

# TEST REPORT

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Gyeonggi-Do, Korea, 443-742

## 2. Products

Name : AT&T HomeManager  
Model /Type : SMT-I8120  
Manufacturer : SAMSUNG ELECTRONICS CO.,LTD.

3. Test Standard : FCC 47 CFR § 2.1093

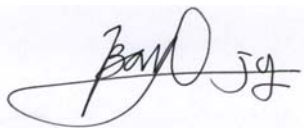
4. Test Method : OET Bulletin 65, Supplement C(July 2001)

5. Test Results : Positive

6. Date of Application : 26<sup>th</sup> May, 2008

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Tested by



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Approved by



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Manager

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## Korea Testing Laboratory

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## **1. EQUIPMENT UNDER TEST**

### **1.1 General Information :**

- 1) **Test item** : UPCS DECT (Digital Enhanced Cordless Telecommunications)
- 2) **Device Category** : Portable Device
- 3) **Model Number** : SMT-I8120
- 4) **FCC ID** : A3LSMT-I8120
- 5) **Test Device** : Production Unit
- 6) **Applicant & Address** : SAMSUNG ELECTRONICS CO.,LTD.  
416 Maetan3-Dong Yeongtong-gu, Suwon city, Gyeonggi-Do, 443-742, Korea
- 7) **Manufacturer & Address** : SAMSUNG ELECTRONICS CO.,LTD.  
259, Gongdan-Dong Gumi-city, Gyeongsangbuk-Do, 730-030, Korea
- 8) **Rule and Test Standard** : FCC 47 CFR § 2.1093; OET Bulletin 65, Supplement C(July 2001)
- 9) **FCC Clasification** : Part 15 Unlicensed PCS portable Tx held to ear (PUE)
- 10) **RF exposure Category** : General Population/Uncontrolled
- 11) **Maximum SAR** : 0.022 W/kg Head SAR / 0.022 W/kg Body SAR

### **1.2 Description of Device :**

|                              |                                                                        |
|------------------------------|------------------------------------------------------------------------|
| Operation Modes              | US Digital Enhanced Cordless Telecommunications                        |
| Conducted RF Power           | 20.41 dBm                                                              |
| Tx Frequency Range           | 1921.536 MHz ~ 1928.448 MHz                                            |
| Duty Cycle                   | 1: 24                                                                  |
| Antenna Type                 | Internal Antenna                                                       |
| Body-Worn Accessories Tested | N/A (handset does not have provision for body-worn transmit operation) |
| Audio Accessories Tested     | N/A (handset does not have provision for audio accessory)              |

## **2. INTRODUCTION**

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency(RF) radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emission due to FCC-regulated portable devices.[1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. (c) 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.[2] The measurement procedure described in IEEE/ANSI C95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave[3] is used for guidance in measuring SAR due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements(NCRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields “NCRP Report No. 86 (c) NCRP, 1986, Bethesda, MD 20814.[4] SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

### **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( $p$ ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body. (see Figure.1)

$$SAR = \frac{d}{dt} \left( \frac{dU}{dm} \right) = \frac{d}{dt} \left( \frac{dU}{p dV} \right)$$

**Figure 1. SAR Mathematical Equation**

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

$$SAR = \sigma E^2 / p$$

**Where :**

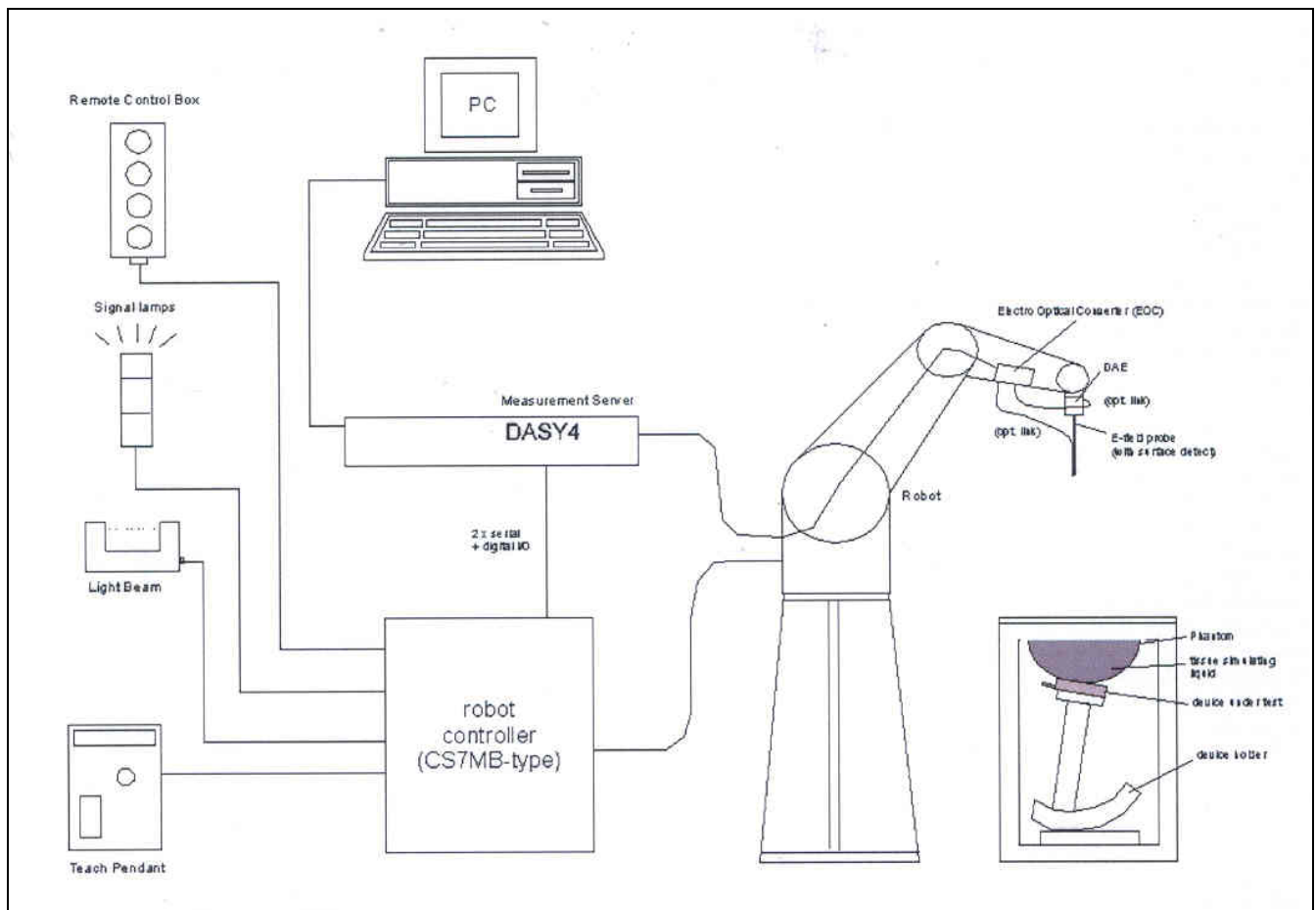
- $\sigma$  = conductivity of the tissue-simulant material (S/m)
- $p$  = mass density of the tissue-simulant material (kg/m<sup>3</sup>)
- $E$  = Total RMS electric field strength (V/m)

Note: The primary factors that control rate or energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[4]

### **3. DESCRIPTION OF SAR MEASUREMENT SYSTEM**

#### **3.1 SAR Measurement System**

These measurements are performed using the DASY4 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, measurement server, Measurement computer, near-field probe, probe alignment sensor, and the SAM twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig.2).



**Figure 2. SAR Measurement System**

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [5].

### 3.2 E-Field Probe Type and Performance

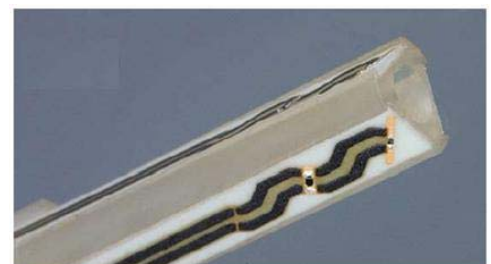
The SAR measurements were conducted with the dosimetric probe ET3DV6, (see Figure 4) designed in the classical triangular configuration [5] and optimised for dosimetric evaluation. The probe has been constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical mortifier line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches a maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2<sup>nd</sup> order fitting. The approach is stopped at reaching the maximum.



**Figure 3. Probe and DAE**

#### Probe Specifications

|                   |                                                                                                                                                  |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction      | Symmetrical design with triangular core<br>Built-in optical fiber for surface detection System<br>Built-in shielding against static charges      |
| Calibration       | In air from 10 MHz to 2.5 GHz<br>In brain and muscle simulating tissue at<br>Frequencies of 450 MHz, 900 MHz and 1.8 GHz (accuracy: 8%)          |
| Frequency         | 10 MHz to > 6 GHz; Linearity: $\pm 0.2$ dB (30 MHz to 3 GHz)                                                                                     |
| Directivity       | $\pm 0.2$ dB in brain tissue (rotation around probe axis)<br>$\pm 0.4$ dB in brain tissue (rotation normal probe axis)                           |
| Dynamic Range     | 5 $\mu$ W/g to > 100 mW/g;                                                                                                                       |
| Linearity         | 0.2 dB                                                                                                                                           |
| Surface Detection | 0.2 mm repeatability in air and clear liquids<br>Over diffuse reflecting surfaces.                                                               |
| Dimensions        | Overall length: 330 mm<br>Tip length: 16 mm<br>Body diameter: 12 mm<br>Tip diameter: 6.8 mm<br>Distance from probe tip to dipole centers: 2.7 mm |
| Application       | General dissymmetry up to 3 GHz<br>Compliance tests of mobile phones<br>Fast automatic scanning in arbitrary phantoms                            |



**Figure 4. ET3DV6 E-Field Probe**

### 3.3 Probe Calibration Process

#### Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described [6] with an accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [7] and found to be better than +/- 0.25dB. The sensitivity parameters (NornX, NornY, NornZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

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

where:

$\Delta t$  = exposure time (30 seconds),

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

$\Delta T$  = temperature increase due to RF exposure.

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;

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

where:

$\sigma$  = simulated tissue conductivity,

$\rho$  = Tissue density (1.25 g/cm<sup>3</sup> for brain tissue)

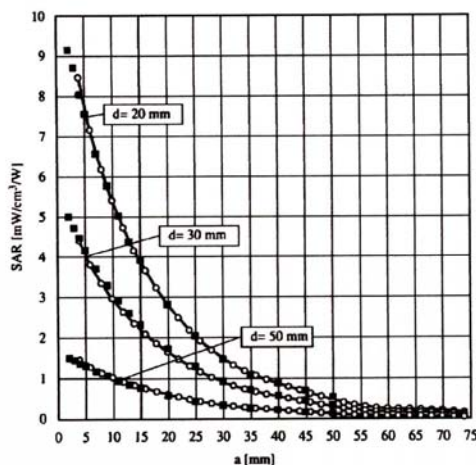


Figure B.1. E-Field and Temperature measurements at 900MHz[5]

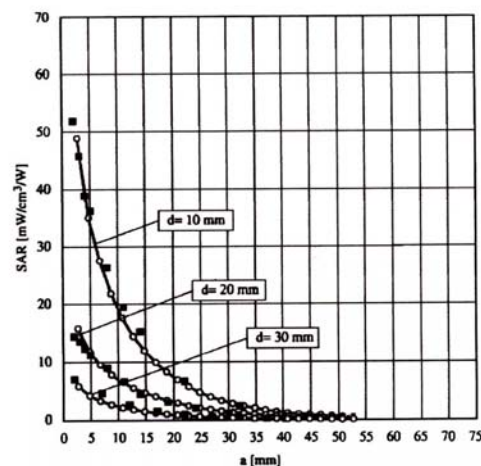


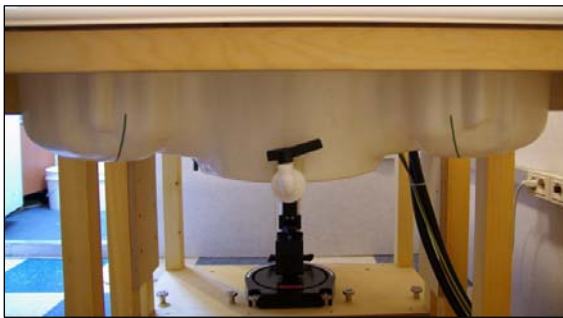
Figure B.2. E-field and temperature measurements at 1.8GHz[5]

### 3.4 Data Acquisition Electronics

The data acquisition electronics (DAE4) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. The input impedance of the DAE4 box is 200 Mohm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB. Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe-mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

### 3.5 Phantom Properties



**Figure 5. SAM twin phantom**

The SAM Phantom is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [9][10]. 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 the 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 in the robot.

| Phantom Properties        | Requirement for specific EUT | Measured       |
|---------------------------|------------------------------|----------------|
| Depth of Phantom          | > 150 mm                     | 200 mm         |
| Width of flat section     | > 10 cm (Twice EUT Width)    | 20 cm          |
| Length of flat section    | > 26 cm (Twice EUT Length)   | 30 cm          |
| Thickness of flat section | 2 mm $\pm$ 0.2 mm            | 2.08 ~ 2.20 mm |

**Table 1. Flat Section Properties of SAM Twin Phantom**

### 3.6 Device Holder for DASY4

In combination with the SAM Phantom V4.0, the Mounting Device(POM) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatably positioned according to the FCC CENELEC specifications. The device holder can be locked at different phantom locations(left head, right head, flat phantom).

Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations [10]. To produce the Worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



**Figure 4. Device Holder**

### 3.7 Brain & Muscle Simulating Mixture Characteristic

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution (see Table 2). Preservation with bacteriacide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrrove [11].

| Ingredients  | 1900MHz Brain | 1900MHz Muscle |
|--------------|---------------|----------------|
| Water        | 55.24%        | 70.23%         |
| Sugar        | -             | -              |
| Salt         | 0.31%         | 0.29%          |
| DGBE         | 44.45%        | 29.47%         |
| Bacteriacide | -             | -              |
| HEC          | -             | -              |

**Table 2. Composition of Tissue Equivalent Matter**

## 4. System Verification

### 4.1 Tissue Verification

The dielectric parameters of the brain and muscle simulating liquid were measured prior to SAR assessment using the HP85070D dielectric probe kit and Agilent 8753D Network Analyzer. The actual dielectric parameters are shown in the following table.

| Freq.<br>[MHz] | Liquid | Date              | Liquid<br>Temp<br>[°C] | parameters   | Target<br>Value | Measured<br>Value | Deviation<br>(%) | Limit<br>(%) |
|----------------|--------|-------------------|------------------------|--------------|-----------------|-------------------|------------------|--------------|
| 1900           | Head   | 9th June,<br>2008 | 21.5                   | $\epsilon_r$ | 40.0            | 39.5              | - 1.3            | $\pm 5$      |
|                |        |                   |                        | $\sigma$     | 1.40            | 1.38              | - 1.5            | $\pm 5$      |
|                | Body   | 9th June,<br>2008 | 21.5                   | $\epsilon_r$ | 53.3            | 52.9              | - 0.8            | $\pm 5$      |
|                |        |                   |                        | $\sigma$     | 1.52            | 1.50              | - 1.4            | $\pm 5$      |

**Table 3. Measured Simulating Liquid Dielectric Values**

The humidity and dielectric/ambient temperatures are recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than  $|2|^\circ\text{C}$ .

## 4.2 System Validation



**Figure 5. Validation setup**

Prior to the SAR assessment, the system validation kit was used to verify that the DASY4 was operating within its specifications. The validation dipoles are highly symmetric and matched at the centre frequency for the specified liquid and distance to the phantom. The accurate distance between the liquid surface and the dipole centre is achieved with a distance holder that snaps onto the dipole.

System validation is performed by feeding a known power level into a reference dipole, set at a known distance from the phantom. The measured SAR is compared to the theoretically derived level.

The reference SAR values are derived using a reference dipole and flat phantom suitable. The forward power into the reference dipole for each SAR validation was adjusted to 250 mW.

These reference SAR values are obtained from the IEEE Std 1528 and are normalized to 1 W. The measured 1g(10g) SAR should be within 10 % of the expected target reference values shown in table 4 below.

| System Validation Kit | Date          | Tissue           | Liquid Temp.(°C) | Ambient Temp.( °C) | Targeted SAR <sub>1g</sub> (mW/g) | Measured SAR 1 g (mW/g) | Deviation (%) |
|-----------------------|---------------|------------------|------------------|--------------------|-----------------------------------|-------------------------|---------------|
| D1900V2<br>S/N:5d038  | 9th June 2008 | 1900MHz<br>Brain | 21.5             | 21.0               | 39.7                              | 38.3                    | - 3.6         |

**Table 4 : Deviation from Reference Validation Values**

During the SAR measurement process the liquid depth was maintained to a level of a least 15 tolerance of  $\pm 0.2$ cm.

The following photo shows the depth of the liquid depth of the liquid maintained during the testing.



**Figure 6. Liquid Depth**

## **5. SAR MEASUREMENT PROCEDURE USING DASY4**

The SAR evaluation was performed with the SPEAG DASY4 system. A summary of the procedure follows ;

- a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test and then again at the end of the test.
- b) The SAR distribution at the exposed side of the phantom is measured at a distance of 3.9 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 15 mm x 15 mm( or 20mm x 20mm). The actual Area Scan has dimensions surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.
- c) Around this point, a volume is assessed by measuring 5 x 5 x 7 (7 x 7 x 7) points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure ;
  - (i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation is based on a least square algorithm[13]. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.
  - (ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot”- condition (in x, y and z-direction)[13][14]. The volume is integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.
  - (iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.
  - (iv) The SAR value at the same location as in Step (a) is again measured (If the value changed by more than 5%, the evaluation is repeatd.)

## 6. MEASUREMENT UNCERTAINTY

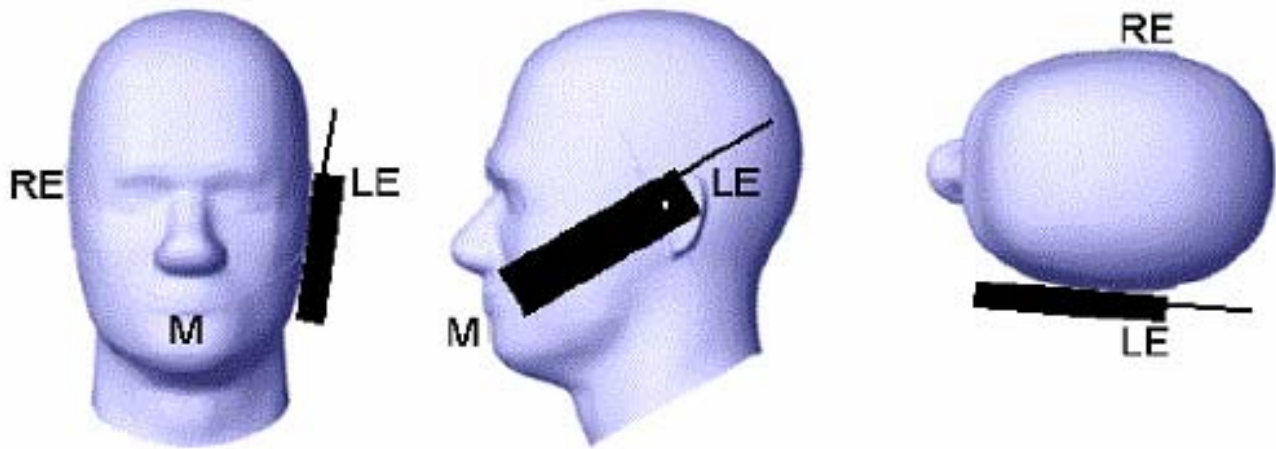
The uncertainty analysis is based on the template listed in the IEEE Std 1528-2003 for both EUT SAR tests and Validation uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95 % confidence level) must be less than 25 %.

| a                                                    | b     | c           | d              | e=<br>f(d,k) | f           | g            | h=cxf/e         | i=cxg/e          | k   |
|------------------------------------------------------|-------|-------------|----------------|--------------|-------------|--------------|-----------------|------------------|-----|
| Uncertainty Component                                | Sec.  | Tol.<br>(%) | Prob.<br>Dist. | Div.         | Ci<br>(1 g) | Ci<br>(10 g) | 1 g Ui<br>(± %) | 10 g Ui<br>(± %) | vi  |
| <b>Measurement System</b>                            |       |             |                |              |             |              |                 |                  |     |
| Probe Calibration (k=1)                              | E.2.1 | 5.9         | N              | 1            | 1           | 1            | 5.9             | 5.9              | ∞   |
| Axial Isotropy                                       | E.2.2 | 4.7         | R              | $\sqrt{3}$   | 0.7         | 0.7          | 1.9             | 1.9              | ∞   |
| Hemispherical Isotropy                               | E.2.2 | 9.6         | R              | $\sqrt{3}$   | 0.7         | 0.7          | 3.9             | 3.9              | ∞   |
| Boundary Effect                                      | E.2.3 | 1.0         | R              | $\sqrt{3}$   | 1           | 1            | 0.6             | 0.6              | ∞   |
| Linearity                                            | E.2.4 | 4.7         | R              | $\sqrt{3}$   | 1           | 1            | 2.7             | 2.7              | ∞   |
| System Detection Limits                              | E.2.5 | 1.0         | R              | $\sqrt{3}$   | 1           | 1            | 0.6             | 0.6              | ∞   |
| Readout Electronics                                  | E.2.6 | 0.3         | N              | 1            | 1           | 1            | 0.3             | 0.3              | ∞   |
| Response Time                                        | E.2.7 | 0.8         | R              | $\sqrt{3}$   | 1           | 1            | 0.5             | 0.5              | ∞   |
| Integration Time                                     | E.2.8 | 2.6         | R              | $\sqrt{3}$   | 1           | 1            | 1.5             | 1.5              | ∞   |
| RF Ambient Noise                                     | E.6.1 | 3.0         | R              | $\sqrt{3}$   | 1           | 1            | 1.7             | 1.7              | ∞   |
| RF Ambient Reflections                               | E.6.1 | 3.0         | R              | $\sqrt{3}$   | 1           | 1            | 1.7             | 1.7              | ∞   |
| Probe Positioner                                     | E.6.2 | 0.4         | R              | $\sqrt{3}$   | 1           | 1            | 0.2             | 0.2              | ∞   |
| Probe Positioning with respect to Phantom Shell      | E.6.3 | 2.9         | R              | $\sqrt{3}$   | 1           | 1            | 1.7             | 1.7              | ∞   |
| Algorithms for Max. SAR Evaluation                   | E.5   | 1.0         | R              | $\sqrt{3}$   | 1           | 1            | 0.6             | 0.6              | ∞   |
| <b>Test Sample Related</b>                           |       |             |                |              |             |              |                 |                  |     |
| Test Sample Positioning                              | E.4.2 | 2.9         | N              | 1            | 1           | 1            | 2.9             | 2.9              | 145 |
| Device Holder Uncertainty                            | E.4.1 | 3.6         | N              | 1            | 1           | 1            | 3.6             | 3.6              | 5   |
| Output Power Variation — SAR Drift Measurement       | 6.6.2 | 5.0         | R              | $\sqrt{3}$   | 1           | 1            | 2.9             | 2.9              | ∞   |
| <b>Phantom and Tissue Parameters</b>                 |       |             |                |              |             |              |                 |                  |     |
| Phantom Uncertainty (shape and thickness tolerances) | E.3.1 | 4.0         | R              | $\sqrt{3}$   | 1           | 1            | 2.3             | 2.3              | ∞   |
| Liquid Conductivity — Deviation from target values   | E.3.2 | 5.0         | R              | $\sqrt{3}$   | 0.64        | 0.43         | 1.8             | 1.2              | ∞   |
| Liquid Conductivity — Measurement uncertainty        | E.3.3 | 2.5         | N              | 1            | 0.64        | 0.43         | 1.6             | 1.1              | ∞   |
| Liquid Permittivity — Deviation from target values   | E.3.2 | 5.0         | R              | $\sqrt{3}$   | 0.6         | 0.49         | 1.7             | 1.4              | ∞   |
| Liquid Permittivity — Measurement uncertainty        | E.3.3 | 2.5         | N              | 1            | 0.6         | 0.49         | 1.5             | 1.2              | ∞   |
| Combined standard Uncertainty                        |       |             | RSS            |              |             |              | ± 10.9          | ± 10.7           | 387 |
| Expanded Uncertainty (95% CONFIDENCE LEVEL)          |       |             | K=2            |              |             |              | ± 21.9          | ± 21.4           |     |

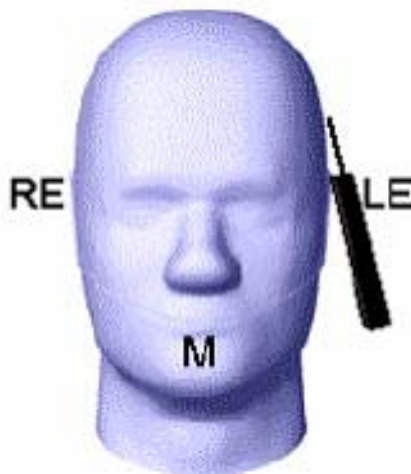
**Table 5. EUT SAR Test - Uncertainty Budget for DASY4 Version V4.6 Build 19**

Estimated total measurement uncertainty for the DASY4 measurement system was ± 10.9 %.  
The extended uncertainty (K=2) was assessed to be ± 21.9 % based on 95 % confidence level.  
The uncertainty is not added to the measurement result.





**Figure 9. Cheek/Touch Position**



**Figure 10. Ear /Tilt Position**



**Figure 11. Belt Position set up with holster**

## 7.2 Tilt Position

The device was positioned in the “Cheek” position. While maintaining the device in the reference plane described above cheek position and pivoting against the ear, device was moved outward away from the mouth by an angle of 15 degrees. (see Figure 10)

## 7.3 Body Holster/Belt-Clip Position

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. A device with a headset output is tested with a headset connectd to the device.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested

with the device with each accessory. If multiple accessories share an identical metallic component(i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

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 with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are test for SAR compliance with the front of the device positioned to face the flat phantom in brain fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom 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 this test case, belt clip and Ear-phone do not have provision for the Body-worn transmit operation.

## **8. FCC RF Exposure Limits**

| <b>HUMAN EXPOSURE</b>                                     | <b>UNCONTROLLED ENVIRONMENT<br/>General Population<br/>(W/Kg) or (mW/g)</b> | <b>CONTROLLED ENVIRONMENT<br/>Occupational<br/>(W/Kg) or (mW/g)</b> |
|-----------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>SPATIAL PEAK SAR<br/>(Brain)</b>                       | 1.60                                                                        | 8.00                                                                |
| <b>SPATIAL AVERAGE SAR<br/>(Whole Body)</b>               | 0.08                                                                        | 0.40                                                                |
| <b>SPATIAL PEAK SAR<br/>(Hand / Feet / Ankle / Wrist)</b> | 4.00                                                                        | 20.00                                                               |

**Table. 8 Safety Limits for Partial Body Exposure**

NOTE 1 : **Whole-Body SAR** is averaged over the entire body, **partial-body SAR** is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. **SAR for hands, wrists, feet and ankles** is averaged over any 10 grams of tissue defined as a tissue volume in the shape of cube

NOTE 2 : At frequencies above 6.0 GHz, SAR limits are not applicable and MPE limits for power density should be applied at 5 cm or more from the transmitting device.

NOTE 3 : The time averaging criteria for field strength and power density do not apply to general population SAR limit of 47 CFR § 2.1093.

## 9. SAR MEASUREMENT RESULTS

### 1) UPCS1900 Head SAR Measurement Result

Date of Test : 9th June 2008

Mixture Type : 1900MHz Brain

Ambient Temperature (C) : 21.0

Dielectric Constant : 39.5

Liquid Temperature (C) : 21.5

Humidity (%) : 46

Conductivity : 1.38

| Frequency |    | Mode | Power Ref.<br>(V/m) | Power drift<br>(dB) | Head Position | Device Position | Antenna Position | 1g SAR<br>(W/Kg) |
|-----------|----|------|---------------------|---------------------|---------------|-----------------|------------------|------------------|
| MHz       | CH |      |                     |                     |               |                 |                  |                  |
| 1921.536  | 1  | UPCS | -                   | -                   | Left          | Cheek Touch     | Internal Ant.    | -                |
| 1924.992  | 3  |      | 3.01                | 0.12                |               | Cheek Touch     | Internal Ant.    | 0.021            |
| 1928.448  | 5  |      | -                   | -                   |               | Cheek Touch     | Internal Ant.    | -                |
| 1924.992  | 3  | UPCS | 2.90                | 0.02                | Left          | Ear Tilt        | Internal Ant.    | 0.013            |
| 1921.536  | 1  | UPCS | 2.82                | 0.36                | Right         | -               | -                | 0.022            |
| 1924.992  | 3  |      | 2.87                | 0.11                |               | Cheek Touch     | Internal Ant.    | 0.022            |
| 1928.448  | 5  |      | 2.90                | 0.03                |               | -               | -                | 0.022            |
| 1924.992  | 3  | UPCS | 2.90                | 0.04                | Right         | Ear Tilt        | Internal Ant.    | 0.012            |

#### NOTES:

1. The test data reported are the worst-case SAR value with the antenna –head position set in a typical configuration
2. All modes of operation were investigated and the worst-case are reported.
3. Battery : Standard Batteries are used and fully charged for all readings.
4. SAR Configuration : Head
5. Test Signal Call mode : Base Station Simulator (CMD60)
6. Justification for reduced test configurations: per FCC/OET Supplement C (July,2001), if the SAR measured at the middle channel for each test configuration (Left, right, cheek/touch, tilt/ear, extended and retracted) is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

## 2) UPCS1900 Body SAR Measurement Result

Date of Test : 9th June 2008

Mixture Type : 1900MHz Muscle

Ambient Temperature (C) : 21.0

Dielectric Constant : 52.9

Liquid Temperature (C) : 21.5

Humidity (%) : 46

Conductivity : 1.50

| Frequency |    | Mode | Power Ref.<br>(V/m) | Power drift<br>(dB) | Body Worn            |                      | Antenna Position | 1g SAR<br>(W/Kg) |
|-----------|----|------|---------------------|---------------------|----------------------|----------------------|------------------|------------------|
| MHz       | CH |      |                     |                     |                      |                      |                  |                  |
| 1921.536  | 1  | UPCS | 2.63                | 0.18                | Rear facing Phantom  | Belt without Holster | Internal Ant.    | 0.021            |
| 1924.992  | 3  |      | 1.77                | 0.26                |                      | Belt without Holster | Internal Ant.    | 0.022            |
| 1928.448  | 5  |      | 2.51                | 0.04                |                      | Belt without Holster | Internal Ant.    | 0.021            |
| 1924.992  | 3  | UPCS | 1.99                | 0.31                | Front facing Phantom | Belt without Holster | Internal Ant.    | 0.018            |

### NOTES:

1. The test data reported are the worst-case SAR value with the antenna –head position set in a typical configuration
2. All modes of operation were investigated and the worst-case are reported.
3. Battery : Standard Batteries are used and fully charged for all readings.
4. SAR Configuration : Body (worst case found in Rear facing phantom)
5. Distance between EUT and phantom : 0 cm
6. Test Signal Call mode : Base Station Simulator (CMD60)
7. Justification for reduced test configurations: per FCC/OET Supplement C (July,2001), if the SAR measured at the middle channel for each test configuration (Left, right, cheek/touch, tilt/ear, extended and retracted) is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

## **10. CONCLUSION**

The SAR evaluation indicates that the SMT-I8120 complies with the RF radiation exposure limits of the FCC. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

## **11. EQUIPMENT LIST AND CALIBRATION DETAILS**

| Equipment Type                       | Manufacturer    | Model Number   | Serial Number    | Calibration Due | Used For this Test? |
|--------------------------------------|-----------------|----------------|------------------|-----------------|---------------------|
| Robot - Six Axes                     | Staubli         | RX60           | N/A              | N/A             | Yes                 |
| Robot Remote Control                 | SPEAG           | CS7MB          | F03/5U96A1 /C/01 | N/A             | Yes                 |
| SAM Twin Phantom                     | SPEAG           | TP1276         | QD000P40CA       | N/A             | Yes                 |
| Flat Phantom V4.4                    | SPEAG           | QD000P44BA, BB | 1001, higher     | N/A             | No                  |
| Data Acquisition Electronics         | SPEAG           | DAE4           | 559              | 2008.04.17      | Yes                 |
| Probe E-Field                        | SPEAG           | ET3DV6         | 1773             | 2008.07.18      | Yes                 |
| Antenna Dipole 835 MHz               | SPEAG           | D835V2         | 481              | 2009.05.24      | No                  |
| Antenna Dipole 900 MHz               | SPEAG           | D900V2         | 194              | 2009.11.19      | No                  |
| Antenna Dipole 1800 MHz              | SPEAG           | D1800V2        | 2d066            | 2009.05.23      | No                  |
| Antenna Dipole 1900 MHz              | SPEAG           | D1900V2        | 5d038            | 2009.11.20      | Yes                 |
| Antenna Dipole 1950 MHz              | SPEAG           | D1950V2        | 1027             | 2009.03.14      | No                  |
| Antenna Dipole 2450 MHz              | SPEAG           | D2450V2        | 746              | 2009.02.20      | No                  |
| High power RF Amplifier              | EMPOWER         | 2057-BBS3Q5KCK | 1002D/C0321      | 2008.10.12      | Yes                 |
| Universal Radio Communication Tester | R&S             | CMU200         | 110019           | 2008.08.29      | No                  |
| Digital Radio Communication Tester   | R&S             | CMD60          | 842989/006       | 2009.01.02      | Yes                 |
| Signal Generator                     | Agilent         | E8257D         | MY44320379       | 2009.04.24      | Yes                 |
| RF Power Meter Dual                  | Hewlett Packard | E4419A         | GB37170495       | 2009.01.11      | Yes                 |
| RF Power Sensor 0.01 - 18 GHz        | Hewlett Packard | 8481A          | US37299851       | 2009.01.11      | Yes                 |
| RF Power Sensor 0.01 - 18 GHz        | Hewlett Packard | 8481A          | 3318A92872       | 2009.04.06      | Yes                 |
| S-Parameter Network Analyzer         | Agilent         | 8753D          | 3410A07251       | 2008.10.12      | Yes                 |
| Dual Directional Coupler             | Hewlett Packard | 778D           | 1144AO4576       | 2008.10.12      | Yes                 |
| Directional Coupler                  | Agilent         | 773D           | MY28390213       | 2008.10.12      | No                  |

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