SAR TEST REPORT

REPORT NO.: SA950803L01A
MODEL NO.: MC7095
RECEIVED: Aug. 03, 2006
TESTED: Aug. 14, 2006 ~ Jan. 19, 2007
ISSUED: Mar. 20, 2007

APPLICANT: Symbol Technologies, Inc.

ADDRESS: One Symbol Plaza, Holtsville, NY 11742, U.S.A.

ISSUED BY: Advance Data Technology Corporation

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0528

ACCREDITED No.: 2177-01

TABLE OF CONTENTS

1. CERTIFICATION

PRODUCT :	Enterprise Digital Assistant
MODEL NO.:	MC7095
BRAND:	Symbol
APPLICANT :	Symbol Technologies, Inc.
TESTED :	Aug. 14, 2006 ~ Jan. 19, 2007
TEST SAMPLE :	ENGINEERING SAMPLE
STANDARDS :	FCC Part 2 (Section 2.1093), RSS-102 FCC OET Bulletin 65, Supplement C (01-01)

The above equipment (Model: MC7095) have been tested by **Advance Data Technology Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY : Andrea Hsia , **DATE:** Mar. 20, 2007

TECHNICAL ACCEPTANCE : Stanely Hsu , **DATE:** Mar. 20, 2007
Responsible for RF

APPROVED BY : Gary Chang / Supervisor , **DATE:** Mar. 20, 2007

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Enterprise Digital Assistant
MODEL NO.	MC7095
FCC ID	H9PMC7095
POWER SUPPLY	3.7Vdc from rechargeable lithium battery 5.4Vdc from power adapter for charger 12.0Vdc from power adapter for cradle
CLASSIFICATION	Portable device, production unit
MODULATION TYPE	Mobile phone: QPSK, OQPSK, HPSK for CDMA2000, 1xEV-DO
	WLAN: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM Bluetooth: GFSK for FHSS
FREQUENCY RANGE	Mobile phone: Tx Frequency: 824.2MHz ~ 848.8MHz (CDMA850) 1850.2MHz ~ 1909.8MHz (CDMA1900) Rx Frequency: 869.2MHz ~ 893.8MHz (CDMA850) 1930.2MHz ~ 1989.8MHz (CDMA1900)
	Wireless LAN: 802.11b & 802.11g: 2400.0MHz ~ 2483.5MHz 802.11a: 5180MHz ~ 5250MHz, 5745MHz ~ 5825MHz Bluetooth: 2400.0MHz ~ 2483.5MHz
CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER	WLAN-OFDM (802.11a) New band **For 5.250 ~ 5.350GHz** 25.119mW / 5260MHz for channel 52 25.293mW / 5280MHz for channel 56 39.811mW / 5320MHz for channel 64 **For 5.470 ~ 5.725GHz** 25.351mW / 5500MHz for channel 100 20.989mW / 5520MHz for channel 104 16.482mW / 5580MHz for channel 116 15.631mW / 5600MHz for channel 120 13.122mW / 5620MHz for channel 124 20.797mW / 5680MHz for channel 136 22.699mW / 5700MHz for channel 140
MAX. AVERAGE SAR (1g)	Head: 5.250 ~ 5.350GHz & 5.470 ~ 5.725GHz: 1.400W/kg
	Body: 5.250 ~ 5.350GHz & 5.470 ~ 5.725GHz: 0.384W/kg
ANTENNA TYPE	Mobile phone: Monopole antenna with 0.79dBi gain (CDMA850) Monopole antenna with 1.11dBi gain (CDMA1900) Wireless LAN: PIFA antenna with 2.0dBi gain (for 2.4GHz) PIFA antenna with 2.5dBi gain (for 5.0GHz) Bluetooth: Chip antenna with 2.0dBi gain
DATA CABLE	0.92m non-shielded cable for earphone
I/O PORTS	Refer to user's manual

ASSOCIATED DEVICES	Earphone, cradle

NOTE:

1. This report is issued as a supplementary report of ADT report no.: SA950803L01. This report is prepared for FCC class II permissive change. The differences compared with the original design is add new band (software control) 5250-5350MHz & 5470-5725MHz.
2. Since H/M/L channel powers are higher than default test channels as specified in "SAR measurement Procedures for 802.11 a/b/g Transmitters dated Oct 2006" The extra SAR test data for those channels have been tested in this report.

Frequency(MHz)	Test channels	Remark
5260~5320	52 (5260MHz)	(L) Default test channel
	56 (5280MHz)	(M) --
	64 (5320MHz)	(H) Default test channel
5470~5725	100 (5500MHz)	(L) --
	104 (5520MHz)	Default test channel
	116 (5580MHz)	Default test channel
	120 (5600MHz)	(M) --
	124 (5620 MHz)	Default test channel
	136 (5680 MHz)	Default test channel
	140 (5700MHz)	(H)

3. The EUT is a CDMA850/CDMA1900 Enterprise Digital Assistant with wireless LAN and bluetooth functions
4. The EUT have two lithium batteries listed as below:

HEAVY BATTERY:	
BRAND:	Symbol
MODEL:	82-71364-02
RATING:	3.7Vdc, 3800mAh

MAIN BATTERY:	
BRAND:	Symbol
MODEL:	82-71363-02
RATING:	3.7Vdc, 1900mAh

5. The cradle was operated with following power adapter:

BRAND:	HIPRO
MODEL:	HP-O2040D43
INPUT:	100-240Vac, 50-60Hz, 1.5A
OUTPUT:	12Vdc, 3.33A
POWER LINE:	AC 1.8m non-shielded cable without core DC 1.8m shielded cable with one core

6. The charging cable was operated with following power adapter:

BRAND:	Delta
MODEL:	ADP-16GB A
INPUT:	100-240Vac, 50-60Hz, 0.4A
OUTPUT:	5.4Vdc, 3A
POWER LINE:	AC 0.7m non-shielded cable without core DC 1.87m non-shielded cable with one core

7. After pretest two batteries, only Heavy battery was the worst case and present in the test report;

for the Main battery only present the worst channel in the test report.
8. Standalone has been investigated in the pretest and final test represent the worst case.
9. Emission of Inter-modulation has been evaluated and is compliance with related rule.
10. Software version: 02.24.0000.

11. Hardware version:
   - IPL version: 01.39.412.
   - Power Micro: 11.27.0005.
   - CPLD version: 02.00.
12. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2.2 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to the specifications of the manufacturer, this product must comply with the requirements of the following standards:

FCC 47 CFR Part 2 (2.1093)

FCC OET Bulletin 65, Supplement C (01- 01)

RSS-102

IEEE 1528-2003

All test items have been performed and recorded as per the above standards.

2.3 GENERAL INOFRMATION OF THE SAR SYSTEM

DASY4 (software 4.7 Build 44) consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY4 software defined. The DASY4 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

ET3DV6 ISOTROPIC E-FIELD PROBE (FREQUENCY BAND < 3GHz)

CONSTRUCTION	Symmetrical design with triangular core. Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., glycolether).
FREQUENCY	10 MHz to 3 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
DYNAMIC RANGE	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
OPTICAL SURFACE DETECTION	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
DIMENSIONS	Overall length: 330 mm (Tip Length: 16 mm) Tip diameter: 6.8 mm (Body diameter: 12 mm) Distance from probe tip to dipole centers: 2.7 mm
APPLICATION	General dosimetric measurements up to 3 GHz Fast automatic scanning in arbitrary phantoms (ET3DV6)

EX3DV3 ISOTROPIC E-FIELD PROBE (FREQUENCY BAND 5 ~ 6GHz)

DIMENSIONS	Overall length: 330 mm (Tip Length: 20 mm) Tip diameter: 2.5 mm (Body diameter: 12 mm) Distance from probe tip to dipole centers: 1.0 mm
APPLICATION	General dosimetric measurements range 5 ~ 6 GHz. Fast automatic scanning in arbitrary phantoms (EX3DV3)

NOTE:

1. The Probe parameters have been calibrated by the SPEAG. Please reference “APPENDIX D” for the Calibration Certification Report.
2. For frequencies above 800 MHz, calibration in a rectangular wave-guide is used, because wave-guide size is manageable.
3. For frequencies below 800 MHz, temperature transfer calibration is used because the wave-guide size becomes relatively large.

TWIN SAM V4.0

CONSTRUCTION The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, 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: 810 mm; Length: 1000 mm; Width: 500 mm

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
CALIBRATION	Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions
FREQUENCY	900, 1800, 1900, 2450 , 5200, 5800MHz
RETURN LOSS	> 20 dB at specified validation position
POWER CAPABILITY	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
OPTIONS	Dipoles for other frequencies or solutions and other calibration conditions upon request

DEVICE HOLDER FOR SAM TWIN PHANTOM

CONSTRUCTION	The device holder for the GSM900/DCS1800/PCS1900 GSM/GPRS/CDMA Mobile Phone device is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles. The holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent δ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. The device holder for the portable device makes up of the polyethylene foam. The dielectric parameters of material close to the dielectric parameters of the air.

DATA ACQUISITION ELECTRONICS

CONSTRUCTION	The data acquisition electronics (DAE3) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplex, 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 is 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.

2.4 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION

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

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	F
	- Crest factor	Cf
Media parameters:	- Conductivity	σ
	- Density	ρ

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

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

V_i	=compensated signal of channel i	(i = x, y, z)
U_i	=input signal of channel I	(i = x, y, z)
Cf	=crest factor of exciting field	(DASY parameter)
dcp_i	=diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E-fieldprobes: } E_i = \sqrt{\frac{V_1}{Norm_i \cdot ConvF}}$$

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

V_i	=compensated signal of channel I	(i = x, y, z)
$Norm_i$	=sensor sensitivity of channel i μV/(V/m)2 for E-field Probes	(i = x, y, z)
ConvF	= sensitivity enhancement in solution	
a_{ij}	= sensor sensitivity factors for H-field probes	
F	= carrier frequency [GHz]	
E_i	= electric field strength of channel i in V/m	
H_i	= magnetic field strength of channel i in A/m	

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

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

SAR	= local specific absorption rate in mW/g
E_{tot}	= total field strength in V/m
σ	= conductivity in [mho/m] or [Siemens/m]
ρ	= equivalent tissue density in g/cm3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid. The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1 g and 10 g.

The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated. The angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within -2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7 x 7 x 7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 30 x 30 x 30mm contains about 30g of tissue. The first procedure is an extrapolation (incl. boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid (42875 points). In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

3. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
1	Universal Radio Communication Tester	R&S	CMU200	104958	Apr. 11, 2007

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

NOTE: All power cords of the above support units are non shielded (1.8m).

4. DESCRIPTION OF TEST POSITION

4.1 DESCRIPTION OF TEST POSITION

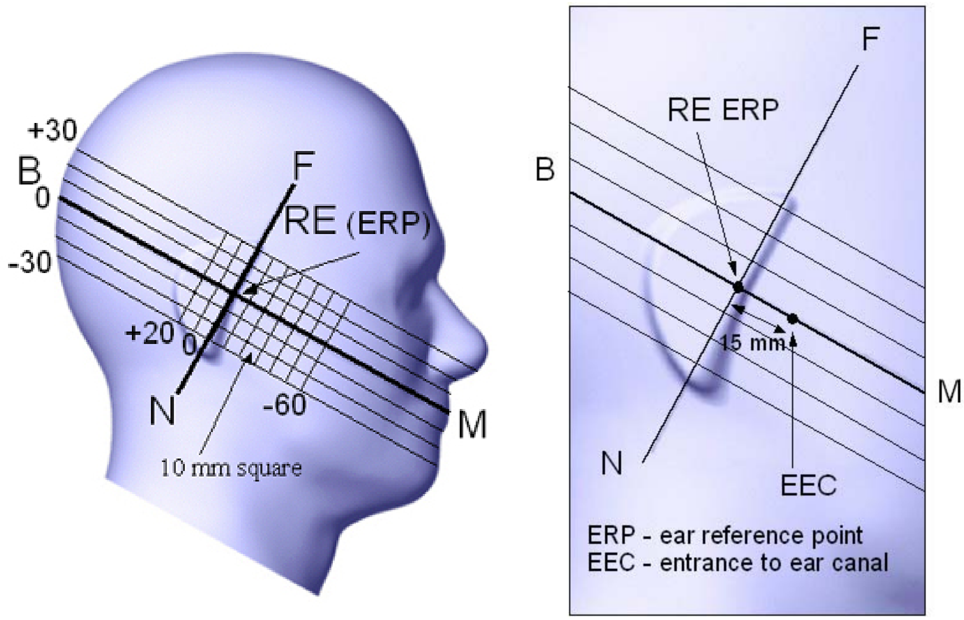


FIGURE 3.1

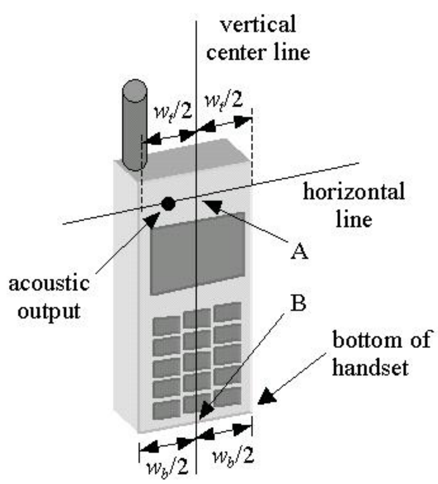


FIGURE 3.1a

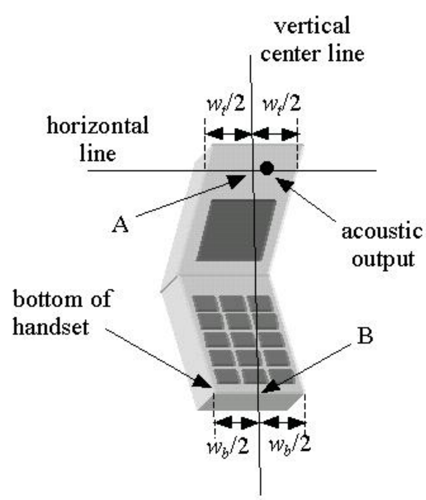
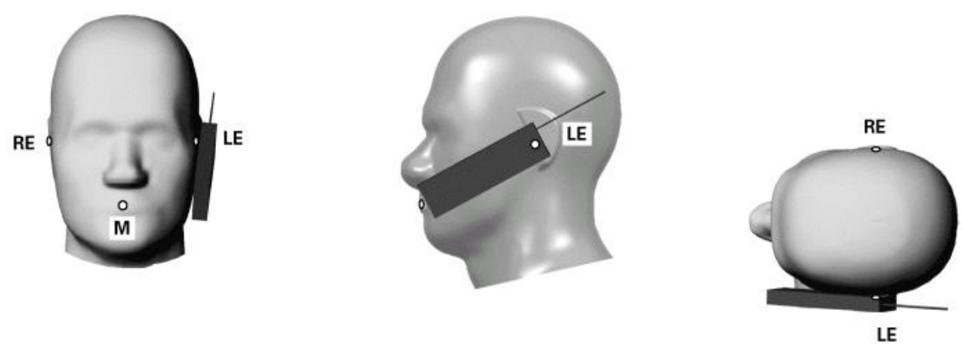


FIGURE 3.1b

4.2.1 TOUCH/CHEEK TEST POSITION

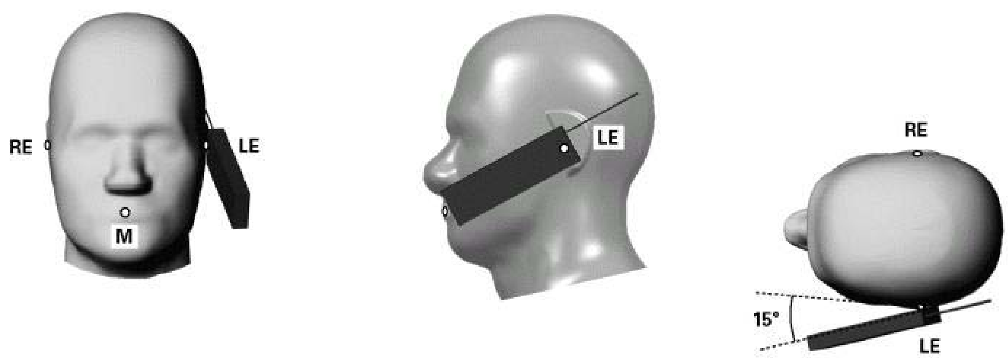
The head position in Figure 3.1, the ear reference points ERP are 15mm above entrance to ear canal along the B-M line. The line N-F (Neck-Front) is perpendicular to the B-M (Back Mouth) line. The handset device in Figure 3.1a and 3.1b,The vertical centerline pass through two points on the front side of handset: the midpoint of the width wt of the handset at the level of the acoustic output (point A) and the midpoint of the width Wb of the bottom of the handset (point B). The vertical centerline is perpendicular to the horizontal line and pass through the center of the acoustic output. The point A touches the ERP and the vertical centerline of the handset is parallel to the B-M line. While maintaining the point A contact with the ear(ERP), rotate the handset about the line NF until any point on handset is in contact with the cheek of the phantom



TOUCH/CHEEK POSITION FIGURE

4.2.2 TILT TEST POSITION

Adjust the device in the cheek position. While maintaining a point of the handset contact in the ear, move the bottom of the handset away from the mouth by an angle of 15 degrees.



TILT POSITION FIGURE

4.2.3 BODY-WORN CONFIGURATION

The handset device attached the belt clip or the holster. The keypad face of the handset is against with the bottom of the flat phantom face and the bottom of the keypad face contact to the bottom of the flat phantom.

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 accessory that dictates the closest spacing to the body must be tested.

4.2 DESCRIPTION OF TEST MODE

TEST MODE	COMMUNICATION MODE	MODULATION TYPE	ASSESSMENT POSTITION	TESTED CHANNEL
1	WLAN 802.11a (New band) 5250MHz ~ 5350MHz & 5470MHz ~ 5725MHz (L/M/H channels with higher output power, please see note 1 below)	BPSK	A / Cheek	52, 56, 64, 100, 120, 140
2		BPSK	A / Tilt	52, 56, 64, 100, 120, 140
3		BPSK	B / Cheek	52, 56, 64, 100, 120, 140
4		BPSK	B / Tilt	52, 56, 64, 100, 120, 140
5		BPSK	C : Body	52, 56, 64, 100, 120, 140
6	WLAN 802.11a (New band) 5470MHz ~ 5725MHz SAR data (Default test channels, please see note 1 below)	BPSK	A / Cheek	104, 116, 124, 136
7		BPSK	A / Tilt	104, 116, 124, 136
8		BPSK	B / Cheek	104, 116, 124, 136
9		BPSK	B / Tilt	104, 116, 124, 136
10		BPSK	C : Body	104, 116, 124, 136
11	CDMA 850+ 802.11a+Bluetooth	NOTE	B / Tilt	NOTE
12	1xEVDO 850+802.11a+Bluetooth	NOTE	C : Body	NOTE
13	CDMA 1900+ 802.11a+Bluetooth	NOTE	B / Tilt	NOTE
14	1xEVDO 1900+802.11b+Bluetooth	NOTE	C : Body	NOTE

NOTE:

1. Since H/M/L channel powers are higher than default test channels as specified in “SAR measurement Procedures for 802.11 a/b/g Transmitters dated Oct 2006” The extra SAR test data for those channels (100, 120,140) have been tested in this report

2. The combination is from the worst situation of each communication mode.

4.3 SUMMARY OF TEST RESULTS

For New band (5250MHz ~ 5350MHz & 5470MHz ~ 5725MHz)
HEAD POSITION

PART OF ASSESSMENT	HEAD POSITION			
COMMUNICATION MODE	802.11a (5250MHz ~ 5350MHz)			
	MEASURED VALUE OF 1g SAR (W/kg)			
	RIGHT		LEFT	
CHANNEL	CHEEK	TILT	CHEEK	TILT
52 (5260MHz)	1.160	1.280	1.160	**1.400**
56 (5280 MHZ)	0.920	1.000	1.000	1.060
64 (5320 MHZ)	1.080	1.160	1.250	1.330

NOTE: The worst value has been marked by boldface.

PART OF ASSESSMENT	HEAD POSITION			
COMMUNICATION MODE	802.11a (5470MHz ~ 5720MHz) (Note: Data below are typical L/M/H channel measurement result)			
	MEASURED VALUE OF 1g SAR (W/kg)			
	RIGHT		LEFT	
CHANNEL	CHEEK	TILT	CHEEK	TILT
100 (5500MHz)	0.671	0.748	0.819	0.881
120 (5600 MHZ)	0.438	0.447	0.568	0.551
140 (5700 MHZ)	0.391	0.383	0.505	0.449

NOTE: The worst value has been marked by boldface.

PART OF ASSESSMENT	HEAD POSITION			
COMMUNICATION MODE	802.11a (5470MHz ~ 5720MHz) (Note: Data below are specific default test channels specified in FCC WLAN test guide line)			
	MEASURED VALUE OF 1g SAR (W/kg)			
	RIGHT		LEFT	
CHANNEL	CHEEK	TILT	CHEEK	TILT
104 (5520MHz)	0.599	0.649	0.831	0.859
116 (5580MHz)	0.458	0.498	0.615	0.676
124 (5620MHz)	0.351	0.364	0.461	0.530
136 (5680MHz)	0.349	0.361	0.456	0.560

NOTE: The worst value has been marked by boldface.

BODY POSITION

PART OF ASSESSMENT	BODY POSITION
COMMUNICATION MODE	802.11a (5250MHz ~ 5350MHz)
	MEASURED VALUE OF 1g SAR (W/kg)
CHANNEL	BODY
52 (5260MHz)	**0.384**
56 (5280 MHZ)	0.183
64 (5320 MHZ)	0.302

NOTE: The worst value has been marked by boldface

PART OF ASSESSMENT	BODY POSITION
COMMUNICATION MODE	802.11a (5470MHz ~ 5725MHz) (Note: Data below are typical L/M/H channel measurement result)
	MEASURED VALUE OF 1g SAR (W/kg)
CHANNEL	BODY
100 (5500MHz)	0.162
120 (5600 MHz)	0.088
140 (5700 MHz)	0.062

NOTE: The worst value has been marked by boldface

PART OF ASSESSMENT	BODY POSITION
COMMUNICATION MODE	802.11a (5470MHz ~ 5725MHz) (Note: Data below are specific default test channels specified in FCC WLAN test guide line)
	MEASURED VALUE OF 1g SAR (W/kg)
CHANNEL	BODY
104 (5520MHz)	0.125
116 (5580MHz)	0.089
124 (5620MHz)	0.058
136 (5680MHz)	0.048

NOTE: The worst value has been marked by boldface

TEST RESULTS OF MULTI-BANDS CO-LOCATED ASSESSMENT

The worst situation has been chosen from the above table, and make up following combinations for the test of co-location listed as below.

TEST MODE	DESCRIPTION	MEASURED VALUE OF 1g SAR (W/kg)
11	CDMA 850+ 802.11a+Bluetooth	1.400
12	1xEVDO 850+802.11a+Bluetooth	0.384
13	CDMA 1900+ 802.11a+Bluetooth	1.400
14	1xEVDO 1900+802.11b+Bluetooth	0.384

5. TEST RESULTS

5.1 TEST PROCEDURES

For CDMA2000, 1xEV-DO:

The EUT (Enterprise Digital Assistant) makes a phone call to the communication simulator station. Establish the simulation communication configuration rather the actual communication. Then the EUT could continuous the transmission mode. Adjust the PCL of the base station could controlled the EUT to transmitted the maximum output power. The base station also could control the transmission channel. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY4 SAR measurement system manufactured and calibrated by SPEAG. According to the IEEE 1528 / EN 50361, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

For WLAN & Bluetooth:

The EUT (Enterprise Digital Assistant) use the software to control the EUT channel and transmission power. Then record the conducted power before the testing. Place the EUT to the specific test location. After the testing, must writing down the conducted power of the EUT into the report. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY4 SAR measurement system manufactured and calibrated by SPEAG. According to the IEEE P1528 / EN 50361 standards, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- Power reference measurement
- Verification of the power reference measurement
- Area scan
- Zoom scan
- Power reference measurement

The area scan with 15mm x 15mm grid was performed for the highest spatial SAR location. Consist of 11 x 13 points while the scan size is the 150mm x 180mm. The zoom scan with 30mm x 30mm x 30mm volume was performed for SAR value averaged over 1g and 10g spatial volumes.

In the zoom scan, the distance between the measurement point at the probe sensor location (geometric center behind the probe tip) and the phantom surface is 4.0 mm and maintained at a constant distance of ±1.0 mm during a zoom scan to determine peak SAR locations. The distance is 4mm between the first measurement point and the bottom surface of the phantom. The secondary measurement point to the bottom surface of the phantom is with 9mm separation distance. The cube size is 7 x 7 x 7 points consist of 343 points and the grid space is 5mm.

The measurement time is 0.5 s at each point of the zoom scan. The probe boundary effect compensation shall be applied during the SAR test. Because of the tip of the probe to the Phantom surface separated distances are longer than half a tip probe diameter.

In the area scan, the separation distance is 4mm between the each measurement point and the phantom surface. The scan size shall be included the transmission portion of the EUT. The measurement time is the same as the zoom scan. At last the reference power drift shall be less than ±5%.

5.2 MEASURED SAR RESULTS

WLAN BAND (802.11a) RIGHT HEAD POSITION

NEW BAND (5.250 ~ 5.350GHz & 5.470 ~ 5.725GHz)

ENVIRONMENTAL CONDITION	Air Temperature：22.3°C, Liquid Temperature：21.2°C Humidity：61%RH		
TESTED BY	Sam Onn	DATE	Oct. 24, 2006

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (mW)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
52	**5260.00**	**BPSK**	25.119	24.888	-0.92	Standard Battery	1	1.160
56	**5280.00**	**BPSK**	25.293	25.020	-1.08	Standard Battery	1	0.920
64	**5320.00**	**BPSK**	39.811	39.369	-1.11	Standard Battery	1	1.080
100	**5500**	**BPSK**	25.351	25.037	-1.24	Standard Battery	1	0.671
120	**5600**	**BPSK**	15.631	15.352	-1.78	Standard Battery	1	0.438
140	**5700**	**BPSK**	22.699	22.388	-1.37	Standard Battery	1	0.391

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

WLAN BAND (802.11a) RIGHT HEAD POSITION

NEW BAND (5.250 ~ 5.350GHz & 5.470 ~ 5.725GHz)

ENVIRONMENTAL CONDITION	Air Temperature：22.3°C, Liquid Temperature：21.2°C Humidity：61%RH		
TESTED BY	Sam Onn	DATE	Oct. 24, 2006

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (mW)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
52	**5260.00**	**BPSK**	25.119	24.928	-0.76	Standard Battery	2	1.280
56	**5280.00**	**BPSK**	25.293	25.103	-0.75	Standard Battery	2	1.000
64	**5320.00**	**BPSK**	39.811	39.353	-1.15	Standard Battery	2	1.160
100	**5500**	**BPSK**	25.351	24.963	-1.53	Standard Battery	2	0.748
120	**5600**	**BPSK**	15.631	15.325	-1.96	Standard Battery	2	0.447
140	**5700**	**BPSK**	22.699	22.390	-1.36	Standard Battery	2	0.383

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

WLAN BAND (802.11a) LEFT HEAD POSITION

NEW BAND (5.250 ~ 5.350GHz & 5.470 ~ 5.725GHz)

ENVIRONMENTAL CONDITION			Air Temperature：22.3°C, Liquid Temperature：21.2°C Humidity：61%RH						
TESTED BY			Sam Onn			**DATE**		Oct. 24, 2006	
CHAN.	**FREQ. (MHz)**	**MODULATION TYPE**	**CONDUCTED POWER (mW)**		**POWER DRIFT (%)**	**DEVICE USE POWER**	**DEVICE TEST POSITION MODE**	**MEASURED 1g SAR (W/kg)**	
			BEGIN TEST	**AFTER TEST**					
52	**5260.00**	**BPSK**	25.119	24.840	-1.11	Standard Battery	3	1.160	
56	**5280.00**	**BPSK**	25.293	24.982	-1.23	Standard Battery	3	1.000	
64	**5320.00**	**BPSK**	39.811	39.071	-1.86	Standard Battery	3	1.250	
100	**5500**	**BPSK**	25.351	24.940	-1.62	Standard Battery	3	0.819	
120	**5600**	**BPSK**	15.631	15.372	-1.66	Standard Battery	3	0.568	
140	**5700**	**BPSK**	22.699	22.250	-1.98	Standard Battery	3	0.505	

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

WLAN BAND (802.11a) LEFT HEAD POSITION

NEW BAND (5.250 ~ 5.350GHz & 5.470 ~ 5.725GHz)

ENVIRONMENTAL CONDITION	Air Temperature：22.3°C, Liquid Temperature：21.2°C Humidity：61%RH							
TESTED BY	Sam Onn				**DATE**	Oct. 24, 2006		

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (mW)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
52	**5260.00**	**BPSK**	25.119	24.835	-1.13	Standard Battery	4	**1.400**
56	**5280.00**	**BPSK**	25.293	24.977	-1.25	Standard Battery	4	1.060
64	**5320.00**	**BPSK**	39.811	39.325	-1.22	Standard Battery	4	1.330
100	**5500**	**BPSK**	25.351	24.981	-1.46	Standard Battery	4	0.881
120	**5600**	**BPSK**	15.631	15.384	-1.58	Standard Battery	4	0.551
140	**5700**	**BPSK**	22.699	22.306	-1.73	Standard Battery	4	0.449

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

WLAN BAND (802.11a) BODY POSITION

NEW BAND (5.250 ~ 5.350GHz & 5.470 ~ 5.725GHz)

ENVIRONMENTAL CONDITION	Air Temperature：22.5°C, Liquid Temperature：21.5°C Humidity：63%RH		
TESTED BY	Sam Onn	**DATE**	Oct. 25, 2006

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (mW)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
52	**5260.00**	**BPSK**	25.119	24.900	-0.87	Standard Battery	5	**0.384**
56	**5280.00**	**BPSK**	25.293	25.030	-1.04	Standard Battery	5	0.183
64	**5320.00**	**BPSK**	39.811	39.337	-1.19	Standard Battery	5	0.302
100	**5500**	**BPSK**	25.351	25.001	-1.38	Standard Battery	5	0.162
120	**5600**	**BPSK**	15.631	15.354	-1.77	Standard Battery	5	0.088
140	**5700**	**BPSK**	22.699	22.356	-1.51	Standard Battery	5	0.062

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

WLAN BAND (802.11a) RIGHT HEAD POSITION

NEW BAND (5.470 ~ 5.725GHz)

ENVIRONMENTAL CONDITION	Air Temperature：23.1°C, Liquid Temperature：22.0°C Humidity：62%RH		
TESTED BY	Sam Onn	**DATE**	Jan. 17, 2007

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (mW)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
104	**5520**	**BPSK**	20.989	20.824	-0.79	Standard Battery	6	0.599
116	**5580**	**BPSK**	16.482	16.346	-0.83	Standard Battery	6	0.458
124	**5620**	**BPSK**	13.122	12.984	-1.05	Standard Battery	6	0.351
136	**5680**	**BPSK**	20.797	20.547	-1.20	Standard Battery	6	0.349
104	**5520**	**BPSK**	20.989	20.756	-1.11	Standard Battery	7	0.649
116	**5580**	**BPSK**	16.482	16.257	-1.37	Standard Battery	7	0.498
124	**5620**	**BPSK**	13.122	12.912	-1.60	Standard Battery	7	0.364
136	**5680**	**BPSK**	20.797	20.423	-1.80	Standard Battery	7	0.361

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

WLAN BAND (802.11a) LEFT HEAD POSITION

NEW BAND (5.470 ~ 5.725GHz)

ENVIRONMENTAL CONDITION	Air Temperature：23.1°C, Liquid Temperature：22.0°C Humidity：62%RH		
TESTED BY	Sam Onn	**DATE**	Jan. 17, 2007

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (mW)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
104	**5520**	**BPSK**	20.989	20.856	-0.63	Standard Battery	8	0.831
116	**5580**	**BPSK**	16.482	16.341	-0.86	Standard Battery	8	0.615
124	**5620**	**BPSK**	13.122	12.974	-1.13	Standard Battery	8	0.461
136	**5680**	**BPSK**	20.797	20.516	-1.35	Standard Battery	8	0.456
104	**5520**	**BPSK**	20.989	20.802	-0.89	Standard Battery	9	0.859
116	**5580**	**BPSK**	16.482	16.293	-1.15	Standard Battery	9	0.676
124	**5620**	**BPSK**	13.122	12.955	-1.27	Standard Battery	9	0.530
136	**5680**	**BPSK**	20.797	20.502	-1.42	Standard Battery	9	0.560

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

WLAN BAND (802.11a) BODY POSITION

NEW BAND (5.470 ~ 5.725GHz)

ENVIRONMENTAL CONDITION	Air Temperature：22.7°C, Liquid Temperature：21.8°C Humidity：63%RH		
TESTED BY	Sam Onn	DATE	Jan. 19, 2007

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (mW)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
104	**5520**	**BPSK**	20.989	20.637	-1.68	Standard Battery	10	0.125
116	**5580**	**BPSK**	16.482	16.176	-1.86	Standard Battery	10	0.089
124	**5620**	**BPSK**	13.122	12.856	-2.03	Standard Battery	10	0.058
136	**5680**	**BPSK**	20.797	20.315	-2.32	Standard Battery	10	0.048

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

CDMA 850 + WLAN (802.11a)+ BLUETOOTH BAND LEFT HEAD (TILT) POSITION

TESTED BY	Sam Onn	DATE	Oct. 24, 2006

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
777	**848.8**	**OQPSK**	0.263W	0.261W	-0.89	Standard Battery	11	1.400
52	**5260.00**	**BPSK**	25.119mW	24.835mW	-1.13			
78	**2480.00**	**GFSK**	0.931mW	0.924mW	-0.77			

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

1xEVDO 850 + WLAN (802.11a)+ BLUETOOTH BAND BODY POSITION

TESTED BY	Sam Onn	DATE	Oct. 25, 2006

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
384	**836.6**	**HPSK**	0.263W	0.262W	-0.36	Standard Battery	12	0.384
52	**5260.00**	**BPSK**	25.119mW	24.900mW	-0.87			
78	**2480.00**	**GFSK**	0.931mW	0.925mW	-0.69			

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3.Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

CDMA 1900 + WLAN (802.11a)+ BLUETOOTH BAND LEFT HEAD (TILT) POSITION

TESTED BY	Sam Onn	DATE	Oct. 24, 2006

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
600	**1880.00**	**OQPSK**	0.275W	0.273W	-0.69	Standard Battery	13	1.400
52	**5260.00**	**BPSK**	25.119mW	24.835mW	-1.13			
78	**2480.00**	**GFSK**	0.931mW	0.924mW	-0.77			

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

1xEVDO 1900 + WLAN (802.11a)+ BLUETOOTH BAND BODY POSITION

TESTED BY	Sam Onn	DATE	Oct. 25, 2006

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
600	**1880.00**	**OQPSK**	0.275W	0.273W	-0.63	Standard Battery	14	0.384
52	**5260.00**	**BPSK**	25.119mW	24.900mW	-0.87			
78	**2480.00**	**GFSK**	0.931mW	0.925mW	-0.69			

NOTE:

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over **1g, 1.6W/kg**, is applied.
3.Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

5.3 SAR LIMITS

HUMAN EXPOSURE	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / controlled Exposure Environment)
Spatial Average (whole body)	0.08	0.4
Spatial Peak (averaged over 1 g)	**1.6**	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

NOTE:

1. This limits accord to 47 CFR 2.1093 – Safety Limit.
2. The EUT property been complied with the partial body exposure limit under the general population environment.

5.4 RECIPES FOR TISSUE SIMULATING LIQUIDS

For the measurement of the field distribution inside the SAM phantom, the phantom must be filled with 25 litters of tissue simulation liquid.

The following ingredients are used：

• **WATER-**	Deionized water (pure H20), resistivity _16 M - as basis for the liquid
• **SUGAR-**	Refined sugar in crystals, as available in food shops - to reduce relative permittivity
• **SALT-**	Pure NaCl - to increase conductivity
• **CELLULOSE-**	Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20_C), CAS # 54290 - to increase viscosity and to keep sugar in solution
• **PRESERVATIVE-**	Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 - to prevent the spread of bacteria and molds
• **DGMBE-**	Diethylenglycol-monobuthyl ether (DGMBE), Fluka Chemie GmbH, CAS # 112-34-5 - to reduce relative permittivity

THE INFORMATION FOR 5GHz SIMULATING LIQUID

The 5GHz liquids was purchased from SPEAG.

Body liquid model: HSL 5800, P/N: SL AAH 5800 AA

Head liquid model: M 5800, P/N: SL AAM 580 AD

5GHz liquids contain the following ingredients:

Water 64 - 78%

Mineral Oil 11 - 18%

Emulsifiers 9 - 15%

Additives and Salt 2 - 3%

Testing the liquids using the Agilent Network Analyzer E8358A and Agilent Dielectric Probe Kit 85070D.The testing procedure is following as

1. Turn Network Analyzer on and allow at least 30 min. warm up.
2. Mount dielectric probe kit so that interconnecting cable to Network Analyzer will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature (±1°).
4. Set water temperature in Agilent-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with >8mm thickness ε'=10.0, ε''=0.0). If measured parameters do not fit within tolerance, repeat calibration (±0.2 for ε': ±0.1 for ε'').
7. Conductivity can be calculated from ε'' by $\sigma = \omega \varepsilon_0 \varepsilon'' = \varepsilon'' f [GHz] / 18$.
8. Measure liquid shortly after calibration. Repeat calibration every hour.
9. Stir the liquid to be measured. Take a sample (~50ml) with a syringe from the center of the liquid container.
10. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
11. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
12. Perform measurements.
13. Adjust medium parameters in DASY4 for the frequencies necessary for the measurements (‘Setup Config’, select medium (e.g. Brain 900 MHz) and press ‘Option’-button.

Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 900 MHz).

FOR 5.0GHz BAND SIMULATING LIQUID

NEW BAND (5.250 ~ 5.350GHz)

LIQUID TYPE		HSL-5200		MSL-5200	
SIMULATING LIQUID TEMP.		21.2		21.5	
TEST DATE		Oct. 24, 2006		Oct. 25, 2006	
TESTED BY		Sam Onn		Sam Onn	
FREQ. (MHz)	**LIQUID PARAMETER**	**STANDARD VALUE**	**MEASUREMENT VALUE**	**STANDARD VALUE**	**MEASUREMENT VALUE**
5200	Permitivity (ε)	36.00	36.90	49.00	50.50
5260		35.90	36.80	48.90	49.50
5280		35.90	36.80	48.90	49.50
5320		35.80	36.70	48.90	50.20
5500		35.60	36.30	48.60	49.70
5600		35.50	36.10	48.50	49.50
5700		35.40	35.20	48.30	49.30
5800		35.30	35.70	48.20	49.10
5200	Conductivity (σ) S/m	4.66	4.57	5.30	5.13
5260		4.72	4.64	5.37	5.22
5280		4.74	4.66	5.39	5.26
5320		4.78	4.71	5.44	5.32
5500		4.96	4.92	5.65	5.58
5600		5.07	5.04	5.77	5.73
5700		5.17	5.16	5.88	5.89
5800		5.27	5.29	6.00	6.05
Dielectric Parameters Required at 21℃					

NEW BAND (5.470 ~ 5.725GHz)

LIQUID TYPE		HSL-5800		MSL-5800	
SIMULATING LIQUID TEMP.		22.0		21.8	
TEST DATE		Jan. 17, 2007		Jan. 19, 2007	
TESTED BY		Sam Onn		Sam Onn	
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	STANDARD VALUE	MEASUREMENT VALUE
5500	Permitivity (ε)	35.60	35.00	48.60	48.10
5520		35.60	35.00	48.60	48.10
5580		35.60	34.90	48.50	47.90
5620		35.50	34.80	48.40	47.80
5680		35.40	34.70	48.40	47.70
5800		35.30	34.50	48.20	47.70
5500	Conductivity (σ) S/m	4.96	5.07	5.65	5.72
5520		4.98	5.09	5.67	5.74
5580		5.04	5.17	5.74	5.83
5620		5.09	5.22	5.79	5.89
5680		5.15	5.29	5.86	6.00
5800		5.27	5.45	6.00	6.02
Dielectric Parameters Required at 21℃					

5.5 TEST EQUIPMENT FOR TISSUE PROPERTY

ITEM	NAME	BAND	TYPE	SERIES NO.	CALIBRATED UNTIL
1	Network Analyzer	Agilent	E8358A	US41480538	Nov. 06, 2007
2	Dielectric Probe	Agilent	85070D	US01440176	NA

NOTE:

1. Before testing the measurement, all test equipment shall have 30 min warm up.
2. The tolerance (k=1) specified by Agilent for general dielectric measurements, deriving from inaccuracies in the calibration data, analyzer drift, and random errors, are usually ±2.5% and ±5% for measured permittivity and conductivity, respectively. However, the tolerances for the conductivity is smaller for material with large loss tangents, i.e., less than ±2.5% (k=1). It can be substantially smaller if more accurate methods are applied.

6. SYSTEM VALIDATION

The system validation was performed in the flat phantom with equipment listed in the following table. Since the SAR value is calculated from the measured electric field, dielectric constant and conductivity of the body tissue and the SAR is proportional to the square of the electric field. So, the SAR value will be also proportional to the RF power input to the system validation dipole under the same test environment. In our system validation test, 250mW RF input power was used.

6.1 TEST EQUIPMENT

For NEW BAND (5250 ~ 5350 MHz)

ITEM	NAME	BAND	TYPE	SERIES NO.	CALIBRATED UNTIL
1	SAM Phantom	S & P	QD000 P40 CA	PT-1150	NA
2	Signal Generator	Agilent	68247B	984703	May 08, 2007
3	E-Field Probe	S & P	EX3DV3	3506	Apr. 19, 2007
4	DAE	S & P	DAE3 V1	579	Mar. 14, 2007
5	Robot Positioner	Staubli Unimation	NA	NA	NA
6	Validation Dipole	S & P	D5GHzV2	1018	May 02, 2007

NOTE: Before starting the measurement, all test equipment shall be warmed up for 30min.

For NEW BAND (5470 ~ 5725MHz)

ITEM	NAME	BAND	TYPE	SERIES NO.	CALIBRATED UNTIL
1	SAM Phantom	S & P	QD000 P40 CA	PT-1150	NA
2	Signal Generator	Agilent	68247B	984703	May 08, 2007
3	E-Field Probe	S & P	EX3DV6	3504	Nov. 22, 2007
4	E-Field Probe	S & P	EX3DV3	3506	Apr. 19, 2007
5	DAE	S & P	DAE3 V1	579	Mar. 14, 2007
6	Robot Positioner	Staubli Unimation	NA	NA	NA
7	Validation Dipole	S & P	D5GHzV2	1018	May 02, 2007

6.2 TEST PROCEDURE

Before you start the system performance check, need only to tell the system with which components (probe, medium, and device) are performing the system performance check; the system will take care of all parameters. The dipole must be placed beneath the flat phantom section of the SAM Twin Phantom with the correct distance holder in place. The distance holder should touch the phantom surface with a light pressure at the reference marking (little cross) and be oriented parallel to the long side of the phantom. Accurate positioning is not necessary, since the system will search for the peak SAR location, except that the dipole arms should be parallel to the surface. The device holder for the EUT can be left in place but should be rotated away from the dipole.

1.The ”Power Reference Measurement” and ”Power Drift Measurement” jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the amplifier output power. If it is too high (above ±0.1 dB), the system performance check should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the DASY system below ±0.02 dB.

2.The ”Surface Check” job tests the optical surface detection system of the DASY system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ±0.1mm). In that case it is better to abort the system performance check and stir the liquid. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^{O}$.) However, varying breaking indices of different liquid compositions might also influence the distance. If the indicated difference varies from the actual setting, the probe parameter ”optical surface

3. The ”Area Scan” job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable. If a finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result.

4. The ”Zoom Scan” job measures the field in a volume around the peak SAR value assessed in the previous ”Area Scan” job (for more information see the application note on SAR evaluation).

About the validation dipole positioning uncertainty, the constant and low loss dielectric spacer is used to establish the correct distance between the top surface of the dipole and the bottom surface of the phantom, the error component introduced by the uncertainty of the distance between the liquid (i.e., phantom shell) and the validation dipole in the DASY4 system is less than ±0.1mm.

$$SAR_{tolerance}[\%] = 100 \times \left(\frac{(a+d)^2}{a^2} - 1\right)$$

As the closest distance is 10mm, the resulting tolerance $SAR_{tolerance}[\%]$ is <2%.

6.3 VALIDATION RESULTS

SYSTEM VALIDATION TEST OF SIMULATING LIQUID					
FREQUENCY (MHz)	REQUIRED SAR (mW/g)	MEASURED SAR (mW/g)	DEVIATION (%)	SEPARATION DISTANCE	TESTED DATE
New Band (5.250 ~ 5.350GHz & 5.470 ~ 5.725GHz)					
HSL 5200	21.30 (1g)	20.90	-1.88	10mm	Oct. 24, 2006
MSL 5200	20.30 (1g)	19.40	-4.43	10mm	Oct. 25, 2006
HSL 5500	21.40 (1g)	20.60	-3.74	10mm	Oct. 24, 2006
MSL 5500	20.30 (1g)	19.60	-3.45	10mm	Oct. 25, 2006
HSL 5500	21.40 (1g)	20.60	-3.74	10mm	Jan. 17, 2007
MSL 5500	20.30 (1g)	19.70	-2.96	10mm	Jan. 19, 2007
HSL 5800	20.90 (1g)	20.10	-3.83	10mm	Oct. 24, 2006
MSL 5800	18.70 (1g)	18.30	-2.14	10mm	Oct. 25, 2006
HSL 5800	20.90 (1g)	20.20	-3.35	10mm	Jan. 17, 2007
MSL 5800	18.70 (1g)	18.10	-3.21	10mm	Jan. 19, 2007
TESTED BY	Sam Onn				

NOTE: Please sees Appendix for the photo of system validation test.

6.4 SYSTEM VALIDATION UNCERTAINTIES

In the table below, the system validation uncertainty with respect to the analytically assessed SAR value of a dipole source as given in the IEEE 1528 standard is given. This uncertainty is smaller than the expected uncertainty for mobile phone measurements due to the simplified setup and the symmetric field distribution.

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i)		Standard Uncertainty (±%)		(v_i)
				(1g)	(10g)	(1g)	(10g)	
Measurement System								
Probe Calibration	4.8	Normal	1	1	1	4.8	4.8	∞
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	1	1	2.7	2.7	∞
Hemispherical Isotropy	0	Rectangular	$\sqrt{3}$	1	1	0	0	∞
Boundary effect	1.0	Rectangular	$\sqrt{3}$	1	1	0.6	0.6	∞
Linearity	4.7	Rectangular	$\sqrt{3}$	1	1	2.7	2.7	∞
System Detection Limit	1.0	Rectangular	$\sqrt{3}$	1	1	0.6	0.6	∞
Readout Electronics	1.0	Normal	1	1	1	1.0	1.0	∞
Response Time	0	Rectangular	$\sqrt{3}$	1	1	0	0	∞
Integration Time	0	Rectangular	$\sqrt{3}$	1	1	0	0	∞
RF Ambient Conditions	3.0	Rectangular	$\sqrt{3}$	1	1	1.7	1.7	∞
Probe Positioner	0.4	Rectangular	$\sqrt{3}$	1	1	0.2	0.2	∞
Probe positioning	2.9	Rectangular	$\sqrt{3}$	1	1	1.7	1.7	∞
Algorithms for Max. SAR Evaluation	1.0	Rectangular	$\sqrt{3}$	1	1	0.6	0.6	∞
Dipole								
Dipole Axis to Liquid Distance	2.0	Rectangular	$\sqrt{3}$	1	1	1.2	1.2	∞
Input power and SAR drift measurement	4.7	Rectangular	$\sqrt{3}$	1	1	2.7	2.7	∞
Phantom and Tissue Parameters								
Phantom Uncertainty	4.0	Rectangular	$\sqrt{3}$	1	1	2.3	2.3	∞
Liquid Conductivity (target)	5.0	Rectangular	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	2.5	Normal	1	0.64	0.43	1.6	1.1	∞
Liquid Permittivity (target)	5.0	Rectangular	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	2.5	Normal	1	0.6	0.49	1.5	1.2	∞
Combined Standard Uncertainty						8.4	8.1	∞
Coverage Factor for 95%						kp=2		
Expanded Uncertainty (K=2)						16.8	16.2	

NOTE: About the system validation uncertainty assessment, please reference the section 7.

6.5 SYSTEM VALIDATION UNCERTAINTIES (For 5.0GHz)

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i)		Standard Uncertainty (±%)		(v_i)
				(1g)	(10g)	(1g)	(10g)	
Measurement System								
Probe Calibration	6.6	Normal	1	1	1	4.8	6.6	∞
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	1	1	2.7	2.7	∞
Hemispherical Isotropy	0.0	Rectangular	$\sqrt{3}$	1	1	0.0	0.0	∞
Boundary effect	2.0	Rectangular	$\sqrt{3}$	1	1	1.2	1.2	∞
Linearity	4.7	Rectangular	$\sqrt{3}$	1	1	2.7	2.7	∞
System Detection Limit	1.0	Rectangular	$\sqrt{3}$	1	1	0.6	0.6	∞
Readout Electronics	1.0	Normal	1	1	1	1.0	1.0	∞
Response Time	0.0	Rectangular	$\sqrt{3}$	1	1	0.0	0.0	∞
Integration Time	0.0	Rectangular	$\sqrt{3}$	1	1	0.0	0.0	∞
RF Ambient Conditions	3.0	Rectangular	$\sqrt{3}$	1	1	1.7	1.7	∞
Probe Positioner	0.8	Rectangular	$\sqrt{3}$	1	1	0.5	0.5	∞
Probe positioning	5.7	Normal	1	1	1	5.7	5.7	∞
Algorithms for Max. SAR Evaluation	4.0	Rectangular	$\sqrt{3}$	1	1	2.3	2.3	∞
Dipole								
Dipole Axis to Liquid Distance	2.0	Rectangular	$\sqrt{3}$	1	1	1.2	1.2	∞
Input power and SAR drift measurement	4.7	Rectangular	$\sqrt{3}$	1	1	2.7	2.7	∞
Phantom and Tissue Parameters								
Phantom Uncertainty	4.0	Rectangular	$\sqrt{3}$	1	1	2.3	2.3	∞
Liquid Conductivity (target)	5.0	Rectangular	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	2.5	Normal	1	0.64	0.43	1.6	1.1	∞
Liquid Permittivity (target)	5.0	Rectangular	$\sqrt{3}$	0.60	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	2.5	Normal	1	0.60	0.49	1.5	1.2	∞
Combined Standard Uncertainty						11.3	11.1	∞
Coverage Factor for 95%						kp=2		
Expanded Uncertainty (K=2)						22.6	22.1	

Table 6.1

NOTE: 1. Table 6.1 Uncertainty of the system performance check in the 5-6GHz range. Probe calibration error reflects uncertainty of the EX3DV3 probe conversion factor at Calibration Frequency.

2. About the system validation uncertainty assessment, please reference the section 7.

7. MEASUREMENT SAR PROCEDURE UNCERTAINTIES

The assessment of spatial peak SAR of the hand handheld devices is according to IEEE 1528. All testing situation shall be met below these requirements.

- The system is used by an experienced engineer who follows the manual and the guidelines taught during the training provided by SPEAG.
- The probe has been calibrated within the requested period and the stated uncertainty for the relevant frequency bands does not exceed 4.8% (k=1).
- The validation dipole has been calibrated within the requested period and the system performance check has been successful.
- The DAE unit has been calibrated within the within the requested period.
- The minimum distance between the probe sensor and inner phantom shell is selected to be between 4 and 5mm.
- The operational mode of the DUT is CW, CDMA, FDMA or TDMA (GSM, DCS, PCS, IS136 and PDC) and the measurement/integration time per point is >500 ms.
- The dielectric parameters of the liquid have been assessed using Agilent 85070D dielectric probe kit or a more accurate method.
- The dielectric parameters are within 5% of the target values.
- The DUT has been positioned as described in section 3.

7.1 PROBE CALIBRATION UNCERTAINTY

SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 50361, IEC 62209, etc.) under ISO17025. The uncertainties are stated on the calibration certificate. For the most relevant frequency bands, these values do not exceed 4.8% (k=1). If evaluations of other bands are performed for which the uncertainty exceeds these values, the uncertainty tables given in the summary have to be revised accordingly.

7.2 ISOTROPY UNCERTAINTY

The axial isotropy tolerance accounts for probe rotation around its axis while the hemispherical isotropy error includes all probe orientations and field polarizations. These parameters are assessed by SPEAG during initial calibration. In 2001, SPEAG further tightened its quality controls and warrants that the maximal deviation from axial isotropy is ±0.20 dB, while the maximum deviation of hemispherical isotropy is ±0.40 dB, corresponding to ±4.7% and ±9.6%, respectively. A weighting factor of cp equal to 0.5 can be applied, since the axis of the probe deviates less than 30 degrees from the normal surface orientation.

7.3 BOUNDARY EFFECT UNCERTAINTY

The effect can be estimated according to the following error approximation formula

$$SAR_{tolerance}[\%] = SAR_{be}[\%] \times \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{e^{-\frac{d_{be}}{\delta/2}}}{\delta/2}$$

$$d_{be} + d_{step} < 10mm$$

The parameter d_{be} is the distance in mm between the surface and the closest measurement point used in the averaging process; d_{step} is the separation distance in mm between the first and second measurement points; δ is the minimum penetration depth in mm within the head tissue equivalent liquids (i.e., δ= 13.95 mm at 3GHz); SAR_{be} is the deviation between the measured SAR value at the distance d_{be} from the boundary and the wave-guide analytical value SAR_{ref}.DASY4 applies a boundary effect compensation algorithm according to IEEE 1528, which is possible since the axis of the probe never deviates more than 30 degrees from the normal surface orientation. SAR_{be}[%] is assessed during the calibration process and SPEAG warrants that the uncertainty at distances larger than 4mm is always less than 1%.In summary, the worst case boundary effect SAR tolerance[%] for scanning distances larger than 4mm is < ± 0.8%.

7.4 PROBE LINEARITY UNCERTAINTY

Field probe linearity uncertainty includes errors from the assessment and compensation of the diode compression effects for CW and pulsed signals with known duty cycles. This error is assessed using the procedure described in IEEE 1528. For SPEAG field probes, the measured difference between CW and pulsed signals, with pulse frequencies between 10 Hz and 1 kHz and duty cycles between 1 and 100, is < ±0.20 dB (< ±4.7%).

7.5 READOUT ELECTRONICS UNCERTAINTY

All uncertainties related to the probe readout electronics (DAE unit), including the gain and linearity of the instrumentation amplifier, its loading effect on the probe, and accuracy of the signal conversion algorithm, have been assessed accordingly to IEEE 1528.The combination (root-sum-square RSS method) of these components results in an overall maximum error of ±1.0%.

7.6 RESPONSE TIME UNCERTAINTY

The time response of the field probes is assessed by exposing the probe to a well-controlled electric field producing SAR larger than 2.0 W/kg at the tissue medium surface. The signal response time is evaluated as the time required by the system to reach 90% of the expected final value after an on/of switch of the power source. Analytically, it can be expressed as:

$$SAR_{tolerance}[\%] = 100 \times \left(\frac{T_m}{T_m + \tau e^{-T_m/\tau} - \tau} - 1\right)$$

where Tm is 500 ms, i.e., the time between measurement samples, and τ the time constant. The response time τ of SPEAG's probes is <5 ms. In the current implementation, DASY4 waits longer than 100 ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

7.7 INTEGRATION TIME UNCERTAINTY

If the device under test does not emit a CW signal, the integration time applied to measure the electric field at a specific point may introduce additional uncertainties due to the discretization and can be assessed as follows

$$SAR_{tolerance}[\%] = 100 \times \sum_{allsub-frames} \frac{t_{frame}}{t_{integration}} \frac{slot_{idle}}{slot_{total}}$$

The tolerances for the different systems are given in Table 7.1, whereby the worst-case $SAR_{tolerance}$ is 2.6%.

System	$SAR_{tolerance}$ %
CW	0
CDMA*	0
WCDMA*	0
FDMA	0
IS-136	2.6
PDC	2.6
GSM/DCS/PCS	1.7
DECT	1.9
Worst-Case	2.6

TABLE 7.1

7.8 PROBE POSITIONER MECHANICAL TOLERANCE

The mechanical tolerance of the field probe positioner can introduce probe positioning uncertainties. The resulting SAR uncertainty is assessed by comparing the SAR obtained according to the specifications of the probe positioner with respect to the actual position defined by the geometric enter of the probe sensors. The tolerance is determined as:

$$SAR_{tolerance}[\%] = 100 \times \frac{d_{ph}}{\delta/2}$$

The specified repeatability of the RX robot family used in DASY4 systems is ±25 µm. The absolute accuracy for short distance movements is better than ±0.1mm, i.e., the $SAR_{tolerance}$[%] is better than 1.5% (rectangular).

7.9 PROBE POSITIONING

The probe positioning procedures affect the tolerance of the separation distance between the probe tip and the phantom surface as:

$$SAR_{tolerance}[\%] = 100 \times \frac{d_{ph}}{\delta/2}$$

where d_{ph} is the maximum deviation of the distance between the probe tip and the phantom surface. The optical surface detection has a precision of better than 0.2 mm, resulting in an $SAR_{tolerance}$[%] of <2.9% (rectangular distribution). Since the mechanical detection provides better accuracy, 2.9% is a worst-case figure for DASY4 system.

7.10 PHANTOM UNCERTAINTY

The SAR measurement uncertainty due to SPEAG phantom shell production tolerances has been evaluated using

$$SAR_{tolerance}[\%] \cong 100 \times \frac{2d}{a}, \qquad d << a$$

For a maximum deviation d of the inner and outer shell of the phantom from that specified in the CAD file of ±0.2 mm, and a 10mm spacing a between source and tissue liquid, the calculated phantom uncertainty is ±4.0%.

7.11 DASY4 UNCERTAINTY BUDGET (For 5 ~ 6GHz)

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i) (1g)	(C_i) (10g)	Standard Uncertainty (±%) (1g)	Standard Uncertainty (±%) (10g)	(v_i)
Measurement System								
Probe Calibration	6.8	Normal	1	1	1	6.8	6.8	∞
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	$\sqrt{3}$	0.7	0.7	3.9	3.9	∞
Boundary effect	2.0	Rectangular	$\sqrt{3}$	1	1	1.2	1.2	∞
Linearity	4.7	Rectangular	$\sqrt{3}$	1	1	2.7	2.7	∞
System Detection Limit	1.0	Rectangular	$\sqrt{3}$	1	1	0.6	0.6	∞
Readout Electronics	1.0	Normal	1	1	1	1.0	1.0	∞
Response Time	0.8	Rectangular	$\sqrt{3}$	1	1	0.5	0.5	∞
Integration Time	2.6	Rectangular	$\sqrt{3}$	1	1	1.5	1.5	∞
RF Ambient Conditions	3.0	Rectangular	$\sqrt{3}$	1	1	1.7	1.7	∞
Probe Positioner	0.8	Rectangular	$\sqrt{3}$	1	1	0.5	0.5	∞
Probe positioning	5.7	Normal	1	1	1	5.7	5.7	∞
Algorithms for Max. SAR Evaluation	4.0	Rectangular	$\sqrt{3}$	1	1	2.3	2.3	∞
Test EUT Related								
Device Positioning	2.9	Normal	1	1	1	2.9	2.9	145
Device Holder	3.6	Normal	1	1	1	3.6	3.6	5
Power Drift	5.0	Rectangular	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and Tissue Parameters								
Phantom Uncertainty	4.0	Rectangular	$\sqrt{3}$	1	1	2.3	2.3	∞
Liquid Conductivity (target)	5.0	Rectangular	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	2.5	Normal	1	0.64	0.43	1.6	1.1	∞
Liquid Permittivity (target)	5.0	Rectangular	$\sqrt{3}$	0.60	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	2.5	Normal	1	0.60	0.49	1.5	1.2	∞
Combined Standard Uncertainty						12.8	12.7	330
Expanded STD Uncertainty						**25.7**	**25.3**	

TABLE 7.3

The table 7.3: Worst-Case uncertainty budget for DASY4 valid for the frequency range 5 ~ 6 GHz. Probe calibration error reflects uncertainty of the narrow-bandwidth EX3DV3 probe conversion factor (±50 MHz).

8. INFORMATION ON THE TESTING LABORATORIES

We, ADT Corp., were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA	FCC, UL, A2LA
GERMANY	TUV Rheinland
JAPAN	VCCI
NORWAY	NEMKO
CANADA	INDUSTRY CANADA , CSA
R.O.C.	CNLA, BSMI, NCC
NETHERLANDS	Telefication
SINGAPORE	PSB , GOST-ASIA (MOU)
RUSSIA	CERTIS (MOU)

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5/phtml. If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.