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EMF Test Report: Ericsson Dot 2272/2282 B5B12A (FCC)

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Tests performed by:	Carla Di Paola	Dates of tests:	2021-06-08 (Rev A) 2021-06-16 (Rev B)
Manufacturer and market name(s) of device:	Ericsson Dot 2272 B5B12A Ericsson Dot 2282 B5B12A		
Testing has been performed in accordance with:	FCC OET Bulletin 65		
Test results:	Minimum separation distance for which the RF EMF exposure complies with the limits in FCC 47 CFR 1.1310 to be included in the Customer Product Information (CPI) for Ericsson Dot 2272/2282 B5B12A.		
Additional information:	Testing was conducted for mobile exposure conditions according to KDB447498 D01.		
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1 Summary of EMF Test Report¹

Equipment under test (EUT)

Product name	Ericsson Dot 2272 B5B12A Ericsson Dot 2282 B5B12A		
Product number	KRY 901 428/1 KRY 901 428/2		
Supported bands, Tx frequency range (MHz), and standards	B5	869 – 894	LTE, NBLoT, NR
	B12A	729 – 746	LTE, NBLoT, NR
Duplexing technology	FDD		
Configuration(s) covered by this report	B5 + B12A		
Exposure environment	General public/uncontrolled		

Results

The minimum (test) separation distance required for the equipment under test (EUT) to comply with the mobile device exposure conditions and relevant limits applicable in the USA [1]-[3] is provided in the table below for the general public (uncontrolled exposure).

RF exposure assessment results for general public (uncontrolled) exposure as obtained for Dot 2272/2282 B5B12A together with an assumed output power tolerance of 2 dB using procedures applicable for the US market [3].

Band	Standard	Maximum nominal output power from the radio	Test position	Separation distance
B5 + B12A	LTE, NBLoT, NR	2 x 0.050 W + 2 x 0.050 W	Direction of maximum gain	20 cm

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 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]-[3].

It should be noted that the test results presented in this test report are valid for the frequency range and for the antenna properties specified in Table 1, in addition to the power level and the power tolerance specified in Table 2. These data were supplied by the client and may affect the validity of the results.

The test results were determined for Dot 2272 B5B12A (equipped with internal antennas) and are also applicable for Dot 2282 B5B12A connected to external antennas provided that the antenna gain values are equal to or smaller than 1.4 dBi and 1.8 dBi for B5 and B12A, respectively.

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

3 Equipment under test

Table 1 summarizes the technical data for the EUT.

Table 1 Technical data for the EUT.

Product name	Ericsson Dot 2272 B5B12A		
Product tested	KRY 901 428/1		
Supported bands, Tx frequency range (MHz), and standards	B5	869 – 894	LTE, NBLoT, NR
	B12A	729 – 746	LTE, NBLoT, NR
Duplexing technology	FDD		
Dimensions of Radio head, H x D (mm)	60 x 140		
Dimensions of Radio head with bracket, h x D (mm)	132 x 140		
Configuration(s) covered by this report	B5 + B12A		
Antenna(s)	Four internal antenna branches (two branches per band).	Maximum antenna gain for B5: 1.4 dBi Maximum antenna gain for B12A: 1.8 dBi	
Exposure environment	General public/uncontrolled		

In Table 2 output power levels of the EUT are given. The EUT related data in Table 1 and Table 2 were supplied by the client.

Table 2 Nominal output power levels.

Band	Standard	Maximum nominal output power [W / dBm]	Power tolerance [dB]	Transmission loss [dB]	Maximum output power ² [W / dBm]
B5 + B12A	LTE, NBLoT, NR	(2 x 0.050 + 2 x 0.050) W / 23 dBm	2	0	(2 x 0.079 + 2 x 0.079) W / 25 dBm

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 minimum 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.

² Conservative measure of the total maximum possible output power level delivered to the antennas including loss and tolerance.

The assessments were conducted for maximum power configurations, i.e., by assuming 100% utilization. Effects of real RBS utilization (time-averaged) is reasonably foreseeable and will significantly reduce the time-averaged power and the RF exposure. This factor was not considered in this assessment, which adds to the conservativeness of the obtained compliance boundaries.

4.1 Field strength calculations

Assuming correlated signals and based on the maximum gain of the single antenna for each band ($G_{\text{ant}} = 1.4$ dBi for B5 and 1.8 dBi for B12A, see Table 1) the directional gain, G , may be taken as 4.4 dBi and 4.8 dBi for B5 and B12A, respectively, according to [4] ($G = G_{\text{ant}} + 10 \log_{10} N$, where N is the number of simultaneously transmitting antennas for each band). This is most likely a very conservative assumption since the antennas are spatially separated and their maximum gain occurs at different locations which add extra conservativeness of the results.

The total effective radiated power based on the maximum antenna gain of 4.4 dBi and 4.8 dBi for B5 and B12A, respectively, as described above and the output power level of Table 2 is 0.26 W and 0.29 W for B5 and B12A, respectively, which is less than the categorical exclusion limit for routine RF exposure evaluation of 1.5 W³ specified in the FCC CFR title 47, § 2.1091(c) [5]. As a consequence, the minimum test separation distance may be estimated by simple calculations according to plane-wave equivalent conditions [3].

Power density for each of the transmitting bands may be conservatively estimated as⁴

$$S = \frac{P_a G}{4\pi r^2},$$

where

P_a : Total conducted power per band⁵,

G : Directional gain for the corresponding band,

r : Separation distance from antenna,

S : Estimated power density.

The total power density, S_{tot} , for B5 and B12A is therefore given by

$$S_{\text{tot}} = S_{\text{B5}} + S_{\text{B12A}}$$

and the total exposure ratio (ER) is given by

$$ER_{\text{tot}} = \frac{S_{\text{B5}}}{S_{\text{lim,B5}}} + \frac{S_{\text{B12A}}}{S_{\text{lim,B12A}}}$$

and the minimum test separation distance to meet compliance with the relevant limits (S_{lim}) applicable in the USA [1]-[3] (see Table 4) for the general public (uncontrolled exposure) is obtained by solving the following equation for r :

$$\frac{S_{\text{B5}}(r)}{S_{\text{lim,B5}}} + \frac{S_{\text{B12A}}(r)}{S_{\text{lim,B12A}}} = 1$$

For a minimum test separation distance of 20 cm, the estimated total exposure ratio is below one and the EUT complies with the RF exposure evaluation conditions and the relevant exposure limit applicable in the USA [1]-[3] (see Table 4) for the general public (uncontrolled exposure).

³ Valid for frequency ≤ 1500 MHz.

⁴ The expression for the far-field formula is provided in IEEE C95.3 [6] and IEC 62232 [7].

⁵ This is equal to the maximum output power (in W) per band in Table 2.

Table 3 RF exposure assessment results for general public (uncontrolled) exposure as obtained for Dot 2272/2282 B5B12A together with an assumed output power tolerance of 2 dB using procedures applicable for the US market [3].

Band	Standard	Maximum nominal output power from the radio	Test position	Separation distance	$\frac{S_{B5}}{S_{lim,B5}}$	$\frac{S_{B12A}}{S_{lim,B12A}}$
B5 + B12A	LTE, NB-IoT, NR	2 x 0.050 W + 2 x 0.050 W	Direction of maximum gain	20 cm	0.15 (at 20 cm)	0.20 (at 20 cm)

Table 4 General public (uncontrolled) RF EMF exposure limit applicable in the US market [1],[2]. The lowest exposure limit value within the tested frequency band was used for the assessment and is reported in the table.

Band	S_{lim} (W/m ²)
B5	5.79
B12A	4.86

5 Uncertainty

For the input parameters defined in the test report, the approach described in Section 4 results in a conservative estimate of the separation distance. This distance was determined by comparing the evaluated RF exposure directly with the limits.

6 Conclusion

The results in Section 4 show that the plane-wave equivalent power density for the Ericsson Dot 2272 B5B12A, estimated according to the requirements of FCC [3] is below the relevant MPE limits [1] at a separation distance of at least 20 cm between the equipment and any nearby person.

As Dot 2282 B5B12A is equipped with the same hardware as Dot 2272 B5B12A except the antennas, the test results are also applicable for Dot 2282 connected to external antennas with similar radiation characteristics as the Dot 2272 antennas.

7 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] FCC KDB 662911 D01, "Emissions Testing of Transmitters with Multiple Outputs in the Same Band", 2013.
- [5] FCC, Code of Federal Regulations CFR title 47, part 2.1091, " Radiofrequency radiation exposure evaluation: mobile devices", Federal Communications Commission (FCC), 2017.
- [6] 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", 2002.
- [7] 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.

8 Revision History

Rev.	Date	Description
A	2021-06-11	First revision.
B	2021-06-17	Second revision. Change in the transmitted power for each band.

Appendix A. Information to be included in the CPI

Table A.1 lists the minimum separation distance for which the RF EMF exposure from Ericsson Dot 2272 B5B12A and Ericsson Dot 2282 B5B12A is below the limits by the FCC as applicable in:

- USA (47 CFR 1.1310)

Table A.1: Minimum separation distance for general public/uncontrolled exposure applicable in USA and markets employing the FCC RF exposure limits (including 2 dB output power tolerance).

Band	Standard	Maximum nominal output power from the radio	Test position	Separation distance
B5 + B12A	LTE, NB-IoT, NR	2 x 0.050 W + 2 x 0.050 W	Direction of maximum gain	20 cm

(1) The test results were determined for Dot 2272 B5B12A (equipped with internal antennas) and are also applicable for Dot 2282 B5B12A connected to external antennas, provided that the antenna gain values are equal to or smaller than 1.4 dBi and 1.8 dBi for B5 and B12A, respectively .

Appendix B. Guidelines on how to install the product

The Ericsson Dot 2272 B5B12A (KRY 901 428/1) and Ericsson Dot 2282 B5B12A (KRY 901 428/2) 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. Photograph of the EUT



Figure C.1 Photograph of Ericsson Dot 2272 B5B12A (top view).