

Appendix A – System Validation Plots and Data

Test Result for UIM Dielectric Parameter

Thu 04/Oct/2012 15:19:14

Freq Frequency(GHz)

FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon

FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma

FCC_eB FCC Limits for Body Epsilon

FCC_sB FCC Limits for Body Sigma

Test_e Epsilon of UIM

Test_s Sigma of UIM

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.7000	55.73	0.96	54.98	0.89
0.7100	55.69	0.96	54.92	0.90
0.7200	55.65	0.96	54.87	0.91
0.7300	55.61	0.96	54.81	0.92
0.7400	55.57	0.96	54.77	0.93
0.7500	55.53	0.96	54.69	0.94
0.7600	55.49	0.96	54.62	0.95
0.7700	55.45	0.96	54.58	0.96
0.7800	55.41	0.97	54.57	0.97
0.7900	55.38	0.97	54.50	0.98
0.8000	55.34	0.97	54.45	0.98

Test Result for UIM Dielectric Parameter

Thu 04/Oct/2012 06:18:38

Freq Frequency(GHz)

FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon

FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma

FCC_eB FCC Limits for Body Epsilon

FCC_sB FCC Limits for Body Sigma

Test_e Epsilon of UIM

Test_s Sigma of UIM

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.8050	55.32	0.97	56.05	0.96
0.8150	55.28	0.97	56.00	0.98
0.8250	55.24	0.97	55.95	0.98
0.8350	55.20	0.97	55.91	0.99
0.8450	55.17	0.98	55.86	0.99
0.8550	55.14	0.99	55.84	1.00
0.8650	55.11	1.01	55.80	1.01
0.8750	55.08	1.02	55.78	1.03
0.8850	55.05	1.03	55.73	1.03
0.8950	55.02	1.04	55.70	1.04

Test Result for UIM Dielectric Parameter

Fri 05/Oct/2012 08:18:57

Freq Frequency(GHz)

FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon

FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma

FCC_eB FCC Limits for Body Epsilon

FCC_sB FCC Limits for Body Sigma

Test_e Epsilon of UIM

Test_s Sigma of UIM

Freq	FCC_eB	FCC_sB	Test_e	Test_s
1.6900	53.59	1.45	52.89	1.51
1.7000	53.56	1.46	52.85	1.52
1.7100	53.54	1.46	52.81	1.53
1.7200	53.51	1.47	52.78	1.54
1.7300	53.48	1.48	52.74	1.55
1.7400	53.46	1.48	52.70	1.55
1.7500	53.43	1.49	52.68	1.56
1.7600	53.41	1.49	52.66	1.56
1.7700	53.38	1.50	52.65	1.57
1.7800	53.35	1.51	52.61	1.58
1.7900	53.33	1.51	52.58	1.59

Test Result for UIM Dielectric Parameter

Wed 03/Oct/2012 07:58:20

Freq Frequency(GHz)

FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon

FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma

FCC_eB FCC Limits for Body Epsilon

FCC_sB FCC Limits for Body Sigma

Test_e Epsilon of UIM

Test_s Sigma of UIM

Freq	FCC_eB	FCC_sB	Test_e	Test_s
1.8200	53.30	1.52	52.47	1.56
1.8300	53.30	1.52	52.47	1.56
1.8400	53.30	1.52	52.46	1.56
1.8500	53.30	1.52	52.45	1.57
1.8600	53.30	1.52	52.44	1.57
1.8700	53.30	1.52	52.42	1.57
1.8800	53.30	1.52	52.38	1.57
1.8900	53.30	1.52	52.37	1.58
1.9000	53.30	1.52	52.35	1.59
1.9100	53.30	1.52	52.32	1.59
1.9200	53.30	1.52	52.30	1.60

Test Result for UIM Dielectric Parameter

Thu 04/Oct/2012 11:54:39

Freq Frequency(GHz)

FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon

FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma

FCC_eB FCC Limits for Body Epsilon

FCC_sB FCC Limits for Body Sigma

Test_e Epsilon of UIM

Test_s Sigma of UIM

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.3900	52.78	1.89	51.83	1.87
2.4000	52.77	1.90	51.81	1.87
2.4100	52.75	1.91	51.79	1.88
2.4200	52.74	1.92	51.76	1.89
2.4300	52.73	1.93	51.74	1.90
2.4400	52.71	1.94	51.70	1.92
2.4500	52.70	1.95	51.68	1.93
2.4600	52.69	1.96	51.65	1.94
2.4700	52.67	1.98	51.62	1.95
2.4800	52.66	1.99	51.59	1.96

RF Exposure Lab

Plot 1

DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN 1016

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: MSL750; Medium parameters used: $f = 750$ MHz; $\sigma = 0.94$ mho/m; $\epsilon_r = 54.69$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Test Date: Date: 10/4/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C

Probe: EX3DV4 - SN3693; ConvF(8.84, 8.84, 8.84); Calibrated: 8/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn759; Calibrated: 8/15/2012

Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

750 MHz Validation/750 MHz Validation/Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.915 W/kg

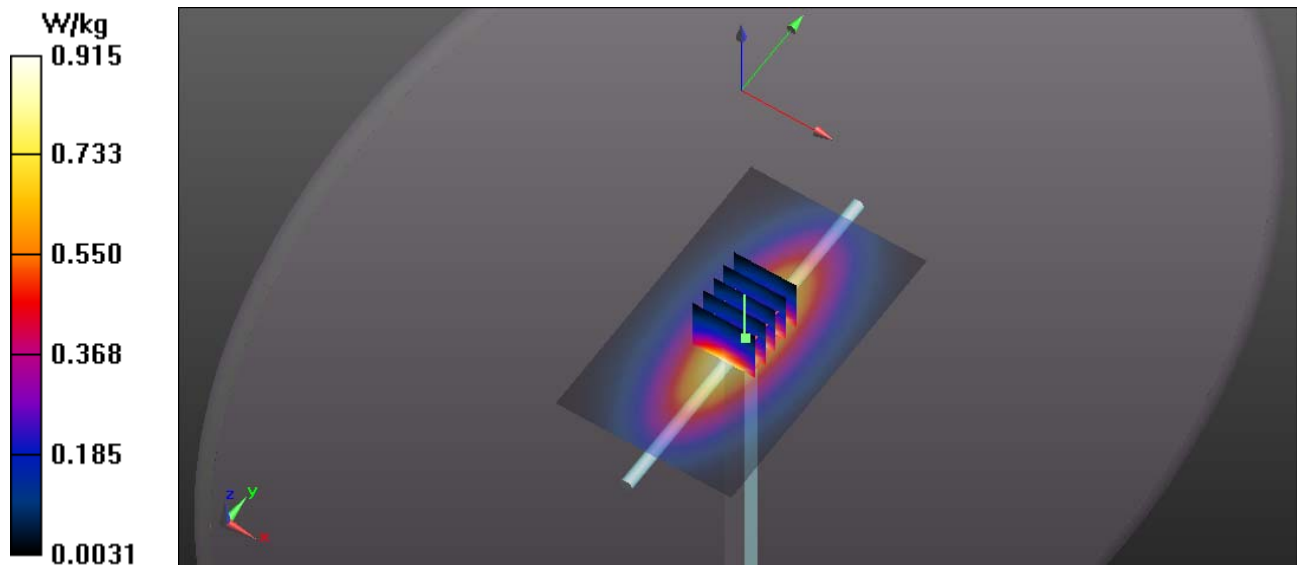
750 MHz Validation/750 MHz Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

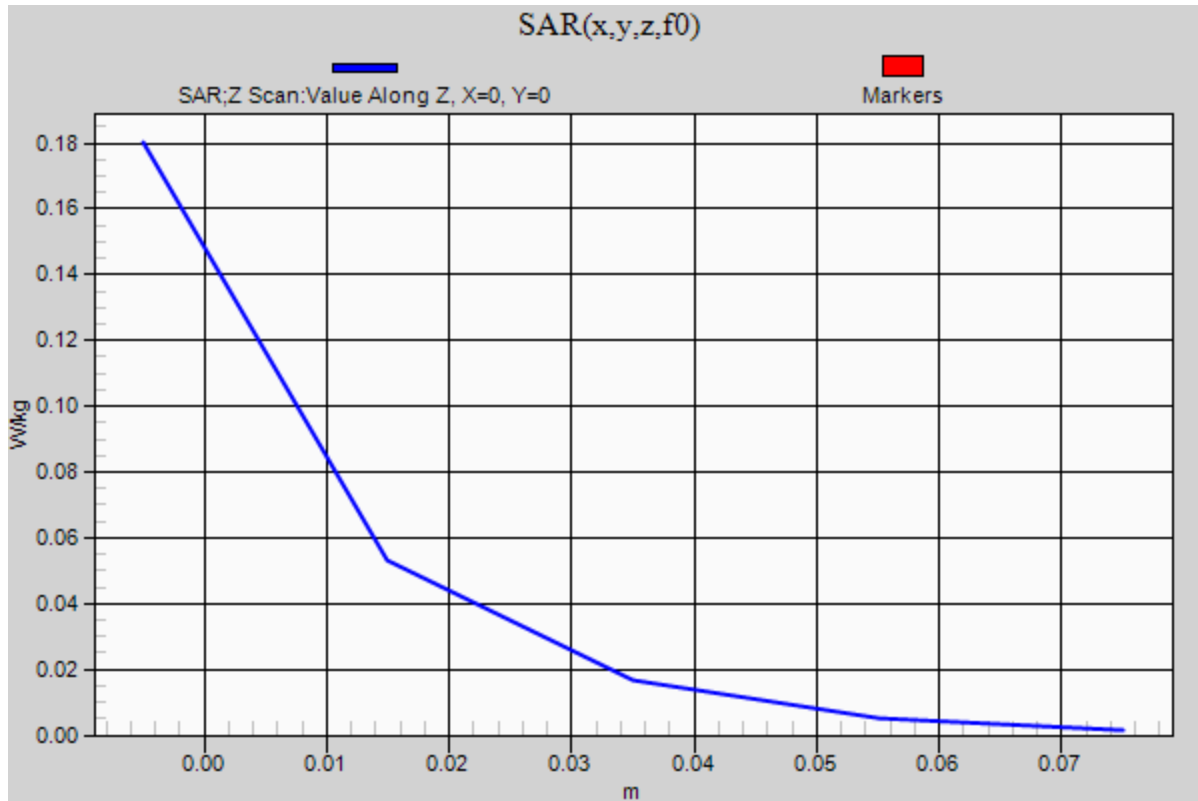
Reference Value = 31.622 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 1.240 mW/g

SAR(1 g) = 0.850 mW/g; SAR(10 g) = 0.564 mW/g

Maximum value of SAR (measured) = 0.915 W/kg





RF Exposure Lab

Plot 2

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:4d089

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900; Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.99 \text{ mho/m}$; $\epsilon_r = 55.91$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Test Date: Date: 10/4/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C

Probe: EX3DV4 - SN3693; ConvF(8.87, 8.87, 8.87); Calibrated: 8/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn759; Calibrated: 8/15/2012

Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

835 MHz Validation/835 MHz Validation/Area Scan (41x81x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 1.06 W/kg

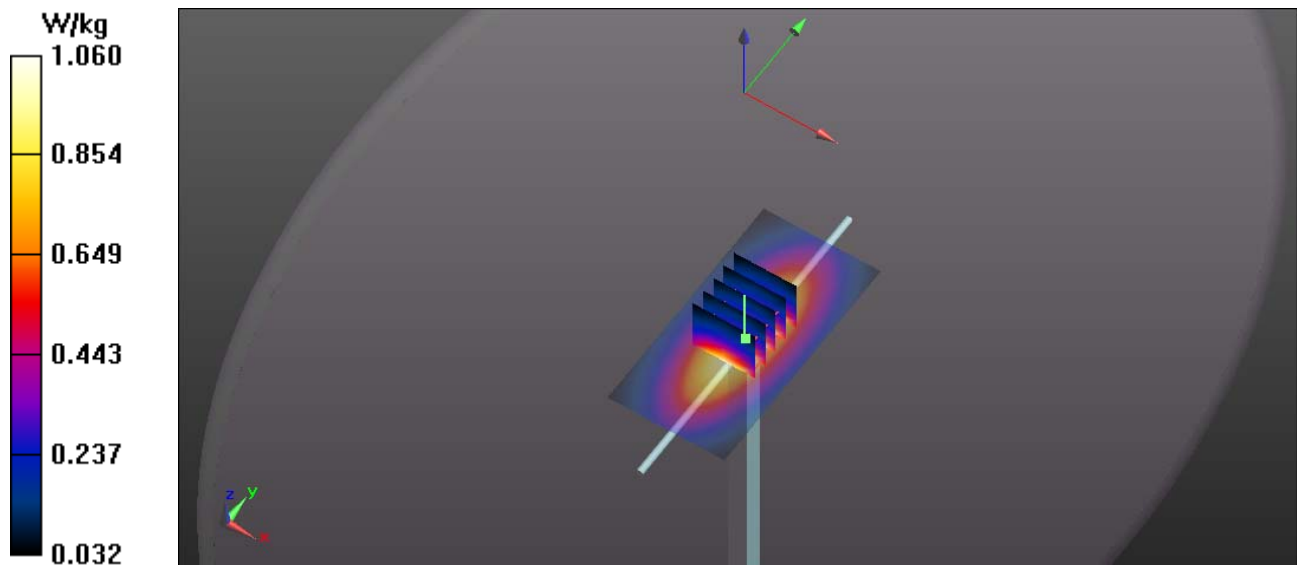
835 MHz Validation/835 MHz Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

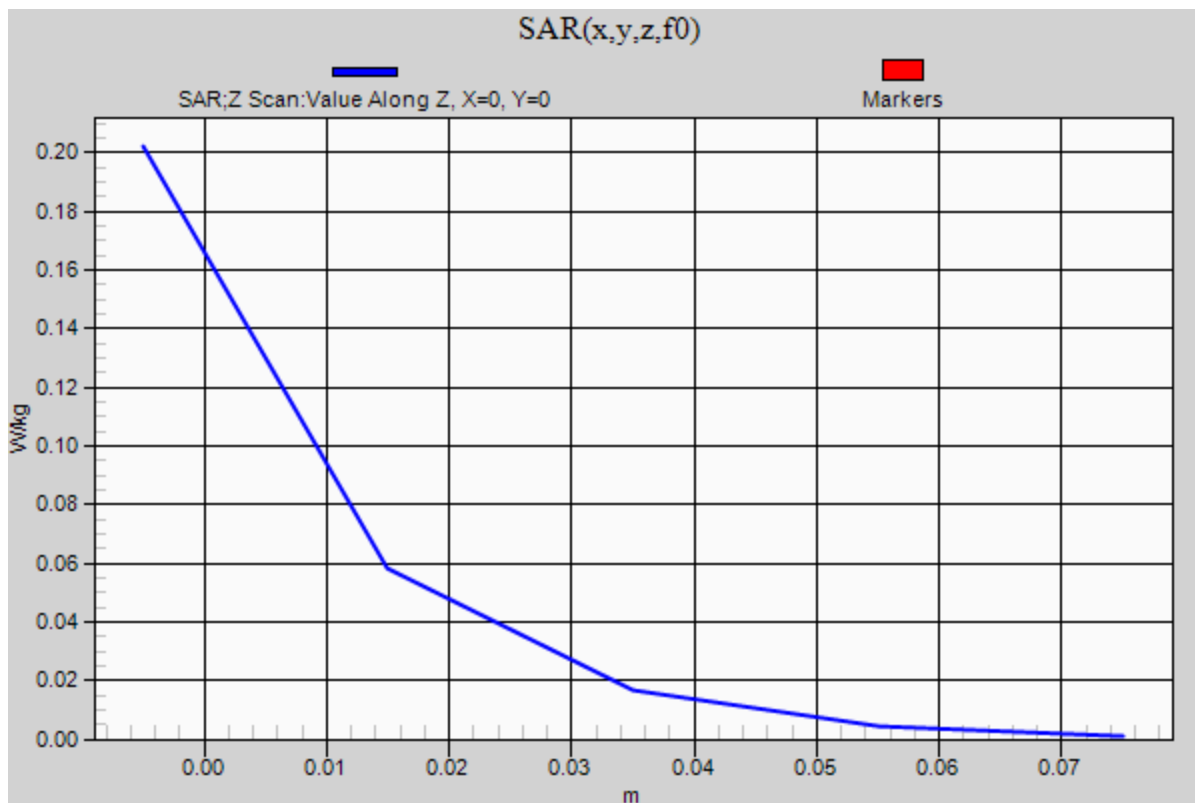
Reference Value = 32.801 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.460 mW/g

SAR(1 g) = 0.987 mW/g; SAR(10 g) = 0.650 mW/g

Maximum value of SAR (measured) = 1.06 W/kg





RF Exposure Lab

Plot 3

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5d116

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL1900; Medium parameters used: $f = 1900$ MHz; $\sigma = 1.59$ mho/m; $\epsilon_r = 52.35$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Test Date: Date: 10/3/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C

Probe: EX3DV4 - SN3693; ConvF(7.13, 7.13, 7.13); Calibrated: 8/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn759; Calibrated: 8/15/2012

Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

1900 MHz Validation/1900 MHz Validation/Area Scan (41x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 4.71 W/kg

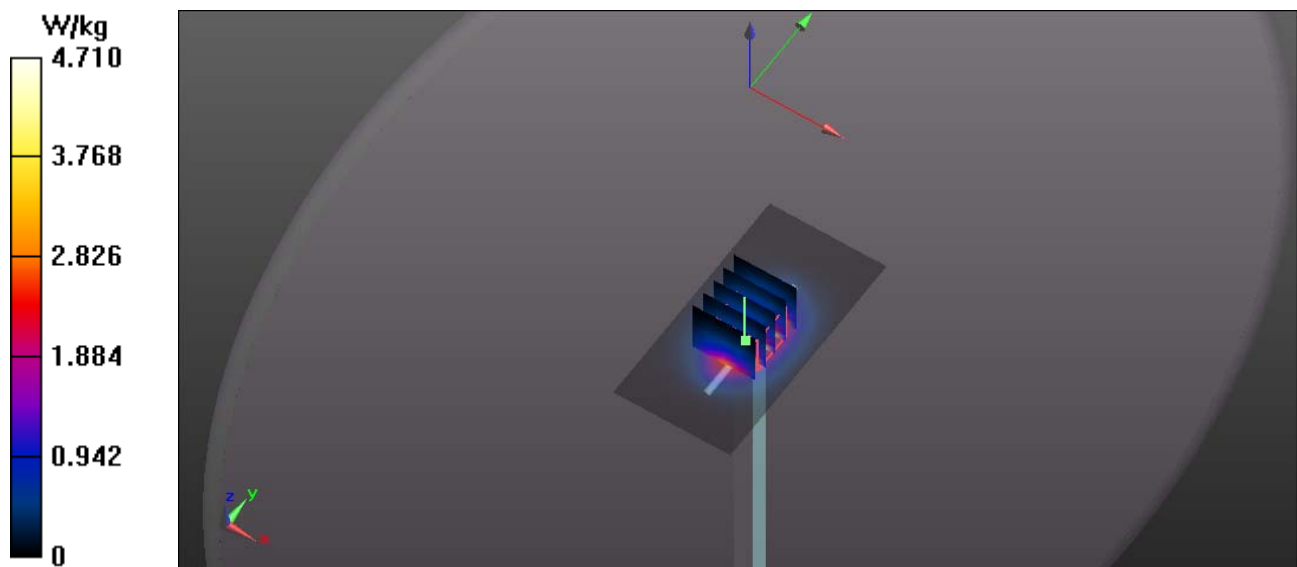
1900 MHz Validation/1900 MHz Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

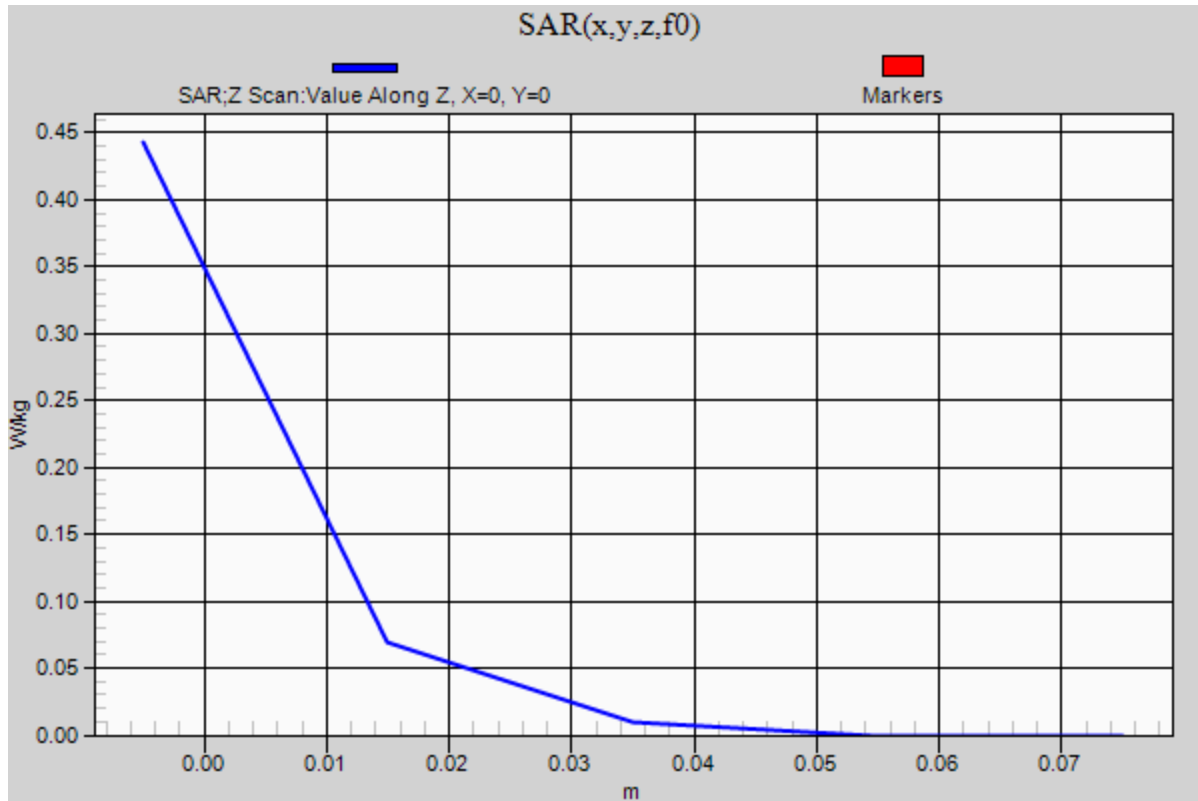
Reference Value = 52.898 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 7.312 mW/g

SAR(1 g) = 4.07 mW/g; SAR(10 g) = 2.15 mW/g

Maximum value of SAR (measured) = 4.47 W/kg





RF Exposure Lab

Plot 4

DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN:1018

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: MSL1750; Medium parameters used: $f = 1750$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 52.68$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Test Date: Date: 10/5/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C

Probe: EX3DV4 - SN3693; ConvF(7.43, 7.43, 7.43); Calibrated: 8/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn759; Calibrated: 8/15/2012

Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

1750 MHz Validation/1750 MHz Validation/Area Scan (41x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 4.53 W/kg

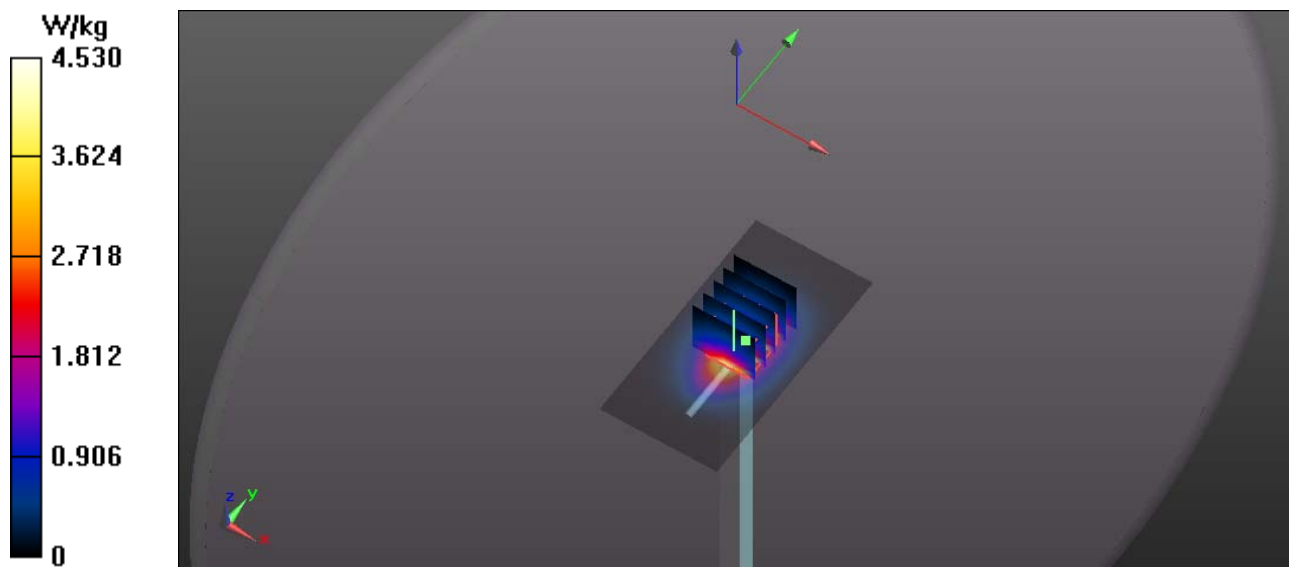
1750 MHz Validation/1750 MHz Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

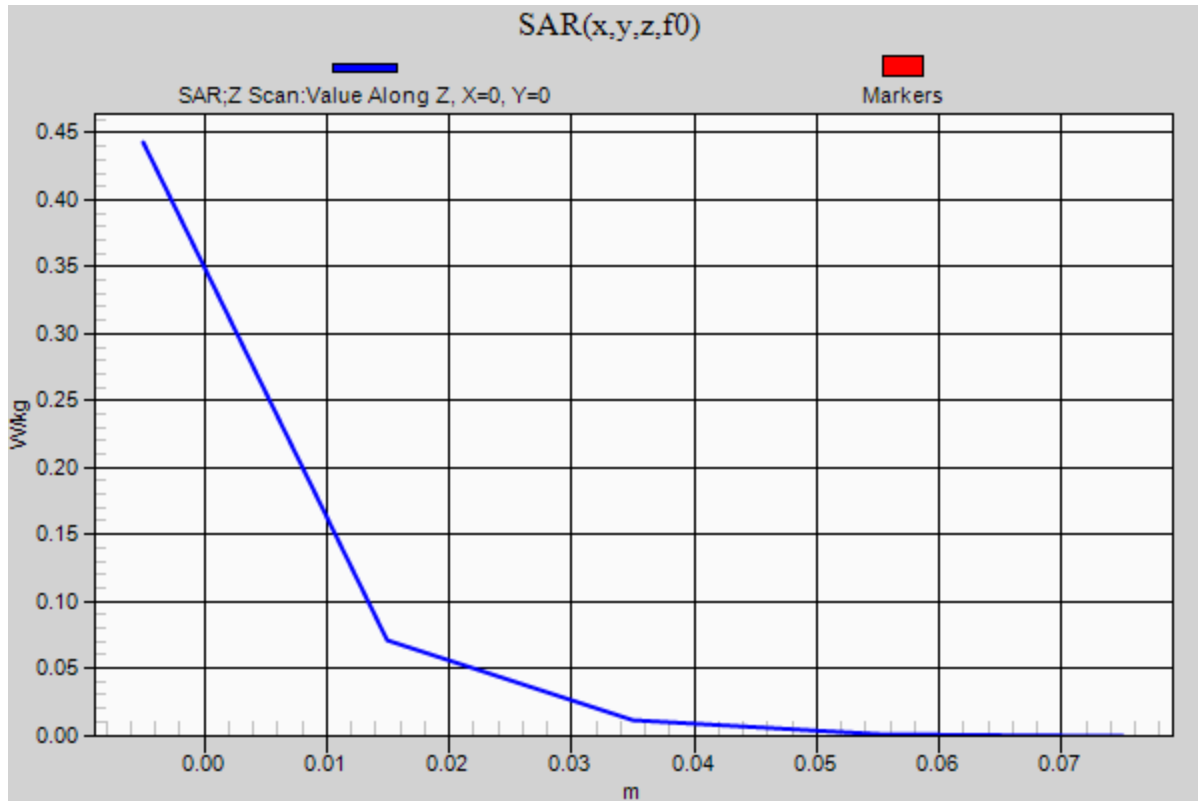
Reference Value = 53.582 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 7.120 mW/g

SAR(1 g) = 3.98 mW/g; SAR(10 g) = 2.12 mW/g

Maximum value of SAR (measured) = 4.33 W/kg





RF Exposure Lab

Plot 5

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:829

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL2450; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.93$ mho/m; $\epsilon_r = 51.68$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Test Date: Date: 10/4/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C

Probe: EX3DV4 - SN3693; ConvF(6.76, 6.76, 6.76); Calibrated: 8/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn759; Calibrated: 8/15/2012

Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

2450 MHz Validation/2450 MHz Validation/Area Scan (41x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 6.03 W/kg

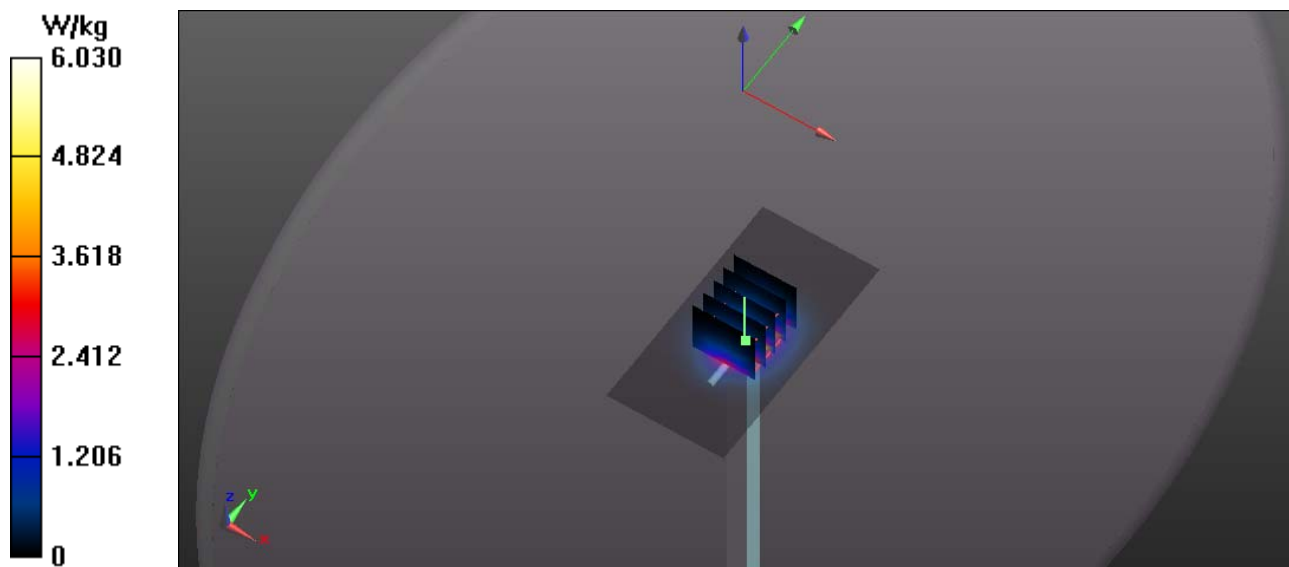
2450 MHz Validation/2450 MHz Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

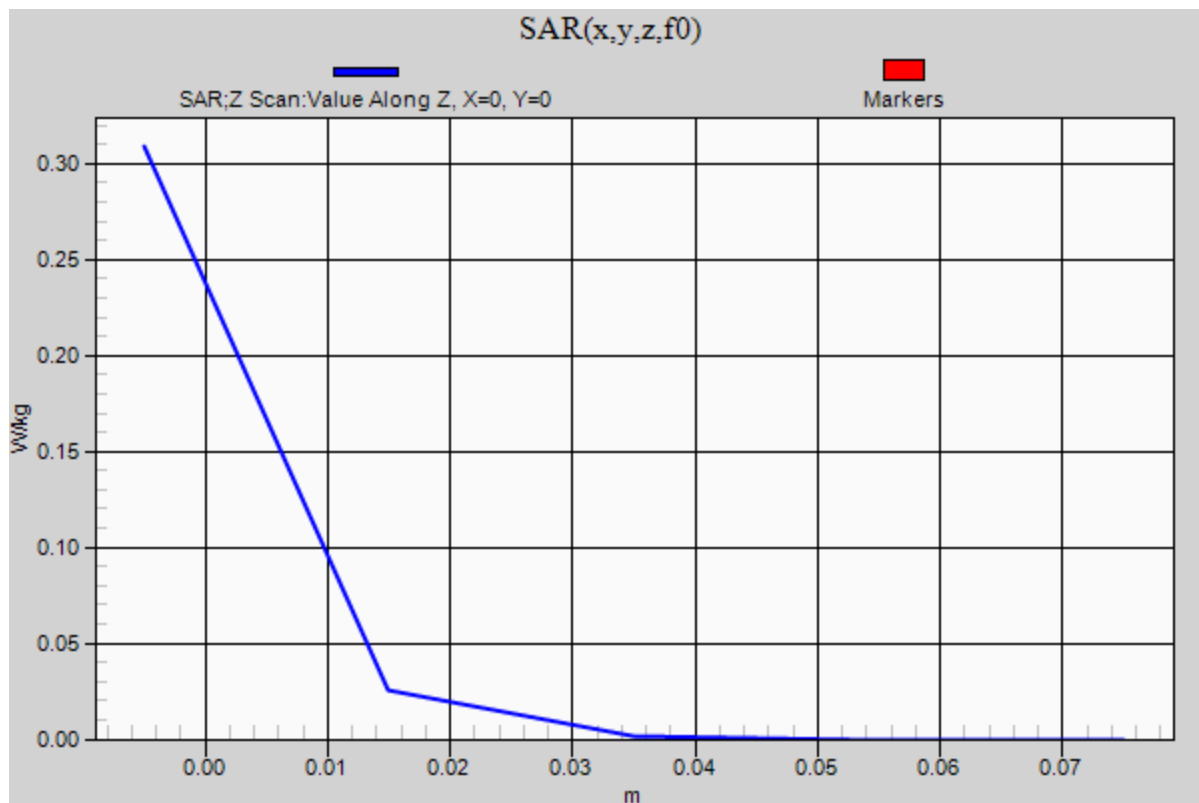
Reference Value = 54.345 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 10.504 mW/g

SAR(1 g) = 5.17 mW/g; SAR(10 g) = 2.39 mW/g

Maximum value of SAR (measured) = 5.90 W/kg





Appendix B – SAR Test Data Plots

RF Exposure Lab

Plot 1

DUT: MiFi5510L; Type: Hotspot; Serial: UB310812700012

Communication System: CDMA2000 (1xEV-DO); Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: MSL900; Medium parameters used (interpolated): $f = 836.52$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 55.902$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Test Date: Date: 10/4/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C
Probe: EX3DV4 - SN3693; ConvF(8.87, 8.87, 8.87); Calibrated: 8/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

Band 5/Side C Mid/Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 1.37 W/kg

Band 5/Side C Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

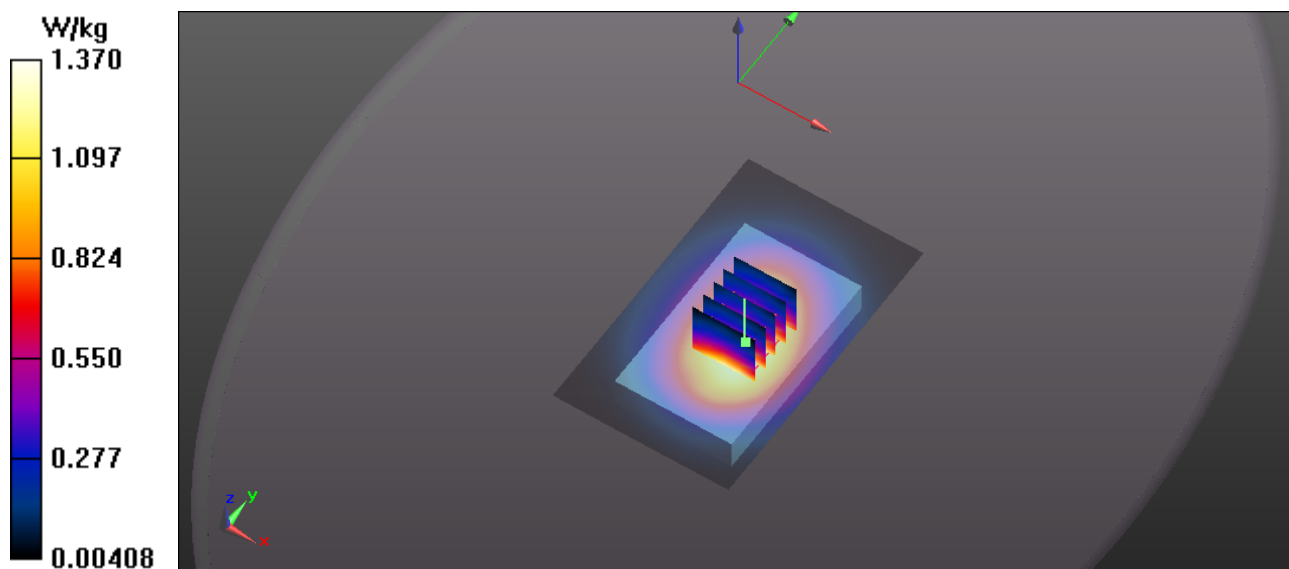
Reference Value = 36.499 V/m; Power Drift = -0.06 dB

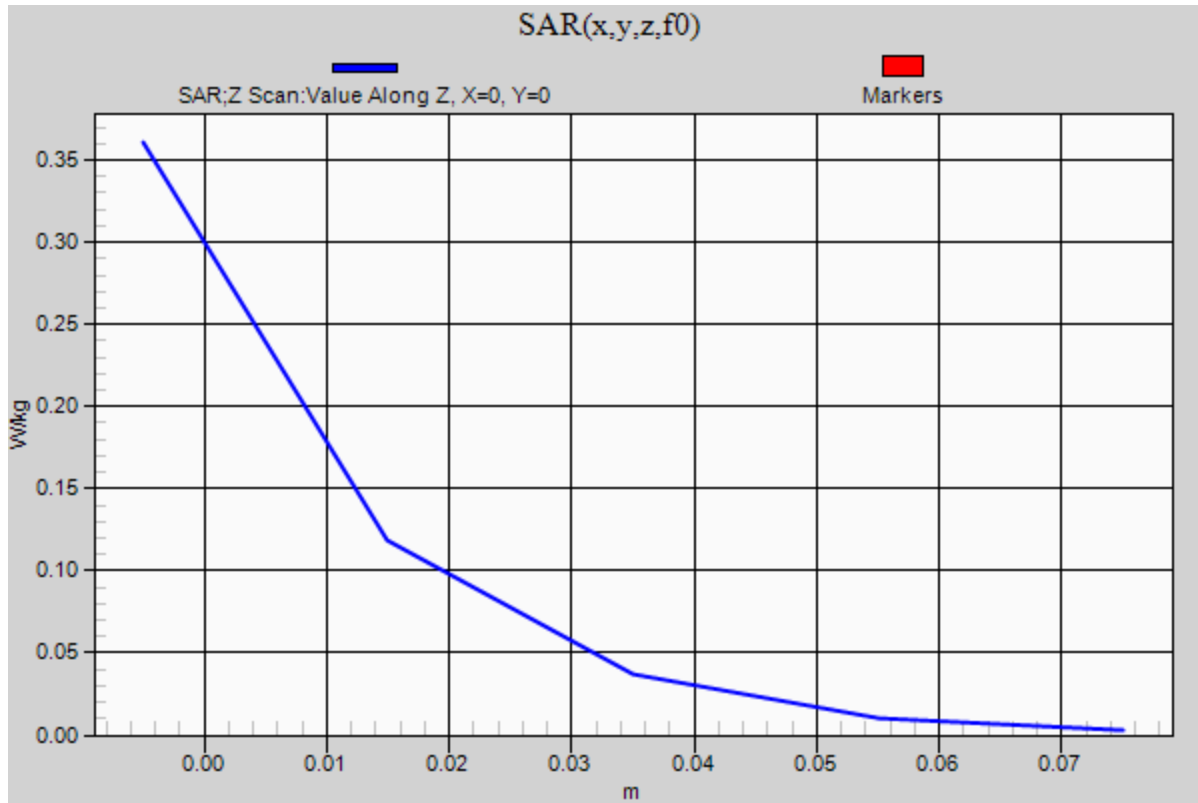
Peak SAR (extrapolated) = 1.707 mW/g

SAR(1 g) = 1.3 mW/g; SAR(10 g) = 0.951 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.37 W/kg





RF Exposure Lab

Plot 2

DUT: MiFi5510L; Type: Hotspot; Serial: UB310812700012

Communication System: CDMA2000 (1xEV-DO); Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used (interpolated): $f = 1908.75$ MHz; $\sigma = 1.59$ mho/m; $\epsilon_r = 52.324$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Test Date: Date: 10/3/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C
Probe: EX3DV4 - SN3693; ConvF(7.13, 7.13, 7.13); Calibrated: 8/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

Band 2/Side E High/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 1.62 W/kg

Band 2/Side E High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

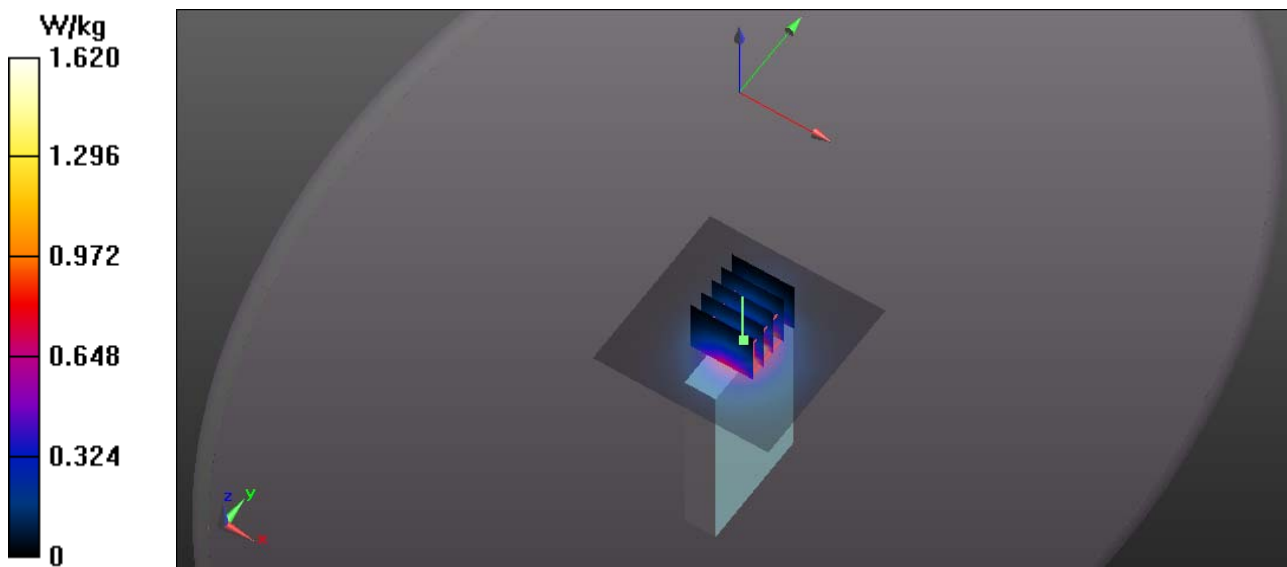
Reference Value = 31.061 V/m; Power Drift = -0.02 dB

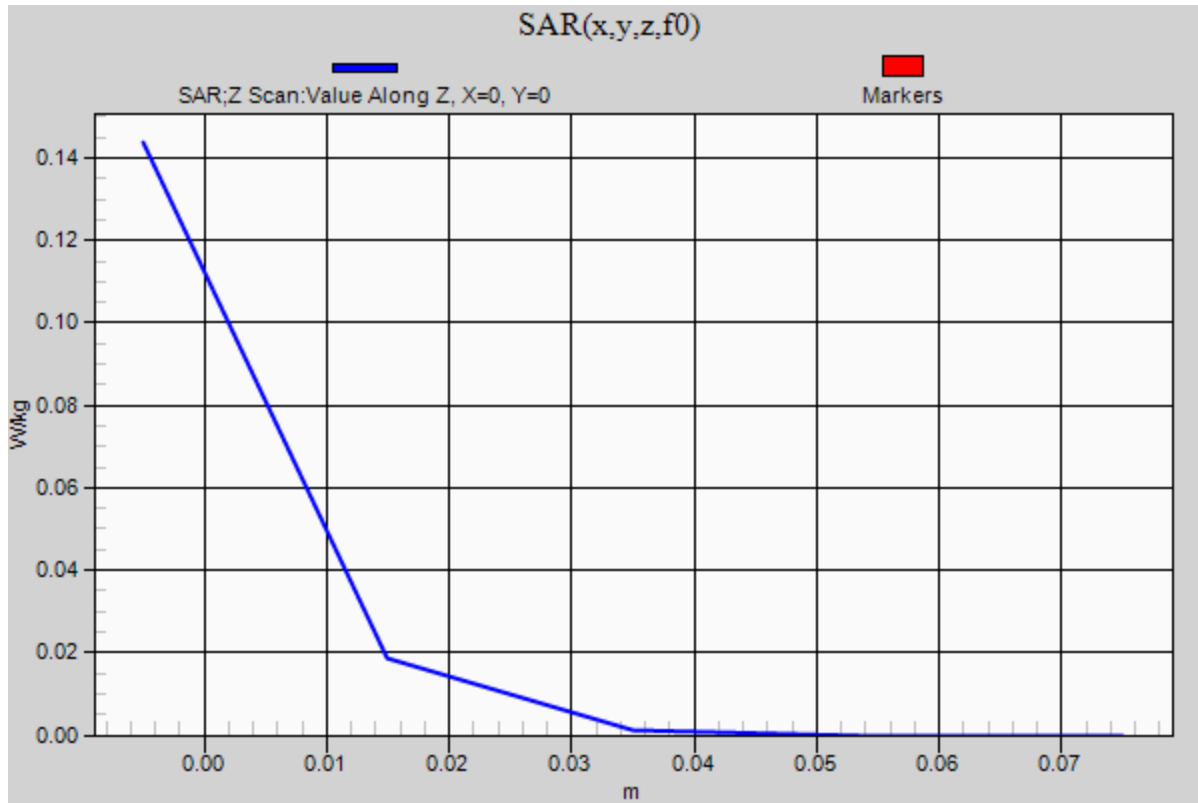
Peak SAR (extrapolated) = 2.420 mW/g

SAR(1 g) = 1.4 mW/g; SAR(10 g) = 0.727 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.58 W/kg





RF Exposure Lab

Plot 3

DUT: MiFi5510L; Type: Hotspot; Serial: UB310812700012

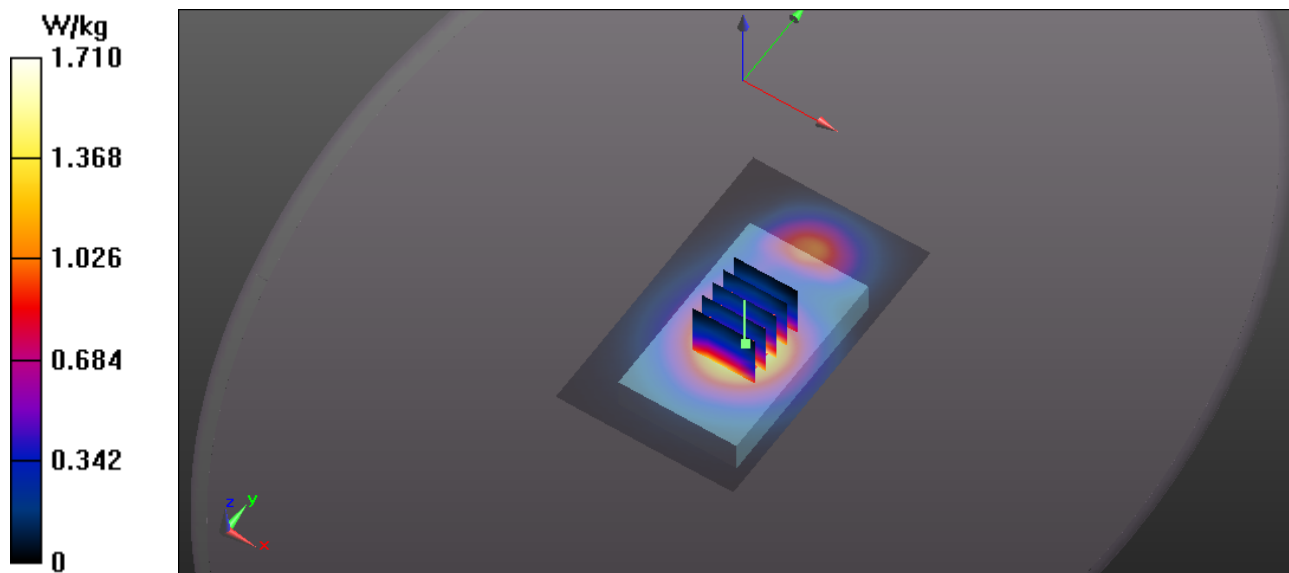
Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1720 MHz; Duty Cycle: 1:1
Medium: MSL1750; Medium parameters used: $f = 1720$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 52.78$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

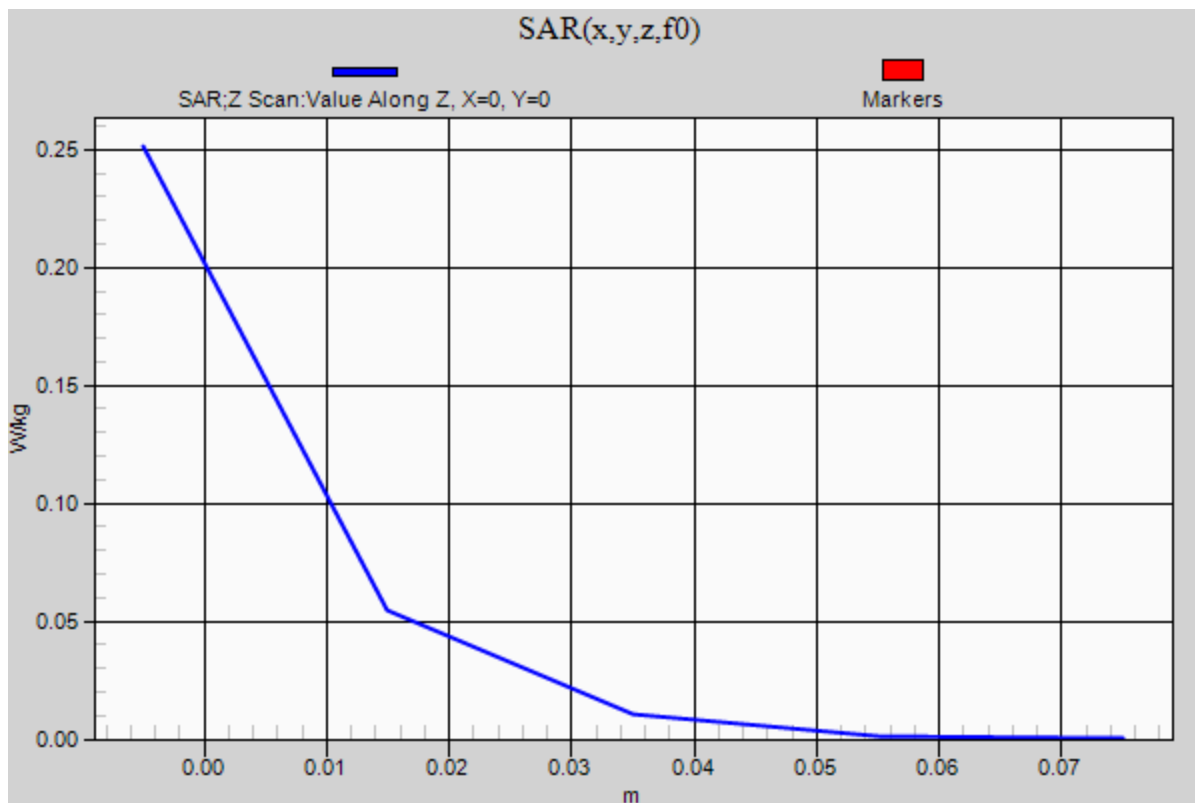
Test Date: Date: 10/5/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C
Probe: EX3DV4 - SN3693; ConvF(7.43, 7.43, 7.43); Calibrated: 8/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

Band 4/Side C QPSK 20 MHz 1 RB Low/Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.71 W/kg

Band 4/Side C QPSK 20 MHz 1 RB Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.884 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.216 mW/g
SAR(1 g) = 1.43 mW/g; SAR(10 g) = 0.909 mW/g
Maximum value of SAR (measured) = 1.53 W/kg





RF Exposure Lab

Plot 4

DUT: MiFi5510L; Type: Hotspot; Serial: UB310812700012

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 782 MHz; Duty Cycle: 1:1
Medium: MSL750; Medium parameters used (interpolated): $f = 782 \text{ MHz}$; $\sigma = 0.926 \text{ mho/m}$; $\epsilon_r = 41.412$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

Test Date: Date: 10/4/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C
Probe: EX3DV4 - SN3693; ConvF(8.99, 8.99, 8.99); Calibrated: 8/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

Band 13/Side C QPSK 10 MHz 1 RB Low/Area Scan (61x101x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.889 W/kg

Band 13/Side C QPSK 10 MHz 1 RB Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

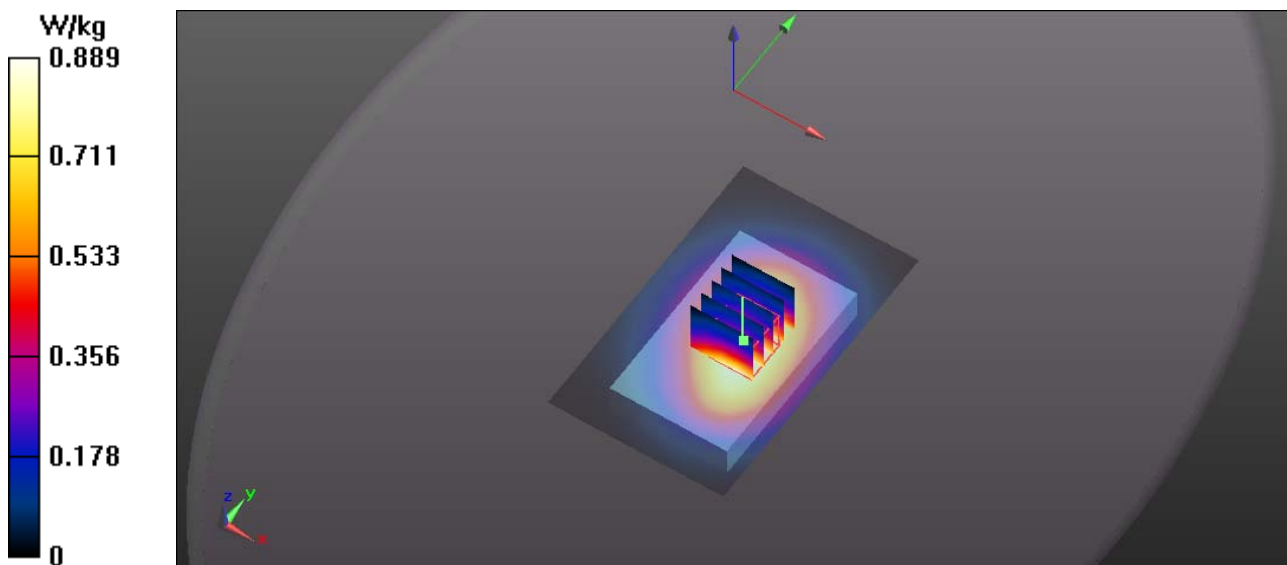
Reference Value = 30.443 V/m; Power Drift = -0.04 dB

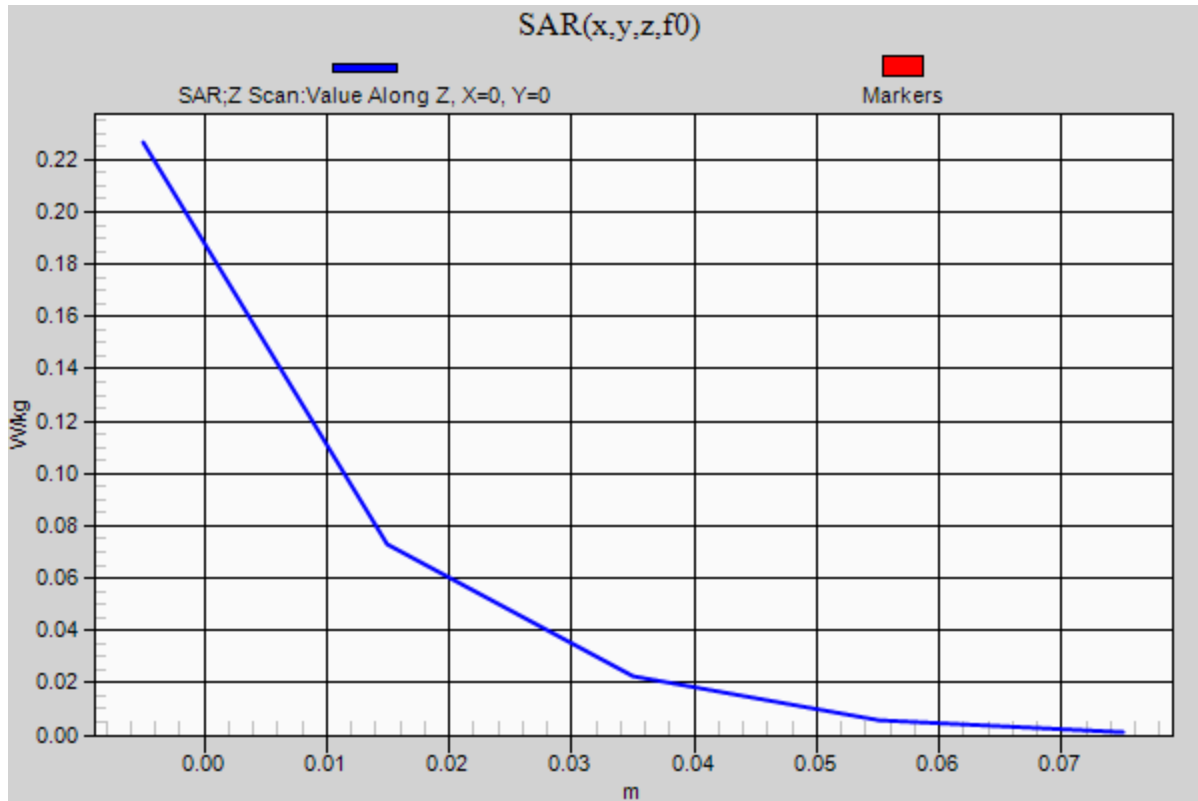
Peak SAR (extrapolated) = 1.084 mW/g

SAR(1 g) = 0.849 mW/g; SAR(10 g) = 0.624 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.884 W/kg





RF Exposure Lab

Plot 5

DUT: MiFi5510L; Type: Hotspot; Serial: UB310812700012

Communication System: WiFi 802.11b (DSSS, 1 Mbps); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: MSL2450; Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.914$ mho/m; $\epsilon_r = 51.712$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Test Date: Date: 10/4/2012; Ambient Temp: Meas. Ambient Temp(celsius)- 23° C; Tissue Temp: Tissue Temp(celsius)- 21° C
Probe: EX3DV4 - SN3693; ConvF(6.76, 6.76, 6.76); Calibrated: 8/20/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Procedure Notes:

WiFi/Side D Mid/Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.242 W/kg

WiFi/Side D Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

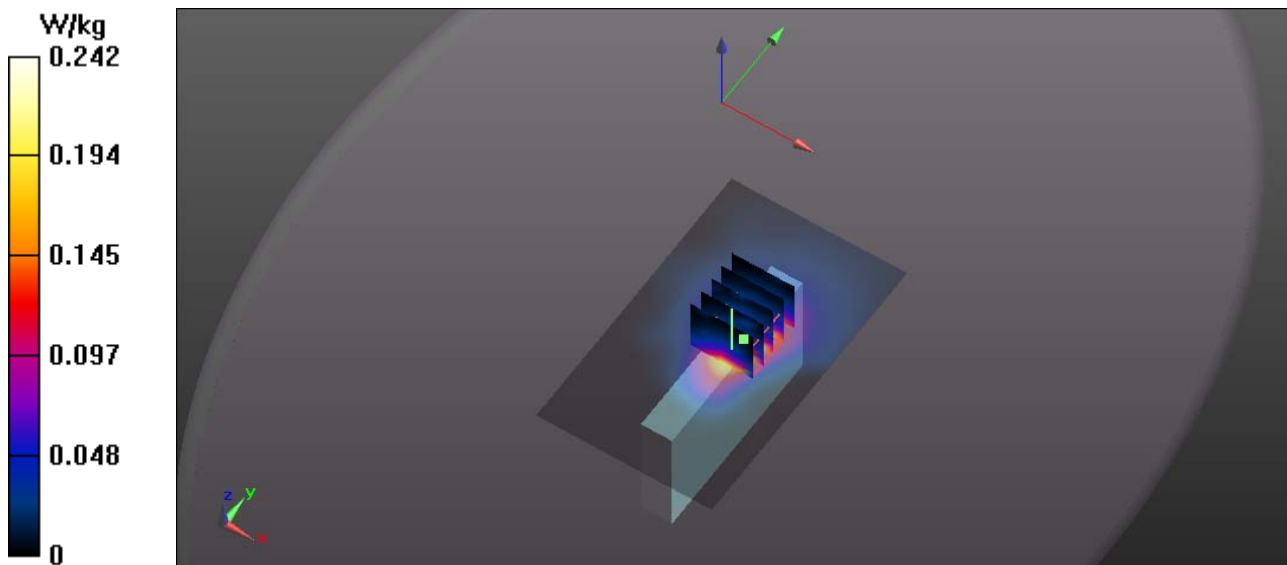
Reference Value = 9.247 V/m; Power Drift = 0.02 dB

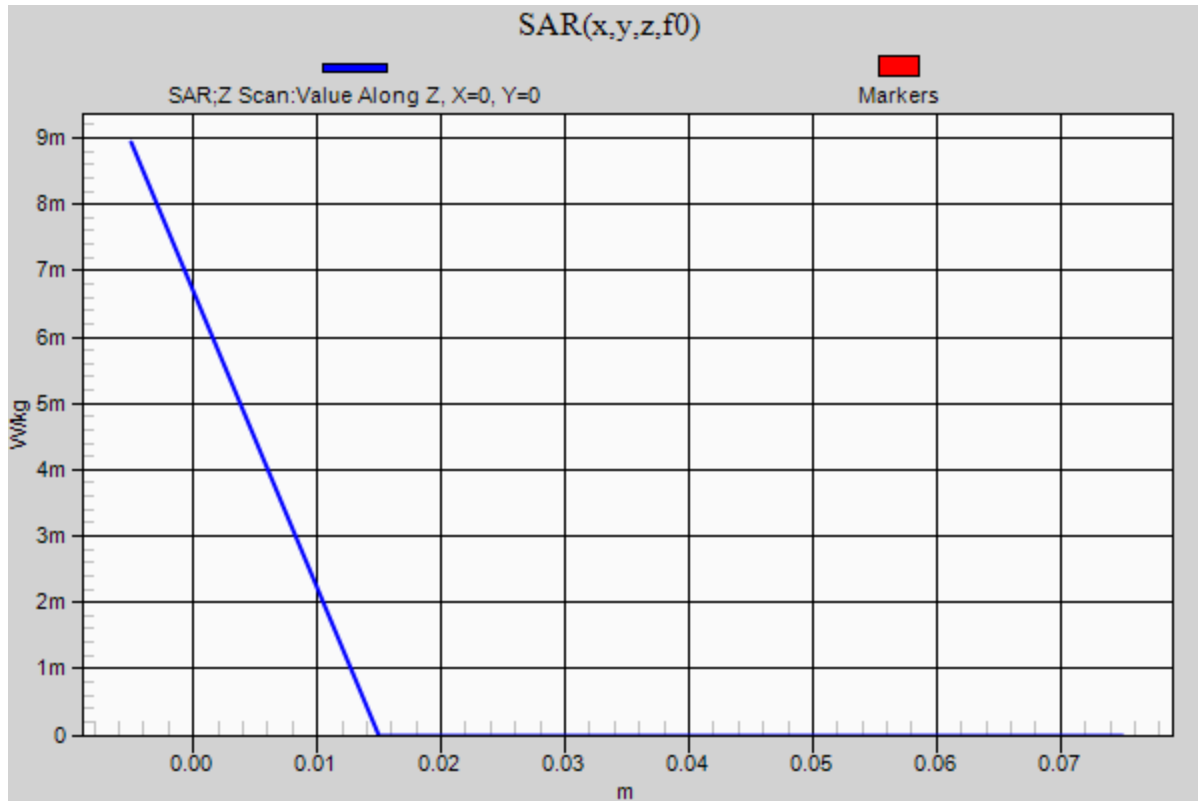
Peak SAR (extrapolated) = 0.392 mW/g

SAR(1 g) = 0.212 mW/g; SAR(10 g) = 0.110 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.243 W/kg





Appendix D – Probe Calibration Data Sheets



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

Client **RF Exposure Lab**

Certificate No: **EX3-3693_Aug12**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3693**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4**
Calibration procedure for dosimetric E-field probes

Calibration date: **August 20, 2012**

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: August 20, 2012			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- 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
- 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:

- NORM_{x,y,z}:** Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 NORM_{x,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 EX3DV4

SN:3693

Manufactured: April 22, 2009
Calibrated: August 20, 2012

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.49	0.48	0.46	$\pm 10.1 \%$
DCP (mV) ^B	98.3	100.5	98.2	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^E (k=2)
0	CW	0.00	X	0.00	0.00	1.00	161.4	$\pm 3.0 \%$
			Y	0.00	0.00	1.00	154.4	
			Z	0.00	0.00	1.00	158.9	

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: EX3DV4 - SN:3693

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)
750	41.9	0.89	8.99	8.99	8.99	0.23	1.20	± 12.0 %
835	41.5	0.90	8.55	8.55	8.55	0.18	1.56	± 12.0 %
1750	40.1	1.37	8.00	8.00	8.00	0.51	0.76	± 12.0 %
1900	40.0	1.40	7.67	7.67	7.67	0.75	0.63	± 12.0 %
2450	39.2	1.80	6.72	6.72	6.72	0.29	1.09	± 12.0 %
2550	39.1	1.91	6.55	6.55	6.55	0.39	0.93	± 12.0 %
5200	36.0	4.66	4.97	4.97	4.97	0.30	1.80	± 13.1 %
5300	35.9	4.76	4.78	4.78	4.78	0.30	1.80	± 13.1 %
5600	35.5	5.07	4.22	4.22	4.22	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.34	4.34	4.34	0.40	1.80	± 13.1 %

^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: EX3DV4 - SN:3693

Calibration Parameter Determined in Body Tissue Simulating Media

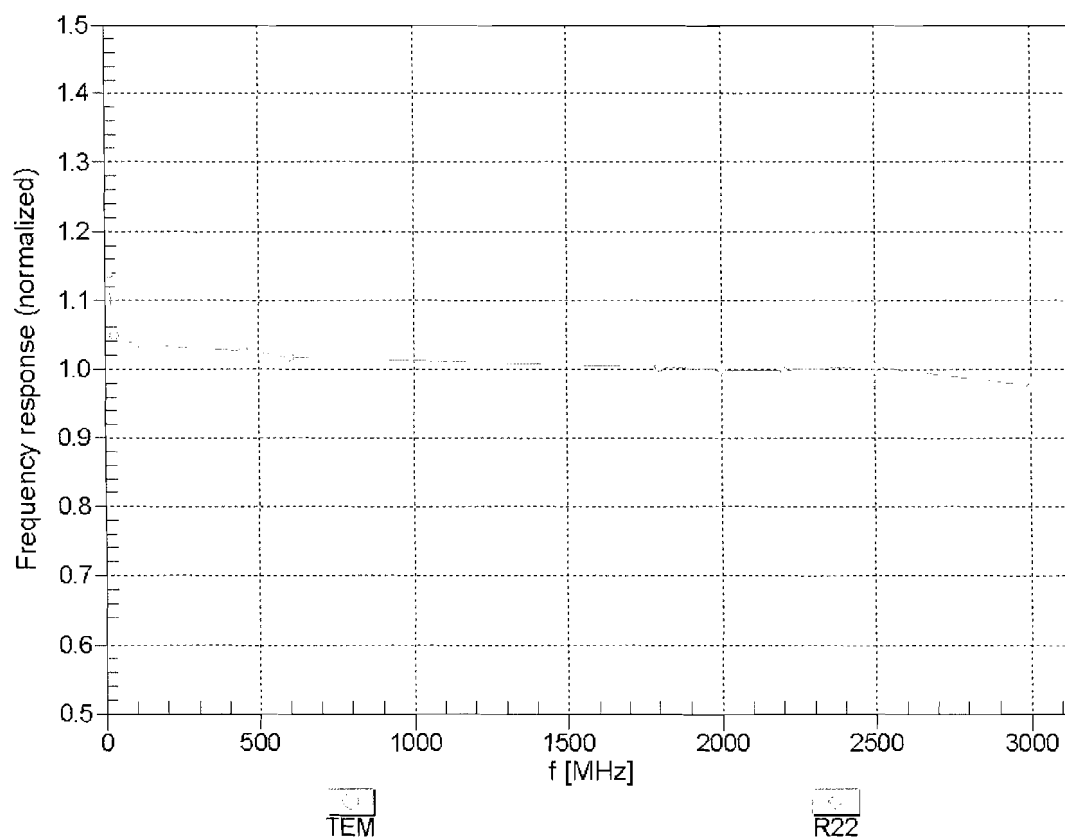
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	8.84	8.84	8.84	0.29	1.09	± 12.0 %
835	55.2	0.97	8.87	8.87	8.87	0.60	0.71	± 12.0 %
1750	53.4	1.49	7.43	7.43	7.43	0.41	0.85	± 12.0 %
1900	53.3	1.52	7.13	7.13	7.13	0.41	0.82	± 12.0 %
2450	52.7	1.95	6.76	6.76	6.76	0.80	0.50	± 12.0 %
2550	52.6	2.09	6.75	6.75	6.75	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.31	4.31	4.31	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.24	4.24	4.24	0.40	1.90	± 13.1 %
5600	48.5	5.77	3.76	3.76	3.76	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.08	4.08	4.08	0.50	1.90	± 13.1 %

^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.

Frequency Response of E-Field

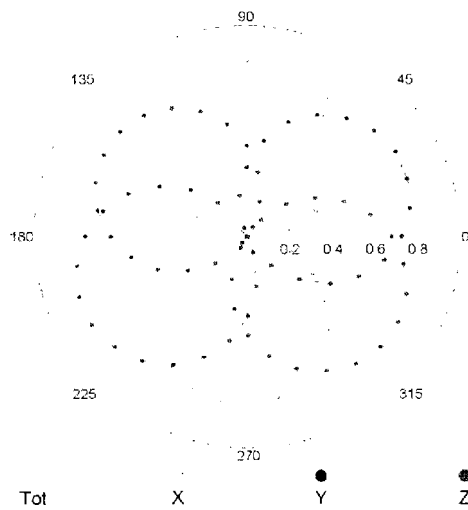
(TEM-Cell: ifi110 EXX, Waveguide: R22)



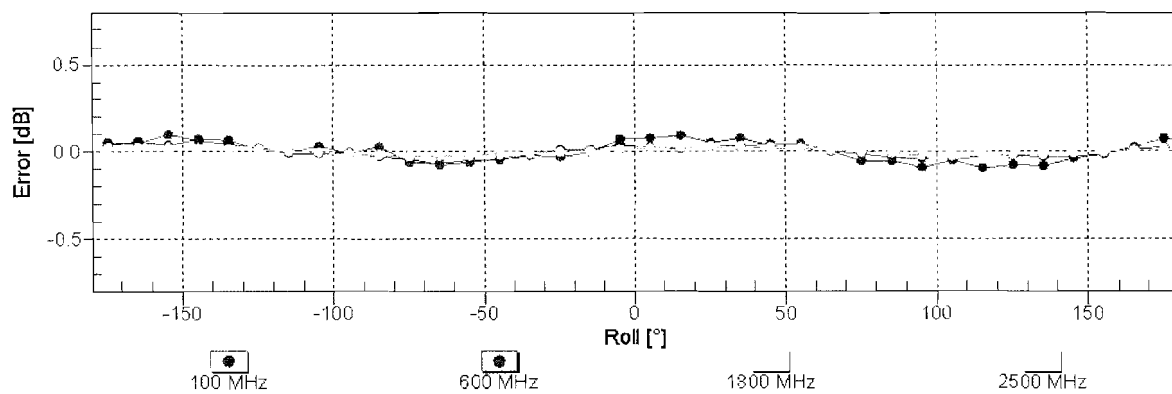
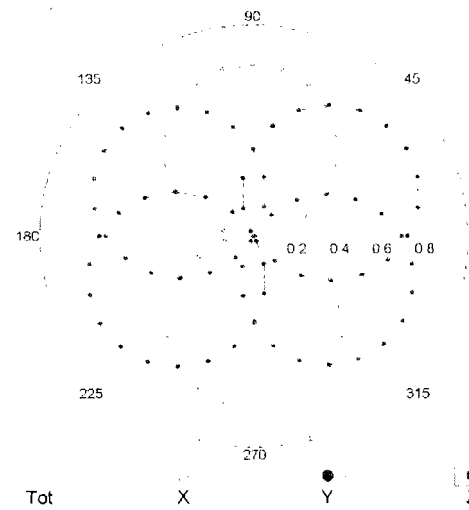
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM



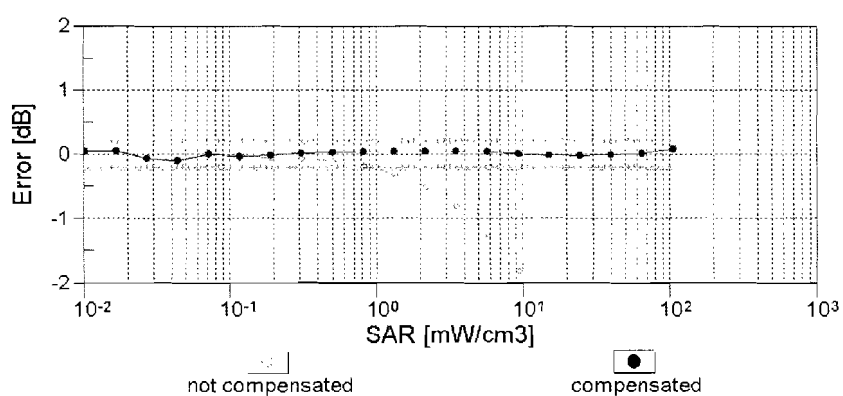
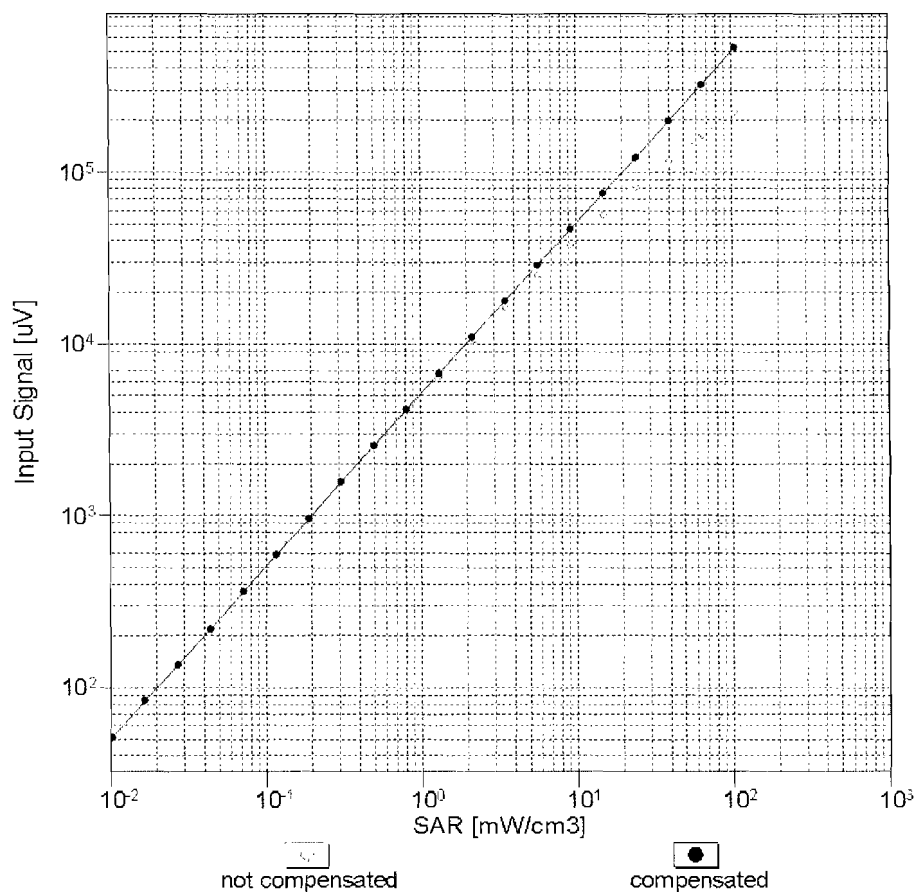
f=1800 MHz,R22



Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

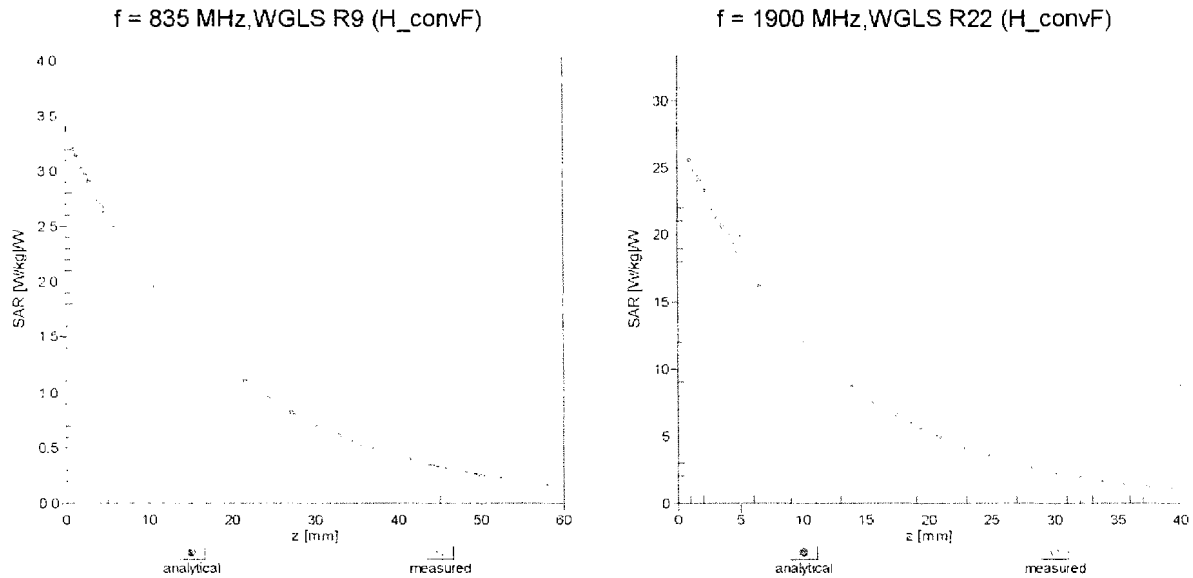
Dynamic Range f(SAR_{head})

(TEM cell , f = 900 MHz)



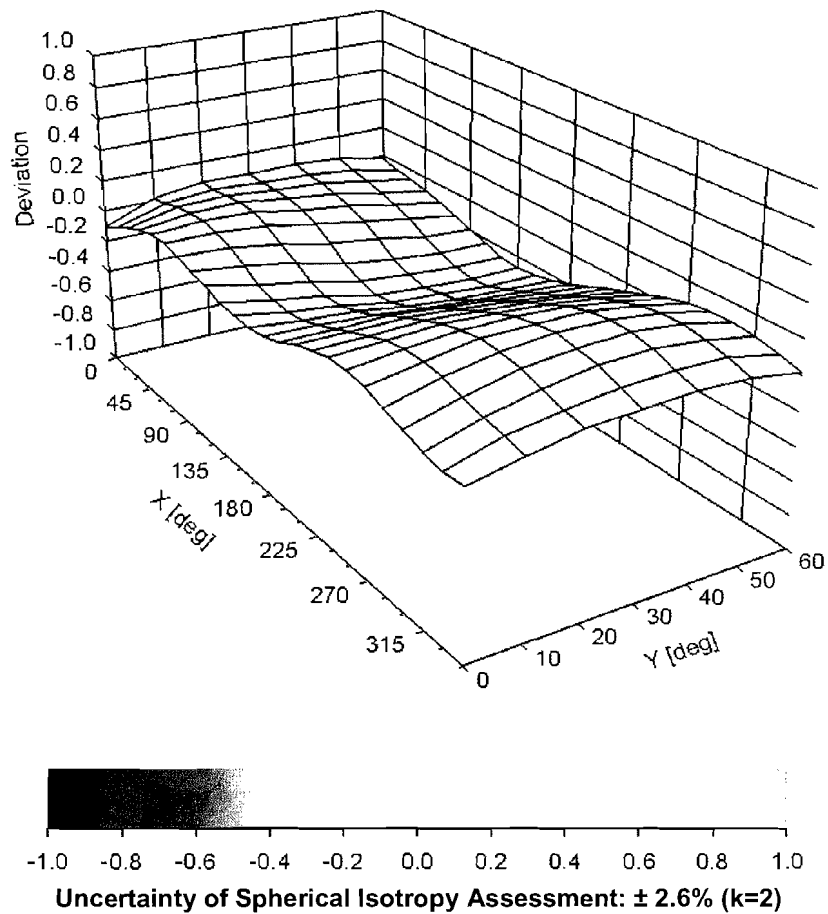
Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	155.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

Appendix E – Dipole Calibration Data Sheets



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 RF Exposure Lab

Certificate No: D750V3-1016_Nov10/2

CALIBRATION CERTIFICATE (Replacement of No:D750V3-1016_Nov10)

Object D750V3 - SN: 1016

Calibration procedure(s) QA CAL-05.v7
Calibration procedure for dipole validation kits

Calibration date: November 02, 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 EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: June 12, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	42.6 $\pm$ 6 %	0.92 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.5 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.12 mW / g
SAR normalized	normalized to 1W	8.48 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	8.29 mW /g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 mW / g
SAR normalized	normalized to 1W	5.52 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	5.42 mW /g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	56.0 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.20 mW / g
SAR normalized	normalized to 1W	8.80 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	8.82 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.46 mW / g
SAR normalized	normalized to 1W	5.84 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	5.85 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5 Ω - 0.3 j Ω
Return Loss	- 29.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.7 Ω - 2.3 j Ω
Return Loss	- 31.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.041 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 22, 2010

See Page 9 for Calibration Extension Data.

DASY5 Validation Report for Head TSL

Date/Time: 02.11.2010 12:14:13

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1016

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: HSL750

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.91 \text{ mho/m}$; $\epsilon_r = 42.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.37, 6.37, 6.37); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250mW; dip=15mm; dist=3.0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

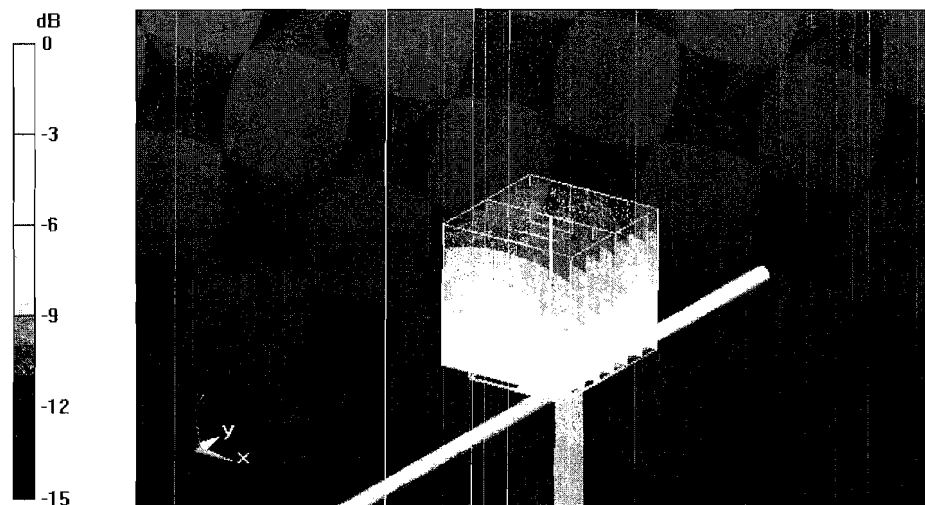
$dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.6 V/m; Power Drift = -0.00884 dB

Peak SAR (extrapolated) = 3.22 W/kg

SAR(1 g) = 2.12 mW/g; SAR(10 g) = 1.38 mW/g

Maximum value of SAR (measured) = 2.49 mW/g

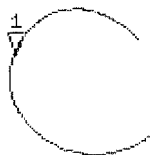


0 dB = 2.49mW/g

Impedance Measurement Plot for Head TSL

2 Nov 2010 14:07:16
[CH1] S11 1 U FS 1: 53.527 Ω -27.344 m Ω 7.7607 nF 750.000 000 MHz

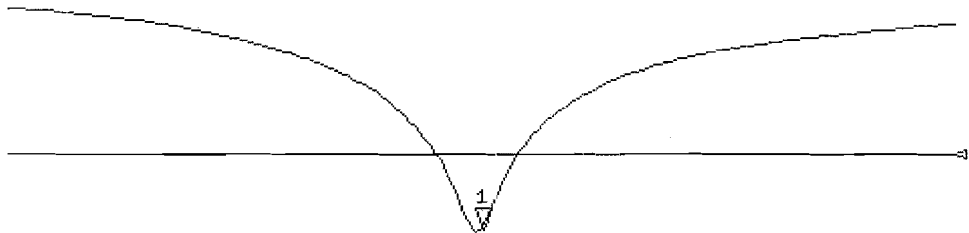
*
Del
Cor



Avg
16
↑

CH2 S11 LOG 5 dB/REF -20 dB 1:-29.345 dB 750.000 000 MHz

Cor
Avg
16
↑



START 550.000 000 MHz STOP 950.000 000 MHz

DASY5 Validation Report for Body TSL

Date/Time: 02.11.2010 14:24:58

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1016

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: MSL750

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.96 \text{ mho/m}$; $\epsilon_r = 56$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.08, 6.08, 6.08); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250mW; dip=15mm; dist=3.0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

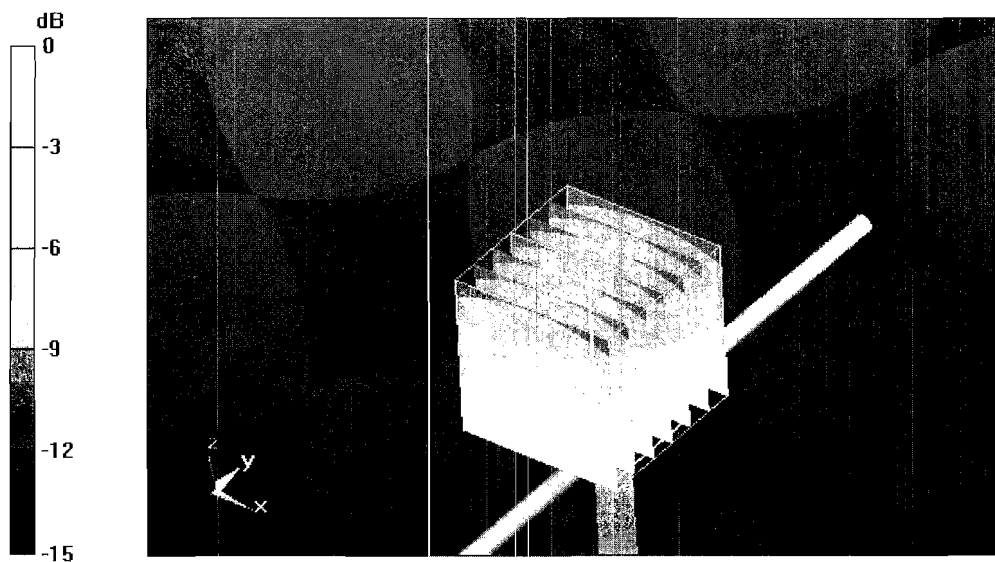
$dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.5 V/m; Power Drift = -0.00866 dB

Peak SAR (extrapolated) = 3.23 W/kg

SAR(1 g) = 2.2 mW/g; SAR(10 g) = 1.46 mW/g

Maximum value of SAR (measured) = 2.57 mW/g



0 dB = 2.57mW/g

Impedance Measurement Plot for Body TSL

2 Nov 2010 16:13:11
 CH1 S11 1 U FS 1: 48.713 Ω -2.2938 Ω 92.547 pF 750.000 000 MHz

*

Del

Cor

Avg
15

↑

CH2 S11 LOG 5 dB/REF -20 dB 1:-31.498 dB 750.000 000 MHz

Cor

Avg
15

↑

START 550.000 000 MHz

STOP 950.000 000 MHz

Extended Calibration

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824:

D750V3 SN: 1016 - Head				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/2/2010	-29.3		53.5	
6/13/2012	-28.9	-1.4	53.9	0.4

D750V3 SN: 1016 - Body				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/2/2010	-31.5		48.7	
6/13/2012	-30.7	-2.5	48.2	-0.5



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Accreditation No.: **SCS 108**

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 Multilateral Agreement for the recognition of calibration certificates

Client **RF Exposure Lab**

Certificate No: **D835V2-4d089_Nov10/2**

CALIBRATION CERTIFICATE (Replacement of No:D835V2-4d089_Nov10)

Object **D835V2 - SN: 4d089**

Calibration procedure(s) **QA CAL-05.v7**
Calibration procedure for dipole validation kits

Calibration date: **November 09, 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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Dimce Iliev** Name: **Dimce Iliev** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature

Issued: June 12, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- 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
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.5 $\pm$ 6 %	0.89 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.8 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 mW / g
SAR normalized	normalized to 1W	9.48 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.56 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 mW / g
SAR normalized	normalized to 1W	6.20 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.24 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.2 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.52 mW / g
SAR normalized	normalized to 1W	10.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.89 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.65 mW / g
SAR normalized	normalized to 1W	6.60 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.51 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.3 Ω - 4.4 j Ω
Return Loss	- 26.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 Ω - 5.9 j Ω
Return Loss	- 23.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 17, 2008

See Page 9 for Calibration Extension Data.

DASY5 Validation Report for Head TSL

Date/Time: 08.11.2010 10:51:31

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d089

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 41.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

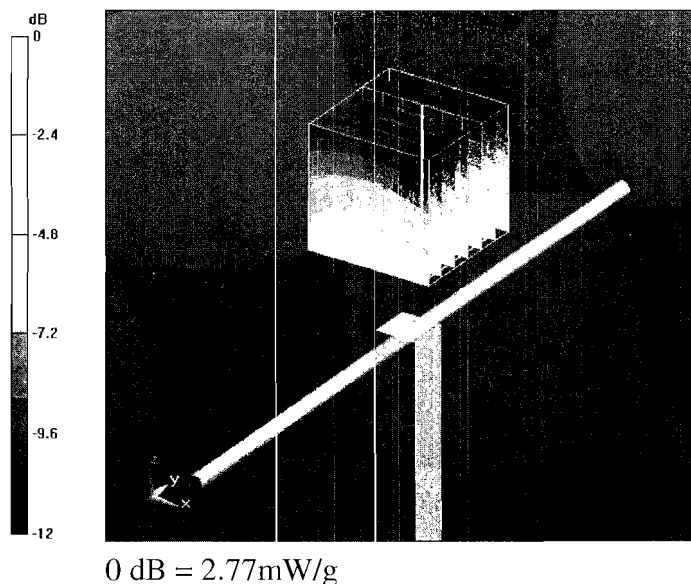
Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.3 V/m; Power Drift = 0.026 dB

Peak SAR (extrapolated) = 3.56 W/kg

SAR(1 g) = 2.37 mW/g; SAR(10 g) = 1.55 mW/g

Maximum value of SAR (measured) = 2.77 mW/g



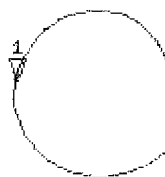
Impedance Measurement Plot for Head TSL

8 Nov 2010 14:48:26
CH1 S11 1 U FS 1: 51.346 Ω -4.3613 Ω 43.703 pF 835.000 000 MHz

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De1

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Avg
15

↑

CH2 S11 LOG 5 dB/REF -20 dB 1: -26.941 dB 835.000 000 MHz

Cor

Avg
15

↑

START 835.000 000 MHz

STOP 1 100.000 000 MHz

DASY5 Validation Report for Body

Date/Time: 09.11.2010 10:47:16

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d089

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.99 \text{ mho/m}$; $\epsilon_r = 54.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

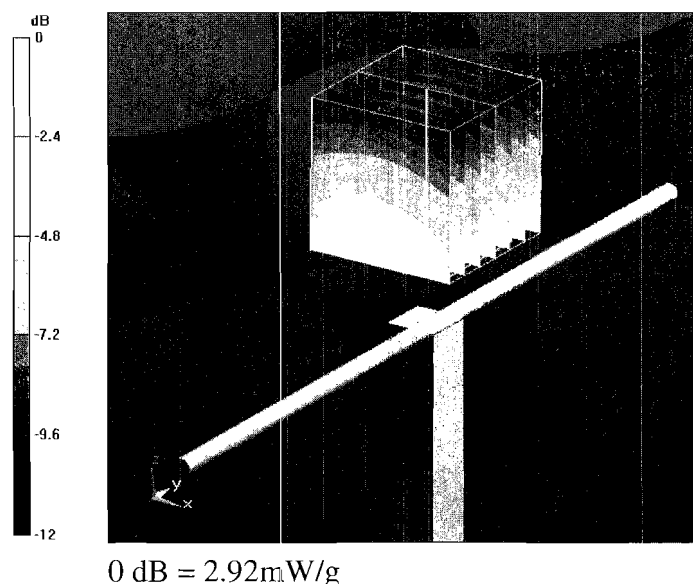
Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56 V/m; Power Drift = 0.024 dB

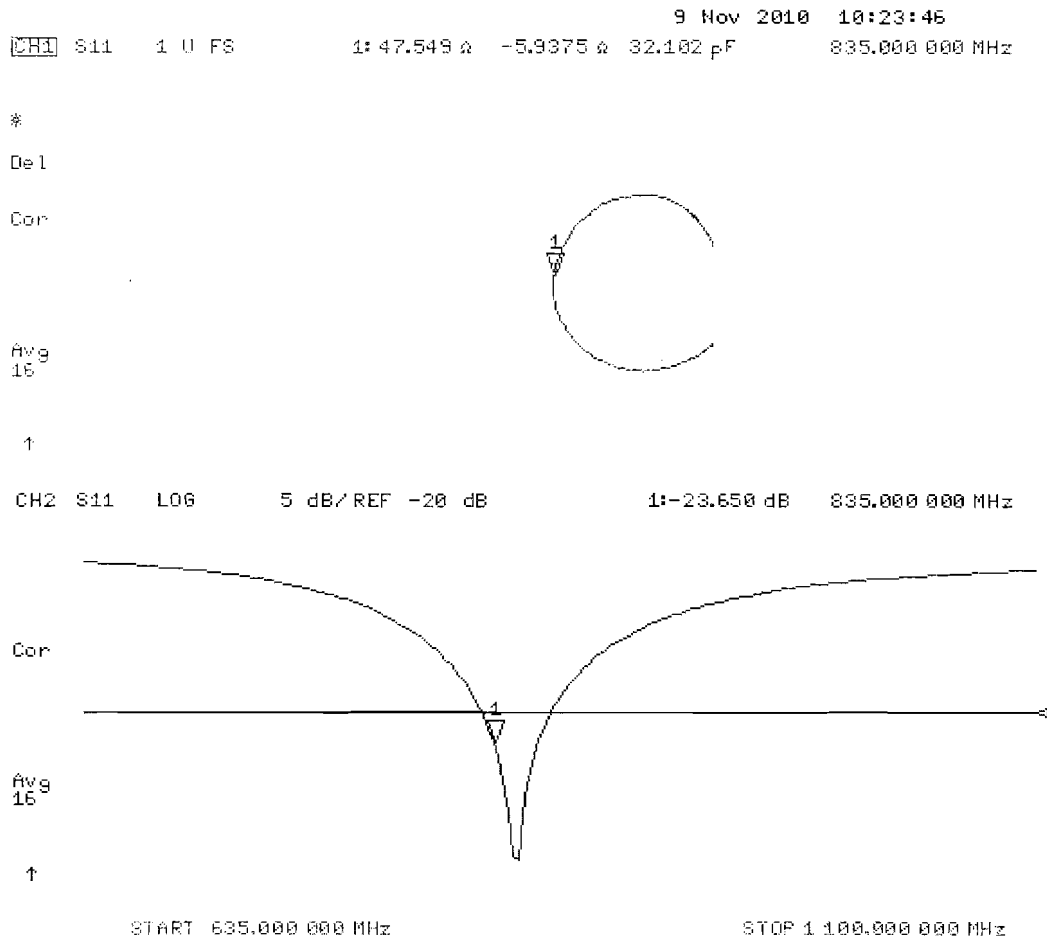
Peak SAR (extrapolated) = 3.72 W/kg

SAR(1 g) = 2.52 mW/g; SAR(10 g) = 1.65 mW/g

Maximum value of SAR (measured) = 2.92 mW/g



Impedance Measurement Plot for Body TSL



Extended Calibration

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824:

D835V2 SN: 4d089 - Head				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/9/2010	-26.9		51.3	
6/13/2012	-27.9	3.7	52.4	1.1

D835V2 SN: 4d089 - Body				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/9/2010	-23.6		47.5	
6/13/2012	-24.6	4.2	49.1	1.6



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Accreditation No.: **SCS 108**

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Client **RF Exposure Lab**

Certificate No: **D1750V2-1018_Nov10/2**

CALIBRATION CERTIFICATE (Replacement of No:D1750V2-1018_Nov10)

Object **D1750V2 - SN: 1018**

Calibration procedure(s) **QA CAL-05.v6**
Calibration procedure for dipole validation kits

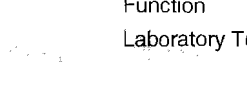
Calibration date: **November 12, 2010**

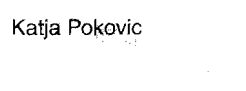
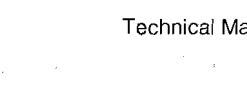
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

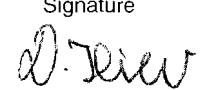
All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Dimce Iliev**  **Dimce Iliev**  **Function**
Laboratory Technician

Approved by: **Katja Pokovic**  **Katja Pokovic**  **Technical Manager**

Signature



Issued: June 12, 2012

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- 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
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.4 $\pm$ 6 %	1.32 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.13 mW / g
SAR normalized	normalized to 1W	36.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	37.2 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.85 mW / g
SAR normalized	normalized to 1W	19.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	19.6 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.43 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	condition	
SAR measured	250 mW input power	9.20 mW / g
SAR normalized	normalized to 1W	36.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	37.6 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.95 mW / g
SAR normalized	normalized to 1W	19.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.0 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$50.5\ \Omega + 0.7\ j\Omega$
Return Loss	- 41.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$46.3\ \Omega + 1.6\ j\Omega$
Return Loss	- 27.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.221 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 11, 2009

See Page 9 for Calibration Extension Data.

DASY5 Validation Report for Head

Date/Time: 10.11.2010 12:45:01

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1018

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.32$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.25, 5.25, 5.25); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

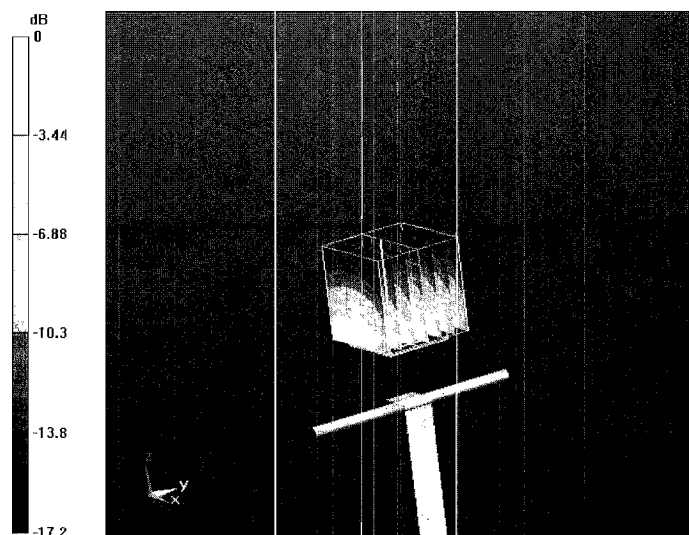
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.8 V/m; Power Drift = 0.052 dB

Peak SAR (extrapolated) = 16.4 W/kg

SAR(1 g) = 9.13 mW/g; SAR(10 g) = 4.85 mW/g

Maximum value of SAR (measured) = 11.3 mW/g



0 dB = 11.3mW/g

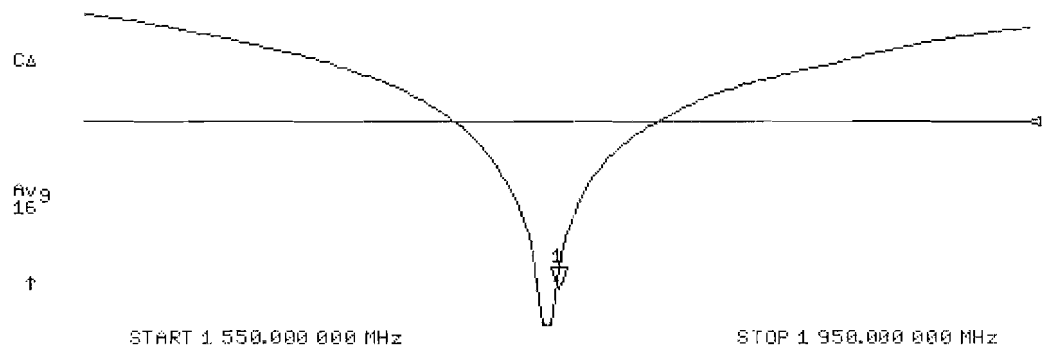
Impedance Measurement Plot for Head TSL

10 Nov 2010 11:35:16
[CH1] S11 1 U FS 1: 50.520 Ω 0.7266 Ω 66.078 μ H 1 750.000 000 MHz

*
Del



↑
CH2 S11 LOG 5 dB/REF -20 dB 1: -40.981 dB 1 750.000 000 MHz



DASY5 Validation Report for Body TSL

Date/Time: 12.11.2010 13:27:27

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1018

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 52.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.8, 4.8, 4.8); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

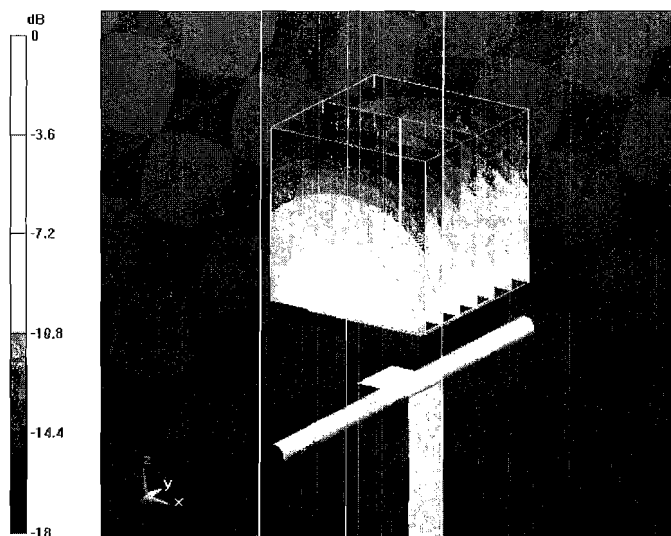
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.3 V/m; Power Drift = -0.020 dB

Peak SAR (extrapolated) = 15.9 W/kg

SAR(1 g) = 9.2 mW/g; SAR(10 g) = 4.95 mW/g

Maximum value of SAR (measured) = 11.5 mW/g



0 dB = 11.5mW/g

Impedance Measurement Plot for Body TSL

12 Nov 2010 10:27:59
 [REF] S11 1 U F8 2: 46.348 Ω 1.5879 Ω 144.41 μ H 1 750.000 000 MHz

*

De1

CA

Avg
15

↑

CH2 S11 LOG 5 dB/REF -20 dB 2: -27.676 dB 1 750.000 000 MHz

CA

Avg
16

↑

START 1 550.000 000 MHz

STOP 1 950.000 000 MHz

Extended Calibration

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824:

D1750V2 SN: 1018 - Head				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/12/2010	-41.0		50.5	
6/13/2012	-37.5	-8.5	53.2	2.7

D1750V2 SN: 1018 - Body				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/12/2010	-27.7		46.3	
6/13/2012	-28.4	2.5	47.6	1.3



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Client **RF Exposure Lab**

Certificate No: **D1900V2-5d116_Nov10/2**

CALIBRATION CERTIFICATE (Replacement of No:D1900V2-5d116_Nov10)

Object **D1900V2 - SN: 5d116**

Calibration procedure(s) **QA CAL-05.v7**
Calibration procedure for dipole validation kits

Calibration date: **November 12, 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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Dimce Iliev** **Dimce Iliev** **Dimce Iliev**
Name Function Laboratory Technician

Approved by: **Katja Pokovic** **Katja Pokovic** **Katja Pokovic**
Name Function Technical Manager

Signature
D. Iliev
K. Pokovic

Issued: June 12, 2012

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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
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- 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
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.3 $\pm$ 6 %	1.40 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR normalized	normalized to 1W	40.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.2 mW /g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.25 mW / g
SAR normalized	normalized to 1W	21.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.9 mW /g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.8 ± 6 %	1.52 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.99 mW / g
SAR normalized	normalized to 1W	40.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	39.9 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.26 mW / g
SAR normalized	normalized to 1W	21.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.0 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$51.7\ \Omega + 6.9\ j\Omega$
Return Loss	- 23.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$46.6\ \Omega + 7.2\ j\Omega$
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 21, 2009

See Page 9 for Calibration Extension Data.

DASY5 Validation Report for Head TSL

Date/Time: 10.11.2010 16:13:01

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d116

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 39.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

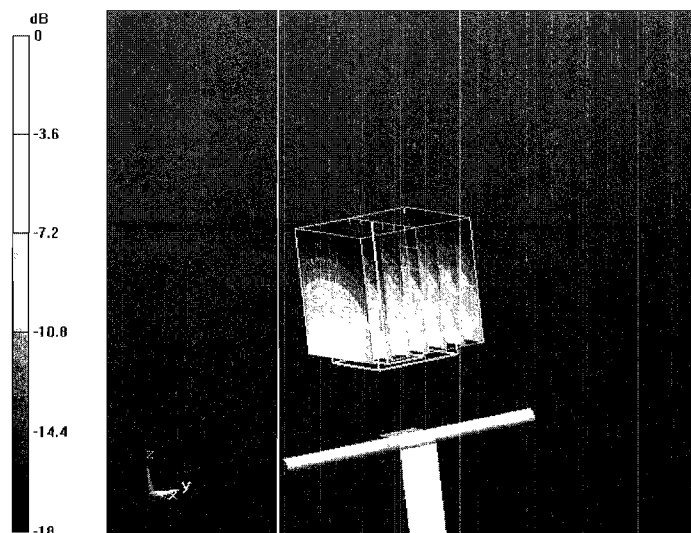
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.5 V/m; Power Drift = 0.071 dB

Peak SAR (extrapolated) = 18.5 W/kg

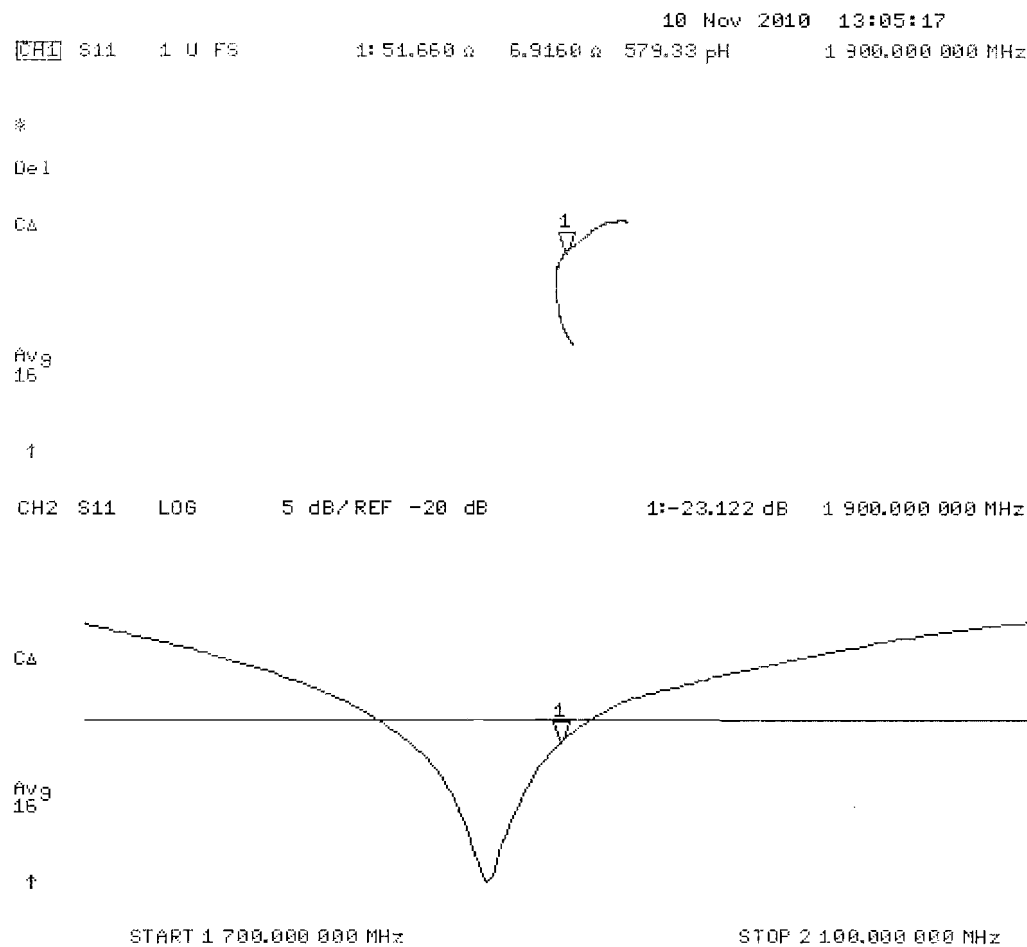
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.25 mW/g

Maximum value of SAR (measured) = 12.6 mW/g



0 dB = 12.6mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body

Date/Time: 12.11.2010 15:58:32

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d116

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 52.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

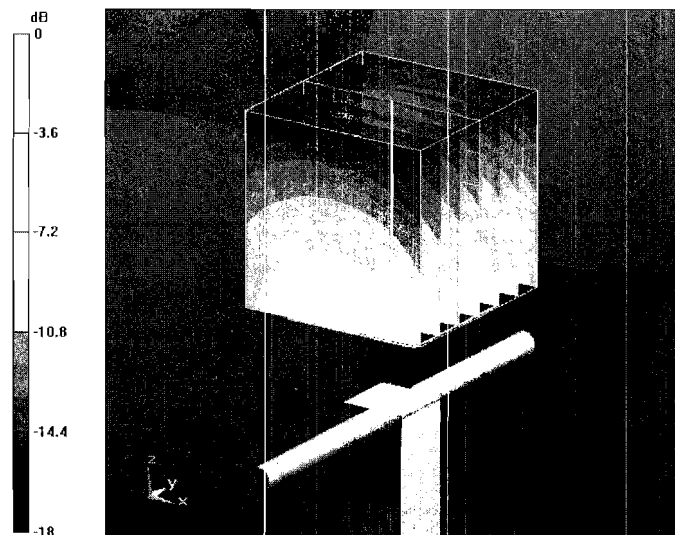
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.7 V/m; Power Drift = -0.020 dB

Peak SAR (extrapolated) = 17.1 W/kg

SAR(1 g) = 9.99 mW/g; SAR(10 g) = 5.26 mW/g

Maximum value of SAR (measured) = 12.6 mW/g



0 dB = 12.6mW/g

Impedance Measurement Plot for Body TSL

12 Nov 2010 10:38:43
 CH1 S11 1 U FS 4: 46.572 Ω 7.1953 Ω 502.72 pH 1 900.000 000 MHz

*

Del

CA

Avg
16



CH2 S11 LOG 5 dB/REF -20 dB 4: -21.690 dB 1 900.000 000 MHz

CA

Avg
16



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz

Extended Calibration

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824:

D1900V2 SN: 5d116 - Head				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/12/2010	-23.1		51.7	
6/14/2012	-24.9	7.8	53.2	1.5

D1900V2 SN: 5d116 - Body				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/12/2010	-21.7		46.6	
6/14/2012	-22.4	3.2	47.3	0.7



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Accreditation No.: **SCS 108**

Client **RF Exposure Lab**

Certificate No: **D2450V2-829_Nov10/2**

CALIBRATION CERTIFICATE (Replacement of No:D2450V2-829_Nov10)

Object **D2450V2 - SN: 829**

Calibration procedure(s) **QA CAL-05.v7**
Calibration procedure for dipole validation kits

Calibration date: **November 11, 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.

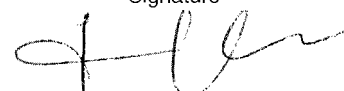
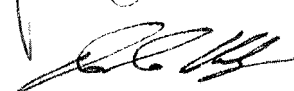
All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Jeton Kastrati**  **Laboratory Technician**

Approved by: **Katja Pokovic**  **Technical Manager**

Signature 


Issued: June 12, 2012

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- 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
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.8 $\pm$ 6 %	1.72 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.5 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	53.8 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.15 mW / g
SAR normalized	normalized to 1W	24.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.7 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	1.92 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.5 mW / g
SAR normalized	normalized to 1W	50.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	50.3 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.79 mW / g
SAR normalized	normalized to 1W	23.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	23.2 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.8 Ω + 2.8 j Ω
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.4 Ω + 5.2 j Ω
Return Loss	- 25.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 11, 2008

See Page 9 for Calibration Extension Data.

DASY5 Validation Report for Head TSL

Date/Time: 11.11.2010 11:45:20

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:829

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.72$ mho/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

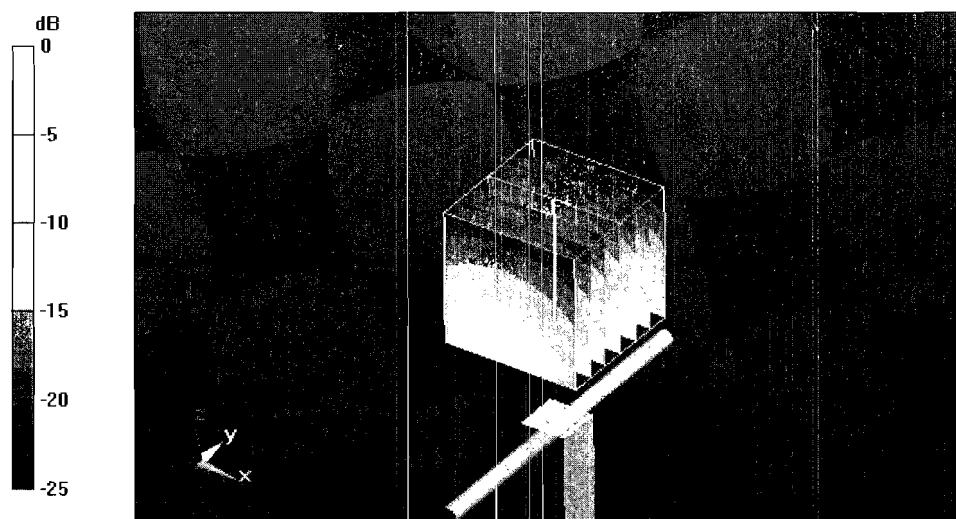
Pin=250 mW/d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.9 V/m; Power Drift = 0.036 dB

Peak SAR (extrapolated) = 26.9 W/kg

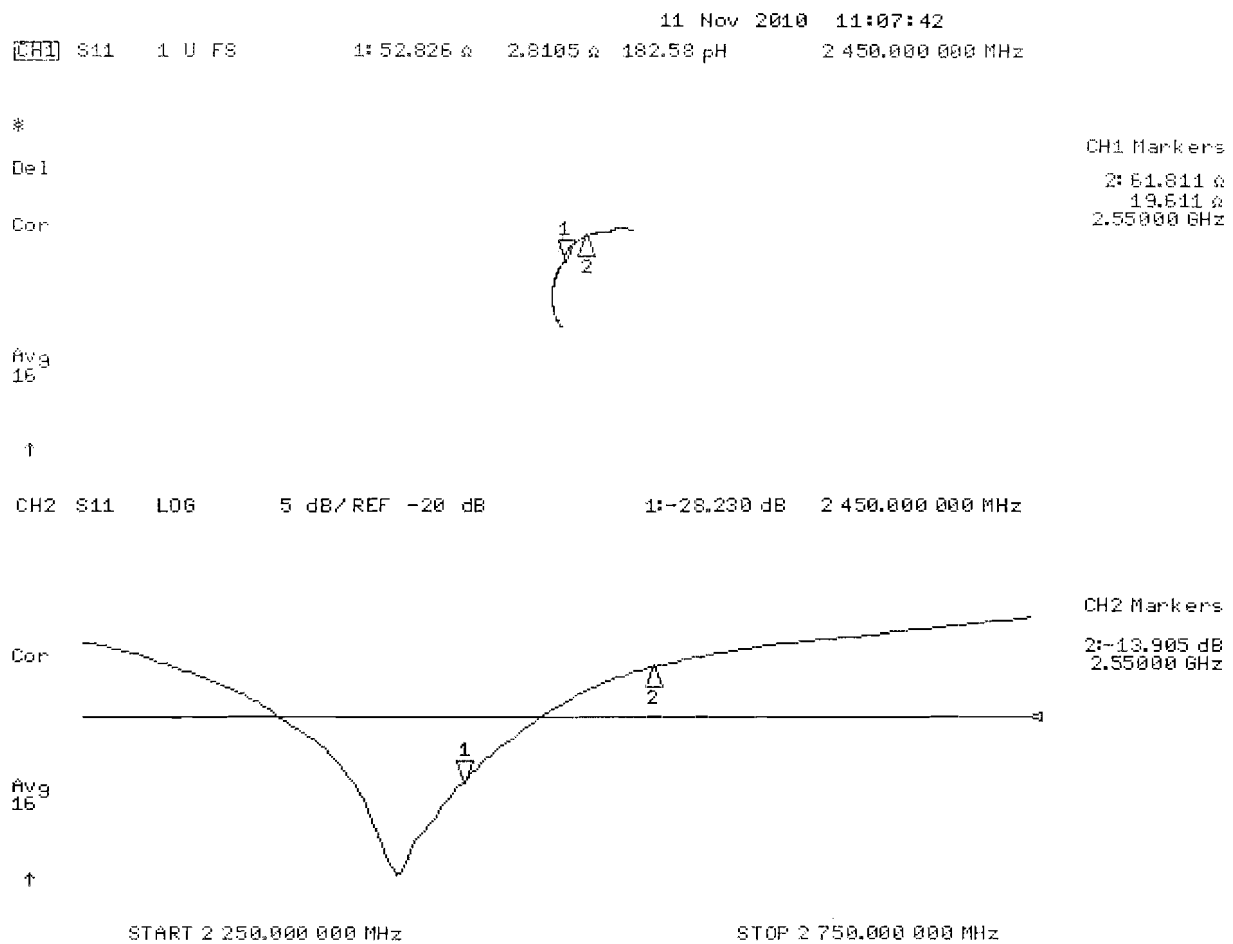
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.15 mW/g

Maximum value of SAR (measured) = 16.9 mW/g



0 dB = 16.9mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body

Date/Time: 11.11.2010 13:58:40

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:829

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.92$ mho/m; $\epsilon_r = 52.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

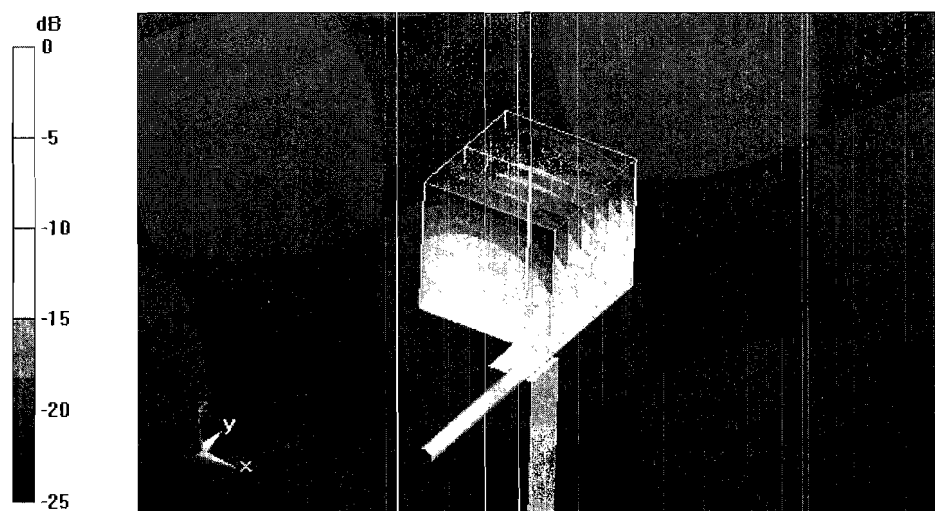
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.5 V/m; Power Drift = 0.012 dB

Peak SAR (extrapolated) = 26.2 W/kg

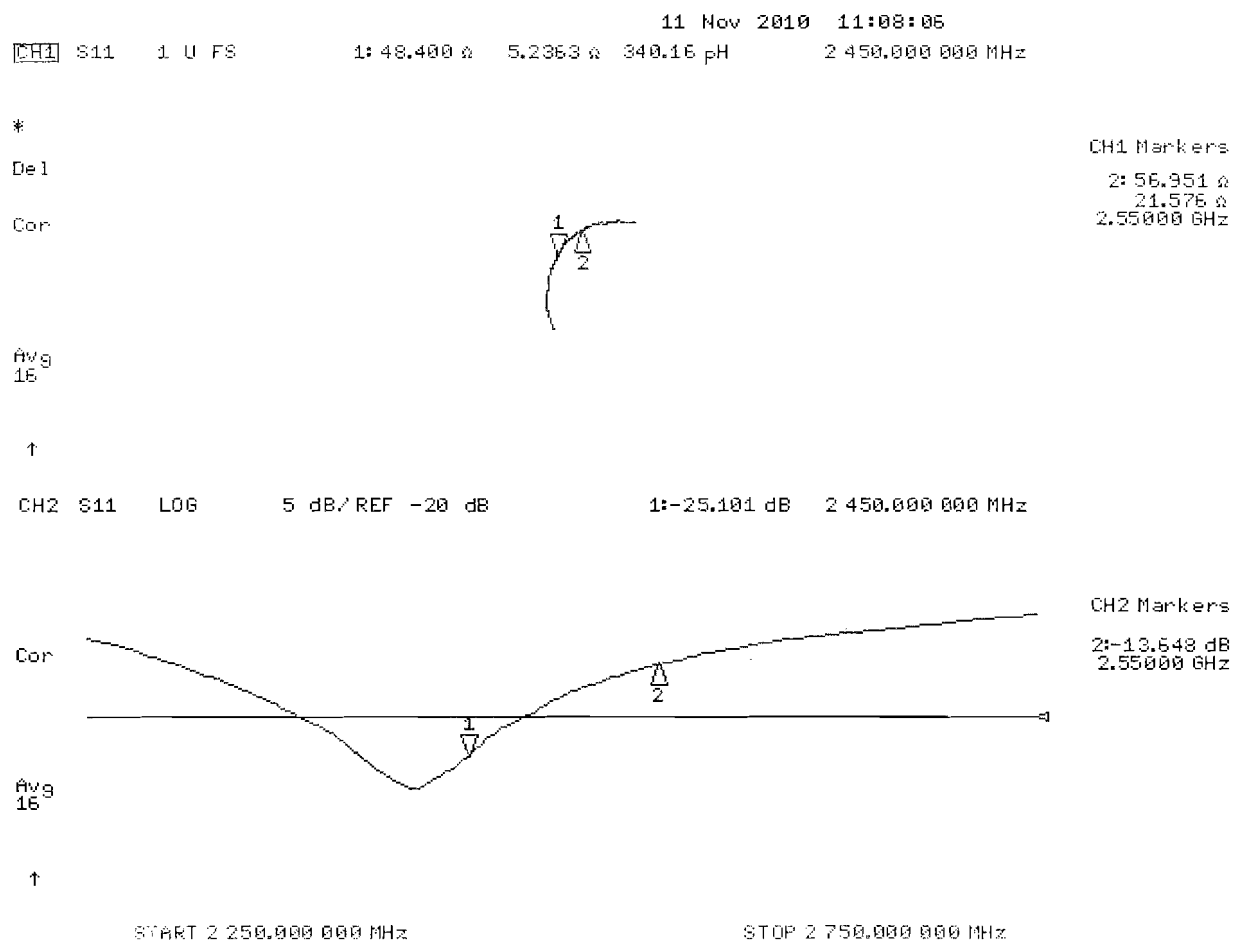
SAR(1 g) = 12.5 mW/g; SAR(10 g) = 5.79 mW/g

Maximum value of SAR (measured) = 16.5 mW/g



0 dB = 16.5mW/g

Impedance Measurement Plot for Body TSL



Extended Calibration

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824:

D2450V2 SN: 829 - Head				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/11/2010	-28.2		52.8	
6/14/2012	-29.1	3.2	52.1	-0.7

D2450V2 SN: 829 - Body				
Date of Measurement	Return Loss (dB)	$\Delta\%$	Impedance (Ω)	$\Delta\Omega$
11/11/2010	-25.1		48.4	
6/14/2012	-24.6	-2.0	49.2	0.8

Appendix F – Phantom Calibration Data Sheets

Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 4.0
Type No	QD OVA 001 B
Series No	1003 and higher
Manufacturer	Untersee Composites Knebelstrasse 8 CH-8268 Mannenbach, Switzerland

Tests

Complete tests were made on the prototype units QD OVA 001 AA 1001, QD OVA 001 AB 1002, pre-series units QD OVA 001 BA 1003-1005 as well as on the series units QD OVA 001 BB, 1006 ff.

Test	Requirement	Details	Units tested
Material thickness	Compliant with the standard requirements	Bottom plate: 2.0mm +/- 0.2mm	all
Material parameters	Dielectric parameters for required frequencies	< 6 GHz: Rel. permittivity = 4 +/-1, Loss tangent ≤ 0.05	Material sample
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions.	DGBE based simulating liquids. Observe Technical Note for material compatibility.	Equivalent phantoms, Material sample
Shape	Thickness of bottom material, Internal dimensions, Sagging compatible with standards from minimum frequency	Bottom elliptical 600 x 400 mm Depth 190 mm, Shape is within tolerance for filling height up to 155 mm, Eventual sagging is reduced or eliminated by support via DUT	Prototypes, Sample testing

Standards

- [1] CENELEC EN 50361-2001, « Basic standard for the measurement of the Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz) », July 2001
- [2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003
- [3] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005
- [4] IEC 62209 – 2, Draft, "Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices – Human models, Instrumentation and Procedures – Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30 MHz to 6 GHz Handheld and Body-Mounted Devices used in close proximity to the Body.", February 2005
- [5] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition January 2001

Based on the tests above, we certify that this item is in compliance with the standards [1] to [5] if operated according to the specific requirements and considering the thickness. The dimensions are fully compliant with [4] from 30 MHz to 6 GHz. For the other standards, the minimum lower frequency limit is limited due to the dimensional requirements ([1]: 450 MHz, [2]: 300 MHz, [3]: 800 MHz, [5]: 375 MHz) and possibly further by the dimensions of the DUT.

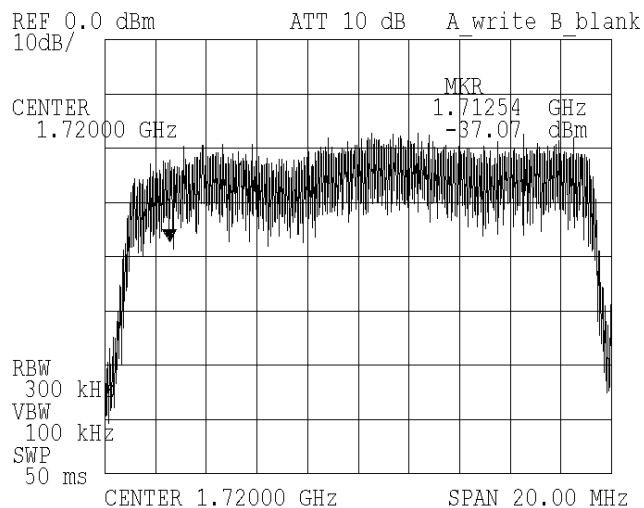
s p e a g

Date 28.4.2008

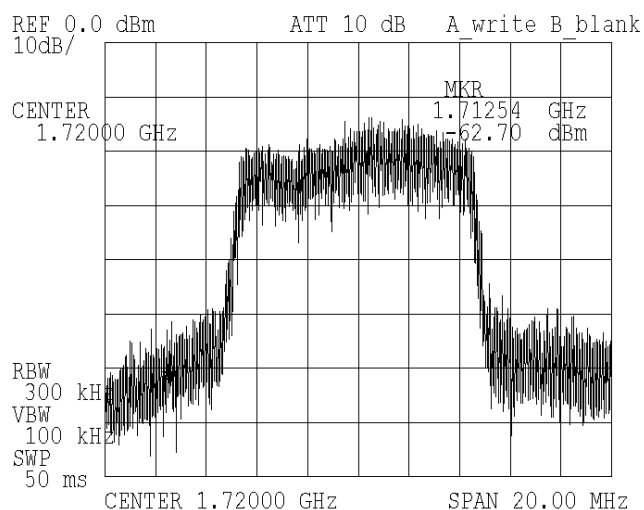
Signature / Stamp

Schmid & Partner Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland
 Phone +41 44 245 9700, Fax +41 44 245 9779
 info@speag.com, http://www.speag.com

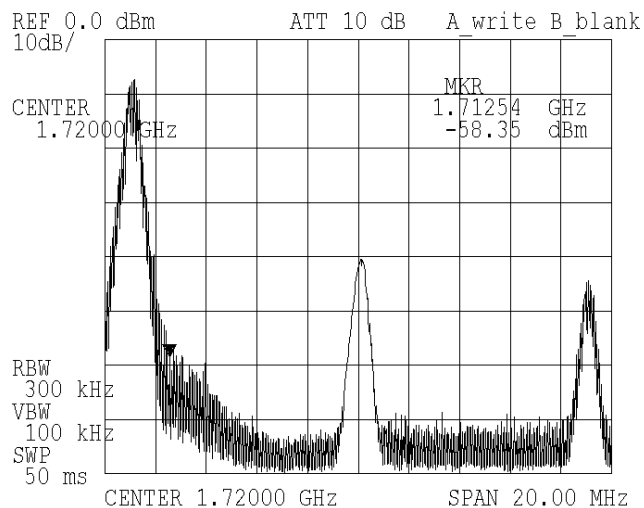
Appendix G – LTE Plots



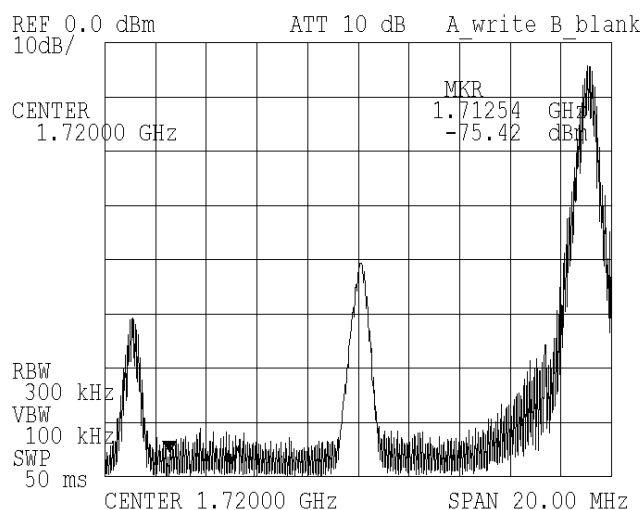
Band 4 QPSK 100% RB Centered



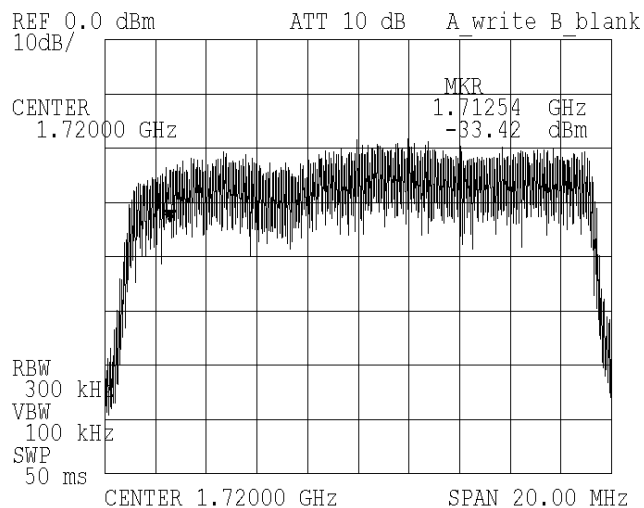
Band 4 QPSK 50% RB Centered



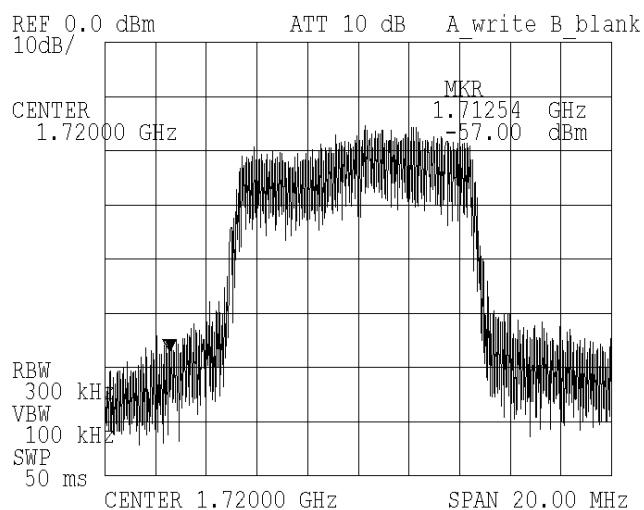
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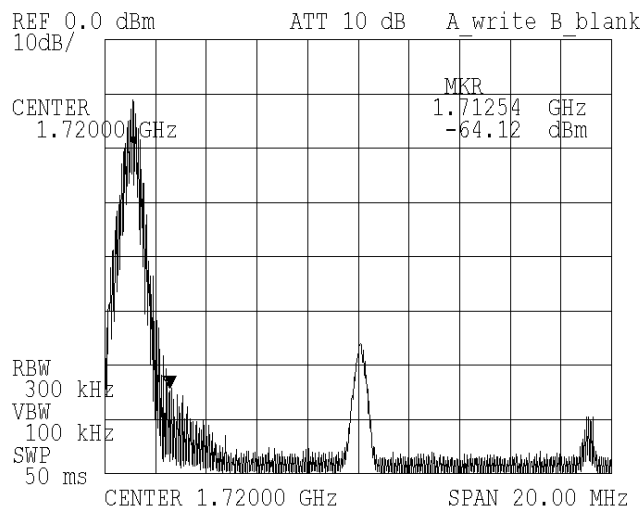
Band 4 QPSK 1 RB High



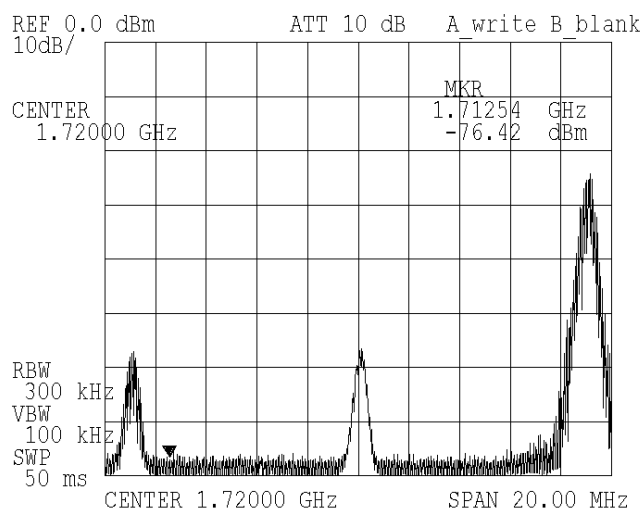
Band 4 16QAM 100% RB Centered



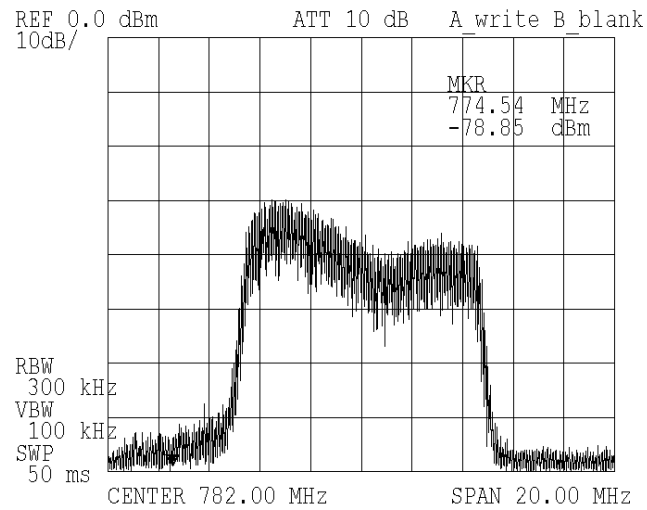
Band 4 16QAM 50% RB Centered



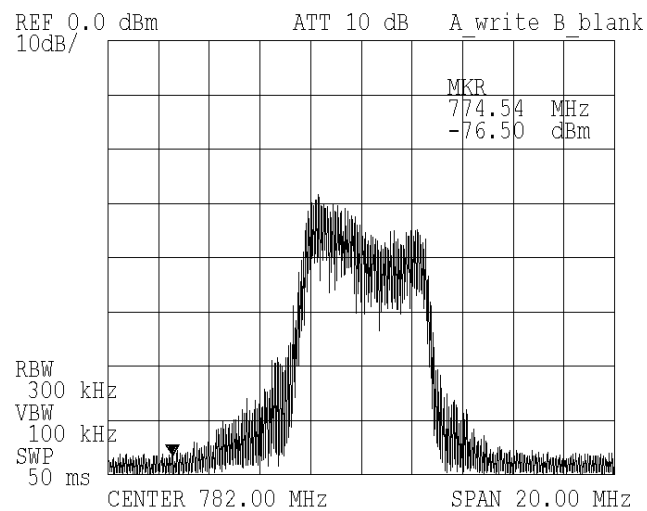
Band 4 16QAM 1 RB Low



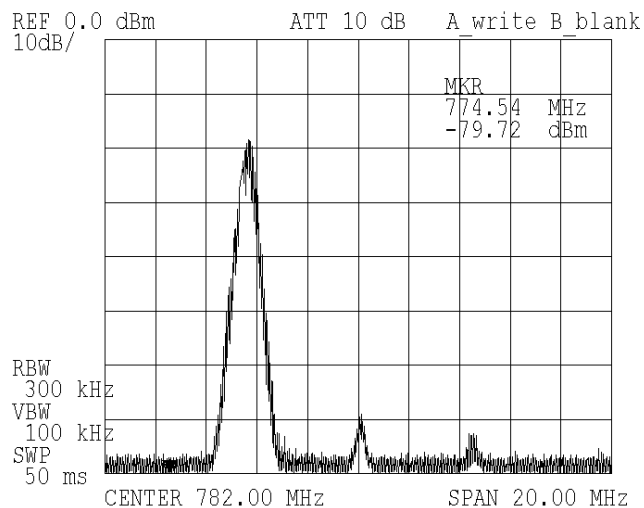
Band 4 16QAM 1 RB High



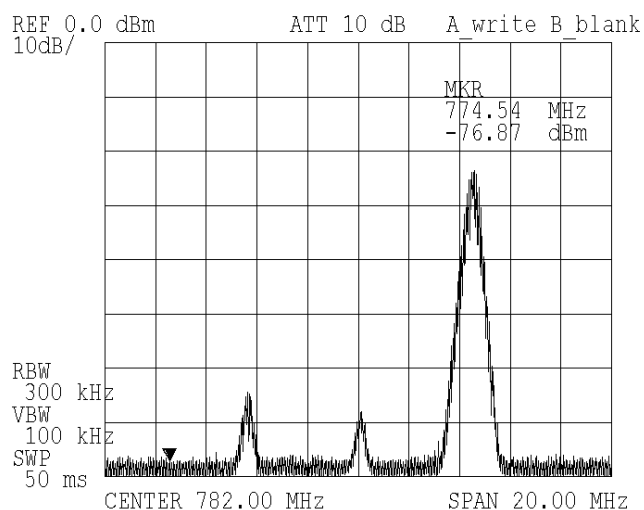
Band 13 QPSK 100% RB Centered



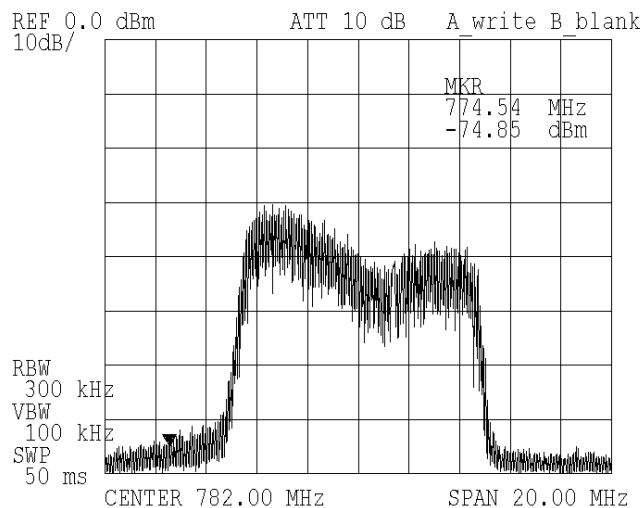
Band 13 QPSK 50% RB Centered



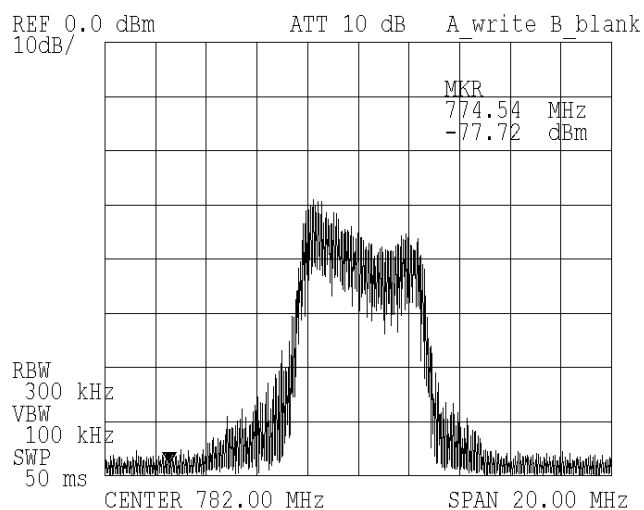
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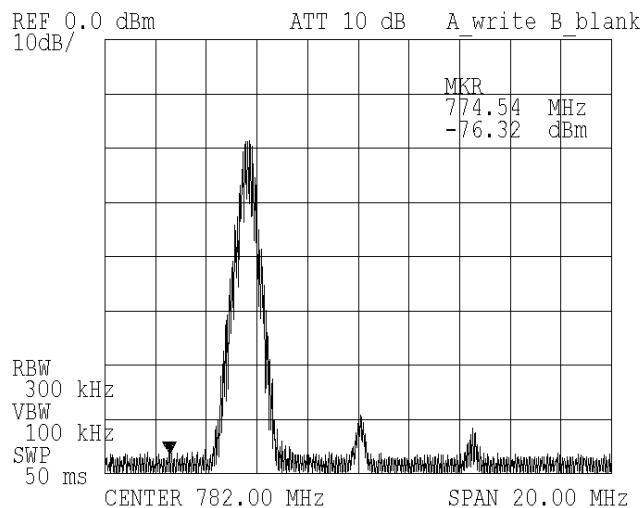
Band 13 QPSK 1 RB High



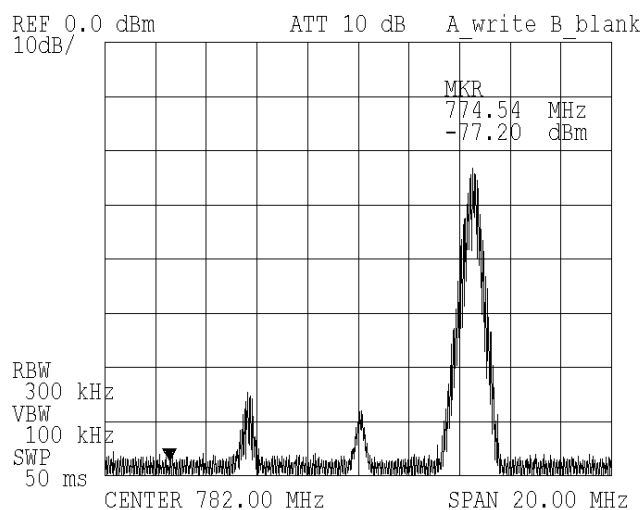
Band 13 16QAM 100% RB Centered



Band 13 16QAM 50% RB Centered



Band 13 16QAM 1 RB Low



Band 13 16QAM 1 RB High