A Test Lab Techno Corp.

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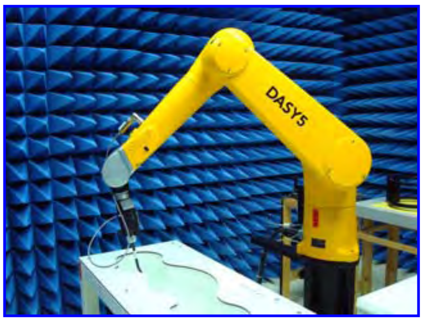
SAR EVALUATION REPORT

Test Report No.	:	1303FS13
Applicant	:	Unitech Electronics Co., Ltd.
Product Type	:	Rugged Tablet Computer
Trade Name	:	unitech
Model Number	:	TB100xxxxxxxxxx
Date of Received	:	Jan. 22, 2013
Test Period	:	Jan. 29, 2013
Date of Issued	:	Mar. 27, 2013
Test Environment	:	Ambient Temperature： 22 ±2 ° C
		Relative Humidity：40 - 70 ％
Standard	:	ANSI/IEEE C95.1-1999
		IEEE Std. 1528-2003
		IEEE Std. 1528a-2005
		47 CFR Part §2.1093;
		FCC/OET Bulletin 65 Supplement C [July 2001]
Max. SAR	:	1.41 W/kg Body SAR
Test Lab Location	:	Chang-an Lab



1. The test operations have to be performed with cautious behavior, the test results are as attached.
2. The test results are under chamber environment of A Test Lab Techno Corp. A Test Lab Techno Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples.
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Approved By : (Yung Tan Tsai) Tested By : (Bill Hu)

Contents

1. Description of Equipment under Test (EUT)

Applicant	Unitech Electronics Co., Ltd.	
Applicant Address	5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan	
Manufacture	AAEON Technology. Inc.	
Manufacture Address	5F, No. 135, Lane 235, Pao Chiao Rd.,Hsin-Tien Dist,New Taipei City,Taiwan	
Product Type	Rugged Tablet Computer	
Trade Name Model Number	unitech TB100xxxxxxxxxx (Where x is 0-9，A-Z，a-z，-or blank) for marketing purpose)	
FCC ID	HLETB100BTNP	
RF Function	GPRS/EGPRS 850 GPRS/EGPRS 1900 WCDMA (RMC 12.2K) / HSDPA / HSUPA / HSPA+ (QPSK) Band II WCDMA (RMC 12.2K) / HSDPA / HSUPA / HSPA+ (QPSK) Band V IEEE 802.11b / 802.11g / IEEE 802.11n 20MHz (2.4GHz) Bluetooth 2.1	
Tx Frequency	Band	Operate Frequency (MHz)
	GPRS/EGPRS 850	824.2 - 848.8
	GPRS/EGPRS 1900	1850.2 - 1909.8
	WCDMA (RMC 12.2K) / HSDPA / HSUPA / HSPA+ (QPSK) Band II	1852.4 - 1907.6
	WCDMA (RMC 12.2K) / HSDPA / HSUPA / HSPA+ (QPSK) Band V	826.4 - 846.6
	IEEE 802.11b / 802.11g / IEEE 802.11n 20MHz	2412 - 2462
	Bluetooth 2.1	2402 - 2480
RF Conducted Power (Avg.)	Band	Power (W / dBm)
	GPRS/EGPRS 850	1.683 / 32.26
	GPRS/EGPRS 1900	0.883 / 29.46
	WCDMA (RMC 12.2K) / HSDPA / HSUPA / HSPA+ (QPSK) Band II	0.216 / 23.35
	WCDMA (RMC 12.2K) / HSDPA / HSUPA / HSPA+ (QPSK) Band V	0.215 / 23.32
	IEEE 802.11b	0.025 / 13.95
	IEEE 802.11g	0.020 / 13.06
	IEEE 802.11n 20MHz (2.4GHz)	0.016 / 11.98
	Bluetooth 2.1	0.003 / 4.87
Max. SAR Measurement	1.41 W/kg Body SAR	
dDevice Category	Mobile Device	
RF Exposure Environment	General Population / Uncontrolled	
Application Type	Certification	

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment / general population exposure limits specified in Standard C95.1-1999 and had been tested in accordance with the measurement procedures specified in IEEE Std. 1528-2003 and IEEE Std. 1528a-2005.

2. Introduction

The A Test Lab Techno Corp. has performed measurements of the maximum potential exposure to the user of **Unitech Electronics Co., Ltd. Trade Name：unitech　Model(s)：TB100xxxxxxxxxx**. The test procedures, as described in American National Standards, Institute C95.1-1999〔1〕, FCC/OET Bulletin 65 Supplement C [July 2001] were employed and they specify the maximum exposure limit of 1.6mW/g as averaged over any 1 gram of tissue for portable devices being used within 20cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

2.1 SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dw) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Figure 2).

$$\text{SAR} = \frac{d}{dt}\left(\frac{dw}{dm}\right) = \frac{d}{dt}\left(\frac{dw}{\rho dv}\right)$$

Figure 2. **SAR Mathematical Equation**

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

$$\text{SAR} = \frac{\sigma E^2}{\rho}$$

Where：

σ = conductivity of the tissue (S/m)

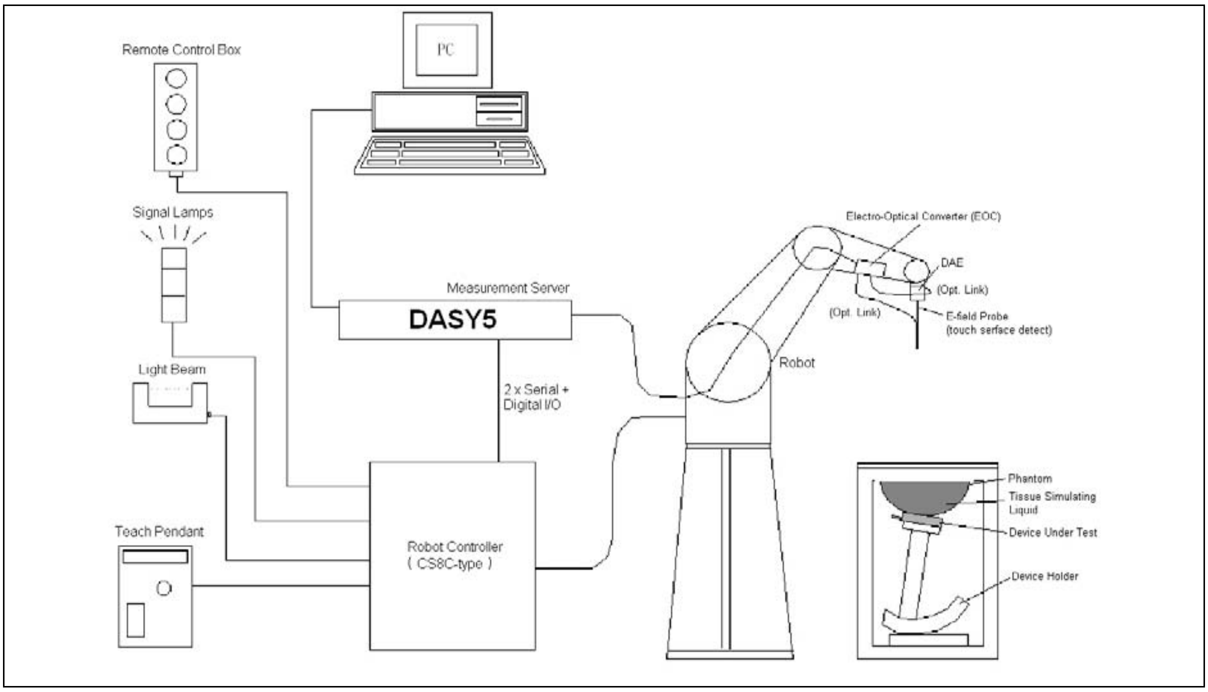
ρ = mass density of the tissue (kg/m^3)

E = RMS electric field strength (V/m)

＊Note：

The primary factors that control rate of 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〔2〕

3. SAR Measurement Setup



The DASY5 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli TX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
5. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
6. A computer operating Windows 2000 or Windows XP.
7. DASY5 software.
8. Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The SAM twin phantom enabling testing left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. Validation dipole kits allowing validating the proper functioning of the system.

3.1 DASY E-Field Probe System

The SAR measurements were conducted with the dosimetric probe (manufactured by SPEAG), designed in the classical triangular configuration〔3〕and optimized for dosimetric evaluation. The probes is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. 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 DASY software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

3.1.1 E-Field Probe Specification

Construction	Symmetrical design with triangular core
	Built-in optical fiber for surface detection System
	Built-in shielding against static charges
	PEEK enclosure material (resistant to organic solvents, e.q., glycol)
Calibration	In air from 10 MHz to 6 GHz
	In brain and muscle simulating tissue at frequencies of 835MHz and 1900MHz (accuracy ±8%)
	Calibration for other liquids and frequencies upon request
Frequency	±0.2 dB (30 MHz to 6 GHz)
Directivity	±0.3 dB in brain tissue (rotation around probe axis)
	±0.5 dB in brain tissue (rotation normal probe axis)
	Dynamic Range 10μW/g to > 100mW/g; Linearity: ±0.2dB
Dimensions	Overall length: 337mm
	Tip length: 9mm
	Body diameter: 10mm
	Tip diameter: 2.5mm
	Distance from probe tip to dipole centers: 1.0mm
Application	General dosimetry up to 6GHz
	Compliance tests of mobile phones
	Fast automatic scanning in arbitrary phantoms

Figure 3. E-field Probe

Figure 4. Probe setup on robot

3.1.2 E-Field Probe Calibration process

Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies 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 rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated head tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

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

Where：

Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (head or body),

ΔT = Temperature increase due to RF exposure.

Or $$SAR = \frac{|E|^2 \sigma}{\rho}$$

Where：

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

3.2 Data Acquisition Electronic (DAE) System

Cell Controller

Processor：	Intel Core(TM)2 CPU
Clock Speed：	@ 1.86GHz
Operating System：	Windows XP Professional

Data Converter

Features：	Signal Amplifier, multiplexer, A/D converter, and control logic
Software：	DASY5 v5.0 (Build 125) & SEMCAD X Version 13.4 Build 125
Connecting Lines：	Optical downlink for data and status info
	Optical uplink for commands and clock

3.3 Robot

Positioner：	Stäubli Unimation Corp. Robot Model: TX90XL
Repeatability：	±0.02 mm
No. of Axis：	6

3.4 Measurement Server

Processor：	PC/104 with a 400MHz intel ULV Celeron
I/O-board：	Link to DAE4 (or DAE3)
	16-bit A/D converter for surface detection system
	Digital I/O interface
	Serial link to robot
	Direct emergency stop output for robot

3.5 Device Holder

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

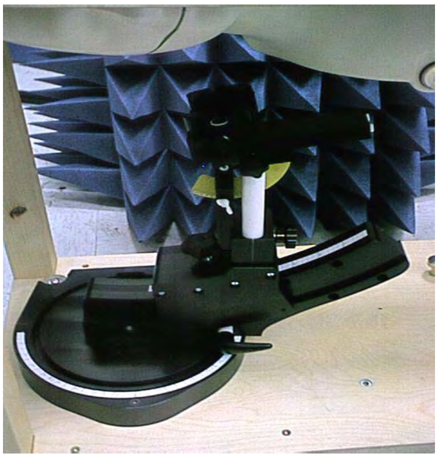


Figure 5. Device Holder

3.6 Phantom - SAM v4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209. 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. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	1000x500 mm (LxW)

Table 1. Specification of SAM v4.0

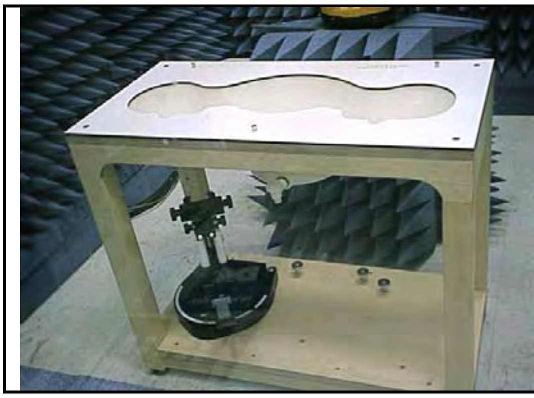


Figure 6. SAM Twin Phantom

3.7 Oval Flat Phantom - ELI 4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (Oval Flat) phantom defined in IEEE 1528-2003, IEEE Std. 1528a-2005, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of wireless portable device usage as well as body mounted usage at the flat phantom region. A cover prevents 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 with the robot.

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 30 liters
Dimensions	190×600×400 mm (H×L×W)

Table 2. Specification of ELI 4.0

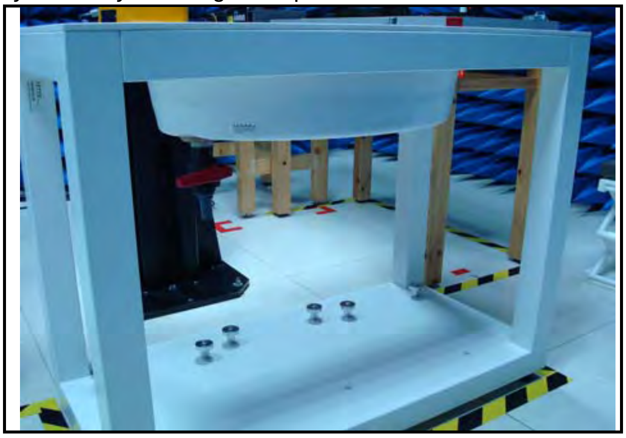


Figure 7. Oval Flat Phantom

3.8 Data Storage and Evaluation

3.8.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension DA4 or DA5. The post processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

3.8.2 Data Evaluation

The DASY post processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software：

Probe parameters：	- Sensitivity	*Normi, ai0, ai1, ai2*
	- Conversion factor	*ConvFi*
	- Diode compression point	*dcpi*
Device parameters：	- Frequency	*f*
	- Crest factor	*cf*
Media parameters：	- Conductivity	*σ*
	- Density	*ρ*

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as：

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

With	*Vi*	= compensated signal of channel i (i = x, y, z)
	Ui	= input signal of channel i (i = x, y, z)
	cf	= crest factor of exciting field (DASY parameter)
	dcpi	= diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated：

E-field probes： $$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field probes：

$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

with *Vi* = compensated signal of channel i (i = x, y, z)
Normi= sensor sensitivity of channel i (i = x, y, z)
µV/(V/m)2 for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/*m*
Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude)：

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with *SAR* = local specific absorption rate in mW/g
Etot = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

＊Note：That the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = \frac{H_{tot}^2}{37.7}$$

with *Ppwe* = equivalent power density of a plane wave in mW/cm2
Etot = total electric field strength in V/m
Htot = total magnetic field strength in A/m

4. Tissue Simulating Liquids

The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.
The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an E5071B Network Analyzer.

IEEE SCC-34/SC-2 in 1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. Other head and body tissue parameters that have not been specified in 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equation and extrapolated according to the head parameter specified in 1528.

Target Frequency	Head		Body	
(MHz)	εr	σ (S/m)	εr	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 - 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00
(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)				

Table 3. Tissue dielectric parameters for head and body phantoms

4.1 Ingredients

The following ingredients are used:

- Water: deionized water (pure H_20), resistivity ≥ 16 M Ω -as basis for the liquid
- Sugar: refied white sugar (typically 99.7 % sucrose, available as crystal sugar in food shops) -to reduce relative permittivity
- Salt: pure NaCl -to increase conductivity
- Cellulose: Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20°C), CAS # 54290 -to increase viscosity and to keep sugar in solution.
- Preservative: Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 -to prevent the spread of bacteria and molds
- DGBE: Diethylenglycol-monobuthyl ether (DGBE), Fluka Chemie GmbH, CAS # 112-34-5 -to reduce relative permittivity

4.2 Recipes

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands.

Note: The goal dielectric parameters (at 22 ℃) must be achieved within a tolerance of ±5% for εand ±5% for σ.

Ingredients (% by weight)	Frequency (MHz)									
	750		835		1750		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	39.28	51.30	41.45	52.40	54.50	40.20	54.90	40.40	62.70	73.20
Salt (NaCl)	1.47	1.42	1.45	1.50	0.17	0.49	0.18	0.50	0.50	0.10
Sugar	58.15	46.18	56.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00
HEC	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Bactericide	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DGBE	0.00	0.00	0.00	0.00	45.33	59.31	44.92	59.10	36.80	26.70
Dielectric Constant	41.88	54.60	42.54	56.10	40.10	53.60	39.90	54.00	39.80	52.50
Conductivity (S/m)	0.90	0.97	0.91	0.95	1.39	1.49	1.42	1.45	1.88	1.78

Salt: 99^+% Pure Sodium Chloride　　Sugar: 98^+% Pure Sucrose

Water: De-ionized, 16 MΩ^+ resistivity　　HEC: Hydroxyethyl Cellulose

DGBE: 99^+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

4.3 Liquid Depth

The liquid level was during measurement 15cm ±0.5cm.
According to KDB865664 ,the depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm ±0.5 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm ±0.5 cm for measurements > 3 GHz.

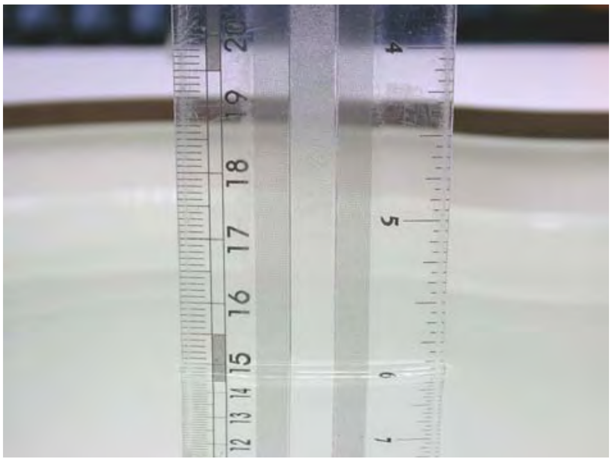


Figure 8. Head-Position	Figure 9. Body-Position

5. SAR Testing with RF Transmitters

5.1 SAR Testing with GSM/GPRS/EGPRS Transmitters

Configure the basestation to support GMSK and 8PSK call respectively, and set timeslot transmission for GMSK GSM/GPRS and 8PSK EDGE. Measure and record power outputs for both modulations, that test is applicable.

5.2 Conducted Power

Band	Modulation	Data Rate	CH	Frequency (MHz)	Average Power (dBm)	
					Time Average	Burst Average
GPRS 850 Multi Class :12 Max Up:4 Max Down:4 Sum:5	GMSK	4Down1Up Duty factor 1/8	Lowest	824.2	23.23	**32.26**
			Middle	836.6	23.21	32.24
			Highest	848.8	23.13	32.16
		3Down2Up Duty factor 2/8	Lowest	824.2	24.58	30.60
			Middle	836.6	24.55	30.57
			Highest	848.8	24.40	30.42
		2Down3Up Duty factor 3/8	Lowest	824.2	**25.30**	29.56
			Middle	836.6	25.21	29.47
			Highest	848.8	25.05	29.31
		1Down4Up Duty factor 4/8	Lowest	824.2	24.50	27.51
			Middle	836.6	24.43	27.44
			Highest	848.8	24.27	27.28
EGPRS 850 Multi Class :12 Max Up:4 Max Down:4 Sum:5	8PSK	4Down1Up Duty factor 1/8	Lowest	824.2	18.31	27.34
			Middle	836.6	18.26	27.29
			Highest	848.8	18.11	27.14
		3Down2Up Duty factor 2/8	Lowest	824.2	19.25	25.27
			Middle	836.6	19.09	25.11
			Highest	848.8	19.04	25.06
		2Down3Up Duty factor 3/8	Lowest	824.2	19.97	24.23
			Middle	836.6	19.89	24.15
			Highest	848.8	19.80	24.06
		1Down4Up Duty factor 4/8	Lowest	824.2	20.11	23.12
			Middle	836.6	20.08	23.09
			Highest	848.8	19.97	22.98

Note: 1. Time Average power slot duty cycle factor calculate:

1up: Average burst power+10*LOG(1/8)

2up: Average burst power+10*LOG(2/8)

3up: Average burst power+10*LOG(3/8)

4up: Average burst power+10*LOG(4/8)

Band	Modulation	Data Rate	CH	Frequency (MHz)	Average Power (dBm)	
					Time Average	Burst Average
GPRS 1900 Multi Class :12 Max Up:4 Max Down:4 Sum:5	8PSK	4Down1Up Duty factor 1/8	Lowest	1850.2	20.33	29.36
			Middle	1880.0	20.38	29.41
			Highest	1909.8	20.43	**29.46**
		3Down2Up Duty factor 2/8	Lowest	1850.2	21.79	27.81
			Middle	1880.0	21.82	27.84
			Highest	1909.8	21.90	27.92
		2Down3Up Duty factor 3/8	Lowest	1850.2	22.48	26.74
			Middle	1880.0	22.50	26.76
			Highest	1909.8	22.58	26.84
		1Down4Up Duty factor 4/8	Lowest	1850.2	22.72	25.73
			Middle	1880.0	22.77	25.78
			Highest	1909.8	**22.84**	25.85
EGPRS 1900 Multi Class :12 Max Up:4 Max Down:4 Sum:5	8PSK	4Down1Up Duty factor 1/8	Lowest	1850.2	17.06	26.09
			Middle	1880.0	17.08	26.11
			Highest	1909.8	17.16	26.19
		3Down2Up Duty factor 2/8	Lowest	1850.2	18.00	24.02
			Middle	1880.0	18.09	24.11
			Highest	1909.8	18.15	24.17
		2Down3Up Duty factor 3/8	Lowest	1850.2	18.63	22.89
			Middle	1880.0	18.67	22.93
			Highest	1909.8	18.81	23.07
		1Down4Up Duty factor 4/8	Lowest	1850.2	18.87	21.88
			Middle	1880.0	18.94	21.95
			Highest	1909.8	19.02	22.03

Note: 1. Time Average power slot duty cycle factor calculate:

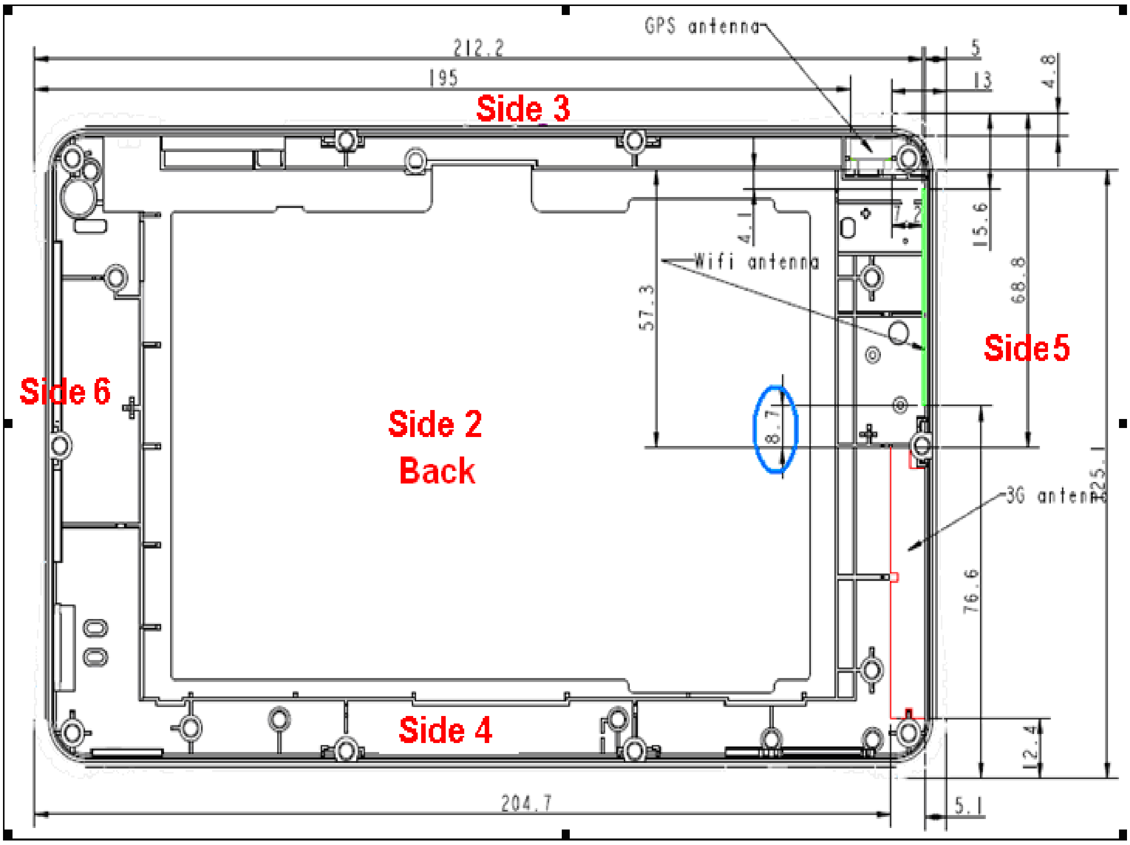
1up: Average burst power+10*LOG(1/8)

2up: Average burst power+10*LOG(2/8)

3up: Average burst power+10*LOG(3/8)

4up: Average burst power+10*LOG(4/8)

5.3 Antenna location



Antenna to User			
Distance of WiFi/Bluetooth to edge (mm)		Distance of 2G/3G to edge (mm)	
2G/3G to Side 1	6.4	2G/3G to Side 1	4.0
2G/3G to Side 2	6.6	2G/3G to Side 2	16.3
2G/3G to Side 3	15.6	2G/3G to Side 3	68.8
2G/3G to Side 4	76.6	2G/3G to Side 4	12.4
2G/3G to Side 5	5.0	2G/3G to Side 5	5.1
2G/3G to Side 6	212.2	2G/3G to Side 6	204.7
Antenna to Antenna			
Antenna account		Distance (cm)	
WLAN to Bluetooth		0	
WWAN to Bluetooth		0.87	

5.4 Stand-alone SAR Evaluate

There have no exclusion issue for transmitters.

Transmitter and antenna implementation as below:

Band	WWAN Main antenna	WLAN antenna
2G/3G	V	X
WLAN	X	V
Bluetooth	X	V

Stand-alone transmission configurations as below:

Band	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
GPRS/EGPRS 850		V		V	V	
GPRS/EGPRS 1900		V		V	V	
WCDMA/HSDPA/HSUPA/HSPA+ BII		V		V	V	
WCDMA/HSDPA/HSUPA/HSPA+ BV		V		V	V	
IEEE 802.11b/g/n		V	V		V	
Bluetooth		V	V		V	

Note: Stand-alone SAR is required when SAR must be measured for all sides and surfaces with a transmitting antenna located within 25 mm from that surface or edge, detail refer antenna location.

5.5 Simultaneous Transmitting Evaluate

Simultaneous transmission configurations as below:

Condition	Side	Frequency Band		
		2G/3G	WLAN	Bluetooth
1	2	V	X	V
2		X	V	V
3	3	X	V	V
4	5	V	X	V
5		X	V	V

5.5.1 Sum of 1-g or 10-g SAR of all simultaneously transmitting

When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in and operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

Sum of 1-g SAR of summary as below:

Phantom Position		Spacing (mm)	ASSY	Simult Tx 1		Simult Tx 2		∑ SAR^{1g}	Event
				Band	SAR^{1g} (mW/g)	Band	SAR^{1g} (mW/g)	(mW/g)	
Flat	Side 2	0	N/A	Bluetooth	0.097	GPRS 850	0.774	0.871	<1.6
		0	N/A	Bluetooth	0.097	GPRS 1900	1.110	1.207	<1.6
		0	N/A	Bluetooth	0.097	WCDMA Band II	1.540	1.637	>1.6
		0	N/A	Bluetooth	0.097	WCDMA Band V	0.550	0.647	<1.6
		0	N/A	Bluetooth	0.097	WLAN	0.752	0.849	<1.6
Flat	Side 3	0	N/A	Bluetooth	0.011	WLAN	0.009	0.110	<1.6
Flat	Side 5	0	N/A	Bluetooth	0.120	GPRS 850	1.410	1.530	<1.6
		0	N/A	Bluetooth	0.120	GPRS 1900	1.170	1.290	<1.6
		0	N/A	Bluetooth	0.120	WCDMA Band II	1.040	1.160	<1.6
		0	N/A	Bluetooth	0.120	WCDMA Band V	0.770	0.890	<1.6
		0	N/A	Bluetooth	0.120	WLAN	1.460	1.580	<1.6

Note: 3G SAR value of original report should be scalle to max tune-up power that Reported SAR please refers Appendix C.

5.5.2 SAR to peak location separation ratio (SPLSR)

When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The ratio is determined by (SAR1 + SAR2)^1.5/Ri, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

SAR to peak location separation ratio (SPLSR) as below:

Step 1 caculated distance of cube

WWAN: Flat_WCDMA Band II CH9262_Back Surface to phantom 0mm			
	X	Y	Z
Max	m	m	m
1.78	-0.0405	-0.087	-0.181

BT: Flat_BT CH39_Back Surface to phantom 0mm			
	X	Y	Z
Max	m	m	m
0.13	0.0345	-0.102	-0.179

Distance calculation

DASY stores the individual coordinates of each measurement point, whereby the center coordinate (x=0, y=0) is always the Grid Reference Point as set in the Phantom properties within DASY setup pane. As long as the same phantom section is used the distance between two hot spots can be calculated with the Pythagoras' theorem.

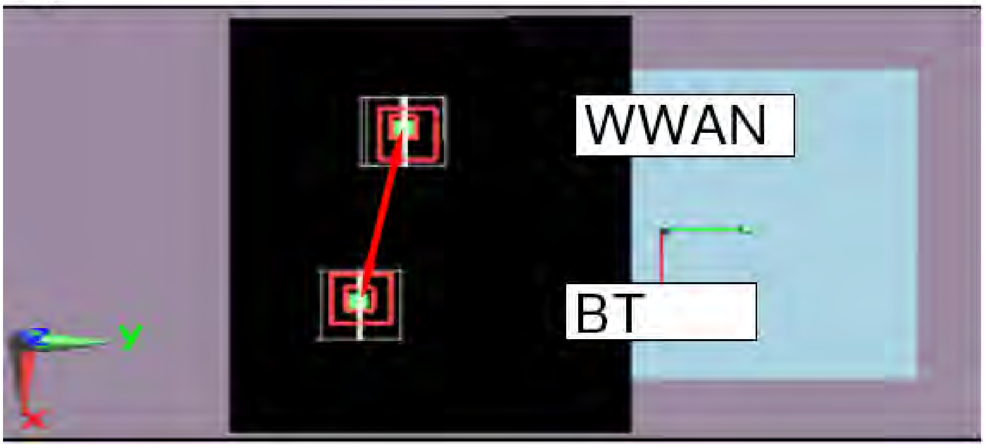
E.g. Antenna 1 has X1, Y1, Z1 and Antenna 2 has X2, Y2, Z2 as the hot spot coordinates. The closest distance between them is

$$d = \sqrt[2]{(X1 - X2)^2 + (Y1 - Y2)^2 + (Z1 - Z2)^2}$$

d=SQRT((0.0345-(-0.0405))^2+(-0.102-(-0.087))^2+(-0.179-(-0.181))^2)

Distance	
0.077	m
7.7	cm

Plot:



Step 2 caculated SPLSR

Max sum of WWAN and BT is 1.54+0.097 =1.637 >1.6 mW/g, SPLSR = (1.54+0.097)^1.5/77=0.03 <0.04, therefore perform volume scan is not required.

5.6 SAR test reduction according to KDB

General:

- The test data reported are the worst-case SAR value with the position set in a typical configuration.
  Test procedures used were according to FCC/OET Bulletin 65, Supplement C [June 2001], IEEE1528-2003 and IEEE Std. 1528a-2005.
- All modes of operation were investigated, and worst-case results are reported.
- Tissue parameters and temperatures are listed on the SAR plots.
- Batteries are fully charged for all readings.
- When the Channel's SAR 1g of maximum conducted power is > 0.8 mW/g, low, middle and high channel are supposed to be tested.

KDB 447498:

- The test data reported are the worst-case SAR value with the position set in a typical configuration.
  Test procedures used were according to FCC/OET Bulletin 65, Supplement C [June 2001], IEEE1528-2003 and IEEE Std. 1528a-2005.

KDB 865664:

- Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.
- When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg.
- Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

KDB 941225:

- In order to qualify for the above test reduction, the maximum burst-averaged output power for each mode (GMS/GPRS/EDGE) and the corresponding multi-slot class must be clearly identified in the SAR report for each frequency band.We perform worst case SAR with maximum time-average power on GMS/GPRS/EDGE mode.
- When HSDPA & (HSUPA / HSPA+ uplink with QPSK) power are not more than WCDMA 12.2K RMC 0.25dB and the SAR value of WCDMA BII/BV<1.2 mW/g ,therefore HSDPA & HSUPA / HSPA+ Stand-alone SAR is not required.
- SAR for EVDO Rev. A is not required when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations.
- For 1xRTT SAR is not required when the maximum average output of each channel is less than 1/4 dB higher than that measured in EVDO Rev.0.
- When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation, otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel.
- For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 5.2.1 and 5.2.2 are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
- SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

- For smaller channel bandwidth SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.
- UMPC mini-tablet devices must be tested on all sides and edges with a transmitting antenna within 25 mm from that surface or edge.

KDB 248227:

- If the conducted power of (802.11g and 802.11n) are higher than 802.11b 0.25dB,(802.11g and 802.11n) are supposed to be tested.

6. System Verification and Validation

6.1 Symmetric Dipoles for System Verification

Construction	Symmetrical dipole with l/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Frequency	835 and 1900MHz
Return Loss	> 20 dB at specified verification position
Power Capability	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request
Dimensions	D835V2: dipole length 161 mm; overall height 340 mm D1900V2: dipole length 67.7 mm; overall height 300 mm

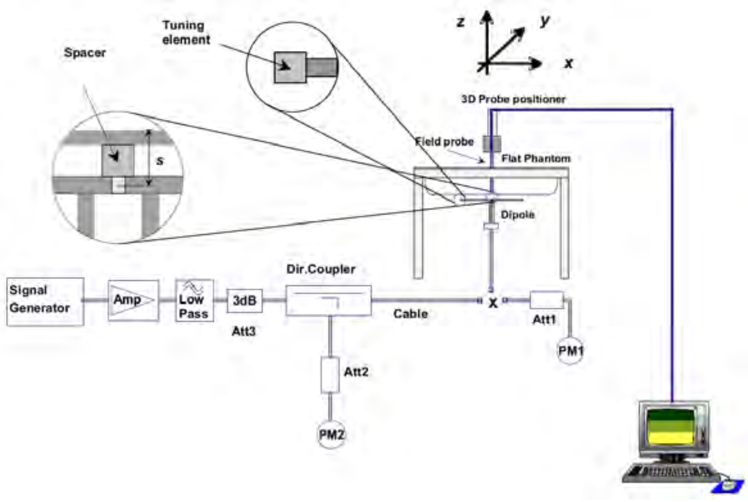


Figure 10. System Verification Setup Diagram

Figure 11. Validation Kit

6.2 Liquid Parameters

Liquid Verify								
Ambient Temperature： 22 ± 2 °C；Relative Humidity：40 -70%								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
835MHz (Body)	820MHz	22.0	εr	55.26	54.96	-0.54	± 5	Jan. 28, 2013
			σ	0.969	0.966	-0.31	± 5	
	835MHz	22.0	εr	55.20	54.82	-0.69	± 5	
			σ	0.970	0.982	1.24	± 5	
	850MHz	22.0	εr	55.15	54.71	-0.80	± 5	
			σ	0.988	1.001	1.32	± 5	
1900MHz (Body)	1850MHz	22.0	εr	53.30	53.60	0.56	± 5	Jan. 29, 2013
			σ	1.520	1.453	-4.41	± 5	
	1900MHz	22.0	εr	53.30	53.42	0.23	± 5	
			σ	1.520	1.507	-0.86	± 5	
	1930MHz	22.0	εr	53.30	53.27	-0.06	± 5	
			σ	1.520	1.539	1.25	± 5	

Table 4. Measured Tissue dielectric parameters for body phantoms

6.3 Verification Summary

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ± 7%. The verification was performed at 835 and 1900MHzMHz.

Mixture Type	Frequency (MHz)	Power	SAR_{1g} (mW/g)	SAR_{10g} (mW/g)	Drift (dB)	Difference percentage		Probe	Dipole	1W Target		Date
						1g	10g	Model / Serial No.	Model / Serial No.	SAR_{1g} (mW/g)	SAR_{10g} (mW/g)	
Body	835	250 mW	2.42	1.61	-0.13	1.50%	2.40%	EX3DV3 SN: 3519	D835V2 SN4d082	9.54	6.29	Jan. 28, 2013
		Normalize to 1 Watt	9.68	6.44								
Body	1900	250 mW	10.1	5.24	0.024	0.20%	-1.60%	EX3DV3 SN: 3519	D1900V2 SN5d111	40.30	21.30	Jan. 29, 2013
		Normalize to 1 Watt	40.40	20.96								

6.4 Validation Summary

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2003 and FCC KDB 865664 D01v01. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters as below.

Probe Type Model / Serial No.	Prob Cal. Point (MHz)	Head / Body	Cond.	Perm.	CW Validation			Mod. Validation			Date
			εr	σ	Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	PAR	
EX3DV3 SN: 3519	835	Head	54.82	0.982	Pass	Pass	Pass	GMSK	Pass	N/A	Jan. 28, 2013
EX3DV3 SN: 3519	1900	Head	53.42	1.507	Pass	Pass	Pass	GMSK	Pass	N/A	Jan. 29, 2013

7. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d082	Jul. 25, 2012	Jul. 25, 2013
SPEAG	1900MHz System Validation Kit	D1900V2	5d111	Jul. 20, 2012	Jul. 20, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV3	3519	Feb. 21, 2012	Feb. 21, 2013
SPEAG	Data Acquisition Electronics	DAE4	541	Jul. 23, 2012	Jul. 23, 2013
SPEAG	Device Holder	N/A	N/A	NCR	
SPEAG	Measurement Server	SE UMS 011 AA	1025	NCR	
SPEAG	Phantom	ELI v5.0	TP-1133	NCR	
SPEAG	Robot	Staubli TX90XL	F07/564ZA1/C/01	NCR	
SPEAG	Software	DASY5 V5.0 Build 125	N/A	NCR	
SPEAG	Software	SEMCAD V13.4 Build 125	N/A	NCR	
Agilent	Dielectric Probe Kit	85070C	US99360094	NCR	
Agilent	ENA Series Network Analyzer	E5071B	MY42404655	Apr. 05, 2012	Apr. 05, 2013
R&S	Power Sensor	NRP-Z22	100179	May 06, 2012	May 06, 2013
Agilent	MXG Vector Signal Generator	N5182A	MY47420962	May 24, 2011	May 24, 2013
Agilent	Dual Directional Coupler	778D	50334	NCR	
Mini-Circuits	Power Amplifier	ZHL-42W-SMA	D111103#5	NCR	
Mini-Circuits	Power Amplifier	ZVE-8G-SMA	D042005 671800514	NCR	
Aisi	Attenuator	IEAT 3dB	N/A	NCR	

Table 5. Test Equipment List

8. Measurement Uncertainty

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR to be less than ±19.62 %〔8〕. The frequency range of the measurement uncertainty is 750 ~ 5800MHz ±10.1 %

According to Std. C95.3〔9〕, the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ±1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ±2dB can be expected.

According to CENELEC〔10〕, typical worst-case uncertainty of field measurements is ±5 dB. For well-defined modulation characteristics the uncertainty can be reduced to ±3 dB.

Item	Uncertainty Component	Uncertainty Value	Prob. Dist	Div.	c_i (1g)	c_i (10g)	Std. Unc. （1-g）	Std. Unc. （10-g）	v_i or V_{eff}
Measurement System									
u1	Probe Calibration (*k*=1)	±5.05%	Normal	1	1	1	±5.05%	±5.05%	∞
u2	Probe Isotropy	±7.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.1%	±3.1%	∞
u3	Boundary Effect	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u4	Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
u5	System Detection Limit	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
u6	Readout Electronics	±0.3%	Normal	1	1	1	±0.3%	±0.3%	∞
u7	Response Time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
u8	Integration Time	±2.6%	Rectangular	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
u9	RF Ambient Conditions	±0%	Rectangular	$\sqrt{3}$	1	1	±0%	±0%	∞
u10	RF Ambient Reflections	±0%	Rectangular	$\sqrt{3}$	1	1	±0%	±0%	∞
u11	Probe Positioner Mechanical Tolerance	±0.4%	Rectangular	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
u12	Probe Positioning with respect to Phantom Shell	±2.9%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u13	Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test sample Related									
u14	Test sample Positioning	±3.6%	Normal	1	1	1	±3.6%	±3.6%	89
u15	Device Holder Uncertainty	±3.5%	Normal	1	1	1	±3.5%	±3.5%	5
u16	Output Power Variation - SAR drift measurement	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Tissue Parameters									
u17	Phantom Uncertainty (shape and thickness tolerances)	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
u18	Liquid Conductivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
u19	Liquid Conductivity - measurement uncertainty	±1.93%	Normal	1	0.64	0.43	±1.24%	±0.83%	69
u20	Liquid Permittivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
u21	Liquid Permittivity - measurement uncertainty	±1.4%	Normal	1	0.6	0.49	±0.84%	±1.69%	69
Combined standard uncertainty			RSS				±9.81%	±9.62%	313
Expanded uncertainty (95% CONFIDENCE LEVEL)			*k*=2				±19.62%	±19.24%	

Table 6. Uncertainty Budget of DASY

9. Measurement Procedure

The measurement procedures are as follows:

1. For WLAN function, engineering testing software installed on Notebook can provide continuous transmitting signal.
2. Measure output power through RF cable and power meter
3. Set scan area, grid size and other setting on the DASY software
4. Find out the largest SAR result on these testing positions of each band
5. Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

1. Power reference measurement
2. Area scan
3. Zoom scan
4. Power drift measurement

9.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.
The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.
The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages

1. Extraction of the measured data (grid and values) from the Zoom Scan
2. Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. Generation of a high-resolution mesh within the measured volume
4. Interpolation of all measured values form the measurement grid to the high-resolution grid
5. Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. Calculation of the averaged SAR within masses of 1g and 10g

9.2 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures points and step size follow as below. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

Grid Type	Frequency		Step size (mm)			X*Y*Z (Point)	Cube size			Step size		
			X	Y	Z		X	Y	Z	X	Y	Z
uniform grid	≦ 3GHz	≦2GHz	≤ 8	≤ 8	≤ 5	5*5*7	32	32	30	8	8	5
		2G - 3G	≤ 5	≤ 5	≤ 5	7*7*7	30	30	30	5	5	5
	3 - 6GHz	3 - 4GHz	≤ 5	≤ 5	≤ 4	7*7*8	30	30	28	5	5	4
		4 - 5GHz	≤ 4	≤ 4	≤ 3	8*8*10	28	28	27	4	4	3
		5 - 6GHz	≤ 4	≤ 4	≤ 2	8*8*12	28	28	22	4	4	2

(Our measure settings are refer KDB Publication 865664 D01v01)

9.3 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

9.4 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard’s method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

9.5 Power Drift Monitoring

All SAR testing is under the DUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of DUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

10. SAR Test Results Summary

10.1 Head Measurement SAR

Evaluated head SAR is not available.

10.2 Body Measurement SAR

Index.	Position	Band	Ch.	Data Rate or Sub-Test	Side to Phantom	Spacing (mm)	SAR $_{1g}$ (mW/g)	Power Drift	Burst Avg Power	Source-Time-Avg power (dBm)	Max tune-up	Time-Avg Tune-Up	Reported SAR $_{1g}$
#1	Flat	GPRS 850	128	2D3U	2	0	0.774	0.104	29.56	25.30	29.56	25.30	0.77
#2	Flat	GPRS 850	128	2D3U	4	0	0.403	-0.038	29.56	25.30	29.56	25.30	0.40
#3	Flat	GPRS 850	128	2D3U	5	0	1.150	0.010	29.56	25.30	29.56	25.30	1.15
#4	Flat	GPRS 850	190	2D3U	5	0	1.240	0.054	29.47	25.21	29.56	25.30	1.27
#5	Flat	GPRS 850	251	2D3U	5	0	1.330	0.087	29.31	25.05	29.56	25.30	1.41
#7	Flat	GPRS 1900	512	1D4U	2	0	1.080	0.195	25.73	22.72	25.85	22.84	1.11
#8	Flat	GPRS 1900	661	1D4U	2	0	1.020	0.153	25.78	22.77	25.85	22.84	1.04
#6	Flat	GPRS 1900	810	1D4U	2	0	1.040	0.184	25.85	22.84	25.85	22.84	1.04
#10	Flat	GPRS 1900	512	1D4U	4	0	0.940	0.031	25.73	22.72	25.85	22.84	0.97
#11	Flat	GPRS 1900	661	1D4U	4	0	0.894	0.075	25.78	22.77	25.85	22.84	0.91
#9	Flat	GPRS 1900	810	1D4U	4	0	0.816	0.011	25.85	22.84	25.85	22.84	0.82
#13	Flat	GPRS 1900	512	1D4U	5	0	1.140	0.050	25.73	22.72	25.85	22.84	1.17
#14	Flat	GPRS 1900	661	1D4U	5	0	0.911	0.076	25.78	22.77	25.85	22.84	0.93
#12	Flat	GPRS 1900	810	1D4U	5	0	0.668	0.004	25.85	22.84	25.85	22.84	0.67

Note:
1. According KDB 447498 D01 V05 section 4.1.4, the "Reported" explanation as below:
   "When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported."
2. If actual power less than tune-up power that Scaling SAR is required.
3. The formula of Reported SAR, that represent as below:
   Reported SAR = Original SAR * 10^[(Tune-up power - Actual power)/10]

10.3 Hot-spot mode Measurement SAR

Evaluated head SAR is not available.

10.4 Extremity Measurement SAR

Evaluated extremity SAR is not available.

10.5 SAR Measurement Variability

Detailed evaluations please refer KDB 865664 on "SAR test reduction according to KDB" section.

Index.	Position	Band	Ch.	Data Rate or Sub-Test	Side to Phantom	Spacing (mm)	SAR $_{1g}$ (mW/g)	Power Drift	Burst Avg Power	Source-Time-Avg power (dBm)	Max tune-up	Time-Avg Tune-Up	Reported SAR $_{1g}$
#15	Flat	GPRS 850	251	2D3U	5	0	1.330	0.015	29.31	25.05	29.56	25.30	1.41
#16	Flat	GPRS 1900	512	1D4U	5	0	1.130	0.041	25.73	22.72	25.85	22.84	1.16

Note:
1. According KDB 447498 D01 V05 section 4.1.4, the “Reported” explanation as below:
   “When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported.”
2. If actual power less than tune-up power that Scaling SAR is required.
3. The formula of Reported SAR, that represent as below:
   Reported SAR = Original SAR * 10^[(Tune-up power - Actual power)/10]

10.6 Std. C95.1-1999 RF Exposure Limit

Human Exposure	Population Uncontrolled Exposure (W/kg) or (mW/g)	Occupational Controlled Exposure (W/kg) or (mW/g)
Spatial Peak SAR* (head)	1.60	8.00
Spatial Peak SAR** (Whole Body)	0.08	0.40
Spatial Peak SAR*** (Partial-Body)	1.60	8.00
Spatial Peak SAR**** (Hands / Feet / Ankle / Wrist)	4.00	20.00

Table 7. Safety Limits for Partial Body Exposure

Notes：

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

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

*** The Spatial Average value of the SAR averaged over the partial – body.

**** 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.

Population / Uncontrolled Environments：are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational / Controlled Environments：are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

11. Conclusion

The SAR test values found for the portable mobile phone **Unitech Electronics Co., Ltd. Trade Name：unitech Model(s)：TB100xxxxxxxxxx** is below the maximum recommended level of 1.6 W/kg (mW/g).

12. References

[1] Std. C95.1-1999, "*American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz",* New York.

[2] NCRP, National Council on Radiation Protection and Measurements, "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields", NCRP report NO. 86, 1986.

[3] T. Schmid, O. Egger, and N. Kuster, "Automatic E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.

[4] K. Poković, T. Schmid, and N. Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.

[5] K. Poković, T. Schmid, and N. Kuster, "E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.

[6] N. Kuster, and Q. Balzano, "Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz", IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[7] Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.

[8] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[9] Std. C95.3-1991, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, Aug. 1992.

[10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz, Jan. 1995.

[11] IEEE Std 1528™-2003 - IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head From Wireless Communications Devices: Measurement Techniques

[12] IEEE Std 1528a™-2005 (Amendment to IEEE Std 1528™-2003), IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

13. SAR Measurement Guidance

[1] KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01

[2] KDB 447498 D01 General RF Exposure Guidance v05

[3] KDB 248227 D01 SAR meas for 802 11 a b g v01r02.

[4] KDB 941225 D01 SAR test for 3G devices v02

[5] KDB 941225 D02 Guidance PBA for 3GPP R6 HSPA v02r01

[6] KDB 941225 D03 SAR Test Reduction GSM GPRS EDGE vo1

[7] KDB 941225 D07 UMPC Mini Tablet Devices v01

Appendix A - System Performance Check

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/28/2013 11:38:49 PM

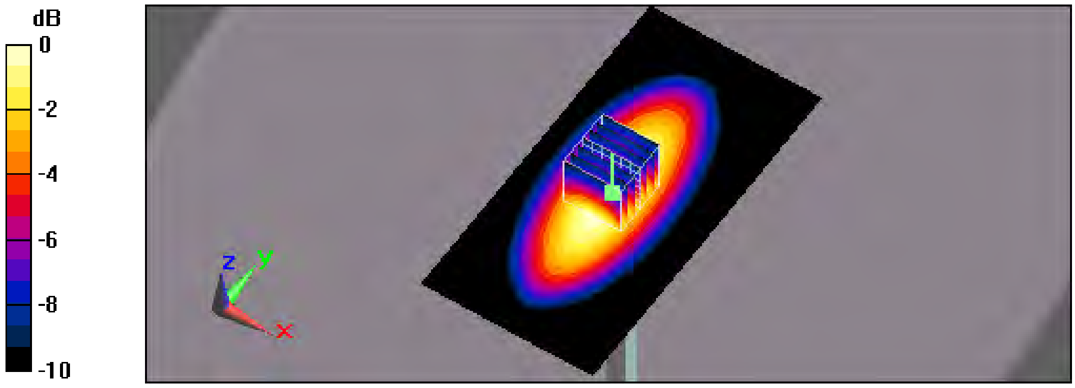
System Performance Check at 835MHz_20130128_Body
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d082

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.982 mho/m; ε_r = 54.82; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(10.36, 10.36, 10.36); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

System Performance Check at 835MHz/Area Scan (61x121x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.08 mW/g

System Performance Check at 835MHz/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.7 V/m; Power Drift = -0.130 dB
Peak SAR (extrapolated) = 3.51 W/kg
SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.61 mW/g
Maximum value of SAR (measured) = 3.03 mW/g



0 dB = 3.03mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 9:57:39 AM

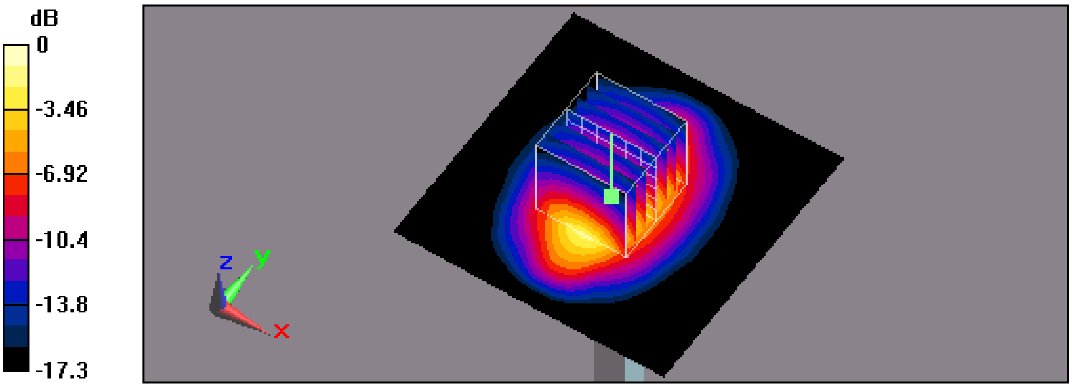
System Performance Check at 1900MHz_20130129_Body
DUT: Dipole D1900V2_SN5d111; Type: D1900V2; Serial: D1900V2 - SN:5d111

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.507 mho/m; εr = 53.42; ρ = 1000 kg/m3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

System Performance Check at 1900MHz/Area Scan (61x61x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.4 mW/g

System Performance Check at 1900MHz/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.6 V/m; Power Drift = 0.024 dB
Peak SAR (extrapolated) = 18.2 W/kg
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.24 mW/g
Maximum value of SAR (measured) = 14.4 mW/g



0 dB = 14.4mW/g

Appendix B - SAR Measurement Data

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 12:44:39 AM

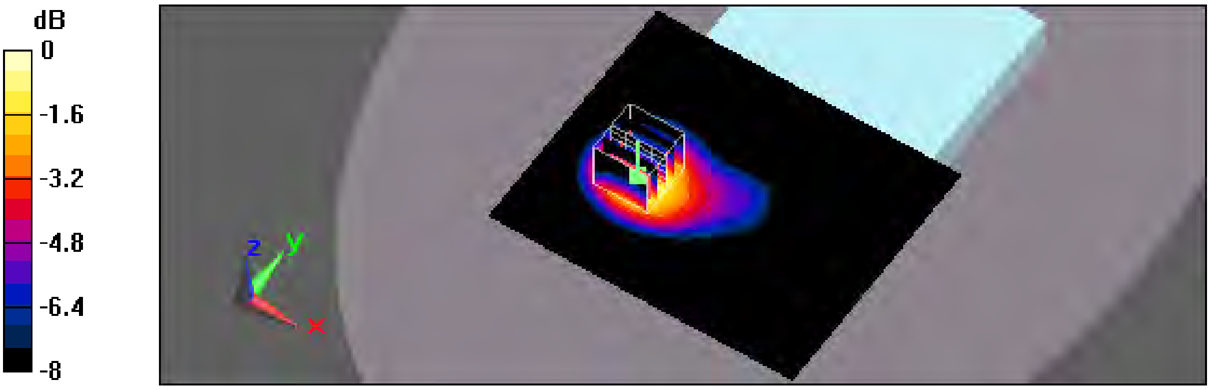
#1_Flat_GPRS 850 CH128_2D3U_Back Surface to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS 850 (2Down, 3Up); Frequency: 824.2 MHz;Duty Cycle: 1:2.67
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.97 mho/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(10.36, 10.36, 10.36); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (121x101x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.999 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.75 V/m; Power Drift = 0.104 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.774 mW/g; SAR(10 g) = 0.507 mW/g
Maximum value of SAR (measured) = 0.974 mW/g



0 dB = 0.974mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 1:09:52 AM

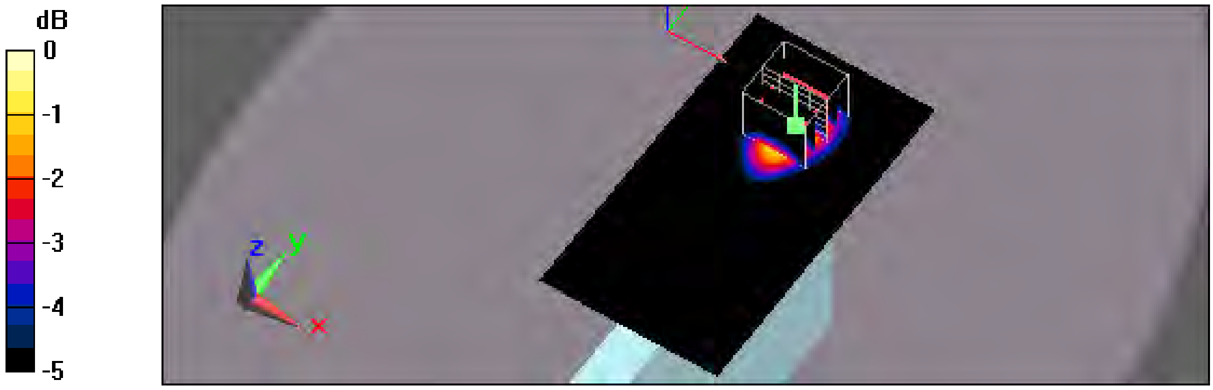
#2_Flat_GPRS 850 CH128_2D3U_Edge Bottom to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS 850 (2Down, 3Up); Frequency: 824.2 MHz;Duty Cycle: 1:2.67
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.97 mho/m; εr = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(10.36, 10.36, 10.36); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.529 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12 V/m; Power Drift = -0.038 dB
Peak SAR (extrapolated) = 0.626 W/kg
SAR(1 g) = 0.403 mW/g; SAR(10 g) = 0.249 mW/g
Maximum value of SAR (measured) = 0.528 mW/g



0 dB = 0.528mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 7:54:00 PM

#3_Flat_GPRS 850 CH128_2D3U_Edge Left to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

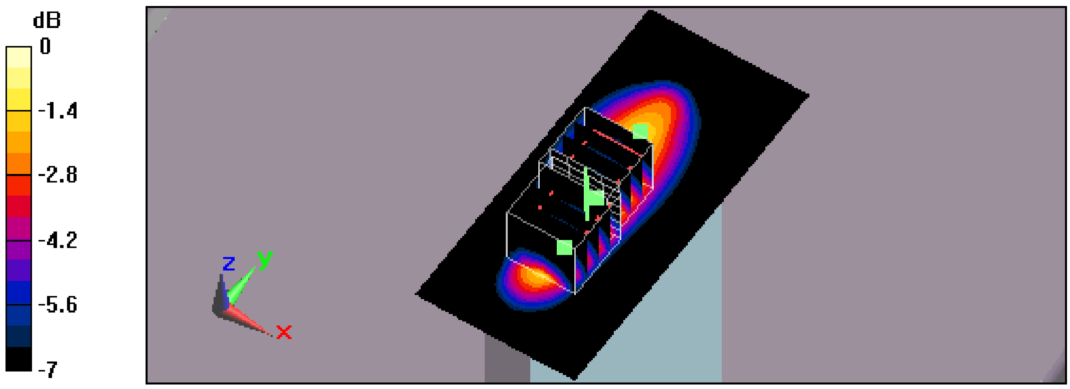
Communication System: GPRS 850 (2Down, 3Up); Frequency: 824.2 MHz;Duty Cycle: 1:2.67
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.97 mho/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(10.36, 10.36, 10.36); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (51x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.39 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 39.9 V/m; Power Drift = 0.00967 dB
Peak SAR (extrapolated) = 1.86 W/kg
SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.713 mW/g
Maximum value of SAR (measured) = 1.47 mW/g

Flat/Zoom Scan (5x5x7)/Cube 1:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 39.9 V/m; Power Drift = 0.00967 dB
Peak SAR (extrapolated) = 1.89 W/kg
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.701 mW/g
Maximum value of SAR (measured) = 1.57 mW/g



0 dB = 1.57mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 7:36:34 PM

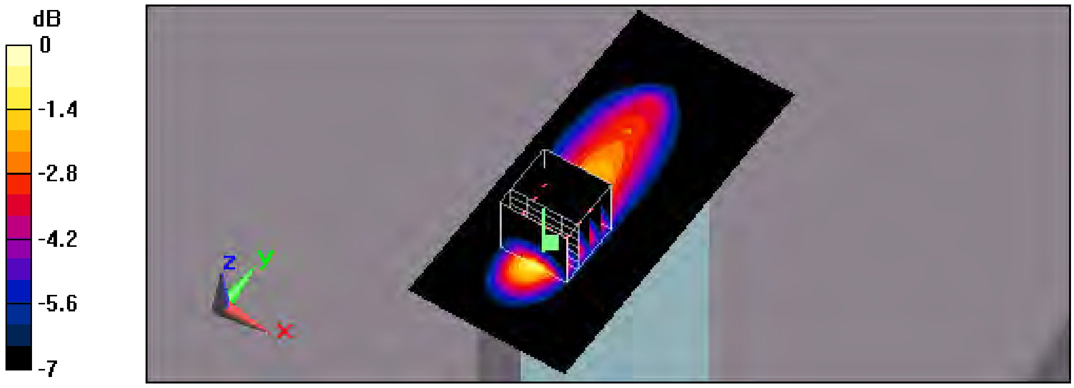
#4_Flat_GPRS 850 CH190_2D3U_Edge Left to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS 850 (2Down, 3Up); Frequency: 836.6 MHz;Duty Cycle: 1:2.67
Medium parameters used: f = 837 MHz; σ = 0.985 mho/m; εr = 54.8; ρ = 1000 kg/m3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(10.36, 10.36, 10.36); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (51x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.49 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 36.4 V/m; Power Drift = 0.054 dB
Peak SAR (extrapolated) = 2.11 W/kg
SAR(1 g) = 1.24 mW/g; SAR(10 g) = 0.732 mW/g
Maximum value of SAR (measured) = 1.69 mW/g



0 dB = 1.69mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 7:20:07 PM

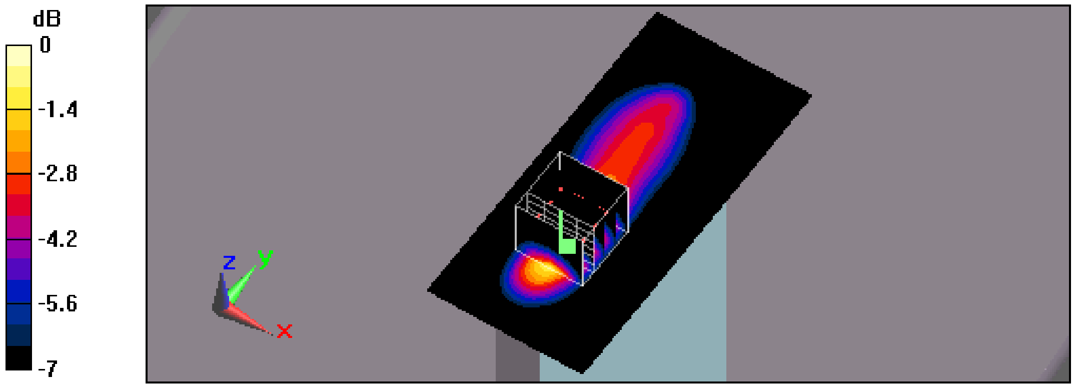
#5_Flat_GPRS 850 CH251_2D3U_Edge Left to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS 850 (2Down, 3Up); Frequency: 848.8 MHz;Duty Cycle: 1:2.67
Medium parameters used: f = 849 MHz; σ = 0.999 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(10.36, 10.36, 10.36); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (51x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.67 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 35 V/m; Power Drift = 0.087 dB
Peak SAR (extrapolated) = 2.33 W/kg
SAR(1 g) = 1.33 mW/g; SAR(10 g) = 0.760 mW/g
Maximum value of SAR (measured) = 1.88 mW/g



0 dB = 1.88mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 11:01:04 AM

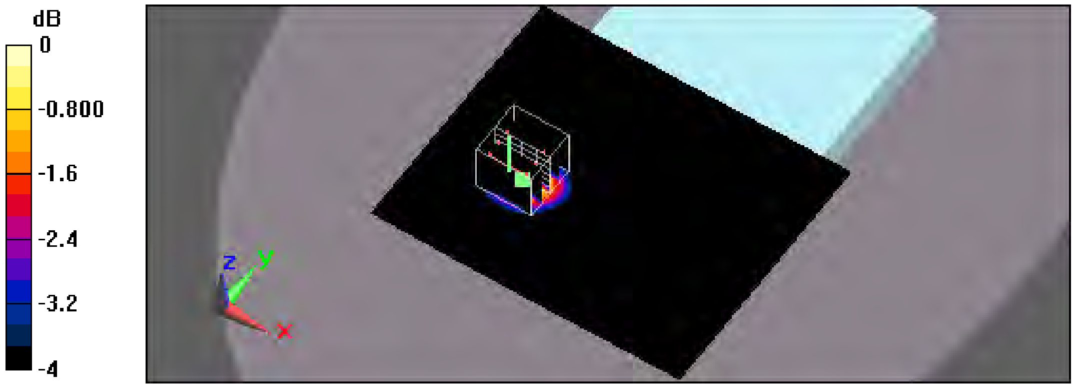
#7_Flat_GPRS PCS CH512_1D4U_Back Surface to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1850.2 MHz;Duty Cycle: 1:2
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.45 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (121x101x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.44 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.94 V/m; Power Drift = 0.195 dB
Peak SAR (extrapolated) = 1.68 W/kg
SAR(1 g) = 1.08 mW/g; SAR(10 g) = 0.658 mW/g
Maximum value of SAR (measured) = 1.39 mW/g



0 dB = 1.39mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 11:27:31 AM

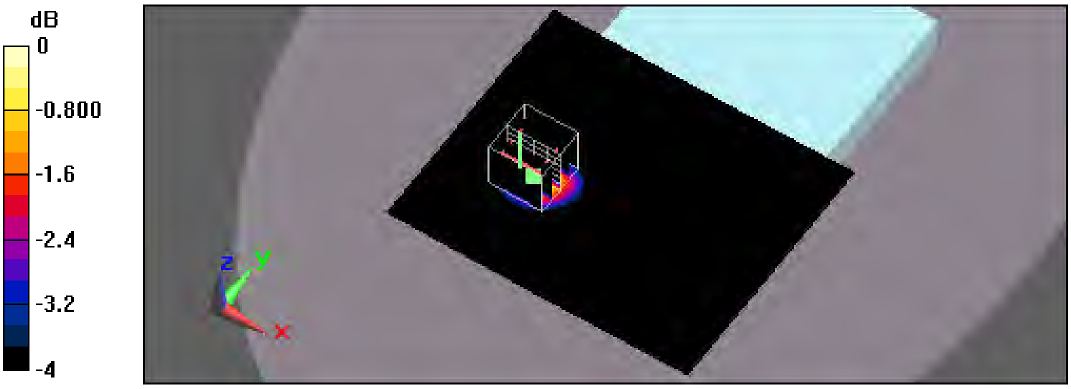
#8_Flat_GPRS PCS CH661_1D4U_Back Surface to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1880 MHz;Duty Cycle: 1:2
Medium parameters used: f = 1880 MHz; σ = 1.49 mho/m; ε_r = 53.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (121x101x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.31 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.56 V/m; Power Drift = 0.153 dB
Peak SAR (extrapolated) = 1.56 W/kg
SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.612 mW/g
Maximum value of SAR (measured) = 1.29 mW/g



0 dB = 1.29mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 10:36:57 AM

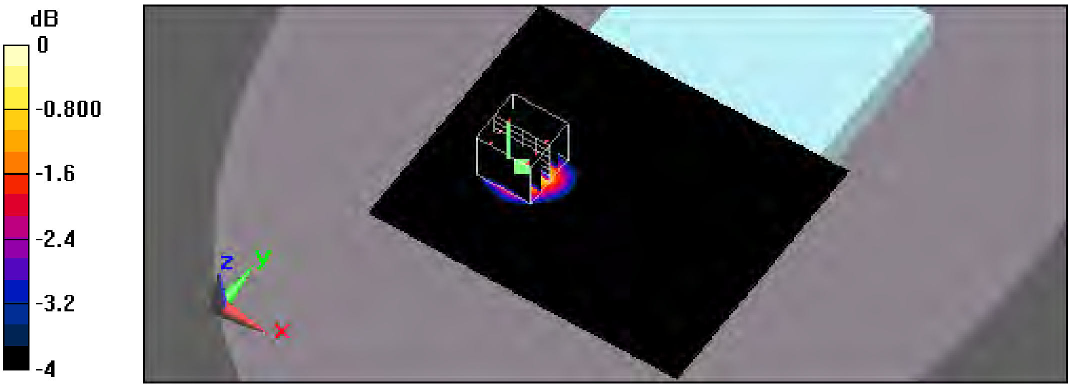
#6_Flat_GPRS PCS CH810_1D4U_Back Surface to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1909.8 MHz;Duty Cycle: 1:2
Medium parameters used: f = 1910 MHz; σ = 1.52 mho/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (121x101x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.42 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.9 V/m; Power Drift = 0.184 dB
Peak SAR (extrapolated) = 1.61 W/kg
SAR(1 g) = 1.04 mW/g; SAR(10 g) = 0.616 mW/g
Maximum value of SAR (measured) = 1.31 mW/g



0 dB = 1.31mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 12:18:40 PM

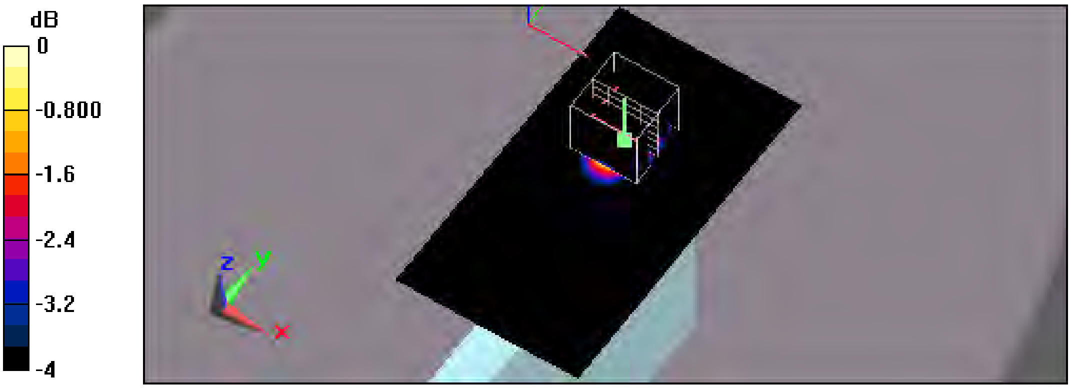
#10_Flat_GPRS PCS CH512_1D4U_Edge Bottom to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1850.2 MHz;Duty Cycle: 1:2
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.45 mho/m; εr = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.5 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16 V/m; Power Drift = 0.031 dB
Peak SAR (extrapolated) = 1.54 W/kg
SAR(1 g) = 0.940 mW/g; SAR(10 g) = 0.527 mW/g
Maximum value of SAR (measured) = 1.26 mW/g



0 dB = 1.26mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 12:41:08 PM

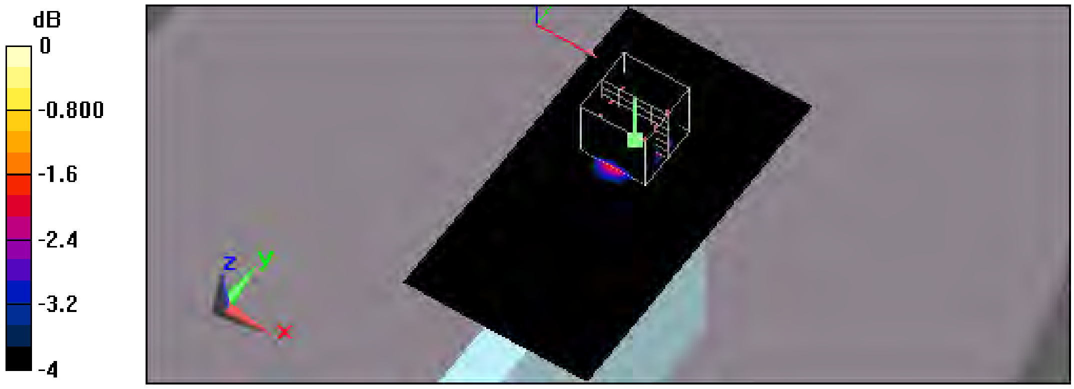
#11_Flat_GPRS PCS CH661_1D4U_Edge Bottom to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1880 MHz;Duty Cycle: 1:2
Medium parameters used: f = 1880 MHz; σ = 1.49 mho/m; ε_r = 53.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.26 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.9 V/m; Power Drift = 0.075 dB
Peak SAR (extrapolated) = 1.46 W/kg
SAR(1 g) = 0.894 mW/g; SAR(10 g) = 0.501 mW/g
Maximum value of SAR (measured) = 1.2 mW/g



0 dB = 1.2mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 11:54:36 AM

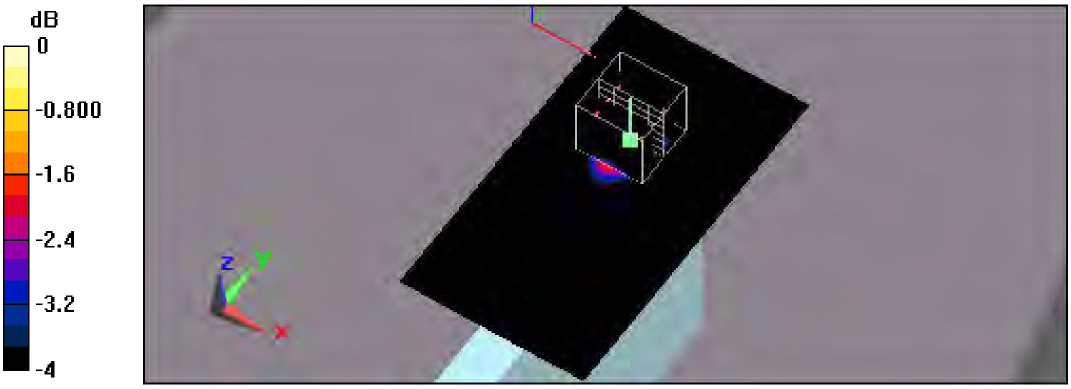
#9_Flat_GPRS PCS CH810_1D4U_Edge Bottom to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1909.8 MHz;Duty Cycle: 1:2
Medium parameters used: f = 1910 MHz; σ = 1.52 mho/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.13 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.1 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 1.36 W/kg
SAR(1 g) = 0.816 mW/g; SAR(10 g) = 0.451 mW/g
Maximum value of SAR (measured) = 1.11 mW/g



0 dB = 1.11mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 1:32:09 PM

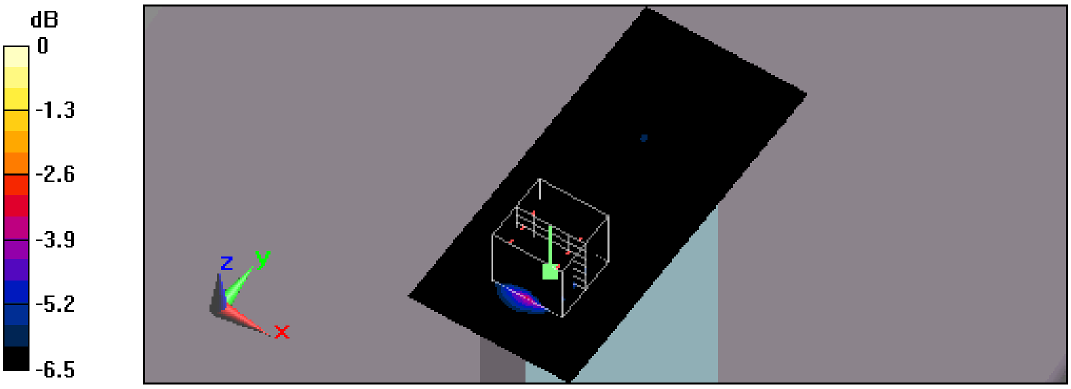
#13_Flat_GPRS PCS CH512_1D4U_Edge Left to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1850.2 MHz;Duty Cycle: 1:2
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.45 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (51x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.47 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.4 V/m; Power Drift = 0.050 dB
Peak SAR (extrapolated) = 2.14 W/kg
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.561 mW/g
Maximum value of SAR (measured) = 1.74 mW/g



0 dB = 1.74mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 1:49:17 PM

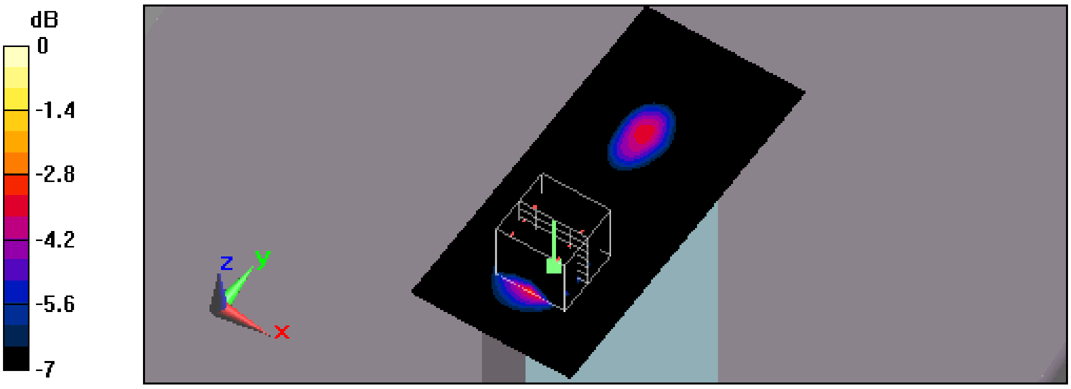
#14_Flat_GPRS PCS CH661_1D4U_Edge Left to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1880 MHz;Duty Cycle: 1:2
Medium parameters used: f = 1880 MHz; σ = 1.49 mho/m; ε_r = 53.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (51x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.17 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.1 V/m; Power Drift = 0.076 dB
Peak SAR (extrapolated) = 1.73 W/kg
SAR(1 g) = 0.911 mW/g; SAR(10 g) = 0.449 mW/g
Maximum value of SAR (measured) = 1.38 mW/g



0 dB = 1.38mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 1:04:57 PM

#12_Flat_GPRS PCS CH810_1D4U_Edge Left to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

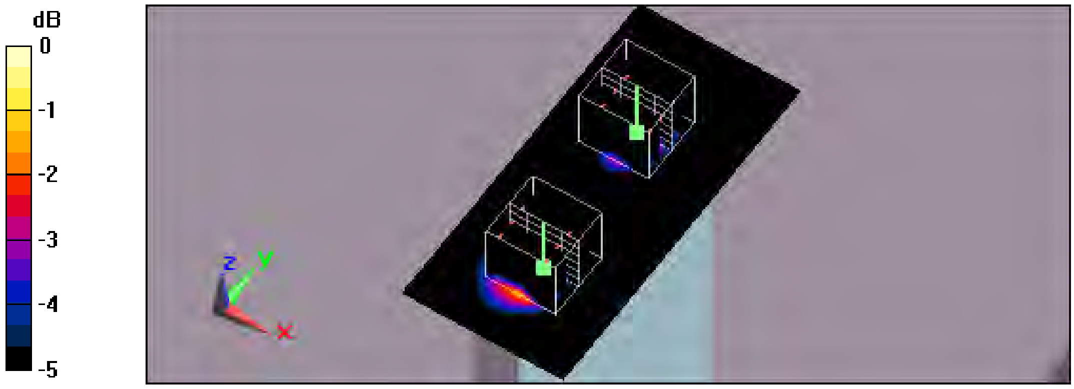
Communication System: GPRS PCS (1Down,4Up); Frequency: 1909.8 MHz;Duty Cycle: 1:2
Medium parameters used: f = 1910 MHz; σ = 1.52 mho/m; εr = 53.4; ρ = 1000 kg/m3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (51x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.837 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.8 V/m; Power Drift = 0.00411 dB
Peak SAR (extrapolated) = 1.28 W/kg
SAR(1 g) = 0.668 mW/g; SAR(10 g) = 0.334 mW/g
Maximum value of SAR (measured) = 1.02 mW/g

Flat/Zoom Scan (5x5x7)/Cube 1:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.8 V/m; Power Drift = 0.00411 dB
Peak SAR (extrapolated) = 0.830 W/kg
SAR(1 g) = 0.499 mW/g; SAR(10 g) = 0.270 mW/g
Maximum value of SAR (measured) = 0.690 mW/g



0 dB = 0.690mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 7:41:37 PM

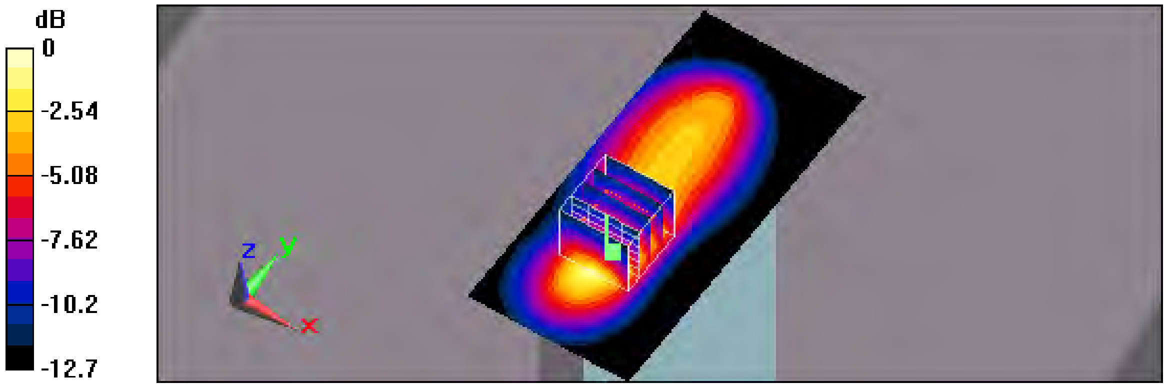
#15_Flat_GPRS 850 CH251_2D3U_Edge Left to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS 850 (2Down, 3Up); Frequency: 848.8 MHz;Duty Cycle: 1:2.67
Medium parameters used: f = 849 MHz; σ = 0.999 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(10.36, 10.36, 10.36); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (51x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.66 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34 V/m; Power Drift = 0.015 dB
Peak SAR (extrapolated) = 2.33 W/kg
SAR(1 g) = 1.33 mW/g; SAR(10 g) = 0.759 mW/g
Maximum value of SAR (measured) = 1.88 mW/g



0 dB = 1.88mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 1/29/2013 2:05:39 PM

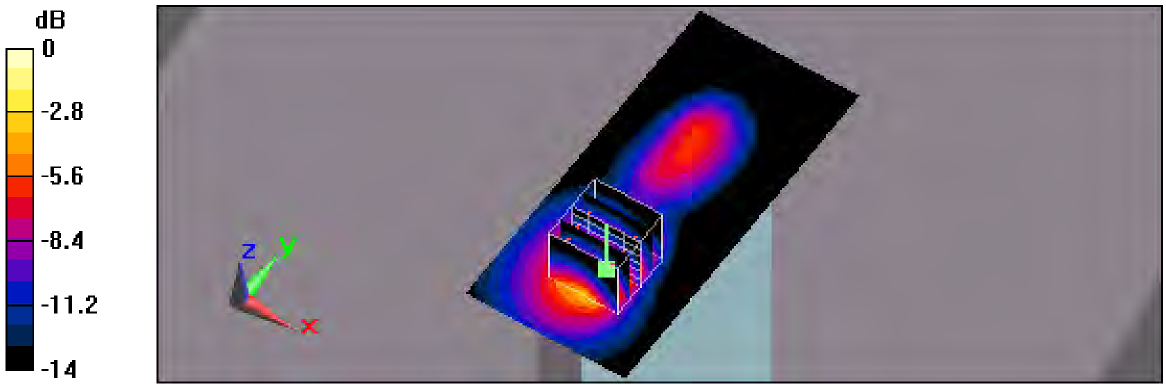
#16_Flat_GPRS PCS CH512_1D4U_Edge Left to phantom 0mm
DUT: TB100-0AC2UA7G; Type: Rugged Tablet Computer; FCC ID: HLETB100BTNP

Communication System: GPRS PCS (1Down,4Up); Frequency: 1850.2 MHz;Duty Cycle: 1:2
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.45 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)
DASY5 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV3 - SN3519; ConvF(9.04, 9.04, 9.04); Calibrated: 2/21/2012
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 7/23/2012
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1133
- Measurement SW: DASY5, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (51x111x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.47 mW/g

Flat/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.4 V/m; Power Drift = 0.041 dB
Peak SAR (extrapolated) = 2.13 W/kg
SAR(1 g) = 1.13 mW/g; SAR(10 g) = 0.561 mW/g
Maximum value of SAR (measured) = 1.74 mW/g



0 dB = 1.74mW/g

Appendix C - Original SAR Measurement Data

Position	Band	Ch.	Data Rate or Sub-Test	Side to Phantom	Spacing (mm)	SAR 1g (mW/g)	Burst Avg Power	Max tune-up	Reported SAR 1g
Flat	WCDMA Band II	9400	---	2	0	1.510	23.35	23.35	1.51
Flat	WCDMA Band II	9262	---	2	0	1.500	23.24	23.35	1.54
Flat	WCDMA Band II	9538	---	2	0	1.470	23.24	23.35	1.51
Flat	WCDMA Band II	9400	---	4	0	1.290	23.35	23.35	1.29
Flat	WCDMA Band II	9262	---	4	0	1.340	23.24	23.35	1.37
Flat	WCDMA Band II	9538	---	4	0	1.250	23.24	23.35	1.28
Flat	WCDMA Band II	9400	---	5	0	0.887	23.35	23.35	0.89
Flat	WCDMA Band II	9262	---	5	0	1.010	23.24	23.35	1.04
Flat	WCDMA Band II	9538	---	5	0	0.822	23.24	23.35	0.84
Flat	HSDPA Band II	9262	Sub-Test1	2	0	1.350	23.22	23.22	1.35
Flat	HSDPA Band II	9400	Sub-Test1	2	0	1.370	23.21	23.22	1.37
Flat	HSDPA Band II	9538	Sub-Test1	2	0	1.360	23.20	23.22	1.37
Flat	HSDPA Band II	9262	Sub-Test1	4	0	1.260	23.22	23.22	1.26
Flat	HSDPA Band II	9400	Sub-Test1	4	0	1.230	23.21	23.22	1.23
Flat	HSDPA Band II	9538	Sub-Test1	4	0	1.180	23.20	23.22	1.19
Flat	HSUPA Band II	9400	Sub-Test1	2	0	1.330	22.60	22.60	1.33
Flat	HSUPA Band II	9262	Sub-Test1	2	0	1.080	22.36	22.60	1.14
Flat	HSUPA Band II	9538	Sub-Test1	2	0	1.260	22.30	22.60	1.35
Flat	HSUPA Band II	9400	Sub-Test1	4	0	0.915	22.60	22.60	0.92
Flat	HSUPA Band II	9262	Sub-Test1	4	0	0.950	22.36	22.60	1.00
Flat	HSUPA Band II	9538	Sub-Test1	4	0	0.603	22.30	22.60	0.65
Flat	HSPA+ Band II	9400	Sub-Test1	2	0	1.140	21.84	21.84	1.14
Flat	HSPA+ Band II	9262	Sub-Test1	2	0	0.989	21.50	21.84	1.07
Flat	HSPA+ Band II	9538	Sub-Test1	2	0	1.060	21.37	21.84	1.18
Flat	HSPA+ Band II	9400	Sub-Test1	4	0	0.796	21.84	21.84	0.80
Flat	HSPA+ Band II	9262	Sub-Test1	4	0	0.733	21.50	21.84	0.79
Flat	HSPA+ Band II	9538	Sub-Test1	4	0	0.734	21.37	21.84	0.82
Flat	WCDMA Band V	4183	---	2	0	0.547	23.27	23.32	0.55
Flat	WCDMA Band V	4183	---	4	0	0.278	23.32	23.32	0.28
Flat	WCDMA Band V	4183	---	5	0	0.754	23.23	23.32	0.77
Flat	IEEE 802.11b	6	1M	2	0	0.752	13.95	---	0.75
Flat	IEEE 802.11b	6	1M	3	0	0.099	13.95	---	0.10
Flat	IEEE 802.11b	1	1M	5	0	1.340	12.90	---	1.34
Flat	IEEE 802.11b	6	1M	5	0	1.360	13.95	---	1.36
Flat	IEEE 802.11b	11	1M	5	0	1.460	13.11	---	1.46
Flat	Bluetooth	39	---	2	0	0.097	4.87	---	0.10
Flat	Bluetooth	39	---	3	0	0.011	4.87	---	0.01
Flat	Bluetooth	39	---	5	0	0.120	4.87	---	0.12

Appendix D - Calibration

All of the instruments Calibration information are listed below.

- Dipole _ D835V2 SN:4d082 Calibration No.D835V2-4d082_Jul12
- Dipole _ D1900V2 SN:5d111 Calibration No.D1900V2-5d111_Jul12
- Probe _ EX3DV3 SN:3519 Calibration No.EX3-3519_Feb12
- DAE _ DAE4 SN:541 Calibration No.DAE4-541_ Jul12

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
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 **ATL (Auden)**

Certificate No: **D835V2-4d082_Jul12**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d082
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 25, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 25, 2012

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

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

S Schweizerischer Kalibrierdienst
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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**

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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
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	40.5 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °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 for nominal Head TSL parameters	normalized to 1W	**9.35 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.10 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.3 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.44 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.54 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.60 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.29 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.9 Ω - 3.4 jΩ
Return Loss	- 28.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0 Ω - 5.4 jΩ
Return Loss	- 24.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.389 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 17, 2008

DASY5 Validation Report for Head TSL

Date: 25.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

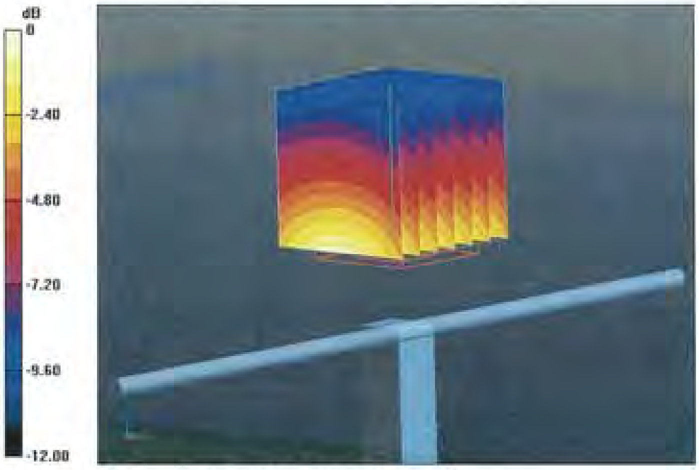
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d082

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.89$ mho/m; $\varepsilon_r = 40.5$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

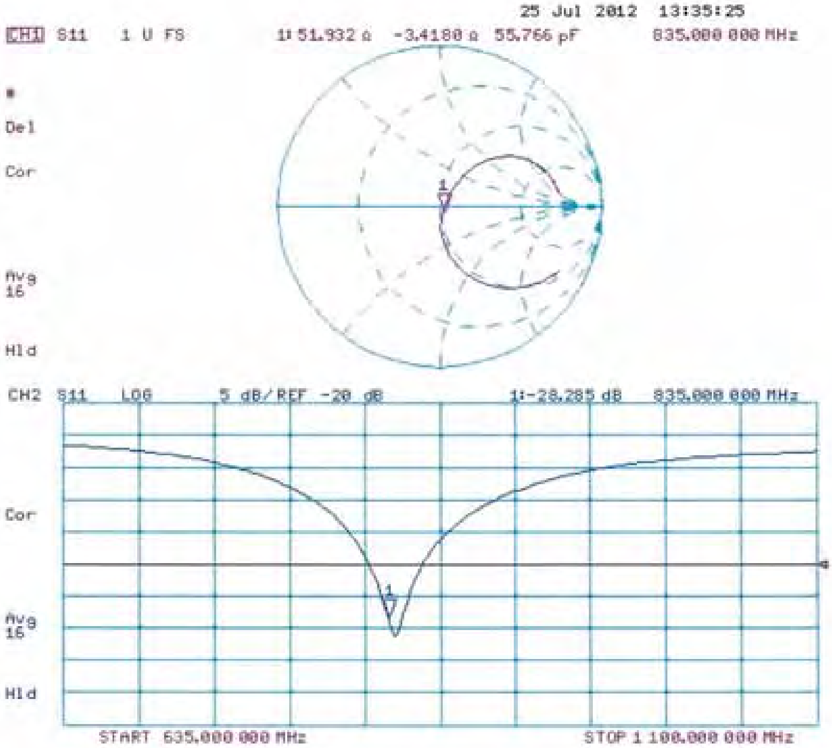
- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.079 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.436 mW/g
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.52 mW/g
Maximum value of SAR (measured) = 2.71 mW/g



0 dB = 2.71 mW/g = 8.66 dB mW/g

Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d082_Jul12 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 25.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

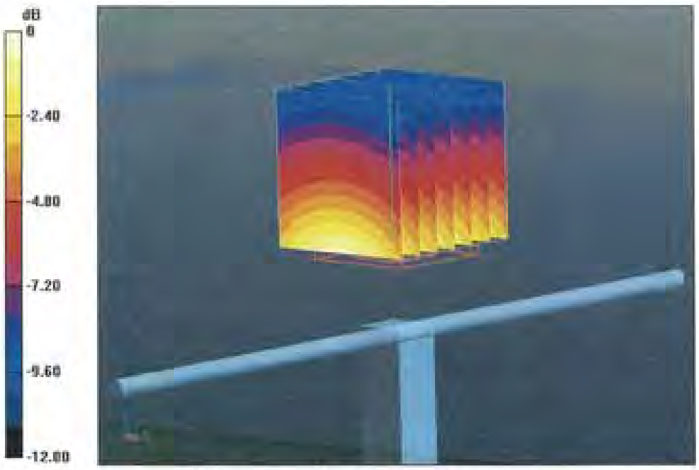
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d082

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.99 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

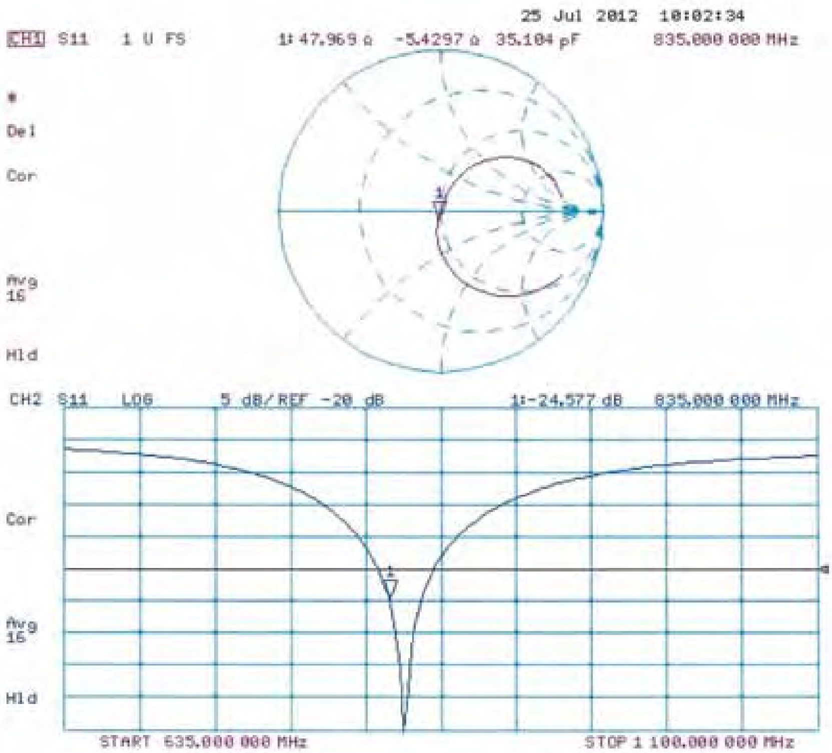
- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.616 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.563 mW/g
SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g
Maximum value of SAR (measured) = 2.85 mW/g



0 dB = 2.85 mW/g = 9.10 dB mW/g

Impedance Measurement Plot for Body TSL



Certificate No: D835V2-4d082_Jul12 Page 8 of 8

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Accreditation No.: SCS 108

Client **ATL (Auden)**

Certificate No: **D1900V2-5d111_Jul12**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d111
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 20, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 20, 2012

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.82 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**39.6 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.8 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.6 ± 6 %	1.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**40.3 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.33 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**21.3 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.9 Ω + 5.6 jΩ
Return Loss	- 25.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2 Ω + 6.1 jΩ
Return Loss	- 22.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 28, 2008

DASY5 Validation Report for Head TSL

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

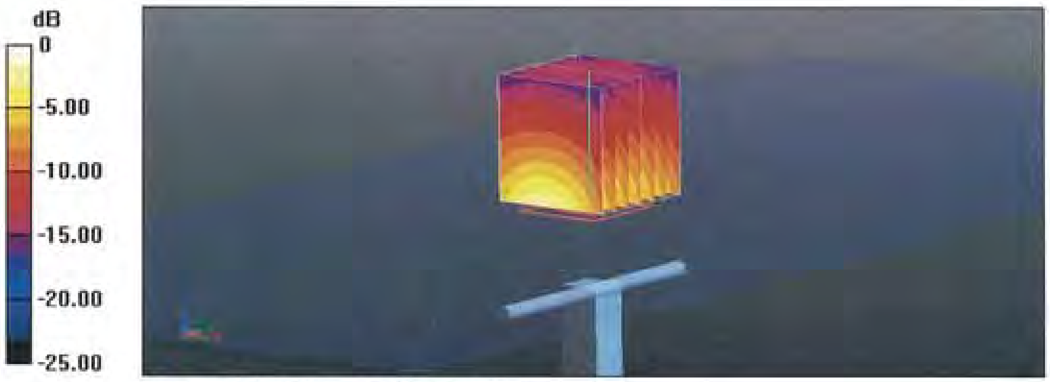
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d111

Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

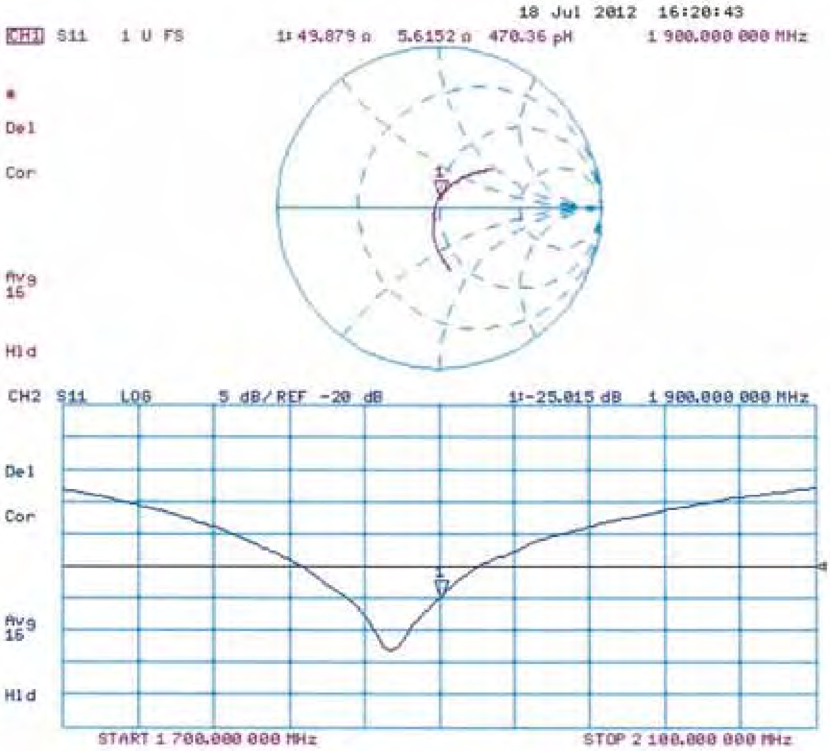
- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.871 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 17.499 mW/g
SAR(1 g) = 9.82 mW/g; SAR(10 g) = 5.18 mW/g
Maximum value of SAR (measured) = 12.1 mW/g



0 dB = 12.1 mW/g = 21.66 dB mW/g

Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d111_Jul12

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DASY5 Validation Report for Body TSL

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d111

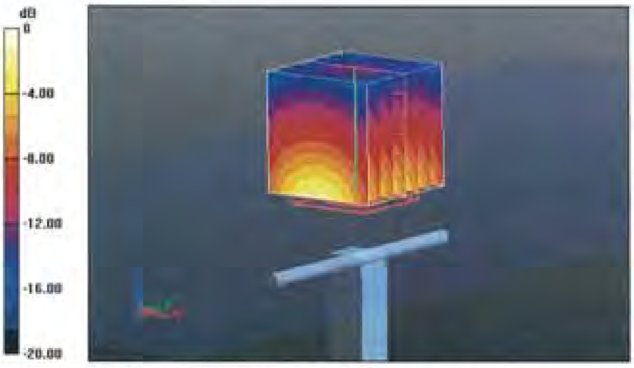
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.52 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

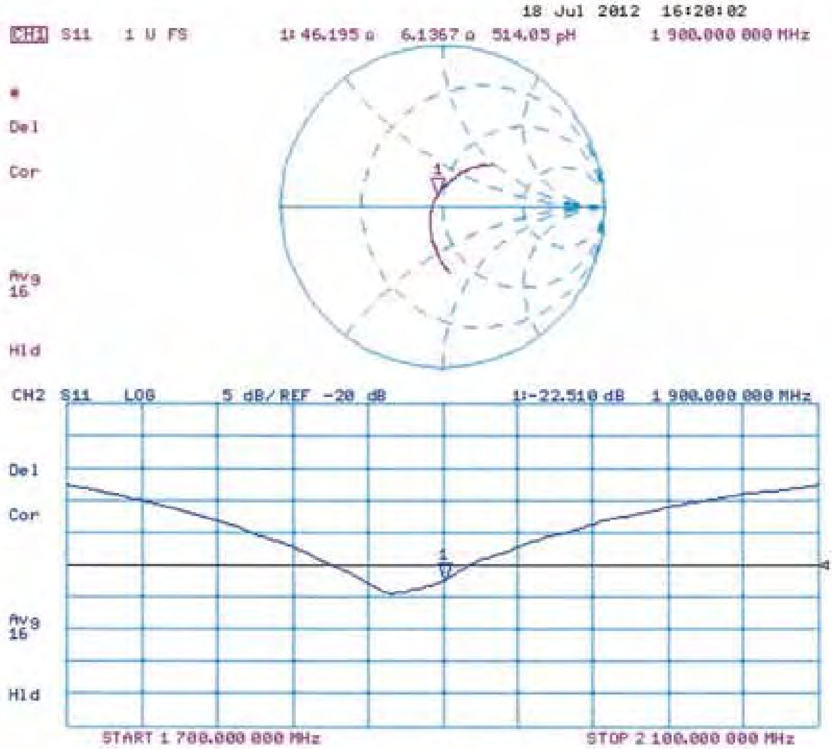
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.399 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.454 mW/g
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.33 mW/g
Maximum value of SAR (measured) = 12.7 mW/g



0 dB = 12.7 mW/g = 22.08 dB mW/g

Impedance Measurement Plot for Body TSL



Certificate No: D1900V2-5d111_Jul12 Page 8 of 8

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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **EX3-3519_Feb12**

CALIBRATION CERTIFICATE

Object	EX3DV3 - SN:3519
Calibration procedure(s)	QA CAL-01.v8, QA CAL-12.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	February 21, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: February 21, 2012

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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
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., 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 affect 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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 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 EX3DV3

SN:3519

Manufactured: March 8, 2004
Calibrated: February 21, 2012

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

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.81	0.70	0.72	± 10.1 %
DCP (mV)[B]	102.5	100.6	101.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	120.7	±1.9 %
			Y	0.00	0.00	1.00	136.5	
			Z	0.00	0.00	1.00	108.9	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	10.74	10.74	10.74	0.10	1.00	± 13.4 %
750	41.9	0.89	10.59	10.59	10.59	0.22	1.15	± 12.0 %
835	41.5	0.90	10.13	10.13	10.13	0.21	1.25	± 12.0 %
900	41.5	0.97	9.99	9.99	9.99	0.31	0.93	± 12.0 %
1750	40.1	1.37	9.40	9.40	9.40	0.64	0.63	± 12.0 %
1810	40.0	1.40	9.17	9.17	9.17	0.52	0.76	± 12.0 %
1900	40.0	1.40	9.04	9.04	9.04	0.35	0.85	± 12.0 %
2000	40.0	1.40	8.93	8.93	8.93	0.46	0.76	± 12.0 %
2450	39.2	1.80	7.82	7.82	7.82	0.36	0.83	± 12.0 %
5200	36.0	4.66	5.06	5.06	5.06	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.82	4.82	4.82	0.38	1.80	± 13.1 %
5500	35.6	4.96	4.67	4.67	4.67	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.36	4.36	4.36	0.45	1.80	± 13.1 %
5800	35.3	5.27	4.31	4.31	4.31	0.42	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

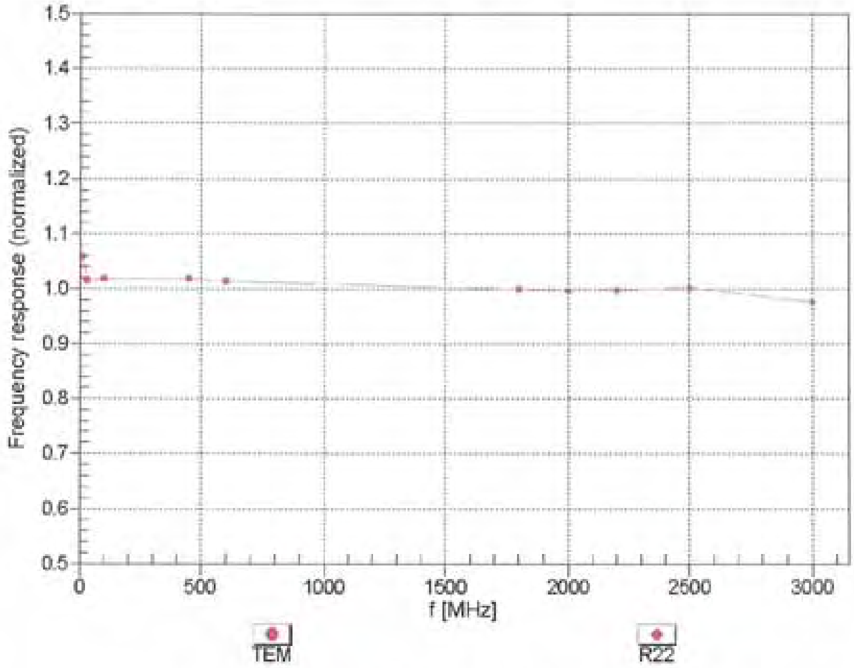
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	11.71	11.71	11.71	0.02	1.00	± 13.4 %
750	55.5	0.96	10.53	10.53	10.53	0.18	1.49	± 12.0 %
835	55.2	0.97	10.36	10.36	10.36	0.23	1.22	± 12.0 %
900	55.0	1.05	10.27	10.27	10.27	0.21	1.34	± 12.0 %
1750	53.4	1.49	9.70	9.70	9.70	0.41	0.92	± 12.0 %
1810	53.3	1.52	9.41	9.41	9.41	0.32	0.96	± 12.0 %
1900	53.3	1.52	9.04	9.04	9.04	0.37	0.91	± 12.0 %
2000	53.3	1.52	9.06	9.06	9.06	0.44	0.80	± 12.0 %
2300	52.9	1.81	8.56	8.56	8.56	0.39	0.84	± 12.0 %
2450	52.7	1.95	8.22	8.22	8.22	0.76	0.54	± 12.0 %
2600	52.5	2.16	7.82	7.82	7.82	0.80	0.50	± 12.0 %
3500	51.3	3.31	7.01	7.01	7.01	0.37	1.18	± 13.1 %
5200	49.0	5.30	4.38	4.38	4.38	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.13	4.13	4.13	0.55	1.90	± 13.1 %
5500	48.6	5.65	3.92	3.92	3.92	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.61	3.61	3.61	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.88	3.88	3.88	0.60	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

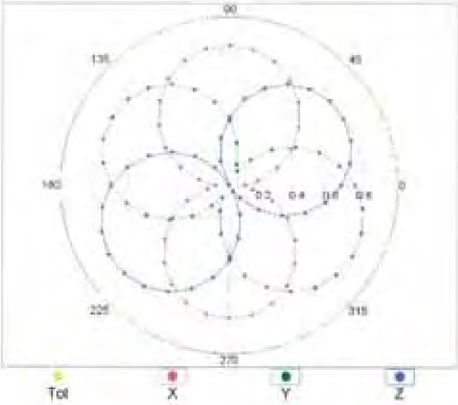
(TEM-Cell:ifi110 EXX, Waveguide: R22)



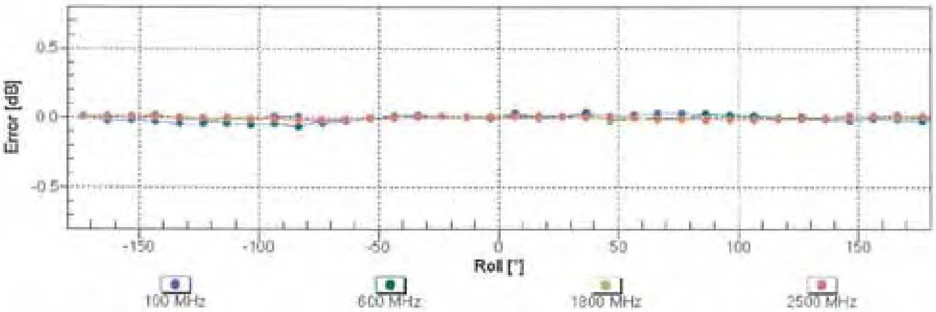
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM

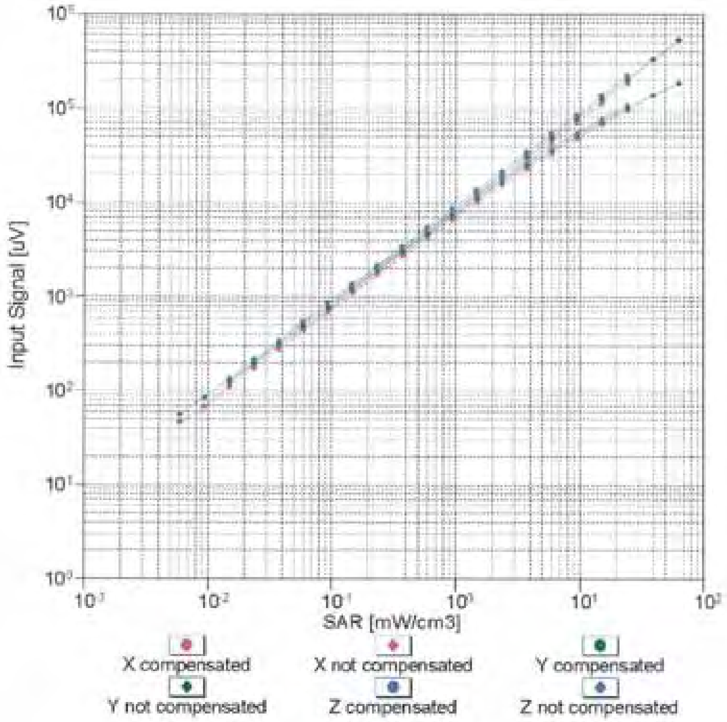


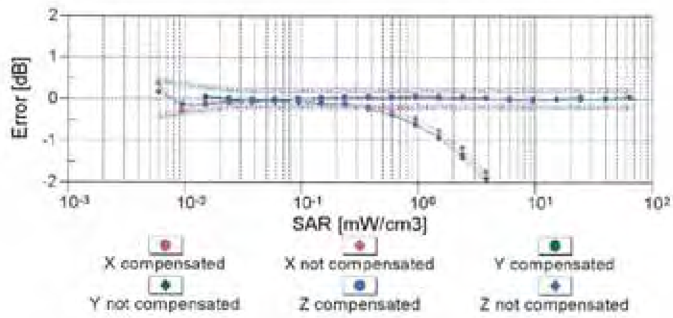
f=1800 MHz,R22



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

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)



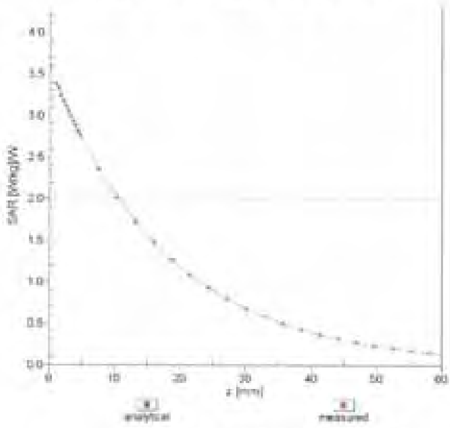


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

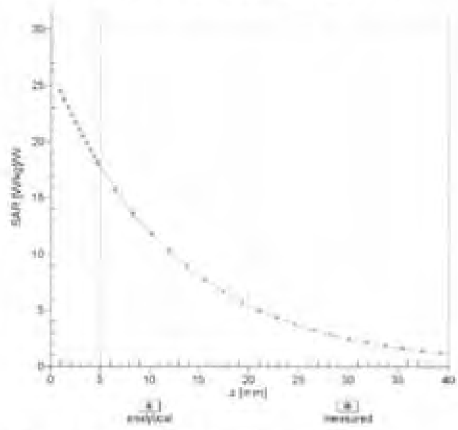
EX3DV3– SN:3519 February 21, 2012

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

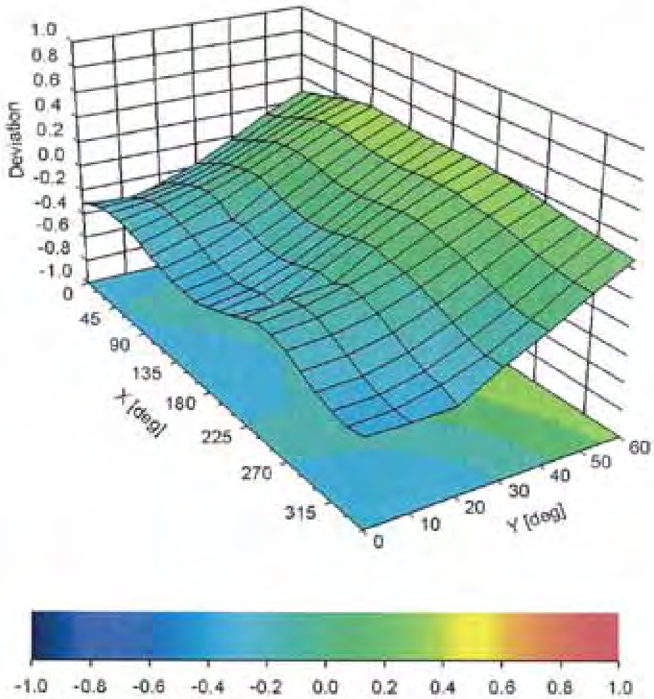


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: EX3-3519_Feb12 Page 10 of 11

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3519

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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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 **ATL (Auden)**

Certificate No: **DAE4-541_Jul12**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 541
Calibration procedure(s)	QA CAL-06.v24 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	July 23, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	28-Sep-11 (No:11450)	Sep-12
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V2.1	SE UWS 053 AA 1001	05-Jan-12 (in house check)	In house check: Jan-13

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	R. Mayoraz
Approved by:	Fin Bomholt	R&D Director	i.V. [signature]

Issued: July 23, 2012

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

Certificate No: DAE4-541_Jul12 Page 1 of 5

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

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Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
    - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
    - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
    - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
    - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
    - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
    - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
    - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
    - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
    - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.581 ± 0.1% (k=2)	404.461 ± 0.1% (k=2)	404.227 ± 0.1% (k=2)
Low Range	3.96788 ± 0.7% (k=2)	3.93541 ± 0.7% (k=2)	3.97576 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	289.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199995.59	-0.97	-0.00
Channel X	+ Input	20003.10	2.41	0.01
Channel X	- Input	-19994.35	5.66	-0.03
Channel Y	+ Input	199994.72	-2.07	-0.00
Channel Y	+ Input	19998.91	-1.88	-0.01
Channel Y	- Input	-19998.62	1.36	-0.01
Channel Z	+ Input	199995.54	-1.18	-0.00
Channel Z	+ Input	20001.38	0.67	0.00
Channel Z	- Input	-19996.65	3.36	-0.02

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.27	-0.06	-0.00
Channel X	+ Input	201.72	-0.07	-0.03
Channel X	- Input	-198.20	0.03	-0.02
Channel Y	+ Input	2000.66	-0.72	-0.04
Channel Y	+ Input	201.70	-0.03	-0.01
Channel Y	- Input	-198.66	-0.42	0.21
Channel Z	+ Input	2001.55	0.19	0.01
Channel Z	+ Input	201.25	-0.48	-0.24
Channel Z	- Input	-199.31	-1.04	0.52

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	11.94	10.52
	- 200	-10.34	-11.69
Channel Y	200	1.48	1.37
	- 200	-2.82	-2.33
Channel Z	200	0.59	0.59
	- 200	-2.65	-2.37

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.31	-1.21
Channel Y	200	9.54	-	3.87
Channel Z	200	3.34	7.99	-

4. **AD-Converter Values with inputs shorted**

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16008	15626
Channel Y	15794	15710
Channel Z	15984	17133

5. **Input Offset Measurement**

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.57	-0.86	1.95	0.41
Channel Y	0.09	-1.01	0.96	0.41
Channel Z	-0.78	-1.65	0.37	0.41

6. **Input Offset Current**

Nominal Input circuitry offset current on all channels: <25fA

7. **Input Resistance** (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. **Low Battery Alarm Voltage** (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. **Power Consumption** (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9