SAR Evaluation Report

IN ACCORDANCE WITH THE REQUIREMENTS OF
FCC REPORT AND ORDER:
ET DOCKET 93-62, AND OET BULLETIN 65 SUPPLEMENT C

FOR

High Power CardBus Adapter

Brand Name: BUFFALO

Model: WLI-CB-G54HP

FCC ID: FDI-09101841-0

REPORT NUMBER: 05I3515-3

ISSUE DATE: June 30, 2005

Prepared for

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LAB CODE:200065-0

Revision History

Rev.	Revisions	Revised By
A	Initial Issue	HS

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: June 24, 28 and 30, 2005

APPLICANT:	Buffalo Inc.
ADDRESS:	15, Shibata Hondori 4-Chome Minami-Ku, Nagoya 457-8520, Japan
FCC ID:	FDI-09101841-0
MODEL:	WLI-CB-G54HP
DEVICE CATEGORY:	Portable Device
EXPOSURE CATEGORY:	General Population/Uncontrolled Explosure

High Power CardBus Adaptor Installed in Laptop PCs (Hosts)

Test Sample is a:	Production unit
Modulation type:	• Direct Sequence Spread Spectrum (DSSS) for 802.11b • Orthogonal Frequency Division Multiplexing (OFDM) for 802.11g
Host devices:	• Host # 1 - IBM, model R50e (P/N: 1834-KC1, S/N:99-HDCD1) • Host # 2 - Toshiba, model Satellite (P/N: PS183U-00KP0X) • Host # 3 - HP, model ze4200 (S/N: CN25110374)

FCC Rule Parts	**Frequency Range [MHz]**	**The Highest SAR Values [1g_mW/g]**
47 CFR 15.247	2412 - 2462	0.717 mW/g for Host # 1 0.689 mW/g for Host # 2 0.699 mW/g for Host # 3

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Explosure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C (Edition 01-01). And RSS-102 Issue 1 (Provisional) September 25, 1999.

The maximum 1g SAR level measured for all the tests performed did not exceed the limits for General Population/Uncontrolled Exposure (W/kg) Partial Body of 1.6 W/kg. Level defined in Supplement C (Edition 01-01) to OET Bulletin 65 (97-01).

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Released For CCS By:

Hsin Fu Shih (Sunny Shih)
COMPLIANCE CERTIFICATION SERVICES

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1 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

High Power CardBus Adaptor (802.11bg) Installed in Laptop PCs (Hosts)	
Host devices:	• Host # 1 - IBM, model R50e (P/N: 1834-KC1, S/N:99-HDCD1) • Host # 2 - Toshiba, model Satellite (P/N: PS183U-00KP0X) • Host # 3 - HP, model ze4200 (S/N: CN25110374)
Normal operation:	Lap-held position
Accessory:	N/A
Earphone/Headset Jack:	N/A
Duty cycle:	95% for DSSS 63% for OFDM
Power supply:	Power supplied through the laptop computer (host device)

2 FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

NVLAP®

LAB CODE:200065-0

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

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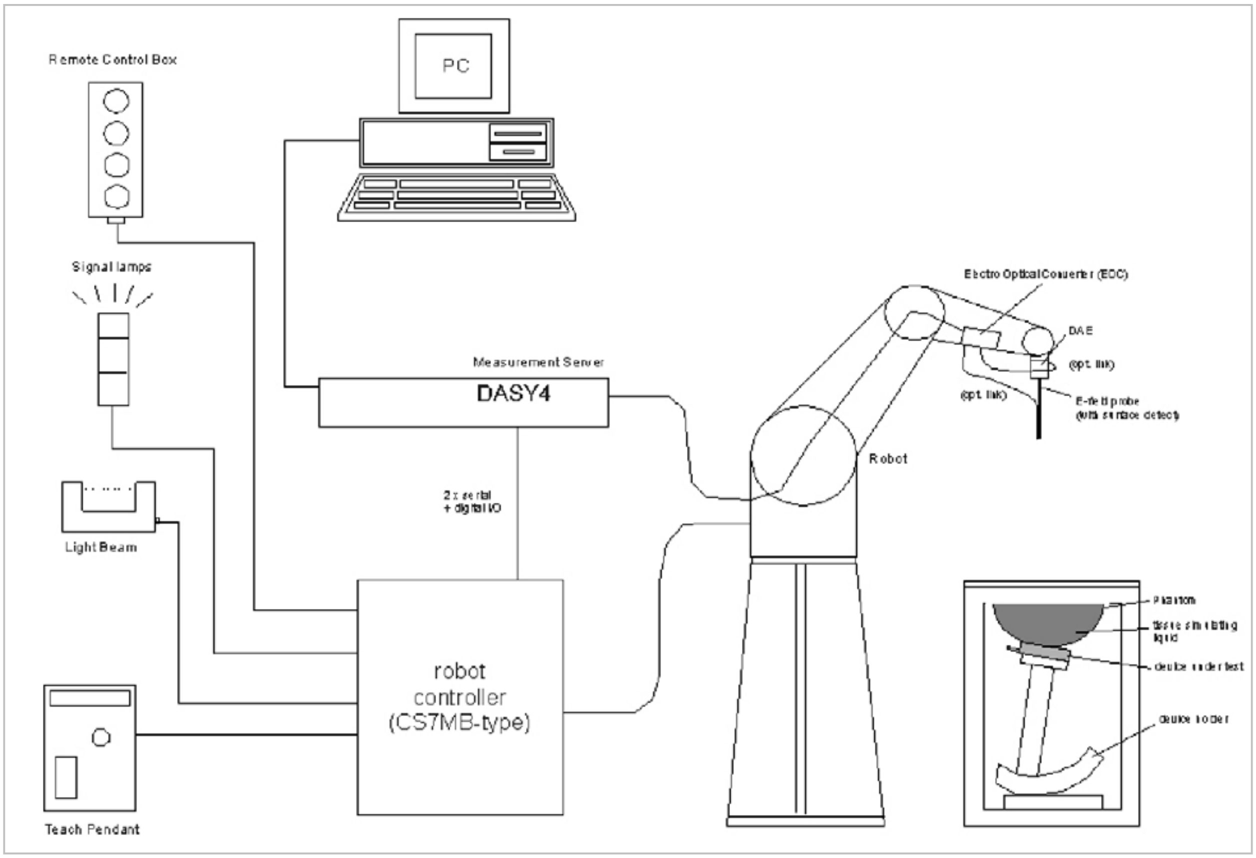
3 SYSTEM DESCRIPTION



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 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 controls 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 to validate the proper functioning of the system.

4 SYSTEM COMPONENT

4.1 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 DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 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 pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

4.2 DATA ACQUISITION ELECTRONICS (DAE)

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. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

4.3 EX3DV3 ISOTROPIC E-FIELD PROBE FOR DOSIMETRIC MEASUREMENTS

Construction: Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis);
± 0.5 dB in tissue material (rotation normal to probe axis)

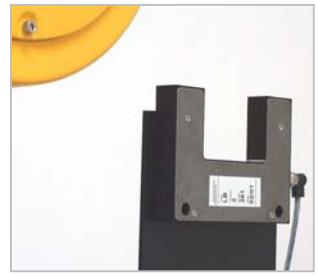
Dynamic Range: 10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)

Dimensions: Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Typical distance from probe tip to dipole centers: 1 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

4.4 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.



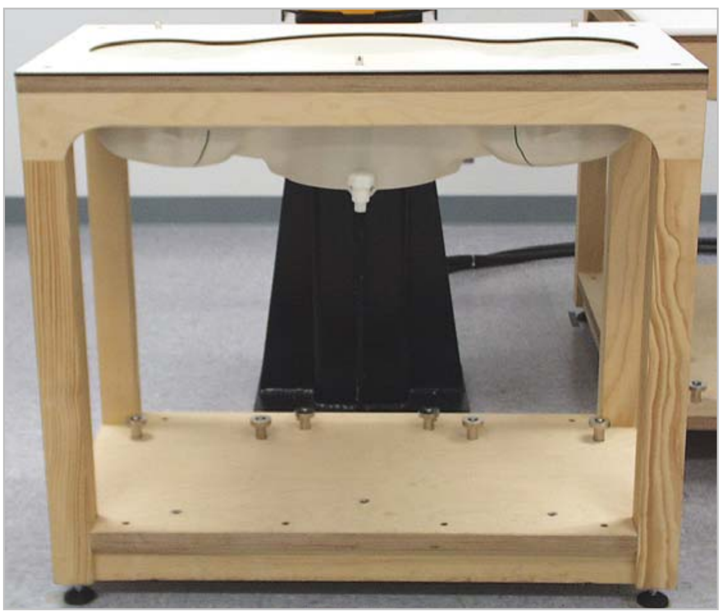
4.5 SAM PHANTOM (V4.0)

Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: Height: 810mm; Length: 1000mm; Width: 500mm



4.6 DEVICE HOLDER FOR SAM TWIN PHANTOM

Construction: In combination with the Twin SAM Phantom V4.0 or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

4.7 SYSTEM VALIDATION KITS

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 450, 900, 1800, 2450, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions: 450V2: dipole length: 270 mm; overall height: 330 mm
D900V2: dipole length: 149 mm; overall height: 330 mm
D1800V2: dipole length: 72 mm; overall height: 300 mm
D835V2: dipole length: 161; overall height: 330
D1900V2: dipole length: 68; overall height: 300
D2450V2: dipole length: 51.5 mm; overall height: 300 mm D5GHzV2: dipole length: 25.5 mm; overall height: 290 mm

4.8 COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUID

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

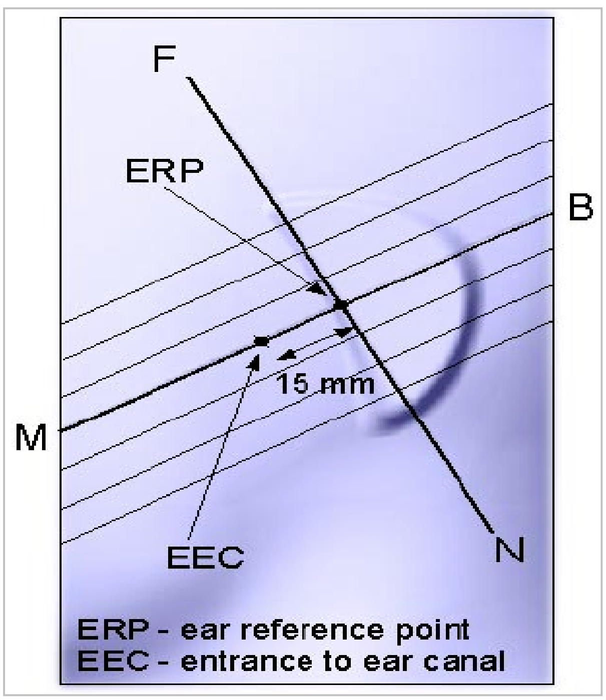
Ingredients (% by weight)	Frequency (MHz) 450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	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

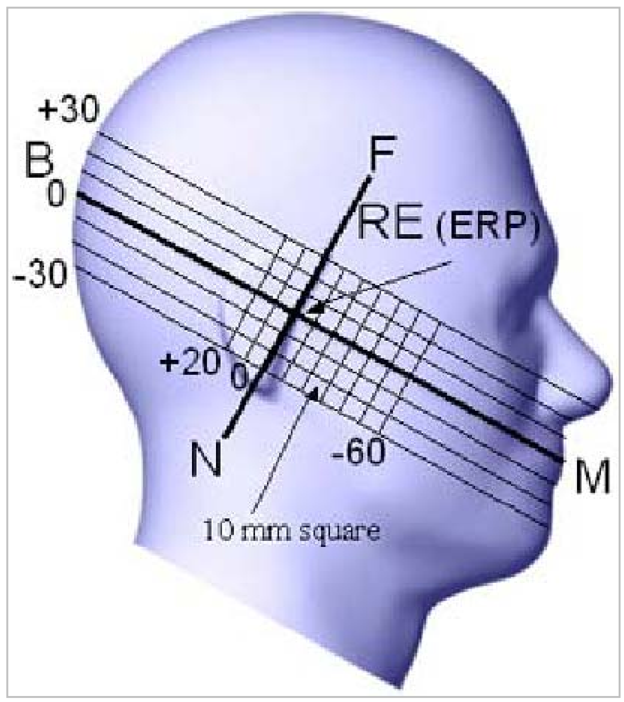
Salt: 99+% Pure Sodium Chloride   Sugar: 98+% Pure Sucrose
Water: De-ionized, 16 MΩ+ resistivity   HEC: Hydroxyethyl Cellulose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

5 TEST POSITIONS FOR DEVICES 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. A "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:





5.1 CHEEK/TOUCH POSITION

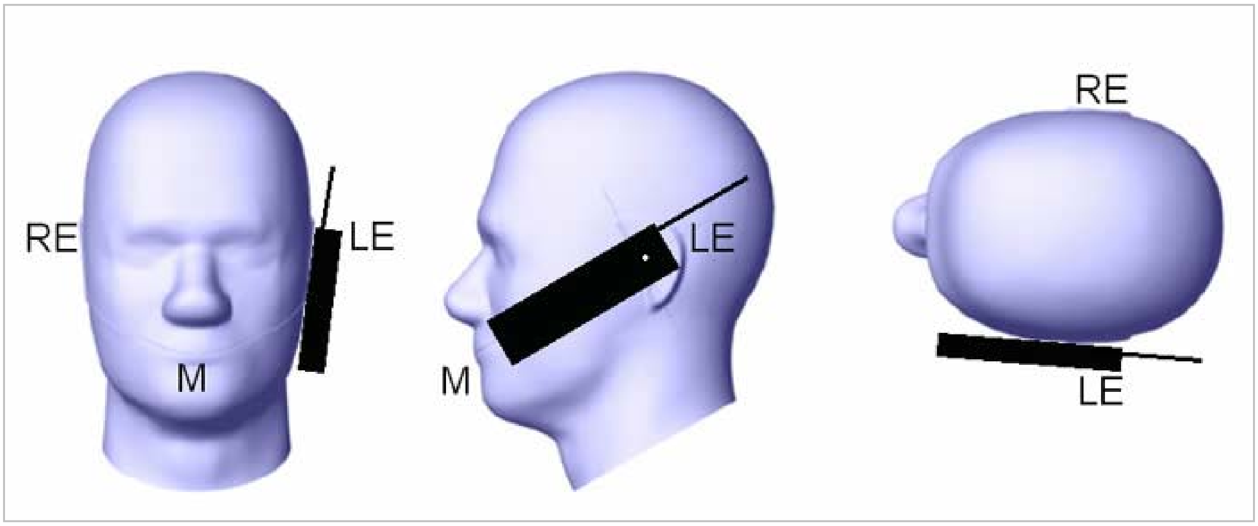
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

This test position is established:

i. When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.
ii. (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.

Cheek / Touch Position



5.2 EAR/TILT POSITION

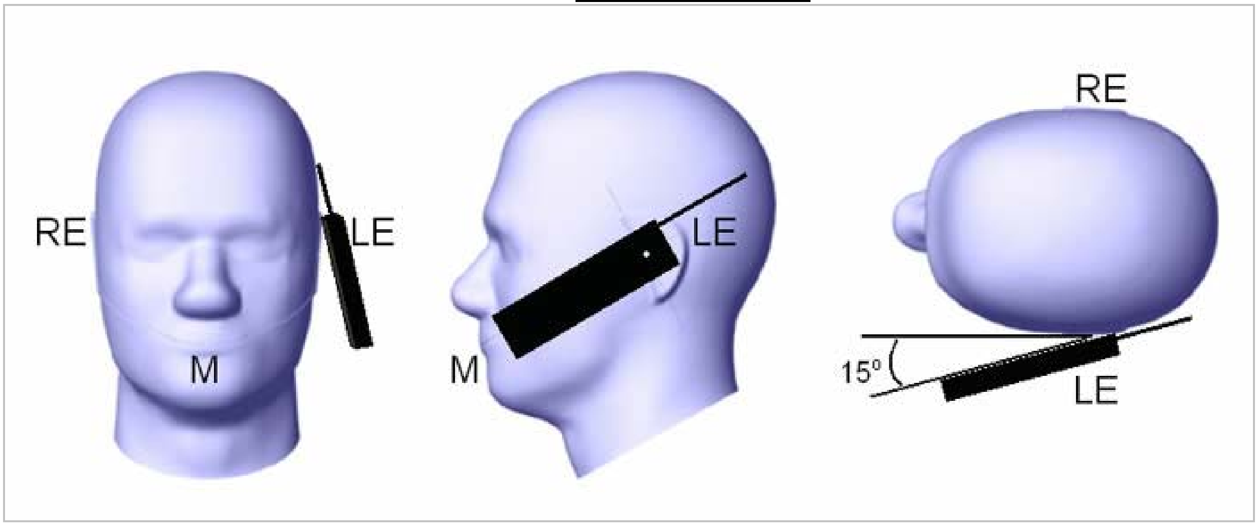
With the handset aligned in the "Cheek/Touch Position":

i. 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.

ii. (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 isby 15°. 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° 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 3.0 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° Position



6 TEST POSITIONS FOR BODY-WORN AND OTHER SIMILAR CONFIGURATIONS

☐ With the belt-clips or holsters

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. For purpose of determining test requirements, accessories may be divided into two categories: those that do not contain metallic components and those that do.

☐ When multiple accessories

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.

☐ Without the belt-clips or holsters

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.

☐ Transmitter that is designed to operate in front of a person’s face (face-held)

Transmitters that are designed to operate in front of a person’s face, in push-to-talk configurations, should be tested for SAR compliance with the front of the device positioned at 2.5 cm from a flat phantom. Frontal face-phantoms are typically not recommended because of the potential of higher E-field probe boundary-effects errors in the non-smooth regions of these face phantoms, such as the nose, lips and eyes etc. For devices that are carried next to the body, such as shoulder, waist or chest-worn transmitters, SAR compliance should be tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in normal use configurations.

☐ With neck-strap or lanyard

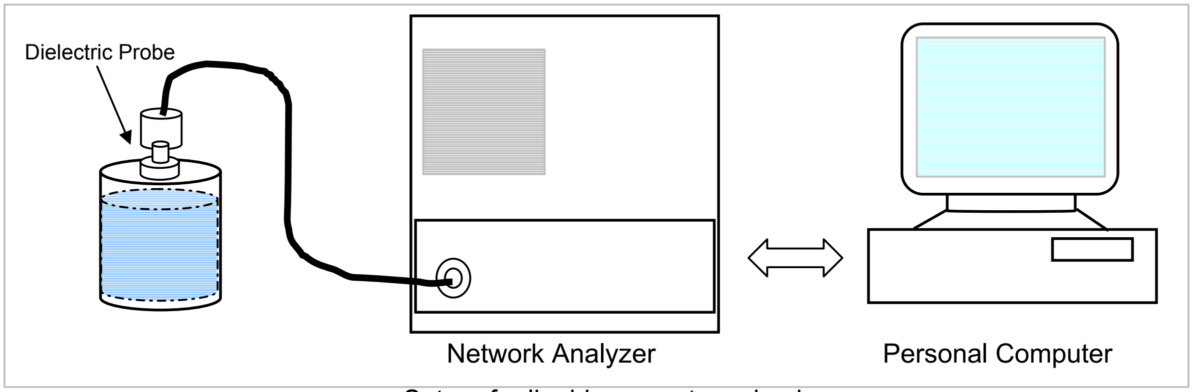
SAR data is requested for cellphones designed to be used with a headset while worn next to the body using a neck-strap or lanyard; device should be tested with front and back sides in contact with a flat phantom

☒ Lap-held

SAR is tested for a lap-held position with the bottom of the computer in direct contact against a flat phantom.

7 SIMULATING LIQUID PARAMETERS CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values. The relative permittivity and conductivity of the tissue material should be within ± 5% of the values given in the table below.



Set-up for liquid parameters check

Reference Values of Tissue Dielectric Parameters for Head and Body Phantom

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE Standard 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

Target Frequency (MHz)	**Head**		**Body**	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
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

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

7.1 SIMULATING LIQUID PARAMETER CHECK RESULT

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature =24°C; Relative humidity = 40% Measured by: Anson Lu

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	e"	Relative Permittivity (e'):	52.7	51.3438	-2.57	± 5
			14.7343	Conductivity (σ):	1.95	2.00824	2.99	± 5

Liquid Check
Ambient temperature: 24.0 deg. C; Liquid temperature: 23.0 deg C
June 24, 2005 11:23 AM

Frequency	e'	e''
2400000000.	51.5408	14.4882
2410000000.	51.5018	14.5459
2420000000.	51.4610	14.5917
2430000000.	51.4255	14.6315
2440000000.	51.4046	14.6726
2450000000.	51.3438	14.7343
2460000000.	51.3240	14.7678
2470000000.	51.2816	14.7970
2480000000.	51.2464	14.8513
2490000000.	51.2135	14.8886
2500000000.	51.1567	14.9646

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature =24°C; Relative humidity = 45% Measured by: James Lee

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	e"	Relative Permittivity (e'):	52.7	52.2075	-0.93	± 5
			14.3916	Conductivity (σ):	1.95	1.96153	0.59	± 5

Liquid Check
Ambient temperature: 24.0 deg. C; Liquid temperature: 23.0 deg C
June 28, 2005 08:35 AM

Frequency	e'	e"
2400000000.	52.3695	14.1858
2410000000.	52.3474	14.2300
2420000000.	52.3064	14.2609
2430000000.	52.2785	14.3098
2440000000.	52.2484	14.3319
2450000000.	52.2075	14.3916
2460000000.	52.1594	14.4003
2470000000.	52.1293	14.4628
2480000000.	52.1005	14.4900
2490000000.	52.0553	14.5355
2500000000.	52.0412	14.5946

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature =24°C; Relative humidity = 45% Measured by: Anson Lu

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	e"	Relative Permittivity (e'):	52.7	52.1634	-1.02	± 5
			14.2244	Conductivity (σ):	1.95	1.93874	-0.58	± 5

Liquid Check
Ambient temperature: 24.0 deg. C; Liquid temperature: 23.0 deg C
June 29, 2005 08:57 AM

Frequency	e'	e"
2400000000.	52.3045	14.0228
2410000000.	52.2861	14.0735
2420000000.	52.2534	14.1354
2430000000.	52.2403	14.1579
2440000000.	52.1806	14.1840
2450000000.	52.1634	14.2244
2460000000.	52.1135	14.2470
2470000000.	52.0715	14.2716
2480000000.	52.0263	14.2897
2490000000.	51.9868	14.3431
2500000000.	51.9814	14.4095

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

8 SYSTEM PERFORMANCE CHECK

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV4-SN: 3552 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point 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 15 mm from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
- Special 5 x 5 x 7 fine cube was chosen for cube integration(dx=dy=7.5mm; dz=5mm).
- Distance between probe sensors and phantom surface was set to 2.5 mm.
- The dipole input power (forward power) was 250 mW±3%.
- The results are normalized to 1 W input power.

Reference SAR Values

The reference SAR values were using measurement results indicated in the dipole calibration document (See attached dipole certificate).

f (MHz)	Head Tissue		Body Tissue	
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
2450	52.0	23.8	54.8	25.4

8.1 SYSTEM PERFORMANCE CHECK RESULTS

@ System Validation Dipole: D2450V2 SN: 748

Date: June 24, 2005

Ambient Temperature = 24°C, Relative humidity = 23% Measured by: Anson Lu

Body Simulating Liquid			Mrasured		$Target\_{1g}$	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	23	15	13.3	53.2	54.8	-2.92	± 10

Date: June 28, 2005

Ambient Temperature = 24°C, Relative humidity = 45% Measured by: James Lee

Body Simulating Liquid			Mrasured		$Target\_{1g}$	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	23	15	12.8	51.2	54.8	-6.57	± 10

Date: June 29, 2005

Ambient Temperature = 24°C, Relative humidity = 45% Measured by: Anson Lu

Body Simulating Liquid			Mrasured		$Target\_{1g}$	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	23	15	12.5	50	54.8	-8.76	± 10

9 SAR MEASUREMENT PROCEDURE

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 flat section of the flat phantom is measured at a distance of 2.5 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. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

c) Around this point, a volume of X=Y=Z=30 mm is assessed by measuring 5 x 5 x 7 mm 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 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 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 to evaluate the actual power drift.

DASY4 SAR MEASUREMENT PROCEDURE

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties (for example, 1.2 mm for an EX3DV3 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 fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal 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 Standard 1528, 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.

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 Zoom Scan measures 5 x 5 x 7 mm points within a cube whose base faces are centered on 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 measures the field at the same location as the most recent power reference measurement 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. 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 measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

10 PROCEDURES USED TO ESTABLISH TEST SIGNAL

The following procedures had been used to prepare the EUT for the SAR test.

- The client supplied a special driving program to program the EUT to continually transmit the specified maximum power. And also to change the channel frequency.
- Power levels were set to maximum power prior to SAR measurement.

B mode

Ch	f (MHz)	Rate (Mbps)	Conducted Power Avg Power
1	2412	1	16.29
6	2437	1	16.33
11	2462	1	16.18

G mode

Ch	f (MHz)	Rate (Mbps)	Conducted Power Avg Power
1	2412	6	16.20
6	2437	6	16.18
11	2462	6	16.10

11 SAR TEST SUMMARY

11.1 Host # 1 – IBM Laptop

Note: The setup photo on this page has been extracted under a separate file.

802.11b (1 Mbps), 95% duty cycle

Separation. distance (mm)	Antenna	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)
11	0	1	2412	0.588	-0.200	0.616
11	0	6	2437	0.541	-0.200	0.566
11	0	11	2462	0.539	-0.139	0.557
11	1	1	2412	0.701	-0.097	0.717
11	1	6	2437	0.623	-0.200	0.652
11	1	11	2462	0.574	-0.200	0.601

802.11g (6 Mbps), 63% duty cycle

Separation. distance (mm)	Antenna	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)
		1	2412			
11	0	6	2437	0.393	-0.078	0.400
		11	2462			
		1	2412			
11	1	6	2437	0.449	-0.159	0.466
		11	2462			

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process.
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

11.2 Host # 2 – Toshiba Laptop

Note: The setup photo on this page has been extracted under a separate file.

802.11b (1 Mbps), 95% duty cycle

Separation. distance (mm)	Antenna	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)
		1	2412			
11	0	6	2437	0.528	-0.181	0.550
		11	2462			
11	1	1	2412	0.687	-0.010	0.689
11	1	6	2437	0.620	-0.124	0.638
11	1	11	2462	0.562	-0.130	0.579

802.11g (6 Mbps), 63% duty cycle

Separation. distance (mm)	Antenna	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)
		1	2412			
11	0	6	2437	0.376	-0.180	0.392
		11	2462			
		1	2412			
11	1	6	2437	0.454	-0.200	0.475
		11	2462			

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process.
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

11.3 Host # 3 – HP Laptop

Note: The setup photo on this page has been extracted under a separate file.

802.11b (1 Mbps), 95% duty cycle

Separation. distance (mm)	Antenna	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)
		1	2412			
13	0	6	2437	0.495	-0.193	0.517
		11	2462			
13	1	1	2412	0.697	-0.010	0.699
13	1	6	2437	0.595	-0.172	0.619
13	1	11	2462	0.534	-0.114	0.548

802.11g (6 Mbps), 63% duty cycle

Separation. distance (mm)	Antenna	Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)
		1	2412			
13	0	6	2437	0.362	-0.117	0.372
		11	2462			
		1	2412			
13	1	6	2437	0.432	-0.179	0.450
		11	2462			

Notes:
1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process.
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

12 PHOTO

12.1 EUT

Note: The photos on this page have been extracted under a separate file.

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12.2 HOST DEVICE

Note: The photos on this page have been extracted under a separate file.

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Note: The photos on this page have been extracted under a separate file.

13 MEASUREMENT UNCERTAINTY

Uncertainty component	Tol. (±%)	Probe Dist.	Div.	Ci (1g)	Ci (10g)	Std. Unc.(±%)	
						Ui (1g)	Ui(10g)
Measurement System							
Probe Calibration	4.80	N	1	1	1	4.80	4.80
Axial Isotropy	4.70	R	1.732	0.707	0.707	1.92	1.92
Hemispherical Isotropy	9.60	R	1.732	0.707	0.707	3.92	3.92
Boundary Effects	1.00	R	1.732	1	1	0.58	0.58
Linearity	4.70	R	1.732	1	1	2.71	2.71
System Detection Limits	1.00	R	1.732	1	1	0.58	0.58
Readout Electronics	1.00	N	1	1	1	1.00	1.00
Response Time	0.80	R	1.732	1	1	0.46	0.46
Integration Time	2.60	R	1.732	1	1	1.50	1.50
RF Ambient Conditions - Noise	1.59	R	1.732	1	1	0.92	0.92
RF Ambient Conditions - Reflections	0.00	R	1.732	1	1	0.00	0.00
Probe Positioner Mechnical Tolerance	0.40	R	1.732	1	1	0.23	0.23
Probe Positioning With Respect to Phantom Shell	2.90	R	1.732	1	1	1.67	1.67
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	3.90	R	1.732	1	1	2.25	2.25
Test sample Related							
Test Sample Positioning	1.10	N	1	1	1	1.10	1.10
Device Holder Uncertainty	3.60	N	1	1	1	3.60	3.60
Power and SAR Drift Measurement	5.00	R	1.732	1	1	2.89	2.89
Phantom and Tissue Parameters							
Phantom Uncertainty	4.00	R	1.732	1	1	2.31	2.31
Liquid Conductivity - Target	5.00	R	1.732	0.64	0.43	1.85	1.24
Liquid Conductivity - Meas.	8.60	N	1	0.64	0.43	5.50	3.70
Liquid Permittivity - Target	5.00	R	1.732	0.6	0.49	1.73	1.41
Liquid Permittivity - Meas.	3.30	N	1	0.6	0.49	1.98	1.62
Combined Standard Uncertainty	RSS					11.44	10.49
Expanded Uncertainty (95% Confidence Interval)	K=2					22.87	20.98

Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

14 EQUIPMENT LIST

Name of Equipment	Manufacturer	Type/Model	Serial Number	Cal. Due date
Robot - Six Axes	Stäubli	RX90BL	N/A	N/A
Robot Remote Control	Stäubli	CS7MB	3403-91535	N/A
DASY4 Measurement Server	SPEAG	SEUMS001BA	1041	N/A
Probe Alignment Unit	SPEAG	LB (V2)	261	N/A
S-Parameter Network Analyzer	Agilent	8753ES-6	US39173569	8/19/05
Electronic Probe kit	Hewlett Packard	85070C	N/A	N/A
E-Field Probe	SPEAG	EX3DV4	3552	3/19/06
Thermometer	ERTCO	639-1	8402	10/13/2005
Thermometer	ERTCO	639-1	8404	10/21/2005
Thermometer	ERTCO	637-1	8661	10/21/2005
SAM Phantom (SAM1)	SPEAG	TP-1185	QD000P40CA	N/A
SAM Phantom (SAM2)	SPEAG	TP-1015	N/A	N/A
Data Acquisition Electronics	SPEAG	DAE3 V1	500	2/7/06
System Validation Dipole	SPEAG	D2450V2	748	5/14/06
System Validation Dipole	SPEAG	D5GHzV2	1003	10/5/05
Signal General	R&H	SMP 04	DE34210	6/2/06
Power Meter	Giga-tronics	8651A	8651404	9/16/05
Power Sensor	Giga-tronics	80701A	1834588	9/16/05
Amplifier	Mini-Circuits	ZVE-8G	0360	N/A
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A
Radio Communication Tester	Rohde & Schwarz	CMU 200	838114/032	12/17/06
Simulating Liquid	CCS	M2450	N/A	within 24 hrs of first test

15 ATTACHMENT

No.	Contents	No. of page (s)
1	System Performance Check Plot	6
2	SAR Test Plot	24
3	Certificate of E-filed Probe EX3DV4 SN 3552	10
4	Certificate of System Validation Dipole D2450V2 SN 748	9

END OF REPORT