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Test report issued by an Accredited Testing Laboratory

EMF Test Report: Ericsson RBS 6402 LTE WCDMA B2 B4 B7 B25 Wi-Fi FCC and Industry Canada

Document number:	Rev B	**Date of report:**	2016-03-22
Testing laboratory:	Ericsson EMF Research Laboratory Ericsson AB SE-164 80 Stockholm Sweden	**Company/Client:**	Mika Savilakso Oy LM Ericsson AB Elektroniikkatie 10 FI - 905903 Oulu Finland
Tests performed by:	Jaroslav Kazejev	**Dates of tests:**	2016-02-01 to 2016-02-05
Manufacturer and market name(s) of device:	Ericsson RBS 6402		
Testing has been performed in accordance with:	FCC CFR title 47, part 1.1310, FCC KDB447498 D01, Industry Canada RSS 102		
Test results:	The tested device complies with the requirements in respect of all parameters subject to the test.		
Additional information:			

Signature:	Test engineer	Quality Manager
	Jaroslav Kazejev Experienced Researcher jaroslav.kazejev@ericsson.com Tel: +46 10 713 43 44	Björn Thors Senior Specialist RF Exposure Assessment bjorn.thors@ericsson.com Tel: +46 10 717 18 24

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1 Summary of EMF Test Report[1]

1.1 Equipment under test (EUT)

Product name	RBS 6402
Product number	KRD 901 060/4, KRD 901 060/6

Frequency Band [MHz]	1900	2100	2600	2412	5180	5500	5745
Modes	LTE, WCDMA	LTE, WCDMA	LTE	Wi-Fi	Wi-Fi	Wi-Fi	Wi-Fi
Supported	☑	☑	☑	☑	☑	☑	☑
Covered by report	☑	☑	☑	☑	☑	☑	☑
Exposure environment	General Public						

1.2 Results

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

RF exposure assessment results for general public (uncontrolled) exposure as obtained for the Pico RBS with the internal cellular antenna together with assumed output power tolerances of 0.6 dB (for B2, B25, B4 and B7) and 2 dB (for Wi-Fi) using procedures and exposure limits applicable for the US markets [3].

3GPP/Wi-Fi band	Standard	Nominal output power from the radio[2]	Test position	Test separation distance[3]	Exposure ratio[4]	Result
B2, B25[5] (1900) B4 (2100) B7 (2600) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	L L L Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4, B7) 2 x 0.25 W (B2, B25, B4, B7) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	Front	20 cm	0.13	**PASSED**
B2, B25[5] (1900) B4 (2100) B7 (2600) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	L L L Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4, B7) 2 x 0.25 W (B2, B25, B4, B7) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	45 degree radial towards the side	20 cm	0.15	**PASSED**
B2, B25[5] (1900) B4 (2100) B7 (2600) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	L L L Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4, B7) 2 x 0.25 W (B2, B25, B4, B7) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	Side	20 cm	0.22	**PASSED**
B2, B25 (1900) B4 (2100) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	W W W Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	Front	20 cm	0.13	**PASSED**
B2, B25 (1900) B4 (2100) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	W W W Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	45 degree radial towards the side	20 cm	0.15	**PASSED**

[1] This and the following page contain a summary of the test results. The full report provides a complete description of all test details and results.
[2] The listed powers are all transmitters available for simultaneous transmission located on two RF cards for cellular bands and one RF card (having six ports) for Wi-Fi bands). WCDMA is supported on one RF card.
[3] The separation distance is measured from the EUT casing.
[4] The exposure ratio is defined as the evaluated exposure parameter expressed as the power fraction of the related exposure limit. Here, the maximum ER value among all different possible configurations is shown including combinations between cellular and Wi-Fi bands.
[5] Test was conducted for B25, since B2 is a sub-set of B25.

B2, B25 (1900) B4 (2100) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	W W W Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	Side	20 cm	0.22	**PASSED**

Expanded uncertainty (k=2) 95 % for field strength measurements using the DASY5 near field scanner.	< 30%

RF exposure assessment results for general public (uncontrolled) exposure as obtained for the Pico RBS with the internal cellular antenna together with assumed output power tolerances of 0.6 dB (for B2, B25, B4 and B7) and 2 dB (for Wi-Fi) using procedures applicable for the Canadian markets [2].

3GPP/Wi-Fi band	Standard	Nominal output power from the radio[2]	Test position	Test separation distance[3]	Exposure ratio[4]	Result
B2, B25[5] (1900) B4 (2100) B7 (2600) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	L L L Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4, B7) 2 x 0.25 W (B2, B25, B4, B7) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	Front	20 cm	0.25	**PASSED**
B2, B25[5] (1900) B4 (2100) B7 (2600) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	L L L Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4, B7) 2 x 0.25 W (B2, B25, B4, B7) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	45 degree radial towards the side	20 cm	0.29	**PASSED**
B2, B25[5] (1900) B4 (2100) B7 (2600) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	L L L Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4, B7) 2 x 0.25 W (B2, B25, B4, B7) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	Side	20 cm	0.45	**PASSED**
B2, B25 (1900) B4 (2100) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	W W W Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	Front	20 cm	0.25	**PASSED**
B2, B25 (1900) B4 (2100) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	W W W Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	45 degree radial towards the side	20 cm	0.29	**PASSED**
B2, B25 (1900) B4 (2100) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	W W W Wi-Fi Wi-Fi	2 x 0.25 W (B2, B25, B4) 3 x 0.04 W (2.4 GHz) 3 x 0.05 W (5 GHz)	Side	20 cm	0.45	**PASSED**

Expanded uncertainty (k=2) 95 % for field strength measurements using the DASY5 near field scanner.	< 30%

2 General information

The test results reported in this document have been obtained by field strength measurements according to FCC [3] and Industry Canada [2] procedures. The purpose of the tests was to verify that the equipment under test (EUT) is in compliance with the appropriate RF exposure standards, recommendations and limits [1] - [3].

3 Equipment under test

Table 1 summarizes the technical data for the EUT. Photographs of the device with the internal antennas are presented in Appendix A. The device can be installed in two different orientations, here denoted wall, for vertical installation on a wall, or ceiling, for horizontal mounting in a ceiling with the radome facing down (see Figure 1). Furthermore, the device is installed with a fan module[6]. Shown in Figure 1 is also the terminology used in this report to denote the different sides of the EUT. Note that this terminology is not dependent on the used mounting position.

Table 1: Technical data for the EUT.

Product name	RBS 6402		
Product tested	KRD 901 060/6X	**Serial number**	C82A249859
Products covered by test	KRD 901 060/4, KRD 901 060/6		
Dimensions, H x W x D (mm)	185 x 280 x 60 (with a fan module)		
Configurations(s) covered by this report	LTE 1900 (B2, B25) LTE 2100 (B4) LTE 2600 (B7) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	WCDMA 1900 (B2, B25) WCDMA 2100 (B4) Wi-Fi 2.4 GHz Wi-Fi 5 GHz	
Antenna(s)	Internal antennas (Cellular bands)		
Transmitter frequency range (MHz)	LTE/WCDMA 1900 (B2): 1930 – 1990 LTE/WCDMA 1900 (B25): 1930 – 1995 LTE/WCDMA 2100 (B4): 2110 – 2155 LTE 2600 (B7): 2620 – 2690 Wi-Fi 2.4 GHz : 2402 - 2482 Wi-Fi 5 GHz: 5170 - 5835		

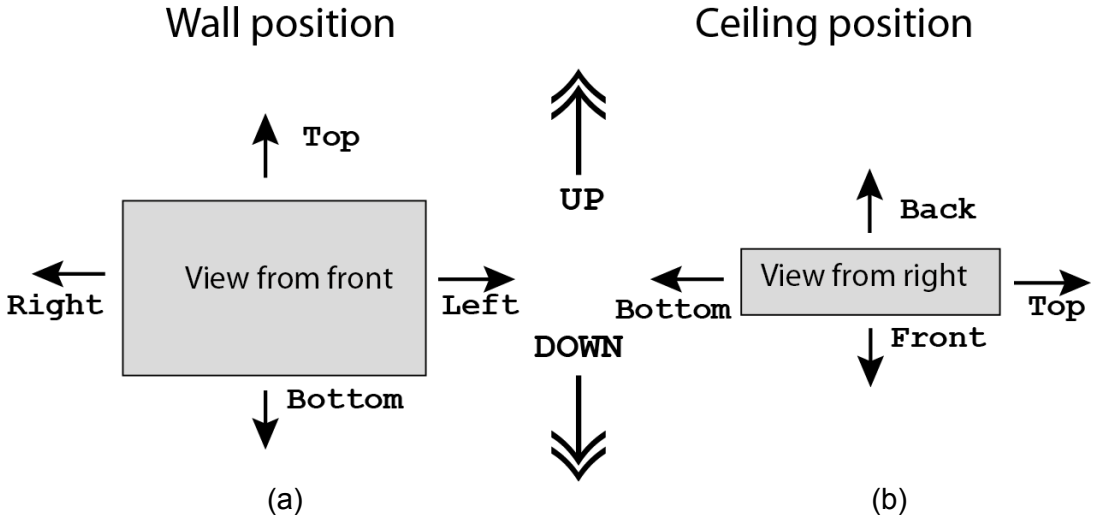

Figure 1: EUT installation positions and terminology used to denote the different sides of the EUT. (a) Wall installation position. (b) Ceiling installation position.

In Table 2, the output power levels provided by the client are given for the different bands.[7] In addition to LTE, the EUT also supports WCDMA for B2, B4 and B25. Output power levels obtained with WCDMA transmission are provided in Appendix D.

[6] Fan module is always present if both the RF cards are installed in the EUT or if the EUT with single RF card is installed in the ceiling.
[7] The presented output power levels correspond to the maximum power configurations for which measurements were made.

Table 2: Nominal and measured output power levels for LTE and Wi-Fi.

Band / Mode	RF card	Nominal output power[8] (dBm)	Tolerance, upper limit (dB)	Maximum output power[9] (dBm)	Tested low, mid and high channels		Measured maximum output power (dBm) TX1/TX2/TX3[10]
					Channel number	Frequency (MHz)	
LTE B25 (1900), 10 MHz Bandwidth	RF0	24.0	0.6	27.6	8090	1935.0	24.0 / 24.1
					8365	1962.5	24.0 / 24.1
					8640	1990.0	24.2 / 24.3
LTE B4 (2100), 5 MHz Bandwidth	RF0	24.0	0.6	27.6	1975	2112.5	24.8[11] / 24.5
					2175	2132.5	24.4 / 24.4
					2375	2152.5	24.6 / 24.5
LTE B7 (2600), 10 MHz Bandwidth	RF0	24.0	0.6	27.6	2800	2625.0	23.9 / 23.6
					3100	2655.0	23.3 / 24.0
					3400	2685.0	23.7 / 23.5
LTE B25 (1900), 10 MHz Bandwidth	RF1	24.0	0.6	27.6	8090	1935.0	23.9 / 24.0
					8365	1962.5	24.2 / 24.2
					8640	1990.0	24.3 / 24.2
LTE B4 (2100), 5 MHz Bandwidth	RF1	24.0	0.6	27.6	1975	2112.5	24.6 / 24.6
					2175	2132.5	24.2 / 24.3
					2375	2152.5	24.4 / 24.6
LTE B7 (2600), 10 MHz Bandwidth	RF1	24.0	0.6	27.6	2800	2625.0	23.8 / 23.8
					3100	2655.0	23.3 / 24.0
					3400	2685.0	23.7 / 23.7
Wi-Fi 2.4 GHz	Wi-Fi	16.0	2.0	22.8	1	2412.0	15.9 / 16.0 / 15.7
Wi-Fi 5 GHz	Wi-Fi	17.0	2.0	23.8	36	5180.0	17.3 / 18.5 / 17.9
					52	5260.0	17.0 / 17.5 / 18.1
					100	5500.0	16.7 / 17.4 / 16.8
					149	5745.0	16.6 / 17.3 / 15.9

Both RF cards of the EUT and the Wi-Fi card (denoted RF 0, RF 1 and Wi-Fi) were used for this test; see Appendix A. RF 0 and RF 1were configured with LTE B4, B7, and B25. Separate measurements were conducted for both ports of each RF card. The four ports of the cellular cards are denoted RF 0 TX 1, RF 0 TX 2, RF 1 TX 1 and RF 1 TX 2, see Appendix A. The exposure measurements were conducted for the bandwidths corresponding to configurations with the highest measured maximum output power. For each band, the same configurations were used for both ports of each RF card. The modulation specified in E-TM 3.1 was used for the LTE assessments.

The Wi-Fi card has three ports for each of the frequency bands at 2.4 GHz and 5 GHz, respectively, denoted TX1, TX2 and TX3. For the Wi-Fi card the measurements were conducted with the three ports of the band transmitting simultaneously since the test mode did not allow individual transmission. The MCS 4 (16-QAM) modulation was used for the Wi-Fi assessments.

The EUT is equipped with four internal antennas for mobile communications and six antennas for Wi-Fi. Each antenna is positioned as shown in Appendix A.

8 Nominal output power per port.

9 Conservative measure of the total maximum possible output power level delivered to the antenna per RF card, i.e. the nominal output power level per port plus the tolerance in production times the number of ports in a RF card.

10 TX3 is applicable only for the Wi-Fi cards

11 The measured output power for this band, channel and port was above the maximum specified output power. Therefore no scaling was applied to the measurements corresponding to this band, channel and port combination.

4 Test equipment

4.1 Near-field scanner

The field strength measurements were conducted using the DASY5 professional near-field scanner by Schmid & Partner Engineering AG.

The equipment list related to the DASY5 near-field scanner is given in Table 3. In Appendix B calibration parameters for the used field strength test probe(s) are listed.

Table 3: Equipment list related to the DASY5 near-field scanner.

Description	Serial number	Calibration due date	Calibration interval
Probe electronics, DAE3	422	2016-06	12 months
E-field probe, ER3DV4R	2210	2016-06	12 months
E-field probe, EF3DV3	4033	2017-01	12 months

4.2 Additional equipment

Additional equipment used during the measurements is listed in Table 4.

Table 4: List of additional equipment with calibration information.

Description	Serial number	Calibration due date	Calibration interval
Power meter, Keysight N1911A	MY45100381	2016-12	24 months
Power sensor, Keysight N1921A	MY45240486	2016-04	
Signal generator, Rhode & Schwartz SMB 100A	100166	2016-12	36 months
HAC dipole, CD1880V3	1053	NA	NA
HAC dipole, CD5500V3	1006	NA	NA
Amplifier, Milmega AS0204-2L	1003362	N/A	N/A

5 EMF exposure assessments

FCC [3] and Industry Canada procedures [2] 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.

A system performance check was conducted to verify the system operations, see Section 5.1. A description of the field strength measurements is given in Section 5.2 and the results are given in Section 5.3. In Section 5.4, an uncertainty budget is provided.

5.1 Field strength system performance check

System performance checks of the DASY5 measurement system were conducted prior to the field strength measurements using the CD1880V3, and CD5500V3 hearing aid compatibility (HAC) dipoles. The electric field strength was measured in the far-field region and compared against theoretical results calculated using the far-field formula

$$E = \frac{\sqrt{\eta P G}}{2\sqrt{\pi} R}, \quad (1)$$

where P, G, η and R denote the transmitted power, the antenna gain, the free space wave impedance and the distance between the probe and the reference antenna, respectively. The results, provided in Table 5, are within ±1 dB of the reference values.

Table 5: Field strength system performance check results

Frequency (MHz)	Transmitted power (W)	Antenna gain (dBi)	Separation distance (m)	*E* (V/m)		Difference (dB)	Date
				Measured	Reference		
1880	0.25	1.64	0.3	11.2	11.8	-0.44	2016-02-01
5500	0.14	1.64	0.3	8.8	8.7	0.03	2016-02-05

5.2 Field strength measurement description

The FCC KDB 447498 D01 [3] and RSS-102 [2] specify that EMF exposure shall be assessed for mobile conditions, i.e. for a test separation distance of at least 20 cm, by conducting measurements of spatially averaged electric field strengths along vertical lines corresponding to the longest dimensions of the exposed person's body. For a typical standing adult, the height may be estimated as 180 cm [3].

Here, however, an averaging length of 90 cm was assumed to make the results more conservative and applicable to all members of the general public[12]. The spatial resolution between the assessment points was 10 cm [3]. The electric field strength measurements were conducted using the DASY5 near field scanner.

The measurements were conducted in front of the EUT to confirm that the exposure is below the exposure limits at a test separation distance of 20 cm. The distance in this context corresponds to the shortest distance between the EUT casing and the line along which the measurements were taken. Prior to the measurements along line for the cellular bands, area scans were conducted for each RF card separately with two ports of the card transmitting simultaneously. An Ericsson internal tool called Lowpower Compliance Analyzer (LCA) [6] was used to find the position of the line that has the maximum averaged field values (averaged over 90 cm) among the lines in the measurement area. To maximize the measured front exposure, measurement lines for different configurations were defined along the corresponding lines with the maximum averaged field values to pass through the hot-spot locations, see Figure 2. The lateral distance between the measurement lines and geometrical centre of the EUT were found to vary from 4 cm to 12 cm depending upon the configurations used by the EUT.

Measurements of the cellular cards were made for each port separately for a wall installation exposure scenario with the line placed along the position suggested by the LCA tool to correspond to a child standing in front of the EUT[13]. This exposure scenario will result in a more conservative exposure assessment than any realistic exposure scenario for the ceiling-installed EUT. The LCA tool was then used to scale the measurements data to the maximum output power values of the corresponding ports including tolerances.

For the Wi-Fi bands the area scans showed that the transmission was directed to the sides and covered by the 45 degree and side radials. Therefore the measurement line for the front exposure was chosen as passing over the centreline. Measurements of the Wi-Fi card were conducted with all ports transmitting simultaneously. The LCA tool was then used to scale the measurements data to the maximum output power values, including tolerances, based on the port with the lowest measured power.

The signals from the two ports of each RF card may be correlated. Therefore, the LCA tool was used to calculate ER per RF card with signal correlation of two ports of the card taken into consideration. The electric field magnitudes from the two ports of each RF card when transmitting separately were added point-by-point and root-mean-square averaged over the 90 cm long measurement line. The plane-wave equivalent power density was determined via

$$S = \frac{E^2}{\eta}, \tag{2}$$

where η is the free space wave impedance (approximately 377 Ω). The reported exposure ratio per RF device was then calculated as

[12] In [4] , a 96 cm long child phantom for whole-body SAR measurements were proposed based on body height statistics for 4-year old children.
[13] In practice, the measurements were conducted in the laboratory with the EUT placed on a table using horizontal averaging lines. Therefore, effects of ground reflections are not included in these measurements. Since the EUT usually is mounted high above the ground this is a conservative estimate.

$$ER^{RF0} = \max_{f=\text{low,mid,high}} \left[\frac{S^{RF0}(f)}{S^{\lim}(f)} \right], \quad (3)$$

$$ER^{RF1} = \max_{f=\text{low,mid,high}} \left[\frac{S^{RF1}(f)}{S^{\lim}(f)} \right], \quad (4)$$

$$ER^{WiFi\ 2GHz} = \frac{S^{WiFi\ 2\ GHz}}{S^{\lim}(f)}, \quad (5)$$

$$ER^{WiFi\ 5GHz} = \max_{f=5180,5260,5500,5745} \left[\frac{S^{WiFi\ 5\ GHz}(f)}{S^{\lim}(f)} \right], \quad (6)$$

where the maximum was taken with respect to the tested low, mid and high LTE channels and Wi-Fi frequencies. The total ER of the EUT was then calculated as

$$ER^{total} = ER^{RF0} + ER^{RF1} + ER^{WiFi\ 2GHz} + ER^{WiFi\ 5\ GHz} \quad (7)$$

The obtained results were compared against the MPE limit [1] and [2], corresponding to the limits for the products aimed for the US markets and Canadian markets, respectively, for general public/uncontrolled exposure. The exposure is below the exposure limits if the exposure ratio for the considered configuration is below 1.

Measurements were also conducted along two other radials to confirm that the exposure values were below the limits in these directions as well [3], see Figure 2. One of the radials was inclined towards the side of the EUT and 45^0 apart from the radial along the front direction. In this case, the measurement line was located 20 cm from the EUT radome perpendicular to the 45^0 inclined radial, see Figure 2. Another radial was defined 90^0 from the radial along the front direction and to the side of the EUT[14]. In this case, the measurement line was located 20 cm from the surface of the side of the EUT. See Appendix C for a photograph of the laboratory set-up.

Due to the low values obtained as shown in Section 5.3, a decision was made to not conduct any measurements behind the EUT.

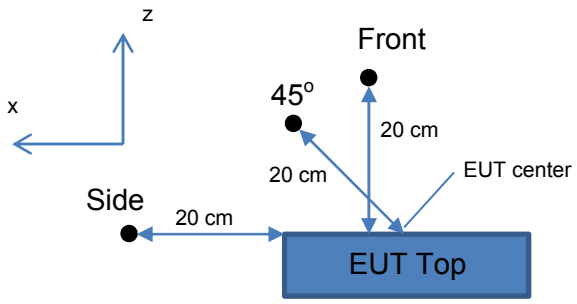

Figure 2: Positions of measurement lines in the vicinity of the EUT. The x-coordinate for the front exposure assessment was chosen to make the measurement line pass through the hot-spot location obtained via a surface (area) scan in the plane z = 20 cm.

5.3 Field strength measurement results

In Table 6 - Table 8, spatially averaged plane-wave equivalent power density values and the corresponding exposure ratios, calculated based on the FCC limits specified in [1] are given.

In Table 9 - Table 11, spatially averaged plane-wave equivalent power density values and the corresponding exposure ratios, calculated based on the Industry Canada limits specified in [2] are given.

[14] Because of symmetry of the EUT, measurements were done only to either the left or the right side and 45^0 inclined-to-the-side radial, and measurements to the other side were skipped. The side was chosen based on which side of the centerline the front scan was located.

Table 6: Spatially averaged plane-wave equivalent power density values and corresponding exposure ratios measured at the selected 20 cm test separation distance in front of the EUT for general public (uncontrolled) exposure (applicable for the products aimed for the US markets).

Wall/Front 20 cm test separation distance								
RF Card	**Band**	**Channel**	**Nominal output power from the radio (W)**	S (W/m^2)	S^{lim} (W/m^2)	*ER*	**Reported** *ER*	**Total combined** ER^{total}
RF 0	**B25**	8090	2 x 0.25 W	0.47	10	0.05	0.06	0.13
		8365	2 x 0.25 W	0.45	10	0.05		
		8640	2 x 0.25 W	0.43	10	0.05		
	B4	1975	2 x 0.25 W	0.42	10	0.05		
		2175	2 x 0.25 W	0.39	10	0.04		
		2375	2 x 0.25 W	0.40	10	0.04		
	B7	2800	2 x 0.25 W	0.32	10	0.04		
		3100	2 x 0.25 W	0.43	10	0.05		
		3400	2 x 0.25 W	0.54	10	**0.06**		
RF 1	**B25**	8090	2 x 0.25 W	0.48	10	0.05	0.05	
		8365	2 x 0.25 W	0.44	10	0.05		
		8640	2 x 0.25 W	0.44	10	0.05		
	B4	1975	2 x 0.25 W	0.41	10	0.05		
		2175	2 x 0.25 W	0.41	10	0.05		
		2375	2 x 0.25 W	0.48	10	**0.05**		
	B7	2800	2 x 0.25 W	0.37	10	0.04		
		3100	2 x 0.25 W	0.40	10	0.04		
		3400	2 x 0.25 W	0.45	10	0.05		
WiFi 2 GHz	**2412**	1	3 x 0.04 W	0.06	10	**0.01**	0.01	
WiFi 5 GHz	**5180**	36	3 x 0.05 W	0.03	10	0.01	0.01	
	5260	52	3 x 0.05 W	0.02	10	0.01		
	5500	100	3 x 0.05 W	0.02	10	0.01		
	5745	149	3 x 0.05 W	0.04	10	**0.01**		

Table 7: Spatially averaged plane-wave equivalent power density values and corresponding exposure ratios measured at the selected 20 cm test separation distance along the 45^0 right-side inclined radial of the EUT for general public (uncontrolled) exposure (applicable for the products aimed for the US markets).

Wall/45^0 20 cm test separation distance								
RF Card	**Band**	**Channel**	**Nominal output power from the radio (W)**	S (W/m^2)	S^{lim} (W/m^2)	*ER*	**Reported** *ER*	**Total combined** ER^{total}
RF 0	**B25**	8090	2 x 0.25 W	0.57	10	0.06	0.07	0.15
		8365	2 x 0.25 W	0.58	10	0.06		
		8640	2 x 0.25 W	0.55	10	0.06		
	B4	1975	2 x 0.25 W	0.46	10	0.05		
		2175	2 x 0.25 W	0.41	10	0.05		
		2375	2 x 0.25 W	0.41	10	0.05		
	B7	2800	2 x 0.25 W	0.39	10	0.04		
		3100	2 x 0.25 W	0.52	10	0.06		
		3400	2 x 0.25 W	0.66	10	**0.07**		
RF 1	**B25**	8090	2 x 0.25 W	0.58	10	**0.06**	0.06	
		8365	2 x 0.25 W	0.56	10	0.06		
		8640	2 x 0.25 W	0.54	10	0.06		
	B4	1975	2 x 0.25 W	0.50	10	0.05		
		2175	2 x 0.25 W	0.52	10	0.06		
		2375	2 x 0.25 W	0.58	10	0.06		
	B7	2800	2 x 0.25 W	0.49	10	0.05		
		3100	2 x 0.25 W	0.50	10	0.06		
		3400	2 x 0.25 W	0.55	10	0.06		
WiFi 2 GHz	**2412**	1	3 x 0.04 W	0.08	10	**0.01**	0.01	
WiFi 5 GHz	**5180**	36	3 x 0.05 W	0.07	10	**0.01**	0.01	
	5260	52	3 x 0.05 W	0.05	10	0.01		
	5500	100	3 x 0.05 W	0.05	10	0.01		
	5745	149	3 x 0.05 W	0.03	10	0.01		

Table 8: Spatially averaged plane-wave equivalent power density values and corresponding exposure ratios measured at the selected 20 cm test separation distance to the right side of the EUT for general public (uncontrolled) exposure (applicable for the products aimed for the US markets).

Wall/Side 20 cm test separation distance								
RF Card	**Band**	**Channel**	**Nominal output power from the radio (W)**	S (W/m^2)	S^{lim} (W/m^2)	*ER*	**Reported** *ER*	**Total combined** ER^{total}
RF 0	**B25**	8090	2 x 0.25 W	0.98	10	**0.10**	0.10	0.22
		8365	2 x 0.25 W	0.84	10	0.09		
		8640	2 x 0.25 W	0.69	10	0.07		
	B4	1975	2 x 0.25 W	0.62	10	0.07		
		2175	2 x 0.25 W	0.55	10	0.06		
		2375	2 x 0.25 W	0.54	10	0.06		
	B7	2800	2 x 0.25 W	0.28	10	0.03		
		3100	2 x 0.25 W	0.38	10	0.04		
		3400	2 x 0.25 W	0.47	10	0.05		
RF 1	**B25**	8090	2 x 0.25 W	0.83	10	0.09	0.09	
		8365	2 x 0.25 W	0.79	10	0.08		
		8640	2 x 0.25 W	0.73	10	0.08		
	B4	1975	2 x 0.25 W	0.81	10	0.09		
		2175	2 x 0.25 W	0.78	10	0.08		
		2375	2 x 0.25 W	0.86	10	**0.09**		
	B7	2800	2 x 0.25 W	0.44	10	0.05		
		3100	2 x 0.25 W	0.40	10	0.04		
		3400	2 x 0.25 W	0.39	10	0.04		
WiFi 2 GHz	**2412**	1	3 x 0.04 W	0.08	10	**0.01**	0.01	
WiFi 5 GHz	**5180**	36	3 x 0.05 W	0.11	10	**0.02**	0.02	
	5260	52	3 x 0.05 W	0.09	10	0.01		
	5500	100	3 x 0.05 W	0.10	10	0.01		
	5745	149	3 x 0.05 W	0.05	10	0.01		

Table 9: Spatially averaged plane-wave equivalent power density values and corresponding exposure ratios measured at the selected 20 cm test separation distance in front of the EUT for general public (uncontrolled) exposure (applicable for the products aimed for the Canadian markets).

Wall/Front 20 cm test separation distance								
RF Card	**Band**	**Channel**	**Nominal output power from the radio (W)**	S (W/m^2)	S^{lim} (W/m^2)	*ER*	**Reported** *ER*	**Total combined** ER^{total}
RF 0	**B25**	8090	2 x 0.25 W	0.47	4.6	**0.11**	0.11	0.25
		8365	2 x 0.25 W	0.45	4.7	0.10		
		8640	2 x 0.25 W	0.43	4.7	0.10		
	B4	1975	2 x 0.25 W	0.42	4.9	0.09		
		2175	2 x 0.25 W	0.39	4.9	0.08		
		2375	2 x 0.25 W	0.40	5.0	0.09		
	B7	2800	2 x 0.25 W	0.32	5.7	0.06		
		3100	2 x 0.25 W	0.43	5.7	0.08		
		3400	2 x 0.25 W	0.54	5.8	0.10		
RF 1	**B25**	8090	2 x 0.25 W	0.48	4.6	**0.11**	0.11	
		8365	2 x 0.25 W	0.44	4.7	0.10		
		8640	2 x 0.25 W	0.44	4.7	0.10		
	B4	1975	2 x 0.25 W	0.41	4.9	0.09		
		2175	2 x 0.25 W	0.41	4.9	0.09		
		2375	2 x 0.25 W	0.48	5.0	0.10		
	B7	2800	2 x 0.25 W	0.37	5.7	0.07		
		3100	2 x 0.25 W	0.40	5.7	0.07		
		3400	2 x 0.25 W	0.45	5.8	0.08		
WiFi 2 GHz	**2412**	1	3 x 0.04 W	0.06	5.4	**0.02**	0.02	
WiFi 5 GHz	**5180**	36	3 x 0.05 W	0.03	9.0	0.01	0.01	
	5260	52	3 x 0.05 W	0.02	9.1	0.01		
	5500	100	3 x 0.05 W	0.02	9.4	0.01		
	5745	149	3 x 0.05 W	0.04	9.7	**0.01**		

Table 10: Spatially averaged plane-wave equivalent power density values and corresponding exposure ratios measured at the selected 20 cm test separation distance along the 45^0 right-side inclined radial of the EUT for general public (uncontrolled) exposure (applicable for the products aimed for the Canadian markets).

Wall/45^0 20 cm test separation distance								
RF Card	**Band**	**Channel**	**Nominal output power from the radio (W)**	S (W/m^2)	S^{lim} (W/m^2)	*ER*	**Reported** *ER*	**Total combined** ER^{total}
RF 0	**B25**	8090	2 x 0.25 W	0.57	4.6	0.13	0.13	0.29
		8365	2 x 0.25 W	0.58	4.7	**0.13**		
		8640	2 x 0.25 W	0.55	4.7	0.12		
	B4	1975	2 x 0.25 W	0.46	4.9	0.10		
		2175	2 x 0.25 W	0.41	4.9	0.09		
		2375	2 x 0.25 W	0.41	5.0	0.09		
	B7	2800	2 x 0.25 W	0.39	5.7	0.07		
		3100	2 x 0.25 W	0.52	5.7	0.10		
		3400	2 x 0.25 W	0.66	5.8	0.12		
RF 1	**B25**	8090	2 x 0.25 W	0.58	4.6	**0.13**	0.13	
		8365	2 x 0.25 W	0.56	4.7	0.12		
		8640	2 x 0.25 W	0.54	4.7	0.12		
	B4	1975	2 x 0.25 W	0.50	4.9	0.11		
		2175	2 x 0.25 W	0.52	4.9	0.11		
		2375	2 x 0.25 W	0.58	5.0	0.12		
	B7	2800	2 x 0.25 W	0.49	5.7	0.09		
		3100	2 x 0.25 W	0.50	5.7	0.09		
		3400	2 x 0.25 W	0.55	5.8	0.10		
WiFi 2 GHz	**2412**	1	3 x 0.04 W	0.08	5.4	**0.02**	0.02	
WiFi 5 GHz	**5180**	36	3 x 0.05 W	0.07	9.0	**0.01**	0.01	
	5260	52	3 x 0.05 W	0.05	9.1	0.01		
	5500	100	3 x 0.05 W	0.05	9.4	0.01		
	5745	149	3 x 0.05 W	0.03	9.7	0.01		

Table 11: Spatially averaged plane-wave equivalent power density values and corresponding exposure ratios measured at the selected 20 cm test separation distance to the right side of the EUT for general public (uncontrolled) exposure (applicable for the products aimed for the Canadian markets).

Wall/Side 20 cm test separation distance								
RF Card	**Band**	**Channel**	**Nominal output power from the radio (W)**	S (W/m^2)	S^{lim} (W/m^2)	*ER*	**Reported** *ER*	**Total combined** ER^{total}
RF 0	**B25**	8090	2 x 0.25 W	0.98	4.6	**0.22**	0.22	0.45
		8365	2 x 0.25 W	0.84	4.7	0.18		
		8640	2 x 0.25 W	0.69	4.7	0.15		
	B4	1975	2 x 0.25 W	0.62	4.9	0.13		
		2175	2 x 0.25 W	0.55	4.9	0.12		
		2375	2 x 0.25 W	0.54	5.0	0.11		
	B7	2800	2 x 0.25 W	0.28	5.7	0.05		
		3100	2 x 0.25 W	0.38	5.7	0.07		
		3400	2 x 0.25 W	0.47	5.8	0.09		
RF 1	**B25**	8090	2 x 0.25 W	0.83	4.6	**0.19**	0.19	
		8365	2 x 0.25 W	0.79	4.7	0.17		
		8640	2 x 0.25 W	0.73	4.7	0.16		
	B4	1975	2 x 0.25 W	0.81	4.9	0.17		
		2175	2 x 0.25 W	0.78	4.9	0.16		
		2375	2 x 0.25 W	0.86	5.0	0.18		
	B7	2800	2 x 0.25 W	0.44	5.7	0.08		
		3100	2 x 0.25 W	0.40	5.7	0.07		
		3400	2 x 0.25 W	0.39	5.8	0.07		
WiFi 2 GHz	**2412**	1	3 x 0.04 W	0.08	5.4	**0.02**	0.02	
WiFi 5 GHz	**5180**	36	3 x 0.05 W	0.11	9.0	**0.02**	0.02	
	5260	52	3 x 0.05 W	0.09	9.1	0.02		
	5500	100	3 x 0.05 W	0.10	9.4	0.02		
	5745	149	3 x 0.05 W	0.05	9.7	0.01		

5.4 Field strength measurement uncertainty

An uncertainty budget [5] for the field strength measurements using the DASY5 near-field scanner is given in Table 12.

Table 12: Uncertainty budget with the combined standard uncertainty and the extended (K=1.96) uncertainty for field strength measurements of base stations using the DASY5 near-field scanner.

Influence quantities	Uncertainty (%)	Probability distribution	Divisor	Weighting factor, c_i €	Weighting factor, c_i (*H*)	Standard uncertainty (%) (*E*)	Standard uncertainty (%) (*H*)
Measurement equipment							
Calibration	± 5.1	Normal	1	1	1	± 5.1	± 5.1
Isotropy	± 4.7	Rectangular	$\sqrt{3}$	1	1	± 2.7	± 2.7
Linearity	± 4.7	Rectangular	$\sqrt{3}$	1	1	± 2.7	± 2.7
Fields out of measurement range	± 1.0	Rectangular	$\sqrt{3}$	1	1	± 0.6	± 0.6
Noise	± 0.0	Normal	1	1	1	± 0.0	± 0.0
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	± 1.5	± 1.5
Power scaling	± 4.5	Rectangular	$\sqrt{3}$	1	1	± 2.6	± 2.6
Mechanical constraints							
Positioning system	± 0.0	Rectangular	$\sqrt{3}$	1	1	± 0.0	±0.0
Matching between probe and EUT	± 4.7	Rectangular	$\sqrt{3}$	1	1	± 2.7	± 2.7
Physical Parameters							
Drifts in output power of the EUT, Probe, temperature and humidity	± 5.0	Rectangular	$\sqrt{3}$	1	1	± 2.9	± 2.9
Perturbation by the environment	± 12.0	Rectangular	$\sqrt{3}$	1	1	± 6.9	± 6.9
Combined standard Uncertainty						**± 10.6**	**±10.6**
Expanded uncertainty (k=1.96)						**± 21.2**	**± 21.2**

6 Conclusion

The results in Section 5 show that the plane-wave equivalent power density values, measured and estimated according to the requirements of FCC [3] and Industry Canada [2], are below the relevant MPE limits [1] and [2] for all specified configurations at a separation distance of 20 cm between the equipment and any nearby person.

Since measurements were scaled with the difference of the power level measured at the antenna port, with the chosen modulation, to the upper tolerance of the output power level the results are also applicable for other modulations.

Consequently, the EUT is in compliance with the appropriate RF exposure standards and recommendations.

7 References

[1] FCC, Code of Federal Regulations CFR title 47, part 1.1310 “Radiofrequency radiation exposure limits”, Federal Communications Commission (FCC), August 1997.

[2] Industry Canada, Radio Standard Specification (RSS) 102, (Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), 2015.

[3] FCC KDB447498 D01, “Mobile and Portable Devices RF exposure procedures and Equipment Authorization Policies”, October 2015.

[4] Thors et al., “Product Compliance Assessments of Low Power Radio Base Stations with Respect to Whole-Body Radiofrequency Exposure Limits”, in EuCAP, 2013.

[5] Ericsson, EAB-13:071570, “Uncertainty budget for field strength measurements of radio base stations using the DASY5 system,” Ericsson AB, Tech. Rep., 2013.

[6] “Ericsson repository lowpower compliance (LCA) tool”, available at https://eforge.ericsson.se/sf/wiki/do/viewPage/projects.postfeko/wiki/LowpowerTool,” Ericsson, 2015.

8 Revision History

Rev.	Date	Description
A	2016-02-08	First revision
B	2016-03-22	Added assessment of WCDMA in Appendix D with updates to sections 1, 3 and 6. Updated with information on the modulations used in the tests.

APPENDIX A: Photographs of the EUT

Figure A.1 Front view of the EUT (with a fan module)

Figure A.2 EUT with the fan module opened

Figure A.3 Rear view of the EUT with rear cover removed showing both RF cards, antenna locations and Wi-Fi card.

APPENDIX B: Electric and magnetic field strength probe calibration parameters

ER3DV4R S/N 2210

Diode compression:

Parameter	Value in mV
DCP X	100.5
DCP Y	100.0
DCP Z	100.9

Sensitivity in free space:

Parameter	Value in $\mu V/(V/m)^2$
Norm X	2.80
Norm Y	3.13
Norm Z	5.23

Probe tip to sensor center (S/N 2210): 2.5 mm

EF3DV3 S/N 4033 for 5-6 GHz

Diode compression:

Parameter	Value in mV
DCP X	95.4
DCP Y	100.8
DCP Z	100.5

Sensitivity in free space:

Parameter	Value in $\mu V/(V/m)^2$
Norm X	1.43
Norm Y	0.96
Norm Z	1.29

Probe tip to sensor center (S/N 2210): 1.5 mm

APPENDIX C: Photographs of the EUT when positioned for field strength measurements

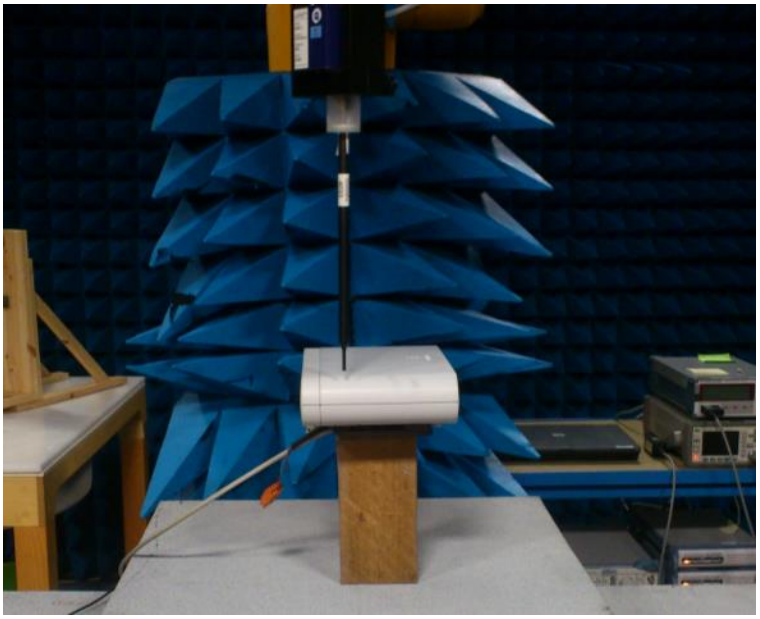

Figure C.1 EUT positioned for field strength measurements in the front position using the DASY5 near-field scanner.

APPENDIX D: Assessment of WCDMA exposure

The DUT supports transmission of WCDMA and LTE carriers on RF card RF0 using the same hardware. In Table 13, the output power levels provided by the client are given for WCDMA B2 and B4. As these are below the power levels of LTE, shown in Table 2 the EMF exposure with WCDMA is less than or equal to that obtained for LTE.

Table 13: Nominal and measured output power levels for WCDMA.

Band / Mode	RF card	Nominal output power[15] (dBm)	Tolerance, upper limit (dB)	Maximum output power[16] (dBm)	Tested low, mid and high channels		Measured maximum output power (dBm) TX1/TX2/TX3[17]
					Channel number	Frequency (MHz)	
WCDMA B2 (1900)	RF0[18]	24.0	0.6	27.6	9662	1932.4	22.8 / 22.7
					9800	1960.0	22.8 / 22.7
					9938	1987.6	22.9 / 23.0
WCDMA B4 (2100)	RF0[18]	24.0	0.6	27.6	1537	2112.4	23.3 / 23.2
					1638	2132.5	23.0 / 23.3
					1738	2152.6	23.2 / 23.2

15 Nominal output power per port.

16 Conservative measure of the total maximum possible output power level delivered to the antenna per RF card, i.e. the nominal output power level per port plus the tolerance in production times the number of ports in a RF card.

17 TX3 is applicable only for the Wi-Fi cards

18 The measurements were made with the card in position RF0 but are applicable regardless of its position.