



**FCC OET BULLETIN 65 SUPPLEMENT C 01-01  
IEEE Std 1528-2003**

**SAR EVALUATION REPORT**

*For*  
**Portable Handset**

**Model: GT-S6102E  
FCC ID: A3LGTS6102E**

**Report Number: 12I14319-4A**

**Issue Date: March 28, 2012**

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**NVLAP LAB CODE 200065-0**

Revision History

| <u>Rev.</u> | <u>Issue Date</u> | <u>Revisions</u>                                            | <u>Revised By</u> |
|-------------|-------------------|-------------------------------------------------------------|-------------------|
| --          | March 27, 2012    | Initial Issue                                               | --                |
| A           | March 28, 2012    | Removed VOIP data and performed additional Body SAR testing | Bobby Bayani      |

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## 1. Attestation of Test Results

| Applicant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SAMSUNG ELECTRONICS CO., LTD.            |                                                                                                   |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------|--------------|
| DUT description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Portable Handset                         |                                                                                                   |              |
| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GT-S6102E                                |                                                                                                   |              |
| Test device is                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | An identical prototype                   |                                                                                                   |              |
| Device category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Portable                                 |                                                                                                   |              |
| Exposure category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | General Population/Uncontrolled Exposure |                                                                                                   |              |
| Date tested                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | March 1 - 6, 2012 & March 28, 2012       |                                                                                                   |              |
| FCC Rule Parts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Freq. Range                              | Highest 1-g SAR                                                                                   | Limit        |
| 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 824-849 MHz                              | Head: <b>0.279</b> W/kg (Left Touch)<br>Body & Hotspot: <b>1.09</b> W/kg (Rear w/10 mm distance)  | 1.6 W/kg     |
| 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1850-1910 MHz                            | Head: <b>0.541</b> W/kg (Left Touch)<br>Body & Hotspot: <b>0.537</b> W/kg (Rear w/10 mm distance) |              |
| 15.247                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2412-2462 MHz                            | Head: <b>0.428</b> W/kg (Left Touch)<br>Body & Hotspot: <b>0.406</b> W/kg (Rear w/10 mm distance) |              |
| Applicable Standards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                                                                   | Test Results |
| FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528:2003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                          |                                                                                                   | Pass         |
| <p>Compliance Certification Services, Inc. (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p> <p><b>Note:</b> The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.</p> <div> <div> <p>Approved &amp; Released For UL CCS By:</p>  </div> <div> <p>Tested By:</p>  </div> </div> |                                          |                                                                                                   |              |
| Dave Weaver<br>Staff Engineer<br>Compliance Certification Services (UL CCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                          | David Rodgers<br>SAR Engineer<br>Compliance Certification Services (UL CCS)                       |              |

## 2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE Std 1528-2003, and the following KDB Procedures.

- 648474 D01 SAR Handsets Multi Xmitter and Ant, v01r05
- 248227 D01 SAR meas for 802 11abg v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 D06 Hot Spot SAR v01

## 3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

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

## 4. Calibration and Uncertainty

### 4.1. Measuring Instrument Calibration

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

| Name of Equipment            | Manufacturer | Type/Model        | Serial No. | Cal. Due date |    |      |
|------------------------------|--------------|-------------------|------------|---------------|----|------|
|                              |              |                   |            | MM            | DD | Year |
| Dielectronic Probe kit       | HP           | 85070C            | N/A        | N/A           |    |      |
| Base Station Simulator       | Agilent      | 8960              | GB46160222 | 6             | 17 | 2012 |
| Base Station Simulator       | R & S        | CMU 200           | 106291     | 6             | 24 | 2012 |
| ESA Series Network Analyzer  | Agilent      | E5071B            | MY42100131 | 2             | 11 | 2013 |
| Synthesized Signal Generator | HP           | 83732B            | US34490599 | 7             | 14 | 2012 |
| E-Field Probe                | SPEAG        | EX3DV4            | 3749       | 1             | 27 | 2013 |
| Thermometer                  | ERTCO        | 639-1S            | 1718       | 7             | 19 | 2012 |
| Data Acquisition Electronics | SPEAG        | DAE3              | 427        | 1             | 17 | 2013 |
| System Validation Dipole     | SPEAG        | D835V2            | 4d117      | 4             | 15 | 2012 |
| System Validation Dipole     | SPEAG        | D1900V2           | 5d140      | 4             | 18 | 2012 |
| System Validation Dipole     | SPEAG        | D2450V2           | 748        | 2             | 7  | 2013 |
| Power Meter                  | HP           | 437B              | 3125U16345 | 5             | 13 | 2012 |
| Power Sensor                 | HP           | 8481A             | 2702A60780 | 5             | 13 | 2012 |
| Amplifier                    | MITEQ        | 4D00400600-50-30P | 1620606    | N/A           |    |      |
| Directional coupler          | Werlatone    | C8060-102         | 2141       | N/A           |    |      |

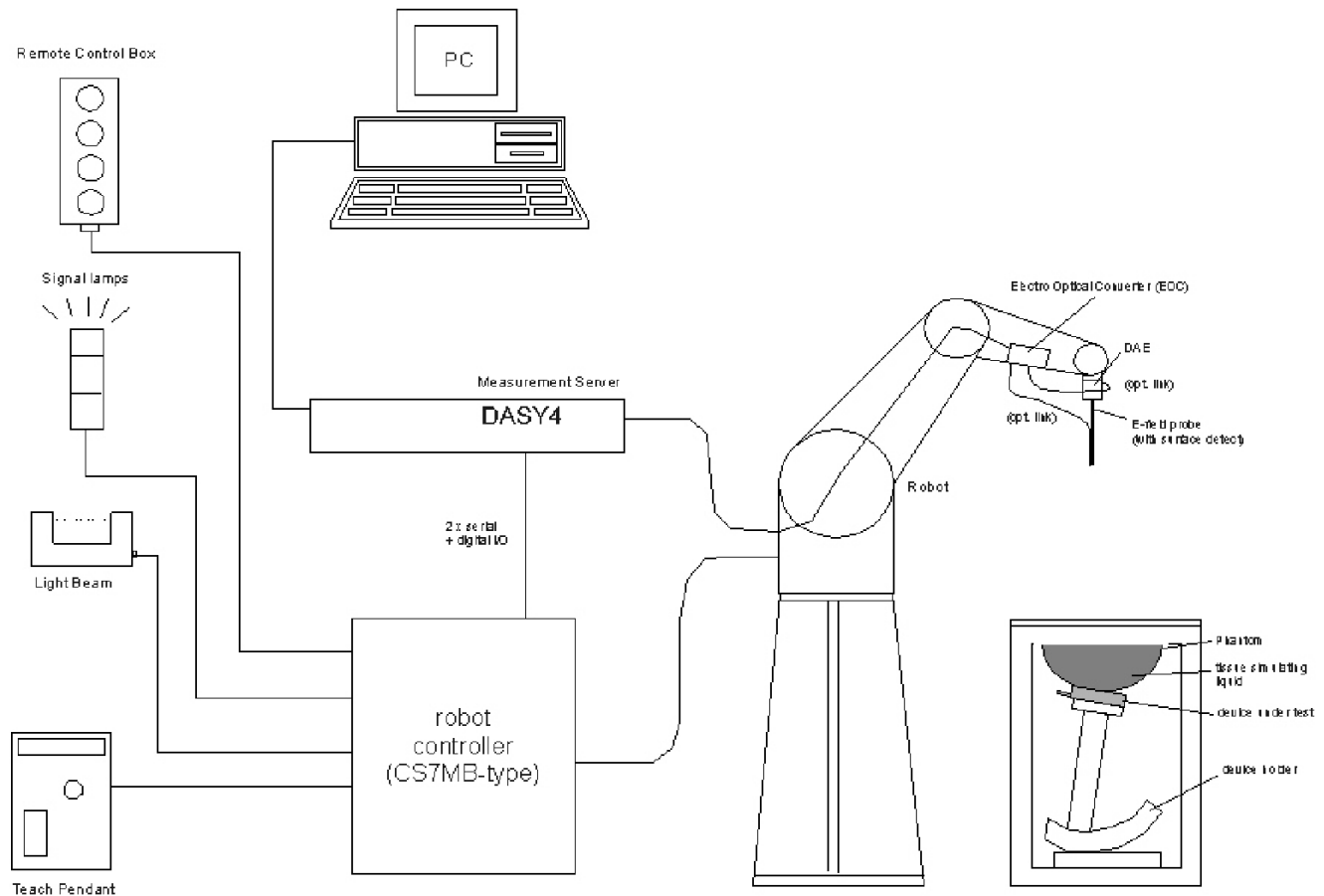
## 4.2. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

| Component                                                        | Error, % | Distribution | Divisor | Sensitivity | U (X), % |
|------------------------------------------------------------------|----------|--------------|---------|-------------|----------|
| <b>Measurement System</b>                                        |          |              |         |             |          |
| Probe Calibration (k=1)                                          | 6.00     | Normal       | 1       | 1           | 6.00     |
| Axial Isotropy                                                   | 1.15     | Rectangular  | 1.732   | 0.7071      | 0.47     |
| Hemispherical Isotropy                                           | 2.30     | Rectangular  | 1.732   | 0.7071      | 0.94     |
| Boundary Effect                                                  | 0.90     | Rectangular  | 1.732   | 1           | 0.52     |
| Probe Linearity                                                  | 3.45     | Rectangular  | 1.732   | 1           | 1.99     |
| System Detection Limits                                          | 1.00     | Rectangular  | 1.732   | 1           | 0.58     |
| Readout Electronics                                              | 0.30     | Normal       | 1       | 1           | 0.30     |
| Response Time                                                    | 0.80     | Rectangular  | 1.732   | 1           | 0.46     |
| Integration Time                                                 | 2.60     | Rectangular  | 1.732   | 1           | 1.50     |
| RF Ambient Conditions - Noise                                    | 3.00     | Rectangular  | 1.732   | 1           | 1.73     |
| RF Ambient Conditions - Reflections                              | 3.00     | Rectangular  | 1.732   | 1           | 1.73     |
| Probe Positioner Mechanical Tolerance                            | 0.40     | Rectangular  | 1.732   | 1           | 0.23     |
| Probe Positioning with respect to Phantom                        | 2.90     | Rectangular  | 1.732   | 1           | 1.67     |
| Extrapolation, Interpolation and Integration                     | 1.00     | Rectangular  | 1.732   | 1           | 0.58     |
| <b>Test Sample Related</b>                                       |          |              |         |             |          |
| Test Sample Positioning                                          | 2.90     | Normal       | 1       | 1           | 2.90     |
| Device Holder Uncertainty                                        | 3.60     | Normal       | 1       | 1           | 3.60     |
| Output Power Variation - SAR Drift                               | 5.00     | Rectangular  | 1.732   | 1           | 2.89     |
| <b>Phantom and Tissue Parameters</b>                             |          |              |         |             |          |
| Phantom Uncertainty (shape and thickness)                        | 4.00     | Rectangular  | 1.732   | 1           | 2.31     |
| Liquid Conductivity - deviation from target                      | 5.00     | Rectangular  | 1.732   | 0.64        | 1.85     |
| Liquid Conductivity - measurement                                | 4.26     | Normal       | 1       | 0.64        | 2.73     |
| Liquid Permittivity - deviation from target                      | 5.00     | Rectangular  | 1.732   | 0.6         | 1.73     |
| Liquid Permittivity - measurement uncertainty                    | -4.41    | Normal       | 1       | 0.6         | -2.65    |
| Combined Standard Uncertainty $U_c(y)$ =                         |          |              |         |             | 10.45    |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = |          |              |         | 20.91 %     |          |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = |          |              |         | 1.65 dB     |          |

## 5. Measurement System Description and Setup

The DASY4 system for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

## 6. SAR Measurement Procedures

### 6.1. Normal SAR Measurement Procedure

#### Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

#### Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

#### Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures  $\geq 7 \times 7 \times 9$  (above 4.5 GHz) or  $5 \times 5 \times 7$  (below 3 GHz) points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

#### Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

#### Step 5: Z-Scan

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

## 6.2. Volume Scan Procedure

### Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.

### Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

### Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures  $\geq 7 \times 7 \times 9$  (above 4.5 GHz) or  $5 \times 5 \times 7$  (below 3 GHz) points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

### Step 4: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

### Step 5: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

## 7. Device Under Test

Portable Handset with BT3.0+HS, 802.11b/g/n HT20 1x1 w/hotspot, GSM850/1900

MODEL: GT-S6102E

|                  |                                                                                                                                                                                                                                  |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Normal operation | <ul style="list-style-type: none"><li>- Held to head,</li><li>- Body (Rear and Front sides) with 10 mm separation distance.</li><li>- Hotspot (wireless router) with 10 mm separation distance to all sides and edges.</li></ul> |
| Accessories      | Headset                                                                                                                                                                                                                          |

### 7.1. Band and Air Interfaces

|                    |                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tx Frequency Bands | <ul style="list-style-type: none"><li>- GSM850: 824 - 849 MHz</li><li>- GSM1900: 1850 - 1910 MHz</li><li>- 802.11b/g/n: 2412 - 2462 MHz</li><li>- Bluetooth: 2402 - 2480 MHz</li></ul> |
| Air Interfaces     | <ul style="list-style-type: none"><li>- GSM, GPRS and EGPRS (Rx only)</li><li>- 802.11b/g/n</li><li>- Bluetooth Ver 3.0 with HS</li></ul>                                              |

**Note:** WiFi and Bluetooth share the same antenna, and WiFi cannot transmit simultaneously with Bluetooth.

### 7.2. Hotspot (Wireless Router) Exposure Conditions

| Mode        | Band | Tx (MHz)  |
|-------------|------|-----------|
| GPRS + WiFi | 835  | 835/2400  |
| GPRS + WiFi | 1900 | 1900/2400 |

### 7.3. Simultaneous Transmission Conditions

| No | Capable TX Configuration | Note |
|----|--------------------------|------|
| 1  | GSM 835 Voice + WiFi/BT  |      |
| 2  | GSM 1900 Voice + WiFi/BT |      |

## 8. Summary of Test Configurations

### 8.1. Exposure Conditions for WWAN

| Test Configurations | Antenna-to-edge/surface | SAR Required | Note                                                                                                                           |
|---------------------|-------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------|
| Rear                | 0.45 mm                 | Yes          |                                                                                                                                |
| Front               | 8.83 mm                 | Yes          |                                                                                                                                |
| Edge 1              | 90 mm                   | No           | SAR is not required because the distance from the WWAN antenna to this edge is >2.5 cm as per KDB 941225 D06 Hot Sport SAR v01 |
| Edge 2              | 2.61 mm                 | Yes          |                                                                                                                                |
| Edge 3              | 2.45 mm                 | Yes          |                                                                                                                                |
| Edge 4              | 2.66 mm                 | Yes          |                                                                                                                                |

### 8.2. Exposure Conditions for WiFi

| Test Configurations | Antenna-to-edge/surface | SAR Required | Note                                                                                                                           |
|---------------------|-------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------|
| Rear                | 0.5 mm                  | Yes          |                                                                                                                                |
| Front               | 8.64 mm                 | Yes          |                                                                                                                                |
| Edge 1              | 31 mm                   | No           | SAR is not required because the distance from the WiFi antenna to this edge is >2.5 cm as per KDB 941225 D06 Hot Sport SAR v01 |
| Edge 2              | 3 mm                    | Yes          |                                                                                                                                |
| Edge 3              | 69 mm                   | No           | SAR is not required because the distance from the WiFi antenna to this edge is >2.5 cm as per KDB 941225 D06 Hot Sport SAR v01 |
| Edge 4              | 52 mm                   | No           | SAR is not required because the distance from the WiFi antenna to this edge is >2.5 cm as per KDB 941225 D06 Hot Sport SAR v01 |

## 9. RF Output Power Measurement

### 9.1. GSM850/1900

#### GSM (GMSK) Voice Mode

| Band | Ch No. | Freq. (MHz) | Avg burst Pwr (dBm) |
|------|--------|-------------|---------------------|
| 850  | 128    | 824.2       | <b>32.3</b>         |
|      | 190    | 836.6       | <b>32.5</b>         |
|      | 251    | 848.8       | <b>32.0</b>         |
| 1900 | 512    | 1850.2      | <b>29.2</b>         |
|      | 661    | 1880.0      | <b>29.6</b>         |
|      | 810    | 1909.8      | <b>29.1</b>         |

#### GPRS (GMSK) - Coding Scheme: CS1

| Band | Ch No. | f (MHz) | Avg burst Pwr (dBm) |               |         |               | Avg burst Pwr (dBm) |               |         |               |
|------|--------|---------|---------------------|---------------|---------|---------------|---------------------|---------------|---------|---------------|
|      |        |         | 1 slot              | Frame Avg Pwr | 2 slots | Frame Avg Pwr | 3 slots             | Frame Avg Pwr | 4 slots | Frame Avg Pwr |
| 850  | 128    | 824.2   | 32.3                | 23.3          | 29.9    | 23.9          | 28.9                | <b>24.6</b>   | 26.9    | 23.9          |
|      | 190    | 836.6   | 32.5                | 23.5          | 30.2    | 24.2          | 29.1                | <b>24.8</b>   | 27.1    | 24.1          |
|      | 251    | 848.8   | 32.0                | 23.0          | 29.7    | 23.7          | 28.7                | <b>24.4</b>   | 26.7    | 23.7          |
| 1900 | 512    | 1850.2  | 29.2                | 20.2          | 26.9    | 20.9          | 25.9                | <b>21.6</b>   | 24.0    | 21.0          |
|      | 661    | 1880.0  | 29.6                | 20.6          | 27.4    | 21.4          | 26.4                | <b>22.1</b>   | 24.3    | 21.3          |
|      | 810    | 1909.8  | 28.9                | 19.9          | 26.8    | 20.8          | 25.7                | <b>21.4</b>   | 23.7    | 20.7          |

#### EGPRS (8PSK) Coding Scheme MCS5

This mode is Rx only.

#### Notes:

Based on output power above and time slots, the following worst-case configurations were chosen for Body SAR testing.

- GPRS850 3 time slots
- GPRS1900 3 time slots

## 9.2. Wi-Fi (802.11bgn)

| Mode              | Channel # | Freq. (MHz) | Conducted Avg Power |       |
|-------------------|-----------|-------------|---------------------|-------|
|                   |           |             | (dBm)               | (mW)  |
| 802.11b           | 1         | 2412        | 15.9                | 38.46 |
|                   | 6         | 2437        | <b>15.9</b>         | 38.64 |
|                   | 11        | 2462        | 15.8                | 38.37 |
| 802.11g           | 1         | 2412        | 14.4                | 27.35 |
|                   | 6         | 2437        | 14.4                | 27.29 |
|                   | 11        | 2462        | 14.3                | 26.79 |
| 802.11n<br>(HT20) | 1         | 2412        | 14.2                | 26.18 |
|                   | 6         | 2437        | 14.2                | 26.06 |
|                   | 11        | 2462        | 14.2                | 26.00 |

## 9.3. Bluetooth

| Mode | Channel # | Freq. (MHz) | Conducted Avg Power |      |
|------|-----------|-------------|---------------------|------|
|      |           |             | (dBm)               | (mW) |
| GFSK | 0         | 2402        | 4.3                 | 2.71 |
|      | 39        | 2441        | 4.6                 | 2.90 |
|      | 78        | 2480        | 4.1                 | 2.55 |
| 8PSK | 0         | 2402        | 2.3                 | 1.70 |
|      | 39        | 2441        | 2.6                 | 1.82 |
|      | 78        | 2480        | 2.1                 | 1.62 |

### Note(s):

According to KDB 648474, Table 2, Unlicensed transmitters

When there is simultaneous transmission, Stand-alone SAR not required due to

- ☒ Output  $\leq 2 \cdot P_{\text{Ref}}$  (24 mW) and antenna is  $\geq 5.0$  cm from other antennas
- ☐ Output  $\leq P_{\text{Ref}}$  (12 mW) and antenna is  $\geq 2.5$  cm from other antennas
- ☐ Output  $\leq P_{\text{Ref}}$  (12 mW) and antenna is  $< 2.5$  cm from other antennas

## 10. Tissue Dielectric Properties

IEEE Std 1528-2003 Table 2

| Target Frequency (MHz) | Head         |                |
|------------------------|--------------|----------------|
|                        | $\epsilon_r$ | $\sigma$ (S/m) |
| 300                    | 45.3         | 0.87           |
| 450                    | 43.5         | 0.87           |
| 835                    | 41.5         | 0.90           |
| 900                    | 41.5         | 0.97           |
| 1450                   | 40.5         | 1.20           |
| 1800 – 2000            | 40.0         | 1.40           |
| 2450                   | 39.2         | 1.80           |
| 2600                   | 39.0         | 1.96           |
| 3000                   | 38.5         | 2.40           |

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| Target Frequency (MHz) | Head         |                | Body         |                |
|------------------------|--------------|----------------|--------------|----------------|
|                        | $\epsilon_r$ | $\sigma$ (S/m) | $\epsilon_r$ | $\sigma$ (S/m) |
| 150                    | 52.3         | 0.76           | 61.9         | 0.8            |
| 300                    | 45.3         | 0.87           | 58.2         | 0.92           |
| 450                    | 43.5         | 0.87           | 56.7         | 0.94           |
| 835                    | 41.5         | 0.9            | 55.2         | 0.97           |
| 900                    | 41.5         | 0.97           | 55           | 1.05           |
| 915                    | 41.5         | 0.98           | 55           | 1.06           |
| 1450                   | 40.5         | 1.2            | 54           | 1.3            |
| 1610                   | 40.3         | 1.29           | 53.8         | 1.4            |
| 1800 – 2000            | 40           | 1.4            | 53.3         | 1.52           |
| 2450                   | 39.2         | 1.8            | 52.7         | 1.95           |
| 3000                   | 38.5         | 2.4            | 52           | 2.73           |
| 5000                   | 36.2         | 4.45           | 49.3         | 5.07           |
| 5100                   | 36.1         | 4.55           | 49.1         | 5.18           |
| 5200                   | 36.0         | 4.66           | 49.0         | 5.30           |
| 5300                   | 35.9         | 4.76           | 48.9         | 5.42           |
| 5400                   | 35.8         | 4.86           | 48.7         | 5.53           |
| 5500                   | 35.6         | 4.96           | 48.6         | 5.65           |
| 5600                   | 35.5         | 5.07           | 48.5         | 5.77           |
| 5700                   | 35.4         | 5.17           | 48.3         | 5.88           |
| 5800                   | 35.3         | 5.27           | 48.2         | 6.00           |

### 10.1. Composition of Ingredients for the Tissue Material used in the SAR Tests

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

| Ingredients<br>(% by weight) | Frequency (MHz) |       |       |      |       |       |       |      |      |      |
|------------------------------|-----------------|-------|-------|------|-------|-------|-------|------|------|------|
|                              | 450             |       | 835   |      | 915   |       | 1900  |      | 2450 |      |
| Tissue Type                  | Head            | Body  | Head  | Body | Head  | Body  | Head  | Body | Head | Body |
| Water                        | 38.56           | 51.16 | 41.45 | 52.4 | 41.05 | 56.0  | 54.9  | 40.4 | 62.7 | 73.2 |
| Salt (NaCl)                  | 3.95            | 1.49  | 1.45  | 1.4  | 1.35  | 0.76  | 0.18  | 0.5  | 0.5  | 0.04 |
| Sugar                        | 56.32           | 46.78 | 56.0  | 45.0 | 56.5  | 41.76 | 0.0   | 58.0 | 0.0  | 0.0  |
| HEC                          | 0.98            | 0.52  | 1.0   | 1.0  | 1.0   | 1.21  | 0.0   | 1.0  | 0.0  | 0.0  |
| Bactericide                  | 0.19            | 0.05  | 0.1   | 0.1  | 0.1   | 0.27  | 0.0   | 0.1  | 0.0  | 0.0  |
| Triton X-100                 | 0.0             | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0  | 36.8 | 0.0  |
| DGBE                         | 0.0             | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 44.92 | 0.0  | 0.0  | 26.7 |
| Dielectric Constant          | 43.42           | 58.0  | 42.54 | 56.1 | 42.0  | 56.8  | 39.9  | 54.0 | 39.8 | 52.5 |
| Conductivity (S/m)           | 0.85            | 0.83  | 0.91  | 0.95 | 1.0   | 1.07  | 1.42  | 1.45 | 1.88 | 1.78 |

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16 MΩ+ resistivity

HEC: Hydroxyethyl Cellulose

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

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

## 10.2. Tissue Dielectric Parameters Check Results

Tissue dielectric parameters measured at the low, middle and high frequency of each operating frequency range of the test device.

| Date      | Freq. (MHz) | Liquid Parameters |                                          |                                          | Measured | Target | Delta (%) | Limit ±(%) |
|-----------|-------------|-------------------|------------------------------------------|------------------------------------------|----------|--------|-----------|------------|
| 3/1/2012  | Head 835    | e'                | 42.0262                                  | Relative Permittivity (ε <sub>r</sub> ): | 42.03    | 41.50  | 1.27      | 5          |
|           |             | e''               | 19.0690                                  | Conductivity (σ):                        | 0.89     | 0.90   | -1.63     | 5          |
|           | Head 825    | e'                | 42.1432                                  | Relative Permittivity (ε <sub>r</sub> ): | 42.14    | 41.58  | 1.36      | 5          |
|           |             | e''               | 19.0965                                  | Conductivity (σ):                        | 0.88     | 0.90   | -2.54     | 5          |
|           | Head 850    | e'                | 41.8566                                  | Relative Permittivity (ε <sub>r</sub> ): | 41.86    | 41.50  | 0.86      | 5          |
|           |             | e''               | 19.0371                                  | Conductivity (σ):                        | 0.90     | 0.92   | -1.67     | 5          |
| 3/2/2012  | Head 1900   | e'                | 40.6832                                  | Relative Permittivity (ε <sub>r</sub> ): | 40.68    | 40.00  | 1.71      | 5          |
|           |             | e''               | 13.4721                                  | Conductivity (σ):                        | 1.42     | 1.40   | 1.66      | 5          |
|           | Head 1855   | e'                | 40.8685                                  | Relative Permittivity (ε <sub>r</sub> ): | 40.87    | 40.00  | 2.17      | 5          |
|           |             | e''               | 13.3497                                  | Conductivity (σ):                        | 1.38     | 1.40   | -1.65     | 5          |
|           | Head 1885   | e'                | 40.7434                                  | Relative Permittivity (ε <sub>r</sub> ): | 40.74    | 40.00  | 1.86      | 5          |
|           |             | e''               | 13.4282                                  | Conductivity (σ):                        | 1.41     | 1.40   | 0.53      | 5          |
| 3/5/2012  | Body 1900   | e'                | 40.6280                                  | Relative Permittivity (ε <sub>r</sub> ): | 40.63    | 40.00  | 1.57      | 5          |
|           |             | e''               | 13.5127                                  | Conductivity (σ):                        | 1.44     | 1.40   | 2.77      | 5          |
|           | Body 1850   | e'                | 51.2471                                  | Relative Permittivity (ε <sub>r</sub> ): | 51.25    | 53.30  | -3.85     | 5          |
|           |             | e''               | 14.2796                                  | Conductivity (σ):                        | 1.51     | 1.52   | -0.75     | 5          |
|           | Body 1880   | e'                | 51.4307                                  | Relative Permittivity (ε <sub>r</sub> ): | 51.43    | 53.30  | -3.51     | 5          |
|           |             | e''               | 14.1591                                  | Conductivity (σ):                        | 1.46     | 1.52   | -4.18     | 5          |
| 3/5/2012  | Body 1910   | e'                | 51.3232                                  | Relative Permittivity (ε <sub>r</sub> ): | 51.32    | 53.30  | -3.71     | 5          |
|           |             | e''               | 14.2330                                  | Conductivity (σ):                        | 1.49     | 1.52   | -2.12     | 5          |
|           | Body 835    | e'                | 51.2066                                  | Relative Permittivity (ε <sub>r</sub> ): | 51.21    | 53.30  | -3.93     | 5          |
|           |             | e''               | 14.3083                                  | Conductivity (σ):                        | 1.52     | 1.52   | -0.03     | 5          |
|           | Body 815    | e'                | 54.6195                                  | Relative Permittivity (ε <sub>r</sub> ): | 54.62    | 55.20  | -1.05     | 5          |
|           |             | e''               | 20.9507                                  | Conductivity (σ):                        | 0.97     | 0.97   | 0.28      | 5          |
| 3/6/2012  | Body 820    | e'                | 54.7802                                  | Relative Permittivity (ε <sub>r</sub> ): | 54.78    | 55.30  | -0.93     | 5          |
|           |             | e''               | 21.0380                                  | Conductivity (σ):                        | 0.95     | 0.97   | -1.52     | 5          |
|           | Body 825    | e'                | 54.7336                                  | Relative Permittivity (ε <sub>r</sub> ): | 54.73    | 55.28  | -0.98     | 5          |
|           |             | e''               | 21.0219                                  | Conductivity (σ):                        | 0.96     | 0.97   | -1.03     | 5          |
|           | Body 850    | e'                | 54.6936                                  | Relative Permittivity (ε <sub>r</sub> ): | 54.69    | 55.26  | -1.02     | 5          |
|           |             | e''               | 20.9946                                  | Conductivity (σ):                        | 0.96     | 0.97   | -0.60     | 5          |
| 3/6/2012  | Body 2450   | e'                | 54.5142                                  | Relative Permittivity (ε <sub>r</sub> ): | 54.51    | 55.16  | -1.17     | 5          |
|           |             | e''               | 20.8945                                  | Conductivity (σ):                        | 0.99     | 0.99   | 0.04      | 5          |
|           | Body 2410   | e'                | 50.4399                                  | Relative Permittivity (ε <sub>r</sub> ): | 50.44    | 52.70  | -4.29     | 5          |
|           |             | e''               | 14.9240                                  | Conductivity (σ):                        | 2.03     | 1.95   | 4.26      | 5          |
|           | Body 2435   | e'                | 50.5755                                  | Relative Permittivity (ε <sub>r</sub> ): | 50.58    | 52.76  | -4.14     | 5          |
|           |             | e''               | 14.7688                                  | Conductivity (σ):                        | 1.98     | 1.91   | 3.75      | 5          |
| Body 2460 | e'          | 50.4879           | Relative Permittivity (ε <sub>r</sub> ): | 50.49                                    | 52.73    | -4.25  | 5         |            |
|           | e''         | 14.8695           | Conductivity (σ):                        | 2.01                                     | 1.93     | 4.25   | 5         |            |
| Body 2460 | e'          | 50.4059           | Relative Permittivity (ε <sub>r</sub> ): | 50.41                                    | 52.69    | -4.33  | 5         |            |
|           | e''         | 14.9639           | Conductivity (σ):                        | 2.05                                     | 1.96     | 4.21   | 5         |            |

**Tissue dielectric parameters check results cont.**

| Date      | Freq. (MHz) | Liquid Parameters |         |                                         | Measured | Target | Delta (%) | Limit ±(%) |
|-----------|-------------|-------------------|---------|-----------------------------------------|----------|--------|-----------|------------|
| 3/6/2012  | Head 2450   | e'                | 37.5178 | Relative Permittivity ( $\epsilon_r$ ): | 37.52    | 39.20  | -4.29     | 5          |
|           |             | e''               | 13.4919 | Conductivity ( $\sigma$ ):              | 1.84     | 1.80   | 2.11      | 5          |
|           | Head 2410   | e'                | 37.6745 | Relative Permittivity ( $\epsilon_r$ ): | 37.67    | 39.28  | -4.09     | 5          |
|           |             | e''               | 13.3794 | Conductivity ( $\sigma$ ):              | 1.79     | 1.76   | 1.84      | 5          |
|           | Head 2435   | e'                | 37.5739 | Relative Permittivity ( $\epsilon_r$ ): | 37.57    | 39.24  | -4.23     | 5          |
|           |             | e''               | 13.4492 | Conductivity ( $\sigma$ ):              | 1.82     | 1.78   | 2.16      | 5          |
|           | Head 2475   | e'                | 37.4402 | Relative Permittivity ( $\epsilon_r$ ): | 37.44    | 39.17  | -4.41     | 5          |
|           |             | e''               | 13.5713 | Conductivity ( $\sigma$ ):              | 1.87     | 1.83   | 2.22      | 5          |
| 3/7/2012  | Body 2450   | e'                | 51.8597 | Relative Permittivity ( $\epsilon_r$ ): | 51.86    | 52.70  | -1.59     | 5          |
|           |             | e''               | 14.4296 | Conductivity ( $\sigma$ ):              | 1.97     | 1.95   | 0.81      | 5          |
|           | Body 2410   | e'                | 51.9652 | Relative Permittivity ( $\epsilon_r$ ): | 51.97    | 52.76  | -1.51     | 5          |
|           |             | e''               | 14.2630 | Conductivity ( $\sigma$ ):              | 1.91     | 1.91   | 0.20      | 5          |
|           | Body 2435   | e'                | 51.9030 | Relative Permittivity ( $\epsilon_r$ ): | 51.90    | 52.73  | -1.56     | 5          |
|           |             | e''               | 14.3704 | Conductivity ( $\sigma$ ):              | 1.95     | 1.93   | 0.75      | 5          |
|           | Body 2460   | e'                | 51.8266 | Relative Permittivity ( $\epsilon_r$ ): | 51.83    | 52.69  | -1.63     | 5          |
|           |             | e''               | 14.4727 | Conductivity ( $\sigma$ ):              | 1.98     | 1.96   | 0.79      | 5          |
| 3/28/2012 | Body 835    | e'                | 55.2545 | Relative Permittivity ( $\epsilon_r$ ): | 55.25    | 55.20  | 0.10      | 5          |
|           |             | e''               | 21.6016 | Conductivity ( $\sigma$ ):              | 1.00     | 0.97   | 3.40      | 5          |
|           | Body 815    | e'                | 55.4545 | Relative Permittivity ( $\epsilon_r$ ): | 55.45    | 55.30  | 0.29      | 5          |
|           |             | e''               | 21.6872 | Conductivity ( $\sigma$ ):              | 0.98     | 0.97   | 1.52      | 5          |
|           | Body 820    | e'                | 55.4092 | Relative Permittivity ( $\epsilon_r$ ): | 55.41    | 55.28  | 0.24      | 5          |
|           |             | e''               | 21.6738 | Conductivity ( $\sigma$ ):              | 0.99     | 0.97   | 2.04      | 5          |
|           | Body 825    | e'                | 55.3563 | Relative Permittivity ( $\epsilon_r$ ): | 55.36    | 55.26  | 0.18      | 5          |
|           |             | e''               | 21.6479 | Conductivity ( $\sigma$ ):              | 0.99     | 0.97   | 2.50      | 5          |
|           | Body 850    | e'                | 55.1199 | Relative Permittivity ( $\epsilon_r$ ): | 55.12    | 55.16  | -0.07     | 5          |
|           |             | e''               | 21.5004 | Conductivity ( $\sigma$ ):              | 1.02     | 0.99   | 2.94      | 5          |

## 11. System Performance Check

The system performance check is performed prior to any usage of the system in order to verify SAR system measurement accuracy. The system performance check verifies that the system operates within its specifications of  $\pm 10\%$ .

### 11.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness:  $2.0 \pm 0.2$  mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.  
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube.
- Distance between probe sensors and phantom surface was set to 3 mm.  
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

### 11.2. Reference SAR Values for System Performance Check

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

| System Dipole | Serial No. | Cal. Date | Freq. (MHz) | SAR Measured (mW/g) |      |      |
|---------------|------------|-----------|-------------|---------------------|------|------|
|               |            |           |             | 1g/10g              | Head | Body |
| D835V2        | 4d117      | 4/15/11   | 835         | 1g                  | 9.64 | 10.1 |
|               |            |           |             | 10g                 | 6.28 | 6.60 |
| D1900V2       | 5d140      | 4/18/11   | 1900        | 1g                  | 41.6 | 41.2 |
|               |            |           |             | 10g                 | 21.5 | 21.6 |
| D2450V2       | 748        | 2/7/12    | 2450        | 1g                  | 53.6 | 50.8 |
|               |            |           |             | 10g                 | 24.8 | 23.6 |

### 11.3. System Performance Check Results

| Date Tested | System dipole |       | Measured<br>(Normalized to 1 W) |      | Target | Delta (%) | Tolerance<br>(%) |
|-------------|---------------|-------|---------------------------------|------|--------|-----------|------------------|
| 3/1/2012    | Head          | 4d117 | 1g SAR                          | 10.0 | 9.36   | 6.84      | ±10              |
|             |               |       | 10g SAR                         | 6.6  | 6.12   | 7.19      |                  |
| 3/2/2012    | Head          | 5d140 | 1g SAR                          | 40.8 | 41.6   | -1.92     | ±10              |
|             |               |       | 10g SAR                         | 21.0 | 21.5   | -2.33     |                  |
| 3/2/2012    | Body          | 5d140 | 1g SAR                          | 42.5 | 41.6   | 2.16      | ±10              |
|             |               |       | 10g SAR                         | 22.4 | 21.5   | 4.19      |                  |
| 3/5/2012    | Body          | 5d140 | 1g SAR                          | 41.5 | 41.6   | -0.24     | ±10              |
|             |               |       | 10g SAR                         | 21.5 | 21.5   | 0.00      |                  |
| 3/5/2012    | Body          | 4d117 | 1g SAR                          | 9.6  | 10.1   | -5.25     | ±10              |
|             |               |       | 10g SAR                         | 6.3  | 6.6    | -4.24     |                  |
| 3/6/2012    | Body          | 748   | 1g SAR                          | 50.5 | 49.9   | 1.20      | ±10              |
|             |               |       | 10g SAR                         | 23.3 | 23.4   | -0.43     |                  |
| 3/6/2012    | Head          | 748   | 1g SAR                          | 49.5 | 52.7   | -6.07     | ±10              |
|             |               |       | 10g SAR                         | 22.6 | 24.6   | -8.13     |                  |
| 3/28/2012   | Body          | 4d117 | 1g SAR                          | 10.1 | 10.1   | 0.00      | ±10              |
|             |               |       | 10g SAR                         | 6.6  | 6.6    | -0.61     |                  |

## 12. SAR Test Results

### 12.1. GSM850

#### Head SAR

| Test Position    | Mode | Ch #. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g)   |       | Note |
|------------------|------|-------|-------------|---------------|--------------|-------|------|
|                  |      |       |             |               | 1-g          | 10-g  |      |
| Left Touch       | GSM  | 128   | 824.20      | 32.3          |              |       | 1    |
|                  |      | 190   | 836.60      | 32.5          | <b>0.279</b> | 0.203 |      |
|                  |      | 251   | 848.80      | 32.0          |              |       | 1    |
| Left Tilt (15°)  | GSM  | 128   | 824.20      | 32.3          |              |       | 1    |
|                  |      | 190   | 836.60      | 32.5          | 0.154        | 0.116 |      |
|                  |      | 251   | 848.80      | 32.0          |              |       | 1    |
| Right Touch      | GSM  | 128   | 824.20      | 32.3          |              |       | 1    |
|                  |      | 190   | 836.60      | 32.5          | 0.224        | 0.168 |      |
|                  |      | 251   | 848.80      | 32.0          |              |       | 1    |
| Right Tilt (15°) | GSM  | 128   | 824.20      | 32.3          |              |       | 1    |
|                  |      | 190   | 836.60      | 32.5          | 0.159        | 0.119 |      |
|                  |      | 251   | 848.80      | 32.0          |              |       | 1    |

#### Note(s):

- SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.

**Body & Hotspot SAR**

| Test Position | Mode            | Dist.<br>(mm) | Ch #. | Freq.<br>(MHz) | Avg Pwr<br>(dBm) | SAR (mW/g)   |       | Note |
|---------------|-----------------|---------------|-------|----------------|------------------|--------------|-------|------|
|               |                 |               |       |                |                  | 1-g          | 10-g  |      |
| Rear          | GPRS<br>3 slots | 10            | 128   | 824.20         | 28.9             | 0.529        | 0.378 |      |
|               |                 |               | 190   | 836.60         | 29.1             | 0.804        | 0.575 |      |
|               |                 |               | 251   | 848.80         | 28.7             | <b>1.090</b> | 0.786 |      |
|               |                 |               | 251   | 848.80         | 28.7             | 0.667        | 0.454 | 2    |
| Front         | GPRS<br>3 slots | 10            | 128   | 824.20         | 28.9             |              |       | 1    |
|               |                 |               | 190   | 836.60         | 29.1             | 0.342        | 0.254 |      |
|               |                 |               | 251   | 848.80         | 28.7             |              |       | 1    |
| Edge 1        | GPRS<br>3 slots | 10            | 128   | 824.20         | 28.9             |              |       | 3    |
|               |                 |               | 190   | 836.60         | 29.1             |              |       | 3    |
|               |                 |               | 251   | 848.80         | 28.7             |              |       | 3    |
| Edge 2        | GPRS<br>3 slots | 10            | 128   | 824.20         | 28.9             |              |       | 1    |
|               |                 |               | 190   | 836.60         | 29.1             | 0.128        | 0.090 |      |
|               |                 |               | 251   | 848.80         | 28.7             |              |       | 1    |
| Edge 3        | GPRS<br>3 slots | 10            | 128   | 824.20         | 28.9             |              |       | 1    |
|               |                 |               | 190   | 836.60         | 29.1             | 0.048        | 0.031 |      |
|               |                 |               | 251   | 848.80         | 28.7             |              |       | 1    |
| Edge 4        | GPRS<br>3 slots | 10            | 128   | 824.20         | 28.9             |              |       | 1    |
|               |                 |               | 190   | 836.60         | 29.1             | 0.303        | 0.212 |      |
|               |                 |               | 251   | 848.80         | 28.7             |              |       | 1    |

**Note(s):**

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
2. With headset attached.
3. SAR is not required due to antenna-to-edge's distance is greater than 2.5 cm per KDB 941225 D06.

## 12.2. GSM1900

### Head SAR

| Test Position       | Mode | Ch #. | Freq.<br>(MHz) | Avg Pwr<br>(dBm) | SAR (mW/g)   |       | Note |
|---------------------|------|-------|----------------|------------------|--------------|-------|------|
|                     |      |       |                |                  | 1-g          | 10-g  |      |
| Left Touch          | GSM  | 512   | 1850.2         | 29.2             |              |       | 1    |
|                     |      | 661   | 1880.0         | 29.6             | <b>0.541</b> | 0.289 |      |
|                     |      | 810   | 1909.8         | 29.1             |              |       | 1    |
| Left Tilt<br>(15°)  | GSM  | 512   | 1850.2         | 29.2             |              |       | 1    |
|                     |      | 661   | 1880.0         | 29.6             | 0.132        | 0.077 |      |
|                     |      | 810   | 1909.8         | 29.1             |              |       | 1    |
| Right Touch         | GSM  | 512   | 1850.2         | 29.2             |              |       | 1    |
|                     |      | 661   | 1880.0         | 29.6             | 0.360        | 0.204 |      |
|                     |      | 810   | 1909.8         | 29.1             |              |       | 1    |
| Right Tilt<br>(15°) | GSM  | 512   | 1850.2         | 29.2             |              |       | 1    |
|                     |      | 661   | 1880.0         | 29.6             | 0.133        | 0.080 |      |
|                     |      | 810   | 1909.8         | 29.1             |              |       | 1    |

**Body & Hotspot SAR**

| Test Position | Mode            | Dist.<br>(mm) | Ch #. | Freq.<br>(MHz) | Avg Pwr<br>(dBm) | SAR (mW/g)   |       | Note |
|---------------|-----------------|---------------|-------|----------------|------------------|--------------|-------|------|
|               |                 |               |       |                |                  | 1-g          | 10-g  |      |
| Rear          | GPRS<br>3 slots | 10            | 512   | 1850.2         | 25.9             |              |       | 1    |
|               |                 |               | 661   | 1880.0         | 26.4             | <b>0.537</b> | 0.306 |      |
|               |                 |               | 661   | 1880.0         | 26.4             | 0.512        | 0.295 | 2    |
|               |                 |               | 810   | 1909.8         | 25.7             |              |       | 1    |
| Front         | GPRS<br>3 slots | 10            | 512   | 1850.2         | 25.9             |              |       | 1    |
|               |                 |               | 661   | 1880.0         | 26.4             | 0.393        | 0.236 |      |
|               |                 |               | 810   | 1909.8         | 25.7             |              |       | 1    |
| Edge 1        | GPRS<br>3 slots | 10            | 512   | 1850.2         | 25.9             |              |       | 3    |
|               |                 |               | 661   | 1880.0         | 26.4             |              |       | 3    |
|               |                 |               | 810   | 1909.8         | 25.7             |              |       | 3    |
| Edge 2        | GPRS<br>3 slots | 10            | 512   | 1850.2         | 25.9             |              |       | 1    |
|               |                 |               | 661   | 1880.0         | 26.4             | 0.089        | 0.053 |      |
|               |                 |               | 810   | 1909.8         | 25.7             |              |       | 1    |
| Edge 3        | GPRS<br>3 slots | 10            | 512   | 1850.2         | 25.9             |              |       | 1    |
|               |                 |               | 661   | 1880.0         | 26.4             | 0.350        | 0.204 |      |
|               |                 |               | 810   | 1909.8         | 25.7             |              |       | 1    |
| Edge 4        | GPRS<br>3 slots | 10            | 512   | 1850.2         | 25.9             |              |       | 1    |
|               |                 |               | 661   | 1880.0         | 26.4             | 0.221        | 0.128 |      |
|               |                 |               | 810   | 1909.8         | 25.7             |              |       | 1    |

**Note(s):**

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
2. With headset attached.
3. SAR is not required due to antenna-to-edge's distance is greater than 2.5 cm per KDB 941225 D06.

## 12.3. Wi-Fi 11bgn

### Head SAR

| Test Position    | Mode    | Ch #. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g)   |       | Note |
|------------------|---------|-------|-------------|---------------|--------------|-------|------|
|                  |         |       |             |               | 1-g          | 10-g  |      |
| Left Touch       | 802.11b | 1     | 2412        | 15.9          |              |       | 1    |
|                  |         | 6     | 2437        | 15.9          | <b>0.428</b> | 0.180 |      |
|                  |         | 11    | 2462        | 15.8          |              |       | 1    |
| Left Tilt (15°)  | 802.11b | 1     | 2412        | 15.9          |              |       | 1    |
|                  |         | 6     | 2437        | 15.9          | 0.114        | 0.058 |      |
|                  |         | 11    | 2462        | 15.8          |              |       | 1    |
| Right Touch      | 802.11b | 1     | 2412        | 15.9          |              |       | 1    |
|                  |         | 6     | 2437        | 15.9          | 0.165        | 0.075 |      |
|                  |         | 11    | 2462        | 15.8          |              |       | 1    |
| Right Tilt (15°) | 802.11b | 1     | 2412        | 15.9          |              |       | 1    |
|                  |         | 6     | 2437        | 15.9          | 0.114        | 0.058 |      |
|                  |         | 11    | 2462        | 15.8          |              |       | 1    |

### Body & Hotspot SAR

| Test Position | Mode    | Dist. (mm) | Ch #. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g)   |       | Note |
|---------------|---------|------------|-------|-------------|---------------|--------------|-------|------|
|               |         |            |       |             |               | 1-g          | 10-g  |      |
| Rear          | 802.11b | 10         | 1     | 2412        | 15.9          |              |       | 1    |
|               |         |            | 6     | 2437        | 15.9          | <b>0.406</b> | 0.181 |      |
|               |         |            | 6     | 2437        | 15.9          | 0.341        | 0.156 | 2    |
|               |         |            | 11    | 2462        | 15.80         |              |       | 1    |
| Front         | 802.11b | 10         | 1     | 2412        | 15.9          |              |       | 1    |
|               |         |            | 6     | 2437        | 15.9          | 0.104        | 0.056 |      |
|               |         |            | 11    | 2462        | 15.8          |              |       | 1    |
| Edge 1        | 802.11b | 10         | 1     | 2412        | 15.9          |              |       | 3    |
|               |         |            | 6     | 2437        | 15.9          |              |       | 3    |
|               |         |            | 11    | 2462        | 15.8          |              |       | 3    |
| Edge 2        | 802.11b | 10         | 1     | 2412        | 15.9          |              |       | 1    |
|               |         |            | 6     | 2437        | 15.9          | 0.352        | 0.153 |      |
|               |         |            | 11    | 2462        | 15.8          |              |       | 1    |
| Edge 3        | 802.11b | 10         | 1     | 2412        | 15.9          |              |       | 3    |
|               |         |            | 6     | 2437        | 15.9          |              |       | 3    |
|               |         |            | 11    | 2462        | 15.8          |              |       | 3    |
| Edge 4        | 802.11b | 10         | 1     | 2412        | 15.9          |              |       | 3    |
|               |         |            | 6     | 2437        | 15.9          |              |       | 3    |
|               |         |            | 11    | 2462        | 15.8          |              |       | 3    |

### Note(s):

1. Testing was performed on the channel with the highest output power only as the SAR was  $\leq 0.8$  W/kg with the operating frequency band having a range of  $< 100$  MHz. Per KDB 447498 1) e) i)
2. With headset attached.
3. SAR is not required due to antenna-to-edge's distance is greater than 2.5 cm per KDB 941225 D06.

### 13. Summary of Highest SAR Values

Results for highest SAR values for each frequency band and mode

| Technology/Band | Test configuration |            | Mode          | Separation distance (mm) | Highest 1g SAR (W/kg) |
|-----------------|--------------------|------------|---------------|--------------------------|-----------------------|
| GSM850          | Head               | Left Touch | GPRS 3 Slots  | 0                        | 0.279                 |
|                 | Body & Hotspot     | Rear       | GPRS 3 Slots  | 10                       | 1.09                  |
| GSM1900         | Head               | Left Touch | GPRS 3 Slots  | 0                        | 0.541                 |
|                 | Body & Hotspot     | Rear       | GPRS 3 Slots  | 10                       | 0.537                 |
| WiFi 2.4 GHz    | Head               | Left Touch | 802.11b 1Mbps | 0                        | 0.428                 |
|                 | Body & Hotspot     | Rear       | 802.11b 1Mbps | 10                       | 0.406                 |

## 14. Worst-Case SAR Plots

Test Laboratory: UL CCS SAR Lab D

Date/Time: 3/1/2012 7:02:22 PM

### GSM 850

Frequency: 836.6 MHz; Duty Cycle: 1:8.3; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.887$  mho/m;  $\epsilon_r = 42$ ;  $\rho = 1000$  kg/m<sup>3</sup>;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012

- Probe: EX3DV4 - SN3749; ConvF(8.68, 8.68, 8.68); Calibrated: 1/27/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105

**Left Touch GSM M ch 190/Area Scan (7x10x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.300 mW/g

**Left Touch GSM M ch 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

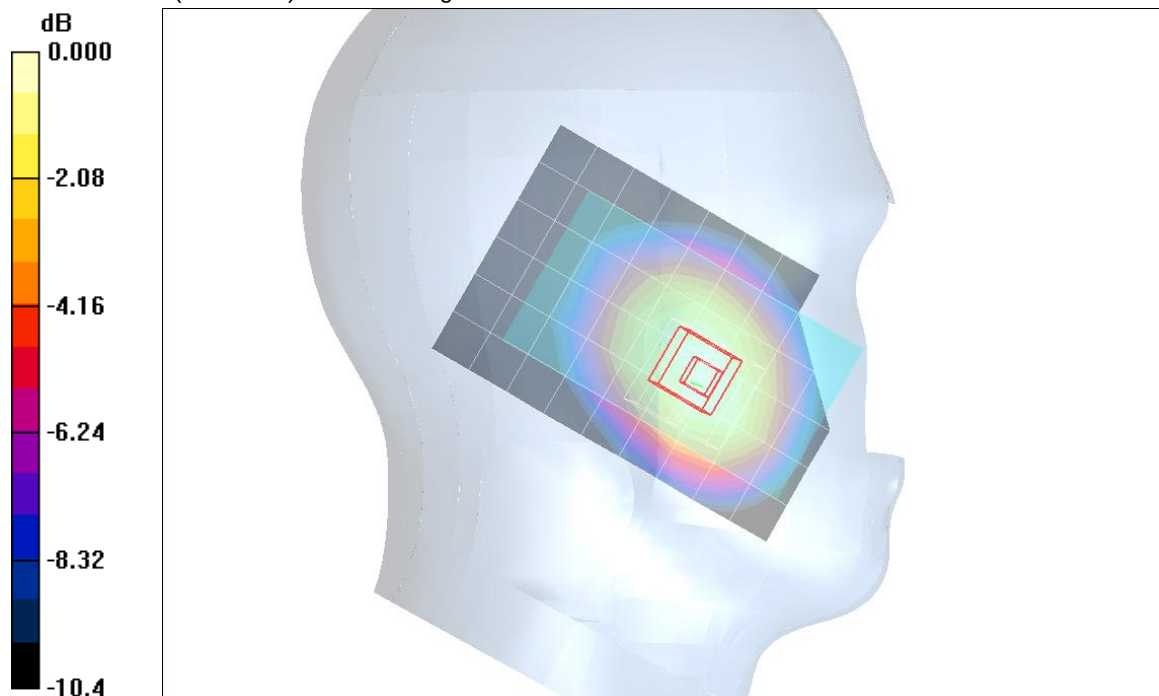
Reference Value = 18.6 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 0.355 W/kg

**SAR(1 g) = 0.279 mW/g; SAR(10 g) = 0.203 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.315 mW/g



0 dB = 0.315mW/g

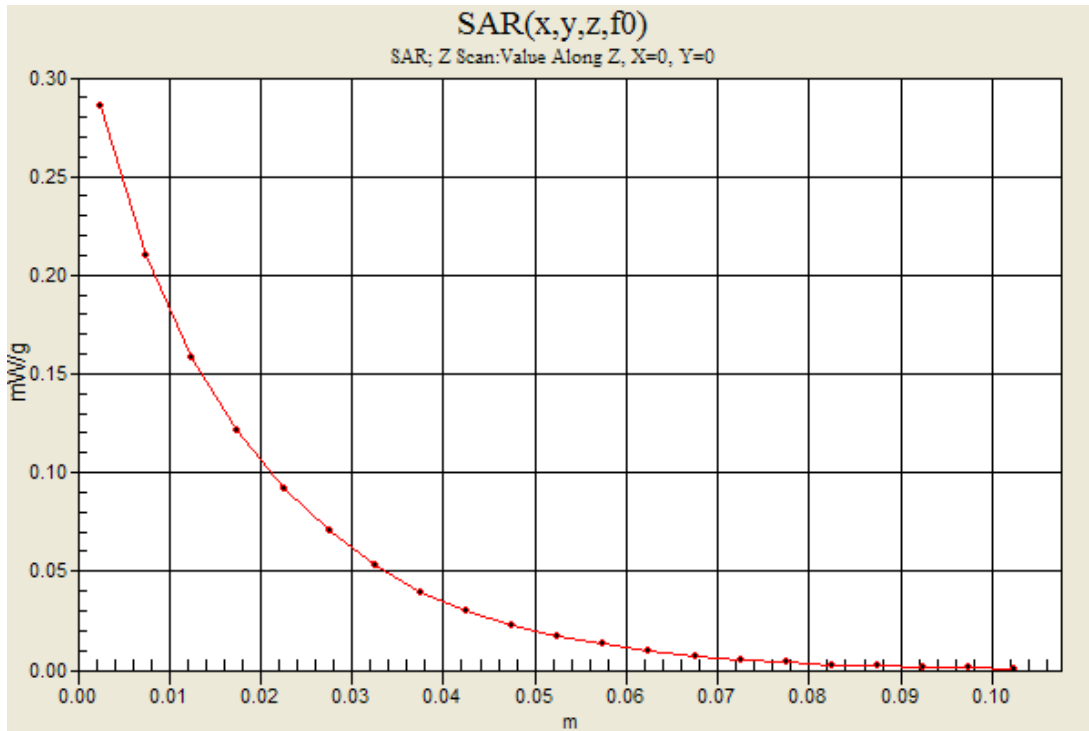
## GSM 850

Frequency: 836.6 MHz; Duty Cycle: 1:8.3

**Left Touch GSM M ch 190/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.286 mW/g



## GPRS 850

Frequency: 848.8 MHz; Duty Cycle: 1:2.67; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C  
Medium parameters used (interpolated):  $f = 848.8$  MHz;  $\sigma = 1.02$  mho/m;  $\epsilon_r = 55.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(8.84, 8.84, 8.84); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

### Rear\_GPRS 3 Slots M ch\_251 3/Area Scan (8x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.21 mW/g

### Rear\_GPRS 3 Slots M ch\_251 3/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

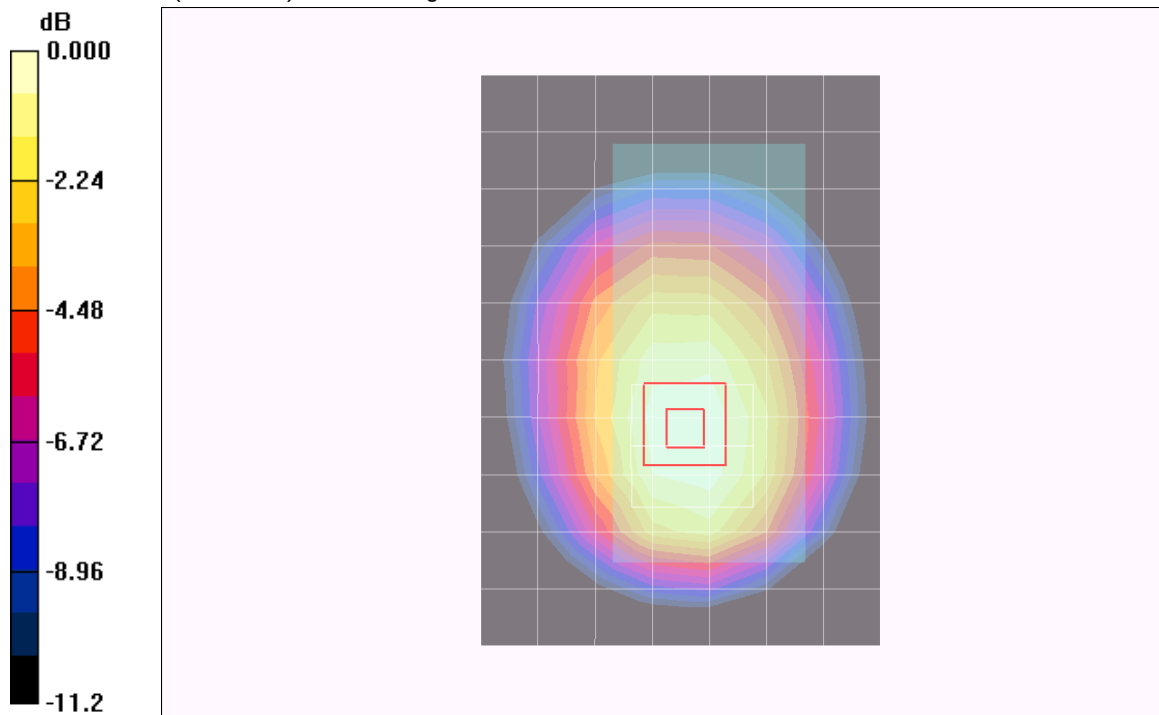
Reference Value = 35.5 V/m; Power Drift = 0.028 dB

Peak SAR (extrapolated) = 1.43 W/kg

**SAR(1 g) = 1.09 mW/g; SAR(10 g) = 0.786 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.25 mW/g



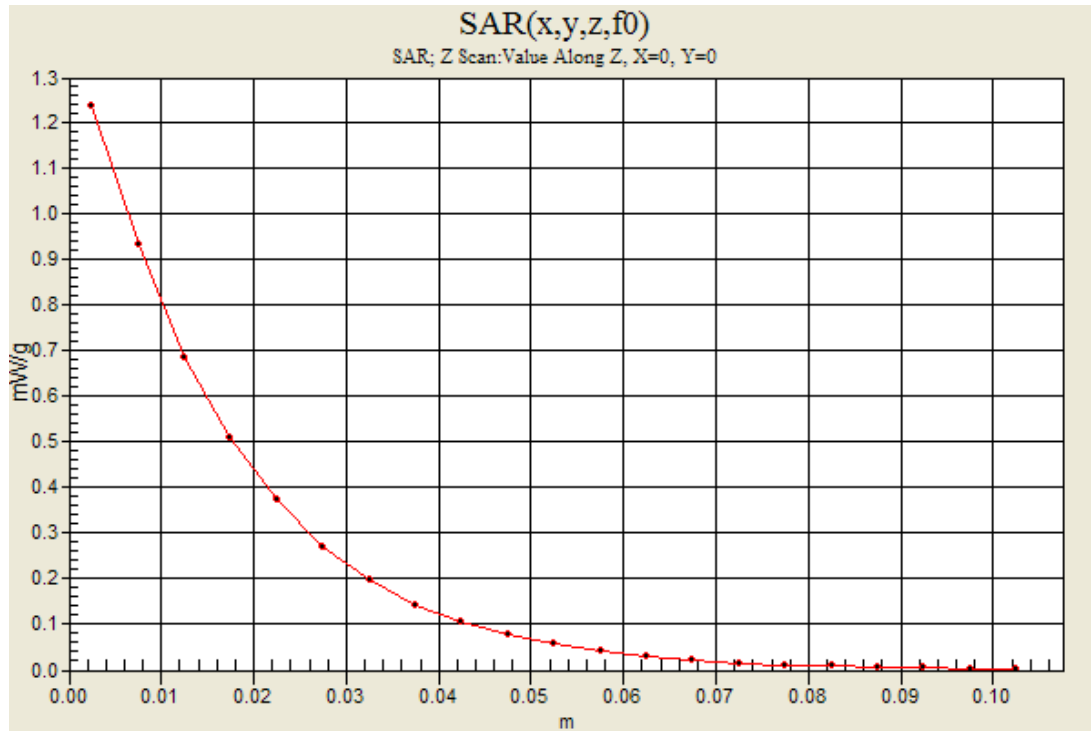
## GPRS 850

Frequency: 848.8 MHz; Duty Cycle: 1:2.67

**Rear\_GPRS 3 Slots M ch\_251 3/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.24 mW/g



## GSM 1900

Frequency: 1880 MHz; Duty Cycle: 1:8; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.4$  mho/m;  $\epsilon_r = 40.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012

- Probe: EX3DV4 - SN3749; ConvF(7.67, 7.67, 7.67); Calibrated: 1/27/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: SAM A (Twin); Type: SAM A; Serial: 1050

**Left Touch GSM M ch 661/Area Scan (7x10x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.544 mW/g

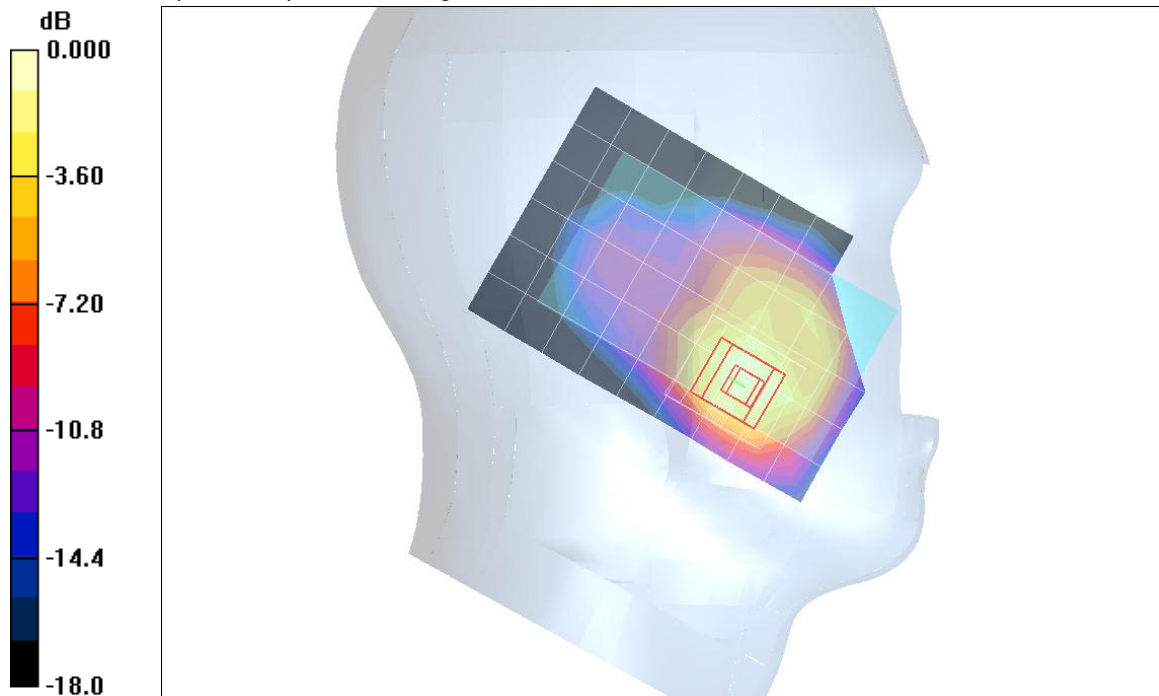
**Left Touch GSM M ch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.7 V/m; Power Drift = 0.023 dB

Peak SAR (extrapolated) = 0.888 W/kg

**SAR(1 g) = 0.541 mW/g; SAR(10 g) = 0.289 mW/g**

Maximum value of SAR (measured) = 0.696 mW/g

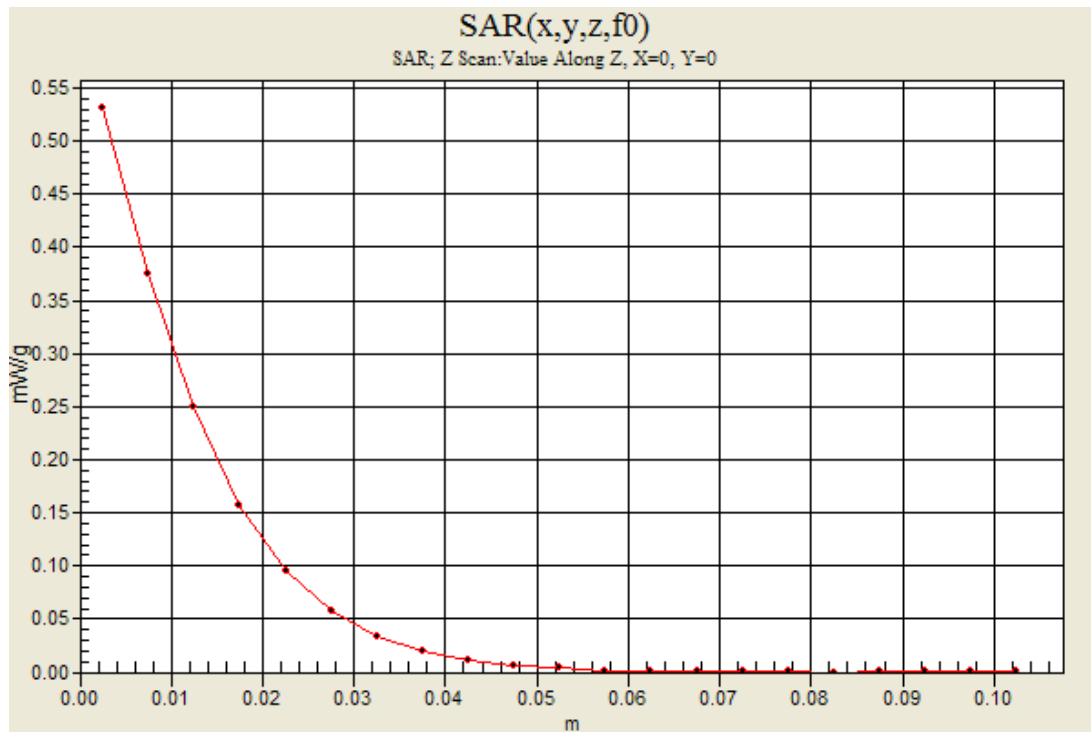


0 dB = 0.696mW/g

## GSM 1900

Frequency: 1880 MHz; Duty Cycle: 1:8

**Left Touch GSM M ch 661/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm  
Maximum value of SAR (measured) = 0.531 mW/g



## GPRS 1900

Frequency: 1880 MHz; Duty Cycle: 1:2.67; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C  
Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.48$  mho/m;  $\epsilon_r = 52.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(6.97, 6.97, 6.97); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

**Rear GPRS 3 Slots M ch 661/Area Scan (8x11x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.679 mW/g

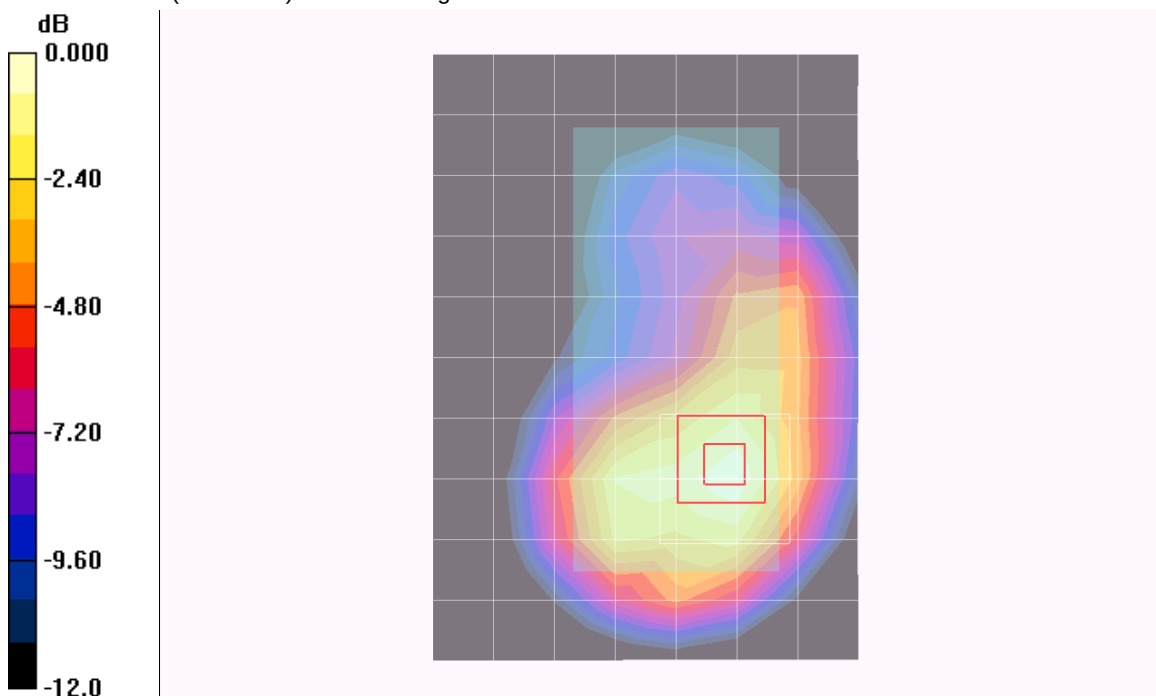
**Rear GPRS 3 Slots M ch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.6 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 0.895 W/kg

**SAR(1 g) = 0.537 mW/g; SAR(10 g) = 0.306 mW/g**

Maximum value of SAR (measured) = 0.682 mW/g

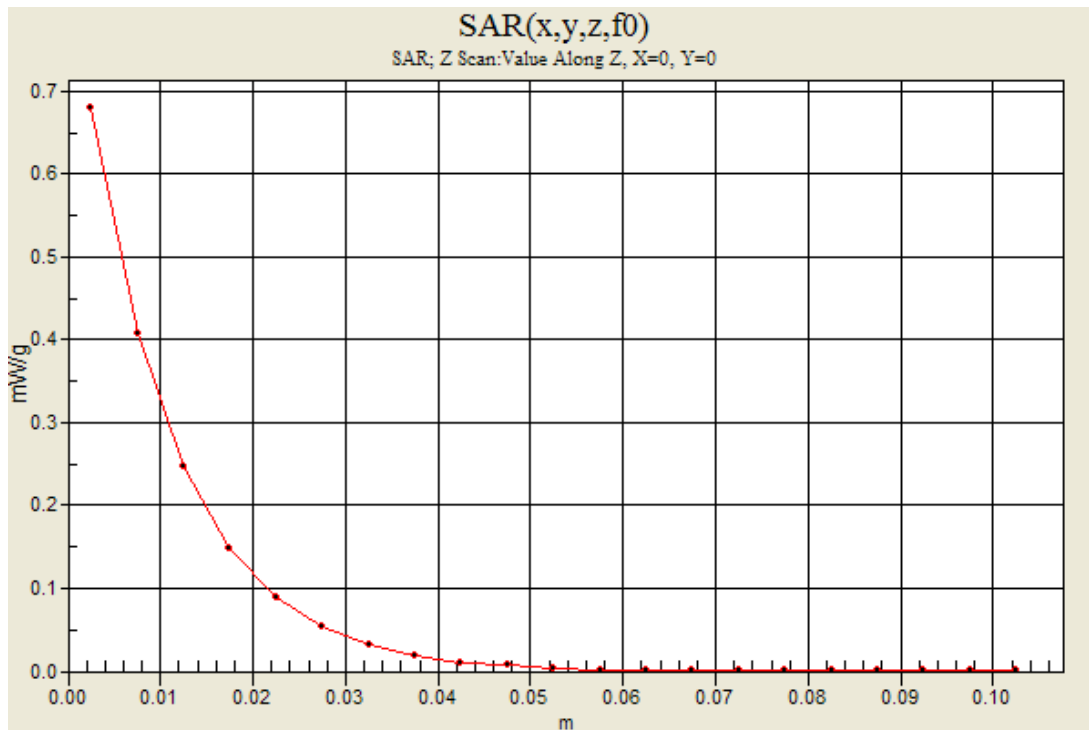


0 dB = 0.682mW/g

## GPRS 1900

Frequency: 1880 MHz; Duty Cycle: 1:2.67

**Rear GPRS 3 Slots M ch 661/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm  
Maximum value of SAR (measured) = 0.680 mW/g



## WiFi

Frequency: 2437 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C  
Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.82$  mho/m;  $\epsilon_r = 37.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(6.76, 6.76, 6.76); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM A (Twin); Type: SAM A; Serial: 1050

**Left Touch 802.11b M ch 6/Area Scan (7x10x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.433 mW/g

**Left Touch 802.11b M ch 6/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

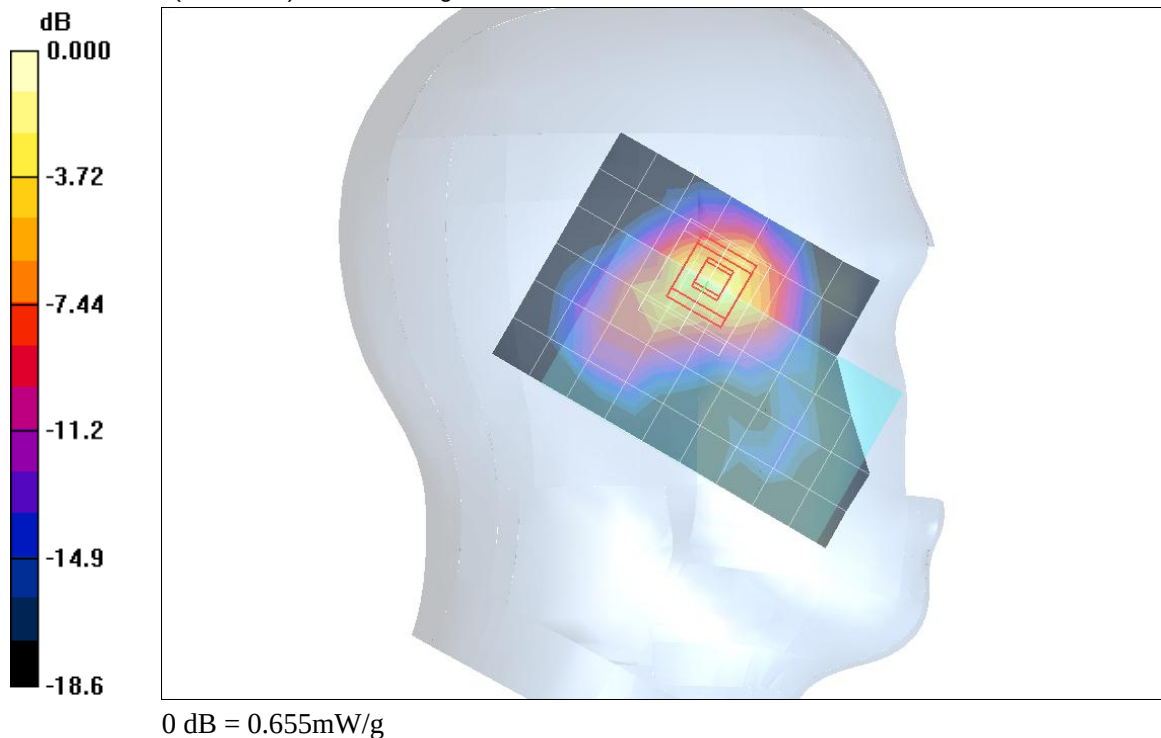
Reference Value = 15.4 V/m; Power Drift = 0.135 dB

Peak SAR (extrapolated) = 1.05 W/kg

**SAR(1 g) = 0.428 mW/g; SAR(10 g) = 0.180 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.655 mW/g



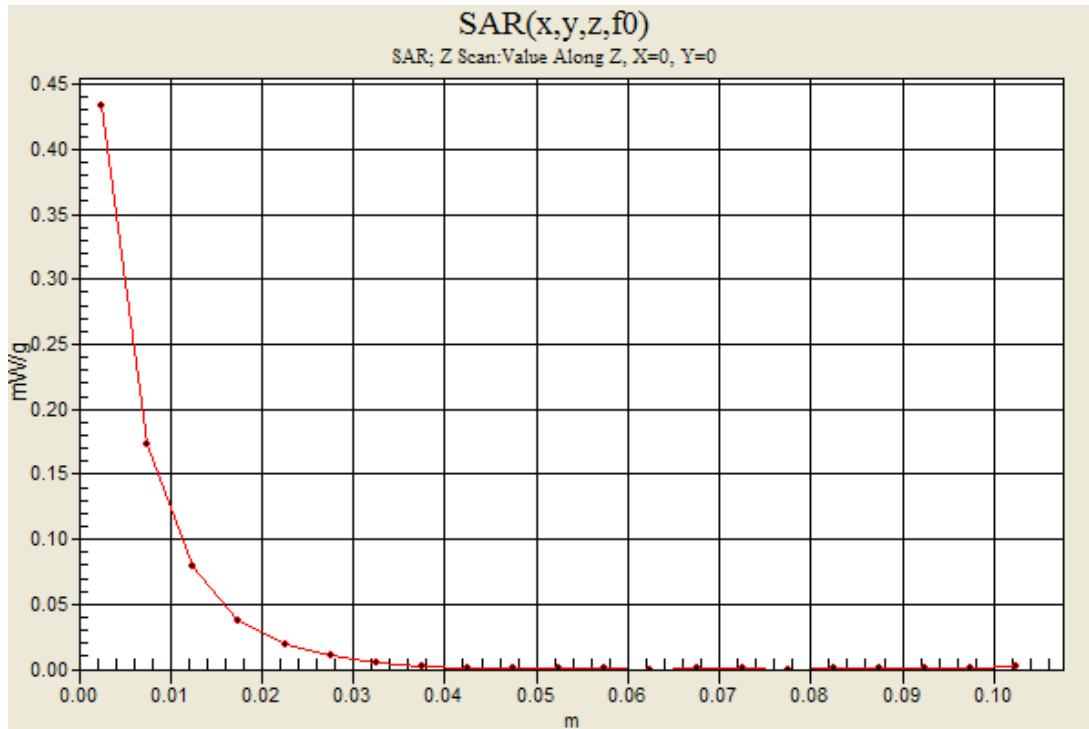
## WiFi

Frequency: 2437 MHz; Duty Cycle: 1:1

**Left Touch 802.11b M ch 6/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.433 mW/g



## WiFi

Frequency: 2437 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 2.02$  mho/m;  $\epsilon_r = 50.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012

- Probe: EX3DV4 - SN3749; ConvF(6.66, 6.66, 6.66); Calibrated: 1/27/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

**Rear 802.11b M ch 6/Area Scan (8x11x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.468 mW/g

**Rear 802.11b M ch 6/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

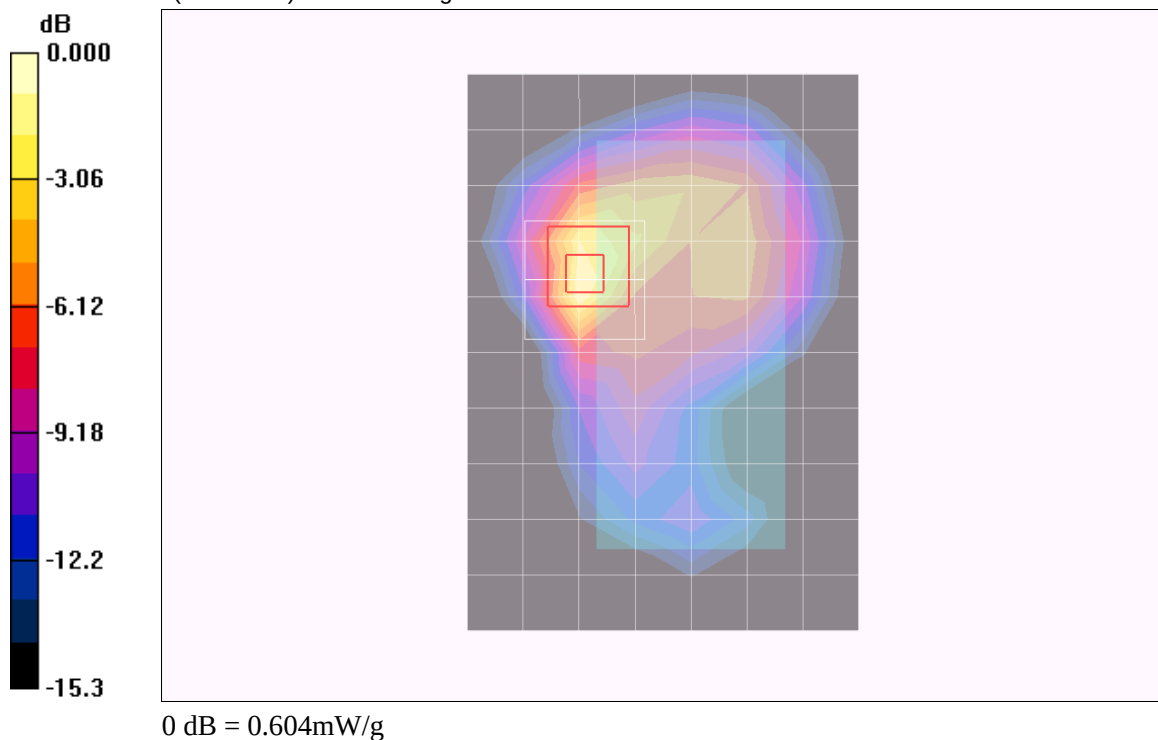
Reference Value = 16.1 V/m; Power Drift = -0.156 dB

Peak SAR (extrapolated) = 0.896 W/kg

**SAR(1 g) = 0.406 mW/g; SAR(10 g) = 0.181 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.604 mW/g



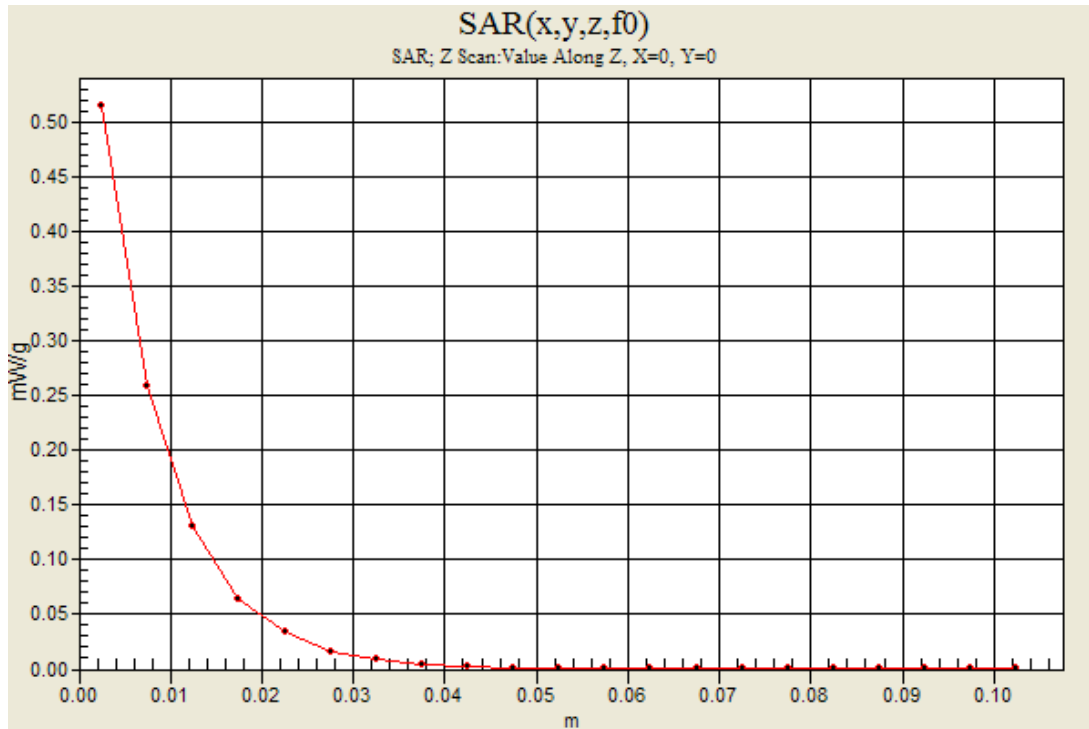
## WiFi

Frequency: 2437 MHz; Duty Cycle: 1:1

**Rear 802.11b M ch 6/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.515 mW/g



## 15. Simultaneous Transmission SAR Analysis

### 15.1. Head Exposure Condition (WWAN + WiFi)

| Test Position | GSM850 | GSM1900 | WiFi  | $\Sigma$ 1-g SAR (W/kg) |
|---------------|--------|---------|-------|-------------------------|
| Left Touch    | 0.279  |         | 0.428 | 0.707                   |
|               |        | 0.541   | 0.428 | 0.969                   |
| Left Tilt     | 0.222  |         | 0.114 | 0.336                   |
|               |        | 0.180   | 0.114 | 0.294                   |
| Right Touch   | 0.311  |         | 0.165 | 0.476                   |
|               |        | 0.518   | 0.165 | 0.683                   |
| Right Tilt    | 0.201  |         | 0.114 | 0.315                   |
|               |        | 0.185   | 0.114 | 0.299                   |

### 15.2. Body Exposure Condition (WWAN + Wi-Fi)

| Test Position | GSM850 | GSM1900 | WiFi  | $\Sigma$ 1-g SAR (W/kg) |
|---------------|--------|---------|-------|-------------------------|
| Rear          | 1.09   |         | 0.406 | <b>1.496</b>            |
|               |        | 0.537   | 0.406 | 0.943                   |
| Front         | 0.342  |         | 0.104 | 0.446                   |
|               |        | 0.393   | 0.104 | 0.497                   |
| Edge 1        |        |         |       |                         |
|               |        |         |       |                         |
| Edge 2        | 0.128  |         | 0.352 | 0.480                   |
|               |        | 0.089   | 0.352 | 0.441                   |
| Edge 3        | 0.048  |         |       | 0.048                   |
|               |        | 0.350   |       | 0.350                   |
| Edge 4        | 0.303  |         |       | 0.303                   |
|               |        | 0.221   |       | 0.221                   |

#### **Conclusion:**

Simultaneous transmission SAR measurement (volume scan) is not required due to the sum of the 1-g SAR is < 1.6 W/kg.

## **16. Appendixes**

Refer to separated files for the following appendixes.

**16.1. System Performance Check Plots**

**16.2. SAR Test Plots for GSM850**

**16.3. SAR Test Plots for GSM1900**

**16.4. SAR Test Plots for WiFi 2.4 GHz**

**16.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3749**

**16.6. Calibration Certificate for D835V2 - SN 4d117**

**16.7. Calibration Certificate for D1900V2 - SN 5d140**

**16.8. Calibration Certificate for D2450V2 - SN 748**