

TECHNICAL REPORT

Case studies supporting IEC 62232 - Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure

CONTENTS

FOREWORD	15
INTRODUCTION	17
1 Scope	18
2 Normative references	18
3 Terms and definitions	18
4 Symbols and abbreviations	35
4.1 Physical quantities	35
4.2 Constants	36
4.3 Abbreviated terms	36
5 General	38
5.1 Overview of case studies	38
5.2 Terminology related to measurement survey implementation	40
6 Small cells product compliance assessment using SAR measurements	41
6.1 General content	41
6.2 Case study A: indoor small cell	41
6.2.1 General description	41
6.2.2 Technical description of the EUT	41
6.2.3 Implementation of IEC 62232:2025	42
6.2.4 Technical outcome	43
6.3 Case study B: outdoor small cell	44
6.3.1 General description	44
6.3.2 Technical description of the EUT	45
6.3.3 Implementation of IEC 62232:2025	45
6.3.4 Technical outcome	46
6.4 Lessons learned	47
7 Street cell with omnidirectional antenna product compliance assessment using SAR measurements and power density spatial averaging	47
7.1 General content	47
7.2 Implementation of IEC 62232:2025	47
7.2.1 Evaluation process	47
7.2.2 Methodology	48
7.2.3 Reporting	48
7.3 Technical outcome	49
7.4 Comparative study	49
7.4.1 Comparison process	49
7.4.2 Comparison of spatial average field strength and SAR results	49
7.5 Lessons learned	50
8 Macro BS with massive MIMO product compliance assessment	50
8.1 General content	50
8.2 Technical description of the EUT	51
8.3 Implementation of IEC 62232:2025	52
8.3.1 Evaluation process	52
8.3.2 Methodology	53
8.3.3 Reporting	54
8.4 Technical outcome	54
8.5 Lessons learned	54

9	Wireless link with parabolic dish antenna product compliance assessment	55
9.1	General content.....	55
9.2	Implementation of IEC 62232:2025.....	56
9.2.1	Evaluation process.....	56
9.2.2	Methodology.....	56
9.2.3	Reporting.....	57
9.3	Technical outcome.....	57
9.4	Lessons learned	58
10	Small cell product installation compliance assessment using simplified installation criteria.....	58
10.1	General content.....	58
10.2	Case study A.....	58
10.2.1	General description	58
10.2.2	Implementation of IEC 62232:2025	59
10.2.3	Technical outcome	60
10.3	Case study B.....	60
10.3.1	General description	60
10.3.2	Implementation of IEC 62232:2025	61
10.3.3	Technical outcome	61
10.4	Lessons learned	61
11	Macro site with massive MIMO product installation compliance assessment	62
11.1	General content.....	62
11.2	Case study A.....	62
11.2.1	General description	62
11.2.2	Implementation of IEC 62232:2025	63
11.2.3	Technical outcome	64
11.3	Case study B.....	66
11.3.1	General description	66
11.3.2	Implementation of IEC 62232:2025	67
11.3.3	Technical outcome	69
11.4	Lessons learned	71
12	General implementation of the actual maximum approach.....	72
12.1	General content.....	72
12.2	Case Study A	72
12.2.1	Implementation of IEC 62232:2025	72
12.2.2	Verification of actual EIRP control on operational sites	72
12.3	Case study B.....	75
12.3.1	Implementation of IEC 62232:2025	75
12.3.2	Verification of actual EIRP control on one operational site.....	76
12.4	Lessons learned	77
13	Power or EIRP control features validation case studies	78
13.1	General content.....	78
13.2	Case study A.....	78
13.2.1	General description	78
13.2.2	Implementation of IEC 62232:2025	78
13.2.3	Technical outcome	81
13.3	Case study B.....	85
13.3.1	General description	85

13.3.2	In-situ validation of MCF in a MU-MIMO scenario	85
13.3.3	Technical outcome	88
13.4	Case study C	88
13.4.1	General description	88
13.4.2	Implementation of IEC 62232:2025	88
13.4.3	Technical outcome	91
13.5	Lessons learned	93
14	Small cell site in-situ exposure measurements	94
14.1	General description	94
14.2	Implementation of IEC 62232:2025 for measurement Campaign A	95
14.2.1	Evaluation process	95
14.2.2	Methodology	96
14.2.3	Reporting	97
14.3	Implementation of IEC 62232:2025 for measurement Campaign B	97
14.3.1	General description	97
14.3.2	Case B (comprehensive exposure evaluation)	98
14.3.3	Reporting	98
14.4	Lessons learned	98
15	Millimetre-wave (FR2) small cell site in-situ exposure assessment	99
15.1	General description	99
15.2	Test campaign A: indoor installation in an entrance hall of an office building	99
15.2.1	Evaluation site	99
15.2.2	Evaluation process	100
15.2.3	Methodology	100
15.2.4	In-situ measurements with emulated BS load profile using frequency spectrum measurement	103
15.2.5	Measurement method using a dedicated NR decoder and extrapolation	104
15.2.6	Reporting	105
15.2.7	Technical outcome	105
15.3	Test campaign B: indoor installation in an operating theatre	106
15.3.1	Evaluation site	106
15.3.2	Evaluation process	107
15.3.3	Methodology	107
15.3.4	Technical outcome	109
15.4	Test campaign C: outdoor installation	112
15.4.1	Evaluation site	112
15.4.2	Evaluation process	113
15.4.3	Methodology	114
15.4.4	Reporting	115
15.4.5	Technical outcome	116
15.5	Test campaign D: in-situ measurement at a residential apartment with 5G millimetre-wave fixed wireless access from rooftop small cell	118
15.5.1	Evaluation site	118
15.5.2	Evaluation process	120
15.5.3	Methodology	120
15.5.4	Reporting	122
15.5.5	Technical outcome	122
15.6	Test campaign E: in-situ measurement case study	124
15.6.1	Product configurations	124

15.6.2	Implementation of IEC 62232:2025	124
15.6.3	Technical outcome	126
15.7	Test campaign F: comparative study about in-situ measurements in NLoS and LoS conditions	128
15.7.1	General content	128
15.7.2	Evaluation process	128
15.7.3	Technical outcome	131
15.8	Lessons learned	131
16	Macro site in-situ measurements	132
16.1	General content	132
16.2	Case study A	132
16.2.1	General description	132
16.2.2	Implementation of IEC 62232:2025	133
16.2.3	Technical outcome	134
16.3	Case study B	134
16.3.1	General description	134
16.3.2	Measurement equipment	135
16.3.3	Implementation of IEC 62232:2025	136
16.3.4	BS site A	137
16.3.5	BS site B	142
16.3.6	Technical outcome	145
16.4	Case study C	145
16.4.1	General description	145
16.4.2	Implementation of IEC 62232:2025	145
16.4.3	Technical outcome	150
16.5	Case study D	151
16.5.1	General description	151
16.5.2	Implementation of IEC 62232:2025	151
16.5.3	Technical outcome	155
16.5.4	Discussion and next step	156
16.6	Lessons learned	157
16.7	Discussion about time averaging	157
16.8	Discussion about spatial averaging	158
17	NR FR1 extrapolation for in-situ RF exposure assessment	158
17.1	General description of case studies	158
17.2	Measurement campaigns A and B	159
17.2.1	General	159
17.2.2	Evaluation sites	159
17.2.3	Evaluation process	161
17.2.4	Methodology	161
17.2.5	Reporting	162
17.2.6	Technical outcome	167
17.3	Measurement campaign C	167
17.3.1	General description	167
17.3.2	Evaluation site(s)	167
17.3.3	Evaluation process	169
17.3.4	Methodology	170
17.3.5	Technical outcome	174
17.4	Measurement campaign D	177

17.4.1	Description of evaluation sites.....	177
17.4.2	Evaluation process.....	181
17.4.3	Methodology.....	181
17.4.4	Technical outcome.....	187
17.5	Lessons learned.....	190
18	Macro site in-situ measurements using drones.....	191
18.1	General content.....	191
18.2	Implementation.....	191
18.2.1	Evaluation system.....	191
18.2.2	Evaluation process and methodology.....	192
18.2.3	Reporting.....	192
18.3	Technical outcome.....	193
18.4	Lessons learned.....	193
19	Emerging laboratory measurement methods for product compliance assessments.....	193
19.1	General description.....	193
19.2	Evaluation of wbSAR from BSs operating at frequencies above 6 GHz by means of reverberation chamber measurements.....	194
19.2.1	Methodology.....	194
19.2.2	Validation.....	197
19.2.3	Example.....	197
19.2.4	Lessons learned.....	199
19.3	Measurements of absorbed power density from BSs by means of an over-the-air augmented technique.....	200
19.3.1	Methodology.....	200
19.3.2	Validation.....	201
19.3.3	Example.....	203
19.3.4	Lessons learned.....	206
Annex A (informative) Technical information supporting the case study "Small cell product installation compliance assessment using simplified installation criteria" (Case study A in Clause 10).....		207
A.1	3GPP categories of BSs.....	207
A.2	E0 installation class case study – Touch compliant.....	207
A.3	E2 installation class case study.....	208
A.4	E10 installation class case study.....	208
A.5	E100 installation class case study.....	210
A.6	E+ installation class case study.....	211
Annex B (informative) Technical information supporting the case study "Macro site with massive MIMO product installation compliance assessment" (case study A in Clause 11).....		214
B.1	Description of the site.....	214
B.2	Description of the EUT.....	215
B.3	Evaluation procedure.....	216
B.4	Calculations.....	216
B.5	Interpretation of the results.....	219
Annex C (informative) Technical information supporting the introduction of the actual maximum approach.....		220
C.1	Rationale and technical background.....	220
C.2	Actual EIRP evaluation assumptions.....	222
C.3	Calculation of the actual power per segment.....	225
C.4	Modelling studies on F_{PR}	227

C.5	Experimental studies on F_{PR}	230
C.6	Configurations with multiple transmitters	232
C.6.1	Guiding principles for configurations with multiple transmitters	232
C.6.2	Rationale	232
C.6.3	Power combination factors applicable to configurations with multiple transmitters	234
C.7	Modelling case studies	236
C.7.1	Modelling case study A	236
C.7.2	Modelling case study B	238
C.7.3	Modelling case study C	240
Annex D (informative)	Technical information supporting the case study "Small cell site in-situ exposure measurements" (Clause 14)	244
D.1	General description and note	244
D.2	Technical information and results for measurement Campaign A	244
D.2.1	General description and measurement process	244
D.2.2	Test results for Trial 1	244
D.2.3	Test results for Trial 2	246
D.2.4	Reporting	249
D.3	Technical information for measurement Campaign B	249
D.3.1	General description	249
D.3.2	Measurement process	249
D.3.3	Results	250
D.3.4	Measurement uncertainty	251
D.3.5	Reporting	252
Annex E (informative)	Technical information supporting the case study "Macro site in-situ measurements using drones" (Clause 18)	253
E.1	Description of the test setup	253
E.1.1	Technical parameters of the measurement system	253
E.1.2	Technical parameters of the drone	253
E.1.3	Software interface of the drone-based measurement system	254
E.2	Description of the BS measurement site	255
E.3	Description of the measurement process	255
E.4	Considerations for performing RF exposure measurements using drones	258
Bibliography		259
Figure 1 – Representation of the terminology related to a typical measurement survey implementation scenario		40
Figure 2 – Tested local area BS		41
Figure 3 – Definition of cylindrical RF compliance boundary		43
Figure 4 – Small remote radio equipment at 3,5 GHz (EUT antenna)		44
Figure 5 – Views of the SAR measurement setup		46
Figure 6 – Characteristics of SAR of EUT antennas as a function of separation distance at 3,5 GHz		46
Figure 7 – Omnidirectional antenna connected to the street cell product		47
Figure 8 – Vertical scan lines for spatially averaged field strength measurements		48
Figure 9 – 5G BS description		51
Figure 10 – Box-shaped RF compliance boundary		53
Figure 11 – Typical radio transmitters using parabolic dish antennas		55

Figure 12 – Cylindrical shape RF compliance boundary	56
Figure 13 – Overview of BS installation classes for simplified RF exposure assessment of small cells.....	59
Figure 14 – Indoor site with 5G small cell product at millimetre-wave frequency.....	60
Figure 15 – Outline of the 5G site.....	63
Figure 16 – Top view of the compliance boundaries (red: occupational, yellow: general public).....	65
Figure 17 – Side view of the compliance boundaries (red: occupational, yellow: general public).....	65
Figure 18 – Outline of the multiband site.....	66
Figure 19 – Compliance boundaries for the pre-existing LTE site (installation scenario 0)	69
Figure 20 – General public compliance boundaries for the new site using installation scenario 2 – reduction of the configured maximum transmitted power	69
Figure 21 – General public compliance boundaries for the new site using installation scenario 3 – actual EIRP control on the entire 5G cell (single segment)	70
Figure 22 – General public compliance boundaries for the new site using installation scenario 4 – EIRP control using two segments	70
Figure 23 – Horizontal and vertical planes corresponding to installation scenario 4	71
Figure 24 – Counter verification of actual EIRP control on an operational site with single segment.....	73
Figure 25 – Counter verification of actual EIRP control on an operational site with two segments.....	74
Figure 26 – Schematic view of monitoring and control of the actual maximum transmit power for a cell-wide solution and a multi-segment solution	75
Figure 27 – Six-minute time-averaged transmitted power (cell-wide) distribution normalized to the configured maximum for a cell-wide monitoring and control feature.....	76
Figure 28 – Distribution of the six-minute time-averaged maximum EIRP within each segment normalized to its maximum for a directional monitoring and control feature.....	77
Figure 29 – Measurement setup for validation case study A	80
Figure 30 – Power density measurement results for TC1	83
Figure 31 – Measured time variation of the power density using TC2	84
Figure 32 – Measured time variation of the power density using TC3	84
Figure 33 – Test site with indication of MU-MIMO systems and MEPs.....	86
Figure 34 – Segments configured on the MCF under test.....	86
Figure 35 – Instantaneous power at mMIMO BS, transmitted RBs, and UE status	87
Figure 36 – OTA configurations used for MCF validation	89
Figure 37 – Example of actual EIRP MCF test results with one segment	91
Figure 38 – Example of actual EIRP MCF test results with two segments	92
Figure 39 – Illustration of small cells integration in street furniture	95
Figure 40 – Photographs of typical examples of the three small cell site groups.....	97
Figure 41 – The measured BS and the measurement area	99
Figure 42 – Installation of the EUT	100
Figure 43 – Description of the EVL and MEPs	102
Figure 44 – The EUT and interested area.....	107
Figure 45 – Measurement locations.....	108
Figure 46 – MEP positions at 1,5 m above ground superimposed with modelling results	108

Figure 47 – Free space modelling of the RF exposure in front of the EUT.....	110
Figure 48 – Electric field strength for the three MELs	110
Figure 49 – Comparison of measurement and modelled results in the boresight direction	111
Figure 50 – Comparison of measurement and modelled results in the direction perpendicular to boresight.....	111
Figure 51 – EUT installation, measurement points and measurement area	112
Figure 52 – EUT frame structure	113
Figure 53 – F_{TDC} calculation per frame.....	115
Figure 54 – The measurement area range and MEPs	116
Figure 55 – The results of electric field strength measurements at MEP1 and MEP2	117
Figure 56 – EUT and measurement location	119
Figure 57 – Transmission path from millimetre-wave small cell to apartment (132 m).....	119
Figure 58 – Example of test case representing family with teenagers and guests during a weekend stay	121
Figure 59 – Example of test case representing technology-intensive usage	122
Figure 60 – Measured RF exposure levels (30-minute time-averaged) – family with teenagers	122
Figure 61 – Measured RF exposure levels (30-minute time-averaged) – technology-intensive usage	123
Figure 62 – Outdoor site with 5G small cell product at millimetre-wave frequency installed on a 44 m radio tower	124
Figure 63 – Measurement locations in the measurement area	126
Figure 64 – Map of the outdoor measurement locations.....	127
Figure 65 – Outdoor measurement location 1	127
Figure 66 – Outdoor measurement location 2	127
Figure 67 – Satellite view of measurement site	129
Figure 68 – Description of the measurement setup.....	130
Figure 69 – View from the measurement location to the BS.....	133
Figure 70 – Example of frequency selective measurement result – POME 3, BS site A with additional data downloading.....	137
Figure 71 – View from the MELs to the BS site A	138
Figure 72 – Measurement results for POME-3 under normal operation for different values of averaging schemes (10-second sampling): tumbling (blue) and sliding average (cyan)	140
Figure 73 – Measurement results in POME-3 for different values of averaging time	141
Figure 74 – Measurement results in POME-3 – comparison between the normal operation mode (left) and the forced data transmission mode (right)	141
Figure 75 – View from the MEL to the BS site B.....	142
Figure 76 – Measurement results on BS site B for different values of averaging time.....	144
Figure 77 – Measurement results on BS site B – comparison between the normal operation mode and the forced data transmission mode	144
Figure 78 – BS, UE and broadband meter positioning.....	146
Figure 79 – Broadband RMS electric field strength measurements using the non-specific BS load profile.....	147
Figure 80 – Measurements with typical BS load profile	148
Figure 81 – Measurements with high BS load profile	149

Figure 82 – Example of exposure assessment in a publicly accessible area in LoS to the EUT.....	151
Figure 83 – Zero-span measurement results for the calculation of F_{extBeam} or measurement of power density per traffic resource element for only the S_x vector component.....	155
Figure 84 – Channel power measurements during streaming test versus when no traffic was instigated.....	156
Figure 85 – Extrapolation of the SS-RSRP measurements versus channel power measurements during UDP downlink transmission (1 min)	156
Figure 86 – Campaign A - OTA test site in France	159
Figure 87 – Campaign B – Commercial site in operation in Rambouillet, France.....	160
Figure 88 – Temporal view on the x -axis of electric field strength measured with non-specific EUT load profile	165
Figure 89 – Temporal view on the x -axis of electric field strength measured with a typical EUT load profile of one UE downloading a 1 GB file.....	166
Figure 90 – Temporal view on the x -axis of electric field strength measured with a typical EUT load profile of two UEs downloading a 1 GB file	166
Figure 91 – Spectral view and averaged channel power measured with non-specific EUT load profile	167
Figure 92 – The commercial 32T32R NR BS in operation.....	168
Figure 93 – EUT frame structure	169
Figure 94 – POME and measurement area range.....	170
Figure 95 – Extrapolated electric field strength, E_{asmt} , distribution across the measurement area (network operator A and cell ID 381).....	171
Figure 96 – The process of E_{SSB} measurement for the multi-beam	173
Figure 97 – Distribution map of the measured electric field strengths for all operator A NR cells in the measurement area.....	173
Figure 98 – Distribution map of the measured electric field strengths for operator B NR cells in the measurement area	174
Figure 99 – Extrapolated electric field strength results at 1,5 m height	176
Figure 100 – Measurement situation at MEP A during run I (a) and run II (b)	179
Figure 101 – Measurement situation at MEP B during run I (a) and run II (b)	179
Figure 102 – Measurement situation at MEP C during run I (a) and run II (b)	180
Figure 103 – Measurement situation at MEP D during run I (a) and run II (b)	180
Figure 104 – Measurement situation at MEP E during run II	181
Figure 105 – Example of zero span measurement with spectrum analyser for MEP B	185
Figure 106 – Spectrogram measurement at MEP A	186
Figure 107 – Graphical representation of the actual maximum power density results normalized to the results using forced maximum traffic load.....	188
Figure 108 – Drone used for field measurements around the BS site	192
Figure 109 – Flow chart of the procedure for wbSAR measurements in RC.....	195
Figure 110 – Illustration of the wbSAR measurement steps.....	196
Figure 111 – wbSAR measured in the RC and compared with simulation for a mmW BS and for a horn antenna as a function of the separation distance	198
Figure 112 – RC measurement setup with the mmW BS	199
Figure 113 – Flow chart of the procedure for measurements of absorbed power density by means of an OTAA approach.....	201

Figure 114 – Illustration of the measurement steps of the OTAA approach for measurements of the absorbed power density	201
Figure 115 – OTAA setup for measurements of the absorbed power density for the slotted horn array (IEC/IEEE 63195-1 [63]) validation antenna	202
Figure 116 – Comparison of the psAPD for the IEC/IEEE 63195-1 [63] cavity-fed dipole array at 30 GHz obtained by means of the OTAA approach compared with full-wave simulations	203
Figure 117 – Comparison of the psAPD for the IEC/IEEE 63195-1 [63] slotted-horn array at 30 GHz obtained by means of the OTAA approach compared with full-wave simulations	203
Figure 118 – Millimetre-wave BS model used as a mock-up for the study of the OTAA approach	204
Figure 119 – Comparison of the psAPD for a mmW BS obtained by means of the OTAA approach compared with full-wave simulations	205
Figure 120 – Comparison of the spatial averaged absorbed power density distribution (1 cm^2) inside the phantom with a distance from the BS set to 1 cm	205
Figure A.1 – Illustrative example of layout design for an E10 installation class configuration	209
Figure A.2 – Illustrative example of layout design for an E100 installation class configuration	211
Figure A.3 – Illustrative example of layout design for an E+ installation class configuration	213
Figure B.1 – Rooftop scheme	214
Figure B.2 – Geometry of the rooftop installation	215
Figure B.3 – Compliance boundaries for general public (yellow)	217
Figure B.4 – Compliance boundaries for occupational exposure (red)	218
Figure C.1 – Empirical CDFs of transmitted power (normalized) for different environments in 3G network in India [82]	221
Figure C.2 – Empirical CDFs of combined transmitted power (normalized) for a 2G/3G/4G network in Sweden [83]	221
Figure C.3 – Extrapolation factor of the power flux density $S(t)$ of the different signals and the $S_{\text{total}}(t)$ (all bands) with a six-minute sliding time averaging applied to the measurements [78]	222
Figure C.4 – CDF of the reference Beta distribution used to assess power combination factors	233
Figure C.5 – CDF resulting from the combination of two independent transmitters having the reference Beta distribution	234
Figure C.6 – Fraction of the total power transmitted in the broadside beam direction for rural and urban scenarios	237
Figure C.7 – CDF of the power reduction factor for rural and urban installation scenarios	238
Figure C.8 – CDF of the normalized transmitted power for both UMa and UMi	240
Figure C.9 – Binomial law CDF for $N = 100$ and $PR = 0,125$	242
Figure C.10 – Binomial law CDF for $N = 82$ and $PR = 2/7$	243
Figure D.1 – Mean value of electric field strength measurements with broadband equipment at intermediate points for each site	245
Figure D.2 – Maximum global electric field strength values measured in close proximity to the sites	245
Figure D.3 – Consistency analysis between Case A and Case B (without extrapolation) results	246

Figure D.4 – Contribution of mobile services compared to Case B results.....	246
Figure D.5 – Routes used for walk-tests around each site in both trials	247
Figure D.6 – CDF of the upload throughput in Trial 1 normalized by the maximum value measured on each site when the small cells are off (left) and CDF of the transmitted power by the handset in Trial 1 (right).....	247
Figure D.7 – CDF of the upload throughput in Trial 2 normalized by the maximum value measured on each site when the small cells are off (left) and CDF of the transmitted power by the handset in Trial 2 (right).....	248
Figure D.8 – CDFs of the power transmitted by the handset during voice calls in Trial 2 when small cells are on and off.....	248
Figure D.9 – Results of the measurements around the selected sites.....	251
Figure D.10 – Comparison between Campaign B results and other countrywide measurement campaigns.....	251
Figure E.1 – Operating interface of the drone-based measurement system software.....	254
Figure E.2 – Photograph of test site	255
Figure E.3 – The measurement system.....	256
Figure E.4 – The route of the drone during the flight.....	256
Figure E.5 – The drone hovering at MEP 1.....	257
Table 1 – Outline of RF exposure assessment case studies	39
Table 2 – Frequency range designation	40
Table 3 – ICNIRP RF exposure limits relevant for the product compliance assessment (from [2], [3]).....	41
Table 4 – EUT technical parameters.....	42
Table 5 – EUT configuration with rated maximum transmitted power level and maximum transmitted power levels.....	42
Table 6 – Dimensions of the cylindrical-shaped RF compliance boundary for general public (GP) and occupational (O) exposure	44
Table 7 – EUT technical parameters.....	45
Table 8 – General public compliance distances for the street cell BS with omnidirectional antenna	49
Table 9 – Street cell EMF compliance assessment comparison: general public (adult) compliance distances based on SAR and field strength	50
Table 10 – Street cell EMF compliance assessment comparison: compliance distances based on ICNIRP-2020 [2] local reference levels and ICNIRP-1998 [3] reference levels	50
Table 11 – RF EMF exposure limits relevant for the product compliance assessment from [2] (whole-body) and [3].....	51
Table 12 – EUT technical parameters	52
Table 13 – Properties of the antenna used	52
Table 14 – EUT configuration with rated maximum transmitted power level and actual maximum transmitted power level including a power tolerance of 1 dB.....	52
Table 15 – Dimensions of the box-shaped RF compliance boundary for general public (GP) and occupational (O) exposure for an actual maximum transmitted power configuration.....	54
Table 16 – RF EMF exposure limits relevant for the product compliance assessment (from [2] [3]).....	55
Table 17 – Examples of radio relay configurations with parabolic dish antennas below 10 GHz	57

Table 18 – Examples of radio relay configurations with parabolic dish antennas above 10 GHz	57
Table 19 – Typical examples of small cell configurations	58
Table 20 – RF EMF exposure limits relevant for the compliance assessment	63
Table 21 – Parameters of the BS installed on the multiband site	67
Table 22 – RF EMF exposure limits relevant for the compliance assessment of the multiband site [11]	67
Table 23 – Configuration parameters of the NR BS	68
Table 24 – Description of validation test cases	80
Table 25 – Overview of validation test results	82
Table 26 – Example of test sequence for a MCF configured with one single segment	90
Table 27 – Example of test sequence for a MCF configured with two segments	90
Table 28 – Information for the access systems and frequency bands of the EUT and ambient BSs	100
Table 29 – Specifications of the EUT regarding the RF exposure evaluation	101
Table 30 – The overview of evaluation and measurement methods for FR2 BS in high DL traffic conditions	101
Table 31 – Settings of SA for frequency spectrum measurement of electric field strength from the EUT	103
Table 32 – Setting of SRM-3006 for frequency spectrum measurement of electric field strength from the ambient sources	104
Table 33 – Setting of frequency selective meter for demodulation measurement of electric field strength for SSB signal from the EUT	105
Table 34 – Other factors for extrapolation using Equation (E.16) in E.8.2.1.2 (IEC 62232:2025)	105
Table 35 – Obtained ERs	106
Table 36 – Parameters of the EUT	107
Table 37 – Technical specifications of the measurement equipment	109
Table 38 – Technical parameters of NR FR2 BS	113
Table 39 – Measurement results of the electric field strength at MEP1 and MEP2	117
Table 40 – Measurement results of the power density and ER for MEP1 and MEP2	118
Table 41 – EUT configuration parameters	120
Table 42 – Measurement results summary	123
Table 43 – Measurement results	126
Table 44 – BS configuration parameters	128
Table 45 – Overview of RSRP test results used for validation	130
Table 46 – Operators and technologies present on the BS site	133
Table 47 – Measurement results for 1,5 m above relative ground level	134
Table 48 – Environmental conditions before and after the measurements	135
Table 49 – Electric field strength measurement equipment (see NOTE 1 in Clause 1)	135
Table 50 – Uncertainty budget for field strength measurement using a broadband meter (example for M-04 with probe S-04)	136
Table 51 – Technologies and frequencies present on the BS site A	138
Table 52 – Measurement results on BS site A	139
Table 53 – Technologies and frequencies present on the BS site B	143
Table 54 – Measurement results on BS site B	143

Table 55 – 5G NR BS technical parameters	146
Table 56 – Summary of measurement results using the non-specific BS load profile.....	147
Table 57 – Summary of measured levels and BS performance parameters	148
Table 58 – Summary of measured field values and BS parameters	150
Table 59 – Frequency selective meter settings used with for RF environmental measurements	154
Table 60 – Frequency selective meter settings for channel power measurements.....	154
Table 61 – Parameters required for the extrapolation of the decoder measurements, and method of estimation	154
Table 62 – Frequency selective meter settings used for scope measurements	155
Table 63 – Calculated results for F_{extBeam}	155
Table 64 – Main characteristic of the BS under test for campaign	159
Table 65 – Main characteristic of the EUT for campaign B	160
Table 66 – Measured channel power values	162
Table 67 – Electric field strength values obtained by channel power measurement over the EUT full carrier	163
Table 68 – Results of extrapolation process for three different EUT transmission conditions in campaign A.....	164
Table 69 – Results of extrapolation process for three different conditions of EUT transmission conditions in campaign B	165
Table 70 – Parameters of the EUT	168
Table 71 – F_{TDC} calculation per frame.....	172
Table 72 – Results of the extrapolated measurement for the POME and MEPs: forward and backward step measurement	175
Table 73 – Results of the extrapolated measurement for the POME and MEPs: left and right step measurement.....	175
Table 74 – TER results	177
Table 75 – Description of test site parameters including F_{extBeam}	178
Table 76 – Actual maximum power density using free space calculation.....	182
Table 77 – Actual maximum power density with maximum traffic load	182
Table 78 – Actual maximum power density based on SSS decoding	183
Table 79 – Actual maximum power density based on analogue SBB measurement.....	183
Table 80 – Actual maximum power density based on traffic time slots in the SSB frequency range	185
Table 81 – Actual maximum power density based on spectrogram measurements.....	186
Table 82 – Comparison of the absolute actual maximum power density values	187
Table 83 – Comparison of the actual maximum power density results normalized to the results using forced maximum traffic load.....	187
Table 84 – The measurement results of the MEPs	193
Table 85 – Measurement equipment used for assessing wbSAR in an RC (see NOTE 1 in Clause 1)	197
Table 86 – BS parameters	197
Table 87 – Phantom dielectric parameters for measurements of the absorbed power density with the OTAA approach	201
Table 88 – Equipment and tools used for assessing absorbed power density (see NOTE 1 in Clause 1).....	202

Table A.1 – Range of transmitted power classes for 3G and 4G BSs (from 3GPP TS 25.104 [24], 3GPP TS 36.104 [25] and 3GPP TS 38.104 [15])	207
Table A.2 – Example of product parameters for an E0 installation class	207
Table A.3 – Example of product parameters for an E2 installation class	208
Table A.4 – Example of product parameters for an E10 installation class	209
Table A.5 – Example of product parameters for an E100 installation class.....	210
Table A.6 – Example of product parameters for an E+ installation class	212
Table B.1 – Properties of the installed BSs	215
Table B.2 – RF EMF exposure limits and product installation compliance assessment	219
Table C.1 – Summary of modelling studies on F_{PR}	229
Table C.2 – Summary of experimental studies on F_{PR}	231
Table C.3 – Quantiles of the reference Beta distribution used to assess power combination factors	233
Table C.4 – Percentiles resulting from the combination of two to five independent transmitters having the reference Beta distribution.....	234
Table C.5 – Power combination factors applicable to the normalized transmitted power CDF in case of combination of multiple independent identical transmitters.....	235
Table C.6 – Power combination factors applicable to two independent transmitters with a ratio p in amplitude	235
Table C.7 – Relevant parameters for conducting RF exposure assessment of mMIMO site according to simulation method A (from [26]).....	236
Table C.8 – Relevant parameters for conducting RF exposure assessment of a mMIMO site or site cluster according to simulation method B (from [34])	238
Table C.9 – Summary of the percentiles of the normalized transmitted power and compliance distances for a UMa scenario from 3GPP TR 36.873 [18] and 3GPP TR 38.901 [19]	240
Table C.10 – EUT technical parameters.....	241
Table D.1 – Main characteristics of the two trials of measurement Campaign A.....	244
Table D.2 – Country and site groups of the sites in measurement Campaign B	249
Table D.3 – The predefined services configured in the measurement equipment.....	250
Table E.1 – Details of the components in the measurement system	253
Table E.2 – The parameters of the drone	253
Table E.3 – BS parameters.....	255
Table E.4 – Measurement steps.....	255

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Case studies supporting IEC 62232 - Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure

FOREWORD

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IEC TR 62669 has been prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure. It is a Technical Report.

This third edition cancels and replaces the second edition published in 2019. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) additional case studies and technical updates illustrating the implementation of IEC 62232:2025;
- b) general implementation of the actual maximum approach for beamforming antennas;
- c) validation of power or EIRP control features;

- d) in-situ measurement and implementation of extrapolation methods;
- e) introduction of emerging laboratory measurement methods for product compliance assessments.

This document contains attached files in the form of test reports that are cited in this document. These files can be downloaded from <https://www.iec.ch/tc106/supportingdocuments>.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
106/740/DTR	106/746/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

When referring to subdivisions of IEC 62232, the number of the subdivision is followed by the corresponding edition, in order to differentiate from subdivisions of this current document. For example:

- "defined in 6.4 (IEC 62232:2025)" means "defined in 6.4 of IEC 62232:2025";
- "see 8.2" means "see 8.2 of this document, i.e. the current edition of IEC TR 62669".

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

This document contains a series of case studies for the evaluation of exposure from sources of electromagnetic (EM) emissions transmitting in the frequency range from 110 MHz to 300 GHz (including consideration of ambient sources transmitting from 100 kHz to 300 GHz) to support the implementation of assessment methods specified in IEC 62232:2025 [1]¹.

Case studies presented in this document have been chosen to illustrate typical radio frequency (RF) exposure assessments for the most common types of base stations (BSs), deployed in mobile and wireless networks, such as small cells, street cells, macro BSs, and parabolic dish antennas used for wireless transmission or mobile backhaul. Many new case studies, such as Clause 12, Clause 13 and Annex C, have been introduced in order to illustrate the implementation of the actual maximum approach and RF exposure assessment of massive multiple-input, multiple-output (mMIMO) BSs, which are used more predominantly in 5G networks. In many clauses, RF exposure levels have been assessed using multiple methods for comparison purposes. These comparative studies are used to highlight the applicability and underlying principles of various implementations of IEC 62232 in order to propose improvements in the next edition.

Clause 19 is dedicated to the introduction of new assessment techniques dedicated to new exposure metrics specified in ICNIRP-2020 [2].

This document is informative. Each clause includes "lessons learned" and improvement suggestions for the next version of IEC 62232. Case studies are described in the main body of the document. Additional details, rationale, and test results can be found in the annexes and supporting documents.

¹ Numbers in square brackets refer to the Bibliography.

1 Scope

This document, which is a Technical Report, presents a series of case studies in which electromagnetic field (EMF) exposure is evaluated in accordance with IEC 62232:2025 [1]. The case studies presented in this document involve intentionally radiating base stations (BSs). The BS transmits on one or more antennas using one or more frequencies in the range 110 MHz to 300 GHz. RF exposure assessments consider, as a minimum, the contribution of ambient sources in at least the 100 kHz to 300 GHz frequency range.

Case studies presented in this document illustrate typical usage of IEC 62232:2025 for the RF exposure assessments of the most common BS types, deployed in mobile and wireless networks, such as small cells, street cells, macro BSs, and parabolic dish antennas used for wireless transmission or mobile backhaul. Many case studies also illustrate the implementation of the actual maximum approach and RF exposure assessment of massive multiple-input, multiple-output (mMIMO) BSs, which are deployed in operational mobile networks, such as 5G.

The case studies are provided for guidance only and are not a substitute for a thorough understanding of the requirements of IEC 62232:2025. Based on the technical outcome and lessons learned from each case study, suggestions are made about RF assessment topics to be considered in the next edition of IEC 62232. New assessment techniques for metrics specified in ICNIRP-2020 [2], such as whole-body average SAR (wbSAR) above 10 GHz and absorbed power density (APD), are also introduced.

NOTE 1 Trade names and trademarks of measurement equipment and computation tools given in this document and in the attached test reports are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.

NOTE 2 The lower frequency considered for ambient sources, 100 kHz, is derived from ICNIRP-2020 [2] and ICNIRP-1998 [3]. Some applicable exposure limit guidelines, however, require ambient fields to be evaluated as low as 3 kHz, e.g. IEEE Std C95.1-2019 [4] and Safety Code 6 [5].

2 Normative references

There are no normative references in this document.

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