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EMF Test Report: Ericsson RD 2243

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Tests performed by:	Paramananda Joshi	Dates of tests:	2018-02-20 – 2018-02-21
Manufacturer and market name(s) of device:	Ericsson RD 2243		
Testing has been performed in accordance with:	FCC CFR title 47, part 1.1310, FCC OET Bulletin 65, FCC KDB447498 D01 Innovation, Science and Economic Development Canada RSS 102		
Test results:	The tested device complies with the requirements in respect of all parameters subject to the test.		
Additional information:	Testing was conducted for mobile exposure conditions		
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1 Summary of EMF Test Report¹

Frequency Band [MHz]	1900	2100
Modes	WCDMA, LTE	WCDMA, LTE
Supported	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Covered by report	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Exposure environment	General public	General public

1.1 Results

RF exposure assessment results for general public (uncontrolled) exposure applicable in USA [1] - [3] are given in the table below. The equipment under test (EUT) conforms to the requirements of the relevant standards when the exposure ratio is less than one.

RF exposure assessment results for general public (uncontrolled) exposure as obtained for RD 2243 together with an assumed output power tolerance of 2 dB using procedures applicable for the US market [3].

3GPP band	Standard	Nominal output power from the radio	Test position	Test separation distance	Exposure ratio	Result
B25 (1900)	W, L	2 x 0.05 W	Direction of maximum gain	20 cm	0.10	PASSED
B66A (2100)	W, L	2 x 0.05 W	Direction of maximum gain	20 cm	0.13	PASSED

The maximum EIRP values of the EUT for all the specified frequency bands have been found to be less than the applicable exemption limits of the corresponding frequency bands for routine evaluations specified in RSS-102 [4]. As a consequence, for the Canadian market, no RF exposure evaluation is required.

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

2 General information

The test results reported in this document have been obtained by simple calculations according to plane-wave equivalent conditions [3]. The purpose of the tests was to verify that the EUT is in compliance with the appropriate RF exposure standards, recommendations and limits [1] - [4].

3 Equipment under test

Table 1 summarizes the technical data for the EUT.

Table 1 Technical data for the EUT.

Product name	RD 2243		
Product tested	KRY 901 402/1, KRY 901 404/1		
Dimensions, Thickness x Diameter (mm)	52 x 140		
Configurations(s) covered by this report	WCDMA, LTE B25 (1900) WCDMA, LTE B66A (2100)		
Antenna(s)	Internal antennas	Product number	Maximum gain (dBi)
		KRE 101 2309/1	1.8 and 1.8 (for B25) ² 2.8 and 2.9 (for B66A) ³
Transmitter frequency range (MHz)	B25 (1900): 1930 – 1995 B66A (2100): 2110 – 2180		

In Table 2 nominal output power levels are given.

Table 2 Nominal output power levels.

Band / Mode	Nominal output power⁴ (dBm)	Tolerance, upper limit (dB)	Transmission loss (dB)	Maximum output power⁵ (dBm)
B25 (1900) / WCDMA, LTE	17	2	0	22
B66A (2100) / WCDMA, LTE	17	2	0	22

4 EMF exposure assessments

FCC procedures [3] specify exposure assessment methods to verify compliance with EMF exposure limits [1] of mobile devices. A minimum test separation distance of at least 20 cm is required between the device and nearby persons to apply mobile device exposure limits. The test separation distance for which the equipment is shown to comply with the exposure limits must be clearly provided in the operating and installation instructions.

4.1 US market – field strength calculations

Assuming correlated signals from the two antenna ports of the EUT, the directional gain, G , is estimated as [5]

² Maximum gains for two different antennas connected to the B25 product.

³ Maximum gains for two different antennas connected to the B66A product.

⁴ Nominal output power per port.

⁵ Conservative measure of the total maximum possible output power level delivered to the antennas including losses and tolerances.

$$G = 10 \log \left[\frac{(10^{\frac{G1}{20}} + 10^{\frac{G2}{20}})^2}{2} \right] \text{ dBi}$$

where $G1$ and $G2$ are maximum antenna gains of the two antenna ports in dBi, which are provided in Table 1. This is most likely a very conservative assumption given the used transmission modes and antenna topology. The estimated directional gain, G , and the total effective radiated power values of the EUT in the applicable frequency bands are provided in Table 3.

Table 3 Estimated directional gain and the total effective radiated power of the EUT.

Band	Estimated directional gain (G) (dBi)	Total effective radiated power ⁶ (W)
B25 (1900)	4.8	0.29
B66A (2100)	5.9	0.38

The total effective radiated power values of the EUT for all the specified frequency bands are less than the categorical exclusion limit for routine RF exposure evaluation of 3 W⁷ specified in the FCC CFR title 47, §2.1091(c) [6]. As a consequence, the minimum test separation distance may be estimated by simple calculations according to plane-wave equivalent conditions [3].

The exposure ratio, ER , may be conservatively estimated as

$$ER = \frac{S_{\text{est}}}{S_{\text{lim}}} = \frac{P_{\text{tot}}G}{4\pi r^2 S_{\text{lim}}},$$

where

P_{tot} : Total conducted power of the EUT⁸,

G : Directional gain⁹,

r : Separation distance from antenna,

S_{lim} : Power density exposure limit.

Table 4 presents the RF EMF exposure limits for general public for the US markets in the applicable frequency bands.

Table 4 RF EMF exposure limits for general public for the US markets

Band	S_{lim} (W/m ²)
B25 (1900)	10
B66A (2100)	10

Setting $r = 0.20$ m and using respective values of P_{tot} , G and S_{lim} for the specified frequency bands gives the results for the corresponding frequency bands for a 20 cm test separation distance in Table 5.

Table 5 RF exposure assessment results for general public (uncontrolled) exposure as obtained for RD 2243 using procedures applicable for the US market [3].

3GPP band	Standard	Nominal output power from the radio	Test position ¹⁰	Test separation distance ¹¹	Exposure ratio	Result
B25 (1900)	W, L	2 x 0.05 W	Direction of maximum gain	20 cm	0.10	PASSED

⁶ Takes into consideration the output power tolerance and transmission loss.

⁷ Valid for frequency ≥ 1500 MHz.

⁸ This is equal to the maximum output power (in W) in Table 2.

⁹ This is equal to linear value of G in Table 3.

¹⁰ For a test separation distance of 20 cm, the exposure was found to be well below applicable exposure limits in the direction of maximum gain. Since this test position corresponds to the direction of maximum exposure and the RD is classified as a mobile device with an intended separation distance to the user or nearby persons of at least 20 cm, other test positions were not considered.

¹¹ The separation distance is measured from the EUT casing.

B66A (2100)	W, L	2 x 0.05 W	Direction of maximum gain	20 cm	0.13	PASSED
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The exposure ratios are well below one. Hence, the RF EMF exposure is below the relevant exposure limits [1] for the 20 cm test separation distance for the frequency bands specified in Table 5.

4.2 Canadian market – use of exemption limits

According to the requirements in RSS-102 [4], in the frequency range at or above 300 MHz and below 6 GHz RF exposure evaluation is not required if the following exemption limit is fulfilled

$$EIRP \leq 0.0131f^{0.6834} \text{ W},$$

where f is the frequency in MHz. The maximum $EIRP$ of the EUT and the limits for exemption ($EIRP_{lim}$) for the applicable frequency bands are provided in Table 6. The $EIRP_{lim}$ values are calculated at the lower frequency limit of the corresponding frequency bands¹².

Table 6 Maximum $EIRP$ and $EIRP_{lim}$ of the EUT.

Band	Maximum $EIRP$ (W) ¹³	$EIRP_{lim}$ (W)
B25 (1900)	0.48	2.30
B66A (2100)	0.62	2.44

The maximum $EIRP$ values of the EUT for all the specified frequency bands are less than $EIRP_{lim}$ of the corresponding frequency bands. As a consequence, no RF exposure evaluation is required according to the Canadian regulatory requirements [4].

5 Conclusion

The results in Section 4 show that the plane-wave equivalent power density, estimated according to the requirements of FCC [3] is below the relevant MPE limits [1] at a separation distance of 20 cm between the equipment and any nearby person.

The maximum EIRP values of the EUT for all the specified frequency bands have been found to be less than the applicable exemption limits of the corresponding frequency bands for routine evaluations specified in RSS-102 [4]. As a consequence, for the Canadian market, no RF exposure evaluation is required.

Consequently, the EUT is in compliance with the appropriate RF exposure standards and recommendations for the specified frequency bands.

¹² For example, the exemption limit for B25 (1930 – 1995 MHz) is calculated at 1930 MHz.

¹³ Takes into consideration the output power tolerance and transmission loss.

6 References

- [1] FCC, Code of Federal Regulations CFR title 47, part 1.1310 "Radiofrequency radiation exposure limits", Federal Communications Commission (FCC), 2017.
- [2] FCC, OET Bulletin 65, "Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", 1997.
- [3] FCC KDB 447498 D01, "Mobile and Portable Devices RF exposure procedures and Equipment Authorization Policies", 2015.
- [4] Innovation, Science, and Economic Development Canada (Industry Canada), Radio Standard Specification (RSS) 102, (Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)), 2015.
- [5] FCC KDB 662911 D01, "Emissions Testing of Transmitters with Multiple Outputs in the Same Band", 2013.
- [6] FCC, Code of Federal Regulations CFR title 47, part 2.1091, " Radiofrequency radiation exposure evaluation: mobile devices", Federal Communications Commission (FCC), 2017.

7 Revision History

Rev.	Date	Description
A	2018-02-22	First revision