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EMF Test Report: Ericsson AIR 6488 B48 NR (FCC)

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|---|---|---|---|
| Document number: | GFTL-24:000928 Uen Rev A | Date of report: | 2024-07-15 |
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| Tests performed by: | Bo Xu | Dates of tests: | 2024-07-04 |
| Manufacturer and market name(s) of device: | Ericsson AIR 6488 B48 | | |
| Testing has been performed in accordance with: | FCC OET Bulletin 65 IEC 62232:2022 | | |
| Test results: | RF exposure compliance boundaries (exclusion zones) in conformity with FCC 47 CFR 1.1310 to be included in the Customer Product Information (CPI) for Ericsson AIR 6488 B48 . | | |
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Summary of EMF Test Report¹

Equipment under test (EUT)

| | | | |
|--|-------------------------------|-------------|----|
| Product name | AIR 6488 B48 | | |
| Product number | KRD 901 160/11, KRD 901 160/1 | | |
| Supported bands, Tx frequency range (MHz) and standards | B48 | 3550 - 3700 | NR |
| Duplexing technology and fraction of downlink transmission time to total time | TDD (75%) | | |

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 6488 B48 applicable in the USA and markets employing the FCC RF exposure limits. The compliance boundaries are determined for maximum total EIRP² with EIRP tolerance and TDD downlink duty cycle included.

| Mode and EIRP for AIR 6488 | | | | | | 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 | Exposure condition | GP | O | GP | O | GP | O | GP | O |
| B48 | NR | 56 dBm | 1 dB | 75 % | Theoretical maximum | 1.8 | 0.8 | 2.0 | 0.9 | 1.3 | 1.3 | 0.2 | 0.2 |

For the power 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 6488 B48 NR. Outside of these compliance boundaries the radio frequency (RF) exposure levels are below the exposure limits specified 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 62232:2022 [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 maximum EIRP level, the EIRP 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 nominal output power from the radio unit and the total time-averaged power delivered to the antenna. The total time-averaged power delivered to the antenna includes the output power 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 for NR and LTE+NR mixed mode. The report applicable for LTE is available in [6].

Table 1 Technical data for the EUT.

| | | | |
|--|--|-------------------------------|----|
| Product name and product number | AIR 6488 B48 | KRD 901 160/11, KRD 901 160/1 | |
| Supported bands, Tx frequency range (MHz), and standards | B48 | 3550 – 3700 | NR |
| Antenna | KRE 105 261 | | |
| Dimensions, H × W × D (mm) | 819 × 400 × 256 | | |
| Duplexing technology and fraction of downlink transmission time to total time | TDD (75 %) | | |
| Exposure environment | General public/uncontrolled, Occupational/controlled | | |
| IEC 62232 installation class³ | 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 | KRE 105 261 |
| Type | Internal AAS |
| Number of polarizations | 2 |
| Gain ⁴ (dBi) | 24.0 |
| Antenna configuration (no. of subarray rows, subarray columns and polarizations) | 4 × 8 × 2 |
| Subarray configuration | 2 × 1 |
| Antenna pattern files | 1/15570-KRD 901 096/11-1 (MastRev1434) |
| Maximum scan range in horizontal plane (degrees) | ±60 |
| Maximum scan range in vertical plane (degrees) | 73 – 113 |

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

| Band | Standard | Maximum EIRP | EIRP tolerance | TDD downlink duty cycle | Total time-averaged EIRP |
|------|----------|--------------|----------------|-------------------------|--------------------------|
| B48 | NR | 56 dBm | 1 dB | 75 % | 55.8 dBm |

3 Exposure conditions

The EUT is intended to be used outdoor and installed on poles, walls, masts, towers, 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 EIRP.

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 EIRP 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 2024-05) [5]. The first step in calculating the compliance boundary was to use the spherical far-field formula to estimate power density:

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

⁴ The stated gain value is the maximum gain of the antenna within the frequency band(s) supported by the product and 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.

where $S, P_a, G, r, \theta,$ and ϕ denote the power density, the total time-averaged power accepted by the antenna, the antenna gain, the distance from the antenna, and the angular variables in a spherical coordinate system, respectively. The total time-averaged power delivered to the antenna includes the tolerance and the TDD downlink duty cycle.

The envelope of antenna gains for all possible traffic beams as well as antenna gain patterns for broadcast beams were provided by the client based on theoretical modelling of the antenna. Only the traffic beam envelope was used in the calculation of the compliance boundary as the contribution from the broadcast beams is negligible for NR and thus the overestimation of the RF exposure by applying the total power to the higher gain traffic beams is insignificant. The use of these antenna gain patterns, together with the applied tolerance, provides an upper bound for the compliance boundary. Such envelope patterns were provided for three frequencies, specifically 3600 MHz, 3650 MHz, and 3700 MHz within B48. Maximum gain values, corresponding to the maximum of all the envelope patterns, were used in the above equation to estimate power density. The maximum gain value of the antenna considering all possible scan directions was found to be 24 dBi. The EUT is connected to a baseband unit with a dynamic power control feature that ensures the maximum EIRP without TDD DL duty cycle and tolerance is not exceeding 56 dBm. Therefore, a value of $P_a = 32 \text{ dBm} + 1\text{dB} + 10 \log_{10} 0.75 = 31.8 \text{ dBm}$ was used in the RF exposure calculation, so that the maximum EIRP without the TDD DL duty cycle and tolerance does not exceed 56 dBm.

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

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

where $S_{\text{gp,o}}^{\text{lim}}$ denotes the FCC power density limits for general public and occupational exposure [1].

The power density limits for the frequency bands of interest are given in Table 4.

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

| Band | $S_{\text{gp}}^{\text{lim}}$ (W/m ²) | S_0^{lim} (W/m ²) |
|------|--|--|
| B48 | 10.0 | 50.0 |

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 antenna 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.

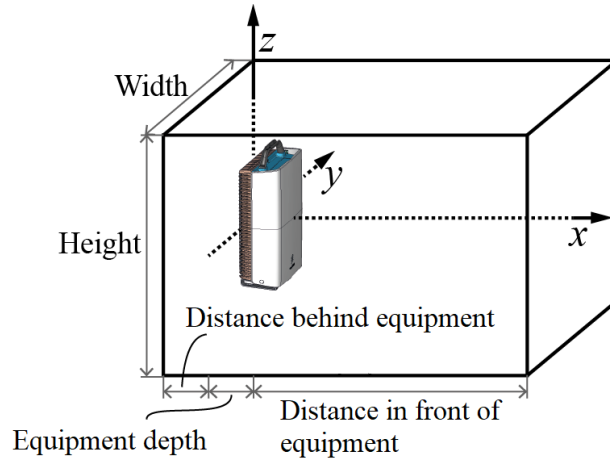


Figure 1 Box-shaped structure specifying the compliance boundary for the tested RBS product.

In Figure 2, compliance distance results for general public exposure (blue line) and occupational exposure (red line) are given for the tested configurations leading to the largest compliance boundary for theoretical maximum exposure condition. 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.

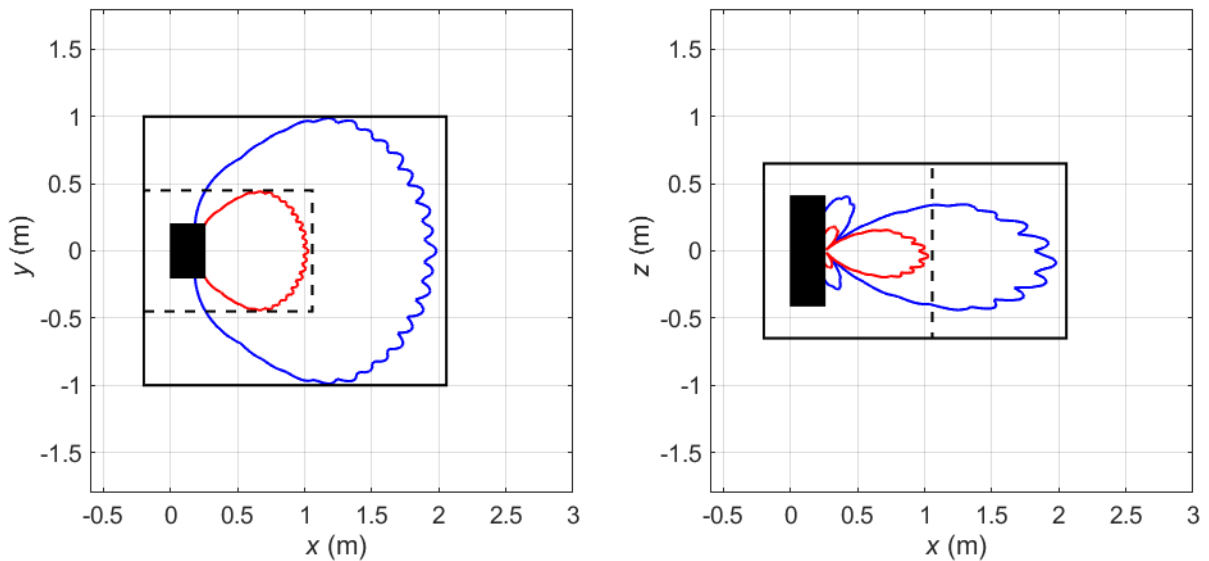


Figure 2 Compliance boundaries for general public exposure (black solid line) and occupational exposure (black dashed line) for the markets where the FCC limits apply. The blue solid lines correspond to compliance distance results for general public exposure obtained using the spherical models. The red solid 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 (NR). Maximum peak EIRP including tolerance and TDD DL duty cycle: 55.8 dBm.

Table 5 Dimensions of the box-shaped compliance boundary for general public (GP) and occupational (O) exposure for AIR 6488 B48 applicable in the USA and markets employing the FCC RF exposure limits. The compliance boundaries are determined for maximum total EIRP with EIRP tolerance and TDD downlink duty cycle included.

| Mode and EIRP for AIR 6488 | | | | | | 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 | Exposure condition | GP | O | GP | O | GP | O | GP | O |
| B48 | NR | 56 dBm | 1 dB | 75 % | Theoretical maximum | 1.8 | 0.8 | 2.0 | 0.9 | 1.3 | 1.3 | 0.2 | 0.2 |

For the power 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 6488 B48 has been tested using methods and procedures specified in FCC OET Bulletin 65 [3] and IEC 62232:2022 [4]. The results in Section 5 show the compliance boundary dimensions of the product to be included in the Customer Product Information (CPI). 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] Ericsson, 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 Edition 3.0, "Determination of RF field strength, power density and SAR in the vicinity of base stations for the purpose of evaluating human exposure", October 2022.
- [5] Ericsson, GFTL-19:000424 Uen, "User manual of MSI compliance analyzer".
- [6] Ericsson, GFTL-19:000827 Uen, "EMF Test Report: Ericsson AIR 6488 B48 LTE (FCC)".
- [7] Ericsson, LME-12:001904 Uen, "Exposure to radio frequency electromagnetic fields".

9 Revision history

| Rev. | Date | Description |
|------|------------|-----------------|
| A | 2024-07-15 | First revision. |

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 6488 is below the limits applicable in:

- USA (47 CFR 1.1310)

Information is provided for the theoretical maximum.

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 RF exposure limits.

| Mode and EIRP | | | | | | | Dimensions of the box-shaped compliance boundary ⁽¹⁾⁽²⁾ (m) | | | | | | | |
|---------------|----------|--------------|------------------------------|----------------|-------------------|---------------------|--|-----|-------|-----|--------|-----|---------------------|-----|
| | | | | | | | Distance in front of AIR | | Width | | Height | | Distance behind AIR | |
| Product | Standard | Maximum EIRP | IEC 62232 installation class | EIRP tolerance | TDD DL duty cycle | Exposure condition | GP | O | GP | O | GP | O | GP | O |
| AIR 6488 B48 | NR | 56 dBm | E+ | 1 dB | 75 % | Theoretical maximum | 1.8 | 0.8 | 2.0 | 0.9 | 1.3 | 1.3 | 0.2 | 0.2 |

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

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

Appendix B. Guidelines on how to install the product

The AIR 6488 B48 product (KRD 901 160/11, KRD 901 160/1) 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 the AIR 6488 B48 product (KRD 901 160/11, KRD 901 160/1), 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

