SAR TEST REPORT

Ref. Report No.
06-PIS05016-4

Name and address of the applicant

Hitachi Cable, Ltd.

Takasago Works, 880 Lsagozawa-cho, Hitachi-shi, Ibaraki-ken, 319-1418 Japan

Standard / Test regulation

- FCC 47 CFR Part 2, § 2.1093
  /OET Bulletin 65-Supplement C(97-01)
- Industry Canada RSS-102 Issue 2(2005.11)

Test result

POSITIVE

Equipment Under Test ;
WLAN IP Phone

FCC ID. ;
S99WIP-3000

Model/type No. ;
WirelessIP 3000

Manufacturer ;
UniData Communication Systems, Inc.

Additional information ;

Incoming date : January 02, 2006
Test : January 05, 2006

Issue date : January 10, 2006

This test report only responds to the tested sample and shall not be reproduced except in full without written approval of the Korea Testing Laboratory.

Tested and reported by

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KOREA TESTING LABORATORY

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1. EQUIPMENT UNDER TEST

1.1 General Information :

1) Test Sample : WLAN IP Phone

2) Device Category : Portable Device

3) Test Device : Production Unit

4) Model Number : WirelessIP 3000

5) FCC ID : S99WIP-3000

6) Applicant & Address : Hitachi Cable, Ltd.

Takasago Works, 880 Lsagozawa-cho,
Hitachi-shi, Ibaraki-ken, 319-1418 Japan

7) Manufacturer & Address : UniData Communication Systems Inc.

2F, OhSung-Bldg, 82-15, NonHyun-Dong, GangNam-Gu,
Seoul, 135-010 Korea

8) Rule and Test Standard :
- FCC 47 CFR § 2.1093,
  Evaluating Compliance with FCC Guidelines For Human Exposure to Radiofrequency Electromagnetic Fields
  Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)
- Industry Canada RSS-102 Issue 2(2005.11)

9) RF exposure Category : General Population/Uncontrolled

1.2 Description of Device :

1) Description of Test Sample

The device tested was WLAN IP Phone operating in the 2412 ~ 2462 MHz frequency bands. It has one

Operating Mode during Testing	: Test Mode(Continuous Wave-Unmodulated)
Modulation Scheme	: DSSS(Direct Sequence Spread Spectrum)
Device Power Rating for test sample and identical production unit	: 16 ±2 dBm
Device Dimensions (L x W x H)	: 13.0 x 4.3 x 1.7 cm
Antenna Type	: Internal Type
Applicable Head Configurations	: Left and Right Position
Applicable Body Worn-Configurations	: N/A
Battery Type	: Rechargeable Battery Pack (DC 3.7 V, 1320 mAh, Li-ion)

integral antenna and was tested in the head configurations of the phantom.

2) Test sample Accessories

2.1) Battery Types

DC 3.7 V rechargeable battery pack is used to power the WLAN IP Phone Model: WirelessIP 3000. The maximum rated power is 16 dBm in the frequency band. SAR measurements were performed with a rechargeable battery pack .

2.2) USB Cable

The device has a USB port and USB cable which is used to communicate with PC etc. See following photographs of accessories.

< Photo 1. Battery Type >

< Photo 2. USB Cable >

3) Test Signal, Frequency and Output Power

The WLAN IP Phone had a total of 11 channels within the frequency bands. The Tx frequency ranges of these modes are 2412 MHz to 2462 MHz. For the SAR measurements the device was operating in test mode(continuous wave-unmodulated). The fixed frequency channels used in the testing are shown in table 1. The frequency-span of each band was more than 10 MHz consequently; the SAR levels of the test sample were measured for the lowest, center and highest channels of the frequency band. There were no wires or other connections to the EUT during the SAR measurements.

The conducted power level of the EUT could not be measured due to the non-RF external output port. The EUT was evaluated for SAR at the EIRP level measured prior to SAR evaluations on a 3-meter Test Site using the signal substitution method in accordance with ANSI TIA/EIA-603-A-2001. The results of this measurement taken after the rechargeable battery pack was fitted are listed in table 1.

Table 1 : Test Frequency and Output Power

Channel	Channel Frequency MHz	Battery Type	EIRP Output Power Measured
Channel 01	2412	DC 3.7 V Rechargeable Battery pack	43.85 mW (16.42 dBm)
Channel 06	2437		46.99 mW (16.72 dBm)
Channel 11	2462		54.45 mW (17.36 dBm)

< Photo 3. EIRP Power meaurement Setup >

4) Battery Status

The device rechargeable battery pack was fully charged prior to commencement of measurement. Each SAR test was completed within 30 minutes. The battery condition was monitored by measuring the RF field at a defined position inside the phantom before the commencement of each test and again after the completion of the test.

5) Test Laboratory Environmental Factors

The measurements were performed in a shielded room with no background network signals. The temperature in the laboratory was controlled to within 22.0 ± 2.0 °C, the humidity was in the range 40 % to 60 %. The liquid parameters were measured daily prior to the commencement of each test. Tests were performed to check that reflections within the environment did not influence the SAR measurements. The noise floor of the DASY4 SAR measurement system using the ET3DV6(SN:1773) probe is less than 5 uV in both air and liquid mediums.

2. DESCRIPTION OF SAR MEASREMENT SYSTEM

2.1 Probe Positioning System

The measurements were performed with the state of the automated near-field scanning system **DASY4 V4.6 Build 23** from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision 6-axis robot (working range greater that 1.1 m), which positions the SAR measurement probes with a positional repeatability of better than ± 0.02 mm. The DASY4 fully complies with the OET 65 C (01-01), IEEE 1528 and EN50361 SAR measurement requirements.

2.2 E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe ET3DV6, SN : 1773 (manufactured by SPEAG) designed in the classical triangular configuration and optimised for dosimetric evaluation. The probe has been calibrated and found to be accurate to better than ± 0.25 dB. The probe is suitable for measurements close to material discontinuity at the surface of the phantom. The sensors of the probe are directly loaded with Schottky diodes and connected via highly resistive lines (length = 300 mm) to the data acquisition unit.

2.3 Data Acquisition Electronics

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. The input impedance of the DAE4 box is 200 Mohm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.Transmission to the PC-card 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.

2.4 Validation Procedures and Data

Prior to the SAR assessment, the system validation kit was used to verify that the DASY4 was operating within its specifications. The validation was performed at 2450 MHz with the SPEAG D2450V2 calibrated dipole.

The validation dipoles are highly symmetric and matched at the centre frequency for the specified liquid and distance to the phantom. The accurate distance between the liquid surface and the dipole centre is achieved with a distance holder that snaps onto the dipole.

System validation is performed by feeding a known power level into a reference dipole, set at a know distance from the phantom. The measured SAR is compared to the theoretically derived level.

1) Tissue Material Properties

The dielectric parameters of the brain and muscle simulating liquid were measured prior to SAR assessment using the HP85070D dielectric probe kit and Agilent 8753ES Network Analyzer. The actual dielectric parameters are shown in the following table.

Table 2 : Measured Brain Simulating Liquid Dielectric Values

date	Frequency Band	ε r (measured)	ε r (target)	σ (mho/m) (measured)	σ (target)	ρ Kg/m^3
05th January 2006	2412 MHz Brain	37.5	-	1.82	-	1000
	2437 MHz Brain	37.6	-	1.83	-	1000
	2450 MHz Brain	37.5	39.0 ± 5 % (37.05 ~ 40.95)	1.83	1.84 ± 5 % (1.75 ~ 1.93)	1000
	2462 MHz Brain	37.1	-	1.84	-	1000
-	-	-	-	-	-	-

The humidity and dielectric/ambient temperatures are recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than |2|°C.

Table 3 : Temperature and Humidity recorded

date	Ambient Temperature(°C)	Liquid Temperature(°C)	Humidity(%)
05th January 2006	21.0	19.6	46

The tissue simulating liquids are created prior to the SAR evaluation and often require slight modification each day to obtain the correct dielectric parameters(refer DASY4 manual V4.6 Build 23)

Table 4 : Volume of Brain Liquid @ 2450 MHz

Approximate Composotion	% By Weight
Distilled Water	55.00
DGMBE	45.00

2) Validation Results at 2450 MHz

The following table lists the dielectric properties of the tissue simulating liquid measured prior to each SAR validation. The results of the validation is listed in columns 4 and 5. The forward power into the reference dipole for each SAR validation was adjusted to 250 mW.

Table 5 : Validation Results (Dipole : SPEAG D2450V2, SN : 746)

1. Validation Date	2. ε_r (measured)	3. σ (mho/m) (measured)	4. Measured SAR 1 g (mW/g)	5. Measured SAR 10 g (mW/g)
05th January 2006	37.5	1.83	13.2	5.92

< Photo 4. 2450 MHz Validation Setup >

3) Deviation from Reference Validation Values

The reference SAR values are derived using a reference dipole and flat phantom suitable for a centre frequency of 2450 MHz. These reference SAR values are obtained from the IEEE Std 1528 and are normalized to 1 W.

The SPEAG calibration reference SAR value is the SAR validation result obtained in a specific dielectric liquid using the validation dipole (D2450V2) during calibration. The measured one-gram SAR should be within 10 % of the expected target reference values shown in table 6 below.

Table 6 : Deviation from Reference Validation Values

Date	Measured SAR 1 g (mW/g at 250 mW)	Measured SAR 1 g (mW/g at Normalized to 1 W)	IEEE Std 1528 reference SAR 1 g Target (mW/g)
05th January 2006	13.2	52.8	52.4 ± 10 % (47.2 ~ 57.6)

NOTE : All reference validation values are referenced to 1 W input power.

4) Liquid Depth 15 cm

During the SAR measurement process the liquid level was maintained to a level of a least 15 cm tolerance of ± 0.2 cm.The following photo shows the depth of the liquid maintained during the testing.

< Photo 5. Liquid Depth >

2.5 Phantom Properties (Size, Shape, Shell Thickness)

The phantom used during the validations was a flat section of SAM Twin Phantom from SPEAG. It is a strictly validation phantom with a single thickness of 2 mm and was filled with the required tissue simulating liquid. The flat phantom support structures were all non-metallic and spaced more than one device width away in transverse directions.

For SAR testing in the head positions, a head section of SAM Twin Phantom from SPEAG was used. The phantom was filled with the required tissue simulating liquid.

< Photo 6. SAM Twin Phantom >

2.6 Device Holder for DASY4

The DASY4 device holder supplied by SPEAG is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The rotation centres for both scales is the ear opening. Thus the device needs no repositioning when changing the angles.

The DASY4 device holder is made of low-loss material having the following dielectric parameters : relative permittivity $\varepsilon_r = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, to reduce the influence on the clamp on the test results.

Refer to Appendix B of photograph of device positioning.

3. SAR MEASUREMENT PROCEDURE USING DASY4

The SAR evaluation was performed with the SPEAG DASY4 system. A summary of the procedure follows ;

a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test and then again at the end of the test.

b) The SAR distribution at the exposed side of the phantom is measured at a distance of 3.9 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 15 mm x 15 mm. The actual Area Scan has dimensions of 75 mm x 105 mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.

c) Around this point, a volume of 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure ;

(i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

(ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot”- condition (in x, y and z-direction). The volume is integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

(iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

(iv) The SAR value at the same location as in Step (a) is again measured

4. MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528-2003 for both EUT SAR tests and Validation uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95 % confidence level) must be less than 25 %.

Table 10 : EUT SAR Test - Uncertainty Budget for DASY4 Version V4.6 Build 19

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (%)	Prob. Dist.	Div.	Ci (1 g)	Ci (10 g)	1 g Ui (± %)	10 g Ui (± %)	vi
Measurement System									
Probe Calibration (k=1)	E.2.1	5.9	N	1	1	1	5.9	5.9	∞
Axial lsotropy	E.2.2	4.7	R	√ 3	0.7	0.7	1.9	1.9	∞
Hemispherical lsotropy	E.2.2	9.6	R	√ 3	0.7	0.7	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	√ 3	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	√ 3	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	√ 3	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	R	√ 3	1	1	0.5	0.5	∞
lntegration Time	E.2.8	2.6	R	√ 3	1	1	1.5	1.5	∞
RF Ambient Noise	E.6.1	3.0	R	√ 3	1	1	1.7	1.7	∞
RF Ambient Refections	E.6.1	3.0	R	√ 3	1	1	1.7	1.7	∞
Probe Positioner	E.6.2	0.4	R	√ 3	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	√ 3	1	1	1.7	1.7	∞
Algorithms for Max. SAR Evaluation	E.5	1.0	R	√ 3	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	2.9	N	1	1	1	2.9	2.9	145
Device Holder Uncertainty	E.4.1	3.6	N	1	1	1	3.6	3.6	5
Output Power Variation — SAR Drift Measurement	6.6.2	5.0	R	√ 3	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	√ 3	1	1	2.3	2.3	∞
Liquid Conductivity — Deviation from target values	E.3.2	5.0	R	√ 3	0.64	0.43	1.8	1.2	∞
Liquid Conductivity — Measurement uncertainty	E.3.3	2.5	N	1	0.64	0.43	1.6	1.1	∞
Liquid Permititivity — Deviation from target values	E.3.2	5.0	R	√ 3	0.6	0.49	1.7	1.4	∞
Liquid Pemiittivity — Measurement uncertainty	E.3.3	2.5	N	1	0.6	0.49	1.5	1.2	∞
Cornbined standard Uncertainty			RSS				± 10.9	± 10.7	387
Expanded Uncertainty (95% CONFIDENCE LEVEL)			K=2				± 21.9	± 21.4	

Estimated total measurement uncertainity for the DASY4 measurement system was ± 10.9 %. The extended uncertainity (K=2) was assessed to be ± 21.9 % based on 95 % confidence level. The uncertainity is not added to the measurement result.

Table 11 : Validation - Uncertainty Budget for DASY4 Version V4.6 Build 19

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (%)	Prob. Dist.	Div.	Ci (1 g)	Ci (10 g)	1 g Ui (± %)	10 g Ui (± %)	vi
Measurement System									
Probe Calibration (k=1)	E.2.1	5.9	N	1	1	1	5.9	5.9	∞
Axial lsotropy	E.2.2	4.7	R	√ 3	1	1	2.7	2.7	∞
Hemispherical lsotropy	E.2.2	9.6	R	√ 3	0	0	0	0	∞
Boundary Effect	E.2.3	1.0	R	√ 3	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	√ 3	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	√ 3	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0	R	√ 3	1	1	0	0	∞
lntegration Time	E.2.8	0	R	√ 3	1	1	0	0	∞
RF Ambient Noise	E.6.1	3.0	R	√ 3	1	1	1.7	1.7	∞
RF Ambient Refections	E.6.1	3.0	R	√ 3	1	1	1.7	1.7	∞
Probe Positioner	E.6.2	0.4	R	√ 3	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	√ 3	1	1	1.7	1.7	∞
Algorithms for Max. SAR Evaluation	E.5.2	1.0	R	√ 3	1	1	0.6	0.6	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	√ 3	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	4.7	R	√ 3	1	1	2.7	2.7	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	√ 3	1	1	2.3	2.3	∞
Liquid Conductivity — Deviation from target values	E.3.2	5.0	R	√ 3	0.64	0.43	1.8	1.2	∞
Liquid Conductivity — Measurement uncertainty	E.3.3	2.5	N	1	0.64	0.43	1.6	1.1	∞
Liquid Permititivity — Deviation from target values	E.3.2	5.0	R	√ 3	0.6	0.49	1.7	1.4	∞
Uquid Pemiittivity — Measurement unceilainty	E.3.3	2.5	N	1	0.6	0.49	1.5	1.2	∞
Cornbined standard Uncertainty			RSS				± 9.2	± 8.9	∞
Expanded Uncertainty (95% CONFIDENCE LEVEL)			K=2				± 18.4	± 17.8	

Estimated total measurement uncertainty for the DASY4 measurement system was ± 9.2 %.
The extended uncertainty (K = 2) was assessed to be ± 18.4 % based on 95 % confidence level.
The uncertainty is not added to the validation measurement result.

5. TEST METHOD

5.1 Description of the Test Positions

SAR measurements were performed in the "cheek" and "tilted" positions on left and right sides of the phantom. Both were measured in the head section of the SAM Twin Phantom . See Appendix B for photos of test positions.

1) "Cheek" Position

The device was positioned with the vertical center line of the body of the device and the horizontal line crossing the center of the ear piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, it was aligned the vertical center line with the reference plane containing the three ear and mouth reference points(M, RE and LE) and aligned the center of the ear piece with the line RE-LE. Then device was translated towards the phantom with the ear piece aligned with the line LE-RE until it touched the ear. While maintaining the device in the reference plane and maintaining the device contact with the ear, the bottom of the device was moved until any point on the front side is in contact with the cheek of the phantom.

2) "Tilted" Position

The device was positioned in the "Cheek" position. While maintaining the device in the reference plane described above cheek position and pivoting against the ear, device was moved outward away from the mouth by an angle of 15 degrees. .

5.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)

The device has a internal antenna. The SAR was measured at three test channels with the test sample operating at maximum power, as specified in section 1.2. 3).

5.3 FCC RF Exposure Limits

1) For Occupational/ Controlled Exposure

Spatial Peak SAR Limits For:	
Partial-Body	8.0 W/kg (averaged over any 1 g cube of tissue)
Hands, Wrists, Feet and Ankles	20.0 W/kg (averaged over l0 g cube of tissue)

2) For General Population/Uncontrolled

Spatial Peak SAR Limits For :	
Partial-Body	1.6 W/kg (averaged over any 1 g cube of tissue)
Hands, Wrists, Feet and Ankles	4.0 W/kg (averaged over 10 g cube of tissue)

6. SAR MEASURMENT RESULTS

The SAR values averaged over 1 g tissue masses were obtained in the conditions of the head configurations of the phantom. Detailed measurement data and plots showing the maximum SAR location of the EUT are reported in Appendix C. Tests were performed with both positions (cheek and tilted) on the left and right sides of head and using the low-end, center and high-end frequency of operating band.

Test Channel	Device Power Source	Head Position	Device Test Position	Antenna Position	Measured 1 g SAR Results (mW/g)	Measured Power Drift (dB)	Plot No. Of APP.C
01 (2412 MHz)	DC 3.7 V Recha-rgeable Battery Pack	Right Side	Cheek	Internal	0.189	0.055	1
				-	-	-	-
			Tilted	Internal	0.142	0.120	2
				-	-	-	-
		Left Side	Cheek	Internal	0.222	- 0.169	3
				-	-	-	-
			Tilted	Internal	0.162	0.011	4
				-	-	-	-
06 (2437 MHz)		Right Side	Cheek	Internal	0.217	- 0.020	5
				-	-	-	-
			Tilted	Internal	0.212	- 0.010	6
				-	-	-	-
		Left Side	Cheek	Internal	0.218	0.034	7
				-	-	-	-
			Tilted	Internal	0.182	- 0.072	8
				-	-	-	-
11 (2462 MHz)		Right Side	Cheek	Internal	0.232	- 0.039	9
				-	-	-	-
			Tilted	Internal	0.175	0.010	10
				-	-	-	-
		Left Side	Cheek	Internal	**0.234**	- 0.063	11
				-	-	-	-
			Tilted	Internal	0.166	0.043	12
				-	-	-	-

7. COMPLIANCE STATEMENT

The WLAN IP phone, Model; WirelessIP 3000 was found to comply with the FCC SAR requirements. The highest SAR level recorded was **0.234 W/kg for a 1 g cube**. This value was measured on channel 11 in the Leftt-Cheek position supplementing the DC 3.7 V Rechargeable Battery Pack . **This was below the uncontrolled limit of 1.6 W/kg.**

8. EQUIPMENT LIST AND CALIBRATION DETAILS

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX60	N/A	N/A	Yes
Robot Remote Control	SPEAG	CS7MB	F03/5U96A1 /C/01	N/A	Yes
SAM Twin Phantom	SPEAG	TP1276	QD000P40CA	N/A	Yes
Flat Phantom	SPEAG	N/A	N/A	N/A	No
Data Acquisition Electronics	SPEAG	DAE4	559	05.03.22	Yes
Probe E-Field	SPEAG	ES3DV2	3020	05.07.20	No
Probe E-Field	SPEAG	ET3DV6	1773	05.05.26	Yes
Antenna Dipole 450 MHz	SPEAG	D450V2	1016	05.09.21	No
Antenna Dipole 835 MHz	SPEAG	D835V2	481	05.05.24	No
Antenna Dipole 900 MHz	SPEAG	D900V2	194	05.11.04	No
Antenna Dipole 1800 MHz	SPEAG	D1800V2	2d066	05.05.19	No
Antenna Dipole 1900 MHz	SPEAG	D1900V2	5d038	05.11.03	No
Antenna Dipole 1950 MHz	SPEAG	D1950V2	1027	04.03.02	No
Antenna Dipole 2450 MHz	SPEAG	D2450V2	746	04.02.25	Yes
High power RF Amplifier	EMPOWER	2057-BBS3Q5KCK	1002D/C0321	05.10.13	Yes
Signal Generator	Hewlett Packard	8648C	3629U00868	05.05.20	Yes
RF Power Meter Dual	Hewlett Packard	E4419A	GB37170495	05.04.30	Yes
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481A	US37299851	05.01.14	Yes
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481A	3318A92872	05.01.14	Yes
S-Parameter Network Analyzer	Agilent	8753ES	MY40002303	05.04.26	Yes
Dual Directional Coupler	Hewlett Packard	778D	1144AO4576	05.10.13	No
Directional Coupler	Agilent	773D	MY28390213	05.10.13	Yes

APPENDIX A : TEST SAMPLE PHOTOGRAPHS

< Photo A.1. Front View >

< Photo A.2. Rear View >

< Photo A.3. Rear Inside View >

< Photo A.4. Battery Pack Used >

APPENDIX B : TEST SET-UP PHOTOGRAPHS

< Photo B.1. Right Head-Cheek >

< Photo B.2. Right Head-Tilt >

< Photo B.3. Left Head-Cheek >

< Photo B.4. Left Head-Tilt >

APPENDIX C : PLOTS OF THE SAR MEASUREMENTS

Plot 1. SAR Measurement of Right Head-Cheek (CH 01) page 23

Plot 2. SAR Measurement of Right Head-Tilt (CH 01) page 24

Plot 3. SAR Measurement of Left Head-Cheek (CH 01) page 25

Plot 4. SAR Measurement of Left Head-Tilt (CH 01) page 26

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Plot 6. SAR Measurement of Right Head-Cheek (CH 06) page 28

Plot 7. SAR Measurement of Left Head-Cheek (CH 06) page 29

Plot 8. SAR Measurement of Left Head-Tilt (CH 06) page 30

Plot 9. SAR Measurement of Right Head-Cheek (CH 11) page 31

Plot 10. SAR Measurement of Right Head-Tilt (CH 11) page 32

Plot 11. SAR Measurement of Left Head-Cheek (CH 11) page 33

Plot 12. SAR Measurement of Left Head-Cheek (CH 11) page 34

Plot 13. SAR Measurement of 2450 MHz Validation page 35

CH 01(2412 MHz) RIGHT HEAD-CHEEK

DUT: WLAN IP Phone; Type: WirelessIP 3000;

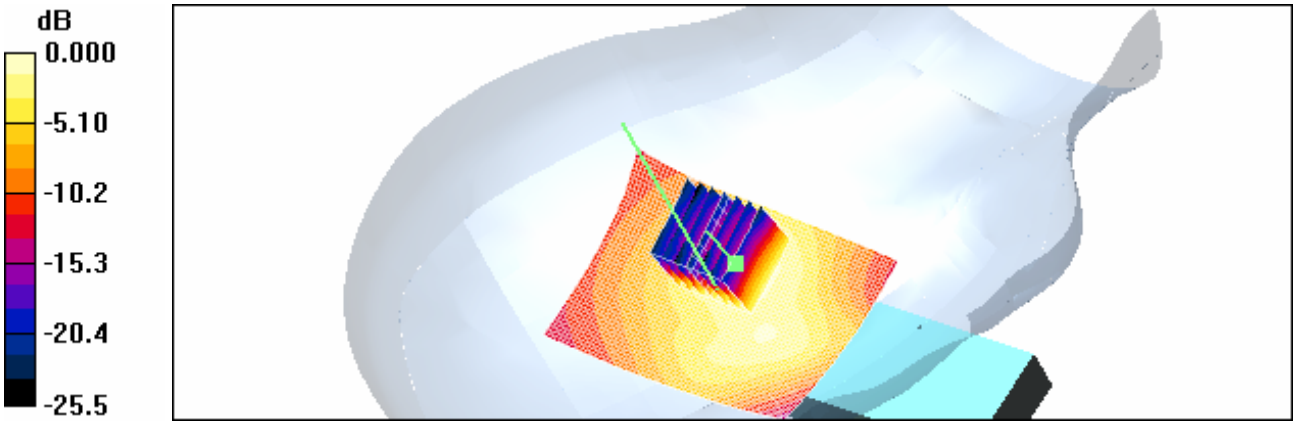
Communication System: CW; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2412 MHz; σ = 1.82 mho/m; ε_r = 37.5; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

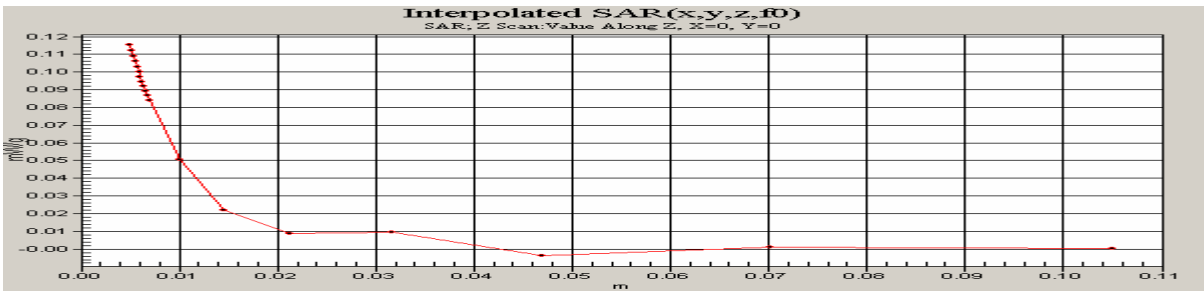
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.211 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.16 V/m; Power Drift = 0.055 dB
Peak SAR (extrapolated) = 0.400 W/kg
SAR(1 g) = 0.189 mW/g; SAR(10 g) = 0.094 mW/g
Maximum value of SAR (measured) = 0.209 mW/g



0 dB = 0.209mW/g



CH 01(2412 MHz) RIGHT HEAD-TILT

DUT: WLAN IP Phone; Type: WirelessIP 3000;

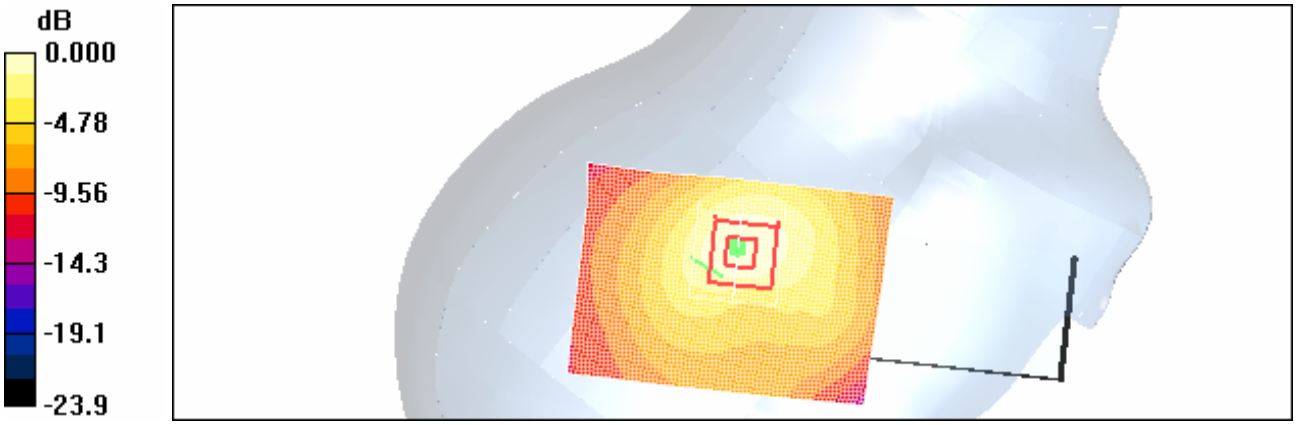
Communication System: CW; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2412 MHz; σ = 1.82 mho/m; ε_r = 37.5; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

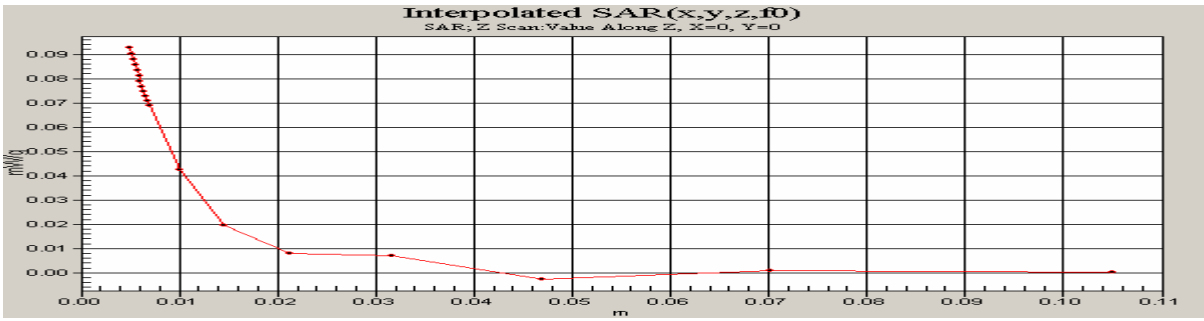
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.155 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.38 V/m; Power Drift = 0.120 dB
Peak SAR (extrapolated) = 0.285 W/kg
SAR(1 g) = 0.142 mW/g; SAR(10 g) = 0.073 mW/g
Maximum value of SAR (measured) = 0.154 mW/g



0 dB = 0.154mW/g



CH 01(2412 MHz) LEFT HEAD-CHEEK

DUT: WLAN IP Phone; Type: WirelessIP 3000

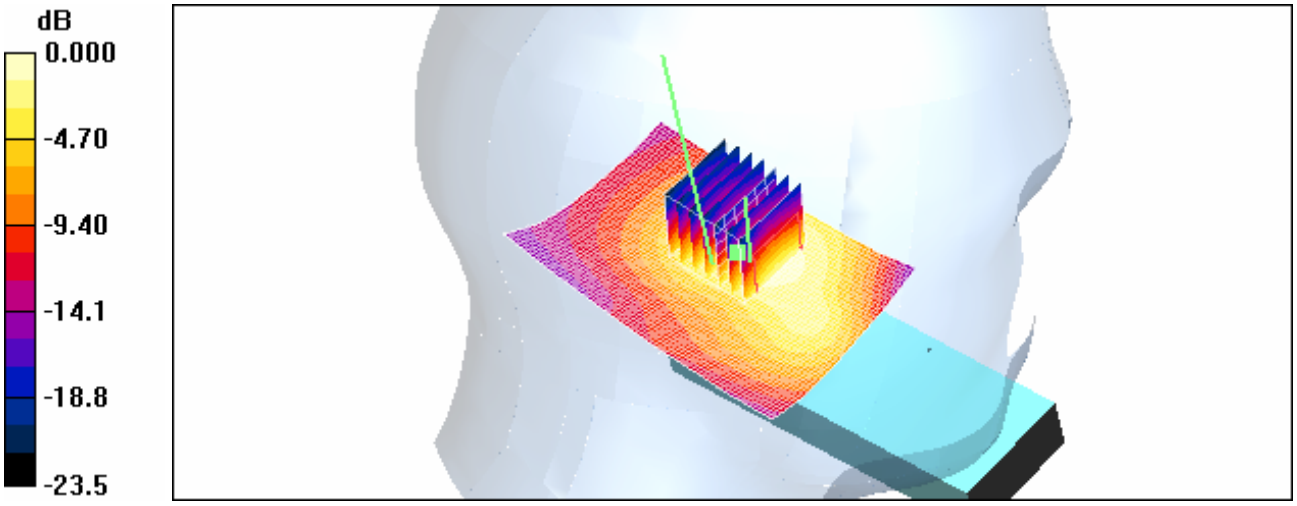
Communication System: CW; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2412 MHz; σ = 1.82 mho/m; ε_r = 37.5; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

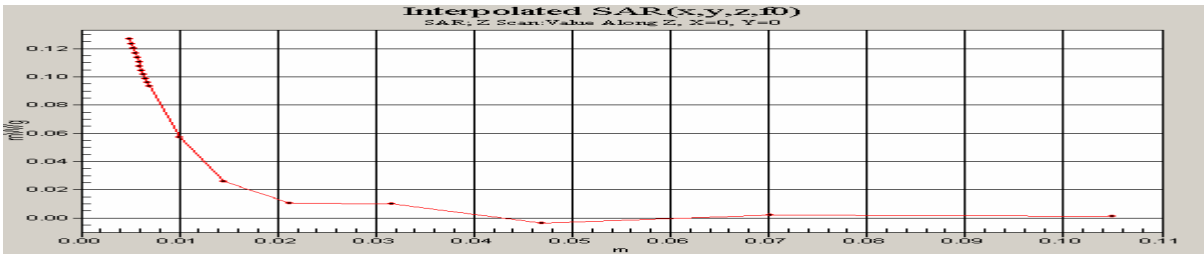
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.256 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.8 V/m; Power Drift = -0.169 dB
Peak SAR (extrapolated) = 0.445 W/kg
SAR(1 g) = 0.222 mW/g; SAR(10 g) = 0.116 mW/g
Maximum value of SAR (measured) = 0.240 mW/g



0 dB = 0.240mW/g



CH 01(2412 MHz) LEFT HEAD-TILT

DUT: WLAN IP Phone; Type: WirelessIP 3000;

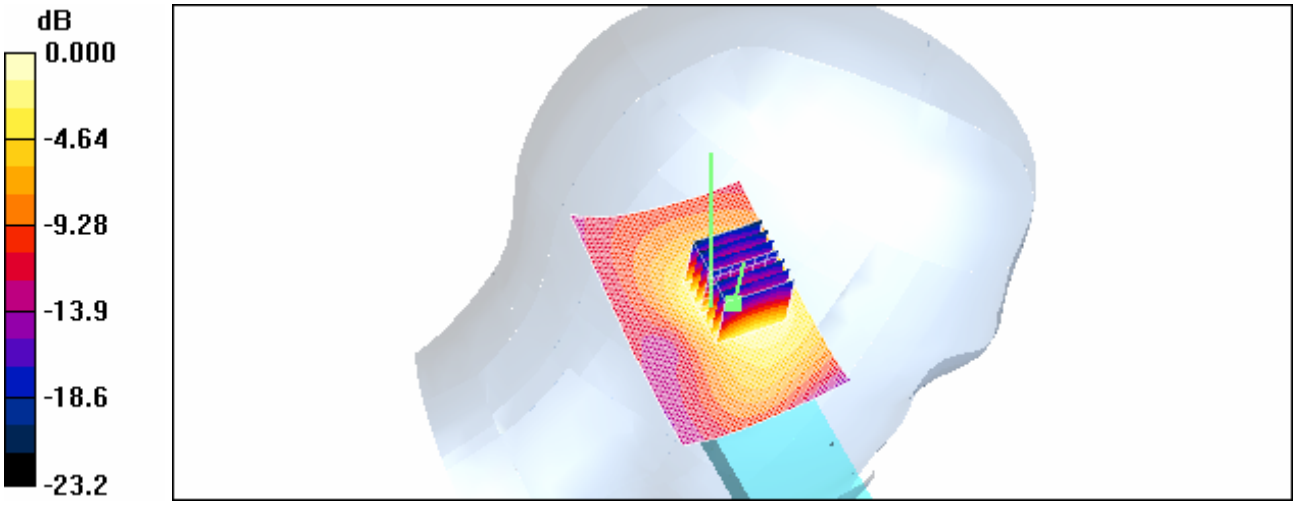
Communication System: CW; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2412 MHz; σ = 1.82 mho/m; ε_r = 37.5; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

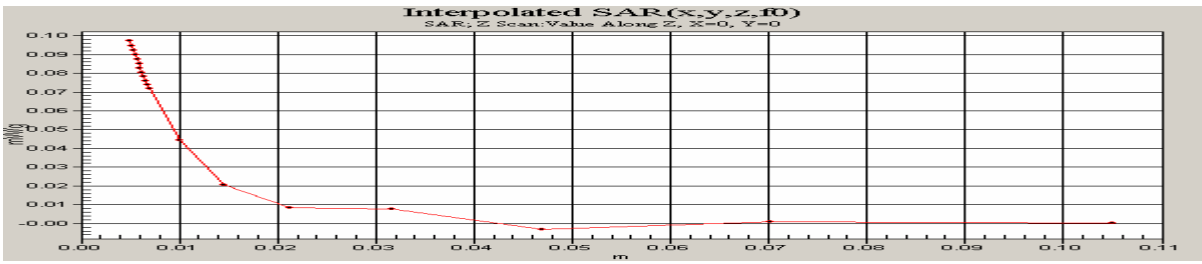
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.185 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.26 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 0.324 W/kg
SAR(1 g) = 0.162 mW/g; SAR(10 g) = 0.084 mW/g
Maximum value of SAR (measured) = 0.176 mW/g



0 dB = 0.176mW/g



CH 06(2437 MHz) RIGHT HEAD-CHEEK

DUT: WLAN IP Phone; Type: WirelessIP 3000;

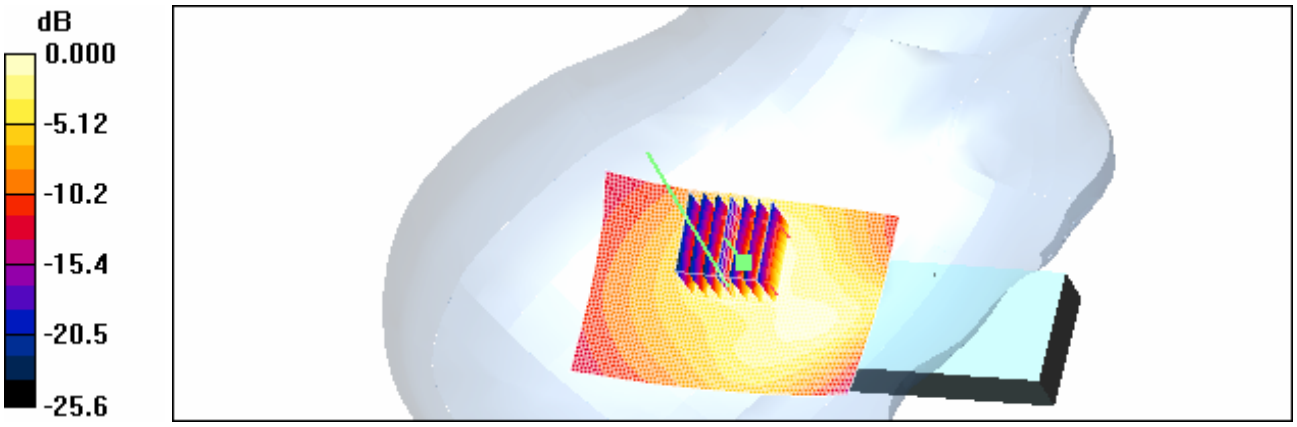
Communication System: CW; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2437 MHz; σ = 1.83 mho/m; ε_r = 37.6; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

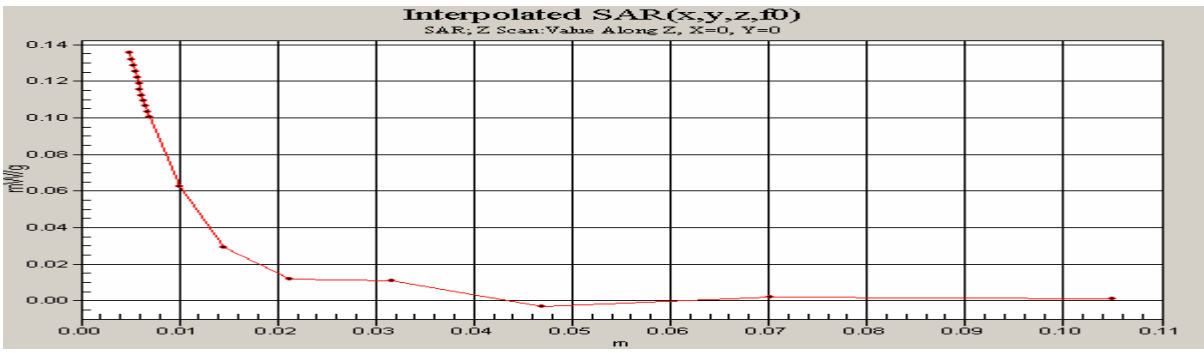
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.233 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.2 V/m; Power Drift = -0.020 dB
Peak SAR (extrapolated) = 0.449 W/kg
SAR(1 g) = 0.217 mW/g; SAR(10 g) = 0.112 mW/g
Maximum value of SAR (measured) = 0.237 mW/g



0 dB = 0.237mW/g



CH 06(2437 MHz) RIGHT HEAD-TILT

DUT: WLAN IP Phone; Type: WirelessIP 3000

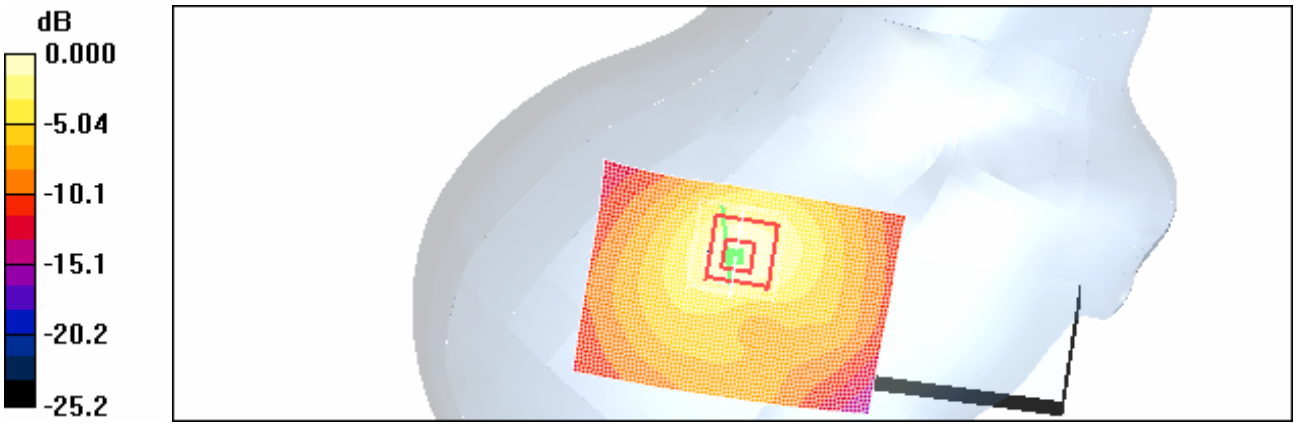
Communication System: CW; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2437 MHz; σ = 1.83 mho/m; ε_r = 37.6; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

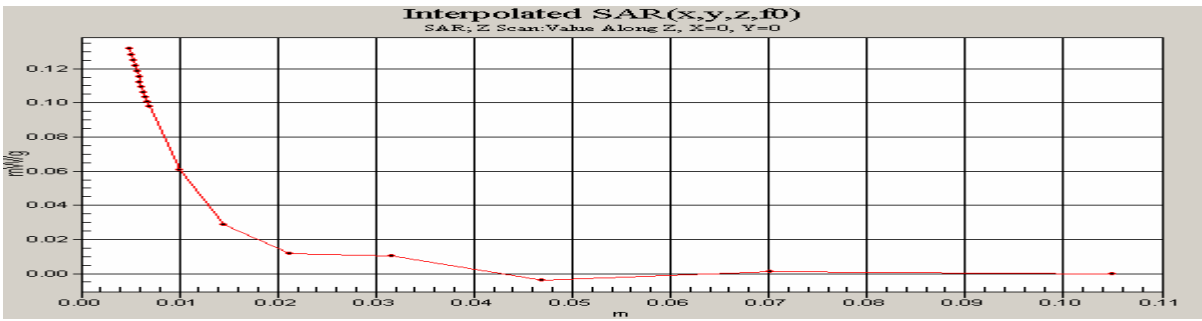
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.237 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.1 V/m; Power Drift = -0.010 dB
Peak SAR (extrapolated) = 0.445 W/kg
SAR(1 g) = 0.212 mW/g; SAR(10 g) = 0.105 mW/g
Maximum value of SAR (measured) = 0.236 mW/g



0 dB = 0.236mW/g



CH 06(2437 MHz) LEFT HEAD-CHEEK

DUT: WLAN IP Phone; Type: WirelessIP 3000;

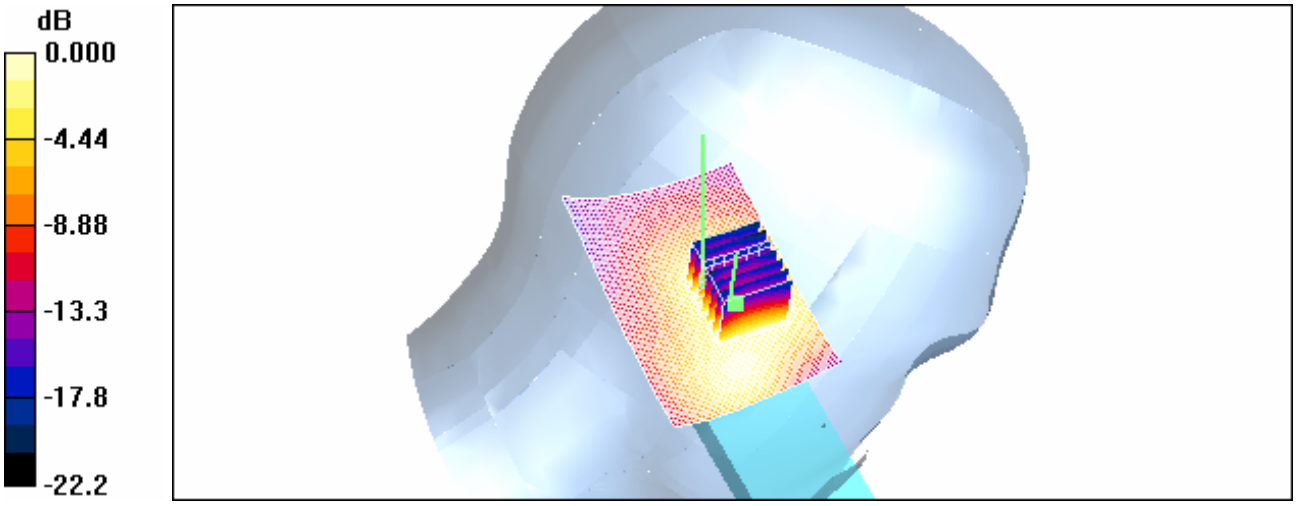
Communication System: CW; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2437 MHz; σ = 1.83 mho/m; ε_r = 37.6; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

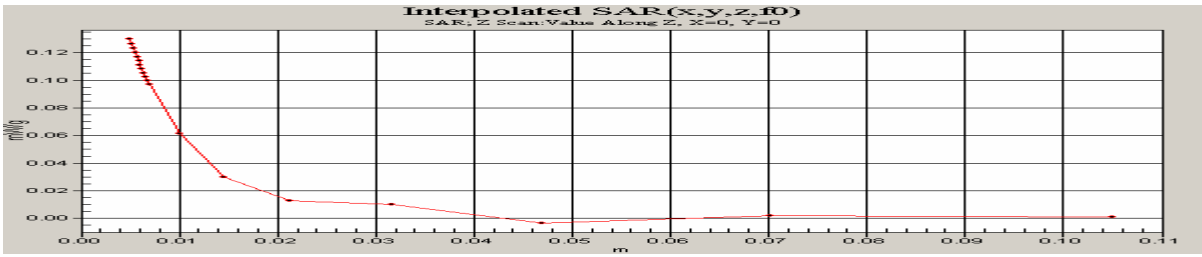
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.236 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.9 V/m; Power Drift = 0.034 dB
Peak SAR (extrapolated) = 0.432 W/kg
SAR(1 g) = 0.218 mW/g; SAR(10 g) = 0.117 mW/g
Maximum value of SAR (measured) = 0.232 mW/g



0 dB = 0.232mW/g



CH 06(2437 MHz) LEFT HEAD-TILT

DUT: WLAN IP Phone; Type: WirelessIP 3000;

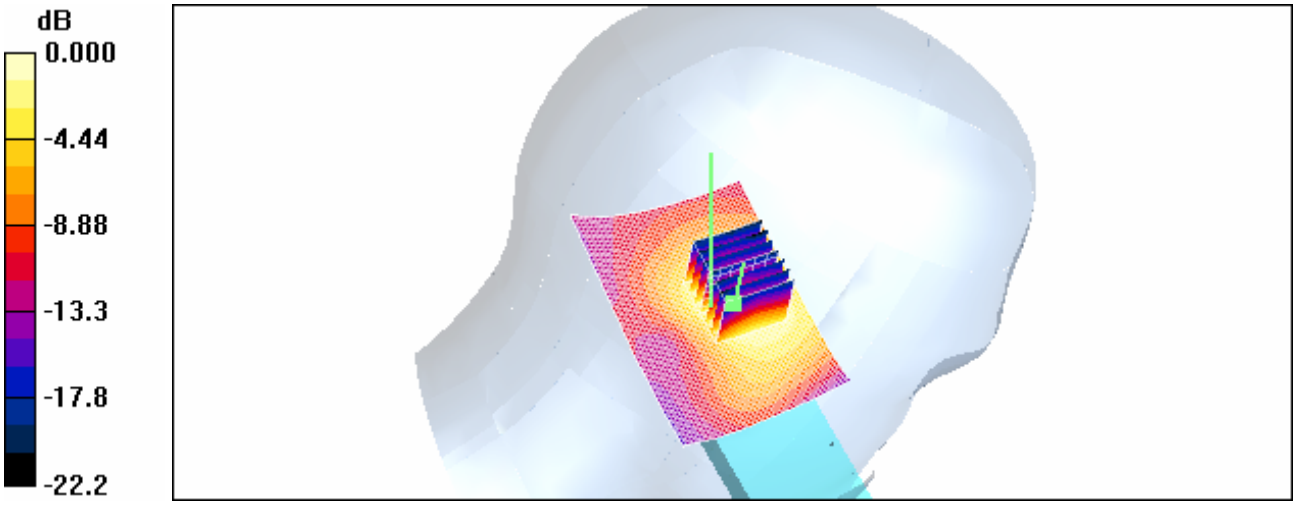
Communication System: CW; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2437 MHz; σ = 1.83 mho/m; ε_r = 37.6; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

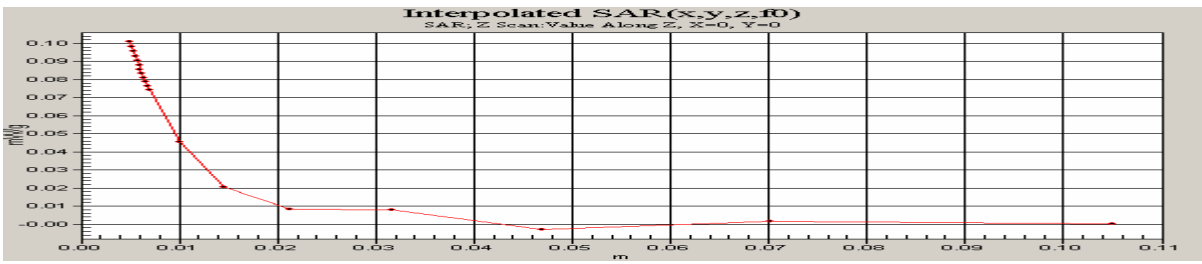
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.212 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.75 V/m; Power Drift = -0.072 dB
Peak SAR (extrapolated) = 0.369 W/kg
SAR(1 g) = 0.182 mW/g; SAR(10 g) = 0.094 mW/g
Maximum value of SAR (measured) = 0.199 mW/g



0 dB = 0.199mW/g



CH 11(2462 MHz) RIGHT HEAD-CHEEK

DUT: WLAN IP Phone; Type: WirelessIP 3000;

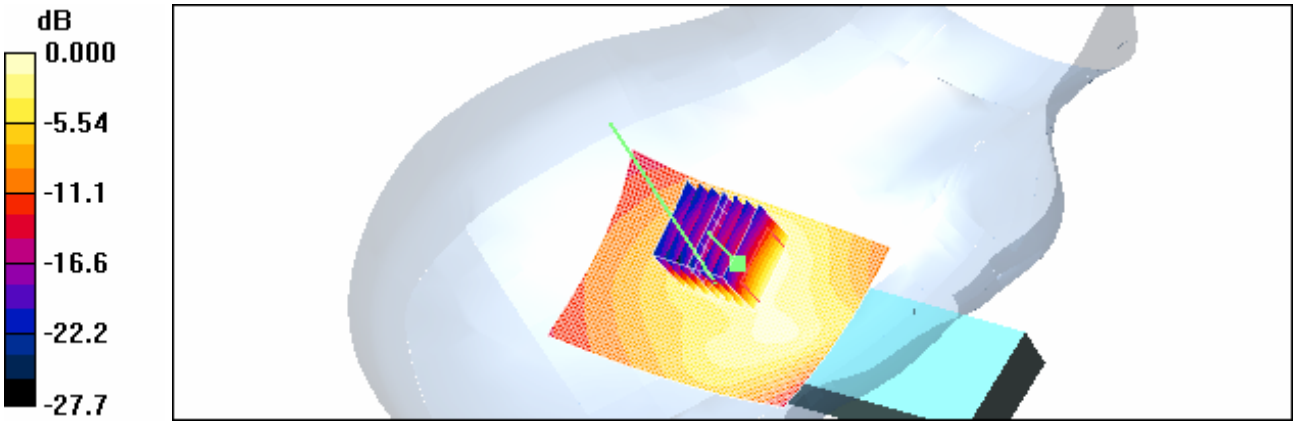
Communication System: CW; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2462 MHz; σ = 1.84 mho/m; ε_r = 37.1; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

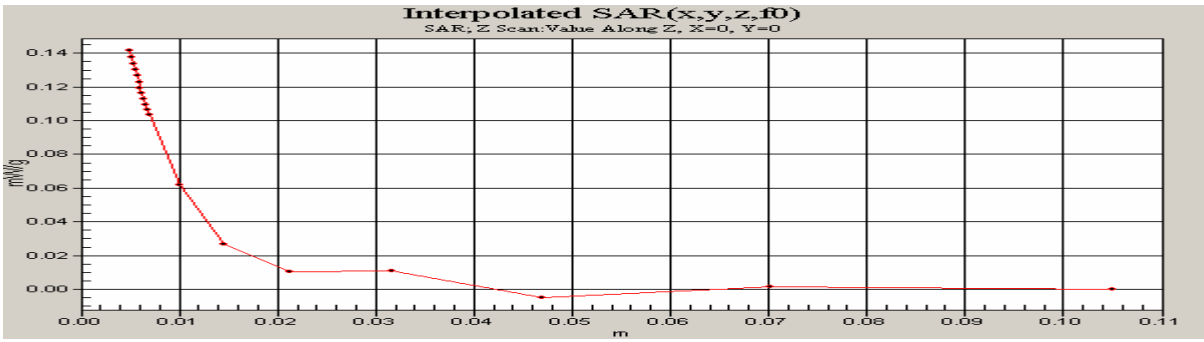
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.253 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.5 V/m; Power Drift = -0.039 dB
Peak SAR (extrapolated) = 0.488 W/kg
SAR(1 g) = 0.232 mW/g; SAR(10 g) = 0.118 mW/g
Maximum value of SAR (measured) = 0.254 mW/g



0 dB = 0.254mW/g



CH 11(2462 MHz) RIGHT HEAD-TILT

DUT: WLAN IP Phone; Type: WirelessIP 3000;

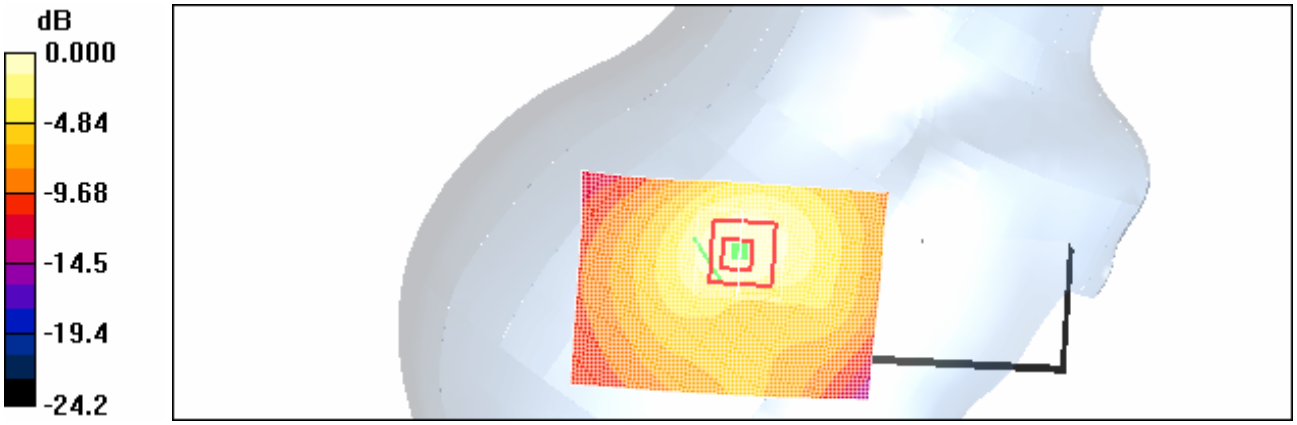
Communication System: CW; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2462 MHz; σ = 1.84 mho/m; ε_r = 37.1; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

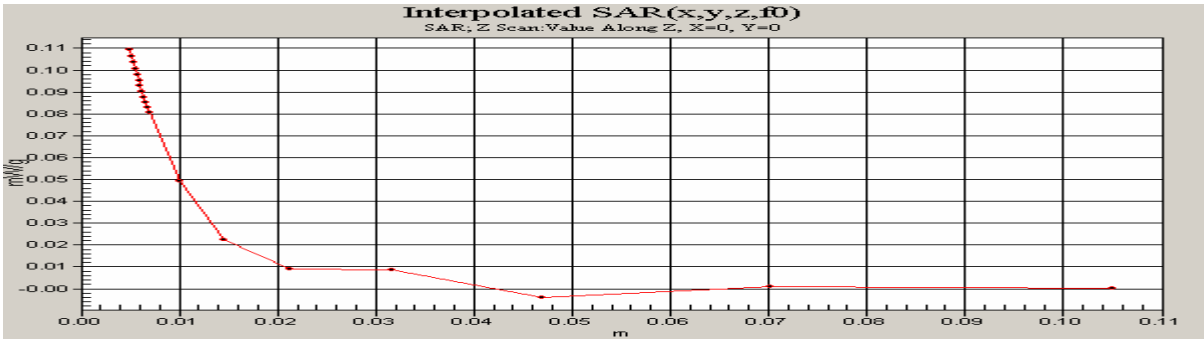
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.195 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.16 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 0.359 W/kg
SAR(1 g) = 0.175 mW/g; SAR(10 g) = 0.090 mW/g
Maximum value of SAR (measured) = 0.188 mW/g



0 dB = 0.188mW/g



CH 11(2462 MHz) LEFT HEAD-CHEEK

DUT: WLAN IP Phone; Type: WirelessIP 3000;

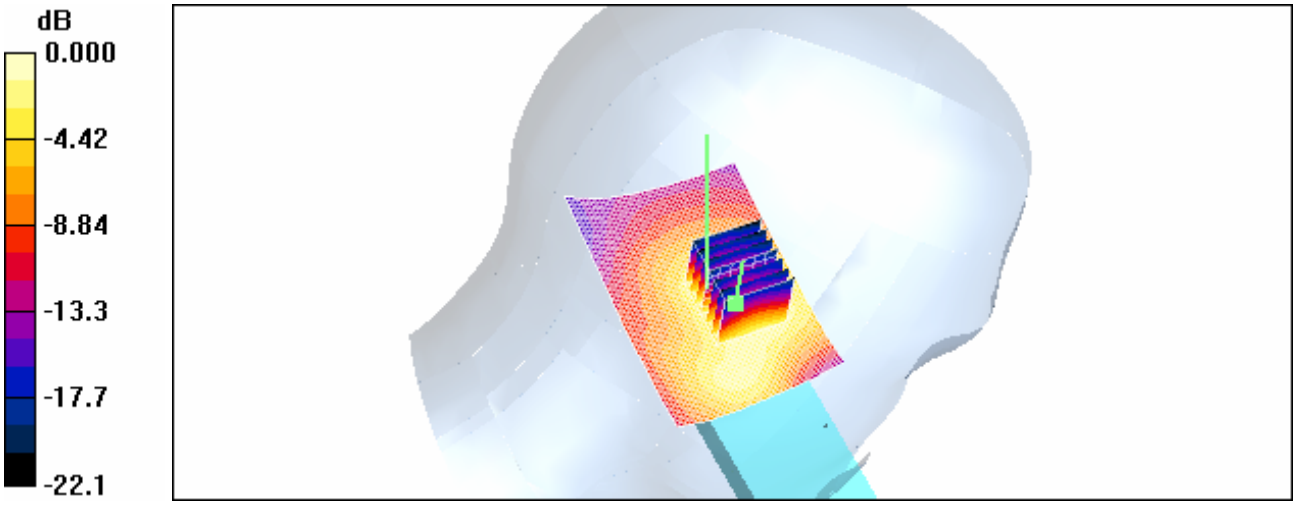
Communication System: CW; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2462 MHz; σ = 1.84 mho/m; ε_r = 37.1; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

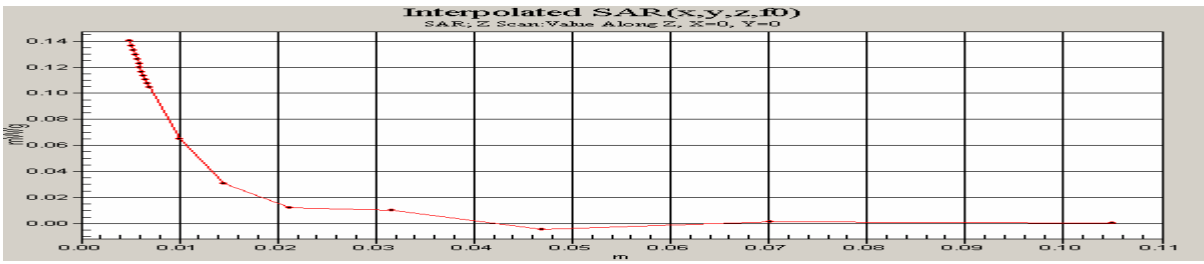
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.256 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.3 V/m; Power Drift = -0.063 dB
Peak SAR (extrapolated) = 0.481 W/kg
SAR(1 g) = 0.234 mW/g; SAR(10 g) = 0.121 mW/g
Maximum value of SAR (measured) = 0.252 mW/g



0 dB = 0.252mW/g



CH 11(2462 MHz) LEFT HEAD-TILT

DUT: WLAN IP Phone; Type: WirelessIP 3000;

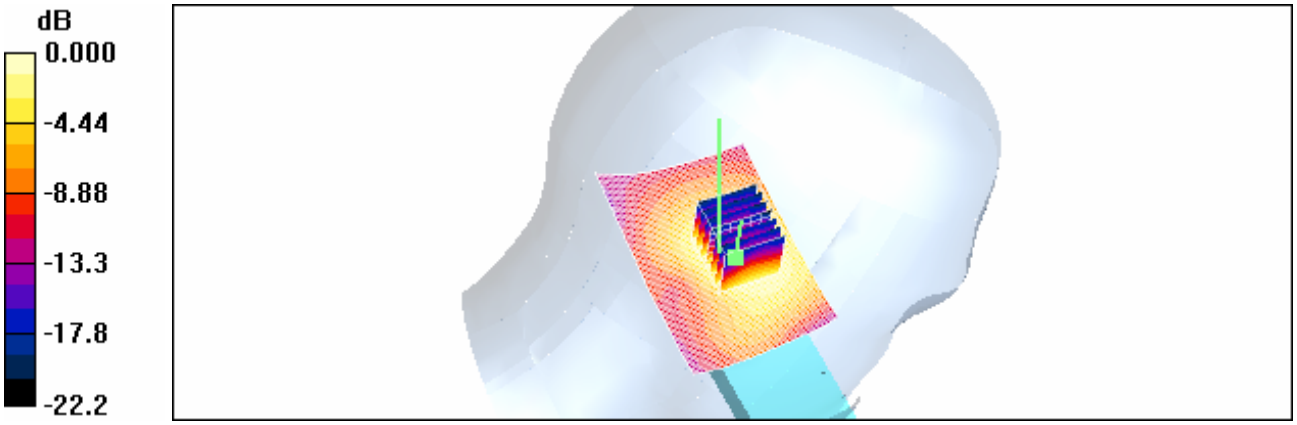
Communication System: CW; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450D Medium parameters used: f = 2462 MHz; σ = 1.84 mho/m; ε_r = 37.1; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

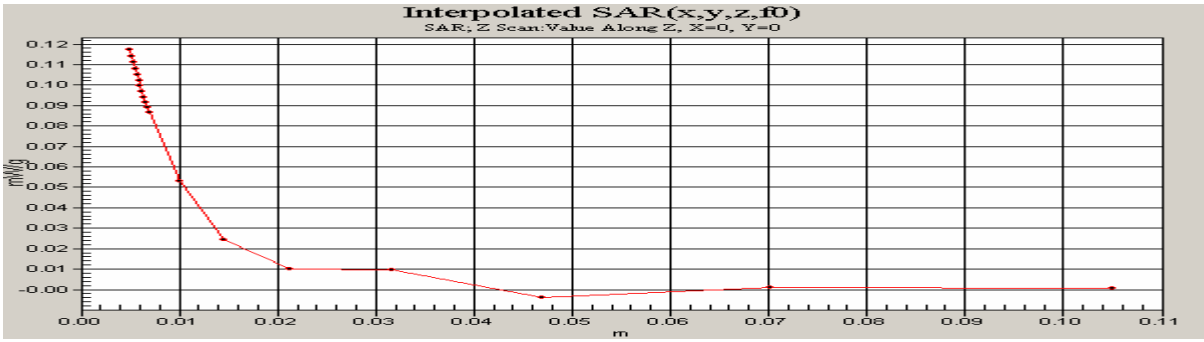
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.185 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.1 V/m; Power Drift = 0.043 dB
Peak SAR (extrapolated) = 0.335 W/kg
SAR(1 g) = 0.166 mW/g; SAR(10 g) = 0.087 mW/g
Maximum value of SAR (measured) = 0.179 mW/g



0 dB = 0.179mW/g



VALIDATION : 2450 MHz

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:746

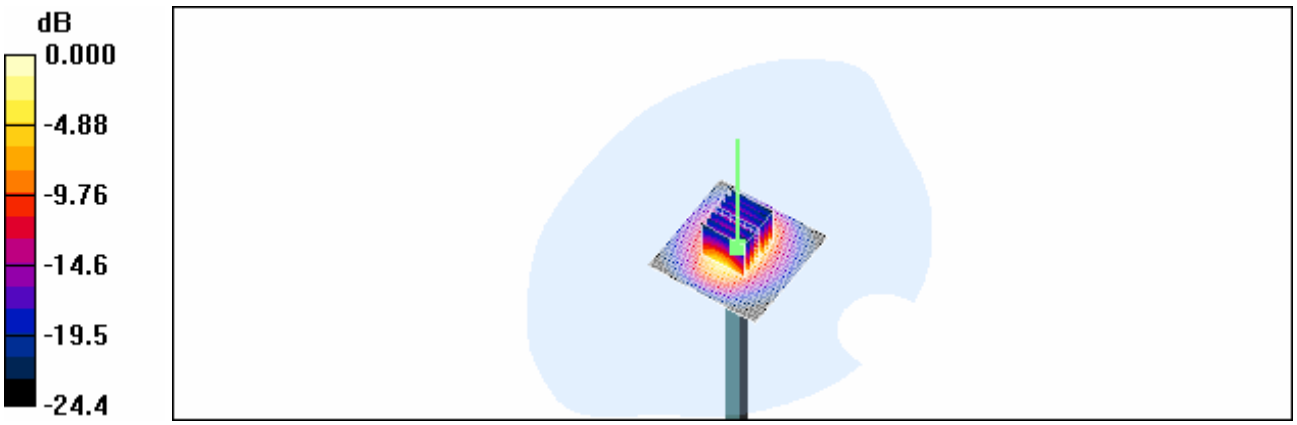
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 1.83 mho/m; ε_r = 37.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

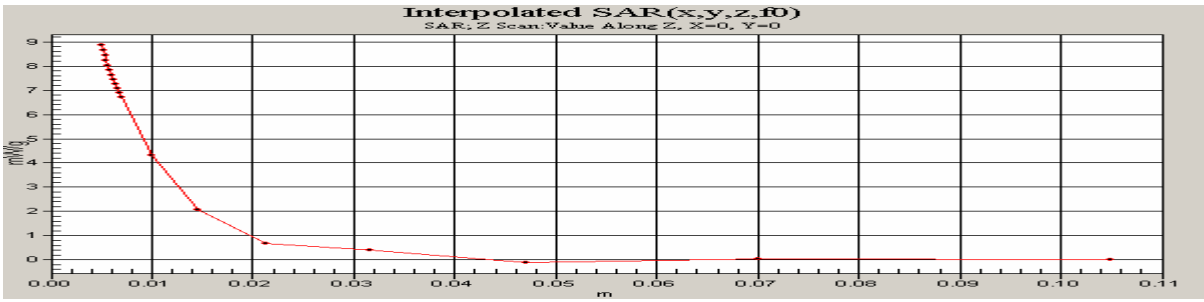
- Probe: ET3DV6 - SN1773; ConvF(4.39, 4.39, 4.39); Calibrated: 2005-05-26
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2005-03-22
- Phantom: SAM twin
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

KTL procedure/Area Scan (5x5x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 18.1 mW/g

KTL procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.4 V/m; Power Drift = -0.058 dB
Peak SAR (extrapolated) = 30.5 W/kg
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 5.92 mW/g
Maximum value of SAR (measured) = 14.4 mW/g



0 dB = 14.4mW/g



APPENDIX D : MEASURED TISSUE DIELECTRIC PARAMETERS

Title

SubTitle

January 05, 2006 10:27 AM

Frequency	e'	e''
2.410000000 GHz	37.5235	13.4949
2.412000000 GHz	37.5393	13.5463
2.414000000 GHz	37.5734	13.5695
2.416000000 GHz	37.5565	13.5898
2.418000000 GHz	37.5760	13.6354
2.420000000 GHz	37.5944	13.6385
2.422000000 GHz	37.5725	13.6490
2.424000000 GHz	37.5763	13.6473
2.426000000 GHz	37.5882	13.6283
2.428000000 GHz	37.5827	13.6285
2.430000000 GHz	37.5992	13.5949
2.432000000 GHz	37.5819	13.5667
2.434000000 GHz	37.5996	13.5483
2.436000000 GHz	37.5995	13.5281
2.438000000 GHz	37.5927	13.5131
2.440000000 GHz	37.5913	13.5047
2.442000000 GHz	37.5759	13.4858
2.444000000 GHz	37.5567	13.4755
2.446000000 GHz	37.5316	13.4646
2.448000000 GHz	37.4934	13.4778
2.450000000 GHz	37.4578	13.4672
2.452000000 GHz	37.3927	13.4670
2.454000000 GHz	37.3395	13.4545
2.456000000 GHz	37.2897	13.4529
2.458000000 GHz	37.2311	13.4503
2.460000000 GHz	37.1837	13.4414
2.462000000 GHz	37.1466	13.4217
2.464000000 GHz	37.0965	13.4260
2.466000000 GHz	37.0820	13.4178
2.468000000 GHz	37.0526	13.3976
2.470000000 GHz	37.0516	13.4162
2.472000000 GHz	37.0689	13.4041
2.474000000 GHz	37.0647	13.4253
2.476000000 GHz	37.1102	13.4548
2.478000000 GHz	37.1348	13.4850

APPENDIX E : SAR TESTING EQUIPMENT CALIBRATION CERTIFICATE ATTACHMENTS

1. 2450 MHz Dipole Calibration Sheet (5 pages)

2. E-Field Probe Calibration Sheet (7 pages)

Schmid & Partner Engineering AG

s p e a g

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

DASY

Dipole Validation Kit

Type: D2450V2

Serial: 746

Manufactured: December 1, 2003
Calibrated: February 25, 2004

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating solution** of the following electrical parameters at 2450 MHz:

Relative Dielectricity	**37.6**	± 5%
Conductivity	**1.88 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ES3DV2 (SN:3013, Conversion factor 4.8 at 2450 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ES3DV2 SN:3013 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**57.6 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**26.0 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.154 ns**	(one direction)
Transmission factor:	**0.981**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance spacer was in place during impedance measurements.

Feedpoint impedance at 2450 MHz:	Re{Z} = **52.3 Ω**
	Im {Z} = **5.1 Ω**
Return Loss at 2450 MHz	**-25.3 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

6. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 02/25/04 14:43:37

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN746

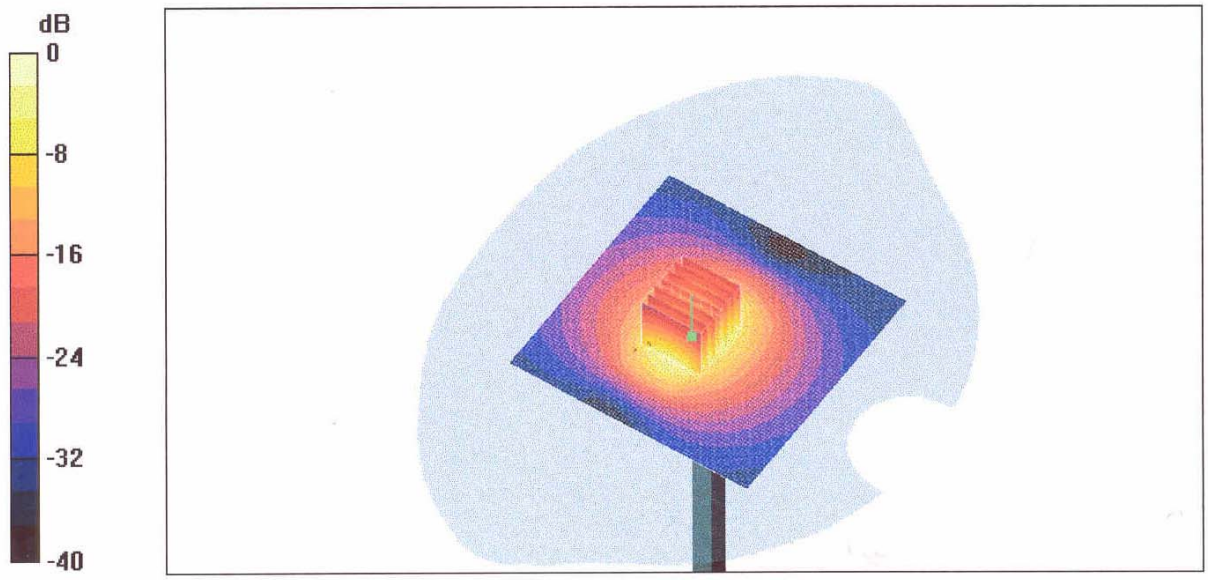
Communication System: CW-2450; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL 2450 MHz;
Medium parameters used: f = 2450 MHz; σ = 1.88 mho/m; ε_r = 37.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

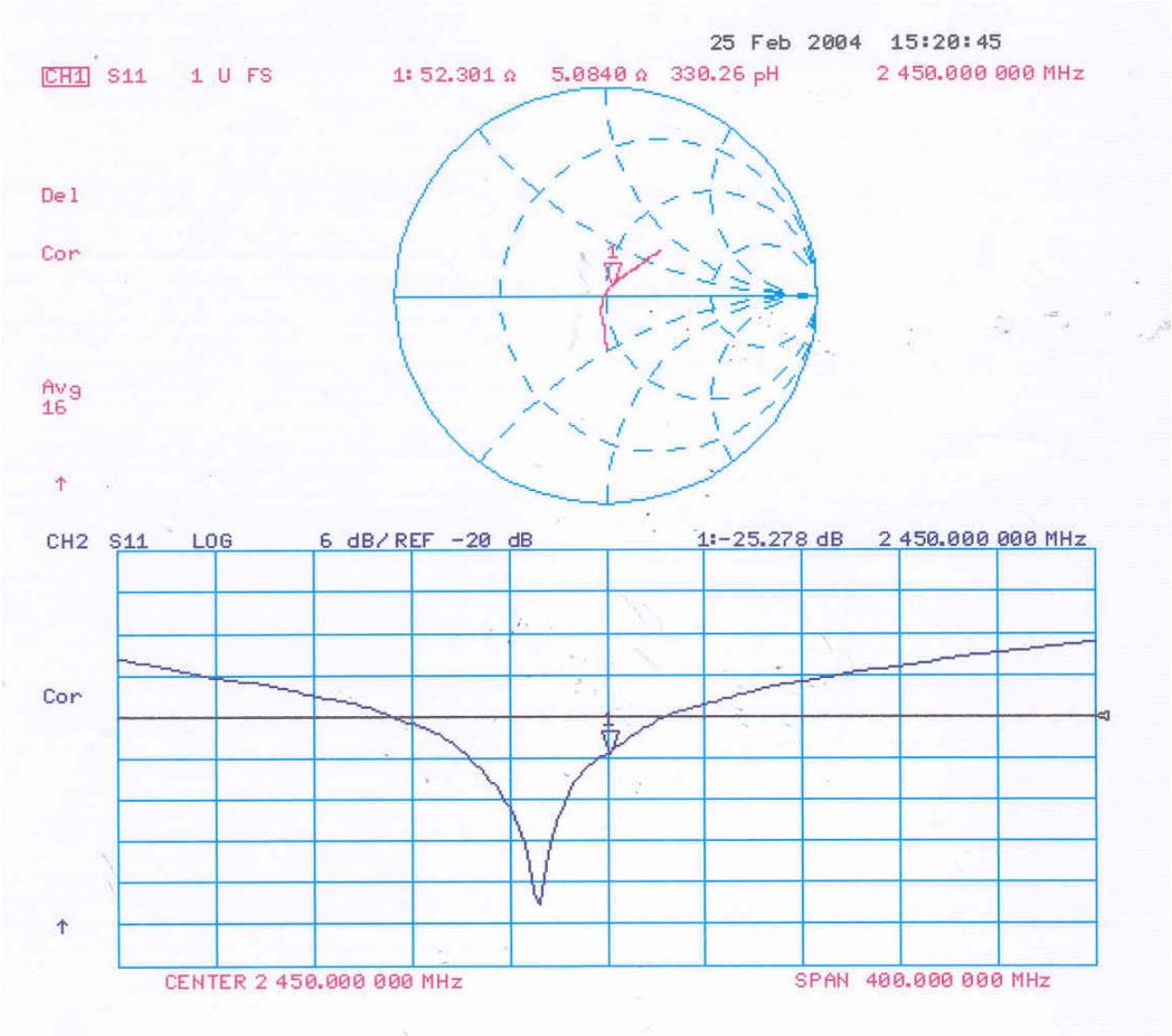
- Probe: ES3DV2 - SN3013; ConvF(4.8, 4.8, 4.8); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn411; Calibrated: 11/6/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006;
- Measurement SW: DASY4, V4.2 Build 37; Postprocessing SW: SEMCAD, V1.8 Build 105

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 87.9 V/m; Power Drift = 0.0 dB
Maximum value of SAR (interpolated) = 16.4 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.9 V/m; Power Drift = 0.0 dB
Maximum value of SAR (measured) = 16.1 mW/g
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 14.4 mW/g; SAR(10 g) = 6.5 mW/g



0 dB = 16.1mW/g


25 Feb 2004 15:20:45
CH1 S11 1 U FS
1: 52.301 Ω 5.0840 Ω 330.26 pH
2 450.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG 6 dB/ REF -20 dB
1:-25.278 dB 2 450.000 000 MHz
Cor
CENTER 2 450.000 000 MHz
SPAN 400.000 000 MHz

Probe ET3DV6

SN:1773

Manufactured:	February 22, 2003
Last calibrated:	June 3, 2004
Recalibrated:	May 26, 2005

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1773 **May 26, 2005**

DASY - Parameters of Probe: ET3DV6 SN:1773

Sensitivity in Free Space[A]

NormX	**1.76** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**94** mV
NormY	**1.59** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**94** mV
NormZ	**1.71** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**94** mV

Diode Compression[B]

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **900 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	9.0	4.9
SAR_{be} [%]	With Correction Algorithm	0.7	0.0

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	13.2	9.0
SAR_{be} [%]	With Correction Algorithm	0.9	0.0

Sensor Offset

Probe Tip to Sensor Center **2.7** mm

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%.

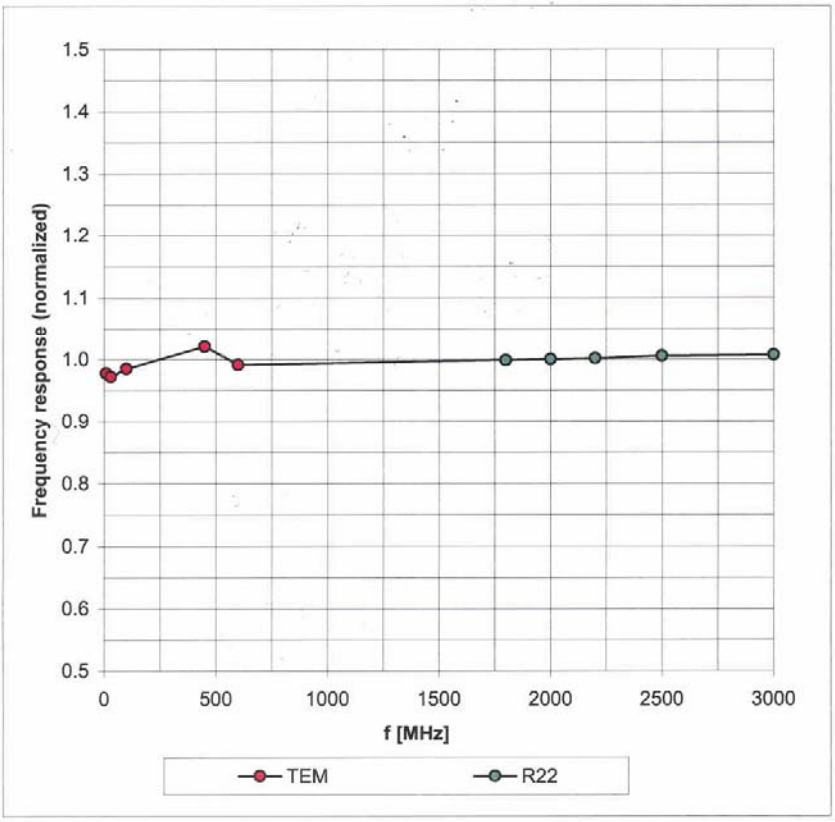
[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

ET3DV6 SN:1773 **May 26, 2005**

Frequency Response of E-Field

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

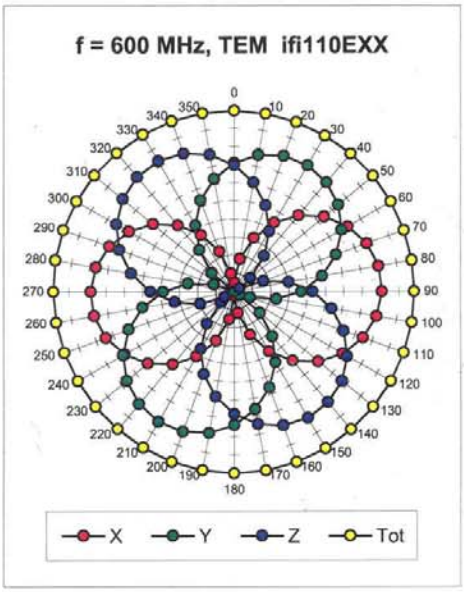


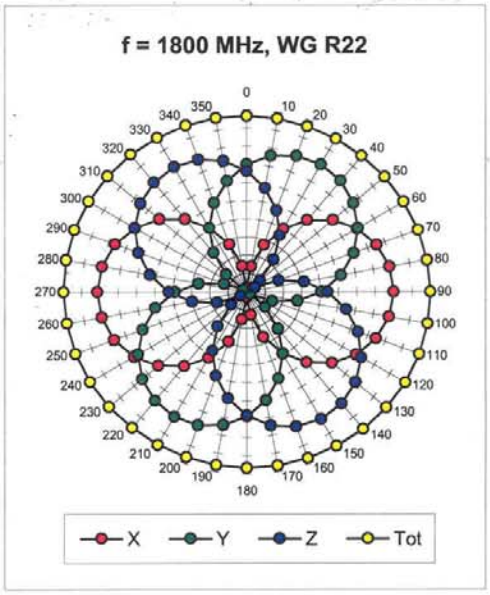
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

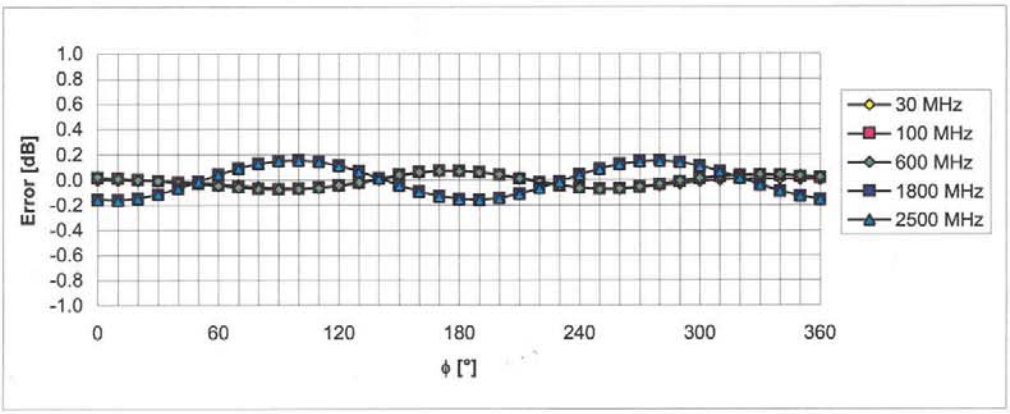
KOREA TESTING LABORATORY, 222-13 Guro-Dong Guro-Gu Seoul 152-848 Korea
Tel: +82 2 860-1462~9, Fax: +82 2 860-1468, Internet: www.ktl.re.kr

ET3DV6 SN:1773 **May 26, 2005**

Receiving Pattern (ϕ), ϑ = 0°







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

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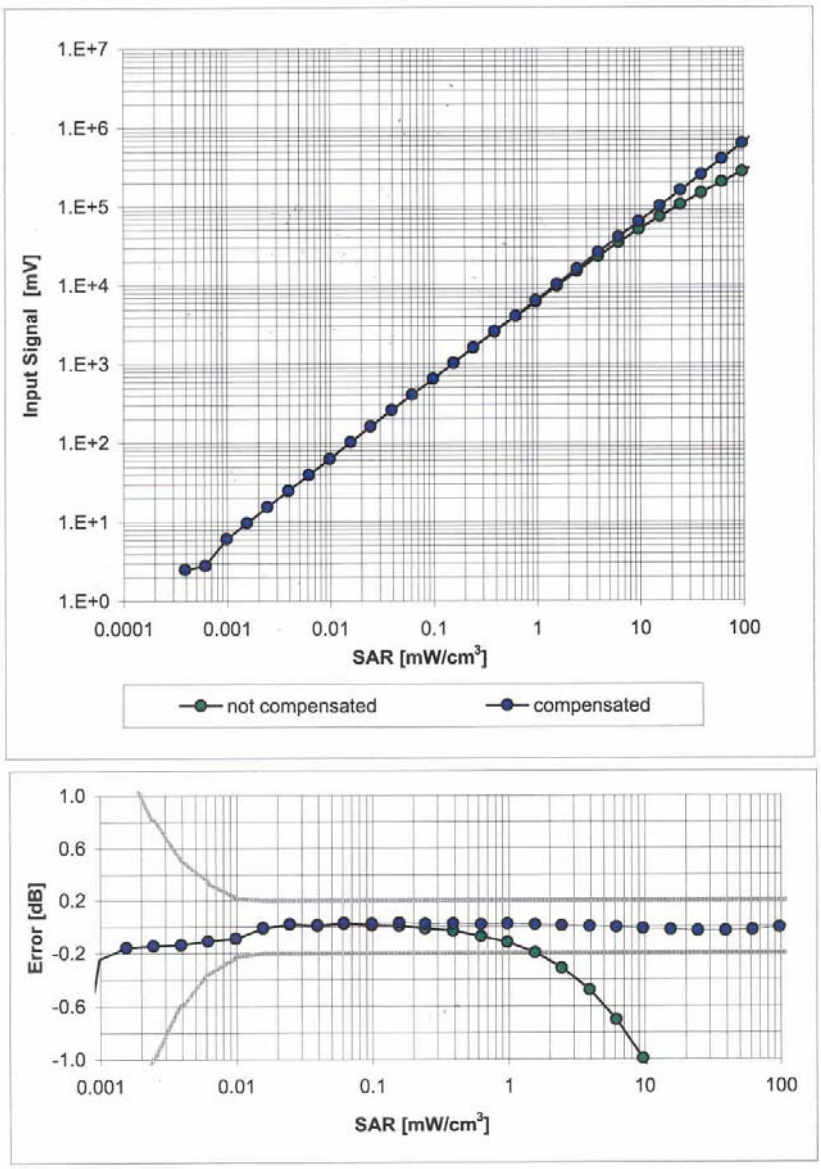
ET3DV6 SN:1773 **May 26, 2005**

Dynamic Range f(SAR_{head})

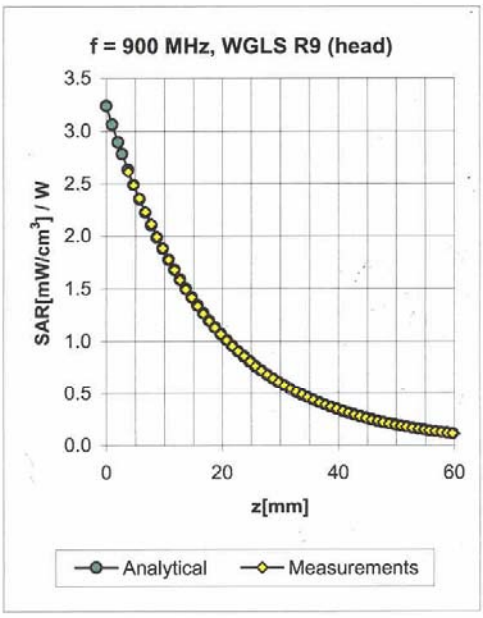
(Waveguide R22, f = 1800 MHz)

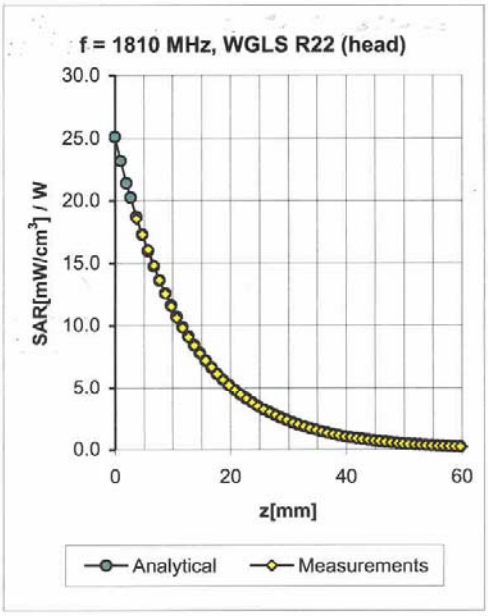


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ET3DV6 SN:1773 **May 26, 2005**

Conversion Factor Assessment





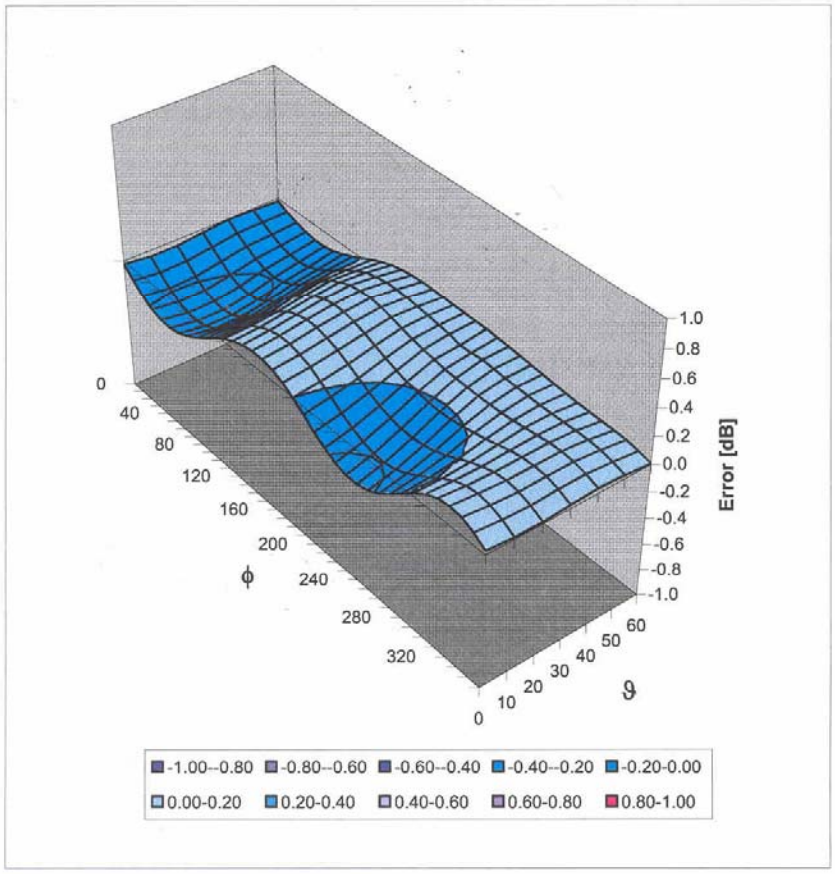
f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.99	1.54	6.25 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.57	2.42	5.02 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.56	2.52	4.73 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.65	2.24	4.39 ± 11.8% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.57	1.93	6.23 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.56	2.84	4.39 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.72	2.02	4.06 ± 11.8% (k=2)

[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.

ET3DV6 SN:1773 **May 26, 2005**

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

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