SAR TEST REPORT

Test item	:	Handheld Terminal
Model No.	:	D3-POS
Order No.	:	1006-00266
Date of receipt	:	2010-07-08
Test duration	:	2010-07-19 ~ 2010-07-23
Date of issue	:	2010-09-14
Use of report	:	FCC Original Grant

Applicant : Partner Tech Corporation

10F, No. 233-2, PaoChiao Road, Shin Tien, Taipei, Taiwan

Test laboratory : Digital EMC Co., Ltd.

683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Kyunggi-Do, 449-080, Korea

Test specification	:	§2.1093, FCC/OET Bulletin 65 Supplement C[July 2001]
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:	Witnessed by:	Reviewed by:
Engineer S.K.RYU	N/A	Manager W.J. Lee

CONTENTS

1. General Information

1.1 Equipment information

FCC Equipment Class	Licensed Non-Broadcast Station Transmitter(PCB)
Equipment type	Handheld Terminal
Equipment model name	D3-POS
Equipment add model name	MF-2350
Equipment serial no.	Identical prototype
TX Frequency Range	824.20 ~848.80 MHz (GSM850) / 1850.20~1909.80MHz(PCS1900) 2412 ~ 2462 MHz (IEEE 802.11 b/g) / 2402~2480 MHz (Bluetooth)
RX Frequency Range	869.20 ~893.80 MHz (GSM850) / 1930.2~1989.8 MHz(PCS1900) 2412 ~ 2462 MHz (IEEE 802.11 b/g) / 2402~2480 MHz (Bluetooth)
Max. SAR Measurement	**0.622**mW/g GSM850 GPRS Body SAR **0.575**mW/g PCS1900 GPRS Body SAR **0.191**mW/g W-LAN(802.11b)

2. INTROCUCTION/SAR DEFINITION

In 1974, the International Radiation Protection Association (IRPA) formed a working group on non-ionizing radiation (NIR), which examined the problems arising in the field of Protection against the various types of NIR. At the IRPA Congress in Paris in 1977, this working group because the International Non-Ionizing Radiation Committee (INIRC).

In cooperation with the Environmental Health Division of the World Health Organization (WHO), the IRPA/INIRC developed a number of health criteria documents on NIR as part of WHO'S Environmental Health Criteria Programme, sponsored by the United Nations Environment Programme (UNEP). Each document includes an overview of the physical characteristics, measurement and instrumentation, sources, and applications of NIR, a thorough review of the literature on biological effects, and an evaluation of the health risks of exposure to NIR. These health criteria have provided the scientific database for the subsequent development of exposure limits and codes of practice relating to NIR.

At the Eighth International Congress of the IRPA (Montreal, 18-22 May 1992), a new, independent scientific organization-the International Commission on Non-Ionizing Radiation Protection (ICNIRP)-was established as a successor to the IRPA/INIRC. The functions of the Commission are to investigate the hazards that may be association with the different forms of NIR, develop international guidelines on NIR exposure to static and extremely-low-frequency (ELF) electric and magnetic field have been reviewed by UNEP/WHO/IRPA (1984, 1987). Those publications and a number of others, including UNEP/WHO/IRPA (1993) and Allen et al. (1991), provided the scientific rationale for these guidelines.

A glossary of terms appears in the Appendix.

2.1 SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU)absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ) It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. 1.1)

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho\, dv}\right)$$

Figure 1.1
SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg).

SAR $= E^2 / \rho$

Where:

σ = conductivity of the tissue-simulant material (S/m)

= mas ρ density of the tissue-simulant material (kg/m3)

E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of theincident field in relations to the dimensions and geometry of the irradiated organism, the orientation of theorganism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whetherconductive contact is made by the organism with a ground plane.[6]

3. SAR MEASUREMENT SETUP

3.1Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system.The DASY4 is made by Schmid& Partner Engineering AG (SPEAG) in Zurich, Switzerlandand consists of high precision robotics system (Staubli), robot controller, Pentium III computer, near-field probe, probe alignment sensor, and the generic twin phantomcontaining the brain equivalent material. The robot is a six-axis industrial robotperforming precise movements to position the probe to the location (points) of maximumelectromagnetic field (EMF) (see Fig. 2.1).

3.2 System Hardware

A cell controller system contains thepower supply, robot controler, teach pendant(Joystick), and a remote control used to drive the robot motors. The PC consists of theMicron Pentium IV 500 MHz computer with Windows NT system and SAR MeasurementSoftware DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robotis connected to the cell controller to allow software manipulation of the robot. A dataacquisition electronic (DAE) circuit that performs the signal amplification, signalmultiplexing, AD-conversion, offset measurements, mechanical surface detection,collision detection, etc. is connected to the Electro-optical coupler (EOC). TheEOCperforms the conversion from the optical intodigitalelectric signal of theDAEandtransfers data to the PC plug-in card.

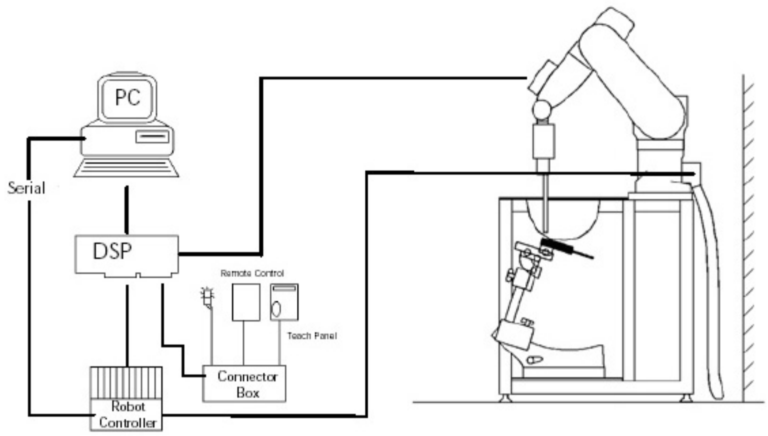


Figure 2.1 SAR Measurement System Setup

3.3 System Electronics

The DAE3 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and acommand decoder and control logic unit. Transmission to the PC-card is accomplishedthrough an opticaldownlink for data and statusinformation and an optical uplink forcommands and clock lines. The mechanicalprobe mounting device includestwodifferent sensor systems for frontal and sidewise probe contacts. They are also used formechanical surface detection and probe collision detection. The robotuses its owncontroller with a built in VME-bus computer. The system is described in detail in [7].

3.4Probe Measurement System

Figure 3.1 DAE System

The SAR measurements were conducted withthedosimetric probe EX3DV4,designed in the classical triangular configuration [7](see Fig. 3.2) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique;with printed resistive lines onceramic substrates. The probe is equipped with an optical multifiber line ending at the front oftheprobe tip (see Fig. 3.3). It isconnected to the EOC box on the robot arm and provides anautomatic detectionof the phantomsurface. Half of the fibers are connected to a pulsed infraredtransmitter, the other half to a synchronized receiver. As the probe approaches thesurface, the reflection from the surface produces a coupling from the transmitting tothe receiving fibers. This reflection increases first during the approach, reachesmaximum and then decreases. Iftheprobe is flatlytouching the surface,thecoupling is zero. The distance of the couplingmaximumto the surface isindependent of the surfacereflectivity andlargely independent of the surface toprobe angle. The DASY4 software reads the reflectionduring a software approachand looks for the maximum using a 2nd order fitting (see Fig.3.1). The approach isstopped at reaching the maximum.

3.5 Probe Specifications

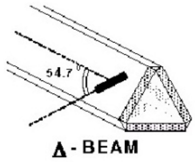


Figure 3.1 Triangular Probe Configuration

Calibration: In air from 10 MHz to 6.0 GHz
In brain and muscle simulating tissue atFrequencies of
835 MHz, 1750 MHz, 1900 MHz, 2450 MHz, 2600 MHz, 3500 MHz

Frequency: 10 MHz to 6 GHz

Linearity: ±0.2dB (30 MHz to 6 GHz)

Dynamic: 10 mW/kg to 100 W/kg

Range: Linearity: ±0.2dB

Dimensions: Overall length: 330 mm

Tip length: 20 mm

Body diameter: 12 mm

Tip diameter: 2.5 mm

Distance from probe tip to sensor center: 1 mm

Application: SAR Dosimetry Testing
Compliance tests of mobile phones

Figure 3.2 Probe Thick-Film Technique

4. Probe Calibration Process

4.1Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described in [8] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in[9] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

4.2Free Space Assessment

The free space E-field fromamplified probe outputs is determined in a testchamber. This isperformed in a TEM cell for frequenciesbelow 1 GHz (see Fig. 4.1), and in a waveguide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center ofthe cavity at the proper orientation with the field. The probe is then rotated 360 degrees.

4.3 Temperature Assessment *

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriatesimulated brain tissue. The measured free space E-field in the medium, correlates to temperature risein a dielectric medium. For temperature correlation calibration a RF transparent thermistorbasedtemperature probe is used in conjunction with the E-field probe (see Fig. 4.2).

$$SAR = C\frac{\Delta T}{\Delta t}$$

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

$$SAR = \frac{|E|^2 \cdot \sigma}{\rho}$$

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm^3 for brain tissue)

SAR is proportional to$\Delta T / \Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

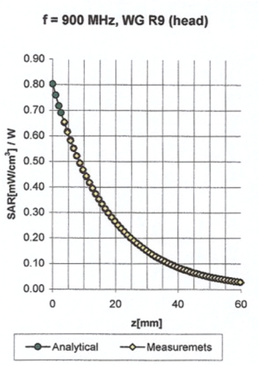


Figure 4.1 E-Field and Temperature Measurements at 900MHz[7]

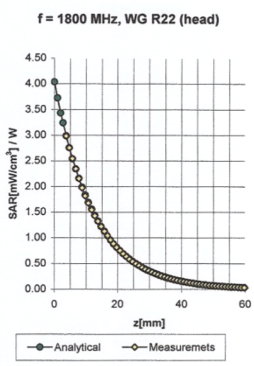


Figure 4.2 E-Field and Temperature Measurements at 1900MHz[7]

5. PHANTOM & EQUIVALENT TISSUES

5.1SAM Phantom

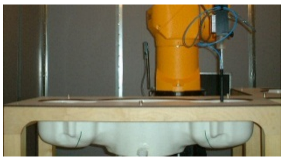


Figure 5.1 SAM Twin Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a woodentable. The shape of the shell is based on data from an anatomical study designed todetermine the maximum exposure in at least 90% of all users [11][12]. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usageat the flat phantom region. A cover preventstheevaporation of the liquid.
Referencemarkings on thePhantom allow thecomplete setup of all predefined phantom positionsand measurement grids by manually teaching three points in the robot. (see Fig. 5.1)

5.2 Brain & Muscle Simulating Mixture Characterization

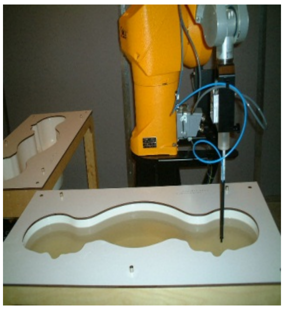


Figure 5.2 Simulated Tissue

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellullose (HEC) gellingagent and saline solution (see Table 6.1). Preservation with a bacteriacide is added and visualinspection is made to make sure air bubbles are not trapped during the mixing process. Themixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been incorporated in the following table. Other head and body tissue parameters that have not be specified in P1528 are derived from the issue dielectric parameters computed from he 4-Cole-Cole equations The mixture characterizations used for the brain and muscle tissuesimulating liquids are according to the data by C. Gabriel and G. Hartsgrove [13].(see Fig. 5.2)

Table 5.1 Composition of the Muscle Tissue Equivalent Matter

INGREDIENTS		SIMULATING TISSUE					
		835 MHz Brain	835 MHz Muscle	1900 MHz Brain	1900 MHz Muscle	2450MHz Brain	2450MHz Muscle
Mixture Percentage							
WATER		41.45	52.50	54.90	40.40	62.70	73.20
DGBE		0.000	0.000	44.92	58.00	0.000	26.70
SUGAR		56.00	45.00	0.000	0.000	0.000	0.000
SALT		1.450	1.400	0.180	0.500	0.500	0.040
BACTERICIDE		0.100	0.100	0.000	0.100	36.80	0.000
HEC		1.000	1.000	0.000	1.000	0.000	0.000
Dielectric Constant	Target	**41.50**	**55.20**	**40.00**	**53.30**	**39.2**	**52.7**
Conductivity (S/m)	Target	**0.900**	**0.970**	**1.400**	**1.520**	**1.80**	**1.95**

5.3Device Holder for Transmitters

Figure 5.2 Mounting Device

In combination with the SAM Twin Phantom V4.0 the Mounting Device(see Fig. 5.2),enables the rotation of the mounted transmitter in spherical coordinates whereby therotation point is the ear opening. The devices can be easily, accurately, and repeatablybe positioned according to the FCC specifications. The device holder can be locked atdifferent phantom locations (left head, right head, flat phantom).

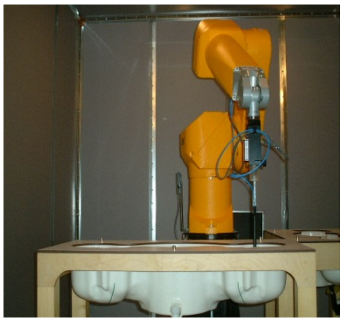
- Note: A simulating human hand is not used due to the complex anatomical and geometricalstructure of the hand that may produce infinite number of configurations [12]. To produce theworst-case condition (the hand absorbs antenna output power), the hand is omitted during thetests.

6. TEST SYSTEM SPECIFICATIONS

6.1Automated Test System Specifications

Positioner

Robot: StäubliUnimation Corp. Robot Model: RX60L
Repeatability:0.02 mm
No. of axis:6



Data Acquisition Electronic (DAE) System
Cell Controller

Processor: Pentium 4 CPU
Clock Speed: 3 GHz
Operating System: Window 2000
Data Card: DASY4 PC-Board

Figure 6.1 DASY4 Test System

Data Converter

Features: Signal,multiplexer,A/D converter. & control logic
Software:DASY4
Connecting Lines: Optical downlink for data and status info
Optical uplink for commands and clock

PC Interface Card

Function:24 bit (64 MHz) DSP for real time processing
Link to DAE 3
16 bit A/D converter for surface detection system
serial link to robot
direct emergency stop output for robot

E-Field Probes

Model: EX3DV4 S/N: 3643
Construction: Triangular core fiber optic detection system
Frequency:10 MHz to 6 GHz
Linearity:±0.2dB (30MHz to 6GHz)

Phantom

Phantom:SAM Twin Phantom (V4.0)
Shell Material: Vivac Composite
Thickness:2.0 ± 0.2 mm

7. DOSIMETRIC ASSESSMENT & PHANTOM SPECS

7.1 Measurement Procedure

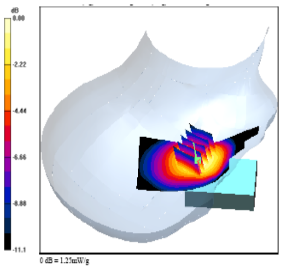


Figure 7.1 Sample Sar Area Scan

The evaluation was performed using the following procedure:

1. The SAR measurement was taken at a selected spatial reference point to monitorpower variations during testing. This fixedlocation point was measured andused as a reference value.
2. The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the Inner surface of the shell.The are a covered then tired imension of the head and thehorizontal gridspacing was 15 mm x 15 mm.
3. Based on theareascan data,the area of the maximumabsorption wasdeterminedby spline interpolation. Around this point, a volume of 32mm x32mm x 30 mm(fine resolution volume scan, zoom scan)was assessedbymeasuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SARvalue was evaluated with the following procedure (see Fig. 7.1):
   a. The data at the surface was extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surfaceand the lowest measuring point is 1.2mm. The extrapolation was based on aleast square algorithm [15]. A polynomial of the fourth order was calculatedthrough the points in z-axes. This polynomial was then used to evaluate thepoints between the surface and the probe tip.
   b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatialvolumes (1g or 10g) were computed using the 3D-Spline interpolationalgorithm. The 3D-spline is composed of three one-dimensional splines withthe “Not a knot” condition (in x, y, and z directions) [15][16]. The volumewas integrated with the trapezoidal algorithm. One thousand points (10 x 10x 10) were interpolated to calculate the average.
   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. TheSAR referencevalue,at the same location as procedure #1,was re-measured. If the value changed by more than 5%, the evaluation is repeated.

7.2 Specific Anthropomorphic Mannequin (SAM) Specifications

The phantom for handset SAR assessment testing is a low-loss dielectric shell, with shapeand dimensions derived from the anthropometricdata of the 90th percentile adult malehead dimensions as tabulated by the US Army. The SAM Twin Phantom shell is bisectedalongthemid-sagittalplane into right and left halves (see Fig. 7.2). The perimetersidewalls of each phantom halves are extended to allow filling withliquid to a depth thatissufficient tominimizedreflections from the upper surface. The liquiddepth ismaintained at a minimum depth of 15cm to minimize reflections from the upper surface.


Figure 7.2 SAM Twin Phantom shell

8. DEFINITION OF REFERENCE POINTS

8.1 EAR Reference Point

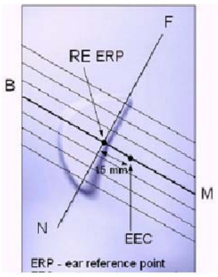


Figure 8.2 Close-up side view of ERPs

Figure 8.1 shows the front,back and side views of the SAM Twin Phantom. The point"M" is the reference point for the center of the mouth, "LE" is the left ear reference point(ERP), and "RE" is the right ERP. The ERPs are 15mm posterior to the entrance to the Earcanal (EEC) along the B-M line (Back-Mouth), as shown in Figure 9.2. The plane Passing, through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck- Front) is perpendicular to the reference plane and passing through the RE (or LE) is calledthe Reference Pivoting Line (see Figure 8.2). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handsetpositioning [5]

Figure 8.1 Front, back and side view of SAM Twin Phantom

8.2 Handset Reference Points

Two imaginary lines on the handset were established: the vertical centerline and thehorizontal line. The test device was placed in a normal operating position with the "testdevice reference point" located along the "vertical centerline" on the front of the devicealigned to the "ear reference point" (See Fig. 8.3). The "test device reference point" wasthan located at the same level as the center of the ear reference point. The test devicewas positioned so that the "vertical centerline" was bisecting the front surface of thehandset at it's top and bottom edges, positioning the "ear reference point" on the outersurface of the both the left and right head phantoms on the ear reference point.

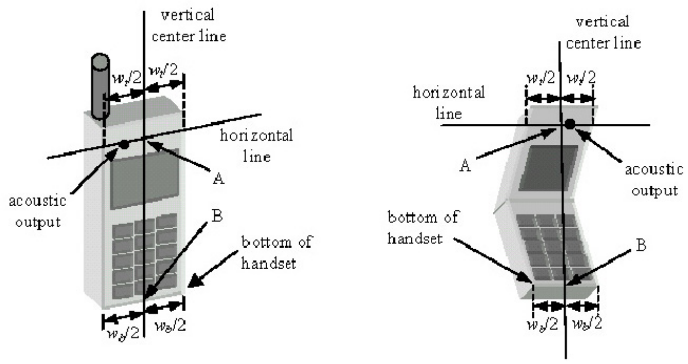


Figure 8.3 Handset Vertical Center & Horizontal Line Reference Points

9. TEST CONFIGURATION POSITIONS

9.1 Positioning for Cheek/Touch

1. The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 9.1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

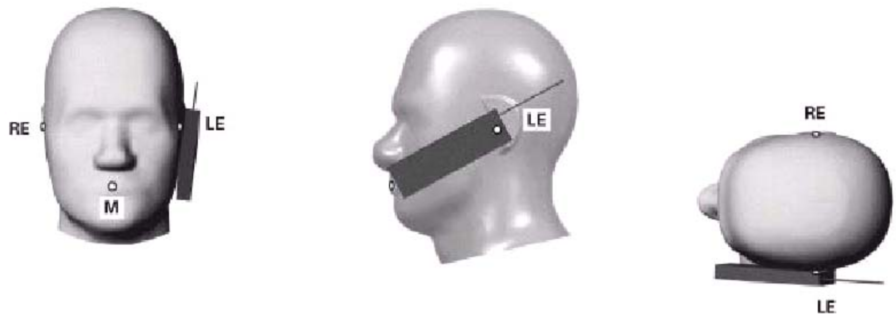


Figure 9.1 Front, Side and Top View of Cheek/Touch Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.

3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).

4. The phone was hen rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.

5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek). See Figure 9.2)

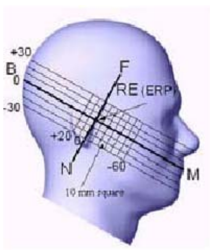


Figure 9.2 Side view w/ relevant markings

9. TEST CONFIGURATION POSITIONS (Continued)

9.2 Positioning for Ear / 15 ° Tilt

With the test device aligned in the "Cheek/Touch Position":

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15degree.
2. The phone was then rotated around the horizontal line by 15 degree.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference planeuntil any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 9.3).

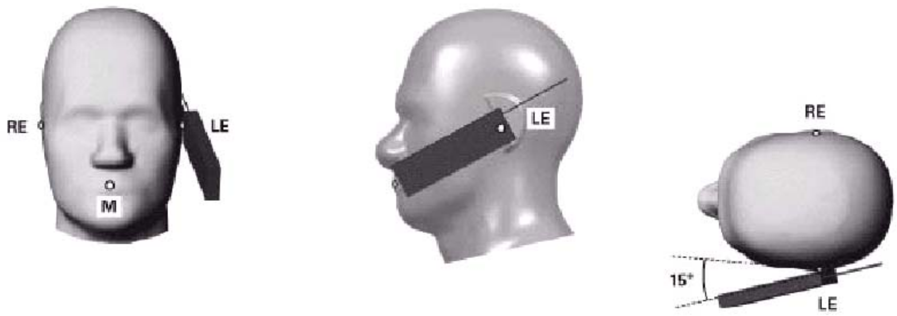


Figure 9.3 Front, Side and Top View of Ear/15° Tilt Position

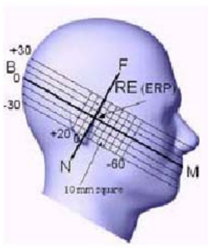


Figure 9.4 Side view w/ relevant markings

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9. TEST CONFIGURATION POSITIONS (Continued)

9.3 Body Holster /Belt Clip Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in anormal use configuration (see Figure 9.5). A devicewith a headset output is tested with a headsetconnected to the device. Body dielectric parametersare used.

Accessories for Body-worn operation configurationsare divided into two categories: those that do notcontain metallic components and those that docontain metallic components. When multipleaccessories that do not contain metallic componentsare supplied with the device, the device is testedwith only the accessory that dictates the closestspacing to the body. Then multiple accessories thatcontain metallic components are supplied with thedevice, the device is tested with each accessory thatcontains a unique metallic component. If multipleaccessories share an identical metallic component(i.e. the same metallic belt-clip used with differentholsters with no other metallic components) only theaccessory that dictates the closest spacing to thebody is tested.

Figure 9.5 Body Belt Clip & Holster Configurations

Body-worn accessories may not always be supplied or available as options for some Devices intended to be authorized for body-worn use. In this case, a test configuration where a separation distance between the back of the device and the flat phantom is used.All test position spacings are documented.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waistorchest-worn transmitters, SAR compliance is tested with the accessory(ies),including headsets and microphones, attached to the device and positioned against a flatphantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning.Worst-case positioning is then documented and used to perform Body SAR testing.In order for users to be aware of the body-worn operating requirements for meeting RFexposure compliance, operating instructions and cautions statements are included in theuser's manual.

10. ANSI / IEEE C95.1-1992 RF EXPOSURE LIMITS

10.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals whohave noknowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential forexposure or cannot exercise control over their exposure. Members of the general public would come under thiscategory when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

10.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 10.1.SAR Human Exposure Specified in ANSI/IEEE C95.1-1992

	HUMAN EXPOSURE LIMITS	
	General Public Exposure (W/kg) or (mW/g)	Occupational Exposure (W/kg) or (mW/g)
Whole-Body average SAR (W/kg)	0.08	0.40
Localized SAR (head and trunk) (W/kg)	1.60	8.00
Localized SAR (limbs) (W/kg)	4.00	20.0

11. IEEE P1528 –MEASUREMENT UNCERTAINTIES

Error Description	Uncertaint value ±%	Probability Distribution	Divisor	(Ci) 1g	Standard (1g)	vi 2 or Veff
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8 %	∞
Axial isotropy	± 4.7	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical isotropy	± 9.6	Rectangular	√3	0.7	± 3.9 %	∞
Boundary Effects	± 1.0	Rectangular	√3	1	± 0.6 %	∞
Probe Linearity	± 4.7	Rectangular	√3	1	± 2.7 %	∞
Detection limits	± 1.0	Rectangular	√3	1	± 0.6 %	∞
Readout Electronics	± 1.0	Normal	1	1	± 1.0 %	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5 %	∞
Integration time	± 2.6	Rectangular	√3	1	± 1.5 %	∞
RF Ambient Conditions	± 3.0	Rectangular	√3	1	± 1.7 %	∞
Probe Positioner	± 0.4	Rectangular	√3	1	± 0.2 %	∞
Probe Positioning	± 2.9	Rectangular	√3	1	± 1.7 %	∞
Algorithms for Max. SAR Eval.	± 1.0	Rectangular	√3	1	± 0.6 %	∞
Test Sample Related						
Device Positioning	± 2.9	Normal	1	1	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	± 2.9 %	∞
Physical Parameters						
Phantom Shell	± 4.0	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	± 1.8 %	∞
Liquid conductivity (Meas.)	± 2.5	Normal	1	0.64	± 1.6 %	∞
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.6	± 1.7 %	∞
Liquid permittivity (Meas.)	± 2.5	Normal	1	0.6	± 1.5 %	∞
CombinedStandard Uncertainty					**± 10.3 %**	330
Expanded Uncertainty (k=2)					**± 20.6 %**	

The above measurement uncertainties are according to IEEE P1528 (2003)

12. SYSTEM VERIFICATION

12.1 Tissue Verification

Table 12.1 Simulated Tissue Verification

MEASURED TISSUE PARAMETERS					
Date(s)	Target Frequency	Dielectric constant: ε		Conductivity: σ	
		Target	Measured	Target	Measured
July.20, 2010	835 MHz Muscle	55.2	55.3	0.97	0.991
July.23, 2010	1900 MHz Muscle	53.3	52.7	1.52	1.560
July.19, 2010	2450 MHz Muscle	52.7	52.6	1.95	2.000

12.2 Test System Validation

Prior to assessment, the system is verified to the±10% of the specifications at 835 MHz, 1900 MHz and 2450 MHz by using the system validation kit(s). (Graphic Plots Attached)

Table 12.2 System Validation

SYSTEM DIPOLE VALIDATION TARGET & MEASURED (835 MHz / 1900 MHz / 2450 MHz values are normalized to a forward power of 1/4 W)					
Date(s)	System Validation Kit:	Target Frequency	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)	Deviation (%)
July.20, 2010	D-835V2, S/N: 464	835 MHz Muscle	2.375	2.370	-0.21
July.23, 2010	D-1900V2, S/N: 5d029	1900 MHz Muscle	9.925	10.70	7.81
July.19, 2010	D-2450V2, S/N: 726	2450 MHz Muscle	13.1	14.20	8.40

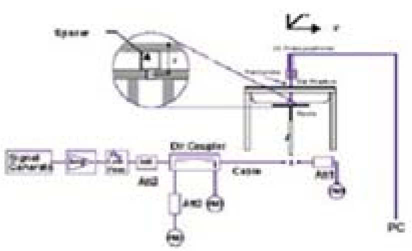


Figure 12.1 Dipole Validation Test Setup

13.Multiple TRANSMITTERS SAR CONSIDERATIONS

13.1 Introduction

The following procedures adopted from "FCC SAR Evaluation Considerations for Handsets with Multiple Transmitters"(v01r05 #648474) on September 2008 are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

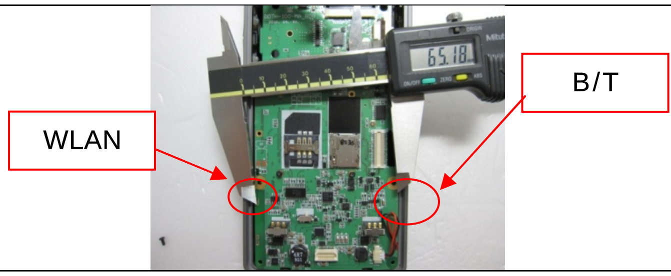
13.2 Output Power Thresholds for Unlicensed Transmitters

	2.45	5.15-5.35	5.47-5.85	GHz
P Ref	12	5	5	mW
Device output power should be rounded to the nearest mW to compare with values specified in this table				

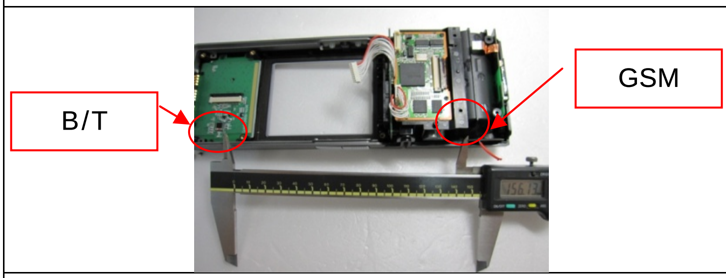
13.3 Multiple Antenna Transmission Information for D3-POS

13.3.1 The closest separation distance between GSM, B/T and WLAN antennas:

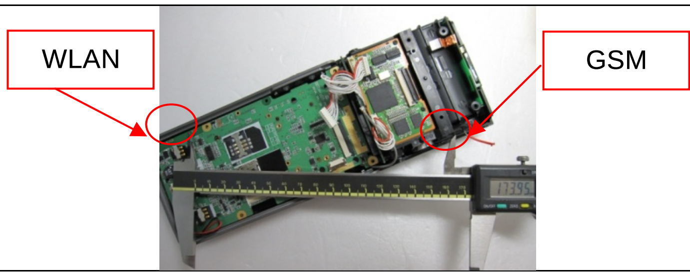
Antenna Location



B/T – WLAN : 65.18 mm



B/T – GSM : 156.13 mm



WLAN – GSM : 173.95 mm

Note 1: Unlicensed transmitter's stand alone SAR is not required when following condition.
- Output power $\le 2P_{Ref}$, antenna distance from other antennas > 5cm each with either output power $\le P_{Ref}$ or 1-g SAR < 1.2 W/kg

Therefore W-LAN stand alone SAR is not required.

Therefore Bluetooth stand alone SAR is not required.

Note 2 :SAR For Simultaneous transmission

- **Because ($GSM850_{sar}$ + $W\text{-}LAN_{sar}$) > 1.6 W/kg, so simultaneous transmission is not performed.**
- **Because ($PCS1900_{sar}$ + $W\text{-}LAN_{sar}$)> 1.6 W/kg, so simultaneous transmission is not performed.**
- **Because($PCS1900_{sar}$+$W\text{-}LAN_{sar}$+$Bluetooth_{sar}$)>1.6W/kg, so simultaneous transmission is not performed.**

13.4 Summary of SAR Evaluation Requirements for Cell phones with MultipleTransmitters

<table>
<tr><th></th><th>Individual Transmitter</th><th>Simultaneous Transmission</th></tr>
<tr><td>Licensed Transmitters</td><td><u>Routine evaluation required</u></td><td rowspan="2">SAR not required:
<u>Unlicensed only</u>
o when stand-alone 1-g SAR is not required and antenna is > 5 cm from other antennas
<u>Licensed & Unlicensed</u>
o when the sum of the 1-g SAR is <1.6 W/kg for all simultaneous transmitting antennas
o when SAR to antenna separation ratio of simultaneous transmitting antenna pair is < 0.3

SAR required:
<u>Licensed & Unlicensed</u>
antenna pairs with SAR to antenna separation ratio ≥ 0.3; test is only required for the configuration that results in the highest SAR in standalone configuration for each wireless mode and exposure condition

Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply</td></tr>
<tr><td>Unlicensed Transmitters</td><td>When there is no simultaneous transmission –
o output < 60/f: SAR not required
o output ≥ 60/f: stand-alone SAR required

When there is simultaneous transmission –
<u>Stand-alone SAR not required when</u>
O output ≤ 2.P_{Ref} and antenna is > 5.0 cm from other antennas
o output ≤ P_{Ref} and antenna is > 2.5 cm from other antennas, each either output power output ≤ P_{Ref} or 1-g SAR < 1.2 W/Kg

<u>Otherwise stand-alone SAR is required</u>

When stand-alone SAR is required
o test SAR on highest output channel for each wireless mode and exposure condition

o if SAR for highest output channel is > 50% of SAR limit, evaluate all channels according to normal procedures</td></tr>
</table>

14. Configuring 802.11 a/b/g Transmitters for SAR Measurement

14.1 SAR Testing with IEEE 802.11 a/b/g Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g transmitters. Unpredictable in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable.

14.2 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be sued for all measurements.

14.3 Frequency Channel Configurations

802.11 a/b/g and 4.9 GHz operation modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channels 1. 6 and 11. 802.11a is tested for UNII operations on channels 36 and 48 in the 5.15-5.25 GHz Band; channels 52 and 64 in the 5.25-5.35 GHz band; channels 104, 116, 124 and 136 in the 5.470-5.725 GHz BAND; and channel 149 and 161 in the 5.8 GHz band. When 5.8 GHz § 15.247 is also available, channels 149, 157 and 165 should be tested of the UNII channels. 4.9 GHz is tested on channels 1., 10 and 5 or 6, whichever has the higher output power, for 5MHz channels; channels 11, 15 and 19 for 10MHz channels; and channels 21 and 25 for 20MHz channels. These are referred to as the " default test channels". 802.11g mode was evaluated only if the output power was 0.25 dB higher than the 802.11b mode.

Table 14.1802.11 Test channels per FCC Requirements

Mode		GHz	Channel	Turbo Channel	"Default Test Channels"			
					§15.247		UNII	
					802.11b	802.11g		
802.11 b/g		2.412	1[#]		√	∇		
		2.437	6	6	√	∇		
		2.462	11[#]		√	∇		
802.11a	UNII	5.18	36				√	
		5.20	40	42 (5.21 GHz)				*
		5.22	44					*
		5.24	48	50 (5.25 GHz)			√	
		5.26	52				√	
		5.28	56	58 (5.29 GHz)				*
		5.30	60					*
		5.32	64				√	
		5.500	100	Unknown				*
		5.520	104				√	
		5.540	108					*
		5.560	112					*
		5.580	116				√	
		5.600	120					*
		5.620	124				√	
		5.640	128					*
		5.660	132					*
		5.680	136				√	
		5.700	140					*
	UNII or §15.247	5.745	149		√		√	
		5.765	153	152 (5.76 GHz)		*		*
		5.785	157		√			*
		5.805	161	160 (5.80 GHz)		*	√	
	§15.247	5.825	165		√			

15. SAR TEST DATA SUMMARY AND POWER TABLE

See Measurement Result Data Pages

Procedures Used To Establish Test Signal

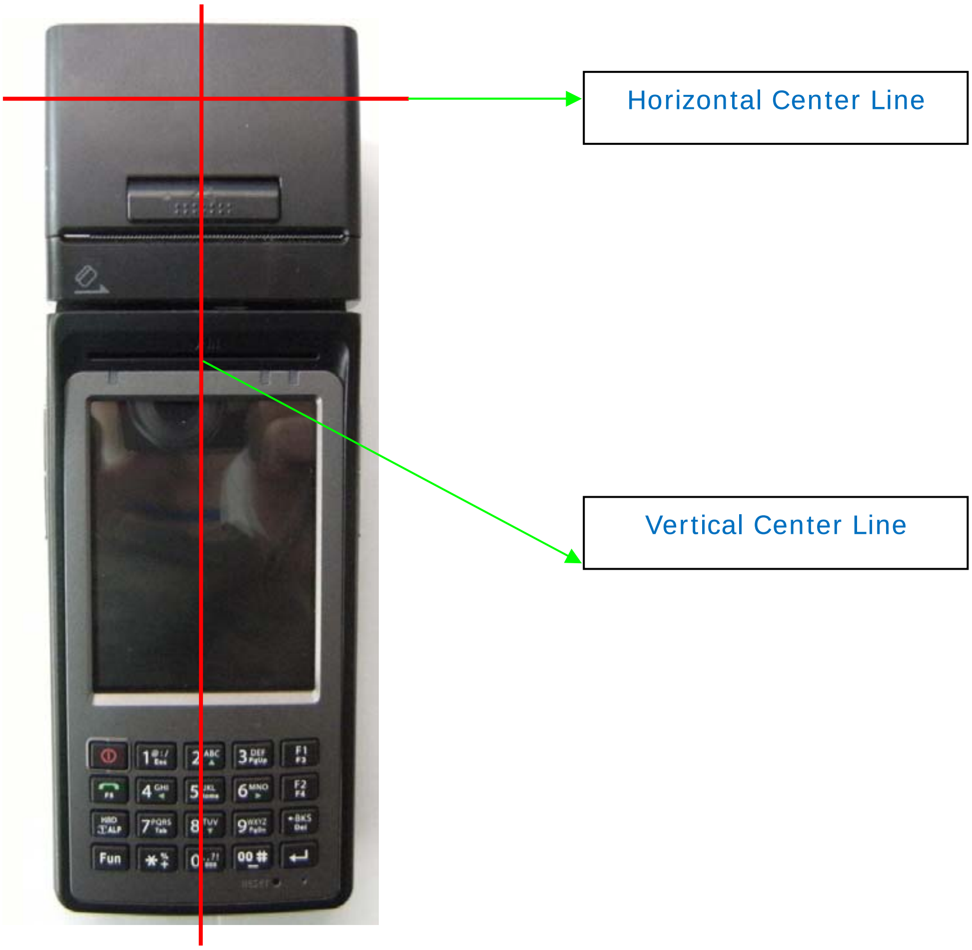
The EUT was placed into simulated call mode (GSM850, PCS1900 GSM) using manufacturers test codes. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR [4]. When test modes are not available or inappropriate for testing a EUT, the actual transmission is activated through a base station simulator or similar equipment. See data pages for actual procedure used in measurement.

Device Test Conditions

The EUT is battery operated. Each SAR measurement was taken with a fully charged battery.
In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power. If a conducted power deviation of more than 5% occurred, the test was repeated.

EUT Reference Points

15.1 EUT Reference Points



15. SAR TEST DATA SUMMARY AND POWER TABLE (Continued)

15.2 Max. Power Output Table for D3-POS (GSM)

Band	Mode	GSM Conducted Output Power(dBm)		
		Low Channel	Middle Channel	High Channel
Cellular	GSM	25.79	25.55	25.42
	GPRS 8	25.79	25.55	25.42
	GPRS 10	25.77	25.51	25.40
PCS	GSM	25.02	25.76	26.01
	GPRS 8	25.02	25.76	26.01
	GPRS 10	24.99	25.73	25.98

15.3 Max. Power Output Table for D3-POS (WLAN)

Mode	Frequency (MHz)	Channel No.	Measured Data (dBm)	(mW)
802.11b	2412	1	**11.882**	**15.424**
	2437	6	11.499	14.122
	2462	11	11.380	13.740
802.11g	2412	1	9.524	8.962
	2437	6	**9.632**	**9.188**
	2462	11	9.603	9.126

※ SAR is not required for 802.11g channels when the maximum average output power is less than $^{1}/_{4}$ dB higher than that measured on the corresponding 802.11b channels.

15.4 Max. Power Output Table for D3-POS (Bluetooth)

Frequency (MHz)	Channel No.	Measured Data (dBm)	(mW)
2402	1	-3.33	0.465
2441	40	-2.71	0.536
2480	79	**-2.14**	**0.611**

16. SAR TEST DATA SUMMARY

Mixture Type: 835 MHz Body

16.1 MEASUREMENT RESULTS (GSM850 GPRS Body SAR)							
FREQUENCY		Begin Power (dBm)	Drift Power (dB)	Mode	Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch						
836.6	190	25.51	0.000	GPRS	0mm [Top]	Internal	0.314
836.6	190	25.51	-0.255	GPRS	0mm [Bottom]	Internal	0.043
836.6	190	25.51	0.114	GPRS	0mm [H - Up]	Internal	0.151
836.6	190	25.51	-0.215	GPRS	0mm [H - Down]	Internal	0.172
824.2	128	25.77	-0.132	GPRS	0mm [V - Front]	Internal	0.590
836.6	**190**	**25.51**	**0.026**	**GPRS**	**0 mm [V - Front]**	**Internal**	**0.622**
848.8	251	25.40	-0.015	GPRS	0 mm [V - Front]	Internal	0.499
836.6	190	25.55	0.011	GSM850	0mm [V - Front]	Internal	*0.323
836.6	190	25.51	-0.225	GPRS	0 mm [V - Back]	Internal	0.100
ANSI / IEEE C95.1 1992 – SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/ Occupational Exposure**							**Body** **1.6 W/kg** **(mW/g)** averaged over 1 gram

NOTE:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Prior to testing the conducted output power was measured.
4. The EUT is tested 2nd hot-spot peak, if it is less than 2dB below the highest peak.
5. Test Signal Call Mode □ Continuous Tx On □Manu.Test Codes ▣BaseStation Simulator
6. Tissue parameters and temperatures are listed on the SAR plots.
7. Liquid tissue depth is 15.0cm.±0.1
8. Basically the Body SAR Tests were performed with GPRS Class10 (2TX, 1RX)
9. GSM and WLAN Simultaneous SAR is not required, Because the sum of the 1g SAR is <1.6 W/kg.
10. * The body SAR test was repeated with GSM mode on the worst case channel of GPRS Class10

16. SAR TEST DATA SUMMARY (Continued)

Mixture Type: **1900 MHz Body**

16.2 MEASUREMENT RESULTS (PCS1900 GPRS Body SAR)							
FREQUENCY		**Begin Power (dBm)**	**Drift Power (dB)**	**Mode**	**Device Test Position**	**Antenna Position**	**SAR (W/kg)**
MHz	**Ch**						
1880.0	661	25.73	-0.319	GPRS	0mm [Top]	Internal	0.241
1880.0	661	25.73	-0.208	GPRS	0mm [Bottom]	Internal	0.00328
1880.0	661	25.73	-0.066	GPRS	0mm [H - Up]	Internal	0.089
1880.0	661	25.73	-0.276	GPRS	0mm [H - Down]	Internal	0.148
1850.2	**512**	**24.99**	**-0.039**	**GPRS**	**0 mm [V - Front]**	**Internal**	**0.575**
1880.0	661	25.73	0.031	GPRS	0 mm [V - Front]	Internal	0.340
1909.8	810	25.98	-0.378	GPRS	0 mm [V - Front]	Internal	0.233
1850.2	512	25.02	-0.167	PCS1900	0mm [V - Front]	Internal	*0.383
1880.0	661	25.73	0.033	GPRS	0 mm [V - Back]	Internal	0.027
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/ Occupational Exposure							**Body 1.6 W/kg (mW/g)** averaged over 1 gram

NOTE:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Prior to testing the conducted output power was measured.
4. The EUT is tested 2nd hot-spot peak, if it is less than 2dB below the highest peak.
5. Test Signal Call Mode □ Continuous Tx On □Manu.Test Codes ▣BaseStation Simulator
6. Tissue parameters and temperatures are listed on the SAR plots.
7. Liquid tissue depth is 15.0cm.±0.1
8. Basically the Body SAR Tests were performed with GPRS Class10 (2TX, 1RX)
9. GSM and WLAN Simultaneous SAR is not required, Because the sum of the 1g SAR is <1.6 W/kg.
10. * The body SAR test was repeated with GSM mode on the worst case channel of GPRS Class10

16. SAR TEST DATA SUMMARY (Continued)

Mixture Type: 2450 MHz Body

16.3 MEASUREMENT RESULTS (W-LAN(802.11b) Body SAR)							
FREQUENCY		Begin Power (dBm)	Drift Power (dB)	Mode	Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch						
2437	6	14.649	-0.155	W-LAN	0 mm [Top]	Internal	0.00136
2437	6	14.649	0.022	W-LAN	0 mm [Bottom]	Internal	0.110
2437	6	14.649	-0.315	W-LAN	0 mm [H - Up]	Internal	0.034
2437	6	14.649	-0.275	W-LAN	0 mm [H - Down]	Internal	0.025
2437	6	14.649	0.204	W-LAN	0 mm [V - Front]	Internal	0.00838
2412	1	14.984	-0.120	W-LAN	0 mm [V - Back]	Internal	0.155
2437	6	14.649	0.239	W-LAN	0 mm [V - Back]	Internal	0.142
2462	11	14.465	0.034	W-LAN	0 mm [V - Back]	Internal	0.190
2462	**11**	14.465	**-0.216**	**W-LAN + BT on**	**0 mm [V -Back]**	**Internal**	***0.191**
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/ Occupational Exposure							**Body 1.6 W/kg (mW/g)** averaged over 1 gram

NOTE:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Prior to testing the conducted output power was measured.
4. The EUT is tested 2nd hot-spot peak, if it is less than 2dB below the highest peak.
5. Battery is fully charged for all readings.
6. Test Signal Call Mode ▣Continuous Tx On □Manu.Test Codes □BaseStation Simulator
7. Tissue parameters and temperatures are listed on the SAR plots.
8. Liquid tissue depth is 15.0cm.±0.1
9. * Simultaneous SAR test were repeated with each worst case channel of W-LAN and B/T on(2480MHz)
10. The 802.11b modes of this DUT were programmed to be in continuously transmitting mode.

17. SAR TEST EQUOPMENT

Table 17.1 Test Equipment Calibration

EQUIPMENT SPECIFICATIONS			
Type	**Calibration Date**	**Next Calibration Date**	**Serial Number**
Robot	N/A	N/A	F02/5Q85A1/A/01
Robot Controller	N/A	N/A	F02/5Q85A1/C/01
Joystick	N/A	N/A	D221340031
Hicron Computer 1.1GHz Pentium Celeron ,Window 2000	N/A	N/A	N/A
Data Acquisition Electronics	November 19, 2009	November 19, 2010	520
Dosimetric E-Field Probe	January 26, 2010	January 26, 2011	3643
Dummy Probe	N/A	N/A	N/A
Sam Phantom	N/A	N/A	N/A
Probe Alignment Unit LB	N/A	N/A	321
SPEAG Validation Dipole D835 MHz	March 22, 2010	March 22, 2012	464
SPEAG Validation Dipole D1900 MHz	March 23, 2010	March 23, 2012	5d029
SPEAG Validation Dipole D2450 MHz	March 18, 2010	March 18, 2012	726
Head/Body Equivalent Matter(835MHz)	January 2010	January 2011	N/A
Head/Body Equivalent Matter(1900MHz)	January 2010	January 2011	N/A
Head/Body Equivalent Matter(2450MHz)	January 2010	January 2011	N/A
HP EPM-442A Power Meter	March 12, 2010	March 12, 2011	GB37170267
HP ESG-3000A Signal Generator	July 01, 2010	July 01, 2011	US37230529
Attenuator (10dB)	January 11, 2010	January 11, 2011	BP4387
Attenuator (3dB)	July 01, 2010	July 01,2011	MY39260700
Low pass filter (1.5GHz)	January 11, 2010	January 11, 2011	N/A
Low pass filter (3.0GHz)	October 13, 2009	October 13, 2010	N/A
Dual Directional Coupler	January 11, 2010	January 11, 2011	50228
Amplifier	November 02, 2009	November 02, 2010	1020 D/C 0221
Network Analyzer	March 12, 2010	March 12, 2011	3410J01204
HP85070D Dielectric Probe Kit	N/A	N/A	LISO1440118
SEMITEC Engineering	N/A	N/A	Shield Room

NOTE:
The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Validation measurement isperformed by Digital EMC. before each test. The brain simulating material is calibrated by Digital EMC using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material.

18.CONCLUSION

Measurement Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposurelimits of the FCC. These measurements are taken to simulate the RF effects exposureunder worst-case conditions. Precise laboratory measures were taken to assurerepeatability of the tests. The tested device complies with the requirements in respect toall parameters subject to the test. The test results and statements relate only to the item(s)tested.

Please note that the absorption and distribution of electromagnetic energy in the body arevery complex phenomena that depend on the mass, shape, and size of the body, theorientation of the body with respect to the field vectors, and the electrical properties ofboth the body and the environment. Other variables that may play a substantial role inpossible biological effects are those that characterize the environment (e.g. ambienttemperature, air velocity, relative humidity, and body insulation) and those thatcharacterize the individual (e.g. age, gender, activity level, debilitation, or disease).

Because innumerable factors may interact to determine the specific biological outcome ofan exposure to electromagnetic fields, any protection guide shall consider maximalamplification of biological effects as a result of field-body interactions, environmentalconditions, and physiological variables.

19. REFERENCES

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