



# **SAR Evaluation Report**

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

**FOR**

**Express MINI-PCI USB Wireless CDMA Modem Module**

**Model: MC5720**

**FCC ID: N7N-MC5720**

**REPORT NUMBER: 05U3503-2**

**ISSUE DATE: June 20, 2005**

*Prepared for*

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Revision History

<u>Rev.</u>	<u>Revisions</u>	<u>Revised By</u>
A	Initial Issue	HS

**CERTIFICATE OF COMPLIANCE (SAR EVALUATION)****DATES OF TEST:** June 13 -15 and 20, 2005

APPLICANT:	Sierra Wireless
ADDRESS:	2290 Cosmos Ct. Carlsbad CA 92009, United States
FCC ID:	N7N-MC5720
MODEL:	MC5720
DEVICE CATEGORY:	Portable Device
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure

Express MINI-PCI USB Wireless CDMA Modem Module installed in host devices.

**Test Sample is a:** Production unit**Host devices:**

<u>Host Devices</u>	<u>LCD Cover</u>	<u>WLAN Module / FCC ID</u>
Lenovo M-Note	Metal	Gwinette / PPD-AR5BXB6
Lenovo M-Note	Plastic	Gwinette / PPD-AR5BXB6
Lenovo W-Note	Plastic	Calexico 2 / S2L20040601CX2
Lenovo W-Note	Plastic	Bartlette / S2L20040600BTL

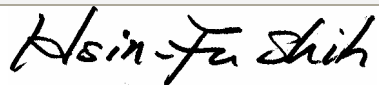
<b>FCC Rule Parts</b>	<b>Frequency Range [MHz]</b>	<b>The Highest SAR Values [1g_mW/g]</b>
22H	824.7 – 848.31	0.084
24E	1851.25 – 1908.75	0.096

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE 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:

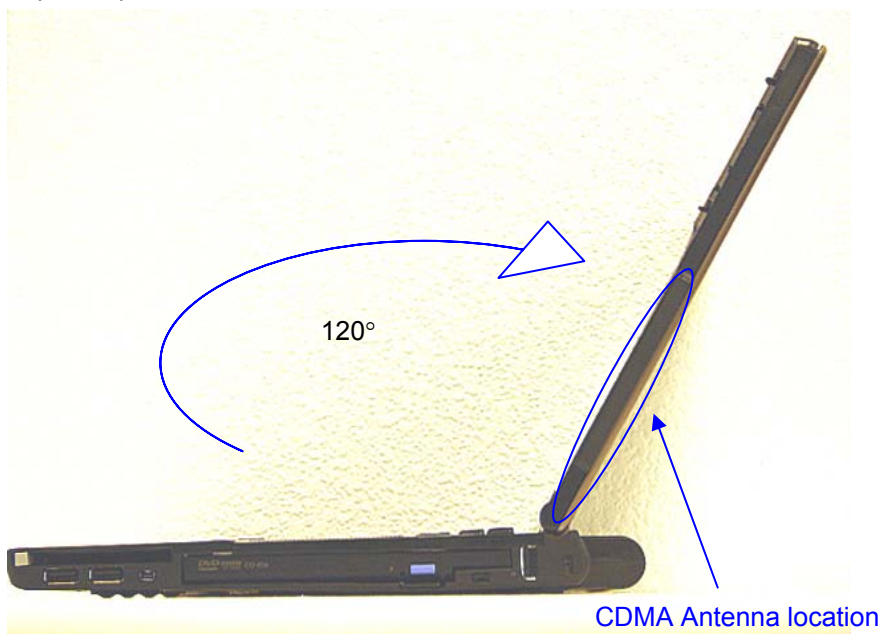


Hsin Fu Shih (Sunny Shih)  
COMPLIANCE CERTIFICATION SERVICES

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**1 EQUIPMENT UNDER TEST (EUT) DESCRIPTION**

Express MINI-PCI USB Wireless CDMA Modem Module installed in host devices			
Host devices:	<u>Host Devices</u>	<u>LCD Cover</u>	<u>WLAN Module / FCC ID</u>
	Lenovo M-Note	Metal	Gwinette / PPD-AR5BXB6
	Lenovo M-Note	Plastic	Gwinette / PPD-AR5BXB6
	Lenovo W-Note	Plastic	Calexico 2 / S2L20040601CX2
	Lenovo W-Note	Plastic	Bartlette / S2L20040600BTL
Normal operation:	Lap-held position		
			
Power supply:	Power supplied through the laptop computer (host device)		

**2 FACILITIES AND ACCREDITATION**

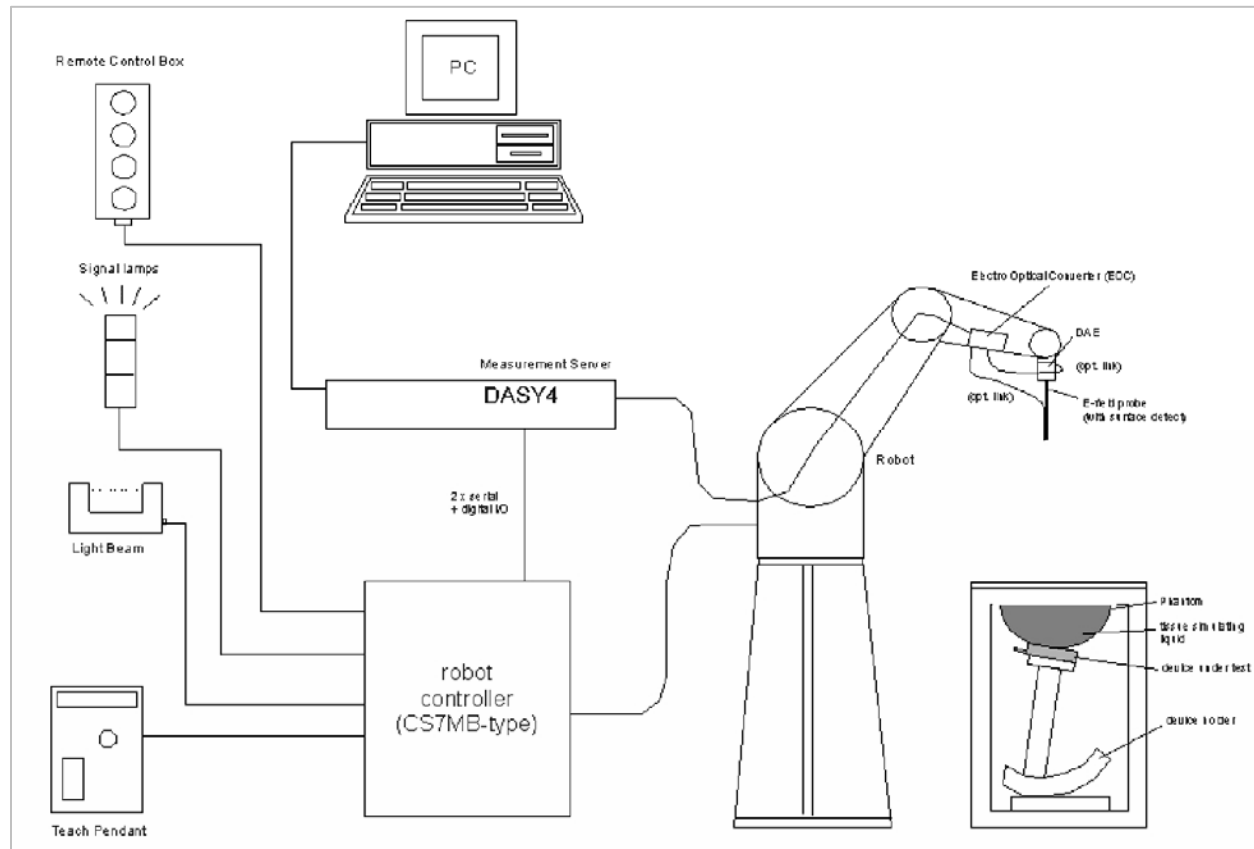
The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1,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



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

No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

### 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 200M $\Omega$ m; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



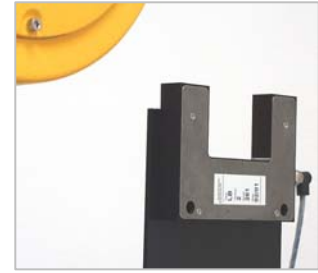
### 4.3 EX3DV3 ISOTROPIC E-FIELD PROBE FOR DOSIMETRIC MEASUREMENTS

- 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:  $\pm 0.2$  dB (30 MHz to 3 GHz)
- Directivity:**  $\pm 0.3$  dB in HSL (rotation around probe axis);  
 $\pm 0.5$  dB in tissue material (rotation normal to probe axis)
- Dynamic Range:** 10  $\mu$ W/g to > 100 mW/g; Linearity:  $\pm 0.2$  dB (noise: typically < 1  $\mu$ W/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.



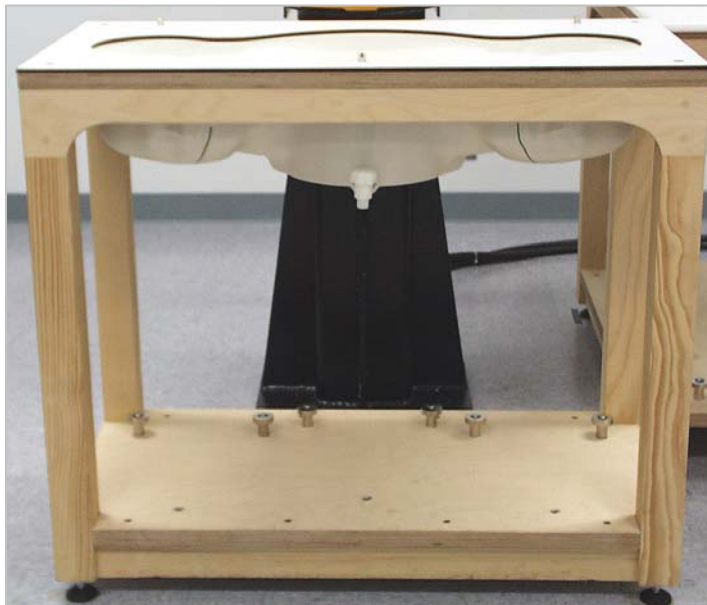
#### 4.5 SAM PHANTOM (V4.0)

**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:**  $2 \pm 0.2$  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 1/4 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

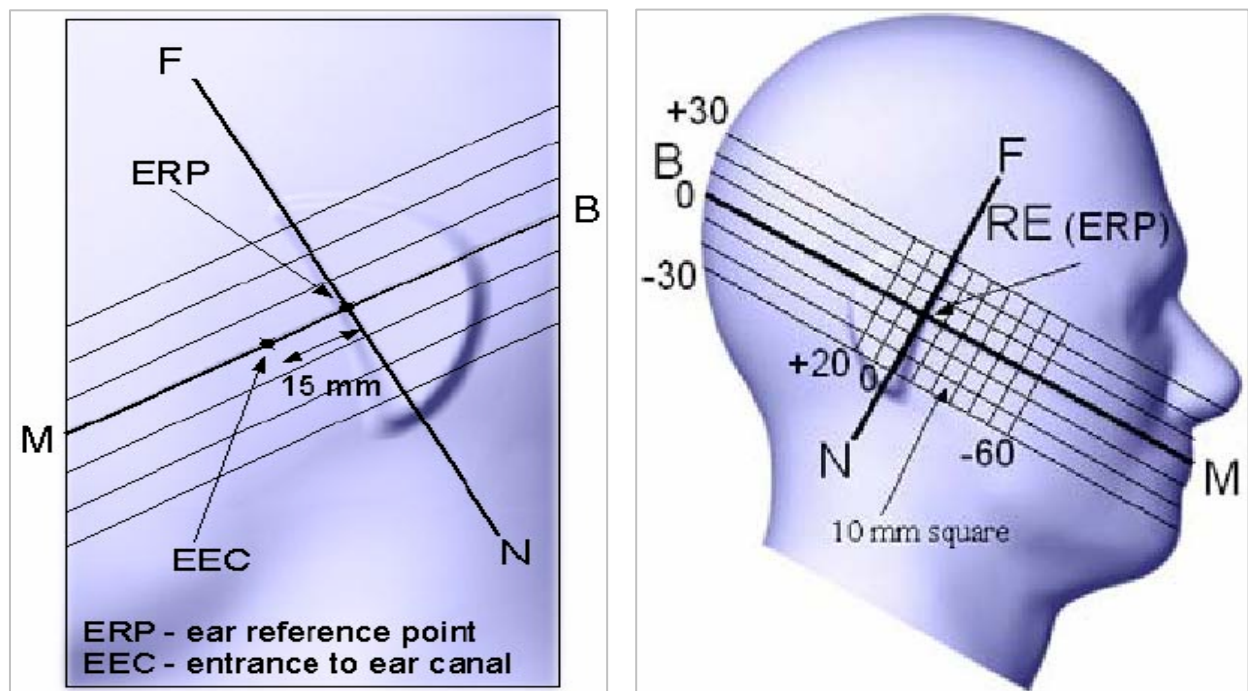
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

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

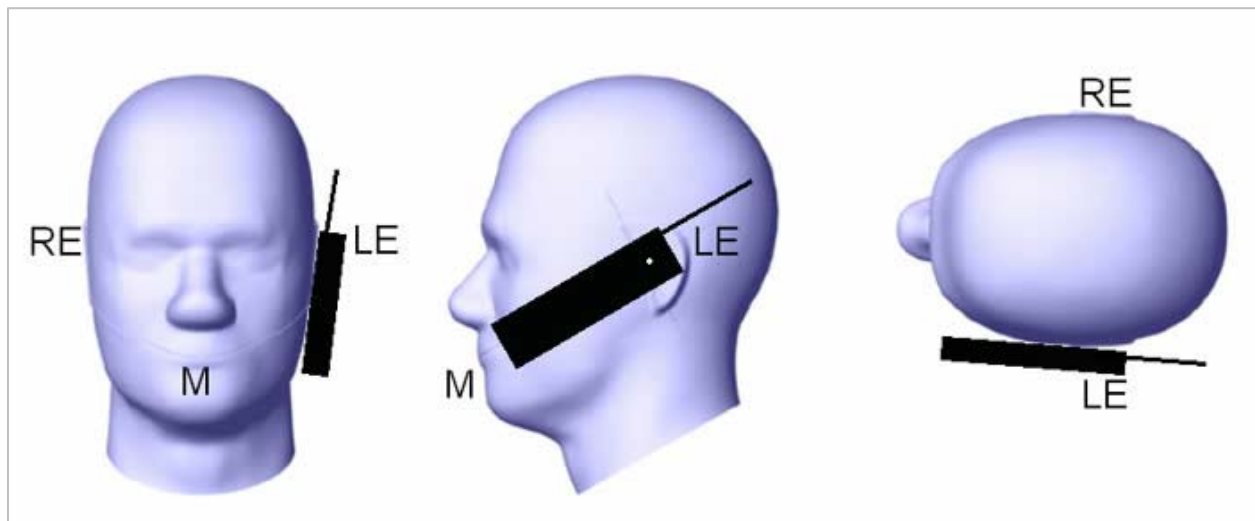
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

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



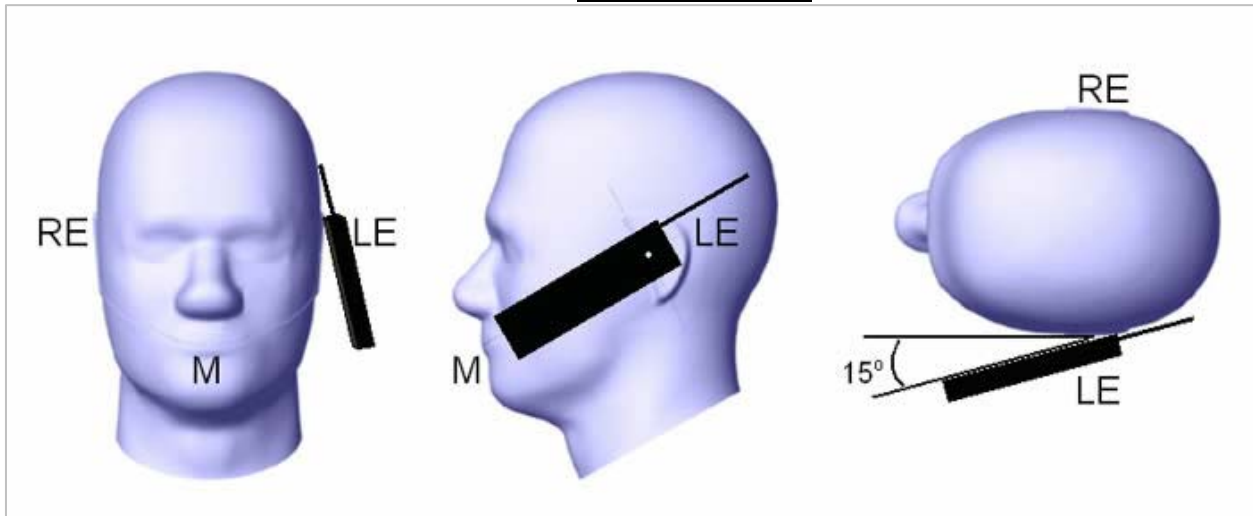
## 5.2 EAR/TILT POSITION

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 is by  $15^\circ$ . 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  $15^\circ$  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  $15^\circ$  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

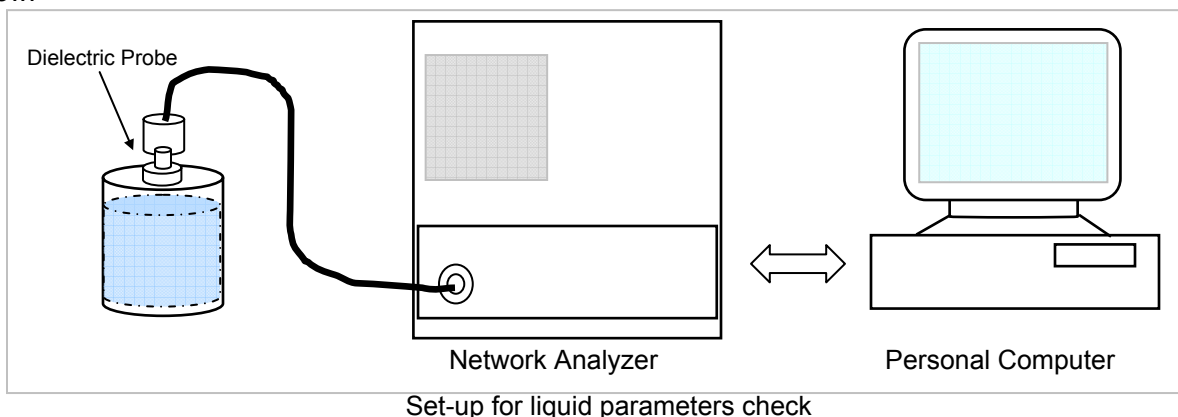
SAR data is requested for cellphones designed to be used with a headset while worn next to the body using a neck-strap or lanyard; device should be tested with front and back sides in contact with a flat phantom

☒ 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 if the dielectric parameters are within the tolerances of the specified target values. The relative permittivity and conductivity of the tissue material should be within  $\pm 5\%$  of the values given in the table below.



### 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	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (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

( $\epsilon_r$  = relative permittivity,  $\sigma$  = conductivity and  $\rho = 1000 \text{ kg/m}^3$ )

**7.1 SIMULATING LIQUID PARAMETER CHECK RESULT**

Simulating Liquid Parameter Check Result @ Head 835 MHz

Room Ambient Temperature = 24.0°C; Relative humidity = 40%

Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)	e'	Relative Permittivity (e'')				
835	23	15	e'	Relative Permittivity (e'')	41.5	41.3308	-0.41	± 5
			20.0805	Conductivity (σ)	0.90	0.9328	3.64	± 5

**Liquid Check**

Ambient temperature: 24.0 deg. C, Liquid temperature: 23.0 deg. C

June 13, 2005 09:54 AM

Frequency	e'	e''
750000000.	42.4039	20.3744
755000000.	42.3279	20.3238
760000000.	42.2588	20.2951
765000000.	42.2065	20.2397
770000000.	42.1285	20.1692
775000000.	42.0394	20.1812
780000000.	41.9853	20.1506
785000000.	41.9191	20.1126
790000000.	41.8539	20.0749
795000000.	41.8110	20.0757
800000000.	41.7533	20.0588
805000000.	41.6892	20.0547
810000000.	41.6299	20.0441
815000000.	41.6039	20.0732
820000000.	41.5239	20.0579
825000000.	41.4657	20.0209
830000000.	41.3695	20.0162
835000000.	41.3308	20.0805
840000000.	41.2604	20.0269
845000000.	41.2202	19.9656
850000000.	41.1088	19.9457
855000000.	41.0565	19.9098
860000000.	40.9954	19.8769
865000000.	40.9570	19.7765
870000000.	40.8693	19.7524
875000000.	40.8016	19.7232
880000000.	40.7814	19.6807
885000000.	40.7327	19.6770
890000000.	40.6859	19.6428
895000000.	40.6728	19.6192
900000000.	40.6158	19.6136

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$



## Simulating Liquid Parameter Check Result @ Muscle 835 MHz

Room Ambient Temperature = 24.0 °C; Relative humidity = 42%

Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)	e'	Relative Permittivity (e'')				
835	23	15	e'	Relative Permittivity (e'')	55.2	56.1377	1.70	± 5
			21.4356	Conductivity (σ)	0.97	0.9957	2.65	± 5

## Liquid Check

Ambient temperature: 24.0 deg. C, Liquid temperature: 23.0 deg. C

June 13, 2005 10:13 AM

Frequency	e'	e''
750000000.	56.9568	21.8446
755000000.	56.9021	21.7665
760000000.	56.8351	21.7532
765000000.	56.8006	21.6931
770000000.	56.7639	21.6578
775000000.	56.7073	21.6300
780000000.	56.6482	21.5917
785000000.	56.6005	21.5497
790000000.	56.5474	21.5217
795000000.	56.5269	21.5167
800000000.	56.4694	21.5021
805000000.	56.4370	21.4900
810000000.	56.3900	21.4663
815000000.	56.3452	21.4759
820000000.	56.3287	21.4523
825000000.	56.2755	21.4482
830000000.	56.1994	21.4249
835000000.	56.1377	21.4356
840000000.	56.1278	21.4043
845000000.	56.0748	21.3455
850000000.	56.0037	21.2943
855000000.	55.9316	21.2660
860000000.	55.9174	21.2156
865000000.	55.8833	21.1407
870000000.	55.8122	21.1350
875000000.	55.7462	21.0845
880000000.	55.7459	21.0620
885000000.	55.7111	21.0319
890000000.	55.6643	20.9963
895000000.	55.6503	20.9741
900000000.	55.6307	20.9753

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$



## Simulating Liquid Parameter Check Result @ Head 835 MHz

Room Ambient Temperature = 24.0°C; Relative humidity = 40%

Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)	e'	Relative Permittivity (e'')				
835	23	15	e'	Relative Permittivity (e'')	41.5	41.4425	-0.14	± 5
			20.1022	Conductivity (σ)	0.90	0.9338	3.75	± 5

## Liquid Check

Ambient temperature: 24.0 deg. C, Liquid temperature: 23.0 deg. C

June 15, 2005 10:14 AM

Frequency	e'	e''
750000000.	42.5316	20.4225
755000000.	42.4685	20.3794
760000000.	42.3823	20.3315
765000000.	42.3109	20.2920
770000000.	42.2323	20.2211
775000000.	42.1427	20.2326
780000000.	42.0853	20.1912
785000000.	42.0310	20.1162
790000000.	41.9577	20.0914
795000000.	41.9087	20.0715
800000000.	41.8356	20.0803
805000000.	41.7969	20.0908
810000000.	41.7393	20.0685
815000000.	41.6873	20.0828
820000000.	41.6173	20.0859
825000000.	41.5668	20.0784
830000000.	41.4926	20.0777
835000000.	41.4425	20.1022
840000000.	41.3759	20.0262
845000000.	41.2919	19.9977
850000000.	41.2092	19.9695
855000000.	41.1714	19.9499
860000000.	41.1016	19.8880
865000000.	41.0112	19.8226
870000000.	40.9623	19.7564
875000000.	40.9088	19.7431
880000000.	40.8548	19.6898
885000000.	40.8150	19.6833
890000000.	40.7586	19.6517
895000000.	40.7544	19.6252
900000000.	40.7322	19.6041

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

## Simulating Liquid Parameter Check Result @ Muscle 835 MHz

Room Ambient Temperature = 24.0 °C; Relative humidity = 40%

Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)	e'	Relative Permittivity (e'')				
835	23	15		Relative Permittivity (e'')	55.2	56.4534	2.27	± 5
			21.6494	Conductivity (σ)	0.97	1.0057	3.68	± 5

## Liquid Check

Ambient temperature: 24.0 deg. C, Liquid temperature: 23.0 deg. C

June 15, 2005 10:41 AM

Frequency	e'	e''
750000000.	57.2594	22.0897
755000000.	57.2070	22.0203
760000000.	57.1344	21.9588
765000000.	57.0887	21.9361
770000000.	57.0426	21.8427
775000000.	56.9393	21.8178
780000000.	56.9066	21.7565
785000000.	56.8784	21.7056
790000000.	56.8343	21.6725
795000000.	56.8013	21.6356
800000000.	56.7464	21.6301
805000000.	56.7139	21.6508
810000000.	56.6769	21.6557
815000000.	56.6733	21.6708
820000000.	56.6215	21.6753
825000000.	56.5764	21.6493
830000000.	56.4772	21.6552
835000000.	56.4534	21.6494
840000000.	56.3925	21.6023
845000000.	56.3385	21.5420
850000000.	56.2621	21.5350
855000000.	56.2160	21.4618
860000000.	56.1686	21.4115
865000000.	56.1130	21.3106
870000000.	56.0561	21.2870
875000000.	55.9984	21.2317
880000000.	55.9731	21.1747
885000000.	55.9595	21.1455
890000000.	55.9283	21.1234
895000000.	55.9506	21.1008
900000000.	55.9363	21.1036

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

## Simulating Liquid Parameter Check Result @ Head 835 MHz

Room Ambient Temperature = 24.0°C; Relative humidity = 40%

Measured by: Anson Lu

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)	e'	Relative Permittivity (e'')				
835	23	15			41.5	40.7193	-1.88	± 5
			19.7744	Conductivity (σ):	0.90	0.9186	2.06	± 5

## Liquid Check

Ambient temperature: 24.0 deg. C; Liquid temperature: 23.0 deg C

June 20, 2005 05:43 PM

Frequency	e'	e''
750000000.	41.7960	20.1141
755000000.	41.7102	20.1035
760000000.	41.6389	20.0553
765000000.	41.5715	20.0183
770000000.	41.5028	20.0159
775000000.	41.4271	19.9819
780000000.	41.3686	19.9664
785000000.	41.3029	19.9198
790000000.	41.2410	19.8839
795000000.	41.1828	19.8585
800000000.	41.1133	19.8693
805000000.	41.0848	19.8258
810000000.	41.0322	19.8108
815000000.	40.9982	19.8018
820000000.	40.9287	19.7971
825000000.	40.8824	19.7758
830000000.	40.8011	19.7590
835000000.	40.7193	19.7744
840000000.	40.6892	19.7443
845000000.	40.6059	19.7084
850000000.	40.5483	19.6866
855000000.	40.5055	19.6405
860000000.	40.4116	19.6298
865000000.	40.3473	19.6111
870000000.	40.2908	19.5805
875000000.	40.2311	19.5715
880000000.	40.1790	19.5504
885000000.	40.1078	19.5653
890000000.	40.0456	19.5378
895000000.	40.0275	19.4880
900000000.	39.9838	19.4856

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

## Simulating Liquid Parameter Check Result @ Muscle 835 MHz

Room Ambient Temperature = 24.0 °C; Relative humidity = 40%

Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)	e'	Relative Permittivity (e'')				
835	23	15	e'	Relative Permittivity (e'')	55.2	56.8623	3.01	± 5
			21.3284	Conductivity (σ)	0.97	0.9907	2.14	± 5

## Liquid Check

Ambient temperature: 24.0 deg. C; Liquid temperature: 23.0 deg C

June 20, 2005 06:56 PM

Frequency	e'	e''
750000000.	56.5931	21.8737
755000000.	56.5163	21.8645
760000000.	56.5154	21.8291
765000000.	56.4655	21.7871
770000000.	56.3913	21.7069
775000000.	56.3510	21.6861
780000000.	56.2984	21.6933
785000000.	56.2587	21.6027
790000000.	56.2112	21.5853
795000000.	56.1889	21.5704
800000000.	56.1360	21.5322
805000000.	56.0917	21.5142
810000000.	56.0765	21.4798
815000000.	56.0135	21.4520
820000000.	56.0315	21.4113
825000000.	55.9606	21.3871
830000000.	55.9228	21.3730
835000000.	55.8633	21.3284
840000000.	55.8330	21.3286
845000000.	55.7755	21.2840
850000000.	55.7566	21.2798
855000000.	55.6931	21.2711
860000000.	55.6349	21.2169
865000000.	55.5737	21.2079
870000000.	55.5265	21.2043
875000000.	55.4528	21.1577
880000000.	55.4170	21.1501
885000000.	55.3949	21.1477
890000000.	55.3187	21.1139
895000000.	55.3174	21.0928
900000000.	55.2777	21.0661

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

## Simulating Liquid Dielectric Parameters Check Result @ Head 1900 MHz

Room Ambient Temperature = 23°C; Relative humidity = 45%

Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)	ε"	Relative Permittivity (ε')				
1900	22	15	ε"	Relative Permittivity (ε')	40.0	41.4183	3.55	± 5
			13.7038	Conductivity (σ)	1.40	1.4485	3.46	± 5

## Liquid Check

Ambient temperature: 23.0 deg. C, Liquid temperature: 22.0 deg. C

June 14, 2005 10:08 AM

Frequency	e'	e"
1710000000.	42.2156	13.1654
1720000000.	42.1702	13.2034
1730000000.	42.1382	13.2300
1740000000.	42.0797	13.2572
1750000000.	42.0388	13.2800
1760000000.	41.9961	13.2977
1770000000.	41.9683	13.3217
1780000000.	41.9191	13.3594
1790000000.	41.8827	13.3952
1800000000.	41.8548	13.4225
1810000000.	41.8111	13.4569
1820000000.	41.7693	13.4777
1830000000.	41.6952	13.5322
1840000000.	41.6433	13.5568
1850000000.	41.5954	13.5853
1860000000.	41.5770	13.6098
1870000000.	41.5453	13.6216
1880000000.	41.5230	13.6549
1890000000.	41.4670	13.6863
1900000000.	41.4183	13.7038
1910000000.	41.3763	13.7292

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 \epsilon'' = 2 \pi f \epsilon_0 \epsilon''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

## Simulating Liquid Dielectric Parameters Check Result @ Muscle 1900 MHz

Room Ambient Temperature = 23°C; Relative humidity = 45%

Measured by: Sunny Shih

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)	e''	Relative Permittivity (ε <sub>r</sub> ):				
1900	22	15			53.3	54.9646	3.12	± 5
			15.0379	Conductivity (σ):	1.52	1.58950	4.57	± 5

## Liquid Check

Ambient temperature: 23.0 deg. C, Liquid temperature: 22.0 deg. C

June 14, 2005 10:29 AM

Frequency	e'	e''
1710000000.	55.5779	14.4759
1720000000.	55.5347	14.5241
1730000000.	55.5126	14.5542
1740000000.	55.4521	14.5725
1750000000.	55.4359	14.5827
1760000000.	55.4049	14.5910
1770000000.	55.4118	14.6225
1780000000.	55.3800	14.6508
1790000000.	55.3428	14.6916
1800000000.	55.3267	14.7364
1810000000.	55.2838	14.7907
1820000000.	55.2469	14.8323
1830000000.	55.1641	14.8750
1840000000.	55.1027	14.9137
1850000000.	55.0792	14.9177
1860000000.	55.0745	14.9196
1870000000.	55.0579	14.9630
1880000000.	55.0529	14.9766
1890000000.	55.0001	15.0210
1900000000.	54.9646	15.0379
1910000000.	54.9088	15.0825

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

## Simulating Liquid Dielectric Parameters Check Result @ Head 1900 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)	ε"	Relative Permittivity (ε <sub>r</sub> ):				
1900	23	15			40.0	41.5365	3.84	± 5
			13.4225	Conductivity (σ):	1.40	1.4188	1.34	± 5

## Liquid Check

Ambient temperature: 24.0 deg. C; Liquid temperature: 23.0 deg C

June 20, 2005 11:18 AM

Frequency	ε'	ε"
1710000000.	42.3408	12.9704
1720000000.	42.2865	13.0012
1730000000.	42.2576	13.0447
1740000000.	42.2075	13.0572
1750000000.	42.1476	13.0918
1760000000.	42.1024	13.1173
1770000000.	42.0516	13.1465
1780000000.	42.0049	13.1701
1790000000.	41.9592	13.2025
1800000000.	41.9277	13.2259
1810000000.	41.8857	13.2406
1820000000.	41.8367	13.2570
1830000000.	41.7851	13.2814
1840000000.	41.7339	13.2996
1850000000.	41.7065	13.3332
1860000000.	41.6581	13.3377
1870000000.	41.6269	13.3616
1880000000.	41.6008	13.3822
1890000000.	41.5705	13.3903
1900000000.	41.5365	13.4225
1910000000.	41.5136	13.4379

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 \epsilon'' = 2 \pi f \epsilon_0 \epsilon''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$

## Simulating Liquid Dielectric Parameters Check Result @ Muscle 1900 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)	ε"	Relative Permittivity (ε <sub>r</sub> ):				
1900	23	15			53.3	52.6451	-1.23	± 5
			14.9025	Conductivity (σ):	1.52	1.57519	3.63	± 5

## Liquid Check

Ambient temperature: 24.0 deg. C; Liquid temperature: 23.0 deg C

June 20, 2005 12:13 PM

Frequency	e'	e"
1710000000.	53.3847	14.4027
1720000000.	53.3370	14.4299
1730000000.	53.2889	14.4541
1740000000.	53.2494	14.4862
1750000000.	53.2095	14.5372
1760000000.	53.1589	14.5902
1770000000.	53.0979	14.6411
1780000000.	53.0620	14.6713
1790000000.	53.0217	14.6982
1800000000.	52.9961	14.7056
1810000000.	52.9580	14.7093
1820000000.	52.8968	14.6969
1830000000.	52.8784	14.7024
1840000000.	52.8508	14.7454
1850000000.	52.8045	14.7979
1860000000.	52.7268	14.8494
1870000000.	52.6545	14.8676
1880000000.	52.6330	14.8593
1890000000.	52.6249	14.8683
1900000000.	52.6451	14.9025
1910000000.	52.5980	14.9326

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

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

$$\epsilon_0 = 8.854 * 10^{-12}$$



## 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  $\pm 10\%$ .

### System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Head simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3-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 10 mm (above 1 GHz) and 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 ( $dx=dy=7.5\text{mm}$ ;  $dz=5\text{mm}$ ).
- Distance between probe sensors and phantom surface was set to 2.5 (below 3 G) mm.
- The dipole input power (forward power) was  $250\text{ mW} \pm 3\%$ .
- 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

**8.1 SYSTEM PERFORMANCE CHECK RESULTS**

System Validation Dipole: D835V2 SN:4d002

Date: June 13, 2005

Ambient Temperature = 24°C; Relative humidity = 45%

Measured by: Sunny Shih

Head Simulating Liquid			Mrasured		Target <sub>1g</sub>	Deviation[%]	Lim it [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
835	23	15	2.47	9.88	9.5	4.00	± 10

Date: June 15, 2005

Ambient Temperature = 24°C; Relative humidity = 45%

Measured by: Sunny Shih

Head Simulating Liquid			Mrasured		Target <sub>1g</sub>	Deviation[%]	Lim it [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
835	23	15	2.47	9.88	9.5	4.00	± 10

Date: June 20, 2005

Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Anson Lu

Head Simulating Liquid			Mrasured		Target <sub>1g</sub>	Deviation[%]	Lim it [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
835	23	15	2.44	9.76	9.5	2.74	± 10

System Validation Dipole: D1900V2 SN:5d043

Date: June 14, 2005

Ambient Temperature = 23°C; Relative humidity = 40%

Measured by: Sunny Shih

Head Simulating Liquid			Mrasured		Target <sub>1g</sub>	Deviation[%]	Lim it [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
1900	22	15	9.15	36.6	39.7	-7.81	± 10

Date: June 20, 2005

Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Anson Lu

Head Simulating Liquid			Mrasured		Target <sub>1g</sub>	Deviation[%]	Lim it [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
1900	23	15	9.03	36.12	39.7	-9.02	± 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 settings were used to configure the Wireless Communications Test Set, Agilent 8960 Series 10, E5515C.

Operation Mode: Active Cell

System Mode: IS-2000

Call Params	Cell band	
	US Cellular	US PCS
Channel	1013 / 384 / 777	25 / 600 / 1175
Protocol Rev	6 (IS-2000-0)	6 (IS-2000-0)
Radio Config	(Fwd3, Rvs3), S055 (Loopback)	(Fwd3, Rvs3), S055 (Loopback)
Rvs Power Ctrl	All Up Bits	All Up Bits
Power Ctrl Size	1.0 dBm	1.0 dBm
Call Drop Timer	Off	Off
Call Limit Mode	Off	Off
Traffic Dada Rate	Full	Full
Rcvr Power Ctrl	Manual	Manual
Meas Frequency	Auto	Auto
Voice SO Mode	Voice Echo	Voice Echo
Echo Delay	Medium	Medium

Power levels were set to maximum power prior to SAR measurement.

CDMA Cell Band:

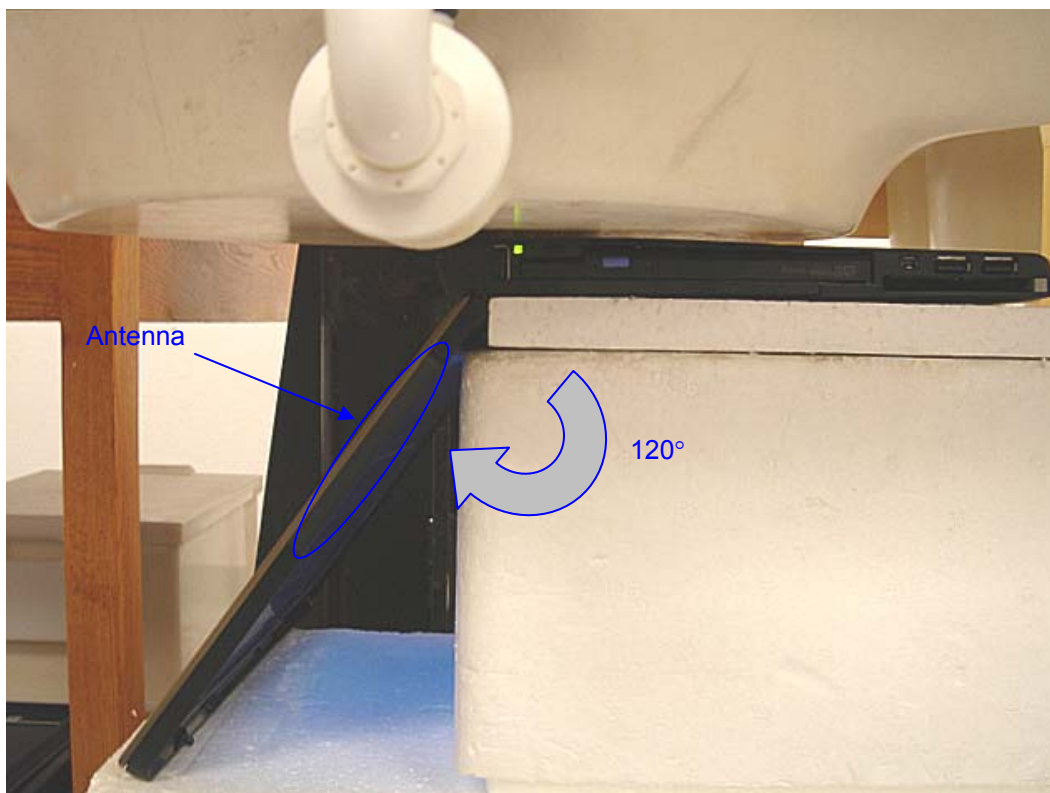
Ch	f (MHz)	Conducted Power
		Avg Power
1013	824.70	26.10
384	836.52	25.88
777	848.31	25.40

CDMA PCS Bnad:

Ch	f (MHz)	Conducted Power
		Avg Power
25	1851.25	26.02
600	1880.00	26.31
1175	1908.75	25.80

## 11 SAR TEST SUMMARY

### 11.1 Lenovo M-note Metal LCD Cover – With Gwinette WLAN module



#### CDMA Cell band

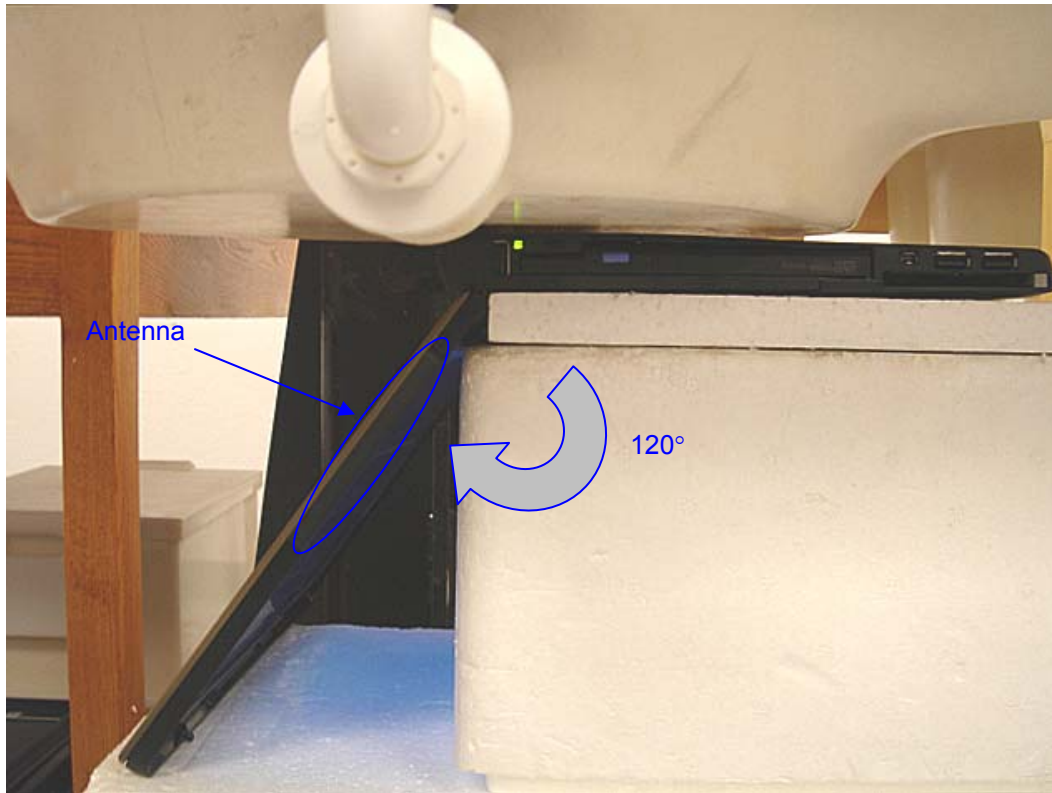
Channel	f (MHz)	WLAN on/off	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
1013	824.70	off	0.063	0.000	0.063	1.6
384	836.52	off	0.065	-0.065	0.066	1.6
777	848.31	off	0.082	-0.085	0.084	1.6
1013	824.70	on				
384	836.52	on	0.061	-0.161	0.063	1.6
777	848.31	on				

#### CDMA PCS band

Channel	f (MHz)	WLAN on/off	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
25	1851.25	off	0.093	-0.149	0.096	1.6
600	1880.00	off	0.089	-0.142	0.092	1.6
1175	1908.75	off	0.080	-0.038	0.081	1.6
25	1851.25	on				
600	1880.00	on	0.088	-0.169	0.091	1.6
1175	1908.75	on				

#### Notes:

- 1) The exact method of extrapolation is  $\text{measured SAR} \times 10^{(-\text{drift}/10)}$ . 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 Lenovo M-note Plastic LCD Cover – With Gwinette WLAN module****CDMA Cell band**

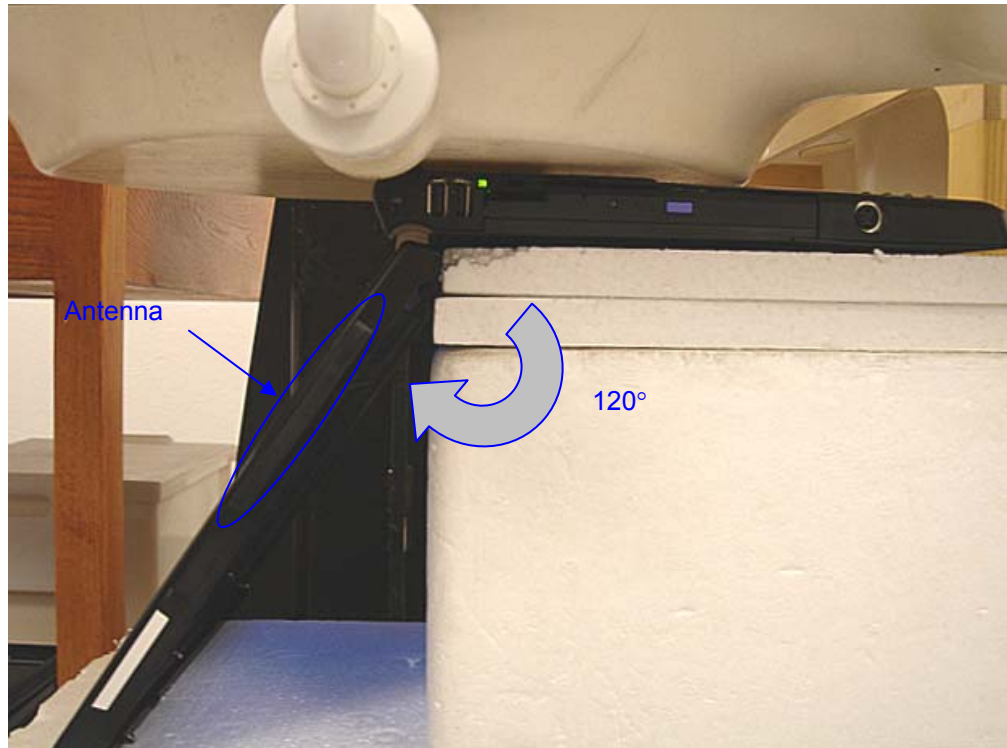
Channel	f (MHz)	WLAN on/off	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
1013	824.70	off				
384	836.52	off	0.045	0.000	0.045	1.6
777	848.31	off				
1013	824.70	on				
384	836.52	on	0.049	-0.105	0.050	1.6
777	848.31	on				

**CDMA PCS band**

Channel	f (MHz)	WLAN on/off	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
25	1851.25	off				
600	1880.00	off	0.046	-0.040	0.046	1.6
1175	1908.75	off				
25	1851.25	on				
600	1880.00	on	0.041	-0.108	0.042	1.6
1175	1908.75	on				

**Notes:**

- 1) The exact method of extrapolation is  $\text{measured SAR} \times 10^{(-\text{drift}/10)}$ . 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 Lenovo W-note Plastic LCD Cover – With Bartlette WLAN module****CDMA Cell band**

Channel	f (MHz)	WLAN on/off	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
1013	824.70	off				
384	836.52	off	0.034	-0.124	0.035	1.6
777	848.31	off				
1013	824.70	on				
384	836.52	on	0.039	-0.070	0.040	1.6
777	848.31	on				

**CDMA PCS band**

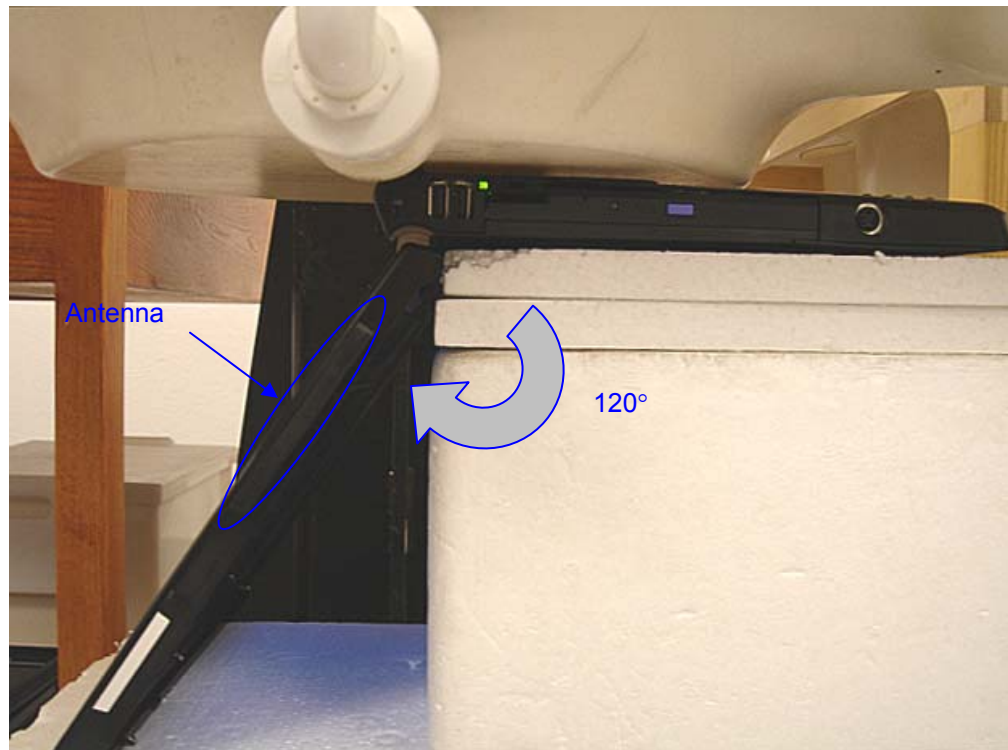
Channel	f (MHz)	WLAN on/off	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
25	1851.25	off				
600	1880.00	off	0.059	-0.049	0.060	1.6
1175	1908.75	off				
25	1851.25	on				
600	1880.00	on	0.058	-0.105	0.059	1.6
1175	1908.75	on				

**Notes:**

- 1) The exact method of extrapolation is  $\text{measured SAR} \times 10^{(-\text{drift}/10)}$ . 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.



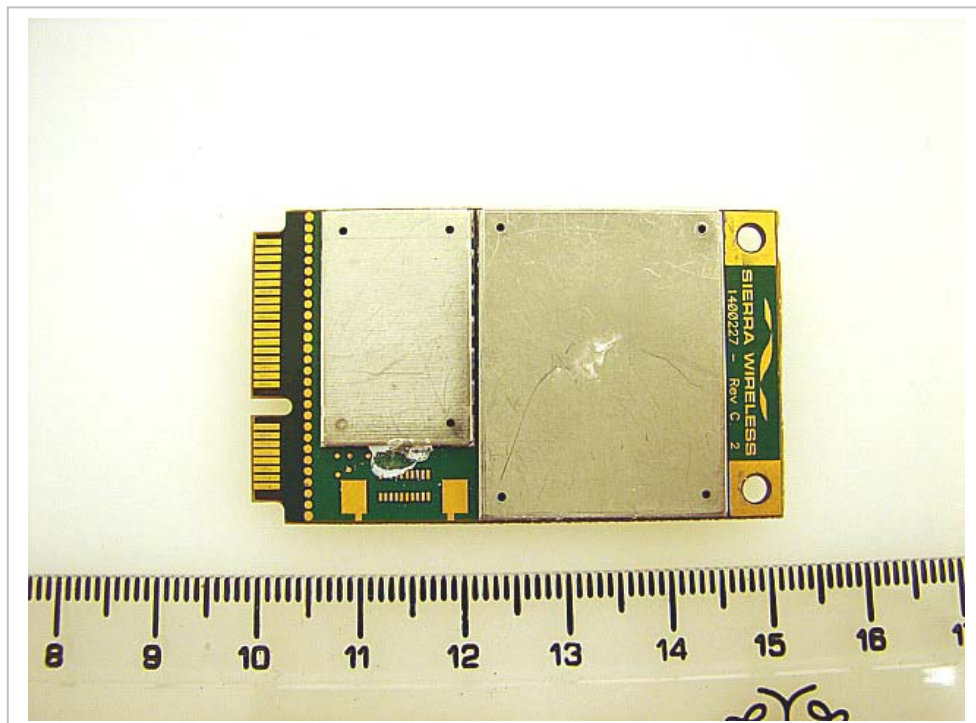
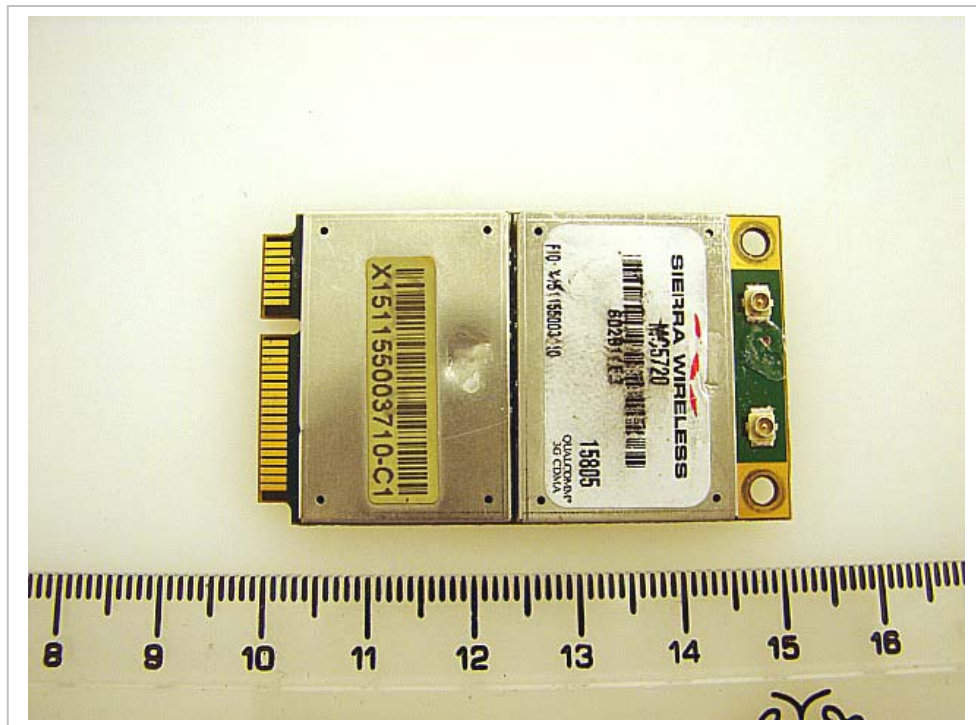
#### 11.4 Lenovo W-note Plastic LCD Cover – With Callexico 2 WLAN module



<b>CDMA Cell band</b>						
Channel	f (MHz)	WLAN on/off	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
1013	824.70	off				
384	836.52	off	0.056	-0.047	0.057	1.6
777	848.31	off				
<b>CDMA PCS band</b>						
Channel	f (MHz)	WLAN on/off	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	Limit (mW/g)
25	1851.25	off				
600	1880.00	off	0.063	-0.031	0.063	1.6
1175	1908.75	off				

**Notes:**

- 1) The exact method of extrapolation is  $\text{measured SAR} \times 10^{(-\text{drift}/10)}$ . 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**

**12.2 HOST DEVICE**

Front View  
Levono W-note



Antenna



Front View  
Levono M-note



Rear View  
Levono M-note – Metal LCD Cover





Rear View  
Levono M-note – Metal LCD Cover



Rear View  
Levono W-note – Plastic LCD Cover



**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 Mechanical 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 quaity							
2. N - Nomal							
3. R - Rectangular							
4. Div. - Divisor used to obtain standard uncertainty							
5. Ci - is te sensitivity coefficient							

**14 EQUIPMENT LIST**

<u>Name of Equipment</u>	<u>Manufacturer</u>	<u>Type/Model</u>	<u>Serial Number</u>	<u>Cal. Due date</u>
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
Wireless Communication Test Set	Agilent	E5515C	GB44051333	5/5/06
Simulating Liquid	CCS	H835 MHz	N/A	within 24 hrs of first test
Simulating Liquid	CCS	M835 MHz	N/A	within 24 hrs of first test
Simulating Liquid	CCS	H1900 MHz	N/A	within 24 hrs of first test
Simulating Liquid	CCS	M1900 MHz	N/A	within 24 hrs of first test

**15 ATTACHMENT**

<b>No.</b>	<b>Contents</b>	<b>No. of page (s)</b>
1	System Performance Check Plot	6
2	SAR Test Plot	18
3	Certificate of E-filed Probe EX3DV4 SN 3552	10
4	Certificate of System Validation Dipole D2450V2 SN 748	9

**END OF REPORT**