

SGS TESTING KOREA

TEST – REPORT

SAR Compliance Test Report

Test report no.:

STROS-06-002

SAR

SGS TESTING KOREA Co., Ltd. 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea, 435-041

PHONE +82 31 428 5700

FAX +82 31 427 2371

TABLE OF CONTENTS

1	<u>General information</u>
1.1	<u>Notes</u>
1.2	<u>Testing laboratory</u>
1.3	<u>Details of approval holder</u>
1.4	<u>Manufacturer</u>
1.5	<u>Test item</u>
1.6	<u>Test results</u>
1.7	<u>Test standards</u>
2	<u>Technical test</u>
2.1	<u>Summary of test results</u>
2.2	<u>Test environment</u>
2.3	<u>Test equipment utilized</u>
2.4	<u>Definitions</u>
2.5	<u>Measurement system description</u>
2.6	<u>Test system specification</u>
2.7	<u>Measurement procedure</u>
2.8	<u>Reference positions for handheld radio transmitters</u>
2.9	<u>Measurement uncertainty</u>
3	<u>Tissue and system verification</u>
3.1	<u>Tissue verification</u>
3.2	<u>System verification</u>
4	<u>Test Results</u>
5	<u>References</u>
6	<u>Appendix</u>

1 General Information

1.1 Notes

The purpose of conformity testing is to increase the probability of adherence to the essential requirements or conformity specifications, as appropriate.

The complexity of the technical specifications, however, means that full and thorough testing is impractical for both technical and economic reasons.

Furthermore, there is no guarantee that a test sample which has passed all the relevant tests conforms to a specification.

The existence of the tests nevertheless provides the confidence that the test sample possesses the qualities as maintained and that its performance generally conforms to representative cases of communications equipment.

The test results of this test report relate exclusively to the item tested as specified in 1.5.

The test report may only be reproduced or published in full.

Reproduction or publication of extracts from the report requires the prior written approval of the SGS Testing Korea.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualification of all persons taking them.

Tester:

January 23, 2006

Elvin Lee



Date

Name

Signature

Technical responsibility for area of testing:

February 1, 2006

Albert Lim



Date

Name

Signature

SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>



1.2 Location of Testing laboratory

SGS Testing Korea Co., Ltd.
18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do
Korea
Telephone : +82 31 428 5700
Fax : +82 31 427 2371

1.3 Details of approval holder

Name	Midland Radio Corporation
Address	1120 Clay Street, North Kansas City, Missouri, USA 64116
Country	USA
Telephone	816 241 8500
Fax	816 241 5713
Contact	David Kingsolver
E-Mail	davidk@midlandradio.com

1.4 Manufacturer: (if applicable)

Name	: Daxian Telecommunication Ltd.
Street	: No.2 industrial Area, Tangxiayong, Songgang
Town	: Shenzhen City
Country	: China

1.5 Test item

FCC ID :MMALXT300
Description of test item :Family Radio Face Held Transmitter
(GMRS/FRS Combination)
Type identification :LXT-300
Serial number : 512000006
Device category : FRS/GMRS TRANSCEIVER

Technical data

Tx Frequency range (GMRS) : 462.5500 – 462.7250 MHz
Tx Frequency range (FRS) : 467.5625 – 467.7125 MHz
Rx Frequency range (GMRS) : 462.5500 – 462.7250 MHz
Rx Frequency range (FRS) : 467.5625 – 467.7125 MHz
Max. Conducted RF output power : 1.0W - GMRS
: 0.5W - FRS
Power supply : 1.5 Vdc battery X 4
Antenna Tx : external
Antenna Rx : external
Antenna type : Permanently Attached

1.6 Test Results

Max. SAR Measurement: 0.635 W/kg (averaged over 1 gram)

This EUT has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001) and IEEE Std. 1528-200X(Draft 6.5, January 2002).

1.7 Test standards

Standards : - IEEE Std. 1528-200X (Draft 6.5, January 2002)
FCC Rule Part(s) : - FCC OET Bulletin 65, Supplement C, Edition 01-01

2 Technical test

2.1 Summary of test results

Classification

Uncontrolled environment/general population	X
Controlled exposure/occupational environment	

Applicable Configuration

Handset (Head)	
Handset (Held to face)	X
Handset (Body)	
Headset (Head)	
Body Worn Equipment	X

EUT complies with the RF radiation exposure limits of the FCC as shown by the SAR measurement results. These measurements are taken to simulate the RF effects exposure under worst -case conditions. The EUT complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interaction, environmental conditions, and physiological variables. [1]

2.2 Test environment

Room temperature : 22.2–22.6°C

Liquid temperature : 22.2 -22.5°C

Relative humidity content :46%



Test equipment utilized

Type / Model	Calib. Date	S/N
Staubli Robot / RX90BL	N/A	F03/5W05A1/A/01
Staubli Robot Controller / RX90B L	N/A	F03/5W05A1/C/01
Staubli Manual Control Operator	N/A	D22134006 1
PC / IBM NetVista 2.66	N/A	99LA523
OS / Windows 2000	N/A	-
SPEAG DAE / DAE3	April 2004	567
SPEAG E-Field Probe / ET3DV6	April 2004	1782
SPEAG Dummy Probe	N/A	-
SPEAG SAM Phantom	N/A	TP -1300, TP -1299
SPEAG Flat Phantom	N/A	1003, 1005
SPEAG Validation Dipole D450V2	July 2003	1015
SPEAG Validation Dipole D835V2	June 2003	490
SPEAG Validation Dipole D900V2	June 2003	188
SPEAG Validation Dipole D1800V2	June 2003	2d074
SPEAG Validation Dipole D1900V2	June 2003	5d033
SPEAG Validation Dipole D2450V2	July 2003	734
Dipole Antenna/ VHAP/UHAP	May 2004	958
Mounting Device	N/A	-

2.3 Definitions

2.3.1 SAR

The specific absorption rate (SAR) is defined as the time derivative of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ), expressed in watts per kilogram (W/kg)

$$SAR = \frac{d}{dt} \left(\frac{dW}{dm} \right) = \frac{d}{dt} \left(\frac{dW}{\rho \cdot dV} \right) = \frac{\sigma}{\rho} |E_t|^2$$

where:

$$\frac{dW}{dt} = \int_v E \cdot J dV = \int_v \sigma E^2 dV$$

2.3.2 Uncontrolled Exposure

The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices. [2]

2.3.3 Controlled Exposure

In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on the risk of potential exposure and instructions on methods to minimize such exposure risks. [2]

Push-to-talk applications (PTT) operating in front of a person's face and certain body worn configurations as occupational/controlled exposure. The consideration of a 50% duty factor for PTT simplex radio-carrying typical voice traffic is possible.

SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

2.4 Measurement System Description

2.4.1 System Setup

Measurements are performed using the DASY4 automated dosimetric assessment system (figure 1) made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland.

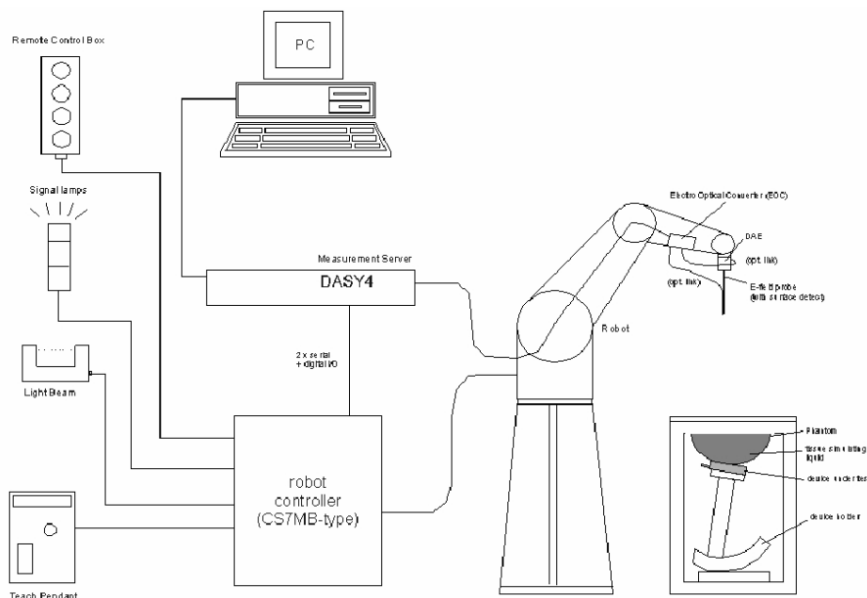


Figure1

The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software.
- An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- An unit to operate the optical surface detector which is connected to the EOC.
- The Electro-optical converter (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the measurement server.
- The functions of the measurement server is to perform the time critical task such as signal filtering, surveillance of the robot operation, fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.

SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041
 Tel. +82 31 428 5700 / Fax. +82 31 427 2371
<http://www.sgstesting.co.kr>

- Tissue simulating liquid mixed according to the given recipes (see Application Notes).
- System validation dipoles allowing to validate the proper functioning of the system.

2.4.2 Phantom Description



(figure 2.1)

The SAM twin phantom V4.0 (figure 2.1) is a fiberglass shell phantom with 2 mm shell thickness. It has three measurement areas:

- Left hand
- Right hand
- Flat phantom
- The phantoms are integrated in a wooden table.



(figure 2.2)

The FLATPHANTOM V4 (figure 2.2) is a phantom for dosimetric evaluations of body mounted usage and system performance check for the frequency up to 3 GHz.

The bottom plate of the table contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used(e.g., for different liquids).

A cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible.

On the phantoms top, three reference markers are provided to identify the phantom positions with respect to the robot.

2.4.3 Tissue Simulating Liquids

The parameters of the tissue simulating liquid strongly influence the SAR. The parameters for the different frequencies are defined in the corresponding compliance standards (e.g., EN 50361, IEEE P1528-200X).

Tissue dielectric properties

Frequency (MHz)	Head		Body	
	Relative Dielectric Constant (ϵ)	Conductivity(σ) (S/m)	Relative Dielectric Constant (ϵ)	Conductivity(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
1450	40.5	1.20	54.0	1.30
1800	40.0	1.40	53.3	1.52
1900	40.0	1.40	53.3	1.52
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

2.4.4 Device Holder

The DASY device holder (figure 3.1) is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The rotation center for both scales is the ear opening. Thus the device needs no repositioning when changing the angles.



Figure 3.1

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

2.4.5 Probes

The SAR measurements were conducted with the dosimetric probe ET3DV6 (figure 4), designed in the classical triangular configuration and optimized for dosimetric evaluation. [3] The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber 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 at reaching the maximum.



Figure 4

Probe Specifications

Calibration:	In air from 10 MHz to 2.5 GHz In brain and muscle simulating tissue at Frequencies of 150 MHz, 300 MHz, 450 MHz, 835 MHz, 900 MHz, 1800 MHz, 1900 MHz and 2450 MHz Calibration certificates please find attached.
Frequency:	10 MHz to > 3 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal probe axis)
Dynamic Range:	5 μ W/g to > 100 mW/g;
Linearity:	± 0.2 dB
Dimensions:	Overall length: 330mm Tip length: 16mm Body diameter: 12mm Tip diameter: 6.8mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

SGS Testing Korea Co., Ltd.

2.5 Test System Specification

Positioner

Robot: Staubli Animation Corp. Robot Model: RX90B L
Repeatability: 0.02 mm
No. of axis: 6

Data Acquisition Electronic(DAE) System

Cell Controller

Processor: Intel Pentium 4
Clock Speed: 2.66GHz
Operating System: Windows 2000
Data Card: DASY4 PC-Board
Data Converter
Features: Signal Amplifier, multiplexer, A/D converter, & control logic
Software: DASY4 software
Connecting Lines: Optical downlink for data and status info.
Optical uplink for commands and clock

PC Interface Card

Function: 24 bit (64 MHz) DSP for real time processing
Link to DAE3
16 bit A/D converter for surface detection system
serial link to robot
direct emergency stop output for robot

E-Field Probes

Model: ET3DV6 / SN1782
Construction: Triangular core fiber optic detection system
Frequency: 10 MHz to 6 GHz
Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Phantom

Phantom: SAM Twin Phantom(V4.0)
Shell Material: Fiberglass
Thickness: 2.0 ± 0.2 mm

Phantom

Phantom: Flat Phantom (V4.4)
Shell Material: Fiberglass
Thickness: $6 \text{ mm} \pm 0.2 \text{ mm}$

2.7 Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.
2. The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 10mm x 10mm.
3. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 30mm x 30mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 5 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:
 - a. The data at the surface was extrapolated, since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. The extrapolation was based on a least square algorithm [4]. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
 - b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions) [4] [5]. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
 - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as procedure #1, was remeasured. If the value changed by more than 5%, the evaluation is repeated.

2.8 Reference Positions for Handheld Radio Transmitters

In general handheld radio transmitters like PMR/SMR devices are used in held to face position or with a speaker/microphone combination as body-worn configuration.

1.8.1 Held to face position

For held to face position the flat section of a SAM Phantom or a flat phantom is used. The center of the radiating structure is to set on the middle position of the flat phantom. The distance between sample and flat phantom is 2.5 cm, similar to the real using. For the measurement head tissue simulating liquid is used.

1.8.2 Belt Clip/Holster Configuration

Test configurations for body-worn operated EUTs are carried out while the belt-clip and/or holster is attached to the EUT and placed against a flat phantom in a regular configuration. An EUT with a headset output is tested with a headset connected to the device.

Body dielectric parameters are used.

There are two categories for accessories for body-worn operation configurations:

1. accessories not containing metallic components
2. accessories containing metallic components.

When the EUT is equipped with accessories not containing metallic components the tests are done with the accessory that dictates the closest spacing to the body. For accessories containing metallic parts a test with each one is implemented. If the multiple accessories share an identical metallic component (e.g. the same metallic belt -clip used with different holsters with no other metallic components) only the accessory that has the closest spacing to the body is tested.

In case that a EUT authorized to be body-worn is not supplied or has no options to be operated with any accessories, a test configuration where a separation distance between the back of the device and the flat phantom is used. All test position spacings are documented.

Transmitters operating in front of a person's face (e.g. push-to -talk configurations) are tested for SAR compliance with the front of the device positioned to face the flat platform. SAR Compliance tests for shoulder, waist or chest-worn transmitters are carried out with the accessories including headsets and microphones attached to the device and placed against a flat phantom in a regular configuration.

The SAR measurements are performed to investigate the worst-case positioning. This is documented and used to perform Body SAR testing. [2]. Body tissue simulating liquid is used.

1.9 Measurement uncertainty

The uncertainty budget has been determined for the DASY4 system performance check according to IEEE Str. 1528-200X, (draft), April 2002.

Error Description	Uncertainty value $\pm\%$	Probability distribution	Divisor	c_i 1g	Standard unc. (1g)	v_i or v_{eff}
Measurement System						
Probe Calibration	± 4.8	normal	1	1	± 4.8	∞
Axial Isotropy	± 4.7	rectangular	$\sqrt{3}$	$(1-\epsilon_p)^{-1/2}$	± 1.9	∞
Hemispherical Isotropy	± 9.6	rectangular	$\sqrt{3}$	$(\epsilon_p)^{-1/2}$	± 3.9	∞
Boundary effects	± 1.0	rectangular	$\sqrt{3}$	1	± 0.6	∞
Linearity	± 4.7	rectangular	$\sqrt{3}$	1	± 2.7	∞
System Detection limits	± 1.0	rectangular	$\sqrt{3}$	1	± 0.6	∞
Readout Electronics	± 1.0	normal	1	1	± 1.0	∞
Response time	± 0.8	rectangular	$\sqrt{3}$	1	± 0.5	∞
Integration time	± 2.6	rectangular	$\sqrt{3}$	1	± 1.5	∞
RF Ambient Conditions	± 3.0	rectangular	$\sqrt{3}$	1	± 1.7	∞
Probe Positioner Mechanical Tolerance	± 0.4	rectangular	$\sqrt{3}$	1	± 0.2	∞
Probe Positioning with respect to Phantom Shell	± 2.9	rectangular	$\sqrt{3}$	1	± 1.7	∞
Extrapolation, Interpolation and Integration Algorithms for Max. SAR Evaluation	± 1.0	rectangular	$\sqrt{3}$	1	± 0.6	∞
Test Sample Related						
Test Sample Positioning	± 2.9	normal	1	1	± 2.9	145
Device Holder Uncertainty	± 3.6	normal	1	1	± 3.6	5
Output Power Variation – SAR drift measurement	± 5.0	rectangular	$\sqrt{3}$	1	± 2.9	∞
Phantom and Tissue Parameters						
Phantom Uncertainty (shape and thickness tolerances)	± 4.0	rectangular	$\sqrt{3}$	1	± 2.3	∞
Liquid conductivity Target - tolerance	± 5.0	rectangular	$\sqrt{3}$	0.64	± 1.8	∞
Liquid conductivity – measurement uncertainty	± 2.5	normal	1	0.64	± 1.6	∞
Liquid permittivity Target - tolerance	± 5.0	rectangular	$\sqrt{3}$	0.6	± 1.7	∞
Liquid permittivity – measurement uncertainty	± 2.5	normal	1	0.6	± 1.5	∞
Combined Standard Uncertainty					± 10.3	330
Coverage Factor for 95%		$k = 2$				
Expanded Standard Uncertainty					± 20.6	

3. Tissue and System Verification

3.1 Tissue Verification

Dielectric parameters of the simulating liquids were verified using a Dielectric Probe Kit Agilent 85070D to a tolerance of $\pm 5\%$.

Room Temperature: 22.2 - 22.6°C

	Measured Tissue Parameters	
	450 MHz Head	
	Target	Measured
Date		January 23, 2005
Liquid Temperature: °C		22.2
Dielectric Constant: ϵ	45.30	43.86
Conductivity: σ	0.87	0.84

	Measured Tissue Parameters	
	450 MHz Body	
	Target	Measured
Date		January 23, 2005
Liquid Temperature: °C		22.5
Dielectric Constant: ϵ	56.70	57.63
Conductivity: σ	0.94	1.00

3.2 System Verification

Prior to the assessment, the system was verified by using a 300 MHz validation dipole. Power level of 250mW was supplied to the dipole antenna placed under the flat section of SAM Phantom.

The system was verified to a tolerance of $\pm 10\%$

Room Temperature: 22.2 - 22.6°C

Liquid Temperature: 22.2 - 22.5°C

Liquid Depth: >15 cm

System Dipole Validation Target & Measurement					
Date	System Validation Kit:	Liquid	Targeted SAR 1g(mW/g)	Measured SAR 1g(mW/g)	Deviation (%)
Jan26, 2006	D450V2	450 MHz Head	4.9	4.68	- 4.49

Comment: Please find attached the measurement plots.

4. Test Results

Procedures Used To Establish Test Signal

The EUT is general 1.5V batteries operated. The battery used new one on each time. The device was tested at full power verified by implementing conducted output power measurements. For confirming of the output power it was tested before and after each SAR measurement. The test was repeated if a conducted power deviation of more than 5% occurred.

The battery of popular brand (Rocket) in local was used at every channel.

And both of batteries of international popular brand (Energizer & Duracell) were used at highest channel.

Mixture Type: 450 MHz Head

Date: Jan 23, 2006

Liquid Temperature: 22.2 - 22.5°C

Room Temperature: 22.2 - 22.6°C

Frequency			Modulation	Antenna Pos.	Battery	Test Position -25 mm	SAR (W/kg) 1g	
Frequency MHz	Mode	Channel No.					Measured SAR values	
							100% Duty Cycle	50% Duty Cycle
462.5500	GMRS (Low)	15	CW	Fixed	Rocket	Flat	0.742	0.371
462.6375	GMRS (Mid)	4	CW	Fixed	Rocket	Flat	0.759	0.380
462.7250	GMRS (High)	22	CW	Fixed	Rocket	Flat	0.889	0.445
467.5625	FRS (Low)	8	CW	Fixed	Rocket	Flat	0.390	0.195
467.6375	FRS (Mid)	11	CW	Fixed	Rocket	Flat	0.425	0.213
467.7125	FRS (High)	14	CW	Fixed	Rocket	Flat	0.480	0.240
462.7250	GMRS (High)	22	CW	Fixed	Energizer	Flat	0.834	0.417
462.7250	GMRS (High)	22	CW	Fixed	Duracell	Flat	0.857	0.429

1. The SAR values found were below the maximum limit of 1.6 w/kg (Uncontrolled exposure):
2. The highest face-held SAR value found was **0.445** W/kg (50% duty cycle)

SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Mixture Type: 4500 MHz Body

Date: Jan 23, 2006

Liquid Temperature: 22.2 - 22.5°C

Room Temperature: 22.2 – 22.6°C

Frequency			Power Drift dBm	Antenna Pos.	Phantom	Test Position	SAR (W/kg) 1g	
MHz	Channel	Modulation					Measured SAR values	
							100% Duty Cycle	50% Duty Cycle
462.5500	GMRS (Low)	15	CW	Fixed	Rocket	Flat	1.01	0.505
462.6375	GMRS (Mid)	4	CW	Fixed	Rocket	Flat	1.23	0.615
462.7250	GMRS (High)	22	CW	Fixed	Rocket	Flat	1.06	0.530
467.5625	FRS (Low)	8	CW	Fixed	Rocket	Flat	0.481	0.241
467.6375	FRS (Mid)	11	CW	Fixed	Rocket	Flat	0.598	0.299
467.7125	FRS (High)	14	CW	Fixed	Rocket	Flat	0.546	0.273
462.6375	GMRS (Mid)	22	CW	Fixed	Energizer	Flat	1.27	0.635
462.6375	GMRS (Mid)	22	CW	Fixed	Duracell	Flat	1.18	0.590

1. The SAR values found were below the maximum limit of 8.0 w/kg (controlled exposure):
2. The highest body-worn SAR value found was 0.635 W/kg (50% duty cycle)
3. The EUT was tested for body-worn SAR with the attached belt-clip providing separation distance between the front of the EUT and the outer surface of the planar phantom.

Limits:

Exposure Limits	SAR (W/kg)	
	Uncontrolled Exposure/General Population Environment	Controlled Exposure/Occupational Environment
Spatial Average SAR (averaged over the whole body)	0.08	0.40
Spatial Peak SAR (averaged over any 1g of tissue)	1.60	8.00
Spatial Peak SAR (Hands, Feet, Ankles, Wrist) (averaged over any 10g of tissue)	4.00	20.00

Notes:

1. Test data represent the worst case SAR value and test procedure used are according to OET Bulletin 65, Supplement C (01-01).
2. All Modes of operation were investigated.

5. References

- [1] ANSI/IEEE C95.3 – 1991, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic fields, 300 KHz to 100 GHz, New York: IEEE, Aug. 1992.
- [2] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields, July 2001.
- [3] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.
- [4] W. Gander, Computer mathematics, Birkhaeuser, Basel, 1992.
- [5] W.H. Press, S.A Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.
- [6] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-200X (Draft 6.1 – January 2002), Draft Recommended Practice for Determining the Peak Spatial-Average Absorption Rate (SAR in the Human Body Due to Wireless Communications Devices: Experimental Techniques).
- [7] DASY4 Dosimetric Assessment System Manual; Draft; September 6, 2002; Schmid & Partner Engineering AG.



6. Appendix

Appendix A	DIPOLE VALIDATION PLOTS	
	SAR TEST PLOTS	- Head
		- Body
Appendix B	TEST SETUP & DUT	
	PHOTOGRAPHS	
Appendix C	CALIBRATION CERTIFICATE	- DAE
		- PROBE
		- DIPOLE

Appendix A

DIPOLE VALIDATION PLOTS

Date/Time: 2006-01-23 11:29:24

Test Laboratory: SGS Testing Korea

Validation Test

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1015

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium: HSL 450MHz Medium parameters used: $f = 450 \text{ MHz}$; $\sigma = 0.841 \text{ mho/m}$; $\epsilon_r = 43.9$; $\rho = 1000$

kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP 900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Validation Test/Area Scan (61x141x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.23 mW/g

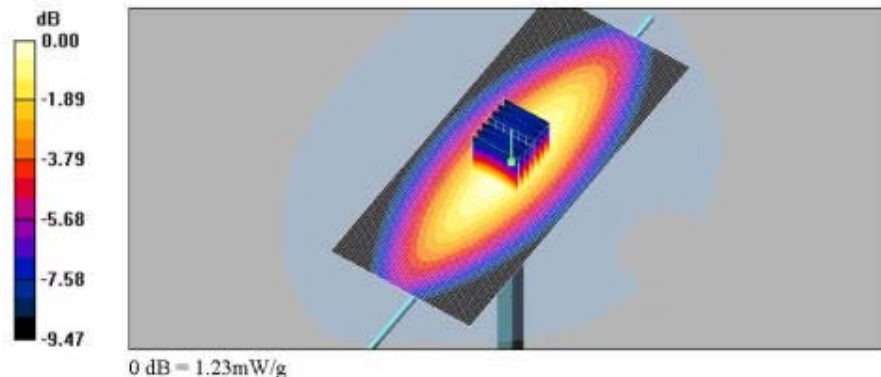
Validation Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 38.4 V/m ; Power Drift = -0.081 dB

Peak SAR (extrapolated) = 2.02 W/kg

SAR(1 g) = 1.17 mW/g ; SAR(10 g) = 0.764 mW/g

Maximum value of SAR (measured) = 1.23 mW/g



SAR TEST PLOTS ? Head SAR

Date/Time: 2006-01-23 2:42:30

Test Laboratory: SGS Testing Korea

Head/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.55 MHz; Duty Cycle: 1:1

Medium: HSL 450MHz Medium parameters used (interpolated): $f = 462.55 \text{ MHz}$; $\sigma = 0.852 \text{ mho/m}$; ϵ_r

$= 43.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Head CH15 (GMRS_Low)/Area Scan (51x71x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.865 mW/g

Head CH15 (GMRS_Low)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

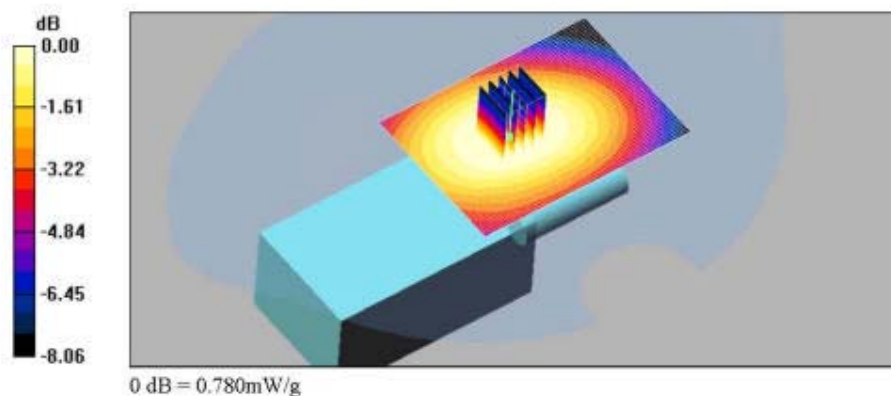
Reference Value = 34.8 V/m ; Power Drift = -0.148 dB

Peak SAR (extrapolated) = 1.16 W/kg

SAR(1 g) = 0.742 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.780 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 3:12:07

Test Laboratory: SGS Testing Korea

Head/GMRS**DUT: LXT-300; Type: UHF; Serial: 512000006**

Communication System: GMRS/FRS; Frequency: 462.637 MHz; Duty Cycle: 1:1

Medium: HSL 450MHz Medium parameters used (interpolated): $f = 462.637$ MHz; $\sigma = 0.852$ mho/m; $\epsilon_r = 43.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Head CH4 (GMRS-Mid)/Area Scan (51x71x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.899 mW/g

Head CH4 (GMRS-Mid)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

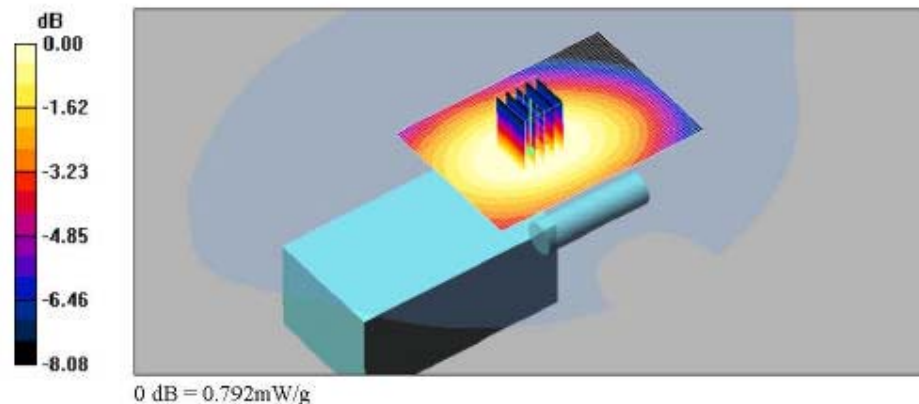
Reference Value = 33.5 V/m; Power Drift = -0.143 dB

Peak SAR (extrapolated) = 1.19 W/kg

SAR(1 g) = 0.759 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.792 mW/g

**SGS Testing Korea Co., Ltd.**

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 2:16:47

Test Laboratory: SGS Testing Korea

Head/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.725 MHz; Duty Cycle: 1:1

Medium: HSL 450MHz Medium parameters used (interpolated): $f = 462.725 \text{ MHz}$; $\sigma = 0.852 \text{ mho/m}$;

$\epsilon_r = 43.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Head CH22 (GMRS_High)/Area Scan (51x71x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 1.02 mW/g

Head CH22 (GMRS_High)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

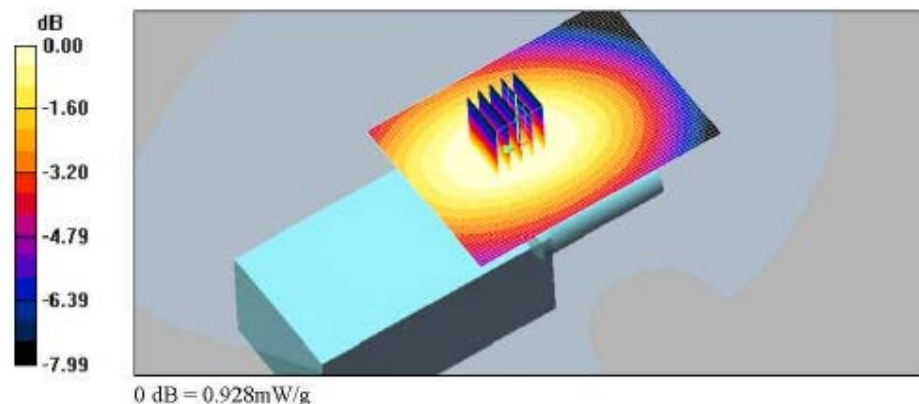
Reference Value = 37.5 V/m ; Power Drift = -0.133 dB

Peak SAR (extrapolated) = 1.37 W/kg

SAR(1 g) = 0.889 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.928 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 3:32:29

Test Laboratory: SGS Testing Korea

Head/FRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 467.563 MHz; Duty Cycle: 1:1

Medium: HSL 450MHz Medium parameters used (extrapolated): $f = 467.563$ MHz; $\sigma = 0.856$ mho/m;

$\epsilon_r = 43.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Head CH8 (FRS_Low)/Area Scan (51x71x1): Measurement grid: dx=15mm, dy=15mm

Info: Extrapolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.467 mW/g

Head CH8 (FRS_Low)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

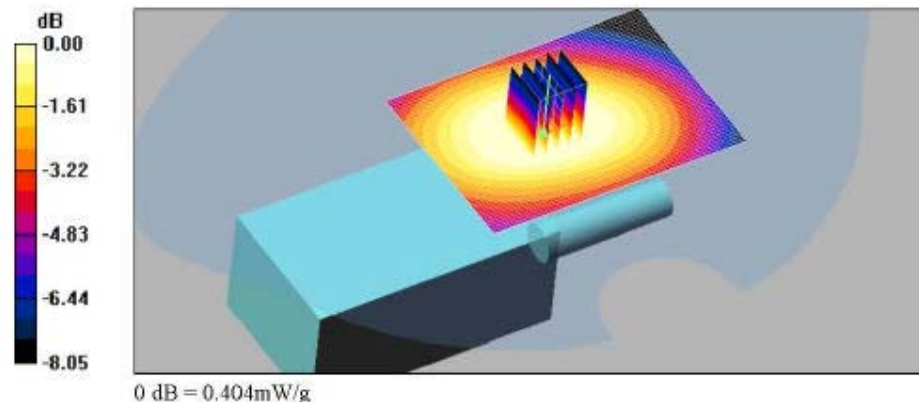
Reference Value = 24.4 V/m; Power Drift = -0.127 dB

Peak SAR (extrapolated) = 0.607 W/kg

SAR(1 g) = 0.390 mW/g

Info: Extrapolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.404 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 3:52:10

Test Laboratory: SGS Testing Korea

Head/FRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 467.637 MHz; Duty Cycle: 1:1
 Medium: HSL 450MHz Medium parameters used (extrapolated): $f = 467.637 \text{ MHz}$; $\sigma = 0.856 \text{ mho/m}$;
 $\epsilon_r = 43.4$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn567; Calibrated: 2005-09-21
- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Head CH11 (FRS_Mid)/Area Scan (51x71x1): Measurement grid: dx=15mm, dy=15mm

Info: Extrapolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.489 mW/g

Head CH11 (FRS_Mid)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

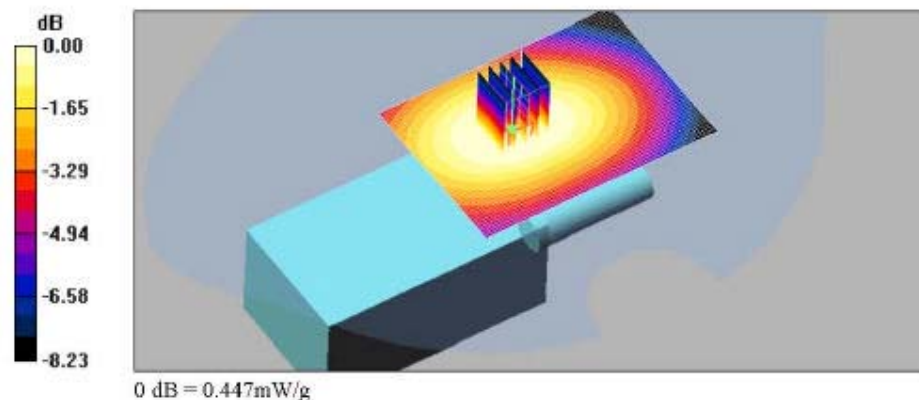
Reference Value = 24.8 V/m; Power Drift = -0.098 dB

Peak SAR (extrapolated) = 0.674 W/kg

SAR(1 g) = 0.425 mW/g

Info: Extrapolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.447 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 4:13:01

Test Laboratory: SGS Testing Korea

Head/FRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 467.712 MHz; Duty Cycle: 1:1

Medium: HSL 450MHz Medium parameters used (extrapolated): $f = 467.712$ MHz; $\sigma = 0.857$ mho/m;

$\epsilon_r = 43.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Head CH14 (FRS_High)/Area Scan (51x71x1): Measurement grid: dx=15mm, dy=15mm

Info: Extrapolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.569 mW/g

Head CH14 (FRS_High)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

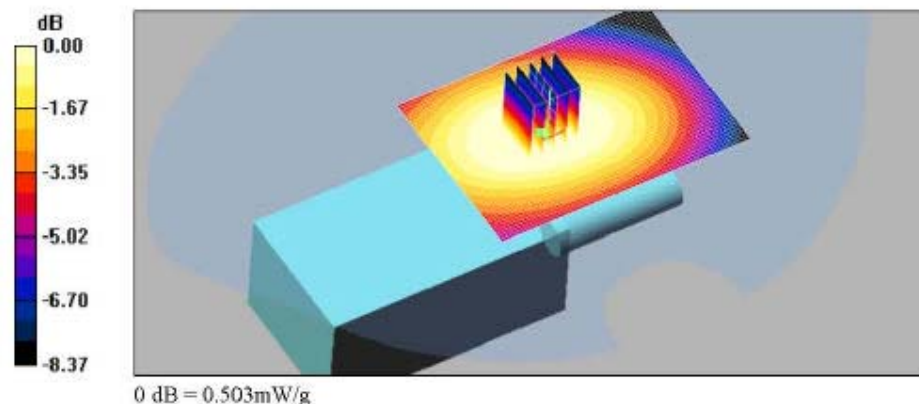
Reference Value = 27.3 V/m; Power Drift = -0.111 dB

Peak SAR (extrapolated) = 0.746 W/kg

SAR(1 g) = 0.480 mW/g

Info: Extrapolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.503 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 4:34:23

Test Laboratory: SGS Testing Korea

Head/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.725 MHz; Duty Cycle: 1:1

Medium: HSL 450MHz Medium parameters used (interpolated): $f = 462.725 \text{ MHz}$; $\sigma = 0.852 \text{ mho/m}$;

$\epsilon_r = 43.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Head CH22 (GMRS_High)_Energizer/Area Scan (51x71x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 1.01 mW/g

Head CH22 (GMRS_High)_Energizer/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

$dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

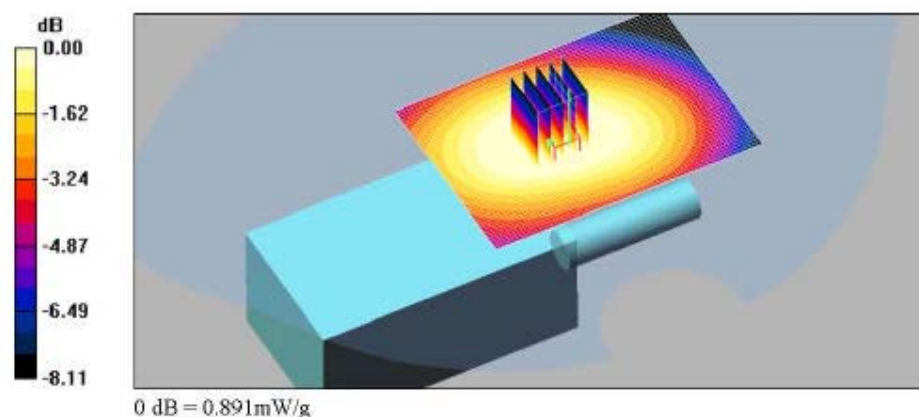
Reference Value = 36.8 V/m; Power Drift = -0.152 dB

Peak SAR (extrapolated) = 1.30 W/kg

SAR(1 g) = 0.834 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.891 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 4:58:19

Test Laboratory: SGS Testing Korea

Head/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.725 MHz; Duty Cycle: 1:1

Medium: HSL 450MHz Medium parameters used (interpolated): $f = 462.725 \text{ MHz}$, $\sigma = 0.852 \text{ mho/m}$;

$\epsilon_r = 43.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.6, 7.6, 7.6); Calibrated: 2004-04-28
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn567; Calibrated: 2005-09-21
- Phantom: SAM MIC #2000-93 with CRP 900MHz; Type: SAM MIC #2000-93; Serial: TP-1300
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Head CH22 (GMRS_High)_Duracell/Area Scan (51x71x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 1.04 mW/g

Head CH22 (GMRS_High)_Duracell/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

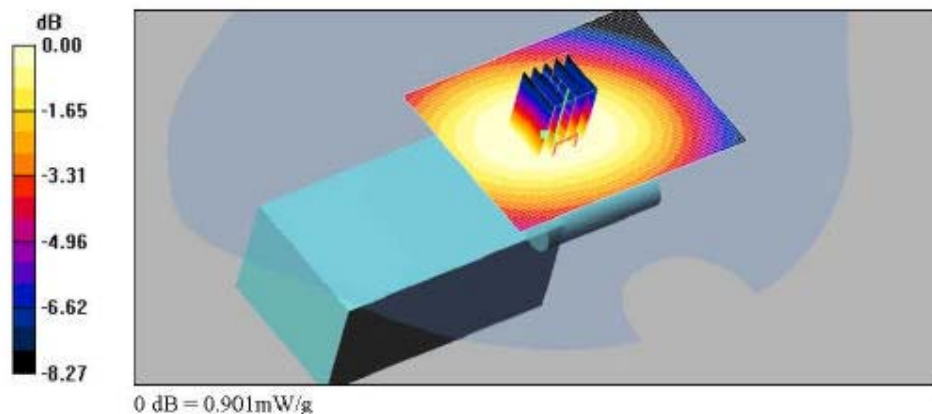
Reference Value = 37.1 V/m; Power Drift = -0.174 dB

Peak SAR (extrapolated) = 1.33 W/kg

SAR(1 g) = 0.857 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.901 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

SAR TEST PLOTS ? Body SAR

Date/Time: 2006-01-23 9:51:32

Test Laboratory: SGS Testing Korea

Body/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.55 MHz; Duty Cycle: 1:1

Medium: M450 Medium parameters used (interpolated): $f = 462.55$ MHz; $\sigma = 1.02$ mho/m; $\epsilon_r = 57.4$; ρ

$= 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.4, 7.4, 7.4); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body CH15 (GMRS_Low)/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 1.20 mW/g

Body CH15 (GMRS_Low)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm,

dy=5mm, dz=5mm

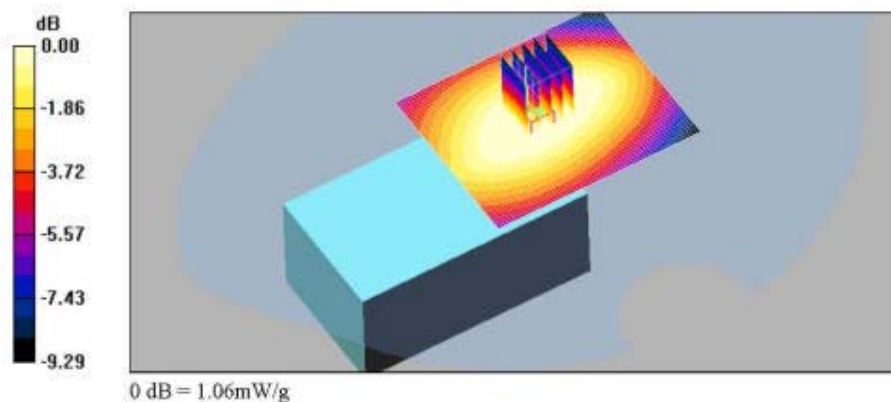
Reference Value = 34.9 V/m; Power Drift = -0.148 dB

Peak SAR (extrapolated) = 1.64 W/kg

SAR(1 g) = 1.01 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 1.06 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 10:11:21

Test Laboratory: SGS Testing Korea

Body/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.637 MHz; Duty Cycle: 1:1

Medium: M450 Medium parameters used (interpolated): $f = 462.637$ MHz; $\sigma = 1.01$ mho/m; $\epsilon_r = 57.4$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.4, 7.4, 7.4); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body CH4 (GMRS_Mid)/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 1.43 mW/g

Body CH4 (GMRS_Mid)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

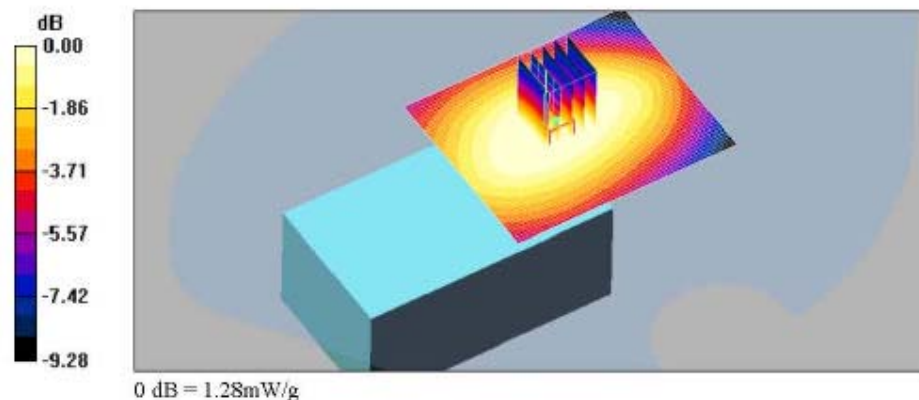
Reference Value = 37.8 V/m; Power Drift = -0.137 dB

Peak SAR (extrapolated) = 2.00 W/kg

SAR(1 g) = 1.23 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 1.28 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 10:29:51

Test Laboratory: SGS Testing Korea

Body/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.725 MHz; Duty Cycle: 1:1

Medium: M450 Medium parameters used (interpolated): $f = 462.725$ MHz; $\sigma = 1.01$ mho/m; $\epsilon_r = 57.4$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.4, 7.4, 7.4); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body CH22 (GMRS_High)/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 1.23 mW/g

Body CH22 (GMRS_High)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

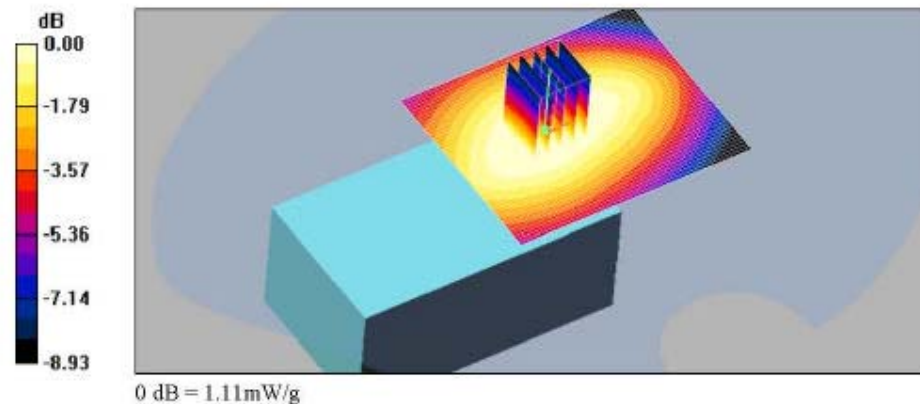
Reference Value = 34.9 V/m; Power Drift = -0.132 dB

Peak SAR (extrapolated) = 1.74 W/kg

SAR(1 g) = 1.06 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 1.11 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 10:53:03

Test Laboratory: SGS Testing Korea

Body/FRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 467.563 MHz; Duty Cycle: 1:1

Medium: M450 Medium parameters used (interpolated): $f = 467.563$ MHz; $\sigma = 1.02$ mho/m; $\epsilon_r = 57.3$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.4, 7.4, 7.4); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body CH8 (FRS_Low)/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.572 mW/g

Body CH8 (FRS_Low)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

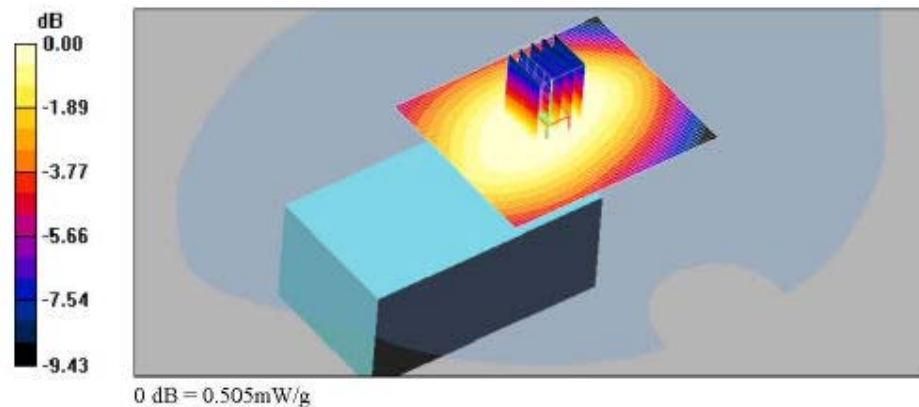
Reference Value = 23.7 V/m; Power Drift = -0.148 dB

Peak SAR (extrapolated) = 0.785 W/kg

SAR(1 g) = 0.481 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.505 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 11:09:03

Test Laboratory: SGS Testing Korea

Body/FRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 467.637 MHz; Duty Cycle: 1:1

Medium: M450 Medium parameters used (interpolated): $f = 467.637$ MHz; $\sigma = 1.02$ mho/m; $\epsilon_r = 57.4$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.4, 7.4, 7.4); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body CH11 (FRS_Mid)/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.698 mW/g

Body CH11 (FRS_Mid)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

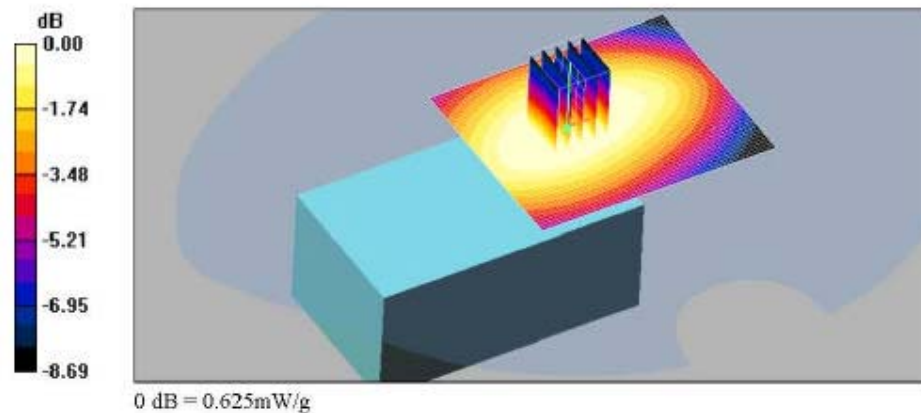
Reference Value = 25.3 V/m; Power Drift = -0.118 dB

Peak SAR (extrapolated) = 0.953 W/kg

SAR(1 g) = 0.598 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.625 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 11:29:46

Test Laboratory: SGS Testing Korea

Body/FRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 467.712 MHz; Duty Cycle: 1:1

Medium: M450 Medium parameters used (interpolated): $f = 467.712$ MHz; $\sigma = 1.02$ mho/m; $\epsilon_r = 57.5$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.4, 7.4, 7.4); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body CH14 (FRS_High)/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 0.618 mW/g

Body CH14 (FRS_High)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

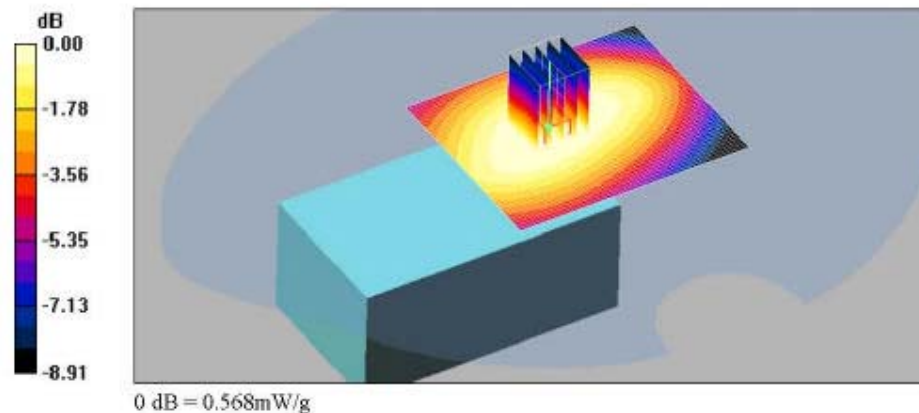
Reference Value = 24.0 V/m; Power Drift = -0.122 dB

Peak SAR (extrapolated) = 0.889 W/kg

SAR(1 g) = 0.546 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 0.568 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-23 12:00:06

Test Laboratory: SGS Testing Korea

Body/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.637 MHz; Duty Cycle: 1:1

Medium: M450 Medium parameters used (interpolated): $f = 462.637$ MHz; $\sigma = 1.01$ mho/m; $\epsilon_r = 57.4$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.4, 7.4, 7.4); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body CH4 (GMRS_Mid)_Energizer/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (interpolated) = 1.49 mW/g

Body CH4 (GMRS_Mid)_Energizer/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

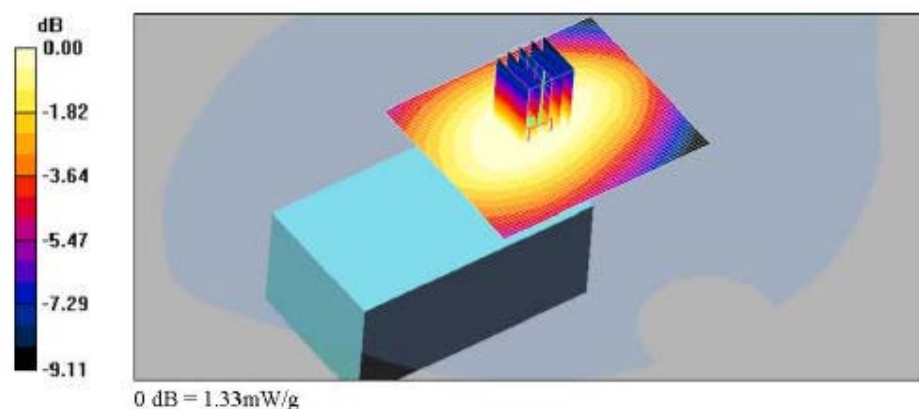
Reference Value = 37.9 V/m; Power Drift = -0.132 dB

Peak SAR (extrapolated) = 2.06 W/kg

SAR(1 g) = 1.27 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 1.33 mW/g



SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Date/Time: 2006-01-24 12:17:56

Test Laboratory: SGS Testing Korea

Body/GMRS

DUT: LXT-300; Type: UHF; Serial: 512000006

Communication System: GMRS/FRS; Frequency: 462.637 MHz; Duty Cycle: 1:1

Medium: M450 Medium parameters used (interpolated): $f = 462.637$ MHz; $\sigma = 1.01$ mho/m; $\epsilon_r = 57.4$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1782; ConvF(7.4, 7.4, 7.4); Calibrated: 2004-04-28

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE3 Sn567; Calibrated: 2005-09-21

- Phantom: SAM MIC #2000-93 with CRP_900MHz; Type: SAM MIC #2000-93; Serial: TP-1300

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body CH4 (GMRS_Mid)_Duracell/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation!

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

Body CH4 (GMRS_Mid)_Duracell/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

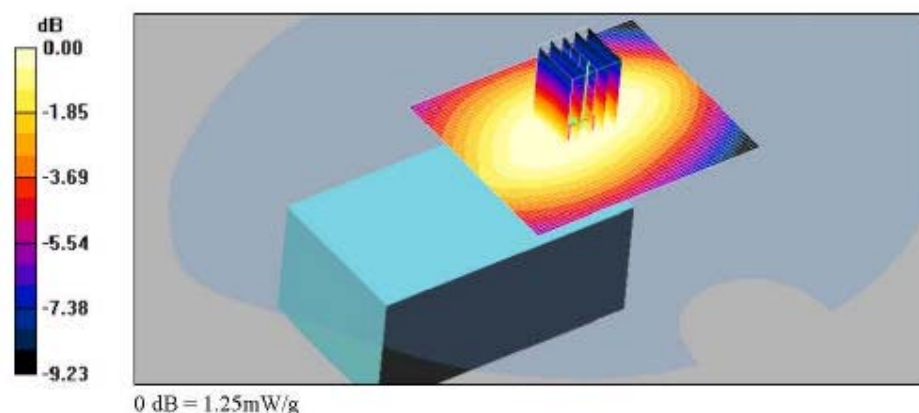
Reference Value = 37.6 V/m; Power Drift = -0.155 dB

Peak SAR (extrapolated) = 1.98 W/kg

SAR(1 g) = 1.18 mW/g

Info: Interpolated medium parameters used for SAR evaluation!

Maximum value of SAR (measured) = 1.25 mW/g



SGS Testing Korea Co., Ltd.

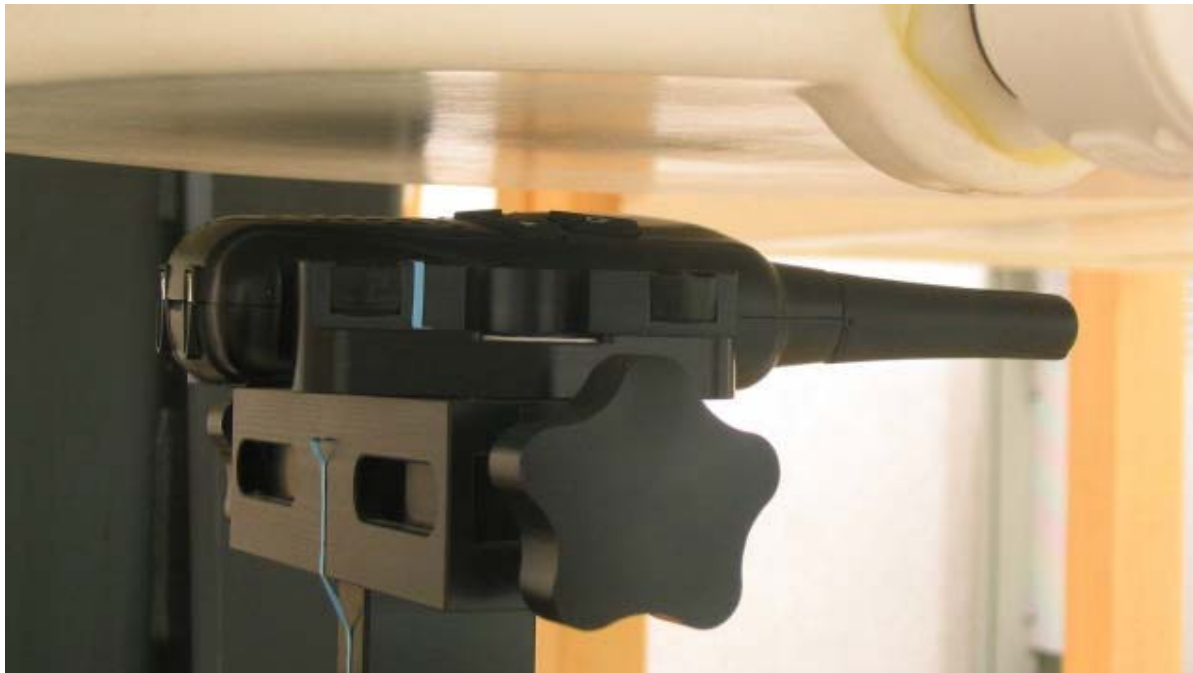
18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Appendix B

TEST SETUP PHOTOGRAPHS



DUT PHOTOGRAPHS

The upper side



The reverse side



Left Flank



Right Flank



Appendix C

Calibration Certificate

- **DAE**
- **Probe**
- **Dipole ANT**

DAE

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **SGS KES (Dymstec)**

Certificate No: DAE3-567_Sep05

CALIBRATION CERTIFICATE

Object **DAE3 - SD 000 D03 AA - SN: 567**

Calibration procedure(s) **QA CAL-06.v12**
 Calibration procedure for the data acquisition unit (DAE)

Calibration date: **September 21, 2005**

Condition of the calibrated item **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Fuke Process Calibrator Type 5101B	SN: 5015004	29-Jun-05 (ELCAL AG, No. 368856)	Jun-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1002	29-Jun-05 (SPEAG, in house check)	In house check Jun-06

Calibrated by:	Name Philipp Storchenegger	Function Technician	Signature 
Approved by:	Fin Bomholt	R&D Director	

Issued: September 21, 2005

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

Certificate No: DAE3-567_Sep05

Page 1 of 5

SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041
 Tel. +82 31 428 5700 / Fax. +82 31 427 2371
<http://www.sgstesting.co.kr>

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary

DAE digital 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 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 = 6.1 μ V, 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	404.737 $\pm$ 0.1% (k=2)	404.490 $\pm$ 0.1% (k=2)	404.564 $\pm$ 0.1% (k=2)
Low Range	3.93878 $\pm$ 0.7% (k=2)	3.95177 $\pm$ 0.7% (k=2)	3.94259 $\pm$ 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	83 ° $\pm$ 1 °
---	----------------

Appendix

1. DC Voltage Linearity

High Range	Input (μV)	Reading (μV)	Error (%)
Channel X + Input	200000	199999.4	0.00
Channel X + Input	20000	20000.91	0.00
Channel X - Input	20000	-19997.17	-0.01
Channel Y + Input	200000	199999.3	0.00
Channel Y + Input	20000	20000.15	0.00
Channel Y - Input	20000	-19996.82	-0.02
Channel Z + Input	200000	199999.6	0.00
Channel Z + Input	20000	19996.08	-0.02
Channel Z - Input	20000	-19997.52	-0.01

Low Range	Input (μV)	Reading (μV)	Error (%)
Channel X + Input	2000	1999.9	0.00
Channel X + Input	200	200.49	0.25
Channel X - Input	200	-200.54	0.27
Channel Y + Input	2000	2000.0	0.00
Channel Y + Input	200	199.48	-0.26
Channel Y - Input	200	-201.00	0.50
Channel Z + Input	2000	2000.1	0.00
Channel Z + Input	200	199.51	-0.25
Channel Z - Input	200	-201.12	0.56

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	3.18	2.44
	- 200	-1.16	-2.24
Channel Y	200	2.15	1.45
	- 200	-2.49	-3.08
Channel Z	200	6.20	5.84
	- 200	-7.85	-7.71

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.04	0.31
Channel Y	200	2.04	-	4.47
Channel Z	200	-1.13	0.50	-

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	16358	16626
Channel Y	16135	16300
Channel Z	15908	15338

5. Input Offset Measurement

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

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	0.18	-0.91	1.18	0.40
Channel Y	-0.98	-2.45	0.54	0.38
Channel Z	-0.57	-1.55	0.47	0.35

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	202.6
Channel Y	0.2001	202.2
Channel Z	0.2000	200.4

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

Probe

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

Client **SGS KES (Dymstec)**

CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN:1782**

Calibration procedure(s) **QA CAL-01.v2
 Calibration procedure for dosimetric E-field probes**

Calibration date: **April 28, 2004**

Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

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 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E442	GB37480704	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	US37262783	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Fuke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

Calibrated by: **Nico Vatterli** (Name) **Technician** (Function) **F. Brunkh** (Signature)

Approved by: **Katja Pokovic** (Name) **Laboratory Director** (Function) **Katja Pokovic** (Signature)

Date issued: April 28, 2004

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.



Report File No. : STROS-06-002

Date of Issue: February 1, 2006

Page : 50 of 68

Probe ET3DV6

SN:1782

Manufactured:	April 15, 2003
Last calibrated:	July 28, 2003
Recalibrated:	April 28, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1782

April 28, 2004

DASY - Parameters of Probe: ET3DV6 SN:1782

Sensitivity in Free Space

NormX	2.03 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.72 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.89 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression^A

DCP X	94	mV
DCP Y	94	mV
DCP Z	94	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 7.

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	8.0	4.0
SAR _{be} [%]	With Correction Algorithm	0.0	0.1

Head 1800 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	12.7	8.5
SAR _{be} [%]	With Correction Algorithm	0.2	0.1

Sensor Offset

Probe Tip to Sensor Center	2.7 mm
Optical Surface Detection	in tolerance

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%.

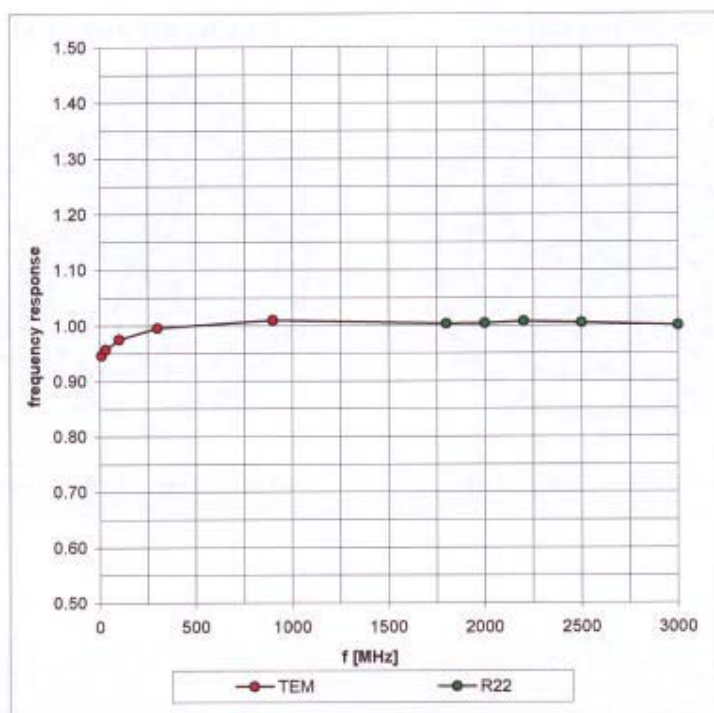
^A numerical linearization parameter; uncertainty not required

ET3DV6 SN:1782

April 28, 2004

Frequency Response of E-Field

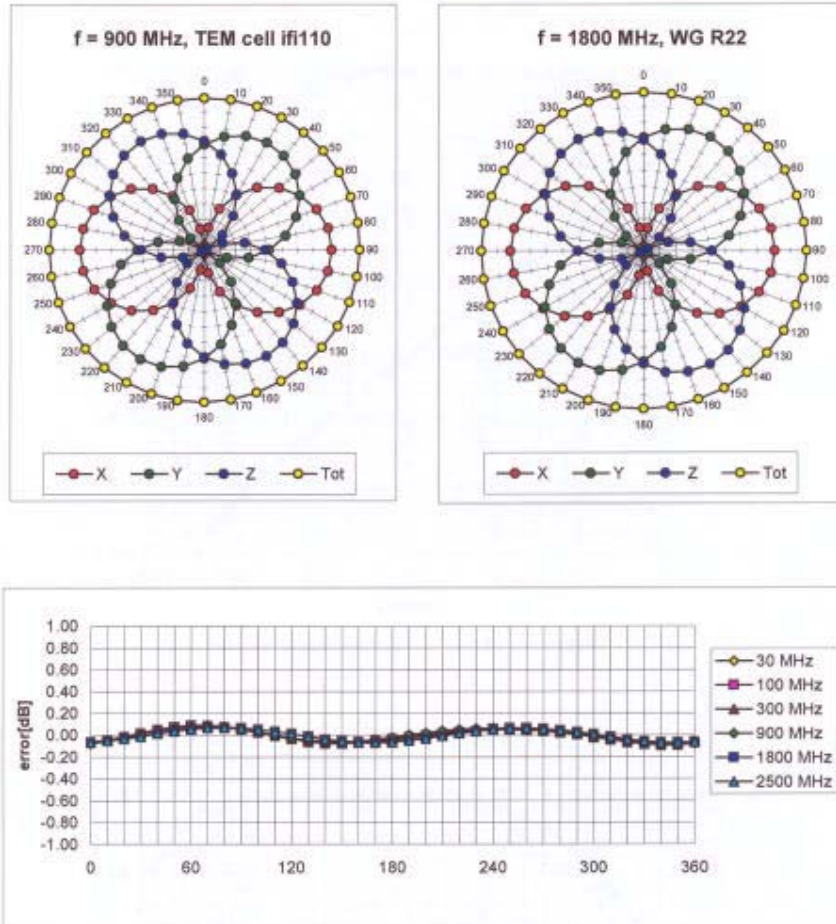
(TEM-Cell:ifi110, Waveguide R22)



ET3DV6 SN:1782

April 28, 2004

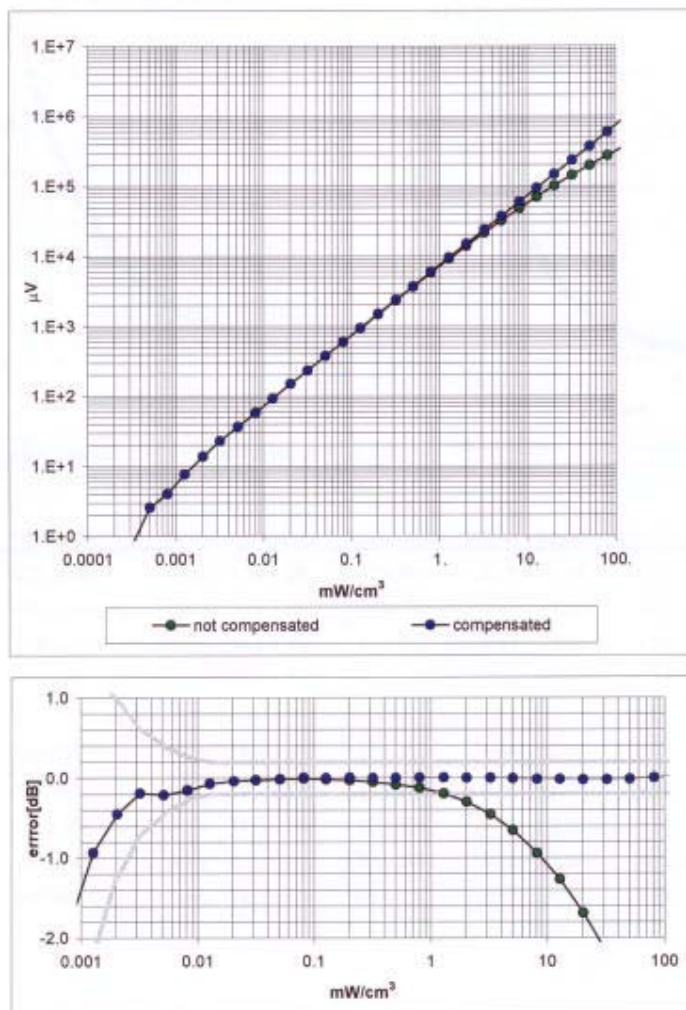
Receiving Pattern (ϕ), $\theta = 0^\circ$



ET3DV6 SN:1782

April 28, 2004

Dynamic Range f(SAR_{head}) (Waveguide R22)

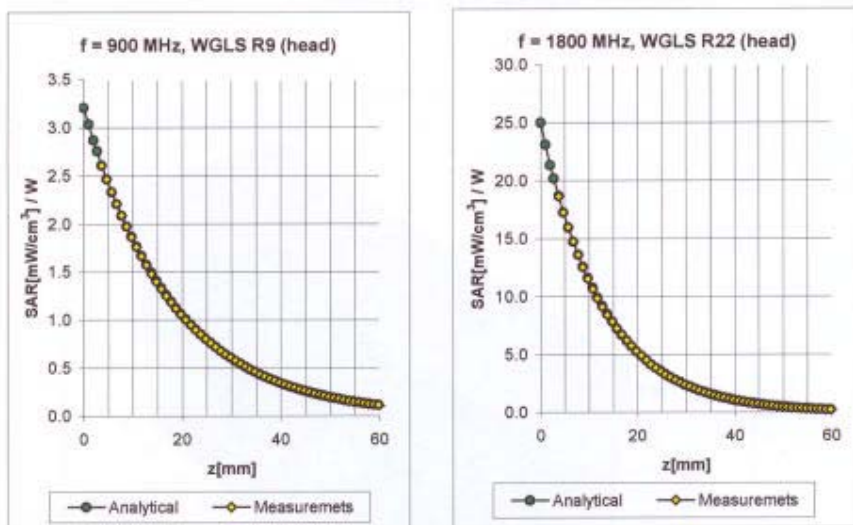


Probe Linearity $< \pm 0.2$ dB

ET3DV6 SN:1782

April 28, 2004

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^B	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	800-1000	Head	41.5 ± 5%	0.97 ± 5%	0.76	1.59	6.45 ± 11.3% (k=2)
1800	1710-1910	Head	40.0 ± 5%	1.40 ± 5%	0.47	2.62	5.07 ± 11.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.89	1.98	4.36 ± 9.7% (k=2)
835	785-885	Body	55.2 ± 5%	0.97 ± 5%	0.46	2.19	6.14 ± 9.7% (k=2)
900	850-950	Body	55.0 ± 5%	1.05 ± 5%	0.44	2.31	5.93 ± 9.7% (k=2)
1800	1710-1890	Body	53.3 ± 5%	1.52 ± 5%	0.52	2.80	4.55 ± 10.9% (k=2)
1900	1805-1995	Body	53.3 ± 5%	1.52 ± 5%	0.56	2.86	4.40 ± 11.1% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	1.01	1.71	4.22 ± 9.7% (k=2)

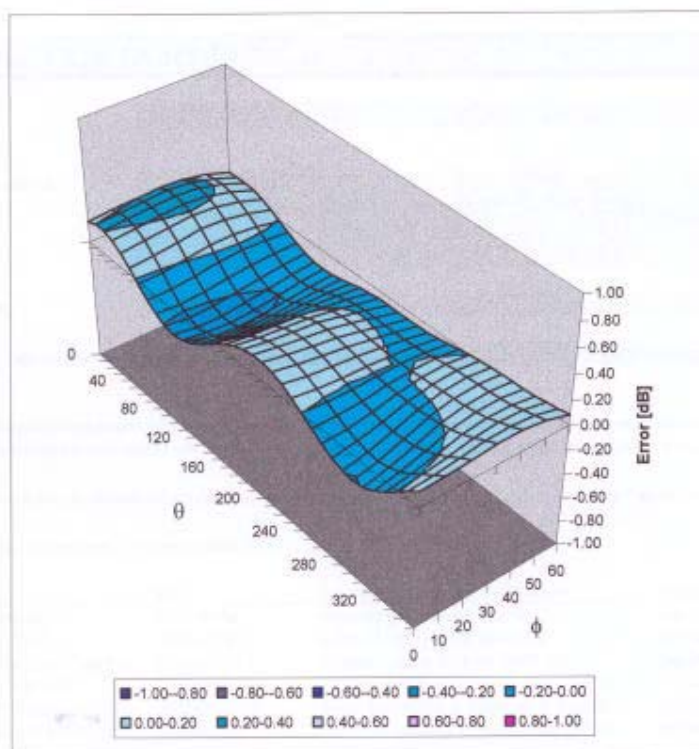
^B The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

ET3DV6 SN:1782

April 28, 2004

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Spherical Isotropy Error $< \pm 0.4$ dB

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, <http://www.speag.com>

Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1782

Place of Assessment:

Zurich

Date of Assessment:

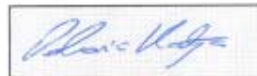
May 1, 2004

Probe Calibration Date:

April 28, 2004

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



ET3DV6-SN:1782

Page 1 of 2

May 1, 2004

SGS Testing Korea Co., Ltd.

18 - 34, Sanbon - dong, Gunpo - si, Gyeonggi - do, Korea, 435 - 041

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

<http://www.sgstesting.co.kr>

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ET3DV6 SN:1782

Conversion factor ($\pm$ standard deviation)

450 MHz ConvF $7.6 \pm 8\%$

$\epsilon_r = 43.5 \pm 5\%$
 $\sigma = 0.87 \pm 5\%$ mho/m
(head tissue)

450 MHz ConvF $7.4 \pm 8\%$

$\epsilon_r = 56.7 \pm 5\%$
 $\sigma = 0.94 \pm 5\%$ mho/m
(body tissue)

Important Note:

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

Please see also Section 4.7 of the DASY4 Manual.

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, <http://www.speag.com>

Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1782

Place of Assessment:

Zurich

Date of Assessment:

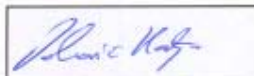
May 21, 2004

Probe Calibration Date:

April 28, 2004

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ET3DV6 SN:1782

Conversion factor ($\pm$ standard deviation)

75 MHz (65-85 MHz)	ConvF	8.6 $\pm$ 8%	$\epsilon_r = 70.0 \pm 5\%$ $\sigma = 0.70 \pm 5\%$ mho/m (body tissue)
150 MHz (100-200 MHz)	ConvF	8.9 $\pm$ 8%	$\epsilon_r = 52.3 \pm 5\%$ $\sigma = 0.76 \pm 5\%$ mho/m (head tissue)
150 MHz (100-200 MHz)	ConvF	8.5 $\pm$ 8%	$\epsilon_r = 61.9 \pm 5\%$ $\sigma = 0.80 \pm 5\%$ mho/m (body tissue)
1950 MHz (1900-2000 MHz)	ConvF	4.8 $\pm$ 8%	$\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m (head tissue)

Important Note:

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

Please see also Section 4.7 of the DASY4 Manual.

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, <http://www.speag.com>

Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1782

Place of Assessment:

Zurich

Date of Assessment:

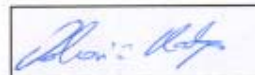
June 14, 2004

Probe Calibration Date:

April 28, 2004

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland

Phone +41 1 245 9700, Fax +41 1 245 9779

info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ET3DV6 SN:1782

Conversion factor ($\pm$ standard deviation)

300 MHz ConvF $7.4 \pm 8\%$
(250-350 MHz)

$\epsilon_r = 58.2 \pm 5\%$
 $\sigma = 0.92 \pm 5\%$ mho/m
(body tissue)

300 MHz ConvF $7.6 \pm 8\%$
(250-350 MHz)

$\epsilon_r = 45.3 \pm 5\%$
 $\sigma = 0.87 \pm 5\%$ mho/m
(head tissue)

Important Note:

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

Please see also Section 4.7 of the DASY4 Manual.

Dipole ANT

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **SGS (Dymstec)**

Certificate No: D450V2-1015_Sep05

CALIBRATION CERTIFICATE

Object **D450V2 - SN: 1015**

Calibration procedure(s) **QA CAL-15.v4
 Calibration Procedure for dipole validation kits below 800 MHz**

Calibration date: **September 21, 2005**

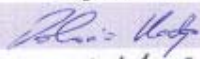
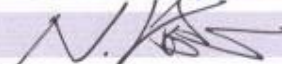
Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41495277	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41498087	3-May-05 (METAS, No. 251-00466)	May-06
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference Probe ET3DVB	SN 1507	11-Jul-05 (SPEAG, No. ET3-1507_Jul05)	Jul-06
DAE4	SN: 601	7-Jan-05 (SPEAG, No. DAE4-601_Jan05)	Jan-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

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

Issued: September 21, 2005

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

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

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) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- d) DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY4	V4.6
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom V4.4	Shell thickness: 6 ± 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 $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.8 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	44.6 $\pm$ 6 %	0.86 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 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	1.96 mW / g
SAR normalized	normalized to 1W	4.92 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	5.01 mW / g $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.31 mW / g
SAR normalized	normalized to 1W	3.29 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	3.33 mW / g $\pm$ 17.6 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	56.9 Ω - 2.7 j Ω
Return Loss	- 23.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	0.993 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	May 30, 2003

DASY4 Validation Report for Head TSL

Date/Time: 21.09.2005 16:18:06

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1015

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium: HSL450;

 Medium parameters used: $f = 450 \text{ MHz}$; $\sigma = 0.86 \text{ mho/m}$; $\epsilon_r = 44.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(6.59, 6.59, 6.59); Calibrated: 11.07.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4; ;
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

d=15mm, Pin=398mW/Area Scan (61x201x1): Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 2.09 mW/g

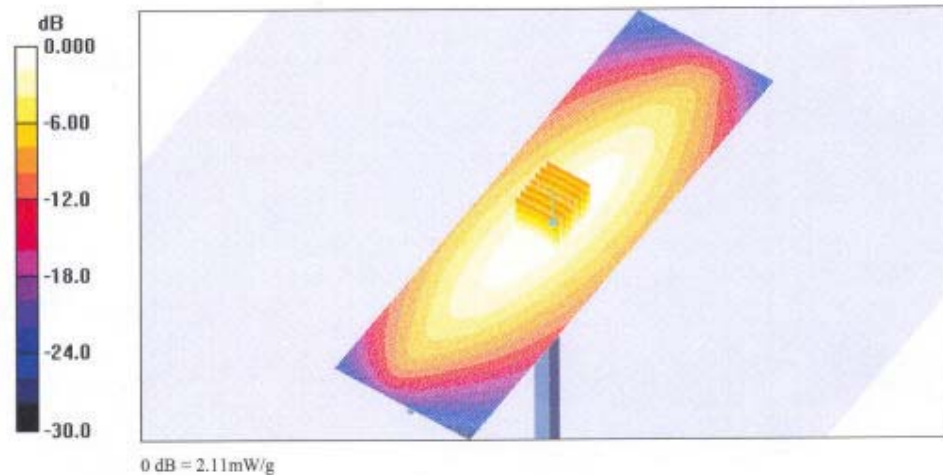
d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 51.2 V/m; Power Drift = -0.028 dB

Peak SAR (extrapolated) = 2.87 W/kg

SAR(1 g) = 1.96 mW/g; SAR(10 g) = 1.31 mW/g

Maximum value of SAR (measured) = 2.11 mW/g



Impedance Measurement Plot for Head TSL

