Lab Code: 200167-0

Bay Area Compliance Labs.Corp.

SAR EVALUATION REPORT

For

Tobii Technology AB

Karlsrovägen 2D, 18253 Danderyd, Sweden

FCC ID: W5MTOBIIC15

Report Type: Original Report	Product Type: Tablet PC with GSM/WLAN/BT Modules

Test Engineer: Arthur Tie

Report Number: R1008238-FCC-SAR

Report Date: 2010-09-07

Reviewed By: Victor Zhang, Test Engineer, RF Lead

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Summary of Test Results	
Rule Part(s):	FCC §2.1093, IC RSS-102, Issue 4
Test Procedure(s):	FCC OET Bulletin 65-C; IEEE 1528
Device Category: **Exposure Category:**	Portable Device General Population/Uncontrolled Exposure
Device Type:	Tablet PC with GSM/WLAN/BT Modules
Modulation:	GMSK/CCK/OFDM/GFSK
TX Frequency Range:	824~849 MHz (GSM 850) 1850~1910 MHz (PCS 1900) 2400~2483.5 MHz (WLAN & Bluetooth)
Conducted RF Power:	GSM 850: 32.57 dBm PCS 1900: 30.11 dBm WLAN: 11.12 dBm Bluetooth: 2.34 dBm
Antenna Type(s):	Internal Antenna (GSM & WLAN) PCB Antenna (Bluetooth)
Battery Type(s):	14.8 Vdc/5300 mAh Rechargeable Batteries 19-30 Vdc input from AC/DC Adaptor
Face-Head Accessories:	None
Max. SAR Level(s) Measured:	GSM 850 Body Tissue: 0.11 W/Kg PCS 1900 Body Tissue: 0.16 W/Kg

This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C and IEEE 1528-2003.

The results and statements contained in this report pertain only to the device(s) evaluated.

EUT Photo

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1008238-FCC-SAR	Original Report	2010-09-07

REFERENCE, STANDARDS AND GUILDELINES

FCC:

The Report and Order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits? SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

CE:

The CE requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by the EN50360 for an uncontrolled environment. According to the Standard, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits? SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in Europe is 2 mW/g average over 10 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

SAR Limits

FCC Limit (1g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

CE Limit (10g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	2.0	10
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

EUT DESCRIPTION

The *Tobii Technology AB* product, model T-C15-R1.0A-V0, FCC ID: W5MTOBIIC15 or the “EUT” as referred to in this report, is a Tablet PC and operates in the same manner as any laptop or mobile computing device with GSM, WLAN and Bluetooth modules.

The EUT measures approximately 37cm (L) × 29.5cm (W) × 4.5cm (H), weight 3548.92g (without standard battery), and 4042.42g (with one standard battery) and 4535.92 g (with two standard batteries).

EUT Technical Specification:

Item	Description
Modulation	GMSK/CCK/OFDM/GFSK
Frequency Range	GSM850: 824.2~848.8 MHz PCS1900: 1850.2~1909.8 MHz 2.4 GHz WLAN: 2412~2462 MHz (802.11b/g/n20) 2422~2452 MHz (802.11n40) Bluetooth: 2402~2480 MHz
Conducted Output Power:	GSM 850: 32.57 dBm PCS 1900: 30.11 dBm 2.4 GHz WLAN: 11.12 dBm Bluetooth: 2.34 dBm
Dimensions (L*W*H)	37cm (L) × 29.5cm (W) × 4.5cm (H)
Power Source	DC19-30V(Normal 24V)
Weight	3.55 kg
Normal Operation	Body-worn

* *The data gathered are from a typical production sample provided by the manufacturer, serial number: R1008238-1 assigned by BACL*

TEST FACILITIES AND ACCREDITATION

The test site used by Bay Area Compliance Laboratories Corp. (BACL) to collect data is located at 1274 Anvilwood Ave, Sunnyvale, California 94089, USA.

BACL is a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0).

Lab Code: 200167-0

The current scope of accreditations can be found at: http://ts.nist.gov/Standards/scopes/2001670.htm

DESCRIPTION OF TEST SYSTEM

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG), which is the fourth generation of the system shown in the figure hereinafter:

The system is based on a high precision robot (working range greater than 0.9m), which positions the probes with a positional repeatability of better than ±0.02mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

The SAR measurements were conducted with the dosimetric probe ET3DV6 SN: 1604 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure and found to be better than ±0.25dB.

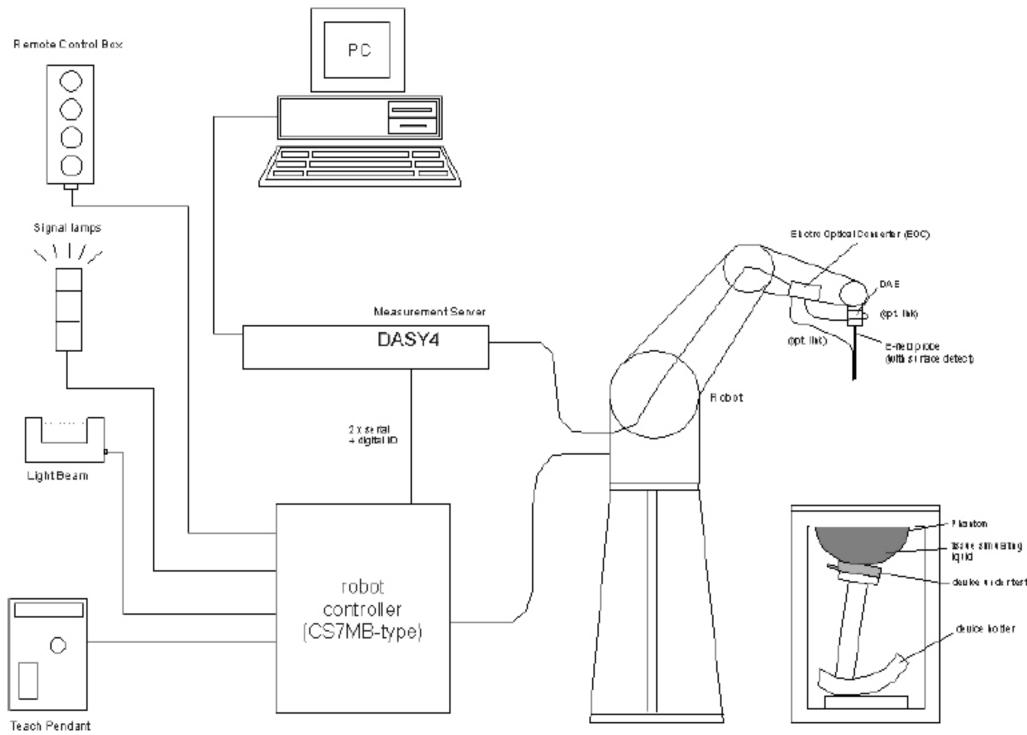
The phantom used was “the Generic Twin Phantom”. The ear was simulated as a spacer of 4 mm thickness between the earpiece of the phone and the tissue simulating liquid. The Tissue simulation liquid used for each test is in according with the FCC OET65 supplement C as listed below.

Ingredients (% by weight)	**Frequency (MHz)**									
	450		**835**		**915**		**1900**		**2450**	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

IEEE SCC-34/SC-2 P1528 Recommended Tissue Dielectric Parameters

Frequency (MHz)	**Head Tissue**		**Body Tissue**	
	εr	**Ơ (S/m)**	**εr**	**Ơ (S/m)**
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

Measurement System Diagram



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

• A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).

• A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

• A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

• The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.

• The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

• A probe alignment unit which improves the (absolute) accuracy of the probe positioning.

• A computer operating Windows 2000 or Windows XP.

• DASY4 software.

• Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.

• The SAM twin phantom enabling testing left-hand and right-hand usage.

• The device holder for handheld mobile phones.

• Tissue simulating liquid mixed according to the given recipes.

• Validation dipole kits allowing system validation.

System Components

• DASY4 Measurement Server
• Data Acquisition Electronics
• Probes
• Light Beam Unit
• SAM Twin Phantom
• Device Holder for SAM Twin Phantom
• System Validation Kits
• Robot

DASY4 Measurement Server

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE4 (or DAE3) electronic box as well as the 16-bit AD-converter system for optical detectio and digital I/O interface are contained on the DASY I/O-board, which is directly connected to the PC/10 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pin out and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server.

Data Acquisition Electronics

The data acquisition electronics DAE3 consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

Probes

The DASY system can support many different probe types.

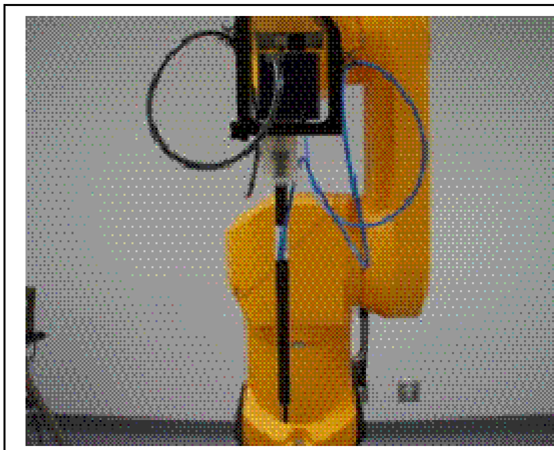
Dosimetric Probes: These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (±2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

Free Space Probes: These are electric and magnetic field probes specially designed for measurements in free space. The z-sensor is aligned to the probe axis and the rotation angle of the x-sensor is specified. This allows the DASY system to automatically align the probe to the measurement grid for field component measurement. The free space probes are generally not calibrated in liquid. (The H-field probes can be used in liquids without any change of parameters.)

Temperature Probes: Small and sensitive temperature probes for general use. They use a completely different parameter set and different evaluation procedures. Temperature rise features allow direct SAR evaluations with these probes.

ET3DV6 Probe Specification

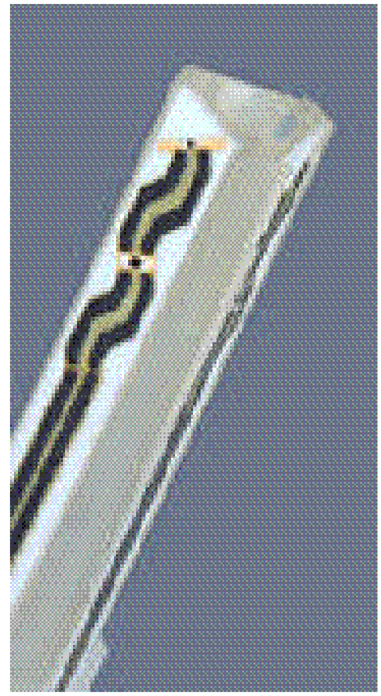
Construction Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
Calibration In air from 10 MHz to 2.5 GHz
In brain and muscle simulating tissue at
Frequencies of 450 MHz, 900 MHz and
1.8 GHz (accuracy ± 8%)
Frequency 10 MHz to > 6 GHz; Linearity: ± 0.2 dB
(30 MHz to 3 GHz)
Directivity ± 0.2 dB in brain tissue (rotation around
probe axis)
± 0.4 dB in brain tissue (rotation normal probe axis)
Dynamic 5 mW/g to > 100 mW/g;
Range Linearity: ± 0.2 dB
Surface ± 0.2 mm repeatability in air and clear liquids
Detection over diffuse reflecting surfaces.
Dimensions Overall length: 330 mm
Tip length: 16 mm



Photograph of the probe

Body diameter: 12 mm
Tip diameter: 6.8 mm
Distance from probe tip to dipole centers: 2.7 mm
Application General dosimetric up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms

The SAR measurements were conducted with the dosimetric probe ET3DV6 designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY3 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.



Inside view of ET3DV6 E-field Probe

E-Field Probe Calibration Process

Each probe is calibrated according to a dosimetric assessment procedure described in [6] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [7] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

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

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

Data Evaluation

The DASY4 postprocessing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters: - Sensitivity Normi, ai0, ai1, ai2
- Conversion factor ConvFi
- Diode compression point dcpi

Device parameters: - Frequency f
- Crest factor cf

Media parameters: - Conductivity σ
- Density ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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

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

With Vi = compensated signal of channel i (i =x, y, z)
Ui = 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:

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

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

With Vi = compensated signal of channel i (i =x, y, z)
$Norm_i$ = sensor sensitivity of channel i (i =x, y, z)
$\mu V/ (V/m)^2$ for E-field probes
ConF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strenggy of channel i in V/m
H_i = diode compression point (DASY parameter)

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.

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

With SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/meter] or [Siemens/meter]
ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1, to account for actual brain density rather than the density of the simulation liquid.

Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, so that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

Medium

Parameters

The parameters of the tissue simulating liquid strongly influence the SAR in the liquid. The parameters for the different frequencies are defined in the corresponding compliance standards (e.g., EN 50361, IEEE 1528-2003).

Parameter measurements

Several measurement systems are available for measuring the dielectric parameters of liquids:

- The open coax test method (e.g., HP85070 dielectric probe kit) is easy to use, but has only moderate acuracy. It is calibrated with open, short, and deionized water and the calibrations a critical process.

- The transmission line method (e.g., model 1500T from DAMASKOS, INC.) measures the transmission and reflection in a liquid filled high precision line. It needs standard two port calibration and is probably more accurate than the open coax method.

- The reflection line method measures the reflection in a liquid filled shorted precision lined.The method is not suitable for these liquids because of its low sensitivity.

• The slotted line method scans the field magnitude and phase along a liquid filled line. The evaluation is straight forward and only needs a simple response calibration. The method is very accurate, but can only be used in high loss liquids and at frequencies above 100 to 200MHz. Cleaning the line can be tedious.

SAM Twin Phantom

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

• Left hand
• Right hand
• Flat phantom

The phantom table comes in two sizes: A 100 x 50 x 85 cm (L x W x H) table for use with free standing robots (DASY4 professional system option) or as a second phantom and a 100 x 75 x 85 cm(L x W x H) table with reinforcements for table mounted robots (DASY4 compact system option) . The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used (e.g., for different liquids) A white cover is provided to tap the phantom during o_-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

The phantom can be used with the following tissue simulating liquids:

• Water-sugar based liquids can be left permanently in the phantom. Always cover the liquid if the system is not used, otherwise the parameters will change due to water evaporation.

• Glycol based liquids should be used with care. As glycol is a softener for most plastics, the liquid should be taken out of the phantom and the phantom should be dried when the system is not used (desirable at least once a week).

• Do not use other organic solvents without previously testing the phantom's compatibility.

Device Holder for SAM Twin Phantom

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. An accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions, in which the devices must be measured, are defined by the standards.

The DASY device holder 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 center for both scales is the ear reference point ERP). Thus the device needs no repositioning when changing the angles.


The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity "=3 and loss tangent _=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.

System Validation Kits

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. For that purpose a well defined SAR distribution in the flat section of the SAM twin phantom is produced.

System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder. Dipoles are available for the variety of frequencies between 300MHz and 6 GHz (dipoles for other frequencies or media and other calibration conditions are available upon request).

The dipoles are highly symmetric and matched at the center frequency for the specified liquid and distance to the flat phantom (or flat section of the SAM-twin phantom). The accurate distance between the liquid surface and the dipole center is achieved with a distance holder that snaps on the dipole.

Robot

The DASY4 system uses the high precision industrial robots RX60L, RX90 and RX90L, as well as the RX60BL and RX90BL types out of the newer series from Stäubli SA (France). The RX robot series offers many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance-free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchronous motors; no stepper motors)
- Low ELF interference (the closed metallic construction shields against motor control fields)

For the newly delivered DASY4 systems as well as for the older DASY3 systems delivered since 1999, the CS7MB robot controller version from Stäubli is used. Previously delivered systems have either a CS7 or CS7M controller; the differences to the CS7MB are mainly in the hardware, but some procedures in the robot software from Stäubli are also not completely the same. The following descriptions about robot hard- and software correspond to CS7MB controller with software version 13.1 (edit S5). The actual commands, procedures and configurations, also including details in hardware, might differ if an older robot controller is in use. In this case please also refer to the Stäubli manuals for further information.

EQUIPMENT LIST AND CALIBRATION

Equipments List & Calibration Info

Type / Model	Calibration Due Date	S/N
DASY4 Professional Dissymmetric System	N/A	N/A
Robot RX60L	N/A	CS7MBSP / 467
Robot Controller	N/A	F01/5J72A1/A/01
Dell Computer Dimension 3000	N/A	N/A
SPEAG EDC3	N/A	N/A
SPEAG DAE3	2010-11-22	456
DASY4 Measurement Server	N/A	1176
SPEAG E-Field Probe ES3DV2	2010-09-23	3019
Antenna, Dipole, CD835V3	2011-07-15	1012
Antenna, Dipole, CD1880V3	2011-07-19	1009
Brain Equivalent Matter (835 MHz)	Each Time	N/A
Muscle Equivalent Matter (835 MHz)	Each Time	N/A
Brain Equivalent Matter (1900 MHz)	Each Time	N/A
Muscle Equivalent Matter (1900 MHz)	Each Time	N/A
Agilent, Spectrum Analyzer E4440A	2011-05-09	MY44303352
Microwave Amp. 8349A	N/A	2644A02662
Power Meter Agilent E4419B	2010-10-10	MY4121511
Power Sensor Agilent E4412A	2010-10-10	MY41497252
Agilent 8960 (E5515C) Wireless Communication Tester	2011-06-11	GB44051221
Dielectric Probe Kit HP85070A	N/A	US99360201
Agilent, Signal Generator, 8648C	2011-02-25	3347M00143
Amplifier, ST181-20	N/A	E012-0101
Antenna, Horn, DRG-11/A	2010-10-27	1132

SAR MEASUREMENT SYSTEM VERIFICATION

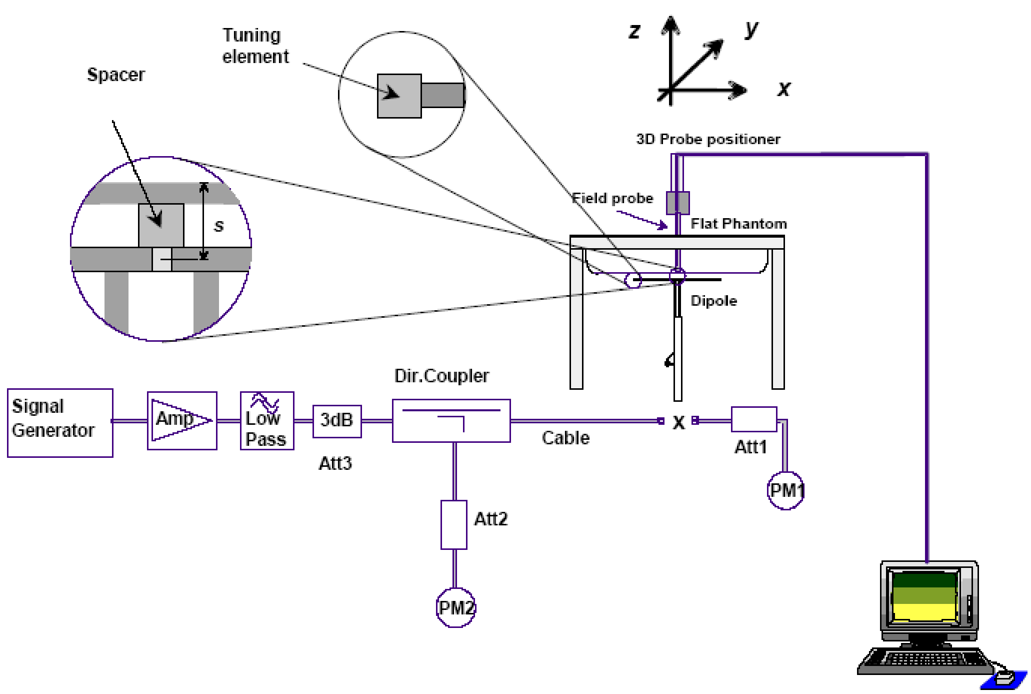
System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

IEEE P1528 recommended reference value for head

Frequency (MHz)	1 g SAR (W/Kg)	10 g SAR (W/Kg)	Local SAR at surface (above feed point)	Local SAR at surface (v=2cm offset from feed point)
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
850	9.5	6.2	16.1	5.4
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
2000	41.1	21.1	74.6	6.5
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

System Setup Block Diagram

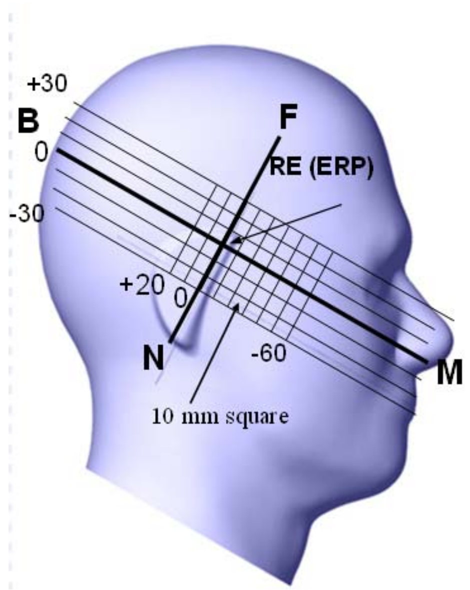


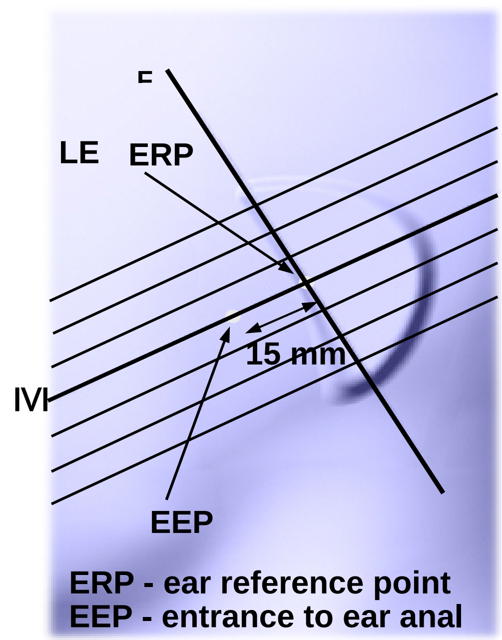
EUT TEST STRATEGY AND METHODOLOGY

Test Positions for Device Operating Next to a Person's Ear

This category includes most wireless handsets with fixed, retractable or internal antennas located toward the top half of the device, with or without a foldout, sliding or similar keypad cover. The handset should have its earpiece located within the upper ¼ of the device, either along the centerline or off-centered, as perceived by its users. This type of handset should be positioned in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point". The "test device reference point" should be located at the same level as the center of the earpiece region. The "vertical centerline" should bisect the front surface of the handset at its top and bottom edges. An "ear reference point" is located on the outer surface of the head phantom on each ear spacer. It is located 1.5 cm above the center of the ear canal entrance in the "phantom reference plane" defined by the three lines joining the center of each "ear reference point" (left and right) and the tip of the mouth.

A handset should be initially positioned with the earpiece region pressed against the ear spacer of a head phantom. For the SCC-34/SC-2 head phantom, the device should be positioned parallel to the "N-F" line defined along the base of the ear spacer that contains the "ear reference point". For interim head phantoms, the device should be positioned parallel to the cheek for maximum RF energy coupling. The "test device reference point" is aligned to the "ear reference point" on the head phantom and the "vertical centerline" is aligned to the "phantom reference plane". This is called the "initial ear position". While maintaining these three alignments, the body of the handset is gradually adjusted to each of the following positions for evaluating SAR:





N

Cheek/Touch Position

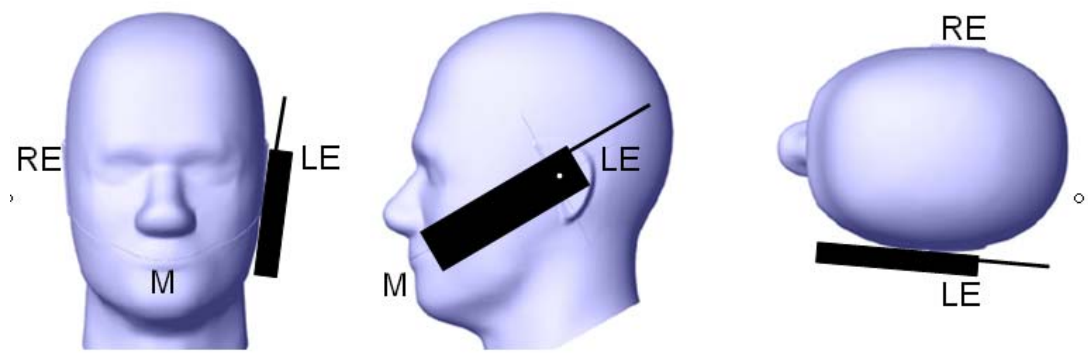
The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom.

This test position is established:

- When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.
- (or) When any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

For existing head phantoms – when the handset loses contact with the phantom at the pivoting point, rotation should continue until the device touches the cheek of the phantom or breaks its last contact from the ear spacer.

Check /Touch Position



Ear/Tilt Position

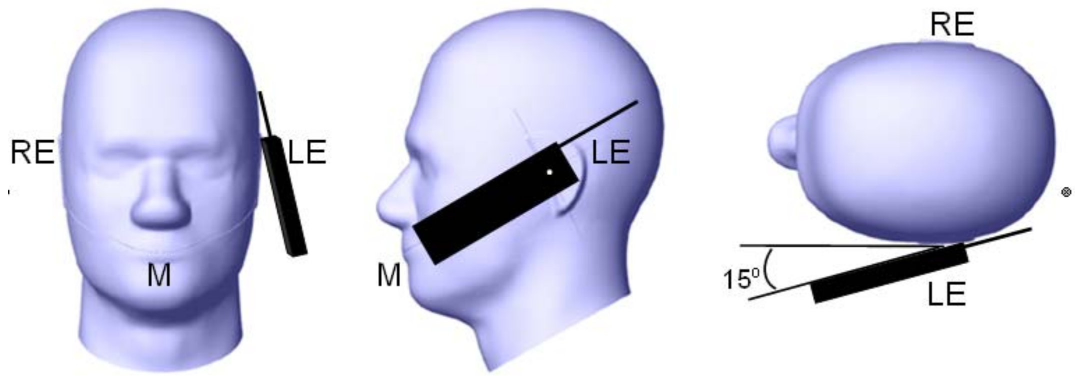
With the handset aligned in the "Cheek/Touch Position":

1) If the earpiece of the handset is not in full contact with the phantom's ear spacer (in the "Cheek/Touch position") and the peak SAR location for the "Cheek/Touch" position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device should be returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer.

2) (otherwise) The handset should be moved (translated) away from the cheek perpendicular to the line passes through both "ear reference points" (note: one of these ear reference points may not physically exist on a split head model) for approximate 2-3 cm. While it is in this position, the device handset is tilted away from the mouth with respect to the "test device reference point" until the inside angle between the vertical centerline on the front surface of the phone and the horizontal line passing through the ear reference point is by 15 80°. After the tilt, it is then moved (translated) back toward the head perpendicular to the line passes through both "ear reference points" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process should be repeated with a tilt angle less than 15 80° so that the device and its antenna would touch the phantom simultaneously. This test position may require a device holder or positioner to achieve the translation and tilting with acceptable positioning repeatability.

If a device is also designed to transmit with its keypad cover closed for operating in the head position, such positions should also be considered in the SAR evaluation. The device should be tested on the left and right side of the head phantom in the “Cheek/Touch” and “Ear/Tilt” positions. When applicable, each configuration should be tested with the antenna in its fully extended and fully retracted positions. These test configurations should be tested at the high, middle and low frequency channels of each operating mode; for example, AMPS, CDMA, and TDMA. If the SAR measured at the middle channel for each test configuration (left, right, Cheek/Touch, Tile/Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s). If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional.

Ear /Tilt 15^o Position



Test positions for body-worn and other configurations

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. 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 the accessory that dictates the closest spacing to the body must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.

SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or EUT and the horizontal grid spacing was 15 mm x 15 mm. Based on these data, the area of the maximum absorption was determined by line interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 21 mm was assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

1. The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

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

3. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

DASY4 SAR Evaluation Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. By default, the Minimum distance of probe sensors to surface is 4mm. This distance can be modified by the user, but cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties (for example, 2.7mm for an ET3DV6 probe type).

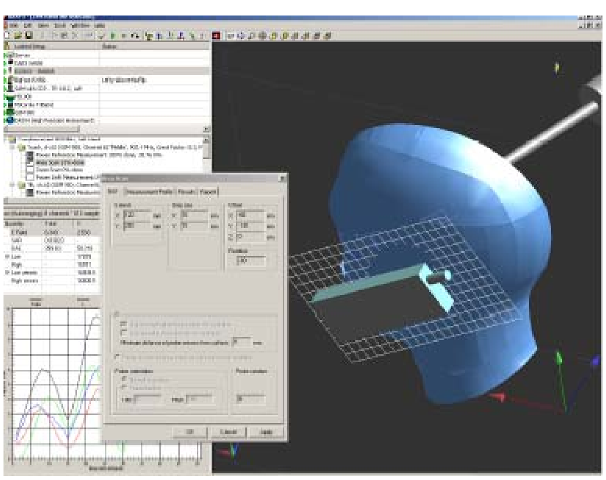
Step 2: Area Scan

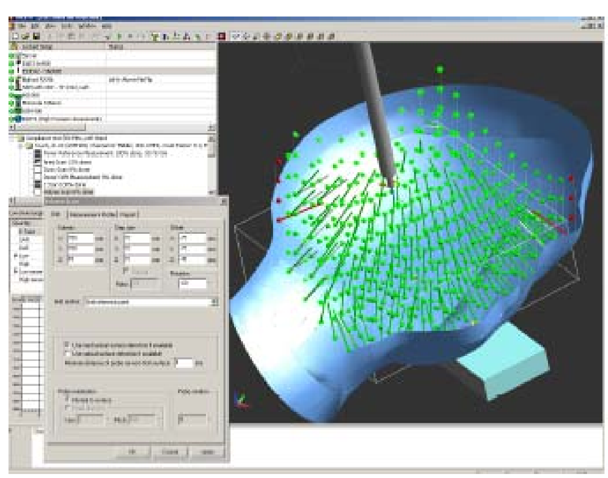
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids.

The scanning area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the Area Scan's property sheet is brought-up, grid settings can be edited by a user.

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2003, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

After measurement is completed, all maxima and their coordinates are listed in the Results property page. The maximum selected in the list is highlighted in the 3-D view. For the secondary maxima returned from an Area Scan, the user can specify a lower limit (peak SAR value), in addition to the Find secondary maxima within x dB condition. Only the primary maximum and any secondary maxima within x dB from the primary maximum and above this limit will be measured.





Step 3: Zoom Scan

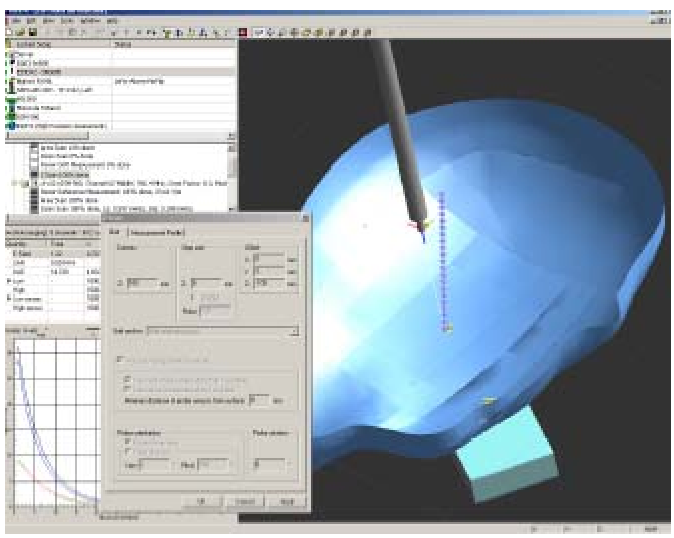
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Power drift measurement

The Power Drift Measurement job measures the field at the same location as the most recent power reference measurement job within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan

The Z Scan job measures points along a vertical straight line. The line runs along the Z axis of a one-dimensional grid. A user can anchor the grid to the section reference point, to any defined user point or to the current probe location. As with any other grids, the local Z axis of the anchor location establishes the Z axis of the grid.



SAR SIMULTANEOUS TRANSMISSION CALCULATION

Position	SAR RESULT [W/Kg]										Antenna Distance (GSM-WLAN) [cm]	Σ 1-g SAR [W/Kg]	SAR to Peak Separation Ratio	Note
	GSM 850			802.11b WLAN			802.11g WLAN			BT				
	1850.2 (MHz)	1880.0 (MHz)	1909.8 (MHz)	2412 (MHz)	2437 (MHz)	2462 (MHz)	2412 (MHz)	2437 (MHz)	2462 (MHz)					
Back Touch	-			- [1]						- [1]	34	-	-	[2]
	-				- [1]					- [1]	34	-	-	[2]
	-					- [1]				- [1]	34	-	-	[2]
	-						- [1]			- [1]	34	-	-	[2]
	-							- [1]		- [1]	34	-	-	[2]
	-								- [1]	- [1]	34	-	-	[2]
		0.11		- [1]						- [1]	34	-	-	[2]
		0.11			- [1]					- [1]	34	-	-	[2]
		0.11				- [1]				- [1]	34	-	-	[2]
		0.11					- [1]			- [1]	34	-	-	[2]
		0.11						- [1]		- [1]	34	-	-	[2]
		0.11							- [1]	- [1]	34	-	-	[2]
			-	- [1]						- [1]	34	-	-	[2]
			-		- [1]					- [1]	34	-	-	[2]
			-			- [1]				- [1]	34	-	-	[2]
			-				- [1]			- [1]	34	-	-	[2]
			-					- [1]		- [1]	34	-	-	[2]
			-						- [1]	- [1]	34	-	-	[2]

Note:

Bluetooth → $P_{Ref} = 12$ mW, $2*P_{Ref} = 24$ mW,
Bluetooth Maximum Power = 1 mW < 24mW
WLAN → $P_{Ref} = 12$ mW, $2*P_{Ref} = 24$ mW,
Bluetooth Maximum Power = 0.59 mW < 24mW

[1]According to KDB648474, when the output of an unlicensed transmitter is ≤ $2*P_{Ref}$ and its antenna(s) is ≥ 5.0 cm from other antennas, stand-alone SAR evaluation is also not required for that unlicensed transmitter. As this device the antenna distance is 34 cm > 5 cm, and the Bluetooth and Wlan power all < $2*P_{Ref}$ So stand alone SAR is not required for the un-license transmitter.

[2]According to KDB648474, when stand-alone SAR evaluation is not required and the antenna is ≥ 5 cm from other antennas, simultaneous transmission SAR evaluation is also not required for that antenna. And this device has the antenna distance which is > 5cm, so no simultaneous SAR is required

Position	SAR RESULT [W/Kg]										Antenna Distance (GSM-WLAN) [cm]	Σ 1-g SAR [W/Kg]	SAR to Peak Separation Ratio	Note
	PCS1900			802.11b WLAN			802.11g WLAN			BT				
	1850.2 (MHz)	1880.0 (MHz)	1909.8 (MHz)	2412 (MHz)	2437 (MHz)	2462 (MHz)	2412 (MHz	2437 (MHz)	2462 (MHz)					
Right Edge [WLAN] / Left Edge [GSM]	-			-[1]						-[1]	34	-	-	*
	-				-[1]					-[1]	34	-	-	*
	-					-[1]				-[1]	34	-	-	*
	-						-[1]			-[1]	34	-	-	*
	-							-[1]		-[1]	34	-	-	*
	-								-[1]	-[1]	34	-	-	*
		0.16		-[1]						-[1]	34	-	-	*
		0.16			-[1]					-[1]	34	-	-	*
		0.16				-[1]				-[1]	34	-	-	*
		0.16					-[1]			-[1]	34	-	-	*
		0.16						-[1]		-[1]	34	-	-	*
		0.16							-[1]	-[1]	34	-	-	*
			-	-[1]						-[1]	34	-	-	*
			-		-[1]					-[1]	34	-	-	*
			-			-[1]				-[1]	34	-	-	*
			-				-[1]			-[1]	34	-	-	*
			-					-[1]		-[1]	34	-	-	*
			-						-[1]	-[1]	34	-	-	*

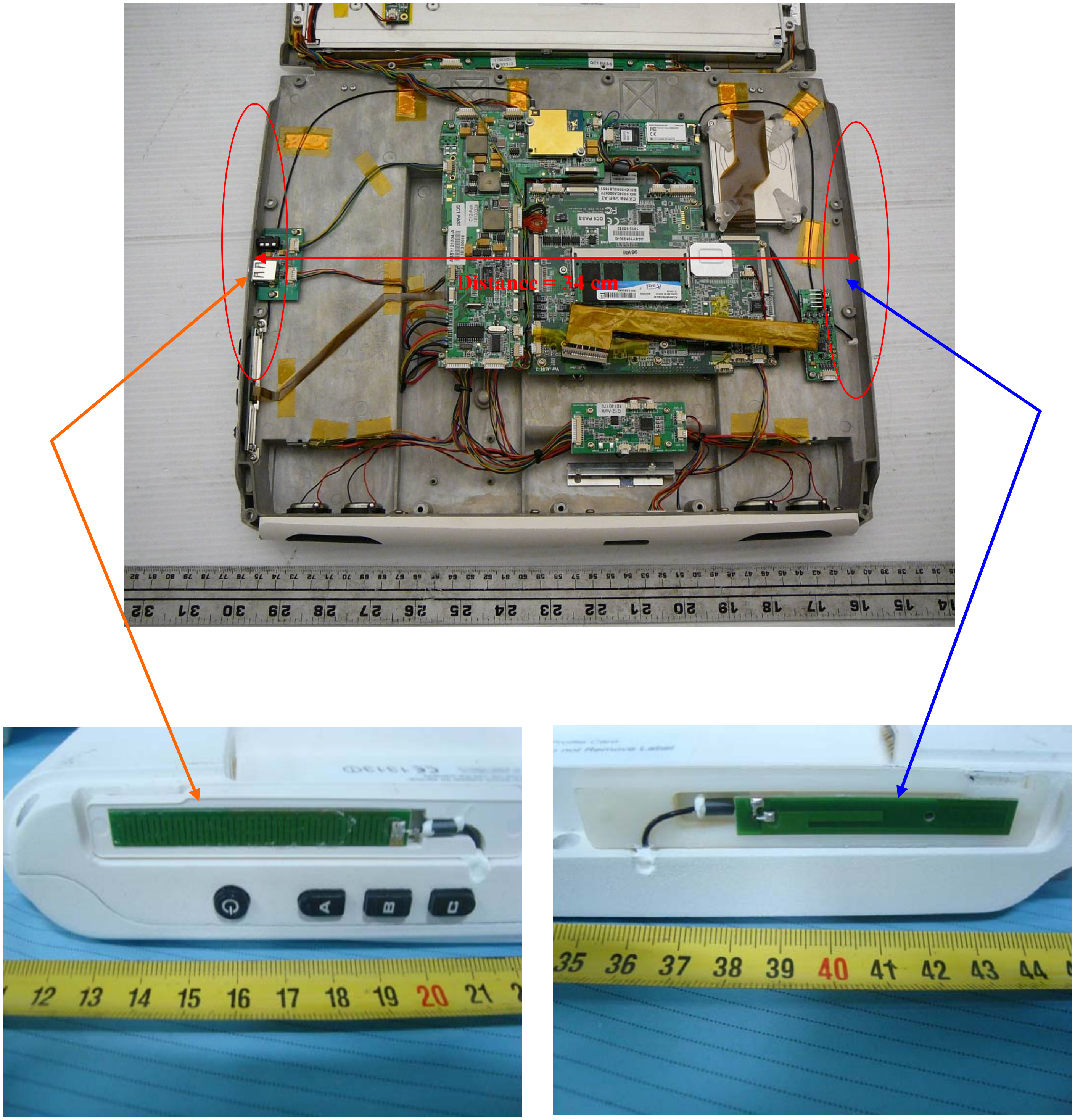
Note:

Bluetooth → $P_{Ref} = 12$ mW, $2*P_{Ref} = 24$ mW,
Bluetooth Maximum Power = 1 mW < 24 mW
WLAN → $P_{Ref} = 12$ mW, $2*P_{Ref} = 24$ mW,
Bluetooth Maximum Power = 0.59 mW < 24 mW

[1]According to KDB648474, when the output of an unlicensed transmitter is ≤ $2*P_{Ref}$ and its antenna(s) is ≥ 5.0 cm from other antennas, stand-alone SAR evaluation is also not required for that unlicensed transmitter. As this device the antenna distance is 34cm > 5cm, and the Bluetooth and Wlan power all < 2* P_{Ref} So stand alone SAR is not required for the un-license transmitter.

[2]According to KDB648474, when stand-alone SAR evaluation is not required and the antenna is ≥ 5 cm from other antennas, simultaneous transmission SAR evaluation is also not required for that antenna. And this device has the antenna distance which is > 5cm, so no simultaneous SAR is required

Antennas Location



GSM Antenna View

2.4 GHz WLAN Antenna View

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device, could be found in Appendix E.

SAR Test Data

Test Environmental Conditions

Temperature:	22-24 °C
Relative Humidity:	40-50%
ATM Pressure:	101-103 kPa

** Testing was performed by Arthur Tie from 2010-08-26 to 2010-08-29.*

GSM 850 Band: Right side and Back side touch the Flat Phantom									
Position	**Separation [mm]**	**Antenna**	**Channel**	**Frequency [MHz]**	**Liquid**	**Phantom**	**1 g SAR (W/Kg)**	**Limit (W/Kg)**	**Ref. Plot**
Right Side	0	Internal	Middle	836.6	Body	Flat	0.11	1.6	1
Back Touch	0	Internal	Middle	836.6	Body	Flat	0.0352	1.6	2
GSM 1900 Band: Right side and Back side touch the Flat Phantom									
Position	**Separation [mm]**	**Antenna**	**Channel**	**Frequency [MHz]**	**Liquid**	**Phantom**	**1 g SAR (W/Kg)**	**Limit (W/Kg)**	**Ref. Plot**
Right Side	0	Internal	Middle	1880	Body	Flat	0.16	1.6	3
Back Touch	0	Internal	Middle	1880	Body	Flat	0.0311	1.6	4

APPENDIX A – MEASUREMENT UNCERTAINTY

The uncertainty budget has been determined for the DASY4 measurement system and is given in the following Table.

SASY4 Uncertainty Budget According to IEEE 1528								
Error Description	Uncertainty Value	Prob. Dist.	Div.	(c i) 1g	(c i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v i) veff
Measurement System								
Probe Calibration	± 5.9 %	N	1	1	1	± 5.9 %	± 5.9 %	∝
Axial Isotropy	± 4.7 %	R	√3	0.7	0.7	± 1.9 %	± 1.9 %	∝
Hemispherical Isotropy	± 9.6 %	R	√3	0.7	0.7	± 3.9 %	± 3.9 %	∝
Boundary Effects	± 1.0 %	R	√3	1	1	± 0.6 %	± 0.6 %	∝
Linearity	± 4.7 %	R	√3	1	1	± 2.7 %	± 2.7 %	∝
System Detection Limits	± 1.0 %	R	√3	1	1	± 0.6 %	± 0.6 %	∝
Readout Electronics	± 0.3 %	N	1	1	1	± 0.3 %	± 0.3 %	∝
Response Time	± 0.8 %	R	√3	1	1	± 0.5 %	± 0.5 %	∝
Integration Time	± 2.6 %	R	√3	1	1	± 1.5 %	± 1.5 %	∝
RF Ambient Conditions	± 3.0 %	R	√3	1	1	± 1.7 %	± 1.7 %	∝
Probe Positioner	± 0.4 %	R	√3	1	1	± 0.2 %	± 0.2 %	∝
Probe Positioning	± 2.9 %	R	√3	1	1	± 1.7 %	± 1.7 %	∝
Max. SAR Eval.	± 1.0 %	R	√3	1	1	± 0.6 %	± 0.6 %	∝
Test Sample Related								
Device Positioning	± 2.9 %	N	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6 %	N	1	1	1	± 3.6 %	± 2.6 %	5
Power Drift	± 5.0 %	R		1	1	± 2.9 %	± 2.9 %	∝
Phantom and Setup								
Phantom Uncertainty	± 4.0 %	R	√3	1	1	± 2.3 %	± 2.3 %	∝
Liquid Conductivity (Target)	± 5.0 %	R	√3	0.64	0.43	± 1.8 %	± 1.2 %	∝
Liquid Conductivity (meas.)	± 2.5 %	N	1	0.64	0.43	± 1.6 %	± 1.1 %	∝
Liquid Permittivity (Target)	± 5.0 %	R	√3	0.6	0.49	± 1.7 %	± 1.4 %	∝
Liquid Permittivity (Target)	± 2.5 %	N	1	0.6	0.49	± 1.5 %	± 1.0 %	∝
Combined Std. Uncertainty	-	-	-	-	-	± 10.8 %	± 10.6 %	330
Expanded STD Uncertainty	-	-	-	-	-	± 21.6 %	± 21.1 %	-

APPENDIX B – PROBE CALIBRATION CERTIFICATES

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
C Servizio svizzero di taratura
S 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 **BACL**

Certificate No: **ES3-3019_Sep09**

CALIBRATION CERTIFICATE

Object	ES3DV2 - SN:3019
Calibration procedure(s)	QA CAL-01.v6, QA CAL-12.v5, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	September 22, 2009
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (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. 217-01028)	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	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: September 22, 2009

Verified
Greeman
Sept. 28, 2009

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

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

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

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
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 (no uncertainty required). DCP does not depend on frequency nor media.
- *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 ES3DV2

SN:3019

Manufactured:	December 5, 2002
Last calibrated:	October 9, 2003
Recalibrated:	September 22, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV2 SN:3019

Sensitivity in Free Space[A]

NormX	**1.07** ± 10.1%	$\mu V/(V/m)^2$
NormY	**1.17** ± 10.1%	$\mu V/(V/m)^2$
NormZ	**0.99** ± 10.1%	$\mu V/(V/m)^2$

Diode Compression[B]

DCP X	**95** mV
DCP Y	**93** mV
DCP Z	**97** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **835 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	7.9	5.0
SAR_{be} [%]	With Correction Algorithm	0.9	0.6

TSL **1900 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	9.0	6.1
SAR_{be} [%]	With Correction Algorithm	0.9	0.3

Sensor Offset

Probe Tip to Sensor Center **2.1** mm

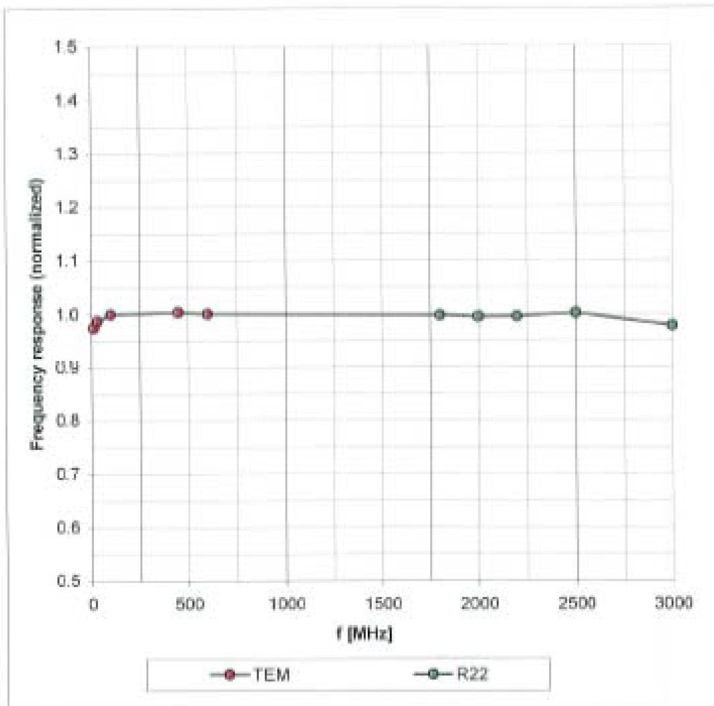
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

ES3DV2 SN:3019 September 22, 2009

Frequency Response of E-Field

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

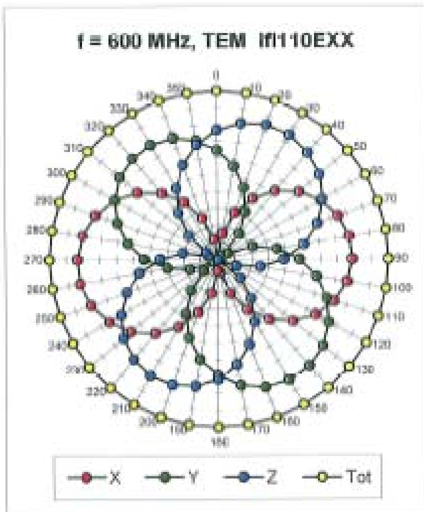


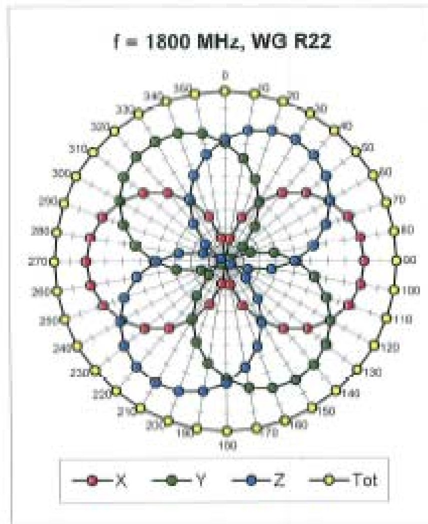
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

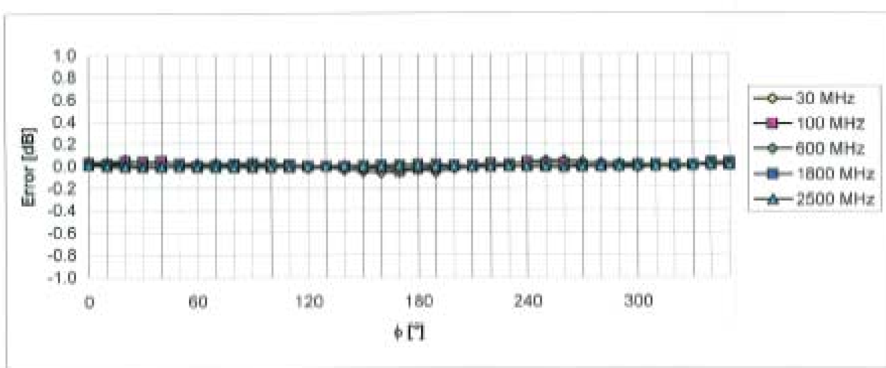
Certificate No: ES3-3019_Sep09 Page 5 of 9

ES3DV2 SN:3019 September 22, 2009

Receiving Pattern (ϕ), $\vartheta = 0°$







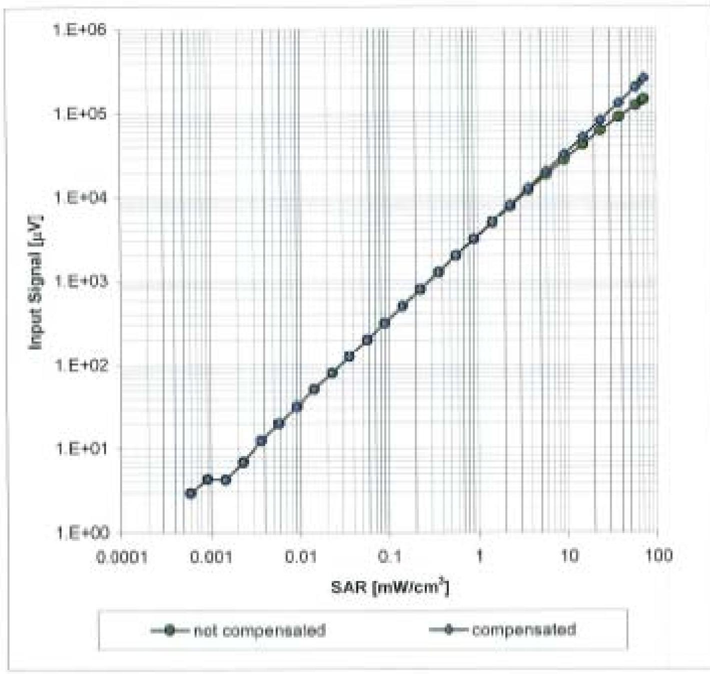
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

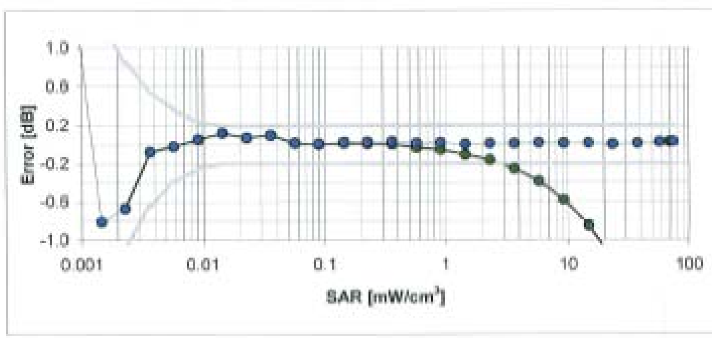
Certificate No: ES3-3019_Sep09 Page 6 of 9

ES3DV2 SN:3019 September 22, 2009

Dynamic Range f(SAR_{head})

(Waveguide R22, f = 1800 MHz)



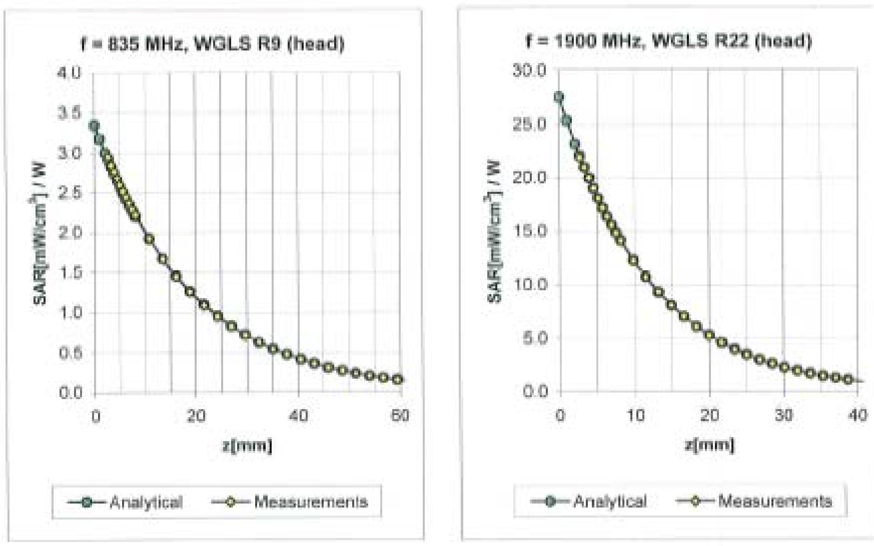


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: ES3-3019_Sep09 Page 7 of 9

ES3DV2 SN:3019 September 22, 2009

Conversion Factor Assessment



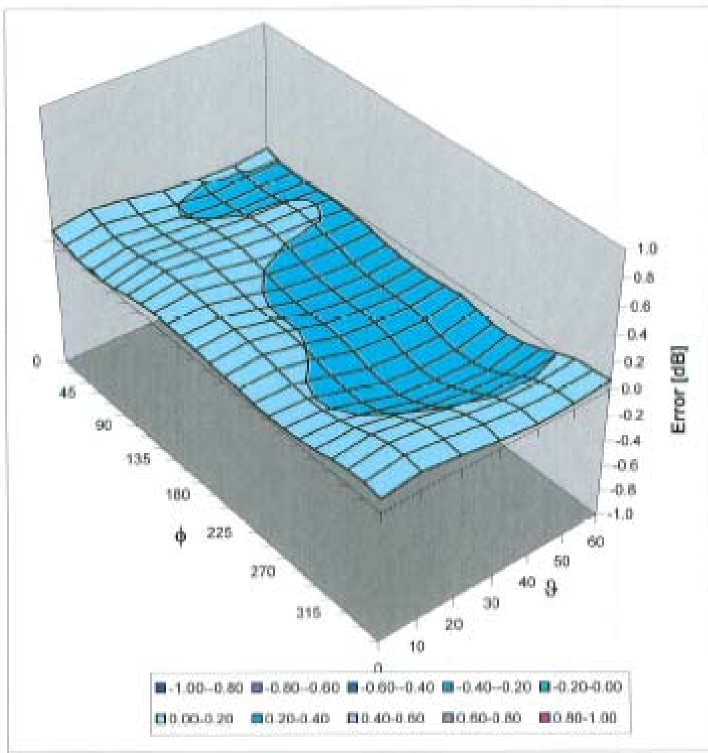
f [MHz]	Validity [MHz][c]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.23	1.33	6.28 ± 13.3% (k=2)
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.43	1.38	6.17 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.19	2.93	4.82 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.28	2.16	4.15 ± 11.0% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.15	1.00	6.93 ± 13.3% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.38	1.51	6.01 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.22	5.71	4.36 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.52	1.20	3.90 ± 11.0% (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.

Certificate No: ES3-3019_Sep09 Page 8 of 9

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

APPENDIX C - DIPOLE CALIBRATION CERTIFICATES

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Ave, Sunnyvale, CA 94089
Tel: (408)732-9162 / Fax: (408)732-9164

Verification of Calibration Report

Report Number: CAL 2010-07-16

Description: Dipole Antenna

Manufacturer: Schmid & Partner Engineering AG

Model Number: CD835V3

Serial Number: SN: 1012

Date of Calibration: 15 July 2010

Condition Received: In Tolerance

Condition Returned: In Tolerance

Conditions and results of calibration: See attachment

This device has been instrumented, measured and calibrated in accordance with the Bay Area Compliance Laboratories Corp. ("BACL") Quality Assurance Manual procedures and the results being traceable to the National Institute of Standards and Technology (NIST). The BACL Quality System is accredited by NVLAP to ISO/IEC 17025:2005. Unless stated otherwise; Measurement Uncertainties are derived from ISO Guide to the Determination of Uncertainties with a Coverage Factor of k = 2 for a 95% level of confidence, no sampling plan or other process was used for this calibration (unless stated otherwise), the results reported herein apply only to the calibration of the item described above, and limitations of use (if any) shall be stated this Calibration Report.

Calibrated By: Victor Zhang — Date: 07/19/2010

Reviewed By: Hans Mellberg — Date: 26 July 2010

Quality Assurance: Steve Hubbard — Date: 7-26-10

Attachment

Ambient Environment of Calibration

Temperature	Relative Humidity	Pressure
23 ° C	47.5 %	101.4 k Pa

Equipment List

Description	Manufacturer	Model	Serial #	Cal Date
Signal Generator	Rohde & Schwarz	SMIQ	849192/0085/DE23746	2010-03-31
Network Analyzer	HP	8753D	3410A04346	2010-06-03
Power meter	Agilent	E4419B	MY41291511	2008-10-10
Power Sensor	Agilent	E9301A	MY41497252	2010-02-19
Reference Probe	SPEAG	ET3DV2	3019	2009-09-22

Measurement Conditions

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom	
Distance Dipole Center-TSL	10 mm	
Area Scan resolution	dx,dy = 15 mm	
Zoom Scan resolution	dx,dy,dz = 15 mm	
Frequency	835 MHz ± 1MHz	

Calibration is performed According to the Following Standards:

1. **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**
2. **IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devise used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005**
3. **DASY 4 System Handbook**

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Calibration Data:

Head TSL Parameters
The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL Parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL Parameters	(22.0±0.3) °C	41.5	0.89 mho/m
Head TSL Temperature during test	(23.0±0.3) °C		

SAR result with Head TSL

SAR average over 1 cm3 (1g) of Head TSL	Condition	
SAR measured	500 mW input power	4.46 mW / g
SAR normalized	Normalized to 1W	8.92 mW / g
SAR for nominal Head TSL parameters[1]	Normalized to 1W	8.86mW / g ± 1.30% (k=2)

SAR average over 10 cm3 (10g) of Head TSL	Condition	
SAR measured	500 mW input power	2.83 mW / g
SAR normalized	Normalized to 1W	5.66 mW / g
SAR for nominal Head TSL parameters[1]	Normalized to 1W	5.64mW / g ± 0.78% (k=2)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.00 Ω
Return Loss	-25.710 dB

[1]Correction to nominal TSL parameters according to DASY 4 System Handbook, chapter "SAR Sensitivities"

DASY4 Validation Report for Head TSL

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

DUT: Dipole 835 MHz; Type: CD835V3; Serial: SN: 1012

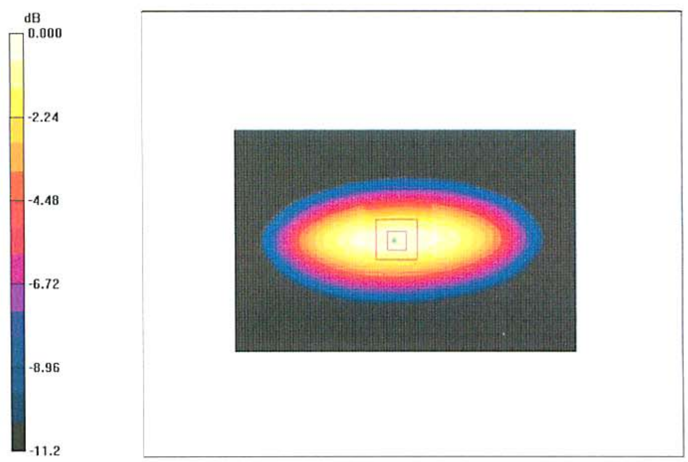
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3019; ConvF(6.17, 6.17, 6.17); Calibrated: 9/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.6 Build 23; Post processing SW: SEMCAD, V1.8 Build 184

d =15 mm, Pin = 0.5W/Area Scan (81x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.82 mW/g

d =15 mm, Pin = 0.5W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 73.3 V/m; Power Drift = 0.200 dB
Peak SAR (extrapolated) = 7.04 W/kg
SAR(1 g) = 4.46 mW/g; SAR(10 g) = 2.83 mW/g
Maximum value of SAR (measured) = 4.85 mW/g



0 dB = 4.85mW/g

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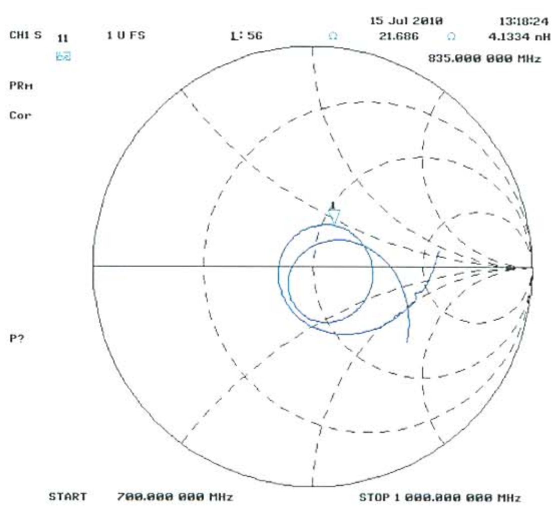
Impedance Measurement Plot for Head TSL

Return Loss Measurement Plot for Head TSL



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Bay Area Compliance Laboratories Corp.
1274 Anvilwood Ave, Sunnyvale, CA 94089
Tel: (408)732-9162 / Fax: (408)732-9164

Verification of Calibration Report

Report Number: CAL 2010-07-19

Description: Dipole Antenna

Manufacturer: Schmid & Partner Engineering AG

Model Number: CD1880V3

Serial Number: SN: 1009

Date of Calibration: 19 July 2010

Condition Received: In Tolerance

Condition Returned: In Tolerance

Conditions and results of calibration: See attachment

This device has been instrumented, measured and calibrated in accordance with the Bay Area Compliance Laboratories Corp. ("BACL") Quality Assurance Manual procedures and the results being traceable to the National Institute of Standards and Technology (NIST). The BACL Quality System is accredited by NVLAP to ISO/IEC 17025:2005. Unless stated otherwise; Measurement Uncertainties are derived from ISO Guide to the Determination of Uncertainties with a Coverage Factor of k = 2 for a 95% level of confidence, no sampling plan or other process was used for this calibration (unless stated otherwise), the results reported herein apply only to the calibration of the item described above, and limitations of use (if any) shall be stated this Calibration Report.

Calibrated By: Victor Zhang — Date: 07/19/2010

Reviewed By: Hans Mellberg — Date: 26 July 2010

Quality Assurance: Steve Hubbard — Date: 7-26-10

Attachment

Ambient Environment of Calibration

Temperature	Relative Humidity	Pressure
22 ° C	42.5 %	102.1 k Pa

Equipment List

Description	Manufacturer	Model	Serial #	Cal Date
Signal Generator	Rohde & Schwarz	SMIQ	849192/0085/DE23746	2010-03-31
Network Analyzer	HP	8753D	3410A04346	2010-06-03
Power meter	Agilent	E4419B	MY41291511	2008-10-10
Power Sensor	Agilent	E9301A	MY41497252	2010-02-19
Reference Probe	SPEAG	ET3DV2	3019	2009-09-22

Measurement Conditions

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom	
Distance Dipole Center-TSL	10 mm	
Area Scan resolution	dx,dy = 15 mm	
Zoom Scan resolution	dx,dy,dz = 15 mm	
Frequency	1900 MHz ± 1MHz	

Calibration is performed According to the Following Standards:

1. **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**
2. **IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devise used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005**
3. **DASY 4 System Handbook**

Calibration Data:

Head TSL Parameters
The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL Parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL Parameters	(22.0±0.3) °C	39.9	1.38 mho/m
Head TSL Temperature during test	(23.0±0.3) °C		

SAR result with Head TSL

SAR average over 1 cm3 (1g) of Head TSL	Condition	
SAR measured	500 mW input power	18.9 mW / g
SAR normalized	Normalized to 1W	37.8 mW / g
SAR for nominal Head TSL parameters[1]	Normalized to 1W	37.57mW / g ± 1.723% (k=2)

SAR average over 10 cm3 (10g) of Head TSL	Condition	
SAR measured	500 mW input power	10.2 mW / g
SAR normalized	Normalized to 1W	20.4 mW / g
SAR for nominal Head TSL parameters[1]	Normalized to 1W	20.36mW / g ± 0.84% (k=2)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.396 Ω
Return Loss	-31.427 dB

[1]Correction to nominal TSL parameters according to DASY 4 System Handbook, chapter "SAR Sensitivities"

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DASY4 Validation Report for Head TSL

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

DUT: Dipole 1900 MHz; Type: CD1880V3; Serial: SN: 1009

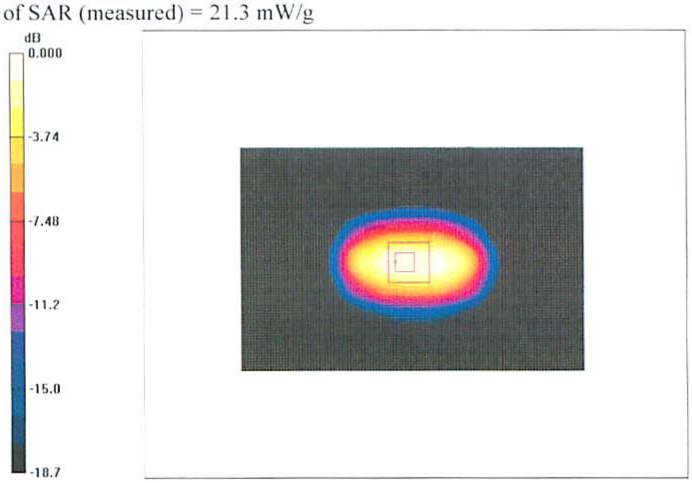
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3019; ConvF(4.82, 4.82, 4.82); Calibrated: 9/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.6 Build 23; Post processing SW: SEMCAD, V1.8 Build 184

d =10 mm, Pin = 0.5W/Area Scan (81x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 22.1 mW/g

d =10 mm, Pin = 0.5W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 124.3 V/m; Power Drift = -0.137 dB
Peak SAR (extrapolated) = 35.1 W/kg
SAR(1 g) = 18.9 mW/g; SAR(10 g) = 10.2 mW/g
Maximum value of SAR (measured) = 21.3 mW/g



0 dB = 21.3mW/g

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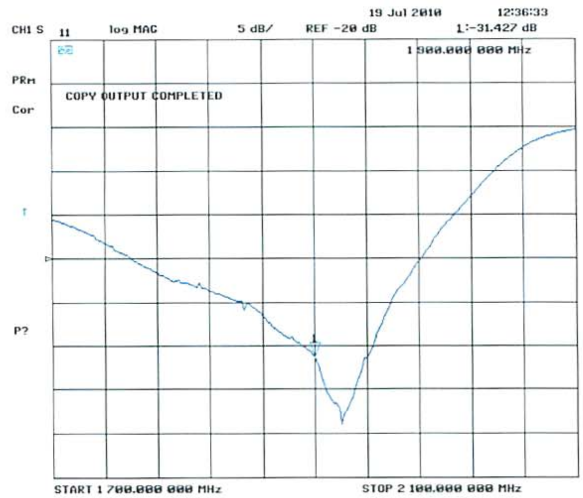
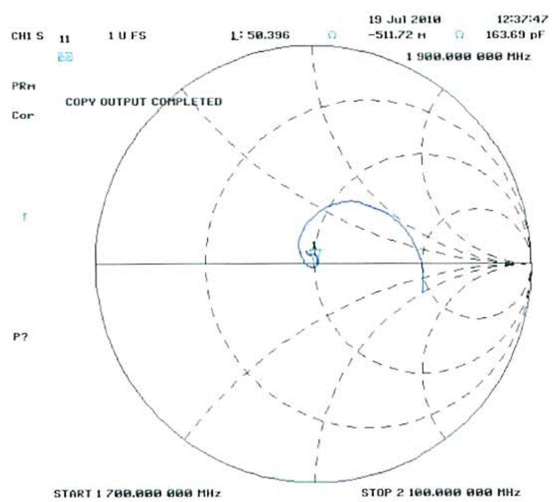
Impedance Measurement Plot for Head TSL



Return Loss Measurement Plot for Head TSL



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APPENDIX D - TEST SYSTEM VERIFICATIONS SCANS

Liquid and System Validation

2010-08-26

Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
Head	835	εr	22	41.5	41.7	0.48	±5
		σ	22	0.90	0.89	-1.11	±5
		1g SAR	22	9.5	9.9	4.21	±10

εr = relative permittivity, σ = conductivity and ρ=1000 kg/m3

2010-08-26

Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
Head	1900	εr	22	40	39.9	-0.39	±5
		σ	22	1.4	1.38	-1.4	±5
		1g SAR	22	39.7	41.2	3.78	±10

εr = relative permittivity, σ = conductivity and ρ=1000 kg/m3

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

System Performance Test (835 MHz, Head Tissue)

Dipole 835 MHz; Type: CD835V3; Serial: SN: 1012

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 41.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

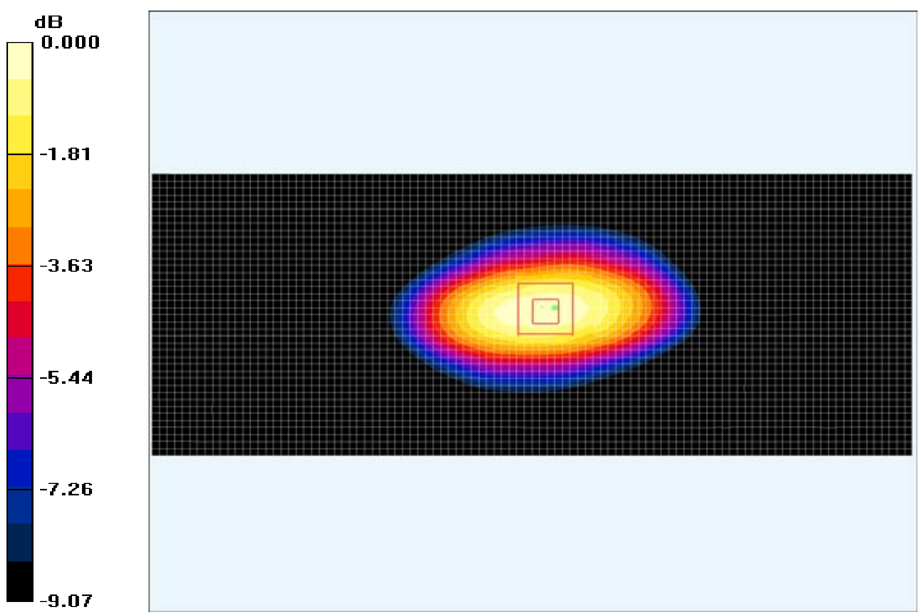
DASY4 Configuration:

- Probe: ES3DV2 - SN3019; ConvF(6.17, 6.17, 6.17); Calibrated: 9/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.6 Build 23; Post processing SW: SEMCAD, V1.8 Build 184

d =15 mm, Pin = 0.5 W/Area Scan (81x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 5.52 mW/g

d =15 mm, Pin = 0.5 W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 79.6 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 7.12 W/kg

SAR (1 g) = 4.95 mW/g; SAR (10 g) = 3.24 mW/g
Maximum value of SAR (measured) = 5.54 mW/g



0 dB = 5.54mW/g

835 MHz System Performance Check

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

System Performance Test (1900 MHz, Head Tissue)

Dipole 1900 MHz; Type: CD1880V3; Serial: SN: 1009

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

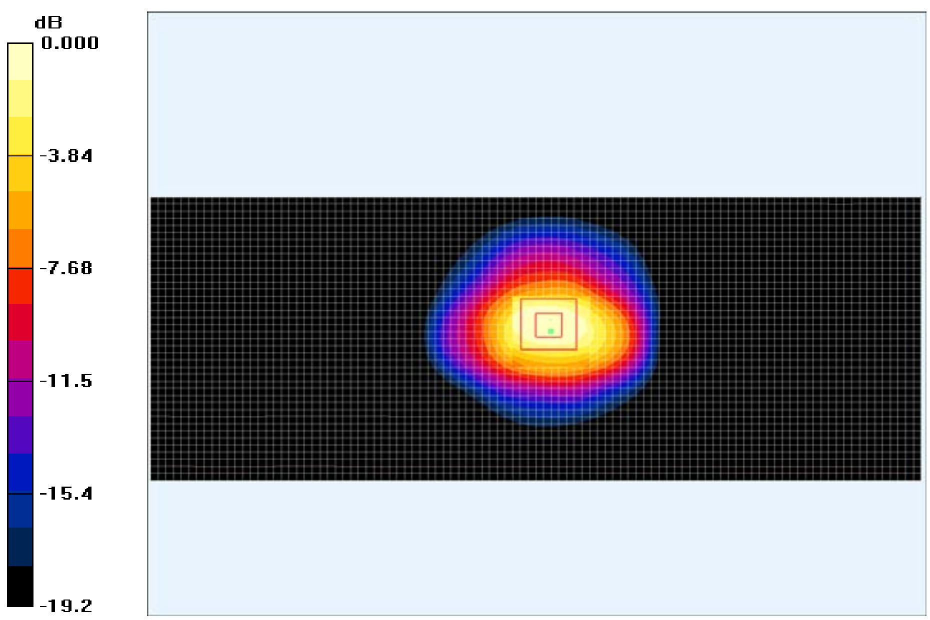
DASY4 Configuration:

- Probe: ES3DV2 - SN3019; ConvF(4.82, 4.82, 4.82); Calibrated: 9/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.6 Build 23; Post processing SW: SEMCAD, V1.8 Build 184

d =10 mm, Pin = 0.5 W/Area Scan (81x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 26.4 mW/g

d =10 mm, Pin = 0.5 W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 118.6 V/m; Power Drift = 0.090 dB
Peak SAR (extrapolated) = 48.6 W/kg

SAR (1 g) = 20.6 mW/g; SAR (10 g) = 10.2 mW/g
Maximum value of SAR (measured) = 25.1 mW/g



0 dB = 25.1mW/g

1900 MHz System Performance Check

APPENDIX E – EUT SCAN RESULTS

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

Right Side Touch to the Phantom (Middle Channel)

Tobii Technology AB; Type: Tobii C15; Serial: R1008238-1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 55.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

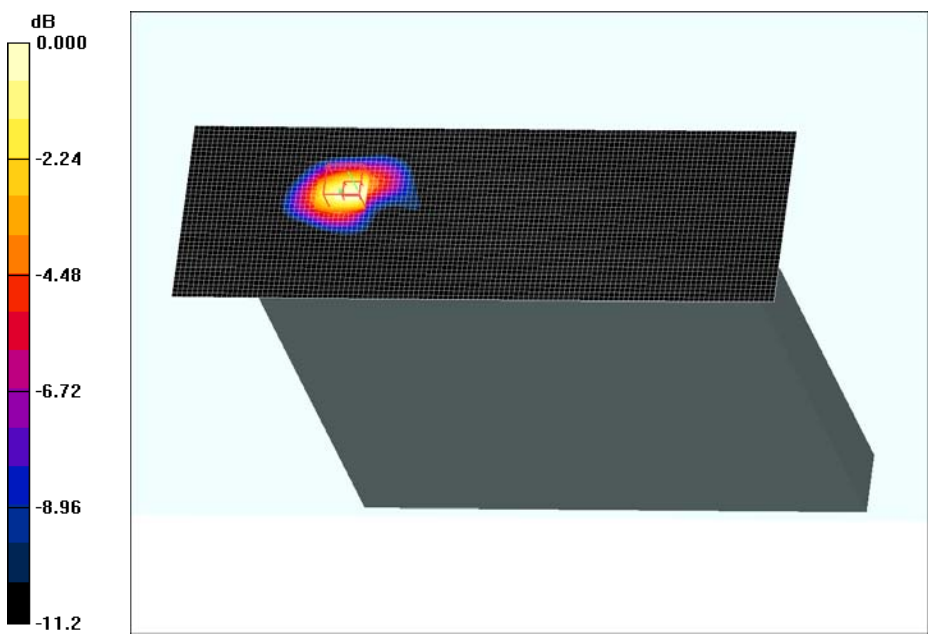
DASY4 Configuration:

- Probe: ES3DV2 - SN3019; ConvF(6.01, 6.01, 6.01); Calibrated: 9/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4; Serial: R1008238-1
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 184

Right Side Touch to the Phantom/Area Scan (41x121x1): Measurement grid: dx=30mm, dy=30mm
Maximum value of SAR (interpolated) = 0.081 mW/g

Right Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.52 V/m; Power Drift = -0.96 dB
Peak SAR (extrapolated) = 0.178 W/kg

SAR (1 g) = 0.110 mW/g; SAR (10 g) = 0.069 mW/g
Maximum value of SAR (measured) = 0.120 mW/g



0 dB = 0.120mW/g

Plot – 1

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

Back Side Touch to the Phantom (Middle Channel)

Tobii Technology AB; Type: Tobii C15; Serial: R1008238-1

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.96 mho/m; ε_r = 55.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

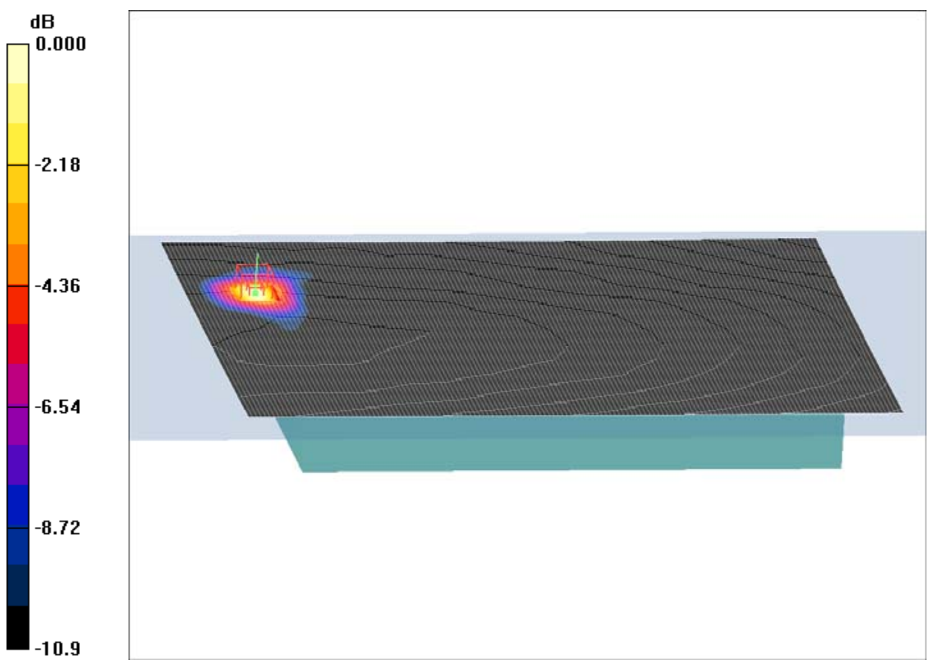
DASY4 Configuration:

- Probe: ES3DV2 - SN3019; ConvF(6.01, 6.01, 6.01); Calibrated: 9/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4; Serial: R1008238-1
- Measurement SW: DASY4, V4.6 Build 23; Post processing SW: SEMCAD, V1.8 Build 184

Back Side Touch to the Phantom/Area Scan (121x151x1): Measurement grid: dx=30mm, dy=30mm
Maximum value of SAR (interpolated) = 0.023 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.780 V/m; Power Drift = 0.47 dB
Peak SAR (extrapolated) = 0.052 W/kg

SAR (1 g) = 0.035 mW/g; SAR (10 g) = 0.024 mW/g
Maximum value of SAR (measured) = 0.038 mW/g



0 dB = 0.038mW/g

Plot – 2

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

Right Side Touch to the Phantom (Middle Channel)

Tobii Technology AB; Type: Tobii C15; Serial: R1008238-1

Communication System: PCS 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 1880 MHz; σ = 1.57 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

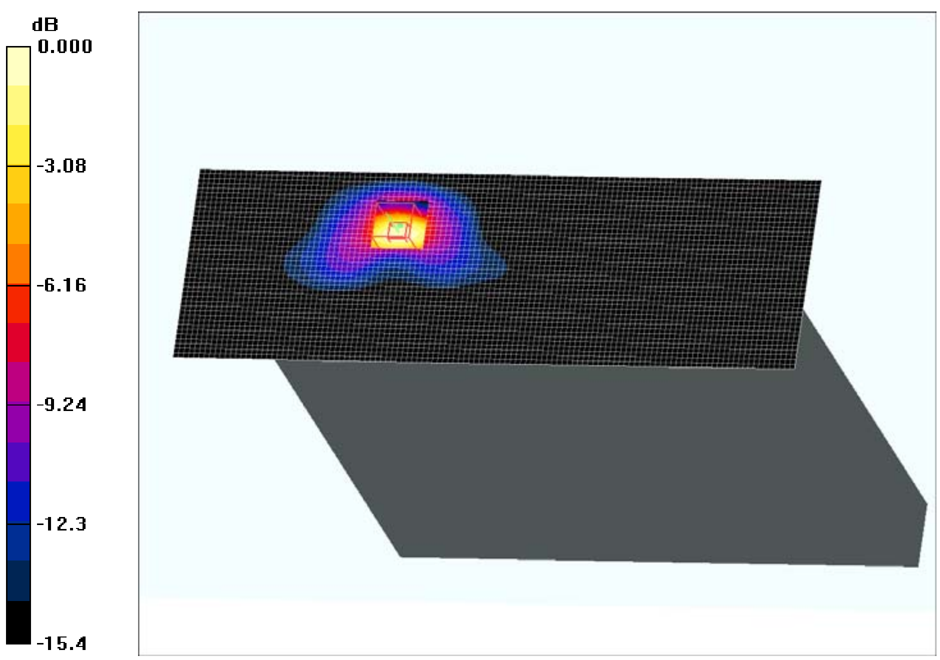
DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.64, 4.64, 4.64); Calibrated: 9/23/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4; Serial: R1008238-1
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 184

Right Side Touch to the Phantom/Area Scan (41x121x1): Measurement grid: dx=30mm, dy=30mm
Maximum value of SAR (interpolated) = 0.097 mW/g

Right Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.47 V/m; Power Drift = -0.290 dB
Peak SAR (extrapolated) = 0.312 W/kg

SAR (1 g) = 0.160 mW/g; SAR (10 g) = 0.078 mW/g.
Maximum value of SAR (measured) = 0.179 mW/g



0 dB = 0.179mW/g

Plot – 3

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

Back Side Touch to the Phantom (Middle Channel)

Tobii Technology AB; Type: Tobii C15; Serial: R1008238-1

Communication System: PCS 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.57 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

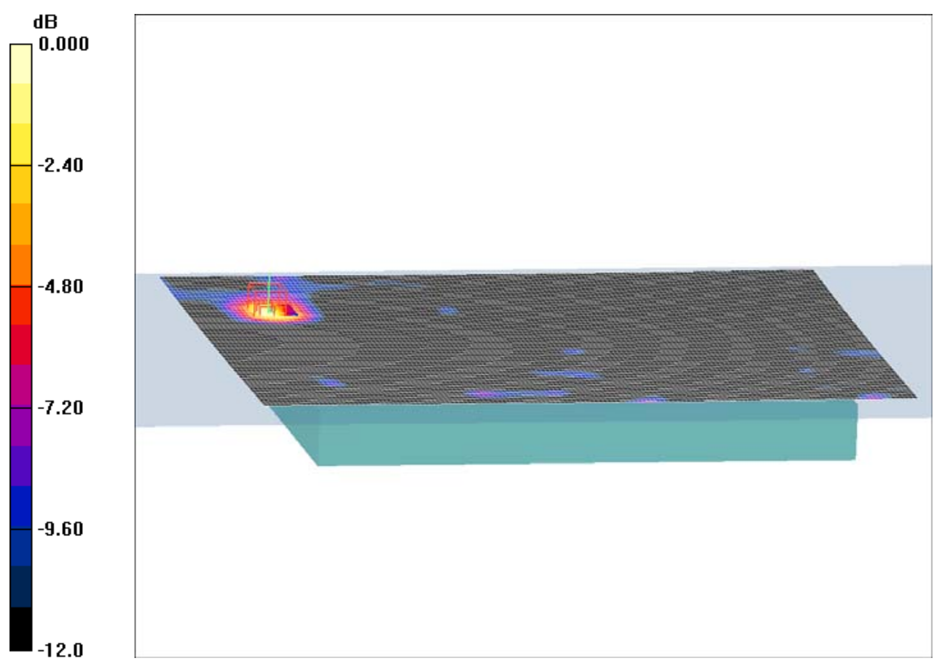
DASY4 Configuration:

- Probe: ES3DV2 - SN3019; ConvF(4.36, 4.36, 4.36); Calibrated: 9/22/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4; Serial: R1008238-1
- Measurement SW: DASY4, V4.6 Build 23; Post processing SW: SEMCAD, V1.8 Build 184

Back Side Touch to the Phantom/Area Scan (121x151x1): Measurement grid: dx=30mm, dy=30mm
Maximum value of SAR (interpolated) = 0.026 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.76 V/m; Power Drift = -0.28 dB
Peak SAR (extrapolated) = 0.045 W/kg

SAR (1 g) = 0.031 mW/g; SAR (10 g) = 0.018 mW/g
Maximum value of SAR (measured) = 0.035 mW/g



0 dB = 0.035mW/g

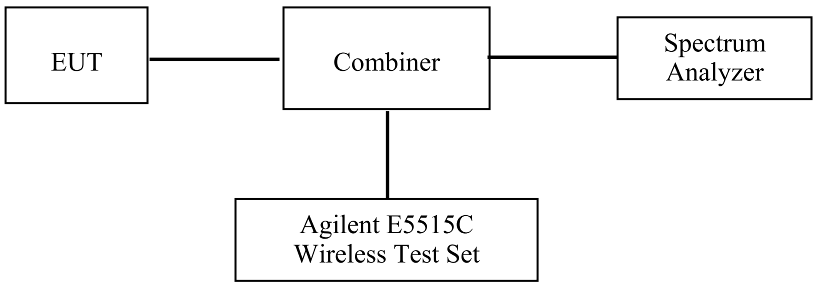
Plot – 4

APPENDIX F – CONDUCTED OUTPUT POWER MEASUREMENT

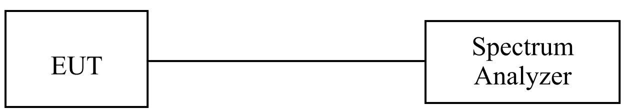
Test Block Diagram and Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation and the combiner.

GSM



802.11b/g/n WLAN:



Test Equipments List and Details

Manufacturer	Equipment Description	Model No.	Serial No.	Calibration Due Date
Agilent	Wireless Communications Tester	E5515C	GB44051221	2011-06-11
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-09

Test Results

GSM:

Band	Channel	Frequency (MHz)	Measured Output Power	
			(dBm)	(Watt)
GSM850	Low	824.2	32.35	1.718
	Middle	836.6	32.57	1.807
	High	848.8	32.48	1.770
PCS1900	Low	1850.2	29.90	0.977
	Middle	1880.0	30.11	1.026
	High	1909.8	29.85	0.966

2.4 GHz WLAN:

Radio Mode	Channel No.	Frequency (MHz)	Measured Output Power	
			(dBm)	(mW)
802.11b	1	2412	11.10	12.882
	6	2437	11.12	12.942
	11	2462	11.08	12.823
802.11g	1	2412	11.08	12.823
	6	2437	11.05	12.735
	11	2462	11.12	12.942
802.11n20	1	2412	11.11	12.912
	6	2437	11.08	12.823
	11	2462	11.10	12.882
802.11n40	1	2422	11.05	12.735
	6	2437	11.08	12.823
	9	2452	11.10	12.882

APPENDIX G – TEST SETUP PHOTOS

Back Touch to Flat Phantom Setup Photo

Right Touch to Flat Phantom Setup Photo

APPENDIX H - EUT PHOTOGRAPHS

Tablet PC Front Side View

Tablet PC Back Side View

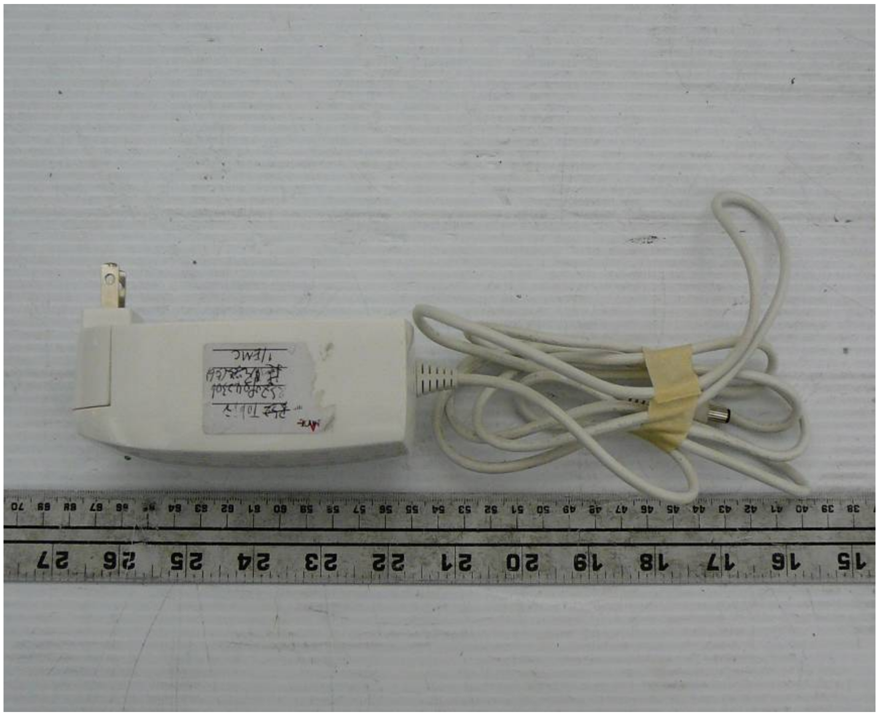
Tablet PC Right Side View

Tablet PC Left Side View

Tablet PC Bottom Side View

Tablet PC Top Side View

AC/DC Power Adaptor



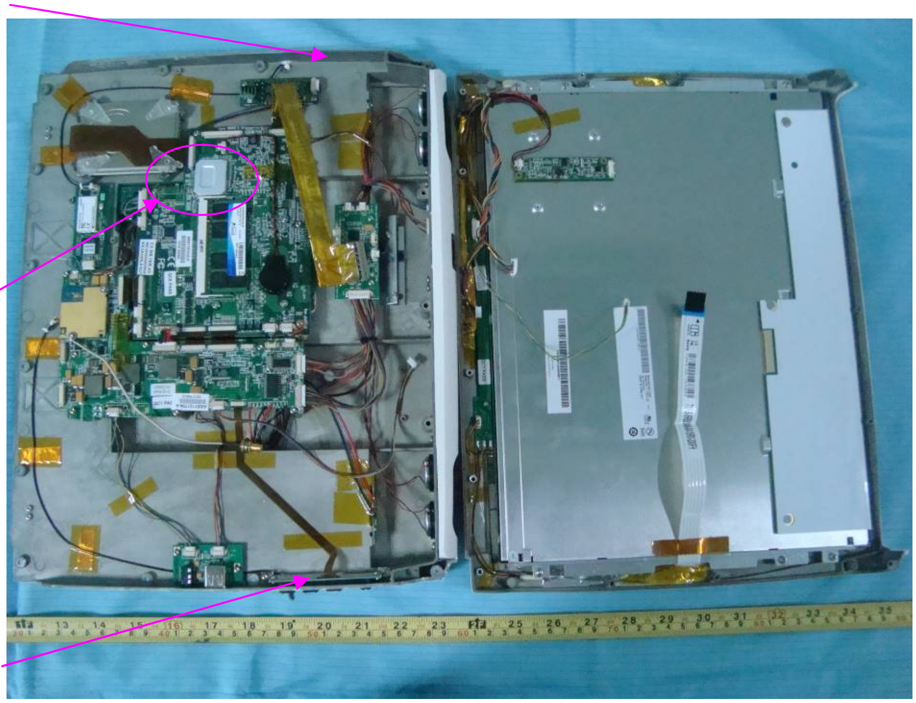
EUT – Battery off View

EUT – Cover off View

Wi-Fi Antenna

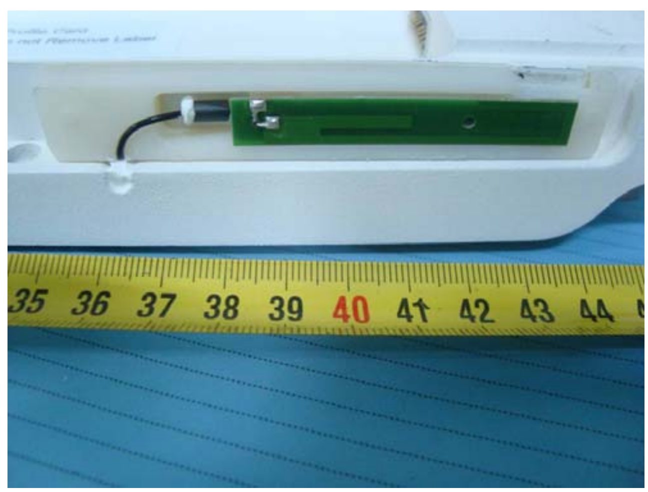
BT module
With antenna

GSM Antenna

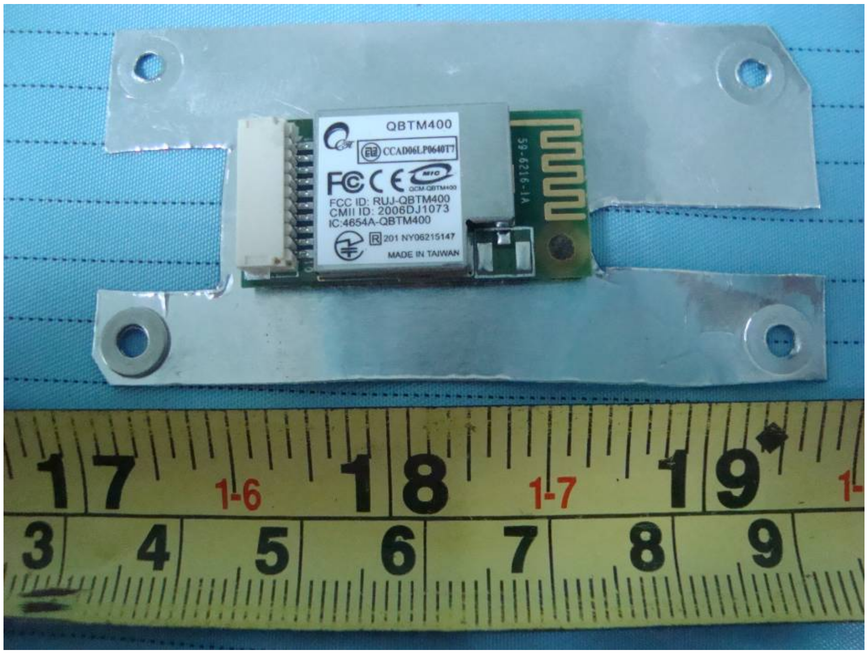


AntennasView

GSM Antenna



2.4 GHz WLAN Antenna



Bluetooth Module with Antenna View

Modules View

GSM Module

2.4 GHz WLAN Module

APPENDIX I - INFORMATIVE REFERENCES

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[2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commission, O_ce of Engineering & Technology, Washington, DC, 1997.

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******* END OF REPORT *******