Specific Absorption Rate (SAR) Test Report
for
EZCOM Inc.
on the
EzFone (WiFi Phone for Skype)

Report No.	: FA782409-1-2-04
Trade Name	: EZCOM
Model Name	: EZ-SKW 110
FCC ID	: VL8-EZ-SKW110
Date of Testing	: Sep. 07 and 09, 2007
Date of Report	: Sep. 28, 2007
Date of Review	: Sep. 28, 2007

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1. *Statement of Compliance*

The Specific Absorption Rate (SAR) maximum result found during testing for the EZCOM Inc. EzFone (WiFi Phone for Skype) EZCOM EZ-SKW 110 are 0.184 W/kg for 2.4GHz WLAN head SAR and 0.155 W/kg for 2.4GHz WLAN body SAR with expanded uncertainty 20.6%. It is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1999 and had been tested in accordance with the measurement methods and procedures specified in OET Bulletin 65 Supplement C (Edition 01-01).

Approved by

Jones Tsai
Manager

2. Administration Data

2.1 Testing Laboratory

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2.2 Detail of Applicant

Company Name :   EZCOM Inc.
Address :   2330 W80th Street Suite #3 Hialeah, Florida 33016, USA

2.3 Detail of Manufacturer

Company Name :   Wistron NeWeb Corporation
Address :   No.10-1,Li-hsin Road I,Hsinchu Science Park,Hsinchu 300,Taiwan, R.O.C.

2.4 Application Detail

Date of reception of application: Aug. 24, 2007
Start of test :   Sep. 07, 2007
End of test :   Sep. 09, 2007

3. *Scope*

3.1 *Description of Device Under Test (DUT)*

DUT Type :	EzFone (WiFi Phone for Skype)
Trade Name :	EZCOM
Model Name :	EZ-SKW 110
FCC ID :	VL8-EZ-SKW110
Type of Modulation :	DSSS / OFDM
Frequency Range :	2400~2483.5 MHz
Antenna Connector :	N/A
Antenna Type :	Main Ant. : Chip Antenna Aux. Ant. : Chip Antenna
Antenna Gain :	Main Ant. : -3.15 dBi Aux. Ant. : -0.14 dBi
Maximum Output Power to Antenna :	802.11b : 9.10 dBm 802.11g : 11.33 dBm
DUT Stage :	Production Unit

Remark : Main Antenna and Aux. Antenna can transmit simultaneously.

3.2 *Applied Standards:*

The Specific Absorption Rate (SAR) testing specification, method and procedure for this EzFone (WiFi Phone for Skype) is in accordance with the following standards:

47 CFR Part 2 (2.1093),
IEEE C95.1-1999,
IEEE C95.3-2002,
IEEE P1528 -2003, and
OET Bulletin 65 Supplement C (Edition 01-01)

3.3 *Device Category and SAR Limits*

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user.

Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

3.4 *Test Conditions*

3.4.1 *Ambient Condition:*

Item	Head	Body
Ambient Temperature (^{o}C)	20-24℃	
Tissue simulating liquid temperature (^{o}C)	21.6℃	21.5℃
Humidity (%)	<60%	

3.4.2 *Test Configuration:*

The data rates for SAR testing are 1Mbps for 802.11b and 6Mbps for 802.11g. Engineering testing software installed on the EUT can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1. The measurements were performed on the lowest, middle, and highest channel, i.e. channel 1, channel 6, and channel 11 for each testing position.

4. *Specific Absorption Rate (SAR)*
4.1 *Introduction*

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The FCC recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

4.2 *SAR Definition*

The SAR definition is 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). The equation description is as below:

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

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

SAR measurement can be either related to the temperature elevation in tissue by

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

, where C is the specific head capacity, δT is the temperature rise and δt the exposure duration,

or related to the electrical field in the tissue by

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

, where σ is the conductivity of the tissue, ρ is the mass density of the tissue and *E* is the rms electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.
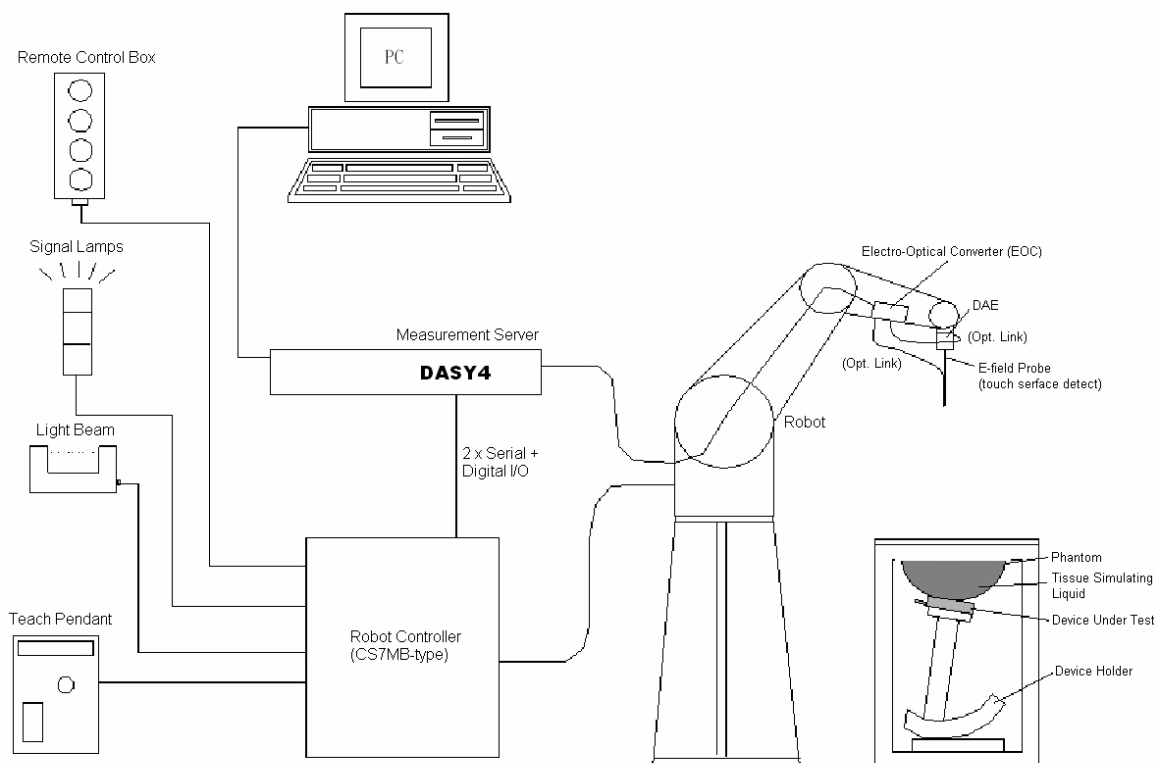
5. SAR Measurement Setup

Fig. 5.1 DASY4 system

The DASY4 system for performance compliance tests is illustrated above graphically. This system consists of the following items:

➢ A standard high precision 6-axis robot with controller, a teach pendant and software
➢ A data acquisition electronic (DAE) attached to the robot arm extension
➢ A dosimetric probe equipped with an optical surface detector system
➢ The electro-optical converter (ECO) performs the conversion between optical and electrical signals
➢ A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
➢ A probe alignment unit which improves the accuracy of the probe positioning
➢ A computer operating Windows XP
➢ DASY4 software
➢ Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
➢ The SAM twin phantom
➢ A device holder
➢ Tissue simulating liquid
➢ Dipole for evaluating the proper functioning of the system

Some of the components are described in details in the following sub-sections.

5.1 *DASY4 E-Field Probe System*

The SAR measurement is conducted with the dosimetric probe ET3DV6 (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

5.1.1   ET3DV6 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)
Calibration	Simulating tissue at frequencies of 900MHz, 1.8GHz and 2.45GHz for brain and muscle (accuracy ±8%)
Frequency	10 MHz to > 3 GHz
Directivity	± 0.2 dB in brain tissue (rotation around probe axis)
	± 0.4 dB in brain tissue (rotation perpendicular to probe axis)
Dynamic Range	5 μ W/g to > 100mW/g; Linearity: ±0.2dB
Surface Detection	± 0.2 mm repeatability in air and clear liquids on reflecting surface
Dimensions	Overall length: 330mm
	Tip length: 16mm
	Body diameter: 12mm
	Tip diameter: 6.8mm
	Distance from probe tip to dipole centers: 2.7mm
Application	General dosimetry up to 3GHz
	Compliance tests for mobile phones and Wireless LAN
	Fast automatic scanning in arbitrary phantoms

Fig. 5.2 Probe setup on robot

5.1.2   ET3DV6 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 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 calibration data are as below:

Sensitivity	X axis : 1.63 µV	Y axis : 1.66 µV	Z axis : 2.08 µV
Diode compression point	X axis : 92 mV	Y axis : 96 mV	Z axis : 91 mV

Conversion factor (Head/Body)	Frequency (MHz)	X axis	Y axis	Z axis
	2350~2550	4.50 / 4.02	4.50 / 4.02	4.50 / 4.02

Boundary effect (Head/Body)	Frequency (MHz)	Alpha	Depth	
	2350~2550	0.67 / 0.65	1.81 / 2.15	

NOTE：The probe parameters have been calibrated by the SPEAG.

5.2 *DATA Acquisition Electronics (DAE)*

The data acquisition electronics (DAE4) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

5.3 *Robot*

The DASY4 system uses the high precision robots RX90BL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASYS system, the CS7MB robot controller version from Stäubli is used. The RX robot series have many features that are important for our application:

➢ High precision (repeatability 0.02 mm)
➢ High reliability (industrial design)
➢ Jerk-free straight movements
➢ Low ELF interference (the closed metallic construction shields against motor control fields)
➢ 6-axis controller

5.4 *Measurement Server*

The DASY4 measurement server is based on a PC/104 CPU board with
166 MHz CPU
32 MB chipset and
64 MB RAM.

Communication with
the DAE4 electronic box
the 16-bit AD-converter system for optical detection and digital I/O interface.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

5.5 *SAM Twin Phantom*

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

➢ Left head
➢ Right head
➢ Flat phantom

The bottom plate 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.

A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters.

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

The phantom can be used with the following tissue simulating liquids:
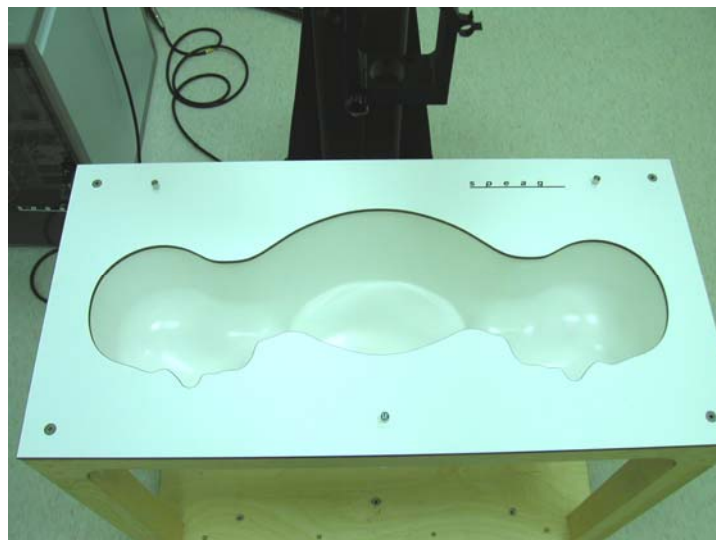*Water-sugar based liquid
*Glycol based liquids

Fig. 5.3 Top view of twin phantom

Fig. 5.4 Bottom view of twin phantom

5.6 *Data Storage and Evaluation*

5.6.1 *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 post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

5.6.2 *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	Norm_i, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	ConvF_i
	- Diode compression point	dcp_i
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 multi-meter 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：

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

with   *V_i = compensated signal of channel i (i = x, y, z)*
U_i = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
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： $E_i = \sqrt{\dfrac{V_i}{Norm_i ConvF}}$

H-field probes： $H_i = \sqrt{V_i} \dfrac{a_{i0+}a_{i1}f + a_{i2}f^2}{f}$

with   **V_i** = compensated signal of channel *i* (*i* = x, y, z)
$Norm_i$ = sensor sensitivity of channel i (*i* = x, y, z)
     μ V/(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
H_i = 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.

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

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

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

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

5.7 *Test Equipment List*

Manufacture	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Dosimetric E-Filed Probe	ET3DV6	1787	Aug. 28, 2007	Aug. 27, 2008
SPEAG	2450MHz System Validation Kit	D2450V2	736	Jul. 12, 2007	Jul. 12, 2009
SPEAG	Data Acquisition Electronics	DAE3	577	Nov. 21, 2006	Nov. 20, 2007
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	Phantom	QD 000 P40 C	TP-1150	NCR	NCR
SPEAG	Robot	Staubli RX90BL	F03/5W15A1/A/01	NCR	NCR
SPEAG	Software	DASY4 V4.7 Build 53	N/A	NCR	NCR
SPEAG	Software	SEMCAD V1.8 Build 172	N/A	NCR	NCR
SPEAG	Measurement Server	SE UMS 001 BA	1021	NCR	NCR
Agilent	ENA Series Network Analyzer	E5071C	MY46100746	Feb. 21, 2007	Feb. 21, 2008
Agilent	Dielectric Probe Kit	85070D	US01440205	NCR	NCR
Agilent	Dual Directional Coupler	778D	50422	NCR	NCR
Agilent	Power Amplifier	8449B	3008A01917	NCR	NCR
Agilent	Wireless Communication Test Set	E5515C	GB46311322	Dec. 22, 2006	Dec. 22, 2008
Agilent	Power Meter	E4416A	GB41292344	Feb. 08, 2007	Feb. 08, 2008
Agilent	Power Sensor	E9327A	US40441548	Feb. 08, 2007	Feb. 08, 2008
Agilent	Signal Generator	E8247C	MY43320596	Mar. 01, 2006	Mar. 01, 2008

Table 5.1 Test Equipment List

6. *Tissue Simulating Liquids*

For the measurement of the field distribution inside the SAM phantom with DASY4, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. The liquid height from the bottom of the phantom body is 15.2 centimeters, which is shown in Fig. 6.1.

The following ingredients for tissue simulating liquid are used:

➢ **Water**: deionized water (pure H_2O), resistivity $\geqq 16M\Omega$ - as basis for the liquid
➢ **Sugar**: refined sugar in crystals, as available in food shops – to reduce relative permittyvity
➢ **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.
➢ **DGMBE**: Deithlenglycol-monobuthyl ether (DGMBE), Fluka Chemie GmbH, CAS#112-34-5 – to reduce relative permittivity.

Table 6.1 gives the recipes for one liter of tissue simulating liquid for frequency band 2450 MHz.

Ingredient	HSL_2450	MSL-2450
Water	450.0 ml	698.3 ml
DGMBE	550.0 ml	301.7 ml
Total amount	1 liter (1.0 kg)	1 liter (1.0 kg)
Dielectric Parameters at 22°	f = 2450MHz ε_r= 39.2±5%, σ = 1.8±5% S/m	f = 2450MHz ε_r= 52.7±5%, σ = 1.95±5% S/m

Table 6.1 Recipes for Tissue Simulating Liquid

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

Table 6.2 shows the measuring results for head and muscle simulating liquid.

Position	Bands	Frequency(MHz)	Conductivity (σ)	Permittivity (ε_r)	Measurement date
Head	2450 MHz	2412	1.73	38.6	Sep. 07, 2007
		2437	1.74	38.2	
		2462	1.78	38.0	
Body	2450 MHz	2412	1.92	52.8	Sep. 09, 2007
		2437	1.95	52.8	
		2462	1.98	52.7	

Table 6.2 Measurement Results for Head and Muscle Simulating Liquid

The measuring data are consistent with $\varepsilon_r = 39.2 \pm 5\%$ and $\sigma = 1.80 \pm 5\%$ for head 2450 band and $\varepsilon_r = 52.7 \pm 5\%$ and $\sigma = 1.95 \pm 5\%$ for body 2450 band.

Fig. 6.1 Homogeneous Body Tissue Simulating Liquid

7. *Uncertainty Assessment*

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 7.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-shape
Multiplying factor[a]	$1/k$ [b]	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a)   standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity
(b) κ is the coverage factor

Table 7.1 Multiplying Factor for Various Distribution Models

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY4 uncertainty Budget is showed in Table 7.2.

Error Description	Uncertainty Value ± %	Probability Distribution	Divisor	*Ci* 1g	Standard Unc. (1-g)	*vi* or V*eff*
Measurement System						
Probe Calibration	± 4.8	Normal	1	1	±4.8	∞
Axial Isotropy	± 4.7	Rectangular	√3	0.7	±1.9	∞
Hemispherical Isotropy	± 9.6	Rectangular	√3	0.7	±3.9	∞
Boundary Effect	± 1.0	Rectangular	√3	1	±0.6	∞
Linearity	± 4.7	Rectangular	√3	1	±2.7	∞
System Detection Limit	± 1.0	Rectangular	√3	1	±0.6	∞
Readout Electronics	± 1.0	Normal	1	1	±1.0	∞
Response Time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 2.6	Rectangular	√3	1	± 1.5	∞
RF Ambient Conditions	± 3.0	Rectangular	√3	1	±1.7	∞
Probe Positioner Mech. Tolerance	± 0.4	Rectangular	√3	1	±0.2	∞
Probe Positioning with respect to Phantom Shell	± 2.9	Rectangular	√3	1	±1.7	∞
Extrapolation and Interpolation Algorithms for Max. SAR Evaluation	± 1.0	Rectangular	√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	√3	1	±2.9	∞
Phantom and Setup						
Phantom uncertainty(Including shap and thickness tolerances)	±4.0	Rectangular	√3	1	±2.3	∞
Liquid Conductivity Target tolerance	±5.0	Rectangular	√3	0.64	±1.8	∞
Liquid Conductivity measurement uncertainty	±2.5	Normal	1	0.64	±1.6	∞
Liquid Permittivity Target tolerance	±5.0	Rectangular	√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 Uncertainty (Coverage factor = 2)			**Normal (k=2) 27**		**±20.6**	

Table 7.2 Uncertainty Budget of DASY

8. *SAR Measurement Evaluation*

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

8.1 *Purpose of System Performance check*

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

8.2 *System Setup*

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator at frequency 2450 MHz. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:
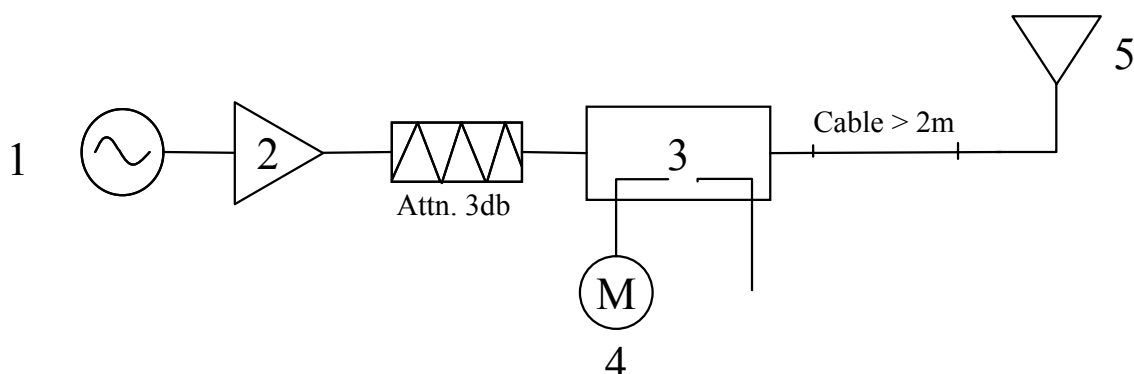

Fig. 8.1 Equipment Setup of Measurement Evaluation

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. 2450 MHz Dipole

The output power on dipole port must be calibrated to 100 mW (20 dBm) before dipole is connected.

Fig 8.2 Dipole Setup

8.3 *Validation Results*

Comparing to the original SAR value provided by Speag, the validation data should within its specification of 10 %. Table 8.1 shows the target SAR and measured SAR after normalized to 1W input power.

Position	SAR	Target (W/kg)	Measurement data (W/kg)	Variation	Measurement date
Head	SAR (1g)	52.7	57	8.2 %	Sep. 07., 2007
	SAR (10g)	24.5	26.8	9.4 %	
Body	SAR (1g)	52.5	53	1.0 %	Sep. 09, 2007
	SAR (10g)	24.4	25.2	3.3 %	

Table 8.1 Target and Measurement SAR values

The table above indicates the system performance check can meet the variation criterion.

9. *Description for DUT Testing Position*

This DUT was tested in 6 different positions. They are left cheek, left tilted, right cheek, right tilted, body worn with keypad up and body worn with keypad down as illustrated below:

1) "Cheek Position"
    i)   To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M, RE and LE) and align the center of the ear piece with the line RE-LE.
    ii) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see Fig. 9.1).

2) "Tilted Position"
    i)   To position the device in the "cheek" position described above.
    ii) While maintaining the device the reference plane described above and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig. 9.2).

3) "Body Worn"
    i)   To position the device parallel to the phantom surface with either keypad up or down.
    ii)   To adjust the phone parallel to the flat phantom.
    iii) To adjust the distance between the phone surface and the flat phantom to 1.5cm.

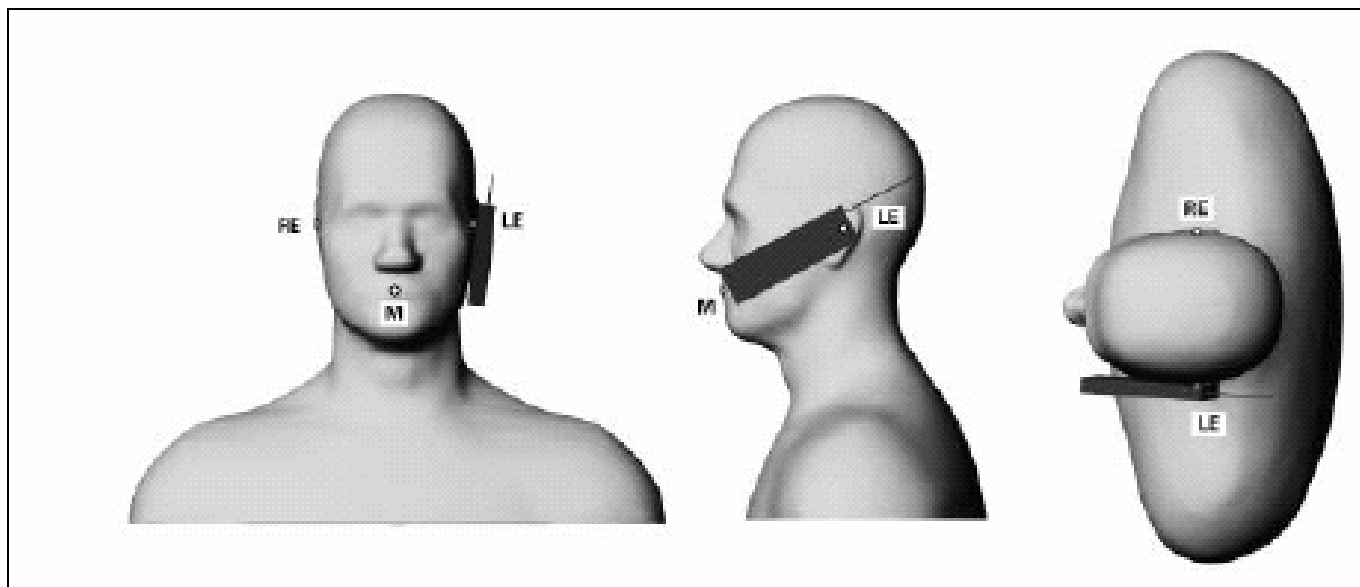Remark: Please refer to Appendix E for the test setup photo.

Fig. 9.1   Phone Position 1, "Cheek" or "Touch" Position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the plane for phone positioning, are indicated.
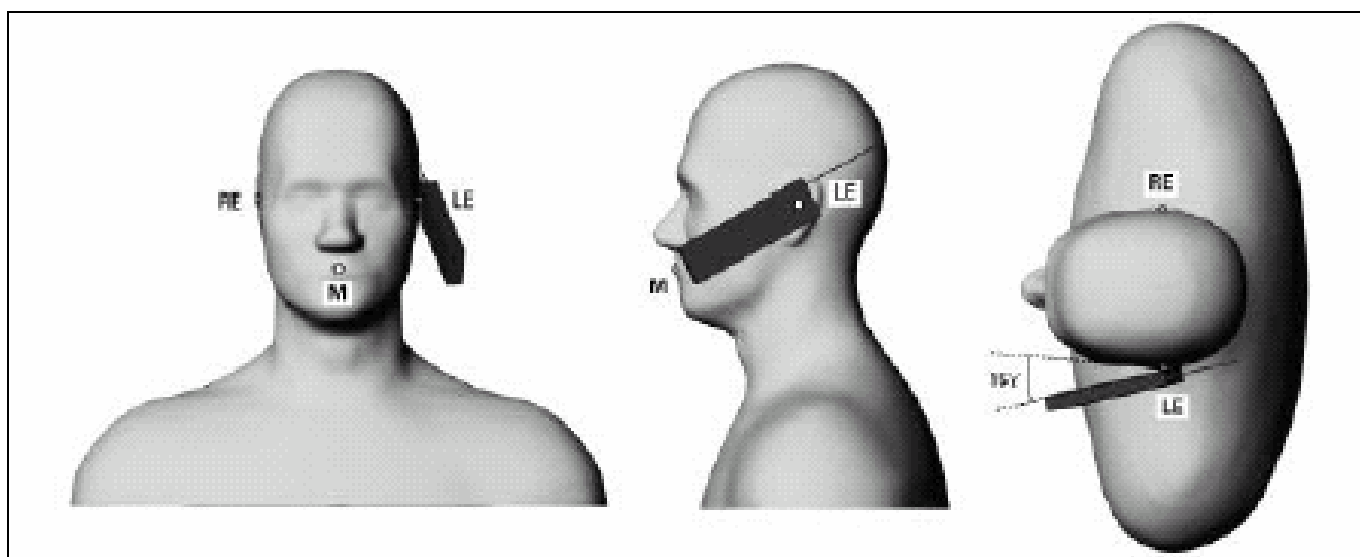

Fig. 9.2   Phone Position 2, "Tilted Position". The reference point for the right ear (RE), left ear (LE) and mouth (M), which define the plane for phone positioning, are indicated.

10. *Measurement Procedures*

The measurement procedures are as follows:

➢ Using engineering software to transmit RF power continuously (continuous Tx) in the middle channel
➢ Placing the DUT in the positions described in the last section
➢ Setting scan area, grid size and other setting on the DASY4 software
➢ Taking data for the low channel
➢ Repeat the previous steps for the low and high channels.

According to the IEEE P1528 draft standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:
➢ Power reference measurement
➢ Area scan
➢ Zoom scan
➢ Power reference measurement

10.1 *Spatial Peak SAR Evaluation*

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1528-2003 standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY4 software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

Base on the Draft: SCC-34, SC-2, WG-2-Computational Dosimetry, P1528/D1.2 (Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement 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. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

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

● extraction of the measured data (grid and values) from the Zoom Scan
● calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
● generation of a high-resolution mesh within the measured volume
● interpolation of all measured values form the measurement grid to the high-resolution grid
● extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
● calculation of the averaged SAR within masses of 1g and 10g

10.2 *Scan Procedures*

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5 mm. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 1 g.

10.3 *SAR Averaged Methods*

In DASY4, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

11. SAR Test Results

11.1 Right Cheek

Mode	Chan.	Freq (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 1g SAR (W/kg)	Limits (W/Kg)	Results
802.11b (Main Ant.)	1	2412(Low)	CCK	8.87	-	-	-	-
	6	2437(Mid)	CCK	8.81	-0.008	0.133	1.6	Pass
	11	2462(High)	CCK	9.10	-	-	-	-
802.11b (Aux. Ant.)	1	2412(Low)	CCK	8.87	-0.098	0.181	1.6	Pass
	6	2437(Mid)	CCK	8.81	-0.065	0.162	1.6	Pass
	11	2462(High)	CCK	9.10	0.047	0.184	1.6	Pass
802.11b (Main Ant. + Aux. Ant.)	1	2412(Low)	CCK	8.87	-	-	-	-
	6	2437(Mid)	CCK	8.81	-0.161	0.161	1.6	Pass
	11	2462(High)	CCK	9.10	-	-	-	-
802.11g (Aux. Ant.)	1	2412(Low)	OFDM	10.78	-	-	-	-
	6	2437(Mid)	OFDM	11.17	-0.131	0.019	1.6	Pass
	11	2462(High)	OFDM	11.33	-	-	-	-

11.2 Right Tilted

Mode	Chan.	Freq (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 1g SAR (W/kg)	Limits (W/Kg)	Results
802.11b (Aux. Ant.)	1	2412(Low)	CCK	8.87	-	-	-	-
	6	2437(Mid)	CCK	8.81	0.064	0.125	1.6	Pass
	11	2462(High)	CCK	9.10	-	-	-	-
802.11g (Aux. Ant.)	1	2412(Low)	OFDM	10.78	-	-	-	-
	6	2437(Mid)	OFDM	11.17	-	-	-	-
	11	2462(High)	OFDM	11.33	-	-	-	-

11.3 Left Cheek

Mode	Chan.	Freq (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 1g SAR (W/kg)	Limits (W/Kg)	Results
802.11b (Aux. Ant.)	1	2412(Low)	CCK	8.87	-	-	-	-
	6	2437(Mid)	CCK	8.81	-0.187	0.133	1.6	Pass
	11	2462(High)	CCK	9.10	-	-	-	-
802.11g (Aux. Ant.)	1	2412(Low)	OFDM	10.78	-	-	-	-
	6	2437(Mid)	OFDM	11.17	-	-	-	-
	11	2462(High)	OFDM	11.33	-	-	-	-

11.4 Left Tilted

Mode	Chan.	Freq (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 1g SAR (W/kg)	Limits (W/Kg)	Results
802.11b (Aux. Ant.)	1	2412(Low)	CCK	8.87	-	-	-	-
	6	2437(Mid)	CCK	8.81	-0.119	0.119	1.6	Pass
	11	2462(High)	CCK	9.10	-	-	-	-
802.11g (Aux. Ant.)	1	2412(Low)	OFDM	10.78	-	-	-	-
	6	2437(Mid)	OFDM	11.17	-	-	-	-
	11	2462(High)	OFDM	11.33	-	-	-	-

11.5 *Keypad Up with 1.5cm Gap*

Mode	Chan.	Freq (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 1g SAR (W/kg)	Limits (W/Kg)	Results
802.11b (Main Ant.)	1	2412(Low)	CCK	8.87	-	-	-	-
	6	2437(Mid)	CCK	8.81	-0.105	0.029	1.6	Pass
	11	2462(High)	CCK	9.10	-	-	-	-

11.6 *Keypad Down with 1.5cm Gap*

Mode	Chan.	Freq (MHz)	Modulation type	Conducted Power (dBm)	Power Drift (dB)	Measured 1g SAR (W/kg)	Limits (W/Kg)	Results
802.11b (Main Ant.)	1	2412(Low)	CCK	8.87	-	-	-	-
	6	2437(Mid)	CCK	8.81	-0.13	0.107	1.6	Pass
	11	2462(High)	CCK	9.10	-	-	-	-
802.11b (Aux. Ant.)	1	2412(Low)	CCK	8.87	-0.05	0.155	1.6	Pass
	6	2437(Mid)	CCK	8.81	-0.114	0.141	1.6	Pass
	11	2462(High)	CCK	9.10	-0.146	0.136	1.6	Pass
802.11b (Main Ant. + Aux. Ant.)	1	2412(Low)	CCK	8.87	-	-	-	-
	6	2437(Mid)	CCK	8.81	-0.187	0.111	1.6	Pass
	11	2462(High)	CCK	9.10	-	-	-	-
802.11g (Aux. Ant.)	1	2412(Low)	OFDM	10.78	-	-	-	-
	6	2437(Mid)	OFDM	11.17	-0.055	0.016	1.6	Pass
	11	2462(High)	OFDM	11.33	-	-	-	-

Test Engineer：John Tsai and Jason Wang

12.*Reference*

[1] FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"

[2] IEEE Std. P1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", April 21,2003.

[3] Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01), "Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to RF Emissions", June 2001

[4] IEEE Std. C95.3-2002, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields-RF and Microwave", 2002

[5] IEEE Std. C95.1-1999, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", 1999

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

[7] DAYS4 System Handbook

Appendix A - System Performance Check Data

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/7

System Check_Head_2450MHz

DUT: Dipole 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2450 MHz; σ = 1.76 mho/m; ε_r = 38.1; ρ = 1000 kg/m^3
Ambient Temperature：22.9 ℃; Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

2450MHz/Area Scan (41x41x1): Measurement grid: dx=20mm, dy=20mm
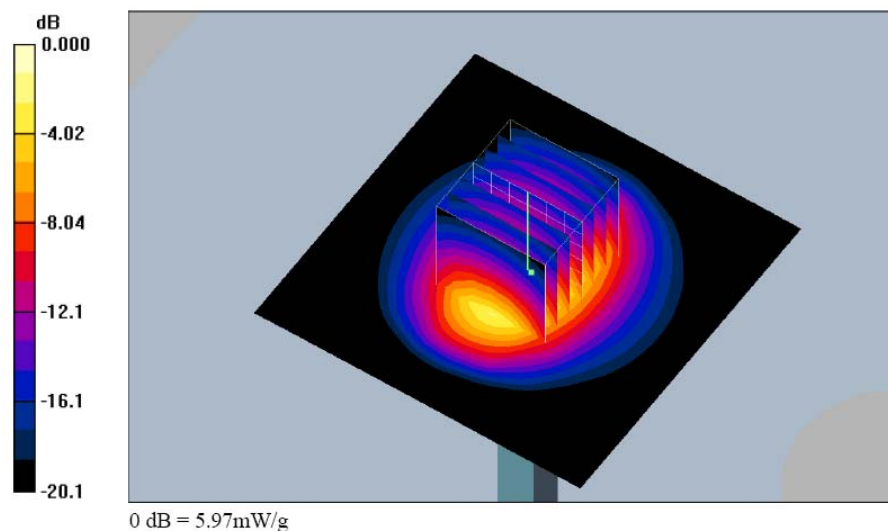Maximum value of SAR (interpolated) = 6.10 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.5 V/m; Power Drift = -0.037 dB
Peak SAR (extrapolated) = 12.4 W/kg
SAR(1 g) = 5.7 mW/g; SAR(10 g) = 2.68 mW/g
Maximum value of SAR (measured) = 6.43 mW/g

0 dB = 6.43mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/9

System Check_Body_2450MHz

DUT: Dipole 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: f = 2450 MHz; σ = 1.97 mho/m; ε_r = 52.7; ρ = 1000 kg/m³
Ambient Temperature：22.8 ℃；Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.02, 4.02, 4.02); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin=100mW/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
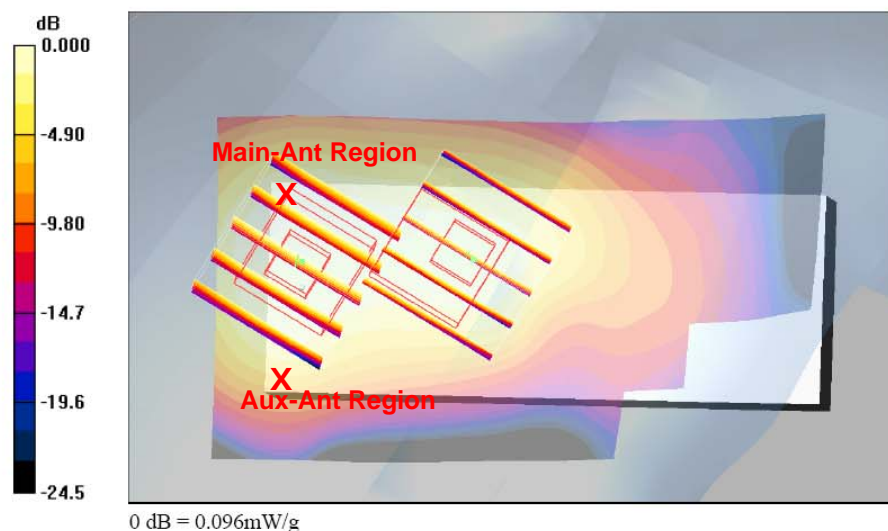Maximum value of SAR (interpolated) = 6.22 mW/g

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.4 V/m; Power Drift = 0.007 dB
Peak SAR (extrapolated) = 11.3 W/kg
SAR(1 g) = 5.3 mW/g; SAR(10 g) = 2.52 mW/g
Maximum value of SAR (measured) = 5.97 mW/g

0 dB = 5.97mW/g

Appendix B - SAR Measurement Data

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/7

Right Cheek_802.11b Ch6_Main Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.74 mho/m; ε_r = 38.2; ρ = 1000 kg/m³
Ambient Temperature：22.9 ℃；Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.142 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.12 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 0.269 W/kg
SAR(1 g) = 0.133 mW/g; SAR(10 g) = 0.070 mW/g
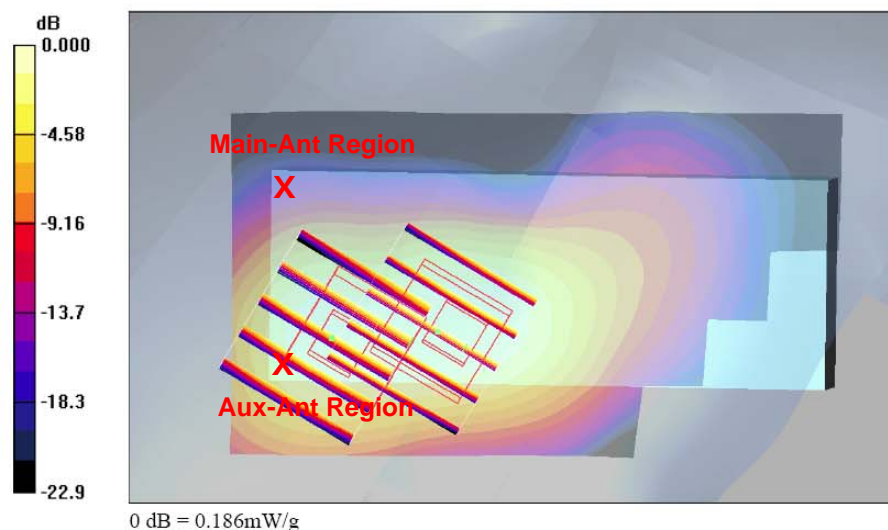Maximum value of SAR (measured) = 0.146 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.12 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 0.165 W/kg
SAR(1 g) = 0.091 mW/g; SAR(10 g) = 0.051 mW/g
Maximum value of SAR (measured) = 0.096 mW/g

0 dB = 0.096mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/7

Right Cheek_802.11b Ch11_Aux Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2462 MHz; σ = 1.78 mho/m; ε_r = 38; ρ = 1000 kg/m^3
Ambient Temperature：22.9 ℃; Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch11/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
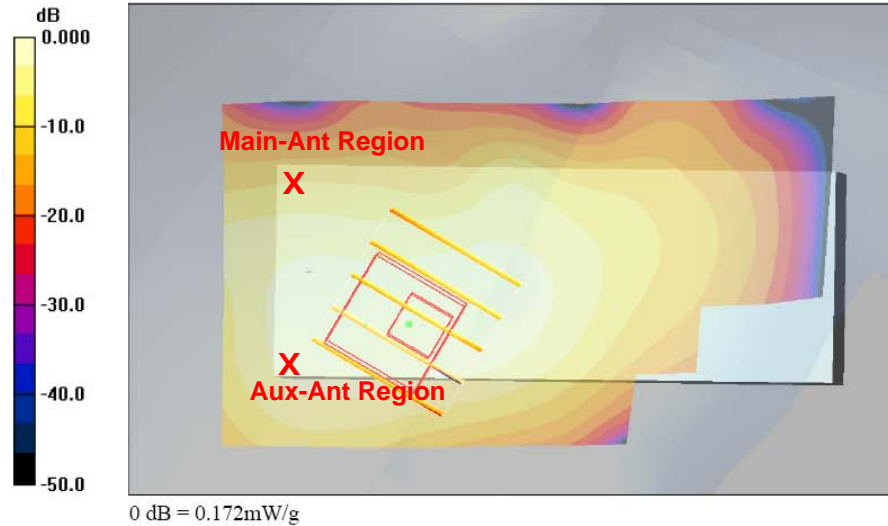Maximum value of SAR (interpolated) = 0.197 mW/g

Ch11/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.60 V/m; Power Drift = 0.047 dB
Peak SAR (extrapolated) = 0.344 W/kg
SAR(1 g) = 0.184 mW/g; SAR(10 g) = 0.099 mW/g
Maximum value of SAR (measured) = 0.197 mW/g

Ch11/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.60 V/m; Power Drift = 0.047 dB
Peak SAR (extrapolated) = 0.343 W/kg
SAR(1 g) = 0.172 mW/g; SAR(10 g) = 0.092 mW/g
Maximum value of SAR (measured) = 0.186 mW/g

0 dB = 0.186mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/7

Right Cheek_802.11b Ch6_Main+Aux Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.74 mho/m; ε_r = 38.2; ρ = 1000 kg/m^3
Ambient Temperature：22.9 ℃；Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
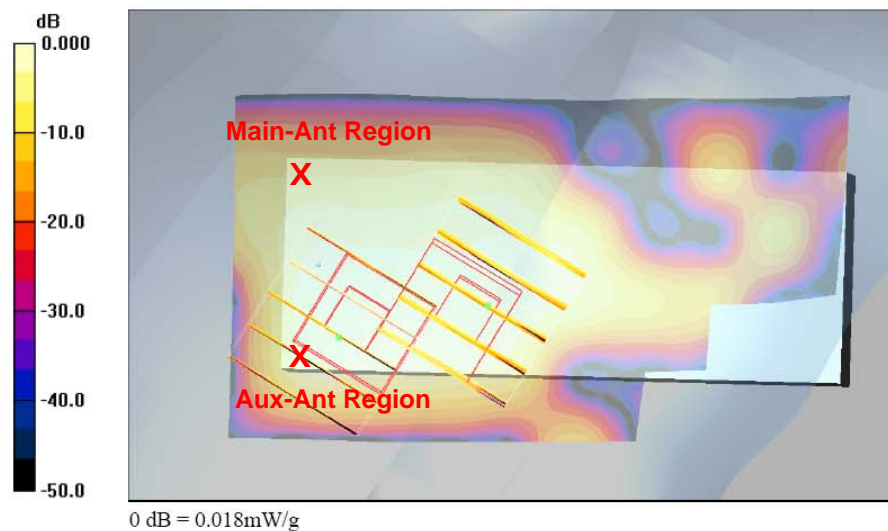Maximum value of SAR (interpolated) = 0.171 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.12 V/m; Power Drift = -0.161 dB
Peak SAR (extrapolated) = 0.294 W/kg
SAR(1 g) = 0.161 mW/g; SAR(10 g) = 0.091 mW/g
Maximum value of SAR (measured) = 0.172 mW/g

0 dB = 0.172mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date 2007/9/7

Right Cheek_802.11g Ch6_Aux Ant

DUT: 782409

Communication System: 802.11g; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.74 mho/m; $ε_r$ = 38.2; ρ = 1000 kg/m^3
Ambient Temperature：22.9 ℃; Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.032 mW/g
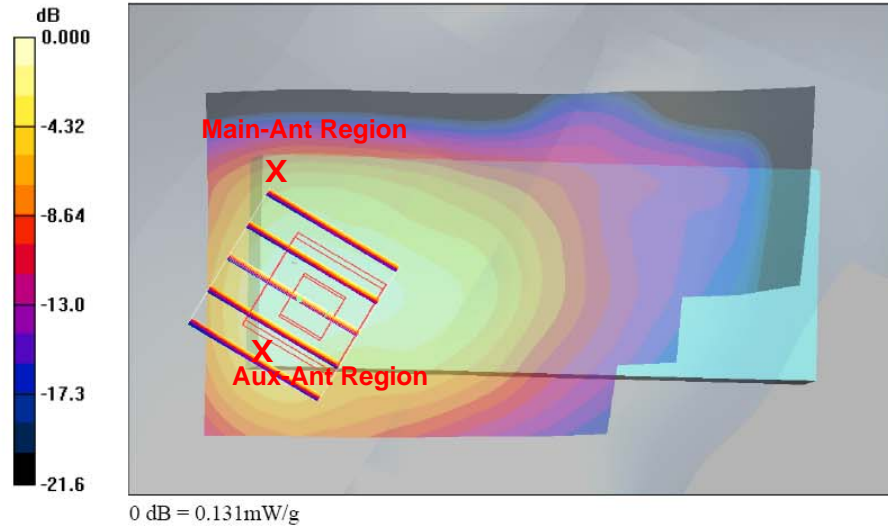
Ch6/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.81 V/m; Power Drift = -0.131 dB
Peak SAR (extrapolated) = 0.051 W/kg
SAR(1 g) = 0.019 mW/g; SAR(10 g) = 0.0083 mW/g
Maximum value of SAR (measured) = 0.019 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.81 V/m; Power Drift = -0.131 dB
Peak SAR (extrapolated) = 0.034 W/kg
SAR(1 g) = 0.016 mW/g; SAR(10 g) = 0.00764 mW/g
Maximum value of SAR (measured) = 0.018 mW/g

0 dB = 0.018mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/7

Right Tilted_802.11b Ch6_Aux Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.74 mho/m; ε_r = 38.2; ρ = 1000 kg/m^3
Ambient Temperature：22.9 ℃；Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.146 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.32 V/m; Power Drift = 0.064 dB
Peak SAR (extrapolated) = 0.236 W/kg
SAR(1 g) = 0.125 mW/g; SAR(10 g) = 0.070 mW/g
Maximum value of SAR (measured) = 0.131 mW/g

0 dB = 0.131mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/7

Left Cheek_802.11b Ch6_Aux Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.74 mho/m; ε_r = 38.2; ρ = 1000 kg/m³
Ambient Temperature：22.9 ℃; Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.147 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.44 V/m; Power Drift = -0.187 dB
Peak SAR (extrapolated) = 0.230 W/kg
SAR(1 g) = 0.133 mW/g; SAR(10 g) = 0.078 mW/g
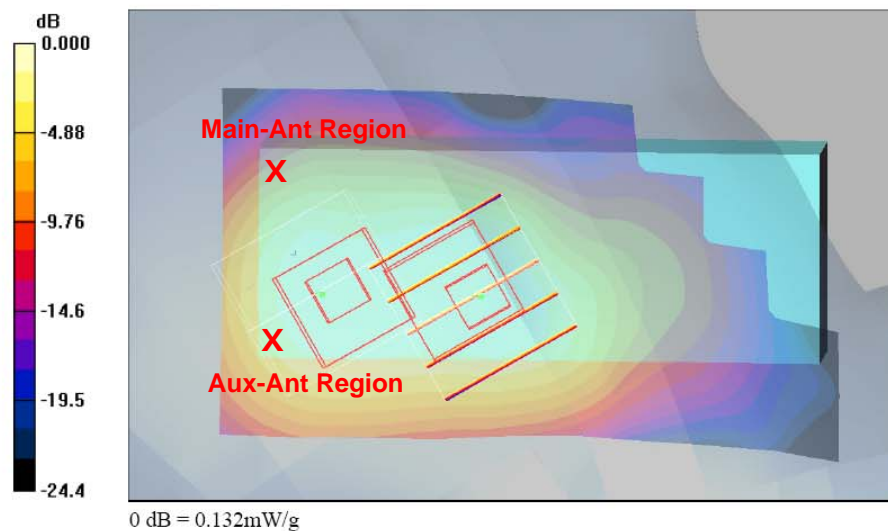Maximum value of SAR (measured) = 0.144 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.44 V/m; Power Drift = -0.187 dB
Peak SAR (extrapolated) = 0.229 W/kg
SAR(1 g) = 0.126 mW/g; SAR(10 g) = 0.070 mW/g
Maximum value of SAR (measured) = 0.132 mW/g

0 dB = 0.132mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date: 2007/9/7

Left Tilted_802.11b Ch6_Aux Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.74 mho/m; ε_r = 38.2; ρ = 1000 kg/m^3
Ambient Temperature：22.9 ℃；Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
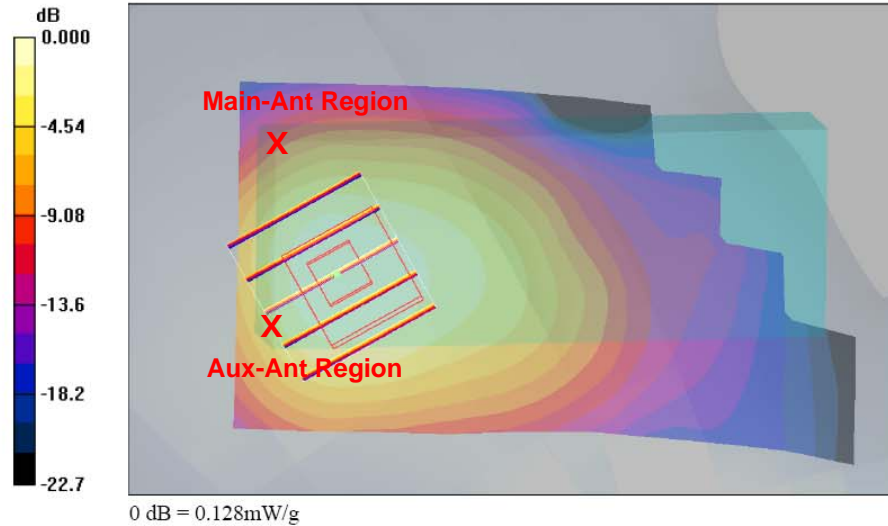Maximum value of SAR (interpolated) = 0.133 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.38 V/m; Power Drift = -0.119 dB
Peak SAR (extrapolated) = 0.224 W/kg
SAR(1 g) = 0.119 mW/g; SAR(10 g) = 0.066 mW/g
Maximum value of SAR (measured) = 0.128 mW/g

0 dB = 0.128mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/9

Body_802.11b Ch6_Keypad Up with 1.5cm Gap_Main Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃；Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.02, 4.02, 4.02); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
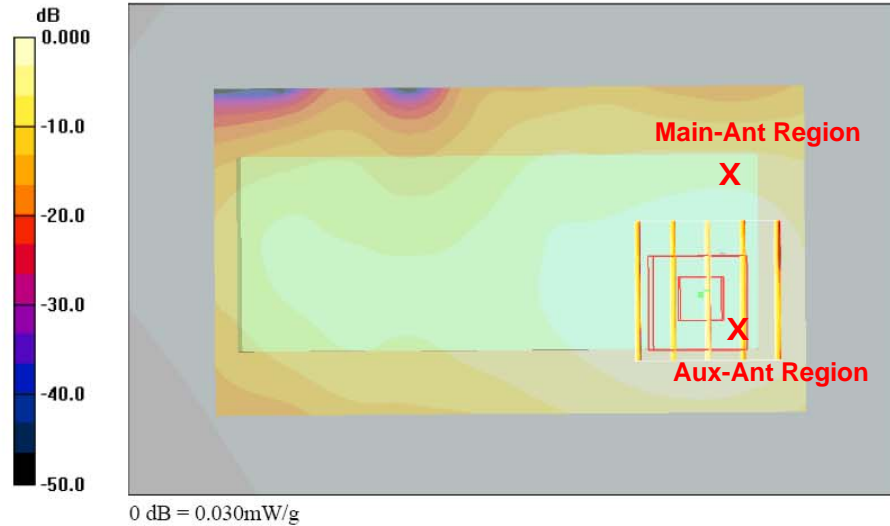Maximum value of SAR (interpolated) = 0.032 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.83 V/m; Power Drift = -0.105 dB
Peak SAR (extrapolated) = 0.061 W/kg
SAR(1 g) = 0.029 mW/g; SAR(10 g) = 0.017 mW/g
Maximum value of SAR (measured) = 0.030 mW/g

0 dB = 0.030mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/9

Body_802.11b Ch6_Keypad Down with 1.5cm Gap_Main Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃；Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.02, 4.02, 4.02); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
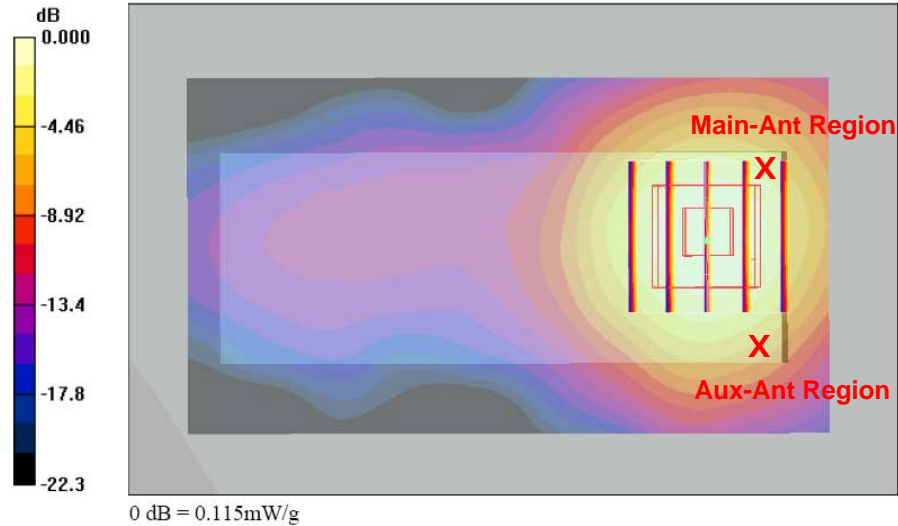Maximum value of SAR (interpolated) = 0.121 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.37 V/m; Power Drift = -0.130 dB
Peak SAR (extrapolated) = 0.198 W/kg
SAR(1 g) = 0.107 mW/g; SAR(10 g) = 0.060 mW/g
Maximum value of SAR (measured) = 0.115 mW/g

0 dB = 0.115mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/9

Body_802.11b Ch1_Keypad Down with 1.5cm Gap_Aux Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: f = 2412 MHz; σ = 1.92 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃; Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.02, 4.02, 4.02); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch1/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
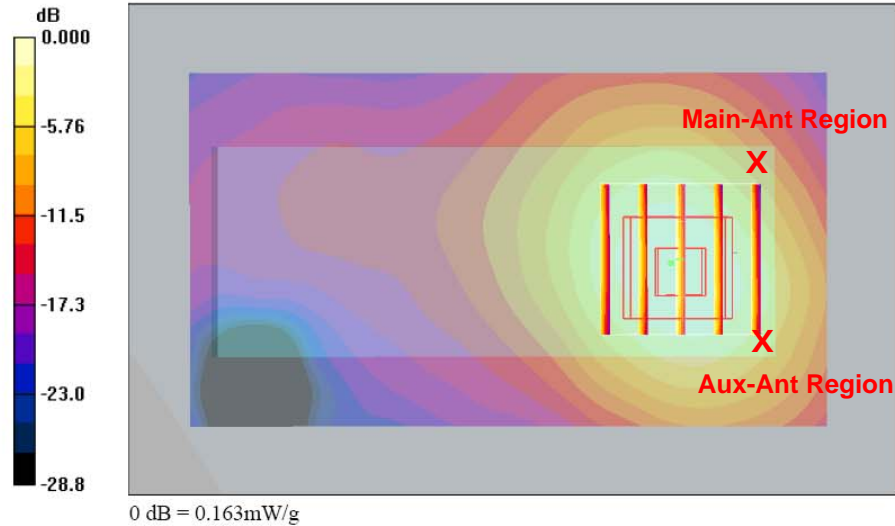Maximum value of SAR (interpolated) = 0.175 mW/g

Ch1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.42 V/m; Power Drift = -0.050 dB
Peak SAR (extrapolated) = 0.315 W/kg
SAR(1 g) = 0.155 mW/g; SAR(10 g) = 0.085 mW/g
Maximum value of SAR (measured) = 0.163 mW/g

0 dB = 0.163mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/9

Body_802.11b Ch6_Keypad Down with 1.5cm Gap_Main+Aux Ant

DUT: 782409

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃; Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.02, 4.02, 4.02); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
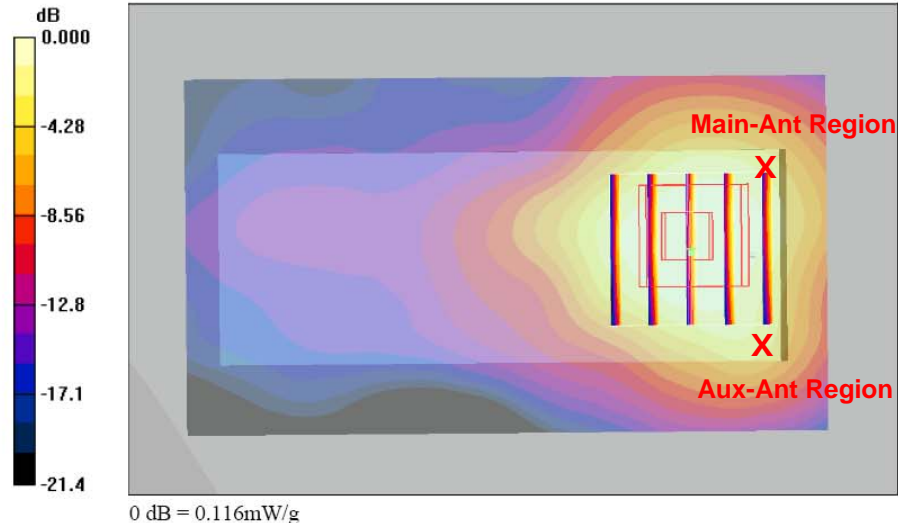Maximum value of SAR (interpolated) = 0.129 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.58 V/m; Power Drift = -0.187 dB
Peak SAR (extrapolated) = 0.198 W/kg
SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.062 mW/g
Maximum value of SAR (measured) = 0.116 mW/g

0 dB = 0.116mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date : 2007/9/9

Body_802.11g Ch6_Keypad Down with 1.5cm Gap_Aux Ant

DUT: 782409

Communication System: 802.11g; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: f = 2437 MHz; σ = 1.95 mho/m; ε_r = 52.8; ρ = 1000 kg/m³
Ambient Temperature：22.8 ℃; Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.02, 4.02, 4.02); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch6/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
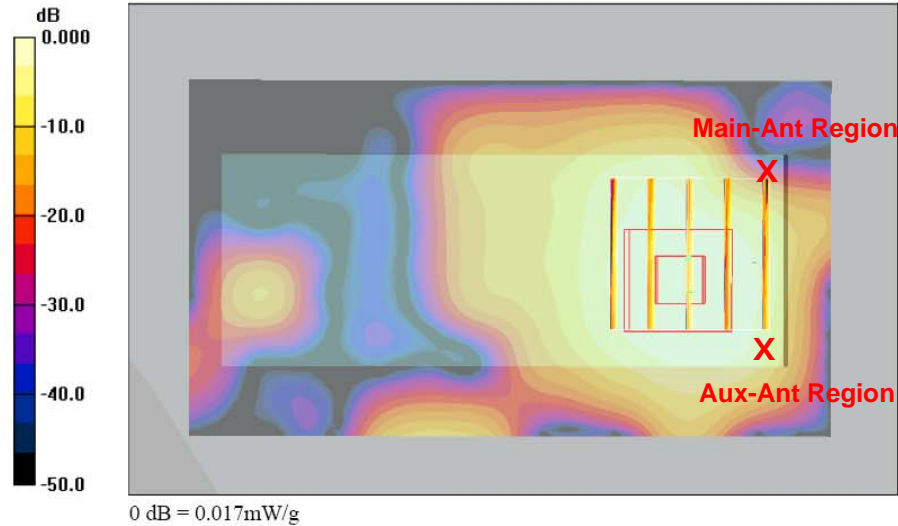Maximum value of SAR (interpolated) = 0.018 mW/g

Ch6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.19 V/m; Power Drift = -0.055 dB
Peak SAR (extrapolated) = 0.029 W/kg
SAR(1 g) = 0.016 mW/g; SAR(10 g) = 0.00796 mW/g
Maximum value of SAR (measured) = 0.017 mW/g

0 dB = 0.017mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab   Date: 2007/9/7

Right Cheek_802.11b Ch11_Aux Ant_2D

DUT: 782409

Communication System: 802.11b ; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2462 MHz; σ = 1.78 mho/m; ε_r = 38; ρ = 1000 kg/m³
Ambient Temperature：22.9 ℃；Liquid Temperature：21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.5, 4.5, 4.5); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch11/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.197 mW/g

Ch11/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.60 V/m; Power Drift = 0.047 dB
Peak SAR (extrapolated) = 0.344 W/kg
SAR(1 g) = 0.184 mW/g; SAR(10 g) = 0.099 mW/g
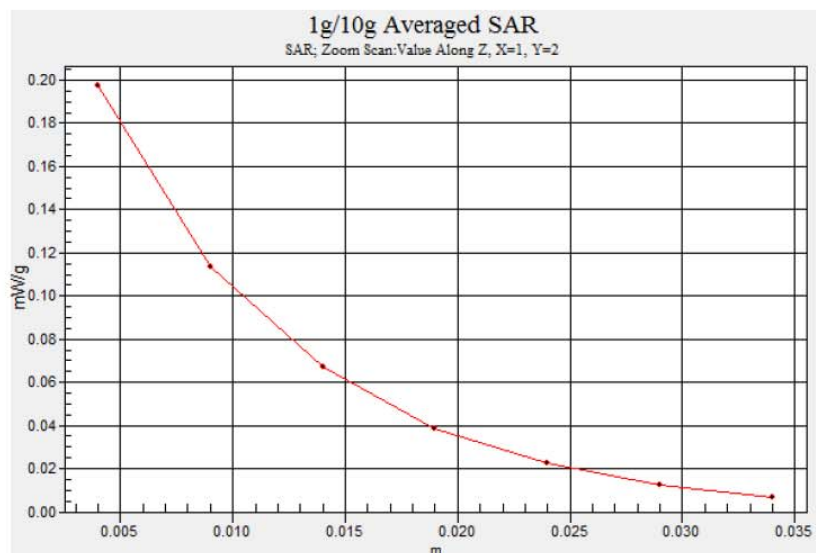Maximum value of SAR (measured) = 0.197 mW/g

Ch11/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.60 V/m; Power Drift = 0.047 dB
Peak SAR (extrapolated) = 0.343 W/kg
SAR(1 g) = 0.172 mW/g; SAR(10 g) = 0.092 mW/g
Maximum value of SAR (measured) = 0.186 mW/g

Body_802.11b Ch1_Keypad Down with 1.5cm Gap_Aux Ant_2D

DUT: 782409

Communication System: 802.11b ; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: MSL_2450 Medium parameters used: f = 2412 MHz; σ = 1.92 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Ambient Temperature：22.8 ℃；Liquid Temperature：21.5 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1787; ConvF(4.02, 4.02, 4.02); Calibrated: 2007/8/28
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 2006/11/21
- Phantom: SAM-A; Type: QD 000 P40 C; Serial: TP-1303
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Ch1/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
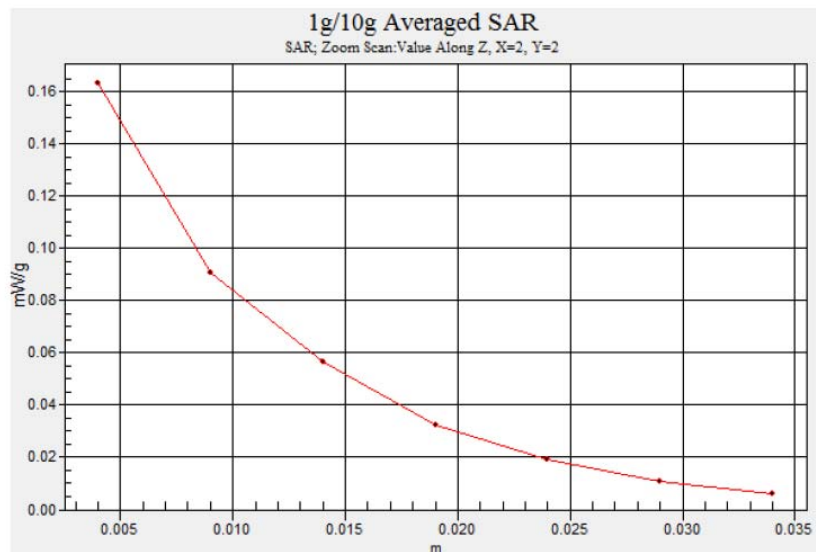Maximum value of SAR (interpolated) = 0.175 mW/g

Ch1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.42 V/m; Power Drift = -0.050 dB
Peak SAR (extrapolated) = 0.315 W/kg
SAR(1 g) = 0.155 mW/g; SAR(10 g) = 0.085 mW/g
Maximum value of SAR (measured) = 0.163 mW/g

Appendix C – Calibration Data

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

ilac-MRA

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

Certificate No: **DAE3-577_Nov06**

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 577
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	November 21, 2006
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	13-Oct-06 (Elcal AG, No: 5492)	Oct-07
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-06 (Elcal AG, No: 5478)	Oct-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1002	15-Jun-06 (SPEAG, in house check)	In house check Jun-07

	Name	Function	Signature
Calibrated by:	Eric Hainfeld	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: November 21, 2006

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

Certificate No: DAE3-577_Nov06   Page 1 of 5

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

Accreditation No.: **SCS 108**

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

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 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.

Certificate No: DAE3-577_Nov06   Page 2 of 5

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	404.355 ± 0.1% (k=2)	403.806 ± 0.1% (k=2)	404.276 ± 0.1% (k=2)
Low Range	3.92854 ± 0.7% (k=2)	3.93862 ± 0.7% (k=2)	3.93591 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	268 ° ± 1 °