

## SAR TEST REPORT

For

LOWEX, LLC

fixed wireless phone

Model No.: DP05

Additional Model No.: DP06, DP07, DP08

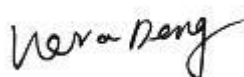
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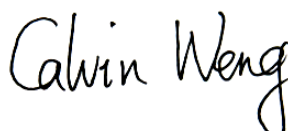
Date of receipt of test sample : September 29, 2018  
Number of tested samples : 1  
Serial number : Prototype  
Date of Test : October 08, 2018~October 15, 2018  
Date of Report : October 16, 2018

**SAR TEST REPORT****Report Reference No. .... : LCS180929023AE****Date Of Issue ..... : October 16, 2018****Testing Laboratory Name ..... : Shenzhen LCS Compliance Testing Laboratory Ltd.****Address ..... : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,  
Bao'an District, Shenzhen, Guangdong, China****Testing Location/ Procedure ..... : Full application of Harmonised standards ■  
Partial application of Harmonised standards □  
Other standard testing method □****Applicant's Name..... : LOWEX, LLC****Address ..... : 739 NW 105th Pl, Miami, Florida 33172, USA****Test Specification:****Standard ..... : IEEE Std C95.1, 2005/IEEE Std 1528™-2013/ FCC Part 2.1093****Test Report Form No. .... : LCSEMC-1.0****TRF Originator ..... : Shenzhen LCS Compliance Testing Laboratory Ltd.****Master TRF ..... : Dated 2014-09****Shenzhen LCS Compliance Testing Laboratory Ltd. All rights reserved.**

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**Test Item Description. .... : fixed wireless phone****Trade Mark ..... : LOWEX****Model/Type Reference ..... : DP05****Operation Frequency ..... : GSM 850/PCS1900, WCDMA Band II/V****Modulation Type ..... : GSM(GMSK), WCDMA/HSDPA/HSUPA(QPSK)****Ratings ..... : DC 3.7V by li-ion battery(800mAh)  
Recharge Voltage: DC 5V/1A****Result ..... : Positive****Compiled by:**

Vera Deng/ File administrators

**Supervised by:**

Calvin Weng/ Technique principal

**Approved by:**

Gavin Liang/ Manager

**SAR -- TEST REPORT****Test Report No. : LCS180929023AE**October 16, 2018  
Date of issue

Type / Model..... : DP05

EUT..... : fixed wireless phone

**Applicant..... : LOWEX, LLC**

Address..... : 739 NW 105th Pl, Miami, Florida 33172, USA

Telephone..... : /

Fax..... : /

**Manufacturer..... : LuZhou XinYu Communication Technology Co., LTD**Address..... : NO.19, Section 5, JiuGu Avenue, High Tech District,  
LuZhou City, SiChuan Provice, China

Telephone..... : /

Fax..... : /

**Factory..... : LuZhou XinYu Communication Technology Co., LTD**Address..... : NO.19, Section 5, JiuGu Avenue, High Tech District,  
LuZhou City, SiChuan Provice, China

Telephone..... : /

Fax..... : /

**Test Result****Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

## Revision History

| Revision | Issue Date       | Revisions     | Revised By  |
|----------|------------------|---------------|-------------|
| 000      | October 16, 2018 | Initial Issue | Gavin Liang |
|          |                  |               |             |
|          |                  |               |             |

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# 1. TEST STANDARDS AND TEST DESCRIPTION

## 1.1. Test Standards

[IEEE Std C95.1, 2005](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

[IEEE Std 1528™-2013](#): IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

[FCC Part 2.1093](#) Radiofrequency Radiation Exposure Evaluation: Portable Devices

[KDB447498 D01 General RF Exposure Guidance](#) : Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

[KDB648474 D04](#): Handset SAR v01r03: SAR Evaluation Considerations for Wireless Handsets

[KDB865664 D01 SAR Measurement 100 MHz to 6 GHz](#) : SAR Measurement Requirements for 100 MHz to 6 GHz

[KDB865664 D02 RF Exposure Reporting](#): RF Exposure Compliance Reporting and Documentation Considerations

[KDB941225 D01 3G SAR Procedures](#): 3G SAR MEAUREMENT PROCEDURES

[KDB 941225 D06 Hotspot Mode](#): SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES

## 1.2. Test Description

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power . And Test device is identical prototype.

## 1.3. General Remarks

|                                |   |                    |
|--------------------------------|---|--------------------|
| Date of receipt of test sample | : | September 29, 2018 |
|                                |   |                    |
| Testing commenced on           | : | October 08, 2018   |
|                                |   |                    |
| Testing concluded on           | : | October 15, 2018   |

## 1.4. Product Description

The **LOWEX, LLC** .'s Model: **DP05** or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

| General Description                                                                                                                                                                                  |                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Product Name:                                                                                                                                                                                        | fixed wireless phone                                            |
| Model/Type reference:                                                                                                                                                                                | DP05                                                            |
| Listed Model(s):                                                                                                                                                                                     | DP06, DP07, DP08                                                |
| Modulation Type:                                                                                                                                                                                     | GMSK for GSM, QPSK for UMTS                                     |
| Device category:                                                                                                                                                                                     | Portable Device                                                 |
| Exposure category:                                                                                                                                                                                   | General population/uncontrolled environment                     |
| EUT Type:                                                                                                                                                                                            | Production Unit                                                 |
| Hardware Version                                                                                                                                                                                     | F66-PCB                                                         |
| Software Version:                                                                                                                                                                                    | /                                                               |
| Power supply:                                                                                                                                                                                        | DC 3.7V by li-ion battery(800mAh)<br>Recharge Voltage: DC 5V/1A |
| Hotspot:                                                                                                                                                                                             | not Supported                                                   |
| VoIP                                                                                                                                                                                                 | not Supported                                                   |
| <i>The EUT is GSM,WCDMA, mobile phone. the mobile phone is intended for speech.It is equipped with GSM850, PCS1900, WCDMA Band V,WCDMA Band II, For more information see the following datasheet</i> |                                                                 |

| Technical Characteristics |                                                     |
|---------------------------|-----------------------------------------------------|
| GSM                       |                                                     |
| Support Networks          | GSM                                                 |
| Support Band              | GSM850/PCS1900                                      |
| Frequency                 | GSM850: 824.2~848.8MHz<br>GSM1900: 1850.2~1909.8MHz |
| Power Class:              | GSM850:Power Class 4                                |

|                           |                                                                   |
|---------------------------|-------------------------------------------------------------------|
|                           | PCS1900:Power Class 1                                             |
| Modulation Type:          | GMSK for GSM                                                      |
| Antenna Type:             | Combo(External)                                                   |
| Antenna Gain:             | 1.8 (max.) For GSM 850<br>2.4 (max.) For PCS1900                  |
| GSM Release Version       | Release 99                                                        |
| GPRS Multislot Class      | Not Supported                                                     |
| EGPRS Multislot Class     | Not Supported                                                     |
| DTM Mode                  | Not Supported                                                     |
| <b>UMTS</b>               |                                                                   |
| Support Networks          | WCDMA RMC12.2K,HSDPA,HSUPA                                        |
| Operation Band:           | Band V,Band II                                                    |
| Frequency Range           | WCDMA Band V: 871.4 ~ 891.6MHz<br>WCDMA Band II: 1852.4~1907.6MHz |
| Modulation Type:          | QPSK for WCDMA/HSUPA/HSDPA                                        |
| Power Class:              | Class 3                                                           |
| WCDMA Release Version:    | Release 6                                                         |
| DC-HSUPA Release Version: | Not Supported                                                     |
| Antenna Type:             | Combo(External)                                                   |
| Antenna Gain:             | 1.8 (max.) For WCDMA Band V;<br>2.4 (max.) For WCDMA Band II      |

### 1.5. Statement of Compliance

The maximum of results of SAR found during testing for DP05 are follows:

<Highest Reported standalone SAR Summary>

| Classment<br>Class | Frequency<br>Band | Body-worn<br>(Report SAR <sub>1-g</sub> (W/kg)) |
|--------------------|-------------------|-------------------------------------------------|
| PCE                | GSM 850           | 0.924                                           |
|                    | GSM1900           | 0.805                                           |
|                    | WCDMA Band V      | 0.860                                           |
|                    | WCDMA Band II     | <b>1.174</b>                                    |

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

## 2. TEST ENVIRONMENT

### 2.1. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

Site Description

EMC Lab.

: FCC Registration Number. is 254912  
 Industry Canada Registration Number. is 9642A-1.  
 ESMD Registration Number. is ARCB0108.  
 UL Registration Number. is 100571-492.  
 TUV SUD Registration Number. is SCN1081.  
 TUV RH Registration Number. is UA 50296516-001  
 NVLAP Registration Code is 600167-0.

### 2.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

|                       |              |
|-----------------------|--------------|
| Temperature:          | 18-25 ° C    |
| Humidity:             | 40-65 %      |
| Atmospheric pressure: | 950-1050mbar |

### 2.3. SAR Limits

| EXPOSURE LIMITS                                              | FCC Limit (1g Tissue)                                          |                                                        |
|--------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------|
|                                                              | SAR (W/kg)                                                     |                                                        |
|                                                              | (General Population /<br>Uncontrolled Exposure<br>Environment) | (Occupational /<br>Controlled Exposure<br>Environment) |
| Spatial Average(averaged over the whole body)                | 0.08                                                           | 0.4                                                    |
| Spatial Peak(averaged over any 1 g of tissue)                | 1.6                                                            | 8.0                                                    |
| Spatial Peak(hands/wrists/<br>feet/anklesaveraged over 10 g) | 4.0                                                            | 20.0                                                   |

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

## 2.4. Equipments Used during the Test

| Test Equipment                      | Manufacturer | Type/Model      | Serial Number          | Calibration      |                 |
|-------------------------------------|--------------|-----------------|------------------------|------------------|-----------------|
|                                     |              |                 |                        | Calibration Date | Calibration Due |
| PC                                  | Lenovo       | G5005           | MY42081102             | N/A              | N/A             |
| SAR Measurement system              | SATIMO       | 4014_01         | SAR_4014_01            | N/A              | N/A             |
| Signal Generator                    | Agilent      | E4438C          | MY42081396             | 11/18/2017       | 11/18/2018      |
| Multimeter                          | Keithley     | Multimeter 2000 | 4059164                | 11/18/2017       | 11/18/2018      |
| S-parameter Network Analyzer        | Agilent      | 8753ES          | US38432944             | 11/18/2017       | 11/18/2018      |
| Wireless Communication Test Set     | R & S        | CMU200          | 105988                 | 11/18/2017       | 11/18/2018      |
| Wideband Radia Communication Tester | R&S          | CMW500          | 1201.0002K50           | 11/18/2017       | 11/18/2018      |
| E-Field PROBE                       | SATIMO       | SSE2            | SN 45/15 EPGO281       | 02/04/2018       | 02/03/2019      |
| DIPOLE 835                          | SATIMO       | SID 835         | SN 07/14 DIP 0G835-303 | 10/01/2018       | 09/30/2021      |
| DIPOLE 1900                         | SATIMO       | SID 1900        | SN 30/14 DIP 1G900-333 | 09/01/2018       | 08/31/2021      |
| COMOSAR OPEN Coaxial Probe          | SATIMO       | OCPG 68         | SN 40/14 OCPG68        | 11/18/2017       | 11/18/2018      |
| SAR Locator                         | SATIMO       | VPS51           | SN 40/14 VPS51         | 11/18/2017       | 11/18/2018      |
| Communication Antenna               | SATIMO       | ANTA57          | SN 39/14 ANTA57        | 11/18/2017       | 11/18/2018      |
| Mobile Phone POSITIONING DEVICE     | SATIMO       | MSH98           | SN 40/14 MSH98         | N/A              | N/A             |
| DUMMY PROBE                         | SATIMO       | DP60            | SN 03/14 DP60          | N/A              | N/A             |
| SAM PHANTOM                         | SATIMO       | SAM117          | SN 40/14 SAM117        | N/A              | N/A             |
| Liquid measurement Kit              | HP           | 85033D          | 3423A03482             | 11/18/2017       | 11/18/2018      |
| Power meter                         | Agilent      | E4419B          | MY45104493             | 06/16/2018       | 06/15/2019      |
| Power meter                         | Agilent      | E4418B          | GB4331256              | 06/16/2018       | 06/15/2019      |
| Power sensor                        | Agilent      | E9301H          | MY41497725             | 06/16/2018       | 06/15/2019      |
| Power sensor                        | Agilent      | E9301H          | MY41495234             | 06/16/2018       | 06/15/2019      |
| Directional Coupler                 | MCLI/USA     | 4426-20         | 0D2L51502              | 06/16/2018       | 06/15/2019      |

Note:

- 1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three year extended calibration interval. Each measured dipole is expected to evaluate with following criteria at least on annual interval.
  - a) There is no physical damage on the dipole;
  - b) System check with specific dipole is within 10% of calibrated values;
  - c) The most recent return-loss results, measured at least annually, deviates by no more than 20% from the previous measurement;

- d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within  $5\Omega$  from the previous measurement.
- 2) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

### 3.SAR MEASUREMENTS SYSTEM CONFIGURATION

#### 3.1. SAR Measurement Set-up

The OPENSAR system for performing compliance tests consist of the following items:

A standard high precision 6-axis robot (KUKA) with controller and software.

KUKA Control Panel (KCP)

A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with a Video Positioning System(VPS).

The stress sensor is composed with mechanical and electronic when the electronic part detects a change on the electro-mechanical switch,It sends an "Emergency signal" to the robot controller that to stop robot's moves

A computer operating Windows XP.

OPENSAR software

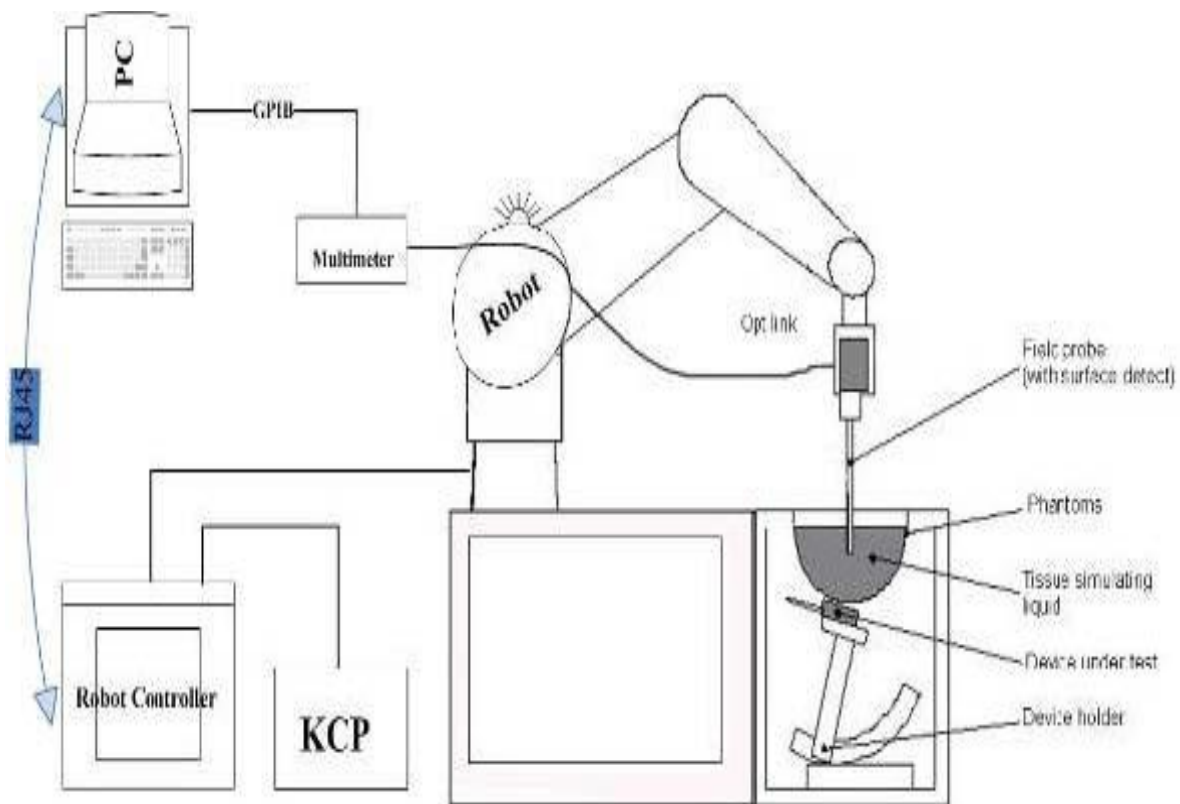
Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

The SAM phantom enabling testing left-hand right-hand and body usage.

The Position device for handheld EUT

Tissue simulating liquid mixed according to the given recipes .

System validation dipoles to validate the proper functioning of the system.



### 3.2. OPENSAR E-field Probe System

The SAR measurements were conducted with the dosimetric probe EPGO281 (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation.

#### Probe Specification

Construction Symmetrical design with triangular core

Interleaved sensors

Built-in shielding against static charges

PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration ISO/IEC 17025 calibration service available.

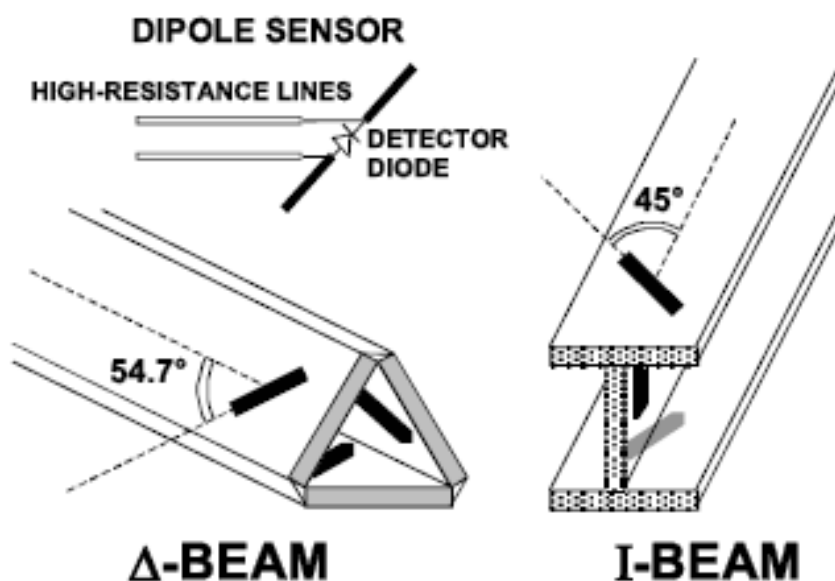
|               |                                                                                                                            |
|---------------|----------------------------------------------------------------------------------------------------------------------------|
| Frequency     | 450 MHz to 6 GHz;<br>Linearity: 0.25dB(450 MHz to 6 GHz)                                                                   |
| Directivity   | 0.25 dB in HSL (rotation around probe axis)<br>0.5 dB in tissue material (rotation normal to probe axis)                   |
| Dynamic Range | 0.01W/kg to > 100 W/kg;<br>Linearity: 0.25 dB                                                                              |
| Dimensions    | Overall length: 330 mm (Tip: 16mm)<br>Tip diameter: 5 mm (Body: 8 mm)<br>Distance from probe tip to sensor centers: 2.5 mm |
| Application   | General dosimetry up to 6 GHz<br>Dosimetry in strong gradient fields<br>Compliance tests of Mobile Phones                  |



#### Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

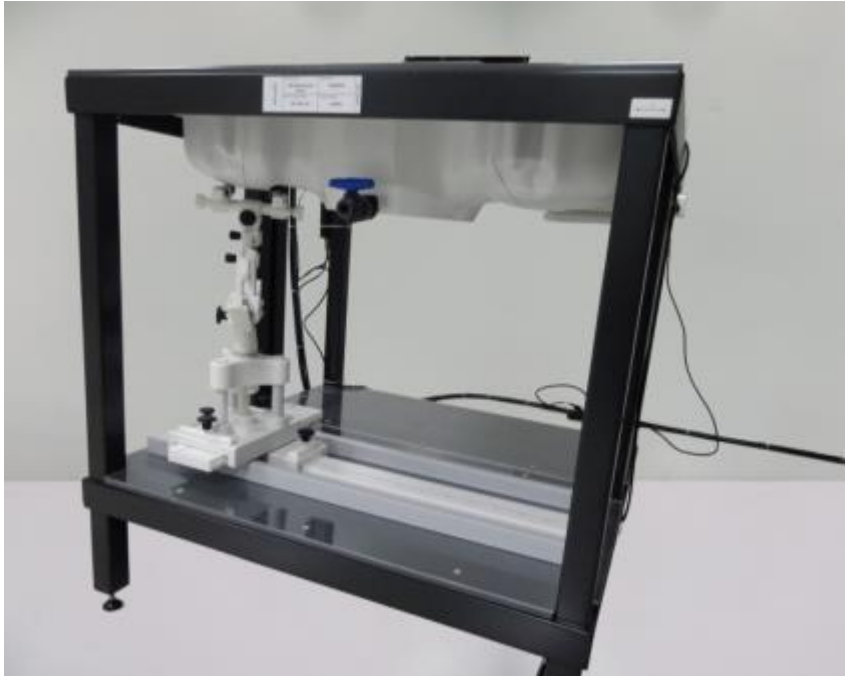
The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



### 3.3. Phantoms

The SAM Phantom SAM117 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE P1528 and CENELEC EN62209-1, EN62209-2:2010. The phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.



SAM Twin Phantom

### 3.4. Device Holder

In combination with the Generic Twin Phantom SAM117, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).



Device holder supplied by SATIMO

### 3.5. Scanning Procedure

The procedure for assessing the peak spatial-average SAR value consists of the following steps

#### Power Reference Measurement

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

#### Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

|                                                                                                        | ≤ 3 GHz                                                                                                                                                                                                                                                           | > 3 GHz                                             |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | 5 mm ± 1 mm                                                                                                                                                                                                                                                       | $\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm ± 0.5 mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location              | 30° ± 1°                                                                                                                                                                                                                                                          | 20° ± 1°                                            |
| Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$                            | ≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm                                                                                                                                                                                                                            | 3 – 4 GHz: ≤ 12 mm<br>4 – 6 GHz: ≤ 10 mm            |
|                                                                                                        | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device. |                                                     |

#### Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

|                                                                                                                                                                                                                                                                                                                         |                                    |                                                                                      |                                                      |                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------|
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$ , $\Delta y_{Zoom}$                                                                                                                                                                                                                                             |                                    |                                                                                      | $\leq 2$ GHz: $\leq 8$ mm<br>2 – 3 GHz: $\leq 5$ mm* | 3 – 4 GHz: $\leq 5$ mm*<br>4 – 6 GHz: $\leq 4$ mm*                            |
| Maximum zoom scan spatial resolution, normal to phantom surface                                                                                                                                                                                                                                                         | uniform grid: $\Delta z_{Zoom}(n)$ |                                                                                      | $\leq 5$ mm                                          | 3 – 4 GHz: $\leq 4$ mm<br>4 – 5 GHz: $\leq 3$ mm<br>5 – 6 GHz: $\leq 2$ mm    |
|                                                                                                                                                                                                                                                                                                                         | graded grid                        | $\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface | $\leq 4$ mm                                          | 3 – 4 GHz: $\leq 3$ mm<br>4 – 5 GHz: $\leq 2.5$ mm<br>5 – 6 GHz: $\leq 2$ mm  |
|                                                                                                                                                                                                                                                                                                                         |                                    | $\Delta z_{Zoom}(n>1)$ : between subsequent points                                   | $\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm             |                                                                               |
| Minimum zoom scan volume                                                                                                                                                                                                                                                                                                | x, y, z                            |                                                                                      | $\geq 30$ mm                                         | 3 – 4 GHz: $\geq 28$ mm<br>4 – 5 GHz: $\geq 25$ mm<br>5 – 6 GHz: $\geq 22$ mm |
| Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.                                                                                                                                                                                   |                                    |                                                                                      |                                                      |                                                                               |
| * When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB Publication 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz. |                                    |                                                                                      |                                                      |                                                                               |

#### Power Drift measurement

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have OPENSAR software stop the measurements if this limit is exceeded.

### 3.6. Data Storage and Evaluation

#### Data Storage

The OPENSAR software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

#### Data Evaluation

The OPENSAR software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

|                    |                           |                      |
|--------------------|---------------------------|----------------------|
| Probe parameters:  | - Sensitivity             | Normi, ai0, ai1, ai2 |
|                    | - Conversion factor       | ConvFi               |
|                    | - Diode compression point | Dcpi                 |
| Device parameters: | - Frequency               | f                    |
|                    | - Crest factor            | cf                   |
| Media parameters:  | - Conductivity            | σ                    |
|                    | - Density                 | ρ                    |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the OPENSAR components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcpi}$$

With  $V_i$  = compensated signal of channel  $i$  ( $i = x, y, z$ )

$U_i$  = input signal of channel  $i$  ( $i = x, y, z$ )

cf = crest factor of exciting field

dcpi = diode compression point

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

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

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

With  $V_i$  = compensated signal of channel  $i$  ( $i = x, y, z$ )

$Norm_i$  = sensor sensitivity of channel  $i$  ( $i = x, y, z$ )  
[mV/(V/m)²] for E-field Probes

ConvF = sensitivity enhancement in solution

- $a_{ij}$  = sensor sensitivity factors for H-field probes  
 $f$  = carrier frequency [GHz]  
 $E_i$  = electric field strength of channel  $i$  in V/m  
 $H_i$  = magnetic field strength of channel  $i$  in A/m

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

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

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

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

with SAR = local specific absorption rate in mW/g

$E_{tot}$  = total field strength in V/m

$\sigma$  = conductivity in [mho/m] or [Siemens/m]

$\rho$  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

### 3.7. Position of the wireless device in relation to the phantom

#### General considerations

This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.

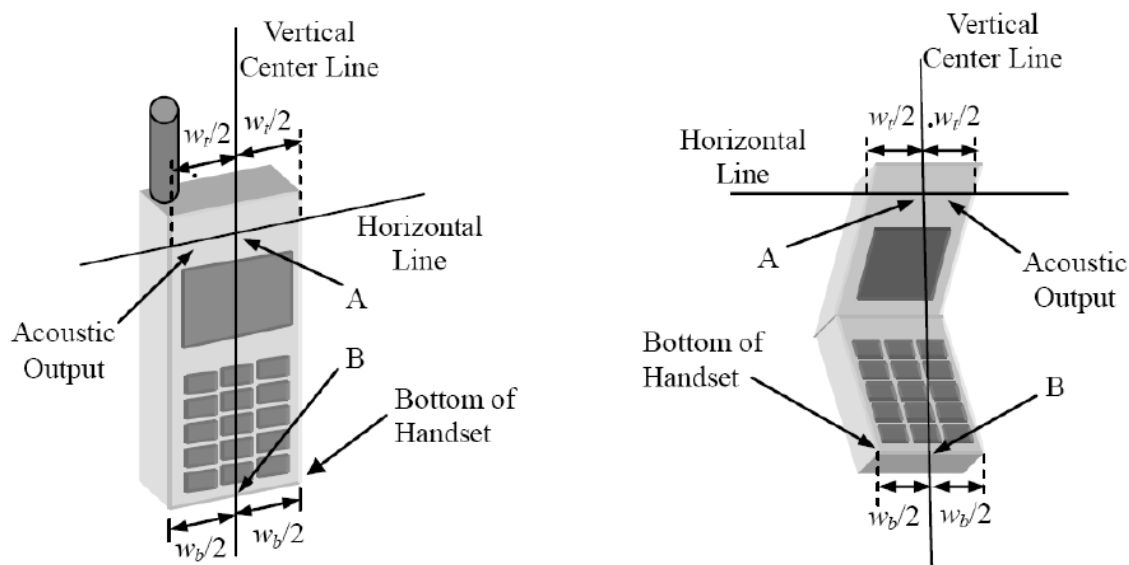
The power flow density is calculated assuming the excitation field as a free space field

$$P_{(pwe)} = \frac{E_{tot}^2}{3770} \text{ or } P_{(pwe)} = H_{tot}^2 \cdot 37.7$$

Where  $P_{pwe}$  = Equivalent power density of a plane wave in mW/cm<sup>2</sup>

$E_{tot}$  = total electric field strength in V/m

$H_{tot}$  = total magnetic field strength in A/m



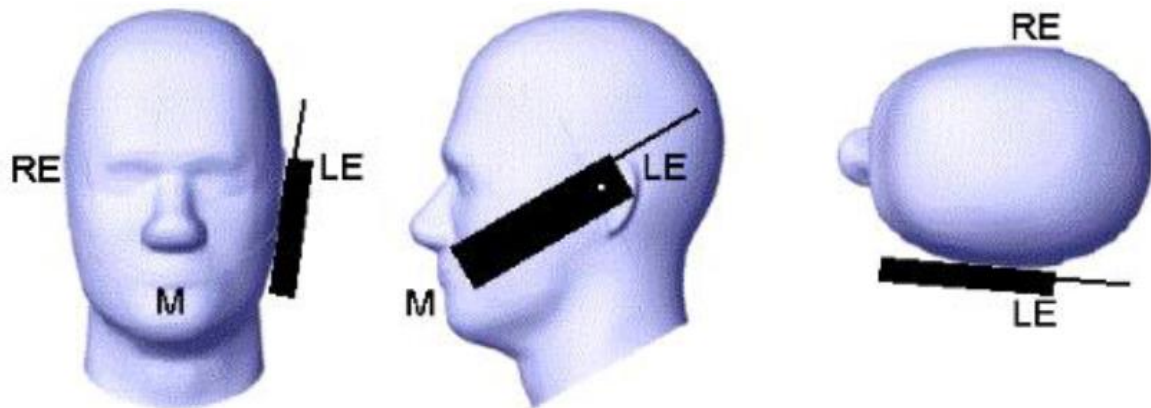
$w_t$  Width of the handset at the level of the acoustic

$w_b$  Width of the bottom of the handset

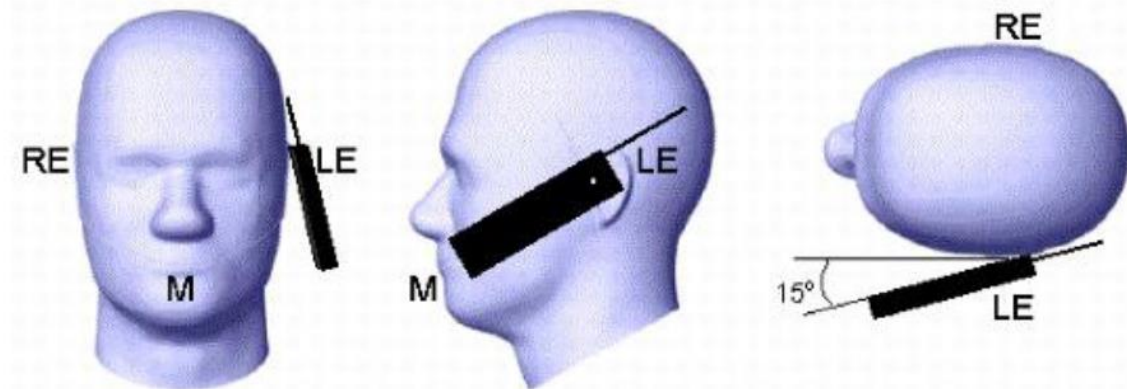
A Midpoint of the width  $w_t$  of the handset at the level of the acoustic output

B Midpoint of the width  $w_b$  of the bottom of the handset

Picture 1-a Typical “fixed” case handset    Picture 1-b Typical “clam-shell” case handset



Picture 2 Cheek position of the wireless device on the left side of SAM



Picture 3 Tilt position of the wireless device on the left side of SAM

For body SAR test we applied to FCC KDB941225, KDB447498, KDB248227, KDB648654;

### 3.8. Tissue Dielectric Parameters for Head and Body Phantoms

The liquid is consisted of water,salt,Glycol,Sugar,Preventol and Cellulose.The liquid has previously been proven to be suited for worst-case.It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664.

The composition of the tissue simulating liquid

| Ingredient<br>(%<br>Weight) | 750MHz |      | 835MHz |      | 1800 MHz |       | 1900 MHz |       | 2450MHz |       | 2600MHz |       | 5000MHz |      |
|-----------------------------|--------|------|--------|------|----------|-------|----------|-------|---------|-------|---------|-------|---------|------|
|                             | Head   | Body | Head   | Body | Head     | Body  | Head     | Body  | Head    | Body  | Head    | Body  | Head    | Body |
| Water                       | 39.28  | 51.3 | 41.45  | 52.5 | 54.5     | 40.2  | 54.9     | 40.4  | 62.7    | 73.2  | 60.3    | 71.4  | 65.5    | 78.6 |
| Preventol                   | 0.10   | 0.10 | 0.10   | 0.10 | 0.00     | 0.00  | 0.00     | 0.00  | 0.00    | 0.00  | 0.00    | 0.00  | 0.00    | 0.00 |
| HEC                         | 1.00   | 1.00 | 1.00   | 1.00 | 0.00     | 0.00  | 0.00     | 0.00  | 0.00    | 0.00  | 0.00    | 0.00  | 0.00    | 0.00 |
| DGBE                        | 0.00   | 0.00 | 0.00   | 0.00 | 45.33    | 59.31 | 44.92    | 59.10 | 36.80   | 26.70 | 39.10   | 28.40 | 0.00    | 0.00 |
| Triton X-100                | 0.00   | 0.00 | 0.00   | 0.00 | 0.00     | 0.00  | 0.00     | 0.00  | 0.00    | 0.00  | 0.00    | 0.00  | 17.2    | 10.7 |

| Target Frequency<br>(MHz) | Head                      |                | Body         |                |
|---------------------------|---------------------------|----------------|--------------|----------------|
|                           | $\epsilon_r$ 介电常数(Calvin) | $\sigma$ (S/m) | $\epsilon_r$ | $\sigma$ (S/m) |
| 150                       | 52.3                      | 0.76           | 61.9         | 0.80           |
| 300                       | 45.3                      | 0.87           | 58.2         | 0.92           |
| 450                       | 43.5                      | 0.87           | 56.7         | 0.94           |
| 835                       | 41.5                      | 0.90           | 55.2         | 0.97           |
| 900                       | 41.5                      | 0.97           | 55.0         | 1.05           |
| 915                       | 41.5                      | 0.98           | 55.0         | 1.06           |
| 1450                      | 40.5                      | 1.20           | 54.0         | 1.30           |
| 1610                      | 40.3                      | 1.29           | 53.8         | 1.40           |
| 1800-2000                 | 40.0                      | 1.40           | 53.3         | 1.52           |
| 2450                      | 39.2                      | 1.80           | 52.7         | 1.95           |
| 3000                      | 38.5                      | 2.40           | 52.0         | 2.73           |
| 5800                      | 35.3                      | 5.27           | 48.2         | 6.00           |

### 3.9. Tissue equivalent liquid properties

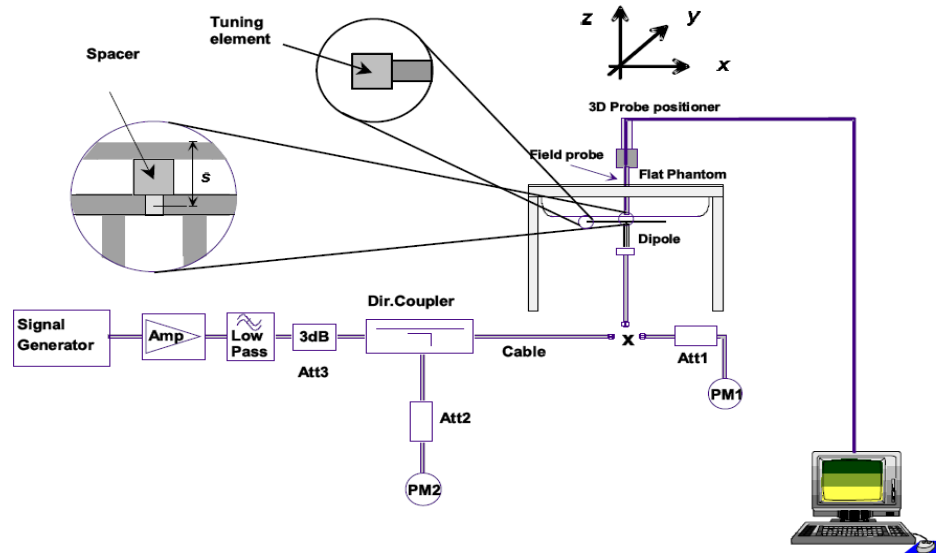
Dielectric Performance of Head and Body Tissue Simulating Liquid

| Tissue Type | Measured Frequency (MHz) | Target Tissue |              | Measured Tissue |        |              |        | Liquid Temp. | Test Data  |
|-------------|--------------------------|---------------|--------------|-----------------|--------|--------------|--------|--------------|------------|
|             |                          | $\sigma$      | $\epsilon_r$ | $\sigma$        | Dev.   | $\epsilon_r$ | Dev.   |              |            |
| 835B        | 835                      | 0.97          | 55.20        | 0.98            | 1.03%  | 54.65        | -1.00% | 20.6         | 10/08/2018 |
| 1900B       | 1800                     | 1.52          | 53.30        | 1.49            | -1.97% | 53.72        | 0.79%  | 21.3         | 10/15/2018 |

### 3.10. System Check

The purpose of the system check is to verify that the system operates within its specifications at the device test frequency. The system check is a simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ).



The output power on dipole port must be calibrated to 20 dBm (100mW) before dipole is connected.



Photo of Dipole Setup

**Justification for Extended SAR Dipole Calibrations**

Referring to KDB 865664D01V01r04, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended. While calibration intervals not exceed 3 years.

**SID835 SN 07/14 DIP 0G835-303 Extend Dipole Calibrations**

| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
|---------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 2018-10-01          | -24.49           |           | 54.9                 |             | 2.8                       |             |

**SID1900 SN 30/14 DIP 1G900-333 Extend Dipole Calibrations**

| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
|---------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 2018-09-01          | -22.98           |           | 50.9                 |             | 6.7                       |             |

| Mixture Type | Frequency (MHz) | Power               | SAR <sub>1g</sub> (W/Kg) | SAR <sub>10g</sub> (W/Kg) | Drift (%) | 1W Target                |                           | Difference percentage |        | Liquid Temp | Date       |
|--------------|-----------------|---------------------|--------------------------|---------------------------|-----------|--------------------------|---------------------------|-----------------------|--------|-------------|------------|
|              |                 |                     |                          |                           |           | SAR <sub>1g</sub> (W/Kg) | SAR <sub>10g</sub> (W/Kg) | 1g                    | 10g    |             |            |
| Body         | 835             | 100 mW              | 0.977                    | 0.638                     | -0.52     | 9.90                     | 6.39                      | -1.31%                | -0.16% | 20.6        | 10/08/2018 |
|              |                 | Normalize to 1 Watt | 9.77                     | 6.38                      |           |                          |                           |                       |        |             |            |
| Body         | 1900            | 100 mW              | 4.114                    | 2.056                     | 1.38      | 43.33                    | 21.59                     | -5.05%                | -4.77% | 21.3        | 10/15/2018 |
|              |                 | Normalize to 1 Watt | 41.14                    | 20.56                     |           |                          |                           |                       |        |             |            |

### 3.11. SAR measurement procedure

The measurement procedures are as follows:

#### 3.11.1 Conducted power measurement

- For WWAN power measurement, use base station simulator connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- Read the WWAN RF power level from the base station simulator.
- For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously Transmission, at maximum RF power in each supported wireless interface and frequency band.
- Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power.

#### 3.11.2 GSM Test Configuration

SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. Using CMU200 the power level is set to "5" for GSM 850, set to "0" for GSM 1900. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslots is 5. the EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslots is 5.

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. GSM voice and GPRS data use GMSK, which is a constant amplitude modulation with minimal peak to average power difference within the time-slot burst. For EDGE, GMSK is used for MCS 1 – MCS 4 and 8-PSK is used for MCS 5 – MCS 9; where 8-PSK has an inherently higher peak-to-average power ratio. The GMSK and 8-PSK EDGE configurations are considered separately for SAR compliance. The GMSK EDGE configurations are grouped with GPRS and considered with respect to time-averaged maximum output power to determine compliance. The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode.

#### 3.11.3 UMTS Test Configuration

##### 3G SAR Test Reduction Procedure

In the following procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is  $\leq \frac{1}{4}$  dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as "otherwise" in the applicable procedures; SAR measurement is required for the secondary mode.

#### Output power Verification

Maximum output power is verified on the high, middle and low channels according to procedures described in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all "1's" for WCDMA/HSDPA or by applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCH and spreading codes, HSDPA, HSPA) are required in the SAR report. All configurations that are not supported by the handset or cannot be measured due to technical or equipment limitations must be clearly identified.

#### Head SAR

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

#### 1) Body-Worn Accessory SAR

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all '1's'. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or DPDCHn, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 DPDCHn are supported by the handset, it may be necessary to configure additional DPDCHn using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

## 2) Handsets with Release 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures in the "Release 5 HSDPA Data Devices" section of this document, for the highest reported SAR body-worn accessory exposure configuration in 12.2 kbps RMC. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

HSDPA should be configured according to the UE category of a test device. The number of HSDSCH/ HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors ( $\beta_c$ ,  $\beta_d$ ), and HS-DPCCH power offset parameters ( $\Delta_{ACK}$ ,  $\Delta_{NACK}$ ,  $\Delta_{CQI}$ ) should be set according to values indicated in the Table below. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set

**Table 2: Subtests for UMTS Release 5 HSDPA**

| Sub-set | $\beta_c$         | $\beta_d$         | $\beta_d$<br>(SF) | $\beta_c/\beta_d$ | $\beta_{hs}$<br>(note 1, note 2) | CM(dB)<br>(note 3) | MPR(dB) |
|---------|-------------------|-------------------|-------------------|-------------------|----------------------------------|--------------------|---------|
| 1       | 2/15              | 15/15             | 64                | 2/15              | 4/15                             | 0.0                | 0.0     |
| 2       | 12/15<br>(note 4) | 15/15<br>(note 4) | 64                | 12/15<br>(note 4) | 24/15                            | 1.0                | 0.0     |
| 3       | 15/15             | 8/15              | 64                | 15/8              | 30/15                            | 1.5                | 0.5     |
| 4       | 15/15             | 4/15              | 64                | 15/4              | 30/15                            | 1.5                | 0.5     |

Note1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$   
Note2: CM=1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ .  
Note3: For subtest 2 the  $\beta_c/\beta_d$  ratio of 12/15 for the TFC during the measurement period(TF1,TF0) is achieved by setting the signaled gain factors for the reference TFC (TFC1,TF1) to  $\beta_c=11/15$  and  $\beta_d=15/15$ .

## HSUPA Test Configuration

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures in the "Release 6 HSPA Data Devices" section of this document, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When VOIP is applicable for next to the ear head exposure in HSPA, the 3G SAR test reduction procedure is applied to HSPA with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body-worn accessory measurements is tested for next to the ear head exposure.

Due to inner loop power control requirements in HSPA, a communication test set is required for output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA are configured according to the  $\beta$  values indicated in Table 2 and other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of this document

**Table 3: Sub-Test 5 Setup for Release 6 HSUPA**

| Sub-set | $\beta_c$            | $\beta_d$            | $\beta_d$<br>(SF) | $\beta_c/\beta_d$    | $\beta_{hs}^{(1)}$ | $\beta_{ec}$ | $\beta_{ed}$                               | $\beta_{ed}$<br>(SF) | $\beta_{ed}$<br>(codes) | CM <sup>(2)</sup><br>(dB) | MPR<br>(dB) | AG <sup>(4)</sup><br>Index | E-TFCI |
|---------|----------------------|----------------------|-------------------|----------------------|--------------------|--------------|--------------------------------------------|----------------------|-------------------------|---------------------------|-------------|----------------------------|--------|
| 1       | 11/15 <sup>(3)</sup> | 15/15 <sup>(3)</sup> | 64                | 11/15 <sup>(3)</sup> | 22/15              | 209/225      | 1039/225                                   | 4                    | 1                       | 1.0                       | 0.0         | 20                         | 75     |
| 2       | 6/15                 | 15/15                | 64                | 6/15                 | 12/15              | 12/15        | 94/75                                      | 4                    | 1                       | 3.0                       | 2.0         | 12                         | 67     |
| 3       | 15/15                | 9/15                 | 64                | 15/9                 | 30/15              | 30/15        | $\beta_{ed1} 47/15$<br>$\beta_{ed2} 47/15$ | 4                    | 2                       | 2.0                       | 1.0         | 15                         | 92     |
| 4       | 2/15                 | 15/15                | 64                | 2/15                 | 4/15               | 2/15         | 56/75                                      | 4                    | 1                       | 3.0                       | 2.0         | 17                         | 71     |
| 5       | 15/15 <sup>(4)</sup> | 15/15 <sup>(4)</sup> | 64                | 15/15 <sup>(4)</sup> | 30/15              | 24/15        | 134/15                                     | 4                    | 1                       | 1.0                       | 0.0         | 21                         | 81     |

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$ .

Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the  $\beta_c/\beta_d$  ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 10/15$  and  $\beta_d = 15/15$ .

Note 4: For subtest 5 the  $\beta_c/\beta_d$  ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 14/15$  and  $\beta_d = 15/15$ .

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Figure 5.1g.

Note 6:  $\beta_d$  can not be set directly; it is set by Absolute Grant Value.

### 3.12. Power Reduction

The product without any power reduction.

### 3.13. Power Drift

To control the output power stability during the SAR test, SAR system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. This ensures that the power drift during one measurement is within 5%.

## 4. TEST CONDITIONS AND RESULTS

### 4.1. Conducted Power Results

According KDB 447498 D01 General RF Exposure Guidance v06 Section 4.1 2) states that “Unless it is specified differently in the published RF exposure KDB procedures, these requirements also apply to test reduction and test exclusion considerations. Time-averaged maximum conducted output power applies to SAR and, as required by § 2.1091(c), time-averaged ERP applies to MPE. When an antenna port is not available on the device to support conducted power measurement, such as FRS and certain Part 15 transmitters with built-in integral antennas, the maximum output power allowed for production units should be used to determine RF exposure test exclusion and compliance.”

#### <GSM Conducted Power>

General Note:

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.

#### Conducted power measurement results for GSM850/PCS1900

<SIM1>

| GSM 850  | Tune-up | Burst Conducted power (dBm) |           |            | Division Factors | Tune-up | Average power (dBm)    |           |            |
|----------|---------|-----------------------------|-----------|------------|------------------|---------|------------------------|-----------|------------|
|          | Max     | Channel/Frequency(MHz)      |           |            |                  | Max     | Channel/Frequency(MHz) |           |            |
|          |         | 128/824.2                   | 190/836.6 | 251/848.8  |                  |         | 128/824.2              | 190/836.6 | 251/848.8  |
| GSM      | 32.50   | 32.37                       | 32.48     | 32.42      | -9.03dB          | 23.47   | 23.34                  | 23.45     | 23.39      |
| GSM 1900 | Tune-up | Burst Conducted power (dBm) |           |            | Division Factors | Tune-up | Average power (dBm)    |           |            |
|          | Max     | Channel/Frequency(MHz)      |           |            |                  | Max.    | Channel/Frequency(MHz) |           |            |
|          |         | 512/1850.2                  | 661/1880  | 810/1909.8 |                  |         | 512/1850.2             | 661/1880  | 810/1909.8 |
| GSM      | 29.50   | 29.44                       | 29.47     | 29.41      | -9.03dB          | 20.47   | 20.41                  | 20.44     | 20.38      |

Note: This all EUTs owns two SIM cards, after we perform the pretest for these two SIM card;we found Two cards can't work at the same time and the SIM 1 is the worst case ,so its result is recorded in this report.

**<UMTS Conducted Power>**

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

**HSDPA Setup Configuration:**

- a. The EUT was connected to Base Station E5515C referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
  - i. Set Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters were set according to each
  - ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
  - iii. Set RMC 12.2Kbps + HSDPA mode.
  - iv. Set Cell Power = -86 dBm
  - v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
  - vi. Select HSDPA Uplink Parameters
  - vii. Set Delta ACK, Delta NACK and Delta CQI = 8
  - viii. Set Ack-Nack Repetition Factor to 3
  - ix. Set CQI Feedback Cycle (k) to 4 ms
  - x. Set CQI Repetition Factor to 2
  - xi. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.

**Table C.10.1.4:  $\beta$  values for transmitter characteristics tests with HS-DPCCH**

| Sub-test | $\beta_c$         | $\beta_d$         | $\beta_d$<br>(SF) | $\beta_c/\beta_d$ | $\beta_{HS}$<br>(Note 1,<br>Note 2) | CM (dB)<br>(Note 3) | MPR (dB)<br>(Note 3) |
|----------|-------------------|-------------------|-------------------|-------------------|-------------------------------------|---------------------|----------------------|
| 1        | 2/15              | 15/15             | 64                | 2/15              | 4/15                                | 0.0                 | 0.0                  |
| 2        | 12/15<br>(Note 4) | 15/15<br>(Note 4) | 64                | 12/15<br>(Note 4) | 24/15                               | 1.0                 | 0.0                  |
| 3        | 15/15             | 8/15              | 64                | 15/8              | 30/15                               | 1.5                 | 0.5                  |
| 4        | 15/15             | 4/15              | 64                | 15/4              | 30/15                               | 1.5                 | 0.5                  |

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 30/15$  with  $\beta_{HS} = 30/15 * \beta_c$ .

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA,  $\Delta_{ACK}$  and  $\Delta_{NACK} = 30/15$  with  $\beta_{HS} = 30/15 * \beta_c$ , and  $\Delta_{CQI} = 24/15$  with  $\beta_{HS} = 24/15 * \beta_c$ .

Note 3: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{HS}/\beta_c = 24/15$ . For all other combinations of DPDCCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the  $\beta_c/\beta_d$  ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 11/15$  and  $\beta_d = 15/15$ .

**Setup Configuration****HSUPA Setup Configuration:**

- a. The EUT was connected to Base Station R&S CMU200 referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting \* :
  - i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
  - ii. Set the Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
  - iii. Set Cell Power = -86 dBm
  - iv. Set Channel Type = 12.2k + HSPA
  - v. Set UE Target Power
  - vi. Power Ctrl Mode= Alternating bits
  - vii. Set and observe the E-TFCI
  - viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
- d. The transmitted maximum output power was recorded.

Table C.11.1.3:  $\beta$  values for transmitter characteristics tests with HS-DPCCH and E-DCH

| Sub-test | $\beta_c$         | $\beta_d$         | $\beta_d$ (SF) | $\beta_c/\beta_d$ | $\beta_{HS}$ (Note 1) | $\beta_{ec}$ | $\beta_{ed}$ (Note 5)<br>(Note 6)              | $\beta_{ed}$ (SF) | $\beta_{ed}$ (Codes) | CM (dB)<br>(Note 2) | MPR (dB)<br>(Note 2) | AG Index<br>(Note 6) | E-TFCI |
|----------|-------------------|-------------------|----------------|-------------------|-----------------------|--------------|------------------------------------------------|-------------------|----------------------|---------------------|----------------------|----------------------|--------|
| 1        | 11/15<br>(Note 3) | 15/15<br>(Note 3) | 64             | 11/15<br>(Note 3) | 22/15                 | 209/25       | 1309/225                                       | 4                 | 1                    | 1.0                 | 0.0                  | 20                   | 75     |
| 2        | 6/15              | 15/15             | 64             | 6/15              | 12/15                 | 12/15        | 94/75                                          | 4                 | 1                    | 3.0                 | 2.0                  | 12                   | 67     |
| 3        | 15/15             | 9/15              | 64             | 15/9              | 30/15                 | 30/15        | $\beta_{ed1}$ : 47/15<br>$\beta_{ed2}$ : 47/15 | 4<br>4            | 2                    | 2.0                 | 1.0                  | 15                   | 92     |
| 4        | 2/15              | 15/15             | 64             | 2/15              | 4/15                  | 2/15         | 56/75                                          | 4                 | 1                    | 3.0                 | 2.0                  | 17                   | 71     |
| 5        | 15/15<br>(Note 4) | 15/15<br>(Note 4) | 64             | 15/15<br>(Note 4) | 30/15                 | 24/15        | 134/15                                         | 4                 | 1                    | 1.0                 | 0.0                  | 21                   | 81     |

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 30/15$  with  $\beta_{HS} = 30/15 * \beta_c$ .

Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{HS}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the  $\beta_c/\beta_d$  ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 10/15$  and  $\beta_d = 15/15$ .

Note 4: For subtest 5 the  $\beta_c/\beta_d$  ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 14/15$  and  $\beta_d = 15/15$ .

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6:  $\beta_{ed}$  can not be set directly, it is set by Absolute Grant Value.

#### General Note

1. Per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If AMR 12.2kbps power is < 0.25dB higher than RMC 12.2kbps, SAR tests with AMR 12.2kbps can be excluded.
2. By design, AMR and HSDPA/HSUPA RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.
3. It is expected by the manufacturer that MPR for some HSDPA/HSUPA subtests may differ from the specification of 3GPP, according to the chipset implementation in this model. The implementation and expected deviation are detailed in tune-up procedure exhibit.

#### Conducted Power Measurement Results(WCDMA Band V, Band II)

| Item  | Band      | WCDMA Band V result (dBm) |                |                | WCDMA Band II result (dBm) |               |                 |
|-------|-----------|---------------------------|----------------|----------------|----------------------------|---------------|-----------------|
|       |           | Test Channel              |                |                | Test Channel               |               |                 |
|       |           | 4132/<br>826.4            | 4183/<br>836.6 | 4233/<br>846.6 | 9262/<br>1852.4            | 9400/<br>1880 | 9538/<br>1907.6 |
| RMC   | 12.2kbps  | 23.44                     | 23.79          | 23.05          | 23.51                      | 23.82         | 23.28           |
|       | 64kbps    | 22.70                     | 22.67          | 22.79          | 22.77                      | 22.79         | 22.73           |
|       | 144kbps   | 22.63                     | 22.62          | 22.75          | 22.74                      | 22.73         | 22.70           |
|       | 384kbps   | 22.57                     | 22.55          | 22.60          | 22.58                      | 22.55         | 22.55           |
| HSDPA | Subtest 1 | 22.36                     | 22.44          | 22.40          | 22.43                      | 22.50         | 22.42           |
|       | Subtest 2 | 22.12                     | 22.33          | 22.06          | 22.26                      | 22.24         | 22.11           |
|       | Subtest 3 | 22.02                     | 21.95          | 21.99          | 21.96                      | 22.19         | 22.10           |
|       | Subtest 4 | 21.90                     | 21.64          | 21.88          | 21.95                      | 22.18         | 21.74           |
| HSUPA | Subtest 1 | 22.51                     | 22.69          | 22.56          | 22.27                      | 22.45         | 22.32           |
|       | Subtest 2 | 22.37                     | 22.71          | 22.41          | 22.18                      | 22.19         | 22.17           |
|       | Subtest 3 | 22.23                     | 22.62          | 22.32          | 22.15                      | 22.18         | 22.20           |
|       | Subtest 4 | 22.18                     | 22.58          | 22.41          | 22.12                      | 22.16         | 22.30           |
|       | Subtest 5 | 22.21                     | 22.63          | 22.19          | 21.85                      | 21.89         | 22.23           |

**Note:**1. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is  $\leq 1/2$ dB higher than the primary mode (RMC12.2kbps) or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for the secondary mode.

2.This all EUTs owns two SIM cards, after we perform the pretest for these two SIM card;we found Two cards can't work at the same time and the SIM 1 is the worst case ,so its result is recorded in this report.

## 4.2. Manufacturing tolerance

### GSM Speech

| GSM 850 (GMSK) (Burst Average Power)  |             |             |             |
|---------------------------------------|-------------|-------------|-------------|
| Channel                               | Channel 128 | Channel 190 | Channel 251 |
| Target (dBm)                          | 31.5        | 31.5        | 31.5        |
| Tolerance $\pm$ (dB)                  | 1.0         | 1.0         | 1.0         |
| GSM 1900 (GMSK) (Burst Average Power) |             |             |             |
| Channel                               | Channel 512 | Channel 661 | Channel 810 |
| Target (dBm)                          | 28.5        | 28.5        | 28.5        |
| Tolerance $\pm$ (dB)                  | 1.0         | 1.0         | 1.0         |

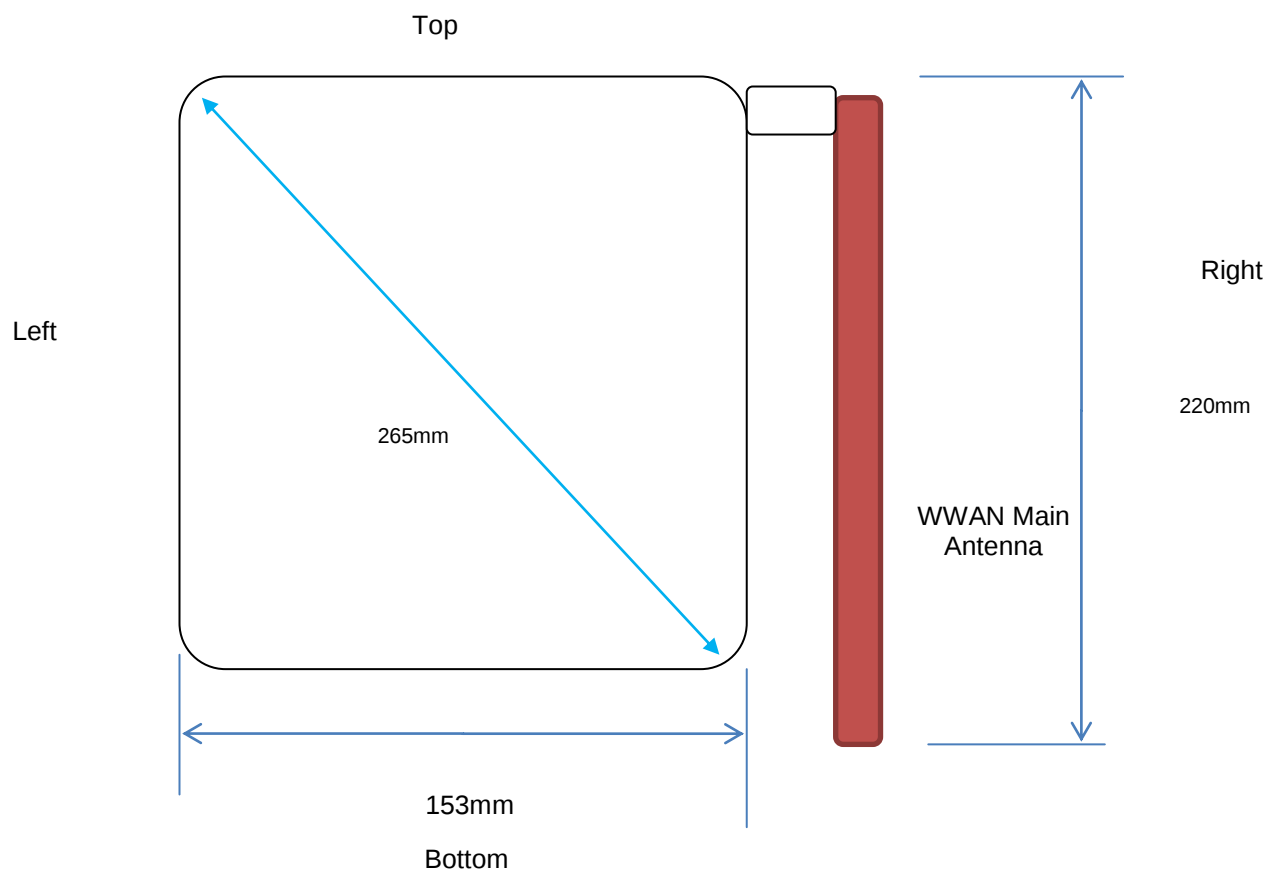
### UMTS

| UMTS Band V                   |              |              |              |
|-------------------------------|--------------|--------------|--------------|
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 23.0         | 23.0         | 23.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSDPA(sub-test 1) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSDPA(sub-test 2) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSDPA(sub-test 3) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 22.0         | 21.0         | 21.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSDPA(sub-test 4) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 21.0         | 21.0         | 21.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSUPA(sub-test 1) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSUPA(sub-test 2) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSUPA(sub-test 3) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSUPA(sub-test 4) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |
| UMTS Band V HSUPA(sub-test 5) |              |              |              |
| Channel                       | Channel 4132 | Channel 4183 | Channel 4233 |
| Target (dBm)                  | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)          | 1.0          | 1.0          | 1.0          |

| UMTS Band II                   |              |              |              |
|--------------------------------|--------------|--------------|--------------|
| Channel                        | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                   | 23.0         | 23.0         | 23.0         |
| Tolerance $\pm$ (dB)           | 1.0          | 1.0          | 1.0          |
| UMTS Band II HSDPA(sub-test 1) |              |              |              |

|                                       |              |              |              |
|---------------------------------------|--------------|--------------|--------------|
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |
| <b>UMTS Band II HSDPA(sub-test 2)</b> |              |              |              |
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |
| <b>UMTS Band II HSDPA(sub-test 3)</b> |              |              |              |
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 21.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |
| <b>UMTS Band II HSDPA(sub-test 4)</b> |              |              |              |
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 21.0         | 22.0         | 21.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |
| <b>UMTS Band II HSUPA(sub-test 1)</b> |              |              |              |
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |
| <b>UMTS Band II HSUPA(sub-test 2)</b> |              |              |              |
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |
| <b>UMTS Band II HSUPA(sub-test 3)</b> |              |              |              |
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |
| <b>UMTS Band II HSUPA(sub-test 4)</b> |              |              |              |
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 22.0         | 22.0         | 22.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |
| <b>UMTS Band II HSUPA(sub-test 5)</b> |              |              |              |
| Channel                               | Channel 9262 | Channel 9400 | Channel 9538 |
| Target (dBm)                          | 21.0         | 21.0         | 22.0         |
| Tolerance $\pm$ (dB)                  | 1.0          | 1.0          | 1.0          |

### 4.3. Transmit Antennas and SAR Measurement Position



### Front View

Antenna information:

|                   |                |
|-------------------|----------------|
| WWAN Main Antenna | GSM/UMTS TX/RX |
|-------------------|----------------|

Note:

- 1). Per KDB648474 D04, because the overall diagonal distance of this device is 265mm > 160mm, it is considered as "Phablet" device.
- 2). Per KDB648474 D04, 10-g extremity SAR is not required when Body-Worn mode 1-g reported SAR < 1.2 W/Kg.

#### 4.4. SAR Measurement Results

The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{\text{target}} - P_{\text{measured}})/10}$$

$$\text{Scaling factor} = 10^{(P_{\text{target}} - P_{\text{measured}})/10}$$

$$\text{Reported SAR} = \text{Measured SAR} \times \text{Scaling factor}$$

Where

$P_{\text{target}}$  is the power of manufacturing upper limit;

$P_{\text{measured}}$  is the measured power;

Measured SAR is measured SAR at measured power which including power drift)

Reported SAR which including Power Drift and Scaling factor

##### Duty Cycle

| Test Mode              | Duty Cycle |
|------------------------|------------|
| Speech for GSM850/1900 | 1:8        |
| UMTS                   | 1:1        |

#### 4.4.1 SAR Results

##### SAR Values [GSM 850]

| Ch.                                                          | Freq.<br>(MHz) | Time<br>slots | Test<br>Position | Conducted<br>Power<br>(dBm) | Maximum<br>Allowed<br>Power<br>(dBm) | Power<br>Drift<br>(%) | Scaling<br>Factor | SAR <sub>1-g</sub> results(W/kg) |              | Graph<br>Results |
|--------------------------------------------------------------|----------------|---------------|------------------|-----------------------------|--------------------------------------|-----------------------|-------------------|----------------------------------|--------------|------------------|
|                                                              |                |               |                  |                             |                                      |                       |                   | Measured                         | Reported     |                  |
| measured / reported SAR numbers - Body (distance 0mm) <SIM1> |                |               |                  |                             |                                      |                       |                   |                                  |              |                  |
| 190                                                          | 836.6          | Voice         | Horizontal-Up    | 32.48                       | 32.50                                | -2.38                 | 1.005             | 0.421                            | 0.423        |                  |
| 190                                                          | 836.6          | Voice         | Horizontal-Down  | 32.48                       | 32.50                                | -2.23                 | 1.005             | 0.759                            | 0.763        |                  |
| 190                                                          | 836.6          | Voice         | Horizontal-Right | 32.48                       | 32.50                                | -1.38                 | 1.005             | <b>0.920</b>                     | <b>0.924</b> | Plot 1           |
| 128                                                          | 824.2          | Voice         | Horizontal-Right | 32.37                       | 32.50                                | 1.02                  | 1.030             | 0.738                            | 0.760        |                  |
| 251                                                          | 848.8          | Voice         | Horizontal-Right | 32.42                       | 32.50                                | 2.97                  | 1.019             | 0.807                            | 0.822        |                  |
| 190                                                          | 836.6          | Voice         | Vertical-Up      | 32.48                       | 32.50                                | 0.05                  | 1.005             | 0.120                            | 0.121        |                  |
| 190                                                          | 836.6          | Voice         | Vertical-Down    | 32.48                       | 32.50                                | -1.64                 | 1.005             | 0.086                            | 0.086        |                  |
| 190                                                          | 836.6          | Voice         | Vertical-Top     | 32.48                       | 32.50                                | 2.17                  | 1.005             | 0.043                            | 0.043        |                  |
| 190                                                          | 836.6          | Voice         | Vertical-Bottom  | 32.48                       | 32.50                                | 3.82                  | 1.005             | 0.025                            | 0.025        |                  |

Remark:

1. The value with block color is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is  $\leq 0.8$  W/kg then testing at the other channels is optional for such test configuration(s).

##### SAR Values [GSM 1900]

| Ch.                                                   | Freq. (MHz) | time slots | Test Position    | Conducted Power (dBm) | Maximum Allowed Power (dBm) | Power Drift (%) | Scaling Factor | SAR <sub>1-g</sub> results(W/kg) |              | Graph Results |
|-------------------------------------------------------|-------------|------------|------------------|-----------------------|-----------------------------|-----------------|----------------|----------------------------------|--------------|---------------|
|                                                       |             |            |                  |                       |                             |                 |                | Measured                         | Reported     |               |
| measured / reported SAR numbers – Body (distance 0mm) |             |            |                  |                       |                             |                 |                |                                  |              |               |
| 661                                                   | 1880.0      | Voice      | Horizontal–Up    | 29.47                 | 29.50                       | 2.85            | 1.007          | 0.465                            | 0.468        |               |
| 661                                                   | 1880.0      | Voice      | Horizontal–Down  | 29.47                 | 29.50                       | 0.86            | 1.007          | 0.516                            | 0.520        |               |
| 661                                                   | 1880.0      | Voice      | Horizontal-Right | 29.47                 | 29.50                       | 1.43            | 1.007          | <b>0.799</b>                     | <b>0.805</b> | Plot 2        |
| 512                                                   | 1850.2      | Voice      | Horizontal-Right | 29.44                 | 29.50                       | 1.02            | 1.014          | 0.615                            | 0.624        |               |
| 810                                                   | 1909.8      | Voice      | Horizontal-Right | 29.41                 | 29.50                       | -2.84           | 1.021          | 0.577                            | 0.589        |               |
| 661                                                   | 1880.0      | Voice      | Vertical- Up     | 29.47                 | 29.50                       | -1.69           | 1.007          | 0.054                            | 0.054        |               |
| 661                                                   | 1880.0      | Voice      | Vertical-Down    | 29.47                 | 29.50                       | -0.21           | 1.007          | 0.048                            | 0.048        |               |
| 661                                                   | 1880.0      | Voice      | Vertical-Top     | 29.47                 | 29.50                       | 3.16            | 1.007          | 0.037                            | 0.037        |               |
| 661                                                   | 1880.0      | Voice      | Vertical-Bottom  | 29.47                 | 29.50                       | 2.95            | 1.007          | 0.024                            | 0.024        |               |

Remark:

1. The value with block color is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is  $\leq 0.8$  W/kg then testing at the other channels is optional for such test configuration(s).

**SAR Values [WCDMA Band V]**

| Ch.                                                   | Freq.<br>(MHz) | Channel<br>Type | Test<br>Position | Conducted<br>Power<br>(dBm) | Maximum<br>Allowed<br>Power<br>(dBm) | Power<br>Drift<br>(%) | Scaling<br>Factor | SAR <sub>1-g</sub> results(W/kg) |              | Graph<br>Results |
|-------------------------------------------------------|----------------|-----------------|------------------|-----------------------------|--------------------------------------|-----------------------|-------------------|----------------------------------|--------------|------------------|
|                                                       |                |                 |                  |                             |                                      |                       |                   | Measured                         | Reported     |                  |
| measured / reported SAR numbers - Body (distance 0mm) |                |                 |                  |                             |                                      |                       |                   |                                  |              |                  |
| 4183                                                  | 836.6          | RMC*            | Horizontal-Up    | 23.79                       | 24.00                                | -1.01                 | 1.050             | 0.522                            | 0.548        |                  |
| 4183                                                  | 836.6          | RMC*            | Horizontal-Down  | 23.79                       | 24.00                                | 0.08                  | 1.050             | 0.728                            | 0.764        |                  |
| 4183                                                  | 836.6          | RMC*            | Horizontal-Right | 23.79                       | 24.00                                | -1.24                 | 1.050             | <b>0.819</b>                     | <b>0.860</b> | <b>Plot 3</b>    |
| 4132                                                  | 826.4          | RMC*            | Horizontal-Right | 23.44                       | 24.00                                | 1.04                  | 1.138             | 0.673                            | 0.766        |                  |
| 4233                                                  | 846.6          | RMC*            | Horizontal-Right | 23.05                       | 24.00                                | 3.02                  | 1.245             | 0.724                            | 0.901        |                  |
| 4183                                                  | 836.6          | RMC*            | Vertical-Up      | 23.79                       | 24.00                                | -3.70                 | 1.050             | 0.120                            | 0.126        |                  |
| 4183                                                  | 836.6          | RMC*            | Vertical-Down    | 23.79                       | 24.00                                | -2.40                 | 1.050             | 0.076                            | 0.080        |                  |
| 4183                                                  | 836.6          | RMC*            | Vertical-Top     | 23.79                       | 24.00                                | 2.00                  | 1.050             | 0.042                            | 0.044        |                  |
| 4183                                                  | 836.6          | RMC*            | Vertical-Bottom  | 23.79                       | 24.00                                | -1.22                 | 1.050             | 0.022                            | 0.023        |                  |

Remark:

1. The value with block color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is  $\leq 0.8$  W/kg then testing at the other channels is optional for such test configuration(s).
3. RMC\* - RMC 12.2kbps mode;

**SAR Values [WCDMA Band II]**

| Ch.                                                   | Freq.<br>(MHz) | Channel<br>Type | Test<br>Position | Condu<br>cted<br>Power<br>(dBm) | Maximum<br>Allowed<br>Power<br>(dBm) | Power<br>Drift<br>(%) | Scaling<br>Factor | SAR <sub>1-g</sub> results(W/kg) |              | Graph<br>Results |
|-------------------------------------------------------|----------------|-----------------|------------------|---------------------------------|--------------------------------------|-----------------------|-------------------|----------------------------------|--------------|------------------|
|                                                       |                |                 |                  |                                 |                                      |                       |                   | Measured                         | Reported     |                  |
| measured / reported SAR numbers - Body (distance 0mm) |                |                 |                  |                                 |                                      |                       |                   |                                  |              |                  |
| 9400                                                  | 1880.0         | RMC*            | Horizontal-Up    | 23.82                           | 24.00                                | 0.31                  | 1.042             | 0.705                            | 0.735        |                  |
| 9400                                                  | 1880.0         | RMC*            | Horizontal-Down  | 23.82                           | 24.00                                | 3.22                  | 1.042             | 1.119                            | 1.166        |                  |
| 9262                                                  | 1852.4         | RMC*            | Horizontal-Down  | 23.51                           | 24.00                                | -0.64                 | 1.119             | 0.843                            | 0.944        |                  |
| 9538                                                  | 1907.6         | RMC*            | Horizontal-Down  | 23.28                           | 24.00                                | -2.14                 | 1.180             | 0.916                            | 1.081        |                  |
| 9400                                                  | 1880.0         | RMC*            | Horizontal-Right | 23.82                           | 24.00                                | -1.02                 | 1.042             | <b>1.126</b>                     | <b>1.174</b> | Plot 4           |
| 9262                                                  | 1852.4         | RMC*            | Horizontal-Right | 23.51                           | 24.00                                | -0.20                 | 1.119             | 1.053                            | 1.179        |                  |
| 9538                                                  | 1907.6         | RMC*            | Horizontal-Right | 23.28                           | 24.00                                | -3.40                 | 1.180             | 0.957                            | 1.130        |                  |
| 9400                                                  | 1880.0         | RMC*            | Vertical-Up      | 23.82                           | 24.00                                | 2.11                  | 1.042             | 0.193                            | 0.201        |                  |
| 9400                                                  | 1880.0         | RMC*            | Vertical-Down    | 23.82                           | 24.00                                | 0.73                  | 1.042             | 0.104                            | 0.108        |                  |
| 9400                                                  | 1880.0         | RMC*            | Vertical-Top     | 23.82                           | 24.00                                | 1.54                  | 1.042             | 0.061                            | 0.064        |                  |
| 9400                                                  | 1880.0         | RMC*            | Vertical-Bottom  | 23.82                           | 24.00                                | 0.00                  | 1.042             | 0.043                            | 0.045        |                  |

Remark:

1. The value with block color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is  $\leq 0.8$  W/kg then testing at the other channels is optional for such test configuration(s).
3. RMC\* - RMC 12.2kbps mode;

## 4.5. SAR Measurement Variability

### Introduction

According to KDB865664, Repeated measurements are required only when the measured SAR is  $\geq 0.80$  W/kg. If the measured SAR value of the initial repeated measurement is  $< 1.45$  W/kg with  $\leq 20\%$  variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required. The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.<sup>19</sup> The repeated measurement results must be clearly identified in the SAR report. All measured SAR, including the repeated results, must be considered to determine compliance and for reporting according to KDB 690783. Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  W/kg; steps 2) through 4) do not apply.

- 3) When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
- 4) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  W/kg ( $\sim 10\%$  from the 1-g SAR limit).
- 5) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .
- 6) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

| Frequency Band (MHz) | Air Interface | RF Exposure Configuration | Test Position     | Repeated SAR (yes/no) | Highest Measured SAR <sub>1-g</sub> (W/kg) | First Repeated                     |                               |
|----------------------|---------------|---------------------------|-------------------|-----------------------|--------------------------------------------|------------------------------------|-------------------------------|
|                      |               |                           |                   |                       |                                            | Measured SAR <sub>1-g</sub> (W/Kg) | Largest to Smallest SAR Ratio |
| 850                  | GSM850        | Standalone                | Horizontal -Right | no                    | 0.920                                      | 0.793                              | 1.160                         |
|                      | WCDMA Band V  | Standalone                | Horizontal -Right | no                    | 0.819                                      | 0.763                              | 1.073                         |
| 1900                 | GSM1900       | Standalone                | Horizontal -Right | no                    | 0.799                                      | n/a                                | n/a                           |
|                      | WCDMA Band II | Standalone                | Horizontal -Right | no                    | 1.126                                      | 1.012                              | 1.113                         |

Remark:

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not  $> 1.20$  or 3 (1-g or 10-g respectively)

### 4.6. General description of test procedures

1. The DUT is tested using CMU 200 communications testers as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted peak power.
2. Test positions as described in the tables above are in accordance with the specified test standard.
3. Tests in body position were performed in that configuration, which generates the highest time based averaged output power (see conducted power results).
4. UMTS was tested in RMC mode with 12.2 kbit/s and TPC bits set to 'all 1'.
5. According to FCC KDB pub 248227 D01, When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement and when there are multiple test channels with the same measured maximum output power and equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.
6. According to IEEE 1528 the SAR test shall be performed at middle channel. Testing of top and bottom channel is optional.
7. According to KDB 447498 D01 testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
  - $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
  - $\leq 0.6$  W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
  - $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz
8. IEEE 1528-2013 require the middle channel to be tested first. This generally applies to wireless devices that are designed to operate in technologies with tight tolerances for maximum output power variations across channels in the band.

9. Per KDB648474 D04 require when the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is  $< 1.2$  W/kg.

#### **4.7. Measurement Uncertainty (450MHz-6GHz)**

Not required as SAR measurement uncertainty analysis is required in SAR reports only when the highest measured SAR in a frequency band is  $\geq 1.5$  W/kg for 1-g SAR according to KDB865664D01.

## 4.8. System Check Results

Test mode:835MHz(Body)

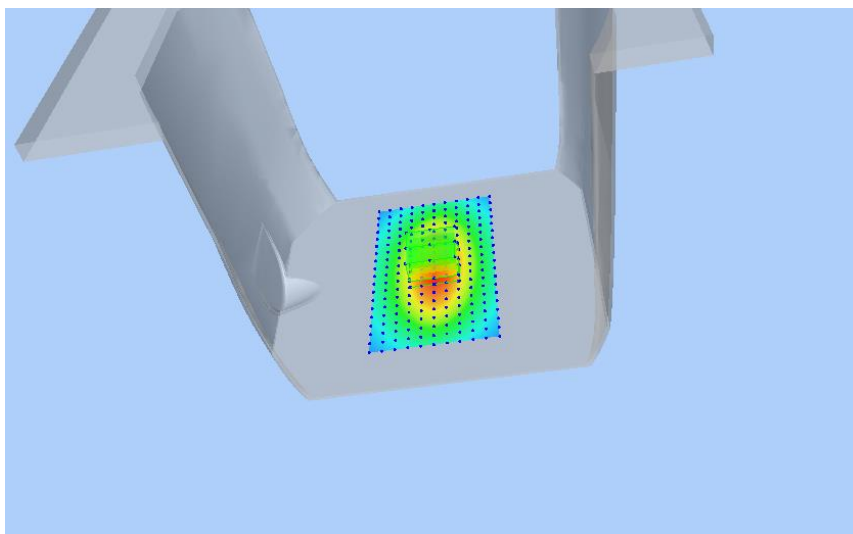
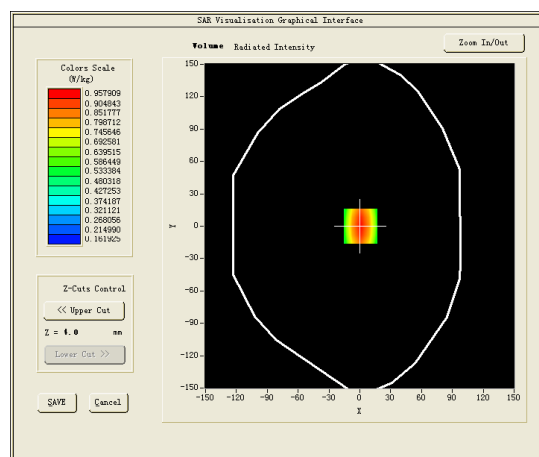
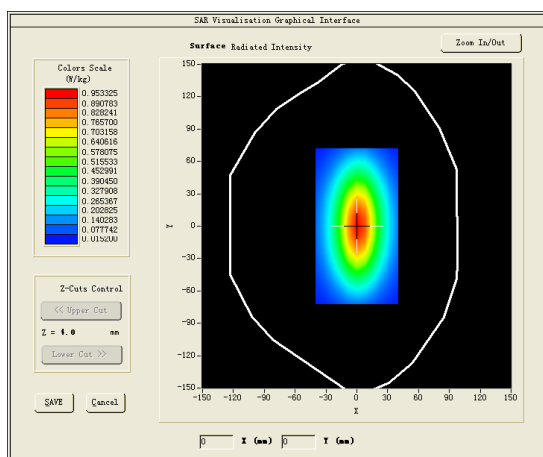
Product Description:Validation

Model:Dipole SID835

E-Field Probe:SSE2(SN 45/15 EPGO281)

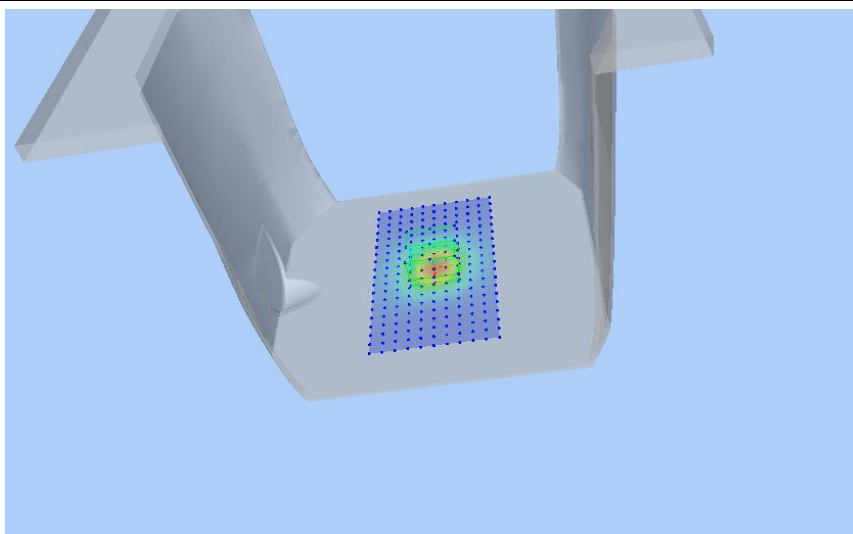
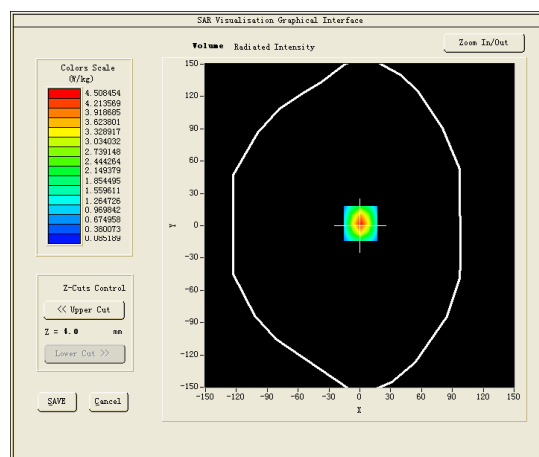
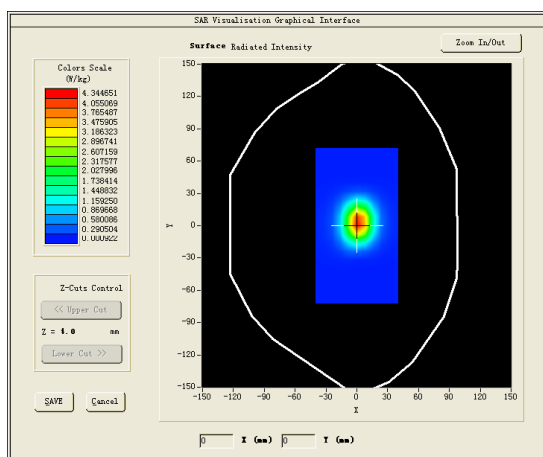
Test Date: October 08, 2018

|                                   |                   |
|-----------------------------------|-------------------|
| Medium(liquid type)               | MSL_850           |
| Frequency (MHz)                   | 835.000000        |
| Relative permittivity (real part) | 54.65             |
| Conductivity (S/m)                | 0.98              |
| Input power                       | 100mW             |
| Crest Factor                      | 1.0               |
| Conversion Factor                 | 1.85              |
| Variation (%)                     | -0.520000         |
| SAR 10g (W/Kg)                    | 0.638254          |
| SAR 1g (W/Kg)                     | 0.977215          |
| <b>SURFACE SAR</b>                | <b>VOLUME SAR</b> |



Test mode:1900MHz(Body)  
 Product Description:Validation  
 Model :Dipole SID1900  
 E-Field Probe: SSE2(SN 45/15 EPGO281)  
 Test Date: October 15, 2018

|                                   |                   |
|-----------------------------------|-------------------|
| Medium(liquid type)               | MSL_1900          |
| Frequency (MHz)                   | 1900.000000       |
| Relative permittivity (real part) | 53.72             |
| Conductivity (S/m)                | 1.49              |
| Input power                       | 100mW             |
| Crest Factor                      | 1.0               |
| Conversion Factor                 | 2.16              |
| Variation (%)                     | 1.380000          |
| SAR 10g (W/Kg)                    | 2.056251          |
| SAR 1g (W/Kg)                     | 4.114582          |
| <b>SURFACE SAR</b>                | <b>VOLUME SAR</b> |



#### 4.10 SAR Test Graph Results

SAR plots for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02;

#1

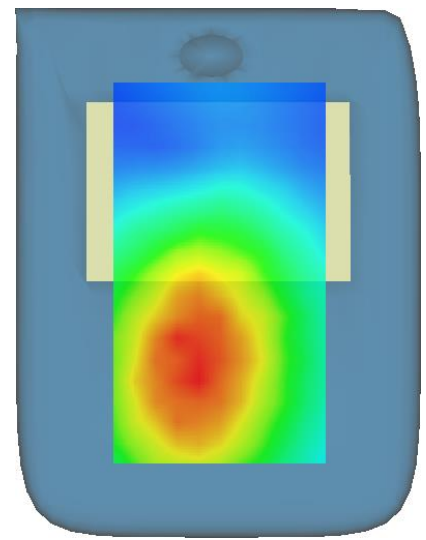
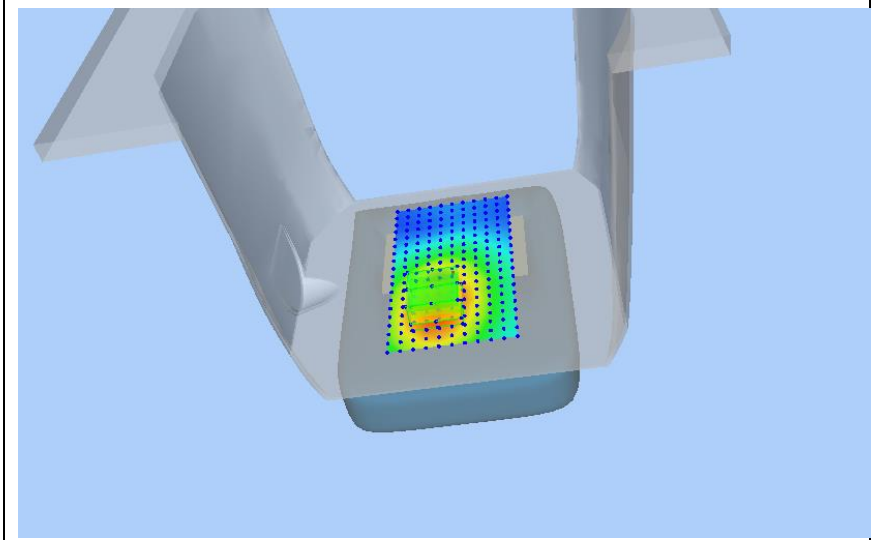
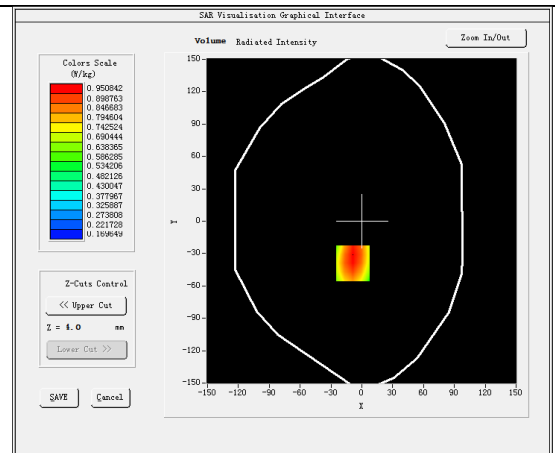
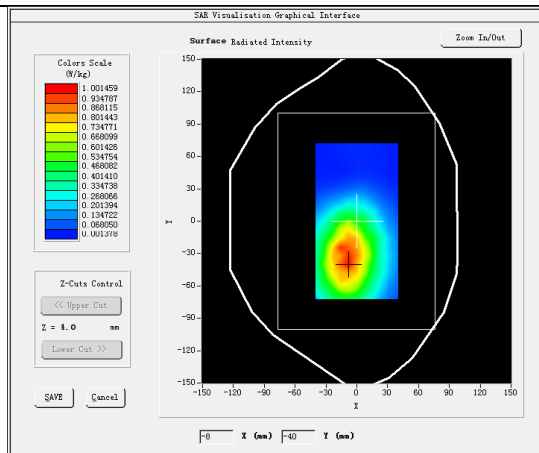
Test Mode: GSM850MHz,Middle channel(Body Horizontal-Right Side)

Product Description: fixed wireless phone

Model: DP05

Test Date: October 08, 2018

|                                   |                            |
|-----------------------------------|----------------------------|
| Medium(liquid type)               | MSL_850                    |
| Frequency (MHz)                   | 836.600000                 |
| Relative permittivity (real part) | 54.65                      |
| Conductivity (S/m)                | 0.98                       |
| E-Field Probe                     | SN 45/15 EPGO281           |
| Crest Factor                      | 8.0                        |
| Conversion Factor                 | 1.85                       |
| Sensor                            | 4mm                        |
| Area Scan                         | dx=8mm dy=8mm              |
| Zoom Scan                         | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Variation (%)                     | -1.380000                  |
| SAR 10g (W/Kg)                    | 0.625385                   |
| SAR 1g (W/Kg)                     | 0.919765                   |
| SURFACE SAR                       | VOLUME SAR                 |



## #2

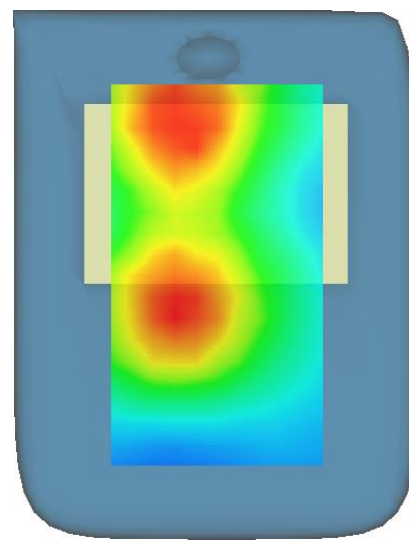
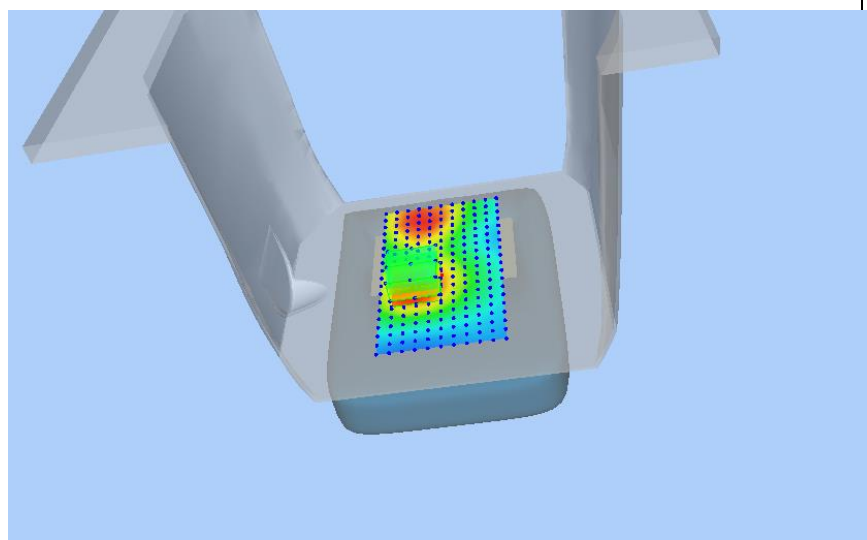
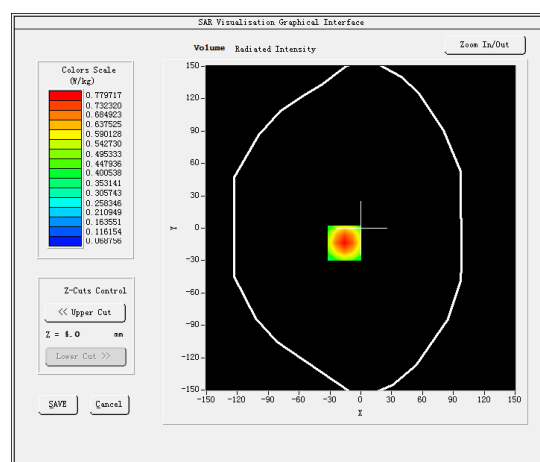
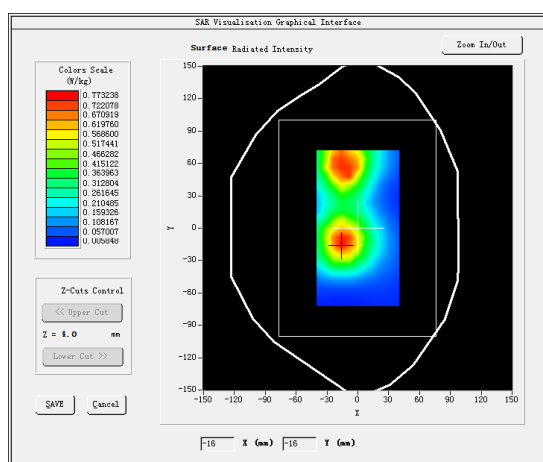
Test Mode: GSM 1900MHz,Middle channel(Body Horizontal-Right Side)

Product Description: fixed wireless phone

Model: DP05

Test Date: October 15, 2018

|                                   |                            |
|-----------------------------------|----------------------------|
| Medium(liquid type)               | MSL_1900                   |
| Frequency (MHz)                   | 1880.000000                |
| Relative permittivity (real part) | 53.72                      |
| Conductivity (S/m)                | 1.49                       |
| E-Field Probe                     | SN 45/15 EPGO281           |
| Crest Factor                      | 8.0                        |
| Conversion Factor                 | 2.16                       |
| Sensor                            | 4mm                        |
| Area Scan                         | dx=8mm dy=8mm              |
| Zoom Scan                         | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Variation (%)                     | 1.430000                   |
| SAR 10g (W/Kg)                    | 0.481889                   |
| SAR 1g (W/Kg)                     | 0.799206                   |
| <b>SURFACE SAR</b>                | <b>VOLUME SAR</b>          |



## #3

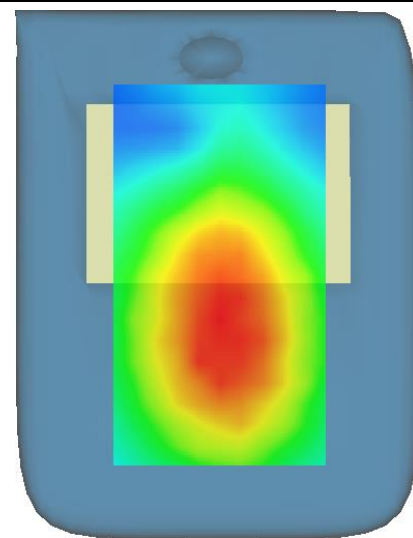
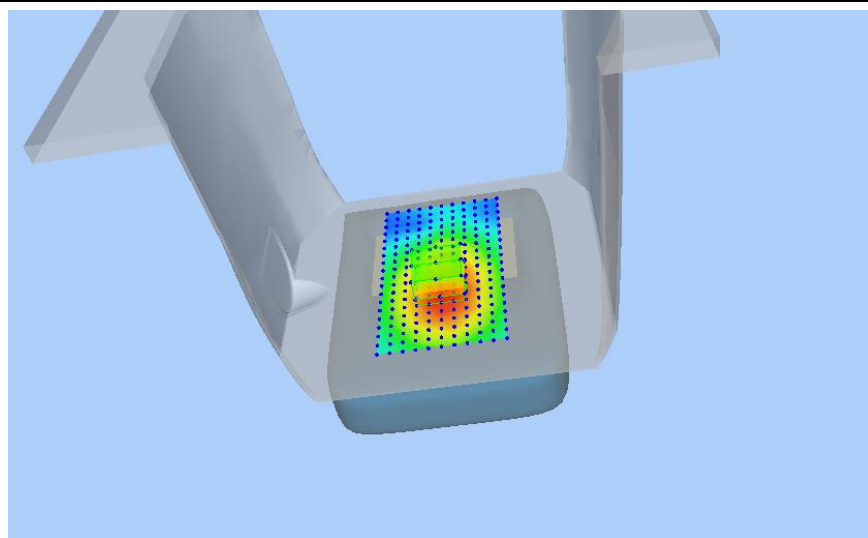
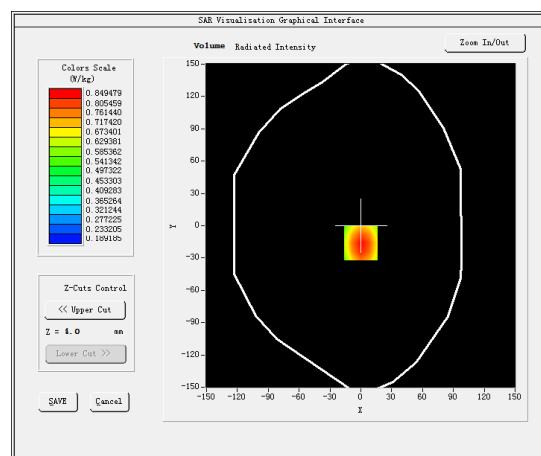
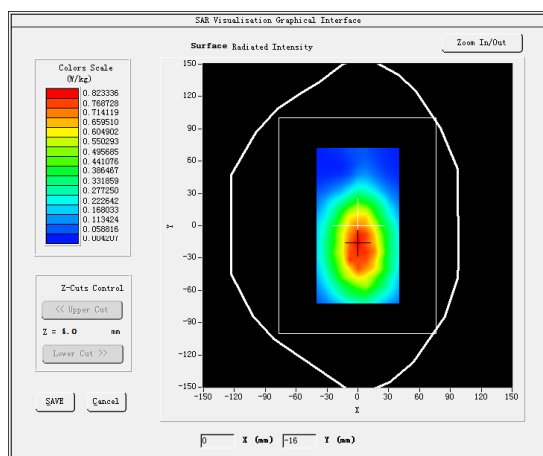
Test Mode: WCDMA Band V,Middle channel(Body Horizontal-Right Side)

Product Description: fixed wireless phone

Model: DP05

Test Date: October 08, 2018

|                                   |                            |
|-----------------------------------|----------------------------|
| Medium(liquid type)               | MSL_850                    |
| Frequency (MHz)                   | 836.600000                 |
| Relative permittivity (real part) | 54.65                      |
| Conductivity (S/m)                | 0.98                       |
| E-Field Probe                     | SN 45/15 EPGO281           |
| Crest Factor                      | 1.0                        |
| Conversion Factor                 | 1.85                       |
| Sensor                            | 4mm                        |
| Area Scan                         | dx=8mm dy=8mm              |
| Zoom Scan                         | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Variation (%)                     | -1.240000                  |
| SAR 10g (W/Kg)                    | 0.568546                   |
| SAR 1g (W/Kg)                     | 0.819082                   |
| <b>SURFACE SAR</b>                | <b>VOLUME SAR</b>          |



## #4

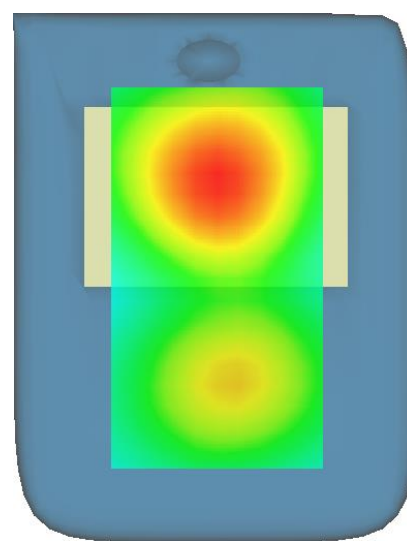
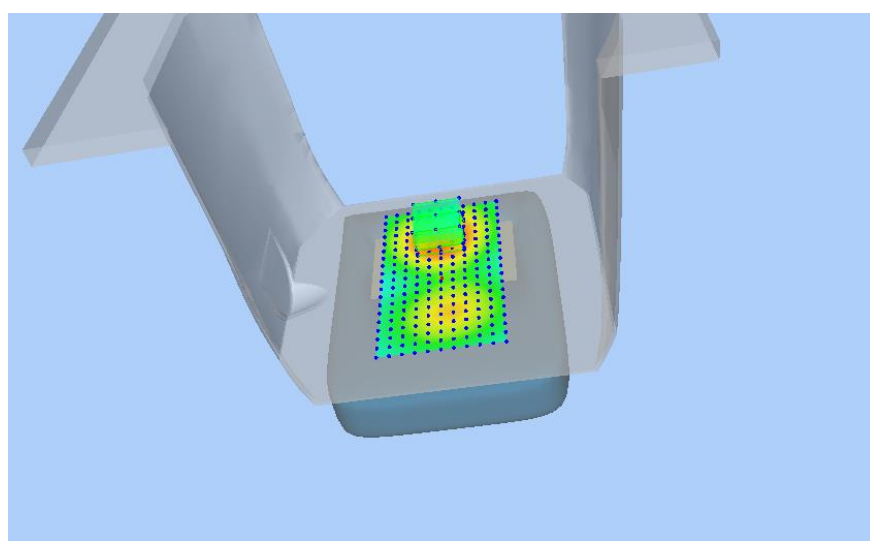
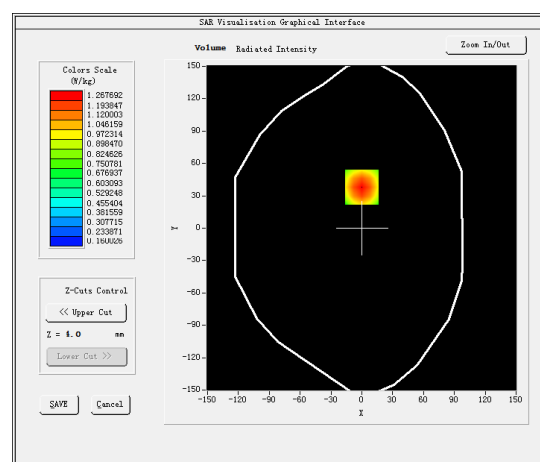
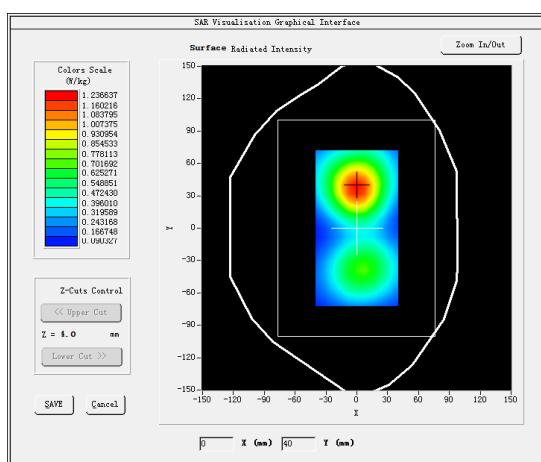
Test Mode: WCDMA Band II,Middle channel(Body Horizontal-Right Side)

Product Description: fixed wireless phone

Model: DP05

Test Date: October 15, 2018

|                                   |                            |
|-----------------------------------|----------------------------|
| Medium(liquid type)               | MSL_1900                   |
| Frequency (MHz)                   | 1880.000000                |
| Relative permittivity (real part) | 53.72                      |
| Conductivity (S/m)                | 1.49                       |
| E-Field Probe                     | SN 45/15 EPG0281           |
| Crest Factor                      | 1.0                        |
| Conversion Factor                 | 2.16                       |
| Sensor                            | 4mm                        |
| Area Scan                         | dx=8mm dy=8mm              |
| Zoom Scan                         | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Variation (%)                     | -1.020000                  |
| SAR 10g (W/Kg)                    | 0.763513                   |
| SAR 1g (W/Kg)                     | 1.126315                   |
| <b>SURFACE SAR</b>                | <b>VOLUME SAR</b>          |



## 5. CALIBRATION CERTIFICATES

### 5.1 Probe-EPGO281 Calibration Certificate



## COMOSAR E-Field Probe Calibration Report

Ref : ACR.348.1.15.SATU.A

**SHENZHEN STS TEST SERVICES CO., LTD.**  
**1/F., BUILDING B, ZHUOKE SCIENCE PARK, No.190,**  
**CHONGQING ROAD, FUYONG STREET**  
**BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA**  
**MVG COMOSAR DOSIMETRIC E-FIELD PROBE**  
**SERIAL NO.: SN 45/15 EPGO281**

**Calibrated at MVG US**  
**2105 Barrett Park Dr. - Kennesaw, GA 30144**



**Calibration Date: 02/04/2018**

#### *Summary:*

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in MVG USA using the CALISAR / CALIBAIR test bench, for use with a COMOSAR system only. All calibration results are traceable to national metrology institutions.



## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.348.1.15.SATU.A

|                      | <i>Name</i>   | <i>Function</i> | <i>Date</i> | <i>Signature</i>     |
|----------------------|---------------|-----------------|-------------|----------------------|
| <i>Prepared by :</i> | Jérôme LUC    | Product Manager | 02/08/2018  | <i>JS</i>            |
| <i>Checked by :</i>  | Jérôme LUC    | Product Manager | 02/08/2018  | <i>JS</i>            |
| <i>Approved by :</i> | Kim RUTKOWSKI | Quality Manager | 02/08/2018  | <i>Kim Rutkowski</i> |

|                       | <i>Customer Name</i>                 |
|-----------------------|--------------------------------------|
| <i>Distribution :</i> | Shenzhen STS Test Services Co., Ltd. |

| <i>Issue</i> | <i>Date</i> | <i>Modifications</i> |
|--------------|-------------|----------------------|
| A            | 02/08/2018  | Initial release      |
|              |             |                      |
|              |             |                      |
|              |             |                      |

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.348.1.15.SATU.A

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.348.1.15.SATU.A

## 1 DEVICE UNDER TEST

| Device Under Test                        |                                                                         |
|------------------------------------------|-------------------------------------------------------------------------|
| Device Type                              | COMOSAR DOSIMETRIC E FIELD PROBE                                        |
| Manufacturer                             | MVG                                                                     |
| Model                                    | SSE2                                                                    |
| Serial Number                            | SN 45/15 EPGO281                                                        |
| Product Condition (new / used)           | New                                                                     |
| Frequency Range of Probe                 | 0.45 GHz-6GHz                                                           |
| Resistance of Three Dipoles at Connector | Dipole 1: R1=0.186 MΩ<br>Dipole 2: R2=0.194 MΩ<br>Dipole 3: R3=0.191 MΩ |

A yearly calibration interval is recommended.

## 2 PRODUCT DESCRIPTION

### 2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.



**Figure 1** – MVG COMOSAR Dosimetric E field Dipole

|                                            |        |
|--------------------------------------------|--------|
| Probe Length                               | 330 mm |
| Length of Individual Dipoles               | 2 mm   |
| Maximum external diameter                  | 8 mm   |
| Probe Tip External Diameter                | 2.5 mm |
| Distance between dipoles / probe extremity | 1 mm   |

## 3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

### 3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.348.1.15.SATU.A

### 3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

### 3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

### 3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

### 3.5 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

## 4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

| Uncertainty analysis of the probe calibration in waveguide |                       |                          |            |    |                          |
|------------------------------------------------------------|-----------------------|--------------------------|------------|----|--------------------------|
| ERROR SOURCES                                              | Uncertainty value (%) | Probability Distribution | Divisor    | ci | Standard Uncertainty (%) |
| Incident or forward power                                  | 3.00%                 | Rectangular              | $\sqrt{3}$ | 1  | 1.732%                   |
| Reflected power                                            | 3.00%                 | Rectangular              | $\sqrt{3}$ | 1  | 1.732%                   |
| Liquid conductivity                                        | 5.00%                 | Rectangular              | $\sqrt{3}$ | 1  | 2.887%                   |
| Liquid permittivity                                        | 4.00%                 | Rectangular              | $\sqrt{3}$ | 1  | 2.309%                   |
| Field homogeneity                                          | 3.00%                 | Rectangular              | $\sqrt{3}$ | 1  | 1.732%                   |
| Field probe positioning                                    | 5.00%                 | Rectangular              | $\sqrt{3}$ | 1  | 2.887%                   |

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.348.1.15.SATU.A

|                                                            |       |             |            |   |        |
|------------------------------------------------------------|-------|-------------|------------|---|--------|
| Field probe linearity                                      | 3.00% | Rectangular | $\sqrt{3}$ | 1 | 1.732% |
| <b>Combined standard uncertainty</b>                       |       |             |            |   | 5.831% |
| <b>Expanded uncertainty</b><br>95 % confidence level k = 2 |       |             |            |   | 12.0%  |

## 5 CALIBRATION MEASUREMENT RESULTS

| Calibration Parameters |       |
|------------------------|-------|
| Liquid Temperature     | 21 °C |
| Lab Temperature        | 21 °C |
| Lab Humidity           | 45 %  |

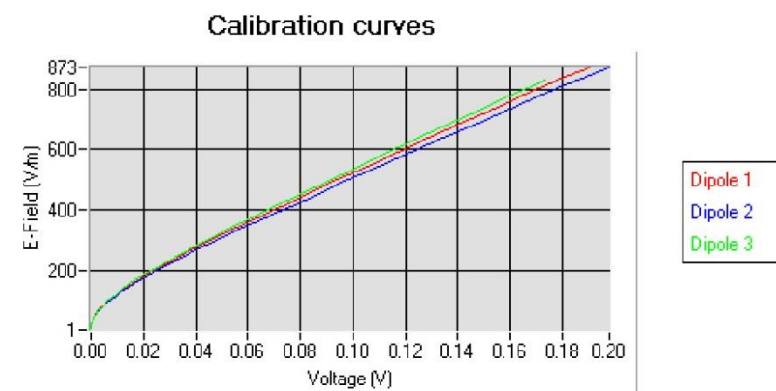
## 5.1 SENSITIVITY IN AIR

| Normx dipole<br>1 ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) | Normy dipole<br>2 ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) | Normz dipole<br>3 ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) |
|-----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|
| 0.77                                                      | 0.83                                                      | 0.67                                                      |

| DCP dipole 1<br>(mV) | DCP dipole 2<br>(mV) | DCP dipole 3<br>(mV) |
|----------------------|----------------------|----------------------|
| 91                   | 90                   | 95                   |

Calibration curves  $e_i=f(V)$  ( $i=1,2,3$ ) allow to obtain H-field value using the formula:

$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



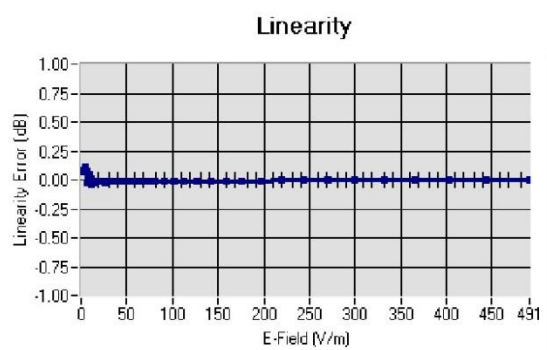
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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.348.1.15.SATU.A

5.2 LINEARITYLinearity:  $\pm 2.60\%$  ( $\pm 0.11$  dB)5.3 SENSITIVITY IN LIQUID

| Liquid | Frequency<br>(MHz $\pm$ 100MHz) | Permittivity | Epsilon (S/m) | ConvF |
|--------|---------------------------------|--------------|---------------|-------|
| HL450  | 450                             | 44.12        | 0.88          | 1.76  |
| BL450  | 450                             | 58.92        | 1.00          | 1.81  |
| HL750  | 750                             | 42.24        | 0.90          | 1.53  |
| BL750  | 750                             | 56.85        | 0.99          | 1.59  |
| HL850  | 835                             | 43.02        | 0.90          | 1.78  |
| BL850  | 835                             | 53.72        | 0.98          | 1.85  |
| HL900  | 900                             | 42.47        | 0.99          | 1.62  |
| BL900  | 900                             | 56.97        | 1.09          | 1.67  |
| HL1800 | 1800                            | 42.24        | 1.40          | 1.83  |
| BL1800 | 1800                            | 53.53        | 1.53          | 1.87  |
| HL1900 | 1900                            | 40.79        | 1.42          | 2.10  |
| BL1900 | 1900                            | 54.47        | 1.57          | 2.16  |
| HL2000 | 2000                            | 40.52        | 1.44          | 2.01  |
| BL2000 | 2000                            | 54.18        | 1.56          | 2.09  |
| HL2450 | 2450                            | 38.73        | 1.81          | 2.21  |
| BL2450 | 2450                            | 53.23        | 1.96          | 2.28  |
| HL2600 | 2600                            | 38.54        | 1.95          | 2.32  |
| BL2600 | 2600                            | 52.07        | 2.23          | 2.38  |
| HL5200 | 5200                            | 36.80        | 4.84          | 2.46  |
| BL5200 | 5200                            | 51.21        | 5.16          | 2.52  |
| HL5400 | 5400                            | 36.35        | 4.96          | 2.70  |
| BL5400 | 5400                            | 50.51        | 5.70          | 2.79  |
| HL5600 | 5600                            | 35.57        | 5.23          | 2.74  |
| BL5600 | 5600                            | 49.83        | 5.91          | 2.83  |
| HL5800 | 5800                            | 35.30        | 5.47          | 2.53  |
| BL5800 | 5800                            | 49.03        | 6.28          | 2.60  |

LOWER DETECTION LIMIT: 9mW/kg

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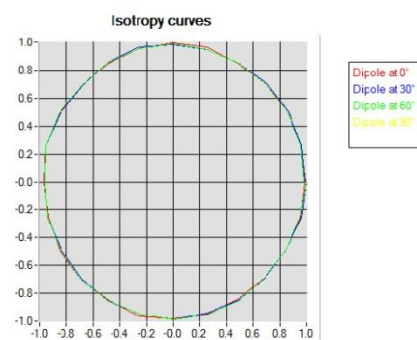
## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.348.1.15.SATU.A

#### 5.4 ISOTROPY

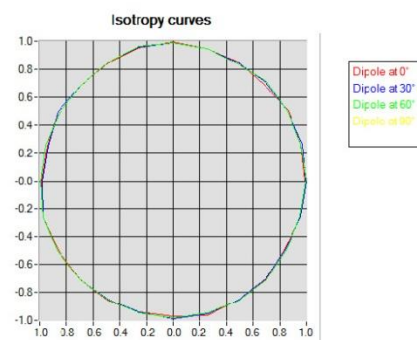
##### HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.06 dB



##### HL1800 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.08 dB



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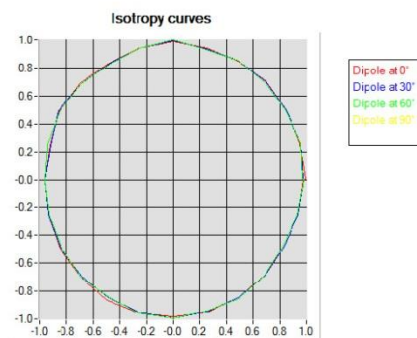


## COMOSAR E-FIELD PROBE CALIBRATION REPORT

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**HL5600 MHz**

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.08 dB



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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.348.1.15.SATU.A

## 6 LIST OF EQUIPMENT

| Equipment Summary Sheet       |                      |                    |                                               |                                               |
|-------------------------------|----------------------|--------------------|-----------------------------------------------|-----------------------------------------------|
| Equipment Description         | Manufacturer / Model | Identification No. | Current Calibration Date                      | Next Calibration Date                         |
| Flat Phantom                  | MVG                  | SN-20/09-SAM71     | Validated. No cal required.                   | Validated. No cal required.                   |
| COMOSAR Test Bench            | Version 3            | NA                 | Validated. No cal required.                   | Validated. No cal required.                   |
| Network Analyzer              | Rhode & Schwarz ZVA  | SN100132           | 02/2018                                       | 02/2021                                       |
| Reference Probe               | MVG                  | EP 94 SN 37/08     | 10/2017                                       | 10/2018                                       |
| Multimeter                    | Keithley 2000        | 1188656            | 12/2015                                       | 12/2018                                       |
| Signal Generator              | Agilent E4438C       | MY49070581         | 12/2015                                       | 12/2018                                       |
| Amplifier                     | Aethercomm           | SN 046             | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Power Meter                   | HP E4418A            | US38261498         | 12/2015                                       | 12/2018                                       |
| Power Sensor                  | HP ECP-E26A          | US37181460         | 12/2015                                       | 12/2018                                       |
| Directional Coupler           | Narda 4216-20        | 01386              | Characterized prior to test. No cal required. | Characterized prior to test. No cal required. |
| Waveguide                     | Mega Industries      | 069Y7-158-13-712   | Validated. No cal required.                   | Validated. No cal required.                   |
| Waveguide Transition          | Mega Industries      | 069Y7-158-13-701   | Validated. No cal required.                   | Validated. No cal required.                   |
| Waveguide Termination         | Mega Industries      | 069Y7-158-13-701   | Validated. No cal required.                   | Validated. No cal required.                   |
| Temperature / Humidity Sensor | Control Company      | 150798832          | 10/2016                                       | 10/2018                                       |

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## 5.2 SID835Dipole Calibration Certificate



### SAR Reference Dipole Calibration Report

Ref : ACR.287.4.14.SATU.A

#### SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.

1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,  
BAO'AN BLVD

BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA

#### SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 835 MHZ

SERIAL NO.: SN 07/14 DIP 0G835-303

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144



10/01/2018

#### Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.4.14.SATU.A

|                      | <i>Name</i>   | <i>Function</i> | <i>Date</i> | <i>Signature</i> |
|----------------------|---------------|-----------------|-------------|------------------|
| <i>Prepared by :</i> | Jérôme LUC    | Product Manager | 10/14/2018  |                  |
| <i>Checked by :</i>  | Jérôme LUC    | Product Manager | 10/14/2018  |                  |
| <i>Approved by :</i> | Kim RUTKOWSKI | Quality Manager | 10/14/2018  |                  |

|                       | <i>Customer Name</i>                                  |
|-----------------------|-------------------------------------------------------|
| <i>Distribution :</i> | Shenzhen LCS<br>Compliance Testing<br>Laboratory Ltd. |

| <i>Issue</i> | <i>Date</i> | <i>Modifications</i> |
|--------------|-------------|----------------------|
| A            | 10/14/2018  | Initial release      |
|              |             |                      |
|              |             |                      |
|              |             |                      |

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.4.14.SATU.A

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.4.14.SATU.A

## 1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

## 2 DEVICE UNDER TEST

| Device Under Test              |                                  |
|--------------------------------|----------------------------------|
| Device Type                    | COMOSAR 835 MHz REFERENCE DIPOLE |
| Manufacturer                   | Satimo                           |
| Model                          | SID835                           |
| Serial Number                  | SN 07/14 DIP 0G835-303           |
| Product Condition (new / used) | New                              |

A yearly calibration interval is recommended.

## 3 PRODUCT DESCRIPTION

### 3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



**Figure 1** – Satimo COMOSAR Validation Dipole

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

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#### 4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

##### 4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

##### 4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

#### 5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ , traceable to the Internationally Accepted Guides to Measurement Uncertainty.

##### 5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

| Frequency band | Expanded Uncertainty on Return Loss |
|----------------|-------------------------------------|
| 400-6000MHz    | 0.1 dB                              |

##### 5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

| Length (mm) | Expanded Uncertainty on Length |
|-------------|--------------------------------|
| 3 - 300     | 0.05 mm                        |

##### 5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

| Scan Volume | Expanded Uncertainty |
|-------------|----------------------|
| 1 g         | 20.3 %               |
| 10 g        | 20.1 %               |

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