SAMSUNG ELECTRONICS Co., Ltd.,
Regulatory Compliance Group
IT R&D Center

416, Maetan-3dong,
Yeongtong-gu, Suwon-si,
Gyeonggi-do, Korea 443-742

TEST REPORT ON SAR

Model Tested:	**GT-I6410**
FCC ID (Requested):	**A3LGTI6410**
Job No:	**FG-248**
Report No:	**FG-248-S1**
Date issued:	**Sep.30, 2009**

- Abstract –

This document reports on SAR Tests carried out in accordance with FCC/OET Bulletin 65, Supplement C(July 2001).

Prepared By

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Authorized By

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Contents

1. GENERAL INFORMATION

Test Sample :	Dual-Band GSM/EDGE 850/1900 Phone with Bluetooth
Model Number :	GT-I6410
Serial Number :	Identical prototype (S/N : # FG-248-B)
Manufacturer :	SAMSUNG ELECTRONICS Co., Ltd.
Address :	416 Maetan3-Dong, Yeongtong-gu, Suwon City Gyeonggi-Do, Korea 443-742
Test Standard :	§2.1093; FCC/OET Bulletin 65, Supplement C(July 2001)
FCC Classification :	Licensed Portable Transmitter Held to Ear (PCE)
Test Dates :	Sep.04, 2009 ~ Sep.07, 2009
Tested for :	FCC/TCB Certification

2. DESCRIPTION OF DEVICE

Tx Freq. Range :	824.2 ~ 848.8 MHz (GSM850)
	1850.20 ~ 1909.80 MHz (GSM1900)
	2402 ~ 2480 MHz (Bluetooth)
Rx Freq. Range :	869.2 ~ 893.8 MHz (GSM850)
	1930.20 ~ 1989.80 MHz (GSM1900)
	2402 ~ 2480 MHz (Bluetooth)
Antenna Manufacturer :	Tyco Electronics Corporation
	Model No.: 2108031-1
Antenna Dimensions :	53.77 X 19.79 X 6.77 (mm)
GPRS	Class 12
Separation distance between	
Main and Bluetooth antenna :	11.7 (mm)

3. DESCRIPTION OF TEST EQUIPMENT

3.1 SAR Measurement Setup

Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. Which is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Stäubli), robot controller, measurement server, Samsung computer, near-field probe, probe alignment sensor, and the SAM twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 3.1).

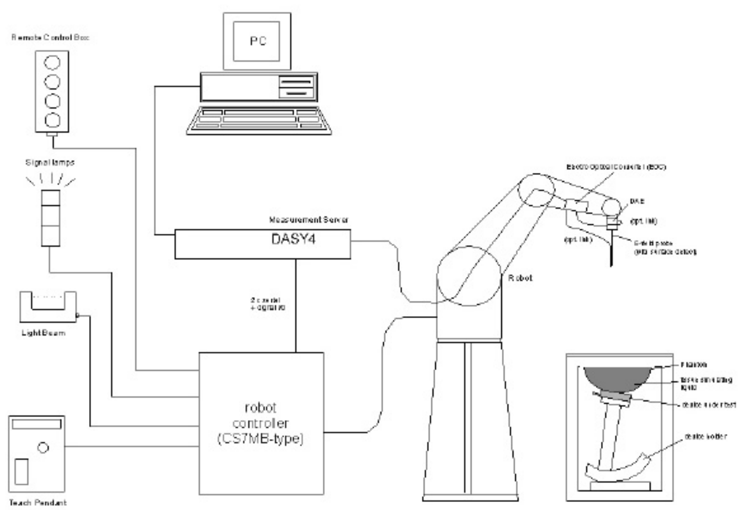

Figure 3.1 SAR Measurement System Setup

System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control is used to drive the robot motors. The PC consists of the Samsung computer with Windows XP system and SAR Measurement Software DASY4, LCD monitor, mouse and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the measurement server

System Electronics

The DAE4(or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

3.2 E-field Probe

The SAR measurement were conducted with the dosimetric probe ES3DV3, designed in the classical triangular configuration (see Fig.3.3) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting (see Fig.3.2). The approach is stopped at reaching the maximum.

Figure 3.2 DAE System

Probe Specifications

Construction	Symmetrical design with triangular core
	Interleaved sensors
	Built-in shielding against static charges
	PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Basic Broad Band Calibration in air: 10-3000 MHz
	Conversion Factors (CF) for HSL 900 and HSL 1800
	Additional CF for other liquids and frequencies upon request
Frequency	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis)
	± 0.3 dB in tissue material (rotation normal to probe axis)

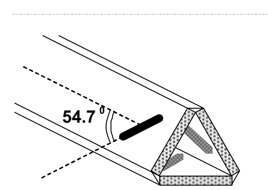

Figure 3.3 Triangular Probe Configuration

Dynamic Range	5μW/g to > 100mW/g; Linearity: ±0.2dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.1 mm
Application	General dosimetry up to 5 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones

Figure 3.4 Probe Thick-Film Technique

3.3 Phantom

SAM Twin Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid.

Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. (See Figure 3.5)

Figure 3.5 SAM Twin Phantom

SAM Twin Phantom Specification

Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid.
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Height: 810 mm; Length: 1000 mm; Width: 500 mm

Modular Flat Phantom

The Modular Flat Phantom V5.1 is constructed of a fiberglass shell integrated in a wooden table. Also It consists of three identical flat phantoms (modules) which can be installed and removed separately without emptying the liquid, as well as a wooden support.. It enables the dosimetric evaluation of body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid.

Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. (See Figure 3.6)

Figure 3.6 Modular Flat Phantom

Modular Flat Phantom Specification

Construction	The shell corresponds to the specifications of IEEE 1528-2003. It enables the dosimetric evaluation of body mounted usage above 800 MHz at the flat phantom region. A cover prevents evaporation of the liquid.
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 10 liters
Dimension	Wooden support - Height: 810 mm; Length: 830 mm; Width: 500 mm Each Module - Height:190 mm; Length: 200 mm; width: 300 mm

3.4 Brain & Muscle Simulating Mixture Characterization

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellullose (HEC) gelling agent and saline solution (see Table 3.1). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been incorporated in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations.

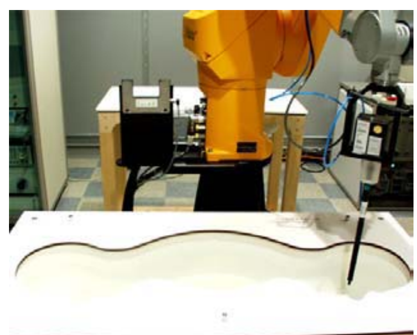

Figure 3.7 Simulated Tissue

Table 3.1 Composition of the Brain & Muscle Tissue Equivalent Matter

INGREDIENTS	835MHz Brain	835MHz Muscle	1900MHz Brain	1900MHz Muscle
WATER	40.29%	50.75%	55.24%	70.23%
SUGAR	57.90%	48.21%	-	-
SALT	1.38%	0.94%	0.31%	0.29%
DGBE	-	-	44.45%	29.47%
BACTERIACIDE	0.18%	0.10%	-	-
HEC	0.24%	-	-	-
Dielectric Constant Target	41.50	55.20	40.00	53.30
Conductivity Target (S/m)	0.900	0.970	1.400	1.520

3.5 Device Holder for Transmitters

In combination with the Twin SAM Phantom V4.0, the Mounting Device (see Fig. 3.7) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately and repeatedly be positioned according to the FCC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

*Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configuration. To produce worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Figure 3.8 Device Holder

3.6 Validation Dipole

The reference dipole should have a return loss better than –20 dB (measured in the setup) at the resonant frequency to reduce the uncertainty in the power measurement.

Frequency	835, 1900 MHz
Return Loss	< -20 dB at specified validation position
Dimensions	D835V2: dipole length: 161 mm; overall height: 330 mm D1900V2: dipole length: 68 mm; overall height: 300 mm

3.7 Equipment Calibration

Table 3.2 Test Equipment Calibration

Type	Calibration Due Date	Serial No.
SPEAG DAE4 V1	Apr.01, 2010	486
E-Field Probe ES3DV3	Jan.20, 2010	3080
SPEAG Validation Dipole D835V2	Mar.16, 2011	4d050
SPEAG Validation Dipole D1900V2	Mar.17, 2011	5d082
Stäubli Robot RX90BL	Not Required	F01/5N19A1/A/01
SPEAG SAM Twin Phantom V4.0	Not Required	TP-1141
SPEAG SAM Twin Phantom V4.0	Not Required	TP-1143
SPEAG Modular Phantom	Not Required	MP-1001
E4438C Signal Generator	Mar.06, 2010	MY45092224
BBS3Q7ECK Power Amp	Oct.21, 2009	1007D/C0035
E4419B Power Meter	May.08, 2010	MY45101765
E9300B Power Sensor	May.08, 2010	MY41495885
HP-8753ES Network Analyzer	Apr.22, 2010	US39173712
HP85070C Dielectric Probe Kit	Not Required	US99360087
E4419B Power Meter	Oct.23, 2009	GB41293847
8481A Power Sensor	Oct.23, 2009	MY41092080
8481A Power Sensor	Dec.16, 2009	MY41092077
DASY4 S/W (ver4.7)	Not Required	-
Directional Coupler	May.22, 2010	18842
Base Satation Simulator	Dec.29, 2009	GB46490113

NOTE:
The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Validation measurement is performed by Samsung Lab. before each test. (see § 7.2) The brain simulating material is calibrated by Samsung using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material. (see § 7.1)

4. SAR MEASUREMENT PROCEDURE

The evaluation was performed using the following procedure.

STEP 1

The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.

STEP 2

The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 20mm x 20mm. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

STEP 3

Around this point, a volume of 32mm x 32mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm.(This can be variable. Refer to the probe specification) The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluated the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

STEP 4

The SAR value at the same location as in step 1 was again measured. (If the value changed by more than 5%, the evaluation is repeated.)

5. DESCRIPTION OF TEST POSITION

5.1 SAM Phantom Shape

Figure 5.1 shows the front, back and side views of SAM. The point "M" is the reference point for the center of mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERPs are 15 mm posterior to the entrance to ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 5.2.

Figure 5.1 Front, back and side view of SAM

The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 5.3). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines should be marked on the external phantom shell to facilitate handset positioning. Posterior to the N-F line, the thickness of the phantom shell with the shape of an ear is a flat surface 6 mm thick at the ERPs.

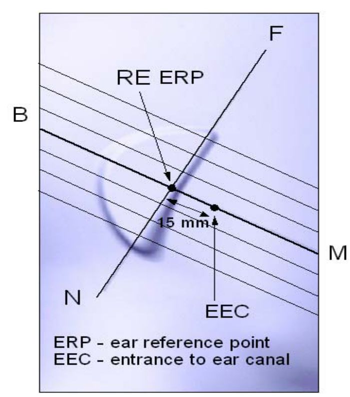

Figure 5.2 Close up side view

5.2 Cheek/Touch Position

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (see Fig. 5.4). The "test device reference point" was than located at the same level as the center of the eat reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at it’s tip and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point

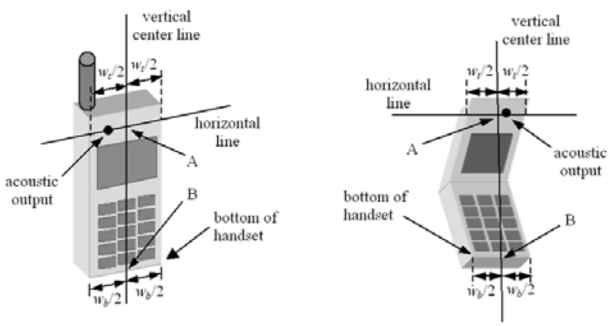

Figure 5.4 Handset vertical and horizontal reference lines

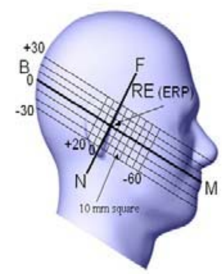

Figure 5.3 Side view of the phantom showing relevant markings

Step 1

The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 5.5), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom

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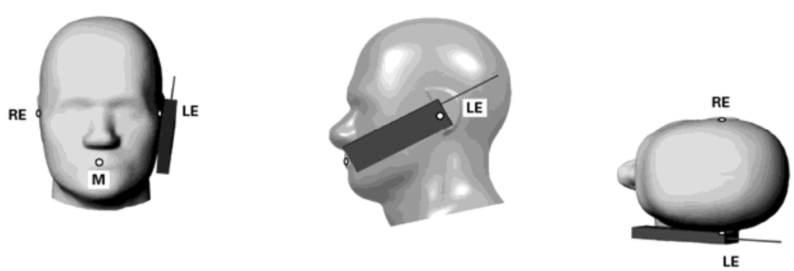

Figure 5.5 Front, Side and Top View of Cheek/Touch Position

Step 2

The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.

Step 3

While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).

Step 4

Rotate the handset around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.

Step 5

While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek). See Figure 5.2.

5.3 EAR/Tilt 15° Position

With the test device aligned in the "Cheek/Touch Position":

Step 1

Repeat steps 1 to 5 of 5.2 to place the device in the "Cheek/Touch Position"

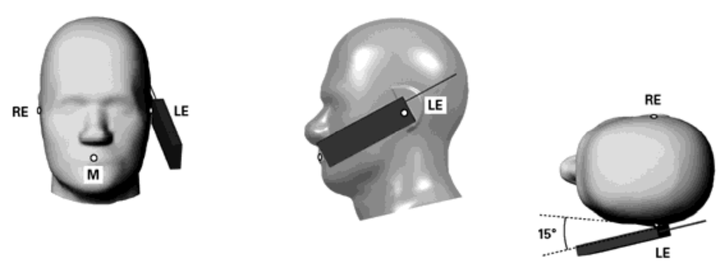

Figure 5.6 Front, side and Top View of Ear/Tilt 15° Position

Step 2

While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degree.

Step 3

The phone was then rotated around the horizontal line by 15 degree.

Step 4

While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head.

5.4 Body Holster/Belt Clip Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 5.7). A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Figure 5.7 Body Belt Clip and Holster Configurations

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains unique metallic component. If multiple accessory share an identical

metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.
Body-worn accessories may not always be supplied or available as options for some Devices intended to be authorized for body-worn use. In this case, a test configuration where a separation distance between the back of the device and the flat phantom is used.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), Including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing.

In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements must be included in the user's manual.

6. MEASUREMENT UNCERTAINTY

Table 6.1 Uncertainty Budget at 835MHz (June 2009)

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	c_i	Standard uncertainty (±%)	v_i^2 or v_{eff}
Measurement System						
Probe Calibration	11.00	normal	2.000	1	5.50	∞
Axial Isotropy	4.70	rectangular	1.732	0.7	1.90	∞
Hemispherical Isotropy	9.60	rectangular	1.732	0.7	3.88	∞
Linearity	4.70	rectangular	1.732	1	2.71	∞
System Detection Limits	0.25	rectangular	1.732	1	0.14	∞
Boundary effects	1.00	rectangular	1.732	1	0.58	∞
Readout electronics	0.30	normal	1.000	1	0.30	∞
Response time	0.80	rectangular	1.732	1	0.46	∞
RF ambient conditions	3.00	rectangular	1.732	1	1.73	∞
Integration time	1.73	rectangular	1.732	1	1.00	∞
Mechanical constrains of robot	1.50	rectangular	1.732	1	0.87	∞
Probe positioning	2.90	rectangular	1.732	1	1.67	∞
Extrapolation and integration	1.00	rectangular	1.732	1	0.58	∞
Test Sample Related						
Test Sample positioning	1.12	normal	1.000	1	1.12	14
Device holded uncertainty	3.44	normal	1.000	1	3.44	∞
Power Drift	5.00	rectangular	1.732	1	2.89	∞
Phantom and Setup						
Modular Phantom uncertainty	5.62	normal	1.000	1	5.62	2
Phantom uncertainty	4.00	rectangular	1.732	1	2.31	∞
Liquid conductivity (deviation from target)	5.00	rectangular	1.732	0.64	1.85	∞
Liquid conductivity (measurement error)	0.38	normal	1.000	0.64	0.24	∞
Liquid permittivity (deviation from target)	5.00	rectangular	1.732	0.6	1.73	∞
Liquid permittivity (measurement error)	5.44	normal	1.000	0.6	3.26	∞
Combined Standard Uncertainty		Normal	-	-	**11.84**	**184200**
Extended Standard Uncertainty(K=2.00)					**23.69**	**184200**

Table 6.2 Uncertainty Budget at 1900MHz (June 2009)

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	c_i	Standard uncertainty (±%)	v_i^2 or v_{eff}
Measurement System						
Probe Calibration	11.00	normal	2.000	1	5.50	∞
Axial Isotropy	4.70	rectangular	1.732	0.7	1.90	∞
Hemispherical Isotropy	9.60	rectangular	1.732	0.7	3.88	∞
Linearity	4.70	rectangular	1.732	1	2.71	∞
System Detection Limits	0.25	rectangular	1.732	1	0.14	∞
Boundary effects	1.00	rectangular	1.732	1	0.58	∞
Readout electronics	0.30	normal	1.000	1	0.30	∞
Response time	0.80	rectangular	1.732	1	0.46	∞
RF ambient conditions	3.00	rectangular	1.732	1	1.73	∞
Integration time	0.00	rectangular	1.732	1	0.00	∞
Mechanical constrains of robot	1.50	rectangular	1.732	1	0.87	∞
Probe positioning	2.90	rectangular	1.732	1	1.67	∞
Extrapolation and integration	1.00	rectangular	1.732	1	0.58	∞
Test Sample Related						
Test Sample positioning	1.50	normal	1.000	1	1.50	14
Device holded uncertainty	3.44	normal	1.000	1	3.44	∞
Power Drift	5.00	rectangular	1.732	1	2.89	∞
Phantom and Setup						
Modular Phantom uncertainty	6.02	normal	1.000	1	6.02	2
Phantom uncertainty	4.00	rectangular	1.732	1	2.31	∞
Liquid conductivity (deviation from target)	5.00	rectangular	1.732	0.64	1.85	∞
Liquid conductivity (measurement error)	1.84	normal	1.000	0.64	1.18	∞
Liquid permittivity (deviation from target)	5.00	rectangular	1.732	0.6	1.73	∞
Liquid permittivity (measurement error)	4.54	normal	1.000	0.6	2.73	∞
Combined Standard Uncertainty		Normal	-	-	**12.00**	**60176**
Extended Standard Uncertainty(K=2.00)					**24.00**	**60176**

7. SYSTEM VERIFICATION

7.1 Tissue Verification

Table 7.1 MEASURED TISSUE PARAMETERS

	835MHz Brain		835MHz Muscle		1900MHz Brain		1900MHz Muscle	
	Target	Measured	Target	Measured	Target	Measured	Target	Measured
Date	-	Sep.04, 2009	-	Sep.04, 2009	-	Sep.07, 2009	-	Sep.07, 2009
Liquid Temperature(°C)	-	22.3	-	22.4	-	21.7	-	21.8
Dielectric Constant: ε'	41.5	40.8	55.2	54.5	40.0	38.9	53.3	52.2
Conductivity: σ	0.90	0.91	0.97	0.99	1.40	1.40	1.52	1.52

The measured value must be within ±5% of the target value.

7.2 Test System Validation

Prior to assessment, the system is verified to the ±10% of the specification at 835MHz and 1900MHz by using the system validation kit(s). (see Appendix E, Graphic Plot Attached)

Table 7.2 System Validation Results

System Validation Kit	Tissue	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)	Deviation (%)	Date	Liquid Temperature(°C)	Ambient Temperature(°C)
4d050	835MHz Brain	9.49	9.24	-2.63	Sep.04, 2009	22.3	22.6
5d082	1900MHz Brain	39.4	39.96	1.42	Sep.07, 2009	21.8	22.2

*Validation was measured with input power 250 mW and normalized to 1W.

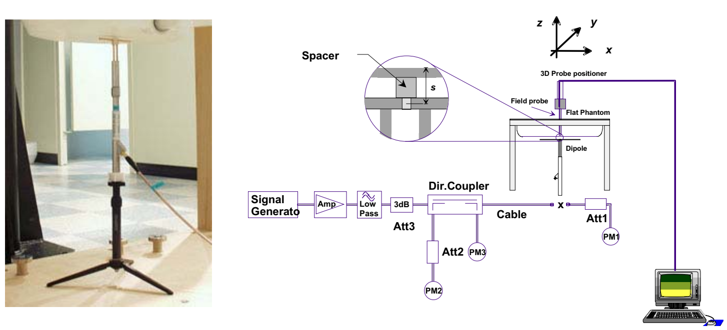

Figure 7.1 Dipole Validation Test Setup

8. SAR MEASUREMENT RESULTS

Procedures Used To Establish Test Signal

The handset was placed into simulated call mode using manufacturers test codes. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR. When test modes are not available or inappropriate for testing a handset, the actual transmission is activated through a base station simulator or similar equipment. See data pages for actual procedure used in measurement.

Device Test Conditions

The handset is battery operated. Each SAR measurement was taken with a fully charged battery. In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power. If a conducted power deviation of more than 5% occurred, the test was repeated. And all Tx(1~4Tx) conducted power were also investigated for Body-Worn SAR measurement.

Table 8.1 GPRS Power Table

Band	Channel	1Tx	2Tx	3Tx	4Tx
GSM850	128	32.62	32.40	29.61	28.20
	190	32.57	32.34	29.55	28.14
	251	32.61	32.38	29.55	28.14
GSM1900	512	29.52	29.25	26.58	25.50
	661	29.77	29.53	26.86	25.78
	810	29.48	29.24	26.61	25.53

Simultaneous Transmission

Refer to the FCC OET document, ‘SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas’ (Feb 2008)

Table 8.1 Output Power Thresholds for Unlicensed Transmitters

	2.45	5.15 - 5.35	5.47 - 5.85	GHz
P Ref	**12**	**6**	**5**	**mW**
Device output power should be rounded to the nearest mW to compare with values specified in this table				

Table 8.2 Summary of SAR Evaluation Requirements for Cell phones with Multiple Transmitters

<table>
<tr><th></th><th>Individual Transmitter</th><th>Simultaneous Transmission</th></tr>
<tr><td>Licensed Transmitters</td><td><u>Routine evaluation required</u></td><td rowspan="2">SAR not required:
<u>Unlicensed only</u>
o when stand-alone 1-g SAR is not required and antenna is > 5 cm from other antennas
<u>Licensed & Unlicensed</u>
o when the sum of the 1-g SAR is <1.6 W/kg for all simultaneous transmitting antennas
o when SAR to antenna separation ratio of simultaneous transmitting antenna pair is < 0.3

SAR required:
<u>Licensed & Unlicensed</u>
antenna pairs with SAR to antenna separation ratio ≥ 0.3; test is only required for the configuration that results in the highest SAR in standalone configuration for each wireless mode and exposure condition

Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply</td></tr>
<tr><td>Unlicensed Transmitters</td><td>When there is no simultaneous transmission –
o output < 60/f: SAR not required
o output ≥ 60/f: stand-alone SAR required

When there is simultaneous transmission –
<u>Stand-alone SAR not required when</u>
O output ≤ 2.P_{Ref} and antenna is > 5.0 cm from other antennas
o output ≤ P_{Ref} and antenna is > 2.5 cm from other antennas, each either output power output ≤ P_{Ref} or 1-g SAR < 1.2 W/Kg

<u>Otherwise stand-alone SAR is required</u>

When stand-alone SAR is required
o test SAR on highest output channel for each wireless mode and exposure condition

o if SAR for highest output channel is > 50% of SAR limit, evaluate all channels according to normal procedures</td></tr>
</table>

Conclusion

Based on the output power, antenna separation distance, and Body SAR, a stand-alone BT SAR test is not required. The summation of BT SAR and Licensed Transmitter SAR is 0.885 + 0 = 0.885, which is less than 1.6 W/Kg, therefore, a simultaneous SAR evaluation is not required.

8.1 Measurement Results(GSM850 Right Head SAR - Touch)

Mixture Type : 835 MHz Brain

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
836.6	190	GSM 850	32.69	32.75	Standard	Cheek/Touch	Intenna	**0.294**
ANSI / IEEE C95.1 2005– SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure / General Population**						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☐ Left Head ☐ Flat Phantom ☒ Right Head
8. SAR Configuration ☒ Head ☐ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator
10. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8.2 Measurement Results(GSM850 Right Head SAR - Tilt)

Mixture Type : 835 MHz Brain

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
836.6	190	GSM 850	32.74	32.80	Standard	Ear/Tilt 15°	Intenna	**0.150**
ANSI / IEEE C95.1 2005– SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure / General Population**						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☐ Left Head ☐ Flat Phantom ☒ Right Head
8. SAR Configuration ☒ Head ☐ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator
10. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8.3 Measurement Results(GSM850 Left Head SAR - Touch)

Mixture Type : 835 MHz Brain

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
836.6	190	GSM 850	32.65	32.74	Standard	Cheek/Touch	Intenna	**0.280**
ANSI / IEEE C95.1 2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☒ Left Head ☐ Flat Phantom ☐ Right Head
8. SAR Configuration ☒ Head ☐ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator
10. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8.4 Measurement Results(GSM850 Left Head SAR - Tilt)

Mixture Type : 835 MHz Brain

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
836.6	190	GSM 850	32.74	32.75	Standard	Ear/Tilt 15°	Intenna	**0.140**
ANSI / IEEE C95.1 2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☒ Left Head ☐ Flat Phantom ☐ Right Head
8. SAR Configuration ☒ Head ☐ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator
10. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8.5 Measurement Results(GSM850 Body SAR without Holster)

Mixture Type : 835 MHz Muscle

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
824.2	128	GSM 850	32.39	32.42	Standard	1.5 cm [w/o Holster]	Intenna	0.290
836.6	190	GSM 850	32.30	32.35	Standard	1.5 cm [w/o Holster]	Intenna	0.304
848.8	251	GSM 850	32.36	32.41	Standard	1.5 cm [w/o Holster]	Intenna	**0.325**
836.6	190	GSM 850	29.51	29.55	Standard	1.5 cm [w/o Holster]	Intenna	1) 0.281
836.6	190	GSM 850	28.09	28.12	Standard	1.5 cm [w/o Holster]	Intenna	2) 0.276
ANSI / IEEE C95.1 2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☐ Left Head ☒ Flat Phantom ☐ Right Head
8. SAR Configuration ☐ Head ☒ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator
10. Test Configuration ☐ With Holster ☒ Without Holster
11. Justification for reduced test configurations: This model supports GPRS CLASS 12(max 4Tx) and EDGE. The burst power and timing period is more than 2dB higher in GPRS mode than in GSM850and EDGE mode. Hence, the GSM850 and EDGE mode was not reported. And all Tx(1~4Tx) cases were also investigated and the worst-case results are reported.**(2Tx)**
12. 1) 3TX
13. 2) 4TX

SAMSUNG

8.6 Measurement Results(GSM1900 Right Head SAR - Touch)

Mixture Type : 1900 MHz Brain

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
1850.2	512	PCS GSM	29.53	29.50	Standard	Cheek/Touch	Intenna	0.946
1880.0	661	PCS GSM	29.86	29.95	Standard	Cheek/Touch	Intenna	1.100
1909.8	810	PCS GSM	29.56	29.58	Standard	Cheek/Touch	Intenna	**1.140**
ANSI / IEEE C95.1 2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☐ Left Head ☐ Flat Phantom ☒ Right Head
8. SAR Configuration ☒ Head ☐ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator

8.7 Measurement Results(GSM1900 Right Head SAR - Tilt)

Mixture Type : 1900 MHz Brain

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
1880.0	661	PCS GSM	29.84	29.76	Standard	Ear/Tilt 15°	Intenna	**0.389**
ANSI / IEEE C95.1 2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☐ Left Head ☐ Flat Phantom ☒ Right Head
8. SAR Configuration ☒ Head ☐ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator
10. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8.8 Measurement Results(GSM1900 Left Head SAR - Touch)

Mixture Type : 1900 MHz Brain

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
1850.2	512	PCS GSM	29.56	29.66	Standard	Cheek/Touch	Intenna	0.920
1880.0	661	PCS GSM	29.84	29.86	Standard	Cheek/Touch	Intenna	1.030
1909.8	810	PCS GSM	29.56	29.49	Standard	Cheek/Touch	Intenna	**1.080**
ANSI / IEEE C95.1 2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☒ Left Head ☐ Flat Phantom ☐ Right Head
8. SAR Configuration ☒ Head ☐ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator

8.9 Measurement Results(GSM1900 Left Head SAR - Tilt)

Mixture Type : 1900 MHz Brain

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
1880.0	661	PCS GSM	29.83	29.87	Standard	Ear/Tilt 15°	Intenna	**0.333**
ANSI / IEEE C95.1 2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☒ Left Head ☐ Flat Phantom ☐ Right Head
8. SAR Configuration ☒ Head ☐ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator
10. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (July, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8.10 Measurement Results(GSM1900 Body SAR without Holster)

Mixture Type : 1900 MHz Muscle

FREQUENCY		Modulation	Begin/End POWER*			Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch.		(dBm)		Battery			
1850.2	512	PCS GSM	29.23	29.26	Standard	1.5 cm [w/o Holster]	Intenna	0.699
1880.0	661	PCS GSM	29.50	29.55	Standard	1.5 cm [w/o Holster]	Intenna	**0.885**
1909.8	810	PCS GSM	29.23	29.30	Standard	1.5 cm [w/o Holster]	Intenna	0.816
1880.0	661	PCS GSM	26.88	26.92	Standard	1.5 cm [w/o Holster]	Intenna	1) 0.704
1880.0	661	PCS GSM	25.77	25.86	Standard	1.5 cm [w/o Holster]	Intenna	2) 0.746
ANSI / IEEE C95.1 2005– SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure / General Population**						**1.6W/kg (mW/g)** averaged over 1 gram		

NOTES:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2cm
5. Battery is fully charged for all readings.
   *Power Measured ☒ Conducted
6. Battery Option ☒ Standard ☐ Extended ☐ Slim
7. Phantom Configuration ☐ Left Head ☒ Flat Phantom ☐ Right Head
8. SAR Configuration ☐ Head ☒ Body ☐ Hand
9. Test Signal Call Mode ☐ Manu. Test Codes ☒ Base Station Simulator
10. Test Configuration ☐ With Holster ☒ Without Holster
11. Justification for reduced test configurations: This model supports GPRS CLASS 12(max 4Tx) and EDGE. The burst power and timing period is more than 2dB higher in GPRS mode than in GSM1900and EDGE mode. Hence, the GSM1900 and EDGE mode was not reported. And all Tx(1~4Tx) cases were also investigated and the worst-case results are reported.**(2Tx)**
12. 1) 3TX
13. 2) 4TX

9. CONCLUSION

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

The highest reported SAR values are as follows:
GSM850: Head: 0.294 W/Kg : Body-worn: 0.325 W/Kg
GSM1900: Head: 1.140 W/Kg : Body-worn: 0.885 W/Kg

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APPENDIX A

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).

$$\text{SAR} = \sigma E^2 / p$$

Where :

σ = conductivity of the tissue-simulant material (S/m)

p = mass density of the tissue-simulant material (kg/m^3)

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.

APPENDIX B

Probe Calibration Process

Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described in **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** with an accuracy better than +/-10%. The spherical isotropy was evaluated with the procedure described in **K. Pokovic, T.Schmid, N. Kuster, *E-field Probe with improved isotropy in brain simulating liquids*, Proceedings of the ELMAR, Zadar, June 23-25, 1996, pp. 172-175** and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz (see Fig. B.1), and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe (see Fig. B.2).

$$\text{SAR} = C\frac{\Delta T}{\Delta t}$$

where:

Δt = exposure time (30 seconds)

C = heat capacity of tissue (brain or muscle).

ΔT = temperature increase due to RF exposure.

SAR is proportional to ΔT/ Δt, the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E-field;

$$\text{SAR} = \frac{|E|^2 \cdot \sigma}{p}$$

where:

σ = simulated tissue conductivity

p = Tissue density (1.25 g/cm^3 for brain tissue)

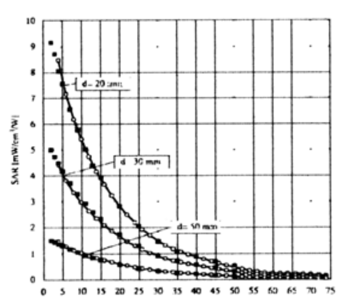


Figure B.1. E-Field and Temperature measurements at 900MHz

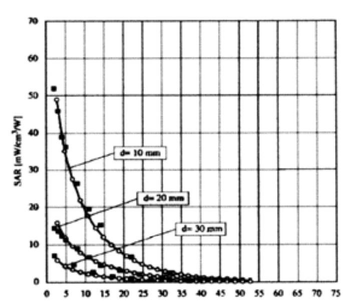


Figure B.2. E-Field and temperature measurements at 1.9GHz

APPENDIX C

ANSI/IEEE C95.1 – 2005 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 SAR[1] Brain	1.60	8.00
SPATIAL PEAK SAR[2] Whole Body	0.08	0.40
SPATIAL PEAK SAR[3] Hands,Feet,Ankles, Wrists	4.00	20.00

[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 D

Test Setup Photographs

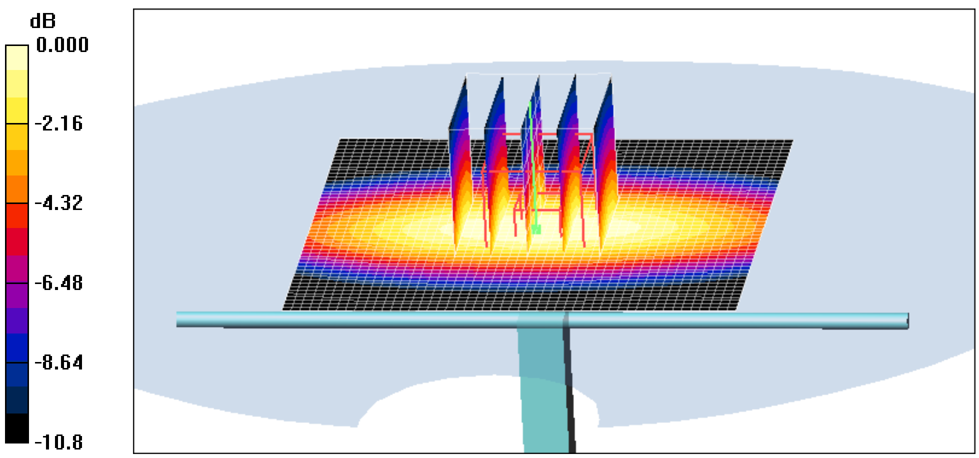
APPENDIX E

The Validation Measurements

DUT: Dipole 835 MHz; Serial: 4d050
Program Name: 835MHz Dipole Validation 2009.09.04
Procedure Name: 835MHz @ 250mW
Meas. Ambient Temp(celsius)-22.6, Tissue Temp(celsius)-22.3 ; Test Date-04/Sep/2009
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.91 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(5.7, 5.7, 5.7); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #2; Type: SAM; Serial: TP-1141
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

835MHz @ 250mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.49 mW/g

835MHz @ 250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 52.9 V/m; Power Drift = 0.080 dB
Peak SAR (extrapolated) = 3.47 W/kg
SAR(1 g) = 2.31 mW/g; SAR(10 g) = 1.5 mW/g
Maximum value of SAR (measured) = 2.50 mW/g

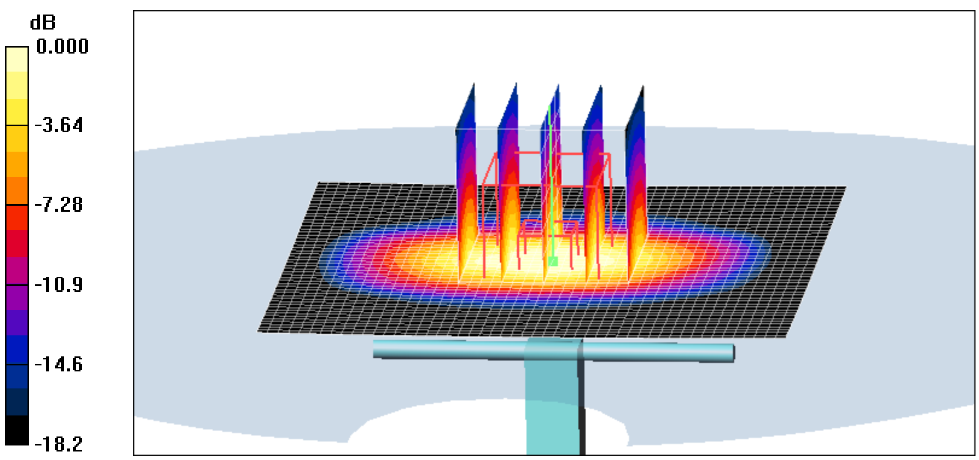


0 dB = 2.50mW/g

DUT: Dipole 1900 MHz; Serial: 5d082
Program Name: 1900MHz Dipole Validation 2009.09.07
Procedure Name: 1900MHz @ 250mW
Meas. Ambient Temp(celsius)-22.2 Tissue Temp(celsius)-21.8; Test Date-07/Sep/2009
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.4 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(4.74, 4.74, 4.74); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #1; Type: SAM; Serial: TP-1143
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

1900MHz @ 250mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 14.8 mW/g

1900MHz @ 250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 87.8 V/m; Power Drift = -0.043 dB
Peak SAR (extrapolated) = 19.9 W/kg
SAR(1 g) = 9.99 mW/g; SAR(10 g) = 5.08 mW/g
Maximum value of SAR (measured) = 11.2 mW/g



0 dB = 11.2mW/g

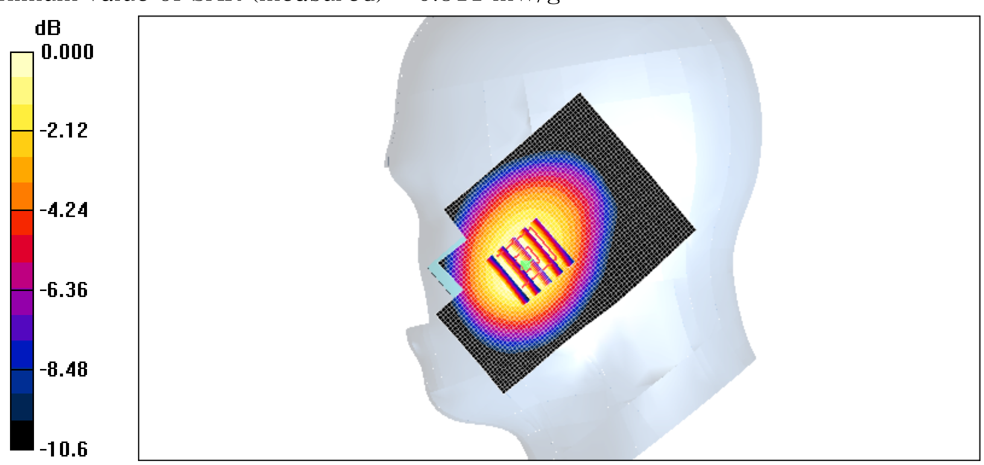
APPENDIX F

Plots of The SAR Measurements

SAMSUNG FCC ID : A3LGTI6410 GSM850 Head SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM850 Right (Job No. : FG-248)
Procedure Name: Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.6, Tissue Temp(celsius)-22.3 ; Test Date-04/Sep/2009
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 836.6 MHz; σ = 0.91 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Right Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(5.7, 5.7, 5.7); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #2; Type: SAM; Serial: TP-1141
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.337 mW/g

Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.6 V/m; Power Drift = -0.054 dB
Peak SAR (extrapolated) = 0.395 W/kg
SAR(1 g) = 0.294 mW/g; SAR(10 g) = 0.213 mW/g
Maximum value of SAR (measured) = 0.311 mW/g

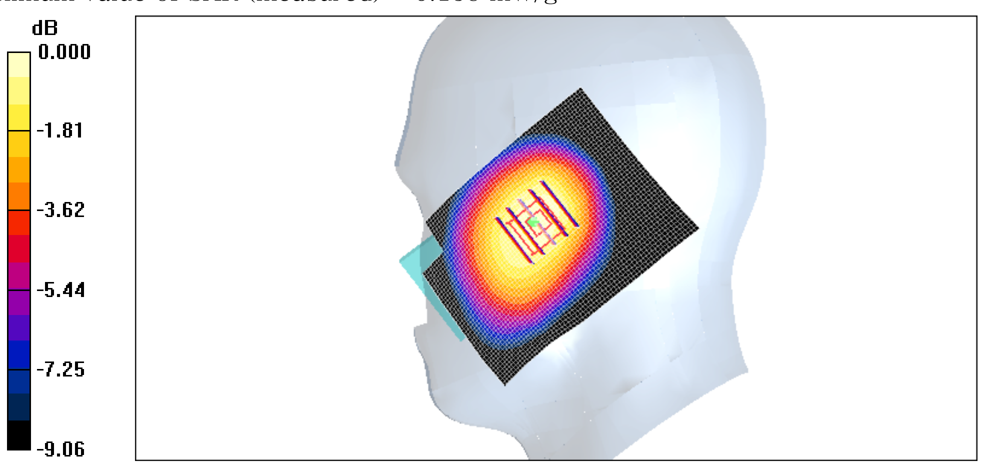


0 dB = 0.311mW/g

SAMSUNG FCC ID : A3LGTI6410 GSM850 Head SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM850 Right (Job No. : FG-248)
Procedure Name: Ear/Tilt, Ch.190, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.6, Tissue Temp(celsius)-22.3 ; Test Date-04/Sep/2009
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 836.6 MHz; σ = 0.91 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Right Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(5.7, 5.7, 5.7); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #2; Type: SAM; Serial: TP-1141
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Ear/Tilt, Ch.190, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.159 mW/g

Ear/Tilt, Ch.190, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.05 V/m; Power Drift = -0.016 dB
Peak SAR (extrapolated) = 0.194 W/kg
SAR(1 g) = 0.150 mW/g; SAR(10 g) = 0.111 mW/g
Maximum value of SAR (measured) = 0.158 mW/g

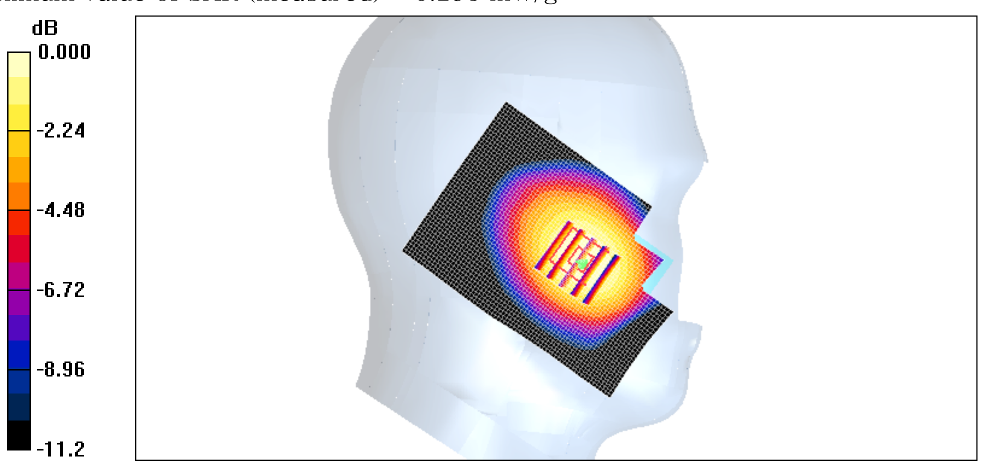


0 dB = 0.158mW/g

SAMSUNG FCC ID : A3LGTI6410 GSM850 Head SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM850 Left (Job No. : FG-248)
Procedure Name: Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.6, Tissue Temp(celsius)-22.3 ; Test Date-04/Sep/2009
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 836.6 MHz; σ = 0.91 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Left Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(5.7, 5.7, 5.7); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #2; Type: SAM; Serial: TP-1141
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.304 mW/g

Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.2 V/m; Power Drift = 0.039 dB
Peak SAR (extrapolated) = 0.352 W/kg
SAR(1 g) = 0.280 mW/g; SAR(10 g) = 0.207 mW/g
Maximum value of SAR (measured) = 0.295 mW/g

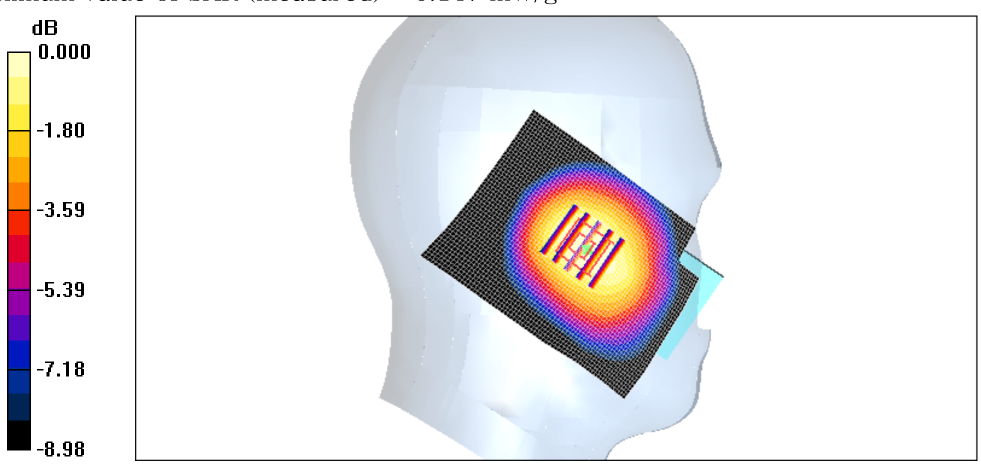


0 dB = 0.295mW/g

SAMSUNG FCC ID : A3LGTI6410 GSM850 Head SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM850 Left (Job No. : FG-248)
Procedure Name: Ear/Tilt, Ch.190, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.6, Tissue Temp(celsius)-22.3 ; Test Date-04/Sep/2009
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 836.6 MHz; σ = 0.91 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Left Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(5.7, 5.7, 5.7); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #2; Type: SAM; Serial: TP-1141
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Ear/Tilt, Ch.190, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.151 mW/g

Ear/Tilt, Ch.190, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.59 V/m; Power Drift = 0.099 dB
Peak SAR (extrapolated) = 0.181 W/kg
SAR(1 g) = 0.140 mW/g; SAR(10 g) = 0.103 mW/g
Maximum value of SAR (measured) = 0.147 mW/g

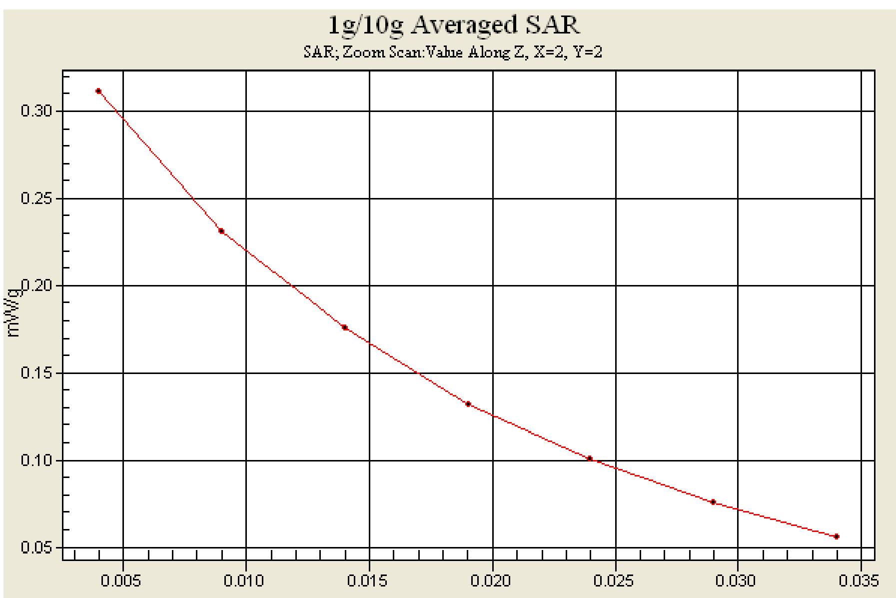


0 dB = 0.147mW/g

SAMSUNG FCC ID : A3LGTI6410 GSM850 Head SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM850 Right (Job No. : FG-248)
Procedure Name: Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.6, Tissue Temp(celsius)-22.3 ; Test Date-04/Sep/2009
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 836.6 MHz; σ = 0.91 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Right Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(5.7, 5.7, 5.7); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #2; Type: SAM; Serial: TP-1141
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.337 mW/g

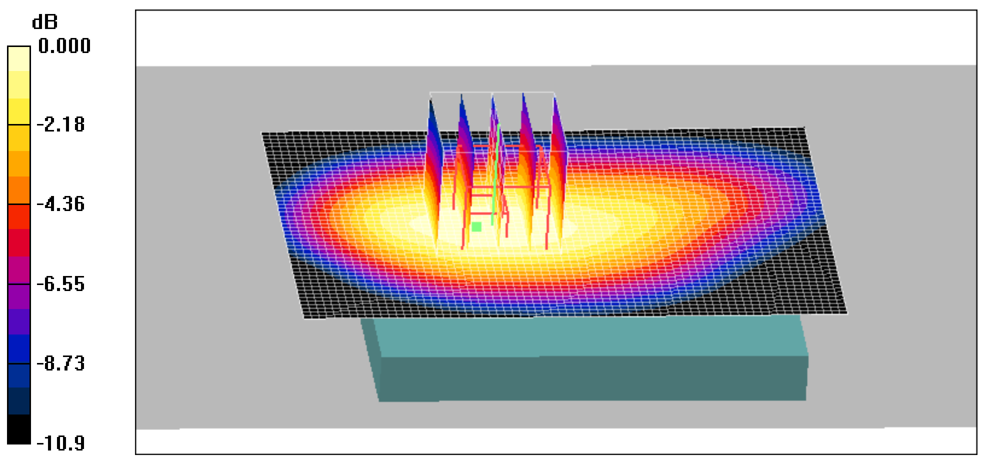
Cheek/Touch, Ch.190, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.6 V/m; Power Drift = -0.054 dB
Peak SAR (extrapolated) = 0.395 W/kg
SAR(1 g) = 0.294 mW/g; SAR(10 g) = 0.213 mW/g
Maximum value of SAR (measured) = 0.311 mW/g



SAMSUNG FCC ID : A3LGTI6410 GPRS850 Body SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GPRS850 Body (Job No. :FG-248)
Procedure Name: Body, Ch.251, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.6, Tissue Temp(celsius)-22.5 ; Test Date-04/Sep/2009
Communication System: GPRS 850; Frequency: 848.8 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 848.8 MHz; σ = 0.99 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Left Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(5.5, 5.5, 5.5); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: 1001
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.251, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.342 mW/g

Body, Ch.251, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.8 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 0.432 W/kg
SAR(1 g) = 0.325 mW/g; SAR(10 g) = 0.233 mW/g
Maximum value of SAR (measured) = 0.345 mW/g

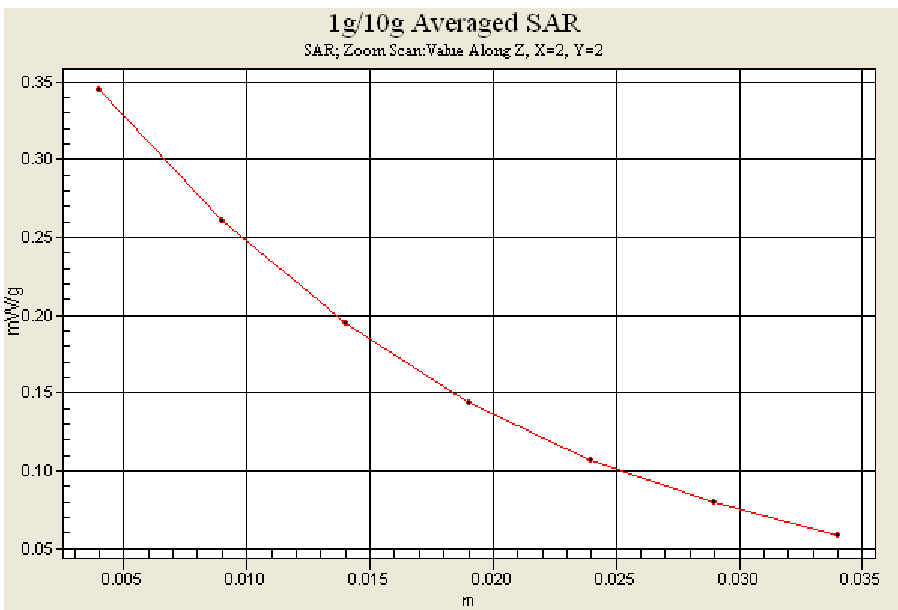


0 dB = 0.345mW/g

SAMSUNG FCC ID : A3LGTI6410 GPRS850 Body SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GPRS850 Body (Job No. :FG-248)
Procedure Name: Body, Ch.251, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.6, Tissue Temp(celsius)-22.5 ; Test Date-04/Sep/2009
Communication System: GPRS 850; Frequency: 848.8 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 848.8 MHz; σ = 0.99 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Left Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(5.5, 5.5, 5.5); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: 1001
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.251, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.342 mW/g

Body, Ch.251, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.8 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 0.432 W/kg
SAR(1 g) = 0.325 mW/g; SAR(10 g) = 0.233 mW/g
Maximum value of SAR (measured) = 0.345 mW/g

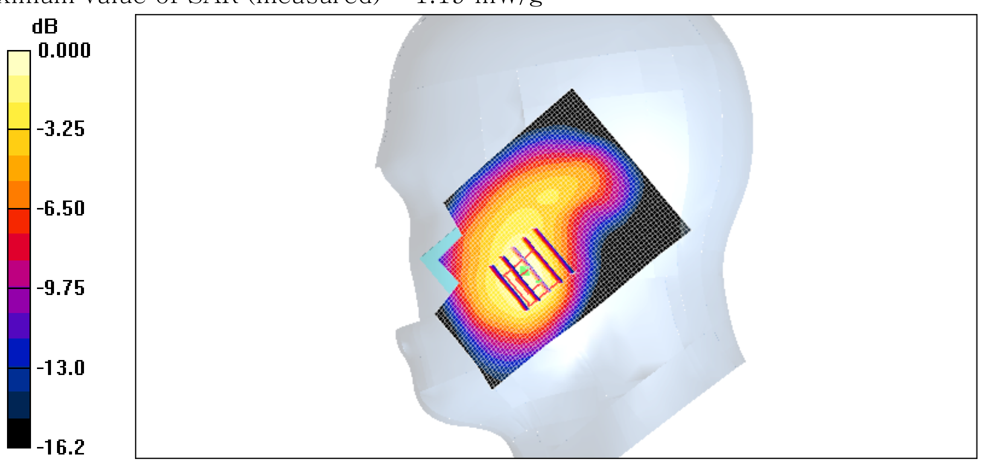


SAMSUNG FCC ID : A3LGTI6410 GSM1900 Head SAR

DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM1900 Right (Job No. : FG-248)
Procedure Name: Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.2 Tissue Temp(celsius)-21.8; Test Date-07/Sep/2009
Communication System: GSM 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1909.8 MHz; σ = 1.4 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Right Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(4.74, 4.74, 4.74); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #1; Type: SAM; Serial: TP-1143
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 1.18 mW/g

Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.4 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 1.98 W/kg
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.645 mW/g
Maximum value of SAR (measured) = 1.19 mW/g



0 dB = 1.19mW/g

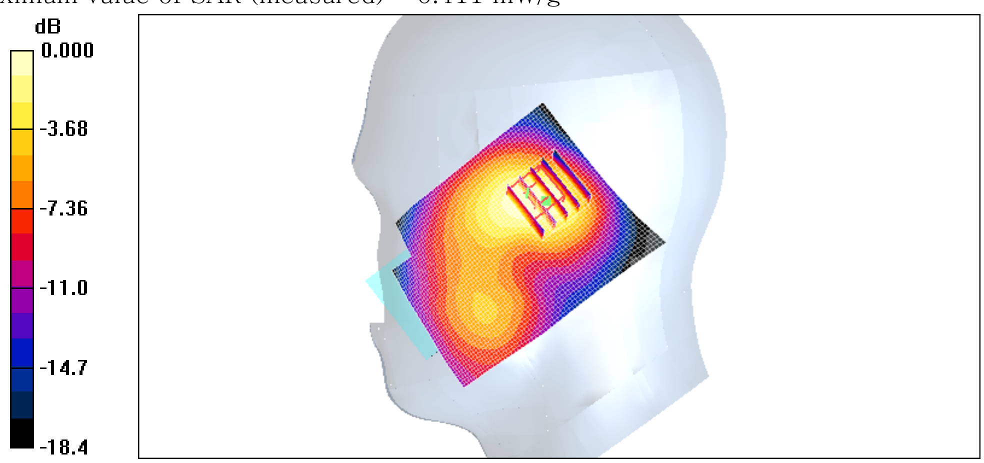
SAMSUNG FCC ID : A3LGTI6410 GSM1900 Head SAR

DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM1900 Right (Job No. : FG-248)
Procedure Name: Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.2 Tissue Temp(celsius)-21.8; Test Date-07/Sep/2009
Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.4 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Right Section
DASY4 Configuration:

- Probe: ES3DV3 - SN3080; ConvF(4.74, 4.74, 4.74); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #1; Type: SAM; Serial: TP-1143
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.411 mW/g

Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.7 V/m; Power Drift = 0.029 dB
Peak SAR (extrapolated) = 0.643 W/kg
SAR(1 g) = 0.389 mW/g; SAR(10 g) = 0.237 mW/g
Maximum value of SAR (measured) = 0.411 mW/g



0 dB = 0.411mW/g

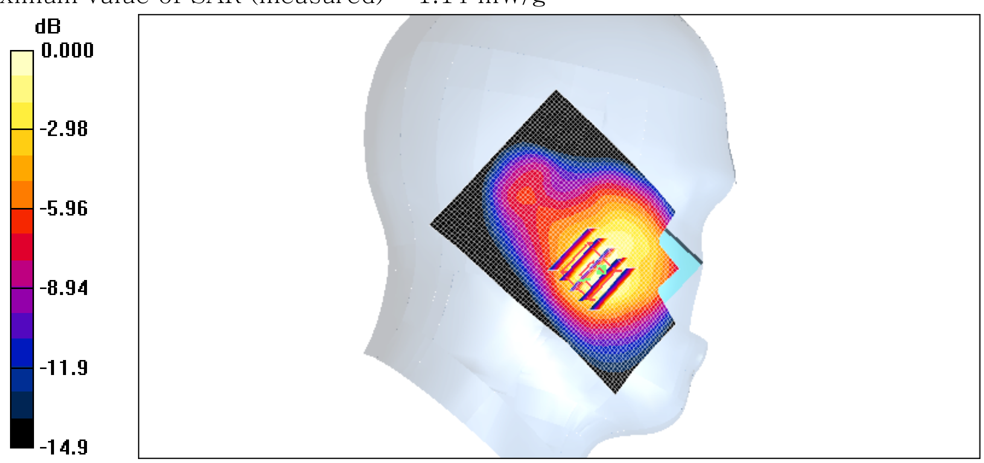
SAMSUNG FCC ID : A3LGTI6410 GSM1900 Head SAR

DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM1900 Left (Job No. : FG-248)
Procedure Name: Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.2 Tissue Temp(celsius)-21.8; Test Date-07/Sep/2009
Communication System: GSM 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1909.8 MHz; σ = 1.4 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Left Section
DASY4 Configuration:

- Probe: ES3DV3 - SN3080; ConvF(4.74, 4.74, 4.74); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #1; Type: SAM; Serial: TP-1143
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 1.22 mW/g

Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.0 V/m; Power Drift = -0.032 dB
Peak SAR (extrapolated) = 1.75 W/kg
SAR(1 g) = 1.08 mW/g; SAR(10 g) = 0.661 mW/g
Maximum value of SAR (measured) = 1.14 mW/g

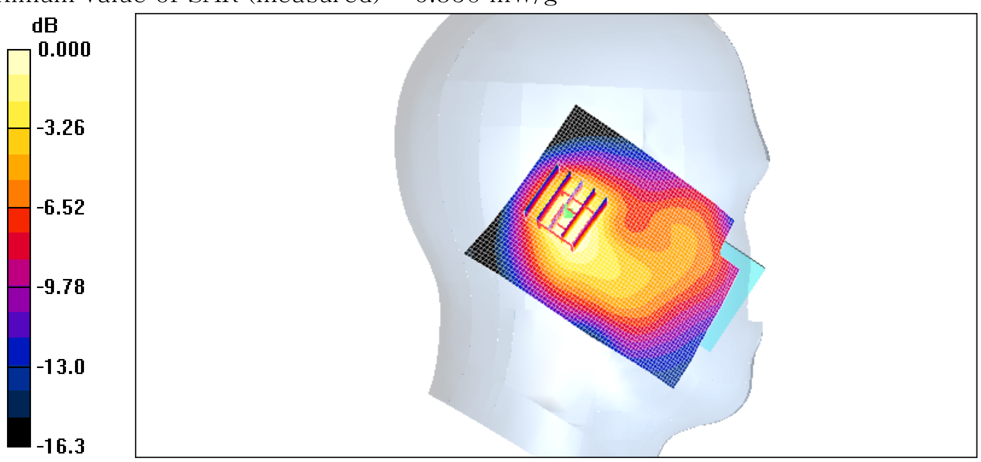


0 dB = 1.14mW/g

SAMSUNG FCC ID : A3LGTI6410 GSM1900 Head SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM1900 Left (Job No. : FG-248)
Procedure Name: Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.2 Tissue Temp(celsius)-21.8; Test Date-07/Sep/2009
Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.4 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Left Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(4.74, 4.74, 4.74); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #1; Type: SAM; Serial: TP-1143
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.376 mW/g

Ear/Tilt, Ch.661, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.8 V/m; Power Drift = -0.058 dB
Peak SAR (extrapolated) = 0.541 W/kg
SAR(1 g) = 0.333 mW/g; SAR(10 g) = 0.201 mW/g
Maximum value of SAR (measured) = 0.356 mW/g



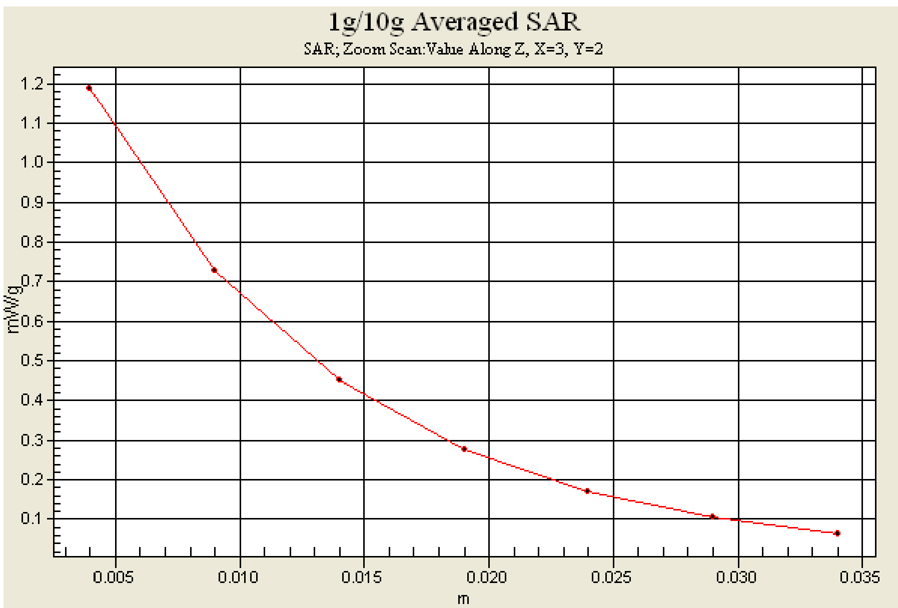
0 dB = 0.356mW/g

SAMSUNG FCC ID : A3LGTI6410 GSM1900 Head SAR

DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GSM1900 Right (Job No. : FG-248)
Procedure Name: Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.2 Tissue Temp(celsius)-21.8; Test Date-07/Sep/2009
Communication System: GSM 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1909.8 MHz; σ = 1.4 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Right Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(4.74, 4.74, 4.74); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: PHANTOM #1; Type: SAM; Serial: TP-1143
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 1.18 mW/g

Cheek/Touch, Ch.810, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.4 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 1.98 W/kg
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.645 mW/g
Maximum value of SAR (measured) = 1.19 mW/g

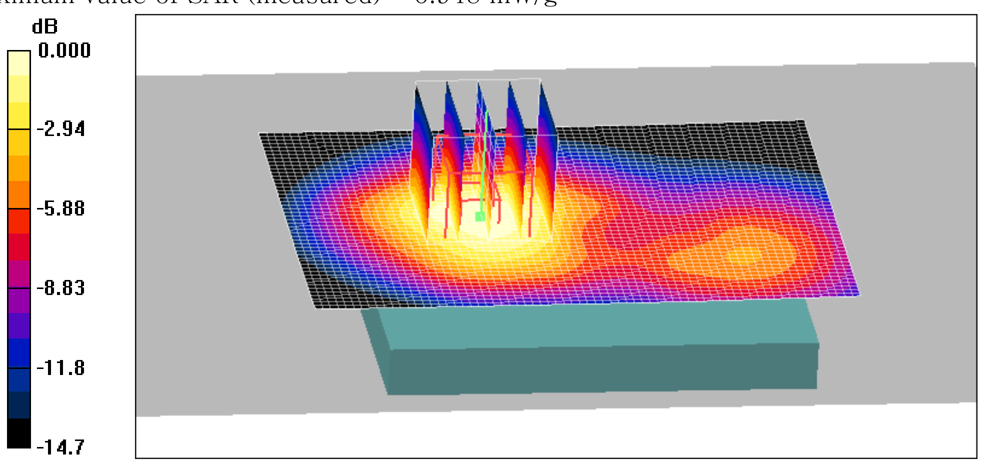


SAMSUNG FCC ID : A3LGTI6410 GPRS1900 Body SAR

DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GPRS1900 Body (Job No. : FG-248)
Procedure Name: Body, Ch.661, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.3 Tissue Temp(celsius)-21.7; Test Date-07/Sep/2009
Communication System: GPRS 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Center Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(4.5, 4.5, 4.5); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: 1001
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.661, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 1.04 mW/g

Body, Ch.661, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.0 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 1.61 W/kg
SAR(1 g) = 0.885 mW/g; SAR(10 g) = 0.525 mW/g
Maximum value of SAR (measured) = 0.948 mW/g

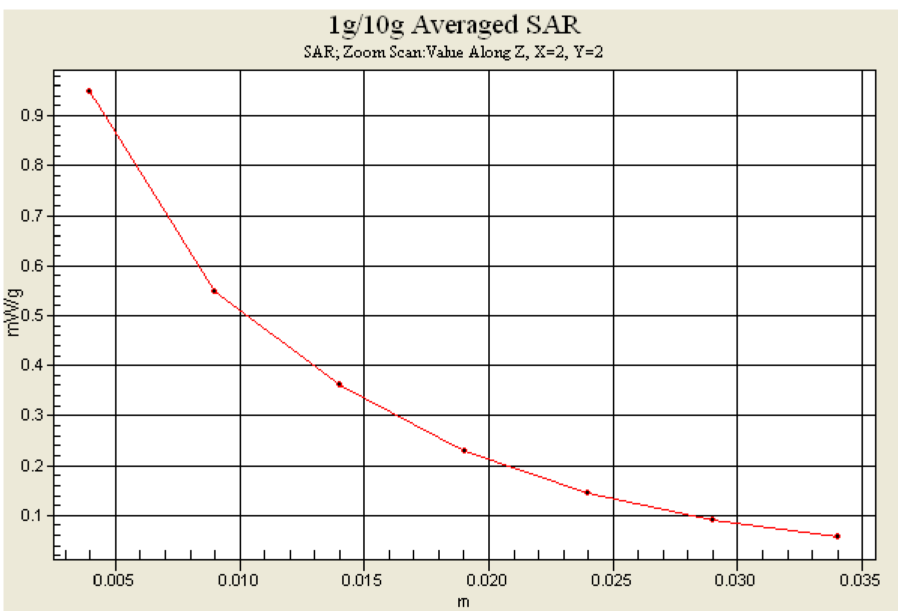


0 dB = 0.948mW/g

SAMSUNG FCC ID : A3LGTI6410 GPRS1900 Body SAR
DUT: GT-I6410; Serial: FG-248-B
Program Name: GT-I6410 GPRS1900 Body (Job No. : FG-248)
Procedure Name: Body, Ch.661, Ant.Intenna, Bat.Standard
Meas. Ambient Temp(celsius)-22.3 Tissue Temp(celsius)-21.7; Test Date-07/Sep/2009
Communication System: GPRS 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium parameters used: f = 1880 MHz; σ = 1.52 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Center Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3080; ConvF(4.5, 4.5, 4.5); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2009-04-01
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: 1001
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.661, Ant.Intenna, Bat.Standard/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 1.04 mW/g

Body, Ch.661, Ant.Intenna, Bat.Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.0 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 1.61 W/kg
SAR(1 g) = 0.885 mW/g; SAR(10 g) = 0.525 mW/g
Maximum value of SAR (measured) = 0.948 mW/g



APPENDIX G

Probe Calibration

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

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

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

Accreditation No.: SCS 108

Client **Samsung (Dymstec)**

Certificate No: ES3-3080_Jan09

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3080
Calibration procedure(s)	QA CAL-01.v6 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	January 20, 2009
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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: January 20, 2009

2009. 2. 9

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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not 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 ES3DV3

SN:3080

Manufactured:	March 14, 2005
Last calibrated:	January 29, 2008
Recalibrated:	January 20, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3080

Sensitivity in Free Space[A]

NormX	**1.23** ± 10.1%	$\mu V/(V/m)^2$
NormY	**1.13** ± 10.1%	$\mu V/(V/m)^2$
NormZ	**1.18** ± 10.1%	$\mu V/(V/m)^2$

Diode Compression[B]

DCP X	**92** mV
DCP Y	**94** mV
DCP Z	**91** 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		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	10.8	6.2
SAR_{be} [%]	With Correction Algorithm	0.8	0.3

TSL 1810 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	11.9	7.3
SAR_{be} [%]	With Correction Algorithm	0.9	0.6

Sensor Offset

Probe Tip to Sensor Center **2.0** mm

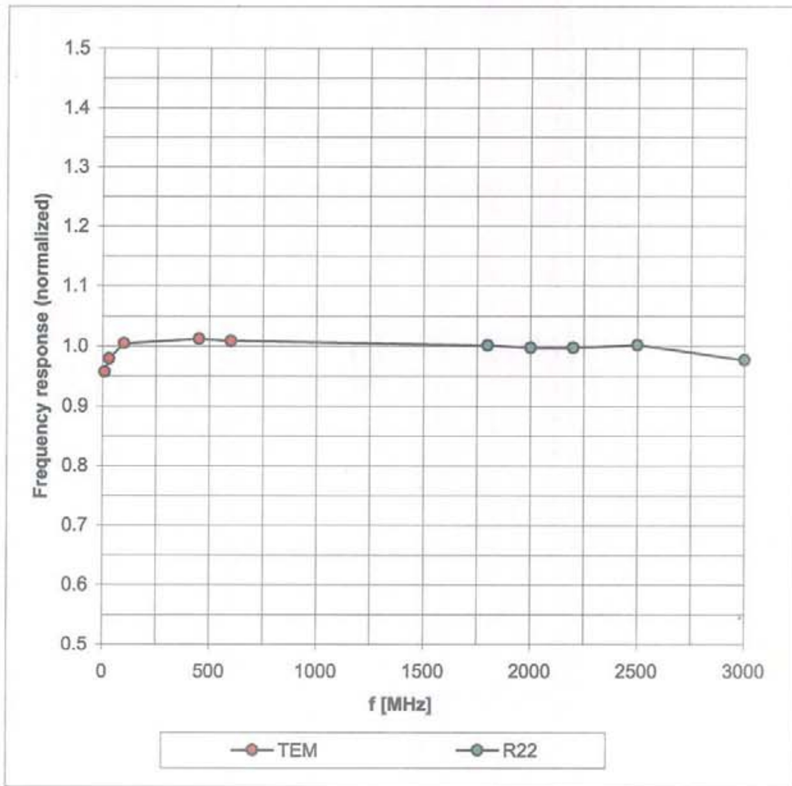
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

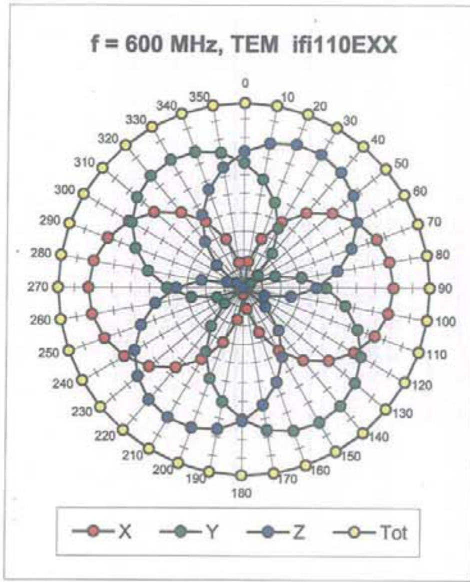
Frequency Response of E-Field

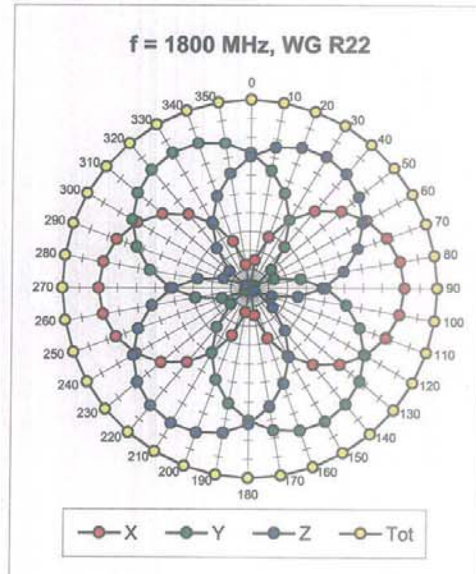
(TEM-Cell:ifi110 EXX, Waveguide: R22)

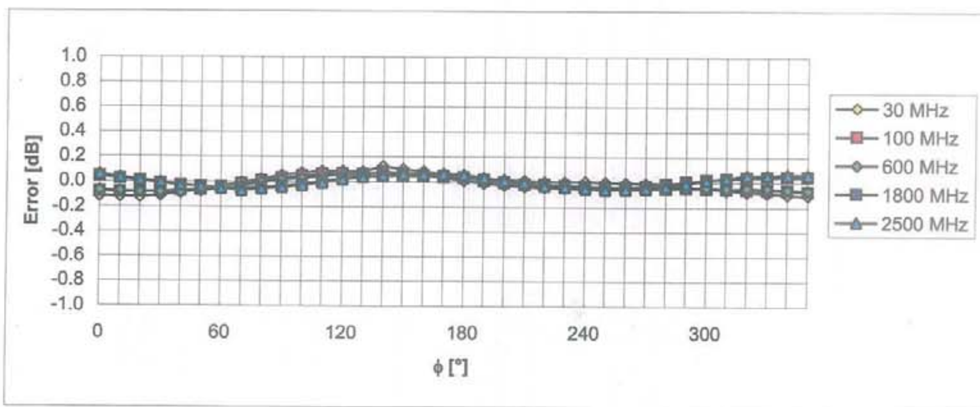


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



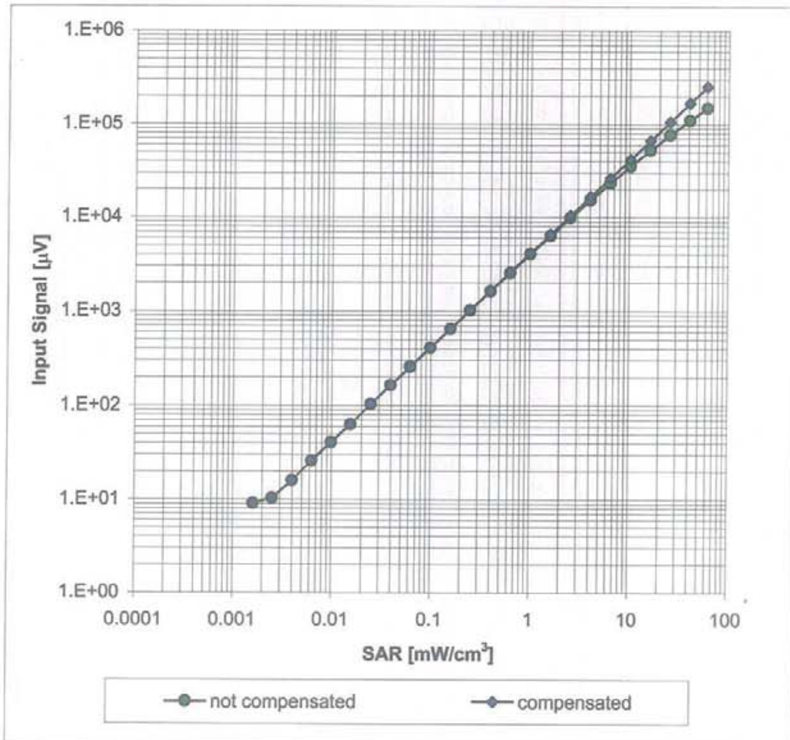


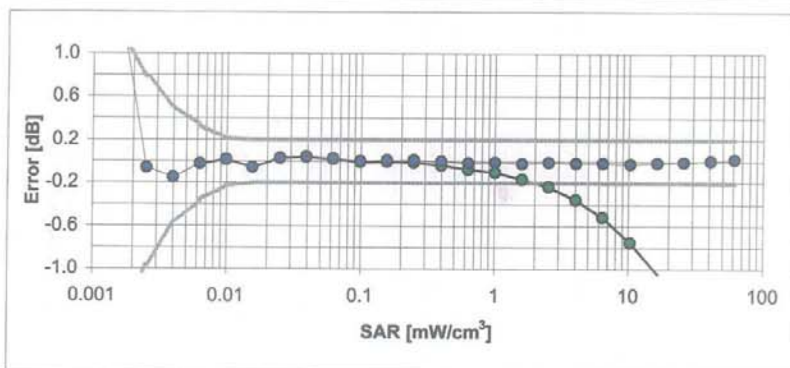


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

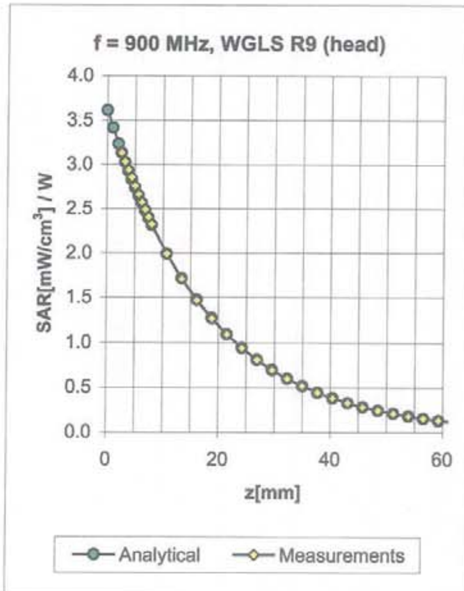
(Waveguide R22, f = 1800 MHz)

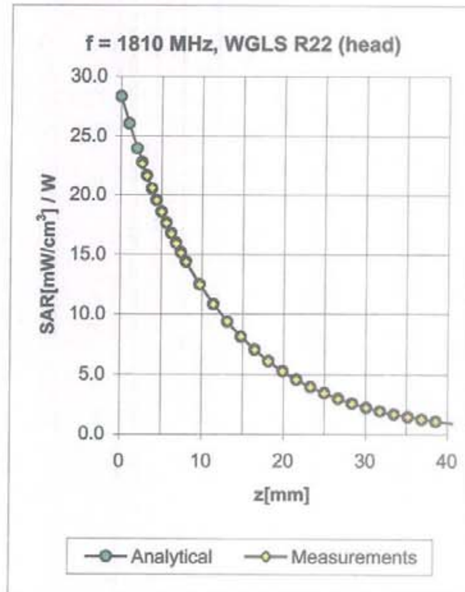




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



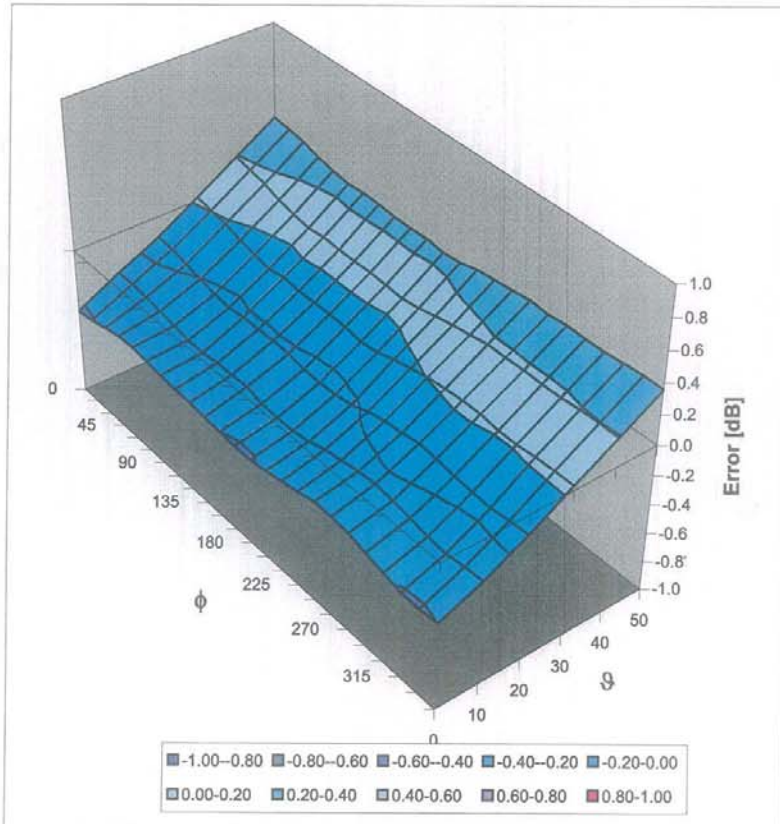


f [MHz]	Validity [MHz][c]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.95	1.13	5.60 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.73	1.31	4.81 ± 11.0% (k=2)
2000	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.66	1.35	4.66 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.61	1.51	4.40 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.99	1.13	5.58 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.59	1.48	4.70 ± 11.0% (k=2)
2000	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.54	1.56	4.57 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.89	1.23	4.10 ± 11.0% (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.

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Schmid & Partner Engineering AG

s p e a g

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

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV3**
Serial Number:	**3080**
Place of Assessment:	**Zurich**
Date of Assessment:	**June 27, 2009**
Probe Calibration Date:	**January 20, 2009**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1810 MHz.

Assessed by:

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

Dosimetric E-Field Probe ES3DV3 - SN:3080

Conversion factor (± standard deviation)

850 ± 50 MHz	*ConvF*	**5.70 ± 7%**	ε_r = 41.5 ± 5% σ = 0.92 ± 5% mho/m (head tissue)
1860 ± 50 MHz	*ConvF*	**4.74 ± 7%**	ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m (head tissue)
850 ± 50 MHz	*ConvF*	**5.50 ± 7%**	ε_r = 55.2 ± 5% σ = 0.99 ± 5% mho/m (body tissue)
1860 ± 50 MHz	*ConvF*	**4.50 ± 7%**	ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.

APPENDIX H

Calibration of The Validation Dipole

4/8

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

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

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

Accreditation No.: SCS 108

Client **Samsung (Dymstec)**

Certificate No: **D835V2-4d050_Mar09**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d050
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	March 16, 2009
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 (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: March 17, 2009

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

2009.4.8

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 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	40.3 ± 6 %	0.87 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 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	2.33 mW / g
SAR normalized	normalized to 1W	9.32 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**9.49 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 mW / g
SAR normalized	normalized to 1W	6.12 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**6.21 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	51.5 Ω - 4.5 jΩ
Return Loss	- 26.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.387 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 16, 2006

DASY5 Validation Report for Head TSL

Date/Time: 16.03.2009 11:58:06

Test Laboratory: SPEAG, Zurich, Switzerland

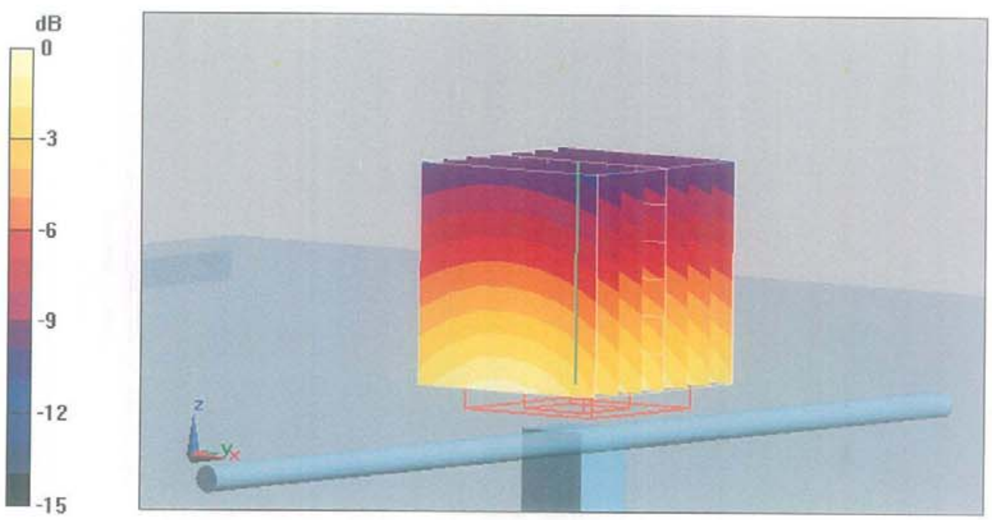
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d050

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL 900 MHz
Medium parameters used: f = 835 MHz; σ = 0.87 mho/m; ε_r = 40.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

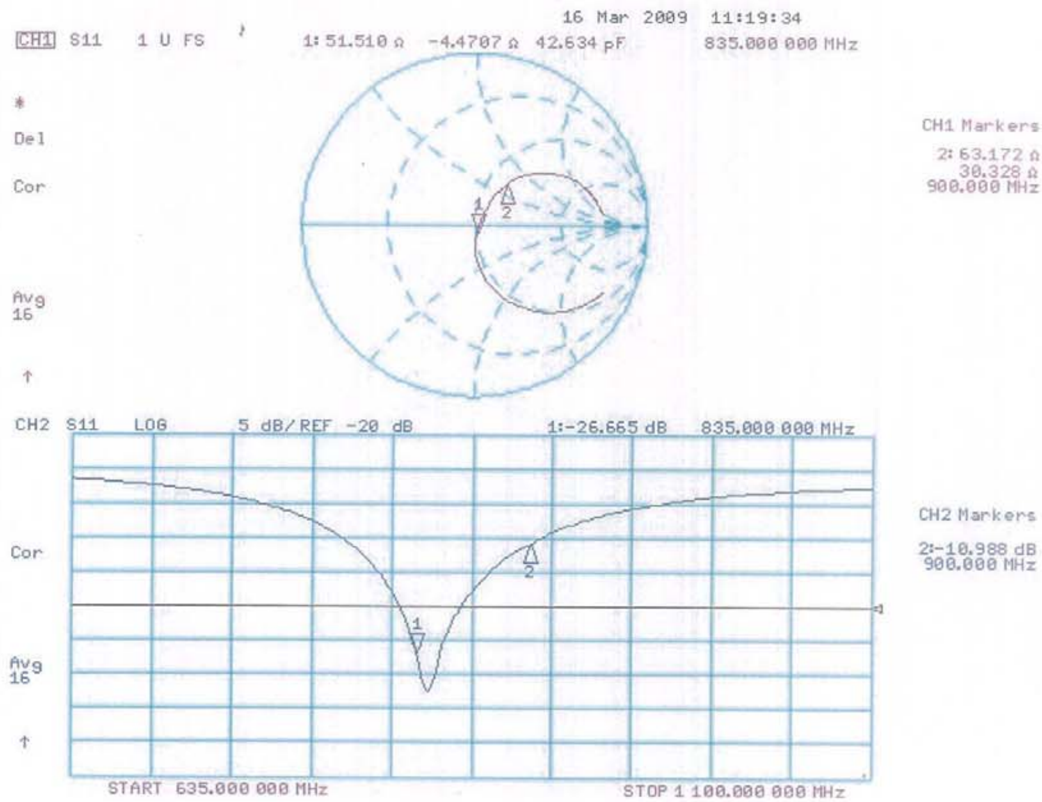
- Probe: ES3DV2 - SN3025; ConvF(5.97, 5.97, 5.97); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin=250mW; dip=15mm; dist=3.4mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.4 V/m; Power Drift = -0.032 dB
Peak SAR (extrapolated) = 3.41 W/kg
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.53 mW/g
Maximum value of SAR (measured) = 2.63 mW/g



0 dB = 2.63mW/g

Impedance Measurement Plot for Head TSL



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Samsung (Dymstec)**

Certificate No: **D1900V2-5d082-Mar09**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d082
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	March 17, 2009
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	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: March 18, 2009

2009. 5.11

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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) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.0
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 %	1.47 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 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	10.2 mW / g
SAR normalized	normalized to 1W	40.8 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**39.4 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.27 mW / g
SAR normalized	normalized to 1W	21.1 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**20.7 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	52.9 Ω + 4.5 jΩ
Return Loss	- 25.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 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	June 28, 2006

DASY5 Validation Report for Head TSL

Date/Time: 17.03.2009 14:52:19

Test Laboratory: SPEAG, Zurich, Switzerland

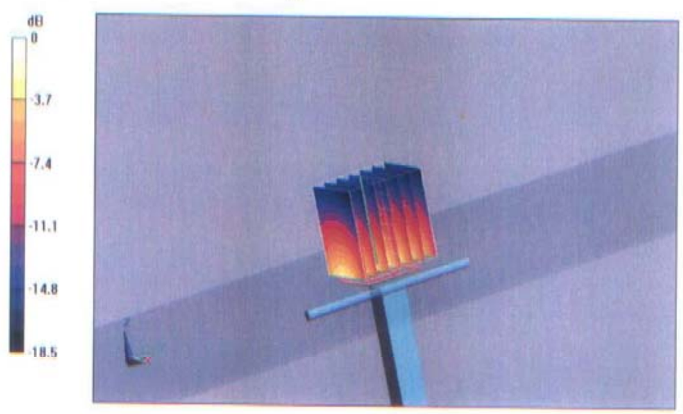
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d082

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL U10 BB
Medium parameters used: f = 1900 MHz; σ = 1.47 mho/m; ε_r = 38.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.9, 4.9, 4.9); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; dip = 10 mm, scan at 3.4mm/Zoom Scan (dist=3.4mm, probe 0deg) (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.3 V/m; Power Drift = 0.022 dB
Peak SAR (extrapolated) = 19.3 W/kg
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.27 mW/g
Maximum value of SAR (measured) = 12.2 mW/g



0 dB = 12.2mW/g

Impedance Measurement Plot for Head TSL