SAR TEST REPORT

REPORT NO.: SA960830L03
MODEL NO.: CLIO200
RECEIVED: Aug. 30, 2007
TESTED: Sep. 28 ~ Oct. 01, 2007
ISSUED: Oct. 04, 2007

APPLICANT: High Tech Computer Corp.

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Testing Laboratory 0528

ACCREDITED No.: 2177-01

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1. CERTIFICATION

PRODUCT: UMPC
MODEL: CLIO200
APPLICANT: High Tech Computer Corp.
TESTED: Sep. 28 ~ Oct. 01, 2007
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: **FCC Part 2 (Section 2.1093)**
FCC OET Bulletin 65, Supplement C (01-01)
RSS-102
IEEE 1528-2003

The above equipment (model: CLIO200) 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 : Rennie Wang / Senior Specialist , **DATE:** Oct. 04, 2007

TECHNICAL ACCEPTANCE : Stanely Hsu / Senior Engineer , **DATE:** Oct. 04, 2007
Responsible for RF

APPROVED BY : Gary Chang / Assistant Manager , **DATE:** Oct. 04, 2007

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

<table>
<tr><td>PRODUCT</td><td colspan="2">UMPC</td></tr>
<tr><td>MODEL NO.</td><td colspan="2">CLIO200</td></tr>
<tr><td>FCC ID</td><td colspan="2">NM8CLIO200</td></tr>
<tr><td>POWER SUPPLY</td><td colspan="2">7.4Vdc from rechargeable lithium battery
12.0Vdc from power adapter</td></tr>
<tr><td>CLASSIFICATION</td><td colspan="2">Portable device, production unit</td></tr>
<tr><td>MODULATION TYPE</td><td colspan="2">Mobile phone: OQPSK, HPSK
WLAN:
CCK, DQPSK, DBPSK for DSSS
64QAM, 16QAM, QPSK, BPSK for OFDM
Bluetooth: GFSK, π /4-DQPSK, 8DPSK for FHSS</td></tr>
<tr><td>FREQUENCY RANGE</td><td colspan="2">Mobile phone:
824MHz ~ 849MHz
1850MHz ~ 1910MHz
Wireless LAN & Bluetooth:
2400.0MHz ~ 2483.5MHz</td></tr>
<tr><td rowspan="5">CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER</td><td>TDSO
SO32
RC3</td><td>CDMA850 band:
0.290W / 824.7MHz for channel 1013
0.282W / 836.5MHz for channel 384
0.282W / 848.3MHz for channel 777</td></tr>
<tr><td>TDSO
SO32
RC3</td><td>CDMA1900 band:
0.292W / 1851.25MHz for channel 25
0.285W / 1880.00MHz for channel 600
0.283W / 1908.75MHz for channel 1175</td></tr>
<tr><td colspan="2">WLAN-DSSS (802.11b):
44.875mW / 2412.0MHz for channel 1
45.082mW / 2437.0MHz for channel 6
44.978mW / 2462.0MHz for channel 11</td></tr>
<tr><td colspan="2">WLAN-OFDM (802.11g):
63.826mW / 2412.0MHz for channel 1
63.680mW / 2437.0MHz for channel 6
63.973mW / 2462.0MHz for channel 11</td></tr>
<tr><td colspan="2">Bluetooth-GFSK:
1.042mW / 2441.0MHz for channel 39
Bluetooth-8DPSK:
0.542mW / 2441.0MHz for channel 39</td></tr>
</table>

MAX. AVERAGE SAR (1g)	Body: 0.510W/kg (CDMA850) 1.310W/kg (CDMA1900) 0.218W/kg (WLAN) 0.0000627W/kg (Bluetooth)
ANTENNA TYPE	Mobile phone: PIFA antenna with 0dBi gain Wireless LAN & Bluetooth: PIFA antenna with -1dBi gain
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ACCESSORY DEVICES	Adapter, Battery, Pouch, Extension Kit, Headset

NOTE:

1. The EUT is a UMPC which has CDMA2000 1xEVDO/ 1xRTT .0/A (850/1900) + EVDO + WLAN (b/g) + BT v2.0 w EDR functions.
2. The EUT has following accessories.

ACCESSORY	BRAND	MODEL	REMARKS
Pouch	Xigma	HTC-021	
Extension Kit	Goodway	HE2130	
Headset (1.7m)	hTC	HS G511	2.5mm audio connector

3. The communicated functions of EUT listed as below:

		850MHz	1900MHz	With 802.11b/g WLAN + Bluetooth w EDR functions
3G	CDMA	V	V	
	EVDO	V	V	
** CDMA, WLAN and BT functions are for data transmission only.				

4. The EUT has lithium batteries listed as below:

BATTERY A:	
BRAND:	Dynapack
MODEL:	CLIO160
RATING:	7.4Vdc, 2700mAh

BATTERY B:	
BRAND:	Simplo
MODEL:	CLIO160
RATING:	7.4Vdc, 2700mAh

NOTE: After pre-tested both batteries, found battery B is worse, therefore all the test results came out from this.

5. The EUT was operated with following power adapter:

BRAND:	DELTA ELECTRONICS, INC.
MODEL:	ADP-36EH A
INPUT:	100-240Vac, 1.0A, 50-60Hz
OUTPUT:	12Vdc, 3A
POWER LINE:	AC 1.6m non-shielded cable without core DC 1.8m non-shielded cable with one core

6. Refer to following table for ESN no.:

ESN NO.
36AE****

7. The EUT used the same antenna in Wireless LAN & Bluetooth function, but the two functions can not work at the same time.
8. 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 SAR MEASUREMENT CONDITIONS FOR CDMA

The following procedures were followed according to FCC "SAR Measurement Procedures Devices", June 2006.

➢ **Output Power Verification**

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices", May 2006.
Maximum output power is verified on the High, Middle and Low channels according to procedures defined in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in **"All Up"** condition.

1. If the mobile station(MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1 (Table 8-1) parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3, 4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

➢ **Head SAR Measurement**

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3.

➢ **Body SAR Measurements**

SAR for body exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCHn) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCHn) with FCH at full rate and SCH0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only.
When multiple code channels are enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts. Body SAR in RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum

output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that results in the highest SAR for that channel in RC3.

- **Handsets with Ev-Do**

For handsets with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 is less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for Ev-Do is not required. Otherwise, SAR for Rev. 0 is measured on the maximum output channel at **153.6 kbps** using the body exposure configuration that results in the highest SAR for that channel in RC3. SAR for Rev. A is not required when the maximum average output of each channel is less than that measured in Rev. 0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots should be configured in the downlink for both Rev. 0 and Rev. A.

CDMA 2000 CONDUCTED POWER (SO2, SO55, TDSO SO32)										
CHAN.	FREQ. (MHz)	CDMA 2000 RC	RAW VALUE (dBm)			CORR. FACTOR (dB)	PEAK OUTPUT POWER (dBm)		
			SO2	SO55	TDSO SO32		SO2	SO55	TDSO SO32
1013	824.70	RC1	20.69	20.70	-	4.00	24.69	24.70	-
		RC3	20.64	20.86	20.63	4.00	24.64	**24.86**	24.63
384	836.50	RC1	20.46	20.49	-	4.00	24.46	24.49	-
		RC3	20.48	20.50	20.51	4.00	24.48	24.50	24.51
777	848.30	RC1	20.49	20.51	-	4.00	24.49	24.51	-
		RC3	20.48	20.52	20.50	4.00	24.48	24.52	24.50

CDMA 2000 CONDUCTED POWER (SO2, SO55, TDSO SO32)									
CHAN.	FREQ. (MHz)	CDMA 2000 RC	RAW VALUE (dBm)			CORR. FACTOR (dB)	PEAK OUTPUT POWER (dBm)		
			SO2	SO55	TDSO SO32		SO2	SO55	TDSO SO32
25	1851.25	RC1	19.62	19.70	-	5.00	24.62	24.70	-
		RC3	19.70	19.75	19.66	5.00	24.70	**24.75**	24.66
600	1880.00	RC1	19.57	19.57	-	5.00	24.57	24.57	-
		RC3	19.55	19.59	19.55	5.00	24.55	24.59	24.55
1175	1908.75	RC1	19.55	19.58	-	5.00	24.55	24.58	-
		RC3	19.43	19.60	19.52	5.00	24.43	24.60	24.52

2.3 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.

2.4 GENERAL INOFRMATION OF THE SAR SYSTEM

DASY4 (software 4.7 Build 53) 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)

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	835, 1900, 2450MHz
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.

2.5 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	101095	Nov. 19, 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

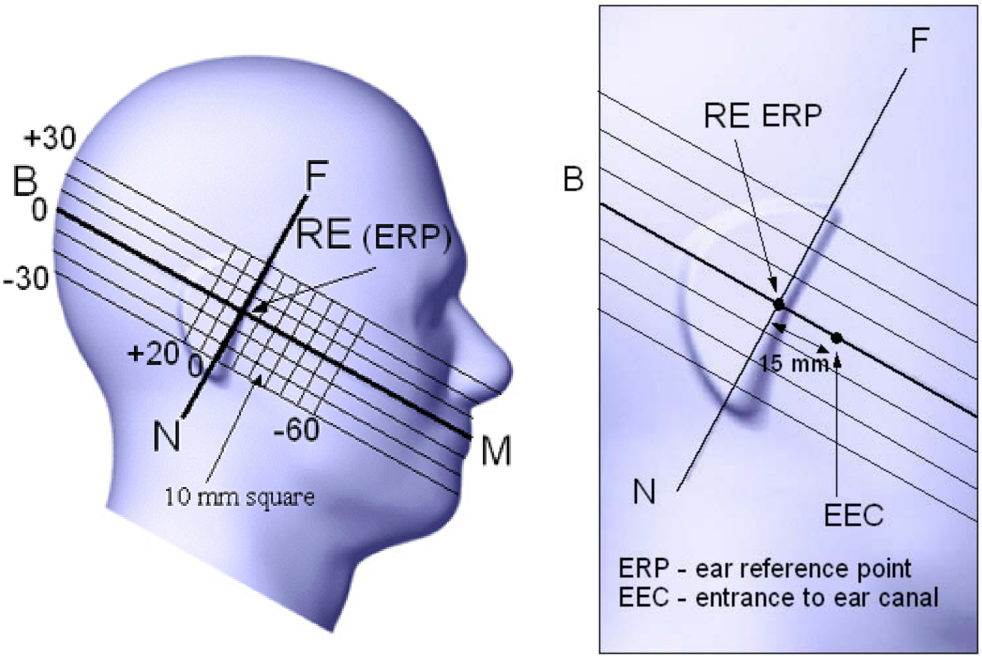


FIGURE 3.1

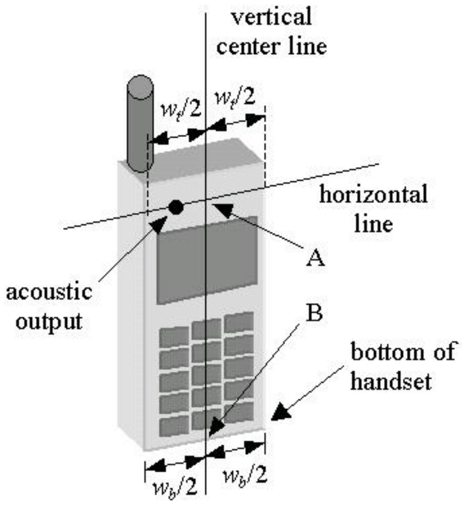


FIGURE 3.1a

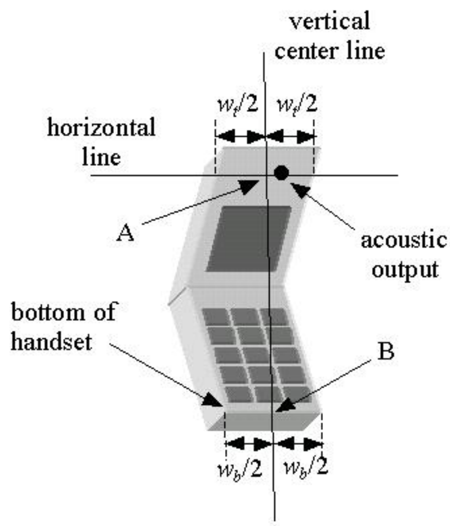
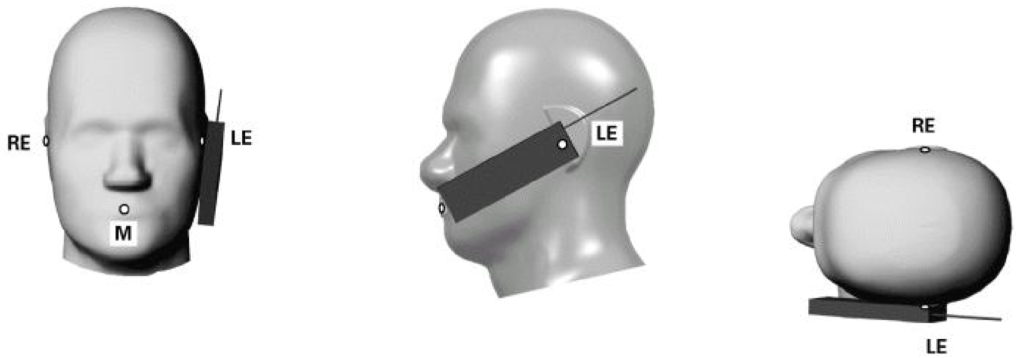


FIGURE 3.1b

4.2.1 TOUCH/CHEEK TEST POSITION

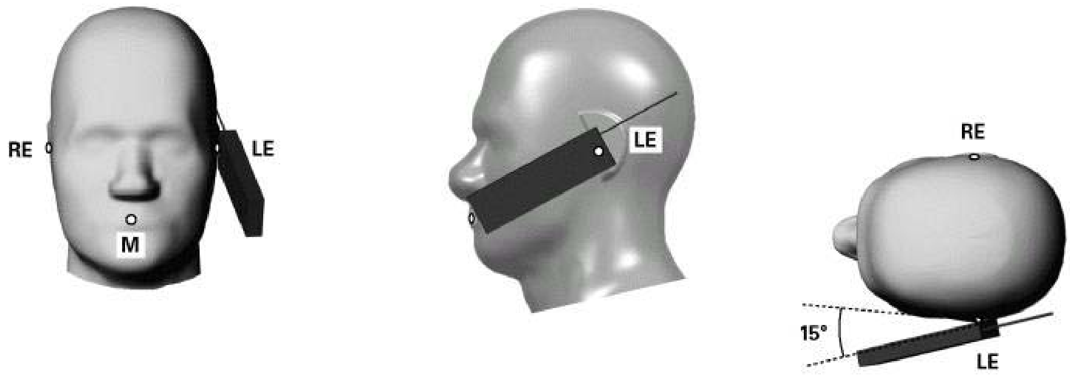
The head position in Figure 3.1, the ear reference points ERP are 15mm above entrance to ear canal along the B-M line. The line N-F (Neck-Front) is perpendicular to the B-M (Back Mouth) line. The handset device in Figure 3.1a and 3.1b,The vertical centerline pass through two points on the front side 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

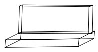
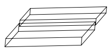
4.2.3 BODY-WORN CONFIGURATION

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

The EUT have been tested under following situations.

CONFIGURATION	DESCRIPTION
1 	Open panel (stand)
2 	Open panel (slide up)
3 	Close panel

TEST MODE	COMMUNICATION MODE	MODULATION TYPE	ASSESSMENT POSTITION	CONFIGURATION	TESTED CHANNEL	REMARK
1	CDMA 850	OQPSK	Body / Bottom	1	L, M, H	-
2		OQPSK	Body / Bottom	2	L	-
3		OQPSK	Body / Bottom	3	L	-
4		OQPSK	Body / edge	1	L	-
5		OQPSK	Body / edge	2	L	-
6		OQPSK	Body / edge	3	L	-
7	1xEVDO 850	HPSK	Body / Bottom	1	L	-
8	CDMA 1900	OQPSK	Body / Bottom	1	L, M, H	-
9		OQPSK	Body / Bottom	2	H	-
10		OQPSK	Body / Bottom	3	H	-
11		OQPSK	Body / edge	1	H	-
12		OQPSK	Body / edge	2	H	-
13		OQPSK	Body / edge	3	H	-
14		OQPSK	Body / Bottom	1	H	Battery A
15	1xEVDO 1900	HPSK	Body / Bottom	1	H	-

TEST MODE	COMMUNICATION MODE	MODULATION TYPE	ASSESSMENT POSTITION	CONFIGU RATION	TESTED CHANNEL	REMARK
16	WLAN 802.11b	DBPSK	Body / Bottom	3	L, M, H	-
17		DBPSK	Body / Bottom	2	H	-
18		DBPSK	Body / Bottom	1	H	-
19		DBPSK	Body / edge	3	H	-
20		DBPSK	Body / edge	2	H	-
21		DBPSK	Body / edge	1	H	-
22	WLAN 802.11g	BPSK	Body / Bottom	3	L, M, H	-
23		BPSK	Body / Bottom	2	H	-
24		BPSK	Body / Bottom	1	H	-
25	Bluetooth	GFSK	Body / Bottom	1	M	-
26		8DPSK	Body / Bottom	1	M	-
27	CDMA 850 + 802.11b + Bluetooth	NOTE 1	Body / Bottom	1	NOTE 1	-
28	CDMA 1900 + 802.11b + Bluetooth	NOTE 1	Body / Bottom	1	NOTE 1	-

NOTE: 1. The combination is from the worst situation of each communication mode.
2. Assessment position, please refer to appendix E for the photo.

4.3 SUMMARY OF TEST RESULTS

THE EUT OF THIS MODE IS WITH BATTERY B:

BODY POSITION

COMMUNICATION MODE	CDMA 850						1XEVDO 850
	MEASURED VALUE OF 1g SAR (W/kg)						
	BOTTOM			EDGE			BOTTOM
CONFIGURATION	1	2	3	1	2	3	1
LOW CHANNEL	**0.510**	0.129	0.441	0.034	0.00141	0.024	0.388
MID. CHANNEL	0.489	-	-	-	-	-	-
HIGH CHANNEL	0.438	-	-	-	-	-	-

COMMUNICATION MODE	CDMA 1900						1XEVDO 1900
	MEASURED VALUE OF 1g SAR (W/kg)						
	BOTTOM			EDGE			BOTTOM
CONFIGURATION	1	2	3	1	2	3	1
LOW CHANNEL	1.070	-	-	-	-	-	-
MID. CHANNEL	1.200	-	-	-	-	-	-
HIGH CHANNEL	**1.310**	0.948	0.919	0.070	0.065	0.088	1.170

NOTE: The worst value of each communication has been marked by boldface.

COMMUNICATION MODE	802.11b					
	MEASURED VALUE OF 1g SAR (W/kg)					
	BOTTOM			EDGE		
CONFIGURATION	3	2	1	3	2	1
LOW CHANNEL	0.141	-	-	-	-	-
MID. CHANNEL	0.164	-	-	-	-	-
HIGH CHANNEL	**0.218**	0.112	0.196	0.053	0.014	0.017

COMMUNICATION MODE	802.11g			BLUETOOTH	
				GFSK	8DPSK
	MEASURED VALUE OF 1g SAR (W/kg)				
	BOTTOM			BOTTOM	
CONFIGURATION	3	2	1	1	1
LOW CHANNEL	0.083	-	-	-	-
MID. CHANNEL	0.106	-	-	**0.0000627**	0.0000282
HIGH CHANNEL	0.138	0.064	0.124	-	-

NOTE: The worst value of each communication has been marked by boldface.

THE EUT OF THIS MODE IS WITH BATTERY A:

COMMUNICATION MODE	CDMA 1900
	MEASURED VALUE OF 1g SAR (W/kg)
CHANNEL	BOTTOM
HIGH	1.260

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)
27	CDMA 850 low channel + 802.11b high channel+ Bluetooth middle channel	0.510
28	CDMA 1900 high channel + 802.11b high channel+ Bluetooth middle channel	1.310

5. TEST RESULTS

5.1 TEST PROCEDURES

FOR CDMA:

The EUT 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 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 1528 / 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

CDMA 850 & 1xEVDO 850 BAND BODY POSITION

ENVIRONMENTAL CONDITION	Air Temperature：23.1°C, Liquid Temperature：22.0°C Humidity：58%RH		
TESTED BY	Sam Onn	DATE	Sep. 28, 2007

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (W)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
1013	**824.7 (Low)**	**OQPSK**	0.290	0.286	-1.38	Standard Battery	1	**0.510**
384	**836.5 (Mid.)**	**OQPSK**	0.282	0.278	-1.42	Standard Battery	1	0.489
777	**848.3 (High)**	**OQPSK**	0.282	0.277	-1.77	Standard Battery	1	0.438
1013	**824.7 (Low)**	**OQPSK**	0.290	0.285	-1.72	Standard Battery	2	0.129
1013	**824.7 (Low)**	**OQPSK**	0.290	0.286	-1.38	Standard Battery	3	0.441
1013	**824.7 (Low)**	**OQPSK**	0.290	0.285	-1.72	Standard Battery	4	0.034
1013	**824.7 (Low)**	**OQPSK**	0.290	0.288	-0.69	Standard Battery	5	0.00141
1013	**824.7 (Low)**	**OQPSK**	0.290	0.287	-1.03	Standard Battery	6	0.024
1013	**824.7 (Low)**	**HPSK**	0.275	0.272	-1.09	Standard Battery	7	0.388

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 & 1xEVDO 1900 BAND BODY POSITION

ENVIRONMENTAL CONDITION	Air Temperature：23.4°C, Liquid Temperature：22.3°C Humidity：61%RH		
TESTED BY	Sam Onn	DATE	Sep. 29, 2007

CHAN.	FREQ. (MHz)	MODULATION TYPE	CONDUCTED POWER (W)		POWER DRIFT (%)	DEVICE USE POWER	DEVICE TEST POSITION MODE	MEASURED 1g SAR (W/kg)
			BEGIN TEST	AFTER TEST				
25	**1851.25 (Low)**	**OQPSK**	0.292	0.290	-0.68	Standard Battery	8	1.070
600	**1880.00 (Mid.)**	**OQPSK**	0.285	0.283	-0.70	Standard Battery	8	1.200
1175	**1908.75 (High)**	**OQPSK**	0.283	0.280	-1.06	Standard Battery	8	**1.310**
1175	**1908.75 (High)**	**OQPSK**	0.283	0.279	-1.41	Standard Battery	9	0.948
1175	**1908.75 (High)**	**OQPSK**	0.283	0.282	-0.35	Standard Battery	10	0.919
1175	**1908.75 (High)**	**OQPSK**	0.283	0.281	-0.71	Standard Battery	11	0.070
1175	**1908.75 (High)**	**OQPSK**	0.283	0.280	-1.06	Standard Battery	12	0.065
1175	**1908.75 (High)**	**OQPSK**	0.283	0.279	-1.41	Standard Battery	13	0.088
1175	**1908.75 (High)**	**OQPSK**	0.283	0.277	-2.12	Standard Battery	14 (Battery A)	1.260
1175	**1908.75 (High)**	**HPSK**	0.285	0.283	-0.70	Standard Battery	15	1.170

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 (802.11b) BAND BODY POSITION

ENVIRONMENTAL CONDITION	Air Temperature：23.0°C, Liquid Temperature：21.8°C Humidity：57%RH		
TESTED BY	Sam Onn	DATE	Oct. 01, 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				
1	**2412.00 (Low)**	**DBPSK**	44.875	44.610	-0.59	Standard Battery	16	0.141
6	**2437.00 (Mid.)**	**DBPSK**	45.082	44.780	-0.67	Standard Battery	16	0.164
11	**2462.00 (High)**	**DBPSK**	44.978	44.650	-0.73	Standard Battery	16	**0.218**
11	**2462.00 (High)**	**DBPSK**	44.978	44.600	-0.84	Standard Battery	17	0.112
11	**2462.00 (High)**	**DBPSK**	44.978	44.564	-0.92	Standard Battery	18	0.196
11	**2462.00 (High)**	**DBPSK**	44.978	44.519	-1.02	Standard Battery	19	0.053
11	**2462.00 (High)**	**DBPSK**	44.978	44.488	-1.09	Standard Battery	20	0.014
11	**2462.00 (High)**	**DBPSK**	44.978	44.411	-1.26	Standard Battery	21	0.017

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 (802.11g) BODY POSITION

ENVIRONMENTAL CONDITION	Air Temperature：23.0°C, Liquid Temperature：21.8°C Humidity：57%RH		
TESTED BY	Sam Onn	DATE	Oct. 01, 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				
1	2412.00 (Low)	BPSK	63.826	63.347	-0.75	Standard Battery	22	0.083
6	2437.00 (Mid.)	BPSK	63.680	63.151	-0.83	Standard Battery	22	0.106
11	2462.00 (High)	BPSK	63.973	63.391	-0.91	Standard Battery	22	0.138
11	2462.00 (High)	BPSK	63.973	63.378	-0.93	Standard Battery	23	0.064
11	2462.00 (High)	BPSK	63.973	63.282	-1.08	Standard Battery	24	0.124

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%.

BLUETOOTH BAND BODY POSITION

ENVIRONMENTAL CONDITION	Air Temperature：23.0°C, Liquid Temperature：21.8°C Humidity：57%RH							
TESTED BY	Sam Onn				DATE		Oct. 01, 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				
39	**2441.00 (Mid.)**	**GFSK**	1.042	1.029	-1.25	Standard Battery	25	**0.0000627**
39	**2441.00 (Mid.)**	**8DPSK**	0.542	0.535	-1.29	Standard Battery	26	0.0000282

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 (802.11b) + BLUETOOTH BAND BODY POSITION

ENVIRONMENTAL CONDITION	Air Temperature：23.1°C, Liquid Temperature：22.0°C Humidity：58%RH		
TESTED BY	Sam Onn	DATE	Sep. 28, 2007

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				
1013	**824.7 (Low)**	**OQPSK**	0.290W	0.286W	-1.38	Standard Battery	27	0.510
11	**2462.00 (High)**	**DBPSK**	44.978mW	44.564mW	-0.92			
39	**2441.00 (Mid.)**	**GFSK**	1.042mW	1.029mW	-1.25			

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 (802.11b) + BLUETOOTH BAND BODY POSITION

ENVIRONMENTAL CONDITION	Air Temperature：23.1°C, Liquid Temperature：22.0°C Humidity：58%RH		
TESTED BY	Sam Onn	**DATE**	Sep. 28, 2007

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				
1175	**1908.75 (High)**	**OQPSK**	0.283W	0.280W	-1.06	Standard Battery	28	1.310
11	**2462.00 (High)**	**DBPSK**	44.978mW	44.564mW	-0.92			
39	**2441.00 (Mid.)**	**GFSK**	1.042mW	1.029mW	-1.25			

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 RECIPES FOR 835MHz SIMULATING LIQUID TABLE

INGREDIENT	HEAD SIMULATING LIQUID 835MHz (HSL-835)	MUSCLE SIMULATING LIQUID 835MHz (MSL-835)
Water	40.28%	50.07%
Cellulose	02.41%	NA
Salt	01.38%	0.94%
Preventtol D-7	00.18%	0.09%
Sugar	57.97%	48.2%
Dielectric Parameters at 22℃	f = 835MHz ε= 41.5 ± 5% σ= 0.97 ± 5% S/m	f= 835MHz ε= 55.0 ± 5% σ= 1.05 ± 5% S/m

THE RECIPES FOR 1900MHz SIMULATING LIQUID TABLE

INGREDIENT	HEAD SIMULATING LIQUID 1900MHz (HSL-1900)	MUSCLE SIMULATING LIQUID 1900MHz (MSL-1900)
Water	55.24%	70.16%
DGMBE	44.45%	29.44%
Salt	0.306%	00.39%
Dielectric Parameters at 22℃	f= 1900MHz ε= 40.0 ± 5% σ= 1.40 ± 5% S/m	f= 1900MHz ε= 53.3 ± 5% σ= 1.52 ± 5% S/m

THE RECIPES FOR 2450MHz SIMULATING LIQUID TABLE

INGREDIENT	HEAD SIMULATING LIQUID 2450MHz (HSL-2450)	MUSCLE SIMULATING LIQUID 2450MHz (MSL-2450)
Water	45%	69.83%
DGMBE	55%	30.17%
Salt	NA	NA
Dielectric Parameters at 22℃	f= 2450MHz ε= 39.2 ± 5% σ= 1.80 ± 5% S/m	f= 2450MHz ε= 52.7 ± 5% σ= 1.95 ± 5% S/m

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 CDMA850 BAND SIMULATING LIQUID

LIQUID TYPE		HSL-835		MSL-835	
SIMULATING LIQUID TEMP.		NA		22.0	
TESTED DATE		NA		Sep. 28, 2007	
TESTED BY		NA		Sam Onn	
FREQ. (MHz)	**LIQUID PARAMETER**	**STANDARD VALUE**	**MEASUREMENT VALUE**	**STANDARD VALUE**	**MEASUREMENT VALUE**
824.70	Permitivity (ε)	NA	NA	55.20	56.00
835.00		NA	NA	55.20	55.90
836.50		NA	NA	55.20	55.90
848.30		NA	NA	55.20	55.80
824.70	Conductivity (σ) S/m	NA	NA	0.97	0.98
835.00		NA	NA	0.97	0.99
836.50		NA	NA	0.97	0.99
848.30		NA	NA	0.99	1.00
Dielectric Parameters Required at 22℃		**f= 835MHz ε= 41.5 ± 5% σ= 0.97 ± 5% S/m**		**f= 835MHz ε= 55.0 ± 5% σ= 1.05 ± 5% S/m**	

FOR CDMA1900 BAND SIMULATING LIQUID

LIQUID TYPE		HSL-1900		MSL-1900	
SIMULATING LIQUID TEMP.		NA		22.3	
TESTED DATE		NA		Sep. 29, 2007	
TESTED BY		NA		Sam Onn	
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	STANDARD VALUE	MEASUREMENT VALUE
1851.25	Permitivity (ε)	NA	NA	53.30	54.40
1880.00		NA	NA	53.30	54.20
1900.00		NA	NA	53.30	53.90
1908.75		NA	NA	53.30	53.90
1851.25	Conductivity (σ) S/m	NA	NA	1.52	1.50
1880.00		NA	NA	1.52	1.52
1900.00		NA	NA	1.52	1.55
1908.75		NA	NA	1.52	1.56
Dielectric Parameters Required at 22℃		**f= 1900MHz ε= 40.0 ± 5% σ= 1.40 ± 5% S/m**		**f= 1900MHz ε= 53.3 ± 5% σ= 1.52 ± 5% S/m**	

FOR WLAN AND BLUETOOTH BAND SIMULATING LIQUID

LIQUID TYPE		HSL-2450		MSL-2450	
SIMULATING LIQUID TEMP.		NA		21.8	
TEST DATE		NA		Oct. 01, 2007	
TESTED BY		NA		Sam Onn	
FREQ. (MHz)	LIQUID PARAMETER	STANDARD VALUE	MEASUREMENT VALUE	STANDARD VALUE	MEASUREMENT VALUE
2412.0	Permitivity (ε)	NA	NA	52.80	54.10
2437.0		NA	NA	52.70	54.00
2441.0		NA	NA	52.70	54.00
2450.0		NA	NA	52.70	53.90
2462.0		NA	NA	52.70	53.80
2412.0	Conductivity (σ) S/m	NA	NA	1.91	1.93
2437.0		NA	NA	1.94	1.97
2441.0		NA	NA	1.94	1.98
2450.0		NA	NA	1.95	2.00
2462.0		NA	NA	1.97	2.02
Dielectric Parameters Required at 22℃		**f= 2450MHz ε= 39.2 ± 5% σ= 1.80 ± 5% S/m**		**f= 2450MHz ε= 52.7 ± 5% σ= 1.95 ± 5% S/m**	

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

ITEM	NAME	BAND	TYPE	SERIES NO.	CALIBRATED UNTIL
1	SAM Phantom	S & P	QD000 P40 CA	PT-1150	NA
2	Signal Generator	Agilent	E8257C	MY43320668	Dec. 28, 2007
3	E-Field Probe	S & P	ET3DV6	1790	Nov. 22, 2007
5	DAE	S & P	DAE3 V1	579	Mar. 22, 2008
6	Robot Positioner	Staubli Unimation	NA	NA	NA
7	Validation Dipole	S & P	D835V2	4d021	May 28, 2008
		S & P	D1900V2	5d036	Apr. 22, 2008
		S & P	D2450V2	737	Apr. 23, 2008

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

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 ±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
MSL 835	2.46 (1g)	2.28	-7.32	15mm	Sep. 28, 2007
MSL 1900	9.59 (1g)	9.32	-2.82	10mm	Sep. 29, 2007
MSL 2450	12.90 (1g)	12.90	0	10mm	Oct. 01, 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.

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

Error Description	Tolerance (±%)	Probability Distribution	Divisor	(C_i)		Standard Uncertainty (±%)		(v_i)
				(1g)	(10g)	(1g)	(10g)	
Measurement Equipment								
Probe Calibration	4.8	Normal	1	1	1	4.8	4.8	∞
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	1	1	1.9	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	$\sqrt{3}$	1	1	3.9	3.9	∞
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	0.8	Normal	1	1	1	0.8	0.8	∞
Integration Time	2.6	Normal	1	1	1	2.6	2.6	∞
Noise	0.0	Normal	1	0	0	0	0	∞
Mechanical Constraints								
Scanning System	0.4	Rectangular	$\sqrt{3}$	1	1	0.2	0.2	∞
Phantom Shell	4.0	Rectangular	$\sqrt{3}$	1	1	2.3	2.3	∞
Probe Positioning	2.9	Rectangular	$\sqrt{3}$	1	1	1.7	1.7	∞
Device Positioning	2.9	Normal	1	1	1	2.9	2.9	875
Physical Parameters								
Liquid Conductivity (target)	5.0	Rectangular	$\sqrt{3}$	0.7	0.5	2	1.4	∞
Liquid Conductivity (measurement)	4.3	Rectangular	$\sqrt{3}$	0.7	0.5	1.7	1.2	∞
Liquid Permittivity (target)	5.0	Rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4	∞
Liquid Permittivity (measurement)	4.3	Rectangular	$\sqrt{3}$	0.6	0.5	1.5	1.2	∞
Power Drift	5	Rectangular	$\sqrt{3}$	1	1	2.9	2.9	∞
RF Ambient Conditions	3.0	Rectangular	$\sqrt{3}$	1	1	1.7	1.7	∞
Post-Processing								
Extrapolation and Integration	1	Rectangular	$\sqrt{3}$	1	1	0.6	0.6	∞
Combined Standard Uncertainty						**9.9**	**9.7**	
Coverage Factor for 95%						**kp=2**		
Expanded Uncertainty (K=2)						**19.9**	**19.3**	

TABLE 7.2

The table 7.2: Worst-Case uncertainty budget for DASY4 assessed according to IEEE 1528. The budget is valid for the frequency range 300MHz ~ 3GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

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.	TAF, BSMI, NCC
NETHERLANDS	Telefication
SINGAPORE	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.