SAR Evaluation Report

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

FOR

802.11b/g Compact Flash Card in 700C Handheld Scanner with GSM/GPRS, CDMA and Bluetooth

FCC ID: EHA2610CF

Model: 2610CF

REPORT NUMBER: 05U3344-1

ISSUE DATE: March 30, 2005

Prepared for

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Prepared by

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Revision History

Rev.	Revisions	Revised By

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: March 24 -30, 2005

APPLICANT:	Intermec Technologies Corporation
ADDRESS:	6001 36th Avenue West Everett, Washington 98203-9280 United States
FCC ID:	EHA2610CF
MODEL:	2610CF
DEVICE CATEGORY:	Portable Device
EXPOSURE CATEGORY:	General Population/Uncontrolled Explosure

802.11b/g Compact Flash Card in 700C Handheld Scanner with GSM/GPRS, CDMA and Bluetooth.

Test Sample is a:	Production unit		
FCC Rule Parts	Descriptions	The Highest Collocated SAR Values [1g_mW/g]	
47 CFR 15.247	802.11b/g Compact Flash Card in 700C Handheld Scanner with **GSM/GPRS** and Bluetooth	Head:	0.443
		Body:	0.779
	802.11b/g Compact Flash Card in 700C Handheld Scanner with **CDMA** and Bluetooth	Head:	0.368
		Body:	0.782

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).

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

802.11b/g Compact Flash Card in 700C Handheld Scanner with GSM/GPRS, CDMA and Bluetooth. GPRS Class Type: 10 (4 Dn/2 Up/ 5 Sum) Phone capabilities: Class B (Class B phone can be attached to both GPRS and GSM services, using one service at a time)	
Host Device(s):	700C Handheld Scanner - SN: 18190400042 with 802.11b/g Compact Flash Card, GSM/GPRS and Bluetooth and SN: 13790400010 with 802.11b/g Compact Flash Card, CDMA and Bluetooth.
Normal operation:	- Held to ear - Worn on body
Body worn Accessories:	- Belt clip, P/N: 805-612-001 - 2 belt mounted holsters, P/N: 815-047-001 and 815-047-002
Earphone/Headset Jack:	Earphone
Duty cycle:	100% for 802.11bg 100% for CDMD (Cellular & PCS band) 12.5% for GMS mode; 25% for GPRS mode 100% for Bluetooth
Power supply:	7.2 Vdc Lithium ION battery pack (Only one type of battery to be used in the 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.”

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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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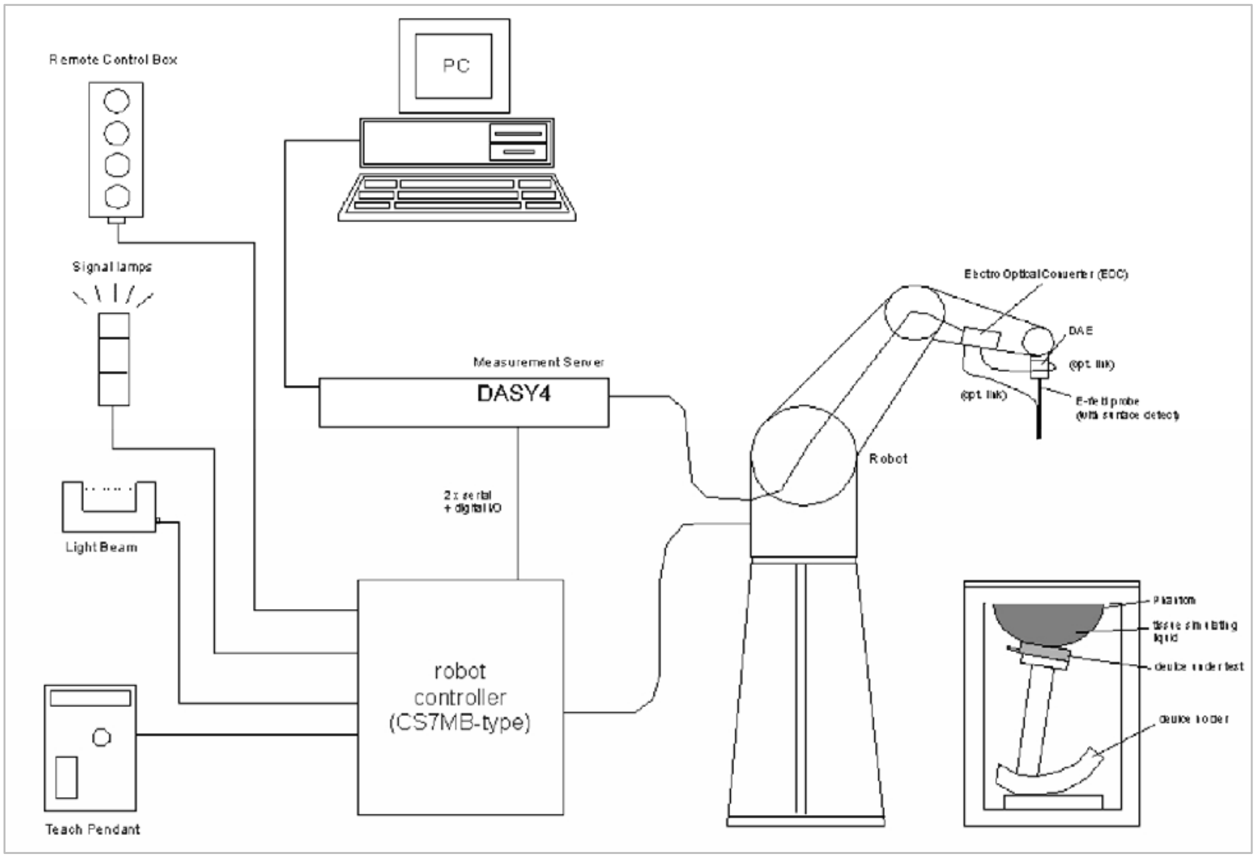
3 SYSTEM DESCRIPTION



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 COMPONENTS

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.

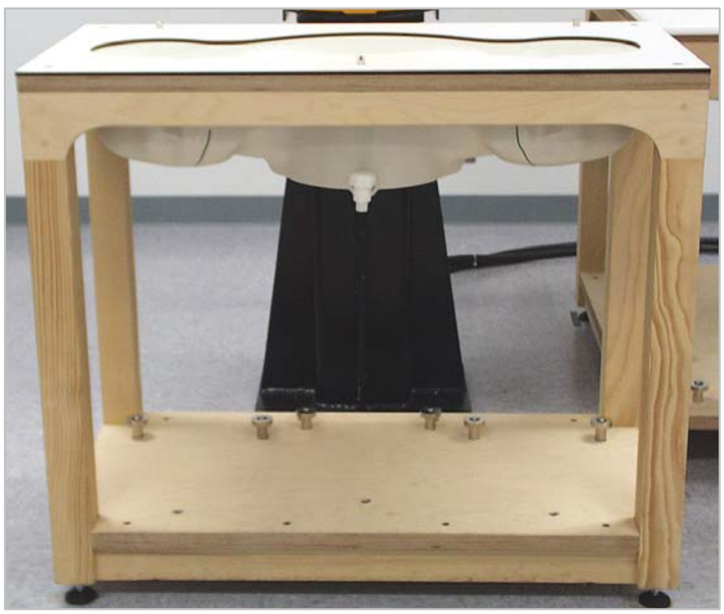
4.5 SAM PHANTOM (V4.0)

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.

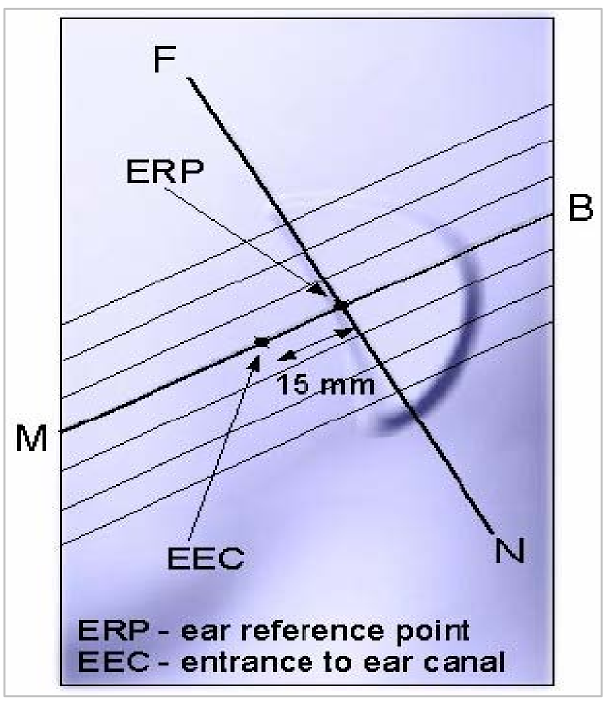
Ingredients (% by weight)	Frequency (MHz) 450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0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

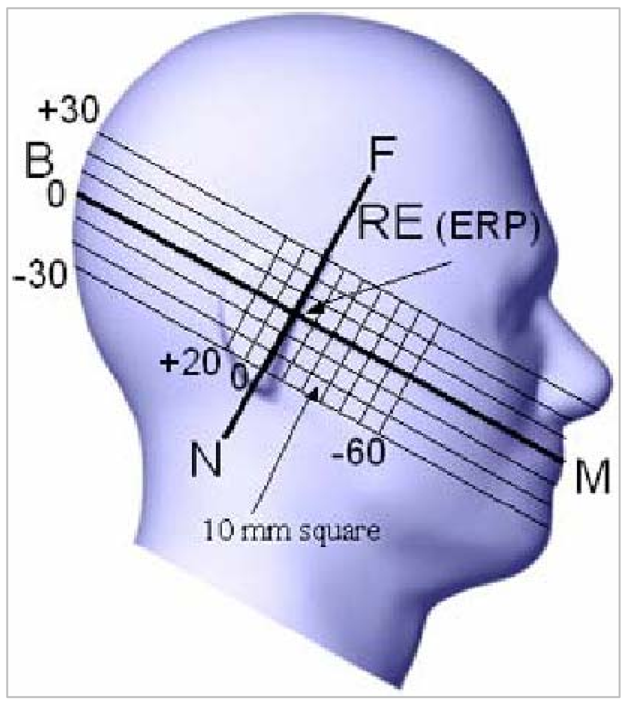
Salt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
Water: De-ionized, 16 MΩ+ resistivity HEC: Hydroxyethyl Cellulose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

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

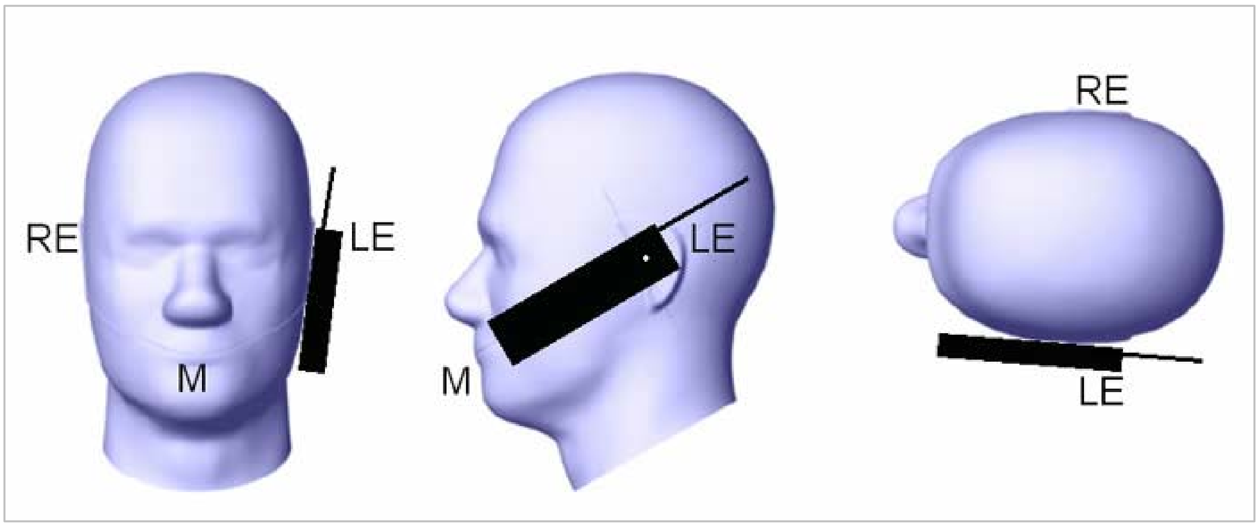
The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom.

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

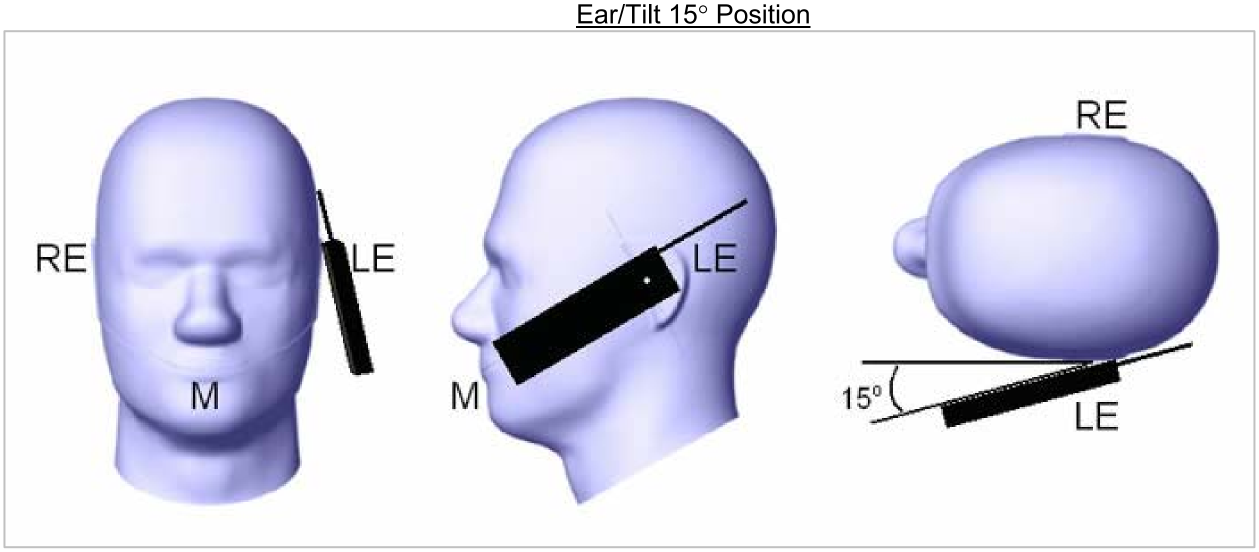
With the handset aligned in the "Cheek/Touch Position":

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

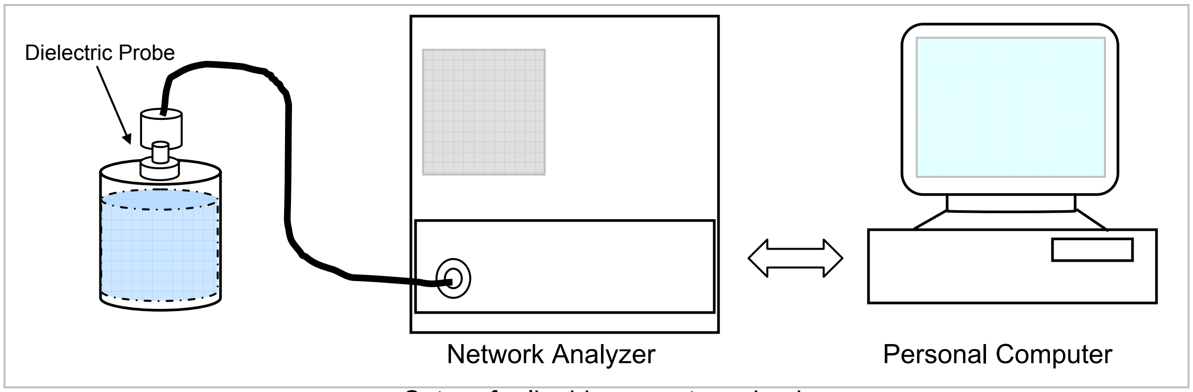
SAR data is requested for cellphones designed to be used with a headset while worn next to the body using a neck-strap or lanyard; device should be tested with front and back sides in contact with a flat phantom

☐ 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 Parameter Check Result @ Head 835 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 38% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
835	23	15	e'	Relative Permittivity (e"):	41.5	41.5036	0.01	± 5
			20.1698	Conductivity (σ):	0.90	0.93693	4.10	± 5

Simulating Liquid Dielectric Parameters Check @ 835 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 24, 2005 07:47 AM

Frequency	e'	e"
750000000.	42.6273	20.5250
755000000.	42.5801	20.4999
760000000.	42.5124	20.4805
765000000.	42.4376	20.4293
770000000.	42.3667	20.3891
775000000.	42.2794	20.4101
780000000.	42.2214	20.3675
785000000.	42.1360	20.3439
790000000.	42.0830	20.3122
795000000.	42.0234	20.2937
800000000.	41.9287	20.2631
805000000.	41.8537	20.2605
810000000.	41.8016	20.2574
815000000.	41.7577	20.2414
820000000.	41.7050	20.1905
825000000.	41.6226	20.1644
830000000.	41.5487	20.1843
835000000.	41.5036	20.1698
840000000.	41.4574	20.1296
845000000.	41.3649	20.0714
850000000.	41.3120	20.0759
855000000.	41.2849	20.0213
860000000.	41.2282	20.0066
865000000.	41.1711	19.9513
870000000.	41.1000	19.9518
875000000.	41.0395	19.9494
880000000.	41.0106	19.9482
885000000.	40.9529	19.9151
890000000.	40.8684	19.8903
895000000.	40.8456	19.8679
900000000.	40.7958	19.8537

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$

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

Simulating Liquid Parameter Check Result @ Muscle 835 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 38% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
835	23	15	e'	Relative Permittivity (e"):	55.2	57.1201	3.48	± 5
			21.5824	Conductivity (σ):	0.97	1.0025	3.36	± 5

Simulating Liquid Dielectric Parameters Check @ 835 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 24, 2005 02:14 PM

Frequency	e'	e''
750000000.	57.9164	22.0652
755000000.	57.8936	22.0552
760000000.	57.8345	21.9740
765000000.	57.7312	21.9335
770000000.	57.6898	21.8951
775000000.	57.6465	21.8814
780000000.	57.5919	21.8014
785000000.	57.5638	21.7593
790000000.	57.4918	21.7220
795000000.	57.4667	21.7141
800000000.	57.4136	21.6590
805000000.	57.3766	21.6444
810000000.	57.3575	21.6744
815000000.	57.3267	21.6401
820000000.	57.2926	21.6244
825000000.	57.2212	21.6118
830000000.	57.1625	21.6282
835000000.	57.1201	21.5824
840000000.	57.0669	21.5635
845000000.	57.0169	21.5214
850000000.	56.9678	21.4794
855000000.	56.9312	21.4109
860000000.	56.8839	21.3690
865000000.	56.8225	21.3442
870000000.	56.7641	21.2968
875000000.	56.7457	21.2661
880000000.	56.7058	21.2335
885000000.	56.6684	21.1788
890000000.	56.6339	21.1553
895000000.	56.6493	21.1220
900000000.	56.6515	21.0940

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$
$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Parameter Check Result @ Head 835 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
835	23	15	e'	Relative Permittivity (e"):	41.5	41.5171	0.04	± 5
			20.0286	Conductivity (σ):	0.90	0.9304	3.37	± 5

Simulating Liquid Dielectric Parameters Check @ 835 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 25, 2005 09:46 AM

Frequency	e'	e''
750000000.	42.6102	20.4138
755000000.	42.5415	20.3950
760000000.	42.4925	20.3600
765000000.	42.4204	20.3202
770000000.	42.3679	20.2645
775000000.	42.2909	20.2835
780000000.	42.2383	20.2624
785000000.	42.1707	20.2235
790000000.	42.1070	20.1952
795000000.	42.0443	20.1670
800000000.	41.9698	20.1316
805000000.	41.8890	20.1094
810000000.	41.8406	20.1222
815000000.	41.7771	20.0959
820000000.	41.7382	20.0580
825000000.	41.6506	20.0340
830000000.	41.5485	20.0304
835000000.	41.5171	20.0286
840000000.	41.4539	20.0044
845000000.	41.3834	19.9511
850000000.	41.3056	19.9423
855000000.	41.2618	19.9035
860000000.	41.2215	19.8745
865000000.	41.1697	19.8388
870000000.	41.0958	19.8304
875000000.	41.0364	19.7978
880000000.	41.0046	19.7880
885000000.	40.9773	19.7568
890000000.	40.9191	19.7551
895000000.	40.8996	19.7122
900000000.	40.8605	19.6855

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$
$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Parameter Check Result @ Muscle 835 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
835	23	15	e'	Relative Permittivity (e"):	55.2	56.6816	2.68	± 5
			21.5172	Conductivity (σ):	0.97	0.9995	3.04	± 5

Simulating Liquid Dielectric Parameters Check @ 835 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 25, 2005 06:05 PM

Frequency	e'	e"
750000000.	57.5079	22.0392
755000000.	57.4508	21.9949
760000000.	57.4480	21.9317
765000000.	57.3718	21.8950
770000000.	57.2933	21.8479
775000000.	57.2625	21.8314
780000000.	57.2138	21.7627
785000000.	57.1671	21.7291
790000000.	57.1102	21.6646
795000000.	57.0666	21.6653
800000000.	57.0193	21.6213
805000000.	56.9843	21.6076
810000000.	56.9402	21.5972
815000000.	56.8966	21.5698
820000000.	56.8539	21.5423
825000000.	56.7736	21.5462
830000000.	56.7120	21.5656
835000000.	56.6816	21.5172
840000000.	56.6209	21.5031
845000000.	56.5730	21.4621
850000000.	56.5261	21.4212
855000000.	56.4726	21.3613
860000000.	56.4539	21.3319
865000000.	56.4190	21.2873
870000000.	56.3662	21.2502
875000000.	56.3329	21.2057
880000000.	56.3245	21.1944
885000000.	56.2576	21.1426
890000000.	56.2453	21.1437
895000000.	56.2769	21.0947
900000000.	56.2463	21.0607

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$

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

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature =23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	e'	Relative Permittivity (e"):	52.7	52.0631	-1.21	± 5
			14.8225	Conductivity (σ):	1.95	2.02026	3.60	± 5

Simulating Liquid Dielectric Parameters Check @ 2450 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 28, 2005 03:01 PM

Frequency	e'	e"
2400000000.	52.3010	14.6295
2410000000.	52.2854	14.5719
2420000000.	52.2465	14.5972
2430000000.	52.1924	14.6423
2440000000.	52.1034	14.7364
2450000000.	52.0631	14.8225
2460000000.	52.0625	14.9352
2470000000.	52.0482	15.0624
2480000000.	51.9783	15.1745
2490000000.	51.9180	15.1947
2500000000.	51.8991	15.1277

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$
$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Parameter Check Result @ Head 2450 MHz

Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	e'	Relative Permittivity (e"):	39.2	39.2436	0.11	± 5
			13.8541	Conductivity (σ):	1.80	1.888	4.90	± 5

Simulating Liquid Dielectric Parameters Check @ 2450 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 28, 2005 04:50 PM

Frequency	e'	e"
2400000000.	39.4242	13.7303
2410000000.	39.4016	13.7505
2420000000.	39.3690	13.7680
2430000000.	39.3376	13.7791
2440000000.	39.2918	13.8252
2450000000.	39.2436	13.8541
2460000000.	39.1887	13.9002
2470000000.	39.1424	13.9225
2480000000.	39.0701	13.9787
2490000000.	39.0314	14.0205
2500000000.	38.9843	14.0222

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$

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

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature =23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	23	15	e'	Relative Permittivity (e"):	52.7	52.5434	-0.30	± 5
			14.8609	Conductivity (σ):	1.95	2.02549	3.87	± 5

Simulating Liquid Dielectric Parameters Check @ 2450 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 29, 2005 10:10 AM

Frequency	e'	e"
2400000000.	52.7272	14.6427
2410000000.	52.7016	14.6791
2420000000.	52.6595	14.7103
2430000000.	52.6222	14.7439
2440000000.	52.5947	14.8078
2450000000.	52.5434	14.8609
2460000000.	52.5000	14.9009
2470000000.	52.4594	14.9536
2480000000.	52.4071	14.9991
2490000000.	52.3559	15.0559
2500000000.	52.3359	15.0529

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$
$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Parameter Check Result @ Head 2450 MHz

Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid f (MHz)	Temp. (°C)	Depth (cm)	Parameters		Target	Measured	Deviation (%)	Limit (%)
2450	23	15	e'	Relative Permittivity (e"):	39.2	39.4975	0.76	± 5
			13.7723	Conductivity (σ):	1.80	1.877	4.28	± 5

Simulating Liquid Dielectric Parameters Check @ 2450 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 29, 2005 10:29 AM

Frequency	e'	e''
2400000000.	39.6873	13.6196
2410000000.	39.6509	13.6477
2420000000.	39.6120	13.6782
2430000000.	39.5859	13.6896
2440000000.	39.5392	13.7385
2450000000.	39.4975	13.7723
2460000000.	39.4464	13.8201
2470000000.	39.4110	13.8490
2480000000.	39.3515	13.8880
2490000000.	39.3043	13.9335
2500000000.	39.2719	13.9270

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 Parameters Check Result @ Head 1900 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
1900	23	15	e'	Relative Permittivity (e"):	40.0	41.8918	4.73	± 5
			13.6119	Conductivity (σ):	1.40	1.4388	2.77	± 5

Simulating Liquid Dielectric Parameters Check @ 1900 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 29, 2005 05:50 PM

Frequency	e'	e"
1710000000.	42.6382	13.0797
1720000000.	42.5833	13.0996
1730000000.	42.5231	13.1039
1740000000.	42.4418	13.1378
1750000000.	42.3840	13.1761
1760000000.	42.3397	13.1934
1770000000.	42.3202	13.2422
1780000000.	42.3267	13.2804
1790000000.	42.3060	13.3326
1800000000.	42.3245	13.3559
1810000000.	42.2949	13.3853
1820000000.	42.2656	13.4082
1830000000.	42.1754	13.4218
1840000000.	42.1044	13.4386
1850000000.	42.0289	13.4651
1860000000.	41.9702	13.4869
1870000000.	41.9113	13.4970
1880000000.	41.8860	13.5277
1890000000.	41.8837	13.5765
1900000000.	41.8918	13.6119
1910000000.	41.8748	13.6489

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 Parameters Check Result @ Muscle 1900 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
1900	23	15	e'	Relative Permittivity (e"):	53.3	53.6331	0.62	± 5
			14.6638	Conductivity (σ):	1.52	1.54996	1.97	± 5

Simulating Liquid Dielectric Parameters Check @ 1900 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 29, 2005 07:53 PM

Frequency	e'	e"
1710000000.	54.2720	14.1065
1720000000.	54.2205	14.1061
1730000000.	54.1423	14.1025
1740000000.	54.0891	14.1305
1750000000.	54.0473	14.2085
1760000000.	54.0132	14.2578
1770000000.	53.9858	14.2905
1780000000.	53.9956	14.3466
1790000000.	54.0095	14.3877
1800000000.	54.0232	14.4176
1810000000.	54.0011	14.4382
1820000000.	53.9824	14.4189
1830000000.	53.9047	14.4269
1840000000.	53.8512	14.4433
1850000000.	53.7623	14.4998
1860000000.	53.6956	14.5295
1870000000.	53.6093	14.5557
1880000000.	53.5918	14.5784
1890000000.	53.6146	14.6265
1900000000.	53.6331	14.6638
1910000000.	53.6333	14.7069

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$

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

Simulating Liquid Dielectric Parameters Check Result @ Head 1900 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
1900	23	15	e'	Relative Permittivity (e"):	40.0	40.9389	2.35	± 5
			13.7839	Conductivity (σ):	1.40	1.4570	4.07	± 5

Simulating Liquid Dielectric Parameters Check @ 1900 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 30, 2005 10:14 AM

Frequency	e'	e"
1710000000.	41.7843	13.1934
1720000000.	41.7316	13.1967
1730000000.	41.6582	13.2003
1740000000.	41.5865	13.2348
1750000000.	41.5049	13.2914
1760000000.	41.4558	13.3468
1770000000.	41.4056	13.4029
1780000000.	41.4029	13.4574
1790000000.	41.4002	13.5145
1800000000.	41.4122	13.5434
1810000000.	41.4007	13.5434
1820000000.	41.3830	13.5226
1830000000.	41.3185	13.5044
1840000000.	41.2494	13.5296
1850000000.	41.1783	13.5873
1860000000.	41.0616	13.6290
1870000000.	40.9693	13.6676
1880000000.	40.9130	13.6891
1890000000.	40.9210	13.7323
1900000000.	40.9389	13.7839
1910000000.	40.9385	13.8108

The conductivity (σ) can be given as:

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

where $f = \text{target } f * 10^6$

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

Simulating Liquid Dielectric Parameters Check Result @ Muscle 1900 MHz

Room Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
1900	23	15	ε"	Relative Permittivity (ε_r):	53.3	53.4751	0.33	± 5
			15.0095	Conductivity (σ):	1.52	1.58650	4.37	± 5

Simulating Liquid Dielectric Parameters Check @ 1900 MHz
Room Ambient Temperature: 23.5 deg. C, Liquid temperature: 23.0 deg. C
March 30, 2005 10:24 AM

Frequency	e'	e''
1710000000.	54.1805	14.3689
1720000000.	54.1137	14.3702
1730000000.	54.0687	14.3687
1740000000.	53.9894	14.4077
1750000000.	53.9413	14.4765
1760000000.	53.8796	14.5351
1770000000.	53.8558	14.6134
1780000000.	53.8795	14.6619
1790000000.	53.8709	14.7049
1800000000.	53.8916	14.7405
1810000000.	53.8847	14.7299
1820000000.	53.8667	14.7216
1830000000.	53.8070	14.7064
1840000000.	53.7420	14.7409
1850000000.	53.6499	14.8004
1860000000.	53.5502	14.8529
1870000000.	53.4552	14.8837
1880000000.	53.4202	14.9012
1890000000.	53.4482	14.9531
1900000000.	53.4751	15.0095
1910000000.	53.4813	15.0333

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 Head for 835 and 1900 MHz simulating liquids and Body for 2450MHz simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3-SN: 3531 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 10 mm (above 1 GHz) and f 15 mm (below 1 GHz) 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

IEEE Standard 1528 Recommended Reference Value

Frequency (MHz)	1 g SAR	10 g SAR	Local SAR at surface (Above feed point)	Local SAR at surface (y=2cm offset from feed point)
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	14.1	4.9
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
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

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: D835V2 SN:4d002 Date: March 24, 2005

Ambient Temperature = 23.5°C; Relative humidity = 38% Measured by: Sunny Shih

Head Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
835	23	15	2.58	10.32	9.5	8.63	± 10

@ System Validation Dipole: D835V2 SN:4d002 Date: March 25, 2005

Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Head Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
835	23	15	2.58	10.32	9.5	8.63	± 10

@ System Validation Dipole: D2450V2 SN: 748 Date: March 28, 2005

Ambient Temperature = 23.5°C, Relative humidity = 35% Measured by: Sunny Shih

Body Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	23	15	13.9	55.6	54.8	1.46	± 10

@ System Validation Dipole: D2450V2 SN: 748 Date: March 29, 2005

Ambient Temperature = 23.5°C, Relative humidity = 35% Measured by: Sunny Shih

Body Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	23	15	13.8	55.2	54.8	0.73	± 10

@ System Validation Dipole: D1900V2 SN:5d043 Date: March 29, 2005

Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Head Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
1900	23	15	10	40	39.7	0.76	± 10

@ System Validation Dipole: D1900V2 SN:5d043 Date: March 30, 2005

Ambient Temperature = 23.5°C; Relative humidity = 35% Measured by: Sunny Shih

Head Simulating Liquid			Mrasured		Target_1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
1900	23	15	10.3	41.2	39.7	3.78	± 10

9 SAR MEASUREMENT PROCEDURES

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 (below 5 G) 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 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

802.11bg Compact Flash Card

The client supplied a special driving program to program the EUT to continually transmit the specified maximum power.

The insertion loss of 10.2 dB (including 9.7 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Mode	Data rate (Mbps)	Channel	f (MHz)	Peak Conducted Output	
				Power (dBm)	Power (mW)
802.11b	1	1	2412	16.9	48.97
802.11b	1	6	2437	16.6	45.70
802.11b	1	11	2462	16.2	41.68
802.11g	6	1	2412	17.8	60.25
802.11g	6	6	2437	17.4	54.95
802.11g	6	11	2462	17.2	52.48

CDMA Cellular and PCS band

The insertion loss of 9.68 dB (Cellular band) and 9.72 (PCS band) was entered as an offset in the power meter to allow for direct reading of power.

CDMA Cellular band		
Channel	f (MHz)	Average conducted power (dBm)
1013	824.70	23.0
363	835.89	22.8
777	848.31	22.3
CDMA PCS band		
25	1851.25	20.6
600	1880.00	21.5
1175	1908.75	21.4

GSM/GPRS 850 & 1900

The following settings were used to configure the Radio Communication Tester, R&S model CMU 200.
GSM mode:
Network Support: *GSM only;* Main Service: *Circuit Switched*
Power Setting: *PCL: 0 (30 dBm)* for GSM1800/1900; *5 (33 dBm)* for GSM900/850
GPRS Mode:
Service Selection: *Test Mode A;* Main Service: *Packet Data*
Network Support: *GSM+GPRS*
Power Setting: *0 (36 dBm) for GPRS850; 0 (36 dBm) for GPRS1900*
The insertion loss of 9.68 dB (GSM850) and 9.72 (GSM1900) was entered as an offset in the power meter to allow for direct reading of power.

GSM850			
Channel	f (MHz)	Average conducted power (dBm)	
		GSM	GPRS
128	824.2	31.65	31.65
189	836.4	31.3	31.3
251	848.8	30.95	30.95
GSM1900			
512	1850.2	29.4	29.4
661	1880.0	28.7	28.7
810	1909.8	29.5	29.5

11 SAR MEASUREMENT RESULTS (700C with 802.11bg, GSM and Bluetooth)

11.1 Left Hand Side

Mode	Position	Channel	f (MHz)	(mW/g)	(dBm)	(mW/g)	Extrapolated (mW/g)	(mW/g)
GSM850	Tilt	189	836.4	0.205	-0.171	0.213	0.315	1.6
802.11b	Tilt	6	2437	0.095	-0.155	0.0988		
Bluetooth	Tilt	39	2441	0.0029	-0.154	0.0030		
GSM1900	Tilt	661	1880	0.103	-0.216	0.108	0.210	1.6

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 battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

11.2 Right Hand Side

Test		Channel	f (MHz)	Measured (mW/g)	Drift (dBm)	Extrapolated (mW/g)	Summation of Extrapolated (mW/g)	Limit (mW/g)
Mode	Position							
GSM850	Tilt	251	848.8	0.387	-0.120	0.398	0.443	1.6
802.11b	Tilt	6	2437	0.041	-0.041	0.0414		
Bluetooth	Tilt	39	2441	0.00366	-0.271	0.0039		
GSM1900	Tilt	661	1880	0.169	-0.126	0.174	0.219	1.6

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 battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

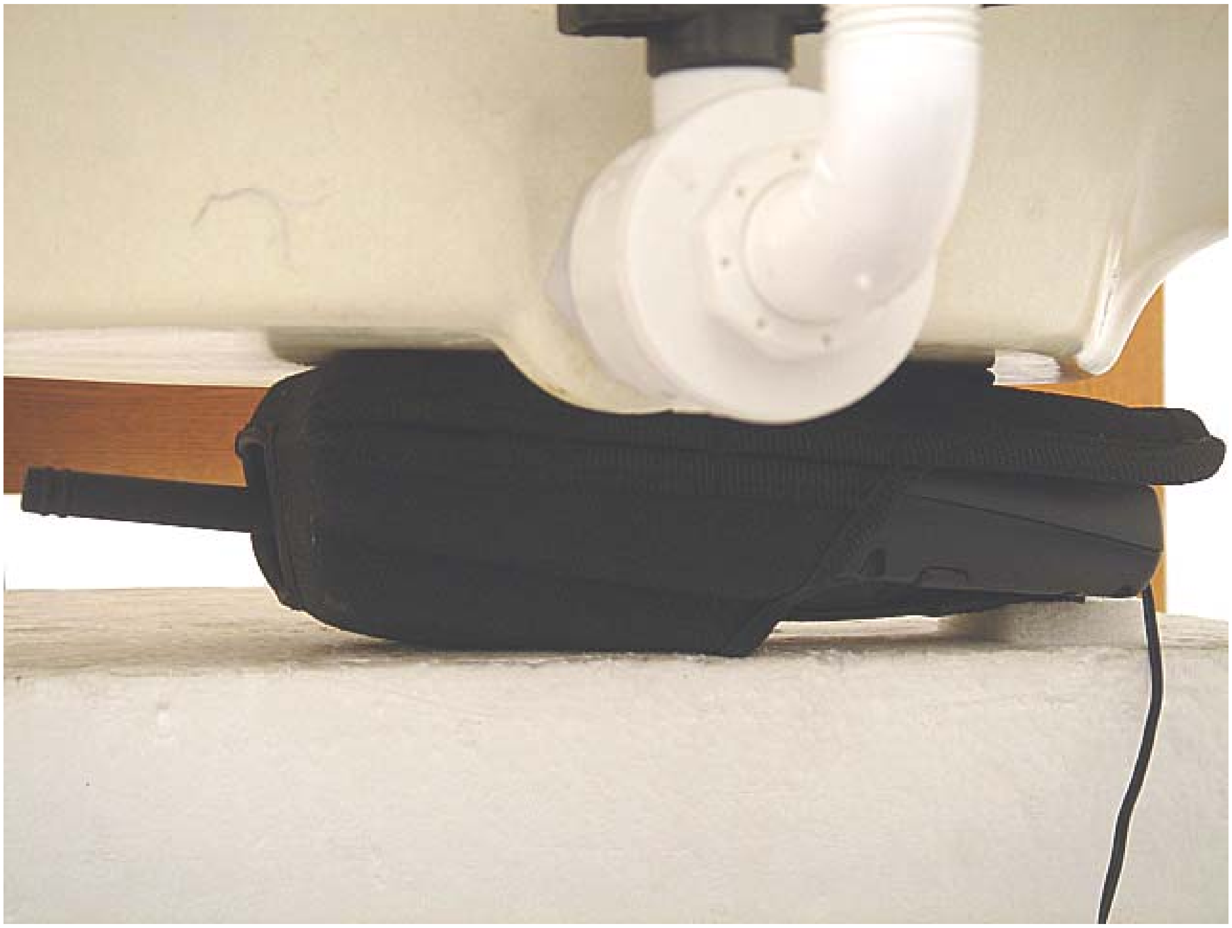
11.3 Body Worn Position – With Holster (814-417-002)/Left Side

Test Mode	Channel	f (MHz)	(mW/g)	(dBm)	(mW/g)	Extrapolated (mW/g)	(mW/g)
GSM850 (GPRS)	189	836.4	0.335	-0.239	0.354		
802.11b	6	2437	0.00973	-0.171	0.01012	0.368	1.6
Bluetooth	39	2441	0.00377	-0.187	0.00394		
GSM900 (GPRS)	600	1880	0.188	-0.150	0.195	0.209	1.6

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 earphone wire connected to the EUT to simulate hand-free operation in a body worn configuration.
3) The battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
4) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

11.4 Body Worn Position – With Holster (814-417-001)

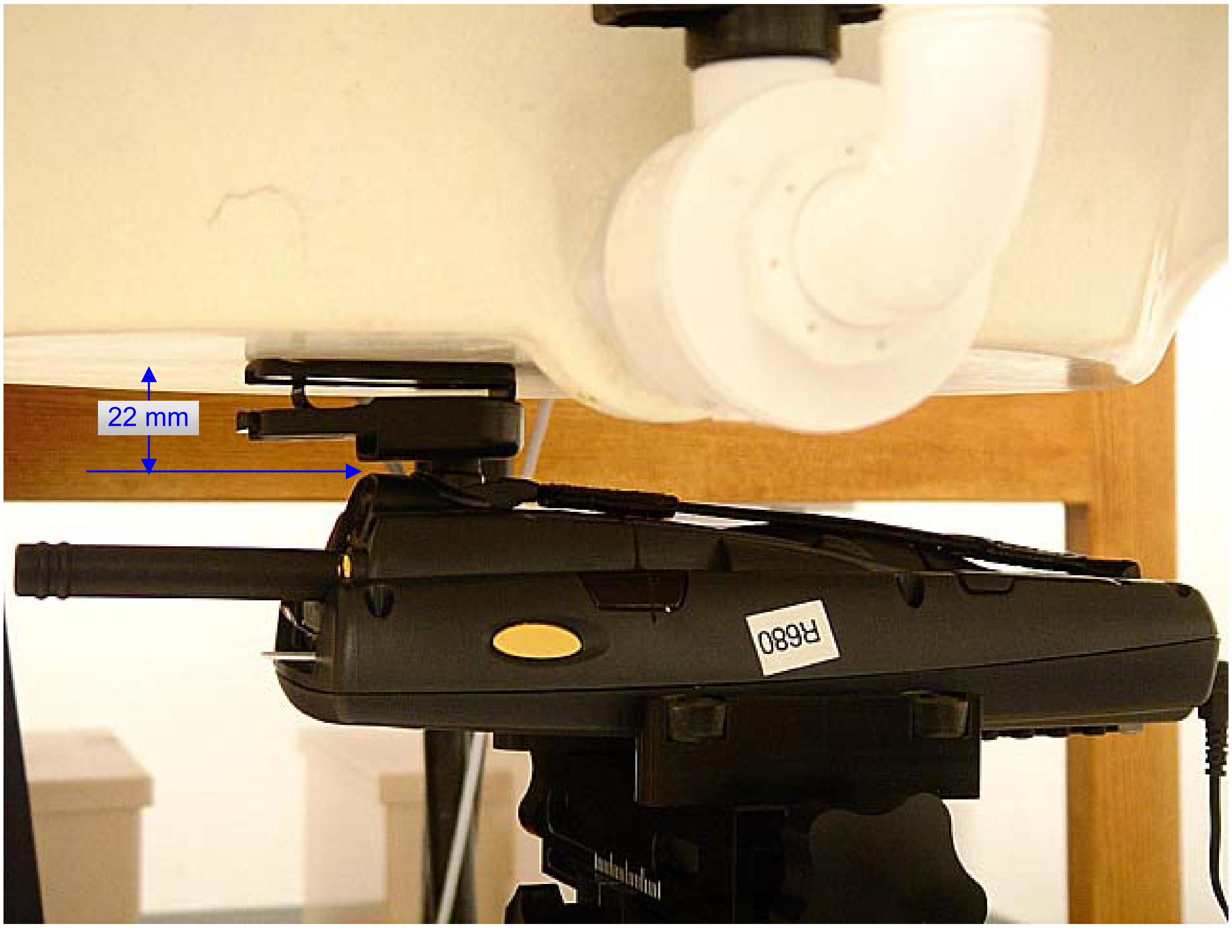


Test Mode	Channel	f (MHz)	Measured (mW/g)	Drift (dBm)	Extrapolated (mW/g)	Summation of Extrapolated (mW/g)	Limit (mW/g)
GSM850 (GPRS)	189	836.4	0.433	-0.205	0.454		
802.11b	6	2437	0.306	-0.233	0.323	0.779	1.6
Bluetooth	39	2441	0.00258	-0.182	0.0027		
GSM900 (GPRS)	600	1880	0.312	-0.167	0.324	0.650	1.6

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 earphone wire connected to the EUT to simulate hand-free operation in a body worn configuration.
3) The battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
4) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

11.5 Body Worn Position – With Belt-Clip (805-612-001)



Test Mode	Channel	f (MHz)	Measured (mW/g)	Drift (dBm)	Extrapolated (mW/g)	Summation of Extrapolated (mW/g)	Limit (mW/g)
GSM 850 GPRS	189	836.4	0.176	-0.199	0.184	0.252	1.6
802.11b	6	2437	0.053	-0.262	0.056		
Bluetooth	39	2441	0.011	-0.154	0.0114		
GSM 1900 GPRS	600	1880	0.346	-0.127	0.356	0.424	1.6

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 earphone wire connected to the EUT to simulate hand-free operation in a body worn configuration.
3) The battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
4) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

12 SAR MEASUREMENT RESULTS (700C with 802.11bg, CDMA and Bluetooth)

12.1 Left Hand Side

Test		Channel	f (MHz)	Measured (mW/g)	Drift (dBm)	Extrapolated (mW/g)	Summation of Extrapolated (mW/g)	Limit (mW/g)
Mode	Position							
Cell band	Tilt	363	835.89	0.181	-0.139	0.187	0.278	1.6
802.11b	Tilt	6	2437	0.084	-0.136	0.087		
Bluetooth	Tilt	39	2441	0.00382	-0.252	0.0040		
PCS band	Tilt	600	1880	0.189	-0.064	0.192	0.283	1.6

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 battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

12.2 Right Hand Side

Test				Measured	Drift	Extrapolated	Summation of	Limit
Mode	Position	Channel	f (MHz)	(mW/g)	(dBm)	(mW/g)	Extrapolated (mW/g)	(mW/g)
Cell band	Tilt	1013	824.7	0.297	-0.073	0.302	0.363	1.6
802.11b	Tilt	6	2437	0.057	-0.031	0.0574		
Bluetooth	Tilt	39	2441	0.00391	-0.137	0.00404		
PCS band	Tilt	600	1880	0.304	-0.033	0.306	0.368	1.6

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 battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
3) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

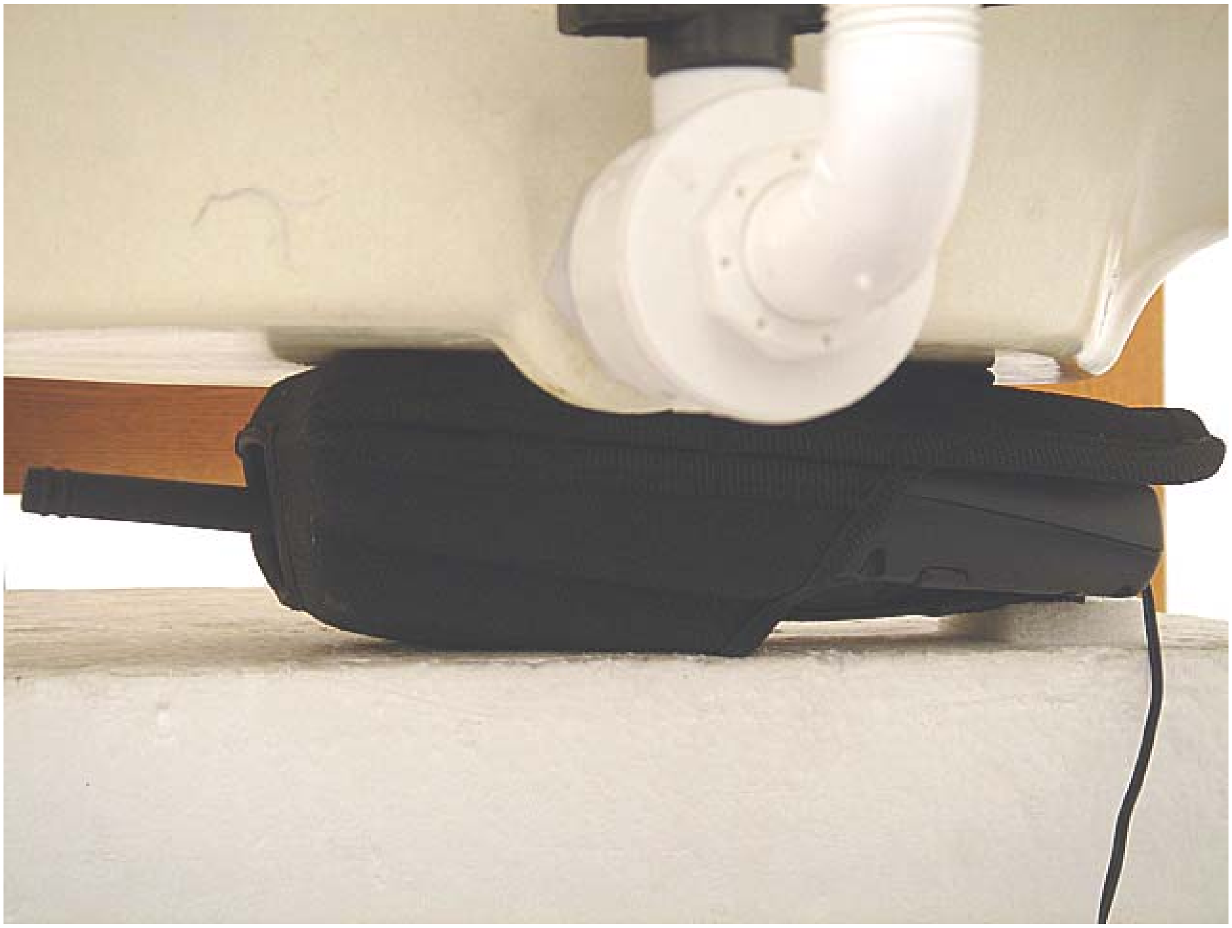
12.3 Body Worn Position – With Holster (814-417-002)/Left Side

Test Mode	Channel	f (MHz)	Measured (mW/g)	Drift (dBm)	Extrapolated (mW/g)	Summation of Extrapolated (mW/g)	Limit (mW/g)
Cell band	1013	824.7	0.263	-0.216	0.276	0.292	1.6
802.11b	6	2437	0.012	-0.089	0.0122		
Bluetooth	39	2441	0.00367	-0.139	0.00379		
PCS band	600	1880	0.141	-0.080	0.144	0.160	1.6

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 earphone wire connected to the EUT to simulate hand-free operation in a body worn configuration.
3) The battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
4) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

12.4 Body Worn Position – With Holster (814-417-001)

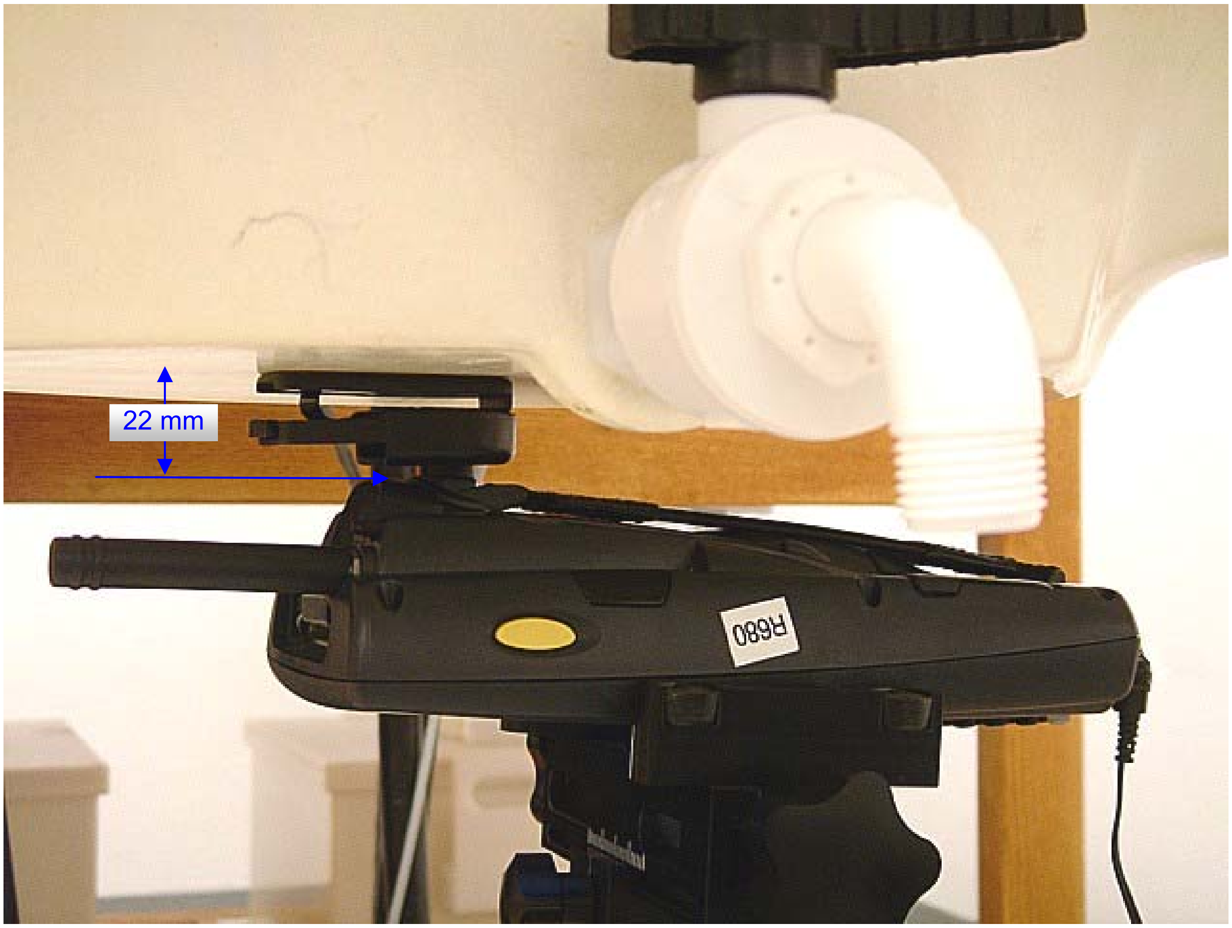


Test Mode	Channel	f (MHz)	Measured (mW/g)	Drift (dBm)	Extrapolated (mW/g)	Summation of Extrapolated (mW/g)	Limit (mW/g)
Cell band	1013	824.7	0.360	-0.057	0.365		
802.11b	6	2437	0.387	-0.254	0.410	0.782	1.6
Bluetooth	39	2441	0.00651	-0.201	0.0068		
PCS band	600	1880	0.147	-0.194	0.154	0.571	1.6

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 earphone wire connected to the EUT to simulate hand-free operation in a body worn configuration.
3) The battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
4) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

12.5 Body Worn Position – With Belt-Clip (805-612-001)



Test Mode	Channel	f (MHz)	Measured (mW/g)	Drift (dBm)	Extrapolated (mW/g)	Summation of Extrapolated (mW/g)	Limit (mW/g)
Cell band	363	835.89	0.080	-0.073	0.081	0.155	1.6
802.11b	6	2437	0.063	-0.109	0.064		
Bluetooth	39	2441	0.00859	-0.227	0.0091		
PCS band	600	1880	0.160	-0.113	0.164	0.238	1.6

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 earphone wire connected to the EUT to simulate hand-free operation in a body worn configuration.
3) The battery was fully charged in accordance with manufacture's instructions prior to SAR measurements.
4) Please see attachment for the detailed measurement data and plots showing the maximum SAR location of the EUT.

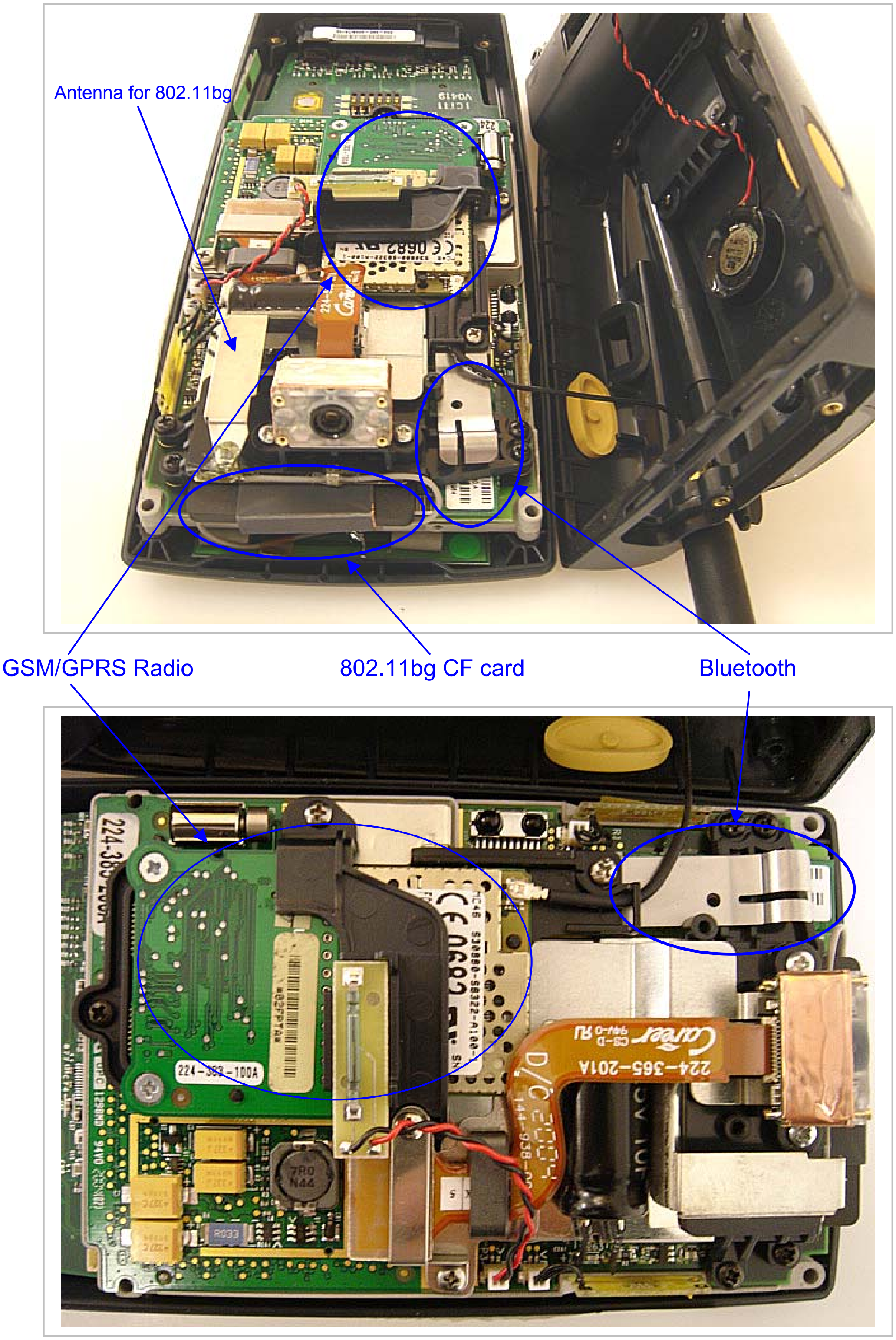
13 PHOTO

EUT PHOTO (802.11B/G COMPACT FLASH CARD)

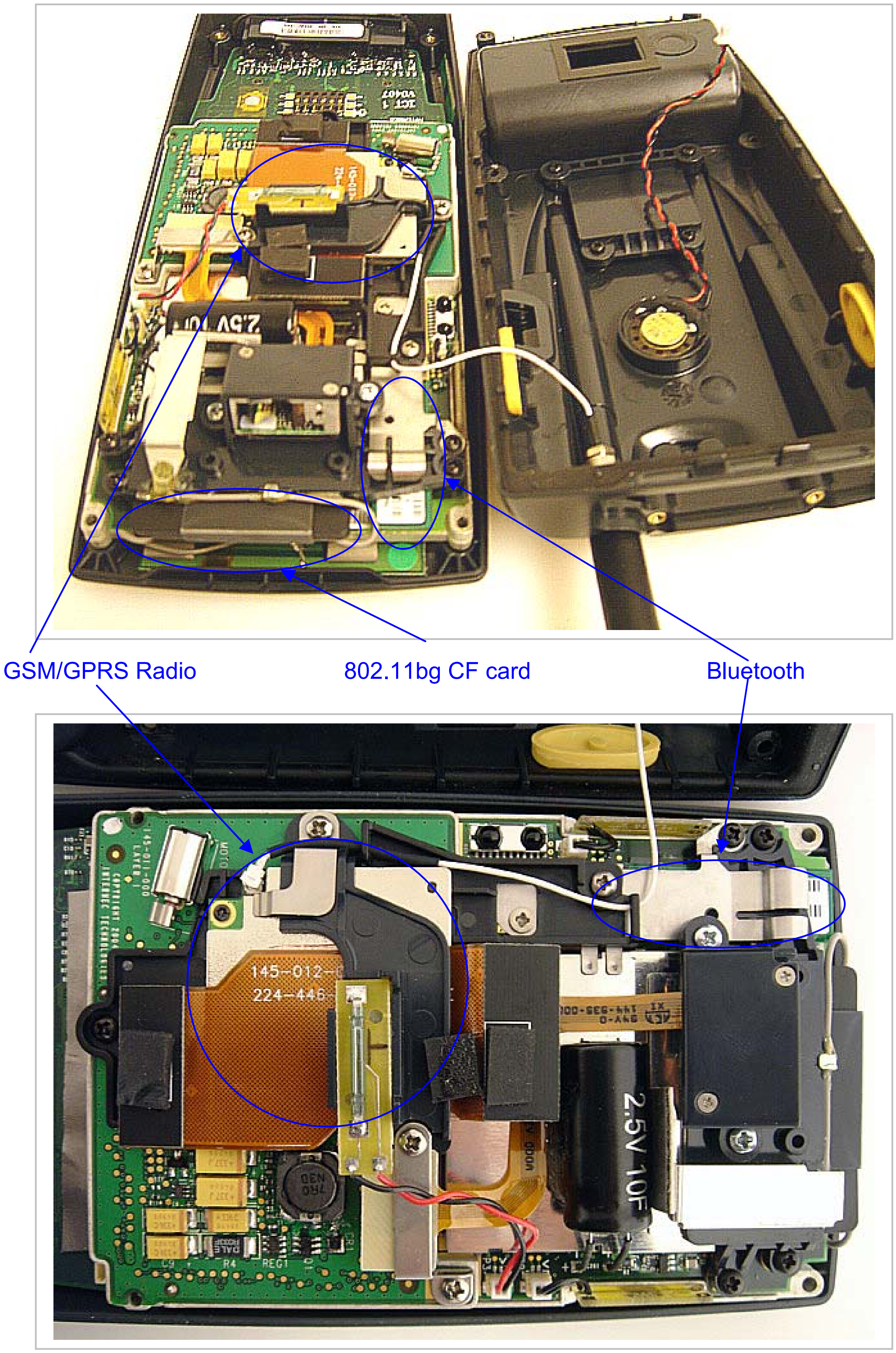
Host device - 700C Handheld Scanner (1/2)

Host device - 700C Handheld Scanner (2/2)

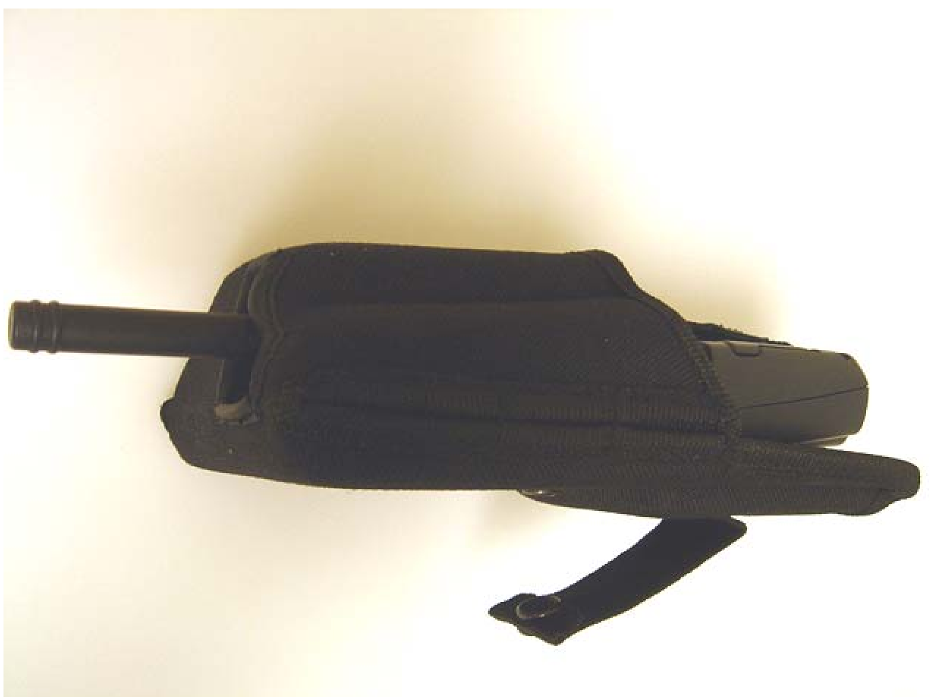
700C Handheld Scanner with 802.11bg, GSM/GPRS and Bluetooth



700C Handheld Scanner with 802.11bg, CDMA and Bluetooth

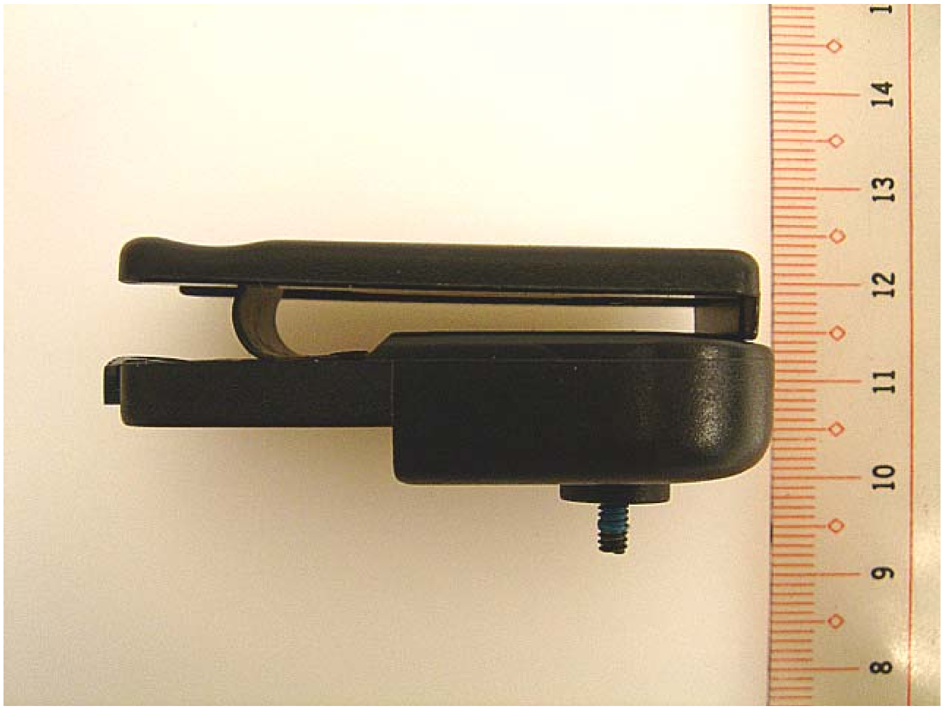


HOLSTER - P/N: 814-417-001



HOLSTER - P/N: 814-417-002

BELT-CLIP – P/N: 805-612-001



ANTENNA - P/N: 805-624-001

14 MEASUREMENT UNCERTAINTY

14.1 MEASUREMENT UNCERTAINTY FOR 300 MHZ – 3GHZ

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

15 EQUIPMENT LIST & CALIBRATION

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	EX3DV3	3531	7/18/05
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	2/7/05
System Validation Dipole	SPEAG	D835V2	4d002	2/11/06
System Validation Dipole	SPEAG	D1900V2	5d043	2/16/06
System Validation Dipole	SPEAG	D2450V2	748	5/14/06
Signal General	R&H	SMP 04	DE34210	5/5/05
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	H835	N/A	Within 24 hrs of first test
Simulating Liquid	CCS	H1900	N/A	Within 24 hrs of first test
Simulating Liquid	CCS	H2450	N/A	Within 24 hrs of first test
Simulating Liquid	CCS	M835	N/A	Within 24 hrs of first test
Simulating Liquid	CCS	M1900	N/A	Within 24 hrs of first test
Simulating Liquid	CCS	M2450	N/A	Within 24 hrs of first test

16 ATTACHMENTS

No.	Contents	No. of page (s)
1	System Performance Check Plots	14
2-1	SAR Test Plots (700C with 802.11bg, GSM and Bluetooth)	25
2-1	SAR Test Plots (700C with 802.11bg, CDMA and Bluetooth)	24
3	Certificate of E-filed Probe EX3DV3 SN 3521	8
4	Certificate of System Validation Dipole DV835 SN 4d002	6
5	Certificate of System Validation Dipole DV1900 SN 5d043	6
6	Certificate of System Validation Dipole D2450V2 SN 748	9

END OF REPORT