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EMF Test Report: Ericsson Dot 4459/4469 B41K (FCC)

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Testing laboratory:	Ericsson EMF Research Laboratory Ericsson AB SE-164 80 Stockholm Sweden	Company/Client:	Denis Lalonde Ericsson Canada 349 Terry Fox Drive Ottawa ON K2K 2V6 Canada
Tests performed by:	Davide Colombi	Dates of tests:	2021-10-25 (Rev A)
Manufacturer and market name(s) of device:	Ericsson Dot 4459/4469 B41K		
Testing has been performed in accordance with:	FCC OET Bulletin 65 IEC 62232:2017		
Test results:	RF exposure compliance distances related to the limits in FCC 47 CFR 1.1310 to be included in the Customer Product Information (CPI) for Ericsson Dot 4459/4469.		
Additional information:			
Signature:	Test Engineer  Davide Colombi Master Researcher davide.colombi@ericsson.com Tel: +46767602089	Laboratory and Quality Manager  Christer Törnevik Senior Expert – EMF and Health christer.tornevik@ericsson.com Tel: +46705863148	

Summary of EMF Test Report¹

Equipment under test (EUT)

Product name	Ericsson Dot 4459 B41K (internal antennas) Ericsson Dot 4469 B41K (external antennas)		
Product number	KRY 901 502/1 KRY 901 502/2		
Supported bands, Tx frequency range (MHz), and standards	B41K	2515–2675	NR TDD, LTE TDD
Exposure environment	General public/uncontrolled, Occupational/controlled		

Results

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

RF compliance distances for general public (GP) and occupational (O) exposure for Dot 4459 B41K and Dot 4469 B41K applicable in the USA and markets employing the FCC RF exposure limits. The compliance distance is determined for the maximum nominal output power with 1 dB output power tolerance included.

Band	Standard	Maximum nominal output power from the radio	Test position	TDD DL duty cycle	Compliance distance	
					GP	O
B41K	NR, LTE	4 x 0.4 W	Direction of maximum gain	75%	31 cm	20 cm

For the power levels specified in the table with tolerances added, and the upward rounding of the compliance distance to the nearest centimeter, 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.

1 General information

The test results presented in this report define compliance distances for Radio Dot 4459 B41K and Dot 4469 B41K. Outside these distances, 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 and for the antenna properties specified in Table 1, in addition to the power level, the power tolerance and TDD downlink duty cycle specified in Table 2. These data as well as the applied antenna pattern files were supplied by the client and may affect the validity of the results.

The test results were determined for Dot 4459 B41K (equipped with internal antennas) and are also applicable for Dot 4469 B41K connected to external antennas provided that the maximum directional antenna gain of all simultaneously transmitting antennas is equal to or smaller than 9 dBi.

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

2 Equipment under test

Table 1 summarizes the technical data for the EUT.

Table 1 Technical data for the EUT.

Product name	Ericsson Dot 4459 B41K		
Product tested	KRY 901 502/1		
Supported bands, Tx frequency range (MHz), and standards	B41K	2515–2675	NR TDD, LTE TDD
Dimensions of Radio head, H x D (mm)	76 × 220		
Configuration(s) covered by this report	B41K		
Antenna(s)	Four internal antenna branches	Maximum antenna gain per branch: 5.5 dBi	
Exposure environment	General public/uncontrolled, Occupational/controlled		

In Table 2 output power levels of the EUT are given.

Table 2 Output power levels of the EUT.

Band	Standard	Maximum nominal output power [W / dBm]	Power tolerance [dB]	Transmission loss [dB]	TDD DL duty cycle	Maximum time-averaged output power ² [W / dBm]
B41K	NR, LTE (TDD)	4 x 0.4 / 32	1	0	75%	1.5 / 31.79

The EUT related data in Table 1 and Table 2 were supplied by the client.

² Conservative measure of the total maximum possible output power level delivered to the antennas including losses, tolerances, and maximum TDD DL duty cycle.

3 Exposure conditions

The EUT is an indoor, low-power radio system intended to be installed at a fixed location such as on walls and ceilings. Other installation related exposure conditions are not reasonably foreseeable for the EUT.

The assessments were conducted for maximum power configurations, i.e., by assuming 100% utilization. Effects of real RBS utilization 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 distance.

4 EMF compliance distance calculations

Assuming correlated signals and based on the combined 3D far-field patterns of all simultaneously transmitting antennas, the maximum directional gain, G , may be calculated as [5][6]:

$$G = \max_{\theta, \phi} G_c(\theta, \phi) = 10 \log \left[\left(\sum_{i=1}^N 10^{\frac{G_i(\theta, \phi)}{20}} \right)^2 / N \right]$$

where θ is elevation, ϕ is azimuth, N is the number of simultaneously transmitting antennas, $G_c(\theta, \phi)$ is the directional gain (in dB) and $G_i(\theta, \phi)$ is the gain value (in dB) of the i th antenna branch at the direction (θ, ϕ) . $G_i(\theta, \phi)$ is based on antenna far-field measurement data provided by the client for four frequencies, specifically 2550 MHz, 2580 MHz, 2600 MHz and 2650 MHz within Band 41K. This is most likely a conservative assumption since the combined field is assumed in phase in all directions at the same time. The resulting maximum directional gain G is 9 dBi.

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 62232:2017 [4]. The calculations were made using the far-field spherical formula. Using the maximum directional gain, the power density may be conservatively estimated as

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

where S , P_a , and r denote the power density, the total accepted power³, and the distance from the EUT, respectively.

The compliance distance for the spherical model, CD_{sph} in the direction of the maximum directional gain was obtained by solving the following equation for r :

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

where $S_{\text{gp, o}}^{\text{lim}}$ denotes the FCC power density limits [1] for general public and occupational exposure. For the frequency bands of interest, the RF EMF exposure limits are given in Table 3.

Table 3 General public (uncontrolled) and occupational (controlled) RF EMF exposure limits applicable in the US market [1].

Band	$S_{\text{gp}}^{\text{lim}}$ (W/m ²)	$S_{\text{o}}^{\text{lim}}$ (W/m ²)
B41K	10	50

³ This is equal to the maximum time-averaged output power (in W) in Table 2.

To comply with the FCC requirement of a minimum test separation distance for a non-portable device of 20 cm, the minimum compliance distance was set to 20 cm.

5 Results

The resulting compliance distances are given in Table 4 rounded upwards to the nearest centimeter.

Table 4 RF compliance distances for general public (GP) and occupational (O) exposure for Dot 4459 B41K and Dot 4469 B41K applicable in the USA and markets employing the FCC RF exposure limits. The compliance distance is determined for maximum nominal output power with 1 dB output power tolerance included.

Band	Standard	Maximum nominal output power from the radio	Test position	TDD DL duty cycle	Compliance distance	
					GP	O
B41K	NR, LTE	4 x 0.4 W	Direction of maximum gain	75%	31 cm	20 cm

For the power levels specified in the table with tolerances added, and the upward rounding of the compliance distance to the nearest centimeter, the specified results are conservative.

6 Uncertainty

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

7 Conclusion

The Ericsson Dot 4459 B41K has been tested using methods and procedures specified in FCC OET Bulletin 65 [3] and IEC 62232:2017 [4]. At larger distances than what specified in Section 5 the RF exposure is below the limits specified in [1].

As Dot 4469 B41K is equipped with the same hardware as Dot 4459 B41K except the antennas, the test results are also applicable for Dot 4469 connected to external antennas provided that the directional antenna gain of all simultaneously transmitting antennas is equal or smaller than 9 dBi.

8 References

- [1] FCC, Code of Federal Regulations CFR title 47, part 1.1310 “Radiofrequency radiation exposure limits”, Federal Communications Commission (FCC), 2017.
- [2] Ericsson, GFTE-16:001718 Uen, “Ericsson RF exposure calculation procedure for base stations.
- [3] FCC, OET Bulletin 65, “Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields”, 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] FCC KDB 662911 D01, “Emissions Testing of Transmitters with Multiple Outputs in the Same Band”, 2013.
- [6] IEC TR 62630, Guidance for evaluating exposure from multiple electromagnetic sources.
- [7] Ericsson, LME-12:001904 Uen, “Exposure to radio frequency electromagnetic fields”.

9 Revision History

Rev.	Date	Description
A	2021-10-26	First revision

Appendix A. Information to be included in the CPI

Table A.1 lists the compliance distances of Dot 4459 B41K and Dot 4469 B41K. For these and larger distances the RF EMF exposure is below the limits specified by the FCC as applicable in:

- USA (47 CFR 1.1310)

Table A.1: Compliance distance for general public/uncontrolled and occupational/controlled exposure applicable in USA and markets employing the FCC RF exposure limits.

Product	Standard	Maximum nominal output power from the radio	Test position	TDD DL duty cycle	Compliance distance	
					GP	O
Dot 4459 and Dot 4469 B41K	NR, LTE	4 x 0.4 W	Direction of maximum gain	75%	31 cm	20 cm

Note to the table: The test results were determined for Dot 4459 (equipped with internal antennas) and are also applicable for Dot 4469 connected to external antennas provided that the total antenna gain for all simultaneously transmitting antennas is equal or smaller than 9 dBi.

Appendix B. Guidelines on how to install the product

The Ericsson Dot 4459 B41K and Dot 4469 B41K (KRY 901 502/1 and KRY 901 502/2) shall be installed to make sure that the general public does not have access within the applicable RF EMF compliance distance. The compliance distance was determined for the product transmitting in free space.

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

If work needs to be performed within the compliance distance of Ericsson Dot 4459 B41K and Dot 4469 B41K (KRY 901 502/1 and KRY 901 502/2) 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].