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EMF Test Report: Ericsson AIR 3268 B48 LTE (FCC)

Document number:	GFTL-22:000973 Uen Rev B	Date of report:	2022-07-25 Replaces GFTL-22:000973 Uen Rev A.
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Tests performed by:	Bo Xu	Dates of tests:	2022-07-07 (Rev A)
Manufacturer and market name(s) of device:	Ericsson AIR 3268 B48		
Testing has been performed in accordance with:	FCC OET Bulletin 65 IEC 62232:2017		
Test results:	RF exposure compliance boundaries (exclusion zones) related to the limits in FCC 47 CFR 1.1310 to be included in the Customer Product Information (CPI) for Ericsson AIR 3268 B48.		
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Summary of EMF Test Report¹

Equipment under test (EUT)

Product name	AIR 3268 B48		
Product number	KRD 901 254/11		
Supported bands, Tx frequency range (MHz) and standards	B48	3550–3700	LTE
Duplexing technology and fraction of downlink transmission time to total time	TDD (75%)		
Exposure environment	General public/uncontrolled, Occupational /controlled		

Results

RF exposure compliance boundaries, outside of which the exposure is below the general public (GP) and occupational (O) exposure limits, are listed below.

Dimensions of the box-shaped compliance boundary for general public (GP) and occupational (O) exposure for AIR 3268 B48 applicable in the USA and markets employing the FCC RF exposure limits. The compliance boundaries are determined for total EIRP² levels with EIRP tolerance and TDD downlink duty cycle included.

Mode and EIRP for AIR 3268						Dimensions of the box-shaped compliance boundary (m)							
						Distance in front of EUT		Width		Height		Distance behind EUT	
Band	Standard	Maximum EIRP	EIRP tolerance	TDD DL duty cycle	IEC 62232 installation class	GP	O	GP	O	GP	O	GP	O
B48	LTE	56.5 dBm	0.5 dB	75 %	E+	1.8	0.8	1.9	0.9	1.0	1.0	0.2	0.2

For the EIRP levels specified in the table with tolerances added, and the upward rounding of compliance boundary dimensions to the nearest decimeter, the specified results are conservative.

¹ This page contains a summary of the test results. The full report provides a complete description of all test details and results.

² Effective Isotropic Radiated Power.

1 General information

The test results presented in this report define compliance boundaries for AIR 3268 B48 LTE. Outside of these compliance boundaries, the radio frequency (RF) exposure levels are below the limits specified by the Federal Communications Commission (FCC) [1]. The tests were performed by calculations in accordance with the Ericsson RF exposure calculation procedure for base stations [2], which is in conformity with the FCC OET Bulletin 65 [3] and IEC 62232:2017 [4].

It should be noted that the test results presented in this test report are valid for the frequency range specified in Table 1, for the antenna properties specified in Table 2, and for the power level, the power tolerance, and TDD downlink duty cycle specified in Table 3. These data as well as the applied antenna pattern files were supplied by the client and may affect the validity of the results.

Proposed EMF health and safety information for inclusion in the Customer Product Information (CPI) is provided in Appendices A, B and C.

2 Equipment under test

Table 1 and Table 2 below summarize the technical data for the equipment under test (EUT) and the properties of the integrated antenna. Table 3 lists the maximum EIRP levels from the radio unit and the total time-averaged EIRP levels for the specified configuration. The total time-averaged EIRP includes tolerance and TDD downlink duty cycle.

The EUT related data in Tables 1-3 were supplied by the client. The product supports LTE, NR and LTE+NR mixed mode. This report is applicable only for LTE. For LTE+NR mixed mode, the report for NR [5] is applicable.

Table 1 Technical data for the EUT.

Product name and product number	AIR 3268 B48	KRD 901 254/11
Supported bands, Tx frequency range (MHz), and standards	B48	3550–3700 LTE
Antenna	ROZ 104 3125/1	
Dimensions, H x W x D (mm)	568 x 370 x 126	
Maximum nominal output power (W)	34	
Maximum EIRP (dBm)	56.5	
Duplexing technology and fraction of downlink transmission time to total time	TDD (75 %)	
Exposure environment	General public/uncontrolled, Occupational/controlled	
IEC 62232 installation class [4]³	E+	

³ The stated IEC 62232 installation class was determined based on the total EIRP without power tolerance included and considering the TDD downlink duty cycle. The total EIRP was obtained using the antenna patterns provided by the client.

Table 2 Properties of the antenna.

Product number	ROZ 104 3125/1
Type	Internal AAS
Antenna configuration (no. of subarray rows, subarray columns and polarizations)	2 × 8 × 2 ports
Gain ⁴ (dBi)	23.0
Antenna pattern files	1/15570-KRD901212/1 (MasterRev5813)
Maximum scan range in horizontal plane (degrees)	± 60
Maximum scan range in vertical plane (degrees)	90 - 103

Table 3 EUT configurations with maximum EIRP levels and the total time-averaged EIRP including tolerance and TDD downlink duty cycle.

Band	Standard	Maximum EIRP (dBm)	EIRP tolerance (dB)	TDD downlink duty cycle	Total time-averaged EIRP (dBm)
B48	LTE	56.5	0.5	75%	55.75

3 Exposure conditions

The EUT is intended to be installed on roof-tops, masts, walls, poles and similar structures making it possible to ensure that the general public has no access to the EMF compliance boundary. Other installation related exposure conditions are not reasonably foreseeable for the EUT.

The maximum TDD downlink duty cycle was considered to obtain the maximum time-averaged power delivered to the antenna.

Other factors, such as beam scanning in elevation and azimuth, RBS utilization, and scheduling time are reasonably foreseeable and will significantly reduce the time-averaged power and the RF exposure. A theoretical maximum exposure condition assessment was conducted, in which these factors were not considered, which makes the obtained compliance boundaries very conservative.

4 EMF compliance boundary calculations

The RF exposure was evaluated using calculations performed according to the Ericsson RF Exposure Calculation Procedure for Base Stations [2], which conforms to FCC OET Bulletin 65 [3] and IEC 62232 [4]. The calculations were made using the Ericsson in-house MATLAB-based tool called MSI compliance analyzer (release 2022-02) [6]. The first step in calculating the compliance boundary was to use the spherical far-field formula to estimate power density:

$$S_{\text{sph}}(\theta, \phi) = \frac{P_a G(\theta, \phi)}{4\pi r^2},$$

where S , P_a , G , r , θ , and ϕ denote the power density, the total time-averaged power accepted by antenna, the antenna gain, the distance from the antenna, and the angular variables in a spherical coordinate system, respectively. The EIRP, i.e., $P_a G(\theta, \phi)$, includes tolerances and the TDD downlink duty cycle. The EUT is supported by the baseband unit with a dynamic power control feature that limits the maximum EIRP including tolerance to ensure it is not exceeding 57 dBm. A fraction of 25% of the total available DL resources are used for broadcast beam whereas the remaining 75% is used for traffic. Therefore, during the EMF calculation, P_a was scaled down for the broadcast beam and traffic, denoted P_{br} and P_{tr} , respectively. Neither $P_{\text{br}} G_{\text{broadcast}}$

⁴ The stated gain value is the maximum antenna gain within B48 obtained using the antenna patterns provided by the client. The patterns used are based on theoretical modelling of the antenna and may differ slightly from the measured ones.

nor $P_{tr}G_{traffic}$ exceeds $57+10 \times \log_{10}(0.75)$ dBm⁵ with tolerance considered, where $G_{broadcast}$ and $G_{traffic}$ denote the antenna gain for the broadcast and traffic beams.

The power density for 25% of DL resources used for the broadcast beam and the power density for remaining 75% used for traffic are calculated as:

$$S_{sph,broadcast}(\theta, \phi) = \frac{0.25P_{br}G_{broadcast}(\theta, \phi)}{4\pi r^2},$$

$$S_{sph,traffic}(\theta, \phi) = \frac{0.75P_{tr}G_{traffic}(\theta, \phi)}{4\pi r^2}.$$

While the beam for the broadcast channel is fixed⁶, the traffic beam is steered in different directions depending on the location of the users requesting service. Therefore, $G_{traffic}$ in the equation above corresponds to the envelope of the antenna gain for all possible beams. The antenna gain patterns for broadcast beams and the envelope of antenna gains for all possible traffic beams were provided by the client based on theoretical modelling of the antenna. The use of these antenna gain patterns, together with the applied tolerance, provides an upper bound for the compliance boundary. Such patterns were provided for four different frequencies, specifically 3550 MHz, 3600 MHz, 3650 MHz, and 3700 MHz within Band 48.

The total power density as estimated by the spherical far-field formula is thus given by

$$S_{total,sph} = S_{sph,broadcast} + S_{sph,traffic}.$$

The compliance distance for the spherical model, $CD_{sph}(\theta, \phi)$ was obtained by solving the following equation for r :

$$\frac{S_{total,sph}(r, \theta, \phi)}{S_{gp,o}^{lim}} = 1,$$

where $S_{gp,o}^{lim}$ denotes the FCC power density limits [1] for general public and occupational exposure. RF EMF exposure limits are given in Table 4.

Table 4 RF EMF exposure limits on power density for the frequency band used by the EUT [1].

Band	S_{gp}^{lim} (W/m ²)	S_o^{lim} (W/m ²)
B48	10	50

Based on the calculated compliance distances, a box-shaped compliance boundary was determined. To comply with the FCC requirement of a minimum test separation distance for a non-portable device of 20 cm, the minimum distance from the EUT to the compliance boundary was set to 20 cm.

5 Results

A box-shaped compliance boundary is used, characterized by its width, height, and the compliance distances behind and in front of the EUT, see Figure 1. Outside of this box, the RF exposure is below the exposure limits.

⁵ $10 \times \log_{10}(0.75)$ added in the expression to consider TDD DL duty cycle.

⁶ The AIR 3268 B48 broadcast beam can be configured to handle two different UE distribution scenarios, denoted Macro and Hotspot. Either of these configurations is characterized by different gain values, beamwidths and electrical tilt angles. The assessment in this report is based on all possible broadcast beam patterns.

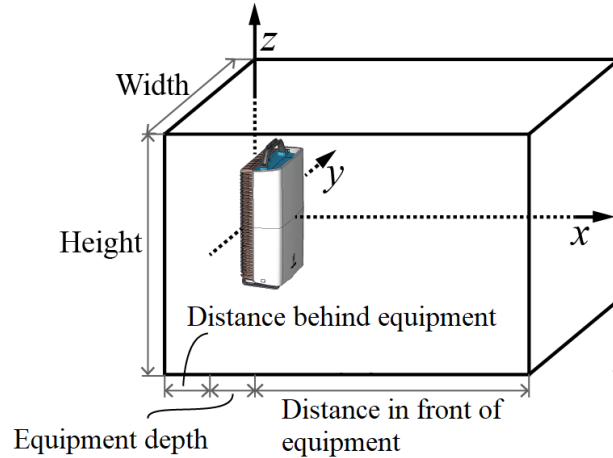


Figure 1 Box-shaped structure specifying the compliance boundary for the tested RBS product.

In Figure 2, the compliance distance results for general public (blue line) and occupational (red line) exposure are given for different tested configurations. The results are provided for the FCC exposure limits. Also shown are the resulting compliance boundaries (black lines, solid for general public, dashed for occupational exposure). The resulting compliance boundary dimensions are given in Table 5 rounded upwards to the nearest decimeter.

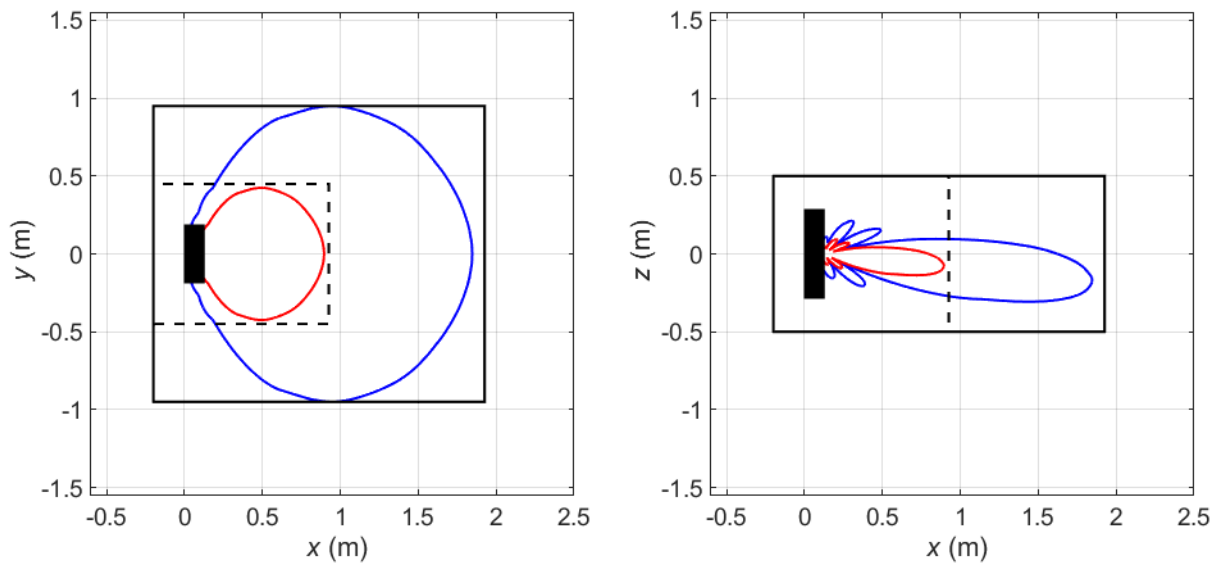


Figure 2 Compliance boundaries for general public (black solid line) and occupational (black dashed line) exposure for the USA and markets where the FCC exposure limits apply. The blue solid lines correspond to compliance distance results for general public exposure obtained using the spherical models. The solid red lines indicate the corresponding compliance distance results for occupational exposure. The EUT is shown from above (left) and from the side (right) with its backplane located at $x = 0$ m. Mode: B48 (LTE). Maximum peak EIRP including tolerance and TDD DL duty cycle: 55.75 dBm.

Table 5 Dimensions of the box-shaped compliance boundary for general public (GP) and occupational (O) exposure for AIR 3268 B48 applicable in the USA and markets employing the FCC RF exposure limits. The compliance boundaries are determined for total EIRP levels with tolerance and TDD downlink duty cycle included.

Mode and EIRP for AIR 3268						Dimensions of the box-shaped compliance boundary (m)							
						Distance in front of EUT		Width		Height		Distance behind EUT	
Band	Standard	Maximum EIRP	EIRP tolerance	TDD DL duty cycle	IEC 62232 installation class	GP	O	GP	O	GP	O	GP	O
B48	LTE	56.5 dBm	0.5 dB	75 %	E+	1.8	0.8	1.9	0.9	1.0	1.0	0.2	0.2

For the EIRP levels specified in the table with tolerances added, and the upward rounding of compliance boundary dimensions to the nearest decimeter, the specified results are conservative.

6 Uncertainty

For the input parameters defined in the test report, the calculated compliance boundary dimensions determined according to the approach described in Section 4 results in an exposure assessment which is conservative. The compliance boundary dimensions were determined by comparing the evaluated RF exposure directly with the limits.

7 Conclusion

The Ericsson AIR 3268 B48 has been tested using methods and procedures specified in FCC OET Bulletin 65 [3] and IEC 62232:2017 [4]. The results in Section 5 show the compliance boundary dimensions for the considered configuration of the product. Outside of these compliance boundaries, the RF exposure is below the limits specified in [1].

8 References

- [1] FCC, Code of Federal Regulations CFR title 47, part 1.1310 “Radiofrequency radiation exposure limits”, Federal Communications Commission (FCC), April 2020.
- [2] GFTE-16:001718 Uen, “Ericsson RF exposure calculation procedure for base stations”.
- [3] FCC, “Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields. OET Bulletin 65. Edition 97-01.” Federal Communications Commission (FCC), Office of Engineering and Technology, August 1997.
- [4] IEC 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”, June 2017.
- [5] Ericsson, GFTL-22:000860 Uen, “EMF Test Report: Ericsson AIR 3268 B48 NR (FCC)”.
- [6] Ericsson, GFTL-19:000424 Uen, “User manual of MSI compliance analyzer”.
- [7] Ericsson, LME-12:001904 Uen, “Exposure to radio frequency electromagnetic fields”.

9 Revision history

Rev.	Date	Description
A	2022-07-08	First revision.
B	2022-07-25	Corrected typos regarding the product and band names in the footnotes.

Appendix A. Information to be included in the CPI

Table A.1 below lists the compliance boundaries (exclusion zones), outside of which the RF EMF exposure from AIR 3268 B48 is below the limits applicable in:

- USA (47 CFR 1.1310)

Information is provided for the theoretical maximum exposure condition.

Table A.1 Dimensions of the box-shaped compliance boundary for general public (GP) and occupational (O) exposure applicable in the USA and markets employing the FCC exposure limits.

Mode and output EIRP						Dimensions of the box-shaped compliance boundary ⁽¹⁾ (m)							
						Distance in front of AIR		Width		Height		Distance behind AIR	
Product	Standard	Maximum EIRP	EIRP tolerance	TDD DL duty cycle	IEC 62232 installation class	GP	O	GP	O	GP	O	GP	O
AIR 3268 B48	NR	56.5 dBm	0.5 dB	75 %	E+	1.8	0.8	1.9	0.9	1.0	1.0	0.2	0.2

(1) The compliance boundaries are determined for total EIRP with tolerance and TDD downlink duty cycle included.

(2) For LTE, the compliance boundaries are determined for 75% of the resources allocated to traffic beams and 25% to the broadcast beam.

(3) For NR+LTE mixed mode, the results for NR apply.

Appendix B. Guidelines on how to install the product

The AIR 3268 B48 product (KRD 901 254/11) shall be installed to make sure that the general public does not have access to the applicable RF EMF compliance boundary. The compliance boundary dimensions were determined for the product transmitting in free space.

Appendix C. Guidelines for workers during installation, maintenance, and repair of the product

For AIR 3268 B48 product (KRD 901 254/11), if work needs to be performed within the compliance boundary applicable for workers, the radio equipment shall be powered off, or the power be reduced to a level ensuring that the RF EMF exposure is below the relevant exposure limit for workers.

If work is conducted on behalf of Ericsson, minimum EMF related requirements are provided in [7].

Appendix D. Photograph/Sketch of the EUT

