9.8 SAR Measurement Result (PCS1900 Right Head Tilted Position)

Date of Test : December 18 , 2006
Mixture Type: Head
Tissue Depth: 15.3 cm

Modulation	Frequency		Power Drift (dB)	Device Test Position	Antenna Position	1g SAR (W/kg)
	CH	MHz				
PCS1900	661	1850.2	**-0.203**	Cheek / Tilted	Intenna	**0.204**

Notes:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ■ DASY4
5. Phantom Configuration ☐ Left Head ☐ Flat Phantom ■ Right Head
6. SAR Configuration ■ Head ☐ Body ☐ Hand
7. Test Signal Call Mode ☐ Manu. Test Codes ■ Base Station Simulator
8. Battery Option ■ Standard Type ☐ Slim Type

Figure 9.8 Right Head SAR Test Setup
-- Ear / Tilted Position --

Measurement Result of Test Data (PCS1900 Right Head Tilted Position)

Date/Time: 2006-12-18 2:15:36

Test Laboratory: Nemko Korea File Name: Right Head Tilt Position CH661.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1880 MHz

Duty Cycle: 1:8.3 Phantom section: Right Section

Medium parameters used: f = 1880.15 MHz; σ = 1.39 mho/m; ε_r = 40.1; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(5.41, 5.41, 5.41); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

PCS Right Tilt Position CH661/Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.205 mW/g

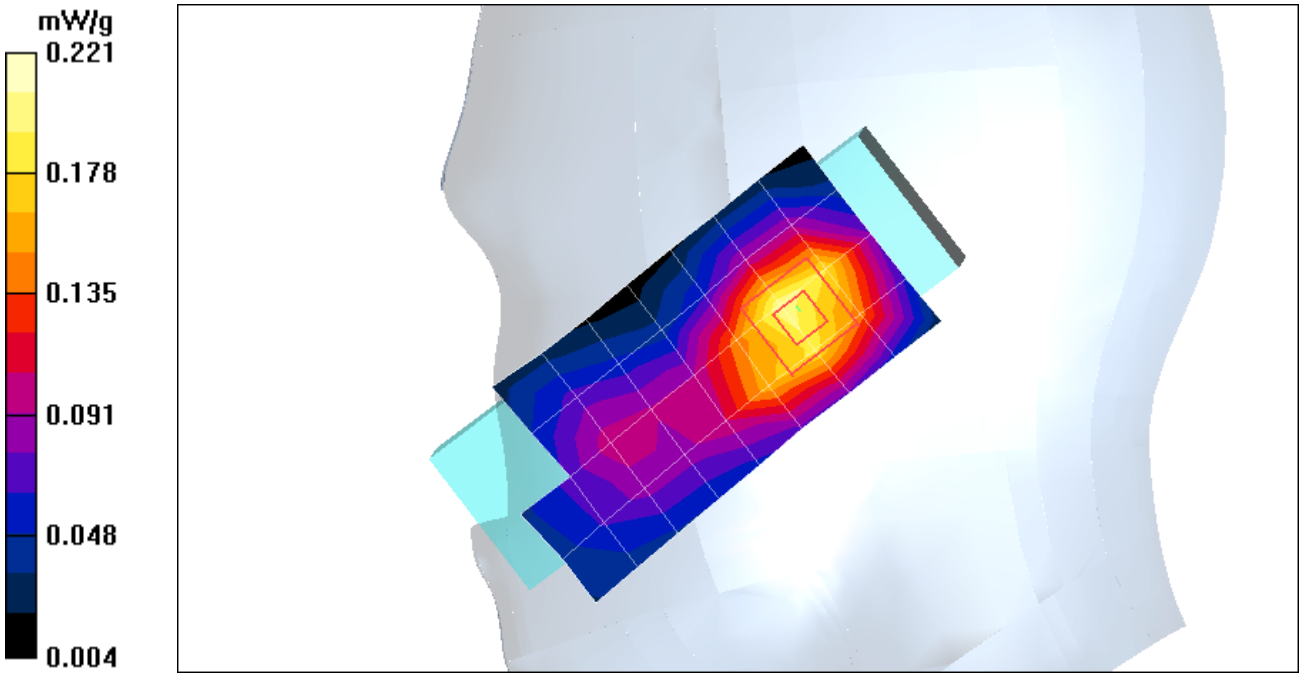
PCS Right Tilt Position CH661/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.00 V/m; Power Drift = -0.203 dB

Peak SAR (extrapolated) = 0.317 W/kg

SAR(1 g) = 0.204 mW/g; SAR(10 g) = 0.122 mW/g

Maximum value of SAR (measured) = 0.221 mW/g



9.9 SAR Measurement Result (PCS1900 Left Head Touch Position)

Date of Test : December 18 , 2006
Mixture Type: Head
Tissue Depth: 15.3 cm

Modulation	Frequency		Power Drift (dB)	Device Test Position	Antenna Position	1g SAR (W/kg)
	CH	MHz				
PCS1900	512	1850.2	**-0.155**	Cheek / Touch	Intenna	**0.882**
	661	1880.0	**-0.066**	Cheek / Touch	Intenna	**0.823**
	810	1909.8	**0.123**	Cheek / Touch	Intenna	**0.641**

Notes:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ■ DASY4
5. Phantom Configuration ■ Left Head ☐ Flat Phantom ☐ Right Head
6. SAR Configuration ■ Head ☐ Body ☐ Hand
7. Test Signal Call Mode ☐ Manu. Test Codes ■ Base Station Simulator
8. Battery Option ■ Standard Type ☐ Slim Type

Figure 9.9 Left Head SAR Test Setup
-- Cheek / Touch Position --

Measurement Result of Test Data (PCS1900 Left Head Touch Position)

Date/Time: 2006-12-18 4:30:04

Test Laboratory: Nemko Korea File Name: Left Head Touch Position CH512.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1850.2 MHz

Duty Cycle: 1:8.3 Phantom section: Left Section

Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.36 mho/m; ε_r = 40.3; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(5.41, 5.41, 5.41); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

PCS Left Touch Position CH512/Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.934 mW/g

PCS Left Touch Position CH512/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

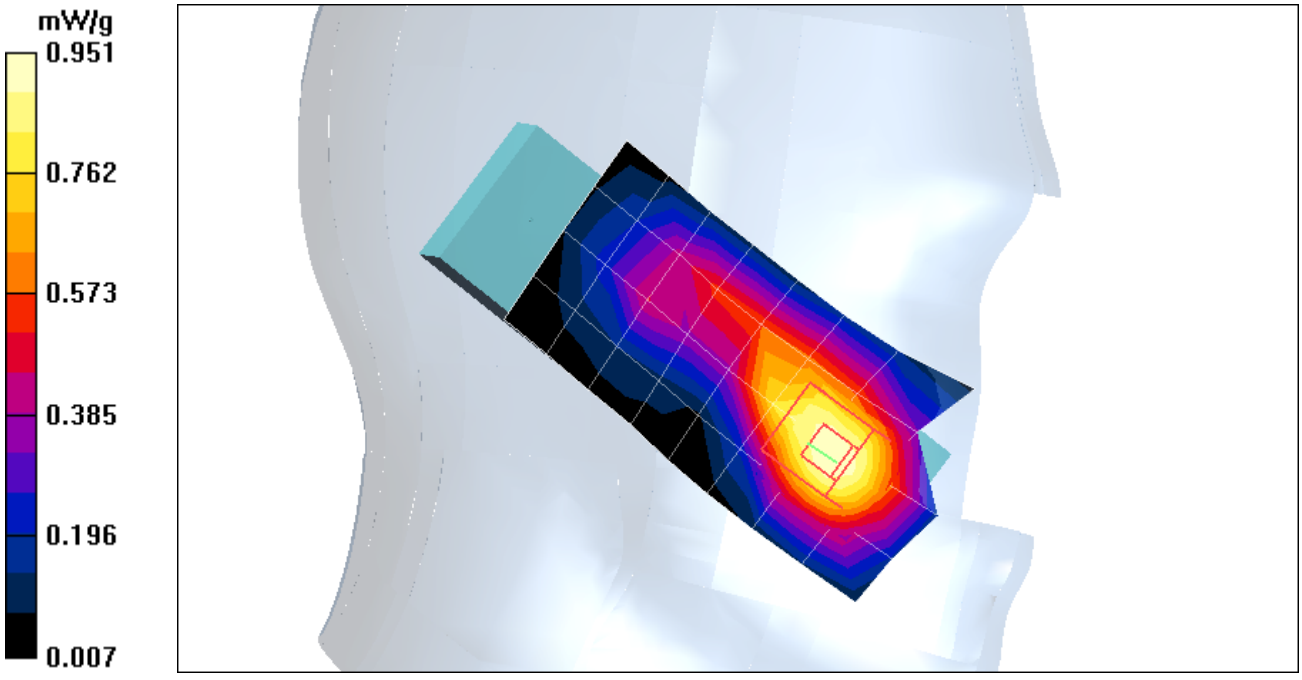
Reference Value = 7.55 V/m; Power Drift = -0.155 dB

Peak SAR (extrapolated) = 1.20 W/kg

SAR(1 g) = 0.882 mW/g; SAR(10 g) = 0.559 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.951 mW/g



Date/Time: 2006-12-18 3:04:23

Test Laboratory: Nemko Korea File Name: Left Head Touch Position CH661.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1880 MHz

Duty Cycle: 1:8.3 Phantom section: Left Section

Medium parameters used: f = 1880.15 MHz; σ = 1.39 mho/m; ε_r = 40.1; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(5.41, 5.41, 5.41); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

PCS Left Touch Position CH661/Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.869 mW/g

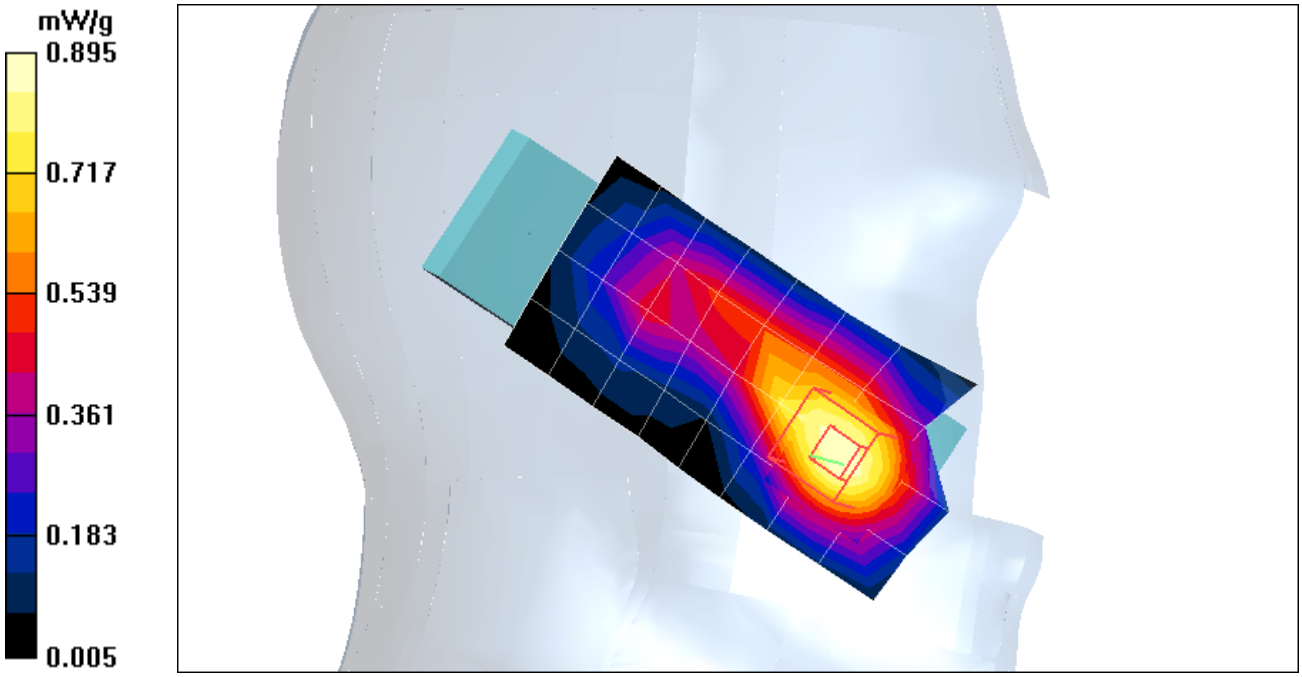
PCS Left Touch Position CH661/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.04 V/m; Power Drift = -0.066 dB

Peak SAR (extrapolated) = 1.15 W/kg

SAR(1 g) = 0.823 mW/g; SAR(10 g) = 0.516 mW/g

Maximum value of SAR (measured) = 0.895 mW/g



Date/Time: 2006-12-18 4:49:24

Test Laboratory: Nemko Korea File Name: Left Head Touch Position CH810.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1909.8 MHz

Duty Cycle: 1:8.3 Phantom section: Left Section

Medium parameters used (interpolated): f = 1909.8 MHz; σ = 1.43 mho/m; ε_r = 40; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(5.41, 5.41, 5.41); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

PCS Left Touch Position CH810/Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.666 mW/g

PCS Left Touch Position CH810/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

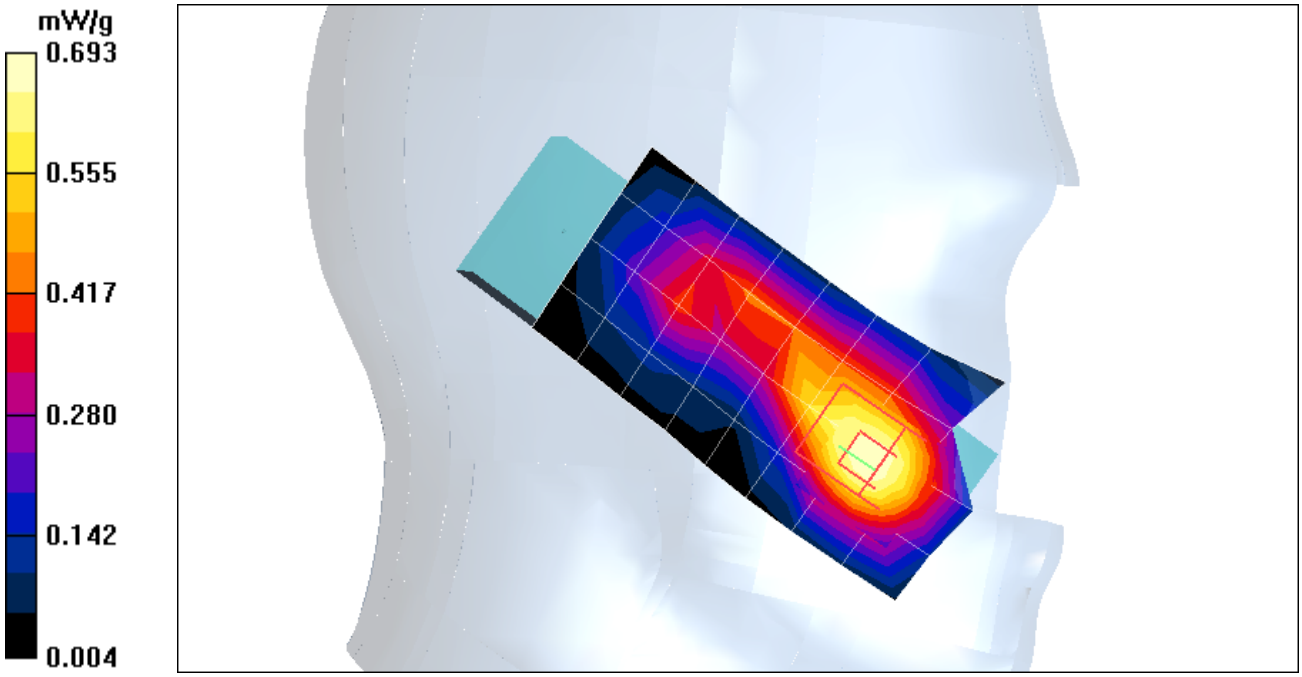
Reference Value = 7.16 V/m; Power Drift = 0.123 dB

Peak SAR (extrapolated) = 0.902 W/kg

SAR(1 g) = 0.641 mW/g; SAR(10 g) = 0.400 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.693 mW/g



9.10 SAR Measurement Result (PCS1900 Left Head Tilted Position)

Date of Test : December 18 , 2006
Mixture Type: Head
Tissue Depth: 15.3 cm

Modulation	Frequency		Power Drift (dB)	Device Test Position	Antenna Position	1g SAR (W/kg)
	CH	MHz				
PCS1900	661	1850.2	**-0.175**	Cheek / Tilted	Intenna	**0.193**

Notes:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ■ DASY4
5. Phantom Configuration ■ Left Head ☐ Flat Phantom ☐ Right Head
6. SAR Configuration ■ Head ☐ Body ☐ Hand
7. Test Signal Call Mode ☐ Manu. Test Codes ■ Base Station Simulator
8. Battery Option ■ Standard Type ☐ Slim Type

Figure 9.10 Left Head SAR Test Setup
-- Ear / Tilted Position --

Measurement Result of Test Data (PCS1900 Left Head Tilted Position)

Date/Time: 2006-12-18 5:25:11

Test Laboratory: Nemko Korea File Name: Left Head Tilt Position CH661.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1880 MHz

Duty Cycle: 1:8.3 Phantom section: Left Section

Medium parameters used: f = 1880.15 MHz; σ = 1.39 mho/m; ε_r = 40.1; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(5.41, 5.41, 5.41); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

PCS Left Tilt Position CH661/Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.188 mW/g

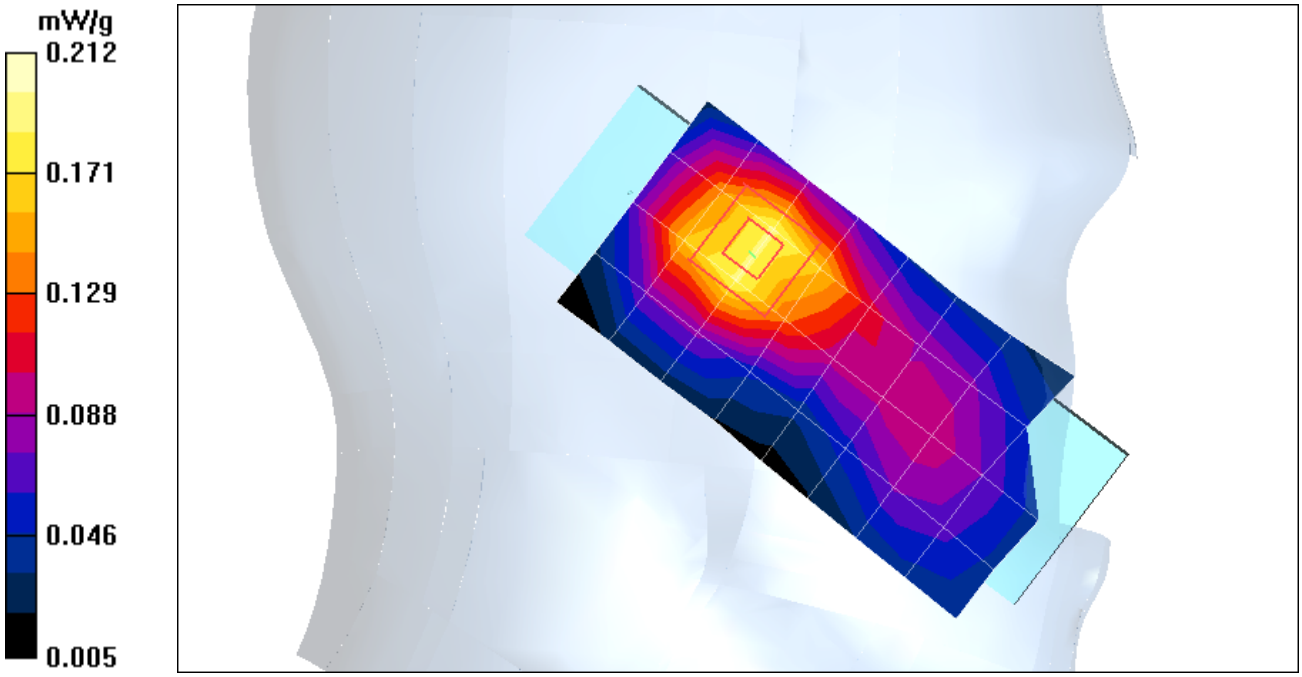
PCS Left Tilt Position CH661/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.25 V/m; Power Drift = -0.175 dB

Peak SAR (extrapolated) = 0.300 W/kg

SAR(1 g) = 0.193 mW/g; SAR(10 g) = 0.115 mW/g

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



9.11 SAR Measurement Result (PCS1900 Muscle -15mm Distance- Position)

Date of Test : December 20 , 2006
Mixture Type: Head
Tissue Depth: 15.0 Cm

Modulation	Frequency		Power Drift (dB)	Device Test Position	Antenna Position	1g SAR (W/kg)
	CH	MHz				
PCS1900	512	1850.2	**-0.069**	15mm distance from Phantom	Intenna	**0.642**
	661	1880.0	**-0.069**	15mm distance from Phantom	Intenna	**0.535**
	810	1909.8	**-0.009**	15mm distance from Phantom	Intenna	**0.437**

Notes:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ■ DASY4
5. Phantom Configuration ☐ Left Head ■ Flat Phantom ☐ Right Head
6. SAR Configuration ☐ Head ■ Muscle ☐ Hand
7. Test Signal Call Mode ☐ Manu. Test Codes ■ Base Station Simulator
8. Battery Option ■ Standard Type ☐ Slim Type

Figure 9.11 Muscle SAR Test Setup
-- 15mm Distance Position --

Measurement Result of Test Data (PCS19000 Muscle -15mm Distance- Position)

Date/Time: 2006-12-20 10:32:18

Test Laboratory: Nemko Korea File Name: GPRS 15mm distance CH 512.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1850.2 MHz

Duty Cycle: 1:4.15 Phantom section: Flat Section

Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.48 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(4.67, 4.67, 4.67); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

GPRS 15mm distance CH 512/Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.696 mW/g

GPRS 15mm distance CH 512/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

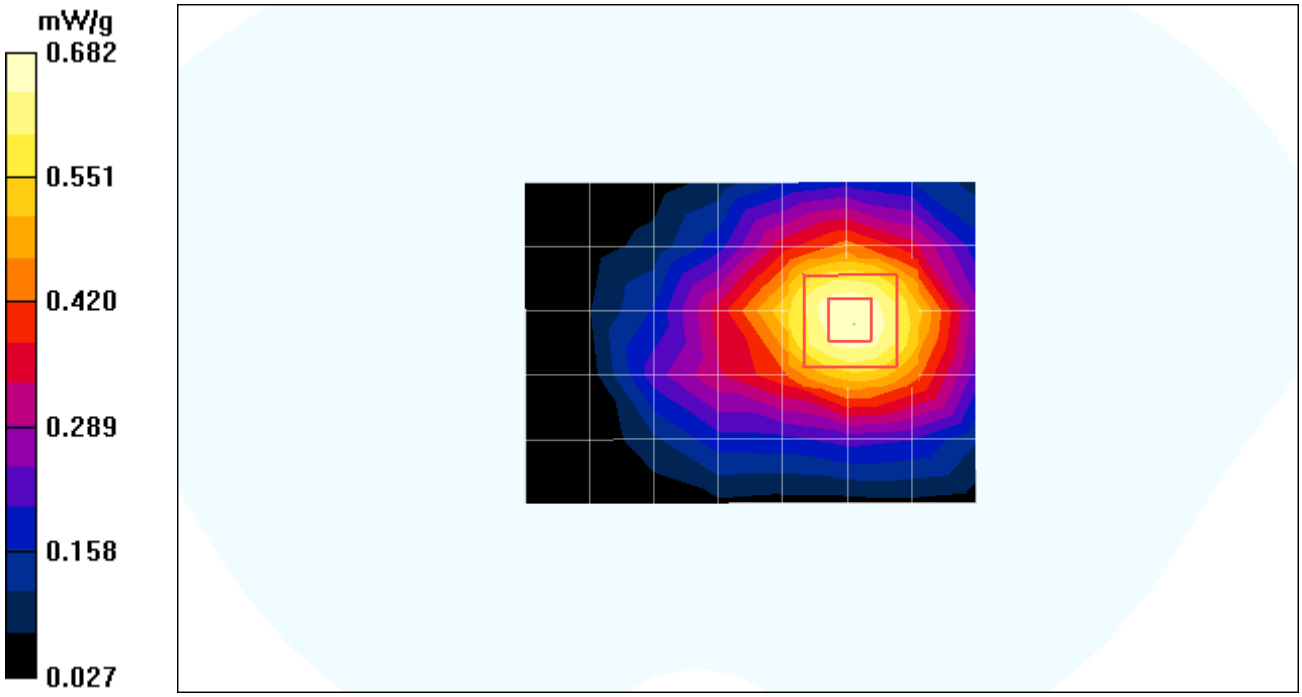
Reference Value = 17.7 V/m; Power Drift = -0.069 dB

Peak SAR (extrapolated) = 0.940 W/kg

SAR(1 g) = 0.642 mW/g; SAR(10 g) = 0.418 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.682 mW/g



Date/Time: 2006-12-20 10:12:54

Test Laboratory: Nemko Korea File Name: GPRS 15mm distance CH 661.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1880 MHz

Duty Cycle: 1:4.15 Phantom section: Flat Section

Medium parameters used: f = 1880 MHz; σ = 1.51 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(4.67, 4.67, 4.67); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

GPRS 15mm distance CH 661/Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm

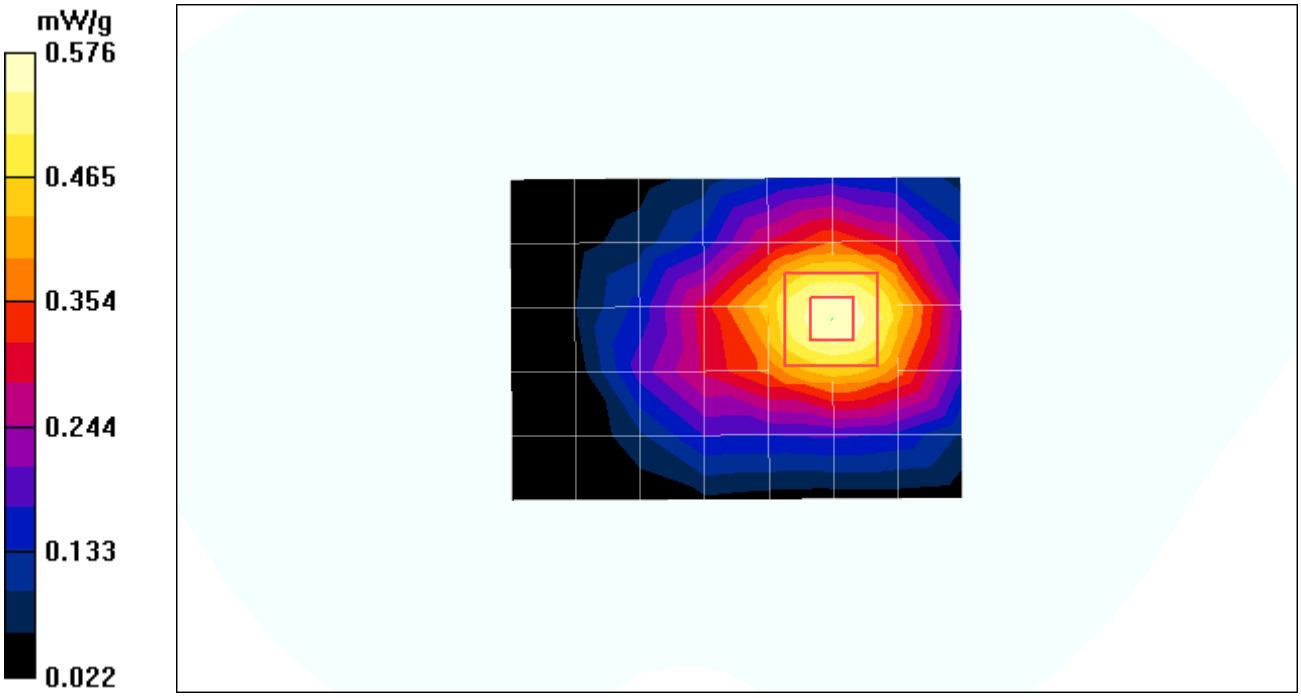
Maximum value of SAR (measured) = 0.576 mW/g

GPRS 15mm distance CH 661/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.4 V/m; Power Drift = -0.069 dB

Peak SAR (extrapolated) = 0.819 W/kg

SAR(1 g) = 0.535 mW/g; SAR(10 g) = 0.345 mW/g



Date/Time: 2006-12-20 10:51:22

Test Laboratory: Nemko Korea File Name: GPRS 15mm distance CH 810.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1909.8 MHz

Duty Cycle: 1:4.15 Phantom section: Flat Section

Medium parameters used: f = 1910 MHz; σ = 1.54 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(4.67, 4.67, 4.67); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

GPRS 15mm distance CH 810/Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.473 mW/g

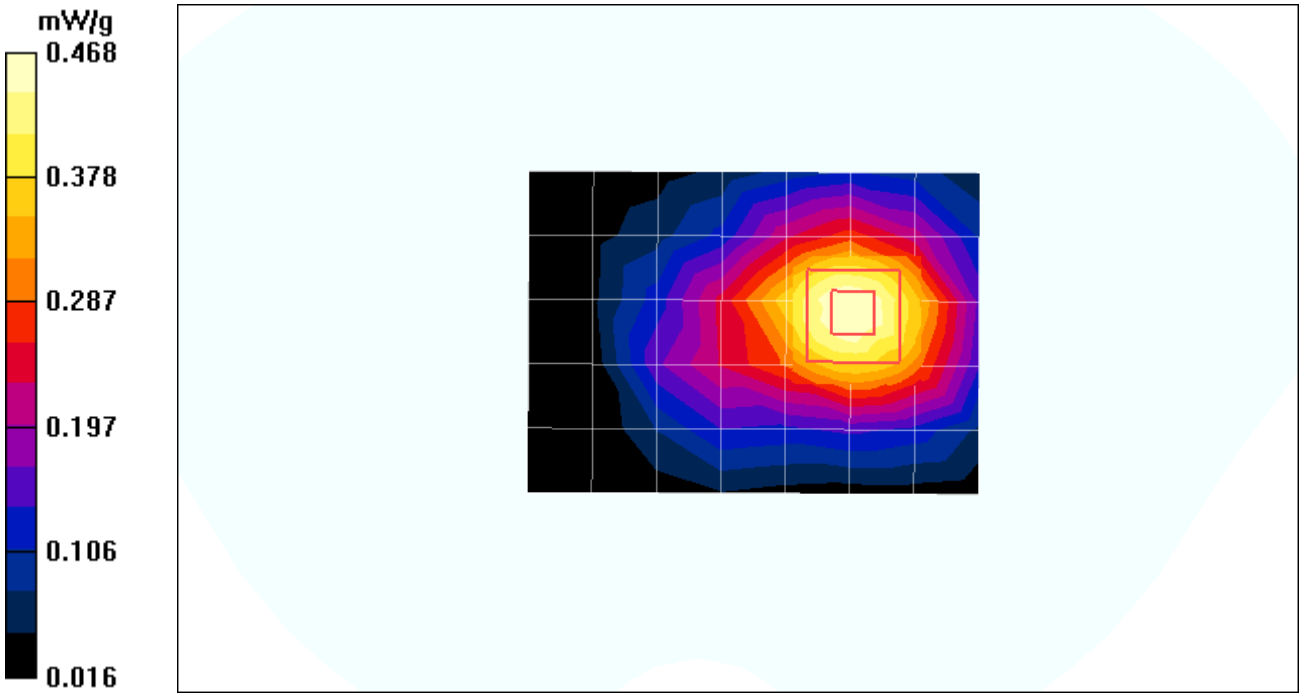
GPRS 15mm distance CH 810/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.2 V/m; Power Drift = -0.009 dB

Peak SAR (extrapolated) = 0.666 W/kg

SAR(1 g) = 0.437 mW/g; SAR(10 g) = 0.280 mW/g

Maximum value of SAR (measured) = 0.468 mW/g



Date/Time: 2006-12-20 10:32:18

Test Laboratory: Nemko Korea File Name: GPRS 15mm distance CH 512.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1850.2 MHz

Duty Cycle: 1:4.15 Phantom section: Flat Section

Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.48 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(4.67, 4.67, 4.67); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

GPRS 15mm distance CH 512/Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.696 mW/g

GPRS 15mm distance CH 512/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

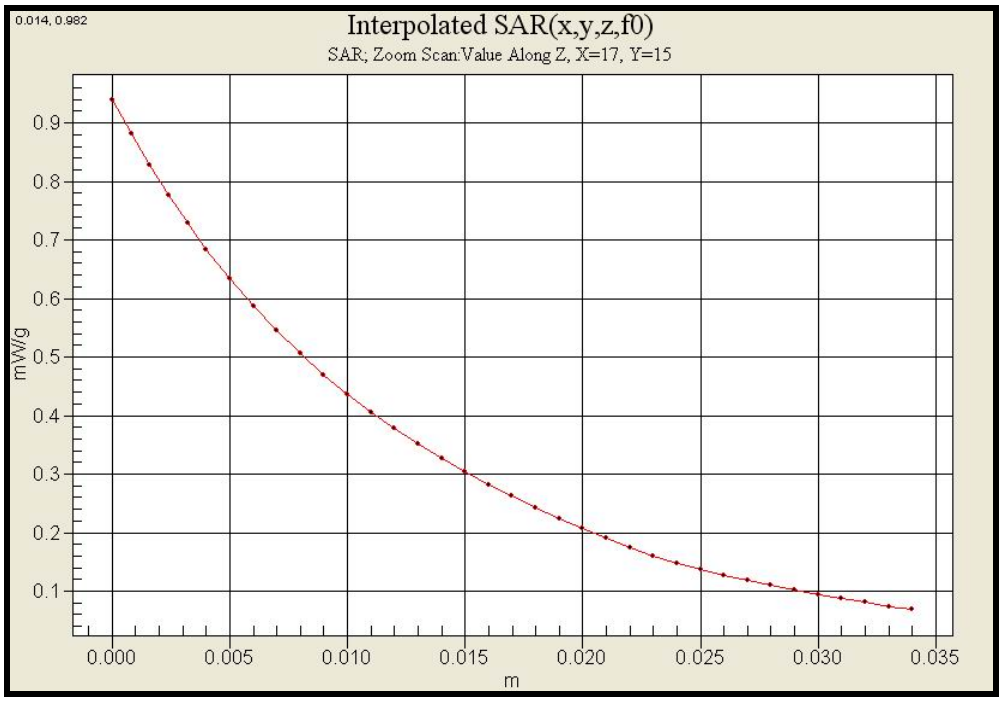
Reference Value = 17.7 V/m; Power Drift = -0.069 dB

Peak SAR (extrapolated) = 0.940 W/kg

SAR(1 g) = 0.642 mW/g; SAR(10 g) = 0.418 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.682 mW/g



9.12 SAR Measurement Result (PCS1900 Muscle -15mm Distance- with Headset)

Date of Test : December 20 , 2006
Mixture Type: Head
Tissue Depth: 15.0 Cm

Modulation	Frequency		Power Drift (dB)	Device Test Position	Antenna Position	1g SAR (W/kg)
	CH	MHz				
PCS1900	661	1880.0	**-0.022**	15mm distance from Phantom with Headset	Intenna	**0.495**

Notes:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ■ DASY4
5. Phantom Configuration ☐ Left Head ■ Flat Phantom ☐ Right Head
6. SAR Configuration ☐ Head ■ Muscle ☐ Hand
7. Test Signal Call Mode ☐ Manu. Test Codes ■ Base Station Simulator
8. Battery Option ■ Standard Type ☐ Slim Type

Figure 9.12 Muscle SAR Test Setup
-- 15mm Distance with Headset position --

Measurement Result of Test Data (PCS19000 Muscle -15mm Distance with Headset)

Date/Time: 2006-12-20 11:09:35

Test Laboratory: Nemko Korea File Name: GPRS 15mm distance CH 661 with Earphone.da4

DUT: BPP-UP560 Type: Folder Type Serial: 00000001 Applicant Name: Bellwave Co.,Ltd

Communication System: PCS1900 Frequency: 1880 MHz

Duty Cycle: 1:4.15 Phantom section: Flat Section

Medium parameters used: f = 1880 MHz; σ = 1.51 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

DASY4 Configuration:

Probe: ET3DV6 - SN1591; ConvF(4.67, 4.67, 4.67); Calibrated: 2006-03-23

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE3 Sn479; Calibrated: 2006-02-23

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

GPRS 15mm distance CH 661 with Earphone/Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.523 mW/g

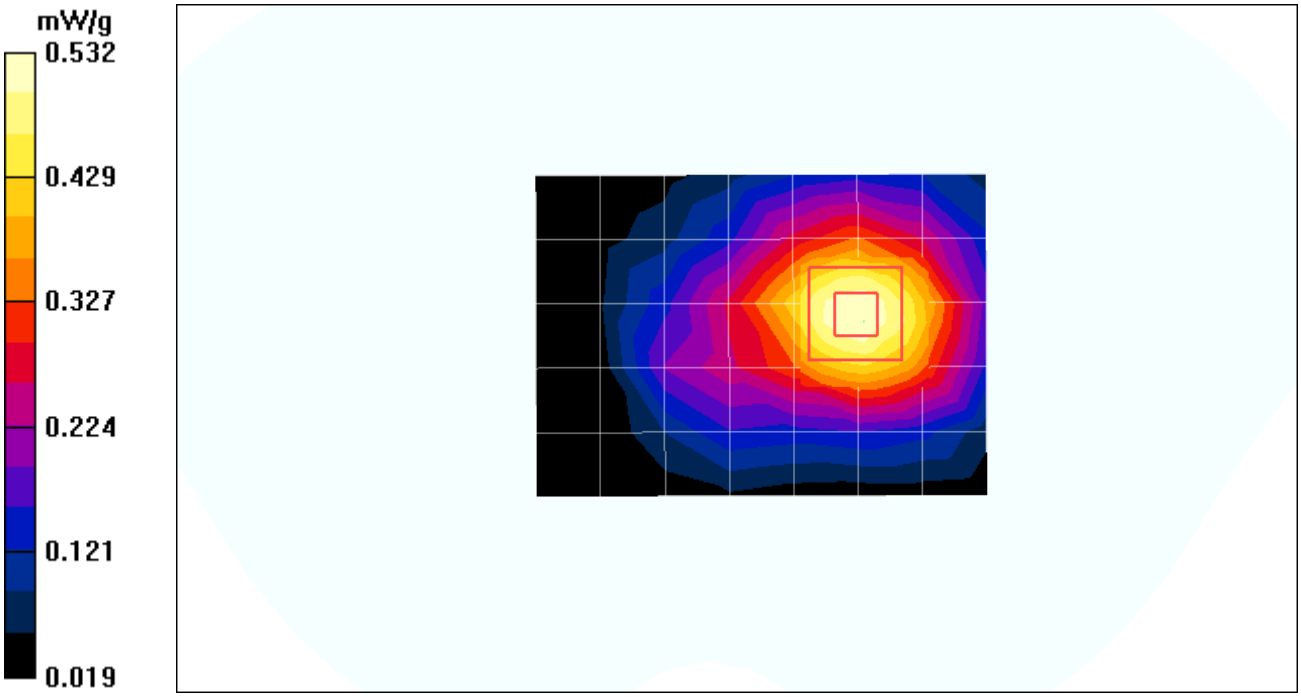
GPRS 15mm distance CH 661 with Earphone/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.3 V/m; Power Drift = -0.022 dB

Peak SAR (extrapolated) = 0.760 W/kg

SAR(1 g) = 0.495 mW/g; SAR(10 g) = 0.318 mW/g

Maximum value of SAR (measured) = 0.532 mW/g



10. SAR Test Equipment

Table 10.1 Test Equipment Calibration

Description	Model	Serial No.	Calibration Date	Calibration Interval
Staubli Robot Unit	RX60L	F05/51E1A1/A/01	N/A	N/A
Data Acquisition Electronics	DAE3	479	February.23. 2006	1 year
E-Field Probe	ET3DV6	1591	March.23. 2006	1 year
Electro-Optical Converter	EOC3	398	N/A	N/A
SAM Twin Phantom V4.0C	TP-1358	SM 00 T02 DA	N/A	N/A
Validation Dipole Antenna	D835V2	4d017	February.20. 2006	2 year
Validation Dipole Antenna	D900V2	1d016	July.17. 2006	2 year
Validation Dipole Antenna	D1800V2	2d111	February.17. 2006	2 year
Validation Dipole Antenna	D1900V2	5d059	July.17. 2006	2 year
VSA Series Transmitter Tester	E4406A	US39480757	August.07.2006	1 year
PSA Series Spectrum Analyzer	E4440A	MY44303257	December.13.2006	1 year
Wireless Communications Test Set	E5515C	GB43193659	June.09. 2006	1 year
Dielectric Probe Kit	85070E	MY44300121	N/A	N/A
Network Analyzer	8753ES	US39171172	Mar.10. 2006	1 year
Power Amplifier	NKRFSPA	NK00SP18	May.11. 2006	1 year
Power Meter	437B	2912U01687	December.05.2006	1 year
Power Sensor	8481A	3318A83210	August.14.2006	1 year
Power Meter	NRVS	835360/002	December.05.2006	1 year
Power Sensor	NRV-Z32	836019/028	December.05.2006	1 year
Series Signal Generator	E4438C	US45092564	April.09.2006	1 year

Note:

The E-field probe was calibrated by SPEAG, by waveguide technique procedure. Dipole Validation measurement is performed by Nemkokorea Lab. before each test. The brain simulating material is calibrated by Nemkokorea using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material.

11. References

[1] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-2003 (Draft 6.1 – July 2001), *IEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.*
[2] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*, July 2001.
[3] ANSI/IEEE C95.3 – 1991, *IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE*, 1992.
[4] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C, Dec. 1997.
[5] ANSI/IEEE C95.1 – 1991, *American National Standard Safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz*, New York: : IEEE, Aug. 1992.
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[7] NCRP, National Council on Radiation Protection and Measurements, *Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,* NCRP Report No. 86, 1986. Reprinted Feb. 1995.
[8] T. Schmid, O. Egger, N. Kuster, *Automated E-field scanning system for dosimetric assessments,* IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.
[9] K. Pokovic, T.Schmid, N. Kuster, *Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies*, ICECOM97, Oct. 1997, pp. 120-124.
[10] G.Hartsgrove, A. raszewski, A. Surowiec, *Simulated Biological Materials for Electromagnetic Radiation Absorption Studies*, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36
[11] Q. Balzano, O. Garay, T. Manning Jr,. *Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones*, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.
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[14] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
[15] V. Hombach, K.Meier, M. Burkhardt, E. Kuhn, N. Kuster, *The Dependence of EM Energy Absorption upon Human Head Modeling at 900MHz*, IEEE Transaction on Microwave Theory and Techniques, vol 44 no. 10, Oct. 1996, pp. 1865-1873.
[16] N. Kuster and Q. Balzano, *Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz*, IEEE Transaction on Vehicular Technology, vol. 41, no.1, Feb.1992, pp. 17-23.
[17] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp.645-652.

APPENDIX A SAR Definition / RF Exposure Limits

SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (*dU*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element (*dV*) of a given density (*p*). It is also defined as the rate of RF energy absorption pet unit mass at a point in an absorbing body (see Fig. A.1).

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{pdv}\right)$$

Figure A.1 SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \sigma E^2 / p$$

Where :

σ = conductivity of the tissue-simulant material (S/m)
p = mass density of the tissue-simulant material (kg/m3)
E = Total RMS electric field strength (V/m)

Note:
The primary factors that control rate or energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.

ANSI/IEEE C95.1 – 1992 RF EXPOSURE LIMITS

Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is the exposure that may be incurred by persons who are aware of the potential for exposure,(i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table C.1 Safety Limits for Partial Body Exposure

	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)
SPATIAL PEAK SAR1 Brain	1.60	8.00
SPATIAL PEAK SAR2 Whole Body	0.08	0.40
SPATIAL PEAK SAR3 Hands,Feet,Ankles, Wrists	4.00	20.00

Note:

1 The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as tissue volume in the shape of a cube) and over the appropriate averaging time.

2 The Spatial Average value of the SAR averaged over the whole body.

3 The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

APPENDIX B : Probe Calibration

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client Dymstec

Certificate No: ET3-1591_Mar06

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1591
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	March 23, 2006
Condition of the calibrated item	In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41495277	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41498087	3-May-05 (METAS, No. 251-00466)	May-06
Reference 3 dB Attenuator	SN: S5054 (3c)	11-Aug-05 (METAS, No. 251-00499)	Aug-06
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference 30 dB Attenuator	SN: S5129 (30b)	11-Aug-05 (METAS, No. 251-00500)	Aug-06
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	2-Feb-06 (SPEAG, No. DAE4-654_Feb06)	Feb-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: March 23, 2006

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

Certificate No: ET3-1591_Mar06 Page 1 of 9

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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

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

Probe ET3DV6

SN:1591

Manufactured:	May 18, 2001
Last calibrated:	July 22, 2004
Recalibrated:	March 23, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1591 **March 23, 2006**

DASY - Parameters of Probe: ET3DV6 SN:1591

Sensitivity in Free Space[A] Diode Compression[B]

NormX	**1.88** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**95** mV
NormY	**1.84** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**95** mV
NormZ	**1.83** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**95** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **900 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	7.6	4.2
SAR_{be} [%]	With Correction Algorithm	0.1	0.2

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	6.4	3.5
SAR_{be} [%]	With Correction Algorithm	0.2	0.3

Sensor Offset

Probe Tip to Sensor Center	**2.7** mm

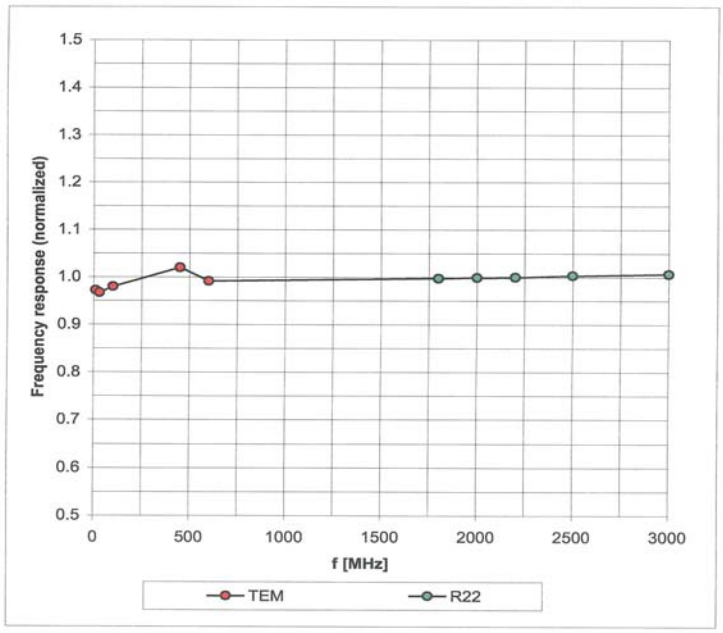
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).
[B] Numerical linearization parameter: uncertainty not required.

ET3DV6 SN:1591 March 23, 2006

Frequency Response of E-Field

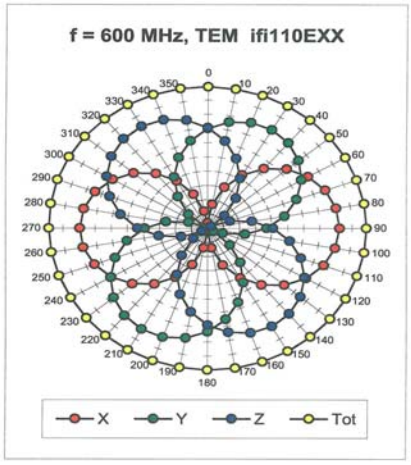
(TEM-Cell:ifi110 EXX, Waveguide: R22)

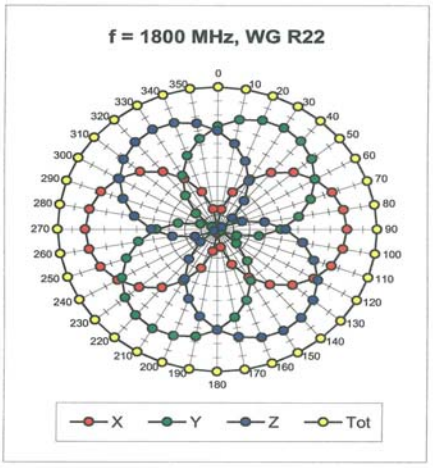


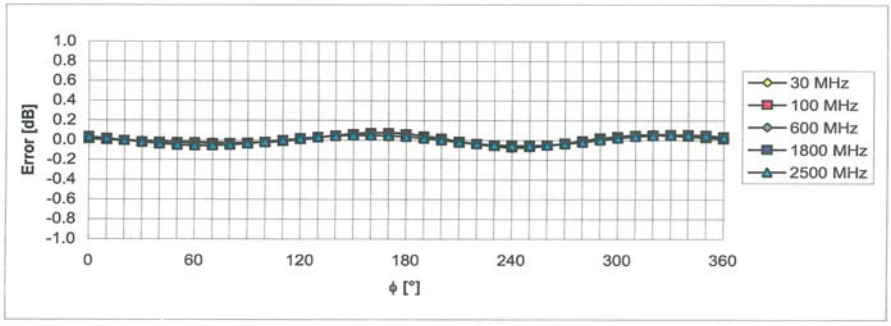
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

ET3DV6 SN:1591 March 23, 2006

Receiving Pattern (ϕ), ϑ = 0°







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

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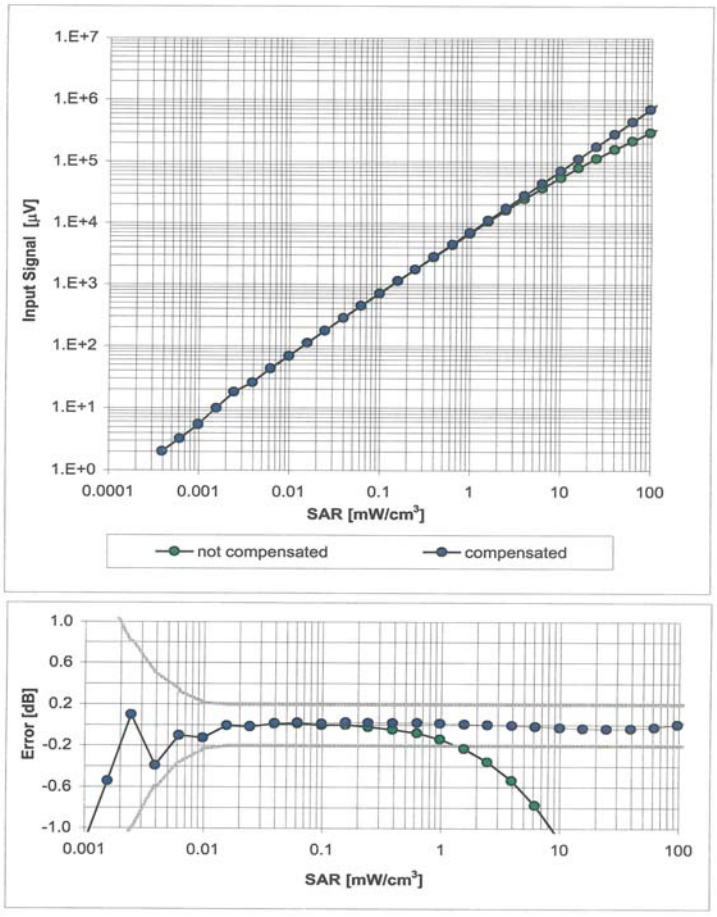
ET3DV6 SN:1591 March 23, 2006

Dynamic Range f(SAR_{head})

(Waveguide R22, f = 1800 MHz)

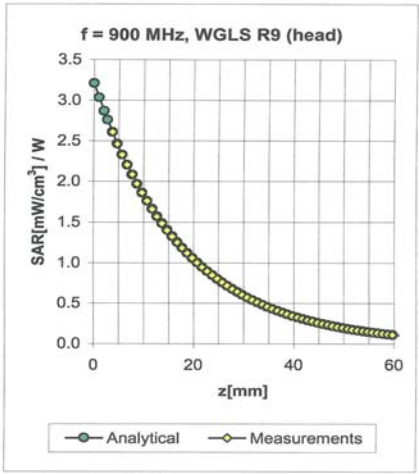


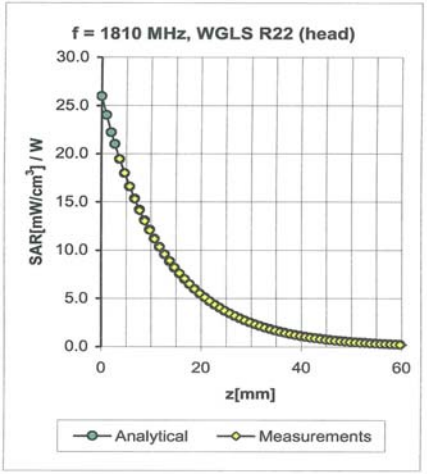
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: ET3-1591_Mar06 Page 7 of 9

ET3DV6 SN:1591 March 23, 2006

Conversion Factor Assessment





f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.49	1.91	6.87 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.43	2.66	5.41 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.58	2.15	4.59 ± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.40	2.24	6.35 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.63	2.34	4.67 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.62	2.03	4.18 ± 11.8% (k=2)

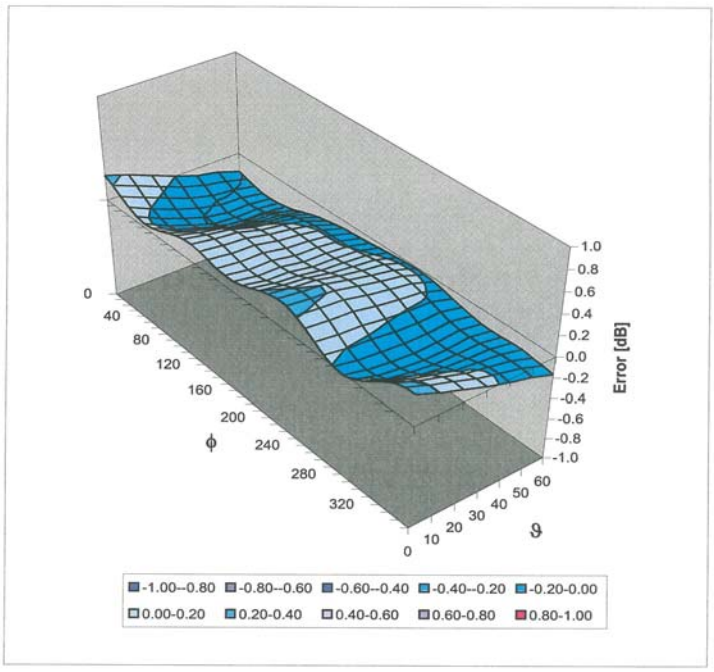
[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Certificate No: ET3-1591_Mar06 Page 8 of 9

ET3DV6 SN:1591 March 23, 2006

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: ET3-1591_Mar06 Page 9 of 9

APPENDIX C : Dipole Calibrations

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Accreditation No.: SCS 108

Client Nemko (Dymstec)

Certificate No: D835V2-4d017_Feb06

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d017
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits
Calibration date:	February 20, 2006
Condition of the calibrated item	In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Reference 20 dB Attenuator	SN: 5086 (20g)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference 10 dB Attenuator	SN: 5047.2 (10r)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference Probe ET3DV6	SN 1507	28-Oct-05 (SPEAG, No. ET3-1507_Oct05)	Oct-06
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	M. Meili
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 21, 2006

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

Certificate No: D835V2-4d017_Feb06 Page 1 of 6

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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:

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) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
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 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	DASY4	V4.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 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 ± 0.2) °C	42.1 ± 6 %	0.95mho/m ± 6 %
Head TSL temperature during test	(22.4 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	250 mW input power	2.38 mW / g
SAR normalized	normalized to 1W	9.52 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**9.36 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 mW / g
SAR normalized	normalized to 1W	6.16 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**6.11 mW / g ± 16.5 % (k=2)**

[1] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5 Ω - 2.1 jΩ
Return Loss	- 29.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.389 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	April 22, 2004

DASY4 Validation Report for Head TSL

Date/Time: 20.02.2006 17:15:40

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d017

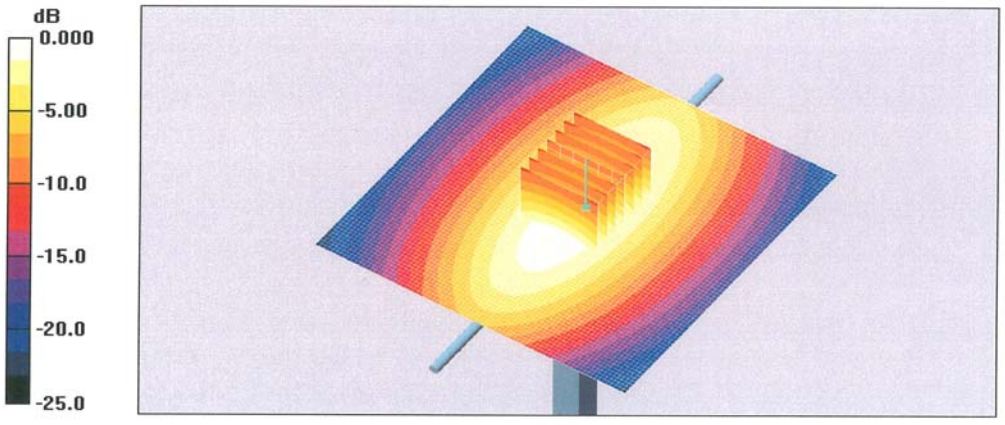
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL U10 BB;
Medium parameters used: f = 835 MHz; σ = 0.945 mho/m; ε_r = 42.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(6.09, 6.09, 6.09); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA
- Measurement SW: DASY4, V4.6 Build 57; Postprocessing SW: SEMCAD, V1.8 Build 160

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.58 mW/g

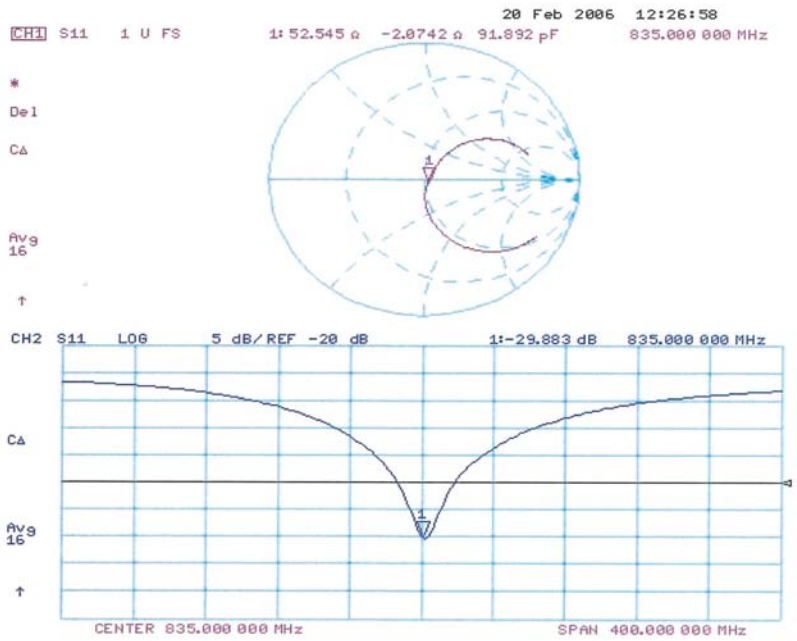
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.1 V/m; Power Drift = -0.011 dB
Peak SAR (extrapolated) = 3.59 W/kg
SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.54 mW/g
Maximum value of SAR (measured) = 2.58 mW/g



0 dB = 2.58mW/g

Certificate No: D835V2-4d017_Feb06 Page 5 of 6

Impedance Measurement Plot for Head TSL



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

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

Accredited by the Swiss Federal Office of Metrology and Accreditation
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: Nemko (Dymstec)

Certificate No: D1900V2-5d059_Jul06

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d059
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits
Calibration date:	July 17, 2006
Condition of the calibrated item	In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Reference 20 dB Attenuator	SN: 5086 (20g)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference 10 dB Attenuator	SN: 5047.2 (10r)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference Probe ET3DV6	SN: 1507	28-Oct-05 (SPEAG, No. ET3-1507_Oct05)	Oct-06
DAE4	SN: 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

	Name	Function	Signature
Calibrated by:	Marcel Fehr	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 18, 2006

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

Certificate No: D1900V2-5d059_Jul06 Page 1 of 6

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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:

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) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
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 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.

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Measurement Conditions

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

DASY Version	DASY4	V4.7
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 ± 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 ± 0.2) °C	39.3 ± 6 %	1.44 mho/m ± 6 %
Head TSL temperature during test	(22.9 ± 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	9.56 mW / g
SAR normalized	normalized to 1W	38.2 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**37.4 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.04 mW / g
SAR normalized	normalized to 1W	20.2 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**19.9 mW / g ± 16.5 % (k=2)**

[1] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 Ω + 3.0 jΩ
Return Loss	- 25.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.196 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 19, 2004

DASY4 Validation Report for Head TSL

Date/Time: 17.07.2006 15:58:20

Test Laboratory: SPEAG, Zurich, Switzerland

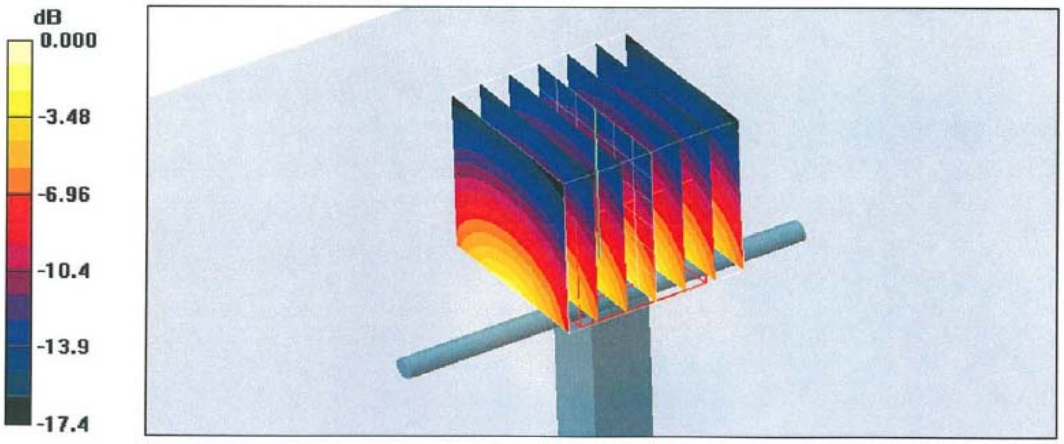
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d059

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL U10 BB;
Medium parameters used: f = 1900 MHz; σ = 1.44 mho/m; ε_r = 39.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

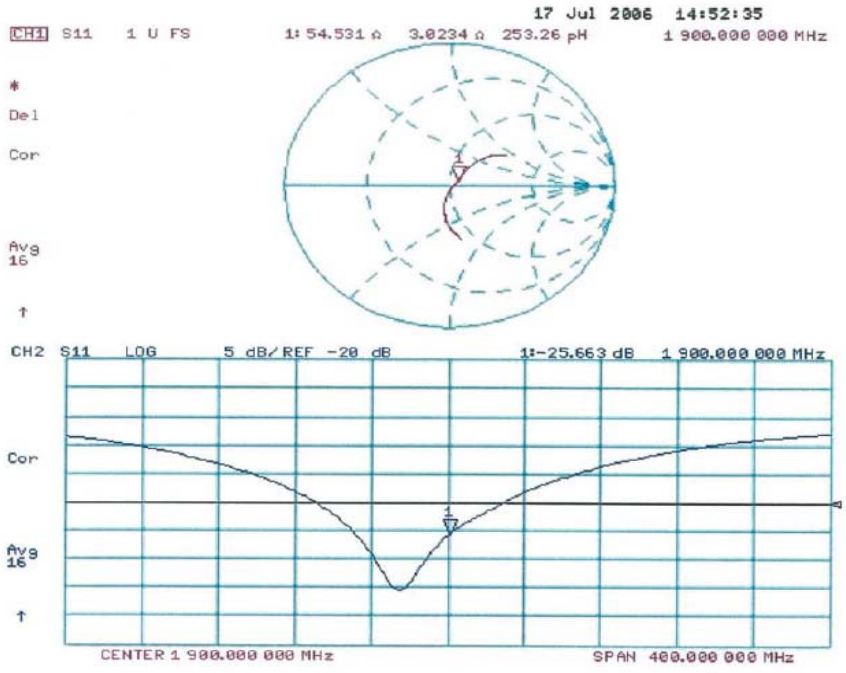
- Probe: ET3DV6 - SN1507 (HF); ConvF(4.74, 4.74, 4.74); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.9 V/m; Power Drift = -0.075 dB
Peak SAR (extrapolated) = 16.5 W/kg
SAR(1 g) = 9.56 mW/g; SAR(10 g) = 5.04 mW/g
Maximum value of SAR (measured) = 10.8 mW/g



0 dB = 10.8mW/g

Impedance Measurement Plot for Head TSL



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APPENDIX D : Photographs of EUT

Front View Of EUT

Rear View Of EUT

Top View Of EUT

Bottom View Of EUT

Side View Of EUT

Side View Of EUT

Label View Of EUT