

## **APPENDIX E**

### **The Validation Measurements**

### 1900MHz Dipole Validation

DUT: Dipole 1900 MHz; Serial: 5d023

Program Name: 1900MHz Dipole Validation 2007.05.31

Procedure Name: 1900MHz

#### Procedure Notes:

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 38.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3085; ConvF(4.95, 4.95, 4.95); Calibrated: 2006-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn468; Calibrated: 2007-04-20
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1247
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

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

Reference Value = 91.5 V/m; Power Drift = -0.019 dB

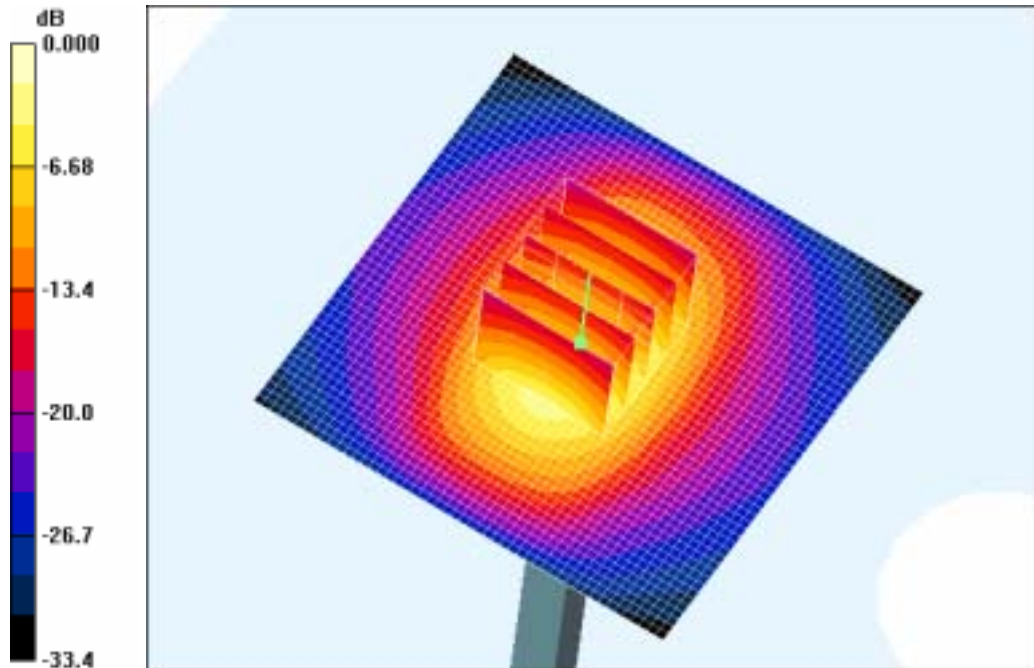
Peak SAR (extrapolated) = 19.3 W/kg

**SAR(1 g) = 10.3 mW/g**

Maximum value of SAR (measured) = 11.6 mW/g

**1900MHz/Area Scan (51x51x1):** Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 15.3 mW/g



0 dB = 15.3mW/g

## **APPENDIX F**

### **Plots of The SAR Measurements**

SAMSUNG FCC ID : A3LSGHP520 GSM1900 Head SAR

DUT: SGH-P520; Serial: FE-098-E

Program Name: SGH-P520 GSM1900 Right (Job No. : FE-098)

Procedure Name: Cheek/Touch, Ch.512, Ant.Intenna, Bat.Standard with BT ON

Meas.Ambient Temp(celsius)-21.9, Tissue Temp(celsius)-21.7 ;Test Date-31/May/2007

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3

Medium parameters used:  $f = 1850.2$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 38.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3085; ConvF(4.95, 4.95, 4.95); Calibrated: 2006-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn468; Calibrated: 2007-04-20
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1247
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Cheek/Touch, Ch.512, Ant.Intenna, Bat.Standard with BT ON/Zoom Scan (5x5x7)/Cube**

0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.0 V/m; Power Drift = 0.145 dB

Peak SAR (extrapolated) = 3.12 W/kg

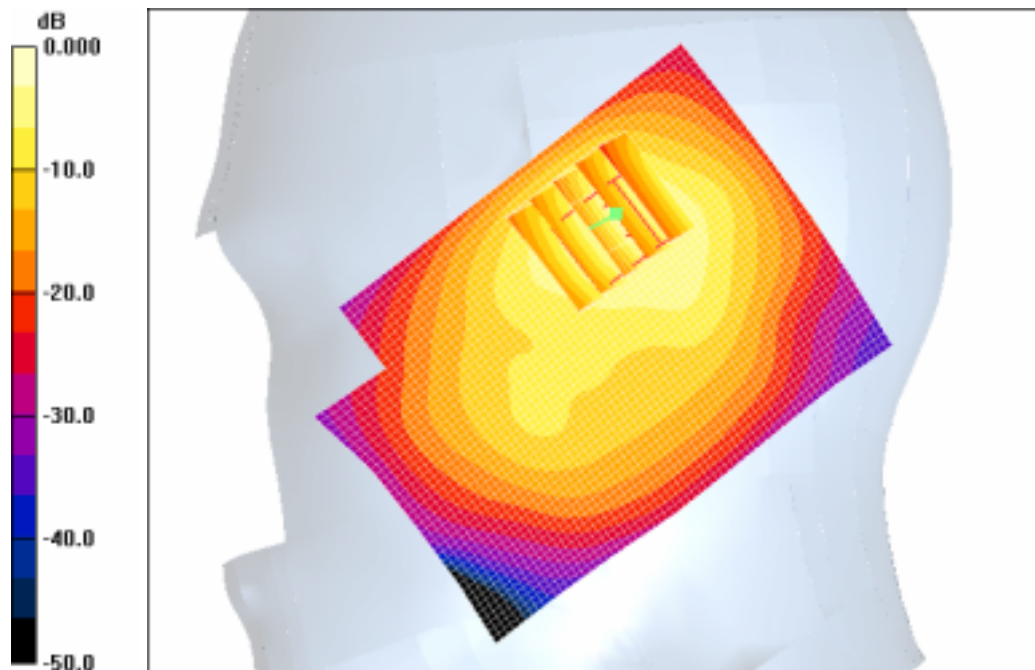
**SAR(1 g) = 1.44 mW/g**

Maximum value of SAR (measured) = 1.59 mW/g

**Cheek/Touch, Ch.512, Ant.Intenna, Bat.Standard with BT ON/Area Scan (51x71x1):**

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 1.82 mW/g



0 dB = 1.82mW/g

SAMSUNG FCC ID : A3LSGHP520 GSM1900 Head SAR

DUT: SGH-P520; Serial: FE-098-E

Program Name: SGH-P520 GSM1900 Right (Job No. : FE-098)

Procedure Name: Ear/Tilt, Ch.512, Ant.Intenna, Bat.Standard

Meas.Ambient Temp(celsius)-21.9, Tissue Temp(celsius)-21.7 ;Test Date-31/May/2007

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3

Medium parameters used:  $f = 1850.2$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 38.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3085; ConvF(4.95, 4.95, 4.95); Calibrated: 2006-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn468; Calibrated: 2007-04-20
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1247
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ear/Tilt, Ch.512, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.6 V/m; Power Drift = -0.044 dB

Peak SAR (extrapolated) = 2.20 W/kg

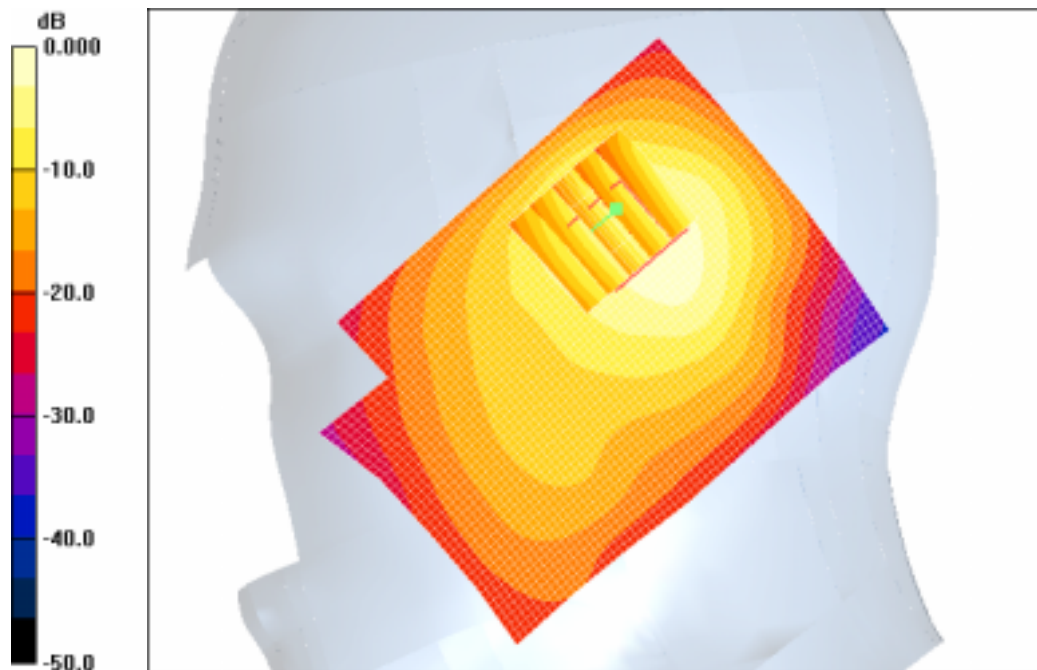
**SAR(1 g) = 1.05 mW/g**

Maximum value of SAR (measured) = 1.15 mW/g

Ear/Tilt, Ch.512, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 1.39 mW/g



0 dB = 1.39mW/g

SAMSUNG FCC ID : A3LSGHP520 GSM1900 Head SAR

DUT: SGH-P520; Serial: FE-098-E

Program Name: SGH-P520 GSM1900 Left (Job No. : FE-098)

Procedure Name: Cheek/Touch, Ch.661, Ant.Intenna, Bat.Standard

Meas.Ambient Temp(celsius)-21.9, Tissue Temp(celsius)-21.7 ;Test Date-31/May/2007

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 38.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3085; ConvF(4.95, 4.95, 4.95); Calibrated: 2006-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn468; Calibrated: 2007-04-20
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1247
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Cheek/Touch, Ch.661, Ant.Intenna, Bat.Standard/Area Scan (51x71x1):** Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.831 mW/g

**Cheek/Touch, Ch.661, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0:**

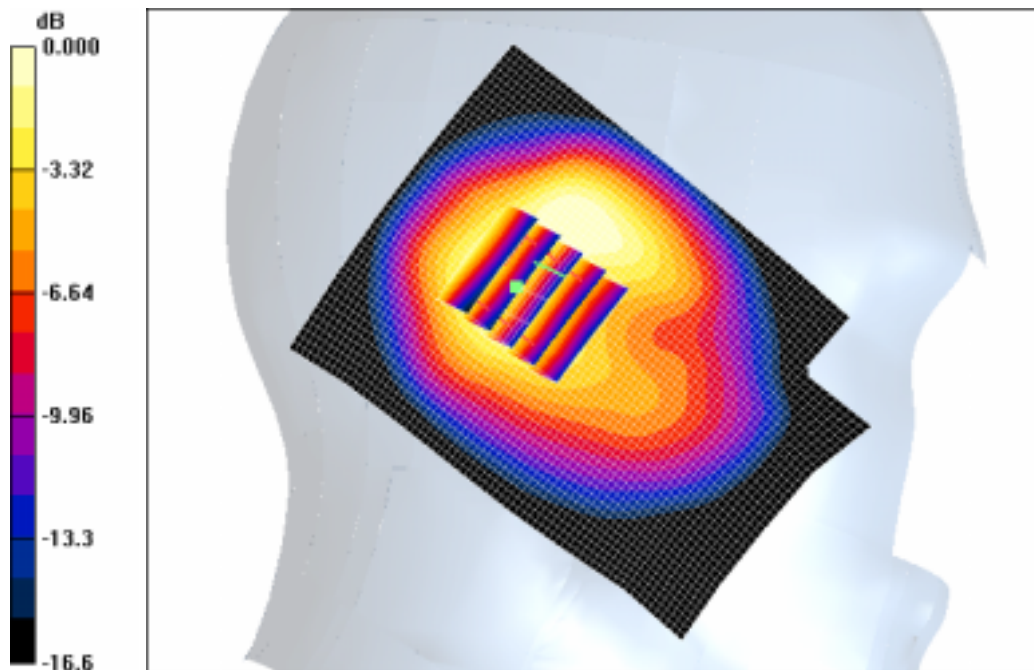
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.6 V/m; Power Drift = 0.052 dB

Peak SAR (extrapolated) = 1.18 W/kg

**SAR(1 g) = 0.666 mW/g**

Maximum value of SAR (measured) = 0.736 mW/g



0 dB = 0.736mW/g

SAMSUNG FCC ID : A3LSGHP520 GSM1900 Head SAR

DUT: SGH-P520; Serial: FE-098-E

Program Name: SGH-P520 GSM1900 Left (Job No. : FE-098)

Procedure Name: Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard

Meas.Ambient Temp(celsius)-21.9, Tissue Temp(celsius)-21.7 ;Test Date-31/May/2007

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 38.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3085; ConvF(4.95, 4.95, 4.95); Calibrated: 2006-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn468; Calibrated: 2007-04-20
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1247
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid:

$dx=20$ mm,  $dy=20$ mm

Maximum value of SAR (interpolated) = 1.38 mW/g

Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement

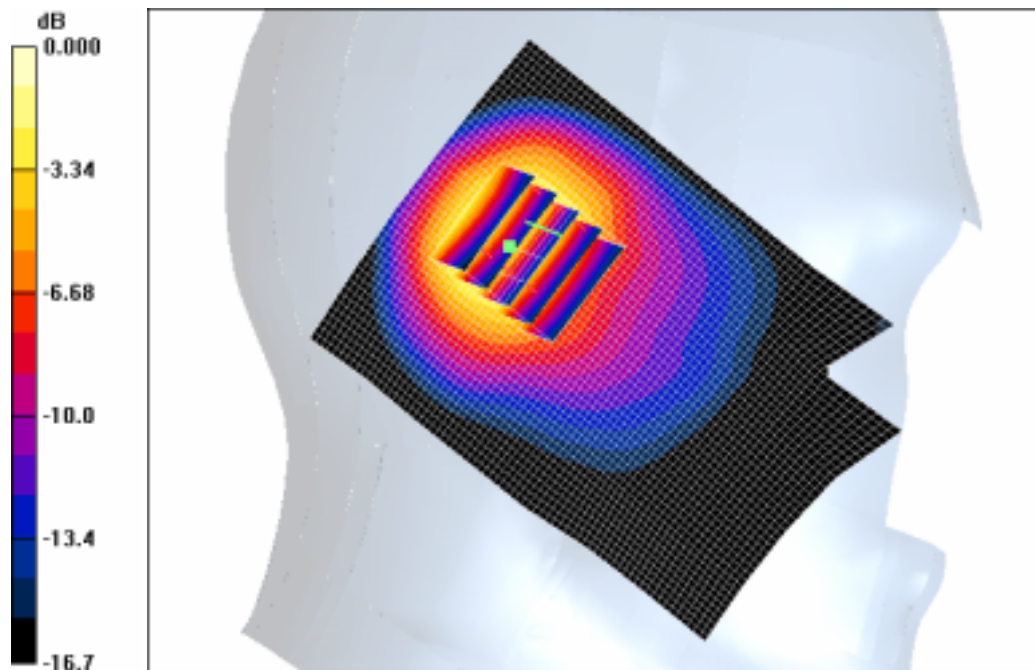
grid:  $dx=8$ mm,  $dy=8$ mm,  $dz=5$ mm

Reference Value = 29.1 V/m; Power Drift = -0.115 dB

Peak SAR (extrapolated) = 1.93 W/kg

**SAR(1 g) = 1.04 mW/g**

Maximum value of SAR (measured) = 1.18 mW/g



0 dB = 1.18mW/g

SAMSUNG FCC ID : A3LSGHP520 GSM1900 Head SAR

DUT: SGH-P520; Serial: FE-098-E

Program Name: SGH-P520 GSM1900 Right (Job No. : FE-098)

Procedure Name: Cheek/Touch, Ch.512, Ant.Intenna, Bat.Standard with BT ON

Meas.Ambient Temp(celsius)-21.9, Tissue Temp(celsius)-21.7 ;Test Date-31/May/2007

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3

Medium parameters used:  $f = 1850.2$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 38.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3085; ConvF(4.95, 4.95, 4.95); Calibrated: 2006-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn468; Calibrated: 2007-04-20
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1247
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Cheek/Touch, Ch.512, Ant.Intenna, Bat.Standard with BT ON/Zoom Scan (5x5x7)/Cube**

0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.0 V/m; Power Drift = 0.145 dB

Peak SAR (extrapolated) = 3.12 W/kg

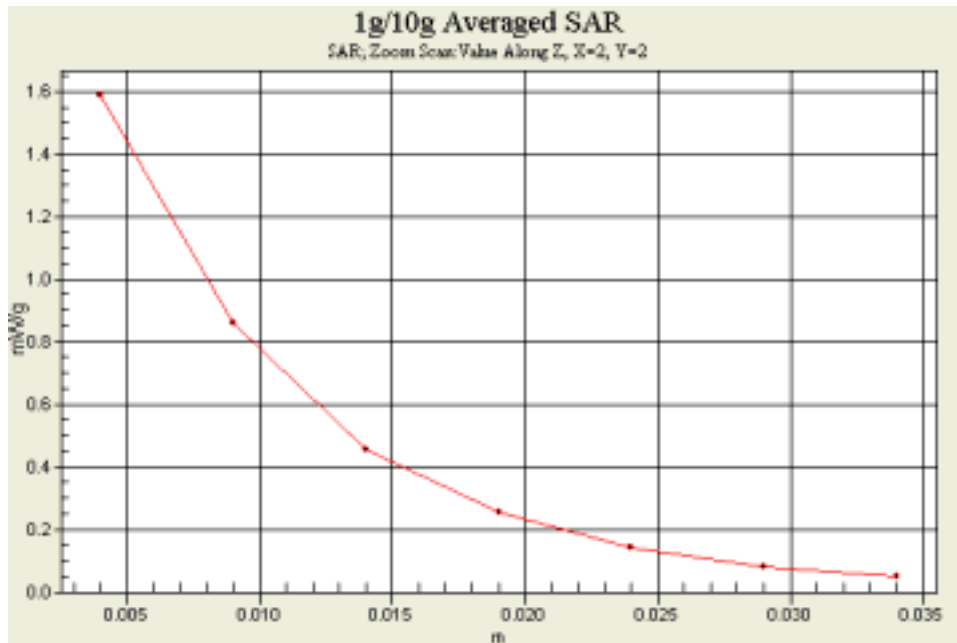
**SAR(1 g) = 1.44 mW/g**

Maximum value of SAR (measured) = 1.59 mW/g

**Cheek/Touch, Ch.512, Ant.Intenna, Bat.Standard with BT ON/Area Scan (51x71x1):**

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 1.82 mW/g



SAMSUNG FCC ID : A3LSGHP520 GPRS1900 Body SAR

DUT: SGH-P520; Serial: FE-098-E

Program Name: SGH-P520 GPRS1900 Body (Job No. : FE-098)

Procedure Name: Body, Ch.810, Ant.Intenna, Bat.Standard

Meas.Ambient Temp(celsius)-22.0, Tissue Temp(celsius)-21.7 ;Test Date-31/May/2007

Communication System: Body GPRS ; Frequency: 1909.8 MHz;Duty Cycle: 1:4.15

Medium parameters used:  $f = 1909.8$  MHz;  $\sigma = 1.56$  mho/m;  $\epsilon_r = 51.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3085; ConvF(4.61, 4.61, 4.61); Calibrated: 2006-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn468; Calibrated: 2007-04-20
- Phantom: SAM PHANTOM #2; Type: SAM; Serial: TP-1248
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Body, Ch.810, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:

$dx=8$ mm,  $dy=8$ mm,  $dz=5$ mm

Reference Value = 15.5 V/m; Power Drift = 0.034 dB

Peak SAR (extrapolated) = 0.603 W/kg

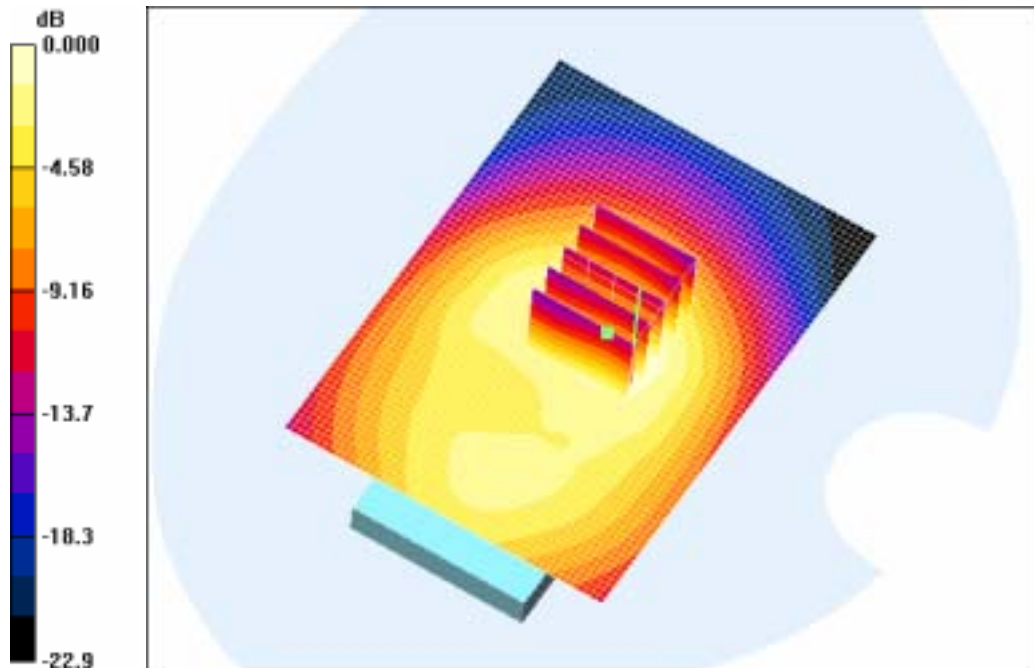
**SAR(1 g) = 0.364 mW/g**

Maximum value of SAR (measured) = 0.389 mW/g

**Body, Ch.810, Ant.Intenna, Bat.Standard/Area Scan (51x71x1):** Measurement grid:

$dx=20$ mm,  $dy=20$ mm

Maximum value of SAR (interpolated) = 0.438 mW/g



0 dB = 0.438mW/g

SAMSUNG FCC ID : A3LSGHP520 GPRS1900 Body SAR

DUT: SGH-P520; Serial: FE-098-E

Program Name: SGH-P520 GPRS1900 Body (Job No. : FE-098)

Procedure Name: Body, Ch.810, Ant.Intenna, Bat.Standard

Meas.Ambient Temp(celsius)-22.0, Tissue Temp(celsius)-21.7 ;Test Date-31/May/2007

Communication System: Body GPRS ; Frequency: 1909.8 MHz;Duty Cycle: 1:4.15

Medium parameters used:  $f = 1909.8$  MHz;  $\sigma = 1.56$  mho/m;  $\epsilon_r = 51.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3085; ConvF(4.61, 4.61, 4.61); Calibrated: 2006-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn468; Calibrated: 2007-04-20
- Phantom: SAM PHANTOM #2; Type: SAM; Serial: TP-1248
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Body, Ch.810, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:

$dx=8$ mm,  $dy=8$ mm,  $dz=5$ mm

Reference Value = 15.5 V/m; Power Drift = 0.034 dB

Peak SAR (extrapolated) = 0.603 W/kg

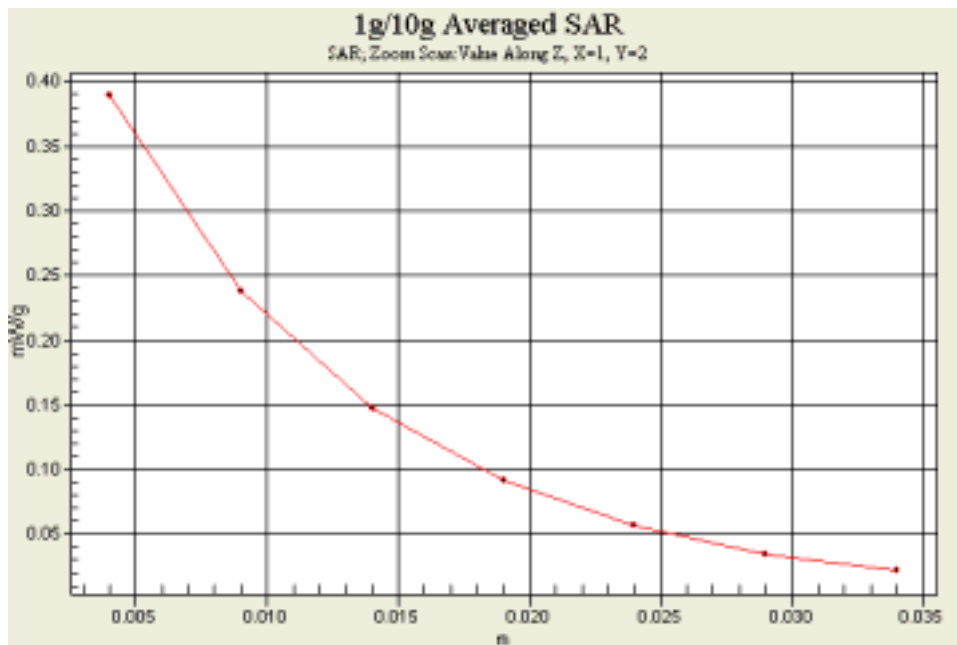
**SAR(1 g) = 0.364 mW/g**

Maximum value of SAR (measured) = 0.389 mW/g

**Body, Ch.810, Ant.Intenna, Bat.Standard/Area Scan (51x71x1):** Measurement grid:

$dx=20$ mm,  $dy=20$ mm

Maximum value of SAR (interpolated) = 0.438 mW/g



## **APPENDIX G**

### **Probe Calibration**



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 **Samsung Suwon C (Dymstec)**

Certificate No: **ES3-3085\_Nov06**

## CALIBRATION CERTIFICATE

Object: **ES3DV3 - SN:3085**

Calibration procedure(s): **QA CAL-01.v5  
Calibration procedure for dosimetric E-field probes**

Calibration date: **November 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	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-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 Oct-06)	In house check: Oct-07

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

Issued: November 23, 2006

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

*Handwritten signature and date: 2006.12.11*

ES3-3085-01(C)



#### 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:

- 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
- 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:

- 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.

# Probe ES3DV3

## SN:3085

Manufactured:	April 12, 2005
Last calibrated:	November 22, 2005
Recalibrated:	November 23, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

**DASY - Parameters of Probe: ES3DV3 SN:3085****Sensitivity in Free Space<sup>A</sup>**

NormX	1.23 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.25 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.30 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$

**Diode Compression<sup>B</sup>**

DCP X	96 mV
DCP Y	96 mV
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>3.0 mm</b>	<b>4.0 mm</b>
SAR <sub>tot</sub> [%]	Without Correction Algorithm	5.6	2.5
SAR <sub>tot</sub> [%]	With Correction Algorithm	0.5	0.0

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

Sensor Center to Phantom Surface Distance		<b>3.0 mm</b>	<b>4.0 mm</b>
SAR <sub>tot</sub> [%]	Without Correction Algorithm	7.8	4.9
SAR <sub>tot</sub> [%]	With Correction Algorithm	0.0	0.0

**Sensor Offset**

Probe Tip to Sensor Center                      **2.0 mm**

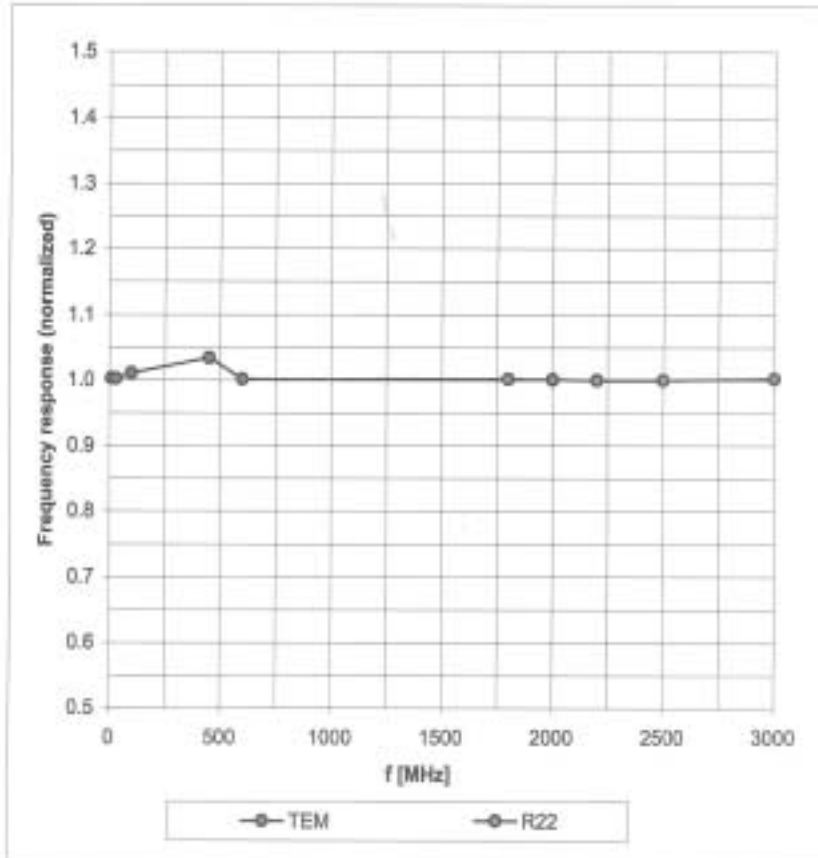
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

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

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

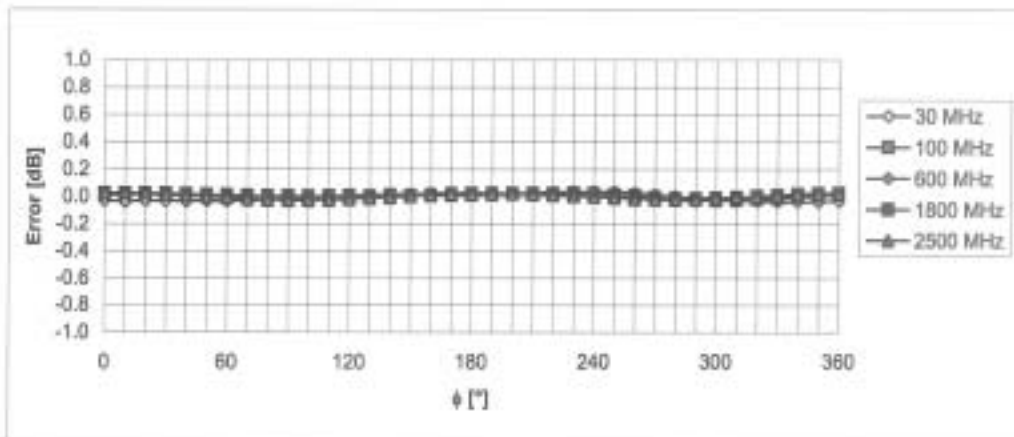
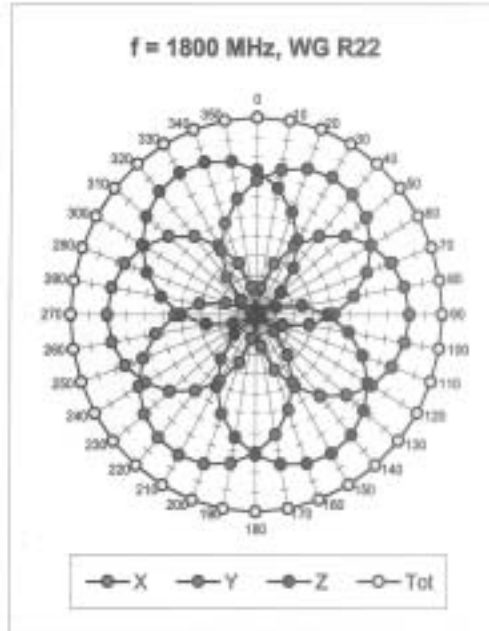
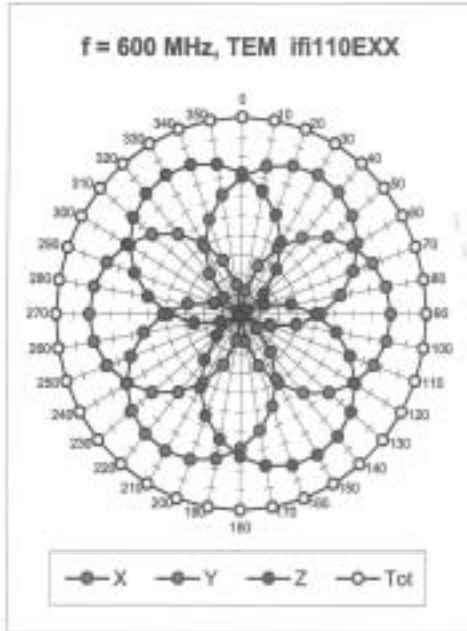
### Frequency Response of E-Field

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



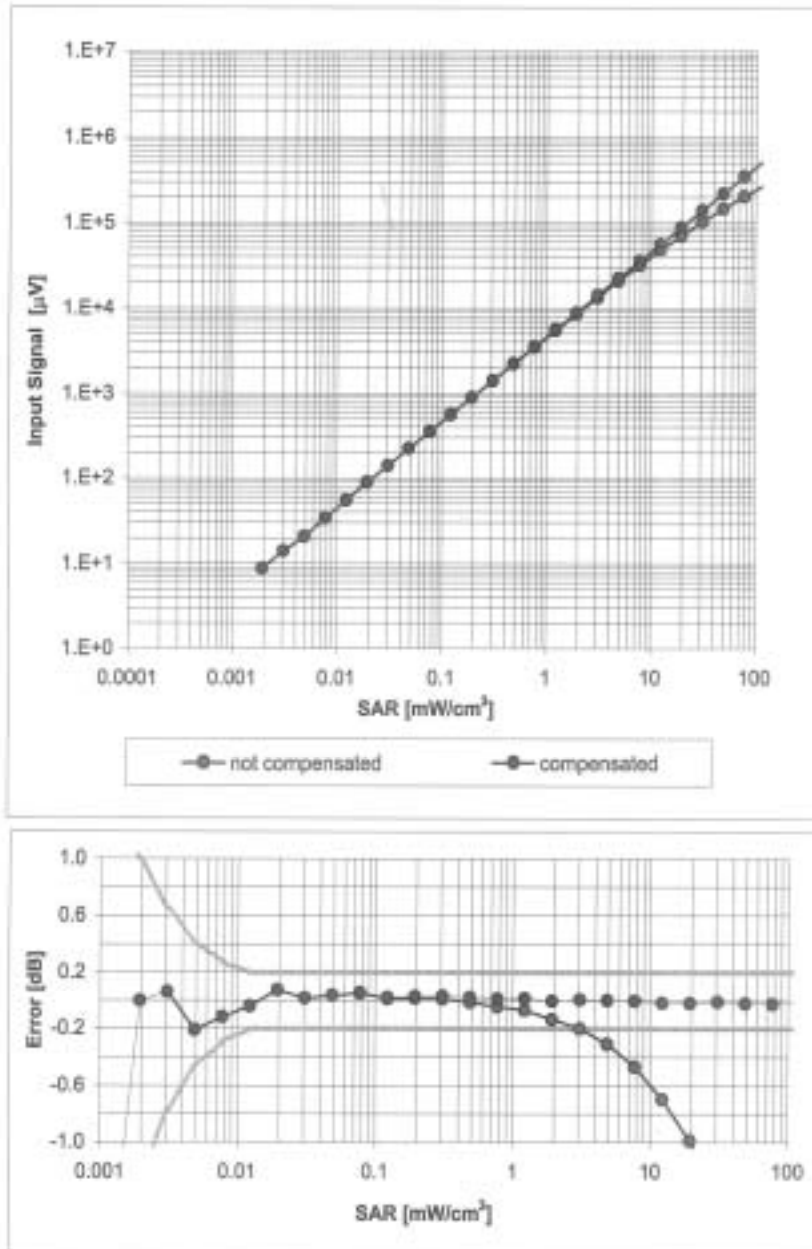
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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



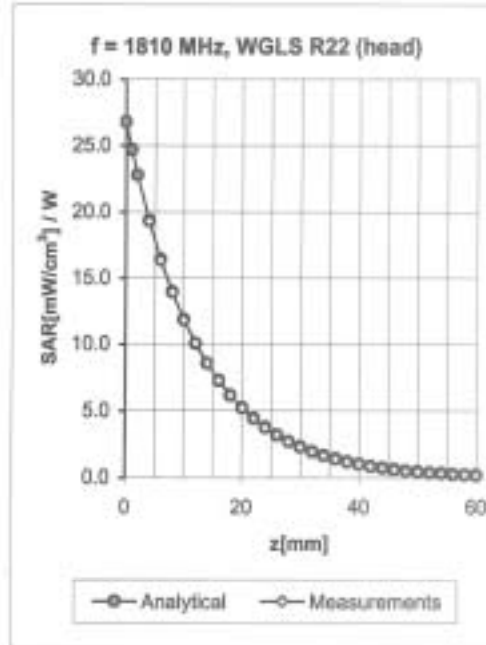
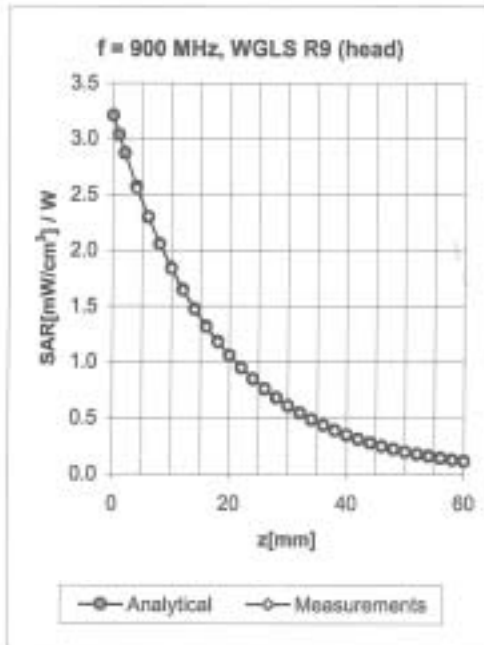
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

### Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$ )



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

## Conversion Factor Assessment

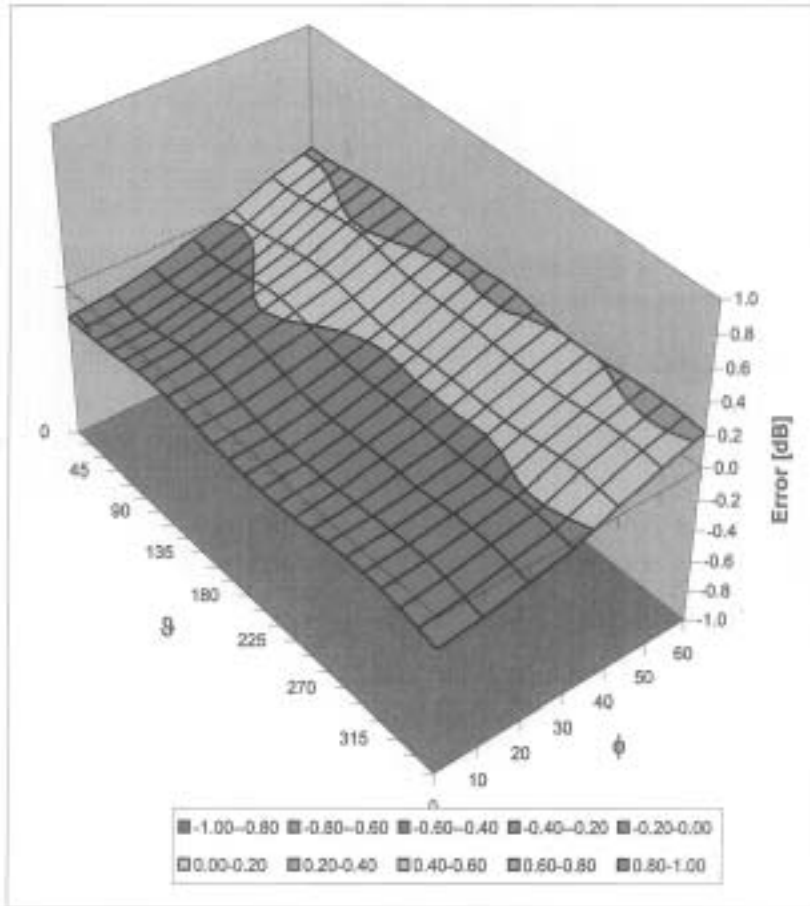


f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	1.00	1.12	5.94 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.90	1.15	4.95 ± 11.0% (k=2)
2000	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.86	1.19	4.84 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	1.00	1.17	6.07 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.87	1.29	4.61 ± 11.0% (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.

### Deviation from Isotropy in HSL

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



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

## **APPENDIX H**

### **Calibration of The Validation Dipole**



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 **Samsung C (Dymstec)**

Certificate No: D1900V2-5d023\_Feb07

## CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d023

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

Calibration date: February 20, 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	0837480704	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
DAE4	SN 601	30-Jan-07 (SPEAG, No. DAE4-601_Jan07)	Jan-08
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 S4208	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

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

Issued: February 21, 2007

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



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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
- 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
- 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 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 $\pm$ 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	38.8 $\pm$ 6 %	1.43 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.0 $\pm$ 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	9.41 mW / g
SAR normalized	normalized to 1W	37.6 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>36.6 mW / g <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.96 mW / g
SAR normalized	normalized to 1W	19.8mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>19.5 mW / g <math>\pm</math> 16.5 % (k=2)</b>

<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	53.8 $\Omega$ + 2.5 j $\Omega$
Return Loss	- 27.1 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.191 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	September 28, 2002

## DASY4 Validation Report for Head TSL

Date/Time: 20.02.2007 14:13:41

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d023**

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;  $\epsilon_r = 38.9$ ;  $\rho = 1000$  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 Sn601; Calibrated: 30.01.2007
- 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:**

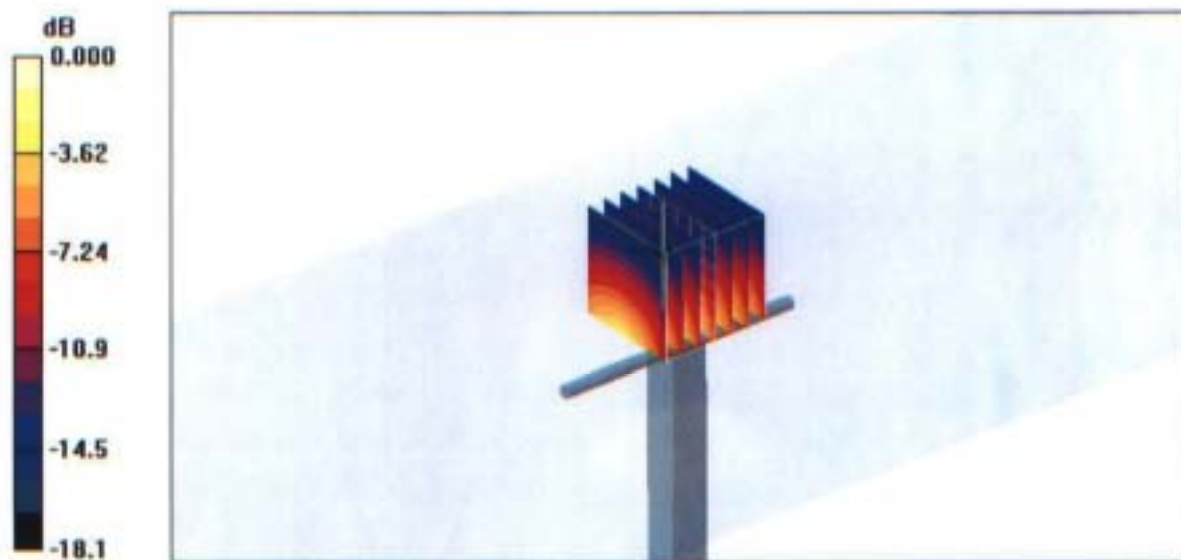
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.5 V/m; Power Drift = 0.068 dB

Peak SAR (extrapolated) = 16.2 W/kg

**SAR(1 g) = 9.41 mW/g; SAR(10 g) = 4.96 mW/g**

Maximum value of SAR (measured) = 10.4 mW/g



# Impedance Measurement Plot for Head TSL

