



**Rapport utfärdad av ackrediterat provningslaboratorium**  
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## EMF Test Report: Ericsson AIR 1281 B261 (FCC)

<b>Document number:</b>	GFTL-20:000501 Uen Rev B		
<b>Date of report:</b>	2020-09-11 (Rev B) Replaces GFTL-20:000501 Uen Rev A.		
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<b>Tests performed by:</b>	Paramananda Joshi	<b>Dates of tests:</b>	2020-04-20 (Rev A)
<b>Manufacturer and market name(s) of device:</b>	Ericsson AIR 1281 B261		
<b>Testing has been performed in accordance with:</b>	FCC OET Bulletin 65 IEC 62232:2017		
<b>Test results:</b>	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 1281 B261.		
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## Summary of EMF Test Report<sup>1</sup>

### Equipment under test (EUT)

Product name	AIR 1281 B261		
Product number	KRD 901 165/2, KRD 901 165/5		
Supported bands, Tx frequency range (GHz) and standards	B261	27.5 – 28.35	NR
Duplexing technology and fraction of downlink transmission time to total time	TDD (75 %)		
Exposure environment	General public/uncontrolled, Workers/controlled		

### Results

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

Dimensions of the box-shaped compliance boundary for general public (GP) and workers (W) exposure for AIR 1281 applicable in markets employing the FCC RF exposure limits for total output power with power tolerance and TDD downlink duty cycle included.

Mode and output power for AIR 1281									Dimensions of the box-shaped compliance boundary (m)							
Band	Standard	Config Mode <sup>2</sup>	Nominal total output power (W)	Nominal total EIRP (dBm)	IEC 62232 installation class [4]	Power tolerance (dB)	TDD DL duty cycle	Sector shapes	Distance in front of EUT		Width		Height		Distance behind EUT	
									GP	W	GP	W	GP	W	GP	W
B261	1	1	0.053	43	E100	1.5	75 %	Hotspot1	0.4	0.2	0.7	0.7	0.7	0.7	0.2	0.2
			0.132	47	E100				0.7	0.3	0.8	0.7	0.7	0.7	0.2	0.2
			0.263	50	E100				0.9	0.4	1.1	0.7	0.7	0.7	0.2	0.2
			0.525	53	E+				1.3	0.6	1.6	0.7	0.7	0.7	0.2	0.2
	NR	2	0.053	46	E100	1.5	75 %	Hotspot2, Macro3	0.6	0.3	0.7	0.7	0.7	0.7	0.2	0.2
			0.132	50	E100				0.9	0.5	1.1	0.7	0.7	0.7	0.2	0.2
			0.263	53	E+				1.3	0.6	1.5	0.7	0.7	0.7	0.2	0.2
			0.525	56	E+				1.8	0.8	2.2	1.0	0.8	0.7	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.

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

<sup>2</sup> Configuration Mode.

## 1 General information

The test results presented in this report define compliance boundaries for AIR 1281 B261. 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 levels, 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

Tables 1 and 2 below summarize the technical data for the equipment under test (EUT) and the antenna properties for the integrated antenna. Table 3 lists the nominal total output power levels from the radio unit and the total time-averaged output power including output power tolerance and the TDD downlink duty cycle for Configuration Mode 1 and Configuration Mode 2. In Configuration Mode 1, the phased array antenna module (PAAM) of the product is divided into two halves, each containing 2 x 24 subarrays. In this configuration, the product can generate four beams, one for each array half and polarization. In Configuration Mode 2, the full array, containing 4 x 24 subarrays, can generate two beams, one for each polarization.

EMF compliance assessments were conducted for each configuration mode at four nominal total output power levels, out of eleven of those provided in Table 3, specifically at 17.2 dBm, 21.2 dBm, 24.2 dBm and 27.2 dBm.

The EUT related data in Tables 1-3 were supplied by the client.

**Table 1 Technical data for the EUT.**

<b>Product name and product number</b>	AIR 1281 B261		KRD 901 165/2, KRD 901 165/5
<b>Supported bands, Tx frequency range (GHz), and standards</b>	B261	27.5 – 28.35	NR
<b>Dimensions<sup>3</sup>, H x W x D (mm)</b>	290 x 200 x 136		
<b>Duplexing technology and fraction of downlink transmission time to total time</b>	TDD (75 %)		
<b>Exposure environment</b>	General public/uncontrolled, Workers/controlled		
<b>IEC 62232 installation class [4]<sup>4</sup></b>	E100 (for configurations with nominal total EIRP ≤ 50 dBm) E+ (for configurations with nominal total EIRP > 50 dBm)		

<sup>3</sup> The dimensions of the EUT exclude mounting brackets.

<sup>4</sup> The stated IEC 62232 installation class was determined from 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 integrated antenna.

Type		Phased Array Antenna Module (PAAM)
Number of antenna panels		2 (Configuration Mode 1) 1 (Configuration Mode 2)
Maximum gain <sup>5</sup> (dBi)		25.6 (Configuration Mode 1) 28.6 (Configuration Mode 2)
Horizontal HPBW <sup>6</sup> (degrees)		4.1
Vertical HPBW <sup>6</sup> (degrees)		20.9 (Configuration Mode 1) 10.4 (Configuration Mode 2)
Number of antenna elements ( $N_H, N_V$ ) per antenna panel		(24, 4) (2 polarizations) for Configuration Mode 1 (24, 8) (2 polarizations) for Configuration Mode 2
Element separation distance ( $\Delta_H, \Delta_V$ ) (mm)		(5.3, 6.4)
Maximum scan range in horizontal plane (degrees)		±60
Maximum scan range in vertical plane (degrees)		±15

Table 3 EUT configuration with nominal output power level and total power level including output power tolerance and TDD downlink duty cycle.

Band	Standard	Config Mode	Nominal total EIRP (dBm)	Nominal total output power (dBm/W)	TDD downlink duty cycle	Power tolerance (dB)	Total time-averaged output power (dBm/W)
B261	NR	1	43	17.2 / 0.053	75 %	1.5	17.5 / 0.056
			44	18.2 / 0.066			18.5 / 0.070
			45	19.2 / 0.083			19.5 / 0.088
			46	20.2 / 0.105			20.5 / 0.111
			47	21.2 / 0.132			21.5 / 0.140
			48	22.2 / 0.166			22.5 / 0.176
			49	23.2 / 0.209			23.5 / 0.221
			50	24.2 / 0.263			24.5 / 0.279
			51	25.2 / 0.331			25.5 / 0.351
			52	26.2 / 0.417			26.5 / 0.442
			53	27.2 / 0.525			27.5 / 0.556
			46	17.2 / 0.053	75 %	1.5	17.5 / 0.056
			47	18.2 / 0.066			18.5 / 0.070
			48	19.2 / 0.083			19.5 / 0.088
			49	20.2 / 0.105			20.5 / 0.111
			50	21.2 / 0.132			21.5 / 0.140
			51	22.2 / 0.166			22.5 / 0.176
			52	23.2 / 0.209			23.5 / 0.221
			53	24.2 / 0.263			24.5 / 0.279
			54	25.2 / 0.331			25.5 / 0.351
			55	26.2 / 0.417			26.5 / 0.442
			56	27.2 / 0.525			27.5 / 0.556

### 3 Exposure conditions

The EUT is intended to be installed on 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 output power. 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. These factors were however not considered in this assessment, which adds to the conservativeness of the obtained compliance boundaries.

<sup>5</sup> The stated gain values are obtained using the antenna patterns provided by the client.

<sup>6</sup> The stated half-power beam widths are for broadside beam.

## 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 far-field spherical formula. 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  $S$ ,  $P_a$ ,  $G$ ,  $r$ ,  $\theta$ , and  $\phi$  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 total time-averaged power delivered to the antenna include tolerances and the TDD downlink duty cycle. The envelope of antenna gains for all possible traffic beams was obtained from far-field measurements provided by the client. Such envelope patterns were provided for two different frequencies, specifically 27.7 GHz and 28 GHz within Band 261.

There are different available coverage shapes of the beam envelope pattern depending on deployment scenarios (Hotspot1 for Configuration Mode 1, and Hotspot2 and Macro3 for Configuration Mode 2). Maximum gain values, corresponding to the envelope patterns, were used in the above equation to estimate power density for each sector shape. The maximum gain value of the antenna considering all possible scan directions and sector shapes was found to be 25.6 dBi for Configuration Mode 1 and 28.6 dBi for Configuration Mode 2.

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

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

where  $S_{\text{gp,w}}^{\text{lim}}$  denotes the FCC power density reference levels for general public/uncontrolled and workers/controlled exposure in the frequency range used by the EUT. RF EMF exposure limits are given in Table 4 [1].

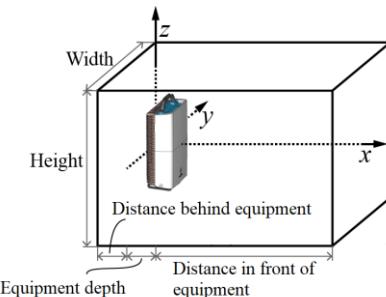
**Table 4** RF EMF exposure limits applicable for the frequency range used by the EUT.

Band	$S_{\text{gp}}^{\text{lim}}$ (W/m <sup>2</sup> )	$S_{\text{w}}^{\text{lim}}$ (W/m <sup>2</sup> )
B261	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.

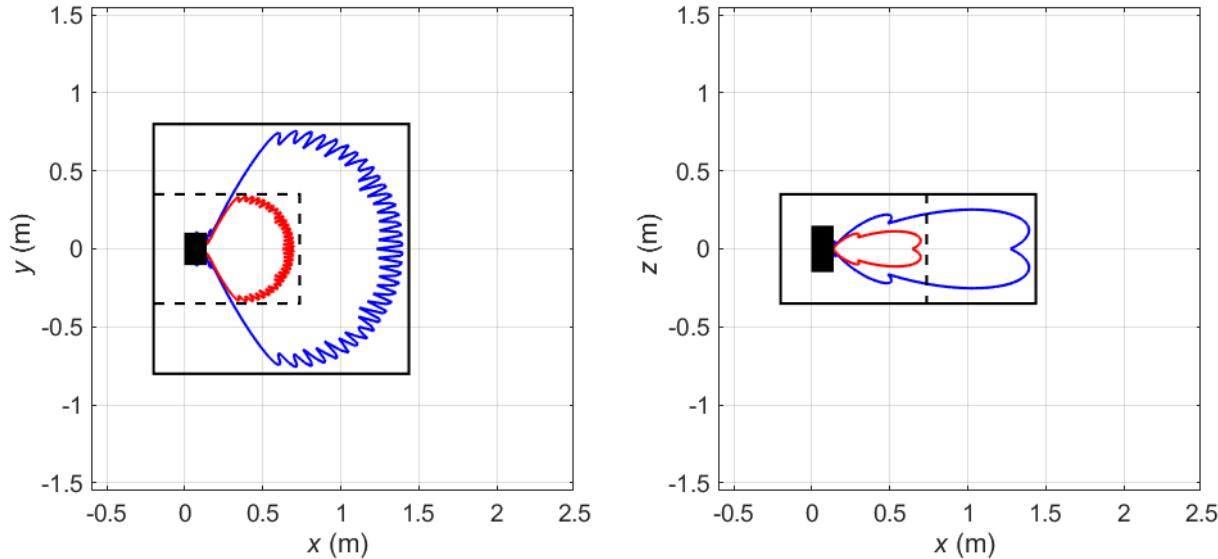
## 5 Results

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

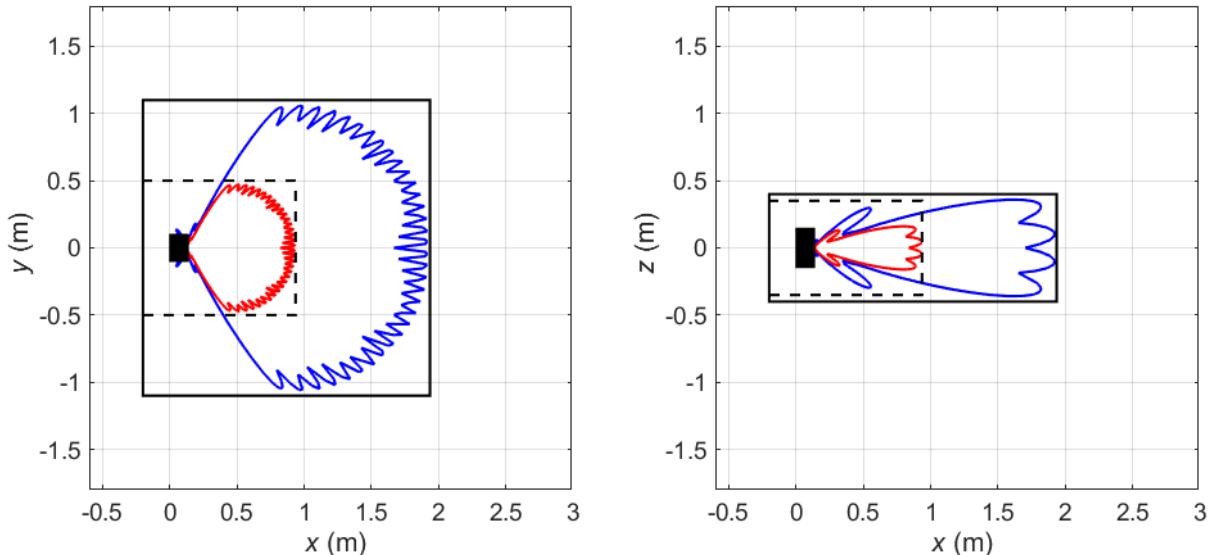


**Figure 1** Box-shaped structure specifying the compliance boundary for the tested RBS product.

In Figure 2 through Figure 4 compliance distance results as obtained using the far-field spherical formula for general public (blue line) and workers (red line) exposure are given for the tested configuration leading to the largest compliance boundary for each sector shape. Results are provided for the FCC exposure limits. Also shown are the resulting symmetric compliance boundaries (black lines, solid for general public, dashed for workers exposure). The reported 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 workers (black dashed line) exposure for markets where the FCC exposure limits apply for Hotspot1 sector shape (Config Mode 1). 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 workers exposure. The EUT is shown from above (left) and from the side (right) with its backplane located at  $x = 0$  m. Mode: B261 (28 GHz) (NR). Total power delivered to the antenna: 0.56 W.



**Figure 3** Compliance boundaries for general public (black solid line) and workers (black dashed line) exposure for markets where the FCC exposure limits apply for Hotspot2 sector shape (Config Mode 2). 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 workers exposure. The EUT is shown from above (left) and from the side (right) with its backplane located at  $x = 0$  m. Mode: B261 (28 GHz) (NR). Total power delivered to the antenna: 0.56 W.

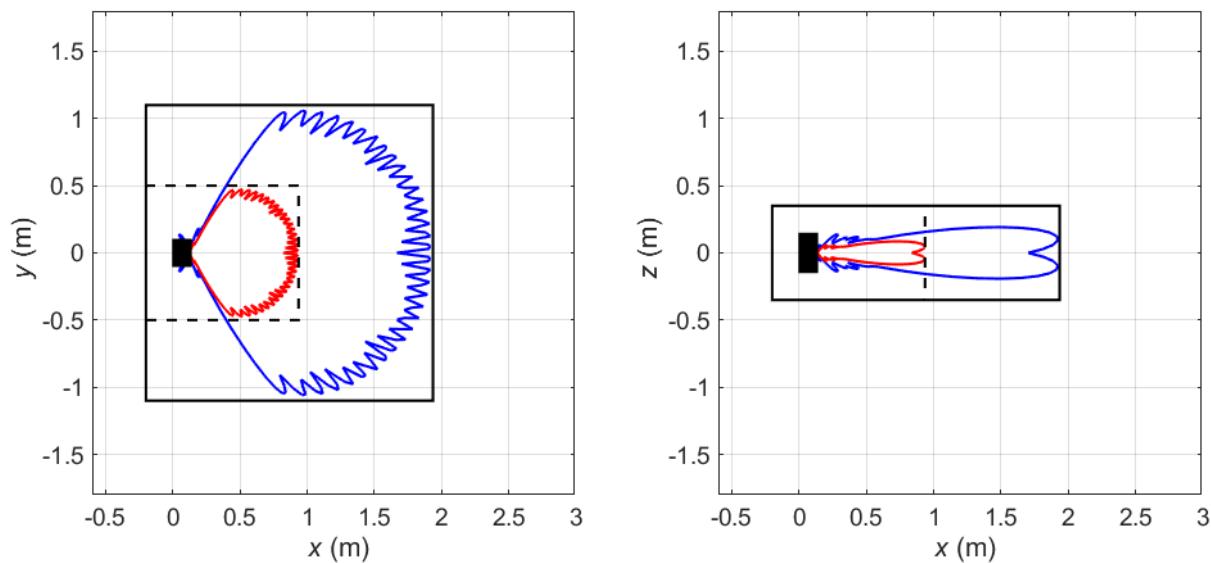


Figure 4 Compliance boundaries for general public (black solid line) and workers (black dashed line) exposure for markets where the FCC exposure limits apply for Macro3 sector shape (Config Mode 2). The blue solid lines correspond to compliance distance results for general public exposure obtained using the spherical models. The solid red lines indicate the corresponding compliance distance results for workers exposure. The EUT is shown from above (left) and from the side (right) with its backplane located at  $x = 0$  m. Mode: B261 (28 GHz) (NR). Total power delivered to the antenna: 0.56 W.

Table 5 Dimensions of the box-shaped compliance boundary for general public (GP) and workers (W) exposure for AIR 1281 applicable in markets employing the FCC RF exposure limits for total output power with power tolerance and TDD downlink duty cycle included.

Mode and output power for AIR 1281									Dimensions of the box-shaped compliance boundary (m)							
									Distance in front of EUT		Width		Height		Distance behind EUT	
Band	Standard	Config Mode <sup>7</sup>	Nominal total output power (W)	Nominal total EIRP (dBm)	IEC 62232 installation class [4] Bookmark not defined.	Power tolerance (dB)	TDD DL duty cycle	Sector shapes	GP	W	GP	W	GP	W	GP	W
B261	NR	1	0.053	43	E100	1.5	75 %	Hotspot1	0.4	0.2	0.7	0.7	0.7	0.7	0.2	0.2
			0.132	47	E100				0.7	0.3	0.8	0.7	0.7	0.7	0.2	0.2
			0.263	50	E100				0.9	0.4	1.1	0.7	0.7	0.7	0.2	0.2
			0.525	53	E+				1.3	0.6	1.6	0.7	0.7	0.7	0.2	0.2
		2	0.053	46	E100	1.5	75 %	Hotspot2, Macro3	0.6	0.3	0.7	0.7	0.7	0.7	0.2	0.2
			0.132	50	E100				0.9	0.5	1.1	0.7	0.7	0.7	0.2	0.2
			0.263	53	E+			Hotspot2, Macro3	1.3	0.6	1.5	0.7	0.7	0.7	0.2	0.2
			0.525	56	E+				1.8	0.8	2.2	1.0	0.8	0.7	0.2	0.2

For the power levels specified in the table with tolerances included, 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 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.

<sup>7</sup> Configuration Mode.

## 7 Conclusion

The Ericsson AIR 1281 B261 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), August 1997.
- [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, LME-12:001904 Uen, "Exposure to radio frequency electromagnetic fields".

## 9 Revision history

Rev.	Date	Description
A	2020-04-20	First revision
B	2020-09-11	Second revision with some editorial corrections to address comments from FCC TCB.

## Appendix A. Information to be included in the CPI

Table A.1 lists the compliance boundaries (exclusion zones), outside of which the RF EMF exposure from AIR 1281 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 USA and markets employing the FCC RF exposure limits.**

Mode and output power for AIR 1281								Dimensions of the box-shaped compliance boundary (m)							
								Distance in front of EUT		Width		Height		Distance behind EUT	
Band	Standard	Config-uration Mode	Nominal total EIRP (dBm)	IEC 62232 installation class	Power tolerance (dB)	TDD DL duty cycle	Sector shapes	GP	W	GP	W	GP	W	GP	W
B261	NR	1	43	E100	1.5	75 %	Hotspot1	0.4	0.2	0.7	0.7	0.7	0.7	0.2	0.2
			47	E100				0.7	0.3	0.8	0.7	0.7	0.7	0.2	0.2
			50	E100				0.9	0.4	1.1	0.7	0.7	0.7	0.2	0.2
			53	E+				1.3	0.6	1.6	0.7	0.7	0.7	0.2	0.2
		2	46	E100	1.5	75 %	Hotspot2, Macro3	0.6	0.3	0.7	0.7	0.7	0.7	0.2	0.2
			50	E100				0.9	0.5	1.1	0.7	0.7	0.7	0.2	0.2
			53	E+			Hotspot2, Macro3	1.3	0.6	1.5	0.7	0.7	0.7	0.2	0.2
			56	E+			Hotspot2, Macro3	1.8	0.8	2.2	1.0	0.8	0.7	0.2	0.2

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

## **Appendix B. Guidelines on how to install the product**

The Ericsson AIR 1281 B261 product (KRD 901 165/2, KRD 901 165/5) 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 Ericsson AIR 1281 B261 product (KRD 901 165/2, KRD 901 165/5), 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 [5].