\_high | -113.9 dBm | -113.7 dBm | -113.6 dBm | 100 kHz |  |
| Medium Range BS | FUL\_low – FUL\_high | -108.9 dBm | -108.7 dBm | -108.6 dBm | 100 kHz |  |
| Local Area BS | FUL\_low – FUL\_high | -105.9 dBm | -105.7 dBm | -105.6 dBm | 100 kHz |  |

#### 6.7.5.4 Additional spurious emissions requirements

##### 6.7.5.4.1 Definition and applicability

These requirements may be applied for the protection of systems operating in frequency ranges other than the BS downlink operating band. The limits may apply as an optional protection of such systems that are deployed in the same geographical area as the BS, or they may be set by local or regional regulation as a mandatory requirement for an NR operating band. It is in some cases not stated in the present document whether a requirement is mandatory or under what exact circumstances that a limit applies, since this is set by local or regional regulation. An overview of regional requirements in the present document is given in subclause 4.4.

Some requirements may apply for the protection of specific equipment (UE, MS and/or BS) or equipment operating in specific systems (GSM, CDMA, UTRA, E-UTRA, NR, etc.).

The requirement shall apply at each RIB supporting transmission in the *operating band*.

All additional spurious requirements are TRP unless otherwise stated.

##### 6.7.5.4.2 Minimum Requirement

The minimum requirement for *BS type 1-O* is specified in TS 38.104 [2], subclause 9.7.5.2.4.

The minimum requirement for *BS type 2-O* is specified in TS 38.104 [2], subclause 9.7.5.3.3.

##### 6.7.5.4.3 Test purpose

The test purpose is to verify the radiated spurious emissions from the BS at the RIB are within the specified additional spurious emissions requirements.

##### 6.7.5.4.4 Method of test

###### 6.7.5.4.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier:

* For FR1:
  + B when testing from 30 MHz to FDL\_low - ΔfOBUE
  + T when testing from FDL\_high + ΔfOBUE to 12.75 GHz (or to 5th harmonic)

RF bandwidth positions to be tested in single-band multi-carrier operation:

* For FR1:
  + BRFBW when testing from 30 MHz to FDL\_low - ΔfOBUE
  + TRFBW when testing from FDL\_high + ΔfOBUE to 12.75 GHz (or to 5th harmonic)

RF bandwidth positions to be tested in multi-band multi-carrier operation:

* For FR1:
  + BRFBW\_T'RFBW when testing from 30 MHz to FDL\_Blow\_low - ΔfOBUE
  + B'RFBW\_TRFBW when testing from FDL\_Bhigh\_high + ΔfOBUE to 12.75 GHz (or to 5th harmonic)
  + BRFBW\_T'RFBW and B'RFBW\_TRFBW when testing from FDL\_Blow\_high + ΔfOBUE to FDL\_Bhigh\_low - ΔfOBUE

Directions to be tested: As the FR1 requirement is TRP the beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex I) as long as the required TRP output power level is achieved.

###### 6.7.5.4.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the AAS BS with the test system.

3) Measurements shall use a measurement bandwidth in accordance to the conditions in subclause 6.7.5.2.5.

4) The measurement device characteristics shall be:

- Detection mode: True RMS.

5) Set the BS to transmit:

- For RIBdeclared to be capable of single carrier operation only, set the RIB to transmit a signal according to E-TM1.1 in subclause 4.12.2, at manufacturer's declared rated output power Prated,c,TRP.

- For a RIB declared to be capable of multi-carrier and/or CA operation, set the set the RIB to transmit according to E-TM1.1 on all carriers configured using the applicable test configuration and corresponding power setting specified in subclause 4.7.

6) Align the BS and the test antenna such that measurements to determine TRP can be performed (see annex I).

7) Measure the emission at the specified frequencies with specified measurement bandwidth.

8) Repeat step 6-7 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

NOTE 1: the TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: the frequency sweep or the TRP measurement grid sweep may be done in any order.

9) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

10) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

##### 6.7.5.4.5 Test requirement

###### 6.7.5.4.5.1 Test requirement for *BS type 1-O*

The power of any spurious emission shall not exceed the test limits in table 6.7.5.4.5-1 for a BS where requirements for co-existence with the system listed in the first column apply. For a *multi-band RIB*, the exclusions and conditions in the Note column of table 6.7.5.4.5-1 apply for each supported *operating band*.

Table 6.7.5.4.5-1: BS spurious emissions test limits for BS for co-existence with systems operating in other frequency bands

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| System type for NR to co-exist with | Frequency range for co-existence requirement | Test limit | Measurement bandwidth | Notes |
| GSM900 | 921 – 960 MHz | -45.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n8. |
| 876 – 915 MHz | -49.4 dBm | 100 kHz | For the frequency range 880-915 MHz, this requirement does not apply to BS operating in band n8, since it is already covered by the requirement in subclause 6.7.5.3. |
| DCS1800 | 1805 – 1880 MHz | -35.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n3. |
| 1710 – 1785 MHz | -49.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in subclause 6.7.5.3. |
| PCS1900 | 1930 1990 MHz | -35.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n2, n25 or band n70. |
| 1850 – 1910 MHz | -49.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n2 or n25 since it is already covered by the requirement in subclause 6.7.5.3. |
| GSM850 or CDMA850 | 869 – 894 MHz | -45.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n5. |
| 824 – 849 MHz | -49.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n5, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band I or  E-UTRA Band 1 or NR Band n1 | 2110 – 2170 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n1. |
| 1920 – 1980 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n1, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band II or  E-UTRA Band 2 or NR Band n2 | 1930 – 1990 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n2 or n70. |
| 1850 – 1910 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band III or  E-UTRA Band 3 or NR Band n3 | 1805 – 1880 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3. |
| 1710 – 1785 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band IV or  E-UTRA Band 4 | 2110 – 2155 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66. |
| 1710 – 1755 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band V or  E-UTRA Band 5 or NR Band n5 | 869 – 894 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n5. |
| 824 – 849 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n5, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band VI, XIX or  E-UTRA Band 6, 18, 19 | 860 – 890 MHz | -40.4 dBm | 1 MHz |  |
| 815 – 830 MHz | -37.4 dBm | 1 MHz |  |
| 830 – 845 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD Band VII or  E-UTRA Band 7 or NR Band n7 | 2620 – 2690 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n7. |
| 2500 – 2570 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n7, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band VIII or  E-UTRA Band 8 or NR Band n8 | 925 – 960 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n8. |
| 880 – 915 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band IX or  E-UTRA Band 9 | 1844.9 – 1879.9 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3. |
| 1749.9 – 1784.9 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band X or  E-UTRA Band 10 | 2110 – 2170 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66 |
| 1710 – 1770 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band XI or XXI or  E-UTRA Band 11 or 21 | 1475.9 – 1510.9 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n74 or n75. |
| 1427.9 – 1447.9 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| 1447.9 – 1462.9 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n74 or n75. |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 729 – 746 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n12. |
| 699 – 716 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n12, since it is already covered by the requirement in sub-clause 6.7.5.3. |
| UTRA FDD Band XIII or  E-UTRA Band 13 | 746 – 756 MHz | -40.4 dBm | 1 MHz |  |
| 777 – 787 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD Band XIV or  E-UTRA Band 14 | 758 – 768 MHz | -40.4 dBm | 1 MHz |  |
| 788 – 798 MHz | -37.4 dBm | 1 MHz |  |
| E-UTRA Band 17 | 734 – 746 MHz | -40.4 dBm | 1 MHz |  |
| 704 – 716 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 791 – 821 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20 or n28. |
| 832 – 862 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in subclause 6.7.5.3. |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3510 – 3590 MHz | -40 dBm | 1 MHz |  |
| 3410 – 3490 MHz | -37 dBm | 1 MHz |  |
| E-UTRA Band 24 | 1525 – 1559 MHz | -40.4 dBm | 1 MHz |  |
| 1626.5 – 1660.5 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD Band XXV or  E-UTRA Band 25 or NR band n25 | 1930 – 1995 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, n25 or n70. |
| 1850 – 1915 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n25 since it is already covered by the requirement in subclause 6.7.5.3. For BS operating in Band n2, it applies for 1910 MHz to 1915 MHz, while the rest is covered in subclause 6.7.5.3. |
| UTRA FDD Band XXVI or  E-UTRA Band 26 | 859 – 894 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n5. |
| 814 – 849 MHz | -37.4 dBm | 1 MHz | For BS operating in Band n5, it applies for 814 MHz to 824 MHz, while the rest is covered in subclause 6.7.5.3. |
| E-UTRA Band 27 | 852 – 869 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n5. |
| 807 – 824 MHz | -37.4 dBm | 1 MHz | This requirement also applies to BS operating in Band n28, starting 4 MHz above the Band n28 downlink *operating band* (Note 5). |
| E-UTRA Band 28 or NR Band n28 | 758 – 803 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20 or n28. |
| 703 – 748 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n28, since it is already covered by the requirement in subclause 6.7.5.3. |
| E-UTRA Band 29 | 717 – 728 MHz | -40.4 dBm | 1 MHz |  |
| E-UTRA Band 30 | 2350 – 2360 MHz | -40.4 dBm | 1 MHz |  |
| 2305 – 2315 MHz | -37.4 dBm | 1 MHz |  |
| E-UTRA Band 31 | 462.5 -467.5 MHz | -40.4 dBm | 1 MHz |  |
| 452.5 -457.5 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD band XXXII or E-UTRA band 32 | 1452 – 1496 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n74 or n75. |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -40.4 dBm | 1 MHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n34. |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -40.4 dBm | 1 MHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n2 or n25. |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -40.4 dBm | 1 MHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n38. |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n39. |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n40. |
| E-UTRA Band 41 or NR Band n41 | 2496 – 2690 MHz | -40.4 dBm | 1 MHz | This is not applicable to BS operating in Band n41. |
| E-UTRA Band 42 | 3400 – 3600 MHz | -40 dBm | 1 MHz |  |
| E-UTRA Band 43 | 3600 – 3800 MHz | -40 dBm | 1 MHz |  |
| E-UTRA Band 44 | 703 – 803 MHz | -40.4 dBm | 1 MHz | This is not applicable to BS operating in Band n28. |
| E-UTRA Band 45 | 1447 – 1467 MHz | -40.4 dBm | 1 MHz |  |
| E-UTRA Band 46 | 5150 – 5925 MHz | -39.5 dBm | 1 MHz |  |
| E-UTRA Band 47 | 5855 – 5925 MHz | -39.5 dBm | 1 MHz |  |
| E-UTRA Band 48 | 3550 – 3700 MHz | -40 dBm | 1 MHz |  |
| E-UTRA Band 50 or NR Band n50 | 1432 – 1517 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75 or n76. |
| E-UTRA Band 65 | 2110 – 2200 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n1, |
| 1920 – 2010 MHz | -37.4 dBm | 1 MHz | For BS operating in Band n1, it applies for 1980 MHz to 2010 MHz, while the rest is covered in subclause 6.7.5.3. |
| E-UTRA Band 66 or NR Band n66 | 2110 – 2200 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66. |
| 1710 – 1780 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in subclause 6.7.5.3. |
| E-UTRA Band 67 | 738 – 758 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n28. |
| E-UTRA Band 68 | 753 -783 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n28. |
| 698-728 MHz | -37.4 dBm | 1 MHz | For BS operating in Band n28, this requirement applies between 698 MHz and 703 MHz, while the rest is covered in subclause 6.7.5.3. |
| E-UTRA Band 69 | 2570 – 2620 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n38. |
| E-UTRA Band 70 or NR Band n70 | 1995 – 2020 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, n25 or n70 |
| 1695 – 1710 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n70, since it is already covered by the requirement in subclause 6.7.5.3. |
| E-UTRA Band 71 or NR Band n71 | 617 – 652 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n71 |
| 663 – 698 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n71, since it is already covered by the requirement in subclause 6.7.5.3. |
| E-UTRA Band 72 | 461 – 466 MHz | -40.4 dBm | 1 MHz |  |
| 451 – 456 MHz | -37.4 dBm | 1 MHz |  |
| E-UTRA Band 74 or NR Band n74 | 1475 – 1518 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n74 or n75. |
| 1427 – 1470 MHz | -37.4 dBm | 1MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| E-UTRA Band 75 or NR Band n75 | 1432 – 1517 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| E-UTRA Band 76 or NR Band n76 | 1427 – 1432 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75 or n76. |
| NR Band n77 | 3.3 – 4.2 GHz | -40 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 and n 78 |
| NR Band n78 | 3.3 – 3.8 GHz | -40 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 and n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -39.5 dBm | 1 MHz | This requirement does not apply to BS operating in Band n79 |

NOTE 1: As defined in the scope for spurious emissions in this clause, except for the cases where the noted requirements apply to a BS operating in Band n28, the co-existence requirements in 6.7.5.4.5-1 do not apply for the 10 MHz frequency range immediately outside the downlink *operating band* (see TS 38.104 [2], table 5.2-1). Emission limits for this excluded frequency range may be covered by local or regional requirements.

NOTE 2: Table 6.7.5.4.5-1 assumes that two *operating bands*, where the frequency ranges in TS 38.104 [2] table 5.2-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NOTE 3: TDD base stations deployed in the same geographical area, that are synchronized and use the same or adjacent *operating bands* can transmit without additional co-existence requirements. For unsynchronized base stations, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NOTE: For NR Band n28 BS, specific solutions may be required to fulfil the spurious emissions limits for BS for co-existence with E-UTRA Band 27 UL *operating band*.

The following requirement may be applied for the protection of PHS. This requirement is also applicable at specified frequencies falling between 10 MHz below the lowest BS transmitter frequency of the downlink *operating band* and 10 MHz above the highest BS transmitter frequency of the downlink *operating band*.

The power of any spurious emission shall not exceed:

Table 6.7.5.4.5-2: BS spurious emissions test limits for BS for co-existence with PHS

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | Test limit | Measurement bandwidth | Note |
| 1884.5 – 1915.7 MHz | -32 dBm | 300 kHz | Applicable when co-existence with PHS system operating in 1884.5 - 1915.7 MHz |

The following requirement may apply to NR BS operating in Band n41 in certain regions. This requirement is also applicable at the frequency range from 10 MHz below the lowest frequency of the BS downlink *operating band* up to 10 MHz above the highest frequency of the BS downlink *operating band*.

The power of any spurious emission shall not exceed test levels specified in table 6.7.5.4.5-3:

Table 6.7.5.4.5-3: Additional BS spurious emissions test limits for Band n41

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | Test limit | Measurement bandwidth | Note |
| 2505 – 2535 MHz | -42 dBm | 1 MHz |  |
| 2535 – 2655 MHz | -22 dBm | 1 MHz | Applicable at offsets ≥ 250% of channel bandwidth from carrier frequency. |
| NOTE: This requirement applies for NR carriers allocated within 2545 – 2575 MHz or 2595 – 2645 MHz. | | | |

In certain regions, the following requirement may apply to BS operating in Band n50 within 1432-1452 MHz or n51. Emissions shall not exceed the test levels specified in table 6.7.5.4.5-4.

Table 6.7.5.4.5-4: Additional operating band unwanted emission test limits for BS operating in Band n50 within 1432-1452 MHz or n51

|  |  |  |
| --- | --- | --- |
| Filter centre frequency, Ffilter | Test limit | Measurement bandwidth |
| Ffilter = 1413.5 MHz | -39.4 | 27 MHz |

NOTE: The regional requirement, included in [15], is defined in terms of EIRP, which is dependent on both the BS emissions at the antenna connector and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the base station needed to verify compliance with the regional requirement. The assessment of the EIRP level is described in TS 38.104 [2] annex E.

In certain regions, the following requirement may apply to BS operating in NR Band n50 within 1492-1517 MHz. The level of emissions, measured on centre frequencies Ffilter with filter bandwidth according to table 6.6.5.2.3-5, shall neither exceed the maximum emission level PEM,n50,a nor PEM,B50,b declared by the manufacturer.

Table 6.6.5.2.3-5: Operating band n50 within 1492-1517 MHz declared emission in the band 1518-1559 MHz

|  |  |  |
| --- | --- | --- |
| Filter centre frequency, Ffilter | Declared emission level [dBm] | Measurement bandwidth |
| 1518.5 MHz ≤ Ffilter ≤ 1519.5 MHz | PEM, n50,a | 1 MHz |
| 1520.5 MHz ≤ Ffilter ≤ 1558.5 MHz | PEM,n50,b | 1 MHz |

NOTE: The regional requirement, included in [15], is defined in terms of EIRP, which is dependent on both the BS emissions at the antenna connector and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the base station needed to verify compliance with the regional requirement. The assessment of the EIRP level is described in TS 38.104 [2] Annex E.

#### 6.7.5.5 Co-location requirements

##### 6.7.5.5.1 Definition and applicability

These requirements may be applied for the protection of other BS receivers when GSM900, DCS1800, PCS1900, GSM850, CDMA850, UTRA FDD, UTRA TDD, E-UTRA and/or NR BS are co-located with a BS.

The requirements assume co-location with base stations of the same class.

NOTE: For co-location with UTRA, the requirements are based on co-location with UTRA FDD or TDD base stations.

This requirement is a co-location requirement as defined in subclause 4.9, in 3GPP TS 38.104 [1], the power levels are specified at the CLTA output.

##### 6.7.5.5.2 Minimum requirements

The minimum requirement for NR BS type 1-O is defined in 3GPP TS 38.104 [1], subclause 9.7.5.2.

##### 6.7.5.5.3 Test purpose

For OTA co-locate spurious emission, the test purpose is to verify that the emission is within the specified requirement limits at the CLTA conducted output(s).

##### 6.7.5.5.4 Method of test

###### 6.7.5.5.4.1 Initial conditions

Test environment: normal; see subclause B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier:

* MRFBW in *single-band RIB*, see subclause 4.9.1;
* BRFBW\_T'RFBW and B'RFBW\_TRFBW in *multi-band RIB*, see subclause 4.9.1.

In addition, for *multi-band RIB*:

* For BRFBW\_T'RFBW, emission testing above the highest operating band may be omitted.
* For B'RFBW\_TRFBW, emission testing below the lowest operating band may be omitted.

Directions to be tested: The FR1 requirement is specified as co-location requirement. For general description of co-location requirements, refer to subclause 4.12.

The co-location spurious emission is measured at the CLTA conducted output(s).

###### 6.7.5.5.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1. Select and place the *NR BS* and CLTA as described in subclause 4.12, with parameters as specified in table 4.12.2.2-1 and table 4.12.2.3-1.
2. Several CLTAs might be required to cover the whole co-location spurious emission frequency ranges.
3. Place test antenna in reference direction at far-field distance, aligned in all supported polarizations (single or dual) with the *NR BS* as depicted in Annex E1.3.
4. The test antenna shall be dual (or single) polarized with the same frequency range as the *NR BS* for co-location spurious emission test case.
5. Connect test antenna and CLTA to the measurement equipment as depicted in Annex E1.3.
6. OTA co-location spurious emission is measured as the power sum over all supported polarizations at the CLTA conducted output(s).
7. The measurement device (signal analyzer) characteristics shall be:

- Detection mode: True RMS.

1. Set the *NR BS* type 1-O to transmit:

- Set the *NR BS* to transmit maximum power according to the applicable test configuration in subclause 4.7 using the corresponding test models or set of physical channels in subclause 4.9.2.

1. Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the test requirement in subclause 6.7.5.5.5.

In addition, for *multi-band RIB*, the following steps shall apply:

1. For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

##### 6.7.5.5.5 Test requirements

6.7.5.5.5.1 Test requirement for *BS type 1-O*

These requirements may be applied for the protection of other BS receivers when GSM900, DCS1800, PCS1900, GSM850, CDMA850, UTRA FDD, UTRA TDD, E-UTRA and/or NR BS are co-located with a BS.

The requirements assume co-location with base stations of the same class.

NOTE: For co-location with UTRA, the requirements are based on co-location with UTRA FDD or TDD base stations.

This requirement is a co-location requirement as defined in subclause 4.9, in TS 38.104 [1], the power levels are specified at the CLTAoutput.

The output of the CLTA of any spurious emission shall not exceed the limits basic limits in table 6.7.5.5.5.1-1.

For a *multi-band RIB*, the exclusions and conditions in the notes column of table 6.7.5.5.5.1-1 apply for each supported operating band.

Table 6.7.5.5.5.1-1: *BS type 1-O* OTA spurious emissions limits for BS co-located with another BS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Type of co-located BS** | **Frequency range for co-location requirement** | **Basic limit** | | | **Measurement bandwidth** | **Note** |
| **WA BS** | **MR BS** | **LA BS** |
| GSM900 | 876-915 MHz | -115.9 dBm | -108.9 dBm | -87.9 dBm | 100 kHz |  |
| DCS1800 | 1710 – 1785 MHz | -115.9 dBm | -108.9 dBm | --97.9 dBm | 100 kHz |  |
| PCS1900 | 1850 – 1910 MHz | -115.9 dBm | -108.9 dBm | --97.9 dBm | 100 kHz |  |
| GSM850 or CDMA850 | 824 – 849 MHz | -115.9 dBm | -108.9 dBm | -87.9 dBm | 100 kHz |  |
| UTRA FDD Band I or E-UTRA Band 1 or NR Band n1 | 1920 – 1980 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band II or E-UTRA Band 2 or NR Band n2 | 1850 – 1910 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band III or E-UTRA Band 3 or NR Band n3 | 1710 – 1785 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band IV or E-UTRA Band 4 | 1710 – 1755 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band V or E-UTRA Band 5 or NR Band n5 | 824 – 849 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band VI, XIX or E-UTRA Band 6, 19 | 830 – 845 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band VII or E-UTRA Band 7 or NR Band n7 | 2500 – 2570 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band VIII or E-UTRA Band 8 or NR Band n8 | 880 – 915 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band IX or E-UTRA Band 9 | 1749.9 – 1784.9 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band X or E-UTRA Band 10 | 1710 – 1770 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band XI or E-UTRA Band 11 | 1427.9 –1447.9 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n50 or n75 |
| UTRA FDD Band XII or  E-UTRA Band 12 | 699 – 716 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band XIII or  E-UTRA Band 13 | 777 – 787 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band XIV or  E-UTRA Band 14 | 788 – 798 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 17 | 704 – 716 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 18 | 815 – 830 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 832 – 862 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band XXI or E-UTRA Band 21 | 1447.9 – 1462.9 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n50 or n75 |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3410 – 3490 MHz | -113.7 dBm | -108.7 dBm | -105.7 dBm | 100 kHz |  |
| E-UTRA Band 23 | 2000 – 2020 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 24 | 1626.5 – 1660.5 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band XXV or  E-UTRA Band 25 | 1850 – 1915 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA FDD Band XXVI or  E-UTRA Band 26 | 814 – 849 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 27 | 807 – 824 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 28 or NR Band n28 | 703 – 748 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 30 | 2305 – 2315 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 31 | 452.5 -457.5 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 | 2010 – 2025 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n2 |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n38. |
| UTRA TDD Band f) or E-UTRA Band 39 | 1880 – 1920MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| UTRA TDD Band e) or E-UTRA Band 40 | 2300 – 2400MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 41 or NR Band n41 | 2496 – 2690 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n41 |
| E-UTRA Band 42 | 3400 – 3600 MHz | -113.7 dBm | -108.7 dBm | -105.7 dBm | 100 kHz |  |
| E-UTRA Band 43 | 3600 – 3800 MHz | -113.7 dBm | -108.7 dBm | -105.7 dBm | 100 kHz |  |
| E-UTRA Band 44 | 703 – 803 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n28 |
| E-UTRA Band 45 | 1447 – 1467 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 46 | 5150 – 5925 MHz | N/A | -108.6 dBm | -105.6 dBm | 100 kHz |  |
| E-UTRA Band 48 | 3550 – 3700 MHz | -113.7 dBm | -108.7 dBm | -105.7 dBm | 100 kHz |  |
| E-UTRA Band 50 or NR Band n50 | 1432 – 1517 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n74 or n75 |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | N/A | N/A | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n50, n75 or n76 |
| E-UTRA Band 65 | 1920 – 2010 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 66 or NR Band n66 | 1710 – 1780 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 68 | 698 – 728 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 70 or NR Band n70 | 1695 – 1710 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 71 or NR Band n71 | 663 – 698 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 72 | 451 – 456 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz |  |
| E-UTRA Band 74 or NR Band n74 | 1427 – 1470 MHz | -113.9 dBm | -108.9 dBm | -105.9 dBm | 100 kHz | This is not applicable to BS operating in Band n50 |
| NR Band n77 | 3.3 – 4.2 GHz | -113.7 dBm | -108.7 dBm | -105.7 dBm | 100 kHz |  |
| NR Band n78 | 3.3 – 3.8 GHz | -113.7 dBm | -108.7 dBm | -105.7 dBm | 100 kHz |  |
| NR Band n79 | 4.4 – 5.0 GHz | -113.6 dBm | -108.6 dBm | -105.6 dBm | 100 kHz |  |
| NR Band n80 | 1710 – 1785 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n81 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n82 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n83 | 703 – 748 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n84 | 1920 – 1980 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 85 | 698 - 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n86 | 1710 – 1780 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |

NOTE 1: As defined in the scope for spurious emissions in this clause, the co-location requirements in table 6.7.5.5.5.1-1 do not apply for the 10 MHz frequency range immediately outside the BS transmit frequency range of a downlink *operating band* (see table 5.2-1 in TS 38.104 [1]). The current state-of-the-art technology does not allow a single generic solution for co-location with other system on adjacent frequencies for 30 dB BS-BS minimum coupling loss. However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [10].

NOTE 2: Table 6.7.5.5.5.1-1 assumes that two *operating bands*, where the corresponding BS transmit and receive frequency ranges in table 5.2-1 in TS 38.104 [1] would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-location requirements may apply that are not covered by the 3GPP specifications.

NOTE 3: Co-located TDD base stations that are synchronized and using the same or adjacent *operating band* can transmit without special co-locations requirements. For unsynchronized base stations (except in Band n46), special co-location requirements may apply that are not covered by the 3GPP specifications.

## 6.8 OTA transmitter intermodulation

### 6.8.1 Definition and applicability

The OTA transmitter intermodulation requirement is a measure of the capability of the transmitter unit to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter unit via the RDN and antenna array from a co-located base station. The requirement applies during the *transmitter ON period* and the *transmitter transient period*.

The requirement applies at each RIB supporting transmission in the operating band.

The transmitter intermodulation level is the total radiated power of the intermodulation products when an interfering signal is injected into the CLTA.

For *BS type 1-O*, the transmitter intermodulation requirement is captured by the co-location transmitter intermodulation scenario case, in which the interfering signal is transmitted from a co-located base station.

### 6.8.2 Minimum requirement

The minimum requirement for *BS type 1-O* operation is defined in TS 38.104 [1], subclause 9.8.2.

The OTA transmitter intermodulation requirement is not applicable for *BS type 2-O*.

### 6.8.3 Test purpose

The test purpose is to verify the ability of the transmitter units associated with the *RIB* under test to restrict the generation of intermodulation products in its nonlinear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter unit via the RDN and antenna array from a co-located base station to below specified levels.

### 6.8.4 Method of test

#### 6.8.4.1 Initial conditions

Test environment: normal; see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier:

* MRFBW in *single-band RIB*, see subclause 4.9.1;
* BRFBW\_T'RFBW and B'RFBW\_TRFBW in *multi-band RIB*, see subclause 4.9.1.

In addition, for *multi-band RIB*:

* For BRFBW\_T'RFBW, emission testing above the highest operating band may be omitted.
* For B'RFBW\_TRFBW, emission testing below the lowest operating band may be omitted.

Directions to be tested: The FR1 requirement is specified as co-location requirement. For general description of co-location requirements, refer to subclause 4.12.

#### 6.8.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1. Select a CLTA according to the description in subclause 4.12 and parameters given in table 4.12.2.2-1.
2. Place the CLTA according to the description in sub-clause 4.12 and parameters given in table 4.12.2.3-1.
3. The test antenna(s) shall be dual (or single) polarized covering the same frequency range as the *NR BS* and the emission frequencies.
4. Several test antennas are required to cover both the *NR BS* and the whole emission frequency range.
5. Connect test antenna and CLTA to the measurement equipment as shown in Annex E1.5.
6. During the OTA emission measurements at the test antenna conducted output(s), both *NR BS* and CLTA are rotated around same axis.
7. The OTA emission measurement method shall be TRP, according to the procedure described in annex I.
8. The measurement device (signal analyzer) characteristics shall be:

- Detection mode: True RMS.

1. Set the *NR BS* to transmit:

- Set the *NR BS* to transmit maximum power according to the applicable test configuration in subclause 4.7 using the corresponding test models or set of physical channels in subclause 4.9.2.

1. Generate the interfering signal via the CLTA. The CLTA is fed with Prated,t,TRP, equally divided on all the supported polarizations, from the same signal generator source:

- using test model as defined in subclause 4.9.2, at a centre frequency offset according to the conditions in table 9.8.2-1 in TS 38.104 [1], but exclude interfering frequencies that are outside of the allocated downlink operating band or interfering frequencies that are not completely within the sub-block gap or within the *Inter RF Bandwidth gap*.

1. Adjust the interfering signal level at the CLTA conducted input (s) as defined in:

- transmitter intermodulation table 9.8.2-1 in TS 38.104 [1].

1. If the interferer signal is applicable according to subclause 4.7, perform the unwanted emission tests specified in subclauses 6.7.3 (OTA ACLR) and 6.7.4 (OTA OBUE) for all third and fifth order intermodulation products which appear in the frequency ranges defined in subclauses 6.7.3 and 6.7.4 (Note 2). The width of the intermodulation products shall be taken into account.
2. If the interferer signal is applicable according to subclause 4.7, perform the Transmitter spurious emissions test as specified in subclause 6.7.5 (OTA spurious emission), except OTA co-location spurious emission, for all third and fifth order intermodulation products which appear in the frequency ranges defined in subclause 6.7.5 (Note 2). The width of the intermodulation products shall be taken into account.
3. Verify that the emission level does not exceed the required level in subclause 6.8.5 (Test requirements) with the exception of interfering signal frequencies.
4. Repeat the test for the remaining interfering signal centre frequency offsets according to the conditions of:

- transmitter intermodulation table 9.8.2-1 in TS 38.104 [1].

1. Repeat the test for the remaining interfering signals defined in subclause 4.7 for requirements 6.7.3 (OTA ACLR), 6.7.4 (OTA OBUE) and 6.7.5 (OTA spurious emission), except OTA co-location spurious emission.

In addition, for *multi-band RIB,* the following steps shall apply:

1. For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

NOTE 1: The third order intermodulation products are centred at 2F1±F2 and 2F2±F1. The fifth order intermodulation products are centred at 3F1±2F2, 3F2±2F1, 4F1±F2, and 4F2±F1 where F1 represents the test signal centre frequency or centre frequency of each sub-block and F2 represents the interfering signal centre frequency. The widths of intermodulation products are:

- (n\*BWF1 + m\*1.6MHz) for the nF1±mF2 products;

- (n\*1.6MHz + m\* BWF1) for the nF2±mF1 products;

where BWF1 represents the test signal RF bandwidth or channel bandwidth in case of single carrier, or sub-block bandwidth.

NOTE 2: During the conformance test the interferer signal can be applied on one side of the wanted signal, while the transmitter intermodulation emission is measured only on the opposite side of the wanted signal. This applies for intermodulation products which are within the operating band or OBUE region.

### 6.8.5 Test requirements

#### 6.8.5.1 Requirement for *BS type 1-O*

The transmitter intermodulation level shall not exceed the TRP unwanted emission limits specified for OTA transmitter spurious emission in subclause 6.7.5 (except co-location with other base stations), OTA out-of-band emissions in subclause 6.7.4 and OTA ACLR in subclause 6.7.3 in the presence of a wanted signal and an interfering signal, defined in table 6.8.5.1-1.

The requirement is applicable outside the *Base Station RF Bandwidth edges*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth* *edges* or *Radio Bandwidth* edges.

For RIBs supporting operation in *non-contiguous spectrum*, the requirement is also applicable inside a *sub-block gap* for interfering signal offsets where the interfering signal falls completely within the *sub-block gap*. The interfering signal offset is defined relative to the *sub-block* edges.

For RIBs supporting operation in multiple *operating bands*, the requirement shall apply relative to the *Base Station RF Bandwidth* *edges* of each *operating band*. In case the inter *Base Station RF Bandwidth* gap is less than [15 MHz], the requirement in the gap shall apply only for interfering signal offsets where the interfering signal falls completely within the inter *Base Station RF Bandwidth* gap.

**Table 6.8.5.1-1: Interfering and wanted signals for  
the OTA transmitter intermodulation requirement**

| **Parameter** | **Value** |
| --- | --- |
| Wanted signal | NR single or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers |
| Interfering signal type | NR signal of minimum supported *BS channel bandwidth* (BWChannel) and SCS set to 15 kHz |
| Interfering signal level | The interfering signal level is the same power level as the BS (Prated,t,TRP) fed into a CLTA. |
| Interfering signal centre frequency offset from the lower (upper) edge of the wanted signal | , for n=1, 2 and 3 |
| NOTE: The Prated,t,TRP is split between polarizations at the CLTA. | |

# 7 Radiated receiver characteristics

## 7.1 General

General test conditions for receiver tests are given in clause 4, including interpretation of measurement results and configurations for testing. BS configurations for the tests are defined in clause 4.5.

Unless otherwise stated the requirements in clause 7 apply during the BS receive period.

[The throughput requirements defined for the receiver characteristics in this clause do not assume HARQ transmissions.]

When the BS is configured to receive multiple carriers, all the throughput requirements are applicable for each received carrier.

Each requirement shall be met over the RoAoA specified.

For requirements which are to be met over the *OTA REFSENS RoAoA* absolute requirement values are offset by the following term:

ΔOTAREFSENS = 44.1 - 10\*log10(BeWθ,REFSENS\*BeWφ,REFSENS) (dB) for the reference direction.

And

ΔOTAREFSENS = 41.1 - 10\*log10(BeWθ,REFSENS\*BeWφ,REFSENS) (dB) for all other directions.

For requirements which are to be met over the *minSENS RoAoA* absolute requirement values are offset by the following term:

ΔminSENS = PREFSENS – EISminSENS (dB)

## 7.2 OTA sensitivity

### 7.2.1 Definition and applicability

The OTA sensitivity requirement is based upon the declaration of one or more *OTA sensitivity direction declarations* (OSDD), related to a *BS type 1-H* and *BS type 1-O* *receiver*.

The *BS type 1-H* and *BS type 1-O* *receiver* may optionally be capable of redirecting/changing the *receiver target* by means of adjusting BS settings resulting in multiple *sensitivity RoAoA*. The *sensitivity RoAoA* resulting from the current AAS BS settings is the active *sensitivity RoAoA*.

If the AAS BS is capable of redirecting the *receiver target* related to the OSDD then the OSDD shall include:

- *BS channel bandwidth* and declared minimum EISlevel applicable to any active *sensitivity RoAoA* inside the *receiver target redirection range* in the OSDD.

- A declared *receiver target redirection range*, describing all the angles of arrival that can be addressed for the OSDD through alternative settings in the *BS*.

- Five declared *sensitivity RoAoA* comprising the conformance testing directions as detailed in [x].

- The *receiver target reference direction*.

NOTE 1: Some of the declared *sensitivity RoAoA* may coincide depending on the redirection capability.

NOTE 2: In addition to the declared *sensitivity RoAoA*, several *sensitivity RoAoA* may be implicitly defined by the *receiver target redirection range* without being explicitly declared in the OSDD.

If the *BS* is not capable of redirecting the *receiver target* related to the OSDD, then the OSDD includes only:

- *BS channel bandwidth* and declared minimum EISlevel applicable to the *sensitivity RoAoA* in the OSDD.

- One declared active *sensitivity RoAoA*.

- The *receiver target reference direction*.

NOTE 3: For *BS* without target redirection capability, the declared (fixed) *sensitivity RoAoA* is always the active *sensitivity RoAoA*.

The OTA sensitivity EIS level declaration shall apply to each supported polarization, under the assumption of *polarization match*.

### 7.2.2 Minimum requirement

For a received signal whose AoA of the incident wave is within the active *sensitivity RoAoA* of an OSDD, the error rate criterion as described in 3GPP TS 38.104 [2] subclause 7.2.2 shall be met when the level of the arriving signal is equal to the minimum EIS level in the respective declared set of EIS level and *BS channel bandwidth*.

### 7.2.3 Test Purpose

The test purpose is to verify that the BS can meet the BER or throughput requirement for a specified measurement channel at the EIS level and the range of angles of arrival declared in the OSDD.

### 7.2.4 Method of test

#### 7.2.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

Directions to be tested:

* *receiver target reference direction* (D.36),
* conformance test directions (D.38).

#### 7.2.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex x.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Set the BS in the declared direction to be tested.

4) Ensure the polarisation is accounted for such that all the power from the test antenna is captured by the BS under test.

5) Configure the beam peak direction of the BS according to declared reference beam direction pair for the appropriate beam identifier.

6) Set the BS to transmit beam(s) of the same operational band as the OSDD being tested according to the appropriate test configuration in clause 5.

7) Start the signal generator for the wanted signal to transmit:

- The test signal as specified in subclause 7.2.5.4.

8) Set the test signal mean power so the calibrated radiated power at the BS Antenna Array coordinate system reference point is as specified in subclause 7.2.5.

9) Measure:

- Throughput according to annex A for each supported polarization.

10) Repeat steps 3 to 9 for all OSDD(s) declared for the BS (D.28).

For multi-band capable BS and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

### 7.2.5 Test requirements

#### 7.2.5.1 General

The minimum EIS level is a declared figure (D.32, D.33) for each OSDD (D.28). The test requirement is calculated from the declared value offset by the EIS Test Tolerance specified in subclause 4.1.

#### 7.2.5.2 Test requirements for *BS type 1-H* and *BS type 1-O*

For each measured carrier, the throughput measured in step 9 of subclause 7.2.4.2 shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in TS 38.104 [2] annex A.1 with parameters specified in table 7.2.5.2-1.

Table 7.2.5.2-1: EIS levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BS channel bandwidth [MHz] | Sub-carrier spacing [kHz] | Reference measurement channel | EIS level [dBm] | | |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15, 25, 30 | 15 | G- FR1-A1-1 in clause A.1 in [1] | Declared minimum EIS + 1.3 | Declared minimum EIS + 1.4 | Declared minimum EIS + 1.6 |
| 5, 10, 15, 25, 30 | 30 | G- FR1-A1-2 in clause A.1 in [1] | Declared minimum EIS + 1.3 | Declared minimum EIS + 1.4 | Declared minimum EIS + 1.6 |
| 10, 15, 25, 30 | 60 | G- FR1-A1-3 in clause A.1 in [1] | Declared minimum EIS + 1.3 | Declared minimum EIS + 1.4 | Declared minimum EIS + 1.6 |
| 20, 40, 50, 60, 70, 80, 90, 100 | 15 | G- FR1-A1-4 in clause A.1 in [1] | Declared minimum EIS + 1.3 | Declared minimum EIS + 1.4 | Declared minimum EIS + 1.6 |
| 20, 40, 50, 60, 70, 80, 90, 100 | 30 | G- FR1-A1-5 in clause A.1 in [1] | Declared minimum EIS + 1.3 | Declared minimum EIS + 1.4 | Declared minimum EIS + 1.6 |
| 20, 40, 50, 60, 70, 80, 90, 100 | 60 | G- FR1-A1-6 in clause A.1 in [1] | Declared minimum EIS + 1.3 | Declared minimum EIS + 1.4 | Declared minimum EIS + 1.6 |

#### 7.2.5.3 Test requirements for *BS type 2-O*

There is no OTA sensitivity requirement for FR2, the OTA sensitivity is the same as the OTA reference sensitivity in subclause 7.3.

## 7.3 OTA reference sensitivity level

### 7.3.1 Definition and applicability

The OTA REFSENS requirement is a directional requirement and is intended to ensure the minimum OTA reference sensitivity level for a declared *OTA REFSENS RoAoA*. The OTA reference sensitivity power level EISREFSENS is the minimum mean power received at the RIB at which a reference performance requirement shall be met for a specified reference measurement channel. The OTA REFSENS requirement shall apply to each supported polarization, under the assumption of *polarization match*.

### 7.3.2 Minimum requirement

For *BS type 1-O* the minimum requirement is in TS 38.104 [1], subclause 10.3.2.

For *BS type 2-O* the minimum requirement is in TS 38.104 [1], subclause 10.3.3.

### 7.3.3 Test Purpose

The test purpose is to verify that the BS can meet the throughput requirement for a specified measurement channel at the EISREFSENS level and the range of angles of arrival within the *OTA REFSENS RoAoA*.

### 7.3.4 Method of test

#### 7.3.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier:

- B, M and T; see subclause 4.9.1.

Directions to be tested:

* OTA REFSENS *receiver target reference direction* (D.62),
* OTA REFSENS conformance test directions (D.63).

#### 7.3.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex D1.1.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Align the BS with the test antenna in the declared direction to be tested.

4) Ensure the polarisation is accounted for such that all the power from the test antenna is captured by the BS under test.

5) Configure the beam peak direction of the BS according to the *OTA REFSENS RoAoA* for the appropriate beam identifier.

6) Set the BS to transmit beam(s) of the same operational band as the *OTA REFSENS RoAoA* being tested according to the appropriate test configuration in clause 5.

7) Start the signal generator for the wanted signal to transmit:

- The test signal as specified in subclause 7.3.5.4.

8) Set the test signal mean power so the calibrated radiated power at the BS Antenna Array coordinate system reference point is as specified in subclause 7.3.5.

9) Measure:

- Throughput according to annex x for each supported polarization.

10) Repeat steps 3 to 9 for all OTA REFSENS conformance test directions of the BS (D.63).

For multi-band capable FR1 BS and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

### 7.3.5 Test requirements

#### 7.3.5.1 General

The FR1 EISREFSENS level is the conducted REFSENS requirement value offset by ΔOTAREFSENS. The test requirement is calculated from the EISREFSENS level offset by the EISREFSENS Test Tolerance specified in subclause 4.1.

#### 7.3.5.2 Test requirements for *BS type 1-O*

For each measured carrier, the throughput measured in step 9 of subclause 7.3.4.2 shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in annex TS 38.104 [2] A.1 with parameters specified in tables 7.3.5.2-1 to 7.3.5.2-3.

Table 7.3.5.2-1: Wide Area BS EISREFSENS levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BS channel bandwidth [MHz] | Sub-carrier spacing [kHz] | Reference measurement channel | EISREFSENS  [dBm] | | |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15, 25, 30 | 15 | G- FR1-A1-1 | -100.4 – ΔOTAREFSENS | -100.3 – ΔOTAREFSENS | -100.1 – ΔOTAREFSENS |
| 5, 10, 15, 25, 30 | 30 | G- FR1-A1-2 | -100.5 – ΔOTAREFSENS | -100.4 – ΔOTAREFSENS | -100.2 – ΔOTAREFSENS |
| 10, 15, 25, 30 | 60 | G- FR1-A1-3 | -97.6 – ΔOTAREFSENS | -97.5 – ΔOTAREFSENS | -97.3 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 15 | G- FR1-A1-4 | -94 – ΔOTAREFSENS | -93.9 – ΔOTAREFSENS | -93.7 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 30 | G- FR1-A1-5 | -94.3 – ΔOTAREFSENS | -94.2 – ΔOTAREFSENS | -94 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 60 | G- FR1-A1-6 | -94.4 – ΔOTAREFSENS | -94.3 – ΔOTAREFSENS | -94.1 – ΔOTAREFSENS |
| NOTE: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | |

Table 7.3.5.2-2: Medium Range BS EISREFSENS levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BS channel bandwidth [MHz] | Sub-carrier spacing [kHz] | Reference measurement channel | EISREFSENS  [dBm] | | |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15, 25, 30 | 15 | G- FR1-A1-1 | -95.4 – ΔOTAREFSENS | -95.3 – ΔOTAREFSENS | -95.1 – ΔOTAREFSENS |
| 5, 10, 15, 25, 30 | 30 | G- FR1-A1-2 | -95.5 – ΔOTAREFSENS | -95.4 – ΔOTAREFSENS | -95.2 – ΔOTAREFSENS |
| 10, 15, 25, 30 | 60 | G- FR1-A1-3 | -92.6 – ΔOTAREFSENS | -92.5 – ΔOTAREFSENS | -92.3 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 15 | G- FR1-A1-4 | -89 – ΔOTAREFSENS | -88.9 – ΔOTAREFSENS | -88.7 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 30 | G- FR1-A1-5 | -89.3 – ΔOTAREFSENS | -89.2 – ΔOTAREFSENS | -89 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 60 | G- FR1-A1-6 | -89.4 – ΔOTAREFSENS | -89.3 – ΔOTAREFSENS | -89.1 – ΔOTAREFSENS |
| NOTE: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | |

Table 7.3.5.2-3: Local Area BS EISREFSENS levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BS channel bandwidth [MHz] | Sub-carrier spacing [kHz] | Reference measurement channel | EISREFSENS  [dBm] | | |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15, 25, 30 | 15 | G- FR1-A1-1 | -92.4 – ΔOTAREFSENS | -92.3 – ΔOTAREFSENS | -92.1 – ΔOTAREFSENS |
| 5, 10, 15, 25, 30 | 30 | G- FR1-A1-2 | -92.5 – ΔOTAREFSENS | -92.4 – ΔOTAREFSENS | -92.2 – ΔOTAREFSENS |
| 10, 15, 25, 30 | 60 | G- FR1-A1-3 | -89.6 – ΔOTAREFSENS | -89.5 – ΔOTAREFSENS | -89.3 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 15 | G- FR1-A1-4 | -86 – ΔOTAREFSENS | -85.9 – ΔOTAREFSENS | -85.7 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 30 | G- FR1-A1-5 | -86.3 – ΔOTAREFSENS | -86.2 – ΔOTAREFSENS | -86 – ΔOTAREFSENS |
| 20, 40, 50, 60, 70, 80, 90, 100 | 60 | G- FR1-A1-6 | -86.4 – ΔOTAREFSENS | -86.3 – ΔOTAREFSENS | -86.1 – ΔOTAREFSENS |
| NOTE: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | |

#### 7.3.5.3 Test requirements for *BS type 2-O*

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in the corresponding table and TS 38.104 [2] annex A.1 when the OTA test signal is at the corresponding EISREFSENS level and arrives from any direction within the *FR2 OTA REFSENS RoAoA*.

EISREFSENS levels are derived from a single declared basis level EISREFSENS\_50M, which is based on a reference measurement channel with 50MHZ *BS channel bandwidth*. EISREFSENS\_50M itself is not a requirement and although it is based on a reference measurement channel with 50MHz BS channel bandwidth it does not imply that BS has to support 50MHz *BS channel bandwidth*.

For wide area BS, EISREFSENS\_50MC is an integer value in the range -96 to -119 dBm. The specific value is declared by the vendor.

For medium range BS, EISREFSENS\_50M is an integer value in the range -91 to -114 dBm. The specific value is declared by the vendor.

For local area BS, EISREFSENS\_50M is an integer value in the range -86 to -109 dBm. The specific value is declared by the vendor.

Table 7.3.5.3-1 FR2 OTA reference sensitivity requirement

|  |  |  |  |
| --- | --- | --- | --- |
| BS channel bandwidth  (MHz) | Sub-carrier spacing  (kHz) | FRC | EISREFSENS level  (dBm) |
| 50, 100, 200 | 60 | G-FR2-A1-1 | EISREFSENS\_50M + 2.4 |
| 50 | 120 | G-FR2-A1-2 | EISREFSENS\_50M + 2.4 |
| 100, 200, 400 | 120 | G-FR2-A1-3 | EISREFSENS\_50M + 3 + 2.4 |
| NOTE 1: EISREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*.  NOTE 2: The declared EISREFSENS\_50M shall be within the range specified in table 10.3.3-2. | | | |

## 7.4 OTA dynamic range

### 7.4.1 Definition and applicability

The OTA dynamic range is a measure of the capability of the receiver unit to receive a wanted signal in the presence of an interfering signal inside the received *BS channel bandwidth*.

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *FR1 OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

### 7.4.2 Minimum requirement

For *BS type 1-O*, the minimum requirement is in TS 38.104 [2], subclause 10.4.2.

### 7.4.3 Test purpose

The test purpose is to verify that at the BS receiver dynamic range, the relative throughput shall fulfil the specified limit.

### 7.4.4 Method of test

#### 7.4.4.1 Initial conditions

Test environment: Normal: see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

Directions to be tested: *OTA REFSENS receiver target reference direction* (D.62).

#### 7.4.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex D.x.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Align the BS with the test antenna in the declared direction to be tested.

4) Ensure the polarisation is accounted for such that all the power from the test antenna is captured by the BS under test.

5) Set the test signal mean power so that the calibrated radiated power at the BS Antenna Array coordinate system reference point is as follows:

a) Set the signal generator for the wanted signal to transmit as specified in table 7.4.5.2-1 to 7.4.5.2-3.

b) Set the signal generator for the AWGN interfering signal at the same frequency as the wanted signal to transmit as specified in table 7.4.5.2-1 to 7.4.5.2-3.

6) Measure the throughput for each supported polarization.

For *multi-band RIB(s)* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

### 7.4.5 Test requirement

#### 7.4.5.1 General

The test requirement is calculated from the OTA wanted signal mean power level offset by the OTA dynamic range Test Tolerance specified in subclause 4.1.

#### 7.4.5.2 Test requirements for *BS type 1-O*

For each measured carrier, the throughput measured in step 6 of subclause 7.4.4.2 shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in TS 38.104 [2] annex A.2 with parameters specified in tables 7.4.5.2-1 to 7.4.5.2-3.

Table 7.4.5.2-1: Wide Area BS dynamic range

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| BS channel bandwidth [MHz] | Subcarrier spacing [kHz] | Reference measurement channel | Wanted signal mean power [dBm] | | | Interfering signal mean power [dBm] / BWConfig | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A2-1 | -70.4 – ΔOTAREFSENS | -70.4 – ΔOTAREFSENS | -70.4 – ΔOTAREFSENS | -82.5 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -71.1 – ΔOTAREFSENS | -71.1 – ΔOTAREFSENS | -71.1 – ΔOTAREFSENS |
| 10 | 15 | G-FR1-A2-1 | -70.4 – ΔOTAREFSENS | -70.4 – ΔOTAREFSENS | -70.4 – ΔOTAREFSENS | -79.3 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -71.1 – ΔOTAREFSENS | -71.1 – ΔOTAREFSENS | -71.1 – ΔOTAREFSENS |
| 60 | G- FR1-A2-3 | -68.1 – ΔOTAREFSENS | -68.1 – ΔOTAREFSENS | -68.1 – ΔOTAREFSENS |
| 15 | 15 | G-FR1-A2-1 | -70.4 – ΔOTAREFSENS | -70.4 – ΔOTAREFSENS | -70.4 – ΔOTAREFSENS | -77.5 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -71.1 – ΔOTAREFSENS | -71.1 – ΔOTAREFSENS | -71.1 – ΔOTAREFSENS |
| 60 | G- FR1-A2-3 | -68.1 – ΔOTAREFSENS | -68.1 – ΔOTAREFSENS | -68.1 – ΔOTAREFSENS |
| 20 | 15 | G- FR1-A2-4 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -76.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 25 | 15 | G- FR1-A2-4 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -75.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 30 | 15 | G- FR1-A2-4 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -74.4 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 40 | 15 | G- FR1-A2-4 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -73.1 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 50 | 15 | G- FR1-A2-4 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -72.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 60 | 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -71.4 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 70 | 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -70.8 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 80 | 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -70.1 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 90 | 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -69.6 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| 100 | 30 | G- FR1-A2-5 | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | -69.1 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS | -64.5 – ΔOTAREFSENS |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | | | |

Table 7.4.5.2-2: Medium Range BS dynamic range

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| BS channel bandwidth [MHz] | Subcarrier spacing [kHz] | Reference measurement channel | Wanted signal mean power [dBm] | | | Interfering signal mean power [dBm] / BWConfig | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A2-1 | -65.4 – ΔOTAREFSENS | -65.4 – ΔOTAREFSENS | -65.4 – ΔOTAREFSENS | -77.5 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -66.1 – ΔOTAREFSENS | -66.1 – ΔOTAREFSENS | -66.1 – ΔOTAREFSENS |
| 10 | 15 | G-FR1-A2-1 | -65.4 – ΔOTAREFSENS | -65.4 – ΔOTAREFSENS | -65.4 – ΔOTAREFSENS | -74.3 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -66.1 – ΔOTAREFSENS | -66.1 – ΔOTAREFSENS | -66.1 – ΔOTAREFSENS |
| 60 | G- FR1-A2-3 | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS |
| 15 | 15 | G-FR1-A2-1 | -65.4 – ΔOTAREFSENS | -65.4 – ΔOTAREFSENS | -65.4 – ΔOTAREFSENS | -72.5 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -66.1 – ΔOTAREFSENS | -66.1 – ΔOTAREFSENS | -66.1 – ΔOTAREFSENS |
| 60 | G- FR1-A2-3 | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS |
| 20 | 15 | G- FR1-A2-4 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -71.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 25 | 15 | G- FR1-A2-4 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -70.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 30 | 15 | G- FR1-A2-4 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -69.4 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 40 | 15 | G- FR1-A2-4 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -68.1 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 50 | 15 | G- FR1-A2-4 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -67.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | --59.2 – ΔOTAREFSENS | --59.2 – ΔOTAREFSENS | --59.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 60 | 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -66.4 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 70 | 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -65.8 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 80 | 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -65.1 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 90 | 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -64.6 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| 100 | 30 | G- FR1-A2-5 | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -59.2 – ΔOTAREFSENS | -64.1 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS | -59.5 – ΔOTAREFSENS |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | | | |

Table 7.4.5.2-3: Local Area BS dynamic range

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| BS channel bandwidth [MHz] | Subcarrier spacing [kHz] | Reference measurement channel | Wanted signal mean power [dBm] | | | Interfering signal mean power [dBm] / BWConfig | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A2-1 | -62.4 – ΔOTAREFSENS | -62.4 – ΔOTAREFSENS | -62.4 – ΔOTAREFSENS | -74.5 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS |
| 10 | 15 | G-FR1-A2-1 | -62.4 – ΔOTAREFSENS | -62.4 – ΔOTAREFSENS | -62.4 – ΔOTAREFSENS | -71.3 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS |
| 60 | G- FR1-A2-3 | -60.1 – ΔOTAREFSENS | -60.1 – ΔOTAREFSENS | -60.1 – ΔOTAREFSENS |
| 15 | 15 | G-FR1-A2-1 | -62.4 – ΔOTAREFSENS | -62.4 – ΔOTAREFSENS | -62.4 – ΔOTAREFSENS | -69.5 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-2 | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS | -63.1 – ΔOTAREFSENS |
| 60 | G- FR1-A2-3 | -60.1 – ΔOTAREFSENS | -60.1 – ΔOTAREFSENS | -60.1 – ΔOTAREFSENS |
| 20 | 15 | G- FR1-A2-4 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -68.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 25 | 15 | G- FR1-A2-4 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -67.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 30 | 15 | G- FR1-A2-4 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -66.4 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 40 | 15 | G- FR1-A2-4 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -65.1 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 50 | 15 | G- FR1-A2-4 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -64.2 – ΔOTAREFSENS | AWGN |
| 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 60 | 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -63.4 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 70 | 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -62.8 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 80 | 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -62.1 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 90 | 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -61.6 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| 100 | 30 | G- FR1-A2-5 | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -56.2 – ΔOTAREFSENS | -61.1 – ΔOTAREFSENS | AWGN |
| 60 | G- FR1-A2-6 | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS | -56.5 – ΔOTAREFSENS |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | | | |

## 7.5 OTA in-band selectivity and blocking

### 7.5.1 OTA adjacent channel selectivity

#### 7.5.1.1 Definition and applicability

OTA Adjacent channel selectivity (ACS) is a measure of the receiver’s ability to receive an OTA wanted signal at its assigned channel frequency in the presence of an OTA adjacent channel signal with a specified centre frequency offset of the interfering signal to the band edge of a victim system.

#### 7.5.1.2 Minimum requirement

For *BS type 1-O*, the minimum requirement is in TS 38.104 [2], subclause 10.5.1.2.

For *BS type 2-O*, the minimum requirement is in TS 38.104 [2], subclause 10.5.1.3.

#### 7.5.1.3 Test purpose

The test purpose is to verify the ability of the BS receiver filter to suppress interfering signals in the channels adjacent to the wanted channel.

#### 7.5.1.4 Method of test

##### 7.5.1.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier:

- M; see subclause 4.9.1.

*Base Station RF Bandwidth* edge position to be tested for multi-carrier and/or CA:

- MRFBW in single-band operation, see subclause 4.9.1;

- BRFBW\_T’RFBW and B’RFBW\_TRFBW in multi-band operation, see subclause 4.9.1.

Directions to be tested:

* For *BS type 1-O*, *receiver target reference direction* (D.36),
* For *BS type 2-O*, *OTA REFSENS receiver target reference direction* (D.62).

##### 7.5.1.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex D.x.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Align the BS with the test antenna in the declared direction to be tested.

4) Ensure the polarisation match is accomplished such that all the power from the test antenna is captured by the BS under test.

5) Set the test signal mean power so that the calibrated radiated power at the BS Antenna Array coordinate system reference point is as follows:

a) Set the signal generator for the wanted signal to transmit as specified in table 7.5.1.5.1-1 for *BS type 1-O* and table 7.5.1.5.2-1 for *BS type 2-O*.

b) Set the signal generator for the interfering signal at the adjacent channel frequency of the wanted signal to transmit as specified in table 7.5.1.5.1-1 for *BS type 1-O* and table 7.5.1.5.2-1 for *BS type 2-O*.

6) Measure throughput for each supported polarization, for multi-carrier and/or CA operation the throughput shall be measured for relevant carriers specified by the test configuration specified in subclause 4.7.2.

For *multi-band RIB(s)* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

#### 7.5.1.5 Test requirement

##### 7.5.1.5.1 General

The test requirement is calculated from the OTA wanted signal mean power level offset by the OTA ACS Test Tolerance specified in subclause 4.1.

##### 7.5.1.5.2 Test requirements for *BS type 1-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption o*f polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel.

For FR1, the OTA wanted and the interfering signal are specified in table 7.5.1.5.2-1 and table 7.5.1.5.2-2 for ACS. The reference measurement channel for the OTA wanted signal is identified in subclause 7.3.5.2 and is further specified in TS 38.104 [2] annex A.1. The characteristics of the interfering signal is further specified in TS 38.104 [2] annex D.

The OTA ACS requirement is applicable outside the Base Station RF Bandwidth or Radio Bandwidth. The OTA interfering signal offset is defined relative to the Base station RF Bandwidth edges or Radio Bandwidth edges.

For RIBs supporting operation in *non-contiguous spectrum* within any operating band, the OTA ACS requirement shall apply in addition inside any sub-block gap, in case the sub-block gap size is at least as wide as the NR interfering signal in table 7.5.1.5.2-2. The OTA interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For *multi-band RIBs*, the OTA ACS requirement shall apply in addition inside any Inter RF Bandwidth gap, in case the Inter RF Bandwidth gap size is at least as wide as the NR interfering signal in table 7.5.1.5.2-2. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.

Table 7.5.1.5.2-1: OTA ACS requirement for *BS type 1-O*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Wanted signal mean power [dBm]  (Note 2) | | | Interfering signal mean power [dBm] |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  (Note 1) | EISminSENS + 6dB | EISminSENS + 6dB | EISminSENS + 6dB | Wide Area: -52 – ΔminSENS  Medium Range: -47– ΔminSENS  Local Area: -44– ΔminSENS |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that bandwidth  NOTE 2: EISminSENS depends on the *BS channel bandwidth* as specified in TS 38.104 [2], subclause 10.2.1. | | | | |

Table 7.5.1.5.2-2: OTA ACS interferer frequency offset for *BS type 1-O*

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap [MHz] | Type of interfering signal |
| 5 | [±2.5025] | 5MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 10 | [±2.5075] | 5MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 15 | [±2.5125] | 5MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 20 | [±2.5025] | 5MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 25 | [±9.535] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 30 | [±9.585] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 40 | [±9.535] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 50 | [±9.485] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 60 | [±9.585] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 70 | [±9.535] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 80 | [±9.485] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 90 | [±9.585] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |
| 100 | [±9.535] | 20MHz DFT-s-OFDM NR signal  SCS: 15kHz |

##### 7.5.1.5.3 Test requirements for *BS type 2-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *FR2 OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption o*f polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel.

For FR2, the OTA wanted and the interfering signal are specified in table 7.5.1.5.3-1 and table 7.5.1.5.3-2 for ACS. The reference measurement channel for the OTA wanted signal is identified in subclause 7.3.5.3 and is further specified in TS 38.104 [2] annex A. The characteristics of the interfering signal is further specified in TS 38.104 [2] annex D.

The OTA ACS requirement is applicable outside the Base Station RF Bandwidth or Radio Bandwidth. The OTA interfering signal offset is defined relative to the Base station RF Bandwidth edges or Radio Bandwidth edges.

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA ACS requirement shall apply in addition inside any sub-block gap, in case the sub-block gap size is at least as wide as the NR interfering signal in table 7.5.1.5.3-2. The OTA interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

Table 7.5.1.5.3-1: OTA ACS requirement for *BS type 2-O*

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Wanted signal mean power [dBm] | | Interfering signal mean power [dBm] |
| 24.24 GHz < f ≤ 33.4 GHz | 37 GHz < f ≤ 52.6 GHz |
| 50, 100, 200, 400 | EISREFSENS + 6dB (Note 3) | EISREFSENS + 6dB (Note 3) | EISREFSENS\_50M + 27.7 (Note 1)  EISREFSENS\_50M + 26.7 (Note 2) |
| NOTE 1: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz.  NOTE 2: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz.  NOTE 3: EISREFSENS is specified in TS 38.104 [2], subclause 10.3.3. | | | |

Table 7.5.1.5.3-2: OTA ACS interferer frequency offset for *BS type 2-O*

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap [MHz] | Type of interfering signal |
| 50 | ±24.29 | 50MHz DFT-s-OFDM NR signal  60 kHz SCS |
| 100 | ±24.31 | 50MHz DFT-s-OFDM NR signal  60 kHz SCS |
| 200 | ±24.29 | 50MHz DFT-s-OFDM NR signal  60 kHz SCS |
| 400 | ±24.31 | 50MHz DFT-s-OFDM NR signal  60 kHz SCS |

### 7.5.2 OTA in-band blocking

#### 7.5.2.1 Definition and applicability

The OTA in-band blocking characteristics is a measure of the receiver’s ability to receive a OTA wanted signal at its assigned channel in the presence of an unwanted OTA interferer, which is an NR signal for general blocking or an NR signal with one RB for narrowband blocking.

#### 7.5.2.2 Minimum requirement

For *BS type 1-O*, the minimum requirement is in TS 38.104 [2], subclause 10.5.2.2.

For *BS type 2-O*, the minimum requirement is in TS 38.104 [2], subclause 10.5.2.3.

#### 7.5.2.3 Test purpose

The test purpose is to verify the ability of the BS receiver to withstand high-levels of in-band interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity.

#### 7.5.2.4 Method of test

##### 7.5.2.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

*Base Station RF Bandwidth* edge position to be tested for multi-carrier and/or CA:

- MRFBW in single-band operation, see subclause 4.9.1;

- BRFBW\_T’RFBW and B’RFBW\_TRFBW in multi-band operation, see subclause 4.9.1.

Directions to be tested:

* *OTA REFSENS receiver target reference direction* (D.62),
* *OTA REFSENS* conformance test directions (D.63),
* In addition, for *BS type 1-O*:
  + *receiver target reference direction* (D.36),
  + conformance test directions (D.38).

##### 7.5.2.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex D.x.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Align the BS with the test antenna in the declared direction to be tested.

4) Ensure the polarisation is accounted for such that all the power from the test antenna is captured by the BS under test.

5) Set the test signal mean power so that the calibrated radiated power at the BS Antenna Array coordinate system reference point is as follows:

a) Set the signal generator for the wanted signal to transmit as specified in table 7.5.2.5.1-1 for *BS type 1-O* and table 7.5.2.5.2-1 for *BS type 2-O*.

b) Set the signal generator for the interfering signal at the specified frequency offset from the wanted signal to transmit as specified in table 7.5.2.5.1-1 for *BS type 1-O* and table 7.5.2.5.2-1 for *BS type 2-O*.

6) Measure throughput for each supported polarization, for multi-carrier and/or CA operation the throughput shall be measured for relevant carriers specified by the test configuration specified in subclause 4.7.2.

7) Repeat steps 3 to 6 for all the specified measurement directions.

For *multi-band RIB(s)* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

#### 7.5.2.5 Test requirement

##### 7.5.2.5.1 General

The test requirement is calculated from the OTA wanted signal mean power level offset by the OTA in-band blocking Test Tolerance specified in subclause 4.1.

##### 7.5.2.5.2 Test requirements for *BS type 1-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and:

- when the wanted signal is based on EISREFSENS: the AoA of the incident wave of a received signal and the interfering signal are within the *FR1 OTA REFSENS RoAoA.*

- when the wanted signal is based on EISminSENS: the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with OTA wanted and OTA interfering signal specified in tables 7.5.2.5.2-1, table 7.5.2.5.2-2 and table 7.5.2.5.2-3 for general OTA and narrowband OTA blocking requirements. The reference measurement channel for the OTA wanted signal is identified in subclause 7.3.5.2 and is further specified in TS 38.104 [2] annex A.1. The characteristics of the interfering signal is further specified in TS 38.104 [2] annex D.

The OTA in-band blocking requirements apply outside the *Base Station RF Bandwidth* or *Radio Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth* *edges* or *Radio Bandwidth* edges.

For *BS type 1-O* the OTA in-band blocking requirement shall apply in the in-band blocking frequency range, which is defined within frequency range from FUL\_low - ΔfOOB to FUL\_high + ΔfOOB, excluding the downlink frequency range of the FDD *operating band,* where the ΔfOOB for *BS type 1-O* is defined in table 7.5.2.5.2-0.

Table 7.5.2.5.2-0: ΔfOOB offset for NR *operating bands* in FR1

|  |  |  |
| --- | --- | --- |
| BS type | *Operating band* characteristics | ΔfOOB (MHz) |
| *BS type 1-O* | FUL\_high – FUL\_low < 100 MHz | 20 |
| 100 MHz ≤ FUL\_high – FUL\_low ≤ 900 MHz | 60 |

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA in-band blocking requirements apply in addition inside any sub-block gap, in case the sub-block gap size is at least as wide as twice the interfering signal minimum offset in table 7.5.2.5.2-1. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For *multi-band RIBs*, the OTA in-band blocking requirements apply in the in-band blocking frequency ranges for each supported *operating band*. The requirement shall apply in addition inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as twice the interfering signal minimum offset in tables 7.5.2.5.2-1 and 7.5.2.5.2-3.

For a RIBs supporting operation in *non-contiguous spectrum* within any operating band, the OTA narrowband blocking requirements apply in addition inside any sub-block gap, in case the sub-block gap size is at least as wide as the interfering signal minimum offset in table 7.5.2.5.2-3. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For a *multi-band RIBs*, the OTA narrowband blocking requirements apply in the narrowband blocking frequency ranges for each supported *operating band*. The requirement shall apply in addition inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as the interfering signal minimum offset in table 7.5.2.5.2-3.

Table 7.5.2.5.2-1: General OTA blocking requirement for *BS type 1-O*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Wanted signal mean power [dBm] | | | Interfering signal mean power [dBm] | Interfering signal centre frequency minimum offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap [MHz] | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15, 20 | EISREFSENS + 6 dB | EISREFSENS + 6 dB | EISREFSENS + 6 dB | Wide Area: -43 - ΔOTAREFSENS  Medium Range: -38 - ΔOTAREFSENS  Local Area: -35 - ΔOTAREFSENS | ±7.5 | 5 MHz DFT-s-OFDM NR signal  SCS: 15 kHz |
| EISminSENS + 6 dB | EISminSENS + 6 dB | EISminSENS + 6 dB | Wide Area: -43 - ΔminSENS  Medium Range: -38 - ΔminSENS  Local Area: -35 - ΔminSENS | ±7.5 | 5 MHz DFT-s-OFDM NR signal  SCS: 15 kHz |
| 25 ,30, 40, 50, 60, 70, 80, 90, 100 | EISREFSENS + 6 dB | EISREFSENS + 6 dB | EISREFSENS + 6 dB | Wide Area: -43 - ΔOTAREFSENS  Medium Range: -38 - ΔOTAREFSENS  Local Area: -35 - ΔOTAREFSENS | ±30 | 20 MHz DFT-s-OFDM NR signal  SCS: 15 kHz |
| EISminSENS + 6 dB | EISminSENS + 6 dB | EISminSENS + 6 dB | Wide Area: -43 - ΔminSENS  Medium Range: -38 - ΔminSENS  Local Area: -35 - ΔminSENS | ±30 | 20 MHz DFT-s-OFDM NR signal  SCS: 15 kHz |
| NOTE: EISREFSENS and EISminSENS depends on the *BS channel bandwidth* as specified in TS 38.104 [2], subclause 10.3.2 and 10.2.1. | | | | | | |

Table 7.5.2.5.2-2: OTA narrowband blocking requirement for *BS type 1-O*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | OTA Wanted signal mean power [dBm] | | | OTA Interfering signal mean power [dBm] |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15, 20 | EISREFSENS + 6 dB | EISREFSENS + 6 dB | EISREFSENS + 6 dB | Wide Area: -49 - ΔOTAREFSENS  Medium Range: -44 - ΔOTAREFSENS  Local Area: -41 - ΔOTAREFSENS |
| EISminSENS + 6 dB | EISminSENS + 6 dB | EISminSENS + 6 dB | Wide Area: -49 - ΔminSENS  Medium Range: -44 - ΔminSENS  Local Area: -41 - ΔminSENS |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | EISREFSENS + 6 dB | EISREFSENS + 6 dB | EISREFSENS + 6 dB | Wide Area: -49 - ΔOTAREFSENS  Medium Range: -44 - ΔOTAREFSENS  Local Area: -41 - ΔOTAREFSENS |
| EISminSENS + 6 dB | EISminSENS + 6 dB | EISminSENS + 6 dB | Wide Area: -49 - ΔminSENS  Medium Range: -44 - ΔminSENS  Local Area: -41 - ΔminSENS |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that bandwidth.  NOTE 2: EISREFSENS and EISminSENS depends on the *BS channel bandwidth* as specified in TS 38.104 [2], subclause 10.3.2 and 10.2.1. | | | | |

Table 7.5.2.5.2-3: OTA narrowband blocking interferer frequency offsets for *BS type 1-O*

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Interfering RB centre frequency offset to the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap [kHz] | Type of interfering signal |
| 5 | ±([342.5] + m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 | 5 MHz DFT-s-OFDM NR signal, 1 RB  SCS: 15 kHz |
| 10 | ±([347.5] + m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 |
| 15 | ±([352.5] + m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 |
| 20 | ±([342.5] + m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 |
| 25 | ±([557.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 | 20 MHz DFT-s-OFDM NR signal, 1 RB  SCS: 15 kHz |
| 30 | ±([562.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 |
| 40 | ±([557.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 |
| 50 | ±([552.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 |
| 60 | ±([562.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 |
| 70 | ±([557.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 |
| 80 | ±([552.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 |
| 90 | ±([562.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 |
| 100 | ±([557.5] + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 100 |
| NOTE: Interfering signal consisting of one resource block is positioned at the stated offset, the channel bandwidthof the interfering signal is located adjacently to the lower/upper Base Station RF Bandwidth edge. | | |

##### 7.5.2.5.3 Test requirements for *BS type 2-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *FR2 OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption o*f polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel.

For *BS type 2-O*, the OTA wanted and OTA interfering signals are provided at RIB using the parameters in table 10.5.2.3-1 for general OTA blocking requirements. The reference measurement channel for the OTA wanted signal is identified in subclause 7.3.5.3 and is further specified in TS 38.104 [2] annex A.1. The characteristics of the interfering signal is further specified in TS 38.104 [2] annex D.

The OTA blocking requirements are applicable outside the *Base Station RF Bandwidth* or *Radio Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Radio Bandwidth* edges.

For *BS type 2-O* the OTA blocking requirement shall apply in the in-band blocking frequency range, which is defined within frequency range from FUL\_low - ΔfOOB to FUL\_high + ΔfOOB,where theΔfOOB for *BS type 2-O* is defined in table 7.5.2.5.3-0.

Table 7.5.2.5.3-0: ΔfOOB offset for NR *operating bands* in FR2

|  |  |  |
| --- | --- | --- |
| BS type | *Operating band* characteristics | ΔfOOB (MHz) |
| *BS type 2-O* | FUL\_high – FUL\_low ≤ 3250 MHz | 1500 |

For a RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA blocking requirements apply in addition inside any sub-block gap, in case the sub-block gap size is at least as wide as twice the interfering signal minimum offset in table 7.5.2.5.3-1. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

Table 7.5.2.5.3-1: General OTA blocking requirement for *BS type 2-O*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | OTA wanted signal mean power [dBm] | | OTA interfering signal mean power [dBm] | OTA interfering signal centre frequency offset  from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap [MHz] | Type of OTA interfering signal |
| 24.24 GHz < f ≤ 33.4 GHz | 37 GHz < f ≤ 52.6 GHz |
| 50, 100, 200, 400 | EISREFSENS + 6 dB | EISREFSENS + 6 dB | EISREFSENS\_50M + 33 dB | ±75 | 50 MHz DFT-s-OFDM NR signal  60 kHz SCS |
| NOTE: EISREFSENS and EISREFSENS\_50M are given in TS 38.104 [2], subclause 10.3.3. | | | | | |

## 7.6 OTA out-of-band blocking

### 7.6.1 Definition and applicability

The OTA out-of-band blocking characteristics are a measure of the receiver unit ability to receive a wanted signal at the *RIB* at its assigned channel in the presence of an unwanted interferer.

For the general OTA out-of-band blocking requirements applies to the wanted signal for each supported polarization, under the assumption of *polarization match.* The interferer shall be polarization matched for in-band frequencies, i.e. the incident waves of the wanted signal and the interferer shall have the same polarization and the polarization maintained for out-of-band frequencies.

In case of multiple supported polarizations, the tests for general out-of-band blocking and co-location blocking shall be performed per supported polarization, i.e. one polarization at a time.

### 7.6.2 Minimum requirement

The minimum requirement for *BS type 1-O* is defined in TS 38.104 [1], subclause 10.6.2.

The minimum requirement for *BS type 2-O* is defined in TS 38.104 [1], subclause 10.6.3.

### 7.6.3 Test purpose

The test stresses the ability of the receiver unit associated with the *RIB* under test to withstand high-level interference from unwanted signals at specified frequency bands, without undue degradation of its sensitivity.

### 7.6.4 Method of test

#### 7.6.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier (SC): M; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier (MC):

- MRFBW in *single-band RIB*, see subclause 4.9.1; BRFBW\_T'RFBW and B'RFBW\_TRFBW in *multi-band RIB*, see subclause 4.9.1.

In addition, for *multi-band RIB*:

- For BRFBW\_T'RFBW, blocking testing above the highest operating band may be omitted.

- For B'RFBW\_TRFBW, blocking testing below the lowest operating band may be omitted.

Directions to be tested:

* For *BS type 1-O*, receiver target reference direction (D.36).
* For *BS type 2-O*, *OTA REFSENS receiver target reference direction* (Dx62).

#### 7.6.4.2 Procedure

##### 7.6.4.2.1 NR BS type 1-O procedure for out-of-band blocking

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1. Place *NR BS* and the test antenna(s) according to annex E2.4.1.
2. Align the NR BS and test antenna(s) according to the directions to be tested.
3. Connect test antenna(s) to the measurement equipment as shown in annex E2.4.1.
4. Polarization match the impinging wanted signal to the supported NR BS element polarizations. The interferer signal polarization shall be meachanically aligned and fixed to the wanted signal polarization. If the test antenna does not cover both the wanted and interfering signal frequencies, separate test antennas for the wanted and interfering signal are required.
5. Generate the wanted signal in reference direction, according to the applicable test configuration (see subclause 4.8) using applicable reference measurement channel to the *RIB*, according to TS 38.104 [2], annex A.1.
6. Set the transmitter unit associated with the *RIB* under test to transmit in reference direction with the carrier set-up and power allocation according to the applicable test configuration(s) (see subclause 4.8).
7. Adjust the signal generators to the type of interfering signals, levels and the frequency offsets as specified for general test requirements in table 7.6.5.1.1-1 and, when applicable, for co-location test requirements in table 7.6.5.1.2-1.
8. The CW interfering signal shall be swept with a step size of 1 MHz within the specified range.
9. Measure the performance of the wanted signal at the receiver unit associated with the *RIB*, as defined in the subclause 7.6.5, for the relevant carriers specified by the test configuration in subclause 4.8.

In addition, for *multi-band RIB*, the following steps shall apply:

1. For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

##### 7.6.4.2.2 NR BS type 1-O procedure for co-location blocking

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1. Place *NR BS* and CLTA as specified in subclause 4.12.2.3.
2. Several CLTA are required to cover the whole co-location blocking frequency ranges. The CLTA shall be selected according to subclause 4.12.2.2.
3. Align the NR BS and test antenna(s) according to the directions to be tested.
4. Connect test antenna and CLTA to the measurement equipment as depicted in annex E2.4.2.
5. The *NR BS* receives the wanted signal in all supported polarizations, in the reference direction from the test antenna.
6. The OTA co-location blocking interferer is injected via the CLTA. The CLTA is fed with the specified co-location blocking interferer power per supported polarization.
7. Generate the wanted signal in reference direction, all supported polarizations, from the test antenna, according to the applicable test configuration (see subclause 4.8) using applicable reference measurement channel to the *RIB* , according to TS 38.141 [2], annex A.1.
8. Set the transmitter unit associated with the *RIB* under test to transmit in reference direction with the carrier set-up and power allocation according to the applicable test configuration(s) (see subclause 4.8).
9. Adjust the signal generators to the type of interfering signals, levels and the frequency offsets as specified for general test requirements in table 7.6.5.1.1-1 and, when applicable, for co-location test requirements in table 7.6.5.1.2-1.
10. The CW interfering signal shall be swept with a step size of 1 MHz within the specified range.
11. Measure the performance of the wanted signal at the receiver unit associated with the *RIB*, as defined in the subclause 7.6.5, for the relevant carriers specified by the test configuration in subclause 4.8.

In addition, for *multi-band RIB*, the following steps shall apply:

1. For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

##### 7.6.4.2.3 *BS type 2-O* procedure for out-of-band blocking

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing the specified measurements.

1. Place *NR BS* and the test antenna(s) according to annex E2.4.1.
2. Align the *NR BS* and test antenna(s) according to the directions to be tested.
3. Connect test antenna(s) to the measurement equipment as shown in annex E2.4.1.
4. Polarization match the impinging wanted signal to the supported *NR BS* element polarizations. The interferer signal polarization shall be mechanically aligned and fixed to the wanted signal polarization. If the test antenna does not cover both the wanted and interfering signal frequencies, separate test antennas for the wanted and interfering signal are required.
5. Generate the wanted signal, according to the applicable test configuration (see subclause 4.7) using applicable reference measurement channel to the *RIB*, according to TS 38.104 [2], annex A.1.
6. Set the transmitter unit associated with the *RIB* under test to transmit in reference direction with the carrier set-up and power allocation according to the applicable test configuration(s) (see subclause 4.7).
7. Adjust the signal generators to the type of interfering signals, levels and the frequency offsets as specified for general test requirements in table 7.6.5.2.1-1.
8. The interfering signal shall be swept within the frequency range and step size specified in table 7.6.4.2.3-1.
9. Measure the performance of the wanted signal at the receiver unit associated with the *RIB*, as defined in the subclause 7.6.5, for the relevant carriers specified by the test configuration in subclause 4.7.

**Table 7.6.4.2.3-1: Interferer signal step size**

|  |  |  |
| --- | --- | --- |
| **Frequency range**  **(MHz)** | **Minimum supported *BS channel bandwidth* (MHz)** | **Measurement**  **step size**  **(MHz)** |
| 30 to 6000 | 50, 100, 200, 400 | 1 |
| 6000 to 60000 | 50 | 15 |
| 100 | 30 |
| 200 | 60 |
| 400 | 60 |

### 7.6.5 Test requirements

#### 7.6.5.1 Requirement for *BS type 1-O*

The test requirement consists of general and co-location requirements.

##### 7.6.5.1.1 General

For OTA wanted and OTA interfering signals provided at the RIB using the parameters in table 7.6.5.1.1-1, the following requirements shall be met:

- The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in subclause 10.3.2 in TS 38.104 [1] for each *BS channel bandwidth* and further specified in Annex A.

For a *multi-band RIB*, the OTA out-of-band requirement shall apply for each supported *operating band*, with the exception that the in-band blocking frequency ranges of all supported *operating bands* according to subclause 7.4.2.2 in TS 38.104 [1] shall be excluded from the OTA out‑of‑band blocking requirement.

For *BS type 1-O* the OTA out-of-band blocking requirement apply from 30 MHz to FUL\_low - ΔfOOB and from FUL\_high + ΔfOOB up to 12750 MHz, including the downlink frequency range of the FDD *operating band*. The ΔfOOB for *BS type 1-O* is defined in table 7.5.2.5.2-0.

Table 7.6.5.1.1-1: OTA out-of-band blocking performance requirement

|  |  |  |
| --- | --- | --- |
| Wanted signal mean power  (dBm) | Interfering signal RMS field-strength  (V/m) | Type of interfering signal |
| EISminSENS + 6 dB  (Note 1) | 0.36 V/m | CW carrier |
| NOTE 1: EISminSENS depends on the *channel bandwidth* as specified in TS 38.104 [2], subclause 10.2.1.  NOTE 2: The RMS field-strength level in V/m is related to the interferer EIRP level at a distance described as , where EIRP is in W and r is in m; for example, 0.36 V/m is equivalent to 36 dBm at fixed distance of 30 m. | | |

##### 7.6.5.1.2 Co-location requirement

This additional OTA out-of-band blocking requirement may be applied for the protection of BS receivers when NR, E‑UTRA BS, UTRA BS, CDMA BS or GSM/EDGE BS operating in a different frequency band are co-located with a BS.

The requirement is a co-location requirement, the interferer power levels specified at the CLTA conducted input.

The interfering signal power is specified per polarization.

For OTA wanted and OTA interfering signal provided at the RIB using the parameters in table 7.6.5.1.2-1, the following requirements shall be met:

- The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in subclause 10.3.2 in [1] for each *BS channel bandwidth* and further specified in annex A in TS 38.104 [1]. The characteristics of the interfering signal is further specified in annex D in TS 38.104 [1].

For *BS type 1-O* the OTA blocking requirement for co-location with BS in other frequency bands is applied for all operating bands for which co-location protection is provided.

Table 7.6.5.1.2-1: OTA blocking requirement for co-location with BS in other frequency bands

| **Frequency range of interfering signal** | **Wanted signal mean power (dBm)** | **Interfering signal mean power for WA BS (dBm)** | **Interfering signal mean power for MR BS (dBm)** | **Interfering signal mean power for LA BS (dBm)** | **Type of interfering signal** |
| --- | --- | --- | --- | --- | --- |
| Frequency range of co-located downlink operating band | EISminSENS + 6 dB  (Note 1) | +46 | +38 | +24 | CW carrier |
| NOTE 1: EISminSENS depends on the BS class and on the *BS channel bandwidth* as specified in TS 38.104 [2], subclause 10.2.1..  NOTE 2: The requirement does not apply when the interfering signal falls within any of the supported uplink operating band(s) or in the 10 MHz frequency range immediately outside any of the supported uplink operating band(s).  NOTE 3: The specified interferer signal power level is applied to all supported CLTA input ports. | | | | | |

#### 7.6.5.2 Requirement for *BS type 2-O*

The test requirement consists of general requirements.

##### 7.6.5.2.1 General requirement

For OTA wanted and OTA interfering signals provided at the RIB using the parameters in table 7.6.5.2.1-1, the following requirements shall be met:

- The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in subclause 10.3.3 in TS 38.104 [2] for each *BS channel bandwidth* and further specified in annex A in TS 38.104 [2].

For *BS type 2-O* the OTA out-of-band blocking requirement apply from 30 MHz to FUL\_low – ΔfOOB and from FUL\_high + ΔfOOB up to min(2nd harmonic of the upper frequency edge of the *operating band*, 60 GHz). The ΔfOOB for *BS type 2-O* is defined in table 7.5.2.5.3-0.

Table 7.6.5.2.1-1: OTA out-of-band blocking performance requirement

| **Frequency range of interfering signal**  **(MHz)** | **Wanted signal mean power**  **(dBm)** | **Interferer RMS field-strength**  **(V/m)** | **Type of interfering signal** |
| --- | --- | --- | --- |
| 30 to 12750 | EISREFSENS\_50M + 6 dB | 0.36 | CW |
| 12750 to FUL\_low – ΔfOOB | EISREFSENS\_50M + 6 dB | 0.10 | CW |
| FUL\_high + ΔfOOB to min(2nd harmonic of the upper frequency edge of the operating band, 60000) | EISREFSENS\_50M + 6 dB | 0.10 | CW |
| NOTE: EISREFSENS is given in TS 38.104 [2], subclause 10.3.3. | | | |

## 7.7 OTA receiver spurious emissions

### 7.7.1 Definition and applicability

The OTA RX spurious emission is the power of the emissions radiated from the antenna array from a receiver unit.

Unless otherwise stated, all requirements are measured as mean power.

The OTA receiver spurious emission limits for FR1 shall apply from 30 MHz to 12.75 GHz, excluding the frequency range from ΔfOBUE below the lowest frequency of each supported downlink *operating band*, up to ΔfOBUE above the highest frequency of each supported downlink *operating band*, where the ΔfOBUE is defined in subclause 6.7.1. For some *operating bands*, the upper limit of the spurious range might be higher than 12.75 GHz in order to comply with the 5th harmonic limit of the downlink *operating band*, as specified in ITU-R recommendation SM.329 [5].

For *multi-band RIB* the above exclusion applies for each supported *operating band*.

The OTA transmitter spurious emission limits for FR2 shall apply from 30 MHz to 2nd harmonic of the upper frequency edge of the downlink *operating band*, excluding the frequency range from ΔfOBUE below the lowest frequency of each supported downlink *operating band*, up to ΔfOBUE above the highest frequency of each supported downlink *operating band*, where the ΔfOBUE is defined in subclause 6.7.1.

For a BS operating in FDD, OTA RX spurious emissions requirement do not apply as they are superseded by the OTA TX spurious emissions requirement. This is due to the fact that TX and RX spurious emissions cannot be distinguished in OTA domain.

For a BS operating in TDD, the OTA RX spurious emissions requirement shall apply during the *transmitter OFF period* only.

The metric used to capture OTA receiver spurious emissions for *BS type 1-O* and *BS type 2-O* is total radiated power (TRP), with the requirement defined at the RIB.

### 7.7.2 Minimum requirement

The minimum requirement for *BS type 1-O* is specified in TS 38.104 [2], subclause 10.7.2.

The minimum requirement for *BS type 2-O* is specified in TS 38.104 [2], subclause 10.7.3.

### 7.7.3 Test purpose

The test purpose is to verify if the receiver radiated spurious emissions from the BS at the RIB are within the specified minimum requirements.

### 7.7.4 Method of test

#### 7.7.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier, see subclause 4.9.1:

* For FR1:
  + B when testing from 30 MHz to FDL\_low - ΔfOBUE
  + T when testing from FDL\_high + ΔfOBUE to 12.75 GHz (or to 5th harmonic)
* For FR2:
  + B when testing from 30 MHz to FDL\_low - ΔfOBUE
  + T when testing from FDL\_high + ΔfOBUE to 2nd harmonic (or to 60 GHz)

RF bandwidth positions to be tested in single-band operation, see subclause 4.9.1:

* For FR1:
  + BRFBW when testing from 30 MHz to FDL\_low - ΔfOBUE
  + TRFBW when testing from FDL\_high + ΔfOBUE to 12.75 GHz (or to 5th harmonic)
* For FR2:
  + BRFBW when testing from 30 MHz to FDL\_low - ΔfOBUE
  + TRFBW when testing from FDL\_high + ΔfOBUE to 2nd harmonic (or to 60 GHz)

RF bandwidth positions to be tested in multi-band operation, see subclause 4.9.1:

* For FR1:
  + BRFBW\_T'RFBW when testing from 30 MHz to FDL\_Blow\_low - ΔfOBUE
  + B'RFBW\_TRFBW when testing from FDL\_Bhigh\_high + ΔfOBUE to 12.75 GHz (or to 5th harmonic)
  + BRFBW\_T'RFBW and B'RFBW\_TRFBW when testing from FDL\_Blow\_high + ΔfOBUE to FDL\_Bhigh\_low - ΔfOBUE
* For FR2:
  + BRFBW\_T'RFBW when testing from 30 MHz to FDL\_Blow\_low - ΔfOBUE
  + B'RFBW\_TRFBW when testing from FDL\_Bhigh\_high + ΔfOBUE to 2nd harmonic (or to 60 GHz)
  + BRFBW\_T'RFBW and B'RFBW\_TRFBW when testing from FDL\_Blow\_high + ΔfOBUE to FDL\_Bhigh\_low - ΔfOBUE

Directions to be tested: As the requirement is TRP the beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex xx) as long as the required TRP output power level is achieved.

#### 7.7.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Measurements shall use a measurement bandwidth in accordance to the conditions in subclause 7.7.5.

4) The measurement device characteristics shall be:

- Detection mode: True RMS.

5) Set the TDD BS to receive only.

6) Align the BS and the test antenna such that measurements to determine TRP can be performed (see annex I).

6) Measure the emission at the specified frequencies with specified measurement bandwidth

7) Repeat step 6-9 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

NOTE 1: the TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: the frequency sweep or the TRP measurement grid sweep may be done in any order

8) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

9) For *multi-band RIB(s)* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

### 7.7.5 Test requirement

#### 7.7.5.1 Test requirement for *BS type 1-O*

For RX only *multi-band RIB*, the OTA receiver spurious emissions requirements are subject to exclusion zones in each supported *operating band*.

The power of any spurious emission shall not exceed the levels in table 7.7.5.1-1:

Table 7.7.5.1-1: General OTA BS receiver spurious emission limits for *BS type 1-O*

| Spurious frequency range | Test limits  (Note 6) | Measurement bandwidth | Notes |
| --- | --- | --- | --- |
| 30 MHz – 1 GHz | -54.5 + X dBm | 100 kHz | Note 1 |
| 1 GHz – 6 GHz | -44.5 + X dBm | 1 MHz | Note 1, Note 2 |
| 6 GHz – 12.75 GHz | -42.8 + X dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the UL *operating band* in GHz | -42.8 + X dBm | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: Measurement bandwidths as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: This spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the UL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: The frequency range from ΔfOBUE below the lowest frequency of the BS transmitter operating band to ΔfOBUE above the highest frequency of the BS transmitter *operating band*, may be excluded from the requirement. ΔfOBUE is defined in subclause 6.7.1.  NOTE 5: For *multi-band* *RIBs*, the exclusion applies for all supported *operating bands*.  NOTE 6: X = 9 dB with the exception of operation in Region 2 where the FCC guidance for MIMO systems in [14] is applicable and any other territories where regulation requires, X = 0 dB. | | | |

#### 7.7.5.2 Test requirement for *BS type 2-O*

The power of any receiver spurious emission shall not exceed the limits in table 7.7.5.2-1.

Table 7.7.5.2-1: General OTA BS receiver spurious emission limits for *BS type 2-O*

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | Test limits | Measurement bandwidth | Notes |
| 30 MHz – 1 GHz | -54.5 dBm | 100 kHz | Note 1 |
| 1 GHz – 6 GHz | -44.5 dBm | 1 MHz | Note 1 |
| 6 GHz – 12.75 GHz | - 44.3dBm | 1 MHz | Note 1 |
| 12.75 GHz – min(2nd harmonic of the upper frequency edge of the UL operating band in GHz; [60] GHz) | -36 dBm | 1 MHz | Note 1, Note 2 |
| NOTE 1: Measurement bandwidth as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: The frequency range between 2.5 \* BWChannel below the first carrier frequency and 2.5 \* BWChannel above the last carrier frequency transmitted by the BS, where BWChannel is the *BS channel bandwidth* according to TS 38.104 [2] subclause 5.3, may be excluded from the requirement. However, frequencies that are more than ΔfOBUE below the lowest frequency of the BS *operating band* or more than ΔfOBUE above the highest frequency of the BS *operating band* shall not be excluded from the requirement. | | | |

## 7.8 OTA receiver intermodulation

### 7.8.1 Definition and applicability

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver unit to receive a wanted signal on its assigned channel frequency in the presence of two interfering signals which have a specific frequency relationship to the wanted signal. The requirement is defined as a directional requirement at the *RIB*.

### 7.8.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 10.8.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 10.8.3.

### 7.8.3 Test purpose

To verify that the BS receiver dynamic range, the relative throughput shall fulfil the specified limit.

### 7.8.4 Method of test

#### 7.8.4.1 Initial conditions

Test environment: Normal, annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- MRFBW  for single-band operation, see subclause 4.9.1.

- BRFBW\_T'RFBW and B'RFBW\_TRFBW for multi-band operation, see subclause 4.9.1.

Directions to be tested:

* OTA REFSENS receiver target reference direction (D.62).
* In addition, for *BS type 1-O*, receiver target reference direction (D.36).

#### 7.8.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in Annex D1.1.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Set the BS in the declared direction to be tested.

4) Ensure the polarisation is accounted for such that all the power from the test antenna is captured by the BS under test.

5) Configure the beam peak direction of the BS according to declared reference beam direction pair for the appropriate beam identifier.

6) Set the BS to transmit the beam(s) of the same operational band as the OSDD being tested according to the appropriate test configuration in clause 5.

7) Set the test signal mean power so the calibrated radiated power at the BS Antenna Array coordinate system reference point is as specified as follows:

a) Set the signal generator for the wanted signal to transmit as specified in table 7.8.5.1-1 and 7.8.5.1-3 for *BS type 1-O* and table 7.8.5.2-1 for *BS type 2-O*.

b) Set the Signal generator for the interfering signal at the same frequency as the wanted signal to transmit as specified in table 7.8.5.1-1 and 7.8.5.1-3 for *BS type 1-O* and table 7.8.5.2-1 for *BS type 2-O*.

8) Measure the throughput, for multi-carrier and/or CA operation the throughput shall be measured for relevant carriers specified by the test configuration specified in subclause 5.3.4.

9) Repeat for all the specified measurement directions.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

10) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

### 7.8.5 Test requirement

#### 7.8.5.1 *BS type 1-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and:

- when the wanted signal is based on EISREFSENS: the AoA of the incident wave of a received signal and the interfering signal are within the *FR1 OTA REFSENS RoAoA.*

- when the wanted signal is based on EISminSENS: the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA*.

For NR, the throughputshall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted signal at the assigned channel frequency and two interfering signals at the RIB with the conditions specified in tables 7.8.5.1-1 and 7.8.5.1-2 for intermodulation performance and in tables 7.8.5.1-3 and 7.8.5.1-4 for narrowband intermodulation performance.

The reference measurement channel for the wanted signal is identified in table 7.3.5.2-1, table 7.3.5.2-2 and table 7.3.5.2-3 for each *BS channel bandwidth* and further specified in annex A.

The subcarrier spacing for the modulated interfering signal shall be the same as the subcarrier spacing for the wanted signal, except for the case of wanted signal subcarrier spacing 60kHz and *BS channel bandwidth* <=20MHz, for which the subcarrier spacing of the interfering signal should be 30kHz.

The receiver intermodulation requirement is applicable outside the Base Station RF Bandwidth or Radio Bandwidth edges. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges or Radio Bandwidth edges.

For a RIBs supporting operation in non-contiguous spectrum within any *operating band*, the narrowband intermodulation requirement shall apply in addition inside any sub-block gap in case the sub-block gap is at least as wide as the *BS channel bandwidth* of the NR interfering signal in tables 7.8.5.1-2 and 7.8.5.1-4. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

[For *multi-band RIBs*, the intermodulation requirement shall apply in addition inside any Inter RF Bandwidth gap, in case the gap size is at least twice as wide as the E-UTRA interfering signal centre frequency offset from the Base Station RF Bandwidth edge.]

[For *multi-band RIBs*, the narrowband intermodulation requirement shall apply in addition inside any Inter RF Bandwidth gap in case the gap size is at least as wide as the E-UTRA interfering signal in tables 7.8.5.1-2 and 7.8.5.1-4. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.]

Table 7.8.5.1-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| BS class | Wanted Signal mean power [dBm] | Mean power of interfering signals [dBm] | Type of interfering signal |
| Wide Area BS | EISREFSENS + 6 dB | -52 - ΔOTAREFSENS | See table 7.8.5.1-2 |
| EISminSENS + 6 dB | -52 - ΔminSENS |
| Medium Range BS | EISREFSENS + 6 dB | -47 - ΔOTAREFSENS |
| EISminSENS + 6 dB | -47 - ΔminSENS |
| Local Area BS | EISREFSENS + 6 dB | -44 - ΔOTAREFSENS |
| EISminSENS + 6 dB | -44 - ΔminSENS |
| NOTE: EISREFSENS and EISminSENS depend on the BS class and on the *BS channel bandwidth* as specified in TS 38.104 [2], subclause 10.3.2 and 10.2.1.. | | | |

Table 7.8.5.1-2: Interfering signals for intermodulation requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Interfering signal centre frequency offset from the lower/upper base station RF Bandwidth edge [MHz] | Type of interfering signal |
| 5 | [±7.5] | CW |
| [±17.5] | 5MHz DFT-S-OFDM NR signal (Note 1) |
| 10 | [±7.45] | CW |
| [±17.5] | 5MHz DFT-S-OFDM NR signal (Note 1) |
| 15 | [±7.43] | CW |
| [±17.5] | 5MHz DFT-S-OFDM NR signal (Note 1) |
| 20 | [±7.38] | CW |
| [±17.5] | 5MHz DFT-S-OFDM NR signal (Note 1) |
| 30 | [±7.43] | CW |
| [±25] | 5MHz DFT-S-OFDM NR signal (Note 1) |
| 25 | [±7.45] | CW |
| [±25] | 20MHz DFT-S-OFDM NR signal (Note 2) |
| 40 | [±7.45] | CW |
| [±25] | 20MHz DFT-S-OFDM NR signal (Note 2) |
| 50 | [±7.35] | CW |
| [±25] | 20MHz DFT-S-OFDM NR signal (Note 2) |
| 60 | [±7.49] | CW |
| [±25] | 20MHz DFT-S-OFDM NR signal (Note 2) |
| 70 | [±7.42] | CW |
| [±25] | 5MHz DFT-S-OFDM NR signal (Note 2) |
| 80 | [±7.44] | CW |
| [±25] | 20MHz DFT-S-OFDM NR signal (Note 2) |
| 90 | [±25] | CW |
| [±7.43] | 5MHz DFT-S-OFDM NR signal (Note 2) |
| 100 | [±7.45] | CW |
| [±25] | 20MHz DFT-S-OFDM NR signal (Note 2) |
| NOTE 1: For the 15 kHz subcarrier spacing, the number of RB is 25. For the 30 kHz subcarrier spacing, the number of RB is 10.  NOTE 2: For the 15 kHz subcarrier spacing, the number of RB is 100. For the 30 kHz subcarrier spacing, the number of RB is 50. For the 60 kHz subcarrier spacing, the number of RB is 24. | | |

Table 7.8.5.1-3: Narrowband intermodulation performance requirement in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| BS class | Wanted signal mean power [dBm] | Interfering signal mean power [dBm] | Type of interfering signal |
| Wide Area BS | EISREFSENS + 6 dB  (Note 1) | -52 - ΔOTAREFSENS | See table 7.8.5.1-4 |
| EISminSENS + 6 dB  (Note 1) | -52 - ΔminSENS |
| Medium Range BS | EISREFSENS + 6 dB  (Note 1) | -47 - ΔOTAREFSENS |
| EISminSENS + 6 dB  (Note 1) | -47 - ΔminSENS |
| Local Area BS | EISREFSENS + 6 dB  (Note 1) | -44 - ΔOTAREFSENS |
| EISminSENS + 6 dB  (Note 1) | -44 - ΔminSENS |
| NOTE: EISREFSENS and EISminSENS depends on the *BS channel bandwidth* as specified in TS 38.104 [2], subclause 10.3.2 and 10.2.1.. | | | |

Table 7.8.5.1-4: Interfering signals for narrowband intermodulation requirement in FR1

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Interfering RB centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap [kHz] | Type of interfering signal |
| 5 | [±360] | CW |
| [±1420] | 5MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 10 | [±325] | CW |
| [±1780] | 5MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 15 (NOTE 2) | [±380] | CW |
| [±1600] | 5MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 20 (NOTE 2) | [±345] | CW |
| [±1780] | 5MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 25 (NOTE 2) | [±325] | CW |
| [±1990] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 30 (NOTE 2) | [±320] | CW |
| [±1990] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 40 (NOTE 2) | [±310] | CW |
| [±2710] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 50 (NOTE 2) | [±330] | CW |
| [±3250] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 60 (NOTE 2) | [±350] | CW |
| [±3790] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 70 (NOTE 2) | [±400] | CW |
| [±4870] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 80 (NOTE 2) | [±390] | CW |
| [±4870] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 90 (NOTE 2) | [±340] | CW |
| [±5770] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| 100 (NOTE 2) | [±340] | CW |
| [±5770] | 20MHz DFT-S-OFDM NR signal, 1 RB (NOTE 1) |
| NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the *BS channel bandwidth* of the interfering signal is located adjacently to the lower/upper Base Station RF Bandwidth edge.  NOTE 2: This requirement shall apply only for a G-FRC mapped to the frequency range at the channel edge adjacent to the interfering signals. | | |

#### 7.8.5.2 *BS type 2-O*

Throughputshall be ≥ 95% of the maximum throughput of the reference measurement channel, with OTA wanted signal at the assigned channel frequency and two OTA interfering signals provided at the RIB using the parameters in tables 7.8.5.2-1 and 7.8.5.2-2. All of the OTA test signals arrive from the same direction, and the requirement is valid if the signals arrive from any direction within the *FR2 OTA REFSENS RoAoA*. The reference measurement channel for the wanted signal is identified in [table 7.3.2-1] for each *BS channel bandwidth* and further specified in annex A.

The subcarrier spacing for the modulated interfering signal shall be the same as the subcarrier spacing for the wanted signal.

The receiver intermodulation requirement is applicable outside the Base Station RF Bandwidth or Radio Bandwidth edges. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges or Radio Bandwidth edges.

Table 7.8.5.2-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Mean power of interfering signals [dBm] | Wanted signal mean power [dBm] | Type of interfering signal |
| 50, 100, 200, 400 | EISREFSENS\_50M + 25dB | EISREFSENS + 6dB | See table 7.8.5.2-2 |
| NOTE: EISREFSENS and EISREFSENS\_50M are given in TS 38.104 [2], subclause 10.3.3. | | | |

Table 7.8.5.2-2: Interfering signals for intermodulation requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received [MHz] | Interfering signal centre frequency offset from the Base Station RF Bandwidth edge [MHz] | Type of interfering signal |
| 50 MHz | [±7.5] | CW |
| [±40] | 50MHz DFT-s-OFDM NR signal  (Note) |
| 100 MHz | [±6.88] | CW |
| [±40] | 50MHz DFT-s-OFDM NR signal  (Note) |
| 200 MHz | [±5.64] | CW |
| [±40] | 50MHz DFT-s-OFDM NR signal  (Note) |
| 400 MHz | [±6.02] | CW |
| [±45] | 50MHz DFT-s-OFDM NR signal  (Note) |
| NOTE: For the 60 kHz subcarrier spacing, the number of RB is 64. For the 120 kHz subcarrier spacing, the number of RB is 32. | | |

## 7.9 OTA in-channel selectivity

### 7.9.1 Definition and applicability

In-channel selectivity (ICS) is a measure of the receiver ability to receive a wanted signal at its assigned resource block locations in the presence of an interfering signal received at a larger power spectral density. In this condition a throughput requirement shall be met for a specified reference measurement channel. The interfering signal shall be an NR signal as specified in annex E in TS 38.141-1 and shall be time aligned with the wanted signal.

### 7.9.2 Minimum requirement

The minimum requirement for *BS type 1-O* is in TS 38.104 [2], subclause 10.9.2.

The minimum requirement for *BS type 2-O* is in TS 38.104 [2], subclause 10.9.3.

### 7.9.3 Test purpose

The purpose of this test is to verify the BS receiver ability to suppress the IQ leakage.

### 7.9.4 Method of test

#### 7.9.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier: M; see subclause 4.9.1.

Directions to be tested:

* For *BS type 1-O*, *receiver target reference direction* (D.36),
* For *BS type 2-O*, OTA REFSENS receiver target reference direction (D.62).

#### 7.9.4.2 Procedure

OTA test requires correct use of an appropriate test facility which has been calibrated and is capable of performing measurements within the measurement uncertainties in subclause 4.1.2.

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex D1.1.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Align the BS with the test antenna in the declared direction to be tested.

4) Ensure the polarisation is accounted for such that all the power from the test antenna is captured by the BS under test.

For each supported NR channel BW:

7) Set the test signal mean power so the calibrated radiated power at the BS Antenna Array coordinate system reference point is as specified as follows:

a) Adjust the signal generator for the wanted signal as specified in:

For *BS type 1-O*, table 7.9.5.1-1 for BS of Wide Area BS class, in table 7.9.5.1-2 for BS of Local Area BS class and in table 7.9.5.1-3 for BS of Medium Range BS class on one side of the FC.

For *BS type 2-O*, table 7.9.5.2-1 on one side of the FC.

b) Adjust the signal generator for the interfering signal as specified in:

For *BS type 1-O*, table 7.9.5.1-1 for BS of Wide Area BS class, in table 7.9.5.1-2 for BS of Local Area BS class and in table 7.9.5.1-3 for BS of Medium Range BS class at opposite side of the FC and adjacent to the wanted signal.

For *BS type 2-O*, table 7.9.5.2-1 at opposite side of the FC and adjacent to the wanted signal.

4) Measure throughput.

5) Repeat the measurement with the wanted signal on the other side of the FC, and the interfering signal at opposite side of the FC and adjacent to the wanted signal.

9) Repeat for all the specified measurement directions.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

10) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

### 7.9.5 Test requirement

#### 7.9.5.1 *BS type 1-O*

The requirement shall apply at the RIBwhen the AoA of the incident wave of the received signal and the interfering signal are the same direction and are within the *minSENS RoAoA*

The wanted and interfering signals applies to all supported polarizations, under the assumption of *polarization matching.*

For a wanted and an interfering signal coupled to the RIB, the following requirements shall be met:

- For *BS type 1-O*, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A with parameters specified in table 7.9.5.1-1 for Wide Area BS, in table 7.9.5.1-2 for Medium Range BS and in table 7.9.5.1-3 for Local Area BS.

Table 7.9.5.1-1: Wide Area BS in-channel selectivity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| BS channel bandwidth (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | | | Interfering signal mean power (dBm) | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A1-7 | -98.9-ΔminSENS | -98.5-ΔminSENS | -98.2-ΔminSENS | -81.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz,  10 RB |
| 10, 15, 20, 25, 30 | 15 | G-FR1-A1-1 | -97-ΔminSENS | -96.6-ΔminSENS | -96.3-ΔminSENS | -77.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz,  25 RB |
| 40, 50 | 15 | G-FR1-A1-4 | -90.6-ΔminSENS | -90.2-ΔminSENS | -89.9-ΔminSENS | -71.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz, 100 RB |
| 5 | 30 | G-FR1-A1-8 | -99.6-ΔminSENS | -99.2-ΔminSENS | -98.9-ΔminSENS | -81.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  5 RB |
| 10, 15, 20, 25, 30 | 30 | G-FR1-A1-2 | -97.1-ΔminSENS | -96.7-ΔminSENS | -96.4-ΔminSENS | -78.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  10 RB |
| 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -90.9-ΔminSENS | -90.5-ΔminSENS | -90.2-ΔminSENS | -71.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  50 RB |
| 10, 15, 20, 25, 30 | 60 | G-FR1-A1-9 | -96.5-ΔminSENS | -96.1-ΔminSENS | -95.8-ΔminSENS | -78.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 60 kHz,  5 RB |
| 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -91-ΔminSENS | -90.6-ΔminSENS | -90.3-ΔminSENS | -71.6 - ΔminSENS | DFT-s-OFDM NR signal, SCS 60 kHz,  24 RB |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1 in TS 38.104 [2]. The aggregated wanted and interferer signal shall be centred in the BS channel bandwidth of the wanted signal. | | | | | | | |

Table 7.9.5.1-2: Medium Range BS in-channel selectivity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| BS channel bandwidth (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | | | Interfering signal mean power (dBm) | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A1-7 | -93.9-ΔminSENS | -93.5-ΔminSENS | -93.2-ΔminSENS | -76.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz,  10 RB |
| 10, 15, 20, 25, 30 | 15 | G-FR1-A1-1 | -92-ΔminSENS | -91.6-ΔminSENS | -91.3-ΔminSENS | -72.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz,  25 RB |
| 40, 50 | 15 | G-FR1-A1-4 | -85.6-ΔminSENS | -85.2-ΔminSENS | -84.9-ΔminSENS | -66.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz, 100 RB |
| 5 | 30 | G-FR1-A1-8 | -94.6-ΔminSENS | -94.2-ΔminSENS | -93.9-ΔminSENS | -76.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  5 RB |
| 10, 15, 20, 25, 30 | 30 | G-FR1-A1-2 | -92.1-ΔminSENS | -91.7-ΔminSENS | -91.4-ΔminSENS | -73.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  10 RB |
| 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -85.9-ΔminSENS | -85.5-ΔminSENS | -85.2-ΔminSENS | -66.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  50 RB |
| 10, 15, 20, 25, 30 | 60 | G-FR1-A1-9 | -91.5-ΔminSENS | -91.1-ΔminSENS | -90.8-ΔminSENS | -73.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 60 kHz,  5 RB |
| 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -86-ΔminSENS | -85.6-ΔminSENS | -85.3-ΔminSENS | -66.6 - ΔminSENS | DFT-s-OFDM NR signal, SCS 60 kHz,  24 RB |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1 in TS 38.104 [2]. The aggregated wanted and interferer signal shall be centred in the BS channel bandwidth of the wanted signal. | | | | | | | |

Table 7.9.5.1-3: Local area BS in-channel selectivity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| BS channel bandwidth (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | | | Interfering signal mean power (dBm) | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A1-7 | -90.9-ΔminSENS | -90.5-ΔminSENS | -90.2-ΔminSENS | -73.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz,  10 RB |
| 10, 15, 20, 25, 30 | 15 | G-FR1-A1-1 | -89-ΔminSENS | -88.6-ΔminSENS | -88.3-ΔminSENS | -69.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz,  25 RB |
| 40, 50 | 15 | G-FR1-A1-4 | -82.6-ΔminSENS | -82.2-ΔminSENS | -81.9-ΔminSENS | -63.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 15 kHz, 100 RB |
| 5 | 30 | G-FR1-A1-8 | -91.6-ΔminSENS | -91.2-ΔminSENS | -90.9-ΔminSENS | -73.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  5 RB |
| 10, 15, 20, 25, 30 | 30 | G-FR1-A1-2 | -89.1-ΔminSENS | -88.7-ΔminSENS | -88.4-ΔminSENS | -70.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  10 RB |
| 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -82.9-ΔminSENS | -82.5-ΔminSENS | -82.2-ΔminSENS | -63.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 30 kHz,  50 RB |
| 10, 15, 20, 25, 30 | 60 | G-FR1-A1-9 | -88.5-ΔminSENS | -88.1-ΔminSENS | -87.8-ΔminSENS | -70.4 - ΔminSENS | DFT-s-OFDM NR signal, SCS 60 kHz,  5 RB |
| 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -83-ΔminSENS | -82.6-ΔminSENS | -82.3-ΔminSENS | -63.6 - ΔminSENS | DFT-s-OFDM NR signal, SCS 60 kHz,  24 RB |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1 in TS 38.104 [2]. The aggregated wanted and interferer signal shall be centred in the BS channel bandwidth of the wanted signal . | | | | | | | |

#### 7.9.5.2 *BS type 2-O*

For *BS type 2-O*, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A with parameters specified in table 7.9.5.2-1.

Table 7.9.5.2-1: OTA in-channel selectivity requirement for *BS type 2-O*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BS channel bandwidth (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm)  (Note 2) | Interfering signal mean power (dBm)  (Note 2) | Type of interfering signal |
| 50 | 60 | G-FR2-A1-4 | EISREFSENS\_50M + 3.4 | EISREFSENS\_50M + 10 | DFT-s-OFDM NR signal, SCS 60 kHz, 32 RB |
| 100,200 | 60 | G-FR2-A1-1 | EISREFSENS\_50M + 6.4 | EISREFSENS\_50M + 13 | DFT-s-OFDM NR signal, SCS 60 kHz, 64 RB |
| 50 | 120 | G-FR2-A1-5 | EISREFSENS\_50M + 3.4 | EISREFSENS\_50M + 10 | DFT-s-OFDM NR signal, SCS 120 kHz, 16 RB |
| 100,200,400 | 120 | G-FR2-A1-2 | EISREFSENS\_50M+ 6.4 | EISREFSENS\_50M + 13 | DFT-s-OFDM NR signal, SCS 120 kHz, 32 RB |
| NOTE 1: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1 in TS 38.104 [2]. The aggregated wanted and interferer signal shall be centred in the BS channel bandwidth of the wanted signal.  NOTE 2: EISREFSENS\_50M is defined in TS38.104 [2], subclause 7.3.3. | | | | | |

# 8 Radiated performance requirements

## 8.1 General

Radiated performance requirements specify the ability of the *BS type 1-O* or *BS type 2-O* to correctly demodulate radiated signals in various conditions and configurations. Radiated performance requirements are specified at the RIB.

Radiated performance requirements for the BS are specified for the fixed reference channels and propagation conditions defined in TS 38.104 [2] annex A and annex F, respectively. The requirements only apply to those FRCs that are supported by the BS.

The radiated performance requirements for *BS type 1-O* and for the *BS type 2-O* are limited to two OTA *demodulations branches* as described in subclause 8.1.1. Conformance requirements can only be tested for 1 or 2 *demodulation branches* depending on the number of polarizations supported by the BS, with the required SNR applied separately per polarization.

NOTE 1: BS can support more than 2 *demodulation branches*, however OTA conformance testing can only be performed for 1 or 2 *demodulation branches*.

Unless stated otherwise, radiated performance requirements apply for a single carrier only. Radiated performance requirements for a BS supporting CA are defined in terms of single carrier requirements.

For *BS type 1-O* in FDD operation the requirements in clause 8 shall be met with the transmitter units associated with the RIB in the *operating* *band* turned ON.

NOTE 2: *BS type 1-O* in normal operating conditions in FDD operation is configured to transmit and receive at the same time. The transmitter unit(s) associated with the RIB may be OFF for some of the tests.

In tests performed with signal generators a synchronization signal may be provided from the BS to the signal generator, to enable correct timing of the wanted signal.

The SNR used in this clause is specified based on a single carrier and defined as:

SNR = S / N

Where:

S is the total signal energy in a slot on a RIB.

N is the noise energy in a bandwidth corresponding to the transmission bandwidth over the duration of a slot.

### 8.1.1 OTA demodulation branches

Radiated performance requirements are only specified for up to 2 *demodulation branches* (i.e. up to 1TX-2RX test setup). If the *BS type 1-O*, or the *BS type 2-O* uses polarization diversity and has the ability to maintain isolation between the radiated performance requirements signals for each of the *demodulation branches*, then radiated performance requirements can be applied to up to two *demodulation branches* (i.e. 1TX-2RX test setups). When applied to two *demodulation branches*, each demodulation branch maps to one polarization.

If the *BS type 1-O*, or the *BS type 2-O* does not use polarization diversity then radiated performance requirements only apply to a single *demodulation branch* (i.e. 1TX-1RX test setup).

## 8.2 OTA performance requirements for PUSCH

### 8.2.1 Requirements for BS type 1-O

### 8.2.2 Requirements for BS type 2-O

#### 8.2.2.1 Performance requirements for PUSCH with transmission precoding disabled

##### 8.2.2.1.1 Definition and applicability

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in Annex A. The performance requirements assume HARQ re-transmissions.

A test for a specific channel bandwidth is only applicable if the BS supports it.

The applicability of tests in TS 38.104 [2] with different SCS and BW combinations is according to the following principle:

*Editor’s note: Applicability rule is FFS.*

##### 8.2.2.1.2 Minimum Requirement

The minimum requirement is in TS 38.104 [2] subclause 11.2.2.1.

##### 8.2.2.1.3 Test purpose

The test shall verify the receiver’s ability to achieve throughput under multipath fading propagation conditions for a given SNR.

##### 8.2.2.1.4 Method of test

###### 8.2.2.1.4.1 Initial conditions

Test environment: Normal, see annex B.2.

###### 8.2.2.1.4.2 Procedure

1) Adjust the AWGN generator, according to the channel bandwidth, defined in table 8.2.2.1.4.2-1.

Table 8.2.2.1.4.2-1: AWGN power level [at the BS input]

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth [MHz] | AWGN power level |
| 60 kHz | 50 | TBD |
| 100 | TBD |
| 120 kHz | 50 | TBD |
| 100 | TBD |
| 200 | TBD |

2) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A and the test parameters in table 8.2.2.1.4.2-2.

Table 8.2.2.1.4.2-2: Test parameters for testing PUSCH

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| Transform precoding | | Disabled |
| Uplink-downlink allocation for TDD | | 60 kHz and 120kHz SCS:  3D1S1U, S=10D:2G:2U |
| HARQ | Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 2, 3, 1 |
| DMRS | DMRS configuration type | 1 |
| Maximum number of OFDM symbols for front loaded DMRS | 1 |
| Number of additional DMRS symbols | 0 |
| Number of DMRS CDM group(s) without data | 2 |
| EPRE ratio of PUSCH to DMRS | -3 dB |
| DMRS port | {0}, {0, 1} |
| DMRS sequence generation | NID=0, nSCID =0 |
| Time domain resource | PUSCH mapping type | B |
| PUSCH starting symbol index | 0 |
| PUSCH symbol length | 10 |
| Frequency domain resource | RB assignment | Full applicable test bandwidth |
| Frequency hopping | Disabled |
| TPMI index for 2Tx two layer spatial multiplexing transmission | | 0 |
| Code block group based PUSCH transmission | | Disabled |
| PTRS configuration | Frequency density (*KPT-RS*) | 2 |
| Time density (*LPT-RS*) | 1 |

3) The multipath fading emulators shall be configured according to the corresponding channel model defined in [TBD].

4) Adjust the equipment so that required SNR specified in table 8.2.2.1.5-1 to 8.2.2.1.5-5 is achieved at the BS input.

5) For each of the reference channels in table 8.2.2.1.5-1 to 8.2.2.1.5-5 applicable for the BS, measure the throughput, according to [TBD].

##### 8.2.2.1.5 Test Requirement

The throughput measured according to subclause 8.2.2.1.4.2 shall not be below the limits for the SNR levels specified in table 8.2.2.1.5-1 to 8.2.2.1.5-5.

Table 8.2.2.1.5-1 Test requirements for PUSCH, 50 MHz Channel Bandwidth, 60 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex TBD) | Fraction of maximum throughput | FRC (Annex A) | DMRS configuration | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-75 | 70 % | [TBD] | 1+0 | [TBD] |
| 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |

Table 8.2.2.1.5-2 Test requirements for PUSCH, 100 MHz Channel Bandwidth, 60 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex TBD) | Fraction of maximum throughput | FRC (Annex A) | DMRS configuration | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-75 | 70 % | [TBD] | 1+0 | [TBD] |
| 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |

Table 8.2.2.1.5-3 Test requirements for PUSCH, 50 MHz Channel Bandwidth, 120 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex TBD) | Fraction of maximum throughput | FRC (Annex A) | DMRS configuration | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-75 | 70 % | [TBD] | 1+0 | [TBD] |
| 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |

Table 8.2.2.1.5-4 Test requirements for PUSCH, 100 MHz Channel Bandwidth, 120 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex TBD) | Fraction of maximum throughput | FRC (Annex A) | DMRS configuration | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-75 | 70 % | [TBD] | 1+0 | [TBD] |
| 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |

Table 8.2.2.1.5-5 Test requirements for PUSCH, 200 MHz Channel Bandwidth, 120 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex TBD) | Fraction of maximum throughput | FRC (Annex A) | DMRS configuration | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-75 | 70 % | [TBD] | 1+0 | [TBD] |
| 2 | Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |
| Normal | TDLA30-300 | 70 % | [TBD] | 1+0 | [TBD] |

## 8.3 OTA performance requirements for PUCCH

### 8.3.1 Requirements for BS type 1-O

### 8.3.2 Requirements for BS type 2-O

## 8.4 OTA performance requirements for PRACH

### 8.4.1 Requirements for *BS type 1-O*

#### 8.4.1.1 PRACH false alarm probability and missed detection

#### 8.4.1.1.1 Definition and applicability

#### 8.4.1.1.2 Minimum requirement

#### 8.4.1.1.3 Test purpose

#### 8.4.1.1.4 Method of test

##### 8.4.1.1.4.1 Initial conditions

##### 8.4.1.1.4.2 Procedure

#### 8.4.1.1.5 Test requirement

### 8.4.2 Requirements for BS type 2-O

Annex A (normative):  
Reference measurement channels

# A.1 Fixed Reference Channels for receiver sensitivity and in-channel selectivity (QPSK, R=1/3)

The parameters for the reference measurement channels are specified in table A.1-1 for FR1 receiver sensitivity and in-channel selectivity.

The parameters for the reference measurement channels are specified in table A.1-2 for FR2 receiver sensitivity and in-channel selectivity.

Table A.1-1: FRC parameters for FR1 receiver sensitivity and in-channel selectivity

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A1-1 | G-FR1-A1-2 | G-FR1-A1-3 | G-FR1-A1-4 | G-FR1-A1-5 | G-FR1-A1-6 | G-FR1-A1-7 | G-FR1-A1-8 | G-FR1-A1-9 |
| Subcarrier spacing [kHz] | 15 | 30 | 60 | 15 | 30 | 60 | 15 | 30 | 60 |
| Allocated resource blocks | 25 | 11 | 11 | 106 | 51 | 24 | 15 | 6 | 6 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 2152 | 984 | 984 | 9224 | 4352 | 2088 | 1320 | 528 | 528 |
| Transport block CRC (bits) | 16 | 16 | 16 | 24 | 24 | 16 | 16 | 16 | 16 |
| Code block CRC size (bits) | - | - | - | 24 | - | - | - | - | - |
| Number of code blocks - C | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits)  (Note 3) | 2168 | 1000 | 1000 | 4648 | 4376 | 2104 | 1336 | 544 | 544 |
| Total number of bits per slot | 7200 | 3168 | 3168 | 30528 | 14688 | 6912 | 4320 | 1728 | 1728 |
| Total symbols per slot | 3600 | 1584 | 1584 | 15264 | 7344 | 3456 | 2160 | 864 | 864 |
| NOTE 1: *UL-DMRS-config-type* = 1 with *UL-DMRS-max-len* = 1, *UL-DMRS-add-pos* = 1 with = 2, = 11 as per Table 6.4.1.1.3-3 of TS 38.211 [5].  NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity and in-channel selectivity.  NOTE 3: Code block size including CRC (bits) equals to  in TS 38.212 [19], subclause 5.2.2. | | | | | | | | | |

Table A.1-2: FRC parameters for FR2 receiver sensitivity and in-channel selectivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR2-A1-1 | G-FR2-A1-2 | G-FR2-A1-3 | G-FR2-A1-4 | G-FR2-A1-5 |
| Subcarrier spacing [kHz] | 60 | 120 | 120 | 60 | 120 |
| Allocated resource blocks | 66 | 32 | 66 | 33 | 16 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 5632 | 2792 | 5632 | 2856 | 1416 |
| Transport block CRC (bits) | 24 | 16 | 24 | 16 | 16 |
| Code block CRC size (bits) | - | - | - | - | - |
| Number of code blocks - C | 1 | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits)  (Note 3) | 5656 | 2808 | 5656 | 2872 | 1432 |
| Total number of bits per slot | 19008 | 9216 | 19008 | 9504 | 4608 |
| Total symbols per slot | 9504 | 4608 | 9504 | 4752 | 2304 |
| NOTE 1: *UL-DMRS-config-type* = 1 with *UL-DMRS-max-len* = 1, *UL-DMRS-add-pos* = 1 with = 2, = 11 as per Table 6.4.1.1.3-3 of TS 38.211 [5].  NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity and in-channel selectivity.  NOTE 3: Code block size including CRC (bits) equals to  in TS 38.212 [19], subclause 5.2.2. | | | | | |

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

The parameters for the reference measurement channels are specified in table A.2-1 for dynamic range.

Table A.2-1: FRC parameters for dynamic range

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A2-1 | G-FR1-A2-2 | G-FR1-A2-3 | G-FR1-A2-4 | G-FR1-A2-5 | G-FR1-A2-6 |
| Subcarrier spacing [kHz] | 15 | 30 | 60 | 15 | 30 | 60 |
| Allocated resource blocks | 25 | 11 | 11 | 106 | 51 | 24 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |
| Code rate (Note 2) | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 |
| Payload size (bits) | 9224 | 4032 | 4032 | 38936 | 18960 | 8968 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | - | - | 24 | 24 | 24 |
| Number of code blocks - C | 2 | 1 | 1 | 5 | 3 | 2 |
| Code block size including CRC (bits)  (Note 3) | 4648 | 4056 | 4056 | 7816 | 6352 | 4520 |
| Total number of bits per slot | 14400 | 6336 | 6336 | 61056 | 29376 | 13824 |
| Total symbols per slot | 3600 | 1584 | 1584 | 15264 | 7344 | 3456 |
| NOTE 1: *UL-DMRS-config-type* = 1 with *UL-DMRS-max-len* = 1, *UL-DMRS-add-pos* = 1 with = 2, = 11 as per Table 6.4.1.1.3-3 of TS 38.211 [5].  NOTE 2: MCS index 16 and target coding rate = 658/1024 are adopted to calculate payload size for dynamic range.  NOTE 3: Code block size including CRC (bits) equals to  in TS 38.212 [19], subclause 5.2.2. | | | | | | |

Annex B (normative):  
Environmental requirements for the BS equipment

# B.1 General

For each test in the present document, the environmental conditions under which the BS is to be tested are defined.

For OTA requirements where it is not possible to environmentally control the entire calibrated OTA chamber either localised control of the BS hardware or alternative OTA measurements which are then related to the original specification are acceptable.

# B.2 Normal test environment

When a normal test environment is specified for a test, the test should be performed within the minimum and maximum limits of the conditions stated in table D.1.

Table B.1: Limits of conditions for normal test environment

|  |  |  |
| --- | --- | --- |
| Condition | Minimum | Maximum |
| Barometric pressure | 86 kPa | 106 kPa |
| Temperature | 15 °C | 30 °C |
| Relative humidity | 20 % | 85 % |
| Power supply | Nominal, as declared by the manufacturer | |
| Vibration | Negligible | |

The ranges of barometric pressure, temperature and humidity represent the maximum variation expected in the uncontrolled environment of a test laboratory. If it is not possible to maintain these parameters within the specified limits, the actual values shall be recorded in the test report.

NOTE: This may, for instance, be the case for measurements of radiated emissions performed on an open field test site.

# B.3 Extreme test environment

The manufacturer shall declare one of the following:

1) The equipment class for the equipment under test, as defined in the IEC 60 721-3-3 [7];

2) The equipment class for the equipment under test, as defined in the IEC 60 721-3-4 [8];

3) The equipment that does not comply with the mentioned classes, the relevant classes from IEC 60 721 [9] documentation for temperature, humidity and vibration shall be declared.

NOTE: Reduced functionality for conditions that fall outside of the standard operational conditions is not tested in the present document. These may be stated and tested separately.

## B.3.1 Extreme temperature

When an extreme temperature test environment is specified for a test, the test shall be performed at the standard minimum and maximum operating temperatures defined by the manufacturer's declaration for the equipment under test.

**Minimum temperature:**

The test shall be performed with the environment test equipment and methods including the required environmental phenomena into the equipment, conforming to the test procedure of IEC 60 068-2-1 [10].

**Maximum temperature:**

The test shall be performed with the environmental test equipment and methods including the required environmental phenomena into the equipment, conforming to the test procedure of IEC 60 068-2-2 [11].

NOTE: It is recommended that the equipment is made fully operational prior to the equipment being taken to its lower operating temperature.

# B.4 Vibration

When vibration conditions are specified for a test, the test shall be performed while the equipment is subjected to a vibration sequence as defined by the manufacturer’s declaration for the equipment under test. This shall use the environmental test equipment and methods of inducing the required environmental phenomena in to the equipment, conforming to the test procedure of IEC 60 068-2-6 [12]. Other environmental conditions shall be within the ranges specified in annex B.2.

NOTE: The higher levels of vibration may induce undue physical stress in to equipment after a prolonged series of tests. The testing body should only vibrate the equipment during the RF measurement process.

# B.5 Power supply

When extreme power supply conditions are specified for a test, the test shall be performed at the standard upper and lower limits of operating voltage defined by manufacturer's declaration for the equipment under test.

**Upper voltage limit:**

The equipment shall be supplied with a voltage equal to the upper limit declared by the manufacturer (as measured at the input terminals to the equipment). The tests shall be carried out at the steady state minimum and maximum temperature limits declared by the manufacturer for the equipment, to the methods described in IEC 60 068-2-1 [10] Test Ab/Ad and IEC 60 068-2-2 [11] Test Bb/Bd: Dry heat.

**Lower voltage limit:**

The equipment shall be supplied with a voltage equal to the lower limit declared by the manufacturer (as measured at the input terminals to the equipment). The tests shall be carried out at the steady state minimum and maximum temperature limits declared by the manufacturer for the equipment, to the methods described in IEC 60 068-2-1 [10] Test Ab/Ad and IEC 60 068-2-2 [11] Test Bb/Bd: Dry heat.

# B.6 Measurement of test environments

The measurement accuracy of the BS test environments defined in annex B shall be:

Pressure: 5 kPa

Temperature: 2 degrees

Relative humidity: 5 %

DC voltage: 1.0 %

AC voltage: 1.5 %

Vibration: 10 %

Vibration frequency: 0.1 Hz

The above values shall apply unless the test environment is otherwise controlled and the specification for the control of the test environment specifies the uncertainty for the parameter.

# B.7 OTA extreme test methods

B.7.1 Direct far field method

The AAS BS under test is placed inside a sealed RF transparent environmental enclosure, as showed in Figure B.7.1-1. This is connected to an environment control system which regulates the temperature inside the enclosure. The remaining equipment inside the OTA chamber (any suitable antenna test range chamber type is acceptable) is outside the environmental control and is at nominal temperature. Positioners, test antennas and all other OTA test equipment do not need to be specified over the extreme temperature range.



**Figure B.7.1-1: Measurement set up for Extreme conditions for EIRP accuracy using direct far field method**

The prescence of the environmental chamber inside the OTA chamber may affect the measurement accuracy due to additional reflections and refractions, also the loss through the environmental enclosure may not be consistant with direction as the path through the radome may vary with angle. Hence the system should be calibrated in all tested directions.

NOTE: Currently only a single direction is specified for extreme testing so a single calibration directipon is sufficient.

Conformance may be demonstated by measuring the diference between the nominal measurement and the extreme measurement (Δsample) or by measuring Pmax,c,EIRP, extreme directly.

As the measurement is done in the far field (or measured in near field transformed to far field):

a) If the test facility only supports single polarization, then measure EIRP with the test facility's test antenna/probe polarization matched to the AAS BS.

b) If the test facility supports dual polarization then measure total EIRP for two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

B.7.2 Relative method

The AAS BS under test is placed inside a small (compared to a far field chamber) anachoic chamber which is both RF a screened and suitable for environmental conditioning. The RF conditionals inside the chamber are absorbative and capable of dispating the power the the AAS BS when radiating. A sample antenna or RF probe are placed in a location which gives a sample of the main beam EIRP but does not have to accuarctly measure the EIRP directly, instead the near-field response is measured. For this method test components are exposed to the full temperature range for example the test antenna/probe, cables, absorbers etc. may change as a function of temperature.

Using the relative method it is also necassary to measure the EIRP under nominal conditions using an appropriately calibrated far field (or near filed) test range to obtain Pmax,c,EIRP.



**Figure B.7.2-1: Measurement set up for Extreme conditions for EIRP accuracy using difference method**

Measurements from the test antenna/probe are taken under nominal conditions and extreme conditions to calculate (Δsample). The difference between the nominal and extreme conditions (Δsample) is then used along with the nominal EIRP measurement (Pmax,c,EIRP) made in the appropriate far field or near field chamber and compared against the extreme requirement. As follows:

Pmax,c,EIRP, extreme = Pmax,c,EIRP + Δsample.

To conserve test time it is beneficial to measure two orthogonal polarizations and add the result together. Otherwise, each polarization must be measured separately including a polarization matching procedure.

Annex C (informative):  
Test tolerances and derivation of test requirements

The test requirements explicitly defined in this specification have been calculated by relaxing the minimum requirements of the core specification 3GPP TS 38.104 [2] using the test tolerances (TT) defined here. When the TT value is zero, the test requirement will be the same as the minimum requirement. When the TT value is non-zero, the test requirements will differ from the minimum requirements, and the formula used for this relaxation is given in the following tables.

The TTOTA values are derived from OTA Test System uncertainties, regulatory requirements and criticality to system performance. As a result, the TTOTA values may sometimes be set to zero.

The TTOTA values should not be modified for any reason e.g. to take account of commonly known OTA Test System errors (such as mismatch, cable loss, etc.).

Note that a formula for applying TTOTA values is provided for all OTA tests, even those with a test tolerance of zero. This is necessary in the case where the OTA Test System uncertainty is greater than that allowed in subclause 4.1.2. In this event, the excess error shall be subtracted from the defined TTOTA value in order to generate the correct tightened test requirements as defined in this annex.

# C.1 Measurement of transmitter

Table C.1-1: Derivation of test requirements (FR1 OTA transmitter tests)

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Minimum requirement in 3GPP TS 38.104 [2] | Test Tolerance (TTOTA) | Test requirement in the present document |
| 6.2 Radiated transmit power (Normal conditions) | See 3GPP TS 38.104 [2], subclause 9.2 | 1.1 dB, f ≤ 3.0 GHz  1.3 dB, 3.0 GHz < f ≤ 4.2 GHz  1.3 dB, 4.2 GHz < f ≤ 6.0 GHz | Formula:  Upper limit + TT, Lower limit – TT |
| 6.2 Radiated transmit power (Extreme conditions) | See 3GPP TS 38.104 [2], subclause 9.2 | 2.5 dB, f ≤ 3.0 GHz  2.6 dB, 3.0 GHz < f ≤ 4.2 GHz  2.6 dB, 4.2 GHz < f ≤ 6.0 GHz | Formula:  Upper limit + TT, Lower limit – TT |
| 6.3 OTA base station output power | See 3GPP TS 38.104 [2], subclause 9.3 | 1.4 dB, f ≤ 3.0 GHz  1.5 dB, 3.0 GHz < f ≤ 4.2 GHz  1.5 dB, 4.2 GHz < f ≤ 6.0 GHz | Formula:  Upper limit + TT, Lower limit – TT |
| 6.4 OTA output power dynamics | See 3GPP TS 38.104 [2], subclause 9.4 | 0.4 dB | Formula:  Total power dynamic range – TT |
| 6.5.1 OTA transmitter OFF power | See 3GPP TS 38.104 [2], subclause 9.5.2 | 3.4 dB , f ≤ 3.0GHz  3.6 dB, 3.0GHz < f ≤ 4.2GHz  3.6 dB, 4.2GHz < f ≤ 6.0GHz | Formula:  Minimum Requirement + TT |
| 6.6.1 OTA frequency Error | See 3GPP TS 38.104 [2], subclause 9.6.1 | 12 Hz | Formula:  Frequency Error limit + TT |
| 6.6.2 OTA Modulation quality (EVM) | See 3GPP TS 38.104 [2], subclause 9.6.2 | 1% | Formula:  EVM limit + TT |
| 6.6.3 OTA time alignment error | See 3GPP TS 38.104 [2], subclause 9.6.3 | 25 ns |  |
| 6.7.2 OTA occupied bandwidth | See 3GPP TS 38.104 [2], subclause 9.7.2 | 0 Hz | Formula:  Minimum Requirement + TT |
| 6.7.3 OTA Adjacent Channel Leakage Power Ratio (ACLR) | See 3GPP TS 38.104 [2], subclause 9.7.3 | Relative:  1.0 dB, f ≤ 3.0GHz  1.2 dB, 3.0GHz < f ≤ 4.2GHz  1.2 dB, 4.2GHz < f ≤ 6.0GHz  Absolute:  0 dB | Formula:  Relative limit - TT  Absolute limit +TT |
| 6.7.4 OTA operating band unwanted emissions | See 3GPP TS 38.104 [2], subclause 9.7.4 | Offsets < 10MHz  1.8 dB, f ≤ 3.0GHz  2 dB, 3.0GHz < f ≤ 4.2GHz  2 dB, 4.2GHz < f ≤ 6.0GHz  Offsets ≥ 10MHz  0 dB | Formula:  Minimum Requirement + TT |
| 6.7.5 General transmitter spurious emissions requirements  Category A | See 3GPP TS 38.104 [2], subclause 9.7.5.2.2 | 0 dB | Formula:  Minimum Requirement + TT |
| 6.7.5.2.1 General transmitter spurious emissions requirements  Category B | See 3GPP TS 38.104 [2], subclause 9.7.5.2.2 | 0 dB | Formula:  Minimum Requirement + TT |
| 6.7.5.2.2 Protection of the BS receiver of own or different BS | See 3GPP TS 38.104 [2], subclause 9.7.5.2.2.3 | 3.1 dB, f ≤ 3.0GHz  3.3 dB, 3.0GHz < f ≤ 4.2GHz  3.4 dB, 4.2GHz < f ≤ 6.0GHz | Formula:  Minimum Requirement + TT |
| 6.7.5.2.3 Additional spurious emissions requirements | See 3GPP TS 38.104 [2], subclause 9.7.5.2.2.4 | 2.6 dB, f ≤ 3 GHz  3.0 dB, 3 GHz < f ≤ 4.2 GHz  3.5 dB, 4.2 GHz < f ≤ 6 GHz  For co-existence with PHS  0 dB | Formula:  Minimum Requirement + TT |
| 6.7.5.2.3 Co-location with other base stations | See 3GPP TS 38.104 [2], subclause 9.7.5.2.2.5 | 3.1 dB, f ≤ 3.0GHz  3.3 dB, 3.0GHz < f ≤ 4.2GHz  3.4 dB, 4.2GHz < f ≤ 6.0GHz | Formula:  Minimum Requirement + TT |
| 6.8 OTA transmitter intermodulation | See 3GPP TS 38.104 [2], subclause 9.8 | 0 dB |  |

Table C.1-2: Derivation of test requirements (FR2 OTA transmitter tests)

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Minimum requirement in 3GPP TS 38.104 [2] | Test Tolerance (TTOTA) | Test requirement in the present document |
| 6.2 Radiated transmit power | See 3GPP TS 38.104 [2], subclause 9.2 | 1.7 dB, 24.25GHz < f ≦ 29.5GHz  2.0 dB, 37GHz < f ≦ 40GHz | Formula:  Upper limit + TT, Lower limit – TT |
| 6.3 OTA base station output power | See 3GPP TS 38.104 [2], subclause 9.3 | Normal conditions:  2.1 dB, 24.25GHz < f ≦ 29.5GHz  2.4 dB, 37GHz < f ≦ 40GHz  Extreme conditions:  FFS | Formula:  Upper limit + TT, Lower limit – TT |
| 6.4 OTA output power dynamics | See 3GPP TS 38.104 [2], subclause 9.4 | 0.4 dB | Formula:  Total power dynamic range – TT |
| 6.5.1 OTA transmitter OFF power | See 3GPP TS 38.104 [2], subclause 9.5.2 | TBD dB | Formula:  Minimum Requirement + TT |
|  |  |  |  |
| 6.6.1 OTA frequency Error | See 3GPP TS 38.104 [2], subclause 9.6.1 | 12 Hz | Formula:  Frequency Error limit + TT |
| 6.6.2 OTA Modulation quality (EVM) | See 3GPP TS 38.104 [2], subclause 9.6.2 | 1 % | Formula:  EVM limit + TT |
| 6.6.3 OTA time alignment error | See 3GPP TS 38.104 [2], subclause 9.6.3 | 25 ns |  |
| 6.7.2 OTA occupied bandwidth | See 3GPP TS 38.104 [2], subclause 9.7.2 | 0 Hz | Formula:  Minimum Requirement + TT |
| 6.7.3 OTA Adjacent Channel Leakage Power Ratio (ACLR) | See 3GPP TS 38.104 [2], subclause 9.7.3 | Relative:  2.3 dB, 24.25GHz < f ≦ 29.5GHz  2.6 dB, 37GHz < f ≦ 40GHz  Absolute:  2.7 dB, 24.25GHz < f ≦ 29.5GHz  2.7 dB, 37GHz < f ≦ 40GHz | Formula:  Relative limit - TT  Absolute limit +TT |
| 6.7.4 OTA operating band unwanted emissions | See 3GPP TS 38.104 [2], subclause 9.7.4 | 0 MHz ≤ Δf < 0.1\*BWcontiguous  2.7 dB, 24.25GHz < f ≦ 29.5GHz  2.7 dB, 37GHz < f ≦ 40GHz  0.1\*BWcontiguous ≤ Δf < Δfmax  0 dB | Formula:  Minimum Requirement + TT |
| 6.7.5.2.1 General transmitter spurious emissions requirements  Category A | See 3GPP TS 38.104 [2], subclause 9.7.5.3.2 | 0 dB | Formula:  Minimum Requirement + TT |
| 6.7.5.2.1 General transmitter spurious emissions requirements  Category B | See 3GPP TS 38.104 [2], subclause 9.7.5.3.2 | 0 dB | Formula:  Minimum Requirement + TT |
| 6.7.5.2.3 Additional spurious emissions requirements | See 3GPP TS 38.104 [2], subclause 9.7.5.3.3 | TBD dB | Formula:  Minimum Requirement + TT |

# C.2 Measurement of receiver

Table C.2-1: Derivation of test requirements (FR1 OTA receiver tests)

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Minimum requirement in 3GPP TS 38.104 [2] | Test Tolerance  (TTOTA) | Test requirement in the present document |
| 7.2 OTA sensitivity | See 3GPP TS 38.104 [2], subclause 10.2 | 1.3 dB, f ≤ 3.0 GHz  1.4 dB, 3.0 GHz < f ≤ 4.2 GHz  1.6 dB, 4.2 GHz < f ≤ 6.0 GHz | Formula:  Declared Minimum EIS + TT |
| 7.3 OTA reference sensitivity level | See 3GPP TS 38.104 [2], subclause 10.3 | 1.3 dB, f ≤ 3.0 GHz  1.4 dB, 3.0 GHz < f ≤ 4.2 GHz  1.6 dB, 4.2 GHz < f ≤ 6.0 GHz | Formula:  EISREFSENS + TT |
| 7.4 OTA dynamic range | See 3GPP TS 38.104 [2], subclause 10.4 | 0.3 dB, f ≤ 6 GHz | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |
| 7.5.1 OTA adjacent channel selectivity | See 3GPP TS 38.104 [2], subclause 10.5.1 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |
| 7.5.2 In-band blocking (General) | See 3GPP TS 38.104 [2], subclause 10.5.2 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |
| 7.5.2 In-band blocking (Narrowband) | See 3GPP TS 38.104 [2], subclause 10.5.2 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |
| 7.6 OTA out-of-band blocking  (General) | See 3GPP TS 38.104 [2], subclause 10.6 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |
| 7.6 OTA out-of-band blocking  (Co-location) | See 3GPP TS 38.104 [2], subclause 10.6 | 0 dB | Formula:  Wanted signal power unchanged  Interferer signal power - TT. |
| 7.7 OTA receiver spurious emissions | See 3GPP TS 38.104 [2], subclause 10.7 | 2.5dB, 30 MHz ≤ f ≤ 6 GHz  4.2dB, 6 GHz < f ≤ 26 GHz | Formula:  Minimum Requirement + TT |
| 7.8 OTA receiver intermodulation | See 3GPP TS 38.104 [2], subclause 10.8 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged |
| 7.9 OTA in-channel selectivity | See 3GPP TS 38.104 [2], subclause 10.9 | 1.7 dB, f ≤ 3.0 GHz  2.1 dB, 3.0 GHz < f ≤ 4.2 GHz  2.4 dB, 4.2 GHz < f ≤ 6.0 GHz | Formula:  Wanted signal power + TT  Interferer signal power unchanged |

Table C.2-2: Derivation of test requirements (FR2 OTA receiver tests)

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Minimum requirement in 3GPP TS 38.104 [2] | Test Tolerance  (TTOTA) | Test requirement in the present document |
| 7.3 OTA reference sensitivity level | See 3GPP TS 38.104 [2], subclause 10.3 | 2.4 dB, 24.25 GHz < f ≦ 33.4 GHz  2.4 dB, 37 GHz < f ≦ 52.6 GHz | Formula:  EISREFSENS+ TT |
| 7.5.1 OTA adjacent channel selectivity | See 3GPP TS 38.104 [2], subclause 10.5.1 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |
| 7.5.2 In-band blocking | See 3GPP TS 38.104 [2], subclause 10.5.2 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |
| 7.6 OTA out-of-band blocking | See 3GPP TS 38.104 [2], subclause 10.6 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged |
| 7.7 OTA receiver spurious emissions | See 3GPP TS 38.104 [2], subclause 10.7 | 2.5 dB, 30 MHz ≤ f ≤ 6 GHz  2.7 dB, 6 GHz < f ≤ 12.75 GHz  0 dB, 12.75 GHz < f ≤ 60 GHz | Formula:  Minimum Requirement + TT |
| 7.8 OTA receiver intermodulation | See 3GPP TS 38.104 [2], subclause 10.8 | 0 dB | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |
| 7.9 OTA in-channel selectivity | See 3GPP TS 38.104 [2], subclause 10.9 | 3.4 dB, 24.25 GHz < f ≦ 33.4 GHz  3.4 dB, 37 GHz < f ≦ 52.6 GHz | Formula:  Wanted signal power + TT  Interferer signal power unchanged. |

Annex D (normative):  
Calibration

OTA test requirements specific and OTA measurement chamber specific calibration (and measurement) procedures were captured in TR 37.843 [16] for the OTA AAS BS for the following requirements sets:

* TX and Rx directional requirements
* In-band and out-of-band TRP requirements
* Co-location requirements
* In-band and out-of-band blocking requirements

All the calibrations procedures captured for OTA AAS BS in TR 37.843 [16] for the frequency range up to 4.2 GHz, are assumed to be also applicable to *BS type 1-H* and *BS type 1-O* for the FR1 frequency range, i.e. up to 6 GHz.

*Editor’s note: OTA test requirements specific and OTA measurement chamber specific calibration procedures for FR2 are FFS. Potential reuse of the FR1 calibration procedures for FR2 is FFS.*

Annex E (informative):  
OTA test system set-up

# E.1 Transmitter

## E1.1 Radiated transmit power, output power dynamics and transmitter signal quality



Figure E.1.1-1: Measurement set up for radiated transmit power, output power dynamics and transmitter signal quality

The OTA chamber shown in figure E.1.1-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, Near field chamber, etc.)

## E.1.2 OTA Base Station output power, ACLR, OTA operating band unwanted emissions

*Editor’s note: In-band TRP diagram to be added here*

Figure E.1.2-1: Measurement set up for OTA Base Station output power, ACLR, OTA operating band unwanted emissions

## E.1.3 OTA spurious emissions



Figure E.1.3-1: Measurement set up for OTA co-location spurious emissions

The OTA chamber shown in figure E.1.3-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.). For testing emission far out-of-band several CLTA might be needed.

## E.1.4 OTA Co-location emissions, TX OFF power

*Editor’s note: co-location emissions diagram to be added here*

Figure E.1.4-1: Measurement set up for OTA Co-location emissions, TX OFF power

## E.1.5 OTA transmitter Intermodulation



Figure E.1.5-1: Measurement set up for OTA transmitter intermodulation

The OTA chamber shown in figure E.1.5-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.). When injecting the interferer signal into the CLTA ports, a splitter might be needed. For testing emission far out-of-band an additional test antenna might be needed.

# E.2 Receiver

## E.2.1 OTA sensitivity and OTA reference sensitivity



Figure E.2.1-1: Measurement set up for OTA sensitivity and OTA reference sensitivity

The OTA chamber shown in figure E.2.1-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.).

## E.2.2 OTA dynamic range



Figure E.2.2-1: Measurement set up for OTA Dynamic range

The OTA chamber shown in figure E.2.2-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.).

## E.2.3 OTA adjacent channel selectivity, general blocking, and narrowband blocking



Figure E.2.3-1: Measurement set up for OTA ACS and narrowband blocking

The OTA chamber shown in figure E.2.3-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.).



Figure E.2.3-2: Measurement set up for OTA general blocking

The OTA chamber shown in figure E.2.3-2 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.).

## E.2.4 OTA blocking

### E.2.4.1 OTA general out-of-band blocking



Figure E.2.4.1-1: Measurement set up for OTA general out-of-band blocking

The OTA chamber shown in figure E.2.4.1-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.).

For testing blocking far out-of-band several CLTAs might be needed.

When combining the wanted and interferer signal into the common test antenna, a directional coupler can be used e.g. a 20 dB directional coupler, to minimize the loss for the interferer signal. If both polarizations are tested simultaneously using a common test antenna, then additional splitter is needed after the directional coupler.

### E.2.4.2 OTA co-location blocking



Figure E.2.4.2-1: Measurement set up for OTA co-location blocking

The OTA chamber shown in figure E.2.4.2-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.). For testing blocking far out-of-band several CLTAs might be needed.

## E.2.5 OTA receiver spurious emissions

*Editor’s note: receiver spurious emissions diagram to be added here*

Figure E.2.5-1: Measurement set up for OTA receiver spurious emissions

## E.2.6 OTA receiver intermodulation



Figure E.2.6-1: Measurement set up for OTA receiver intermodulation

The OTA chamber shown in figure E.2.6-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.).

## E.2.7 OTA in-channel selectivity



Figure E.2.7-1: Measurement set up for OTA In-channel selectivity

The OTA chamber shown in figure E.2.7-1 is intended to be generic and can be replaced with any suitable OTA chamber (Far field anechoic chamber, CATR, etc.).

Annex F (normative):  
Estimation of Measurement Uncertainty

Annex G (informative):  
Transmitter Spatial emissions Declaration

# G.1 General

The transmitter spatial emission declaration is an optional declaration which provides additional information on the power level of emission in the intended (in cell) spatial directions and the unintended (out of cell) spatial directions. The declarations are only valid when the beam is configured in one of the EIRP conformance directions.



Figure G.1-1: Example of out of cell directions set and declared single beam at a single extreme steering direction

The declaration of unwanted spatial emission may in many circumstances not directly relate to system performance on its own. This is because it is often not possible to differentiate wanted and unwanted radiation, and furthermore because the benefits of optimizing beamforming performance may outweigh the impacts of “unwanted” radiation, leading to systems with apparently higher unwanted radiation also providing superior throughput performance. System performance should additionally be characterized taking all factors into account.

# G.2 Declarations

Table G.2-1: Optional manufacturer declarations

| Declaration identifier | Declaration | Description |
| --- | --- | --- |
| Dxx.1 | Out of cell directions set | The set of directions which are outside the intended directions of radiation or outside the wanted cell. Declared per operating band. |
| Dxx.2 | Out of cell power level | Declared in band average power inside each of the out of cell directions set(s) (DE.1) declared for each of the 5 conformance directions (D9.x) |
| Dxx.3 | In cell power level | Declared in band average power outside the out of cell directions set(s) (DE.1) declared for each of the 5 conformance directions (D9.x) |
| Dxx.4 | Average out of cell power level | Declared in band average power inside each of the out of cell directions set(s) (DE.1) averaged over the 5 conformance directions (D9.x). |
| DE.5 | Average in cell power level | Declared in band average power inside each of the out of cell directions set(s) (DE.1) averaged over the 5 conformance directions (D9.x) |

NOTE 1: The declaration of unwanted spatial emission may in many circumstances not directly relate to system performance on its own. This is because it is often not possible to differentiate wanted and unwanted radiation, and furthermore because the benefits of optimizing beamforming performance may outweigh the impacts of “unwanted” radiation, leading to systems with apparently higher unwanted radiation also providing superior throughput performance. System performance should additionally be characterized taking all factors into account.

NOTE 2: The average out of cell power level reflects the impact of out of cell radiation on other cells more accurately than the out of cell power level for individual test beams.

Annex H (informative):  
Format and interpretation of tests

Each test has a standard format:

**X Title**

All tests are applicable to all equipment within the scope of the present document, unless otherwise stated.

**X.1 Definition and applicability**

This subclause gives the general definition of the parameter under consideration and specifies whether the test is applicable to all equipment or only to a certain subset. Required manufacturer declarations may be included here.

**X.2 Minimum requirement**

This subclause contains the reference to the subclause to the 3GPP reference (or core) specification which defines the minimum requirement.

**X.3 Test purpose**

This subclause defines the purpose of the test.

**X.4 Method of test**

**X.4.1 General**

In some cases there are alternative test procedures or initial conditions. In such cases, guidance for which initial conditions and test procedures can be applied are stated here. In the case only one test procedure is applicable, that is stated here.

**X.4.2y First test method**

**X.4.2y.1 Initial conditions**

This subclause defines the initial conditions for each test, including the test environment, the RF channels to be tested and the basic measurement set-up. The OTA Test System is assumed to be correctly calibrated as part of the initial conditions. Calibration is not explicitly mentioned.

**X.4.2y.2 Procedure**

This subclause describes the steps necessary to perform the test and provides further details of the test definition like domain (e.g. frequency-span), range, weighting (e.g. bandwidth), and algorithms (e.g. averaging). The procedure may comprise data processing of the measurement result before comparison with the test requirement (e.g. average result from several measurement positions).

**X.4.3y Alternative test method (if any)**

If there are alternative test methods, each is described with its initial conditions and procedures.

**X.5 Test requirement**

This subclause defines the pass/fail criteria for the equipment under test, see subclause 4.1.3 (Interpretation of measurement results). Test requirements for every minimum requirement referred in subclause X.2 are listed here. Cases where minimum requirements do not apply need not be mentioned.

Annex I (normative):  
TRP measurement grids

# I.1 General

The annex describes various sampling grids and procedures for OTA TRP performance of AAS BS.

# I.2 Spherical equal angle grid

## I.2.1 General

TRPEstimate is defined as

when EIRP measurements is used or as

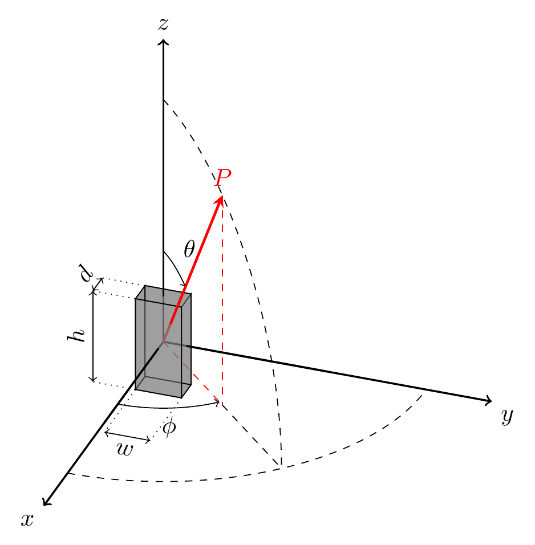
when power density measurements are used, and d is the test distance. N and M are the number of samples in the and angles. Each () is a sampling point. The sampling angular intervals for and angles are and . The sampling intervals and are described in I.2.2.

## I.2.2 Reference angular step criteria

The reference angular steps and in are radians are defined as

Dcyl and D are calculated as

The definition of d, w and h is shown in figure I2.2-1. The radiation source can be EUT antenna array or the whole of EUT.



**Figure I2.2-1: Dimensions of a radiation source: depth (d), width (w) and height (h)**

In the case of Uniform Linear Array (ULA) and the EUT is mounted along the yz plane as shown in figure I2.2-2, the reference angular step can be determined by

Where Dy is the length of radiating parts of EUT along y-axis, Dz is the length of radiating parts of EUT along the z-axis and  is wavelength for the measured frequency.

Figure 3

Figure I2.2-2. Spherical coordinate for OTA conformance testing of EUT

Where due to practical reasons such as time constraints or turn-table precision, measurement with the reference steps is not practical, sparser grids can be used. Use of sparse grids can lead to errors in TRP assessment. In order to characterize these errors, the SF (sparsity factor) of the grid is defined as



Where and  are the actual angular steps used in the measurement.

# I.3 Spherical equal area grid

TRPEstimate is defined as

N is the total number of samples and specified as

.

The sampling intervals and are described in annex I.2.2. Each () is a sampling point.

# I.4 Spherical Fibonacci grid

TRPEstimate is defined as

I is the total number of samples and specified as

The sampling intervals and are described in annex I.2.2. Each () is a sampling point.

# I.5 Orthogonal cut grid

Here, at least two cuts (default) shall be used, an optional third cut can be used. The alignment of the cuts must be along the symmetry planes of the antenna array. No alignment is required for spurious emissions.

When alignment is required:

1. The first mandatory cut is a horizontal cut passing through the peak direction of the main beam.
2. The second mandatory is a vertical cut passing through the peak direction of the main beam. Using the data from these two mandatory cuts, a conditional pattern multiplication can be used.
3. The third optional cut is a vertical cut orthogonal to the first and the second cut.

When alignment is not required, the cuts can be aligned arbitrarily.

Once the number and the orientation of the cuts are decided, the total EIRP is measured on the orthogonal cuts and the TRP is then calculated as follows: First the contributions from each cut is calculated as

where *P* is the number of sampling points in the cut. The final contribution for all cuts is calculated as

where *N* is the number of cuts. Note that when orthogonal cuts are measured, the intersection points are measured multiple times and the repeated values can be removed from the samples before averaging.

When two cuts measurements are used, a conditional pattern multiplication can be applied. The following are the conditions for applying pattern multiplication:

* + 1. The vertical cut (and the main beam) is in the -plane
    2. The frequency of the emission is within the downlink operating band.
    3. The bandwidth of the emission is the same as the bandwidth of the in-band modulated signal
    4. The emission appears/disappears when the Tx power is turned on/off.
    5. The antenna arrays of the EUT
       1. Have rectangular grids of antenna element positions
       2. Have symmetry planes that are vertical and horizontal.
       3. Have parallel antenna planes

The antenna array is here assumed to be placed in the *yz*-plane. The pattern multiplication is performed in *uv*-coordinates and the data in the two cuts are denoted at and a vertical cut with data at . The data is split in two parts corresponding to the forward and backward hemispheres. The *uv*-coordinates are the projections of the angular directions onto the antenna plane, here the *yz*-plane. Using the spherical coordinates as depicted in Fig. F.1.2.-1 the *u* and *v* coordinates are defined as

Note that only the data on the cuts are measured.

Calculate power density/EIRP values outside the two cardinal cuts as

The pattern multiplication is applied separately for the forward (fwd) and backward (bwd) hemisphere. The TRP is then calculated as

Note: the numerical singularity at must be treated with care, e.g. by change of variables.

# I.6 Wave vector space grid

If EUT is mounted along the yz plane as shown in Figure I2.2-1, the reference step in wave vector space can be determined by

where *Dy* is the length of radiating parts of EUT along y-axis, *Dz* is the length of radiating parts of EUT along the z-axis.

According to the relationship between the normalized wave vector and spherical coordinate, the wave vector can be represented as following:

The total radiated power (TRP) in the wave vector space is determined by

Where due to practical reasons such as time constraints or turn-table precision, measurement with the reference steps is not practical, sparser grids can be used. Use of sparse grids can lead to errors in TRP assessment. In order to characterize these errors, the SF (sparsity factor) of the grid is defined as



Where and  are the actual steps used in the wave vector space in the measurement.

# I.7 Orthogonal 2 cuts with pattern multiplication

This method can be used when the antenna symmetries are compatible with pattern multiplication, see annex I.1.2.4. The procedure is as follows:

1. Calculate the reference angular steps as described in annex I.1.2.
2. Align the EUT to allow for proper pattern multiplication, see annex I.5. Measure EIRP on two orthogonal cuts with steps smaller or equal to the reference steps according to step 1.
3. Apply pattern multiplication according to annex I.5 to extrapolate the two cuts data to full-sphere.
4. Apply numerical integration to obtain the TRP estimate as described in annex I.5.

# I.8 Orthogonal 2 or 3 cut with dense sampling

The procedure is as follows:

1. Follow steps described in annex I.5 and calculate the TRP estimate.
2. Add the appropriate correction factor ΔTRP according to table I.8-1 to ensure overestimation with 95% confidence.
3. Compare the (TRP estimate + ΔTRP) to the limit.
4. If the (TRP estimate + ΔTRP) is above the limit, perform the measurement on an additional third cut and repeat steps 1 to 3.

|  |  |  |
| --- | --- | --- |
|  | Three cuts | Two cuts |
| Correction factor ΔTRP (dB) | [2.0] | [2.5] |

**Table I.8-1: The correction factor for two or three cuts dense sampling**

# I.9 Full sphere with sparse sampling

The procedure is as follows:

1. Set the angular grid:
   1. Non-harmonic frequencies: choose the angular steps and smaller than or equal to [15] degrees. Calculate the sparsity factor (SF) as

and the correction factor as:

where corresponds to 15 degrees angular step. If the sparsity factor is smaller than 1, the correction factor ΔTRP is 0 dB.

* 1. Harmonic frequencies with fixed beam test signal: choose the angular steps smaller than or equal to the reference angular steps and . Correction factor ΔTRP is 0 dB.
  2. [Harmonic frequencies with beam sweeping test signal: set the angular steps to [15] degrees. Correction factor is ΔTRP 0 dB].

1. Apply a suitable numerical integration to calculate the TRP estimate.
2. Add the appropriate correction factor ΔTRP according to step 1 to ensure an overestimation with 95% confidence.
3. Compare the (TRP estimate + ΔTRP) with the limit. If the (TRP estimate + ΔTRP) is above the limit, choose a smaller angular step and repeat steps 2-4. If the sparsity factor is less than one, no significant improvement of accuracy is expected.

# I.10 Beam-based directions

Beam-based direction can be used if directivity of the EUT antenna is known for the base station *operating band*. TRPEstimate is defined as

, where is the maximum EIRP in the *beam peak direction* within a particular *beam direction pair* and is directivity of the EUT antenna.

# I.11 Peak method

The peak method can be used when frequencies with unwanted peak emissions are identified during pre-scan. The method does not provide an estimate of TRP.

For each peak emission frequency identified during pre-scan, measure peak EIRP or power density as follows:

1. Move EUT and test antenna to the same position where the peak emission is recorded during the pre-scan.
2. Move the EUT around the position and test antenna orientation to find the final peak EIRP or power density.
3. The measured peak power density or EIRP shall be used to demonstrate conformance.

NOTE: Peak EIRP is the linear sum of two orthogonal polarized components.

# I.12 Equal sector with peak average

Equal sector with peak average can be performed on frequencies with unwanted peak emission, which are considered by the peak method for further measurements.

The spherical angle is divided into K equal sectors. If the largest dimension of EUT is less than 60 cm, then each sector is a half quadrant of 45°.

For each peak emission frequency, measure peak EIRP of beams belonging to different sectors of the sphere as follows:

1. Move EUT and test antenna to the same position where the emission peak is recorded during the pre-scan.
2. Move EUT around the position and test antenna orientation to find the final peak EIRP.
3. Repeat Steps 1 to 2 until all sectors are covered.
4. Calculate TRPEstimate as

, where is the peak EIRP in the kth sector.

NOTE: Peak EIRP is the linear sum of two orthogonal polarized components.

# I.13 Pre-scan

Pre-scan is used to identify frequencies with unwanted emission power levels above a certain threshold. The pre-scan does not provide an estimate of TRP.

The procedure for pre-scan is as follows:

1. Scan the entire surface around EUT.
2. Rotate test antenna to cover all possible polarizations of emissions to detect maximum emissions.
3. Record the list of frequencies and corresponding unwanted emission power levels, EUT spatial positions, and test antenna polarization for which the maximum emission levels occur.
4. Emissions which [20 dB] or more below the specified limit shall not require further measurements.

Annex J (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2017/11 | R4-84bis | R4-1711983 | - | - | - | TS skeleton | 0.0.1 |
| 2018/04 | R4-86bis | R4-1805875, R4-1805876, R4-1804931, R4-1805877, R4-1805386, R4-1805916, R4-1805915, R4-1805878 | - | - | - | Implementation of TPs agreed during RAN4#86bis, on top of the agreed R4-1803913:  - R4-1805875 TP for TS 38.141-2: Addition of applicability table in sub-clause 4.7.2  - R4-1805876 TP for TS 38.141-2: Addition of co-location reference antenna description to sub-clause 4.13  - R4-1804931 TP to TS 38.141-2: clauses 1-3  - R4-1805877 TP to TS 38.141-2: clauses 4, 5  - R4-1805386 TP to TS 38.141-2: clause 6  - R4-1805916 TP to TS 38.141-2: clause 7  - R4-1805915 TP to TS 38.141-2: NR BS OTA sensitivity conformance test (7.2)  - R4-1805878 TP to TS 38.141-2: NR BS OTA REFSENS conformance test (7.3) | 0.1.0 |
| 2018/06 | R4-87 | R4-1714157,  R4-1806599, R4-1807591, R4-1807747, R4-1808325, R4-1808329, R4-1808331, R4-1808332, R4-1808333, R4-1808334, R4-1808336, R4-1808337, R4-1808483, R4-1808487 | - | - | - | Implementation of TPs agreed during RAN4#87, on top of R4-1807255:  - R4-1714157 TP to TS 38.141-2 - annex with spatial declarations definitions  - R4-1806599 TP to TS 38.141-2: NR BS OTA dynamic range conformance test (7.4)  - R4-1807591 TP to TS 38.141-2 - update to Rx general section (7.1)  - R4-1807747 TP to TS 38.141-2: Annexes  - R4-1808325 TP to TS 38.141-2: Improvement of RIB interface in Figures 4.2-1, 4.2-2 and 4.2-3, in sub-clause 4.2  - R4-1808329 TP to TS 38.141-2: NR BS OTA in-band selectivity and blocking conformance test (7.5)  - R4-1808331 TP to TS 38.141-2: Definitions, symbols and abbreviations (Sections 3)  - R4-1808332 TP to TS 38.141-2: NR BS OTA occupied bandwidth (6.7.2)  - R4-1808333 TP to TR 38.141-2: Clarifications on OTA sensitivity requirement (7.2.1, 7.3.1)  - R4-1808334 TP to TS 38.141-2 - OTA base station output power (6.3)  - R4-1808336 TP to TS 38.141-2 - OTA in-band receiver intermodulation (7.8)  - R4-1808337 TP to TS 38.141-2 - OTA in-channel selectivity (7.9)  - R4-1808483 TP to TS 38.141-2: multi-band operation  - R4-1808487 TP to TS 38.141-2 - OTA output power dynamics (6.4) | 0.2.0 |
| 2018/07 | R4-AH-1807 | R4-1808823  R4-1808874  R4-1809109  R4-1809465  R4-1809485  R4-1809486  R4-1809487  R4-1809488  R4-1809489  R4-1809490  R4-1809491  R4-1809493  R4-1809494  R4-1809495  R4-1809496  R4-1809497  R4-1809499  R4-1809501  R4-1809516  R4-1809561  R4-1809562 | - | - | - | Implementation of TPs approved during RAN4-AH-1807, on top of R4-1809266 (TS 38.141-2, v0.2.0):  - R4-1808823 TP to TS 38.141-2: Applicability of requirements (Sections 4.7)  - R4-1808874 TP to TS 38.141-2: Introduction of the transmit, receive and co-location configurations, in subclause 4.5  - R4-1809109 TP to TS 38.141-2 - Annex D, TX and RX Test setup  - R4-1809465 TP to TS 38 141-2 - 4.8.2 Test signal Configurations  - R4-1809485 TP to TS 38.141-2: NR BS acceptable uncertainty of OTA Test System (4.1.2)  - R4-1809486 TP to TS 38.141-2: NR BS derivation of test requirement (Annex C)  - R4-1809487 TP to TS 38.141-2: Correction of RX procedures  - R4-1809488 TP to TS 38.141-2: Correction of TX directional power related requirements  - R4-1809489 TP to TS 38.141-2 – OTA unwanted emissions – General (6.7.1)  - R4-1809490 TP to TS 38.141-2: NR BS OTA occupied bandwidth (6.7.2)  - R4-1809491 TP to TS 38.141-2 – OTA ACLR (6.7.3)  - R4-1809493 TP to TS 38.141-2 Annex XX - measuring extreme conditions  - R4-1809494 TP to TS 38 141-2 Test requirement for Radiated transmit power  - R4-1809495 TP to TS 38.141-2 Transmitter spurious emissions (6.7.5)  - R4-1809496 TP to TS 38.141-2: Adding requirement text for OTA Tx IMD in sub-clause 6.8 and Annex E1.7  - R4-1809497 TP to TS 38.141-2 Receiver spurious emissions (7.7)  - R4-1809499 TP to TS38.141-2: OTA frequency error (6.6.2)  - R4-1809501 TP to TS38.141-2: OTA time alignment error (6.6.4)  - R4-1809516 TP to TR 38.141-2: NR BS OTA manufacturers declarations for radiated test requirements (4.6)  - R4-1809561 TP to TS38.141-2: OTA modulation quality (6.6.3)  - R4-1809562 TP to TS 38.141-2 – OTA operating band unwanted emissions (6.7.4) | 0.3.0 |
| 2018/08 | R4-88 | R4-1810818,  R4-1810822,  R4-1810823,  R4-1811150,  R4-1811538,  R4-1811592,  R4-1811618,  R4-1811621,  R4-1811626,  R4-1811742,  R4-1811743,  R4-1811745,  R4-1811746,  R4-1811747,  R4-1811748,  R4-1811749,  R4-1811750,  R4-1811751,  R4-1811752,  R4-1811754,  R4-1811760,  R4-1811766,  R4-1811767,  R4-1811848,  R4-1811879,  R4-1811886,  R4-1811887 | - | - | - | Implementation of TPs approved during RAN4#88, on top of R4-1810576 (TS 38.141-2, v0.3.0):  - R4-1810818 TP to TS 38.141-2: Operating bands and channel arrangement (5)  - R4-1810822 TP to TS 38.141-2: initial conditions for FR2 Rx spur test (7.7)  - R4-1810823 TP to TS 38.141-2: FRC annex (A)  - R4-1811150 TP: Add parameters band n50 in TS 38.141-2  - R4-1811538 TP for introduction of band n74 for TS38.141-2  - R4-1811592 TP to TS38.141-2: OTA operating band unwanted emissions requirements (6.7.4)  - R4-1811618 Correction on general clause for 38.141-2  - R4-1811621 TP to TS 38.141-2 Section 4.8.2.1 Test signal used to build Test Configurations  - R4-1811626 TP to TS 38.141-2: Section 6.1 NR Test Models  - R4-1811742 TP to TS38.141-2: Regional requirements (4.4)  - R4-1811743 TP to TS 38.141-2: Remaining issues and corrections for Radiated Tx power (EIRP) (6.2)  - R4-1811745 TP to TS 38.141-2: Corrections and improvements to the OTA Tx spurious emissions test (6.7.5)  - R4-1811746 TP to TS 38.141-2: Calibration annex (D)  - R4-1811747 TP to TS 38.141-2: Improvements of co-location requirement description in sub-clause 4.12  - R4-1811748 TP to TS 38.141-2: NR BS OTA occupied bandwidth (6.7.2)  - R4-1811749 TP to TS 38.141-2: Adding requirement text for OTA co-location spurious emission in subclause 6.7.5 and Annex E1.3  - R4-1811750 TP to TS 38.141-2 on MU and TT for Rx requirements for FR1 and FR2  - R4-1811751 TP to TS 38.141-2 on MU and TT for transmission in-band TRP emission and directional requirements or FR2 and FR1  - R4-1811752 TP to TS38.141-2 on MU and TT for extreme EIRP for FR1 and FR2  - R4-1811754 TP to TS 38.141-2: Improvement of requirement text for OTA TX IMD in subclause 6.8 and Annex E.1.5  - R4-1811760 TP to TS 38.141-2: test tolerance table (Annex C)  - R4-1811766 TP to TS 38.141-2: wideband operation corrections and FBW declarations (4.6)  - R4-1811767 TP to TS 38.141-2: OTA declarations cleanup (4.6)  - R4-1811848 TP to TS 38.141-2: Adding requirement text for OTA out-of-band blocking in subclause 7.6 and Annex E2.4.1 and E2.4.2  - R4-1811879 TP to TS 38.141-2 – Overview of radiated Tx and Rx requirements (4.13)  - R4-1811886 TP to TS 38.141-2: OBUE correction  - R4-1811887 TP to TS 38.141-2 on OTA Tx ON/OFF power requirements | 0.4.0 |
| 2018/09 | RP-81 | RP-181664 | - | - | - | Presented to TSG RAN for information. | 1.0.0 |
| 2018/11 | R4-88bis | R4-1812584,  R4-1812666,  R4-1812683,  R4-1813300,  R4-1813301,  R4-1813310,  R4-1813532,  R4-1813754,  R4-1813877,  R4-1813881,  R4-1813883,  R4-1813896,  R4-1813899,  R4-1813900,  R4-1813901,  R4-1813902,  R4-1813903,  R4-1813907,  R4-1813908,  R4-1813911,  R4-1813912,  R4-1813913,  R4-1813914,  R4-1813915,  R4-1813993,  R4-1814074,  R4-1814078,  R4-1814080,  R4-1814120,  R4-1814193,  R4-1814250,  R4-1814251,  R4-1814253,  R4-1814254 | - | - | - | Implementation of TPs approved during RAN4#88bis, on top of RP-181664 (TS 38.141-1, v1.0.0):  - R4-1812584 TP to TS 38.141-2: Correction on NOTE for wanted signal mean power for NR BS RX requirements  - R4-1812666 TP to TS 38.141-2: Correction of directions for OTA requirements  - R4-1812683 TP to TS 38.141-2: Clarification Note on non-zero Test Tolerance  - R4-1813300 TP to TS 38.141-2: correction of the OSDD definition for single RAT NR BS specification  - R4-1813301 TP to TS 38.141-2: alignment with TS 38.104 modifications after RAN4#88  - R4-1813310 TP to TS 38.141-2: structure alignments with TS 38.141-1  - R4-1813532 TP to TS 38.141-2: Corrections to Modulation quality test in Clause 6.6.3  - R4-1813754 TP to TS 38.141-2: Radiated performance requirements (8)  - R4-1813877 TP for TS38.141-2: RF channel for BS OTA conformance test  - R4-1813881 TP to TS 38.141-2: Section 4.9.2.3 Data content of PHY channels  - R4-1813883 TP to TS 38.141-2: FR2 test model(Section 4.9.3)  - R4-1813896 TP to TS 38.141-2: Addition of MU for OTA performance requirements for FR1  - R4-1813899 TP to TS 38.141-2: alignment of directions to be tested for OTA requirements  - R4-1813900 TP to TS 38.141-2 on CLTA definition  - R4-1813901 TP to TS 38.141-2 on MU and TT corrections for FR1 and FR2  - R4-1813902 TP to TS 38.141-2 on Rx requirement corrections for FR1 and FR2  - R4-1813903 TP to 38.141-2: Clause 4.6 - correction for manufacturer declaration  - R4-1813907 TP to TS 38.141-2: frequency range for the inband blocking requirement for FR2  - R4-1813908 TP to TS 38.141-2 – adding TRP measurement grids to the annex  - R4-1813911 TP to TS 38.141-2: Update for NR BS occupied bandwidth requirement (6.7.2)  - R4-1813912 TP to 38.141-2: Corrections to OTA co-location spurious emission (6.7.5 and E.1.3)  - R4-1813913 TP to 38.141-2: Corrections to OTA transmitter intermodulation in sub-clause 6.8 and Annex E.1.5  - R4-1813914 TP to TS 38.141-2: Correction of the RX intermodulation interferer  - R4-1813915 TP to TS 38.141-2: In-channel selectivity (7.9)  - R4-1813993 TP to TS 38.141-2: Radiated performance requirements for CP-OFDM based PUSCH  - R4-1814074 TP to TS 38.141-2: Corrections on OTA transmit ON/OFF power  - R4-1814078 TP to TS38.141-2: OTA CACLR absolute limits (6.7.3)  - R4-1814080 TP to TS 38.141-2: OTA declarations numbering and cross-referencing  - R4-1814120 TP to TS 38.141-2: Correction on the FRCs in Annex A1 and A2  - R4-1814193 TP to TS38.141-2: OTA UEM(Section 6.7.4)  - R4-1814250 TP to TS 38.141-2: operating bands applicable for spurious emissions testing above 12.75 GHz  - R4-1814251 TP to TS 38.141-2: correction for the narrowest supported CHBW and SCS  - R4-1814253 TP to TS 38.141-2: Improvement of out-of-band blocking requirement in sub-clause 7.6  - R4-1814254 TP to TS 38.141-2 on CLTA related MU | 1.1.0 |