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**IMT cellular networks;  
Harmonised Standard for access to radio spectrum;  
Part 24: New Radio (NR) Base Stations (BS)  
Release 15**

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**ETSI**

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

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

Siret N° 348 623 562 00017 - APE 7112B  
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# Contents

Intellectual Property Rights .....	9
Foreword.....	9
Modal verbs terminology.....	10
Introduction .....	10
1 Scope .....	11
2 References .....	12
2.1 Normative references .....	12
2.2 Informative references.....	13
3 Definition of terms, symbols and abbreviations.....	15
3.1 Terms.....	15
3.2 Symbols.....	19
3.3 Abbreviations .....	20
4 Technical requirements specifications .....	21
4.1 Environmental profile.....	21
4.2 Requirement set applicability .....	22
4.3 Conformance requirements .....	22
4.3.1 Introduction.....	22
4.3.1.1 General .....	22
4.3.1.2 Conducted transmitter requirements .....	24
4.3.1.3 Conducted receiver requirements .....	24
4.3.1.4 Conducted requirements for BS capable of multi-band operation .....	25
4.3.1.5 Radiated transmitter requirements .....	26
4.3.1.6 Radiated receiver requirements.....	26
4.3.1.7 Radiated requirements for BS capable of multi-band operation .....	27
4.3.1.8 Additional BS conformance to other standards.....	27
4.3.2 Operating band unwanted emissions .....	29
4.3.2.1 Definition and applicability.....	29
4.3.2.2 Limits .....	29
4.3.2.2.1 General .....	29
4.3.2.2.2 Wide Area BS.....	31
4.3.2.2.3 Medium Range BS .....	33
4.3.2.2.4 Local Area BS .....	35
4.3.2.2.5 Additional limits .....	35
4.3.2.3 Conformance.....	37
4.3.3 Adjacent Channel Leakage power Ratio (ACLR) .....	37
4.3.3.1 Definition and applicability.....	37
4.3.3.2 Limits .....	37
4.3.3.2.1 General .....	37
4.3.3.2.2 Absolute limits .....	37
4.3.3.2.3 Relative Limits .....	38
4.3.3.3 Conformance.....	39
4.3.4 Transmitter spurious emissions.....	40
4.3.4.1 Definition and applicability.....	40
4.3.4.2 Limits .....	40
4.3.4.2.1 General spurious emissions limits .....	40
4.3.4.2.2 Limits for protection of the <i>BS receiver</i> .....	41
4.3.4.2.3 Limits for co-existence with other systems .....	41
4.3.4.2.4 Additional limits .....	43
4.3.4.3 Conformance.....	43
4.3.5 Base Station output power .....	44
4.3.5.1 Definition and applicability.....	44
4.3.5.2 Limits .....	44
4.3.5.3 Conformance.....	44
4.3.6 Transmit intermodulation .....	44

4.3.6.1	Definition and applicability.....	44
4.3.6.2	Limits .....	45
4.3.6.2.1	<i>BS type 1-C</i> : Co-location limits .....	45
4.3.6.2.2	<i>BS type 1-H</i> : Co-location limits.....	45
4.3.6.2.3	<i>BS type 1-H</i> : Intra-system requirement.....	46
4.3.6.3	Conformance.....	46
4.3.7	Receiver spurious emissions .....	46
4.3.7.1	Definition and applicability.....	46
4.3.7.2	Limits .....	47
4.3.7.3	Conformance.....	47
4.3.8	In-band blocking.....	47
4.3.8.1	Definition and applicability.....	47
4.3.8.2	Limits .....	47
4.3.8.3	Conformance.....	49
4.3.9	Out-of-band blocking.....	49
4.3.9.1	Definition and applicability.....	49
4.3.9.2	Limits .....	50
4.3.9.3	Conformance.....	50
4.3.10	Receiver intermodulation.....	50
4.3.10.1	Definition and applicability.....	50
4.3.10.2	Limits .....	50
4.3.10.3	Conformance.....	53
4.3.11	Adjacent Channel Selectivity (ACS) .....	53
4.3.11.1	Definition and applicability.....	53
4.3.11.2	Limits .....	53
4.3.11.3	Conformance.....	54
4.3.12	Reference sensitivity level.....	54
4.3.12.1	Definition and applicability.....	54
4.3.12.2	Limits .....	54
4.3.12.3	Conformance.....	55
4.3.13	OTA <i>operating band</i> unwanted emissions.....	55
4.3.13.1	Definition and applicability.....	55
4.3.13.2	Limits for <i>BS type 1-O</i> .....	56
4.3.13.2.1	General .....	56
4.3.13.2.2	Wide Area BS.....	57
4.3.13.2.3	Medium Range BS .....	59
4.3.13.2.4	Local Area BS .....	61
4.3.13.2.5	Additional limits.....	61
4.3.13.3	Limits for <i>BS type 2-O</i> .....	62
4.3.13.4	Conformance.....	63
4.3.14	OTA Adjacent Channel Leakage power Ratio (ACLR) .....	63
4.3.14.1	Definition and applicability.....	63
4.3.14.2	Limits .....	63
4.3.14.2.1	General .....	63
4.3.14.2.2	Absolute limits .....	64
4.3.14.2.3	Relative Limits .....	64
4.3.14.3	Conformance.....	67
4.3.15	OTA transmitter spurious emissions.....	67
4.3.15.1	Definition and applicability.....	67
4.3.15.2	Limits .....	68
4.3.15.2.1	General spurious emission limits for <i>BS type 1-O</i> .....	68
4.3.15.2.2	General spurious emission limits for <i>BS type 2-O</i> .....	68
4.3.15.2.3	Limits for protection of <i>BS receiver</i> for <i>BS type 1-O</i> .....	69
4.3.15.2.4	Limits for co-existence with systems operating in other frequency bands for <i>BS type 1-O</i> .....	69
4.3.15.2.5	Additional limits .....	71
4.3.15.3	Conformance.....	72
4.3.16	Radiated transmit power .....	72
4.3.16.1	Definition and applicability.....	72
4.3.16.2	Limits .....	72
4.3.16.3	Conformance.....	73
4.3.17	OTA Base Station output power .....	73
4.3.17.1	Definition and applicability.....	73

4.3.17.2	Limits .....	73
4.3.17.3	Conformance .....	73
4.3.18	OTA transmitter intermodulation .....	73
4.3.18.1	Definition and applicability.....	73
4.3.18.2	Limits .....	74
4.3.18.2.1	<i>BS type 1-O</i> .....	74
4.3.18.3	Conformance .....	74
4.3.19	OTA receiver spurious emissions .....	74
4.3.19.1	Definition and applicability.....	74
4.3.19.2	Limits .....	75
4.3.19.2.1	<i>BS type 1-O</i> .....	75
4.3.19.2.2	<i>BS type 2-O</i> .....	75
4.3.19.3	Conformance .....	76
4.3.20	OTA In-band blocking.....	76
4.3.20.1	Definition and applicability.....	76
4.3.20.2	Limits .....	77
4.3.20.2.1	<i>BS type 1-O</i> .....	77
4.3.20.2.2	<i>BS type 2-O</i> .....	79
4.3.20.3	Conformance.....	80
4.3.21	OTA Out-of-band blocking .....	80
4.3.21.1	Definition and applicability.....	80
4.3.21.2	Limits .....	81
4.3.21.2.1	<i>BS type 1-O</i> General blocking .....	81
4.3.21.2.2	<i>BS type 2-O</i> general blocking .....	81
4.3.21.3	Conformance .....	81
4.3.22	OTA Receiver intermodulation.....	82
4.3.22.1	Definition and applicability.....	82
4.3.22.2	Limits .....	82
4.3.22.2.1	<i>BS type 1-O</i> .....	82
4.3.22.2.2	<i>BS type 2-O</i> .....	85
4.3.22.3	Conformance.....	85
4.3.23	OTA Adjacent Channel Selectivity (ACS).....	86
4.3.23.1	Definition and applicability.....	86
4.3.23.2	Limits .....	86
4.3.23.2.1	<i>BS type 1-O</i> .....	86
4.3.23.2.2	<i>BS type 2-O</i> .....	87
4.3.23.3	Conformance .....	87
4.3.24	OTA Sensitivity .....	88
4.3.24.1	Definition and applicability.....	88
4.3.24.2	Limits .....	88
4.3.24.3	Conformance.....	88
4.3.25	OTA Reference sensitivity.....	88
4.3.25.1	Definition and applicability.....	88
4.3.25.2	Limits .....	89
4.3.25.2.1	<i>BS type 1-O</i> .....	89
4.3.25.2.2	<i>BS type 2-O</i> .....	90
4.3.25.3	Conformance .....	91
5	Testing for compliance with technical requirements.....	91
5.1	Environmental conditions for testing .....	91
5.2	Interpretation of measurement results .....	91
5.3	Essential radio test suites.....	91
5.3.1	Introduction.....	91
5.3.2	<i>Operating band</i> unwanted emissions.....	91
5.3.2.1	General .....	91
5.3.2.2	Initial conditions .....	92
5.3.2.3	Procedure .....	92
5.3.2.4	Test Requirement .....	92
5.3.3	Adjacent Channel Leakage power Ratio (ACLR) .....	92
5.3.3.1	General .....	92
5.3.3.2	Initial conditions .....	93
5.3.3.3	Procedure .....	93

5.3.3.4	Test requirement .....	93
5.3.4	Transmitter spurious emissions.....	94
5.3.4.1	General .....	94
5.3.4.2	Initial conditions .....	94
5.3.4.3	Procedure .....	94
5.3.4.4	Test Requirement .....	94
5.3.5	Base Station output power .....	95
5.3.5.1	General .....	95
5.3.5.2	Initial conditions .....	95
5.3.5.3	Procedure .....	95
5.3.5.4	Test Requirement .....	95
5.3.6	Transmit intermodulation .....	96
5.3.6.1	General .....	96
5.3.6.2	Initial conditions .....	96
5.3.6.3	Procedure .....	96
5.3.6.3.1	Procedure for co-location requirement .....	96
5.3.6.3.2	Procedure for intra-system requirement .....	97
5.3.6.4	Test Requirement .....	98
5.3.7	Receiver spurious emissions .....	98
5.3.7.1	General .....	98
5.3.7.2	Initial conditions .....	98
5.3.7.3	Procedure .....	98
5.3.7.4	Test Requirement .....	99
5.3.8	In-band blocking .....	99
5.3.8.1	General .....	99
5.3.8.2	Initial conditions .....	99
5.3.8.3	Procedure .....	99
5.3.8.3.1	Procedure for general blocking.....	99
5.3.8.3.2	Procedure for narrowband blocking .....	100
5.3.8.4	Requirement .....	100
5.3.9	Out-of-band blocking.....	100
5.3.9.1	General .....	100
5.3.9.2	Initial conditions .....	100
5.3.9.3	Procedure .....	101
5.3.9.4	Test Requirement .....	101
5.3.10	Receiver intermodulation.....	101
5.3.10.1	General .....	101
5.3.10.2	Initial conditions .....	101
5.3.10.3	Procedure .....	102
5.3.10.4	Test Requirement .....	102
5.3.11	Adjacent Channel Selectivity (ACS) .....	102
5.3.11.1	General .....	102
5.3.11.2	Initial conditions .....	102
5.3.11.3	Procedure .....	103
5.3.11.4	Test Requirement .....	103
5.3.12	Reference sensitivity level.....	103
5.3.12.1	General .....	103
5.3.12.2	Initial conditions .....	103
5.3.12.3	Procedure .....	104
5.3.12.4	Test Requirement .....	104
5.3.13	OTA <i>operating band</i> unwanted emissions.....	104
5.3.13.1	General .....	104
5.3.13.2	Initial conditions .....	104
5.3.13.3	Procedure .....	105
5.3.13.4	Test Requirement .....	105
5.3.14	OTA Adjacent Channel Leakage power Ratio (ACLR) .....	105
5.3.14.1	General .....	105
5.3.14.2	Initial conditions .....	105
5.3.14.3	Procedure .....	106
5.3.14.4	Test Requirement .....	107
5.3.15	OTA transmitter spurious emissions.....	107
5.3.15.1	General spurious emissions.....	107

5.3.15.1.1	General .....	107
5.3.15.1.2	Initial conditions .....	107
5.3.15.1.3	Procedure .....	108
5.3.15.1.4	Test Requirement .....	109
5.3.15.2	Protection of <i>BS receiver</i> .....	109
5.3.15.2.1	General .....	109
5.3.15.2.2	Initial conditions .....	109
5.3.15.2.3	Procedure .....	109
5.3.15.2.4	Test Requirement .....	110
5.3.15.3	Co-existence with other systems .....	110
5.3.15.3.1	General .....	110
5.3.15.3.2	Initial conditions .....	110
5.3.15.3.3	Procedure .....	111
5.3.15.3.4	Test Requirement .....	111
5.3.16	Radiated transmit power .....	111
5.3.16.1	General .....	111
5.3.16.2	Initial conditions .....	111
5.3.16.3	Procedure .....	112
5.3.16.4	Test Requirement .....	112
5.3.17	OTA Base Station output power .....	113
5.3.17.1	General .....	113
5.3.17.2	Initial conditions .....	113
5.3.17.3	Procedure .....	113
5.3.17.4	Test Requirement .....	114
5.3.18	OTA transmitter intermodulation .....	114
5.3.18.1	General .....	114
5.3.18.2	Initial conditions .....	114
5.3.18.3	Procedure .....	114
5.3.18.4	Test Requirement .....	115
5.3.19	OTA receiver spurious emissions .....	115
5.3.19.1	General .....	115
5.3.19.2	Initial conditions .....	116
5.3.19.3	Procedure .....	116
5.3.19.4	Test Requirement .....	117
5.3.20	OTA In-band blocking .....	117
5.3.20.1	General .....	117
5.3.20.2	Initial conditions .....	117
5.3.20.3	Procedure .....	118
5.3.20.4	Test Requirement .....	118
5.3.21	OTA Out-of-band blocking .....	118
5.3.21.1	General .....	118
5.3.21.2	Initial conditions .....	118
5.3.21.3	Procedure .....	119
5.3.21.3.1	<i>BS type 1-O</i> procedure for out-of-band blocking .....	119
5.3.21.3.2	<i>BS type 2-O</i> procedure for out-of-band blocking .....	119
5.3.21.4	Test Requirement .....	120
5.3.22	OTA receiver intermodulation .....	120
5.3.22.1	General .....	120
5.3.22.2	Initial conditions .....	120
5.3.22.3	Procedure .....	121
5.3.22.4	Test Requirement .....	121
5.3.23	OTA Adjacent Channel Selectivity (ACS) .....	121
5.3.23.1	General .....	121
5.3.23.2	Initial conditions .....	121
5.3.23.3	Procedure .....	122
5.3.23.4	Test Requirement .....	122
5.3.24	OTA sensitivity .....	122
5.3.24.1	General .....	122
5.3.24.2	Initial conditions .....	122
5.3.24.3	Procedure .....	123
5.3.24.4	Test Requirement .....	123
5.3.25	OTA Reference sensitivity .....	123



5.3.25.1	General .....	123
5.3.25.2	Initial conditions .....	123
5.3.25.3	Procedure .....	124
5.3.25.4	Test Requirement .....	124
<b>Annex A (informative):</b>	<b>Relationship between the present document and the essential requirements of Directive 2014/53/EU .....</b>	<b>125</b>
<b>Annex B (informative):</b>	<b>Maximum Measurement Uncertainty.....</b>	<b>127</b>
<b>Annex C (normative):</b>	<b>BS configurations for conducted testing .....</b>	<b>130</b>
C.1	<i>BS type I-C</i> .....	130
C.1.1	Transmit configurations .....	130
C.1.1.1	General.....	130
C.1.1.2	Transmission with multiple transmitter antenna connectors.....	130
C.1.2	Receive configurations .....	130
C.1.2.1	General.....	130
C.1.2.2	Reception with multiple receiver antenna connectors, receiver diversity.....	131
C.1.3	Duplexers .....	131
C.1.4	Power supply options .....	132
C.1.5	Ancillary RF amplifiers.....	132
C.2	<i>BS type I-H</i> .....	132
C.2.1	Transmit configurations .....	132
C.2.2	Receive configurations .....	133
C.2.3	Power supply options .....	133
C.3	BS with integrated Iuant BS modem.....	134
<b>Annex D (normative):</b>	<b>BS configurations for OTA testing.....</b>	<b>135</b>
D.1	Transmit configurations .....	135
D.2	Receive configurations.....	136
D.3	Power supply options .....	137
D.4	BS with integrated Iuant BS modem.....	137
<b>Annex E (informative):</b>	<b>Checklist .....</b>	<b>138</b>
<b>Annex F (informative):</b>	<b>Bibliography.....</b>	<b>139</b>
<b>Annex G (informative):</b>	<b>Change History .....</b>	<b>140</b>
History .....		141



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# Foreword

This final draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Mobile Standards Group (MSG), and is now submitted for the Vote phase of the ETSI standards EN Approval Procedure.

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The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.1] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.2].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A-1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

The present document is part 24 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.6].

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## Introduction

The present document is part of a set of standards developed by ETSI that are designed to fit in a modular structure to cover radio equipment within the scope of the Radio Equipment Directive [i.2]. The present document is produced following the guidance in ETSI EG 203 336 [i.3] as applicable.

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# 1 Scope

The present document specifies technical characteristics and methods of measurements for types of radio equipment:

- Base Stations for New Radio (NR).

These radio equipment types are capable of operating in whole or any part of the *operating band(s)* given in tables 1-2 and 1-3. FR1 and FR2 frequency ranges are defined as in table 1-1.

**Table 1-1: Frequency ranges**

Frequency range designation	Frequency range
FR1	410 MHz to 7 125 MHz
FR2	24 250 MHz to 52 600 MHz

**Table 1-2: NR Base Station operating bands in FR1**

NR band	Direction of transmission	NR operating bands	Related EC/ECC decision
n1	Transmit	2 110 MHz to 2 170 MHz	[i.19] and [i.20]
	Receive	1 920 MHz to 1 980 MHz	
n3	Transmit	1 805 MHz to 1 880 MHz	[i.17] and [i.18]
	Receive	1 710 MHz to 1 785 MHz	
n7	Transmit	2 620 MHz to 2 690 MHz	[i.21] and [i.13]
	Receive	2 500 MHz to 2 570 MHz	
n8	Transmit	925 MHz to 960 MHz	[i.17] and [i.18]
	Receive	880 MHz to 915 MHz	
n20	Transmit	791 MHz to 821 MHz	[i.12] and [i.13]
	Receive	832 MHz to 862 MHz	
n28 (note 1)	Transmit	758 MHz to 803 MHz	[i.10] and [i.11]
	Receive	703 MHz to 748 MHz	
n38	Transmit	2 570 MHz to 2 620 MHz	[i.22] and [i.23]
	Receive	2 570 MHz to 2 620 MHz	
n40	Transmit	2 300 MHz to 2 400 MHz	[i.21]
	Receive	2 300 MHz to 2 400 MHz	
n41 (note 2)	Transmit	2 496 MHz to 2 690 MHz	[i.22] and [i.23]
	Receive	2 496 MHz to 2 690 MHz	
n50 (note 3)	Transmit	1 432 MHz to 1 517 MHz	[i.14], [i.15] and [i.16]
	Receive	1 432 MHz to 1 517 MHz	
n51 (notes 3 and 6)	Transmit	1 427 MHz to 1 432 MHz	[i.14] and [i.15]
	Receive	1 427 MHz to 1 432 MHz	
n65 (note 7)	Transmit	2 110 MHz to 2 200 MHz	[i.19], [i.20] and [i.27]
	Receive	1 920 MHz to 2 010 MHz	
n75 (note 3)	Transmit	1 432 MHz to 1 517 MHz	[i.14], [i.15] and [i.16]
	Receive	N/A	
n76 (notes 3 and 6)	Transmit	1 427 MHz to 1 432 MHz	[i.14] and [i.15]
	Receive	N/A	
n77 (note 4)	Transmit	3 300 MHz to 4 200 MHz	[i.8] and [i.24]
	Receive	3 300 MHz to 4 200 MHz	
n78 (note 5)	Transmit	3 300 MHz to 3 800 MHz	[i.8] and [i.24]
	Receive	3 300 MHz to 3 800 MHz	
n80	Transmit	N/A	[i.17] and [i.18]
	Receive	1 710 MHz to 1 785 MHz	
n81	Transmit	N/A	[i.17] and [i.18]
	Receive	880 MHz to 915 MHz	
n82	Transmit	N/A	[i.12] and [i.13]
	Receive	832 MHz to 862 MHz	
n83	Transmit	N/A	[i.10] and [i.11]
	Receive	703 MHz to 748 MHz	

NR band	Direction of transmission	NR operating bands	Related EC/ECC decision
n84	Transmit	N/A	
	Receive	1 920 MHz to 1 980 MHz	[i.19] and [i.20]
NOTE 1: In Europe, according to [i.12] and [i.13], radio equipment in band 28 operates between 758 MHz and 791 MHz for the transmitter ( $F_{DL\_low} = 758$ MHz and $F_{DL\_high} = 791$ MHz) and between 703 MHz and 736 MHz for the receiver ( $F_{UL\_low} = 703$ MHz and $F_{UL\_high} = 736$ MHz).			
NOTE 2: In Europe according to [i.22] and [i.23], radio equipment in band 41 operates between 2 570 MHz and 2 620 MHz ( $F_{DL\_low} = 2 570$ MHz and $F_{DL\_high} = 2 620$ MHz).			
NOTE 3: Radio equipment in bands n50 and n51 only operates in transmit mode (downlink only). Only transmitter requirements are applicable.			
NOTE 4: In Europe, according to [i.24] and [i.8], radio equipment in band n77 operates between 3 400 MHz and 3 800 MHz ( $F_{DL\_low} = 3 400$ MHz and $F_{DL\_high} = 3 800$ MHz).			
NOTE 5: In Europe, according to [i.24] and [i.8], radio equipment in band n78 operates between 3 400 MHz and 3 800 MHz ( $F_{DL\_low} = 3 400$ MHz and $F_{DL\_high} = 3 800$ MHz).			
NOTE 6: Only requirements for Local Area <i>BS class</i> are defined.			
NOTE 7: This band includes two frequency ranges that are harmonised in Europe:			
(a) According to [i.19] and [i.20], radio equipment in band n65 operates between 2 110 MHz and 2 170 MHz for the transmitter ( $F_{DL\_low} = 2 110$ MHz and $F_{DL\_high} = 2 170$ MHz), and between 1 920 MHz and 1 980 MHz for the receiver ( $F_{UL\_low} = 1 920$ MHz and $F_{UL\_high} = 1 980$ MHz).			
(b) Based on [i.27], radio equipment in band n65 operates between 2 170 MHz and 2 200 MHz for the transmitter ( $F_{DL\_low} = 2 170$ MHz and $F_{DL\_high} = 2 200$ MHz) and between 1 980 MHz and 2 010 MHz for the receiver ( $F_{UL\_low} = 1 980$ MHz and $F_{UL\_high} = 2 010$ MHz) as the Complementary Ground Component (CGC) of a Mobile-satellite service by reference to the present Harmonised Standard.			

Table 1-3: NR Base Station operating bands in FR2

NR band	Direction of transmission	NR Base Station operating bands	Relevant EC/ECC decision
n257 (note)	Transmit	26 500 MHz to 29 500 MHz	[i.25] and [i.26]
	Receive	26 500 MHz to 29 500 MHz	
n258	Transmit	24 250 MHz to 27 500 MHz	[i.25] and [i.26]
	Receive	24 250 MHz to 27 500 MHz	
NOTE: In Europe according to [i.25] and [i.26], radio equipment in band n257 operates between 26 500 MHz and 27 500 MHz ( $F_{UL\_low} = 26 500$ MHz and $F_{UL\_high} = 27 500$ MHz).			

The present document covers conducted and radiated requirements for NR Base Stations for 3GPP Release 15. Additionally, it includes requirements for selected NR *operating bands* from 3GPP Release 16.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.2] is given annex A.

## 2 References

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] [ETSI TS 138 141-1 \(V15.14.0\) \(01-2023\)](#): "5G; NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing (3GPP TS 38.141-1 version 15.14.0 Release 15)".

- [2] [ETSI TS 138 141-2 \(V15.17.0\) \(05-2023\)](#): "5G; NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing (3GPP TS 38.141-2 version 15.17.0 Release 15)".
- [3] [ETSI TS 138 104 \(V15.18.0\) \(10-2022\)](#): "5G; NR; Base Station (BS) radio transmission and reception (3GPP TS 38.104 version 15.18.0 Release 15)".
- [4] [ETSI EN 301 908-18 \(V15.1.1\) \(09-2021\)](#): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 18: E-UTRA, UTRA and GSM/EDGE Multi-Standard Radio (MSR) Base Station (BS) Release 15".
- [5] [ETSI EN 301 908-23 \(V15.0.1\) \(07-2023\)](#): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 23: Active Antenna System (AAS) Base Station (BS); Release 15".

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] [Commission implementing decision C\(2015\) 5376 final of 4.8.2015](#) on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.
- [i.2] [Directive 2014/53/EU](#) of the European parliament and of the council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.3] ETSI EG 203 336 (V1.2.1) (05-2020): "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.4] Recommendation ITU-R SM.329-12 (09-2012): "Unwanted emissions in the spurious domain".
- [i.5] ETSI TR 100 028 (parts 1 and 2) (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.6] ETSI EN 301 908-1 (V15.1.1) (09-2021): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 1: Introduction and common requirements Release 15".
- [i.7] [ERC Recommendation 74-01 \(05-2019\)](#): "Unwanted emissions in the spurious domain".
- [i.8] [Commission implementing Decision \(EU\) 2019/235 of 24 January 2019](#) on amending Decision 2008/411/EC as regards an update of relevant technical conditions applicable to the 3400-3800 MHz frequency band.
- [i.9] ETSI TS 103 807 (V1.1.1) (10-2021): "Mobile Standards Group (MSG); IMT Cellular Networks Base Stations (BS) Additional Regulatory Requirements".
- [i.10] [Commission Implementing Decision \(EU\) 2016/687 of 28 April 2016](#) on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union.
- [i.11] [ECC Decision \(15\)01](#): "Harmonised technical conditions for mobile/fixed communications networks (MFCN) in the band 694-790 MHz including a paired frequency arrangement (Frequency Division Duplex 2x30 MHz) and an optional unpaired frequency arrangement (Supplemental Downlink)", Approved 06 March 2015.

- [i.12] [Commission Decision 2010/267/EU of 6 May 2010](#) on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union.
- [i.13] [ECC Decision \(09\)03](#): "Harmonised conditions for mobile/fixed communications networks (MFCN) operating in the band 790 - 862 MHz", 30 October 2009.
- [i.14] [Commission Implementing Decision \(EU\) 2018/661 of 26 April 2018](#) amending Implementing Decision (EU) 2015/750 on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union as regards its extension in the harmonised 1427-1452 MHz and 1492-1517 MHz frequency bands.
- [i.15] [ECC Decision \(13\)03](#): "The harmonised use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)", Approved 8 November 2013, Amended 02 March 2018.
- [i.16] [ECC Decision 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)", Approved 17 November 2017, corrected 2 March 2018.
- [i.17] [Commission Implementing Decision \(EU\) 2022/173 of 7 February 2022](#) on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing electronic communications services in the Union and repealing Decision 2009/766/EC.
- [i.18] [ECC Decision \(06\)13](#): "Designation of the bands 880-915 MHz, 925-960 MHz, 1710-1785 MHz and 1805-1880 MHz for terrestrial UMTS, LTE, WiMAX and IoT cellular systems", Approved 01 December 2006, Amended 8 March 2019.
- [i.19] [Commission Implementing Decision \(EU\) 2020/667 of 6 May 2020](#) amending Decision 2012/688/EU as regards an update of relevant technical conditions applicable to the frequency bands 1 920-1 980 MHz and 2 110-2 170 MHz.
- [i.20] [ECC Decision \(06\)01](#): "The harmonised utilisation of the bands 1920-1980 MHz and 2110-2170 MHz for mobile/fixed communications networks (MFCN) including terrestrial IMT systems", Approved 24 March 2006, Amended 8 March 2019.
- [i.21] [ECC Decision 14\(02\)](#): "Harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for Mobile/Fixed Communications Networks (MFCN)", Approved 27 June 2014, amended 10 March 2023.
- [i.22] [Commission Implementing Decision \(EU\) 2020/636 of 8 May 2020](#) amending Decision 2008/477/EC as regards an update of relevant technical conditions applicable to the 2500-2690 MHz frequency band.
- [i.23] [ECC Decision \(05\)05](#): "Harmonised utilization of spectrum for Mobile/Fixed Communications Networks (MFCN) operating within the band 2 500-2 690 MHz", Approved 18 March 2005, Amended 05 July 2019.
- [i.24] [ECC Decision \(11\)06](#): "Harmonised frequency arrangements and least restrictive technical conditions (LRTC) for mobile/fixed communications networks (MFCN) operating in the band 3400-3800 MHz", Approved 09 December 2011, Amended 26 October 2018.
- [i.25] [Commission Implementing Decision \(EU\) 2020/590 of 24 April 2020](#) amending Decision (EU) 2019/784 as regards an update of relevant technical conditions applicable to the 24,25-27,5 GHz frequency band.
- [i.26] [ECC Decision \(18\)06](#): "Harmonised technical conditions for Mobile/Fixed Communications Networks (MFCN) in the band 24.25-27.5 GHz", Approved 06 July 2018, Last amended 20 November 2020.
- [i.27] [ECC Decision \(06\)09](#): "Designation of the bands 1980-2010 MHz and 2170-2200 MHz for use by systems in the Mobile-Satellite Service including those supplemented by a Complementary Ground Component (CGC)", Approved 01 December 2006, Amended 05 September 2007.



- [i.28] ETSI TR 137 941 (V15.3.0) (10-2021): "Universal Mobile Telecommunications System (UMTS); LTE; 5G; Radio Frequency (RF) conformance testing background for radiated Base Station (BS) requirements (3GPP TR 37.941 version 15.3.0 Release 15)".
- [i.29] ETSI TR 103 877 (V1.1.1): "Task Force for European Standards for IMT-2000 (MSG); Technical Parameter selection in ETSI EN 301 908 Base Station (BS) Harmonised Standards".

## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

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

**active transmitter unit:** transmitter unit which is on, and has the ability to send modulated data streams, that are parallel and distinct to those sent from other transmitter units, to an *antenna connector* or to one or more *TAB connectors*

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

**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 *BS 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 Recommendation ITU-R SM.329-12 [i.4] used for the formulation of unwanted emission requirements for FR1

**beam:** 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:** intended direction for maximum EIRP

**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 expressed in MHz and is used as a reference for transmitter and receiver RF requirements.

NOTE 2: The BS can transmit to and/or receive from one or more UE bandwidth parts that are less than or equal to the BS *transmission bandwidth* configuration, in any part of the BS *transmission bandwidth* configuration.

**BS class:** classification of BS according to its intended use

NOTE: There are three *BS classes* in the present document: *wide area Base Station*, *medium range Base Station* and *local Area Base Station*

**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*