Prepared (also subject responsible if other)		No.		
EAB/TFE Björn Hansson		EAB-11:028990 Uen		
Approved	Checked	Date	Rev	Reference
		2011-09-27	PA8	

SAR Measurements on four different terminal antennas connected to the Ericsson F5521gw Mobile Broadband Module

Executive summary

In this report SAR measurement results are given for four different terminal antennas connected to the Ericsson F5521gw Mobile Broadband Module (MBM) transmitting at the maximum output power level for each supported mode and band. The SAR measurements were for each antenna conducted at three different antenna orientations with respect to the phantom. The three orientations were: front of antenna, back of antenna, and top of antenna facing the phantom. Two of the antennas were coupling type antennas and two antennas were IFA (Inverted F Antenna) type antennas. The two coupling type antennas were assessed at a phantom-antenna separation distance of 30 mm whereas the two IFA type antennas were assessed at 35 mm.

The purpose of this report together with reports [1] (CETECOM report No: 2205-03-02/10) and [2] (Supplementary Ericsson report No: EAB-11:048101) is to determine under which conditions the rules in FCC KDB 616217 D03 and FCC KDB 447498 D01 regarding approval of a transmitter for use in multiple host platforms can be applied. According to FCC KDB 616217 D03 and FCC KDB 447498 D01 the measured 1g averaged SAR for a reference case shall be less than 1/4th of the true FCC SAR limits for the multiple host platform approval rules to be applied. This is the reason why the results obtained in this report are compared with 1/4th of the true FCC SAR limits and not the true FCC SAR limits.

The results show that the maximum 1g and 10g averaged SAR results for the all antennas are below 1/4th of the applicable SAR limits at the considered phantom-antenna separation distances.

Although this is not an ordinary compliance test report, measurements have been conducted in accordance with applicable international standards and national regulations. The rest of this report is written in a similar way as an ordinary compliance test report produced by the Ericsson EMF Research Laboratory.

1 Table of Contents

2 Summary of Report[1]

2.1 Equipment under test (EUT)

Description	Four different terminal antennas connected to Notebook PC with built-in Ericsson F5521gw Mobile Broadband Module
Brand / model names	Antennas designed by Yageo. Dell Inspiron mini (host device); Ericsson F5521gw (wireless module)
Identification number (host device)	D-1011-32-851
Type number (wireless module)	KRD 131 18/2
IMEI / Serial Number (wireless module)	004401700665835 / C370024JES
FCC ID / IC Canada reg. number (wireless module)	VV7-MBMF5521GW1 / 287AG-MBMF5521GW1

Frequency Band	**GSM 850**	**WCDMA V**	**GSM 900**	**WCDMA VIII**	**DCS 1800**	**PCS 1900**	**WCDMA II**	**WCDMA I**
Modes	GPRS EDGE	UMTS HSPA	GPRS EDGE	UMTS HSPA	GPRS EDGE	GPRS EDGE	UMTS HSPA	UMTS HSPA
Supported	☑	☑	☑	☑	☑	☑	☑	☑
Covered by report	☑	☑	☑	☑	☑	☑	☑	☑
Data and connectivity	*GPRS/EDGE MS class 10, GPRS cap. class B, HSDPA Cat. up to 21 Mbps, HSUPA Cat. up to 5.76 Mbps*							
Exposure environment	*General public / Occupational*							

2.2 Results

The maximum obtained 1g and 10g SAR results for each tested terminal antenna and mode are given in the tables below. The purpose of this work was to determine whether or not the SAR levels were below 1/4th of the relevant SAR limits [3]-[9] at an antenna to phantom separation distance of 40 mm or less. The verdict is given in the rightmost column.

1g SAR results:

Antenna	**Test position**	**Mode**	**Channel/ Frequency (MHz)**	**Max *SAR1g* (W/kg)**	**Result below 1/4 of the relevant SAR limit[2]?**
Ant #3	Front facing phantom (30 mm)	GSM 850 (GPRS, 2TS)	190 / 836.6	0.271	YES
	Front facing phantom (30 mm)	UMTS FDD V (RMC 12.2)	4183 / 836.6	0.234	YES
	Front facing phantom (30 mm)	PCS 1900 (GPRS, 2TS)	661 / 1880	0.188	YES
	Front facing phantom (30 mm)	UMTS FDD II (RMC 12.2)	9400 / 1880	0.196	YES
Ant #4	Top facing phantom (35 mm)	GSM 850 (GPRS, 2TS)	190 / 836.6	0.089	YES
	Back facing phantom (35 mm)	UMTS FDD V (RMC 12.2)	4183 / 836.6	0.087	YES
	Back facing phantom (35 mm)	PCS 1900 (GPRS, 2TS)	661 / 1880	0.135	YES
	Top facing phantom (35 mm)	UMTS FDD II (RMC 12.2)	9400 / 1880	0.182	YES
Extended Uncertainty (k=2) 95%				*± 23.9 % (1g)*	

10g SAR results:

Antenna	**Test position**	**Mode**	**Channel/ Frequency (MHz)**	**Max *SAR10g* (W/kg)**	**Result below 1/4 of the relevant SAR limit[3]?**
Ant #1	Top facing phantom (30 mm)	GSM 900 (GPRS, 2TS)	37 / 897.4	0.294	YES
	Front facing phantom (30 mm)	UMTS FDD VIII (RMC 12.2)	2787 / 897.4	0.118	YES
	Front facing phantom (30 mm)	DCS 1800 (GPRS, 2TS)	699 / 1747.6	0.096	YES
	Front facing phantom (30 mm)	UMTS FDD I (RMC 12.2)	9750 / 1950	0.178	YES
Ant #2	Front facing phantom (35 mm)	GSM 900 (GPRS, 2TS)	37 / 897.4	0.154	YES
	Front facing phantom (35 mm)	UMTS FDD VIII (RMC 12.2)	2787 / 897.4	0.065	YES
	Top facing phantom (35 mm)	DCS 1800 (GPRS, 2TS)	699 / 1747.6	0.141	YES
	Back facing phantom (35 mm)	UMTS FDD I (RMC 12.2)	9750 / 1950	0.237	YES
Ant #3	Front facing phantom (30 mm)	GSM 900 (GPRS, 2TS)	37 / 897.4	0.321	YES
	Front facing phantom (30 mm)	UMTS FDD VIII (RMC 12.2)	2787 / 897.4	0.145	YES
	Back facing phantom (30 mm)	DCS 1800 (GPRS, 2TS)	699 / 1747.6	0.128	YES
	Front facing phantom (30 mm)	UMTS FDD I (RMC 12.2)	9750 / 1950	0.216	YES
Ant #4	Front facing phantom (35 mm)	GSM 900 (GPRS, 2TS)	37 / 897.4	0.086	YES
	Back facing phantom (35 mm)	UMTS FDD VIII (RMC 12.2)	2787 / 897.4	0.049	YES
	Top facing phantom (35 mm)	DCS 1800 (GPRS, 2TS)	699 / 1747.6	0.199	YES
	Front facing phantom (35 mm)	UMTS FDD I (RMC 12.2)	9750 / 1950	0.132	YES
Extended Uncertainty (k=2) 95%				*± 23.8 % (10g)*	

[1] This page contains a summary of the test results. The full report provides a complete description of all test details and results.
[2] SAR limit of 1.6 W/kg for general public exposure applicable in USA and Canada.
[3] SAR limit of 2.0 W/kg for general public exposure applicable in the rest of the world.

3 General information

The SAR measurement results reported in this document have been obtained in accordance with the International standard IEC 62209-2 [10], the FCC OET Bulletin 65 Supplement C [3] and IEEE 1528 [13]. The purpose of this work was to determine whether or not the SAR levels were below 1/4th of the relevant SAR limits [3]-[9] at an antenna to phantom separation distance of 40 mm for the antennas under test.

One host device (identification number D-1011-32-851 was used for the measurements. The host device was equipped with the KRD 131 18/2 F5521gw module which was connected to the different terminal antennas.

4 Equipment under test

The tables below summarize the technical data for the equipment under test (EUT). Photographs of the antennas, the wireless module, and the host device are presented in Appendix A.

Description	Four different terminal antennas connected to Notebook PC with built-in Ericsson F5521gw Mobile Broadband Module	
Brand Names	Antennas designed by Yageo. Dell inc. (host device); Ericsson (wireless module)	
Model Names	Inspiron mini (host device); F5521gw (wireless module)	
Identification number (host device)	D-1011-32-851	
Type number (wireless module)	KRD 131 18/2	
IMEI Number (wireless module)	004401700665835	
Serial Number (wireless module)	C370024JES	
FCC ID Number (wireless module)	VV7-MBMF5521GW1	
IC Canada reg. Number (wireless module)	287AG-MBMF35521GW1	
Hardware status (wireless module)	FP1.1	
Mode(s) covered by this report and nominal output power levels	GSM/GPRS/EDGE 850/900 GSM/GPRS/EDGE 1800/1900 UMTS/HSPA FDD I/II/V/VIII	33 dBm 30 dBm 24 dBm
Data and connectivity	GPRS multislot/capability class: 10/B; EDGE multislot class: 10 HSDPA Category up to 21Mbps; HSUPA Category up to 5.73Mbps	
Transmitter frequency range (MHz)	GSM 850: 824.2 – 848.8 UMTS FDD V: 826.4 – 846 6 GSM 900: 880.2 – 914.8 UMTS FDD VIII: 882.4 – 912.6 GSM 1800: 1710.2 – 1784.8 GSM 1900: 1850.2 – 1909.8 UMTS FDD II: 1852.4 – 1907.6 UMTS FDD I: 1922.4 – 1977.6	

Mode	Measured output power level[4] (dBm)		
	Low ch	Mid ch	High ch
GPRS 850[5]	32.2	32.3	32.4
EDGE 850[5]	26.7	26.6	26.5
GPRS 1900[5]	28.7	28.9	29.0
EDGE 1900[5]	25.4	25.5	25.5
UMTS FDD V (12.2 kbps RMC)[6]	23.8	23.8	23.8
UMTS FDD V (HSDPA Subtest 1)[6]	23.1	22.9	22.9
UMTS FDD V (HSDPA Subtest 2)[6]	21.6	21.6	21.6
UMTS FDD V (HSDPA Subtest 3)[6]	20.5	20.2	20.2
UMTS FDD V (HSDPA Subtest 4)[6]	19.7	19.8	19.9
UMTS FDD V (HSUPA Subtest 1)[6]	23.1	23.0	23.0
UMTS FDD V (HSUPA Subtest 2)[6]	21.0	20.9	20.9
UMTS FDD V (HSUPA Subtest 3)[6]	22.1	22.0	22.1
UMTS FDD V (HSUPA Subtest 4)[6]	21.1	21.0	21.0
UMTS FDD V (HSUPA Subtest 5)[6]	23.2	22.9	23.1
UMTS FDD II (12.2 kbps RMC)[6]	22.6	22.6	22.4
UMTS FDD II (HSDPA Subtest 1)[6]	22.0	22.0	21.7
UMTS FDD II (HSDPA Subtest 2)[6]	20.6	20.5	20.4
UMTS FDD II (HSDPA Subtest 3)[6]	19.4	19.5	19.7
UMTS FDD II (HSDPA Subtest 4)[6]	18.8	18.8	18.7
UMTS FDD II (HSUPA Subtest 1)[6]	22.0	22.0	21.9
UMTS FDD II (HSUPA Subtest 2)[6]	20.0	20.0	19.9
UMTS FDD II (HSUPA Subtest 3)[6]	21.1	21.1	21.1
UMTS FDD II (HSUPA Subtest 4)[6]	20.1	20.1	19.8
UMTS FDD II (HSUPA Subtest 5)[6]	22.1	22.2	21.9

5 Test equipment

5.1 Dosimetric system

The SAR measurements were conducted using the DASY5 professional near-field scanner by Schmid & Partner Engineering AG. The system includes a high precision 6-axis robot, liquid-filled plastic phantoms and miniature electric field probes. The dosimetric probe is sensitive to E-fields and incorporates three small dipoles arranged so that the overall response is close to isotropic. The probe sensors are covered by an outer protective shell made of plastic

Measurements are conducted in a metal screen room, which is designed to provide shielding from external radiofrequency signals and to prevent devices under test from interfering with local wireless networks. The ambient noise level is kept low so that the 1-gram averaged SAR is below 12 mW/kg when the device under test (DUT) is turned off. The electromagnetic field reflections in the shielded chamber are kept low using RF absorbers.

Figure 1 shows the SAR measurement system components.

[4] As given in separate test report by CETECOM **Error! Reference source not found.** (measured at module main port).
[5] Average power level per time slot.
[6] Average RMS power level.

Figure 1. The SAR measurement system.

An uncertainty budget including total uncertainty (k=1) and expanded uncertainty (k=2) for 1g and 10g SAR assessments is given in Section 8.

The equipment list is given below. In Appendix E calibration certificates for the SAR test probe(s) are attached and in Appendix F calibration certificate(s) of the validation dipoles are attached [11].

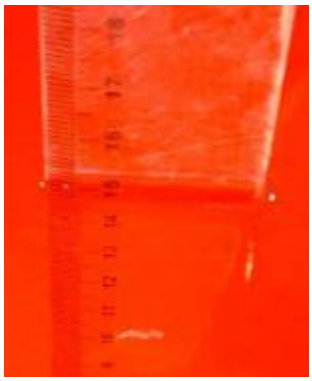
Description	Serial number	Calibration due date	Calibration interval
Probe electronics, DAE3	S/N 422	2012-04-21	12 months
Probe electronics, DAE3	S/N 304	2011-10-15	12 months
E-field (SAR) probe, ES3DV3	S/N 3113	2012-04-13	12 months
E-field (SAR) probe, ET3DV6	S/N 1394	2011-10-21	12 months
Dipole validation kit, D835V2	S/N 413	2013-01-14	36 months
Dipole validation kit, D900V2	S/N 1d039	2013-01-11	36 months
Dipole validation kit, D1800V2	S/N 203	2013-01-12	36 months
Dipole validation kit, D1900V2	S/N 510	2013-01-15	36 months
Dipole validation kit, D2000V2	S/N 1003	2013-01-13	36 months
ELI-4 flat phantom	S/N 1003	NA	NA

5.2 Additional equipment

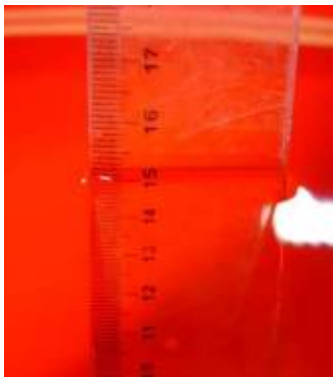
Description	Serial number	Calibration due date	Calibration interval
Dielectric probe kit, HP 85070C	S/N US99360060	NA	NA
Network analyzer, Agilent E5071C	MY46104892	2011-05-31	12 months
Power meter, Agilent N1911A	MY45100381	2011-12-14	12 months
Power sensor, Agilent N1921A	MY45240486	2011-11-29	12 months
Universal radio communication tester, R&S CMU 200	S/N 107639	2011-05-26	12 months
Thermometer, EBRO TFX-392SKWT	S/N 10130918	2011-10-19	12 months

6 Electrical parameters of the tissue simulating liquids

The parameters of the tissue simulating liquids were measured with a dielectric probe kit prior to the SAR measurements and the results are shown below. The measured values were within 5% of the specified values in [10] and [3] and the mass density of the liquid entered into the DASY5 software was 1000 kg/m^3. The depth of the tissue simulating liquid was in the range 15.0-15.5 cm. Pictures of liquid depth for FCC band liquids are shown below.



Measured level (153 mm) of 835 MHz muscle tissue simulating liquid in the ELI-4 phantom



Measured level (152 mm) of 1900 MHz muscle tissue simulating liquid in the ELI-4 phantom

f (MHz)	Tissue type	Measured/Specification	ε_r	σ (S/m)	Temp (°C)
835	Body (Muscle)	Measured[7]	54.5; 54.1	0.97; 0.96	21.6; 21.4
		Specified value [1]	55.2	0.97	-
		Difference (%)	-1; -2	±0; -1	-
900	Head	Measured[7]	42.7; 42.5; 40.4; 41.3	0.95; 0.96; 0.94; 0.95	20.9; 21.2; 22.9; 22.1
		Specified value [10]	41.5	0.97	-
		Difference (%)	+3; +2; -3; -1	-2; -1; -3; -2	-
1800	Head	Measured	39.1	1.42	21.3
		Specified value [10]	40.0	1.40	-
		Difference (%)	-2	+1	-
1900	Body (Muscle)	Measured[7]	51.3; 51.3	1.53; 1.52	20.7; 21.6
		Specified value [3]	53.3	1.52	
		Difference (%)	-4 -4	+1 ±0	
2000	Head	Measured[7]	40.6; 39.7	1.468; 1.44	21.6; 22.5
		Specified value [10]	40.0	1.40	-
		Difference (%)	+2; -1	+4.9; +3	-

7 SAR system performance check

System performance checks of the SAR test system were conducted at 835, 900, 1800, 1900, and 2000 MHz prior to the SAR measurements using the D835V2, D900V2, D1800V2, D1900V2 and D2000V2 dipole validation kits and the obtained results are shown in the table below. The forward power was measured using the R&S power meter. Thereafter the dipole was connected via a directional coupler and the return power was measured at the return port in order to determine the radiated power of the dipole. The radiated power was for all cases close to 250 mW as shown in the table below. The measured 1g and 10g averaged SAR was normalized to 1 W and compared with the nominal values [12], [13]. SAR distribution plots from the system performance checks are given in Appendix C. The results were within 10% of the nominal values [12], [13] . The temperature of the test facility during the system performance checks was in the range 20°C to 25°C.

[7] The liquid parameters were measured at more than one occasion.

f (MHz)	Tissue type	Measured/ Reference	Radiated power (mW)	SAR 1g (W/kg), norm. to 1 W	SAR 10g (W/kg), norm. to 1 W	ε_r	σ (S/m)	Liquid temp (°C)	Date
835	Body (muscle)	Measured	248	9.50	6.30	54.5	0.97	21.6	110502
		Reference [12]	-	9.75	6.39	55.2	0.97	-	-
		Difference (%)	-	-3	-2	-1	±0	-	-
900	Head	Measured[8]	250 249	10.6 10.2	6.9 6.6	42.7 40.4	0.95 0.94	20.9 22.9	110418 110426
		Reference [13]	-	10.8	6.9	41.5	0.97	-	-
		Difference (%)	-	-2 -6	±0 -4	+3 -2	-2 -3	-	-
1800	Head	Measured	244	38.9	20.8	38.1	1.41	21.2	110413
		Reference [13]	-	38.1	19.8	40.0	1.40	-	-
		Difference (%)	-	+2	+5	-5	+1	-	-
1900	Body (muscle)	Measured	248	38.0	19.8	51.3	1.53	20.7	110503
		Reference [12]	-	40.4	21.1	53.3	1.52	-	-
		Difference (%)	-	-6	-6	-4	+1	-	-
2000	Head	Measured	249	41.8	21.3	40.7	1.468	21.6	110429
		Reference [13]	-	41.1	21.1	40.0	1.40	-	-
		Difference (%)	-	+2	+1	+2	+4.9	-	-

[8] System performance checking was conducted at more than one occasion for this frequency band.

8 DASY5 uncertainty budget for assessments according to IEC 62209-2 [10]

Uncertainty component	Uncer. (%)	Prob Dist.	Div.	$C_{i,1g}$	$C_{i,10g}$	Std. Uncer. (1g) (%)	Std. Uncer. (10g) (%)	(v_i) v_{eff}
Measurement system								
Probe calibration	±6.55	N	1	1	1	±6.55	±6.55	∞
Axial isotropy	±4.7	R	√3	0.7	0.7	±1.9	±1.9	∞
Hemispherical isotropy	±9.6	R	√3	0.7	0.7	±3.9	±3.9	∞
Linearity	±4.7	R	√3	1	1	±2.7	±2.7	∞
Modulation response	±2.4	R	√3	1	1	±1.4	±1.4	∞
System detection limits	±1.0	R	√3	1	1	±0.6	±0.6	∞
Boundary effects	±2.0	R	√3	1	1	±1.2	±1.2	∞
Readout electronics	±0.3	N	1	1	1	±0.3	±0.3	∞
Response time	±0.8	R	√3	1	1	±0.5	±0.5	∞
Integration time	±2.6	R	√3	1	1	±1.5	±1.5	∞
RF ambient noise	±3.0	R	√3	1	1	±1.7	±1.7	∞
RF ambient reflections	±3.0	R	√3	1	1	±1.7	±1.7	∞
Probe positioner	±0.8	R	√3	1	1	±0.5	±0.5	∞
Probe positioning	±6.7	R	√3	1	1	±3.9	±3.9	∞
Post-processing	±4.0	R	√3	1	1	±2.3	±2.3	∞
Test Sample Related								
Device holder	±3.6	N	1	1	1	±3.6	±3.6	5
Test sample positioning	±2.9	N	1	1	1	±2.9	±2.9	145
Power scaling	±0.0	R	√3	1	1	±0.0	±0.0	∞
Power drift	±5.0	R	√3	1	1	±2.9	±2.9	∞
Phantom and setup								
Phantom uncertainty	±4.0	R	√3	1	1	±2.3	±2.3	∞
SAR correction	±1.9	R	√3	1	0.84	±1.1	±0.9	∞
Liquid conductivity (meas.)	±2.5	N	1	0.78	0.71	±2.0	±1.8	∞
Liquid permittivity (meas.)	±2.5	N	1	0.26	0.26	±0.6	±0.7	∞
Temp unc. – conductivity	±1.7	R	√3	0.78	0.71	±0.8	±0.7	∞
Temp unc. – permittivity	±0.3	R	√3	0.23	0.26	±0.0	±0.0	∞
Combined standard uncertainty						±12.0	±11.9	748
Expanded standard uncertainty (k=2)						**±23.9**	**±23.8**	

9 SAR measurement configurations

The SAR measurements were conducted on four different terminal antennas (see Figure A.1) connected to the main port of the Ericsson F5521gw mobile broadband module (see Figure A.2), which was integrated in the host device (see Figure A.3). Antennas #1 and #3 are IFA (Inverted F Antenna) type antennas and antennas #2 and #4 are coupling type antennas.

The antennas were positioned in 3 different orientations with respect to the SAR measurement phantom (see Figures B.1, B.2 and B.3). The measurements were conducted with 30 mm (for Ant #1 and Ant #3) or 35 mm (for Ant #2 and Ant #4) separation distance between the antenna and the phantom.

The SAR testing was conducted at the middle channel of each tested band only [14]. For the GSM bands SAR measurements with GPRS (2TS[9]) and EDGE (2TS) transmission were conducted [15]. For the UMTS bands SAR measurements with RMC 12.2 kbps transmission was conducted [16].

A universal radio communication tester (CMU-200) was used to control the device during the SAR measurements.

10 SAR test results

The tables in this section show the measured 1g and 10g averaged SAR for the device. The flat oval ELI-4 phantom (thickness 2 ± 0.2 mm) was used for all measurements. A coarse rectangular approximately 900x1000 mm large area scan (grid step 10 mm for frequencies > 1 GHz and 15 mm for frequencies < 1 GHz) covering the antenna under test was first used to locate the SAR maxima. Thereafter a 32x32x30 mm zoom scan (8x8x5 mm grid step) was used to determine the 1g and 10g averaged SAR in the region of maximum SAR. The measurement system uses a modified Quadratic Shepard's method for maximum search, interpolation and extrapolation to the surface of the phantom (which is unreachable due to probe case and boundary effects) in order to accurately determine the 1g and 10g averaged SAR.

The temperature of the test facility during the tests was in the range 20 to 25ºC. During the tests, the temperature of the tissue simulating liquid was within ±2ºC from the liquid temperature at system performance check.

Some of the SAR results have been corrected using formulas for SAR correction due to deviation from liquid parameter target values as required in [10]. In cases where the SAR correction formula gave a negative (-) sign no correction was made [10].

Note: No measurements were conducted for antennas #1 and #2 for GSM/WCDMA 850 and GSM/WCDMA 1900, since results were already available in separate report [1] and therefore not requested by the customer.

10.1 Results for the GPRS 850 modes

Antenna / Test position	Liquid temperature (°C)	Separation distance (mm)	Mode	f (MHz)	Measured SAR (W/kg)	
					SAR_{1g}	SAR_{10g}
Ant #3 / Front facing phantom	22.2	30	GPRS (2TS)	836.6	**0.271**	**0.193**
Ant #3 / Back facing phantom	22.1	30	GPRS (2TS)	836.6	0.163	0.116
Ant #3 / Top facing phantom	22.0	30	GPRS (2TS)	836.6	0.221	0.164
Ant #4 / Front facing phantom	22.0	35	GPRS (2TS)	836.6	0.077	0.055
Ant #4 / Back facing phantom	22.0	35	GPRS (2TS)	836.6	0.077	0.056
Ant #4 / Top facing phantom	22.0	35	GPRS (2TS)	836.6	**0.089**	**0.067**

In Figure D.1 the SAR distribution for the antenna / test position giving the maximum SAR in the GPRS 850 band is shown.

[9] Two active uplink time slots.

10.2 Results for the UMTS FDD V mode

Antenna / Test position	Liquid temperature (°C)	Separation distance (mm)	Mode	f (MHz)	Measured SAR (W/kg)	
					SAR_{1g}	SAR_{10g}
Ant #3 / Front facing phantom	22.0	30	12.2 kbps RMC	836.6	**0.234**	**0.167**
Ant #3 / Back facing phantom	22.1	30	12.2 kbps RMC	836.6	0.086	0.063
Ant #3 / Top facing phantom	22.0	30	12.2 kbps RMC	836.6	0.144	0.104
Ant #4 / Front facing phantom	22.0	35	12.2 kbps RMC	836.6	0.049	0.036
Ant #4 / Back facing phantom	21.9	35	12.2 kbps RMC	836.6	**0.087**	**0.063**
Ant #4 / Top facing phantom	22.0	35	12.2 kbps RMC	836.6	0.037	0.028

In Figure D.2 the SAR distribution for the antenna / test position giving the maximum SAR in the UMTS FDD V band is shown.

10.3 Results for the GPRS 1900 modes

Antenna / Test position	Liquid temperature (°C)	Separation distance (mm)	Mode	f (MHz)	Measured SAR (W/kg)		SAR (W/kg) corrected for liquid parameter deviation from target[10]	
					SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
Ant #3 / Front facing phantom	21.9	30	GPRS (2TS)	1880	**0.188**	**0.125**	**0.191**	**0.126**
Ant #3 / Back facing phantom	22.0	30	GPRS (2TS)	1880	0.164	0.110	0.166	0.111
Ant #3 / Top facing phantom	22.1	30	GPRS (2TS)	1880	0.184	0.121	0.187	0.122
Ant #4 / Front facing phantom	22.0	35	GPRS (2TS)	1880	0.132	0.088	0.134	0.089
Ant #4 / Back facing phantom	21.9	35	GPRS (2TS)	1880	**0.135**	**0.092**	**0.137**	**0.093**
Ant #4 / Top facing phantom	22.0	35	GPRS (2TS)	1880	0.132	0.087	0.134	0.088

In Figure D.3 the SAR distribution for the antenna / test position giving the maximum SAR in the GPRS 1900 band is shown.

10.4 Results for the UMTS FDD II mode

Antenna / Test position	Liquid temperature (°C)	Separation distance (mm)	Mode	f (MHz)	Measured SAR (W/kg)		SAR (W/kg) corrected for liquid parameter deviation from target[10]	
					SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
Ant #3 / Front facing phantom	22.1	30	12.2 kbps RMC	1880	**0.196**	**0.128**	**0.199**	**0.129**
Ant #3 / Back facing phantom	22.0	30	12.2 kbps RMC	1880	0.176	0.119	0.179	0.120
Ant #3 / Top facing phantom	22.1	30	12.2 kbps RMC	1880	0.177	0.116	0.180	0.117
Ant #4 / Front facing phantom	22.0	35	12.2 kbps RMC	1880	0.130	0.087	0.132	0.088
Ant #4 / Back facing phantom	22.0	35	12.2 kbps RMC	1880	0.156	0.107	0.158	0.108
Ant #4 / Top facing phantom	22.0	35	12.2 kbps RMC	1880	**0.182**	**0.120**	**0.185**	**0.121**

In Figure D.4 the SAR distribution for the antenna / test position giving the maximum SAR in the UMTS FDD II band is shown.

[10] According to IEC 62209-2 [10].

10.5 Results for the GPRS 900 mode

Antenna / Test position	Liquid temperature (°C)	Separation distance (mm)	Mode	f (MHz)	Measured SAR (W/kg)	
					SAR_{1g}	SAR_{10g}
Ant #1 / Front facing phantom	22.0	30	GPRS (2TS)	897.4	0.300	0.202
Ant #1 / Back facing phantom	22.0	30	GPRS (2TS)	897.4	0.181	0.120
Ant #1 Top facing phantom	22.0	30	GPRS (2TS)	897.4	**0.427**	**0.294**
Ant #2 / Front facing phantom	22.0	35	GPRS (2TS)	897.4	**0.206**	**0.154**
Ant #2 / Back facing phantom	22.0	35	GPRS (2TS)	897.4	0.203	0.154
Ant #2 / Top facing phantom	22.0	35	GPRS (2TS)	897.4	0.128	0.095
Ant #3 / Front facing phantom	22.1	30	GPRS (2TS)	897.4	**0,465**	**0,321**
Ant #3 / Back facing phantom	22.0	30	GPRS (2TS)	897.4	0.228	0.164
Ant #3 / Top facing phantom	22.0	30	GPRS (2TS)	897.4	0.384	0.268
Ant #4 / Front facing phantom	22.0	35	GPRS (2TS)	897.4	**0.122**	**0.086**
Ant #4 / Back facing phantom	22.0	35	GPRS (2TS)	897.4	0.094	0.068
Ant #4 / Top facing phantom	22.0	35	GPRS (2TS)	897.4	0.072	0.051

In Figure D.5 the SAR distribution for the antenna / test position giving the maximum SAR in the GPRS 900 band is shown.

10.6 Results for the UMTS FDD VIII mode

Antenna / Test position	Liquid temperature (°C)	Separation distance (mm)	Mode	f (MHz)	Measured SAR (W/kg)	
					SAR_{1g}	SAR_{10g}
Ant #1 / Front facing phantom	21.9	30	12.2 kbps RMC	897.4	**0.157**	**0.118**
Ant #1 / Back facing phantom	21.9	30	12.2 kbps RMC	897.4	0.106	0.071
Ant #1 Top facing phantom	21.9	30	12.2 kbps RMC	897.4	0.150	0.108
Ant #2 / Front facing phantom	21.9	35	12.2 kbps RMC	897.4	**0.088**	**0.065**
Ant #2 / Back facing phantom	22.0	35	12.2 kbps RMC	897.4	0.075	0.056
Ant #2 / Top facing phantom	22.0	35	12.2 kbps RMC	897.4	0.078	0.056
Ant #3 / Front facing phantom	21.9	30	12.2 kbps RMC	897.4	**0.201**	**0.145**
Ant #3 / Back facing phantom	21.9	30	12.2 kbps RMC	897.4	0.170	0.121
Ant #3 / Top facing phantom	22.0	30	12.2 kbps RMC	897.4	0.170	0.118
Ant #4 / Front facing phantom	22.0	35	12.2 kbps RMC	897.4	0.044	0.031
Ant #4 / Back facing phantom	22.0	35	12.2 kbps RMC	897.4	**0.067**	**0.049**
Ant #4 / Top facing phantom	22.0	35	12.2 kbps RMC	897.4	0.043	0.031

In Figure D.6 the SAR distribution for the antenna / test position giving the maximum SAR in the UMTS FDD VIII band is shown.

10.7 Results for the GPRS 1800 mode

Antenna / Test position	Liquid temperature (°C)	Separation distance (mm)	Mode	f (MHz)	Measured SAR (W/kg)		SAR (W/kg) corrected for liquid parameter deviation from target[10]	
					SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
Ant #1 / Front facing phantom	22.1	30	GPRS (2TS)	1747.6	**0.148**	**0.096**	**0.150**	**0.097**
Ant #1 / Back facing phantom	22.1	30	GPRS (2TS)	1747.6	0.106	0.069	0.107	0.070
Ant #1 Top facing phantom	22.1	30	GPRS (2TS)	1747.6	0.085	0.055	0.086	0.055
Ant #2 / Front facing phantom	22.1	35	GPRS (2TS)	1747.6	0.143	0.093	0.145	0.094
Ant #2 / Back facing phantom	22.0	35	GPRS (2TS)	1747.6	0.199	0.128	0.201	0.129
Ant #2 / Top facing phantom	22.0	35	GPRS (2TS)	1747.6	**0.219**	**0.141**	**0.221**	**0.142**
Ant #3 / Front facing phantom	21.9	30	GPRS (2TS)	1747.6	0.178	0.118	0.180	0.119
Ant #3 / Back facing phantom	21.9	30	GPRS (2TS)	1747.6	**0.195**	**0.128**	**0.197**	**0.129**
Ant #3 / Top facing phantom	22.1	30	GPRS (2TS)	1747.6	0.108	0.071	0.109	0.072
Ant #4 / Front facing phantom	22.0	35	GPRS (2TS)	1747.6	0.123	0.080	0.124	0.081
Ant #4 / Back facing phantom	22.0	35	GPRS (2TS)	1747.6	0.113	0.074	0.114	0.075
Ant #4 / Top facing phantom	22.1	35	GPRS (2TS)	1747.6	**0.308**	**0.199**	**0.311**	**0.201**

In Figure D.7 the SAR distribution for the antenna / test position giving the maximum SAR in the GPRS 1800 band is shown.

10.8 Results for the UMTS FDD I mode

Antenna / Test position	Liquid temperature (°C)	Separation distance (mm)	Mode	f (MHz)	Measured SAR (W/kg)		SAR (W/kg) corrected for liquid parameter deviation from target[10]	
					SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
Ant #1 / Front facing phantom	22.1	30	12.2 kbps RMC	1950	**0.277**	**0.178**	**0.284**	**0.180**
Ant #1 / Back facing phantom	22.1	30	12.2 kbps RMC	1950	0.272	0.176	0.279	0.178
Ant #1 Top facing phantom	22.1	30	12.2 kbps RMC	1950	0.173	0.111	0.177	0.113
Ant #2 / Front facing phantom	22.1	35	12.2 kbps RMC	1950	0.081	0.053	0.083	0.054
Ant #2 / Back facing phantom	22.0	35	12.2 kbps RMC	1950	**0.366**	**0.237**	**0.374**	**0.240**
Ant #2 / Top facing phantom	22.0	35	12.2 kbps RMC	1950	0.333	0.213	0.341	0.216
Ant #3 / Front facing phantom	21.9	30	12.2 kbps RMC	1950	**0.336**	**0.216**	**0.344**	**0.219**
Ant #3 / Back facing phantom	21.9	30	12.2 kbps RMC	1950	0.243	0.157	0.249	0.159
Ant #3 / Top facing phantom	22.1	30	12.2 kbps RMC	1950	0.223	0.145	0.228	0.147
Ant #4 / Front facing phantom	22.0	35	12.2 kbps RMC	1950	**0.200**	**0.132**	**0.205**	**0.134**
Ant #4 / Back facing phantom	22.0	35	12.2 kbps RMC	1950	0.130	0.086	0.133	0.087
Ant #4 / Top facing phantom	22.1	35	12.2 kbps RMC	1950	0.198	0.129	0.203	0.131

In Figure D.8 the SAR distribution for the antenna / test position giving the maximum SAR in the UMTS FDD I band is shown.

11 Conclusion

The results in Section 10 show that the maximum 1g and 10g averaged SAR results for the all antennas are below 1/4th of the applicable SAR limits at phantom-antenna separation distances less than 40 mm.

12 References

[1] CETECOM, “Test Report No.: 1-2205-03-02/10”, February 2011.

[2] EAB-11:048101 Uen, “SAR Measurements on a Terminal Antennas Connected to the Ericsson F5521gw Mobile Broadband Module for GPRS 850”, September, 2011.

[3] FCC, “Evaluating Compliance with FCC Guidelines from Human Exposure To Radiofrequency Electromagnetic Fields”, Supplement C Edition 01-01 to OET Bulletin 65 Edition 97-01, June 2001.

[4] FCC, Code of Federal Regulations CFR title 47, part 2.1093 “Radiofrequency radiation exposure evaluation: portable devices.”, Federal Communications Commission (FCC), October 2008.

[5] ICNIRP, “Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)”, International Commission on Non-Ionizing Radiation Protection (ICNIRP), Health Physics, vol. 74, pp 494-522, April 1998.

[6] Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 HZ to 300 GHz) (Official Journal L 197 of 30 July 1999).

[7] ARPANSA, “Radiation Protection Standard for Maximum Exposure Levels for Radiofrequency Fields – 3 kHz to 300 GHz (2002)”, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), May 2002.

[8] Radio Standard Specification (RSS) 102, (Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), Industry Canada, 2009.

[9] IEEE Std C95.1-2005 (Revision of IEEE Std C95.1-1991), “Safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz”, The Institute of Electrical and Electronics Engineers Inc., New York, 2006.

[10] IEC 62209-2, “Procedure to determine the specific absorption rate (SAR) for mobile wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)”, March 2010.

[11] FCC KDB450824 D01. “SAR Probe Calibration and System Verification Considerations for Measurements at 150 MHz – 3 GHz”, Rev. 1.1, January 2007.

[12] EAB/TF-03:090, “Calculation of reference SAR values for system performance checks with muscle tissue simulating liquid”, Ericsson technical report, December 2006.

[13] IEEE, Standard 1528, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.”, The Institute for Electrical and Electronics Engineers (IEEE) Inc., June 2003.

[14] FCC KDB447498 D01. “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, v04, November 2009.

[15] FCC KDB941225 D03. “Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE”, v01, December 2008.

[16] FCC KDB941225 D01. “SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-Do – WCDMA / HSDPA / HSPA-, v02, October 2007.

APPENDIX A: Photographs of the EUT

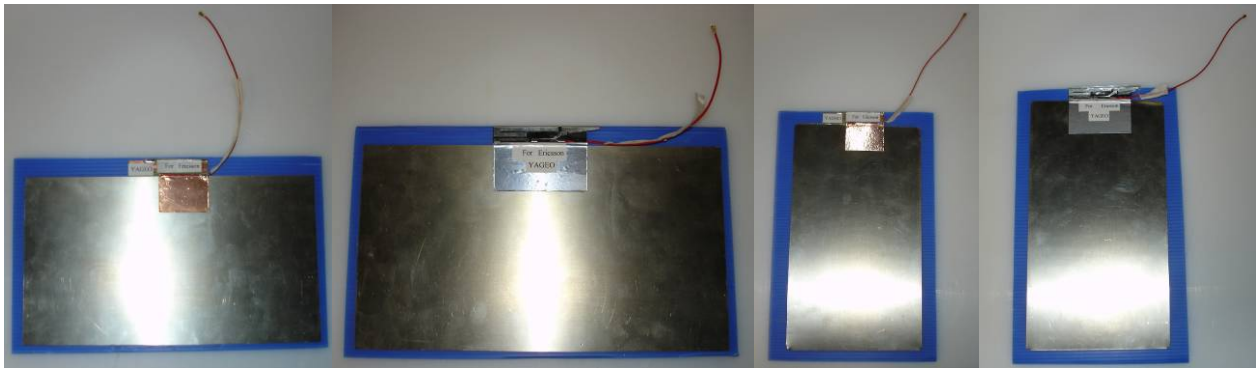


Figure A.1 Antennas #1, #2, #3, and #4.

Figure A.2 The Ericsson F5521gw mobile broadband module.

Figure A.3 The Dell inspiron mini host device.

APPENDIX B: Photographs of the antennas when positioned for SAR measurements

Figure B.1 Antenna #3 positioned with the top facing the ELI 4 phantom at 30 mm separation distance.

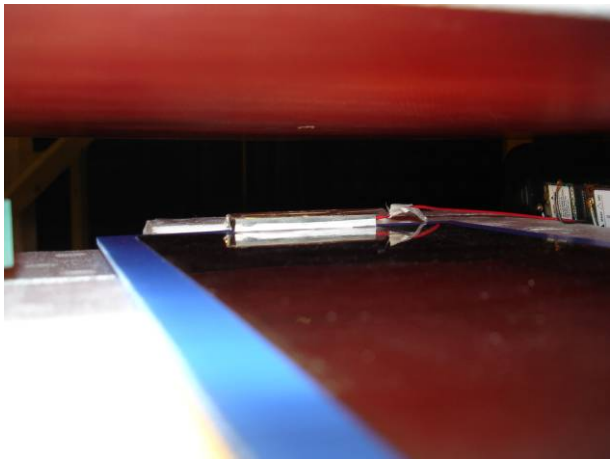


Figure B.2 Antenna #4 positioned with the front facing the ELI 4 phantom at 35 mm separation distance.

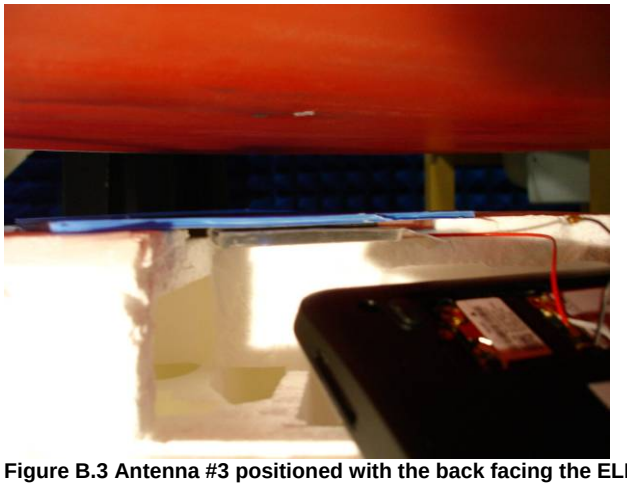


Figure B.3 Antenna #3 positioned with the back facing the ELI 4 phantom at 30 mm separation distance.

APPENDIX C: SAR distribution plots for the system performance checks

System performance check at 835 MHz conducted on the 2nd of May

Date/Time: 2011-05-02 13:11:51

-Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
-Medium: Body 835 MHz; $\sigma = 0.97$ mho/m; $\varepsilon_r = 54.5$; $\rho = 1000$ kg/m^3

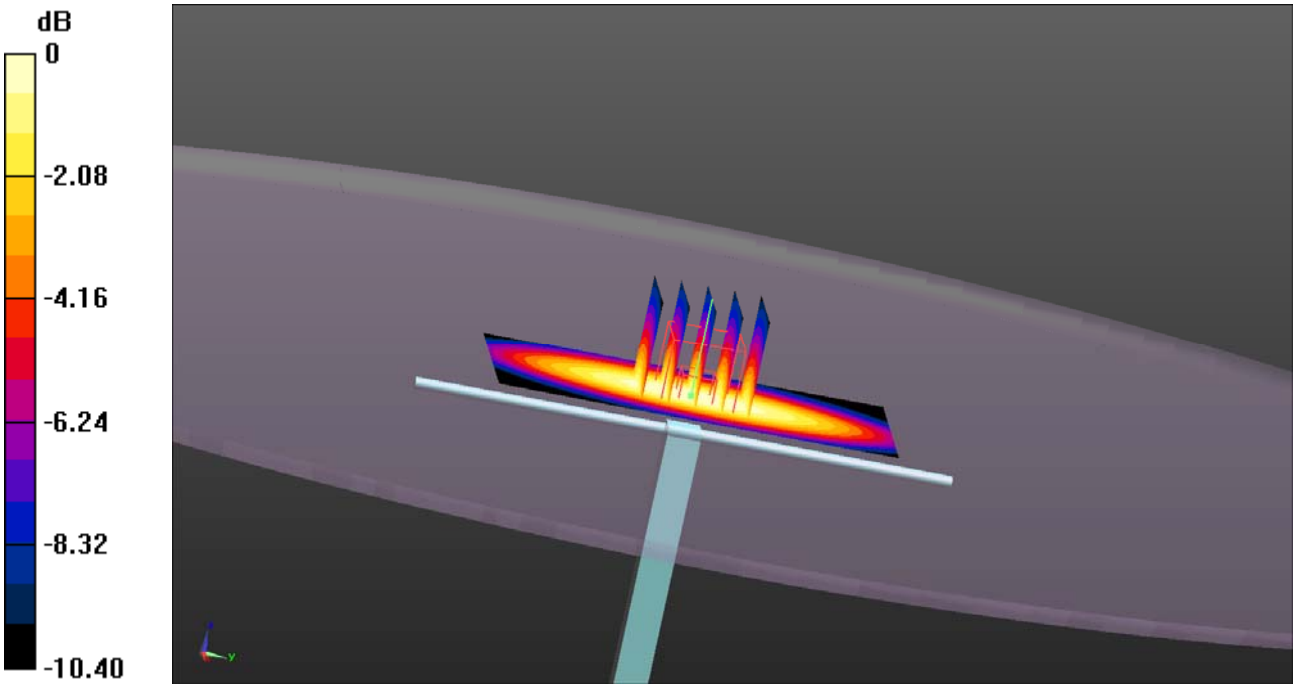
DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(5.78, 5.78, 5.78)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.4.2 (2595)

SPC 835B, d=15 mm, Prad=248 mW/Area Scan 2 2 2 (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.744 mW/g

SPC 835B, d=15 mm, Prad=248 mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 52.047 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.376 W/kg
SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.56 mW/g

Maximum value of SAR (measured) = 2.731 mW/g



0 dB = 2.730mW/g

System performance check at 900 MHz conducted on the 18th of April

Date/Time: 2011-04-18 13:12:54

-Communication System: CW; Frequency: 900 MHz;Duty Cycle: 1:1
-Medium: Head 900 MHz; $\sigma = 0.95$ mho/m; $\varepsilon_r = 42.7$; $\rho = 1000$ kg/m^3

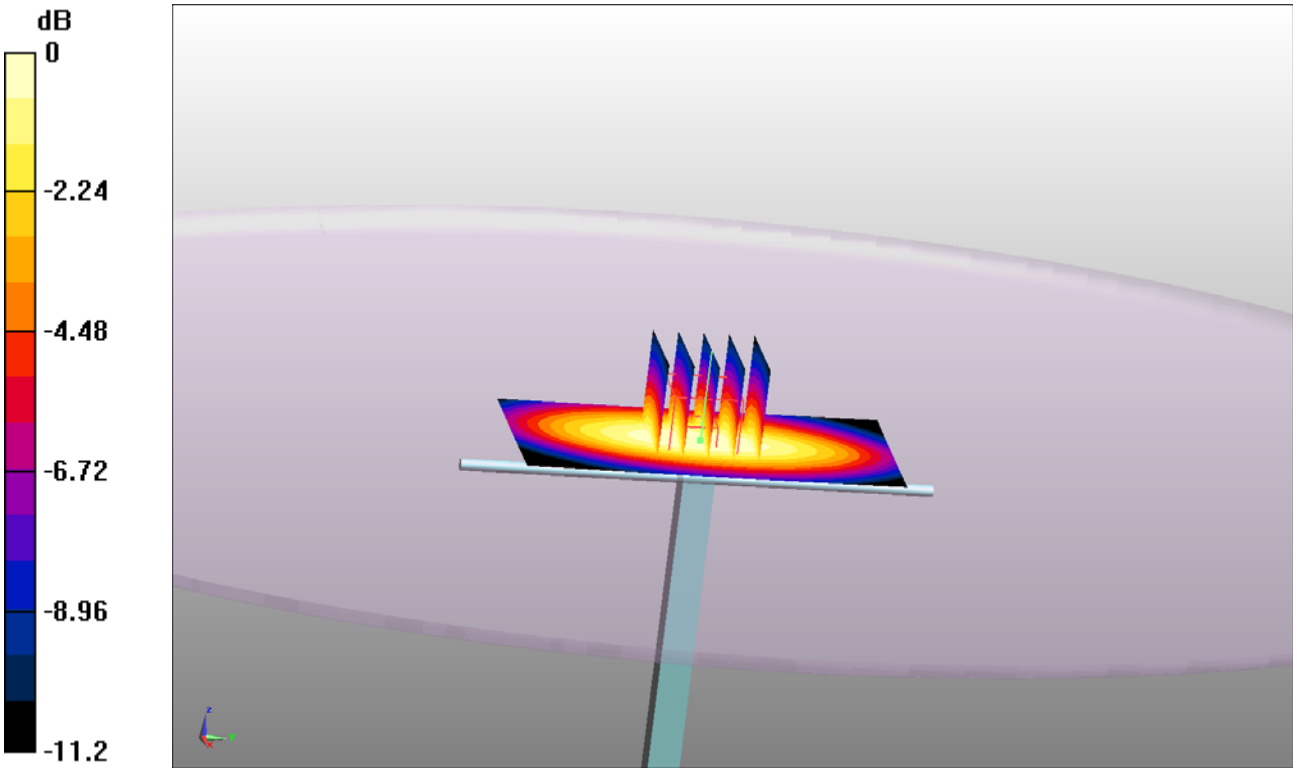
DASY4 Configuration:
-Probe: ET3DV6 - SN1394; ConvF(6.21, 6.21, 6.21)
-Electronics: DAE3 Sn304
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

SPC900, d=15 mm, Prad= 250 mW/Area Scan 2 2 (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.96 mW/g

SPC900, d=15 mm, Prad= 250 mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 57.5 V/m; Power Drift = -0.080 dB
Peak SAR (extrapolated) = 3.9 W/kg
SAR(1 g) = 2.64 mW/g; SAR(10 g) = 1.71 mW/g

Maximum value of SAR (measured) = 2.88 mW/g



0 dB = 2.88mW/g

System performance check at 900 MHz conducted on the 26th of April

Date/Time: 2011-04-26 19:58:42

-Communication System: CW; Frequency: 900 MHz;Duty Cycle: 1:1
-Medium: Head 900 MHz; $\sigma = 0.94$ mho/m; $\varepsilon_r = 40.4$; $\rho = 1000$ kg/m^3

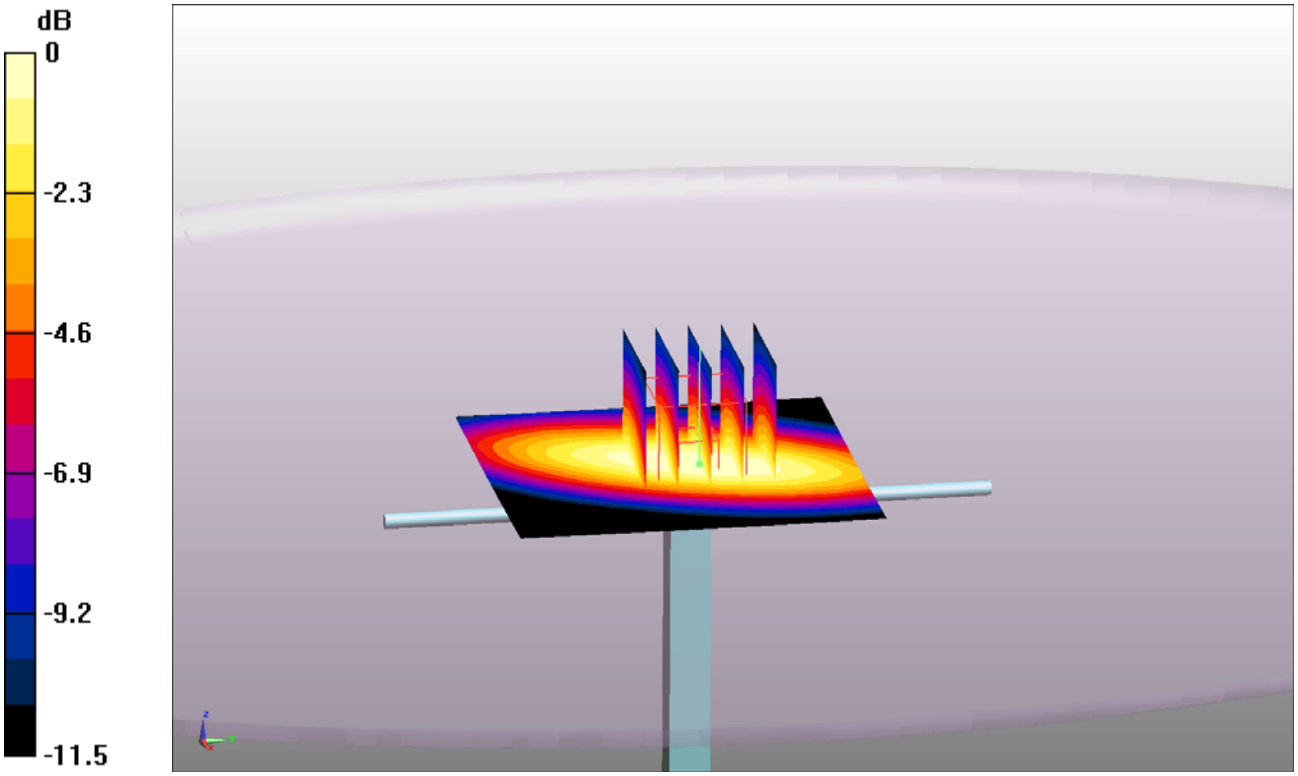
DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(5.85, 5.85, 5.85)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

SPC900, d=15 mm, Prad=249 mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.04 mW/g

SPC900, d=15 mm, Prad=249 mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 54.5 V/m; Power Drift = -0.057 dB
Peak SAR (extrapolated) = 3.89 W/kg
SAR(1 g) = 2.56 mW/g; SAR(10 g) = 1.65 mW/g

Maximum value of SAR (measured) = 3 mW/g



0 dB = 3mW/g

System performance check at 1800 MHz conducted on the 13th of April

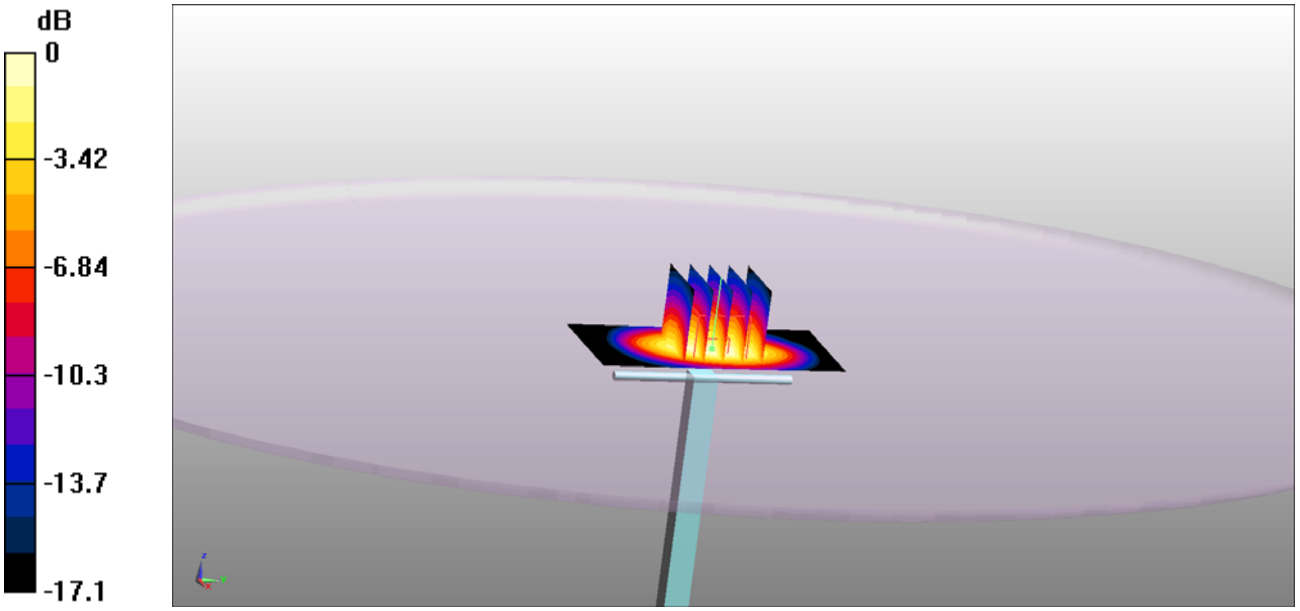
Date/Time: 2011-04-13 15:51:36

-Communication System: CW; Frequency: 1800 MHz;Duty Cycle: 1:1
-Medium: Head 1800 MHz; σ = 1.41 mho/m; ε_r = 38.1; ρ = 1000 kg/m^3

DASY4 Configuration:
-Probe: ET3DV6 - SN1394; ConvF(5.22, 5.22, 5.22)
-Electronics: DAE3 Sn304
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

SPC1800, d=10 mm, Prad=246 mW/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 10.8 mW/g

SPC1800, d=10 mm, Prad=246 mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 92.8 V/m; Power Drift = -0.012 dB
Peak SAR (extrapolated) = 15.9 W/kg
SAR(1 g) = 9.5 mW/g; SAR(10 g) = 5.08 mW/g
Maximum value of SAR (measured) = 10.8 mW/g



0 dB = 10.8mW/g

System performance check at 1900 MHz (Body) conducted on the 3rd of May

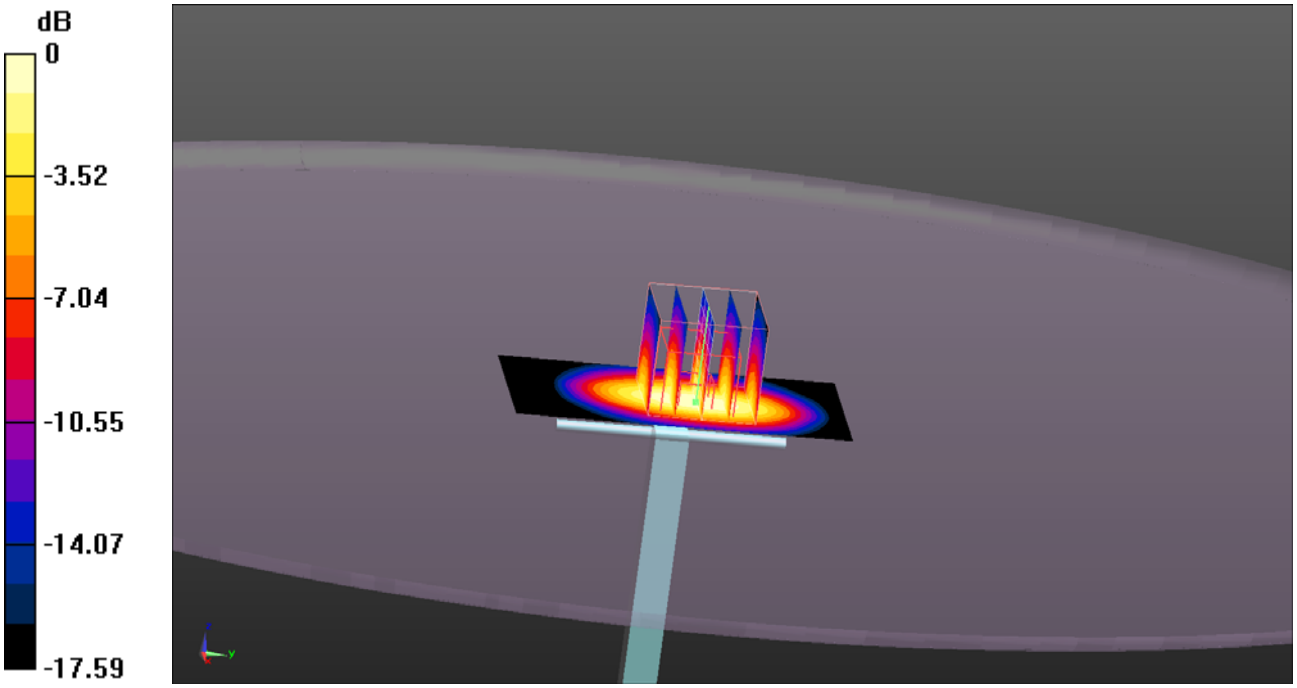
Date/Time: 2011-05-03 10:36:12

-Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
-Medium: Body 1900 MHz; σ = 1.53 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(4.86, 4.86, 4.86)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.4.2 (2595)

SPC 1900B, d=10 mm, Prad=248 mW/Area Scan 2 2 2 (51x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 12.003 mW/g

SPC 1900B, d=10 mm, Prad=248 mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 83.394 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 16.309 W/kg
SAR(1 g) = 9.42 mW/g; SAR(10 g) = 4.92 mW/g
Maximum value of SAR (measured) = 11.963 mW/g



0 dB = 11.960mW/g

System performance check at 2000 MHz conducted on the 29th of April

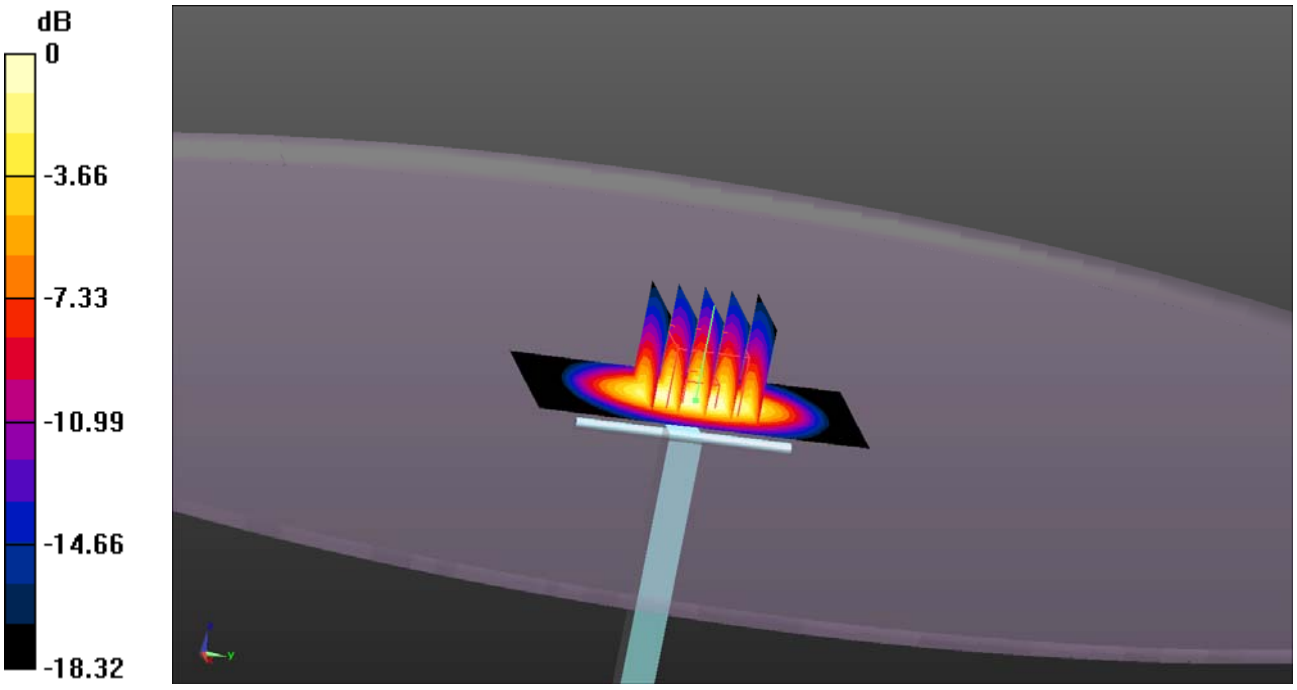
Date/Time: 2011-04-29 10:18:46

-Communication System: CW; Frequency: 2000 MHz;Duty Cycle: 1:1
-Medium: Head 2000 MHz; σ = 1.468 mho/m; ε_r = 40.6; ρ = 1000 kg/m^3

DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(4.9, 4.9, 4.9)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.4.2 (2595)

SPC 2000, d=10 mm, Prad=249 mW/Area Scan 2 2 2 (51x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 13.316 mW/g

SPC 2000, d=10 mm, Prad=249 mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 90.687 V/m; Power Drift = 0.0058 dB
Peak SAR (extrapolated) = 18.951 W/kg
SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.31 mW/g
Maximum value of SAR (measured) = 13.300 mW/g



0 dB = 13.300mW/g

APPENDIX D: SAR distribution plots

Date/Time: 2011-05-02 14:54:18

-Communication System: GPRS 850 (2ts); Frequency: 836.6 MHz;Duty Cycle: 1:4.14954
-Medium: Body 835 MHz; $\sigma = 0.97$ mho/m; $\varepsilon_r = 54.5$; $\rho = 1000$ kg/m^3

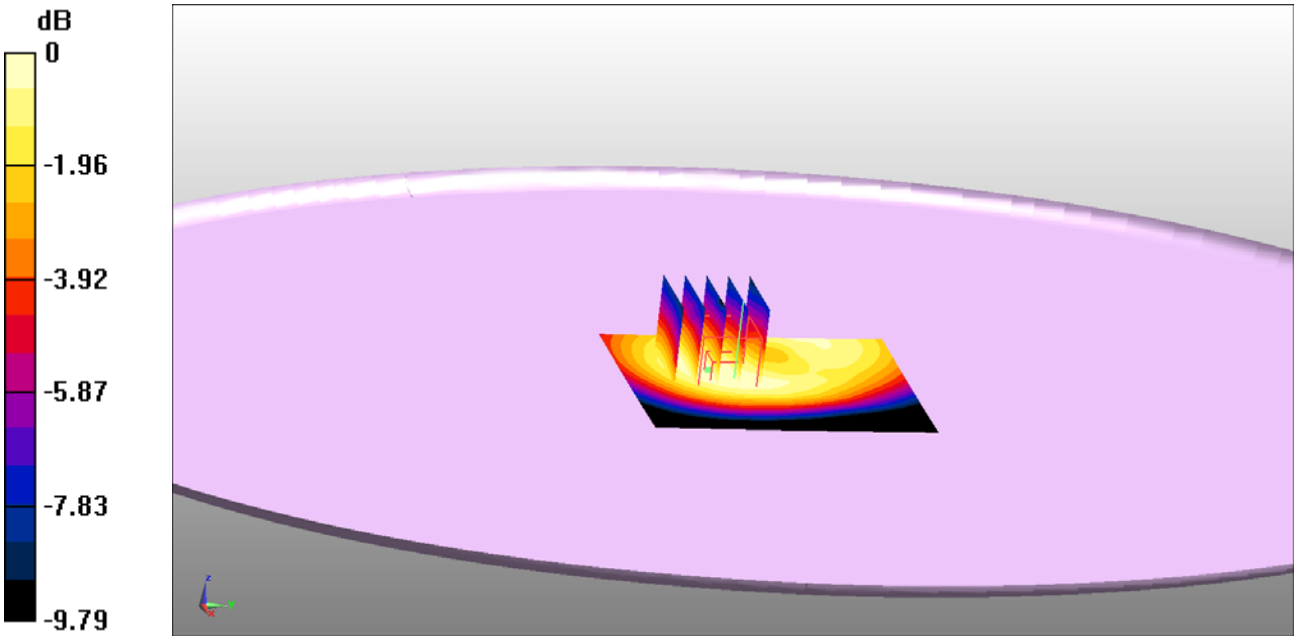
DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(5.78, 5.78, 5.78)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

ant #3, MBM, FRONT, 30 mm, GPRS 850 (2TS), mid ch/Area Scan 2 2 2 (61x71x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.301 mW/g

ant #3, MBM, FRONT, 30 mm, GPRS 850 (2TS), mid ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.7 V/m; Power Drift = 0.025 dB
Peak SAR (extrapolated) = 0.370 W/kg
SAR(1 g) = 0.271 mW/g; SAR(10 g) = 0.193 mW/g

Maximum value of SAR (measured) = 0.305 mW/g



0 dB = 0.305mW/g

Figure D.1 SAR distribution of antenna #3, transmitting in the mid channel of the GSM850 band (GPRS with two active uplink timeslots). The antenna is positioned with the front facing the phantom shell with a separation distance of 30 mm.

Date/Time: 2011-05-02 16:44:16

-Communication System: WCDMA 850; Frequency: 836.6 MHz;Duty Cycle: 1:1
-Medium: Body 835 MHz; σ = 0.97 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3

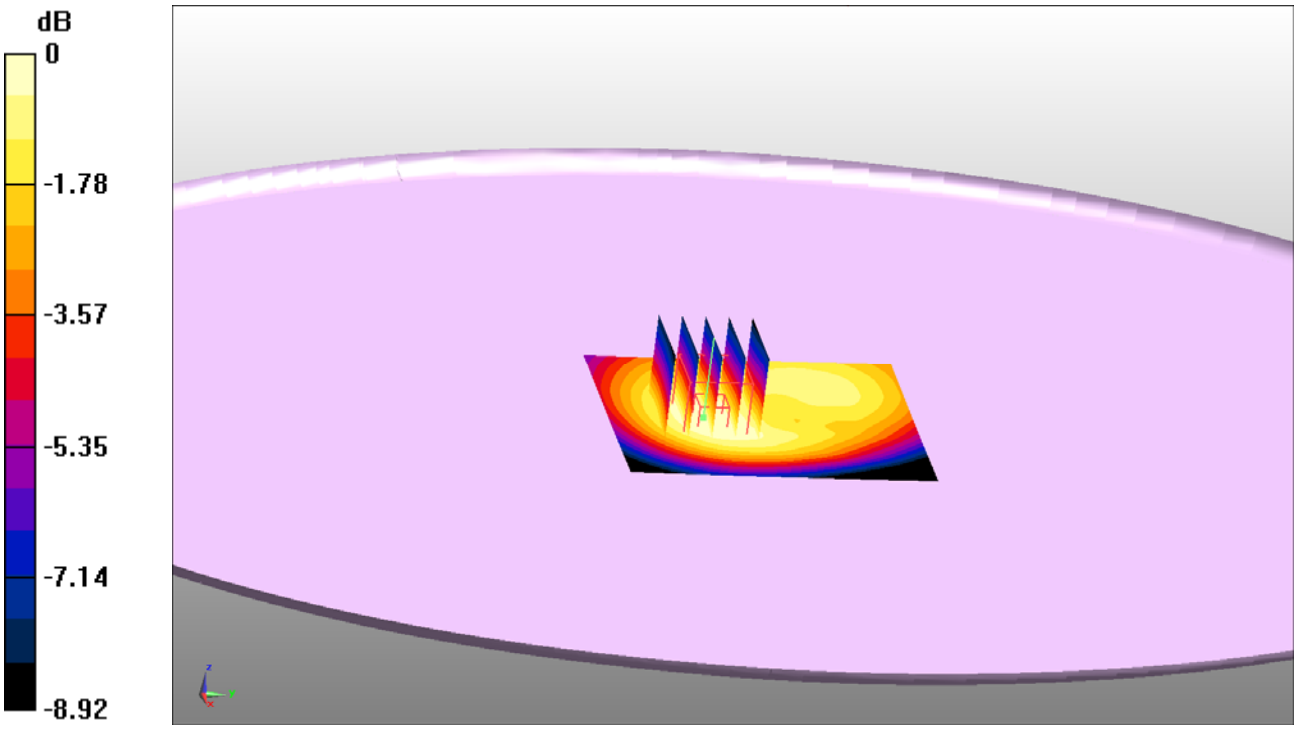
DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(5.78, 5.78, 5.78)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

ant #3, MBM, FRONT, 30 mm, WCDMA V, mid ch/Area Scan 2 2 2 (61x71x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.266 mW/g

ant #3, MBM, FRONT, 30 mm, WCDMA V, mid ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.3 V/m; Power Drift = -0.021 dB
Peak SAR (extrapolated) = 0.318 W/kg
SAR(1 g) = 0.234 mW/g; SAR(10 g) = 0.167 mW/g

Maximum value of SAR (measured) = 0.265 mW/g



0 dB = 0.265mW/g

Figure D.2 SAR distribution of antenna #3, transmitting in the mid channel of the WCDMA V band (12.2 kbps RMC). The antenna is positioned with the front facing the phantom shell with a separation distance of 30 mm.

Date/Time: 2011-05-04 10:33:29

-Communication System: GPRS 1900 (2ts); Frequency: 1880 MHz;Duty Cycle: 1:4.14954
-Medium: Body 1900 MHz; σ = 1.52 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

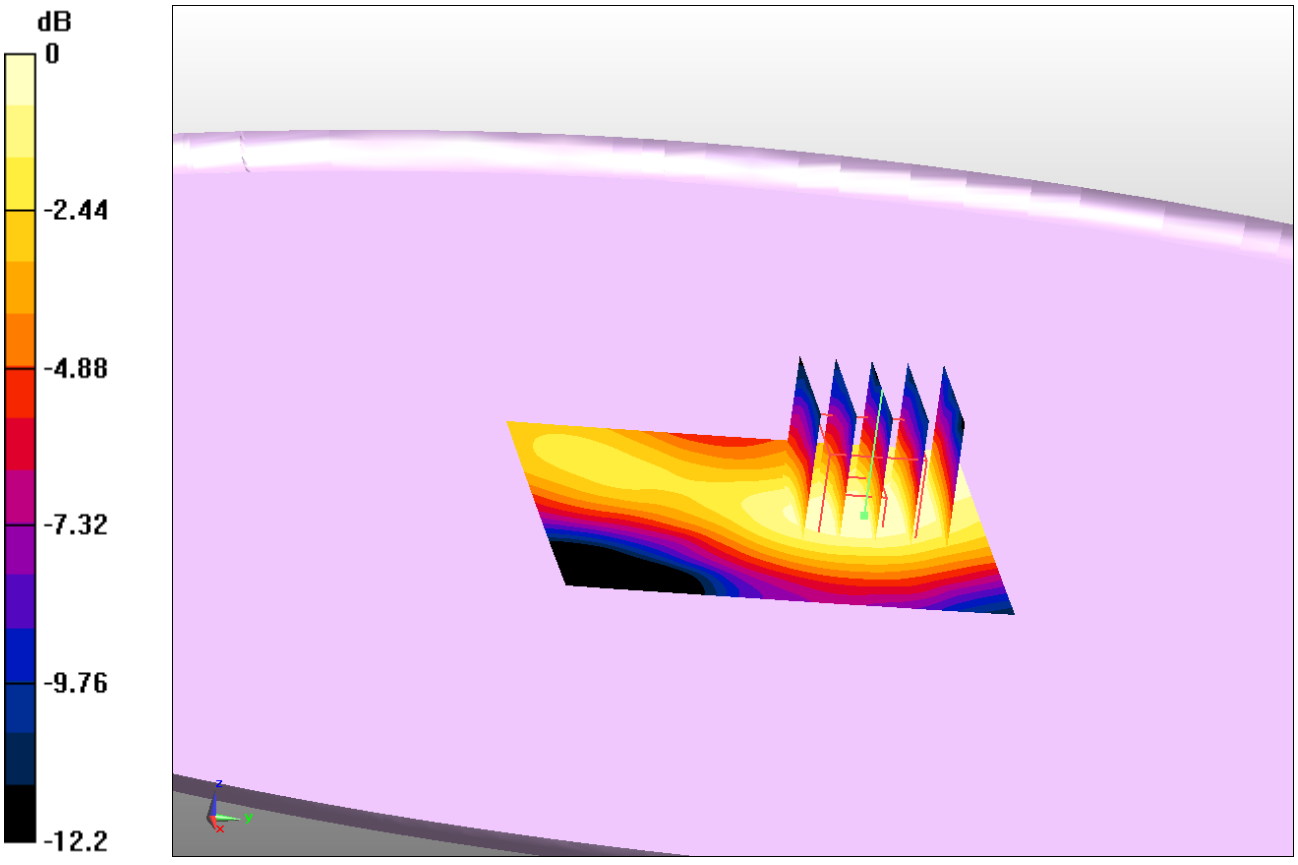
DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(4.86, 4.86, 4.86)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

ant #3, MBM, FRONT, 30 mm, GPRS 1900 (2TS), mid ch/Area Scan 2 2 2 (91x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.213 mW/g

ant #3, MBM, FRONT, 30 mm, GPRS 1900 (2TS), mid ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.4 V/m; Power Drift = 0.075 dB
Peak SAR (extrapolated) = 0.283 W/kg
SAR(1 g) = 0.188 mW/g; SAR(10 g) = 0.125 mW/g

Maximum value of SAR (measured) = 0.219 mW/g



0 dB = 0.219mW/g

Figure D.3 SAR distribution of antenna #3, transmitting in the mid channel of the GSM1900 band (GPRS with two active uplink timeslots). The antenna is positioned with the front facing the phantom shell with a separation distance of 30 mm.

Date/Time: 2011-05-04 10:49:12

-Communication System: WCDMA 1900; Frequency: 1880 MHz;Duty Cycle: 1:1
-Medium: Body 1900 MHz; σ = 1.52 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

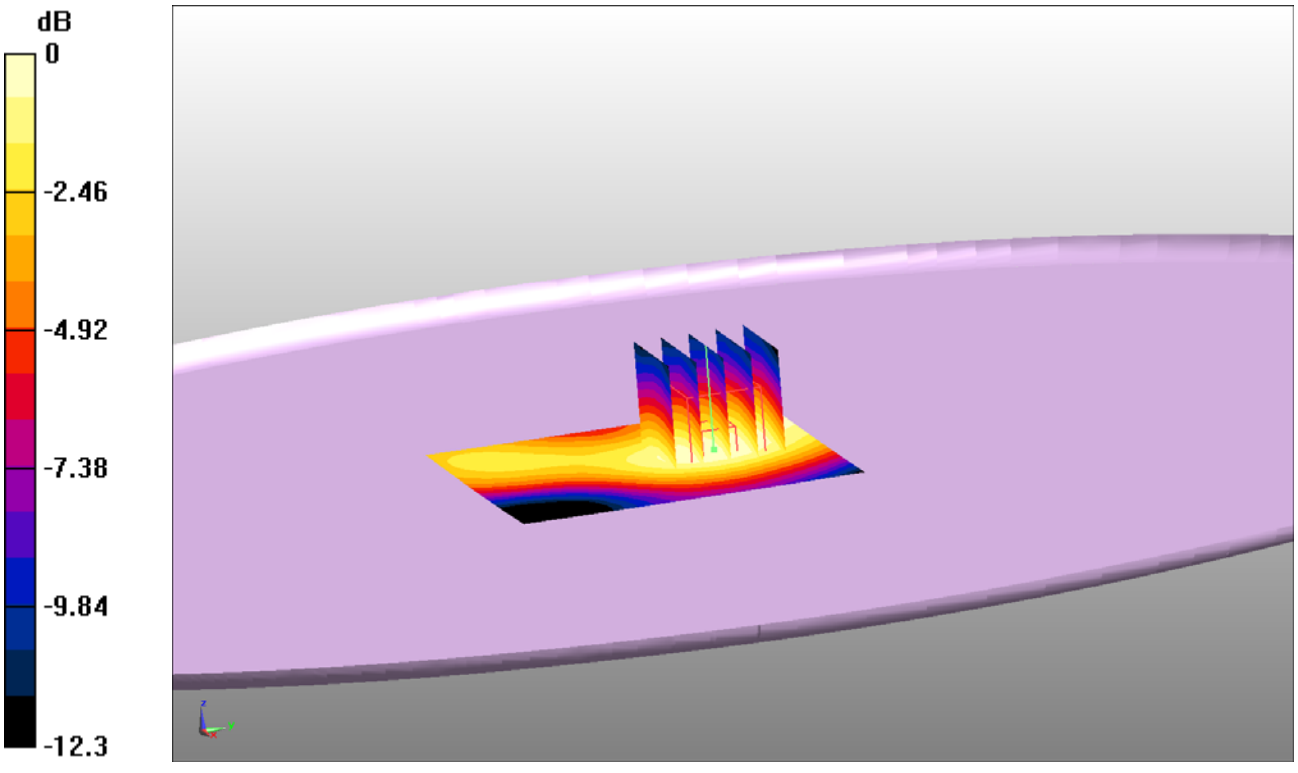
DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(4.86, 4.86, 4.86)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

ant #3, MBM, FRONT, 30 mm, WCDMA band II, 12.2 kbps RMC, mid ch/Area Scan 2 2 2 (91x101x1):
Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.225 mW/g

ant #3, MBM, FRONT, 30 mm, WCDMA band II, 12.2 kbps RMC, mid ch/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.6 V/m; Power Drift = -0.00649 dB
Peak SAR (extrapolated) = 0.285 W/kg
SAR(1 g) = 0.196 mW/g; SAR(10 g) = 0.128 mW/g

Maximum value of SAR (measured) = 0.227 mW/g



0 dB = 0.227mW/g

Figure D.4 SAR distribution of antenna #3, transmitting in the mid channel of the WCDMA II band (12.2 kbps RMC). The antenna is positioned with the front facing the phantom shell with a separation distance of 30 mm.

Date/Time: 2011-04-19 15:09:16

-Communication System: GPRS 900 (2ts); Frequency: 897.4 MHz;Duty Cycle: 1:4.14954
-Medium: Head 900 MHz; $\sigma = 0.96$ mho/m; $\varepsilon_r = 42.5$; $\rho = 1000$ kg/m^3

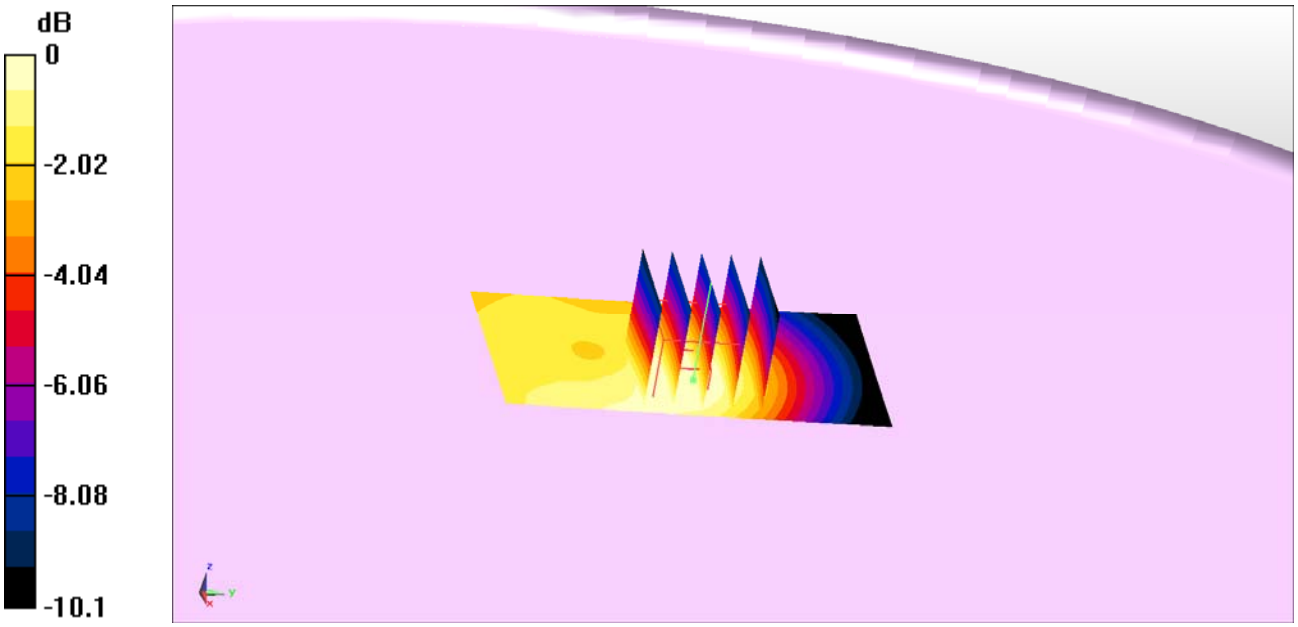
DASY4 Configuration:
-Probe: ET3DV6 - SN1394; ConvF(6.21, 6.21, 6.21)
-Electronics: DAE3 Sn304
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

Ant #3, MBM, FRONT, d=30 mm, GPRS 900, 2TS, mid ch/Area Scan 2 2 (41x71x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.499 mW/g

Ant #3, MBM, FRONT, d=30 mm, GPRS 900, 2TS, mid ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.8 V/m; Power Drift = -0.091 dB
Peak SAR (extrapolated) = 0.641 W/kg
SAR(1 g) = 0.465 mW/g; SAR(10 g) = 0.321 mW/g

Maximum value of SAR (measured) = 0.499 mW/g



0 dB = 0.499mW/g

Figure D.5 SAR distribution of antenna #3, transmitting in the mid channel of the GSM900 band (GPRS with two active uplink timeslots). The antenna is positioned with the front facing the phantom shell with a separation distance of 30 mm.

Date/Time: 2011-04-27 12:19:50

-Communication System: WCDMA 900; Frequency: 897.4 MHz;Duty Cycle: 1:1
-Medium: Head 900 MHz; $\sigma = 0.94$ mho/m; $\varepsilon_r = 40.4$; $\rho = 1000$ kg/m^3

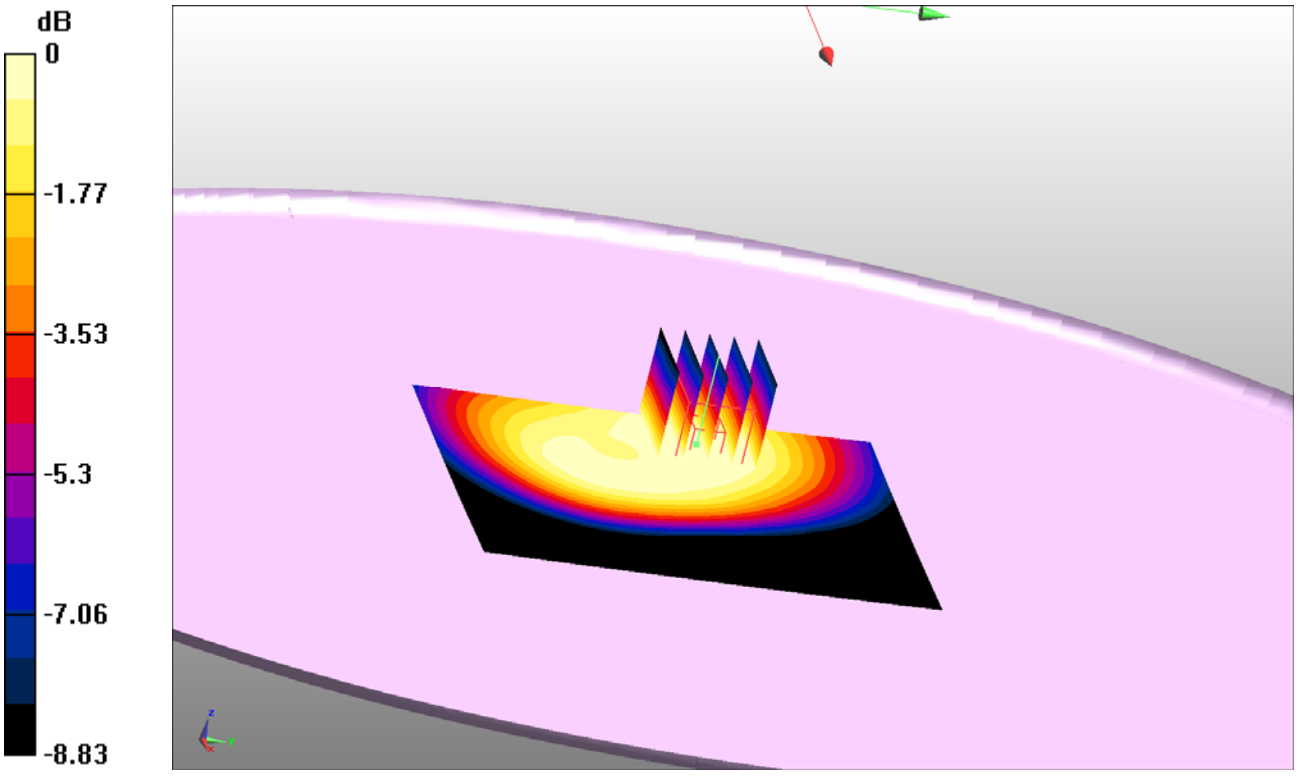
DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(5.85, 5.85, 5.85)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

Ant #3, MBM, FRONT, d=30 mm, WCDMA 900, 12.2 kbps RMC, mid ch/Area Scan 2 2 2 (81x101x1):
Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.227 mW/g

Ant #3, MBM, FRONT, d=30 mm, WCDMA 900, 12.2 kbps RMC, mid ch/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.9 V/m; Power Drift = 0.015 dB
Peak SAR (extrapolated) = 0.272 W/kg
SAR(1 g) = 0.201 mW/g; SAR(10 g) = 0.145 mW/g

Maximum value of SAR (measured) = 0.212 mW/g



0 dB = 0.212mW/g

Figure D.6 SAR distribution of antenna #3, transmitting in the mid channel of the WCDMA VIII band (12.2 kbps RMC). The antenna is positioned with the front facing the phantom shell with a separation distance of 30 mm.

Date/Time: 2011-04-14 15:39:04

-Communication System: GPRS 1800 (2ts); Frequency: 1747.6 MHz;Duty Cycle: 1:4.14954
-Medium: Head 1800 MHz; σ = 1.42 mho/m; ε_r = 39.1; ρ = 1000 kg/m^3

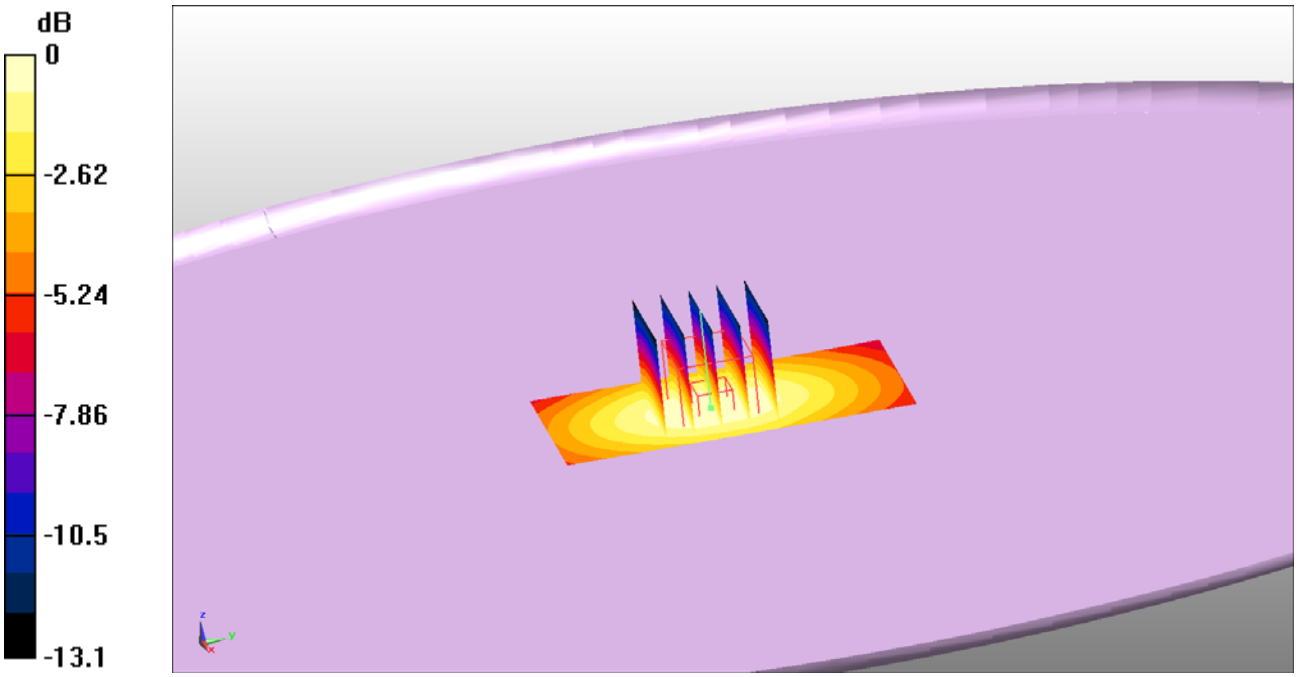
DASY4 Configuration:
-Probe: ET3DV6 - SN1394; ConvF(5.22, 5.22, 5.22)
-Electronics: DAE3 Sn304
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

ant #4, TOP, MBM, d=35 mm, GPRS 1800 2TS, mid ch/Area Scan 2 2 2 2 (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.338 mW/g

ant #4, TOP, MBM, d=35 mm, GPRS 1800 2TS, mid ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.4 V/m; Power Drift = -0.093 dB
Peak SAR (extrapolated) = 0.442 W/kg
SAR(1 g) = 0.308 mW/g; SAR(10 g) = 0.199 mW/g

Maximum value of SAR (measured) = 0.333 mW/g



0 dB = 0.333mW/g

Figure D.7 SAR distribution of antenna #4, transmitting in the mid channel of the GSM1800 band (GPRS with two active uplink timeslots). The antenna is positioned with the top facing the phantom shell with a separation distance of 35 mm.

Date/Time: 2011-04-29 15:03:40

-Communication System: WCDMA 2100; Frequency: 1922.4 MHz;Duty Cycle: 1:1
-Medium: Head 2000 MHz; σ = 1.47 mho/m; ε_r = 40.6; ρ = 1000 kg/m^3

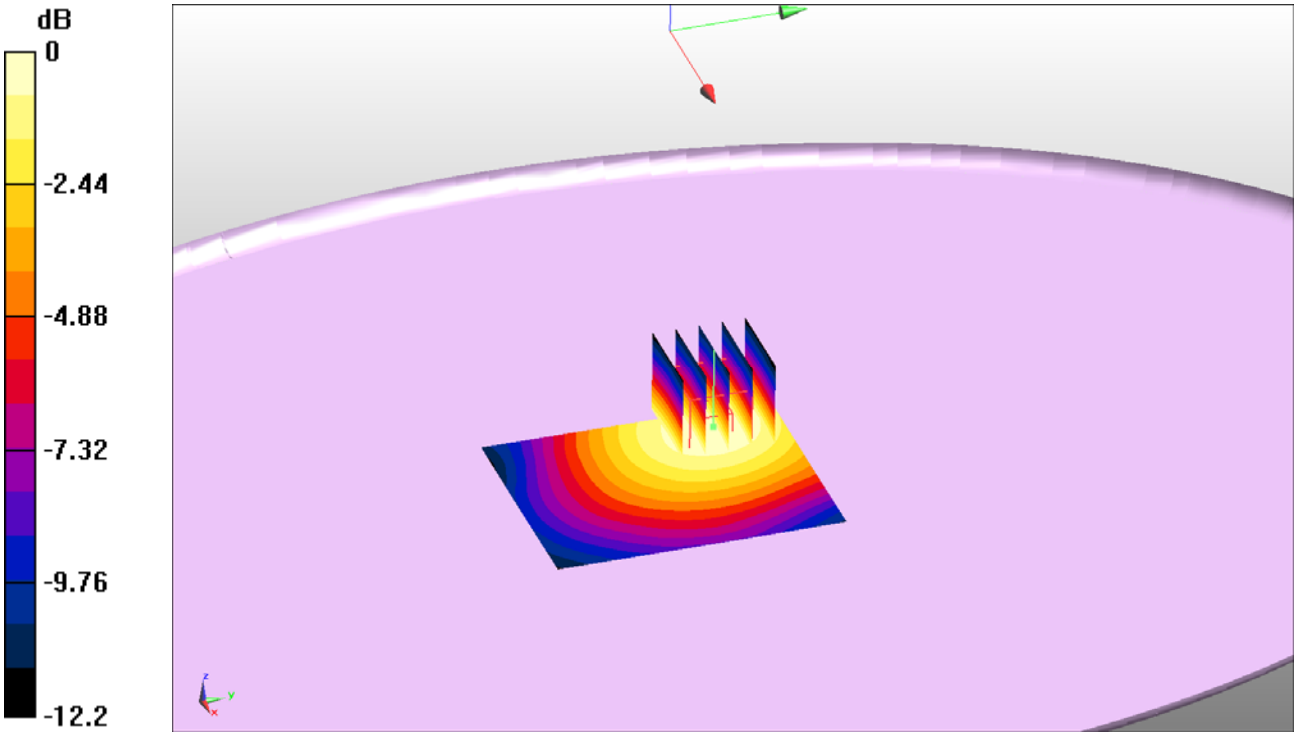
DASY4 Configuration:
-Probe: ES3DV3 - SN3113; ConvF(4.9, 4.9, 4.9)
-Electronics: DAE3 Sn422
-Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1014
-; SEMCAD X Version 14.0 Build 62

ant #2, MBM, BACK, 35 mm, WCDMA band I, mid ch/Area Scan 2 2 2 (81x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.427 mW/g

ant #2, MBM, BACK, 35 mm, WCDMA band I, mid ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.9 V/m; Power Drift = 0.082 dB
Peak SAR (extrapolated) = 0.564 W/kg
SAR(1 g) = 0.366 mW/g; SAR(10 g) = 0.237 mW/g

Maximum value of SAR (measured) = 0.429 mW/g



0 dB = 0.429mW/g

Figure D.8 SAR distribution of antenna #2, transmitting in the mid channel of the WCDMA I band (12.2 kbps RMC). The antenna is positioned with the back facing the phantom shell with a separation distance of 35 mm.

APPENDIX E: Probe calibration certificates

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client Ericsson AB

Certificate No: ET3-1394_Oct10

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1394
Calibration procedure(s)	QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	October 21, 2010

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: October 21, 2010

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z*: *A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ET3DV6

SN:1394

Manufactured:	October 1, 1999
Last calibrated:	October 27, 2009
Recalibrated:	October 21, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1394 October 21, 2010

DASY/EASY - Parameters of Probe: ET3DV6 SN:1394

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.85	2.06	1.79	± 10.1%
DCP (mV)[B]	95.5	94.7	91.0	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

ET3DV6 SN:1394 October 21, 2010

DASY/EASY - Parameters of Probe: ET3DV6 SN:1394

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
750	± 50 / ± 100	41.9 ± 5%	0.89 ± 5%	6.67	6.67	6.67	0.63	1.89	± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	6.21	6.21	6.21	0.42	2.36	± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.22	5.22	5.22	0.63	2.41	± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.54	4.54	4.54	0.99	1.70	± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ET3DV6 SN:1394 October 21, 2010

DASY/EASY - Parameters of Probe: ET3DV6 SN:1394

Calibration Parameter Determined in Body Tissue Simulating Media

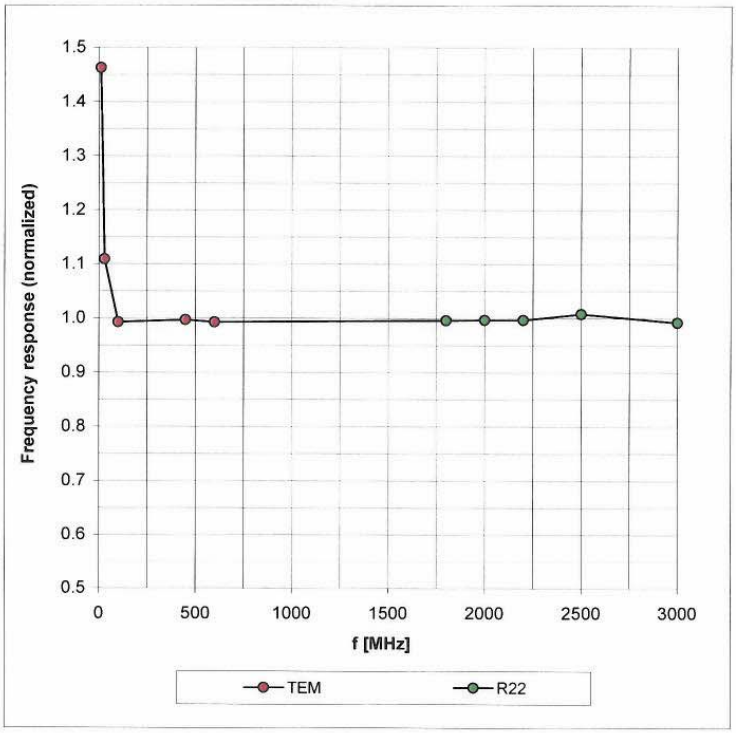
f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	6.34	6.34	6.34	0.52	2.07 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.71	4.71	4.71	0.78	2.62 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.15	4.15	4.15	0.99	1.38 ± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ET3DV6 SN:1394 October 21, 2010

Frequency Response of E-Field

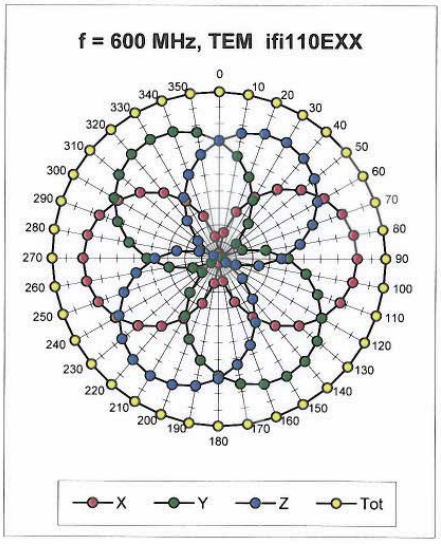
(TEM-Cell:ifi110 EXX, Waveguide: R22)

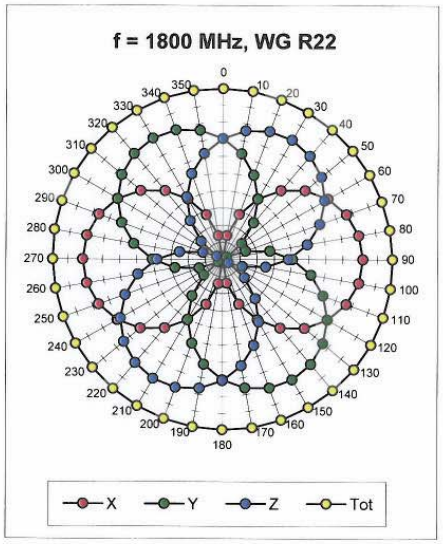


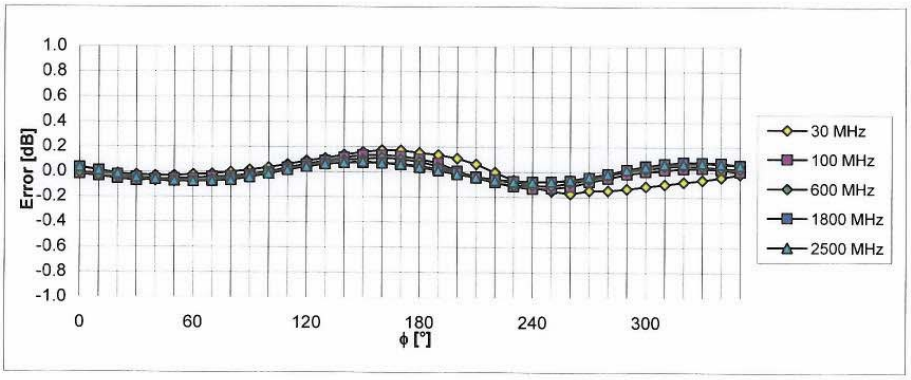
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

ET3DV6 SN:1394 October 21, 2010

Receiving Pattern (ϕ), ϑ = 0°





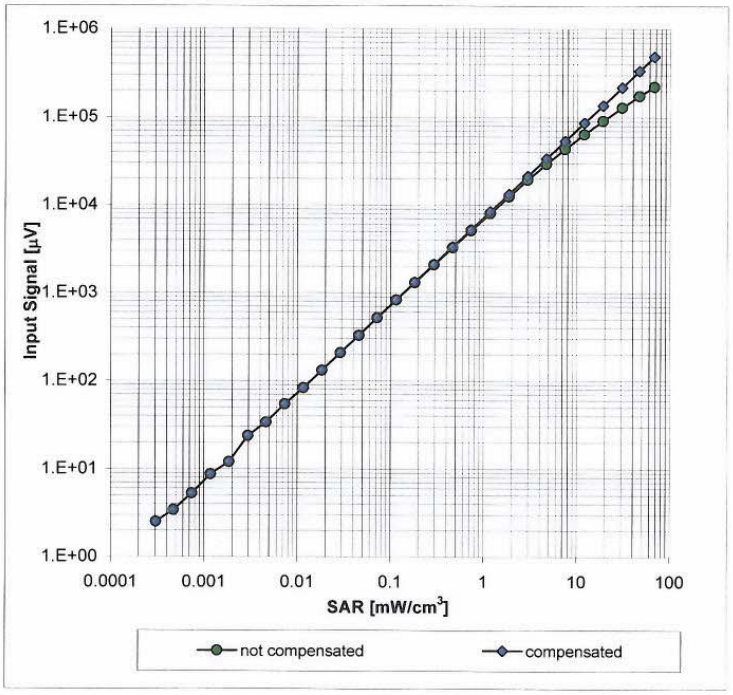


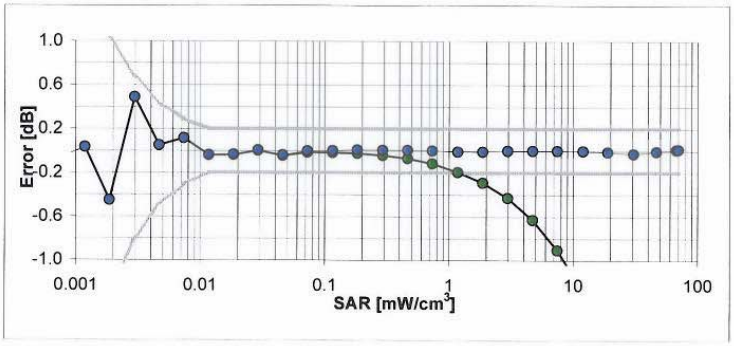
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ET3DV6 SN:1394 October 21, 2010

Dynamic Range f(SAR_{head})

(Waveguide R22, f = 1800 MHz)

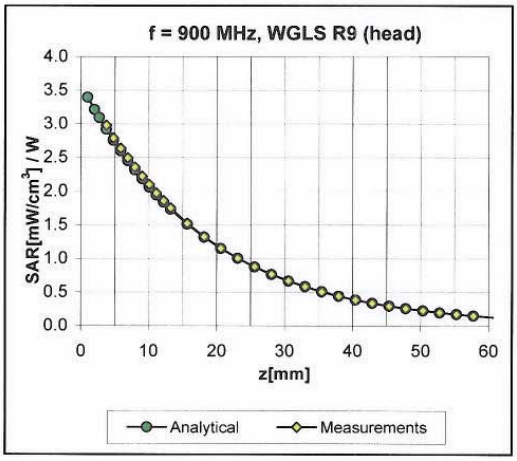


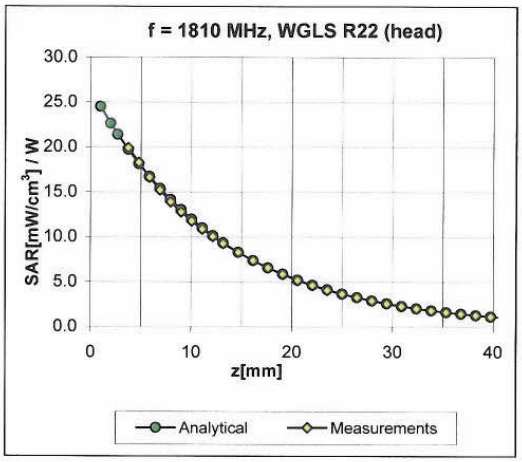


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ET3DV6 SN:1394 October 21, 2010

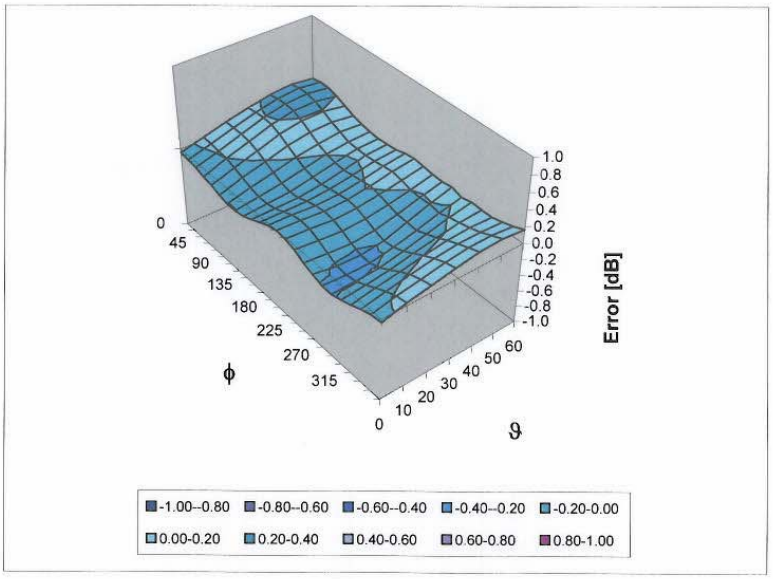
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client Ericsson AB

Certificate No: ES3-3113_Apr11

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3113

Calibration procedure(s): QA CAL-01.v7, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes

Calibration date: April 13, 2011

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41495277	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 14, 2011

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z* are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- *VR:* VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3113

Manufactured: June 3, 2006
Calibrated: April 13, 2011

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3113

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.21	1.14	1.28	± 10.1 %
DCP (mV)[B]	100.9	104.8	99.4	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	108.0	±3.0 %
			Y	0.00	0.00	1.00	106.7	
			Z	0.00	0.00	1.00	119.7	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3113

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
900	41.5	0.97	5.85	5.85	5.85	1.00	1.00	± 11.0 %
1810	40.0	1.40	5.00	5.00	5.00	0.88	1.24	± 11.0 %
2000	40.0	1.40	4.90	4.90	4.90	0.89	1.18	± 11.0 %
2450	39.2	1.80	4.27	4.27	4.27	0.84	1.24	± 11.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3- SN:3113

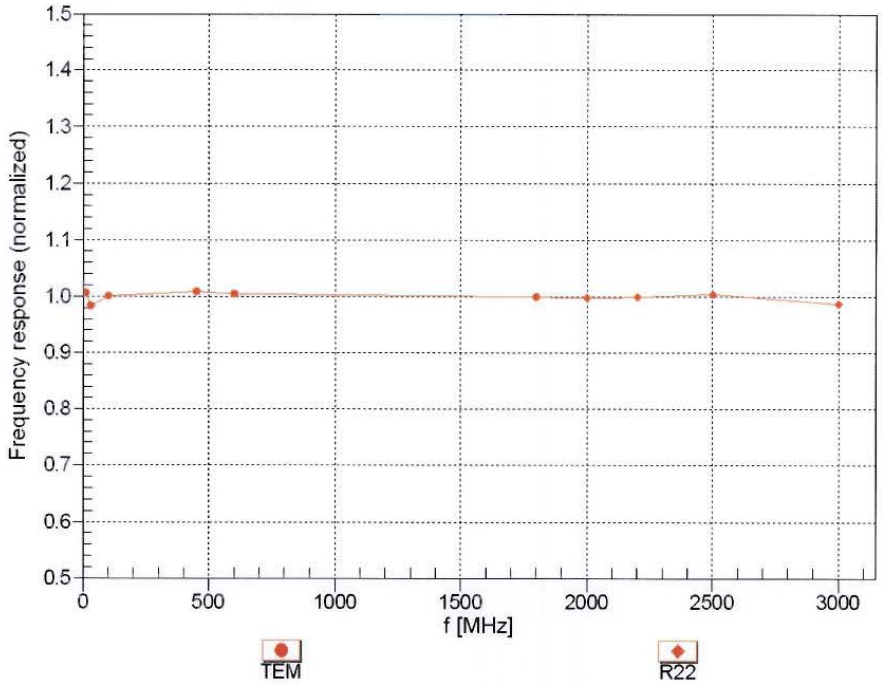
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
900	55.0	1.05	5.78	5.78	5.78	1.00	1.11	± 11.0 %
1810	53.3	1.52	4.86	4.86	4.86	0.78	1.45	± 11.0 %
2000	53.3	1.52	4.78	4.78	4.78	0.76	1.36	± 11.0 %
2450	52.7	1.95	4.31	4.31	4.31	1.00	1.05	± 11.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

ES3DV3– SN:3113 April 13, 2011

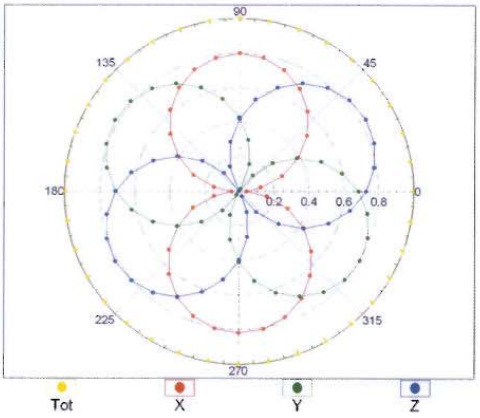
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



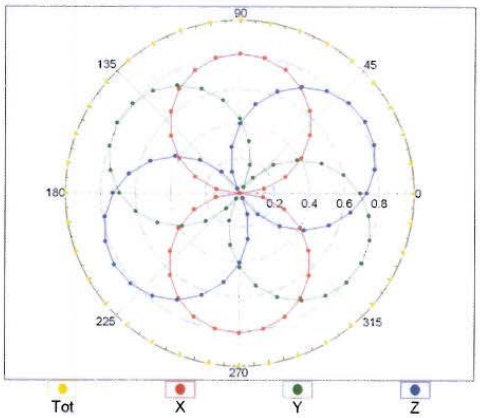
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

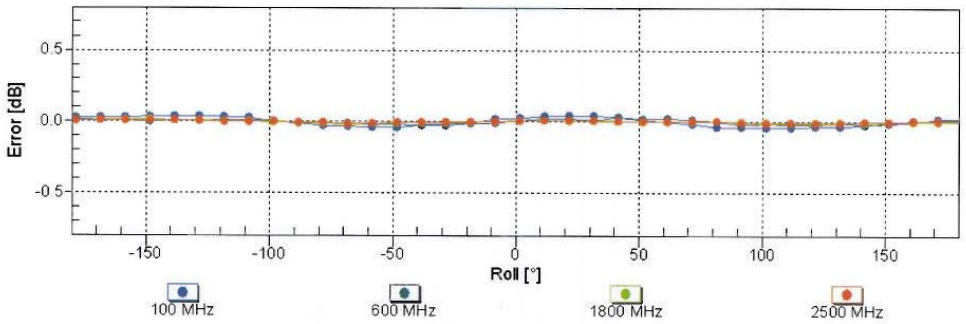
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



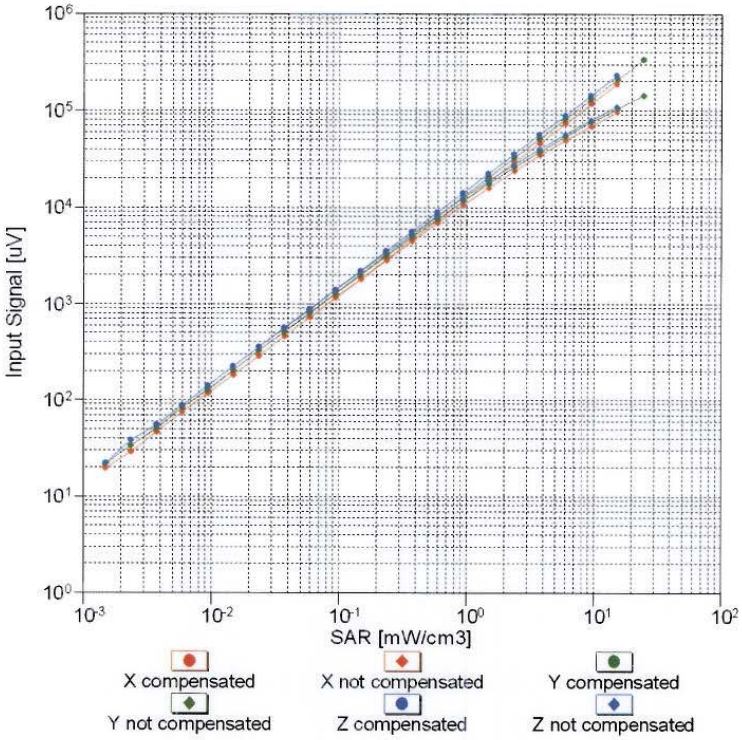
f=1800 MHz,R22

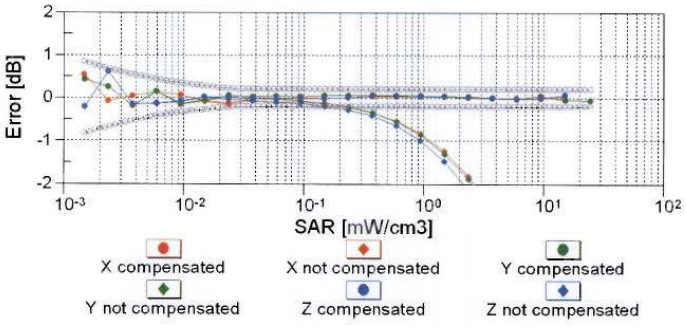




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)