Report on the Exposure Calculation for Nokia Solutions and Networks Massive MIMO antenna+radios bands 25/66, Model: AAFIB In accordance with EU, FCC, ISED, ARPANSA

Product Service

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Document Number: 75943179-02 | Issue: 01

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Authorised Signatory	Simon Bennett	24 August 2018	

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ENGINEERING STATEMENT
The calculations shown in this report were made in accordance with the procedures described in EU, FCC, ISED, ARPANSA regulatory requirements listed in this report.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Calculation	Pete Dorey	24 August 2018	

EXECUTIVE SUMMARY
The calculation was found to comply with the exposure requirements for general public and worker/occupational exposure at the stated separation distances.

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Product Service

Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	24 August 2018

1.2 Introduction

Objective	To perform electromagnetic field exposure assessment to determine the equipment under test's (EUT's) compliance with the applied specifications.
Applicant	Nokia Solutions and Networks
Manufacturer	Nokia Solutions and Networks
Model Number(s)	AAFIB
Hardware Version(s)	Massive MIMO Adaptive Antenna (MMAA) assembly with AAFB/AAIC radios+4-column antenna
Software Version(s)	Not supplied
Specification/Issue/Date	• EU: EN 62232:2017 Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure • FCC: CFR 47 Pt1.1310:2016 • ISED Canada: Health Canada Safety Code 6:2015 • Australia: ARPANSA Radiation Protection Series No.3:2002
Order Number Date	0090891343 27 June 2018
Related Document(s)	• Directive 2013/35/EU on minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields). • European Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz), Official Journal, L199, of 1999-7-30, p.59-70. • OET65:97 Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields • IEEE C95.3:2002 IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz • RSS-102 Issue 5 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

1.3 Brief Summary of Results

The wireless device described within this report was compliant with the restrictions related to human exposure to electromagnetic fields for both general public and worker/occupational exposures at the compliance distances calculated.

The calculations shown in this report were made in accordance with the procedures specified in the applied test specification(s).

1.3.1 Compliance Boundary

Regional Requirement	RAT	Calculated Compliance Boundary (m) (Rounded up to nearest 0.1 m)	
		Worker/Occupational	General Public
EU	LTE Band B25	4.7	10.2
	LTE Band B66	5.6	12.6
	LTE Band B25 & LTE Band B66 combined	7.3	16.2
FCC	LTE Band B25	4.5	10.1
	LTE Band B66	5.5	12.3
	LTE Band B25 & LTE Band B66 combined	7.1	15.9
CANADA	LTE Band B25	6.0	14.8
	LTE Band B66	7.2	17.6
	LTE Band B25 & LTE Band B66 combined	9.3	22.9
AUSTRALIA	LTE Band B25	4.6	10.3
	LTE Band B66	5.5	12.3
	LTE Band B25 & LTE Band B66 combined	7.2	16.0

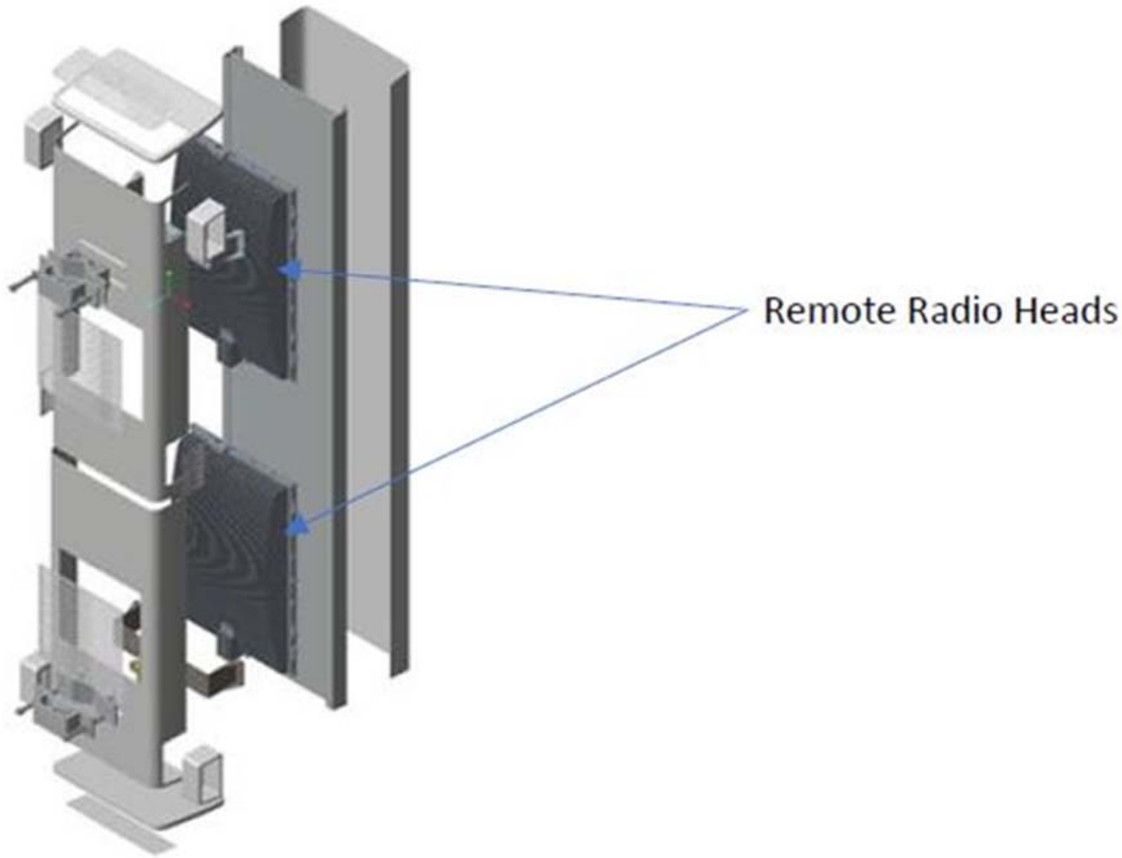
Table 1 – Compliance Boundary Calculation Results

1.4 Product Information

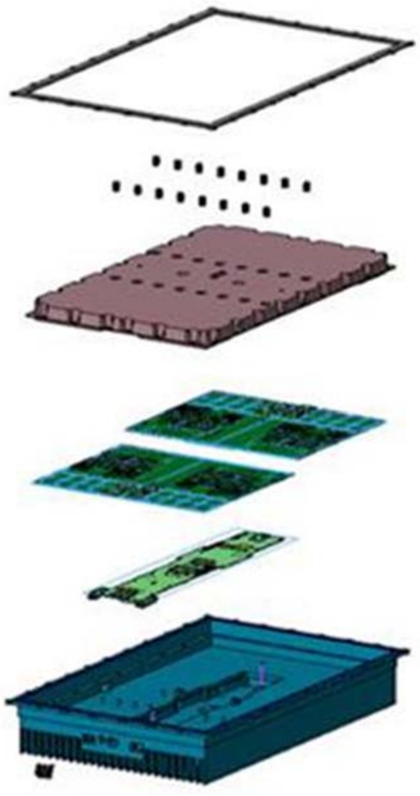
1.4.1 Technical Description

AAFIB Dual 16T16R 150W +100W (4 column antenna):

Each radio+antenna configuration consists of 2 Remote Radio Heads (RRHs), each that can plug into a dedicated beam steerable matrix antenna, contained within an enclosure that is mountable to a pole, wall, etc.

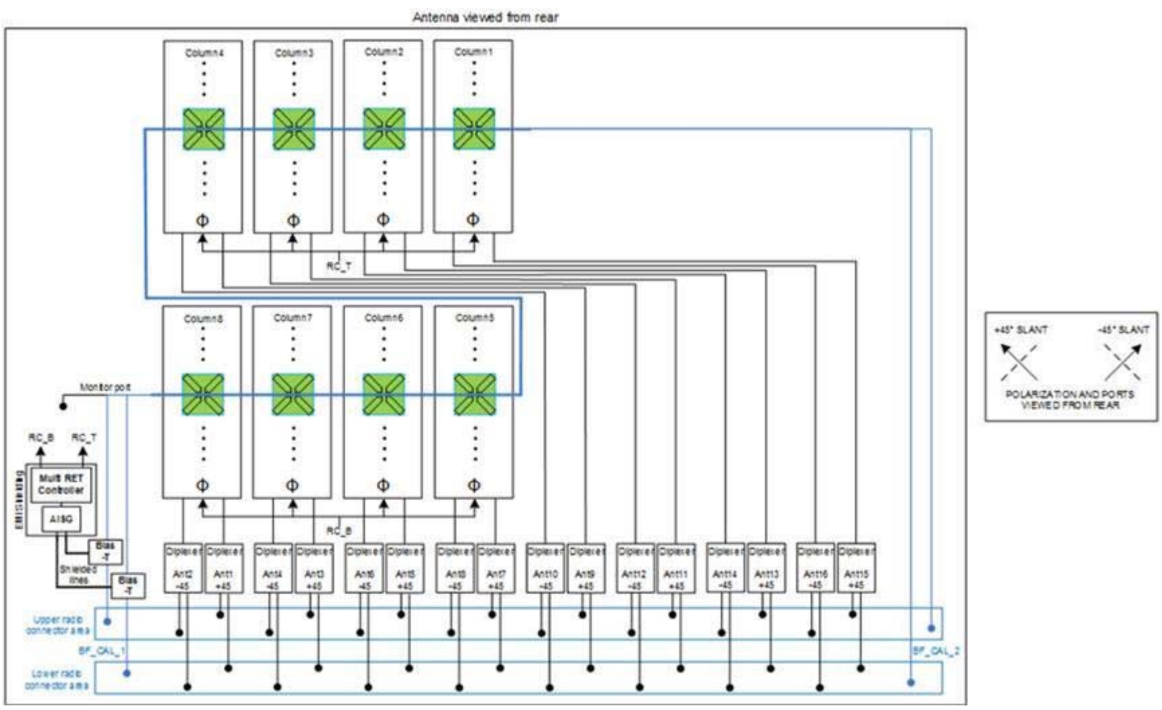


Each radio contains 16 transmitters. Each transmitter in the AAIB and AAFB is rated at 6.25W, and in the AAIC each transmitter is rated at 9.375W. Each radio will consist of a chassis, spine card, baseband/RF boards, filter, and antenna, stacked as shown below.



The antenna is a 4-column (21 dBi max gain) type. Columns within the antenna contain ±45° cross-polarized radiators. Of the 16 transmitter output ports each transmitter output is connected to a column.

Refer to the depiction below for the 4-column antenna:



1.4.2 Transmitter Description

The following radio access technologies and frequency bands are supported by the equipment under test.

Radio Access Technology	Antenna Port	Frequency Band	Minimum Frequency	Output Power	Duty Cycle
		MHz	MHz	dBm	%
LTE Band B25 AAFB 16T16R B25 100W Radio	4 Column antenna	1930-1995	1930	50 (100 W = 16 x 6.25W)	100
LTE Band B66 AAIC 16T16R B66 150W Radio	4 Column antenna	2110-2200	2110	51.76 (150 W = 16 x 9.375W)	100

Table 2 – Transmitter Description

1.4.3 Antenna Description

The following antennas are supported by the equipment under test.

Antenna No	Radio Access Technology	Antenna Model	Gain	Antenna length
			dBi	cm
1	LTE Band B25	4 Column antenna	21	85
2	LTE Band B66	4 Column antenna	21	85

Table 3 – Antenna description

1.4.4 Additional Antenna Data

The manufacturer's data and the derived value needed for the calculations in section 2.3 is shown below.

Main Parameter	Detailed Parameter	Value
Side Lobe Suppression	Manufacturers sidelobe level	>10 dB
	A_{sl} side lobe suppression value in linear scale	0.1
Tilt	Manufacturer's electric tilt range	+2 to +12 °
	Manufacturer's mechanical tilt range	0 to +10 °
	α downtilt in radians	0.384
Vertical Beamwidth	Manufacturer's half power width in vertical plane	10 °
	θ_{bw} Vertical half power beamwidth in radians	0.175

Table 4 – Additional Antenna Data

1.4.5 Equipment Configuration

The assumed worst-case configuration is when all users are at the same evaluation point (in the same beam direction), the maximum power is directed to the evaluation point. The maximum power is divided between the beams (in Multi-user MIMO), which means that the same maximum EIRP is applied whether there is only one user far away (which receives maximum power) or there are for example 4 users that all receive 25% of the maximum EIRP.

For the exposure calculation the maximum power and gain will be used assuming a single user location is illuminated.

2 Assessment Details

2.1 Assessment Method

The assessment method is by calculation of the power density S, electric field strength E, magnetic field strength H or magnetic flux density B.

The calculation uses the spherical model applicable under far field conditions.

$$S = E \times H = \frac{E^2}{\eta} = H^2 \times \eta = \frac{P \times G_i}{4 \times \pi \times r^2}$$

Where:
η - Impedance of free space (377 ohm in far field)
P – Transmitter power W
G_i – Antenna gain ratio relative to isotropic
R – Separation distance m

The magnetic flux density is related to the magnetic field strength by a constant:

$$B = \mu_o \times H$$

Where:
μo – Permeability of free space 4xπ E-7 H/m

Where additional calculations are required by the regional specifications these are detailed below.

The far field region boundary depends on the frequency and wavelength and also on the antenna dimension. The boundary of the far field region is calculated below to demonstrate the validity of using the spherical model.

2.2 Approach for SMART Antenna

The base station standard EN 62232:2017 provides some technology guidance on SMART antennas in its Annex F.10. It is proposed to apply the “deterministic conservative approach” described in the EN 62232 extracts below:

F.10.2 Deterministic conservative approach

The gain per user may be several decibels higher than the equivalent average gain over all channels. A very conservative case can be derived from the maximum gain in any direction and the total radiated power. This would be equivalent to having all communications channels operating at maximum power and all the individual directed beams aligned towards the evaluation point. This is not usually a realistic case, but it may be simple to apply.

F.10.4.2 Deterministic conservative power density model

Considering Figure F.15, this model assumes that all N_u users are in the same direction as the evaluation point and that all the transmitted power is directed towards the evaluation point, i.e. $N_{max} = N_u$. The deterministic conservative power density can be determined using the evaluation methods in this document according to their validity. However, as an example, Equation (F.22) uses the simple spherical model, see Equation (B.18):

$$S_{det} = \frac{\overline{P}_{avg} \cdot G_u \cdot D_{\theta ep}}{4 \cdot \pi \cdot r^2} \qquad (F.22)$$

NOTE Where a single reflector is present, a factor of $(1+|\Gamma|)^2$ is appropriate (see Equation (B.21)).

G_u is the maximum gain of the narrow beam directed to a user;

$D_{\varphi side}$ is the maximum horizontal directivity of the side lobes of the narrow beam;

$D_{\theta ep}$ is the vertical directivity of the narrow beam directed to the evaluation point;

2.3 Approach for Product Installation Compliance Calculation

EU, EN 62232:2017 specifies additional product installation calculation requirements in clause 6.2.4, extract below. This data is used by the network operator or entity putting the base station into service. The separation distance calculations D_m take ground reflection into account and EN 62232:2017 Table 2 Note b specifies a ground reflection factor of 1 (i.e. worst case full in-phase reflection). Additionally, the minimum height H_m is required to be calculated.

For frequencies between 100 MHz and 400 MHz:

$$H_m = \max\begin{cases} 2+\sqrt{\dfrac{EIRP \cdot A_{sl}}{2\pi}} \\ 2+\sqrt{\dfrac{EIRP}{2\pi}}\sin(\alpha + 1.129\theta_{bw}) \end{cases} \qquad D_m = \sqrt{\frac{EIRP}{2\pi}} \qquad (6.1)$$

For frequencies between 400 MHz and 2 000 MHz:

$$H_m = \max\begin{cases} 2+\sqrt{\dfrac{EIRP \cdot 200 A_{sl}}{f\pi}} \\ 2+\sqrt{\dfrac{200 \cdot EIRP}{f\pi}}\sin(\alpha + 1{,}129\theta_{bw}) \end{cases} \qquad D_m = \sqrt{\frac{EIRP \cdot 200}{f\pi}} \qquad (6.2)$$

For frequencies between 2 000 MHz and 100 000 MHz (i.e. 100 GHz):

$$H_m = \max\begin{cases} 2+\sqrt{\dfrac{EIRP \cdot A_{sl}}{10\pi}} \\ 2+\sqrt{\dfrac{EIRP}{10\pi}}\sin(\alpha + 1{,}129\theta_{bw}) \end{cases} \qquad D_m = \sqrt{\frac{EIRP}{10\pi}} \qquad (6.3)$$

where:

f is the frequency of operation of the RBS in MHz;

A_{sl} is the side lobe suppression value in linear scale;

α is the downtilt in radians (both electric and mechanic);

θ_{bw} is the vertical half power beamwidth in radians.

2.4 Individual Antenna Port Exposure Results

2.4.1 Calculation of Compliance Distance

The frequencies shown in the tables below have been chosen based on the lowest possible frequency that the EUT can transmit. A full list of the regional requirements is shown in Annex A.

Regional Requirement	Antenna Port	RAT	Frequency (MHz)	Calculated Compliance Boundary (m) at Limit for:			
				S Power Density	E Field	H Field	B Field
EU	1	LTE Band B25	1930	N/A	4.6629	N/A	4.6628
EU	2	LTE Band B66	2110	N/A	5.3757	N/A	5.5746
FCC	1	LTE Band B25	1930	4.4762	N/A	N/A	N/A
FCC	2	LTE Band B66	2110	5.4816	N/A	N/A	N/A
CANADA	1	LTE Band B25	1930	5.9437	5.9436	5.9436	N/A
CANADA	2	LTE Band B66	2110	7.1183	7.1181	7.1182	N/A
AUSTRALIA	1	LTE Band B25	1930	4.5567	4.5566	4.5585	N/A
AUSTRALIA	2	LTE Band B66	2110	5.4816	5.4934	5.4844	N/A

Table 5 – Calculation of Compliance Distance Worker/Occupational

Regional Requirement	Antenna Port	RAT	Frequency (MHz)	Calculated Compliance Boundary (m) at Limit for:			
				S Power Density	E Field	H Field	B Field
EU	1	LTE Band B25	1930	10.1890	10.1737	10.0288	10.1365
EU	2	LTE Band B66	2110	12.2573	12.3376	12.4770	12.5429
FCC	1	LTE Band B25	1930	10.0091	N/A	N/A	N/A
FCC	2	LTE Band B66	2110	12.2573	N/A	N/A	N/A
CANADA	1	LTE Band B25	1930	14.7453	14.7462	14.7451	N/A
CANADA	2	LTE Band B66	2110	17.5154	17.5165	17.5153	N/A
AUSTRALIA	1	LTE Band B25	1930	10.1890	10.2108	10.1941	N/A
AUSTRALIA	2	LTE Band B66	2110	12.2573	12.2572	12.2473	N/A

Table 6 – Calculation of Compliance Distance General Public

The following table shows the regional requirements for the frequencies used in the RF exposure calculation. A full list of the requirements is shown in Annex A.

Regional Requirement	Frequency (MHz)	Worker/Occupational Limit				General Public Limit			
		S Power Density (W/m^2)	E Field (V/m)	H Field (A/m)	B Field (µT)	S Power Density (W/m^2)	E Field (V/m)	H Field (A/m)	B Field (µT)
EU	1930	N/A	131.8	N/A	0.4393	9.650	60.406	0.1625	0.2021
EU	2110	N/A	140.0	N/A	0.4500	10	61.0	0.1600	0.2000
FCC	1930	50.00	N/A	N/A	N/A	10.00	N/A	N/A	N/A
FCC	2110	50.00	N/A	N/A	N/A	10.00	N/A	N/A	N/A
CANADA	1930	28.36	103.40	0.2743	N/A	4.61	41.68	0.1106	N/A
CANADA	2110	29.65	105.73	0.2805	N/A	4.90	42.96	0.1140	N/A
AUSTRALIA	1930	48.25	134.87	0.3576	N/A	9.65	60.19	0.1599	N/A
AUSTRALIA	2110	50.00	137.00	0.3640	N/A	10.00	61.40	0.1630	N/A

Table 7 – Limits

2.5 Combined Antenna Port RF Exposure Results

As the frequency of operation for each transmitter is not the same, in order to evaluate compliance with the limit which is dependent on frequency, the calculated S power density are divided by the limit to get a fractional exposure value. The calculated E and H fields are divided by the limit and squared to get a fractional exposure value. Any values less than one are compliant with the limit. Table 2 shows a summary of each antenna port and the summation of the fractional RF exposure results of each transmitter. The compliance boundary distance has been calculated to ensure the summation is ≤1.

EU EN 62232 specifies the method of summation in clause 8.3 with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 7.3 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	N/A	0.4080	N/A	0.4080
2	LTE Band B66	2110	N/A	0.5423	N/A	0.5832
Summation			N/A	0.9503	N/A	0.9911

Table 8 – EU Worker/Occupational Combined Exposure

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 16.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	0.3956	0.3944	0.3832	0.3915
2	LTE Band B66	2110	0.5725	0.5800	0.5932	0.5995
Summation			0.9681	0.9744	0.9764	0.9910

Table 9 – EU General Public Combined Exposure

FCC OET 65 specifies the method of summation in clause; Multiple-Transmitter Sites and Complex Environments; with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 7.1 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	0.3975	N/A	N/A	N/A
2	LTE Band B66	2110	0.5961	N/A	N/A	N/A
Summation			0.9935	N/A	N/A	N/A

Table 10 – FCC Worker/Occupational Combined Exposure

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 15.9 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	0.3963	N/A	N/A	N/A
2	LTE Band B66	2110	0.5943	N/A	N/A	N/A
Summation			0.9906	N/A	N/A	N/A

Table 11 – FCC General Public Combined Exposure

CANADA Health Canada Safety Code 6 specifies the method of summation in clause 2.2.1 Note 6 with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 9.3 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	0.4085	0.4084	0.4084	N/A
2	LTE Band B66	2110	0.5859	0.5858	0.5858	N/A
Summation			0.9943	0.9943	0.9943	N/A

Table 12 – CANADA Worker/Occupational Combined Exposure

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 22.9 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	0.4146	0.4147	0.4146	N/A
2	LTE Band B66	2110	0.5850	0.5851	0.5850	N/A
Summation			0.9996	0.9997	0.9996	N/A

Table 13 – CANADA General Public Combined Exposure

AUSTRALIA ARPANSA Radiation Protection Series No.3 specifies the method of summation in clause 3.4 with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 7.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	0.4005	0.4005	0.4009	N/A
2	LTE Band B66	2110	0.5796	0.5821	0.5802	N/A
Summation			0.9802	0.9826	0.9811	N/A

Table 14 – AUSTRALIA Worker/Occupational Combined Exposure

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 16.0 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	0.4055	0.4073	0.4059	N/A
2	LTE Band B66	2110	0.5869	0.5869	0.5859	N/A
Summation			0.9924	0.9941	0.9919	N/A

Table 15 – AUSTRALIA General Public Combined Exposure

2.6 Additional Product Installation Calculation Results

The results for the EU product installation compliance as described in Section 2.3 in accordance with EN 62232:2017 Table 2, are shown in Table 16:

Regional Requirement	Standard Reference	RAT	Frequency MHz	Compliance Distance D_m (m)	Minimum Height H_m (m)
EU	EN 62232 Para 6.2.4	LTE Band B25	1930	20.3780	13.194
EU	EN 62232 Para 6.2.4	LTE band B66	2110	24.5146	15.467

Table 16 – Individual Product Installation Compliance Data

The combined product installation compliance boundary was calculated using the method in Section 2.5 but taking account of ground reflection as described in Section 2.3. The resulting compliance boundary is shown in Table 17:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 32.3 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
1	LTE Band B25	1930	0.3980	0.3968	0.3856	0.3939
2	LTE Band B66	2110	0.5760	0.5836	0.5969	0.6032
Summation			0.9741	0.9804	0.9825	0.9971

Table 17 – Combined Exposure Compliance Boundary Product Installation Compliance Calculation

The combined product installation minimum height was calculated using the method in Section 2.5 to calculate the proportion of limit using equations rearranged from Section 2.3 and summing the proportions to ensure they were less than 1. The resulting minimum height for the combined exposure is shown in

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at minimum height of 19.6 m as a fraction of the limit
			S Power Density
1	LTE Band B25	1930	0.4046
2	LTE Band B66	2110	0.5855
Summation			0.9900

Table 18 – Combined Exposure Minimum Height Product Installation Compliance Calculation

The combined exposure product installation compliance data is summarised in Table 19:

Regional Requirement	Standard Reference	RAT	Frequency MHz	Compliance Distance D_m (m)	Minimum Height H_m (m)
EU	EN 62232 Para 6.2.4	LTE Band B25 & LTE band B66	1930 & 2110	32.3	19.6

Table 19 – Combined Exposure Product Installation Compliance Summary

2.7 Far Field Region Boundary Results

The far field region boundary calculation is shown in Table 20:

Near Field / Far Field Boundary		
RAT Name	Boundary of validity for calculation (Calculation overestimates within boundary). Maximum is boundary (Ref: (Ref: IEEE C95.3 Annex B.2, EN 62232 Table B.20 C)	
	Rayleigh Range Boundary $2D^2/\lambda$ (m)	Alternative boundary $D/2+2.5\lambda$ (m)
LTE Band B25	9.2962	0.8136
LTE band B66	10.1632	0.7805

Table 20 – Far Field Boundary

The far field boundary is 10.2 m. Calculated compliance boundaries beyond this distance are in the far field and therefore the approach described in section 2.1 is valid. Calculated compliance boundaries within this distance are within the near field and therefore the approach described in section 2.1 is an over estimate of the exposure and therefore a conservative assessment.

2.8 Uncertainty

The basic computation formulas presented in section 2.1 are conservative formulas for the estimation of RF field strength or power density. No uncertainty estimations are required when using these formulas but there is clear guidance on where and when these formulas are applicable. (Reference EN 62232 clause B.4.1).

For the estimate of S, E or H to be conservative, the transmitter power P and antenna gain G_i values shall be the upper bounds of uncertainty therefore maximum values are used.

The spherical formula is valid under far field conditions which are established in section 2.7.

ANNEX A

REGIONAL REQUIREMENTS

Frequency Range (MHz)	Power Density (W/m^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m) (Converted from µT)	Magnetic Flux Density (µT)
0.1 - 1	-	610	N/A	2/f
1 - 10	-	610/f	N/A	2/f
10 - 400		61	N/A	0.2
400 - 2000		3*f^0.5	N/A	1E-2*f^0.5
2000 - 6000		140	N/A	0.45
6000 -300000	50	140	N/A	0.45

Table A.1 – EN 62232:2017: Action levels in Directive 2013/35/EU Annex III Table B1 Worker/Occupational Limits

Frequency Range (MHz)	Power Density (W/m^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Magnetic Flux Density (µT)
0.003 - 0.15	-	87	5	6.25
0.15 - 1	-	87	0.73/f	0.92/f
1 - 10	-	87/f^0.5	0.73/f	0.92/f
10 - 400	2	28	0.073	0.092
400 - 2000	f/200	1.375*f^0.5	0.0037*f^0.5	0.0046*f^0.5
2000 - 300000	10	61	0.16	0.2

Table A.2 – EN 62232:2017: Council Recommendation 1999/519/EC Annex II Table 1 General Public Limits

Frequency Range (MHz)	Power Density (mW/cm^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0 - 0.3	-	-	-
0.3 - 3	100	614	1.63
3 - 30	900/f^2	1842/f	4.89/f
30 - 300	1	61.4	0.163
300 - 1500	f/300	-	-
1500 - 100000	5	-	-

Table A.3 – CFR 47 Pt1.1310 (2016) Worker/Occupational Limits

Frequency Range (MHz)	Power Density (mW/cm^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0 - 0.3	-	-	-
0.3 - 3	100	614	1.63
3 - 30	180/f^2	824/f	2.19/f
30 - 300	0.2	27.5	0.073
300 - 1500	f/1500	-	-
1500 - 100000	1	-	-

Table A.4 – CFR 47 Pt1.1310 (2016) General Public Limits

Frequency Range (MHz)	Power Density (W/m^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
10 - 20	10	61.4	0.163
20 - 48	44.72/f^0.5	129.8/f^0.25	0.3444/f^0.25
48 - 100	6.455	49.33	0.1309
100 - 6000	0.6455*f^0.5	15.60*f^0.25	0.04138*f^0.25
6000 - 150000	50	137	0.364

Table A.5 – Health Canada Safety Code 6 Worker/Occupational Limits

Frequency Range (MHz)	Power Density (W/m^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
10 - 20	2	27.46	0.0728
20 - 48	8.944/f^0.5	58.07/f^0.25	0.1540/f^0.25
48 - 300	1.291	22.06	0.05852
300 - 6000	0.02619*f^0.6834	3.142*f^0.3417	0.008335*f^0.3417
6000 - 15000	10	61.4	0.163

Table A.6 – Health Canada Safety Code 6 General Public Limits

Frequency Range (MHz)	Power Density (W/m^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.1 - 1	-	614	1.63/f
1 - 10	1000/f^2	614/f	1.63/f
10 - 400	10	61.4	0.163
400 - 2000	f/40	3.07*f^0.5	0.00814*f^0.5
2000 - 300000	50	137	0.364

Table A.7 – ARPANSA Radiation Protection Series No.3 Worker/Occupational Limits

Frequency Range (MHz)	Power Density (W/m^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.1 - 0.15	-	86.8	4.86
0.15 - 1	-	86.8	0.729/f
1 - 10	-	86.8/f^0.5	0.729/f
10 - 400	2	27.4	0.0729
400 - 2000	f/200	1.37*f^0.5	0.00364*f^0.5
2000 - 300000	10	61.4	0.163

Table A.8 – ARPANSA Radiation Protection Series No.3 General Public Limits