A Test Lab Techno Corp.

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SAR EVALUATION REPORT

Test Report No.	:	**1101FS12-03**
Applicant	:	**Giant Electronics Limited**
Trade Mark	:	**Motorola**
Model Number	:	**MS350R**
Product Name	:	**Two Way Radio with GMRS ,FRS ,repeater channel and Weather Band Receiver**
Date of Test	:	**Jan. 24 ~ Jan. 25, 2011**
Issued Date	:	**Mar. 11, 2011**
Test Environment	:	**Ambient Temperature： 22 ± 3 ℃** **Relative Humidity：40 - 70 %**
Test Specification	:	**Standard C95.1-1992** **IEEE Std. 1528-2003** **2.1093;FCC/OET Bulletin 65 Supplement C [July 2001]**
Max. SAR	:	**0.019 W/kg FRS FACE SAR_15mm (50% Duty Cycle)** **1.407 W/kg GMRS FACE SAR_15mm (50% Duty Cycle)** **0.028 W/kg FRS Body SAR With Headset_15mm(50% Duty Cycle)** **1.309 W/kg GMRS Body SAR With Headset_15mm (50% Duty Cycle)** **0.021 W/kg FRS Body SAR With Headset_Belt Clip_15mm(50% Duty Cycle)** **1.154 W/kg GMRS Body SAR With Headset_Belt Clip_15mm (50% Duty Cycle)** **(Condition: 50% Duty Cycle and positive power drift)**
Test Lab	:	**Changan Lab.**

1. The test operations have to be performed with cautious behavior, the test results are as attached.
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Approved By : (Sam Chuang)

Tested By : (Alex Wu)

Contents

1. Description of Equipment under Test (EUT)

Applicant	:	Giant Electronics Limited
Applicant Address	:	7/F, Elite Industrial Building, 135 - 137 Hoi Bun Rd, Kwun Tong, Kowloon, HK
Manufacturer	:	Giant Electronics Limited
Manufacturer Address	:	7/F, Elite Industrial Building, 135 - 137 Hoi Bun Rd, Kwun Tong, Kowloon, HK
Product Name	:	Two Way Radio with GMRS ,FRS ,repeater channel and Weather Band Receiver
Trade Mark	:	Motorola
Model Number	:	MS350R
FCC ID	:	K7GMSFGJ
Battery Type	:	Internal Battery(3.6 V Ni-MH Battery, 650 mAh) ALKALINE Battery(1.5 V AA Battery x 3PCS)
TX Frequency	:	467.5625 - 467.7125 MHz (FRS CH8 - CH 14) 462.5500 - 467.7250 MHz (GMRS CH1 - CH 7, CH15 - CH 30)
Max. RF Output Power	:	0.25 W ERP (23.98 dBm) FRS 1.87 W ERP (32.72 dBm) GMRS
Max. SAR Measurement	:	0.019 W/kg FRS FACE SAR _15mm (50% Duty Cycle) 1.407 W/kg GMRS FACE SAR _15mm (50% Duty Cycle) 0.028 W/kg FRS Body SAR With Headset_15mm (50% Duty Cycle) 1.309 W/kg GMRS Body SAR With Headset_15mm (50% Duty Cycle) 0.021 W/kg FRS Body SAR With Headset_Belt Clip_15mm (50% Duty Cycle) 1.154 W/kg GMRS Body SAR With Headset_Belt Clip_15mm (50% Duty Cycle) (Condition: 50% Duty Cycle and positive power drift)
Antenna Type	:	Fixed Type
Antenna Gain	:	0dBi
Device Category	:	Portable
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 C95.1-1992 and had been tested in accordance with the measurement procedures specified in IEEE Std. 1528-2003.

	
Front view	**Back view**
Figure 1. EUT Photo	

2. Other Accessories

Figure 2. Headset

Figure 3. Belt Clip

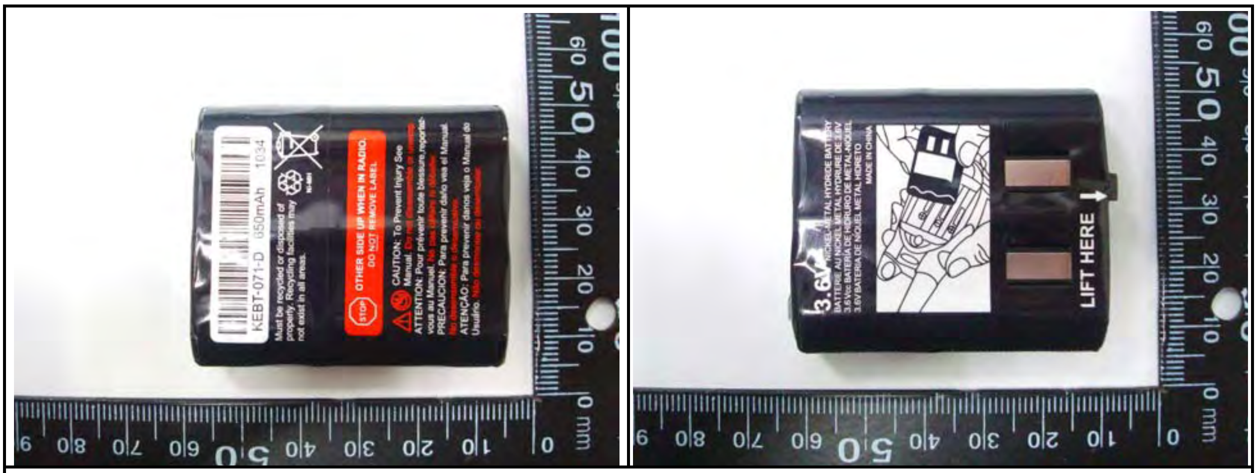


Figure 4. Ni-MH Battery (3.6 V, 650 mAh)

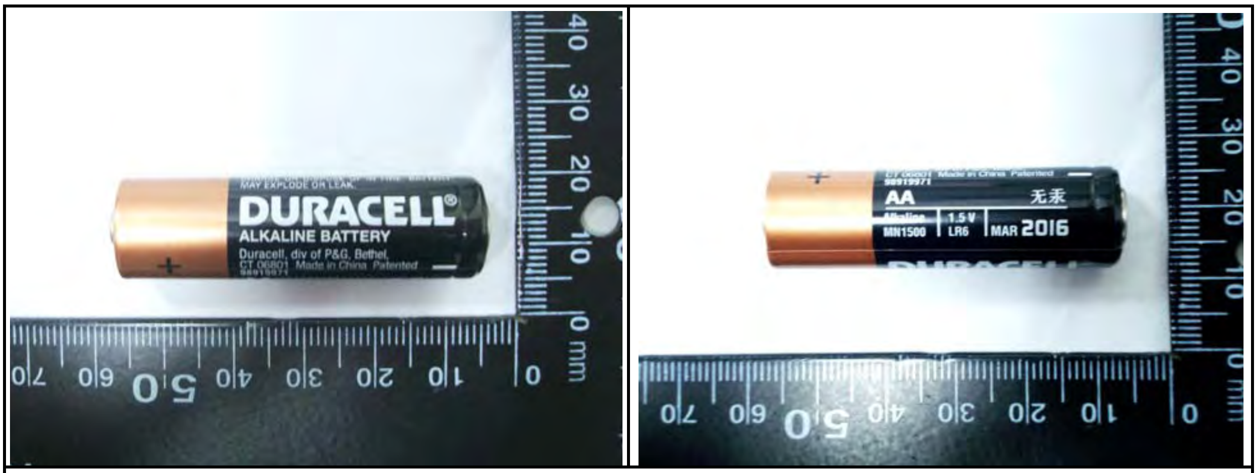


Figure 5. ALKALINE Battery (AA)

Figure 6. Charger

3. Introduction

The A Test Lab Techno Corp. RF Testing Laboratory has performed measurements of the maximum potential exposure to the user of **Giant Electronics Limited Trade Mark：Motorola Model(s) ：MS350R**. The test procedures, as described in American National Standards, Institute C95.1 - 2005〔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.

4. 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 9).

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

Figure 7. 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〕

5. SAR Measurement Setup

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than ±0.025mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines (length = 300mm) to the data acquisition unit.

A cell controller system contains the power supply, robot controller, teaches pendant (Joystick) and remote control, and is used to drive the robot motors. The Measurement Server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chipdisk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The PC consists of the Intel Pentium 4 2.4GHz computer with Windows XP system and SAR Measurement Software DASY4, Post Processor SEMCAD, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection…etc. is connected to the Electro-optical converter (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the Measurement Server.

The DAE4 (or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in〔3〕.

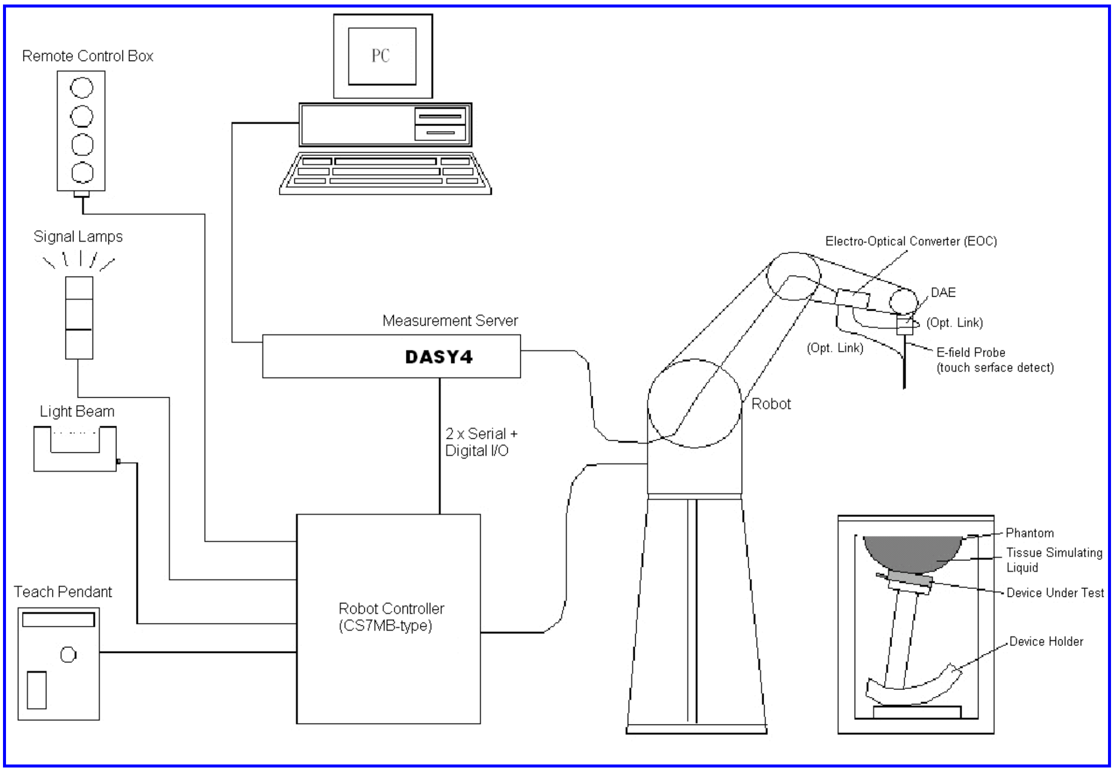


Figure 8. SAR Lab Test Measurement Setup

6. System Components

6.1 DASY 4 E-Field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (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 DASY4 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.

6.1.1 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 450MHz Calibration for other liquids and frequencies upon request
Frequency	10 MHz to > 6 GHz; Linearity: ±0.2 dB (30 MHz to 3 GHz)
Directivity	±0.3 dB in brain tissue (rotation around probe axis) ±0.5 dB in brain tissue (rotation normal probe axis)
Dynamic Range	10 μW/g to > 100mW/g; Linearity: ±0.2dB
Surface Detection	±0.2 mm repeatability in air and clear liquids over diffuse reflecting surface
Dimensions	Overall length: 330mm Tip length: 20mm Body diameter: 12mm 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 9.
E-field Probe

Figure 10.
Probe setup on robot

6.1.2 E-Field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure described in〔4〕with accuracy better than ±10%. The spherical isotropy was evaluated with the procedure described in〔5〕and found to be better than ±0.25dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

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

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

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

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).

6.2 Data Acquisition Electronic (DAE) System

Cell Controller

Processor：	Intel Pentium 4
Clock Speed：	2.4GHz
Operating System：	Windows XP Professional

Data Converter

Features：	Signal Amplifier, multiplexer, A/D converter, and control logic
Software：	DASY4 v4.7 (Build 80) & SEMCAD v1.8 (Build 186)
Connecting Lines：	Optical downlink for data and status info
	Optical uplink for commands and clock

6.3 Robot

Positioner：	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability：	±0.025 mm
No. of Axis：	6

6.4 Measurement Server

Processor：	PC/104 with a 166MHz low-power Pentium
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

6.5 Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device (POM) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeat ably positioned according to the IEEE SCC34-SC2 and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

＊**Note**：A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations〔6〕. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Larger DUT cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values. Therefore those devices are normally only tested at the flat part of the SAM.

Figure 11. Device Holder

6.6 Phantom - SAM v4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, 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.

Figure 12. SAM Twin Phantom

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	810×1000×500 mm (H×L×W)

Table 1. Specification of SAM v4.0

6.7 Data Storage and Evaluation

6.7.1 Data Storage

The DASY4 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. The postprocessing 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.

6.7.2 Data Evaluation

The DASY4 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 $\boldsymbol{V_i}$ = compensated signal of channel i (i = x, y, z)

$\boldsymbol{U_i}$ = input signal of channel i (i = x, y, z)

$\boldsymbol{cf}$ = crest factor of exciting field (DASY parameter)

$\boldsymbol{dcp_i}$ = 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 V_i = compensated signal of channel i (i = x, y, z)

$Norm_i$ = sensor sensitivity of channel i (i = x, y, z)

μV/(V/m)^2 for E-field Probes

$ConvF$ = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = 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

E_{tot} = total field strength in V/m

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm^3

＊**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 P_{pwe} = equivalent power density of a plane wave in mW/cm^2

E_{tot} = total electric field strength in V/m

H_{tot} = total magnetic field strength in A/m

7. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Dosimetric E-Field Probe	EX3DV4	3632	Jan. 26, 2010	Jan. 26, 2011
SPEAG	450MHz System Validation Kit	D450V2	1021	Feb. 24, 2010	Feb. 24, 2011
SPEAG	Data Acquisition Electronics	DAE4	541	Jul. 21, 2010	Jul. 21, 2011
SPEAG	Measurement Server	SE UMS 001 BA	1021	NCR	NCR
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	Phantom	SAM V4.0	1009	NCR	NCR
SPEAG	Robot	Staubli RX90L	F00/589B1/A/01	NCR	NCR
SPEAG	Software	DASY4 V4.7 Build 80	N/A	NCR	NCR
SPEAG	Software	SEMCAD V1.8 Build 186	N/A	NCR	NCR
R & S	Wireless Communication Test Set	CMU200	109369	Aug. 10, 2010	Aug. 10, 2011
Agilent	Wireless Communication Test Set	E5515C	MY47511156	Sep. 21, 2010	Sep. 21, 2011
Agilent	ENA Series Network Analyzer	E5071B	MY42404655	Apr. 14, 2010	Apr. 14, 2011
Agilent	Dielectric Probe Kit	85070C	US99360094	NCR	NCR
R&S	Power Sensor	NRP-Z22	100179	May 20, 2010	May 20, 2011
Agilent	Signal Generator	E8257D	MY44320425	NCR	NCR
Agilent	Dual Directional Coupler	778D	50334	NCR	NCR
Mini-Circuits	Power Amplifier	ZHL-42W-SMA	D111103#5	NCR	NCR

Table 2. Test Equipment List

8. *Tissue Simulating Liquids*

The Head and body mixtures consist of a viscous gel using hydroxethylcellullouse (HEC) gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. 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)	ε_r	σ (S/m)	ε_r	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
(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)				

Table 3. Tissue dielectric parameters for head and body phantoms

8.1 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

8.2 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 ε and ±5% for σ.

Liquid type	HSL 450 - A	
Ingredient	Weight (g)	Weight (%)
Water	522.94	38.91
Sugar	765.09	56.93
Cellulose	3.39	0.25
Salt	50.94	3.79
Preventol	1.63	0.12
Total amount	1’344.00	100.00
Goal dielectric parameters		
Frequency [MHz]	450	
Relative Permittivity	43.5	
Conductivity [S/m]	0.87	

Liquid type	MSL 450 - B	
Ingredient	Weight (g)	Weight (%)
Water	590.62	46.21
Sugar	654.00	51.17
Cellulose	2.36	0.18
Salt	29.96	2.34
Preventol	1.06	0.08
Total amount	1'278.00	100.00
Goal dielectric parameters		
Frequency [MHz]	450	
Relative Permittivity	56.7	
Conductivity [S/m]	0.94	

8.3 Liquid Confirmation

8.3.1 Parameters

Liquid Verify

Ambient Temperature： 22±3 ℃ ; Relative Humidity：40-70 ％

Liquid Type	Freq.	Temp (℃)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
450MHz Head	450MHz	22.0	εr	43.5	**44.40**	2.03	± 5	Jan. 24, 2011
			σ	0.87	**0.876**	0.68	± 5	
450MHz Body	450MHz	22.0	εr	56.7	**55.70**	-1.80	± 5	Jan. 25, 2011
			σ	0.94	**0.934**	-0.64	± 5	

Table 4. Measured Tissue dielectric parameters for head and body phantoms

8.3.2 Liquid Depth

The liquid level was during measurement 15cm ±0.5cm.

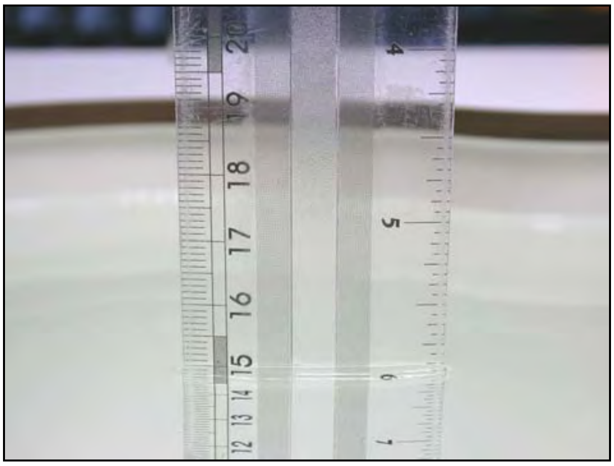


Figure 13. Head-Tissue-Simulating-Liquid

Figure 14. Body-Tissue-Simulating-Liquid

9. Measurement Process

9.1 Device and Test Conditions

The Test Device was provided by Giant Electronics Limited for this evaluation. The spatial peak SAR values were assessed for the middle channel defined by FRS (Ch11 = 467.6375MHz) and GMRS (Ch6 = 462.6875MHz, Ch26 = 467.6250) systems. Battery and accessories shall be those specified by the manufacturer. The battery shall be fully charged before each measurement and there shall be no external connections.

<table>
<tr><td colspan="4">Usage</td><td colspan="3">Operates with a built-in test mode by client</td></tr>
<tr><td colspan="4">Distance between antenna axis at the joint and the liquid surface:</td><td colspan="3">For Body,
EUT front to phantom, 15mm separation.
EUT back to phantom, 15mm separation.
EUT back to phantom, to attach belt clip.</td></tr>
<tr><td colspan="4">Simulating human Head/Body</td><td colspan="3">Head / Body</td></tr>
<tr><td colspan="4">EUT Battery</td><td colspan="3">Fully-charged with Ni-MH Battery and Alkaline Battery.</td></tr>
<tr><td rowspan="5">Output Power (ERP)</td><td colspan="3" rowspan="2">Channel</td><td rowspan="2">Frequency MHz</td><td>Before</td><td>After</td></tr>
<tr><td>dBm</td><td>dBm</td></tr>
<tr><td>FRS</td><td>Middle</td><td>- 11</td><td>467.6375</td><td>23.98</td><td>23.95</td></tr>
<tr><td rowspan="2">GMRS</td><td rowspan="2">Middle</td><td>- 06</td><td>462.6875</td><td>32.72</td><td>32.68</td></tr>
<tr><td>- 26</td><td>467.6250</td><td>32.72</td><td>32.68</td></tr>
</table>

9.2 System Performance Check

9.2.1 Symmetric Dipoles for System Validation

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 450MHz

Return Loss > 20 dB at specified validation 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 D450V2：dipole length 270 mm; overall height 330 mm

Figure 15. Validation Kit

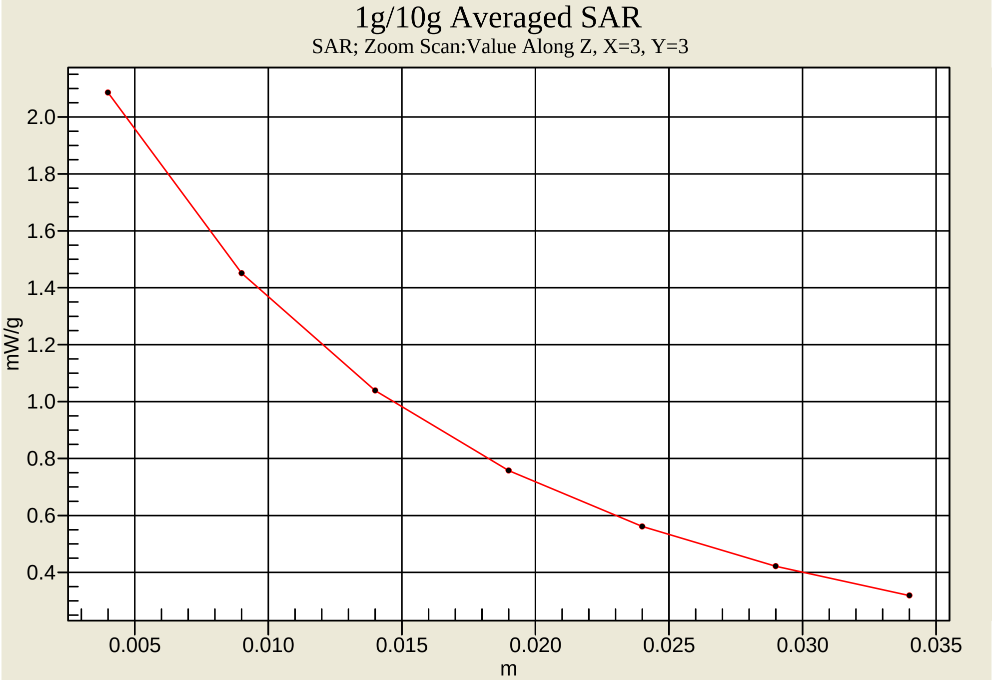
9.2.2 Validation

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ± 10%. The validation was performed at 450 MHz.

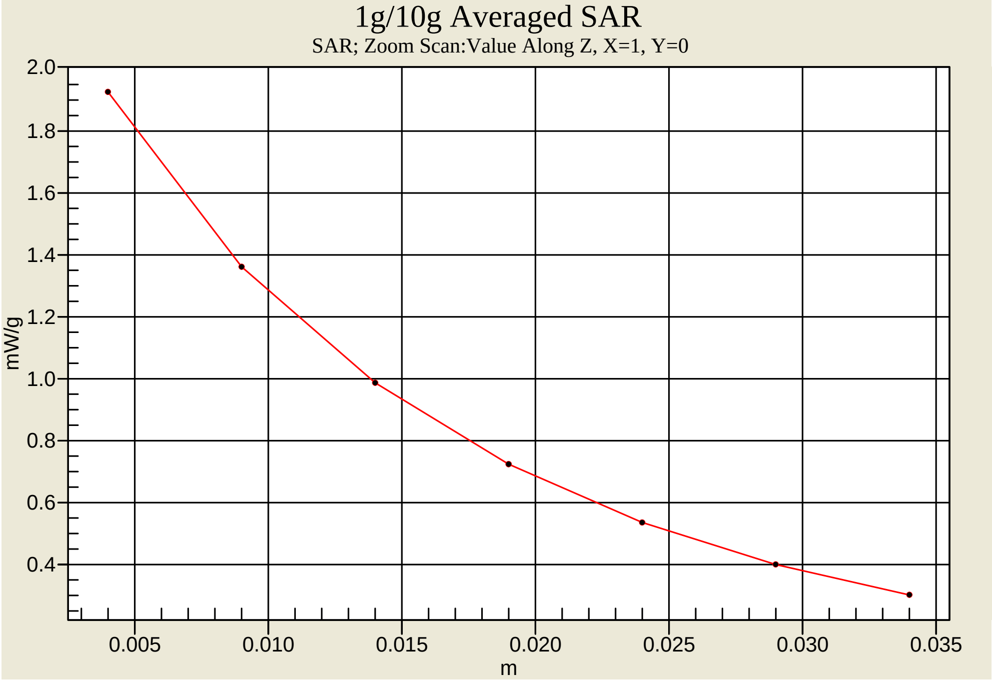
Validation kit	Mixture Type	SAR_{1g} [mW/g]	SAR_{10g} [mW/g]	Cal. Date	Due Date
D450V2-SN1021	Head	5.01	3.33	Feb. 24, 2010	Feb. 24, 2011
	Body	4.83	3.22		

Frequency (MHz)	Power	SAR_{1g} (mW/g)	SAR_{10g} (mW/g)	Drift (dB)	Difference percentage		Date
					1g	10g	
450 (Head)	398mW	1.95	1.33	-0.001	-2.2 %	0.3 %	Jan. 24, 2011
	Normalize to 1 Watt	4.90	3.34				
450 (Body)	398mW	1.81	1.21	-0.001	-5.8 %	-5.6 %	Jan. 25, 2011
	Normalize to 1 Watt	4.55	3.04				

Z-axis Plot of System Performance Check



Head-Tissue-Simulating-Liquid 450MHz



Body -Tissue-Simulating-Liquid 450MHz

9.3 Dosimetric Assessment Setup

9.3.1 Body Test Position

Body - Worn Configuration

Body - Worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device.

Body - Worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 15 mm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances.
For this test：

■ The EUT is placed into the holster/belt clip and the holster is positioned against the surface of the phantom in a normal operating position.

■ Since this EUT doesn’t supply any body-worn accessory to the end user, a distance of 15 mm was tested to confirm the necessary “minimum SAR separation distance”.
(＊Note：This distance includes the 2 mm phantom shell thickness.)

9.3.2 Measurement Procedures

The evaluation was performed with the following procedures：

Surface Check： A surface checks job gathers data used with optical surface detection. It determines the distance from the phantom surface where the reflection from the optical detector has its peak. Any following measurement jobs using optical surface detection will then rely on this value. The surface check performs its search a specified number of times, so that the repeatability can be verified. The probe tip distance is 1.3mm to phantom inner surface during scans.

Reference： The reference job measures the field at a specified reference position, at 4 mm from the selected section's grid reference point.

Area Scan： The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines can find the maximum locations even in relatively coarse grids. When an area scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. Any following zoom scan within the same procedure will then perform fine scans around these maxima. The area covered the entire dimension of the EUT and the horizontal grid spacing was 15 mm × 15 mm.

Zoom Scan： Zoom scans are used to assess the highest averaged SAR for cubic averaging volumes with 1 g and 10 g of simulated tissue. The zoom scan measures 7 x 7 x 9 points in a 30 x 30 x 24 mm cube whose base faces are centered around the maxima returned from a preceding area scan within the same procedure.

Drift： The drift job measures the field at the same location as the most recent reference job within the same procedure, with the same settings. The drift measurement gives the field difference in dB from the last reference measurement. Several drift measurements are possible for each reference measurement. This allows monitoring of the power drift of the device in the batch process. If the value changed by more than 5%, the evaluation was repeated.

9.4 Spatial Peak SAR Evaluation

The DASY4 software includes all numerical procedures necessary to evaluate the spatial peak SAR values. Based on the Draft: SCC-34, SC-2, WG-2 - Computational Dosimetry, IEEE P1529/D0.0 (Draft Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) Associated with the Use of Wireless Handsets - Computational Techniques), a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.

The base for the evaluation is a "cube" measurement in a volume of $(30\times30\times24)mm^3$ ($7\times7\times9$ points). 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. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Postprocessing engine (SEMCAD). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location.

The entire evaluation of the spatial peak values is performed within the Postprocessing 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 three stages:

Interpolation and Extrapolation

The probe is calibrated at the center of the dipole sensors which is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASY4, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and SAR extrapolation routines. The interpolation, Maxima Search and extrapolation routines are all based on the modified Quadratic Shepard's method [7].

10. 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 ±27 %〔8〕.

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.

Source of Uncertainty	Uncertainty Value	Probability Distribution	Divisor	c_i	Standard Uncertainty ±1% (1-g)	v_i or V_{eff}
Type-A	0.9 %	Normal	1	1	0.9	9
Measurement System						
Probe Calibration	7 %	Normal	1	1	3.5	∞
Axial Isotropy	0.2dB	Rectangular	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
Hemispherical Isotropy	9.6 %	Rectangular	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
Spatial Resolution	0 %	Rectangular	$\sqrt{3}$	1	0	∞
Boundary Effect	11.0 %	Rectangular	$\sqrt{3}$	1	6.4	∞
Linearity	0.2dB	Rectangular	$\sqrt{3}$	1	2.7	∞
Detection Limit	1.0 %	Rectangular	$\sqrt{3}$	1	0.6	∞
Readout Electronics	1.0 %	Normal	1	1	1.0	∞
RF Ambient Conditions	3.0 %	Rectangular	$\sqrt{3}$	1	1.73	∞
Probe Positioner Mech. Const.	0.4 %	Rectangular	$\sqrt{3}$	1	0.2	∞
Probe Positioning	0.35 %	Rectangular	$\sqrt{3}$	1	0.2	∞
Extrapolation and Integration	3.9 %	Rectangular	$\sqrt{3}$	1	2.3	∞
Test sample Related						
Test sample Positioning	4.7 %	Normal	1	1	4.7	5
Device Holder Uncertainty	6.1 %	Normal	1	1	6.1	5
Drift of Output Power	5.0 %	Rectangular	$\sqrt{3}$	1	2.9	∞
Phantom and Setup						
Phantom Uncertainty (Including temperature effects)	4.0%	Rectangular	$\sqrt{3}$	1	2.3	∞
Liquid Conductivity (target)	5.0%	Rectangular	$\sqrt{3}$	0.6	1.7	∞
Liquid Conductivity (meas.)	10.0%	Rectangular	$\sqrt{3}$	0.6	3.4	∞
Liquid Permittivity (target)	5.0%	Rectangular	$\sqrt{3}$	0.6	1.7	∞
Liquid Permittivity (meas.)	5.0%	Rectangular	$\sqrt{3}$	0.6	1.7	∞
Combined standard uncertainty		RSS			13.5	88.7
Expanded uncertainty (Coverage factor = 2)		Normal (k=2)			27	

Table 5. Uncertainty Budget of DASY

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								
Probe Calibration	±7.0	N	1	1	1	±7.0	±7.0	∞
Axial Isotropy	±4.7	R	$\sqrt{3}$	1	1	±2.7	±2.7	∞
Hemispherical Isotropy	±9.6	R	$\sqrt{3}$	0	0	0	0	∞
Boundary Effects	±1.0	R	$\sqrt{3}$	1	1	±0.6	±0.6	∞
Linearity	±4.7	R	$\sqrt{3}$	1	1	±2.7	±2.7	∞
System Detection Limit	±1.0	R	$\sqrt{3}$	1	1	±0.6	±0.6	∞
Readout Electronics	±0.3	N	1	1	1	±0.3	±0.3	∞
Response Time	0	R	$\sqrt{3}$	1	1	0	0	∞
Integration Time	0	R	$\sqrt{3}$	1	1	0	0	∞
RF Ambient Noise	±3.0	R	$\sqrt{3}$	1	1	±1.7	±1.7	∞
RF Ambient Reflections	±3.0	R	$\sqrt{3}$	1	1	±1.7	±1.7	∞
Probe Positioner	±0.4	R	$\sqrt{3}$	1	1	±0.2	±0.2	∞
Probe Positioning	±2.9	R	$\sqrt{3}$	1	1	±1.7	±1.7	∞
Algorithms for Max. SARE val.	±1.0	R	$\sqrt{3}$	1	1	±0.6	±0.6	∞
Dipole								
Dipole Axis to Liquid Distance	±2.0	R	$\sqrt{3}$	1	1	±1.2	±1.2	∞
Input power and SAR drift meas.	±4.7	R	$\sqrt{3}$	1	1	±2.7	±2.7	∞
Phantom and Tissue Parameters								
Phantom Uncertainty	±4.0	R	$\sqrt{3}$	1	1	±2.3	±2.3	∞
Liquid Conductivity (target)	±5.0	R	$\sqrt{3}$	0.64	0.43	±1.7	±1.2	∞
Liquid Conductivity (meas.)	±2.5	N	1	0.64	0.43	±1.6	±1.1	∞
Liquid Permittivity (target)	±5.0	R	$\sqrt{3}$	0.6	0.49	±1.7	±1.4	∞
Liquid Permittivity (meas.)	±2.5	N	1	0.6	0.49	±1.5	±1.2	∞
Combined standard uncertainty						±9.9	±9.7	∞
Coverage Factor for 95%		kp=2						
Expanded Uncertainty						±19.8	±19.4	

Table 6. Uncertainty of a system performance check with DASY 4 system

11. SAR Test Results Summary

11.1 FRS Face SAR _ 15 mm Spacing

Ambient：

Temperature (℃)：	22 ± 2	Relative HUMIDITY (%)：	40-70

Liquid：

Mixture Type：	HSL450	Liquid Temperature (℃)：	22
		Depth of liquid (cm)：	15

Measurement：

Crest Factor：	1	Probe S/N：	3632

Frequency		Modulation	Battery	Accessory	SAR_{1g}[mW/g] Duty Cycle		Power Drift	Amb. Temp	Remark
MHz	Ch.				100%	50%			
467.6375	11	FM	Ni-MH	N/A	0.037	0.019	0.068	22.0	---
467.6375	11	ALKALINE	Ni-MH	N/A	0.038	0.019	0.071	22.0	---
Std. C95.1-1992 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				

◆ SAR values are scaled for the power drift

Frequency		Battery	SAR_{1g}[mW/g] Duty Cycle		power drift (dB)	+ power drift 10^(dB/10)	SAR_{1g}[mW/g] (include +power drift) Duty Cycle	
MHz	Ch.		100%	50%			100%	50%
467.6375	11	Ni-MH	0.037	0.019	0.068	1.016	0.038	0.019
467.6375	11	ALKALINE	0.038	0.019	0.071	1.016	0.039	**0.019**

SAR is basically proportional to average transmit power and duty cycle

(i.e. SAR = P x T where P is the average transmit power and T is the transmit duty cycle).

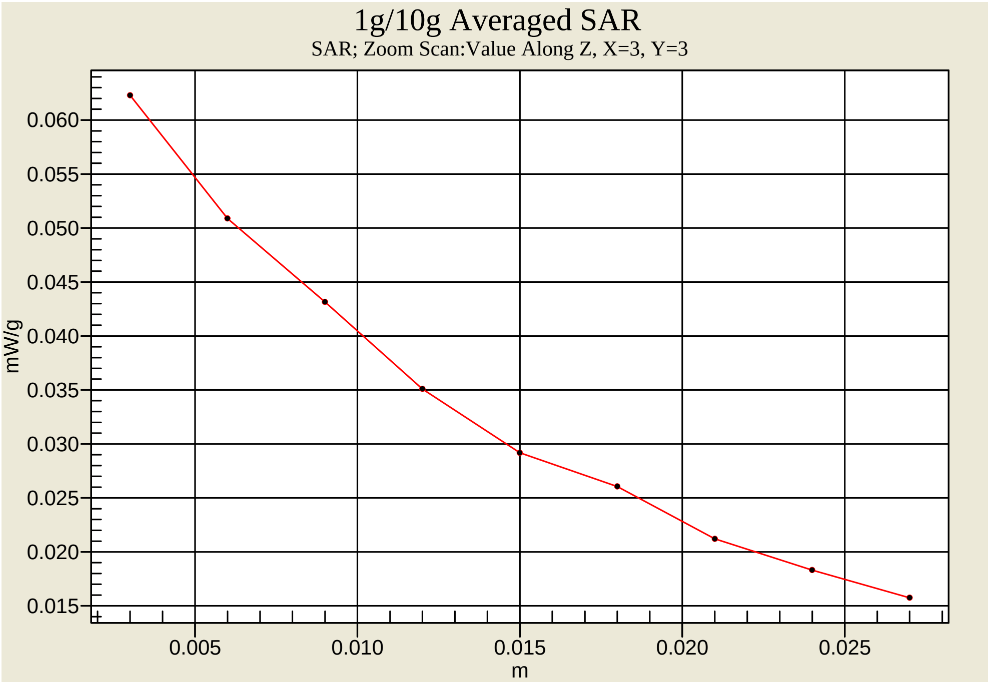
SAR(unknown) = SAR(know) x (PxTx/P(known) T(known))

Where Px is the unknown power (i.e. the power at the highest drift)

Tx is the transmit duty cycle used at that unknown power.

If transmitter duty cycle is the same then it should be a relationship of Px/Pknown)

Z-axis Plot of SAR Measurement



FRS Face SAR -15 mm Spacing _ CH11 (ALKALINE Battery)

11.2 GMRS Face SAR _ 15mm Spacing

Ambient：

Temperature (℃)：	22 ± 2	Relative HUMIDITY (%)：	40-70

Liquid：

Mixture Type：	HSL450	Liquid Temperature (℃)：	22
		Depth of liquid (cm)：	15

Measurement：

Crest Factor：	1	Probe S/N：	3632

Frequency		Modulation	Battery	Accessory	SAR_{1g}[mW/g] Duty Cycle		Power Drift	Amb. Temp	Remark
MHz	Ch.				100%	50%			
462.6875	6	FM	Ni-MH	N/A	2.330	1.165	-0.026	22.1	---
462.6875	6	FM	ALKALINE	N/A	2.210	1.105	-0.023	22.1	---
467.6250	26	FM	Ni-MH	N/A	2.260	1.130	-0.010	22.1	Repeater channel
467.6250	26	FM	ALKALINE	N/A	2.790	1.395	-0.036	22.1	Repeater channel
Std. C95.1-1992 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				

◆ SAR values are scaled for the power drift

Frequency		Battery	SAR_{1g}[mW/g] Duty Cycle		power drift (dB)	+ power drift 10^(dB/10)	SAR_{1g}[mW/g] (include +power drift) Duty Cycle	
MHz	Ch.		100%	50%			100%	50%
462.6875	6	Ni-MH	2.330	1.165	-0.026	1.006	2.344	1.172
462.6875	6	ALKALINE	2.210	1.105	-0.023	1.005	2.222	1.111
467.6250	26	Ni-MH	2.260	1.130	-0.010	1.002	2.265	1.133
467.6250	26	ALKALINE	2.790	1.395	-0.036	1.008	2.813	**1.407**

SAR is basically proportional to average transmit power and duty cycle

(i.e. SAR = P x T where P is the average transmit power and T is the transmit duty cycle).

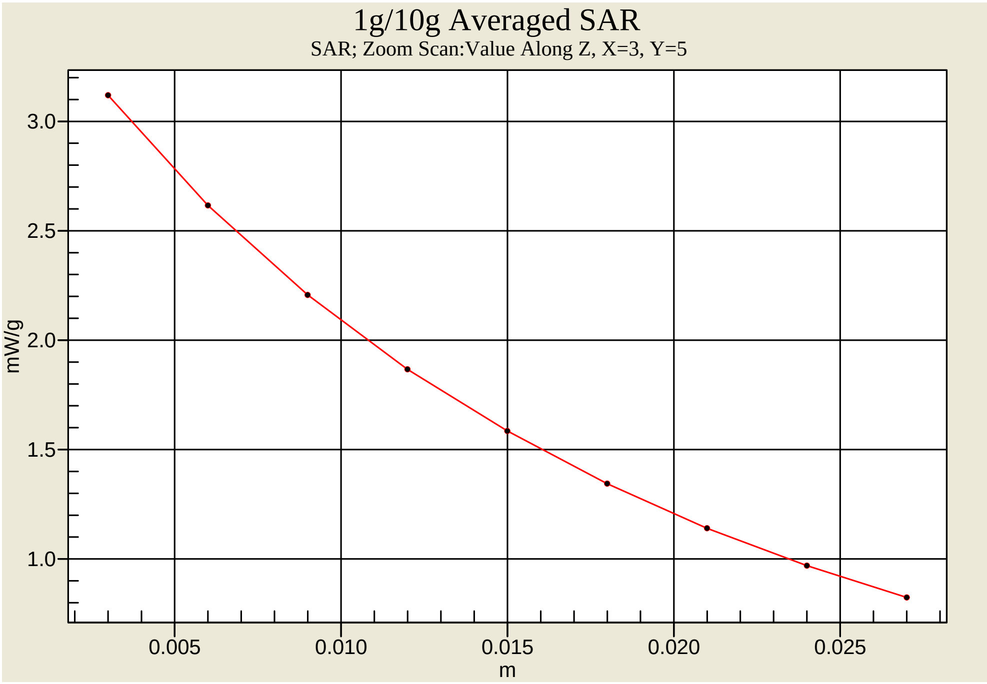
SAR(unknown) = SAR(know) x (PxTx/P(known) T(known))

Where Px is the unknown power (i.e. the power at the highest drift)

Tx is the transmit duty cycle used at that unknown power.

If transmitter duty cycle is the same then it should be a relationship of Px/Pknown)

Z-axis Plot of SAR Measurement



GMRS Face SAR - 15 mm Spacing _ CH26 (ALKALINE Battery)

11.3 FRS Body SAR with Headset _ 15 mm Spacing

Ambient：

Temperature (℃)： **22 ± 2** Relative HUMIDITY (%)： **40-70**

Liquid：

Mixture Type： **MSL450** Liquid Temperature (℃)： **22**

Depth of liquid (cm)： **15**

Measurement：

Crest Factor： **1** Probe S/N： **3632**

Frequency		Modulation	Battery	Accessory	SAR_{1g}[mW/g] Duty Cycle		Power Drift	Amb. Temp	Remark
MHz	Ch.				100%	50%			
467.6375	11	FM	Ni-MH	Headset	0.053	0.027	0.030	22.0	---
467.6375	11	ALKALINE	Ni-MH	N/A	0.055	0.028	0.031	22.0	---
Std. C95.1-1992 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1 gram**				

◆ SAR values are scaled for the power drift

Frequency		Battery	SAR_{1g}[mW/g] Duty Cycle		power drift (dB)	+ power drift 10^(dB/10)	SAR_{1g}[mW/g] (include +power drift) Duty Cycle	
MHz	Ch.		100%	50%			100%	50%
467.6375	11	Ni-MH	0.053	0.027	0.030	1.007	0.053	0.027
467.6375	11	ALKALINE	0.055	0.028	0.031	1.007	0.055	**0.028**

SAR is basically proportional to average transmit power and duty cycle

(i.e. SAR = P x T where P is the average transmit power and T is the transmit duty cycle).

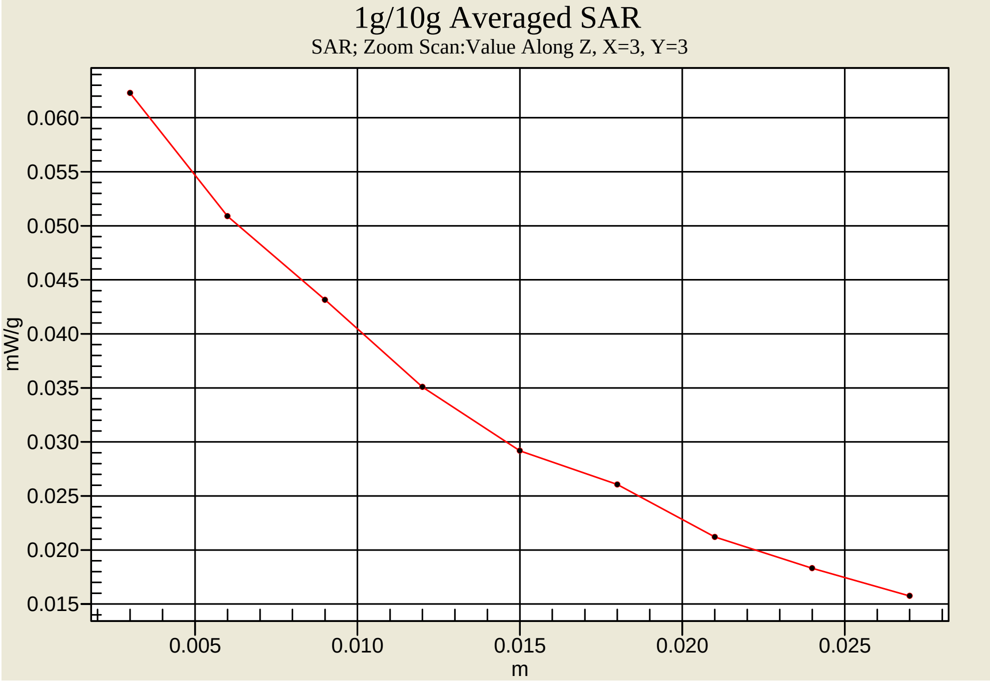
SAR(unknown) = SAR(know) x (PxTx/P(known) T(known))

Where Px is the unknown power (i.e. the power at the highest drift)

Tx is the transmit duty cycle used at that unknown power.

If transmitter duty cycle is the same then it should be a relationship of Px/Pknown)

Z-axis Plot of SAR Measurement



FRS Body SAR - 15 mm Spacing _ CH11 (ALKALINE Battery)

11.4 GMRS Body SAR with Headset _15 mm Spacing

Ambient：

Temperature (℃)：	**22 ± 2**	Relative HUMIDITY (%)：	**40-70**

Liquid：

Mixture Type：	**MSL450**	Liquid Temperature (℃)：	**22**
		Depth of liquid (cm)：	**15**

Measurement：

Crest Factor：	**1**	Probe S/N：	**3632**

Frequency		Modulation	Battery	Accessory	SAR_{1g}[mW/g] Duty Cycle		Power Drift	Amb. Temp	Remark
MHz	Ch.				100%	50%			
462.6875	6	FM	Ni-MH	Headset	1.880	0.940	-0.011	22.1	---
462.6875	6	FM	ALKALINE	Headset	2.560	1.280	-0.031	22.1	---
467.6250	26	FM	Ni-MH	Headset	2.080	1.040	-0.193	22.1	Repeater channel
467.6250	26	FM	ALKALINE	Headset	2.610	1.305	-0.014	22.1	Repeater channel
Std. C95.1-1992 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				

◆ SAR values are scaled for the power drift

Frequency		Battery	SAR_{1g}[mW/g] Duty Cycle		power drift (dB)	+ power drift 10^(dB/10)	SAR_{1g}[mW/g] (include +power drift) Duty Cycle	
MHz	Ch.		100%	50%			100%	50%
462.6875	6	Ni-MH	1.880	0.940	-0.011	1.003	1.885	0.942
462.6875	6	ALKALINE	2.560	1.280	-0.031	1.007	2.578	1.289
467.6250	26	Ni-MH	2.080	1.040	-0.193	1.045	2.175	1.087
467.6250	26	ALKALINE	2.610	1.305	-0.014	1.003	2.618	**1.309**

SAR is basically proportional to average transmit power and duty cycle

(i.e. SAR = P x T where P is the average transmit power and T is the transmit duty cycle).

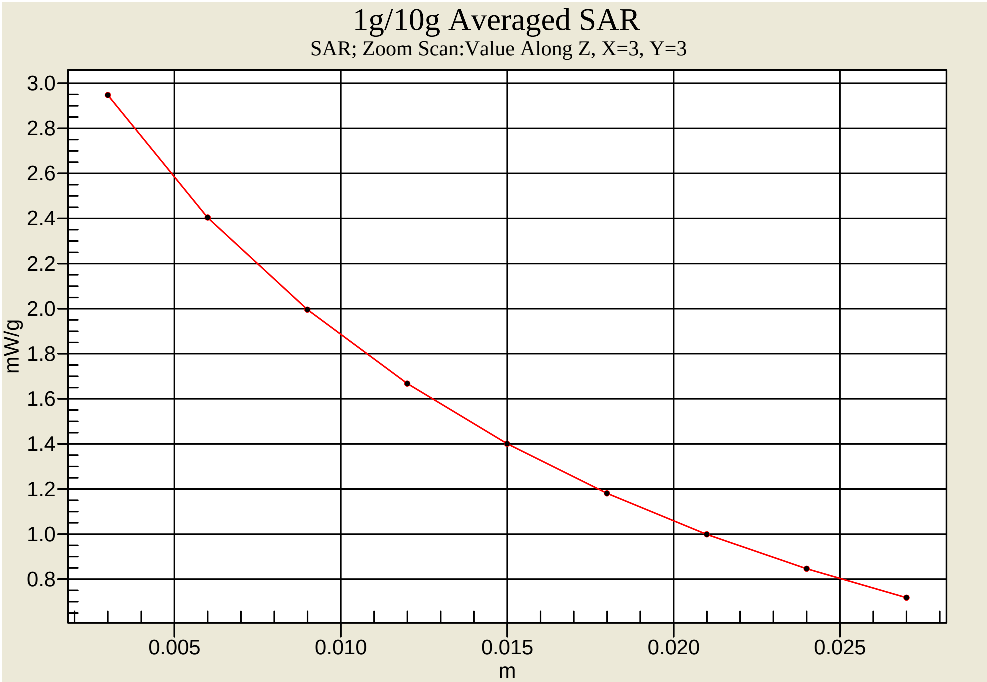
SAR(unknown) = SAR(know) x (PxTx/P(known) T(known))

Where Px is the unknown power (i.e. the power at the highest drift)

Tx is the transmit duty cycle used at that unknown power.

If transmitter duty cycle is the same then it should be a relationship of Px/Pknown)

Z-axis Plot of SAR Measurement



GMRS Body SAR - 15 mm Spacing _ CH26 (ALKALINE Battery)

11.5 FRS Body SAR with Headset and Belt Clip

Ambient：

Temperature (℃)：	**22 ± 2**	Relative HUMIDITY (%)：	**40-70**

Liquid：

Mixture Type：	**MSL450**	Liquid Temperature (℃)：	**22**
		Depth of liquid (cm)：	**15**

Measurement：

Crest Factor：	**1**	Probe S/N：	**3632**

Frequency		Modulation	Battery	Accessory	SAR_{1g}[mW/g]		Power Drift	Amb. Temp	Remark
					Duty Cycle				
MHz	Ch.				100%	50%			
467.6375	11	FM	Ni-MH	Headset & Belt Clip	0.040	0.020	0.087	22.0	---
467.6375	11	FM	ALKALINE	Headset & Belt Clip	0.042	0.021	0.093	22.0	---
Std. C95.1-1992 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				

◆ SAR values are scaled for the power drift

Frequency		Battery	SAR_{1g}[mW/g]		power drift (dB)	+ power drift 10^(dB/10)	SAR_{1g}[mW/g] (include +power drift)	
			Duty Cycle				Duty Cycle	
MHz	Ch.		100%	50%			100%	50%
467.6375	11	Ni-MH	0.040	0.020	0.087	1.020	0.041	0.020
467.6375	11	ALKALINE	0.042	0.021	0.093	1.022	0.043	**0.021**

SAR is basically proportional to average transmit power and duty cycle

(i.e. SAR = P x T where P is the average transmit power and T is the transmit duty cycle).

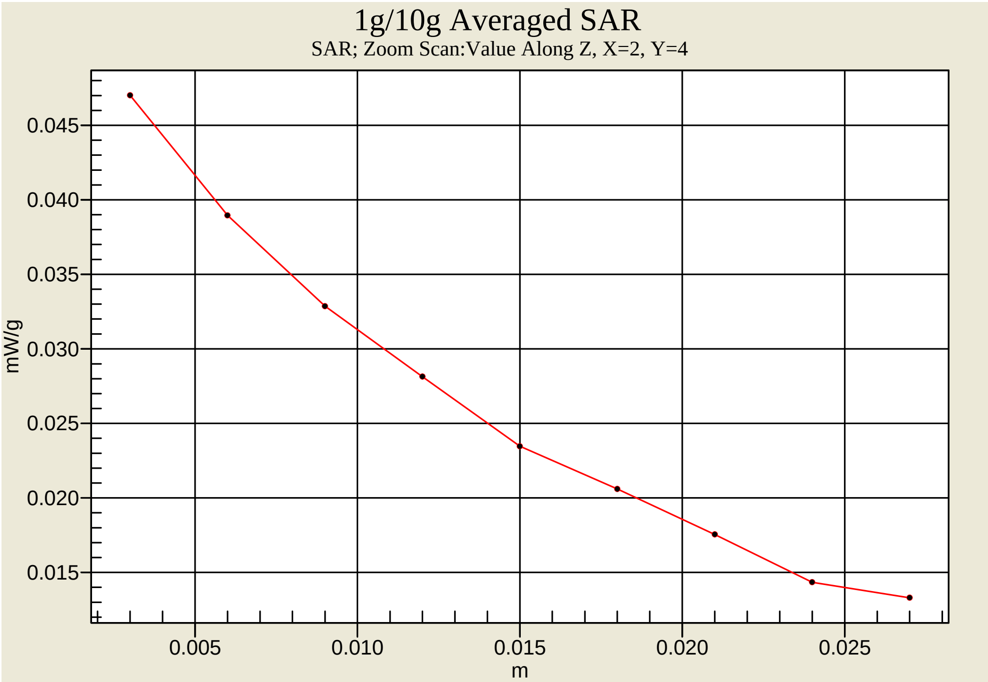
SAR(unknown) = SAR(know) x (PxTx/P(known) T(known))

Where Px is the unknown power (i.e. the power at the highest drift)

Tx is the transmit duty cycle used at that unknown power.

If transmitter duty cycle is the same then it should be a relationship of Px/Pknown)

Z-axis Plot of SAR Measurement



FRS Body SAR with Headset and Belt Clip _ CH11 (ALKALINE Battery)

11.6 GMRS Body SAR with Headset and Belt Clip

Ambient：

Temperature (℃)：	**22 ± 2**	Relative HUMIDITY (%)：	**40-70**

Liquid：

Mixture Type：	**MSL450**	Liquid Temperature (℃)：	**22**
		Depth of liquid (cm)：	**15**

Measurement：

Crest Factor：	**1**	Probe S/N：	**3632**

Frequency		Modulation	Battery	Accessory	SAR_{1g}[mW/g] Duty Cycle		Power Drift	Amb. Temp	Remark
MHz	Ch.				100%	50%			
462.6875	6	FM	Ni-MH	Headset & Belt Clip	2.030	1.015	-0.062	22.1	---
462.6875	6	FM	ALKALINE	Headset & Belt Clip	2.300	1.150	-0.014	22.1	---
467.6250	26	FM	Ni-MH	Headset & Belt Clip	1.640	0.820	0.085	22.1	Repeater channel
467.6250	26	FM	ALKALINE	Headset & Belt Clip	2.150	1.075	-0.039	22.1	Repeater channel
Std. C95.1-1992 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1 gram**				

◆ SAR values are scaled for the power drift

Frequency		Battery	SAR_{1g}[mW/g] Duty Cycle		power drift (dB)	+ power drift 10^(dB/10)	SAR_{1g}[mW/g] (include +power drift) Duty Cycle	
MHz	Ch.		100%	50%			100%	50%
462.6875	6	Ni-MH	2.030	1.015	-0.062	1.014	2.059	1.030
462.6875	6	ALKALINE	2.300	1.150	-0.014	1.003	2.307	**1.154**
467.6250	26	Ni-MH	1.640	0.820	0.085	1.020	1.672	0.836
467.6250	26	ALKALINE	2.150	1.075	-0.039	1.009	2.169	1.085

SAR is basically proportional to average transmit power and duty cycle

(i.e. SAR = P x T where P is the average transmit power and T is the transmit duty cycle).

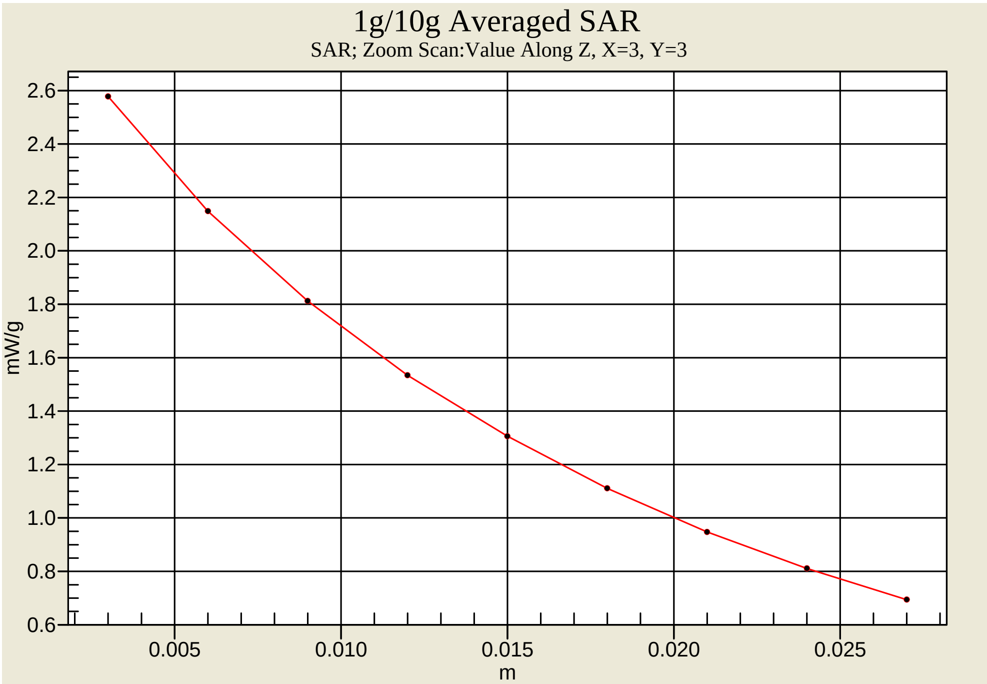
SAR(unknown) = SAR(know) x (PxTx/P(known) T(known))

Where Px is the unknown power (i.e. the power at the highest drift)

Tx is the transmit duty cycle used at that unknown power.

If transmitter duty cycle is the same then it should be a relationship of Px/Pknown)

Z-axis Plot of SAR Measurement

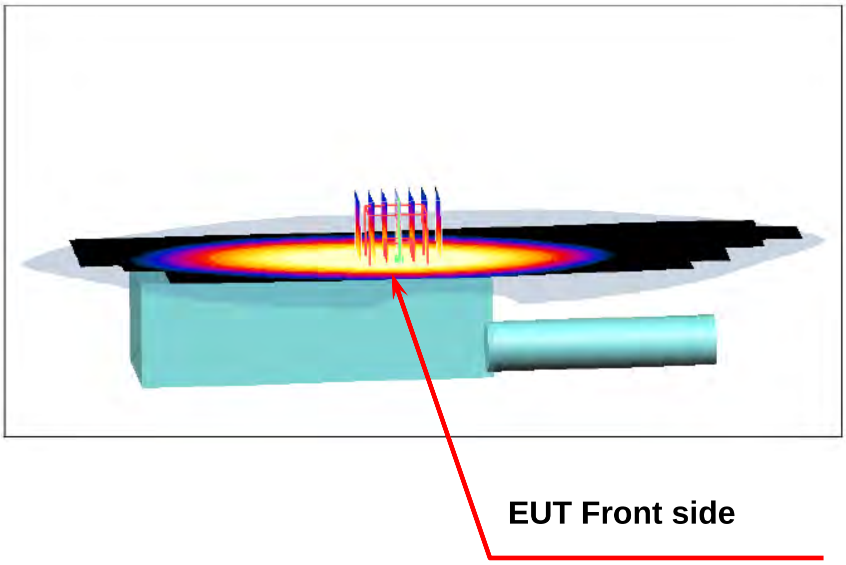


GMRS Body SAR with Headset and Belt Clip _ CH6 (ALKALINE Battery)

11.7 Setup Photo

Face Position

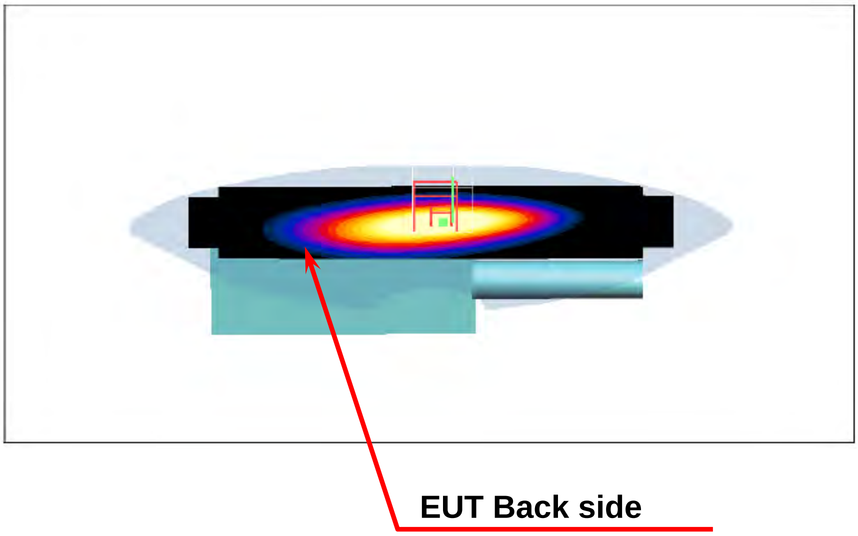
Figure 16. EUT Face to Phantom 15 mm spacing



EUT Front side

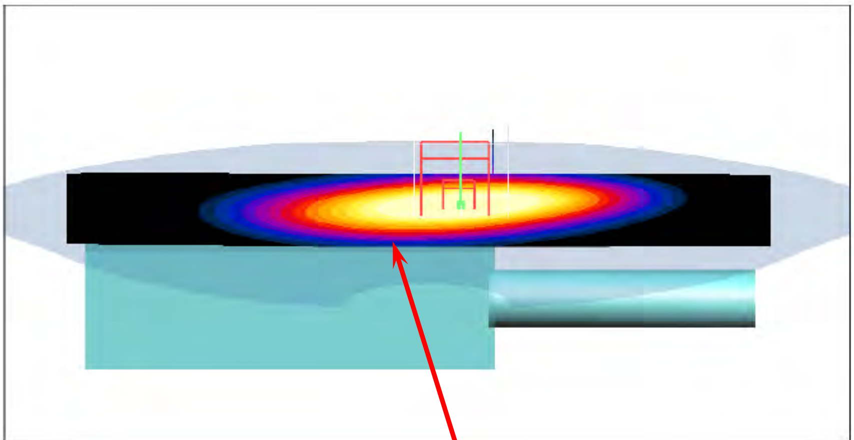
Body Position

Figure 17. EUT with Headset to Phantom 15 mm spacing



Body Position

Figure 18. EUT with Headset and Belt clip



EUT Back side

11.8 Std. C95.1-1992 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).

12. Conclusion

The SAR test values found for the portable mobile phone **Giant Electronics Limited Trade Mark：Motorola Model(s)：MS350R** are below the maximum recommended level of 1.6 W/kg (mW/g).

13. References

[1] Std. C95.1-1992, "*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.

Appendix A - System Performance Check

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/24 PM 02:02:27

System Performance Check at 450 MHz_20110124_Head

DUT: Dipole 450MHz; Type: D450V2; Serial: D450V2 SN:1021

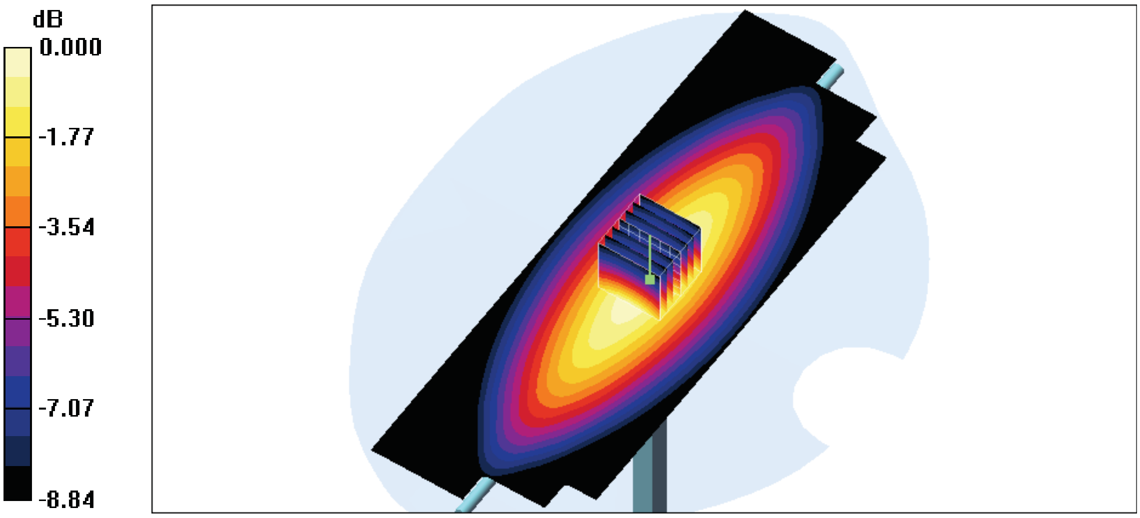
Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.876 mho/m; ε_r = 44.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.64, 9.64, 9.64); Calibrated: 2010/1/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

System Performance Check at 450 MHz/Area Scan (61x201x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.08 mW/g

System Performance Check at 450 MHz/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 48.9 V/m; Power Drift = -0.001 dB
Peak SAR (extrapolated) = 2.84 W/kg
SAR(1 g) = 1.95 mW/g; SAR(10 g) = 1.33 mW/g
Maximum value of SAR (measured) = 2.09 mW/g



0 dB = 2.09mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 AM 04:03:46

System Performance Check at 450 MHz_20110125_Body

DUT: Dipole 450MHz; Type: D450V2; Serial: D450V2 SN:1021

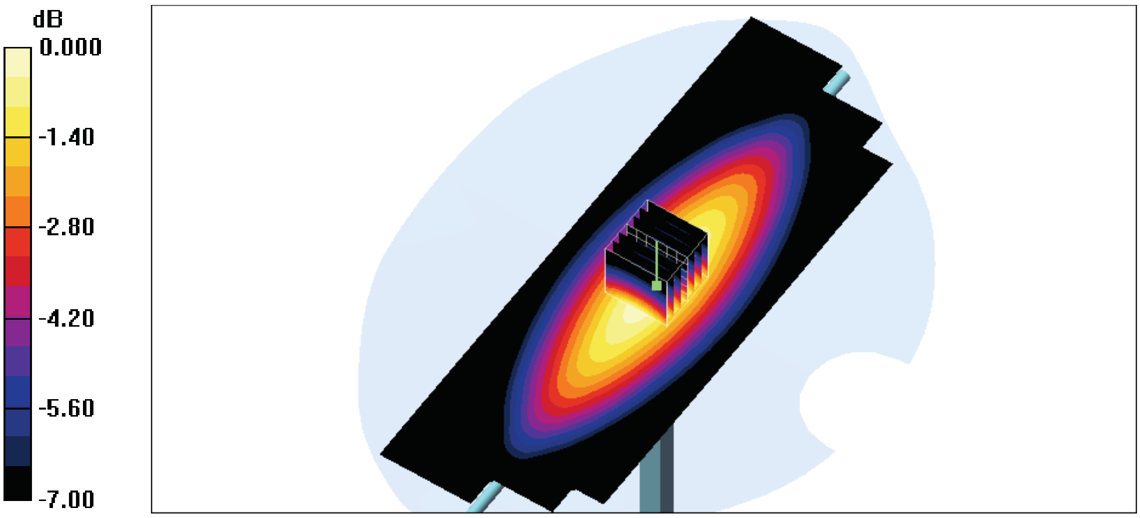
Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.934 mho/m; ε_r = 55.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

System Performance Check at 450 MHz/Area Scan (61x201x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.06 mW/g

System Performance Check at 450 MHz/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 45.7 V/m; Power Drift = -0.001 dB
Peak SAR (extrapolated) = 2.62 W/kg
SAR(1 g) = 1.81 mW/g; SAR(10 g) = 1.21 mW/g
Maximum value of SAR (measured) = 1.93 mW/g



0 dB = 1.93mW/g

Appendix B - SAR Measurement Data

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/24 PM 05:09:39

Flat_GMRS CH6_Brain_Ni-MH_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

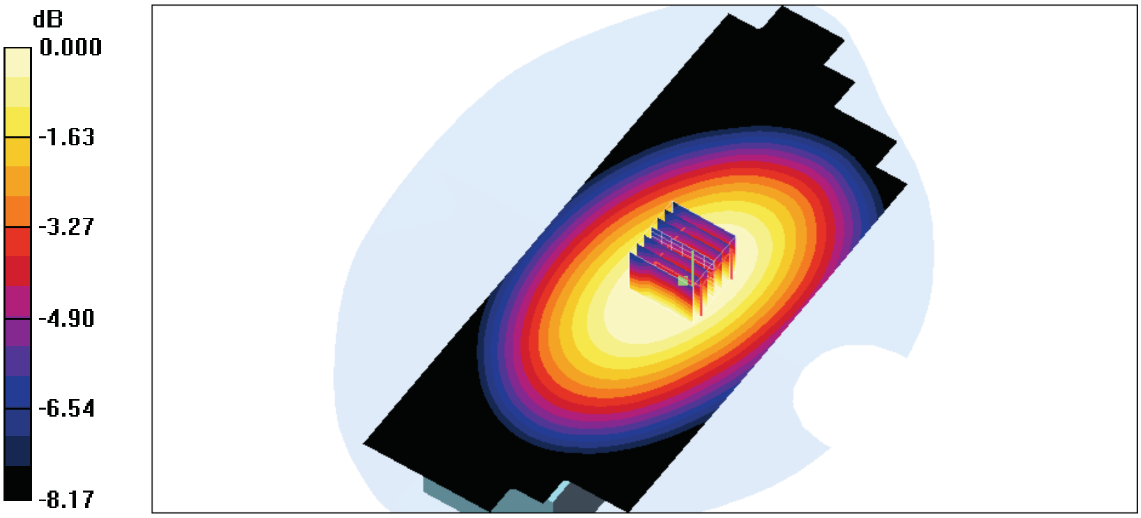
Communication System: GMRS; Frequency: 462.6875 MHz;Duty Cycle: 1:1
Medium parameters used: f = 462.6875 MHz; σ = 0.884 mho/m; ε_r = 44.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.64, 9.64, 9.64); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x181x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.00 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 58.0 V/m; Power Drift = -0.026 dB
Peak SAR (extrapolated) = 3.10 W/kg
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.72 mW/g
Maximum value of SAR (measured) = 2.59 mW/g



0 dB = 2.59mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/24 PM 07:18:33

Flat_GMRS CH6_Brain_Alkaline_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

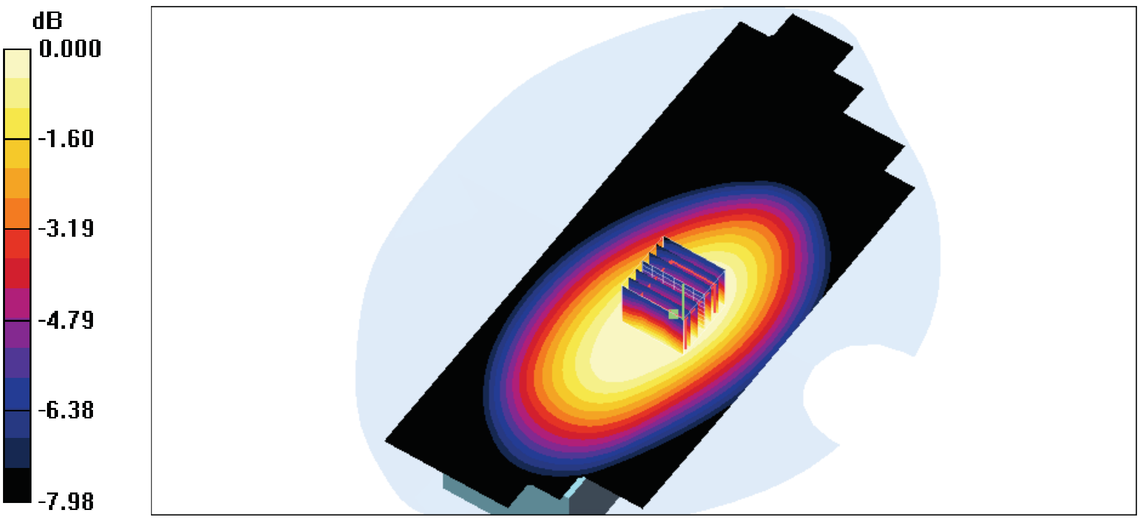
Communication System: GMRS; Frequency: 462.6875 MHz;Duty Cycle: 1:1
Medium parameters used: f = 462.6875 MHz; σ = 0.884 mho/m; ε_r = 44.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.64, 9.64, 9.64); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x181x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.31 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 55.6 V/m; Power Drift = -0.023 dB
Peak SAR (extrapolated) = 3.12 W/kg
SAR(1 g) = 2.21 mW/g; SAR(10 g) = 1.55 mW/g
Maximum value of SAR (measured) = 2.51 mW/g



0 dB = 2.51mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/24 PM 06:06:33

Flat_GMRS CH26_Brain_Ni-MH_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

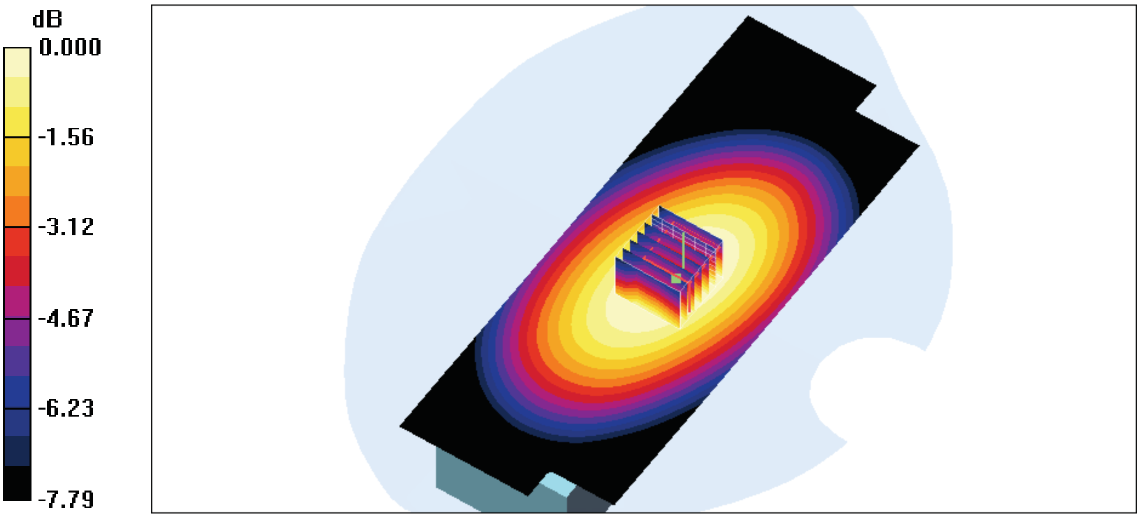
Communication System: GMRS; Frequency: 467.6250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6250 MHz; σ = 0.887 mho/m; ε_r = 44; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.64, 9.64, 9.64); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (61x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.76 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 56.2 V/m; Power Drift = -0.010 dB
Peak SAR (extrapolated) = 3.01 W/kg
SAR(1 g) = 2.26 mW/g; SAR(10 g) = 1.66 mW/g
Maximum value of SAR (measured) = 2.51 mW/g



0 dB = 2.51mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/24 PM 06:22:40

Flat_GMRS CH26_Brain_Alkaline_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

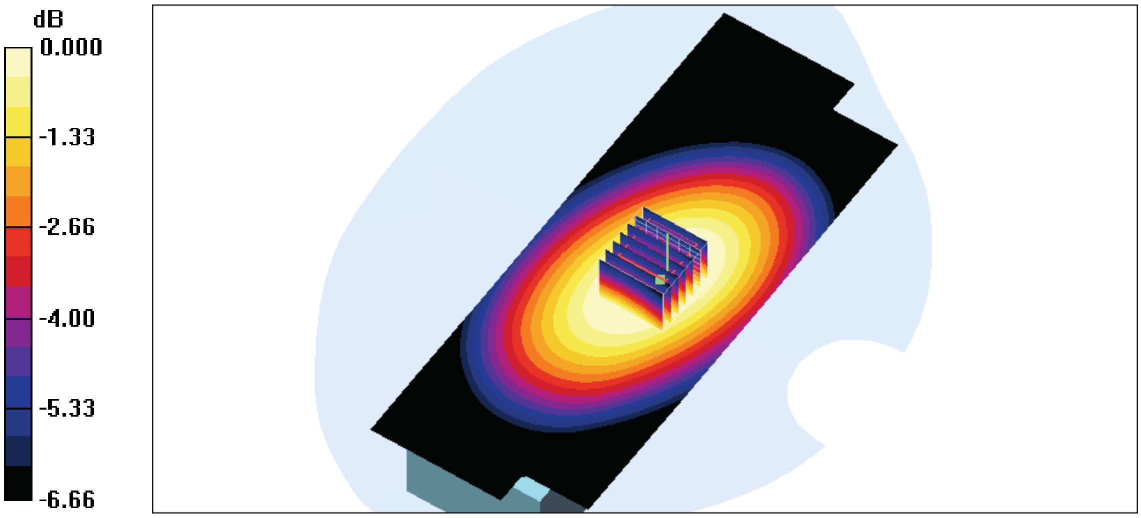
Communication System: GMRS; Frequency: 467.6250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6250 MHz; σ = 0.887 mho/m; ε_r = 44; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.64, 9.64, 9.64); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (61x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.57 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 67.1 V/m; Power Drift = -0.036 dB
Peak SAR (extrapolated) = 3.71 W/kg
SAR(1 g) = 2.79 mW/g; SAR(10 g) = 2.06 mW/g
Maximum value of SAR (measured) = 3.12 mW/g



0 dB = 3.12mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/24 PM 06:39:03

Flat_FRS CH11_Brain_Ni-MH_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

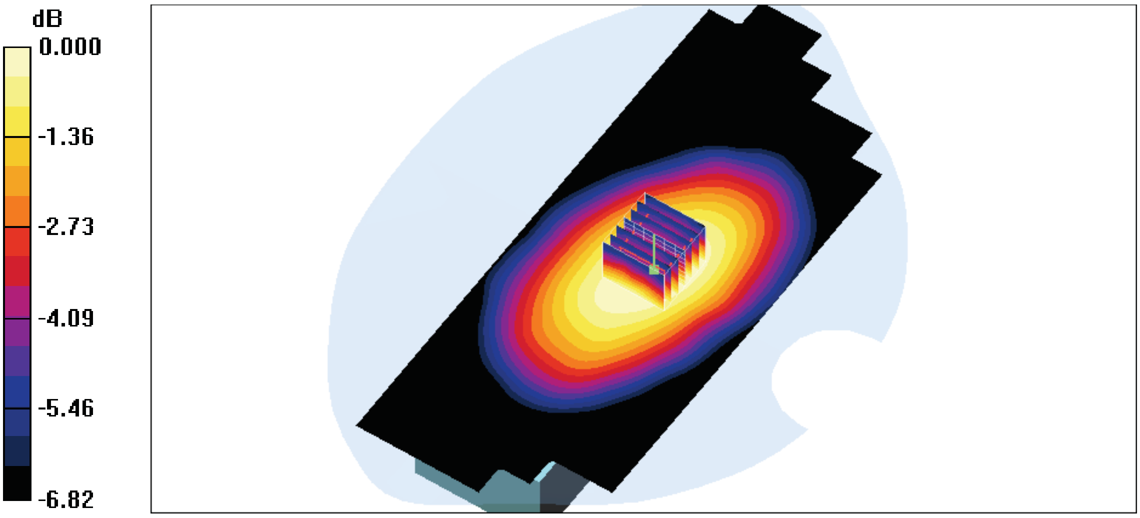
Communication System: FRS; Frequency: 467.6375 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6375 MHz; σ = 0.887 mho/m; ε_r = 44; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.64, 9.64, 9.64); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x181x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.044 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 6.48 V/m; Power Drift = 0.068 dB
Peak SAR (extrapolated) = 0.050 W/kg
SAR(1 g) = 0.037 mW/g; SAR(10 g) = 0.027 mW/g
Maximum value of SAR (measured) = 0.041 mW/g



0 dB = 0.041mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/1/24 PM 06:45:22

Flat_FRS CH11_Brain_Alkaline_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

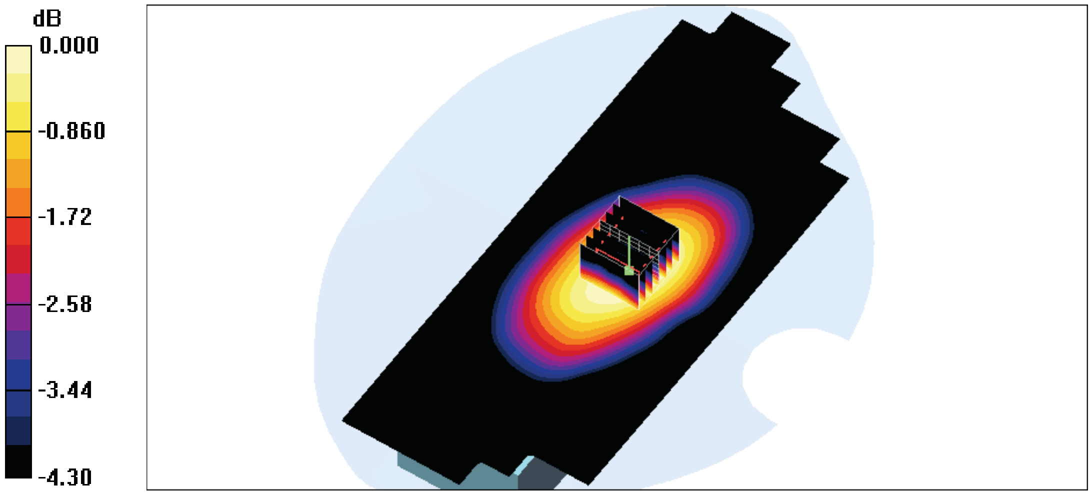
Communication System: FRS; Frequency: 467.6375 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6375 MHz; σ = 0.887 mho/m; ε_r = 44; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.64, 9.64, 9.64); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x181x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.045 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 6.58 V/m; Power Drift = 0.071 dB
Peak SAR (extrapolated) = 0.052 W/kg
SAR(1 g) = 0.038 mW/g; SAR(10 g) = 0.028 mW/g
Maximum value of SAR (measured) = 0.043 mW/g



0 dB = 0.043mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 AM 09:51:29

Flat_GMRS CH6_Headset_muscle_Ni-MH_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

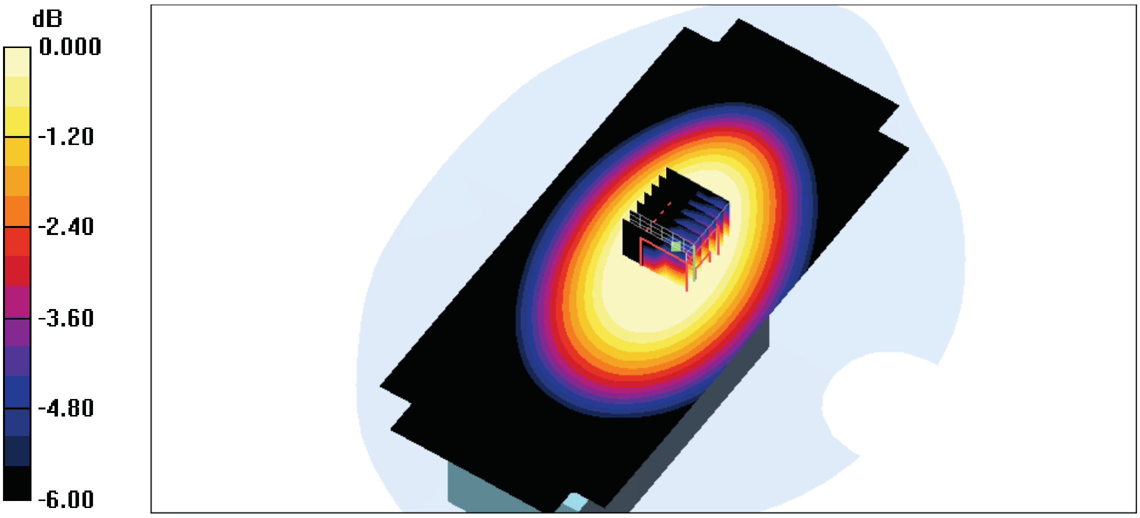
Communication System: GMRS; Frequency: 462.6875 MHz;Duty Cycle: 1:1
Medium parameters used: f = 462.6875 MHz; σ = 0.946 mho/m; ε_r = 55.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.80 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 53.9 V/m; Power Drift = -0.011 dB
Peak SAR (extrapolated) = 3.18 W/kg
SAR(1 g) = 1.88 mW/g; SAR(10 g) = 1.27 mW/g
Maximum value of SAR (measured) = 2.13 mW/g



0 dB = 2.13mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 PM 08:16:44

Flat_GMRS CH6_Headset_muscle_Alkaline_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

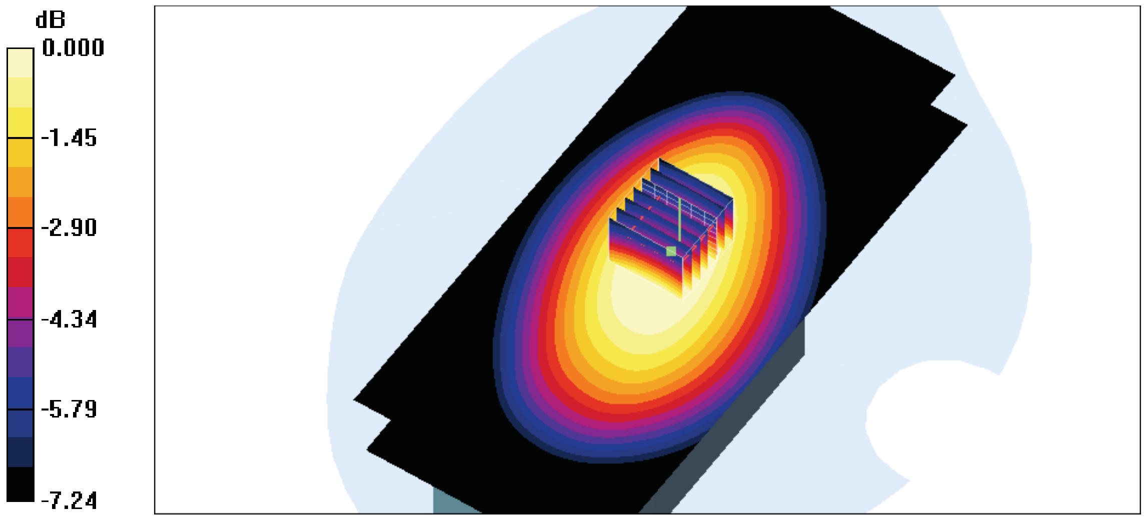
Communication System: GMRS; Frequency: 462.6875 MHz;Duty Cycle: 1:1
Medium parameters used: f = 462.6875 MHz; σ = 0.946 mho/m; ε_r = 55.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.50 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 62.3 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 3.91 W/kg
SAR(1 g) = 2.56 mW/g; SAR(10 g) = 1.88 mW/g
Maximum value of SAR (measured) = 3.12 mW/g



0 dB = 3.12mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/26 AM 01:04:13

Flat_GMRS CH26_Headset_muscle_Ni-MH_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

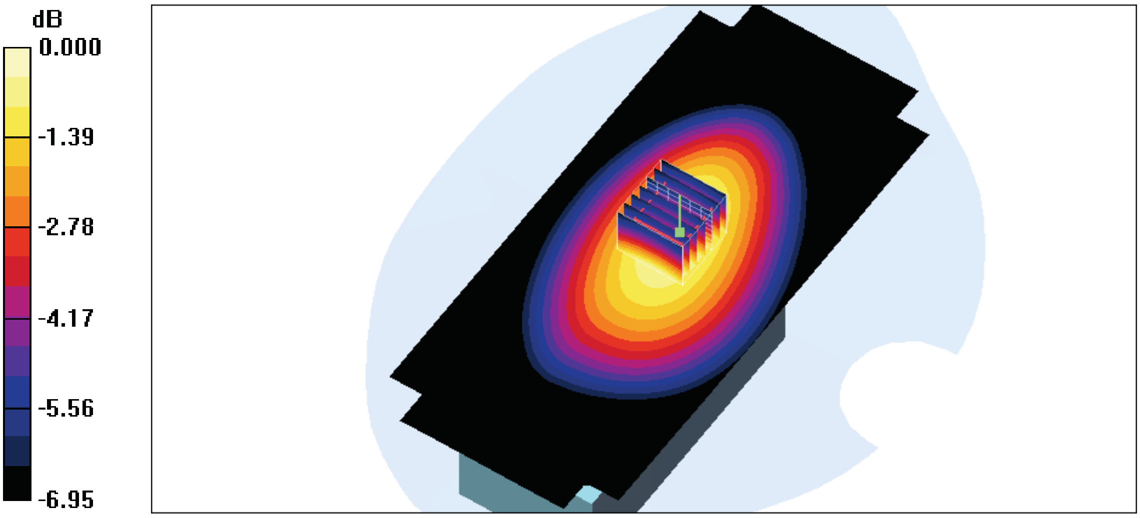
Communication System: GMRS; Frequency: 467.6250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6250 MHz; σ = 0.951 mho/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.17 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 48.2 V/m; Power Drift = -0.193 dB
Peak SAR (extrapolated) = 2.91 W/kg
SAR(1 g) = 2.08 mW/g; SAR(10 g) = 1.51 mW/g
Maximum value of SAR (measured) = 2.34 mW/g



0 dB = 2.34mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/26 AM 02:05:29

Flat_GMRS CH26_Headset_muscle_Alkaline_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

Communication System: GMRS; Frequency: 467.6250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6250 MHz; σ = 0.951 mho/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

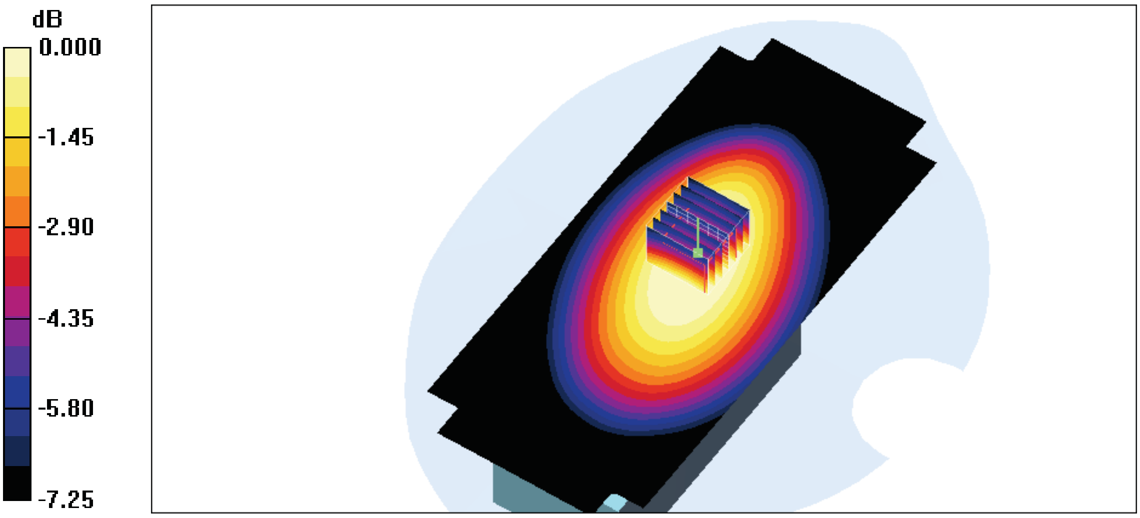
- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x161x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.33 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 58.9 V/m; Power Drift = -0.014 dB
Peak SAR (extrapolated) = 3.69 W/kg
SAR(1 g) = 2.61 mW/g; SAR(10 g) = 1.89 mW/g
Maximum value of SAR (measured) = 2.95 mW/g



0 dB = 2.95mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 AM 10:51:12

Flat_FRS CH11_Headset_muscle_Ni-MH_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

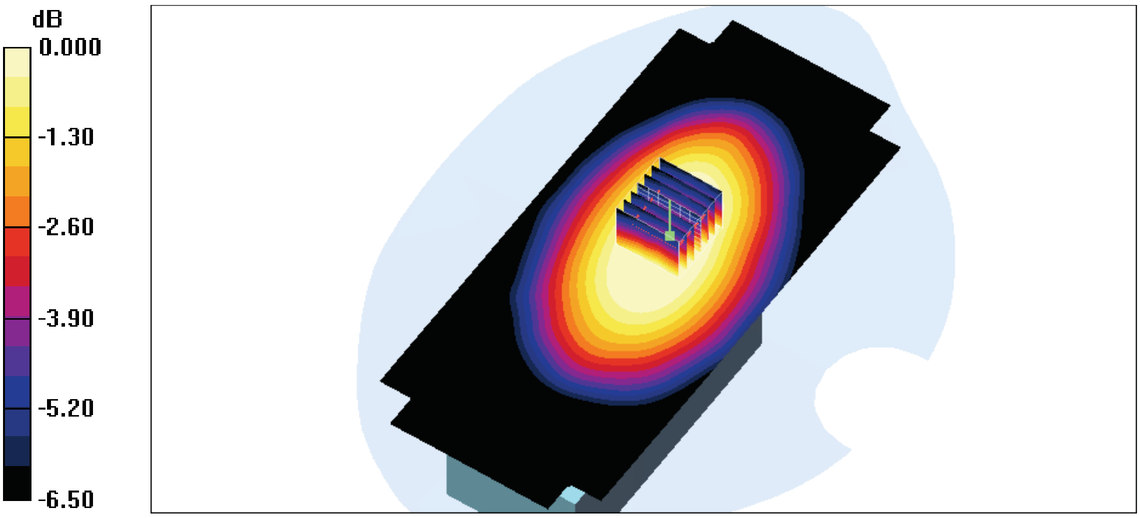
Communication System: FRS; Frequency: 467.6375 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6375 MHz; σ = 0.951 mho/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.071 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 8.15 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 0.075 W/kg
SAR(1 g) = 0.053 mW/g; SAR(10 g) = 0.039 mW/g
Maximum value of SAR (measured) = 0.060 mW/g



0 dB = 0.060mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/1/25 AM 10:58:26

Flat_FRS CH11_Headset_muscle_Alkaline_15mm

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

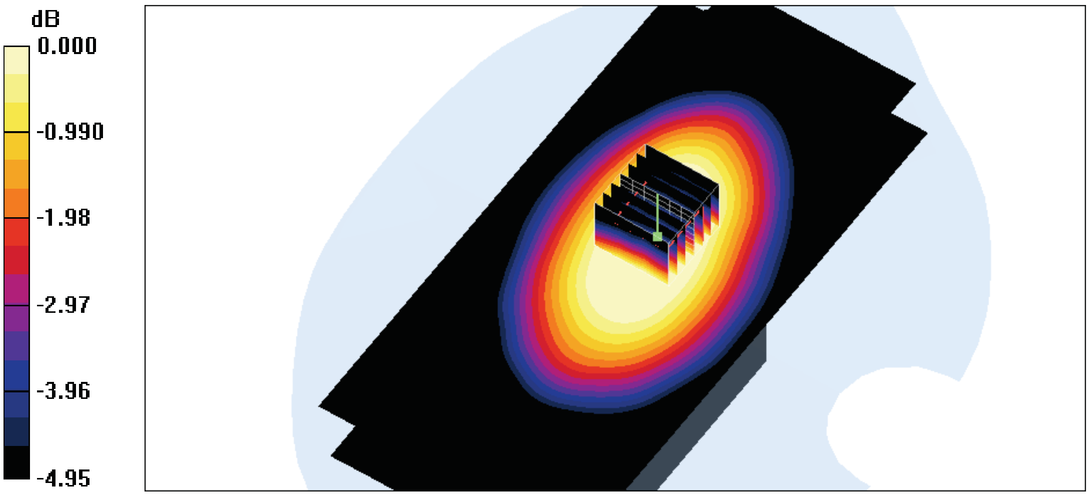
Communication System: FRS; Frequency: 467.6375 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6375 MHz; σ = 0.951 mho/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.075 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 8.33 V/m; Power Drift = 0.031 dB
Peak SAR (extrapolated) = 0.079 W/kg
SAR(1 g) = 0.055 mW/g; SAR(10 g) = 0.040 mW/g
Maximum value of SAR (measured) = 0.062 mW/g



0 dB = 0.062mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 PM 03:45:55

Flat_GMRS CH6_Headset_muscle_belt clip_Ni-MH

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

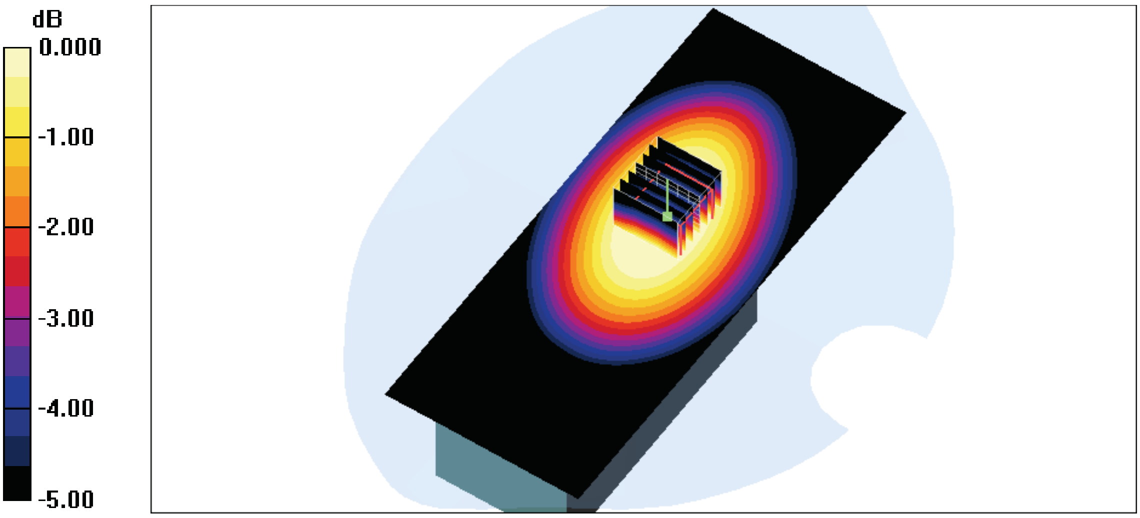
Communication System: GMRS; Frequency: 462.6875 MHz;Duty Cycle: 1:1
Medium parameters used: f = 462.6875 MHz; σ = 0.946 mho/m; ε_r = 55.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (61x151x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.53 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 51.5 V/m; Power Drift = -0.062 dB
Peak SAR (extrapolated) = 2.76 W/kg
SAR(1 g) = 2.03 mW/g; SAR(10 g) = 1.5 mW/g
Maximum value of SAR (measured) = 2.25 mW/g



0 dB = 2.25mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 PM 08:44:25

Flat_GMRS CH6_Headset_muscle_belt clip_Alkaline

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

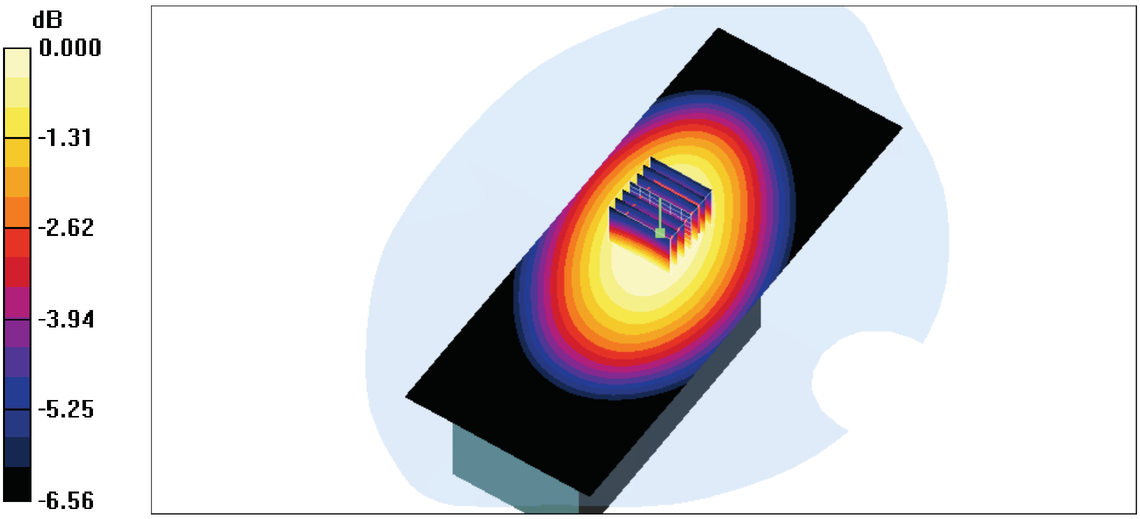
Communication System: GMRS; Frequency: 462.6875 MHz;Duty Cycle: 1:1
Medium parameters used: f = 462.6875 MHz; σ = 0.946 mho/m; ε_r = 55.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (61x151x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.81 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 55.5 V/m; Power Drift = -0.014 dB
Peak SAR (extrapolated) = 3.13 W/kg
SAR(1 g) = 2.3 mW/g; SAR(10 g) = 1.71 mW/g
Maximum value of SAR (measured) = 2.57 mW/g



0 dB = 2.57mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 PM 03:59:00

Flat_GMRS CH26_Headset_muscle_belt clip_Ni-MH

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

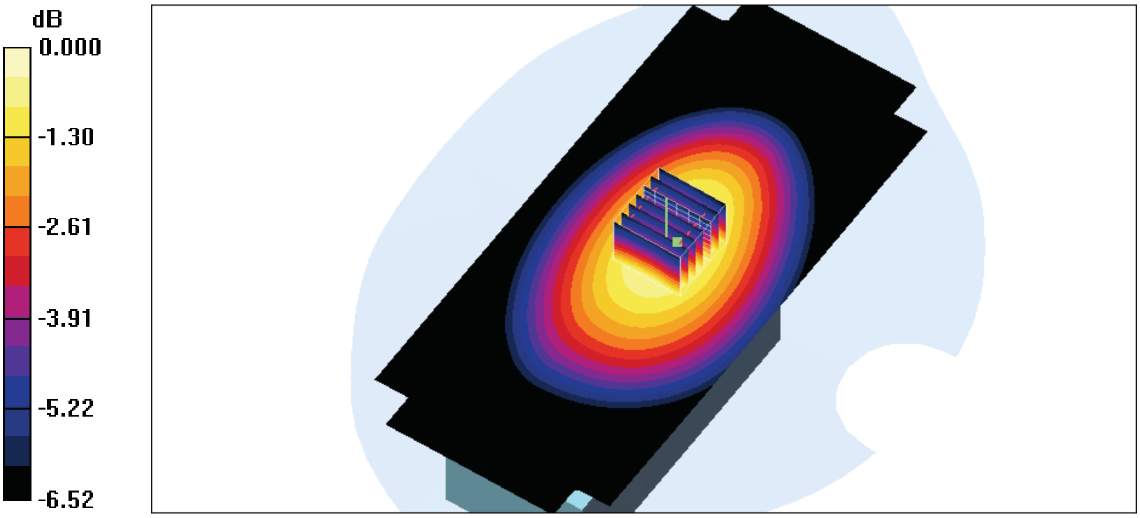
Communication System: GMRS; Frequency: 467.6250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6250 MHz; σ = 0.951 mho/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.77 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 43.6 V/m; Power Drift = 0.085 dB
Peak SAR (extrapolated) = 2.26 W/kg
SAR(1 g) = 1.64 mW/g; SAR(10 g) = 1.2 mW/g
Maximum value of SAR (measured) = 1.83 mW/g



0 dB = 1.83mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 PM 04:43:11

Flat_GMRS CH26_Headset_muscle_belt clip_Alkaline

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

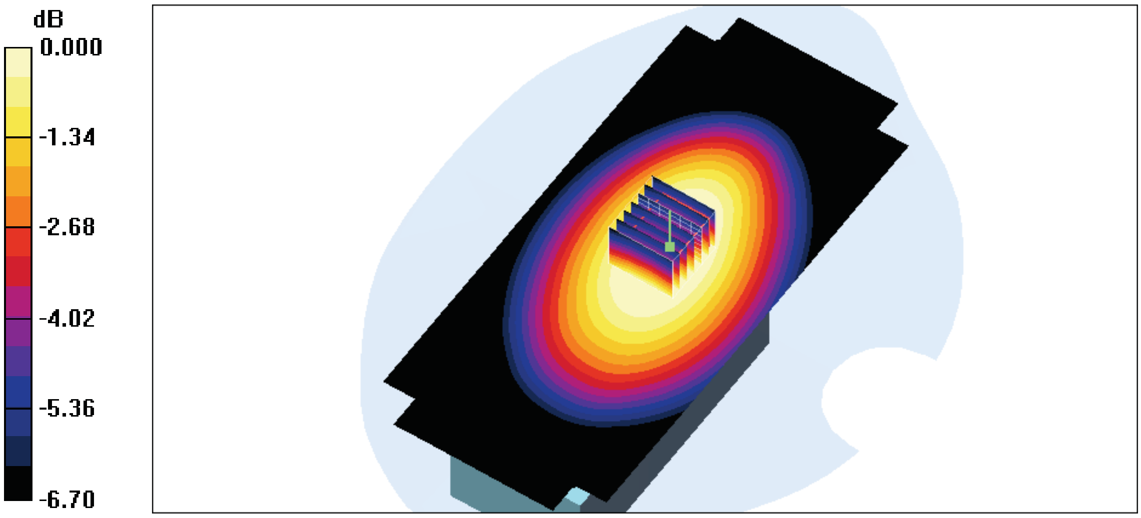
Communication System: GMRS; Frequency: 467.6250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6250 MHz; σ = 0.951 mho/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (71x161x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.76 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 56.1 V/m; Power Drift = -0.039 dB
Peak SAR (extrapolated) = 2.95 W/kg
SAR(1 g) = 2.15 mW/g; SAR(10 g) = 1.58 mW/g
Maximum value of SAR (measured) = 2.40 mW/g



0 dB = 2.40mW/g

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2011/1/25 PM 05:11:31

Flat_FRS CH11_Headset_muscle_belt clip_Ni-MH

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

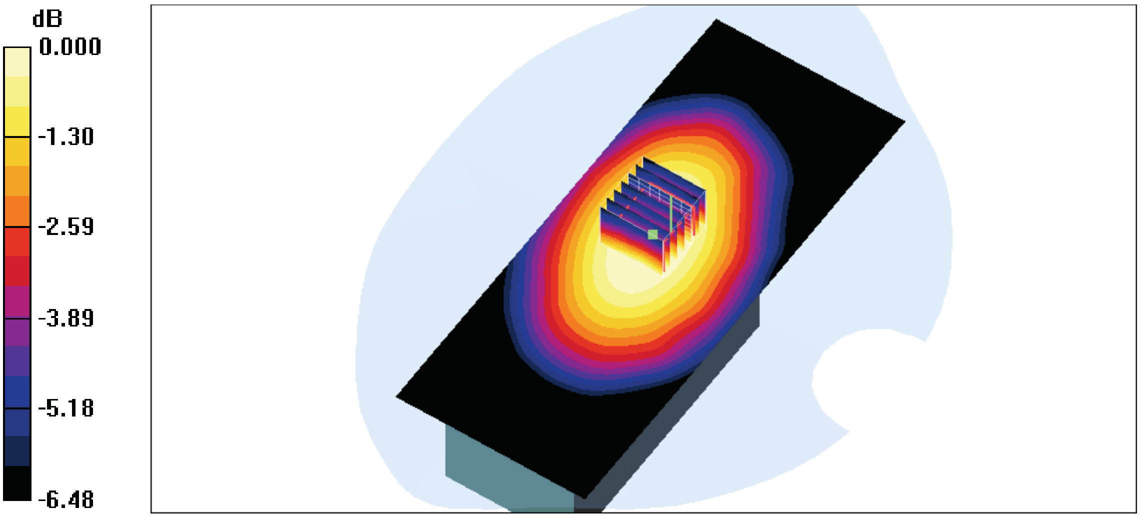
Communication System: FRS; Frequency: 467.6375 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6375 MHz; σ = 0.951 mho/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (61x151x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.048 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 6.62 V/m; Power Drift = 0.087 dB
Peak SAR (extrapolated) = 0.055 W/kg
SAR(1 g) = 0.040 mW/g; SAR(10 g) = 0.030 mW/g
Maximum value of SAR (measured) = 0.045 mW/g



0 dB = 0.045mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2011/1/25 PM 05:14:21

Flat_FRS CH11_Headset_muscle_belt clip_Alkaline

DUT: MS350R; Type: Two Way Radio with GMRS ,FRS; FCC ID: K7GMSFGJ

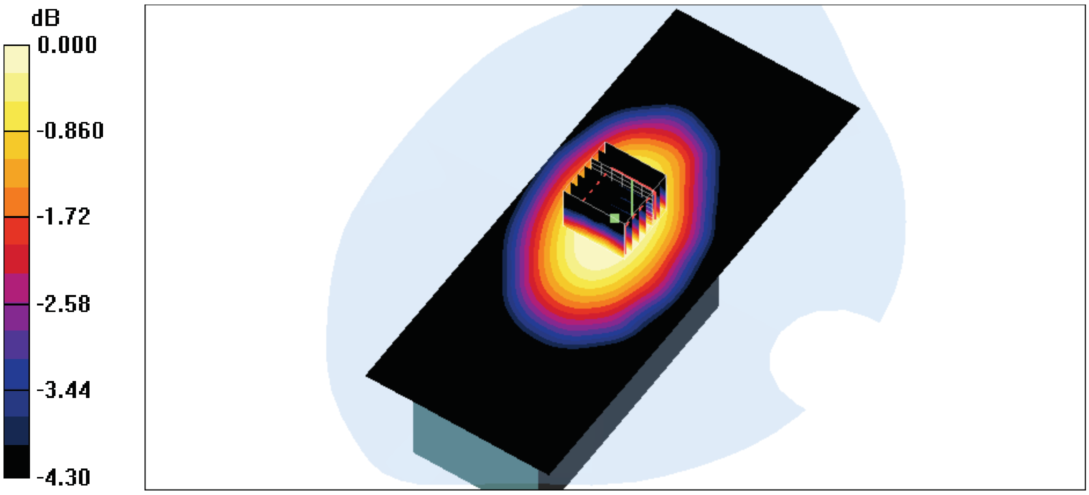
Communication System: FRS; Frequency: 467.6375 MHz;Duty Cycle: 1:1
Medium parameters used: f = 467.6375 MHz; σ = 0.951 mho/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(10.57, 10.57, 10.57); Calibrated: 2010/1/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2010/7/21
- Phantom: SAM 12; Type: SAM v4.0; Serial: TP:1009
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Flat/Area Scan (61x151x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.051 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 6.78 V/m; Power Drift = 0.093 dB
Peak SAR (extrapolated) = 0.059 W/kg
SAR(1 g) = 0.042 mW/g; SAR(10 g) = 0.031 mW/g
Maximum value of SAR (measured) = 0.047 mW/g



0 dB = 0.047mW/g

Appendix C - Calibration

All of the instruments Calibration information are listed below.

- Dipole _ D450V2 SN:1021 Calibration No.D450V2-1021_Feb10
- Probe _ EX3DV4 SN:3632 Calibration No.EX3-3632_Jan10
- DAE _ DAE4 SN:541 Calibration No.DAE4-541_ Jul10

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: **D450V2-1021_Feb10**

CALIBRATION CERTIFICATE

Object	D450V2 - SN: 1021
Calibration procedure(s)	QA CAL-15.v5 Calibration Procedure for dipole validation kits below 800 MHz
Calibration date:	February 24, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ET3DV6 (LF)	SN: 1507	03-Jul-09 (No. ET3-1507_Jul09)	Jul-10
DAE4	SN: 654	04-May-09 (No. DAE4-654_May09)	May-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

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

Issued: February 25, 2010

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

Certificate No: D450V2-1021_Feb10 Page 1 of 9

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**

Glossary:

TSL	tissue simulating liquid
ConF	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 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan Resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	44.4 ± 6 %	0.85 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	398 mW input power	1.95 mW / g
SAR normalized	normalized to 1W	4.90 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**5.01 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.30 mW / g
SAR normalized	normalized to 1W	3.27 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**3.33 mW / g ± 17.6 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ± 6 %	0.90 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	condition	
SAR measured	398 mW input power	1.88 mW / g
SAR normalized	normalized to 1W	4.72 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**4.83 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.25 mW / g
SAR normalized	normalized to 1W	3.14 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**3.22 mW / g ± 17.6 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.2 Ω - 5.9 jΩ
Return Loss	- 21.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	53.9 Ω - 7.8 jΩ
Return Loss	- 21.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.352 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 04, 2004

DASY5 Validation Report for Head TSL

Date/Time: 24.02.2010 10:26:14

Test Laboratory: The name of your organization

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1021

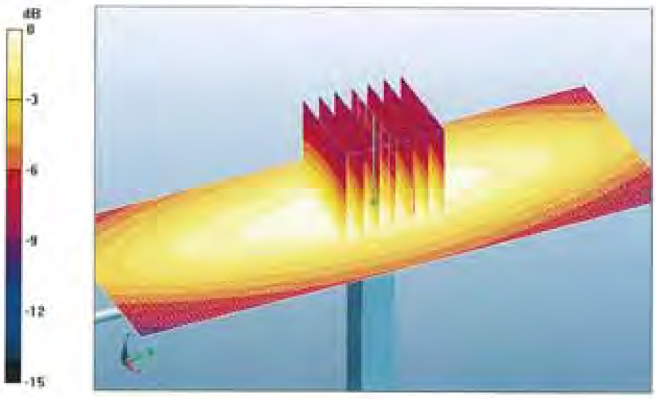
Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450
Medium parameters used: f = 450 MHz; σ = 0.85 mho/m; ε_r = 44.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(6.66, 6.66, 6.66); Calibrated: 03.07.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 04.05.2009
- Phantom: Flat Phantom 4.4 ; Type: Flat Phantom 4.4; Serial: 1002
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 57

Head/d=15mm, Pin=398mW/Area Scan (41x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.06 mW/g

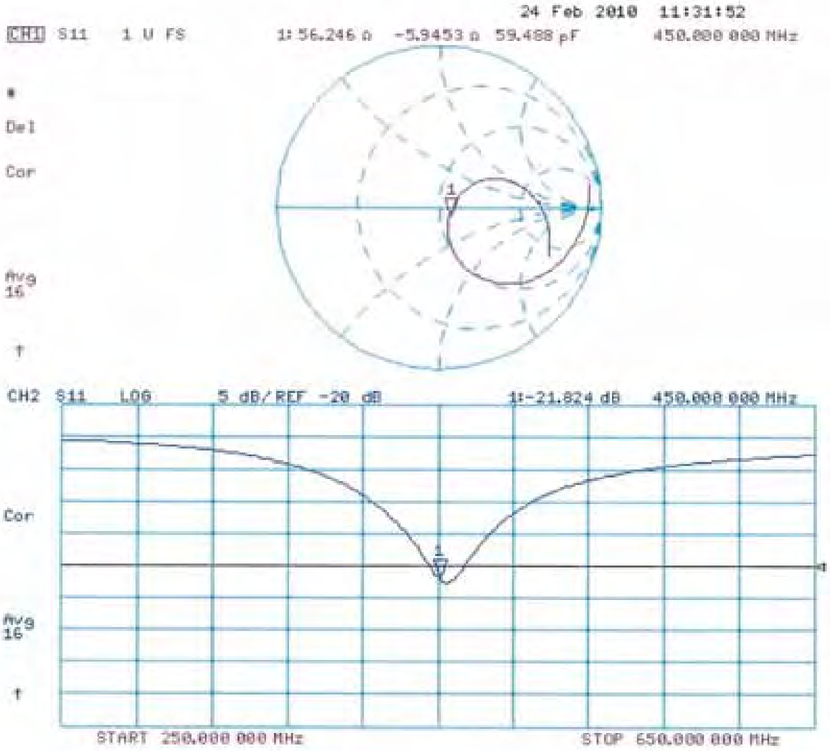
Head/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 51 V/m; Power Drift = -0.032 dB
Peak SAR (extrapolated) = 2.93 W/kg
SAR(1 g) = 1.95 mW/g; SAR(10 g) = 1.3 mW/g
Maximum value of SAR (measured) = 2.09 mW/g



0 dB = 2.09mW/g

Certificate No: D450V2-1021_Feb10 Page 6 of 9

Impedance Measurement Plot for Head TSL



Certificate No: D450V2-1021_Feb10

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DASY5 Validation Report for Body TSL

Date/Time: 24.02.2010 13:35:43

Test Laboratory: The name of your organization

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1021

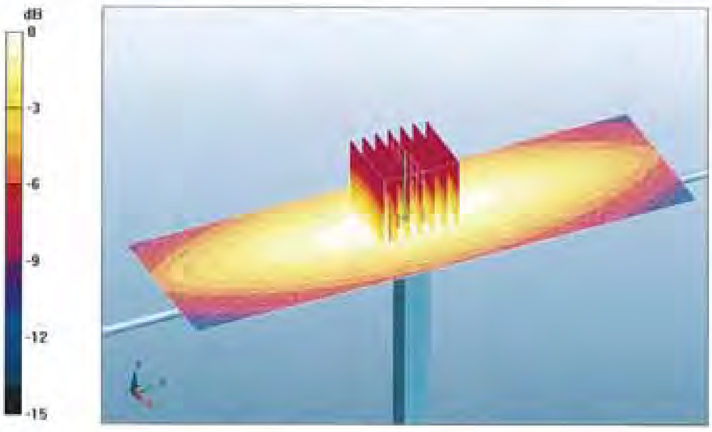
Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1
Medium: MSL450
Medium parameters used: f = 450 MHz; σ = 0.9 mho/m; ε_r = 54.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(7.11, 7.11, 7.11); Calibrated: 03.07.2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 04.05.2009
- Phantom: Flat Phantom 4.4 ; Type: Flat Phantom 4.4; Serial: 1002
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 57

Body/d=15mm, Pin=398mW/Area Scan (61x201x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.99 mW/g

Body/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 48.1 V/m; Power Drift = -0.025 dB
Peak SAR (extrapolated) = 2.86 W/kg
SAR(1 g) = 1.88 mW/g; SAR(10 g) = 1.25 mW/g
Maximum value of SAR (measured) = 2.02 mW/g



0 dB = 2.02mW/g

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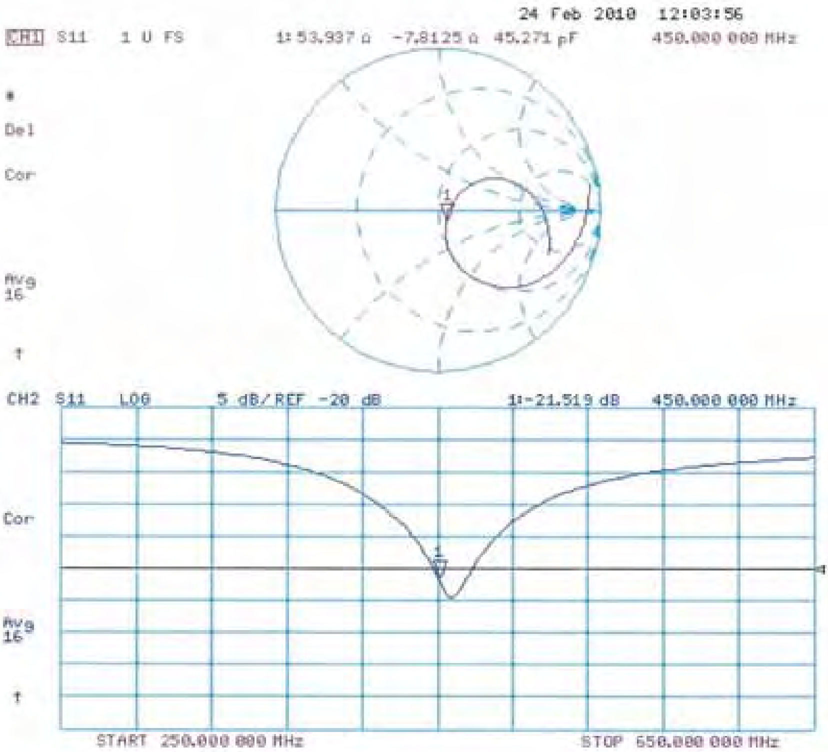
Impedance Measurement Plot for Body TSL



Certificate No: D450V2-1021_Feb10 Page 9 of 9

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Accreditation No.: SCS 108

Client **ATL (Auden)**

Certificate No: **EX3-3632_Jan10**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3632
Calibration procedure(s)	QA CAL-01.v6, QA CAL-12.v6, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	January 26, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Fin Bomholt	R&D Director	

Issued: January 26, 2010

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

Certificate No: EX3-3632_Jan10 Page 1 of 11

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 effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *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 EX3DV4

SN:3632

Manufactured:	November 1, 2007
Last calibrated:	January 13, 2009
Recalibrated:	January 26, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV4 SN:3632

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.46	0.44	0.39	± 10.1%
DCP (mV)[B]	88.1	83.7	91.9	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	± 1.5%
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

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 maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY - Parameters of Probe: EX3DV4 SN:3632

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	9.64	9.64	9.64	0.24	1.00	± 13.3%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	9.11	9.11	9.11	0.63	0.67	± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.80	7.80	7.80	0.64	0.66	± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.81	7.81	7.81	0.76	0.59	± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	7.16	7.16	7.16	0.41	0.82	± 11.0%

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

DASY - Parameters of Probe: EX3DV4 SN:3632

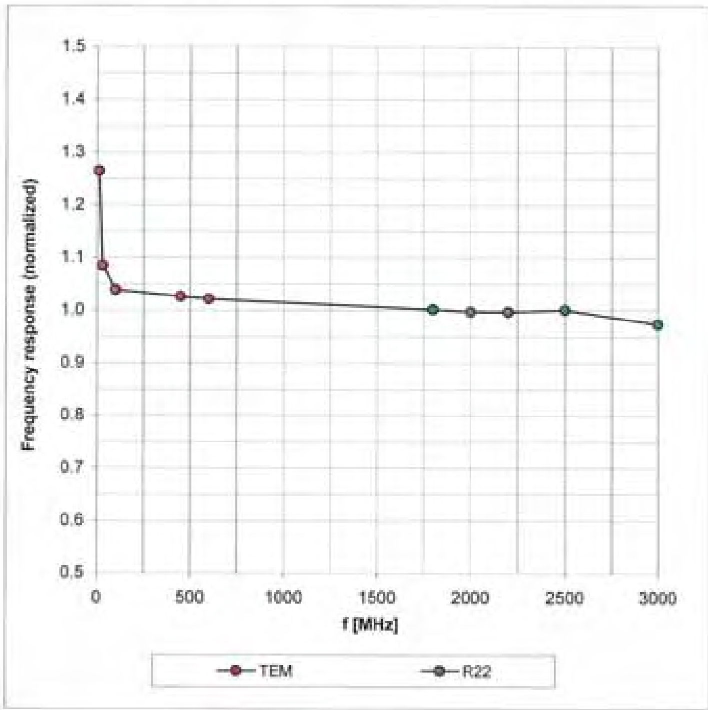
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	10.57	10.57	10.57	0.32	0.47 ± 13.3%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	9.17	9.17	9.17	0.59	0.73 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.84	7.84	7.84	0.68	0.68 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.57	7.57	7.57	0.82	0.60 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	7.40	7.40	7.40	0.45	0.80 ± 11.0%

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

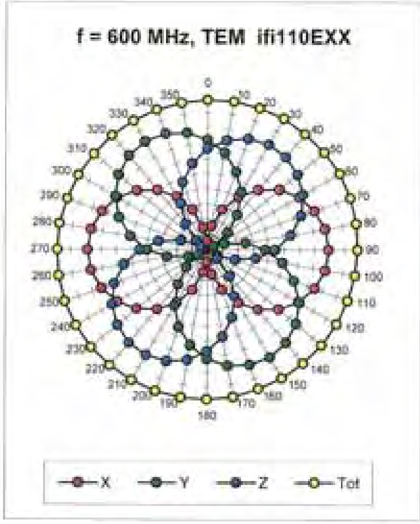
Frequency Response of E-Field

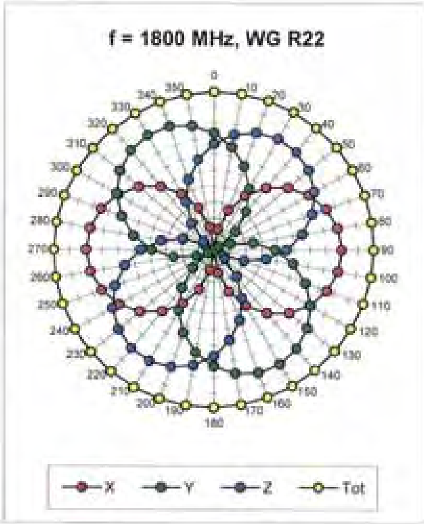
(TEM-Cell:ifi110 EXX, Waveguide: R22)

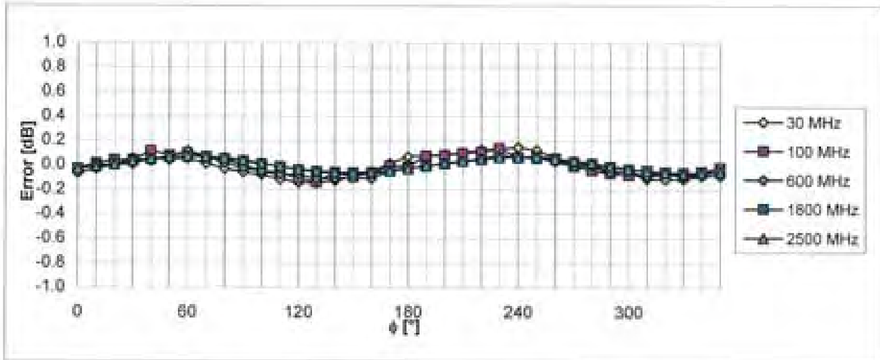


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (φ), ϑ = 0°



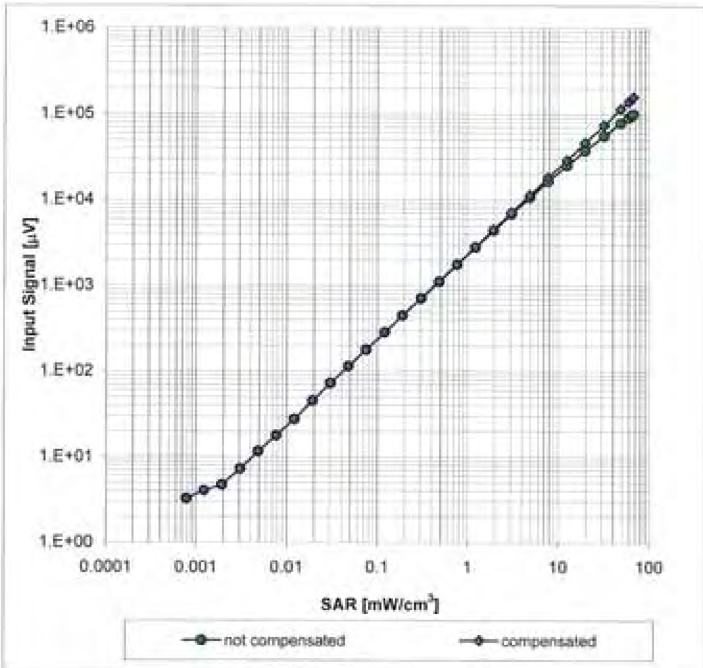


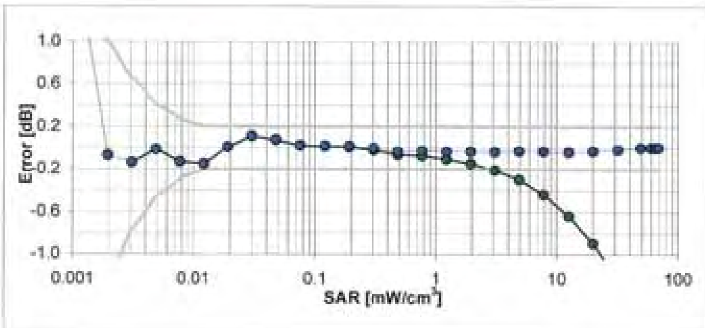


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

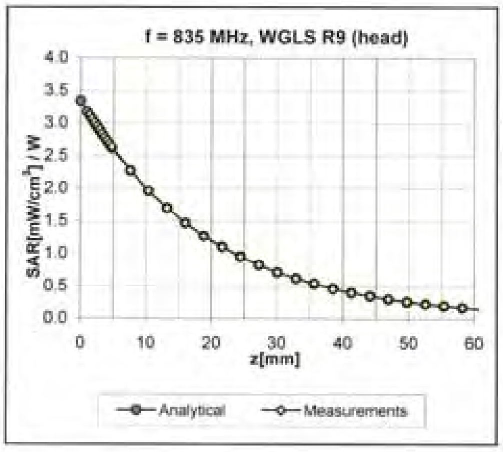
(Waveguide R22, f = 1800 MHz)

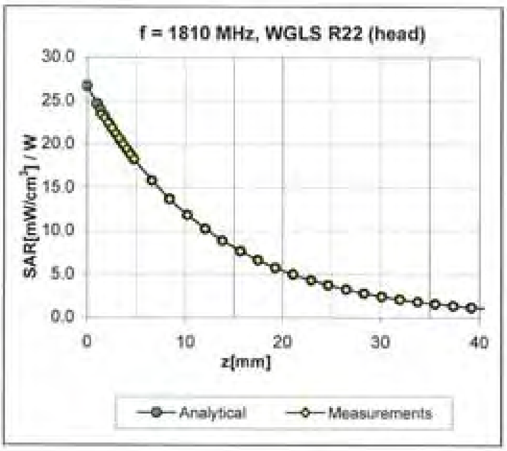




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

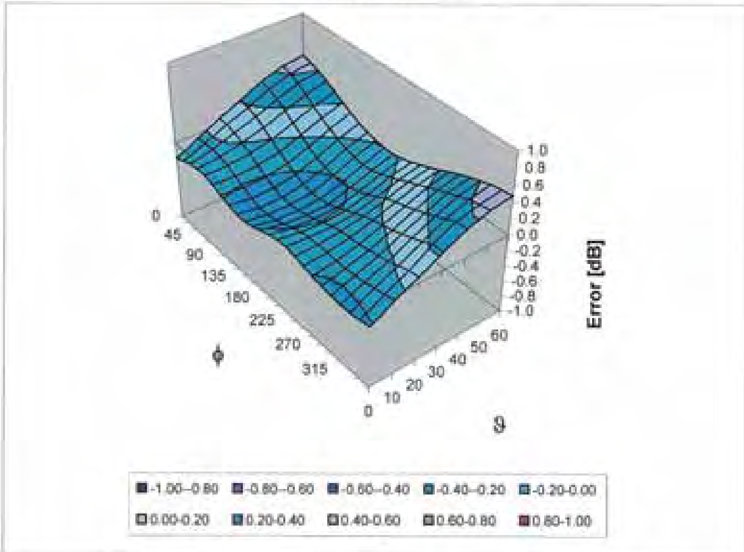
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

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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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **DAE4-541_Jul10**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 541
Calibration procedure(s)	QA CAL-06.v21 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	July 21, 2010

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	1-Oct-09 (No: 9055)	Oct-10
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: July 21, 2010

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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:* 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	404.537 ± 0.1% (k=2)	404.418 ± 0.1% (k=2)	404.182 ± 0.1% (k=2)
Low Range	3.96832 ± 0.7% (k=2)	3.93576 ± 0.7% (k=2)	3.97526 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	290.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200007.6	-2.45	-0.00
Channel X	+ Input	20002.71	3.11	0.02
Channel X	- Input	-19993.80	5.60	-0.03
Channel Y	+ Input	200009.7	0.90	0.00
Channel Y	+ Input	19997.49	-2.11	-0.01
Channel Y	- Input	-20001.06	-0.96	0.00
Channel Z	+ Input	200007.5	-0.73	-0.00
Channel Z	+ Input	20001.10	1.40	0.01
Channel Z	- Input	-19996.58	3.52	-0.02

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.2	0.31	0.02
Channel X	+ Input	199.75	-0.05	-0.03
Channel X	- Input	-200.44	-0.34	0.17
Channel Y	+ Input	2001.5	1.51	0.08
Channel Y	+ Input	199.36	-0.64	-0.32
Channel Y	- Input	-200.93	-0.93	0.47
Channel Z	+ Input	2000.3	0.13	0.01
Channel Z	+ Input	198.98	-1.02	-0.51
Channel Z	- Input	-201.02	-1.02	0.51

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	11.44	10.03
	- 200	-8.47	-10.20
Channel Y	200	1.54	1.18
	- 200	-2.96	-2.67
Channel Z	200	1.08	0.90
	- 200	-2.05	-2.13

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	-	1.55	-0.83
Channel Y	200	2.34	-	3.70
Channel Z	200	0.27	-0.67	-

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	16010	15908
Channel Y	15784	14840
Channel Z	15973	16097

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	-0.03	-0.96	1.03	0.29
Channel Y	-0.54	-1.32	0.40	0.34
Channel Z	-0.86	-1.49	-0.32	0.26

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	199.5
Channel Y	0.2000	203.1
Channel Z	0.2001	203.2

8. Low Battery Alarm Voltage (verified during pre test)

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

9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9