

# LG Electronics Inc.

**DUT: KC550 ;Type: PCS GSM/ EDGE Phone with Bluetooth; Serial:#1**

Communication System: PCS 1900; Frequency: 1880.00 MHz;Duty Cycle: 1:8.3  
Medium: Head 1880.00 MHz;(σ = 1.4 mho/m; ε<sub>r</sub> = 39.6; ρ = 1000 kg/m<sup>3</sup>)  
Phantom section: Left Section

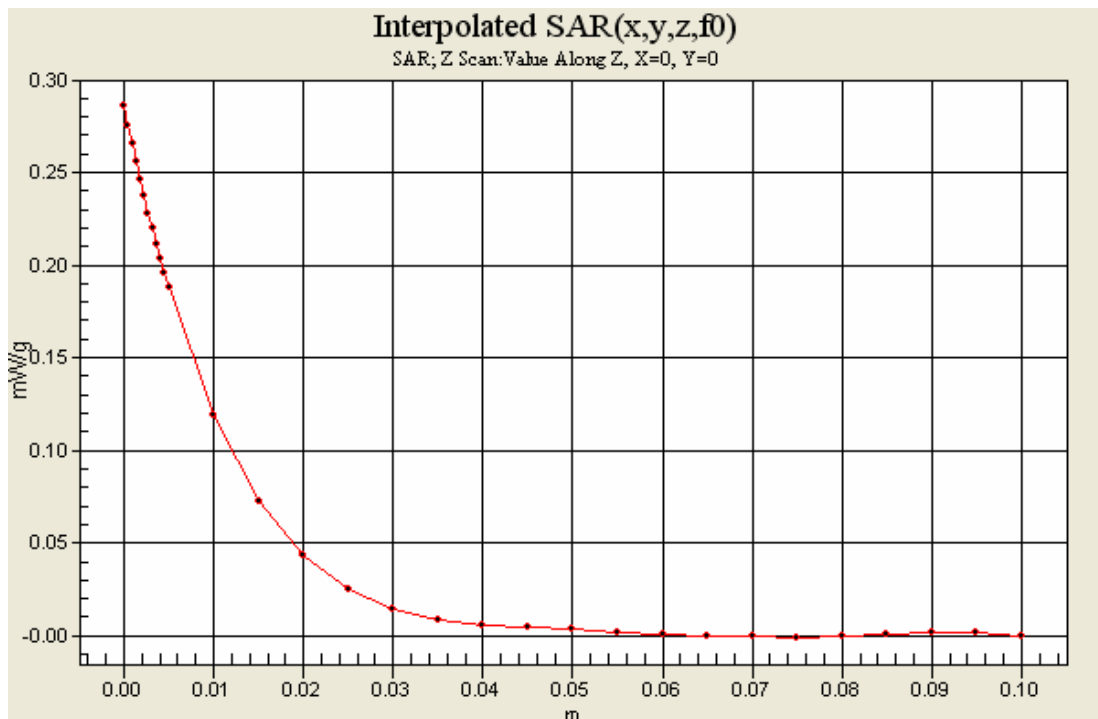
Test Date: 03/24/2008;Ambient Temp: 22. 9°C;Tissue Temp: 21.8°C

Probe: ET3DV6 - SN1715; ConvF(5.14, 5.14, 5.14); Calibrated: 2007-09-26  
Sensor-Surface: 4mm (Mechanical Surface Detection)  
Electronics: DAE4 Sn534; Calibrated: 2007-09-24  
Phantom: SAM 1800; Type: SAM 4.0; Serial:TP-1244  
Measurement SW: DASY4, V4.7 Build 55; Post processing SW: SEMCAD, V1.8 Build 171

## Left Head Tilt, Ch.661, Slider Down, Fixed Ant., Standard Battery

**Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.343mW/g

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 15.5V/m; Power Drift = -0.292dB  
Peak SAR (extrapolated) = 0.445W/kg  
**SAR(1 g) = 0.286mW/g; SAR(10 g) = 0.167mW/g**  
Maximum value of SAR (measured) = 0.305mW/g



0 dB = 0.305mW/g

# LG Electronics Inc.

**DUT: KC550 ;Type: PCS GSM/ EDGE Phone with Bluetooth; Serial:#1**

Communication System: EGPRS 1900; Frequency: 1880.00 MHz;Duty Cycle: 1:2.075

Medium: Head 1880.00 MHz;(σ = 1.49 mho/m; ε<sub>r</sub> = 53.8; ρ = 1000 kg/m<sup>3</sup>)

Phantom section: Flat Section

Test Date: 03/24/2008;Ambient Temp: 22. 9°C;Tissue Temp: 21.8°C

Probe: ET3DV6 - SN1715; ConvF(4.72, 4.72, 4.72); Calibrated: 2007-09-26

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn534; Calibrated: 2007-09-24

Phantom: SAM 1800; Type: SAM 4.0; Serial:TP-1244

Measurement SW: DASY4, V4.7 Build 55; Post processing SW: SEMCAD, V1.8 Build 171

**Flat Touch, Ch.661, Rear, Slider Up, Fixed Ant., Standard Battery**

**Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.359mW/g

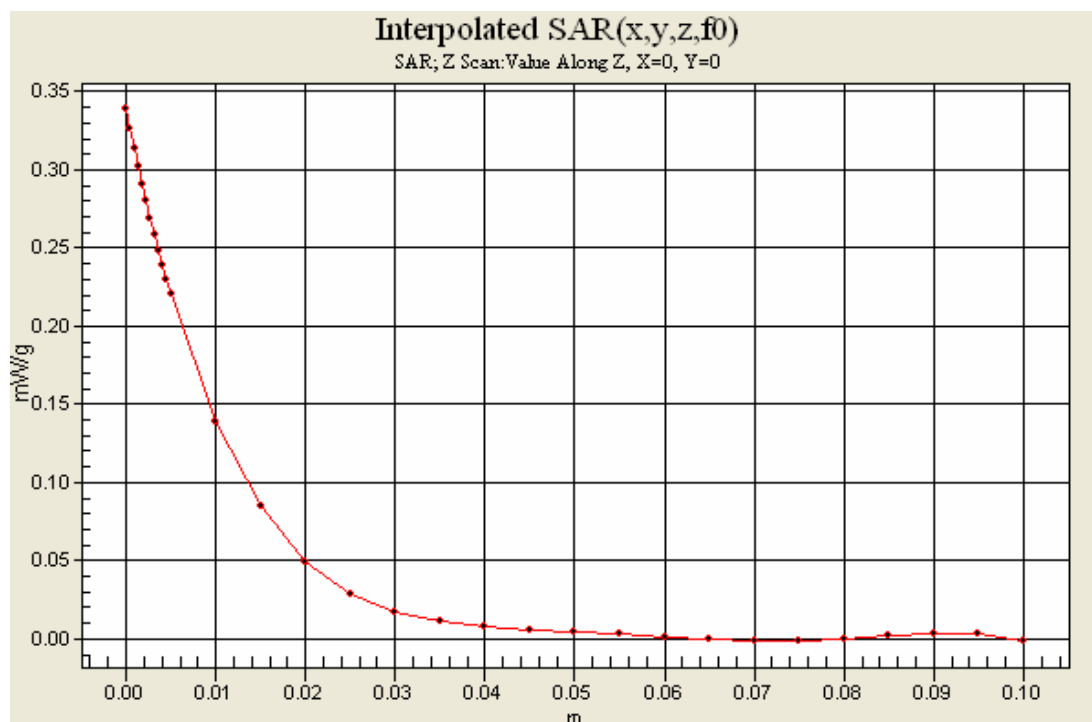
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.19V/m; Power Drift = 0.006dB

Peak SAR (extrapolated) = 0.523W/kg

**SAR(1 g) = 0.324mW/g; SAR(10 g) = 0.187mW/g**

Maximum value of SAR (measured) = 0.352mW/g



0 dB = 0.352mW/g

**Calibration Laboratory of  
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: **SCS 108**

Client **LG (Dymstec)**

Certificate No: **ET3-1715\_Sep07**

**CALIBRATION CERTIFICATE**

Object: **ET3DV6 - SN:1715**

Calibration procedure(s): **QA CAL-01.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **September 26, 2007**

Condition of the calibrated item: **In Tolerance**

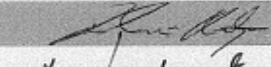
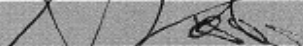
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (METAS, No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (METAS, No. 217-00720)	Aug-08
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08


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 Oct-06)	In house check: Oct-07


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

Issued: September 26, 2007

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Accreditation No.: **SCS 108**

**Glossary:**

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ 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:**

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

**Methods Applied and Interpretation of Parameters:**

- **NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- **NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* 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<sub>x,y,z</sub>**: 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  $f \leq 800$  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<sub>x,y,z</sub> \* *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  $\pm 50$  MHz to  $\pm 100$  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.

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Certificate No: ET3-1715\_Sep07

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ET3DV6 SN:1715

September 26, 2007

# Probe ET3DV6

## SN:1715

Manufactured:	August 7, 2002
Last calibrated:	November 21, 2006
Recalibrated:	September 26, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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ET3DV6 SN:1715

September 26, 2007

**DASY - Parameters of Probe: ET3DV6 SN:1715**

Sensitivity in Free Space<sup>A</sup>

Diode Compression<sup>B</sup>

NormX	1.77 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	92 mV
NormY	1.53 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	95 mV
NormZ	1.79 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	96 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		<b>3.7 mm</b>	<b>4.7 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	5.8	2.9
SAR <sub>be</sub> [%]	With Correction Algorithm	0.1	0.1

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

Sensor Center to Phantom Surface Distance		<b>3.7 mm</b>	<b>4.7 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	11.9	8.5
SAR <sub>be</sub> [%]	With Correction Algorithm	0.2	0.1

Sensor Offset

Probe Tip to Sensor Center	<b>2.7 mm</b>
Optical Surface Detection	<b>low, but repeatable</b>

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%.

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

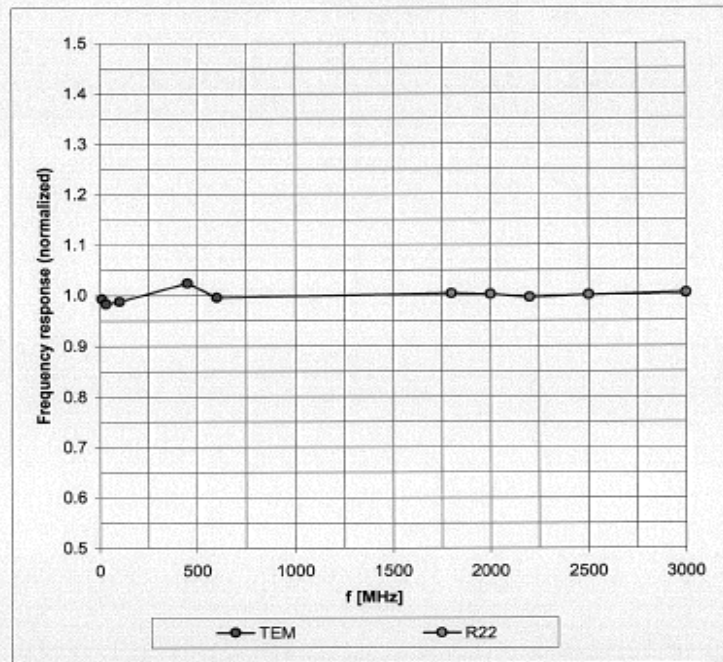
<sup>B</sup> Numerical linearization parameter: uncertainty not required.

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### Frequency Response of E-Field

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

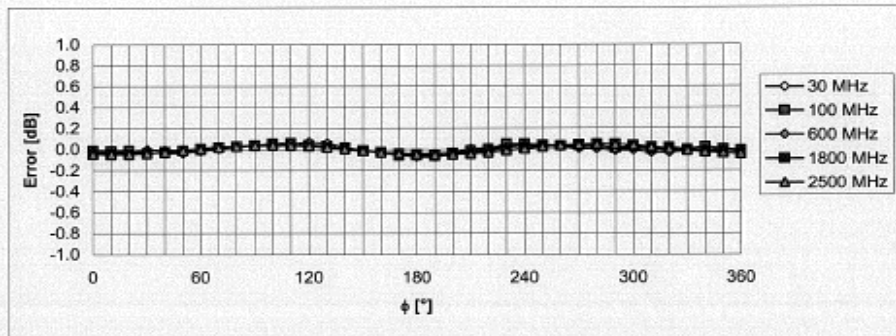
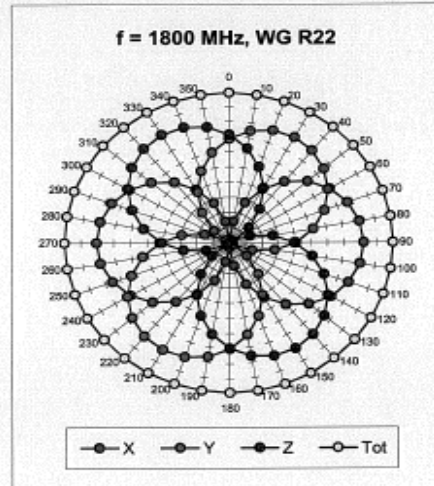
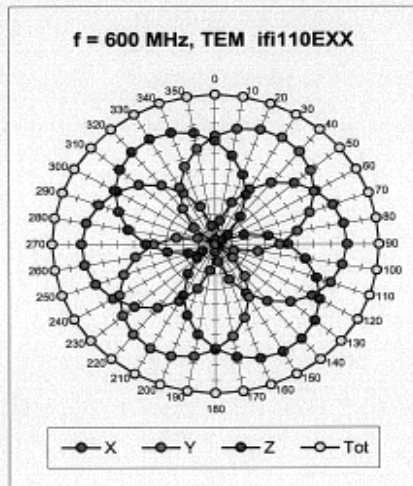


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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Receiving Pattern ( $\phi$ ),  $\vartheta = 0^\circ$



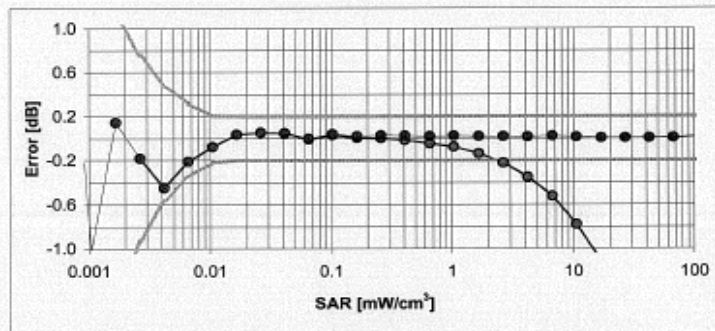
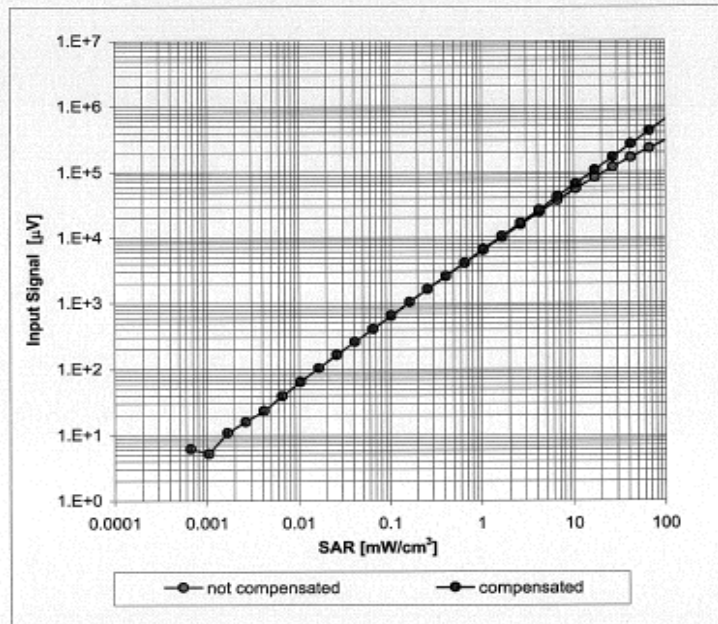
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)



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**Dynamic Range f(SAR<sub>head</sub>)**  
(Waveguide R22, f = 1800 MHz)

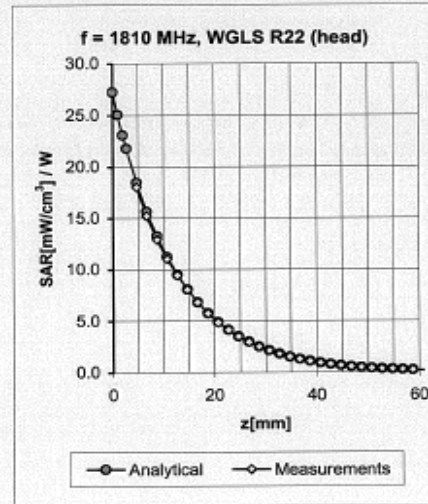
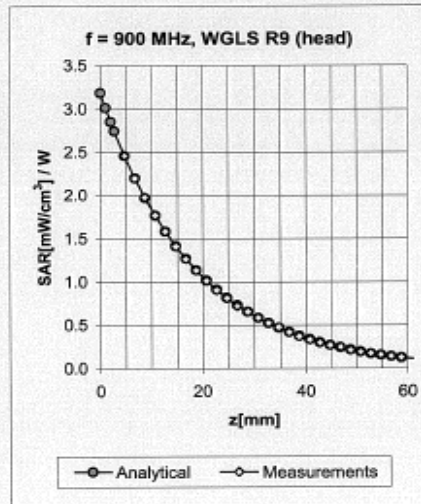


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

ET3DV6 SN:1715

September 26, 2007

### Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.22	3.30	6.40 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.48	2.67	5.14 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.67	2.24	4.89 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.51	2.94	4.52 ± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.34	2.66	6.16 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.51	3.21	4.72 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.81	2.04	4.41 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.53	2.96	3.84 ± 11.8% (k=2)

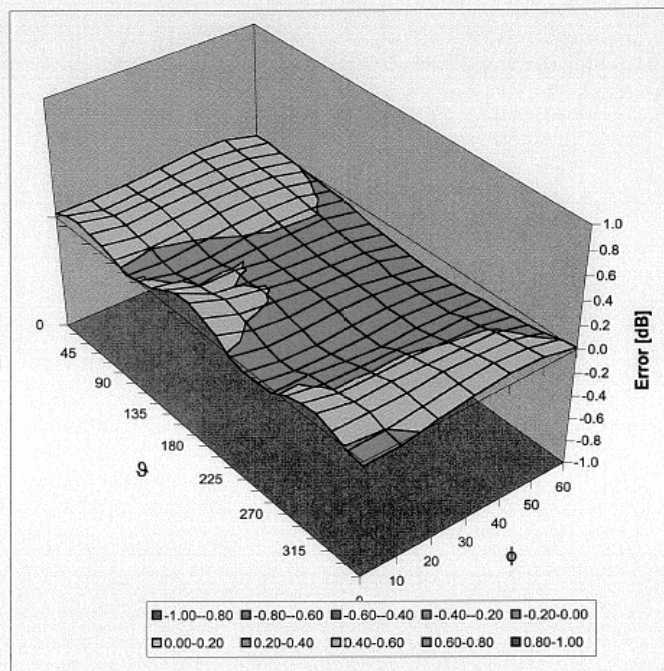
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ET3DV6 SN:1715

September 26, 2007

### Deviation from Isotropy in HSL

Error ( $\phi, \theta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

Certificate No: ET3-1715\_Sep07

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Accreditation No.: **SCS 108**

Client **LG (Dymstec)**

Certificate No: **D1900V2-5d017\_Jan07**

**CALIBRATION CERTIFICATE**

Object **D1900V2- SN: 5d017**

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

Calibration date: **January 23, 2007**



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	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Power sensor HP 8481A	US37292783	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference Probe ET3DV6	SN: 1507	19-Oct-06 (SPEAG, No. ET3-1507_Oct06)	Oct-07
Reference Probe ES3DV3	SN: 3025	19-Oct-06 (SPEAG, No. ES3-3025_Oct06)	Oct-07
DAE4	SN 907	20-Jul-06 (SPEAG, No. DAE4-907_Jul06)	Jul-07
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 Oct-06)	In house check: Oct-07

	Name	Function	Signature
Calibrated by:	Mike Melli	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 24, 2007

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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	V4.7
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	38.8 ± 6 %	1.43 mho/m ± 6 %
Head TSL temperature during test	(21.7 ± 0.2) °C	—	—

**SAR result with Head TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	condition	
SAR measured	250 mW input power	9.66 mW / g
SAR normalized	normalized to 1W	38.6 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	37.6 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.05 mW / g
SAR normalized	normalized to 1W	20.2mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	19.9 mW / g ± 16.5 % (k=2)

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	53.2 $\Omega$ + 3.0 j $\Omega$
Return Loss	- 27.4 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.196 ns
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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	June 4, 2002

**DASY4 Validation Report for Head TSL**

Date/Time: 23.01.2007 14:37:49

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d017**

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

Medium: HSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.43$  mho/m;  $\epsilon_r = 38.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

**DASY4 Configuration:**

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.97, 4.97, 4.97); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn907; Calibrated: 20.07.2006
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:**

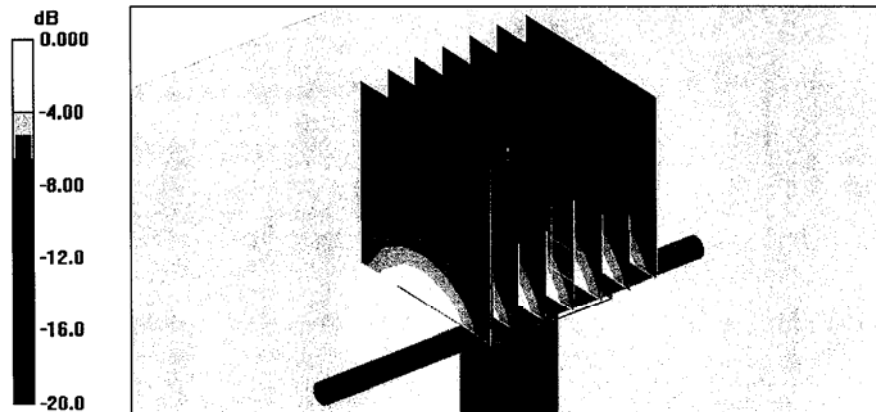
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.0 V/m; Power Drift = 0.028 dB

Peak SAR (extrapolated) = 16.9 W/kg

**SAR(1 g) = 9.66 mW/g; SAR(10 g) = 5.05 mW/g**

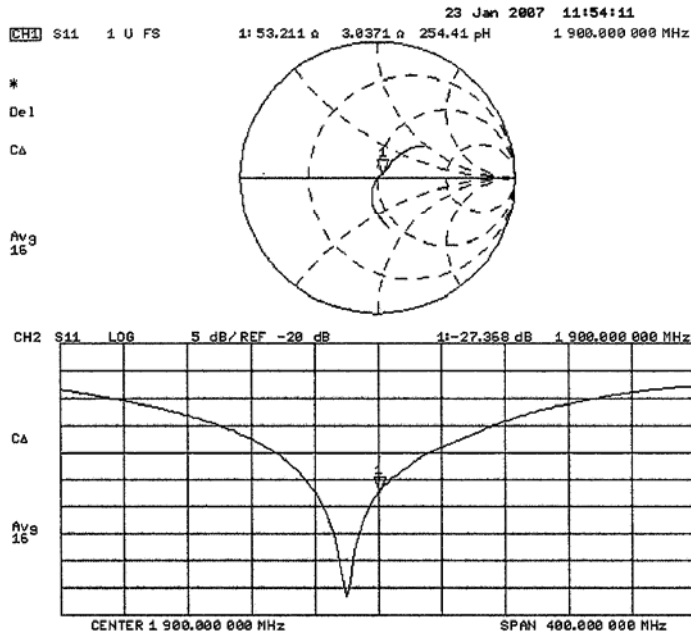
Maximum value of SAR (measured) = 11.0 mW/g



0 dB = 11.0mW/g



### Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d017\_Jan07

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