SAR TEST REPORT

REPORT NO.: SA990121L17

MODEL NO.: FreeStyl 1

RECEIVED: Jan. 21, 2010

TESTED: Feb. 22, 2010

ISSUED: Feb. 26, 2010

APPLICANT: Senao Networks, Inc.

ADDRESS: 3F, No. 529, Chung Cheng Rd., Hsintien, Taipei, Taiwan, R.O.C.

ISSUED BY: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

LAB ADDRESS: No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang, Taipei Hsien 244, Taiwan, R.O.C.

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Testing Laboratory
2021

TABLE OF CONTENTS

1. CERTIFICATION

PRODUCT:	Single Line Long Range Cordless Telephone
MODEL:	FreeStyl 1
BRAND:	EnGenius
APPLICANT:	Senao Networks, Inc.
TESTED:	Feb. 22, 2010
TEST SAMPLE:	ENGINEERING SAMPLE
STANDARDS:	**FCC Part 2 (Section 2.1093)** **FCC OET Bulletin 65, Supplement C (01-01)** **RSS-102**

The above equipment (model: FreeStyl 1) have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY :	Polly Chien / Specialist	**, DATE :**	Feb. 26, 2010
TECHNICAL ACCEPTANCE : Responsible for RF	Mason Chang / Engineer	**, DATE :**	Feb. 26, 2010
APPROVED BY :	Gary Chang / Assistant Manager	**, DATE :**	Feb. 26, 2010

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

EUT	Single Line Long Range Cordless Telephone
MODEL NO.	FreeStyl 1
FCC ID	U2M-FS1
IC ID	3616C-FS1
POWER SUPPLY	12Vdc (from AC Adapter) 3.7Vdc (from battery) 5.5Vdc (from charger)
CLASSIFICATION	Portable device, production unit
MODULATION TYPE	MSK / TDD (Frequency hopping)
FREQUENCY RANGE	902.269668 ~ 927.654755MHz
CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER	27.85dBm / 902.269668MHz for channel 1 27.80dBm / 914.911644MHz for channel 126 27.13dBm / 927.654755MHz for channel 252
MAXIMUM SAR (1g)	**Head:** 0.450W/kg
	Body: 1.130W/kg
ANTENNA TYPE	Dipole antenna with 2dBi gain (Base Station) Dipole antenna with 2.5dBi gain (long Ant. Portable Handset) Rubber antenna with 1.5dBi gain (short Ant. Portable Handset)
ANTENNA CONNECTOR	RTNC (Base Station) Sheet metal (Portable Handset)
DATA CABLE	NA
I/O PORTS	Refer to user’s manual
ACCESSORY DEVICES	Adapter, charger (Brand: EnGenius), Battery

NOTE:

1. The EUT uses following adapter, battery & charger’s adapter.

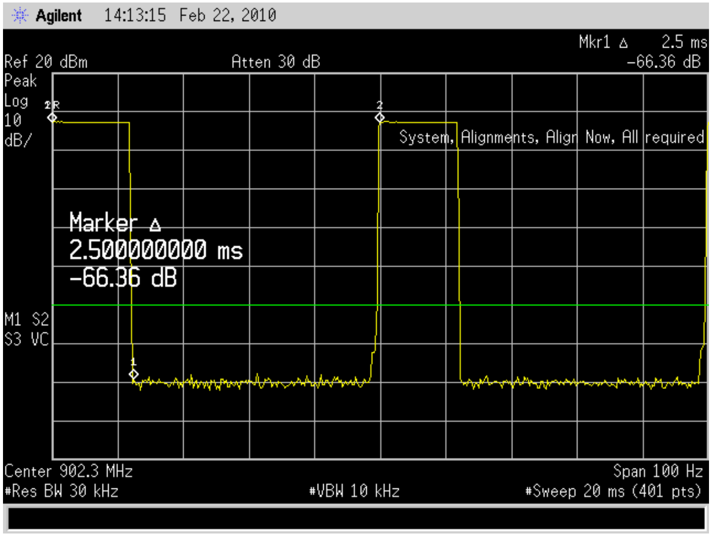
ADAPTER (for Base Station used)	
BRAND	DVE
MODEL	DSA-12G-12 FUS 120120
INPUT POWER	100-240Vac, 50/60Hz, 0.3A
OUTPUT POWER	12Vdc, 1A
POEWR LINE	1.8m non-shielded cable without core

BATTERY (for Portable Handset used)	
BRAND	EnGenius
INPUT POWER	1100mAh
OUTPUT POWER	3.7Vdc

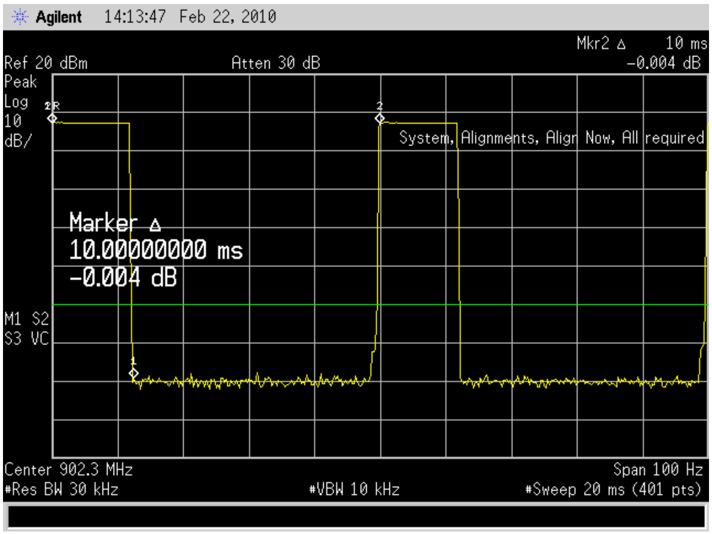
ADAPTER (for Portable Handset Charger used)	
MODEL	WRG10F-055A
INPUT POWER	100-240Vac, 50-60Hz, 0.5A
OUTPUT POWER	5.5Vdc, 1.5A
POEWR LINE	1.8m non-shielded cable with one core

2. A set of the EUT include Base station & Portable handset (The test report is for portable handset only. Base station has no SAR test issue).
3. The duty cycle of Handset is 25 %. Therefore crest factor = 1/ (25/100) = 4.

TX burst length: 2.5 ms



A completed transmission period: 10.0 ms



4. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2.2 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to the specifications of the manufacturer, this product must comply with the requirements of the following standards:

FCC 47 CFR Part 2 (2.1093)

FCC OET Bulletin 65, Supplement C (01- 01)

RSS-102

IEEE 1528-2003

All test items have been performed and recorded as per the above standards.

2.3 GENERAL INOFRMATION OF THE SAR SYSTEM

DASY5 (software 5.2 Build 157) consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY5 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

EX3DV4 ISOTROPIC E-FIELD PROBE

CONSTRUCTION	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
FREQUENCY	10 MHz > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
DIRECTIVITY	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
DYNAMIC RANGE	10 μW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μW/g)
DIMENSIONS	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
APPLICATION	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

NOTE

1. The Probe parameters have been calibrated by the SPEAG. Please reference “APPENDIX D” for the Calibration Certification Report.
2. For frequencies above 800MHz, calibration in a rectangular wave-guide is used, because wave-guide size is manageable.
3. For frequencies below 800MHz, temperature transfer calibration is used because the wave-guide size becomes relatively large.

TWIN SAM V4.0

CONSTRUCTION	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
SHELL THICKNESS	2 ± 0.2 mm
FILLING VOLUME	Approx. 25 liters
DIMENSIONS	Height: 810 mm; Length: 1000 mm; Width: 500 mm

SYSTEM VALIDATION KITS:

CONSTRUCTION	Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor
CALIBRATION	Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions
FREQUENCY	900 MHz
RETURN LOSS	> 20 dB at specified validation position
POWER CAPABILITY	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
OPTIONS	Dipoles for other frequencies or solutions and other calibration conditions upon request

DEVICE HOLDER FOR SAM TWIN PHANTOM

CONSTRUCTION	The device holder for the GSM900/DCS1800/PCS1900 GSM/GPRS/CDMA Mobile Phone device 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 reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles. The holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent δ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. The device holder for the portable device makes up of the polyethylene foam. The dielectric parameters of material close to the dielectric parameters of the air.

DATA ACQUISITION ELECTRONICS

CONSTRUCTION	The data acquisition electronics (DAE3) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplex, 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 is 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 DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

2.4 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION

The DASY5 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the micro-volt 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

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

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

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:

$$\text{E-fieldprobes: } E_i = \sqrt{\frac{V_1}{Norm_i \cdot ConvF}}$$

$$\text{H-fieldprobes: } H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

V_i	=compensated signal of channel I	(i = x, y, z)
$Norm_i$	=sensor sensitivity of channel i μV/(V/m)2 for E-field Probes	(i = x, y, z)
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.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

SAR	= local specific absorption rate in mW/g
E_{tot}	= total field strength in V/m
σ	= conductivity in [mho/m] or [Siemens/m]
ρ	= equivalent tissue density in g/cm3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid. The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

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

The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated. The angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within -2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). 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 5mm.

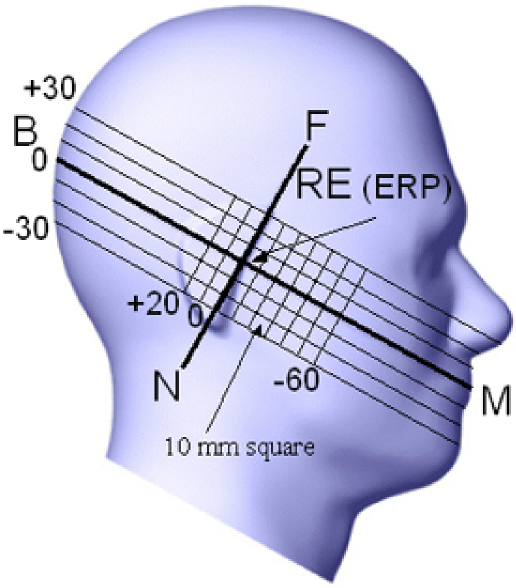
The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7 x 7 x 7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 30 x 30 x 30mm contains about 30g of tissue. The first procedure is an extrapolation (incl. boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid (42875 points). In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

3. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

4. DESCRIPTION OF TEST POSITION

4.1 DESCRIPTION OF TEST POSITION



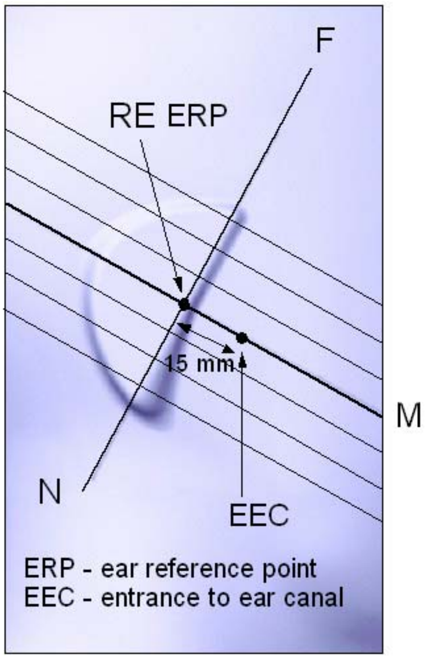


FIGURE 3.1

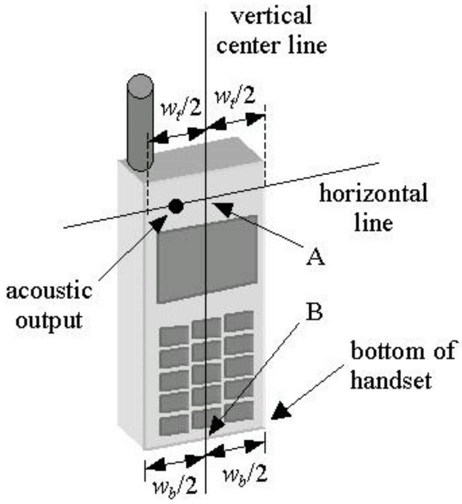


FIGURE 3.1a

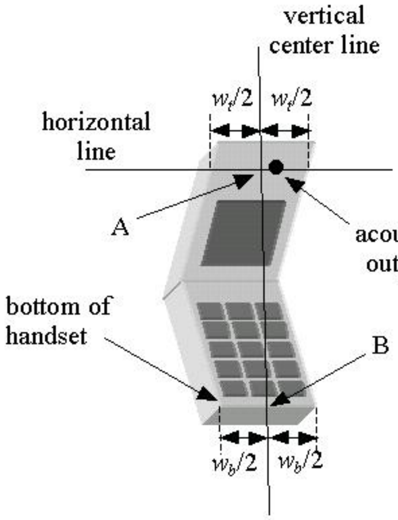
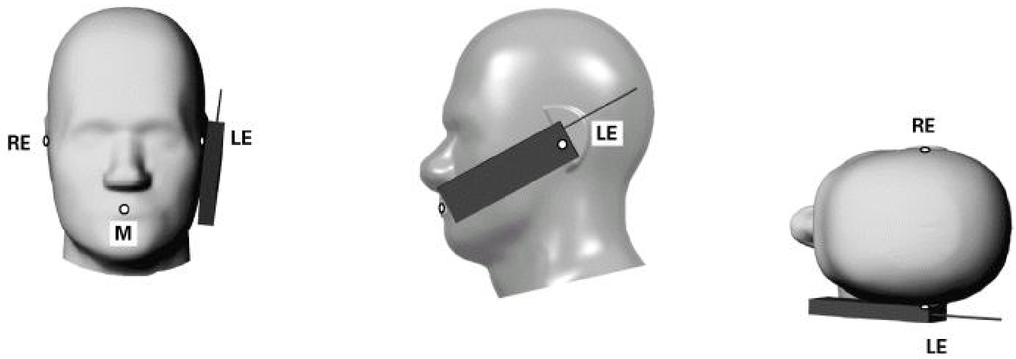


FIGURE 3.1b

4.1.1 TOUCH/CHEEK TEST POSITION

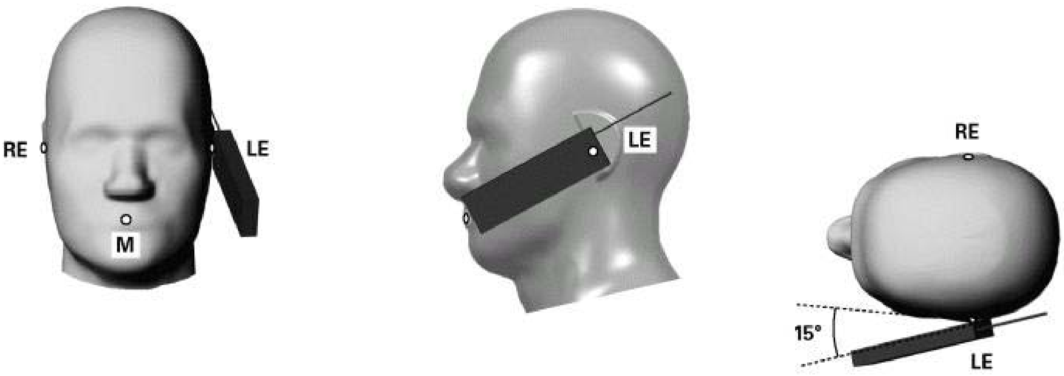
The head position in Figure 3.1, the ear reference points ERP are 15mm above entrance to ear canal along the B-M line. The line N-F (Neck-Front) is perpendicular to the B-M (Back Mouth) line. The handset device in Figure 3.1a and 3.1b,The vertical centerline pass through two points on the front side of handset: the midpoint of the width wt of the handset at the level of the acoustic output (point A) and the midpoint of the width Wb of the bottom of the handset (point B). The vertical centerline is perpendicular to the horizontal line and pass through the center of the acoustic output. The point A touches the ERP and the vertical centerline of the handset is parallel to the B-M line. While maintaining the point A contact with the ear(ERP), rotate the handset about the line NF until any point on handset is in contact with the cheek of the phantom



TOUCH/CHEEK POSITION FIGURE

4.1.2 TILT TEST POSITION

Adjust the device in the cheek position. While maintaining a point of the handset contact in the ear, move the bottom of the handset away from the mouth by an angle of 15 degrees.



TILT POSITION FIGURE

4.1.3 BODY-WORN CONFIGURATION

The handset device attached the belt clip or the holster. The keypad face of the handset is against with the bottom of the flat phantom face and the bottom of the keypad face contact to the bottom of the flat phantom.

When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only accessory that dictates the closest spacing to the body must be tested.

4.2 DESCRIPTION OF TEST MODE

TEST MODE	COMMUNICATION MODE	MODULATION TYPE	ASSESSMENT POSTITION	TESTED CHANNEL	REMARK
1	TDD_900MHz	MSK	Right Head / Cheek	1	Dipole Ant.
2			Right Head / Tilt	1	Dipole Ant.
3			Left Head / Cheek	1	Dipole Ant.
4			Left Head / Tilt	1	Dipole Ant.
5			Right Head / Cheek	1	Rubber Ant.
6			Right Head / Tilt	1	Rubber Ant.
7			Left Head / Cheek	1	Rubber Ant.
8			Left Head / Tilt	1	Rubber Ant.
9			Body / Back	1, 126, 252	Dipole Ant.
10			Body / Back	1	Rubber Ant.

NOTE: The Body position to the phantom with 0mm-separation distance.

4.3 SUMMARY OF TEST RESULTS

ITEM		1	2	3	4
PART OF ASSESSMENT		HEAD POSITION			
COMMUNICATION MODE		TDD_900MHz			
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			
1	902.269668	0.111	0.139	0.097	0.240

ITEM		5	6	7	8
PART OF ASSESSMENT		HEAD POSITION			
COMMUNICATION MODE		TDD_900MHz			
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)			
1	902.269668	0.441	0.242	**0.450**	0.258

ITEM		9	10
PART OF ASSESSMENT		BODY POSITION	
COMMUNICATION MODE		TDD_900MHz	
CHAN.	FREQ. (MHz)	MEASURED VALUE OF 1g SAR (W/kg)	
1	902.269668	0.886	0.317
126	914.911644	**1.130**	**-**
252	927.654755	0.816	-

NOTE: The worst value of each communication has been marked by boldface.

5. TEST RESULTS

5.1 TEST PROCEDURES

The EUT (Single Line Long Range Cordless Telephone) makes a phone call to the communication simulator station. Establish the simulation communication configuration rather the actual communication. Then the EUT could continuous the transmission mode. Adjust the PCL of the base station could controlled the EUT to transmitted the maximum output power. The base station also could control the transmission channel. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY5 SAR measurement system manufactured and calibrated by SPEAG. According to the IEEE 1528 / EN 50361, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

• Power reference measurement

• Verification of the power reference measurement

• Area scan

• Zoom scan

• Power reference measurement

The area scan with 15mm x 15mm grid was performed for the highest spatial SAR location. Consist of 11 x 13 points while the scan size is the 150mm x 180mm. The zoom scan with 30mm x 30mm x 30mm volume was performed for SAR value averaged over 1g and 10g spatial volumes.

In the zoom scan, the distance between the measurement point at the probe sensor location (geometric center behind the probe tip) and the phantom surface is 4.0 mm and maintained at a constant distance of ±1.0 mm during a zoom scan to determine peak SAR locations. The distance is 4mm between the first measurement point and the bottom surface of the phantom. The secondary measurement point to the bottom surface of the phantom is with 9mm separation distance. The cube size is 7 x 7 x 7 points consist of 343 points and the grid space is 5mm.

The measurement time is 0.5 s at each point of the zoom scan. The probe boundary effect compensation shall be applied during the SAR test. Because of the tip of the probe to the Phantom surface separated distances are longer than half a tip probe diameter.

In the area scan, the separation distance is 4mm between the each measurement point and the phantom surface. The scan size shall be included the transmission portion of the EUT. The measurement time is the same as the zoom scan. At last the reference power drift shall be less than ±5%.

5.2 MEASURED SAR RESULTS

HEAD POSITION

ENVIRONMENTAL CONDITION	Air Temperature：22.1°C, Liquid Temperature：21.3°C Humidity：58%RH		
TESTED BY	Sam Onn	DATE	Feb. 22, 2010

CHAN.	FREQ. (MHz)	MODULATION TYPE	TX POWER (dBm)	POWER DRIFT (%)	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
1	902.269668	MSK	27.85	0.05200	1	0.111
1	902.269668		27.85	-0.00786	2	0.139
1	902.269668		27.85	0.04600	3	0.097
1	902.269668		27.85	0.02800	4	0.240
1	902.269668		27.85	0.01100	5	0.441
1	902.269668		27.85	0.02000	6	0.242
1	902.269668		27.85	-0.01100	7	**0.450**
1	902.269668		27.85	0.02900	8	0.258

NOTE:

1. Test configuration of each mode is described in section 4.2.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

BODY POSITION

ENVIRONMENTAL CONDITION	Air Temperature：22.5°C, Liquid Temperature：21.2°C Humidity：58%RH		
TESTED BY	Sam Onn	DATE	Feb. 22, 2010

CHAN.	FREQ. (MHz)	MODULATION TYPE	TX POWER (dBm)	POWER DRIFT (%)	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
1	**902.269668**	**MSK**	27.85	-0.09500	9	0.886
126	**914.911644**		27.80	-0.15100		**1.130**
252	**927.654755**		27.13	0.07000		0.816
1	**902.269668**		27.85	-0.08700	10	0.317

NOTE:

1. Test configuration of each mode is described in section 4.2.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

5.3 SAR LIMITS

HUMAN EXPOSURE	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	**(Occupational / controlled Exposure Environment)**
Spatial Average (whole body)	0.08	0.4
Spatial Peak (averaged over 1 g)	**1.6**	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

NOTE:

1. This limits accord to 47 CFR 2.1093 – Safety Limit.
2. The EUT property been complied with the partial body exposure limit under the general population environment.

5.4 RECIPES FOR TISSUE SIMULATING LIQUIDS

For the measurement of the field distribution inside the SAM phantom, the phantom must be filled with 25 litters of tissue simulation liquid.

The following ingredients are used：

- **WATER-** Deionized water (pure H20), resistivity _16 M - as basis for the liquid
- **SUGAR-** Refined sugar in crystals, as available in food shops - to reduce relative permittivity
- **SALT-** Pure NaCl - to increase conductivity
- **CELLULOSE-** Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20_C),
  CAS # 54290 - to increase viscosity and to keep sugar in solution
- **PRESERVATIVE-** Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 - to prevent the spread of bacteria and molds
- **DGMBE-** Diethylenglycol-monobuthyl ether (DGMBE), Fluka Chemie GmbH, CAS # 112-34-5 - to reduce relative permittivity

THE RECIPES FOR 900MHz SIMULATING LIQUID TABLE

INGREDIENT	HEAD SIMULATING LIQUID 900MHz (HSL-900)	MUSCLE SIMULATING LIQUID 900MHz (MSL-900)
Water	40.28%	50.07%
Cellulose	02.41%	NA
Salt	01.38%	0.94%
Preventtol D-7	00.18%	0.09%
Sugar	57.97%	48.2%
Dielectric Parameters at 22℃	f= 900MHz ε= 41.5 ± 5% σ= 0.97 ± 5% S/m	f= 900MHz ε= 55.0 ± 5% σ= 1.05 ± 5% S/m

Testing the liquids using the Agilent Network Analyzer E8358A and Agilent Dielectric Probe Kit 85070D.The testing procedure is following as

1. Turn Network Analyzer on and allow at least 30 min. warm up.
2. Mount dielectric probe kit so that interconnecting cable to Network Analyzer will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature (±1°).
4. Set water temperature in Agilent-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with >8mm thickness ε'=10.0, ε''=0.0). If measured parameters do not fit within tolerance, repeat calibration (±0.2 for ε': ±0.1 for ε'').
7. Conductivity can be calculated from ε'' by $\sigma = \omega \varepsilon_0 \varepsilon'' = \varepsilon'' f$ [GHz] / 18.
8. Measure liquid shortly after calibration. Repeat calibration every hour.
9. Stir the liquid to be measured. Take a sample (~50ml) with a syringe from the center of the liquid container.
10. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
11. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
12. Perform measurements.
13. Adjust medium parameters in DASY5 for the frequencies necessary for the measurements (‘Setup Config’, select medium (e.g. Brain 900 MHz) and press ‘Option’-button.

Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 900 MHz).

SIMULATING LIQUID

LIQUID TYPE		HSL900		
SIMULATING LIQUID TEMP.		21.3		
TEST DATE		Feb. 22, 2010		
TESTED BY		Sam Onn		
FREQ. (MHz)	**LIQUID PARAMETER**	**STANDARD VALUE**	**MEASUREMENT VALUE**	**ERROR PERCENTAGE (%)**
900.000000	Permitivity (ε)	41.50	42.50	2.41
902.269668		41.50	42.50	2.41
900.000000	Conductivity (σ) S/m	0.97	1.00	3.09
902.269668		0.97	1.00	3.09
Dielectric Parameters Required at 22℃		**f= 900MHz** **ε= 41.5 ± 5%** **σ= 0.97 ± 5% S/m**		

LIQUID TYPE	MSL900			
SIMULATING LIQUID TEMP.	21.2			
TEST DATE	Feb. 22, 2010			
TESTED BY	Sam Onn			
FREQ. (MHz)	**LIQUID PARAMETER**	**STANDARD VALUE**	**MEASUREMENT VALUE**	**ERROR PERCENTAGE (%)**
900.000000	Permitivity (ε)	55.00	53.70	-2.36
902.269668		55.00	53.70	-2.36
914.911644		55.00	53.60	-2.55
927.654755		55.00	53.50	-2.73
900.000000	Conductivity (σ) S/m	1.05	1.06	0.95
902.269668		1.05	1.06	0.95
914.911644		1.06	1.07	0.94
927.654755		1.07	1.08	0.93
Dielectric Parameters Required at 22℃	**f= 900MHz ε= 55.0 ± 5% σ= 1.05 ± 5% S/m**			

5.5 TEST EQUIPMENT FOR TISSUE PROPERTY

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	Network Analyzer	Anritsu	MA2491A	030953	Aug. 01, 2009	Jul. 31, 2010
2	Dielectric Probe	Agilent	85070D	US01440176	NA	NA

NOTE:

1. Before starting, all test equipment shall be warmed up for 30min.
2. The tolerance (k=1) specified by Agilent for general dielectric measurements, deriving from inaccuracies in the calibration data, analyzer drift, and random errors, are usually ±2.5% and ±5% for measured permittivity and conductivity, respectively. However, the tolerances for the conductivity is smaller for material with large loss tangents, i.e., less than ±2.5% (k=1). It can be substantially smaller if more accurate methods are applied.

6. SYSTEM VALIDATION

The system validation was performed in the flat phantom with equipment listed in the following table. Since the SAR value is calculated from the measured electric field, dielectric constant and conductivity of the body tissue and the SAR is proportional to the square of the electric field. So, the SAR value will be also proportional to the RF power input to the system validation dipole under the same test environment. In our system validation test, 250mW RF input power was used.

6.1 TEST EQUIPMENT

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	SAM Phantom	S & P	QD000 P40 CA	TP-1150	NA	NA
2	Signal Generator	Agilent	E4438C	MY45092849	Nov. 19, 2009	Nov. 18, 2010
3	E-Field Probe	S & P	EX3DV3	3504	Jan. 26, 2010	Jan. 25, 2011
4	DAE	S & P	DAE	510	Dec. 16, 2009	Dec. 15, 2010
5	Robot Positioner	Staubli Unimation	NA	NA	NA	NA
6	Validation Dipole	S & P	D1900V2	156	Mar. 16, 2009	Mar. 15, 2010

NOTE: Before starting the measurement, all test equipment shall be warmed up for 30min.

6.2 TEST PROCEDURE

Before you start the system performance check, need only to tell the system with which components (probe, medium, and device) are performing the system performance check; the system will take care of all parameters. The dipole must be placed beneath the flat phantom section of the SAM Twin Phantom with the correct distance holder in place. The distance holder should touch the phantom surface with a light pressure at the reference marking (little cross) and be oriented parallel to the long side of the phantom. Accurate positioning is not necessary, since the system will search for the peak SAR location, except that the dipole arms should be parallel to the surface. The device holder for the EUT can be left in place but should be rotated away from the dipole.

1.The ”Power Reference Measurement” and ”Power Drift Measurement” jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the amplifier output power. If it is too high (above ±0.1 dB), the system performance check should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the DASY system below ±0.02 dB.

2.The ”Surface Check” job tests the optical surface detection system of the DASY system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ±0.1mm). In that case it is better to abort the system performance check and stir the liquid.

3. The ”Area Scan” job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable. If a finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result.

4. The ”Zoom Scan” job measures the field in a volume around the peak SAR value assessed in the previous ”Area Scan” job (for more information see the application note on SAR evaluation).

About the validation dipole positioning uncertainty, the constant and low loss dielectric spacer is used to establish the correct distance between the top surface of the dipole and the bottom surface of the phantom, the error component introduced by the uncertainty of the distance between the liquid (i.e., phantom shell) and the validation dipole in the DASY5 system is less than ±0.1mm.

$$SAR_{tolerance}[\%] = 100 \times \left(\frac{(a+d)^2}{a^2} - 1\right)$$

As the closest distance is 10mm, the resulting tolerance $SAR_{tolerance}[\%]$ is <2%.

6.3 VALIDATION RESULTS

SYSTEM VALIDATION TEST OF SIMULATING LIQUID					
FREQUENCY (MHz)	**REQUIRED SAR (mW/g)**	**MEASURED SAR (mW/g)**	**DEVIATION (%)**	**SEPARATION DISTANCE**	**TESTED DATE**
HSL 900	2.65 (1g)	2.69	1.51	15mm	Feb. 22, 2010
MSL 900	2.85 (1g)	2.78	-2.46	15mm	Feb. 22, 2010
TESTED BY	Sam Onn				

NOTE: Please sees Appendix for the photo of system validation test.

6.4 SYSTEM VALIDATION UNCERTAINTIES

In the table below, the system validation uncertainty with respect to the analytically assessed SAR value of a dipole source as given in the IEEE 1528 standard is given. This uncertainty is smaller than the expected uncertainty for mobile phone measurements due to the simplified setup and the symmetric field distribution.

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i)		Standard Uncertainty (±%)		(v_i)
				(1g)	(10g)	(1g)	(10g)	
Measurement System								
Probe Calibration	5.50	Normal	1	1	1	5.50	5.50	∞
Axial Isotropy	4.70	Rectangular	$\sqrt{3}$	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.60	Rectangular	$\sqrt{3}$	0.7	0.7	3.88	3.88	∞
Boundary effects	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	1	2.71	2.71	∞
System Detection Limits	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	0.30	Normal	1	1	1	0.30	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	1	0.46	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1	1.50	1.50	∞
RF Ambient Noise	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe Positioner	0.40	Rectangular	$\sqrt{3}$	1	1	0.23	0.23	∞
Probe Positioning	2.90	Rectangular	$\sqrt{3}$	1	1	1.67	1.67	∞
Max. SAR Eval.	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Dipole Related								
Dipole Axis to Liquid Distance	2.00	Rectangular	$\sqrt{3}$	1	1	1.15	1.15	145
Input Power Drift	5.00	Rectangular	$\sqrt{3}$	1	1	2.89	2.89	∞
Phantom and Tissue parameters								
Phantom Uncertainty	4.00	Rectangular	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid Conductivity (target)	5.00	Rectangular	$\sqrt{3}$	0.64	0.43	1.85	1.24	∞
Liquid Conductivity (measurement)	3.69	Normal	1	0.64	0.43	2.36	1.59	∞
Liquid Permittivity (target)	5.00	Rectangular	$\sqrt{3}$	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	3.40	Normal	1	0.6	0.49	2.04	1.67	∞
Combined Standard Uncertainty						**9.99**	**9.62**	
Coverage Factor for 95%						**Kp=2**		
Expanded Uncertainty (K=2)						**19.98**	**19.24**	

NOTE: About the system validation uncertainty assessment, please reference the section 7.

7. MEASUREMENT SAR PROCEDURE UNCERTAINTIES

The assessment of spatial peak SAR of the hand handheld devices is according to IEEE 1528. All testing situation shall be met below these requirements.

- The system is used by an experienced engineer who follows the manual and the guidelines taught during the training provided by SPEAG.
- The probe has been calibrated within the requested period and the stated uncertainty for the relevant frequency bands does not exceed 4.8% (k=1).
- The validation dipole has been calibrated within the requested period and the system performance check has been successful.
- The DAE unit has been calibrated within the within the requested period.
- The minimum distance between the probe sensor and inner phantom shell is selected to be between 4 and 5mm.
- The operational mode of the DUT is CW, CDMA, FDMA or TDMA (GSM, DCS, PCS, IS136 and PDC) and the measurement/integration time per point is >500 ms.
- The dielectric parameters of the liquid have been assessed using Agilent 85070D dielectric probe kit or a more accurate method.
- The dielectric parameters are within 5% of the target values.
- The DUT has been positioned as described in section 3.

7.1 PROBE CALIBRATION UNCERTAINTY

SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 50361, IEC 62209, etc.) under ISO17025. The uncertainties are stated on the calibration certificate. For the most relevant frequency bands, these values do not exceed 4.8% (k=1). If evaluations of other bands are performed for which the uncertainty exceeds these values, the uncertainty tables given in the summary have to be revised accordingly.

7.2 ISOTROPY UNCERTAINTY

The axial isotropy tolerance accounts for probe rotation around its axis while the hemispherical isotropy error includes all probe orientations and field polarizations. These parameters are assessed by SPEAG during initial calibration. In 2001, SPEAG further tightened its quality controls and warrants that the maximal deviation from axial isotropy is ±0.20 dB, while the maximum deviation of hemispherical isotropy is ±0.40 dB, corresponding to ±4.7% and ±9.6%, respectively. A weighting factor of cp equal to 0.5 can be applied, since the axis of the probe deviates less than 30 degrees from the normal surface orientation.

7.3 BOUNDARY EFFECT UNCERTAINTY

The effect can be estimated according to the following error approximation formula

$$SAR_{tolerance}[\%] = SAR_{be}[\%] \times \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{e^{-\frac{d_{be}}{\delta/2}}}{\delta/2}$$

$$d_{be} + d_{step} < 10mm$$

The parameter d_{be} is the distance in mm between the surface and the closest measurement point used in the averaging process; d_{step} is the separation distance in mm between the first and second measurement points; δ is the minimum penetration depth in mm within the head tissue equivalent liquids (i.e., δ= 13.95 mm at 3GHz); SAR_{be} is the deviation between the measured SAR value at the distance d_{be} from the boundary and the wave-guide analytical value SAR_{ref}.DASY5 applies a boundary effect compensation algorithm according to IEEE 1528, which is possible since the axis of the probe never deviates more than 30 degrees from the normal surface orientation. SAR_{be}[%] is assessed during the calibration process and SPEAG warrants that the uncertainty at distances larger than 4mm is always less than 1%.In summary, the worst case boundary effect SAR tolerance[%] for scanning distances larger than 4mm is < ± 0.8%.

7.4 PROBE LINEARITY UNCERTAINTY

Field probe linearity uncertainty includes errors from the assessment and compensation of the diode compression effects for CW and pulsed signals with known duty cycles. This error is assessed using the procedure described in IEEE 1528. For SPEAG field probes, the measured difference between CW and pulsed signals, with pulse frequencies between 10 Hz and 1 kHz and duty cycles between 1 and 100, is < ±0.20 dB (< ±4.7%).

7.5 READOUT ELECTRONICS UNCERTAINTY

All uncertainties related to the probe readout electronics (DAE unit), including the gain and linearity of the instrumentation amplifier, its loading effect on the probe, and accuracy of the signal conversion algorithm, have been assessed accordingly to IEEE 1528.The combination (root-sum-square RSS method) of these components results in an overall maximum error of ±1.0%.

7.6 RESPONSE TIME UNCERTAINTY

The time response of the field probes is assessed by exposing the probe to a well-controlled electric field producing SAR larger than 2.0 W/kg at the tissue medium surface. The signal response time is evaluated as the time required by the system to reach 90% of the expected final value after an on/of switch of the power source. Analytically, it can be expressed as:

$$SAR_{tolerance}[\%] = 100 \times \left(\frac{T_m}{T_m + \tau e^{-T_m/\tau} - \tau} - 1\right)$$

where Tm is 500 ms, i.e., the time between measurement samples, and τ the time constant. The response time τ of SPEAG's probes is <5 ms. In the current implementation, DASY5 waits longer than 100 ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

7.7 INTEGRATION TIME UNCERTAINTY

If the device under test does not emit a CW signal, the integration time applied to measure the electric field at a specific point may introduce additional uncertainties due to the discretization and can be assessed as follows

$$SAR_{tolerance}[\%] = 100 \times \sum_{allsub-frames} \frac{t_{frame}}{t_{integration}} \frac{slot_{idle}}{slot_{total}}$$

The tolerances for the different systems are given in Table 7.1, whereby the worst-case $SAR_{tolerance}$ is 2.6%.

System	$SAR_{tolerance}$ %
CW	0
CDMA*	0
WCDMA*	0
FDMA	0
IS-136	2.6
PDC	2.6
GSM/DCS/PCS	1.7
DECT	1.9
Worst-Case	2.6

TABLE 7.1

7.8 PROBE POSITIONER MECHANICAL TOLERANCE

The mechanical tolerance of the field probe positioner can introduce probe positioning uncertainties. The resulting SAR uncertainty is assessed by comparing the SAR obtained according to the specifications of the probe positioner with respect to the actual position defined by the geometric enter of the probe sensors. The tolerance is determined as:

$$SAR_{tolerance}[\%] = 100 \times \frac{d_{ph}}{\delta/2}$$

The specified repeatability of the RX robot family used in DASY5 systems is ±25 μm. The absolute accuracy for short distance movements is better than ±0.1mm, i.e., the $SAR_{tolerance}$[%] is better than 1.5% (rectangular).

7.9 PROBE POSITIONING

The probe positioning procedures affect the tolerance of the separation distance between the probe tip and the phantom surface as:

$$SAR_{tolerance}[\%] = 100 \times \frac{d_{ph}}{\delta/2}$$

where d_{ph} is the maximum deviation of the distance between the probe tip and the phantom surface. The optical surface detection has a precision of better than 0.2 mm, resulting in an $SAR_{tolerance}$[%] of <2.9% (rectangular distribution). Since the mechanical detection provides better accuracy, 2.9% is a worst-case figure for DASY5 system.

7.10 PHANTOM UNCERTAINTY

The SAR measurement uncertainty due to SPEAG phantom shell production tolerances has been evaluated using

$$SAR_{tolerance}[\%] \cong 100 \times \frac{2d}{a}, \qquad d << a$$

For a maximum deviation d of the inner and outer shell of the phantom from that specified in the CAD file of ±0.2 mm, and a 10mm spacing a between source and tissue liquid, the calculated phantom uncertainty is ±4.0%.

7.11 DASY5 UNCERTAINTY BUDGET

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i) (1g)	(C_i) (10g)	Standard Uncertainty (±%) (1g)	Standard Uncertainty (±%) (10g)	(v_i)
Measurement Equipment								
Probe Calibration	5.50	Normal	1	1	1	5.50	5.50	∞
Axial Isotropy	4.70	Rectangular	$\sqrt{3}$	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.60	Rectangular	$\sqrt{3}$	0.7	0.7	3.88	3.88	∞
Boundary effects	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	1	2.71	2.71	∞
System Detection Limits	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	0.30	Normal	1	1	1	0.30	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	1	0.46	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1	1.50	1.50	∞
RF Ambient Noise	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe Positioner	0.40	Rectangular	$\sqrt{3}$	1	1	0.23	0.23	∞
Probe Positioning	2.90	Rectangular	$\sqrt{3}$	1	1	1.67	1.67	∞
Max. SAR Eval.	1.00	Rectangular	$\sqrt{3}$	1	1	0.58	0.58	∞
Test Sample Related								
Device Positioning	0.89	Normal	1	1	1	0.89	0.89	9
Device Holder	3.60	Normal	1	1	1	3.60	3.60	5
Power Drift	5.00	Rectangular	$\sqrt{3}$	1	1	2.89	2.89	∞
Phantom and Tissue parameters								
Phantom Uncertainty	4.00	Rectangular	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid Conductivity (target)	5.00	Rectangular	$\sqrt{3}$	0.64	0.43	1.85	1.24	∞
Liquid Conductivity (measurement)	3.69	Normal	1	0.64	0.43	2.36	1.59	∞
Liquid Permittivity (target)	5.00	Rectangular	$\sqrt{3}$	0.6	0.49	1.73	1.41	∞
Liquid Permittivity (measurement)	3.40	Normal	1	0.6	0.49	2.04	1.67	∞
Combined Standard Uncertainty						**10.60**	**10.24**	
Coverage Factor for 95%						**Kp=2**		
Expanded Uncertainty (K=2)						**21.19**	**20.49**	

TABLE 7.2

8. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5/phtml. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:
Tel: 886-3-5935343
Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab:
Tel: 886-3-3183232
Fax: 886-3-3185050

Web Site: www.adt.com.tw

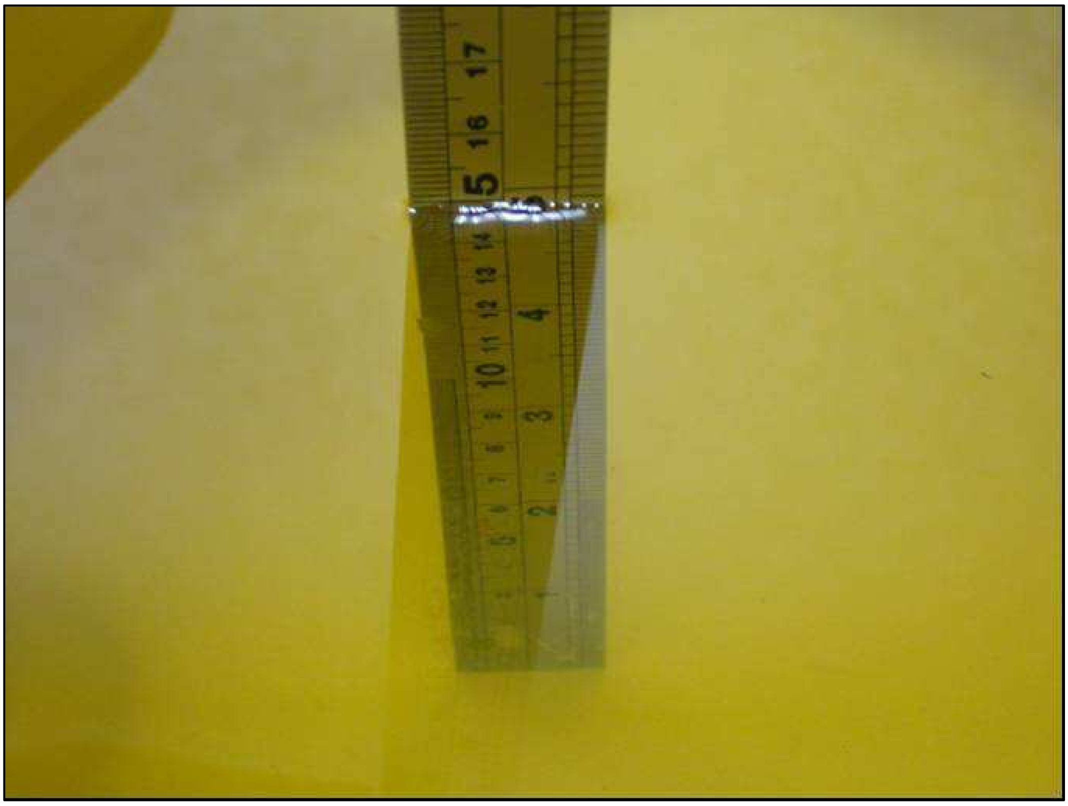
The address and road map of all our labs can be found in our web site also.

---END---

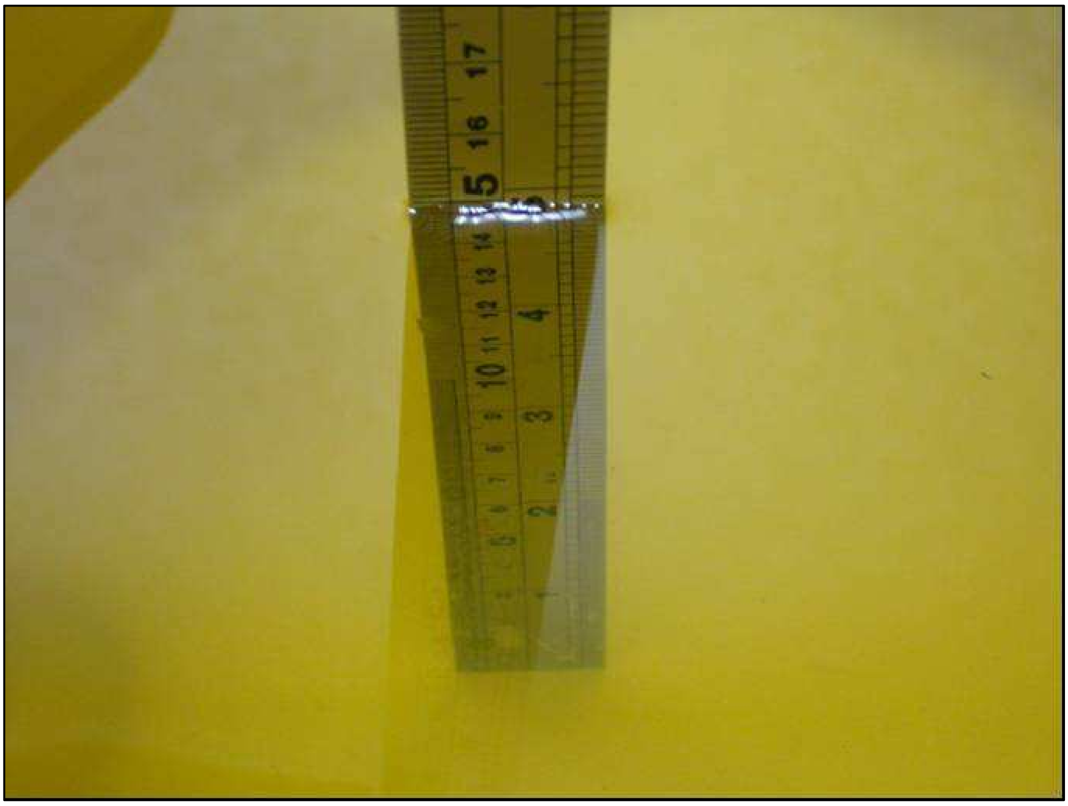
APPENDIX A: TEST DATA

Liquid Level Photo

Tissue HSL900MHz D=150mm



Tissue MSL900MHz D=150mm



Date/Time: 2010/2/22 17:06:53

Test Laboratory: Bureau Veritas ADT

M01-Dipole-Right Head-Cheek-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

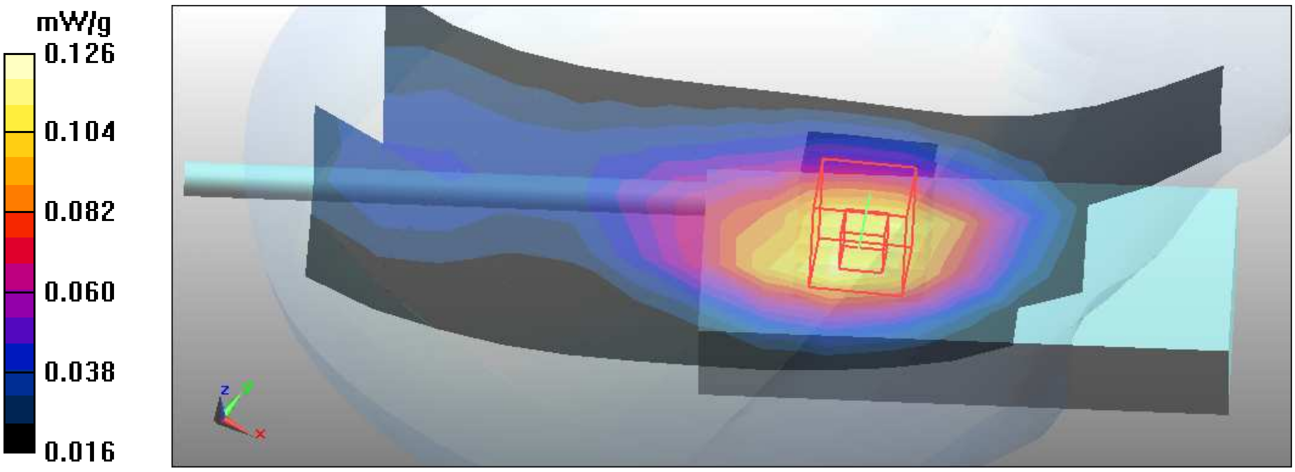
Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4
Medium: HSL900 Medium parameters used: f = 902.269668 MHz; σ = 1 mho/m; εr = 42.5; ρ = 1000 kg/m^3
Phantom section: Right Section ; DUT test position : Cheek ; Modulation type: MSK

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Touch Position - Low Channel 1/Area Scan (6x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.113 mW/g

Touch Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 10.8 V/m; Power Drift = 0.052 dB
Peak SAR (extrapolated) = 0.151 W/kg
SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.077 mW/g
Maximum value of SAR (measured) = 0.126 mW/g



Date/Time: 2010/2/22 17:51:02

Test Laboratory: Bureau Veritas ADT

M02-Dipole-Right Head-Tilt-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

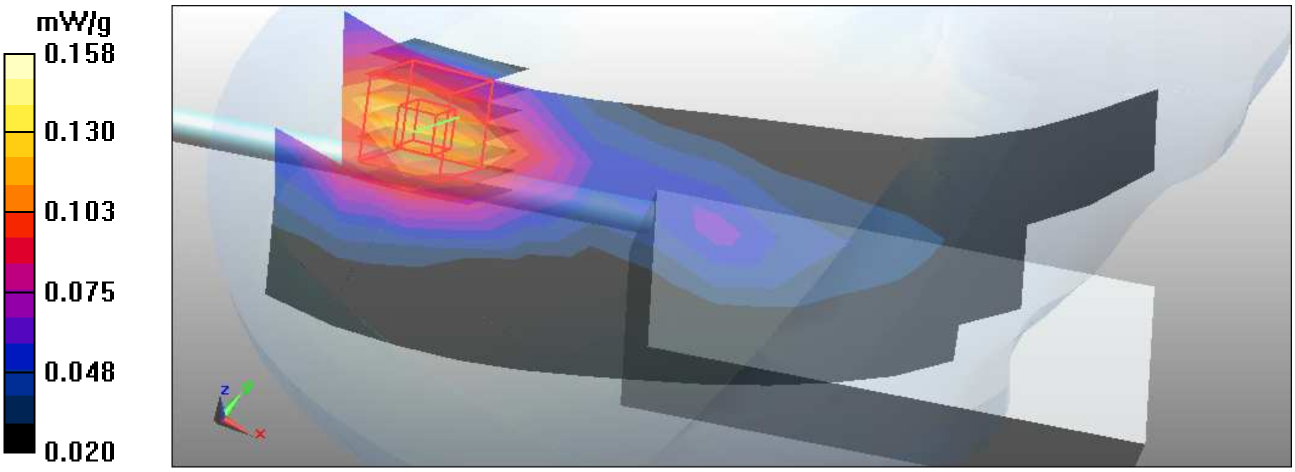
Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4
Medium: HSL900 Medium parameters used: f = 902.269668 MHz; σ = 1 mho/m; εr = 42.5; ρ = 1000 kg/m^3
Phantom section: Right Section ; DUT test position : Tilt ; Modulation type: MSK

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Tilt Position - Low Channel 1/Area Scan (6x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.148 mW/g

Tilt Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 12.5 V/m; Power Drift = -0.00786 dB
Peak SAR (extrapolated) = 0.192 W/kg
SAR(1 g) = 0.139 mW/g; SAR(10 g) = 0.098 mW/g
Maximum value of SAR (measured) = 0.158 mW/g



Date/Time: 2010/2/22 18:20:13

Test Laboratory: Bureau Veritas ADT

M03-Dipole-Left Head-Cheek-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

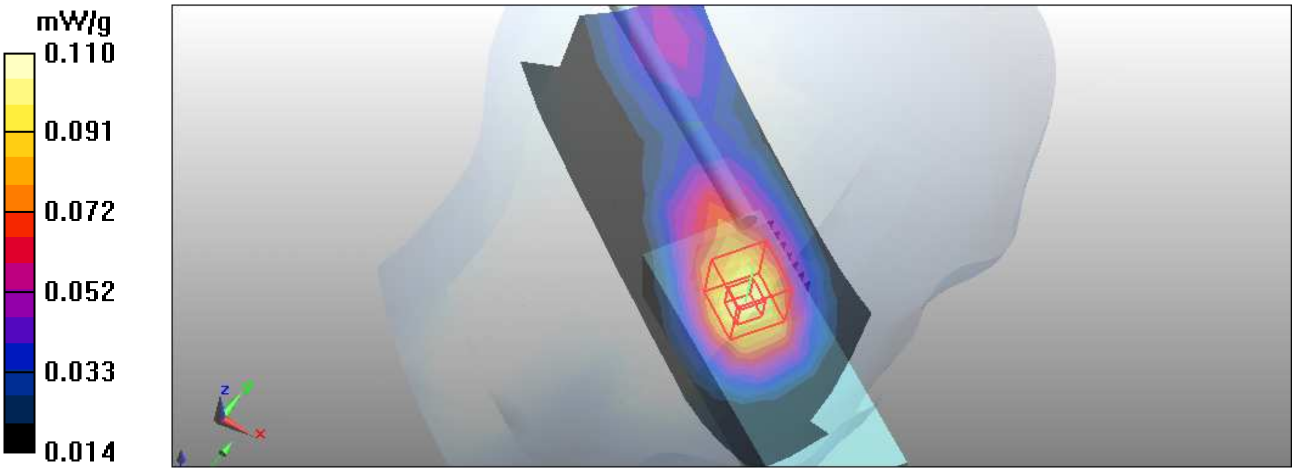
Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4
Medium: HSL900 Medium parameters used: f = 902.269668 MHz; σ = 1 mho/m; εr = 42.5; ρ = 1000 kg/m^3
Phantom section: Left Section ; DUT test position : Cheek ; Modulation type: MSK

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Touch Position - Low Channel 1/Area Scan (6x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.104 mW/g

Touch Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 10.5 V/m; Power Drift = 0.046 dB
Peak SAR (extrapolated) = 0.132 W/kg
SAR(1 g) = 0.097 mW/g; SAR(10 g) = 0.068 mW/g
Maximum value of SAR (measured) = 0.110 mW/g



Date/Time: 2010/2/22 19:15:55

Test Laboratory: Bureau Veritas ADT

M04-Dipole-Left Head-Tilt-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

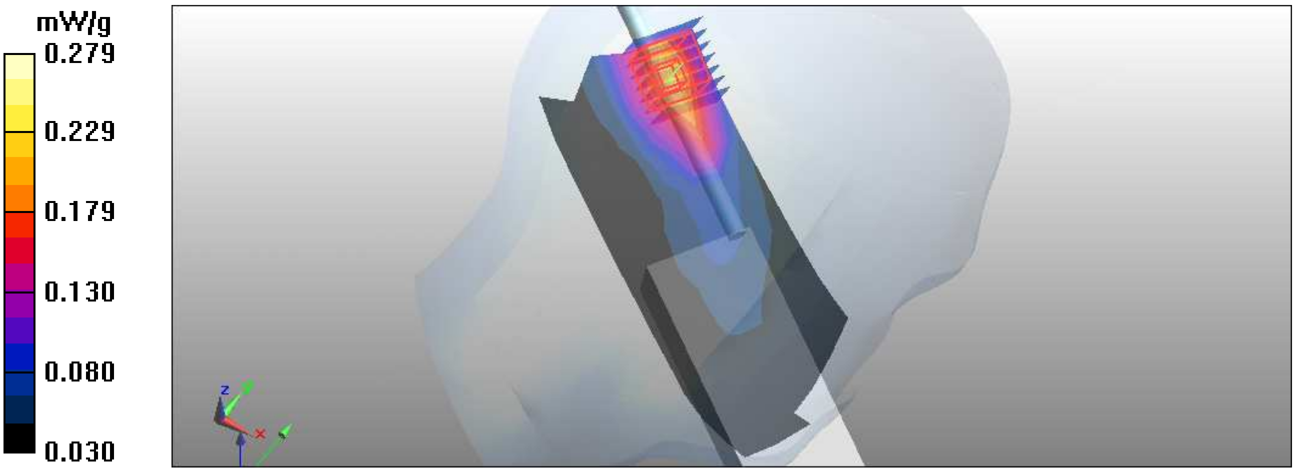
Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4
Medium: HSL900 Medium parameters used: f = 902.269668 MHz; σ = 1 mho/m; εr = 42.5; ρ = 1000 kg/m^3
Phantom section: Left Section ; DUT test position : Tilt ; Modulation type: MSK

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Tilt Position - Low Channel 1/Area Scan (6x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.216 mW/g

Tilt Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 16.6 V/m; Power Drift = 0.028 dB
Peak SAR (extrapolated) = 0.356 W/kg
SAR(1 g) = 0.240 mW/g; SAR(10 g) = 0.159 mW/g
Maximum value of SAR (measured) = 0.279 mW/g



Date/Time: 2010/2/22 19:43:57

Test Laboratory: Bureau Veritas ADT

M05-Rubber-Right Head-Cheek-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

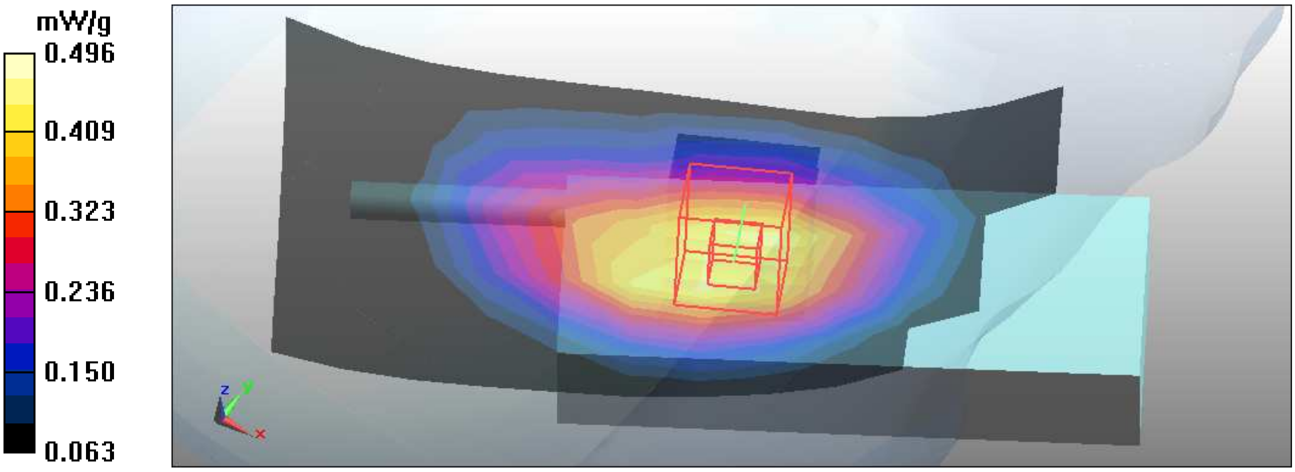
Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4
Medium: HSL900 Medium parameters used: f = 902.269668 MHz; σ = 1 mho/m; εr = 42.5; ρ = 1000 kg/m^3
Phantom section: Right Section ; DUT test position : Cheek ; Modulation type: MSK

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Touch Position - Low Channel 1/Area Scan (6x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.450 mW/g

Touch Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 22 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 0.591 W/kg
SAR(1 g) = 0.441 mW/g; SAR(10 g) = 0.307 mW/g
Maximum value of SAR (measured) = 0.496 mW/g



Date/Time: 2010/2/22 20:19:18

Test Laboratory: Bureau Veritas ADT

M06-Rubber-Right Head-Tilt-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4

Medium: HSL900 Medium parameters used: f = 902.269668 MHz; σ = 1 mho/m; εr = 42.5; ρ = 1000 kg/m^3

Phantom section: Right Section ; DUT test position : Tilt ; Modulation type: MSK

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Tilt Position - Low Channel 1/Area Scan (6x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.253 mW/g

Tilt Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 16.5 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 0.392 W/kg

SAR(1 g) = 0.242 mW/g; SAR(10 g) = 0.150 mW/g

Maximum value of SAR (measured) = 0.287 mW/g

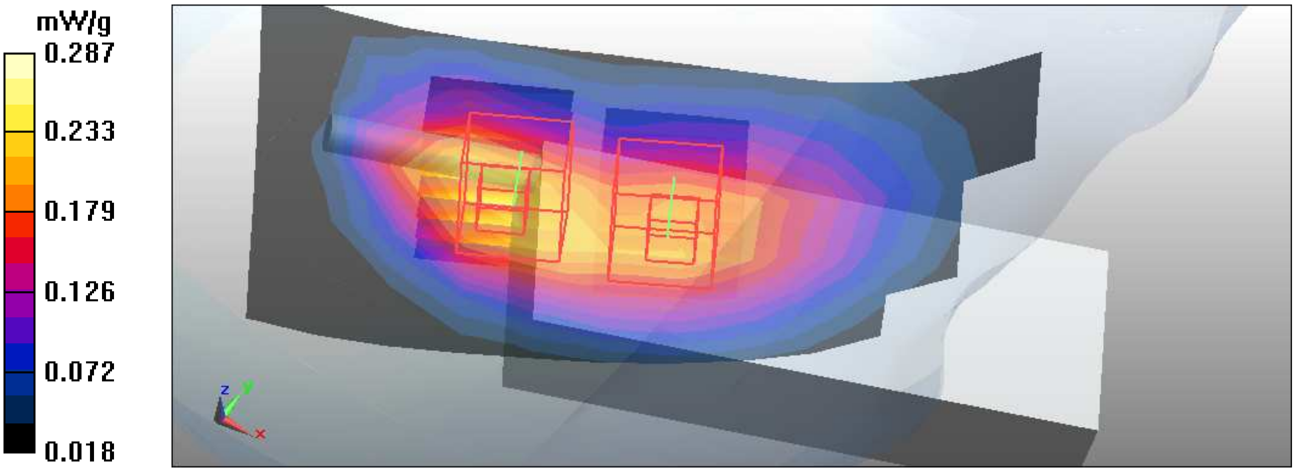
Tilt Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 16.5 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 0.273 W/kg

SAR(1 g) = 0.204 mW/g; SAR(10 g) = 0.147 mW/g

Maximum value of SAR (measured) = 0.229 mW/g



Date/Time: 2010/2/22 20:37:40

Test Laboratory: Bureau Veritas ADT

M07-Rubber-Left Head-Cheek-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

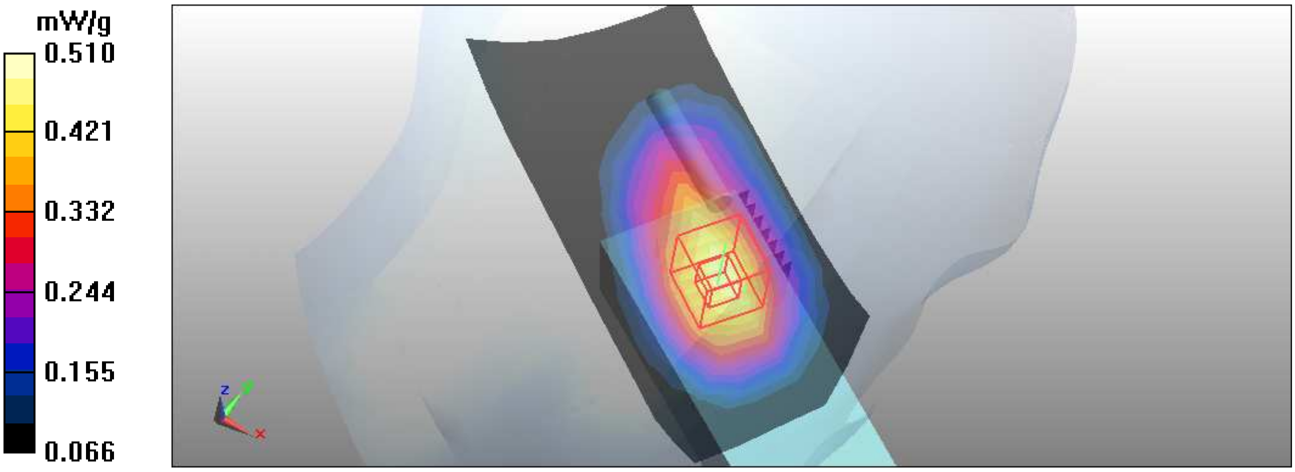
Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4
Medium: HSL900 Medium parameters used: f = 902.269668 MHz; σ = 1 mho/m; εr = 42.5; ρ = 1000 kg/m^3
Phantom section: Left Section ; DUT test position : Cheek ; Modulation type: MSK

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Touch Position - Low Channel 1/Area Scan (6x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.487 mW/g

Touch Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 22.8 V/m; Power Drift = -0.011 dB
Peak SAR (extrapolated) = 0.608 W/kg
SAR(1 g) = 0.450 mW/g; SAR(10 g) = 0.311 mW/g
Maximum value of SAR (measured) = 0.510 mW/g



Date/Time: 2010/2/22 21:02:47

Test Laboratory: Bureau Veritas ADT

M08-Rubber-Left Head-Tilt-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4

Medium: HSL900 Medium parameters used: f = 902.269668 MHz; σ = 1 mho/m; εr = 42.5; ρ = 1000 kg/m^3

Phantom section: Left Section ; DUT test position : Tilt ; Modulation type: MSK

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157;

Tilt Position - Low Channel 1/Area Scan (6x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.283 mW/g

Tilt Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 17.5 V/m; Power Drift = 0.029 dB

Peak SAR (extrapolated) = 0.415 W/kg

SAR(1 g) = 0.258 mW/g; SAR(10 g) = 0.158 mW/g

Maximum value of SAR (measured) = 0.304 mW/g

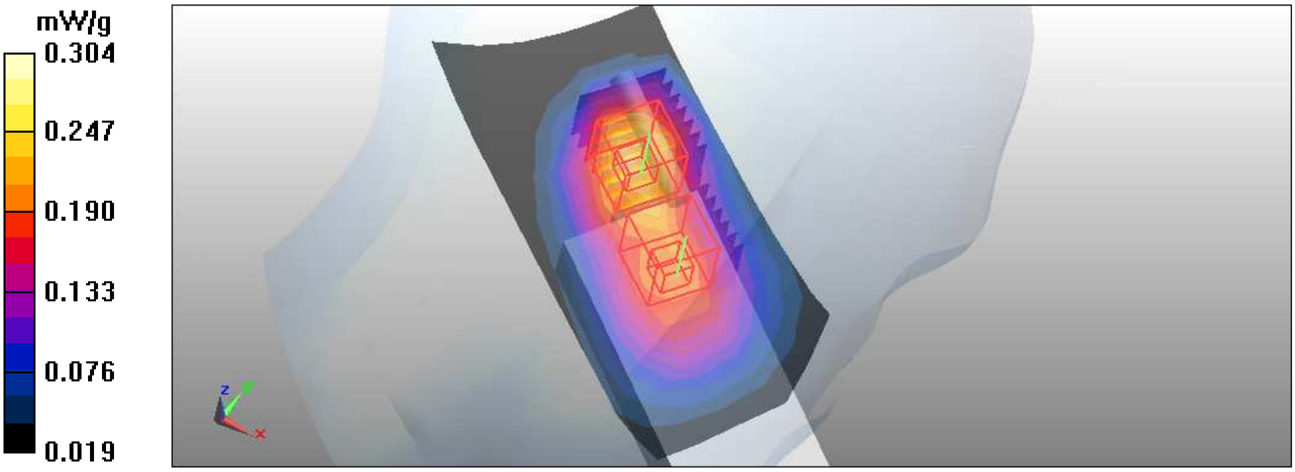
Tilt Position - Low Channel 1/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 17.5 V/m; Power Drift = 0.029 dB

Peak SAR (extrapolated) = 0.265 W/kg

SAR(1 g) = 0.198 mW/g; SAR(10 g) = 0.142 mW/g

Maximum value of SAR (measured) = 0.222 mW/g



Date/Time: 2010/2/22 13:03:33

Test Laboratory: Bureau Veritas ADT

M09-Dipole-Body-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

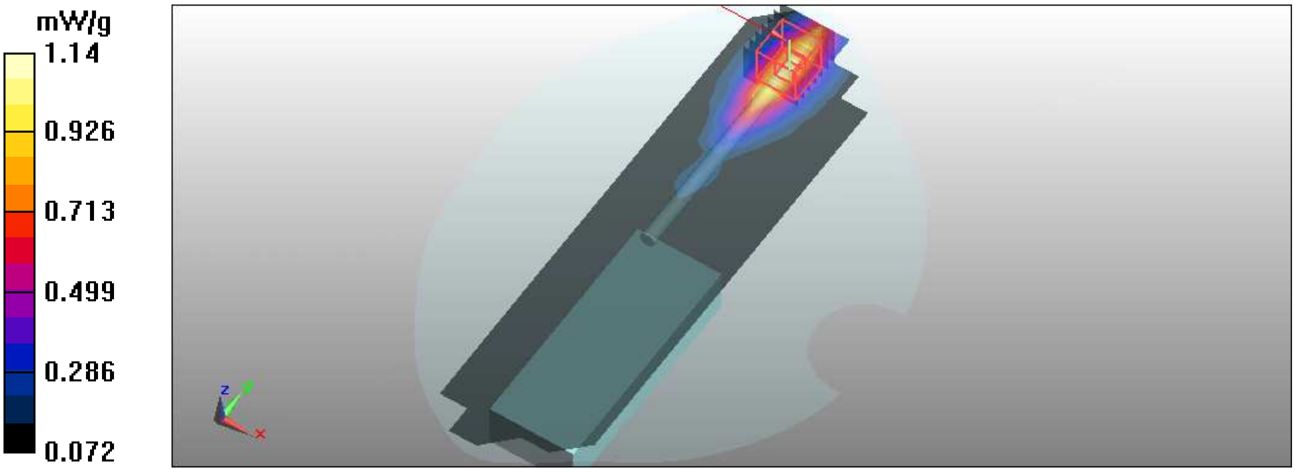
Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4
Medium: MSL900 Medium parameters used: f = 902.269668 MHz; σ = 1.06 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: MSK
Separation Distance : 0 mm (The back side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.83, 9.83, 9.83);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Low Channel 1/Area Scan (6x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.12 mW/g

Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 33.2 V/m; Power Drift = -0.095 dB
Peak SAR (extrapolated) = 1.77 W/kg
SAR(1 g) = 0.886 mW/g; SAR(10 g) = 0.481 mW/g
Maximum value of SAR (measured) = 1.14 mW/g



Date/Time: 2010/2/22 13:33:59

Test Laboratory: Bureau Veritas ADT

M09-Dipole-Body-Ch126

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

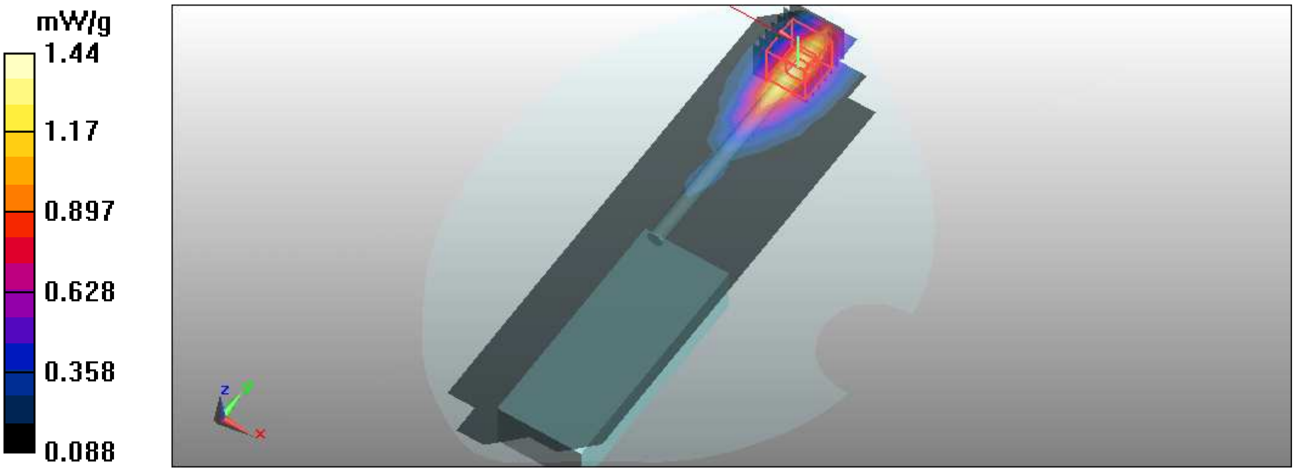
Communication System: TDD_900MHZ ; Frequency: 914.911644 MHz ; Duty Cycle: 1:4
Medium: MSL900 Medium parameters used: f = 914.911644 MHz; σ = 1.07 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: MSK
Separation Distance : 0 mm (The back side of the EUT to the Phantom)

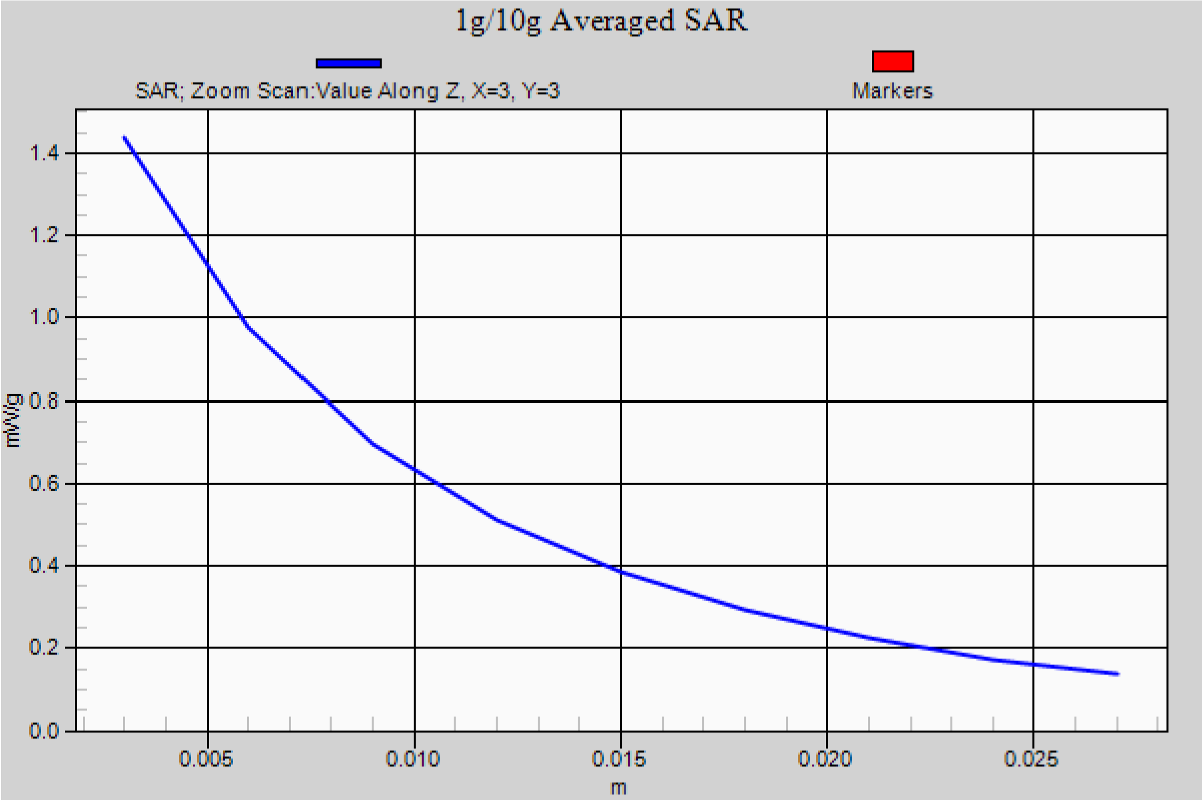
DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.83, 9.83, 9.83);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Mid Channel 126/Area Scan (6x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.37 mW/g

Mid Channel 126/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 36.5 V/m; Power Drift = -0.151 dB
Peak SAR (extrapolated) = 2.27 W/kg
SAR(1 g) = 1.13 mW/g; SAR(10 g) = 0.618 mW/g
Maximum value of SAR (measured) = 1.44 mW/g




1g/10g Averaged SAR
SAR; Zoom Scan:Value Along Z, X=3, Y=3
Markers
mW/g
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.005
0.010
0.015
0.020
0.025
m

Date/Time: 2010/2/22 14:02:44

Test Laboratory: Bureau Veritas ADT

M09-Dipole-Body-Ch252

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1

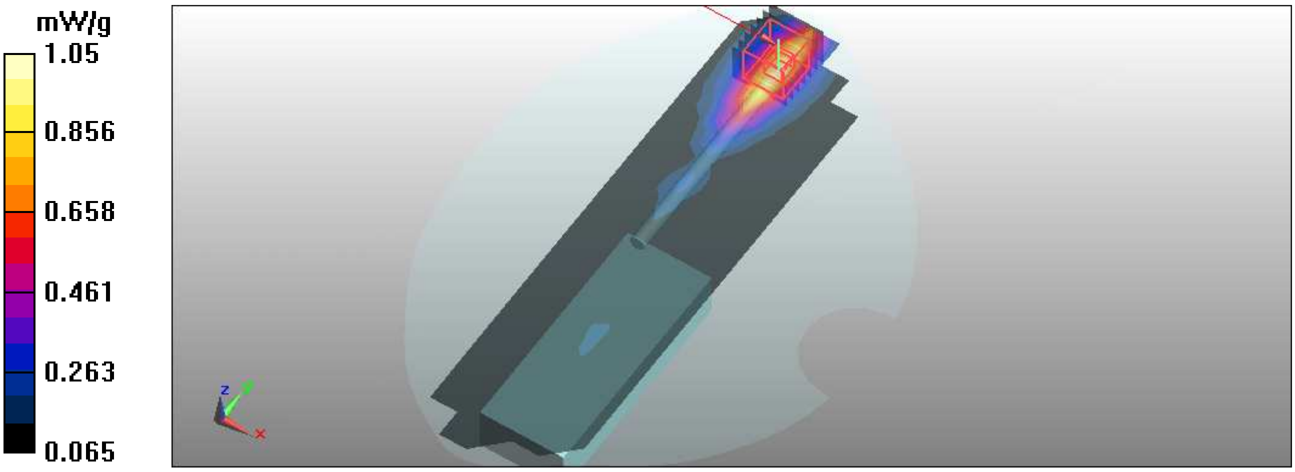
Communication System: TDD_900MHZ ; Frequency: 927.654755 MHz ; Duty Cycle: 1:4
Medium: MSL900 Medium parameters used : f = 927.654755 MHz; σ = 1.08 mho/m; ε_r = 53.5; ρ = 1000 kg/m^3
Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: MSK
Separation Distance : 0 mm (The back side of the EUT to the Phantom)

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.83, 9.83, 9.83);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

High Channel 252/Area Scan (6x21x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.05 mW/g

High Channel 252/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 31.4 V/m; Power Drift = 0.070 dB
Peak SAR (extrapolated) = 1.66 W/kg
SAR(1 g) = 0.816 mW/g; SAR(10 g) = 0.438 mW/g



Date/Time: 2010/2/22 14:33:49
Test Laboratory: Bureau Veritas ADT

M10-Rubber-Body-Ch1

DUT: Single Line Long Range Cordless Telephone ; Type: FreeStyl 1
Communication System: TDD_900MHZ ; Frequency: 902.269668 MHz ; Duty Cycle: 1:4
Medium: MSL900 Medium parameters used: f = 902.269668 MHz; σ = 1.06 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Phantom section: Flat Section ; DUT test position : Body ; Modulation Type: MSK
Separation Distance : 0 mm (The back side of the EUT to the Phantom)

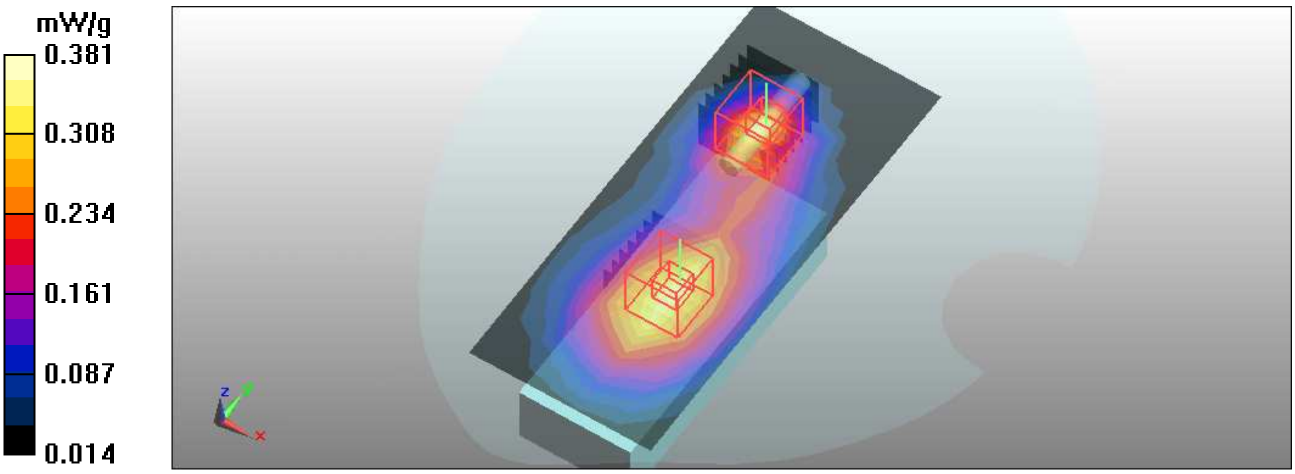
DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.83, 9.83, 9.83);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Low Channel 1/Area Scan (6x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.367 mW/g

Low Channel 1/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 19.1 V/m; Power Drift = -0.087 dB
Peak SAR (extrapolated) = 0.673 W/kg
SAR(1 g) = 0.298 mW/g; SAR(10 g) = 0.162 mW/g
Maximum value of SAR (measured) = 0.381 mW/g

Low Channel 1/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 19.1 V/m; Power Drift = -0.087 dB
Peak SAR (extrapolated) = 0.448 W/kg
SAR(1 g) = 0.317 mW/g; SAR(10 g) = 0.222 mW/g
Maximum value of SAR (measured) = 0.361 mW/g



Date/Time: 2010/2/22 16:25:35

Test Laboratory: Bureau Veritas ADT

SystemPerformanceCheck-HSL900 MHz

DUT: Dipole 900 MHz ; Type: D900V2 ; Serial: 156 ; Test Frequency: 900 MHz

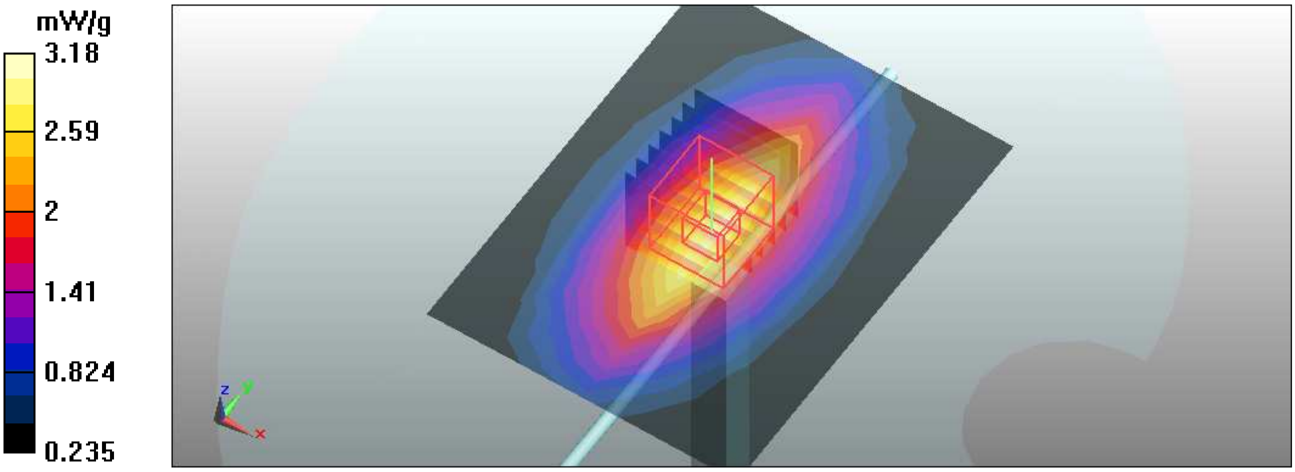
Communication System: CW ; Frequency: 900 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: HSL900;Medium parameters used: f = 900 MHz; σ = 1 mho/m; ε_r = 42.5; ρ = 1000 kg/m^3 ;
Liquid level : 150 mm
Phantom section: Flat Section ; Separation distance : 15 mm (The feetpoint of the dipole to the Phantom)Air temp. : 22.1 degrees ; Liquid temp. : 21.3 degrees

DASY5 Configuration:

- Probe: EX3DV3 - SN3504; ConvF(9.8, 9.8, 9.8);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

System Performance Check at Frequencies 0.9 GHz/d=15mm, Pin=250 mW, dist=3.0mm /Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.16 mW/g

System Performance Check at Frequencies 0.9 GHz/d=15mm, Pin=250 mW, dist=3.0mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.7 V/m; Power Drift = 0.037 dB
Peak SAR (extrapolated) = 4.17 W/kg
SAR(1 g) = 2.69 mW/g; SAR(10 g) = 1.72 mW/g
Maximum value of SAR (measured) = 3.18 mW/g



Date/Time: 2010/2/22 11:47:12

Test Laboratory: Bureau Veritas ADT

SystemPerformanceCheck-MSL900 MHz

DUT: Dipole 900 MHz ; Type: D900V2 ; Serial: 156 ; Test Frequency: 900 MHz

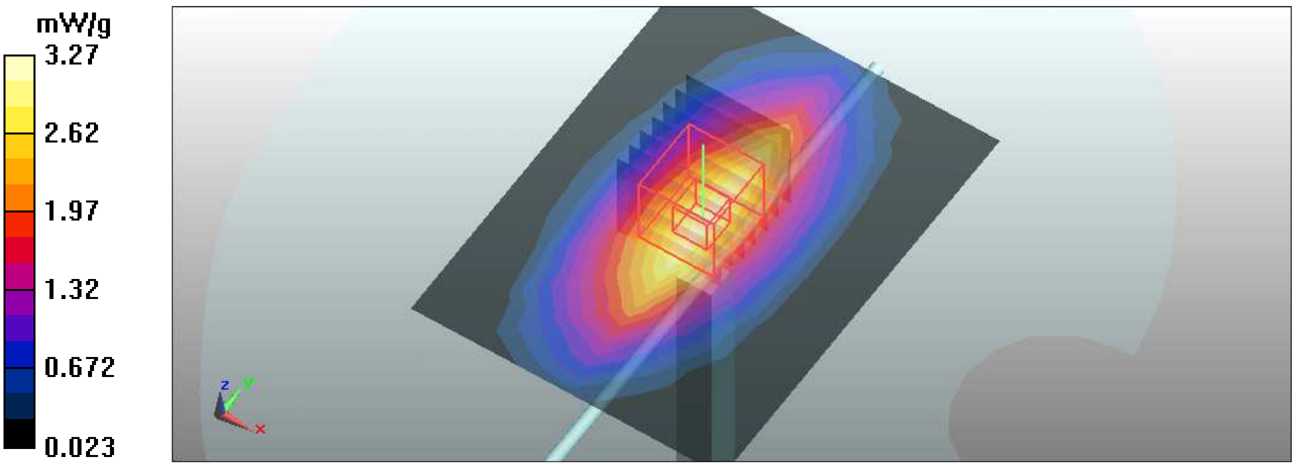
Communication System: CW ; Frequency: 900 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL900;Medium parameters used: f = 900 MHz; σ = 1.06 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3 ;
Liquid level : 150 mm
Phantom section: Flat Section ; Separation distance : 15 mm (The feetpoint of the dipole to the Phantom)Air temp. : 22.5 degrees ; Liquid temp. : 21.2 degrees

DASY5 Configuration:

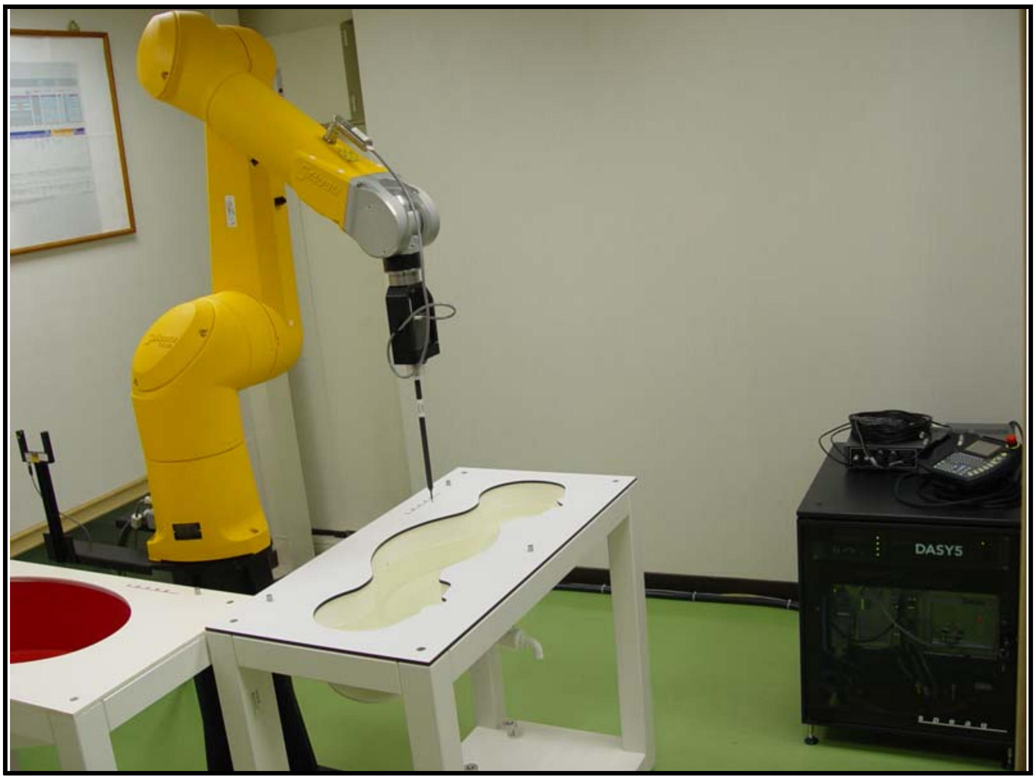
- Probe: EX3DV3 - SN3504; ConvF(9.83, 9.83, 9.83);
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn510; Calibrated: 2009/12/16
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1485
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

System Performance Check at Frequencies 0.9 GHz/d=15mm, Pin=250 mW, dist=3.0mm /Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.27 mW/g

System Performance Check at Frequencies 0.9 GHz/d=15mm, Pin=250 mW, dist=3.0mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.8 V/m; Power Drift = -0.073 dB
Peak SAR (extrapolated) = 4.26 W/kg
SAR(1 g) = 2.78 mW/g; SAR(10 g) = 1.78 mW/g



APPENDIX B: BV ADT SAR MEASUREMENT SYSTEM



APPENDIX C: PHOTOGRAPHS OF SYSTEM VALIDATION

APPENDIX D: SYSTEM CERTIFICATE & CALIBRATION

D1: PHANTOM

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

Certificate of Conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer	SPEAG Zeughausstrasse 43 CH-8004 Zürich Switzerland

Tests
The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series items (called samples) or are tested at each item.

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness of shell	Compliant with the requirements according to the standards	2mm +/- 0.2mm in flat and specific areas of head section	First article, Samples, TP-1314 ff.
Material thickness at ERP	Compliant with the requirements according to the standards	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	Dielectric parameters for required frequencies	300 MHz – 6 GHz: Relative permittivity < 5, Loss tangent < 0.05	Material samples
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility.	DEGMBE based simulating liquids	Pre-series, First article, Material samples
Sagging	Compliant with the requirements according to the standards. Sagging of the flat section when filled with tissue simulating liquid.	< 1% typical < 0.8% if filled with 155mm of HSL900 and without DUT below	Prototypes, Sample testing

Standards
[1] CENELEC EN 50361
[2] IEEE Std 1528-2003
[3] IEC 62209 Part I
[4] FCC OET Bulletin 65, Supplement C, Edition 01-01
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

Conformity
Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standards [1] to [4].

Date 07.07.2005

Signature / Stamp

D2: DOSIMETRIC E-FIELD PROBE

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

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

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

Accreditation No.: SCS 108

Client **BV-ADT (Auden)**

Certificate No: EX3-3504_Jan10

CALIBRATION CERTIFICATE

Object	EX3DV3 - SN:3504
Calibration procedure(s)	QA CAL-01.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	January 26, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV3

SN:3504

Manufactured: December 15, 2003
Last calibrated: January 21, 2009
Recalibrated: January 26, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV3 SN:3504

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.59	0.62	0.62	± 10.1%
DCP (mV)[B]	97.9	95.0	98.0	

Modulation Calibration Parameters

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

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY - Parameters of Probe: EX3DV3 SN:3504

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	9.80	9.80	9.80	0.48	0.73	± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	8.70	8.70	8.70	0.50	0.67	± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	8.20	8.20	8.20	0.38	0.75	± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	7.77	7.77	7.77	0.21	1.06	± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	7.79	7.79	7.79	0.22	1.16	± 11.0%
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	4.87	4.87	4.87	0.45	1.70	± 13.1%
5300	± 50 / ± 100	35.9 ± 5%	4.76 ± 5%	4.62	4.62	4.62	0.45	1.70	± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.51	4.51	4.51	0.50	1.70	± 13.1%
5600	± 50 / ± 100	35.5 ± 5%	5.07 ± 5%	4.25	4.25	4.25	0.55	1.70	± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.53	4.53	4.53	0.50	1.70	± 13.1%

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

DASY - Parameters of Probe: EX3DV3 SN:3504

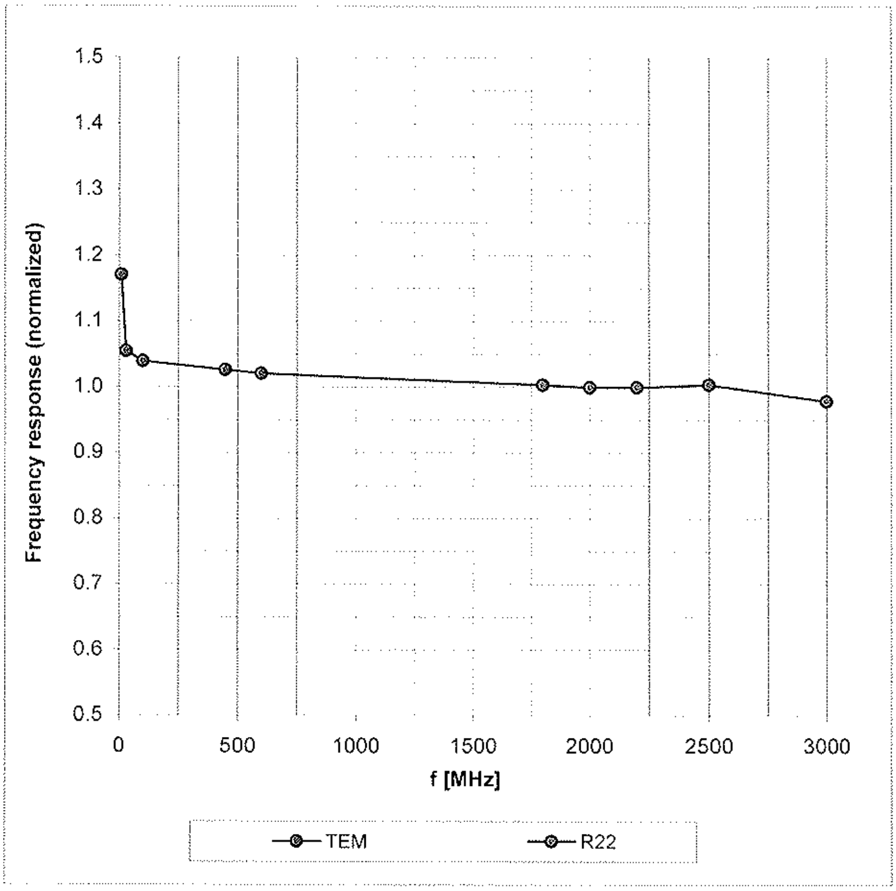
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	9.83	9.83	9.83	0.44	0.76	± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	8.64	8.64	8.64	0.44	0.74	± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	8.52	8.52	8.52	0.39	0.79	± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	7.91	7.91	7.91	0.32	0.86	± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	7.80	7.80	7.80	0.27	0.90	± 11.0%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.45	4.45	4.45	0.50	1.80	± 13.1%
5300	± 50 / ± 100	48.5 ± 5%	5.42 ± 5%	4.18	4.18	4.18	0.55	1.80	± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	3.91	3.91	3.91	0.60	1.80	± 13.1%
5600	± 50 / ± 100	48.5 ± 5%	5.77 ± 5%	3.70	3.70	3.70	0.65	1.80	± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	3.95	3.95	3.95	0.60	1.75	± 13.1%

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

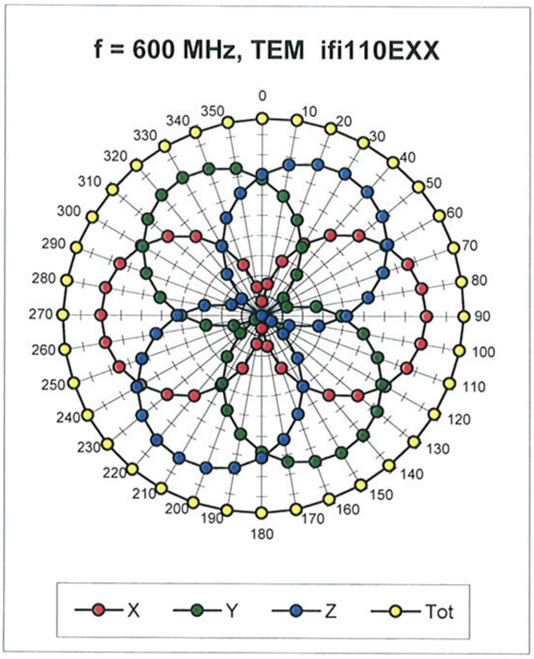
Frequency Response of E-Field

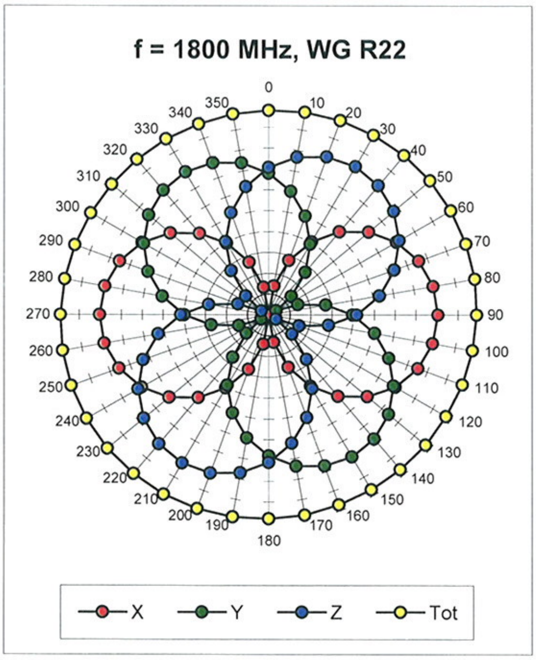
(TEM-Cell:ifi110 EXX, Waveguide: R22)

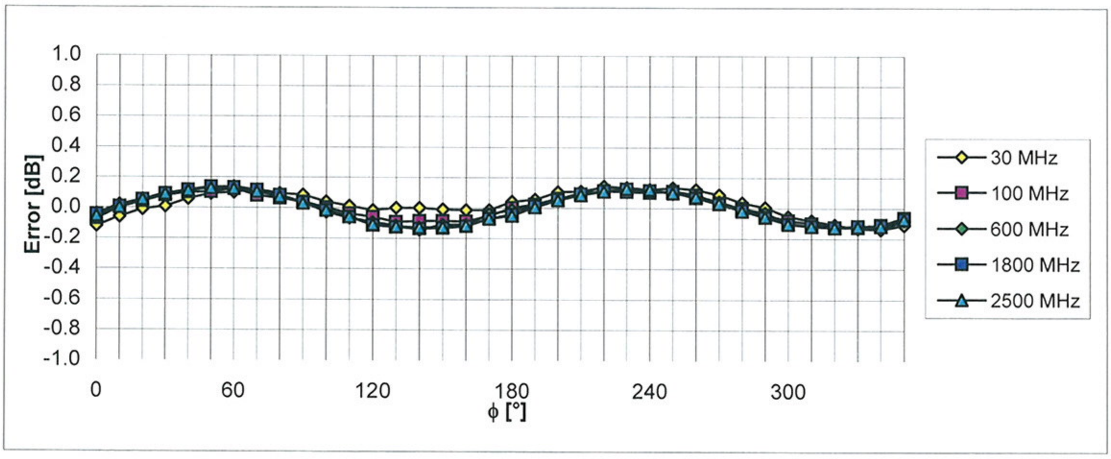


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



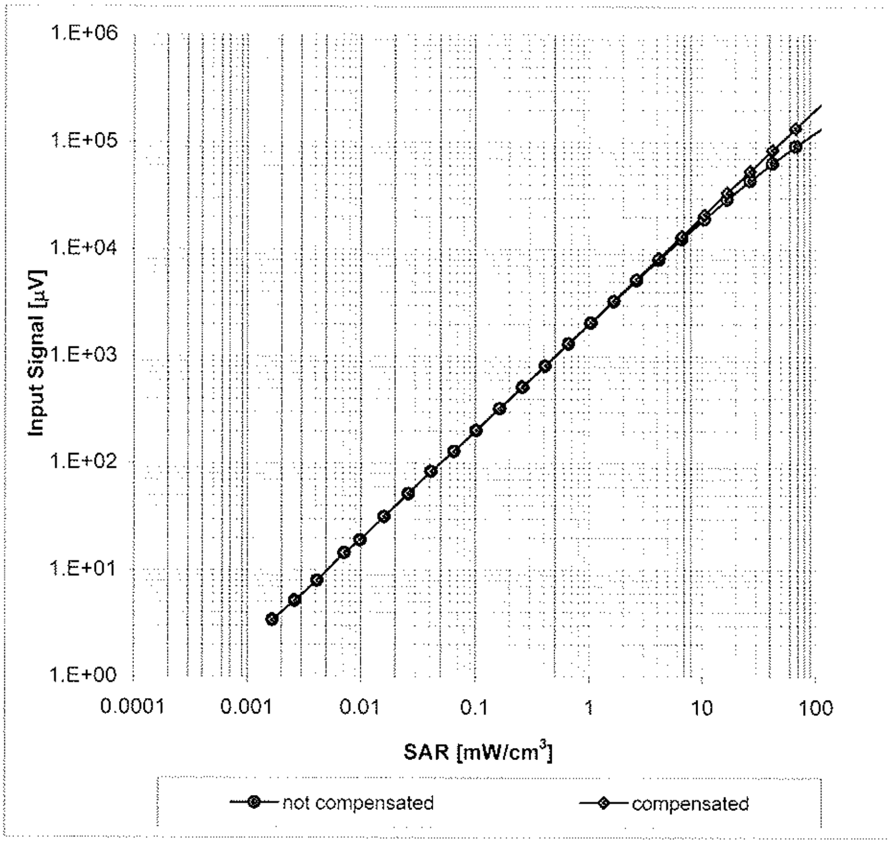


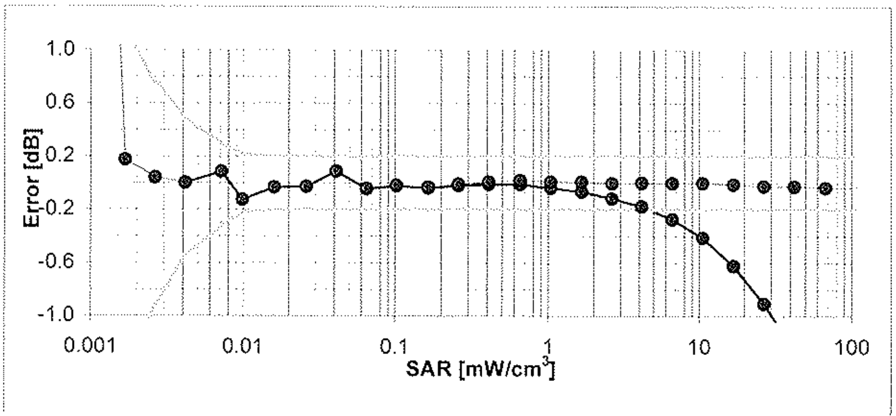


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

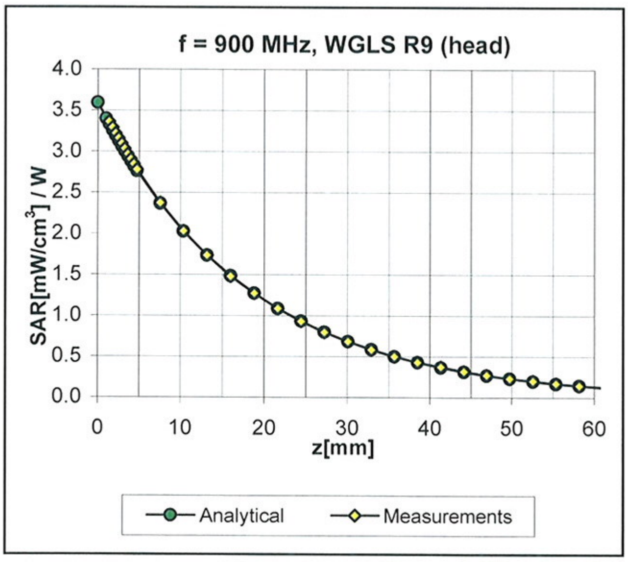
(Waveguide R22, f = 1800 MHz)

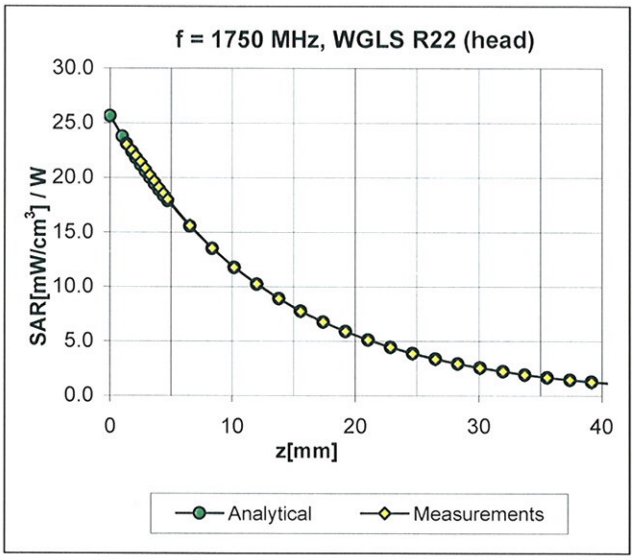




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

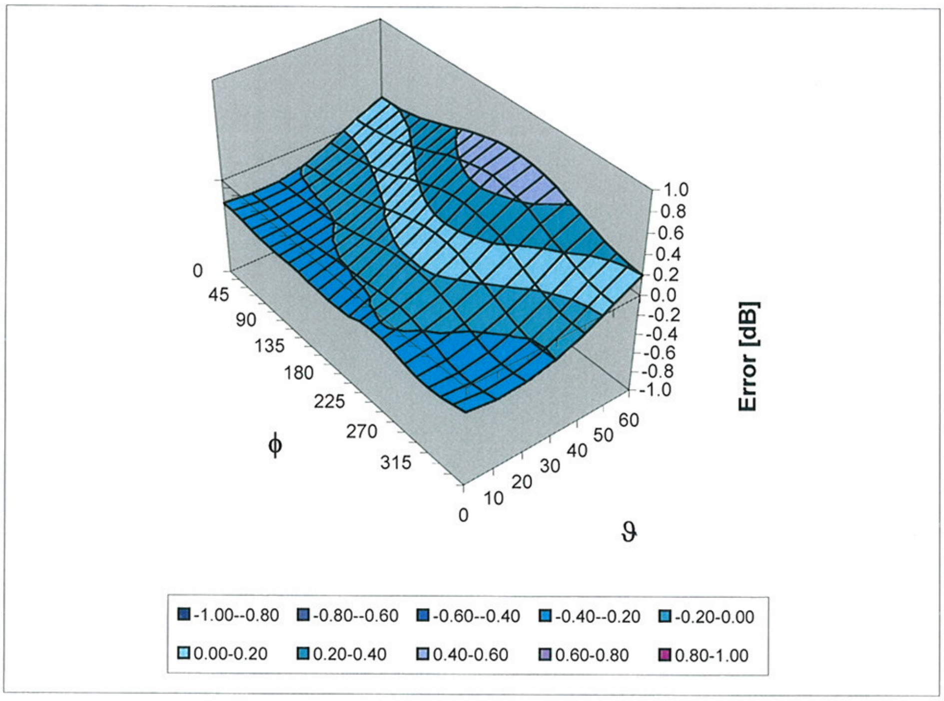
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

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