

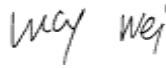
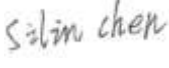

# FCC SAR Measurement and Test Report

For

**Worldwide telecom limited**

**2F, Block C, Shenfang building, zhen hua lu, futian district, Shenzhen, China**

**FCC ID: 2ARO3-WF01**

<b>FCC Rules:</b>	FCC Part 2.1093 ANSI / IEEE C95.1 :2005 ANSI / IEEE C95.3 :2002 <u>IEEE 1528 :2013</u>
<b>Product Description:</b>	<u>Mobile phone</u>
<b>Tested Model:</b>	<u>WF01</u>
<b>Report No.:</b>	<u>STR18118357H</u>
<b>Sample Received Date:</b>	<u>2018-12-10</u>
<b>Tested Date:</b>	<u>2018-12-10 to 2018-12-12</u>
<b>Issued Date:</b>	<u>2018-12-14</u>
<b>Tested By:</b>	<u>Lucy Wei / Engineer</u> 
<b>Reviewed By:</b>	<u>Silin Chen / EMC Manager</u> 
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM. Test Technology Co., Ltd.

## **TABLE OF CONTENTS**

<b>1. General Information</b>	<b>3</b>
1.1 Product Description for Equipment Under Test (EUT)	3
1.2 Test Standards	5
1.3 Test Methodology	5
1.4 Test Facility	5
<b>2. Summary of Test Results</b>	<b>6</b>
<b>3. Specific Absorption Rate (SAR)</b>	<b>7</b>
3.1 Introduction	7
3.2 SAR Definition	7
<b>4. SAR Measurement System</b>	<b>8</b>
4.1 The Measurement System	8
4.2 Probe	8
4.3 Probe Calibration Process	10
4.4 Phantom	11
4.5 Device Holder	11
4.6 Test Equipment List	12
<b>5. Tissue Simulating Liquids</b>	<b>13</b>
5.1 Composition of Tissue Simulating Liquid	13
5.2 Tissue Dielectric Parameters for Head and Body Phantoms	14
5.3 Tissue Calibration Result	15
<b>6. SAR Measurement Evaluation</b>	<b>16</b>
6.1 Purpose of System Performance Check	16
6.2 System Setup	16
6.3 Validation Results	17
<b>7. EUT Testing Position</b>	<b>18</b>
7.1 Define Two Imaginary Lines on The Handset	18
7.2 Cheek Position	19
7.3 Tilted Position	19
7.4 Body Position	20
7.5 EUT Antenna Position	20
7.6 EUT Testing Position	21
<b>8. SAR Measurement Procedures</b>	<b>22</b>
8.1 Measurement Procedures	22
8.2 Spatial Peak SAR Evaluation	22
8.3 Area & Zoom Scan Procedures	23
8.4 Volume Scan Procedures	23
8.5 SAR Averaged Methods	23
8.6 Power Drift Monitoring	23
<b>9. SAR Test Result</b>	<b>24</b>
9.1 Conducted RF Output Power	24
9.2 Test Results for Standalone SAR Test	26
9.3 Simultaneous Multi-band Transmission SAR Analysis	29
<b>10. Measurement Uncertainty</b>	<b>32</b>
10.1 Uncertainty for EUT SAR Test	32
10.2 Uncertainty for System Performance Check	33
<b>Annex A. Plots of System Performance Check</b>	<b>35</b>
<b>Annex B. Plots of SAR Measurement</b>	<b>43</b>
<b>Annex C. EUT Photos</b>	<b>56</b>
<b>Annex D. Test Setup Photos</b>	<b>58</b>
<b>Annex E. Calibration Certificate</b>	<b>63</b>

## 1. General Information

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

Applicant: Worldwide telecom limited  
Address of applicant: 2F, Block C, Shenfang building, zhen hua lu, futian district, Shenzhen, China

Manufacturer: H K RICH TECHNOLOGY INTERNATIONAL COMPANY LIMITED  
Address of manufacturer: RM906, Tower A, phase 1 High-Tech Plaza, Tian'An Cyber Park, Fu Tian District, Shen Zhen China

General Description of EUT	
Product Name:	Mobile phone
Brand Name:	WOLKI
Model No.:	WF01
Adding Model(s):	/
Rated Voltage:	DC 3.7V by battery
Battery Capacity:	600mAh
<i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i>	

Technical Characteristics of EUT	
<b>2G</b>	
Support Networks:	GSM, GPRS
Support Band:	GSM850/PCS1900
Uplink Frequency:	GSM/GPRS 850: 824~849MHz GSM/GPRS 1900: 1850~1910MHz
Downlink Frequency:	GSM/GPRS 850: 869~894MHz GSM/GPRS 1900: 1930~1990MHz
RF Output Power:	GSM850: 34.07dBm, GSM1900: 30.97dBm
Type of Modulation:	GMSK
Antenna Type:	Internal Antenna
Antenna Gain:	GSM850: -0.5dBi; GSM1900: -0.8dBi
GPRS Class:	Class 12
<b>Bluetooth</b>	
Bluetooth Version:	V2.1+EDR
Frequency Range:	2402-2480MHz
AV Output Power:	1.29dBm (Conducted)

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Data Rate:	1Mbps, 2Mbps, 3Mbps
Modulation:	GFSK, Pi/4 QDPSK, 8DPSK
Quantity of Channels:	79
Channel Separation:	1MHz
Antenna Type:	Integral Antenna
Antenna Gain:	-0.4dBi

## 1.2 Test Standards

The following report is prepared on behalf of the Worldwide telecom limited in accordance with FCC 47 CFR Part 2.1093, ANSI/IEEE C95.1-2005, IEEE 1528-2013 and KDB 865664 D01 v01r04 and KDB 865664 D02 v01r02.

The objective is to determine compliance with FCC Part 2.1093 of the Federal Communication Commissions rules.

*Maintenance of compliance* is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with KDB 865664 D01 v01r04 and KDB 865664 D02 v01r02. The public notice KDB 447498 D01 v06 for Mobile and Portable Devices RF Exposure Procedure also.

## 1.4 Test Facility

### **FCC – Registration No.: 125990**

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipme subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

### **Industry Canada (IC) Registration No.: 11464A**

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

## 2. Summary of Test Results

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The maximum results of Specific Absorption Rate (SAR) have found during testing are as follows:

Frequency Band	Head SAR	Body (10mm Gap)	SAR <sub>1g</sub> Limit (W/kg)
	Maximum SAR <sub>1g</sub> (W/kg)	Maximum SAR <sub>1g</sub> (W/kg)	
GSM850	<b>0.229</b>	0.782	1.6
GSM1900	0.164	<b>1.037</b>	1.6
Simultaneous Transmission	0.288	<b>1.066</b>	1.6

*The highest reported SAR values for head, body and simultaneous transmission conditions are **0.229W/kg, 1.037W/kg , and 1.066W/kg** respectively*

The 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 2.1093 and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedure specified in IEEE 1528-2013 and KDB 865664 D01 v01r04 and KDB 865664 D02 v01r02

### 3. Specific Absorption Rate (SAR)

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#### 3.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

#### 3.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density ( $\rho$ ). The equation description is as below:

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$\text{SAR} = C \left( \frac{\delta T}{\delta t} \right)$$

Where: C is the specific heat capacity,  $\delta T$  is the temperature rise and  $\delta t$  is the exposure duration, or related to the electrical field in the tissue by

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

Where:  $\sigma$  is the conductivity of the tissue,  $\rho$  is the mass density of the tissue and E is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

## 4. SAR Measurement System

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### 4.1 The Measurement System

Comosar is a system that is able to determine the SAR distribution inside a phantom of human being according to different standards. The Comosar system consists of the following items:

- Main computer to control all the system
- 6 axis robot
- Data acquisition system
- Miniature E-field probe
- Phone holder
- Head simulating tissue

The following figure shows the system.



The EUT under test operating at the maximum power level is placed in the phone holder, under the phantom, which is filled with head simulating liquid. The E-Field probe measures the electric field inside the phantom. The OpenSAR software computes the results to give a SAR value in a 1g or 10g mass.

### 4.2 Probe

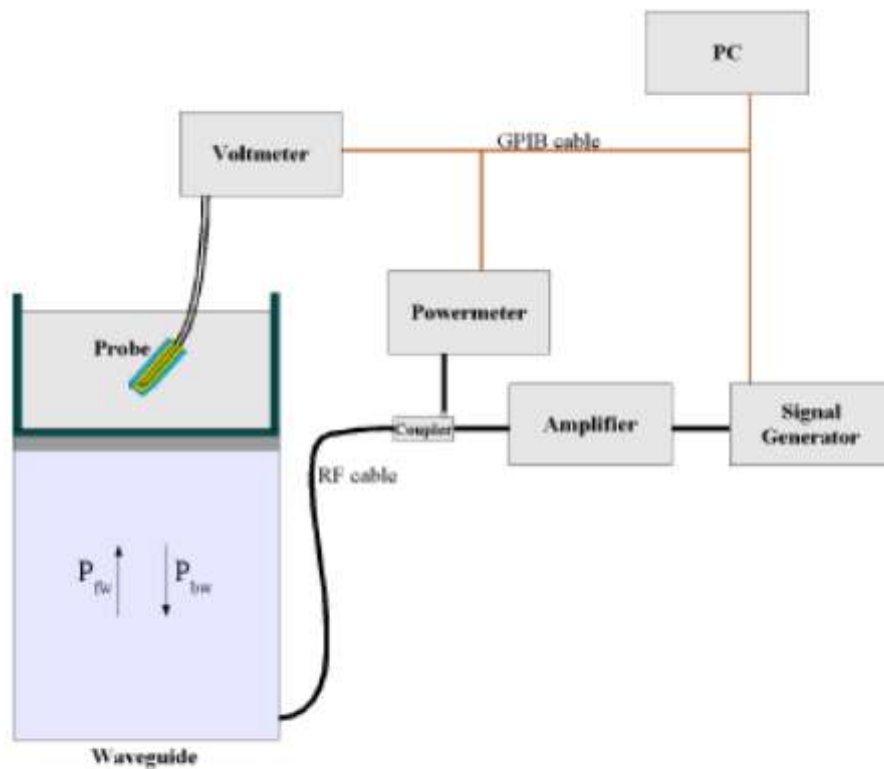
For the measurements the Specific Dosimetric E-Field Probe SSE5 SN 09/13 EP168 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Probe Length: 330 mm
- Length of Individual Dipoles: 4.5 mm
- Maximum external diameter: 8 mm
- Probe Tip External Diameter : 5 mm
- Distance between dipoles / probe extremity: 2.7mm



- Probe linearity: <0.25 dB
  - Axial Isotropy: <0.25 dB
  - Spherical Isotropy: <0.50 dB
  - Calibration range: 700 to 3000MHz for head & body simulating liquid.
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

Probe calibration is realized, in compliance with EN 62209-1 and IEEE 1528 STD, with CALISAR, Antenna proprietary calibration system. The calibration is performed with the EN 62209-1 annexe technique using reference guide at the five frequencies.



$$SAR = \frac{4(P_{fw} - P_{bw})}{ab\delta} \cos^2\left(\pi \frac{y}{a}\right) e^{-(2z/\delta)}$$

Where :

$P_{fw}$  = Forward Power

$P_{bw}$  = Backward Power

a and b = Waveguide dimensions

$\delta$  = Skin depth

Keithley configuration:

Rate = Medium; Filter = ON; RDGS = 10; Filter type = Moving Average; Range auto after each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

The calibration factors, CF(N), for the 3 sensors corresponding to dipole 1, dipole 2 and dipole 3 are:

$$CF(N)=SAR(N)/V_{lin}(N) \quad (N=1,2,3)$$

The linearised output voltage  $V_{lin}(N)$  is obtained from the displayed output voltage  $V(N)$  using

$$V_{lin}(N)=V(N)*(1+V(N)/DCP(N)) \quad (N=1,2,3)$$

where DCP is the diode compression point in mV.

### 4.3 Probe Calibration Process

#### Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. SATIMO Probe calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm<sup>2</sup>) using an with CALISAR, Antenna proprietary calibration system.

#### Free Space Assessment Procedure

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1mW/cm<sup>2</sup>.

#### Temperature Assessment Procedure

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

Where:

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

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

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

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

SAR is proportional to  $\Delta T / \Delta t$ , the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

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

Where:

$\sigma$  = simulated tissue conductivity,

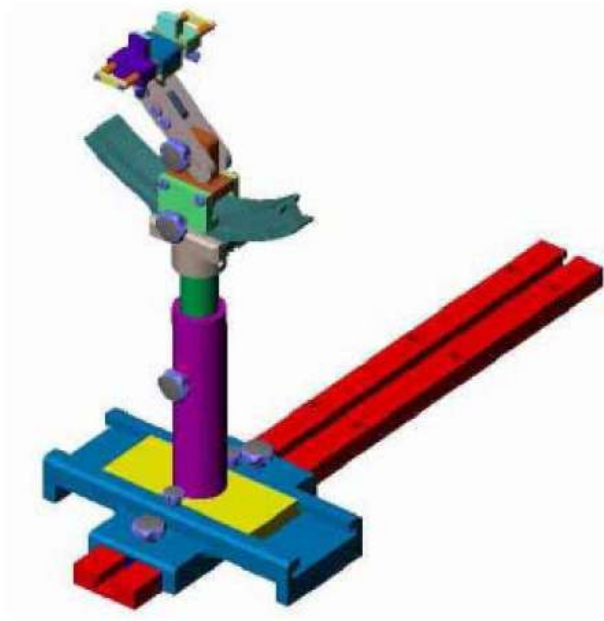
$\rho$  = Tissue density (1.25 g/cm<sup>3</sup> for brain tissue)

#### 4.4 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

#### 4.5 Device Holder

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than 1 °.



System Material	Permittivity	Loss Tangent
Delrin	3.7	0.005

#### 4.6 Test Equipment List

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
E-Field Probe	MVG	SSE5	SN 09/13 EP168	2018-06-01	2019-05-31
835MHz Dipole	MVG	SID835	SN 47/12 DIP 0G835-204	2018-03-20	2019-03-19
1900MHz Dipole	MVG	SID1900	SN 47/12 DIP 1G900-207	2018-03-20	2019-03-19
Dielectric Probe Kit	SATIMO	SCLMP	SN 47/12 OCPG49	2018-03-20	2019-03-19
SAM Phantom	SATIMO	SAM	SN/ 47/12 SAM95	N/A	N/A
MULTIMETER	KEITHLEY	Keithley 2000	4006367	2018-05-22	2019-05-21
Signal Generator	Rohde & Schwarz	SMR20	100047	2018-05-22	2019-05-21
Universal Tester	Rohde & Schwarz	CMU200	112012	2018-05-22	2019-05-21
Network Analyzer	HP	8753C	2901A00831	2018-05-22	2019-05-21
Directional Couplers	Agilent	778D	20160	2018-05-22	2019-05-21

## 5. Tissue Simulating Liquids

### 5.1 Composition of Tissue Simulating Liquid

For the measurement of the field distribution inside the SAM phantom with SMTIMO, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. Please see the following photos for the liquid height.



**Liquid Height for Head SAR**



**Liquid Height for Body SAR**

### The Composition of Tissue Simulating Liquid

Frequency (MHz)	Water (%)	Salt (%)	Sugar (%)	HEC (%)	Preventol (%)	DGBE (%)
<b>Head</b>						
835	40.3	1.4	57.9	0.2	0.2	0
1900	55.2	0.3	0	0	0	44.5
<b>Body</b>						
835	50.8	0.9	48.1	0.1	0.1	0
1900	70.2	0.4	0	0	0	29.4

## 5.2 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

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

### 5.3 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using COMOSAR Dielectric Probe Kit and an Agilent Network Analyzer.

#### Calibration Result for Dielectric Parameters of Tissue Simulating Liquid

Head Tissue Simulating Liquid									
Freq. MHz.	Temp. (°C)	Conductivity			Permittivity			Limit (%)	Date
		Reading ( $\sigma$ )	Target ( $\sigma$ )	Delta (%)	Reading ( $\epsilon_r$ )	Target ( $\epsilon_r$ )	Delta (%)		
835	21.2	0.87	0.90	-3.33	41.11	41.50	-0.94	$\pm 5$	2018-12-10
1900	21.3	1.38	1.40	-1.43	38.56	40.00	-3.60	$\pm 5$	2018-12-11

Body Tissue Simulating Liquid									
Freq. MHz.	Temp. (°C)	Conductivity			Permittivity			Limit (%)	Date
		Reading ( $\sigma$ )	Target ( $\sigma$ )	Delta (%)	Reading ( $\epsilon_r$ )	Target ( $\epsilon_r$ )	Delta (%)		
835	21.2	0.95	0.97	-2.06	54.85	55.20	-0.63	$\pm 5$	2018-12-10
1900	21.3	1.50	1.52	-1.32	52.42	53.30	-1.65	$\pm 5$	2018-12-11

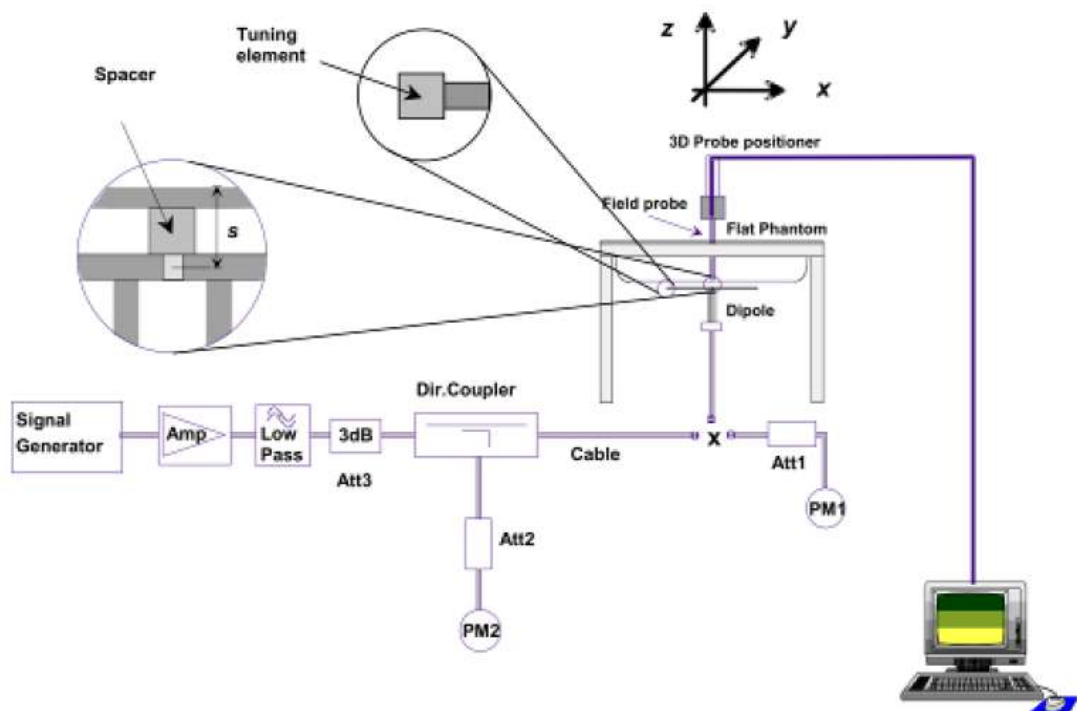
## 6. SAR Measurement Evaluation

### 6.1 Purpose of System Performance Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

### 6.2 System Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator at frequency 835 MHz and 1900MHz. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom.



System Verification Setup Block Diagram





**Setup Photo of Dipole Antenna**

The output power on dipole port must be calibrated to 24 dBm (250 mW) before dipole is connected.

### 6.3 Validation Results

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10 %. Table 6.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion.

Frequency	Targeted SAR <sub>1g</sub>	Measured SAR <sub>1g</sub>	Normalized SAR <sub>1g</sub>	Tolerance
MHz	(W/kg)	(W/kg)	(W/kg)	(%)
Head				
835	9.67	2.39	9.56	-1.14
1900	39.58	9.91	39.64	0.15
Body				
835	9.38	2.36	9.44	0.64
1900	39.10	9.80	39.2	0.26

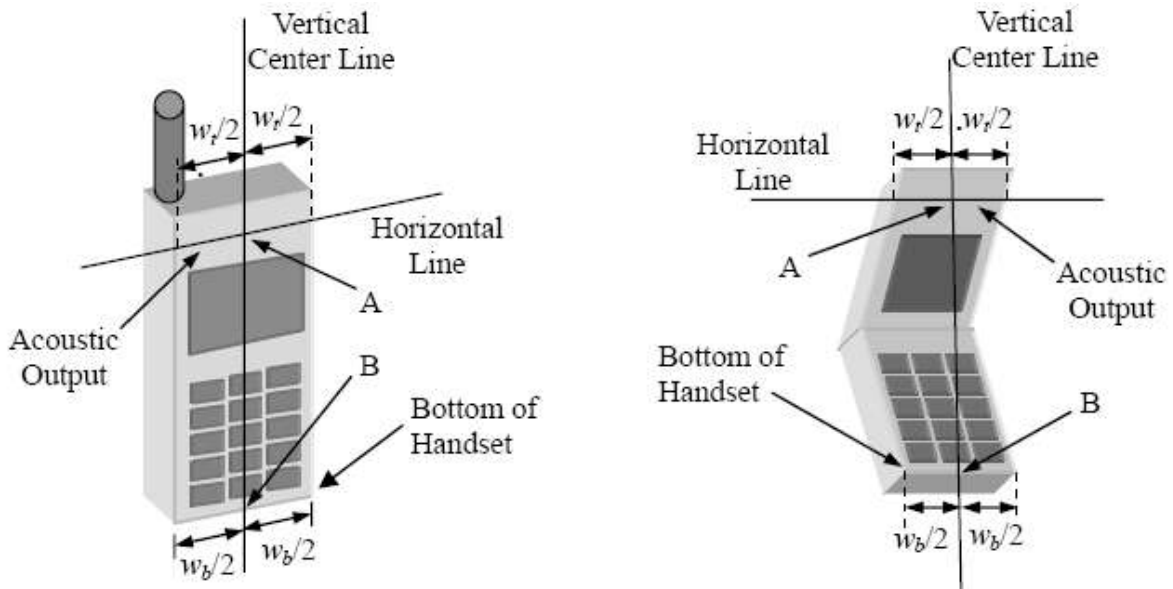
**Targeted and Measurement SAR**

*Please refer to Annex A for the plots of system performance check.*

## 7. EUT Testing Position

### 7.1 Define Two Imaginary Lines on The Handset

- (a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width  $w_t$  of the handset at the level of the acoustic output, and the midpoint of the width  $w_b$  of the bottom of the handset.
- (b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.
- (c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



**Illustration for Handset Vertical and Horizontal Reference Lines**

## 7.2 Cheek Position

(a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see Fig. 7.2).

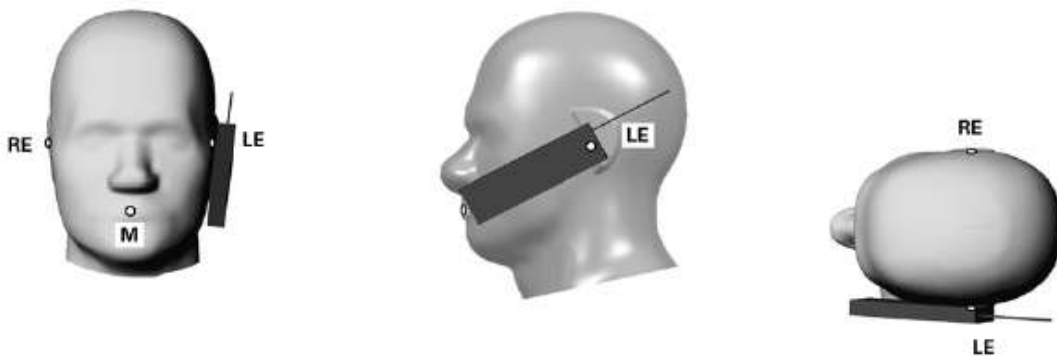


Illustration for Cheek Position

## 7.3 Tilted Position

(a) To position the device in the “cheek” position described above.

(b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig. 7.3).



Illustration for Tilted Position

## 7.4 Body Position

- To position the device parallel to the phantom surface with either keypad up or down.
- To adjust the device parallel to the flat phantom.
- To adjust the distance between the device surface and the flat phantom to 10mm.

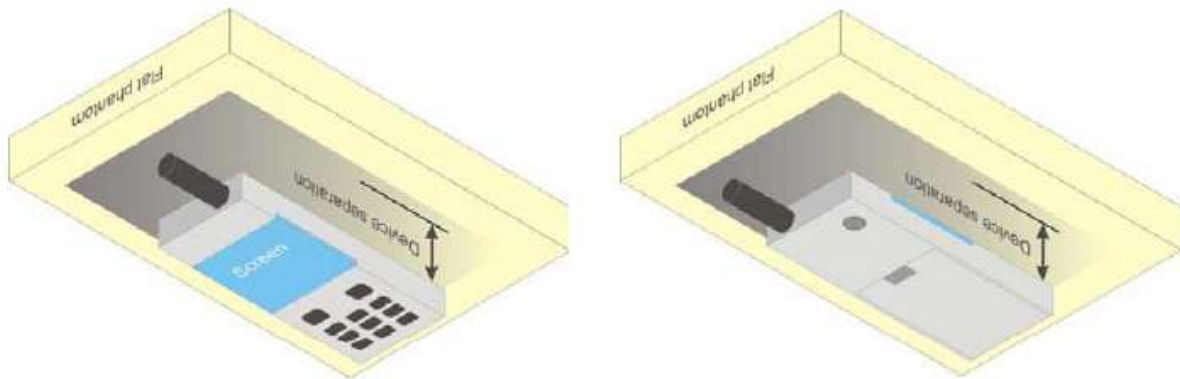
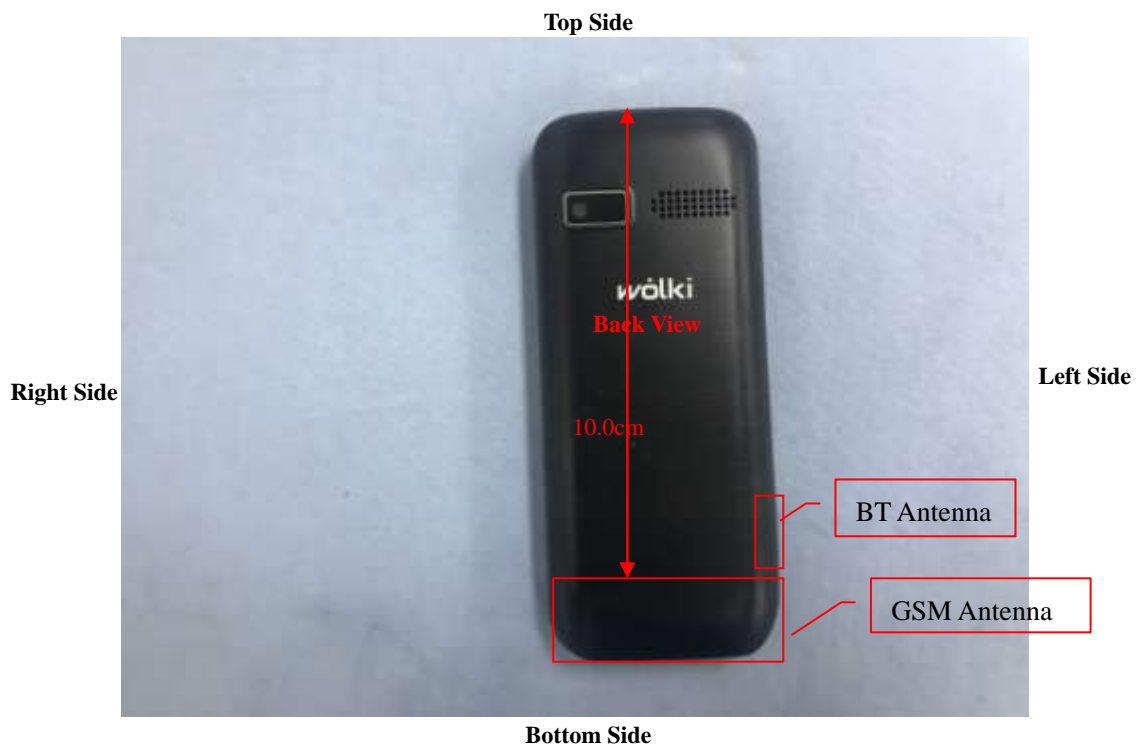


Illustration for Body Position

## 7.5 EUT Antenna Position



Block Diagram for EUT Antenna Position

## 7.6 EUT Testing Position

Head/Body mode SAR assessments are required for this device. This EUT was tested in different positions for different SAR test modes, more information as below:

Head SAR tests				
Antennas	Right Cheek	Left Cheek	Right Tilted	Left Tilted
WWAN	Yes	Yes	Yes	Yes

Body SAR tests, Test distance: 10mm						
Antennas	Front	Back	Right Side	Left Side	Top Side	Bottom Side
WWAN	Yes	Yes	Yes	Yes	No	Yes

**Remark:**

1. Referring to KDB 447498 D01 v06, the test separation distances is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

***Please refer to Annex D for the EUT test setup photos.***

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## 8. SAR Measurement Procedures

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### 8.1 Measurement Procedures

The measurement procedures are as follows:

- (a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the highest power channel.
- (b) Keep EUT to radiate maximum output power or 100% factor (if applicable)
- (c) Measure output power through RF cable and power meter.
- (d) Place the EUT in the positions as Annex D demonstrates.
- (e) Set scan area, grid size and other setting on the SATIMO software.
- (f) Measure SAR results for the highest power channel on each testing position.
- (g) Find out the largest SAR result on these testing positions of each band
- (h) Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

### 8.2 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The SATIMO software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine. The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

### 8.3 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5 mm for 300 MHz to 3 GHz, and 8x8x8 points with step size 4, 4 and 2.5 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

### 8.4 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software can combine and subsequently superpose these measurement data to calculating the multiband SAR.

### 8.5 SAR Averaged Methods

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimize measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10g and 1 g requires a very fine resolution in the three dimensional scanned data array.

### 8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In SATIMO measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

## 9. SAR Test Result

### 9.1 Conducted RF Output Power

GSM - Burst Average Power (dBm)						
Band	GSM850			PCS1900		
Channel	128	190	251	512	661	810
Frequency (MHz)	824.2	836.4	848.8	1850.2	1880	1909.8
GSM	34.00	34.01	33.92	30.33	30.45	30.95
GPRS (1 slot)	34.04	34.07	33.92	30.34	30.50	30.97
GPRS (2 slots)	32.36	32.32	32.30	27.74	28.12	28.53
GPRS (3 slots)	30.72	30.71	30.67	26.27	26.64	27.11
GPRS (4 slots)	29.14	29.04	28.89	24.36	24.84	25.30

GSM - Source-Based Time-Average Power (dBm)						
Band	GSM850			PCS1900		
Channel	128	190	251	512	661	810
Frequency (MHz)	824.2	836.4	848.8	1850.2	1880	1909.8
GSM	25.00	25.01	24.92	21.33	21.45	21.95
GPRS (1 slot)	25.04	25.07	24.92	21.34	21.50	21.97
GPRS (2 slots)	26.36	26.32	26.30	21.74	22.12	22.53
GPRS (3 slots)	26.47	26.46	26.42	22.02	22.39	22.86
GPRS (4 slots)	26.14	26.04	25.89	21.36	21.84	22.30

Note: The source-based time-averaged power is linearly scaled the maximum burst averaged power based on time slots. The calculated method are shown as below:

Source based time-average power = Burst averaged power - Duty cycle factor in dB

#### Remark:

1. For Head SAR testing, GSM should be evaluated, therefore the EUT was set in GSM for GSM850 and GSM1900 due to its highest source-based time-average power.
2. For Body SAR testing, GPRS should be evaluated, therefore the EUT was set in GPRS (3Tx slots) for GSM850 and GPRS (3Tx slots) for GSM1900 due to its highest source-based time-average power.
3. Per KDB 447498 D01 v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
4. The DUT do not support DTM function.



Bluetooth - Maximum Average Power		
Test Mode	Data Rate	Average Power(dBm)
GFSK	1Mbps	1.29
Pi/4 QDPSK	2Mbps	0.59
8DPSK	3Mbps	0.57

**Remark:**

Bluetooth maximum output power is 1.29dBm, and Tune-Up output power is 1.5dBm. Per KDB 447498 D01 v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:  $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR,<sup>16</sup> where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation<sup>17</sup>
- The result is rounded to one decimal place for comparison

Tune-Up Power (dBm)	Max. Power (mW)	Distance (mm)	Frequency (GHz)	Result	Limit
1.5	1.41	5	2.441	0.44	3

The exclusion thresholds is  $0.44 < 3$ , therefore, the RF exposure evaluation is not required.

## 9.2 Test Results for Standalone SAR Test

### Head SAR

GSM850 – Head SAR Test									
Plot No.	Mode	Test Position Head	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
			CH.	MHz					
1.	GSM	Right Cheek	190	836.6	34.01	34.5	1.119	0.205	0.229
2.	GSM	Right Tilted	190	836.6	34.01	34.5	1.119	0.131	0.147
3.	GSM	Left Cheek	190	836.6	34.01	34.5	1.119	0.191	0.214
4.	GSM	Left Tilted	190	836.6	34.01	34.5	1.119	0.102	0.114

GSM1900 – Head SAR Test									
Plot No.	Mode	Test Position Head	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
			CH.	M Hz					
5.	GSM	Right Cheek	810	1909.8	30.95	31.0	1.012	0.162	0.164
6.	GSM	Right Tilted	810	1909.8	30.95	31.0	1.012	0.088	0.089
7.	GSM	Left Cheek	810	1909.8	30.95	31.0	1.012	0.155	0.157
8.	GSM	Left Tilted	810	1909.8	30.95	31.0	1.012	0.076	0.077

**Remark:** Per KDB447498 D01 v06, if the highest output channel SAR for each exposure position  $\leq 0.8$  W/kg other channels SAR tests are not necessary.

**Body SAR**

GSM850 – Body SAR Test (Gap: 10mm)									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
			CH.	MHz					
9.	GSM	(Body-worn)Back	190	836.6	34.01	34.5	1.119	0.489	0.547
10.	GSM	(Body-worn)Front	190	836.6	34.01	34.5	1.119	0.187	0.209
11.	GPRS_3TX	Back Side	128	824.2	30.72	31.0	1.067	0.733	0.782
12.	GPRS_3TX	Front Side	128	824.2	30.72	31.0	1.067	0.273	0.291
13.	GPRS_3TX	Bottom side	128	824.2	30.72	31.0	1.067	0.053	0.057
14.	GPRS_3TX	Right side	128	824.2	30.72	31.0	1.067	0.141	0.150
15.	GPRS_3TX	Left side	128	824.2	30.72	31.0	1.067	0.130	0.139

GSM1900 – Body SAR Test (Gap: 10mm)									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
			CH.	MHz					
16.	GSM	(Body-worn)Back	810	1909.8	30.95	31.0	1.012	0.431	0.436
17.	GSM	(Body-worn)Front	810	1909.8	30.95	31.0	1.012	0.163	0.165
18.	GPRS_3TX	Back Side	810	1909.8	27.11	27.5	1.094	0.948	1.037
19.	GPRS_3TX	Back Side	512	1850.2	26.27	27.5	1.327	0.627	0.832
20.	GPRS_3TX	Back Side	661	1880.0	26.64	27.5	1.219	0.698	0.851
21.	GPRS_3TX	Front Side	810	1909.8	27.11	27.5	1.094	0.377	0.412
22.	GPRS_3TX	Bottom side	810	1909.8	27.11	27.5	1.094	0.395	0.432
23.	GPRS_3TX	Right side	810	1909.8	27.11	27.5	1.094	0.211	0.231
24.	GPRS_3TX	Left side	810	1909.8	27.11	27.5	1.094	0.197	0.216

**Remark:** Per KDB447498 D01 v06, if the highest output channel SAR for each exposure position  $\leq 0.8$  W/kg other channels SAR tests are not necessary.

**Repeated SAR**

GSM1900 – Body SAR Test (Gap: 10mm)									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
			CH.	MHz					
25.	GPRS_3TX	Back Side	810	1909.8	27.11	27.5	1.094	0.941	1.029

**Remark:**

- 1) Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
- 3) 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 (~ 10% from the 1-g SAR limit).
- 4) 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  $> 1.20$ .

### 9.3 Simultaneous Multi-band Transmission SAR Analysis

#### List of Mode for Simultaneous Multi-band Transmission

No.	Configurations	Head SAR	Body SAR
1	GSM(Voice/Data) + Bluetooth(Data)	Yes	Yes

#### Remark:

1. GSM and WCDMA share the same antenna, and cannot transmit simultaneously.
2. According to the KDB 447498 D01 v06, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm) $^{-[\sqrt{f(\text{GHz})}/x]}$  W/kg for test separation distances  $\leq 50$  mm;

where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.

For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 v06 as below:

#### Bluetooth:

Tune-Up Power (dBm)	Max. Power (mW)	Distance (mm)	Frequency (GHz)	X	SAR(1g) 5mm	SAR(1g) 10mm
1.5	1.41	5/10	2.441	7.5	0.059	0.029

3. The maximum SAR summation is calculated based on the same configuration and test position.

**Head SAR****WWAN and Bluetooth**

Position	WWAN		Bluetooth	Summed SAR (W/kg)
	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
Right Cheek	GSM850	0.229	0.059	<b>0.288</b>
Right Tilted	GSM850	0.147	0.059	0.206
Left Cheek	GSM850	0.214	0.059	0.273
Left Tilted	GSM850	0.114	0.059	0.173
Right Cheek	GSM1900	0.164	0.059	0.223
Right Tilted	GSM1900	0.089	0.059	0.148
Left Cheek	GSM1900	0.157	0.059	0.216
Left Tilted	GSM1900	0.077	0.059	0.136

**Body SAR**
**WWAN and Bluetooth**

Position	WWAN		Bluetooth	Summed SAR (W/kg)
	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
(Body-worn)Back	GSM850	0.547	0.029	0.576
(Body-worn)Front	GSM850	0.209	0.029	0.238
Back	GSM850	0.782	0.029	0.811
Front	GSM850	0.291	0.029	0.320
Top side	GSM850	--	0.029	0.029
Bottom side	GSM850	0.057	0.029	0.086
Right side	GSM850	0.150	0.029	0.179
Left side	GSM850	0.139	0.029	0.168
(Body-worn)Back	GSM1900	0.436	0.029	0.465
(Body-worn)Front	GSM1900	0.165	0.029	0.194
Back	GSM1900	1.037	0.029	<b>1.066</b>
Front	GSM1900	0.412	0.029	0.441
Top side	GSM1900	--	0.029	0.029
Bottom side	GSM1900	0.432	0.029	0.461
Right side	GSM1900	0.231	0.029	0.260
Left side	GSM1900	0.216	0.029	0.245

## 10. Measurement Uncertainty

### 10.1 Uncertainty for EUT SAR Test

a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
<b>Measurement System</b>									
Probe calibration	E.2.1	7.0	N	1	1	1	7.00	7.00	$\infty$
Axial Isotropy	E.2.2	2.5	R	$\sqrt{3}$	$(1_{Cp})^{1/2}$	$(1_{Cp})^{1/2}$	1.02	1.02	$\infty$
Hemispherical Isotropy	E.2.2	4.0	R	$\sqrt{3}$	$(Cp)^{1/2}$	$(Cp)^{1/2}$	1.63	1.63	$\infty$
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	$\infty$
Linearity	E.2.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	$\infty$
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	$\infty$
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.02	$\infty$
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	$\infty$
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	$\infty$
RF ambient Conditions – Noise	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	$\infty$
RF ambient Conditions - Reflections	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	$\infty$
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	$\infty$
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	$\infty$
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	E.5	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	$\infty$
<b>Test Sample Related</b>									
Test sample positioning	E.4.2	0.03	N	1	1	1	0.03	0.03	N-1
Device Holder Uncertainty	E.4.1	5.00	N	1	1	1	5.00	5.00	
Output power Variation - SAR drift measurement	E.2.9	12.02	R	$\sqrt{3}$	1	1	6.94	6.94	$\infty$
SAR scaling	E6.5	0.0	R	$\sqrt{3}$	1	1	0.0	0.0	$\infty$
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	$\infty$
Uncertainty in SAR correction for deviations in permittivity and conductivity	E3.2	1.9	R	$\sqrt{3}$	1	0.84	1.10	0.90	$\infty$
Liquid conductivity - deviation	E.3.2	5.00	R	$\sqrt{3}$	0.64	0.43	1.85	1.24	$\infty$



from target value										
Liquid conductivity measurement uncertainty	E.3.3	5.00	N	1	0.64	0.43	3.20	2.15	$\infty$	
Liquid permittivity - deviation from target value	E.3.2	0.37	R	$\sqrt{3}$	0.6	0.49	0.13	0.10	$\infty$	
Liquid permittivity measurement uncertainty	E.3.3	10.00	N	1	0.6	0.49	6.00	4.90	$\infty$	
Combined Standard Uncertainty			RSS				12.98	12.53		
Expanded Uncertainty (95% Confidence interval)			K=2				25.32	24.43		

## 10.2 Uncertainty for System Performance Check

a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
<b>Measurement System</b>									
Probe calibration	E.2.1	7.0	N	1	1	1	7.00	7.00	$\infty$
Axial Isotropy	E.2.2	2.5	R	$\sqrt{3}$	$(1_{Cp})^{1/2}$	$(1_{Cp})^{1/2}$	1.02	1.02	$\infty$
Hemispherical Isotropy	E.2.2	4.0	R	$\sqrt{3}$	$(Cp)^{1/2}$	$(Cp)^{1/2}$	1.63	1.63	$\infty$
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	$\infty$
Linearity	E.2.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	$\infty$
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	$\infty$
Modulation response	E.2.5	0	R	$\sqrt{3}$	0	0	0.0	0.0	$\infty$
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.02	$\infty$
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	$\infty$
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	$\infty$
RF ambient Conditions – Noise	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	$\infty$
RF ambient Conditions - Reflections	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	$\infty$
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	$\infty$
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	$\infty$
Extrapolation, interpolation and integration Algorithms for Max.	E.5.2	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	$\infty$

SAR Evaluation									
<b>Dipole</b>									
Dipole axis to liquid Distance	8,E.4.2	1.00	N	$\sqrt{3}$	1	1	0.58	0.58	N-1
Input power and SAR drift measurement	8,6.6.2	12.02	R	$\sqrt{3}$	1	1	6.94	6.94	$\infty$
Deviation of experimental dipole from numerical dipole	E.6.4	5.5	R	$\sqrt{3}$	1	1	3.20	3.20	$\infty$
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	$\infty$
Uncertainty in SAR correction for deviations in permittivity and conductivity	E3.2	2.0	R	$\sqrt{3}$	1	0.84	1.10	1.10	$\infty$
Liquid conductivity - deviation from target value	E.3.2	5.00	R	$\sqrt{3}$	0.64	0.43	1.85	1.24	
Liquid conductivity - measurement uncertainty	E.3.3	5.00	N	1	0.64	0.43	3.20	2.15	
Liquid permittivity - deviation from target value	E.3.2	0.37	R	$\sqrt{3}$	0.6	0.49	0.13	0.10	
Liquid permittivity - measurement uncertainty	E.3.3	10.00	N	1	0.6	0.49	6.00	4.90	M
Combined Standard Uncertainty			RSS				12.00	11.50	
Expanded Uncertainty (95% Confidence interval)			K=2				23.39	22.43	

## Annex A. Plots of System Performance Check

# MEASUREMENT 1

### For Head Liquid

Type: Validation measurement (Fast, 75.00 %)

Date of measurement: 12/10/2018

Measurement duration: 7 minutes 21 seconds

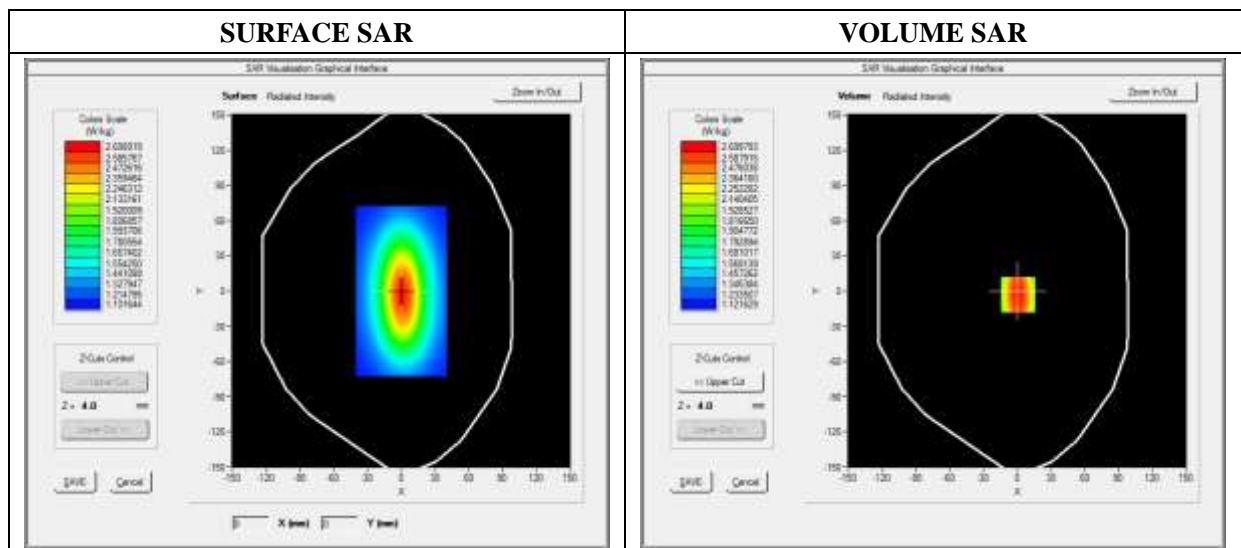
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.93; Calibrated: 06/01/2018

### A. Experimental conditions

Area Scan	dx=8mm dy=8mm
Zoom Scan	dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW835
Signal	Duty Cycle 1:1

### B. SAR Measurement Results

Frequency (MHz)	835.000000
Relative Permittivity (real part)	41.110245
Conductivity (S/m)	0.871245
Power Variation (%)	1.814580
Ambient Temperature	21.1
Liquid Temperature	21.3

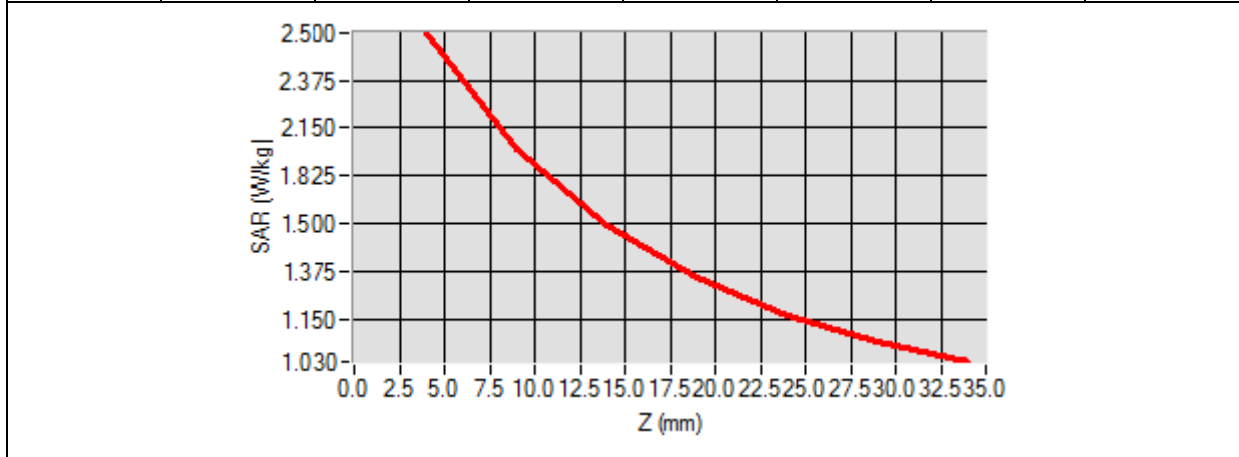


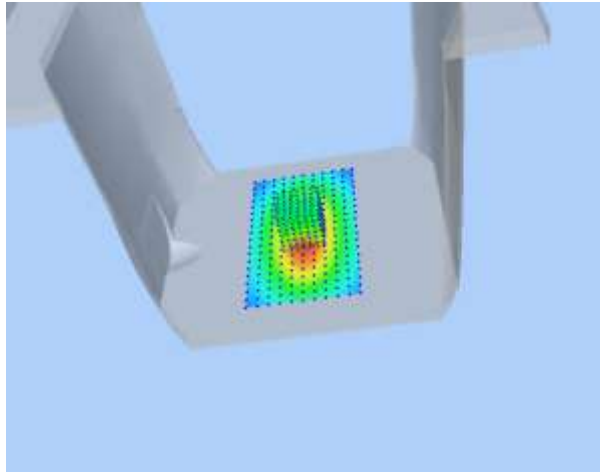
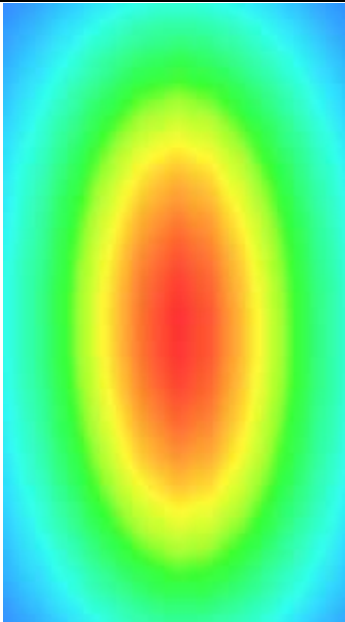
Maximum location: X=0.00, Y=0.00

SAR 10g (W/Kg)	1.529489
SAR 1g (W/Kg)	2.391250

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	2.4900	1.8942	1.4811	1.3541	1.1123	1.0539



3D screen shot	Hot spot position
	

## MEASUREMENT 2

### For Head Liquid

Type: Validation measurement (Fast, 75.00 %)

Date of measurement: 12/11/2018

Measurement duration: 12 minutes 21 seconds

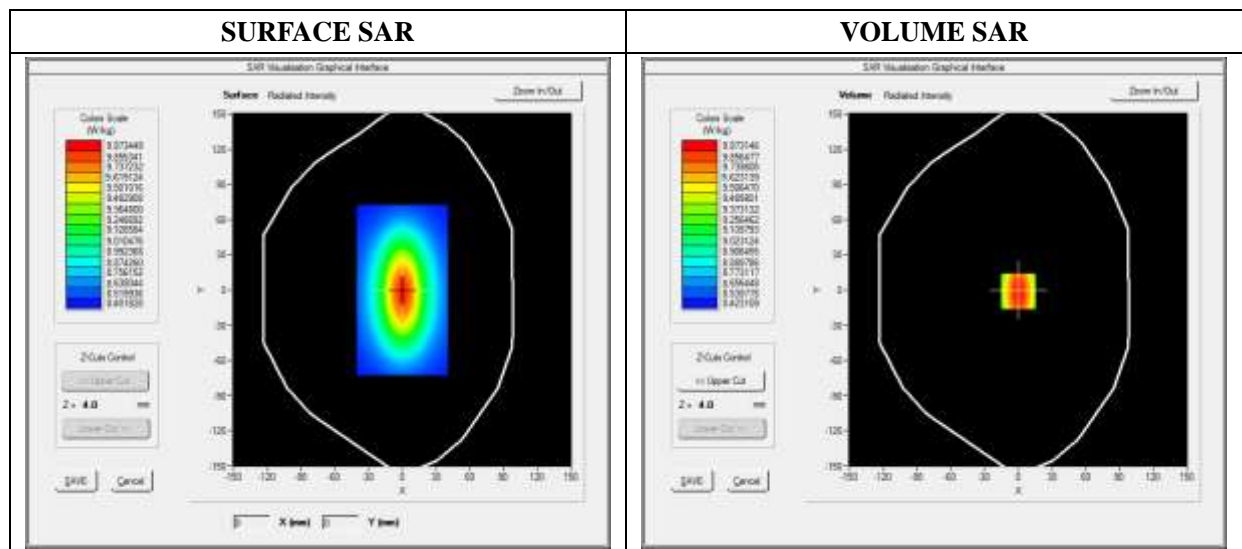
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.35; Calibrated: 06/01/2018

### A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Validation plane
<b>Device Position</b>	Dipole
<b>Band</b>	CW1900
<b>Signal</b>	Duty Cycle 1:1

### B. SAR Measurement Results

<b>Frequency (MHz)</b>	1900.000000
<b>Relative Permittivity (real part)</b>	38.560124
<b>Conductivity (S/m)</b>	1.380369
<b>Power Variation (%)</b>	1.022540
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3

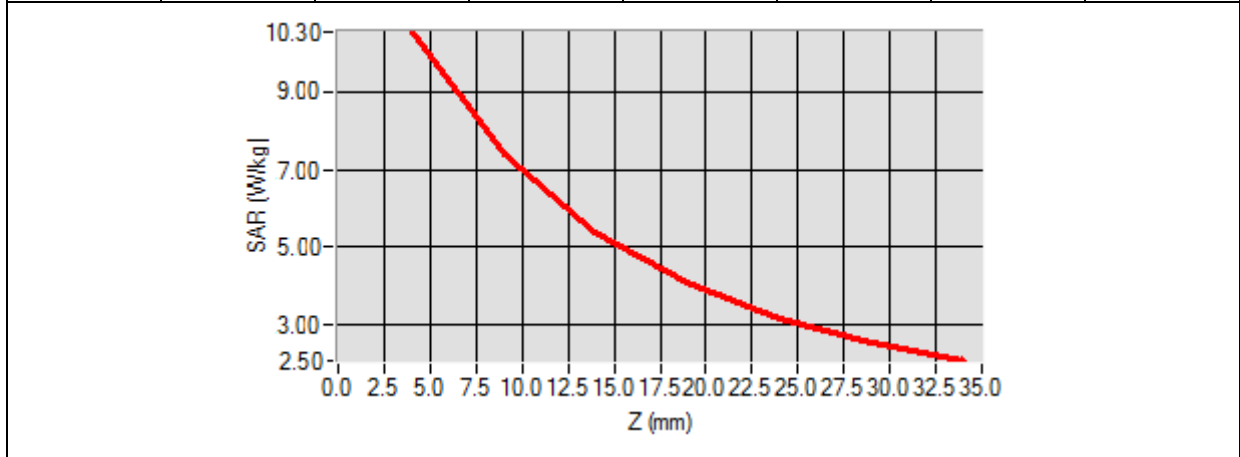


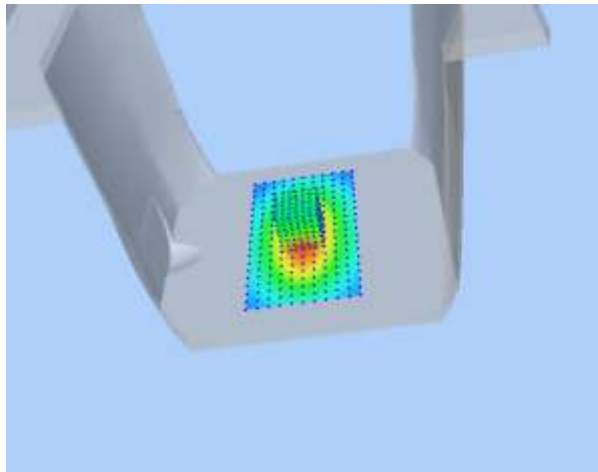
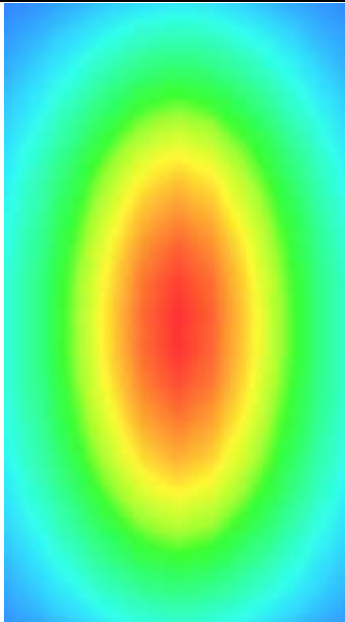
Maximum location: X=0.00, Y=0.00

SAR 10g (W/Kg)	5.174526
SAR 1g (W/Kg)	9.913214

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	10.2354	6.8400	5.0121	4.1189	3.0522	2.8424



3D screen shot	Hot spot position
	

## MEASUREMENT 3

### For Body Liquid

Type: Validation measurement (Fast, 75.00 %)

Date of measurement: 12/10/2018

Measurement duration: 12 minutes 21 seconds

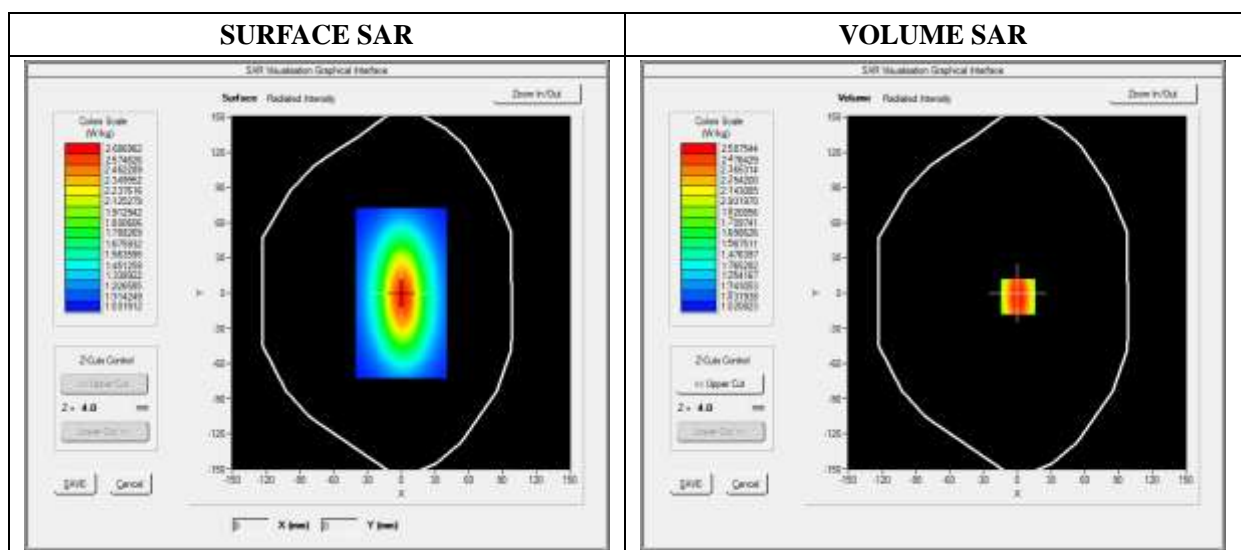
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 7.13; Calibrated: 06/01/2018

### A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Validation plane
<b>Device Position</b>	Dipole
<b>Band</b>	CW835
<b>Signal</b>	Duty Cycle 1:1

### B. SAR Measurement Results

<b>Frequency (MHz)</b>	835.000000
<b>Relative Permittivity (real part)</b>	54.851214
<b>Conductivity (S/m)</b>	0.951454
<b>Power Variation (%)</b>	0.901472
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3

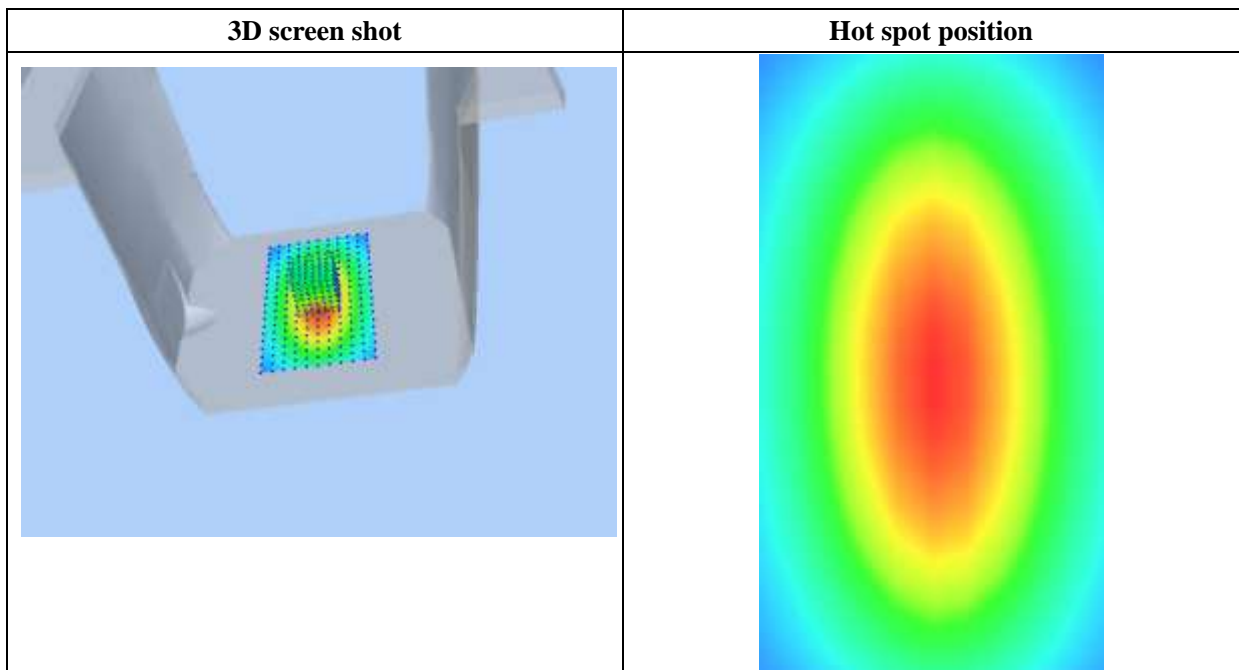
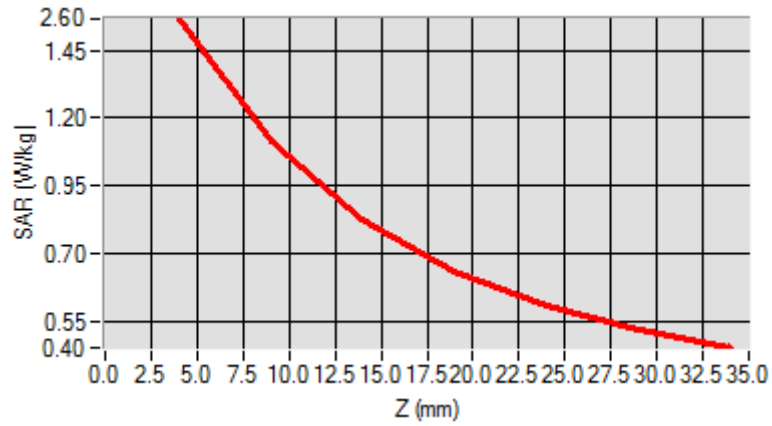


Maximum location: X=0.00, Y=0.00

SAR 10g (W/Kg)	1.528956
SAR 1g (W/Kg)	2.364211

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	2.5789	1.1300	0.8795	0.5940	0.5011	0.5100





# MEASUREMENT 4

## For Body Liquid

Type: Validation measurement (Fast, 75.00 %)

Date of measurement: 12/11/2018

Measurement duration: 12 minutes 21 seconds

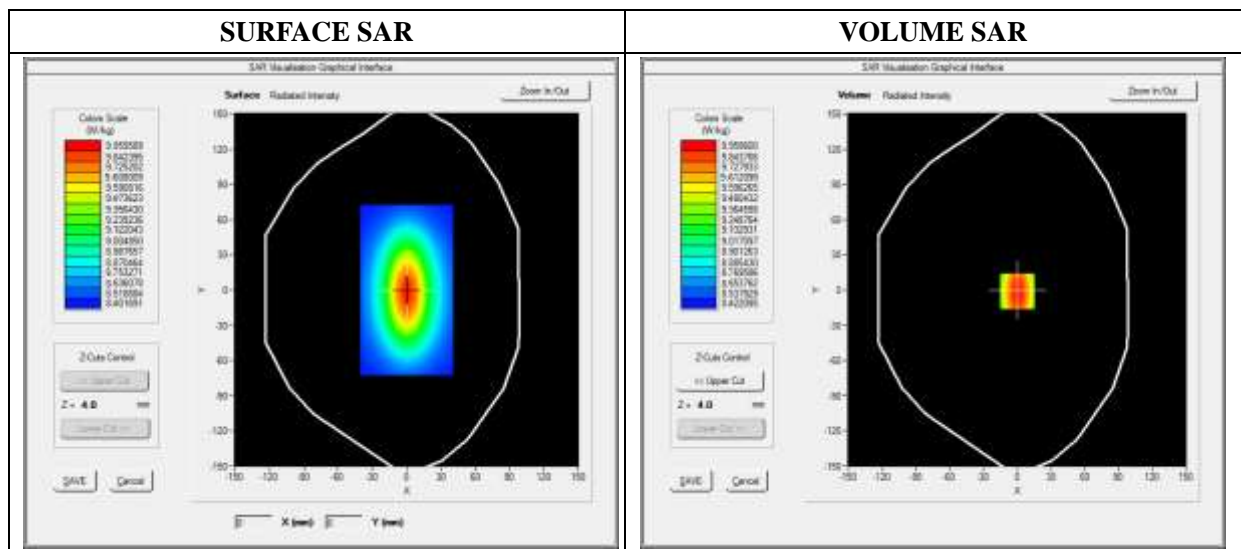
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.55; Calibrated: 06/01/2018

### A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Validation plane
<b>Device Position</b>	Dipole
<b>Band</b>	CW1900
<b>Signal</b>	Duty Cycle 1:1

### B. SAR Measurement Results

<b>Frequency (MHz)</b>	1900.000000
<b>Relative Permittivity (real part)</b>	52.420415
<b>Conductivity (S/m)</b>	1.501966
<b>Power Variation (%)</b>	0.541872
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3

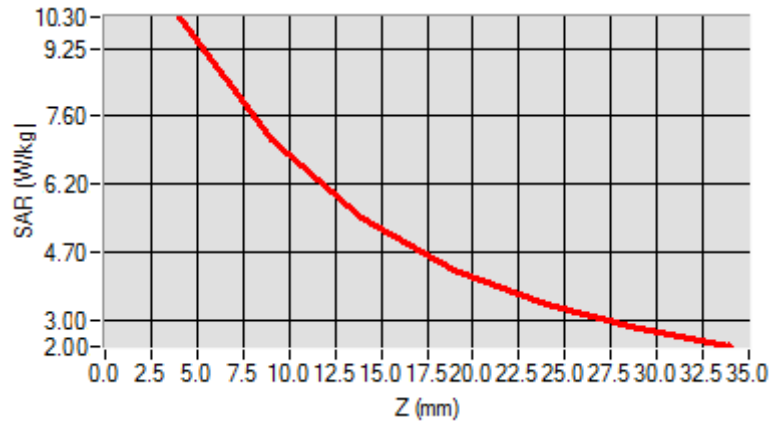


Maximum location: X=0.00, Y=0.00

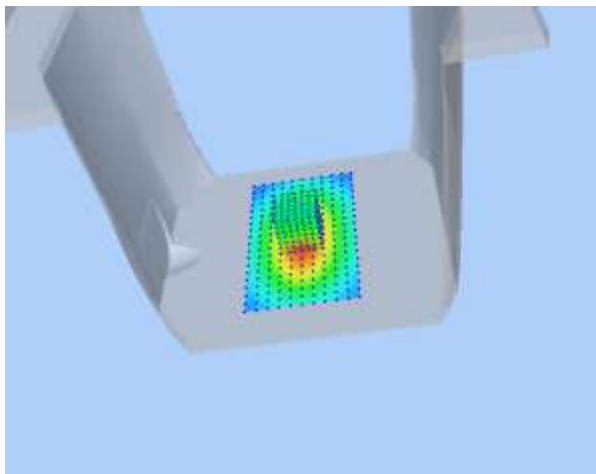
SAR 10g (W/Kg)	5.134651
SAR 1g (W/Kg)	9.801550

Z Axis Scan

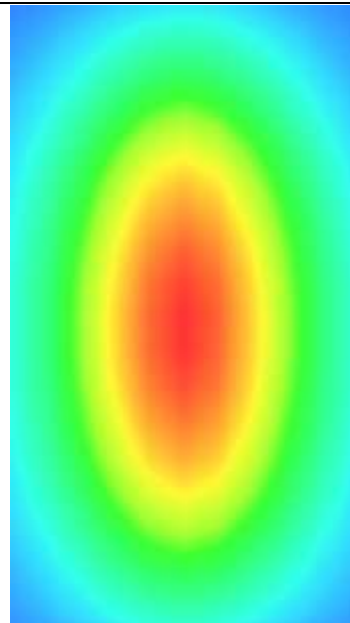
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	10.2031	6.43001	4.9011	4.5325	3.1201	2.5024



3D screen shot



Hot spot position



## Annex B. Plots of SAR Measurement

<b><u>TYPE</u></b>	<b><u>BAND</u></b>	<b><u>PARAMETERS</u></b>
<b>Phone</b>	<b>GSM850</b>	<u>Measurement 1:</u> Right Head with Cheek device position on Middle Channel in GSM mode
<b>Phone</b>	<b>GSM1900</b>	<u>Measurement 5:</u> Right Head with Cheek device position on High Channel in GSM mode
<b>Phone</b>	<b>GSM850</b>	<u>Measurement 9:</u> Flat Plane with Back(Body-worn) device position on Middle Channel in GSM mode
<b>Phone</b>	<b>GPRS850_3TX</b>	<u>Measurement 11:</u> Flat Plane with Back device position on Low Channel in GPRS mode
<b>Phone</b>	<b>GSM1900</b>	<u>Measurement 16:</u> Flat Plane with Back(Body-worn) device position on High Channel in GSM mode
<b>Phone</b>	<b>GPRS1900_3TX</b>	<u>Measurement 18:</u> Flat Plane with Back device position on High Channel in GPRS mode
<i>Remark: SAR plot is showed the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.</i>		

# MEASUREMENT 1

Type: Phone measurement (Complete)

Date of measurement: 12/10/2018

Measurement duration: 11 minutes 48 seconds

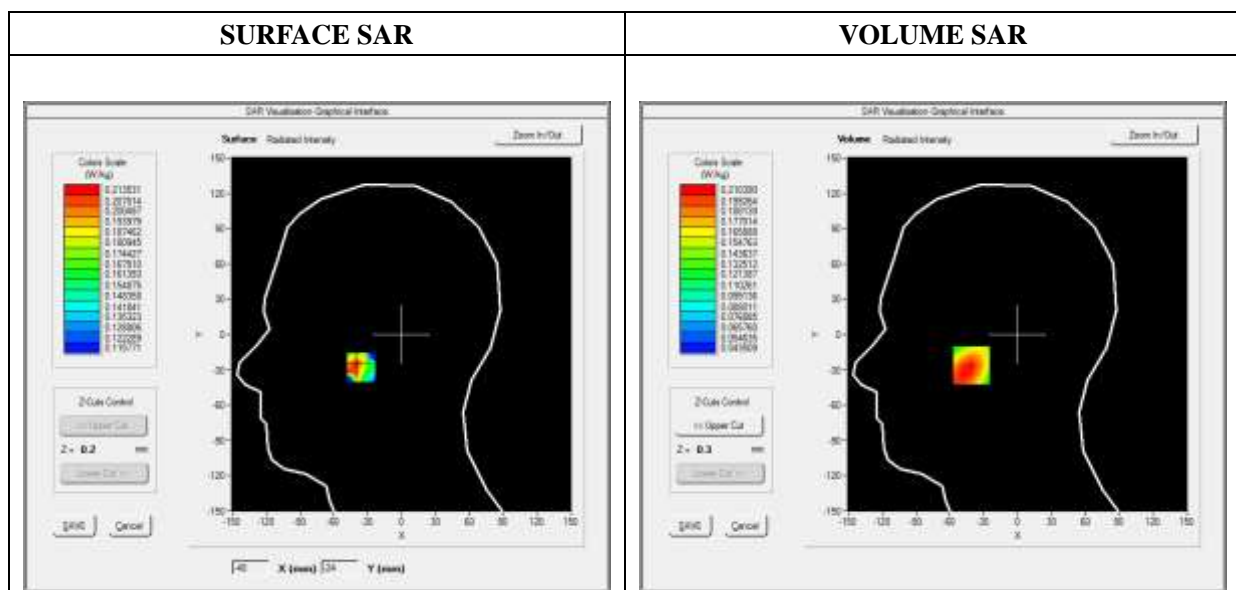
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.93; Calibrated: 06/01/2018

## A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Right head
<b>Device Position</b>	Cheek
<b>Band</b>	GSM850
<b>Channels</b>	Middle
<b>Signal</b>	TDMA (Crest factor: 8.0)

## B. SAR Measurement Results

<b>Frequency (MHz)</b>	836.600000
<b>Relative Permittivity (real part)</b>	41.110245
<b>Conductivity (S/m)</b>	0.871245
<b>Power Variation (%)</b>	1.956700
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3

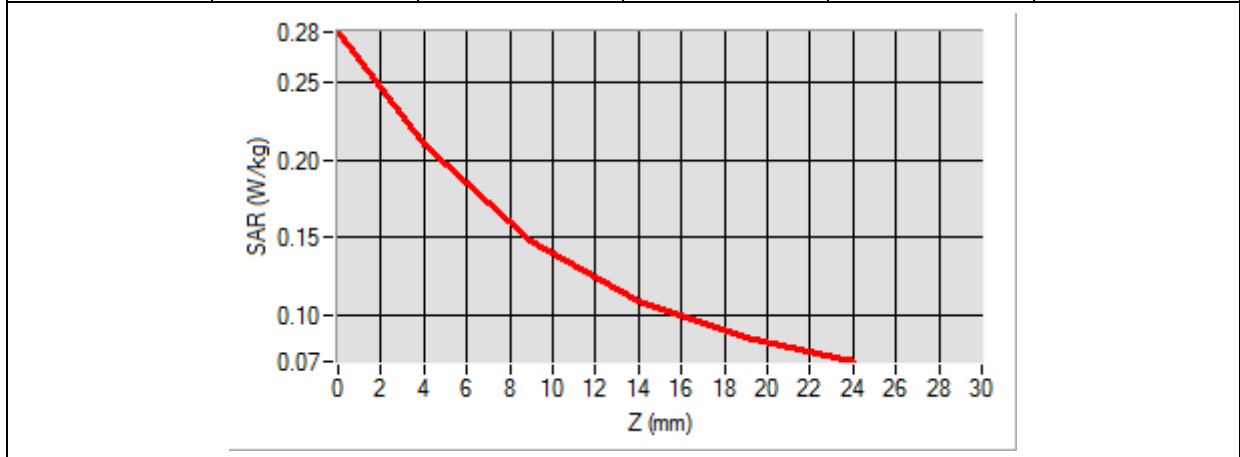


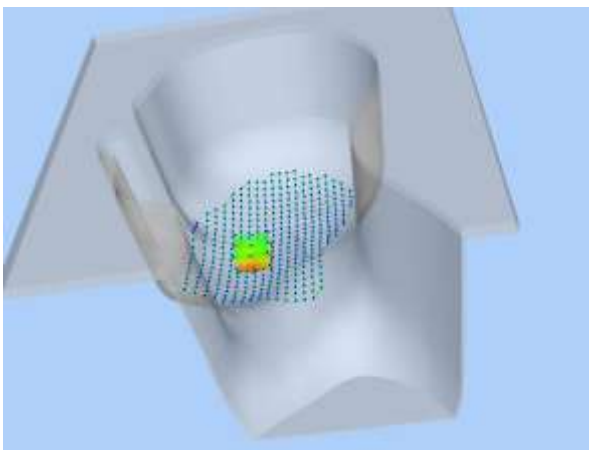

**Maximum location: X=-41.00, Y=-26.00**

**SAR Peak: 0.29 W/kg**

<b>SAR 10g (W/Kg)</b>	<b>0.142934</b>
<b>SAR 1g (W/Kg)</b>	<b>0.204549</b>

<b>Z (mm)</b>	<b>0.00</b>	<b>4.00</b>	<b>9.00</b>	<b>14.00</b>	<b>19.00</b>
<b>SAR (W/Kg)</b>	<b>0.2829</b>	<b>0.2104</b>	<b>0.1478</b>	<b>0.1090</b>	<b>0.0858</b>



<b>3D screen shot</b>	<b>Hot spot position</b>
	

# MEASUREMENT 5

Type: Phone measurement (Complete)

Date of measurement: 12/11/2018

Measurement duration: 12 minutes 3 seconds

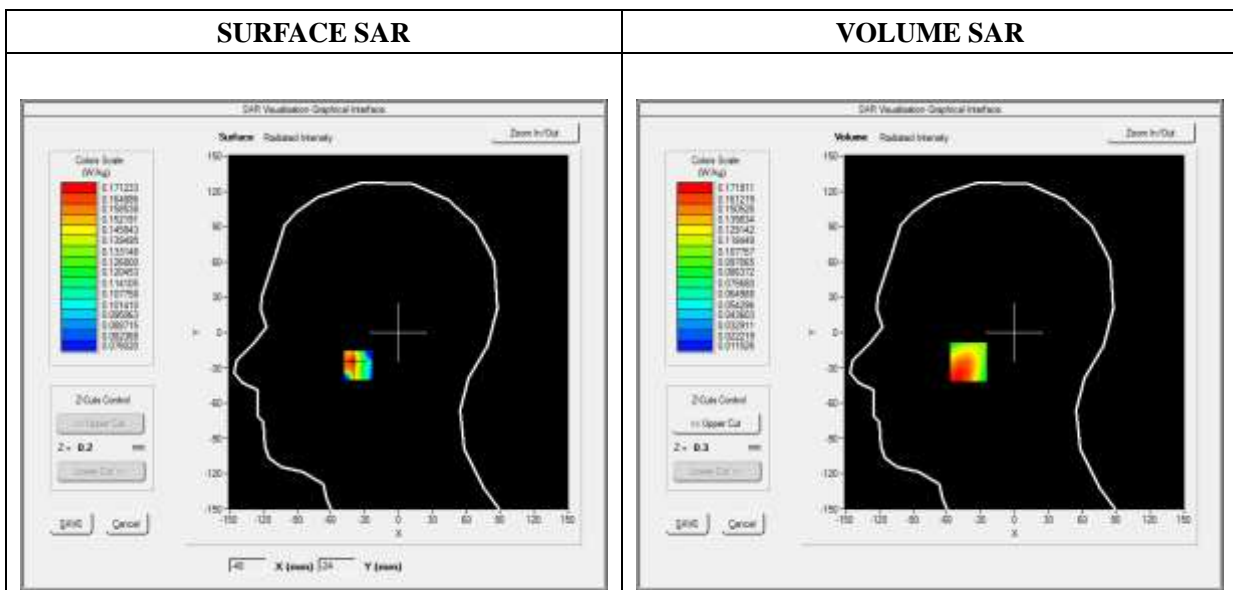
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.35; Calibrated: 06/01/2018

### A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Right head
<b>Device Position</b>	Cheek
<b>Band</b>	GSM1900
<b>Channels</b>	High
<b>Signal</b>	TDMA (Crest factor: 8.0)

### B. SAR Measurement Results

<b>Frequency (MHz)</b>	1909.800000
<b>Relative Permittivity (real part)</b>	38.560124
<b>Conductivity (S/m)</b>	1.380369
<b>Power Variation (%)</b>	1.869568
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3

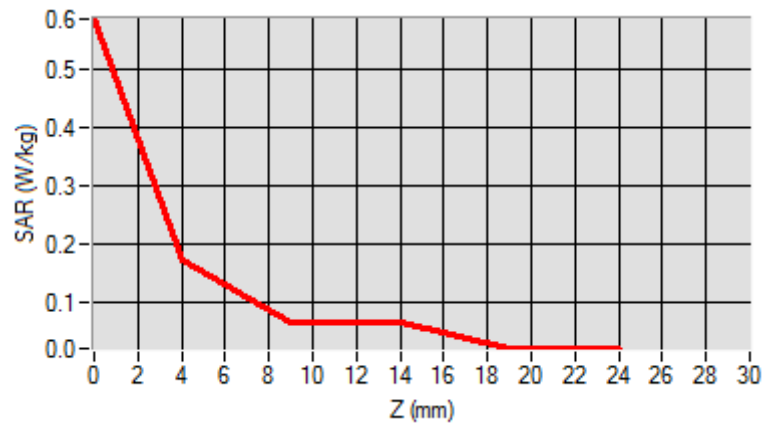


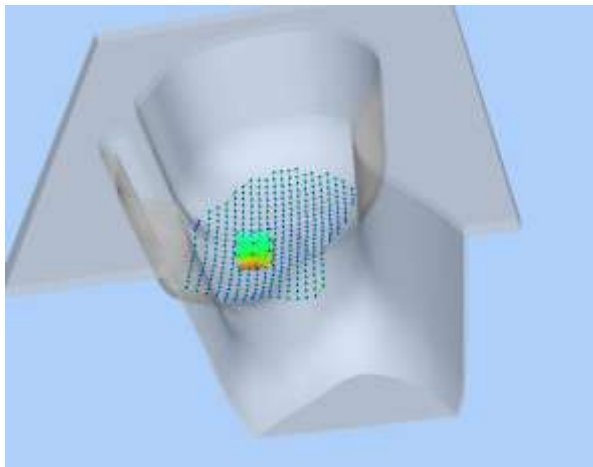

Maximum location: X=-41.00, Y=-25.00

SAR Peak: 0.25 W/kg

SAR 10g (W/Kg)	0.096681
SAR 1g (W/Kg)	0.162366

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.5855	0.1719	0.0668	0.0670	0.0226



3D screen shot	Hot spot position
	

# MEASUREMENT 9

Type: Phone measurement (Complete)

Date of measurement: 12/10/2018

Measurement duration: 12 minutes 3 seconds

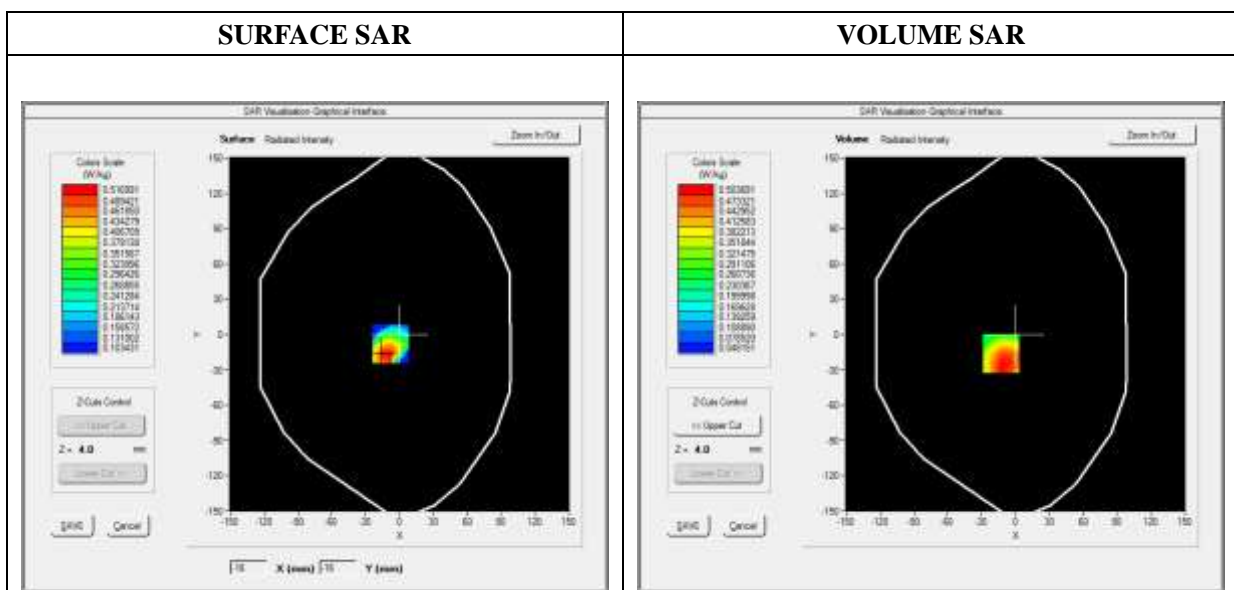
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 7.13; Calibrated: 06/01/2018

## A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Flat Plane
<b>Device Position</b>	Back(Body-worn)
<b>Band</b>	GSM850
<b>Channels</b>	Middle
<b>Signal</b>	TDMA (Crest factor: 8.0)

## B. SAR Measurement Results

<b>Frequency (MHz)</b>	836.600000
<b>Relative Permittivity (real part)</b>	54.851214
<b>Conductivity (S/m)</b>	0.951454
<b>Power Variation (%)</b>	0.785060
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3



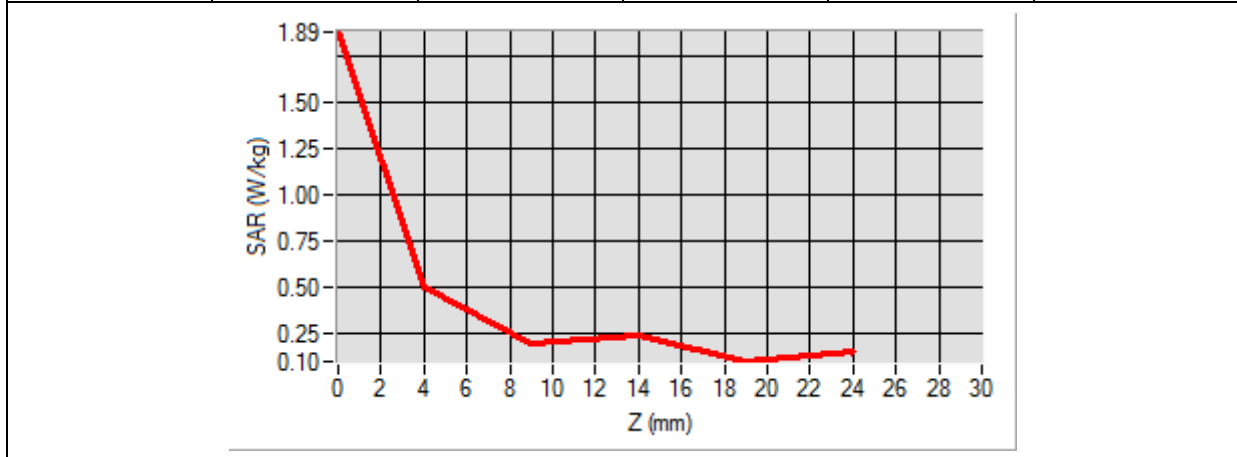


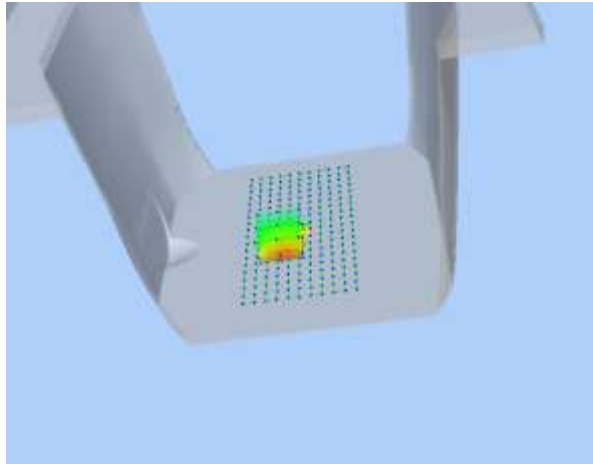
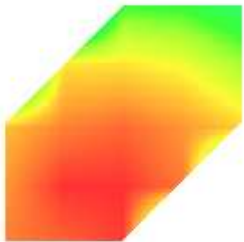
**Maximum location: X=-13.00, Y=-16.00**

**SAR Peak: 0.71 W/kg**

<b>SAR 10g (W/Kg)</b>	<b>0.328437</b>
<b>SAR 1g (W/Kg)</b>	<b>0.488608</b>

<b>Z (mm)</b>	<b>0.00</b>	<b>4.00</b>	<b>9.00</b>	<b>14.00</b>	<b>19.00</b>
<b>SAR (W/Kg)</b>	<b>1.8859</b>	<b>0.5037</b>	<b>0.2008</b>	<b>0.2354</b>	<b>0.0984</b>



<b>3D screen shot</b>	<b>Hot spot position</b>
	

# MEASUREMENT 11

Type: Phone measurement (Complete)

Date of measurement: 12/10/2018

Measurement duration: 12 minutes 3 seconds

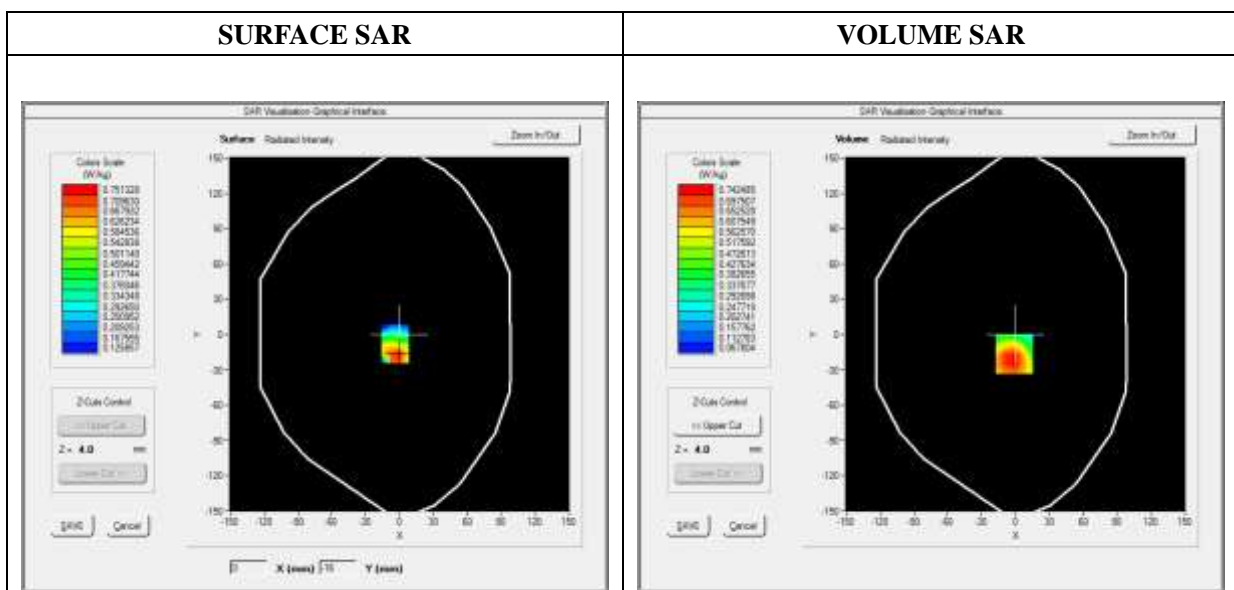
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 7.13; Calibrated: 06/01/2018

## A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Flat plane
<b>Device Position</b>	Back
<b>Band</b>	GPRS850_3TX
<b>Channels</b>	Low
<b>Signal</b>	Duty Cycle: 1:2.66

## B. SAR Measurement Results

<b>Frequency (MHz)</b>	824.200000
<b>Relative Permittivity (real part)</b>	54.851214
<b>Conductivity (S/m)</b>	0.951454
<b>Power Variation (%)</b>	0.562472
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3

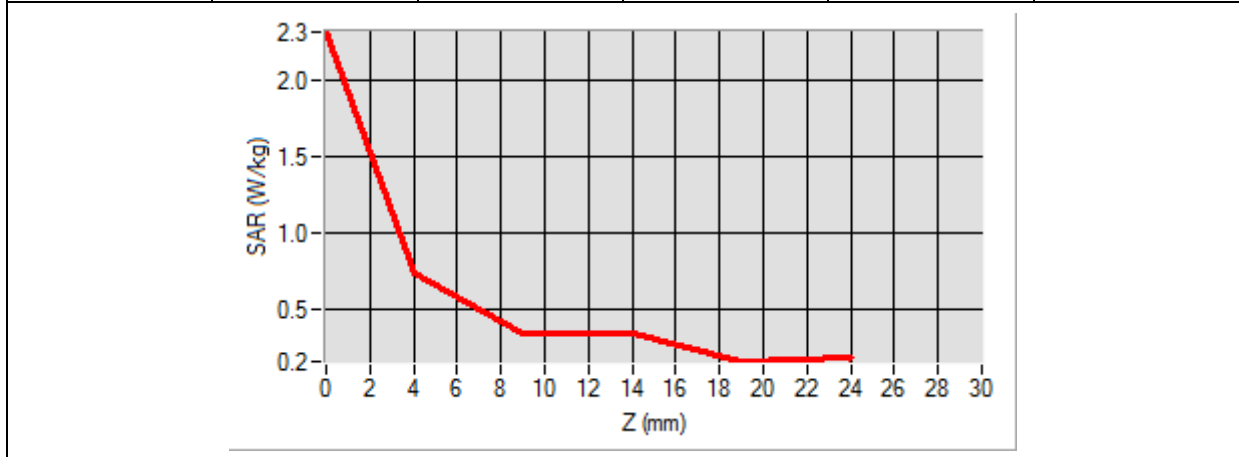


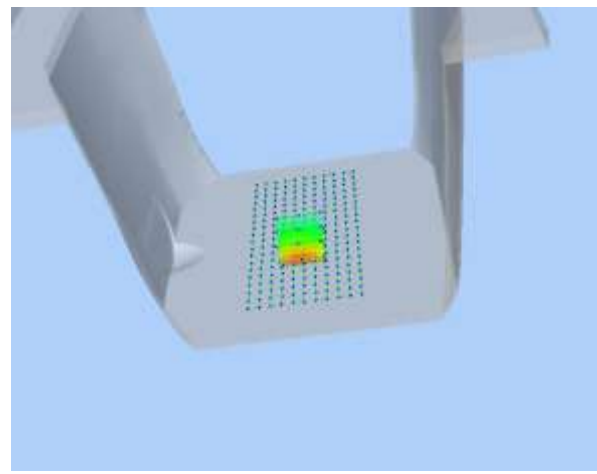
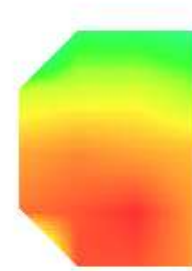
Maximum location: X=-1.00, Y=-17.00

SAR Peak: 1.11 W/kg

SAR 10g (W/Kg)	0.466960
SAR 1g (W/Kg)	0.733314

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.3159	0.7425	0.3475	0.3406	0.1588



3D screen shot	Hot spot position
	

# MEASUREMENT 16

Type: Phone measurement (Complete)

Date of measurement: 12/11/2018

Measurement duration: 12 minutes 3 seconds

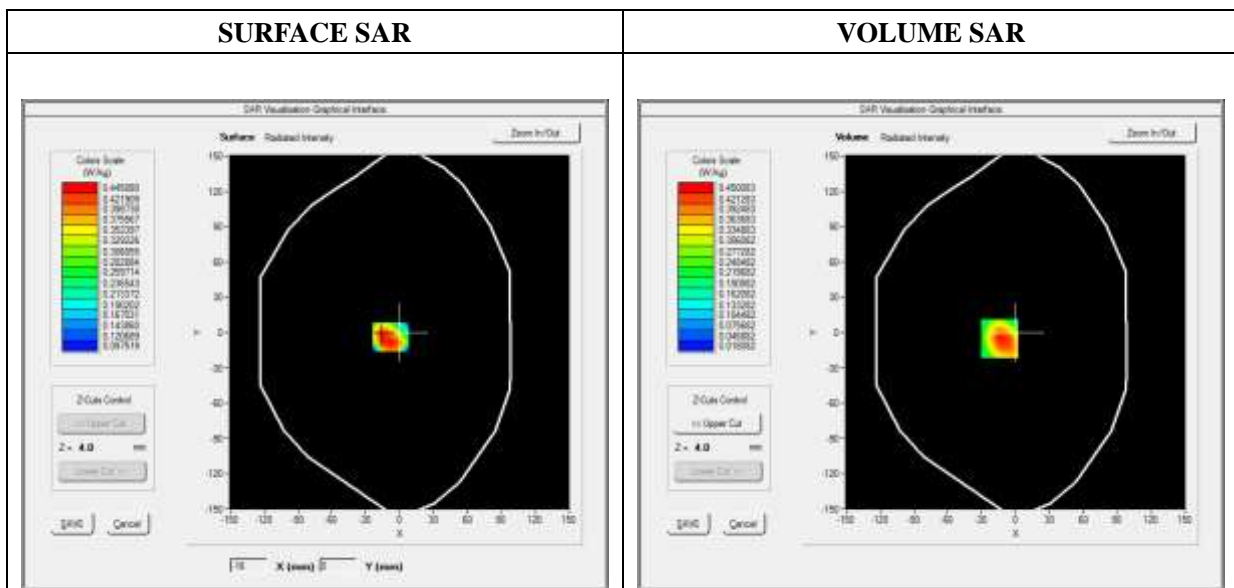
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.55; Calibrated: 06/01/2018

## A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Flat Plane
<b>Device Position</b>	Back(Body-worn)
<b>Band</b>	GSM1900
<b>Channels</b>	High
<b>Signal</b>	TDMA (Crest factor: 8.0)

## B. SAR Measurement Results

<b>Frequency (MHz)</b>	1909.800000
<b>Relative Permittivity (real part)</b>	52.420415
<b>Conductivity (S/m)</b>	1.501966
<b>Power Variation (%)</b>	0.568946
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3

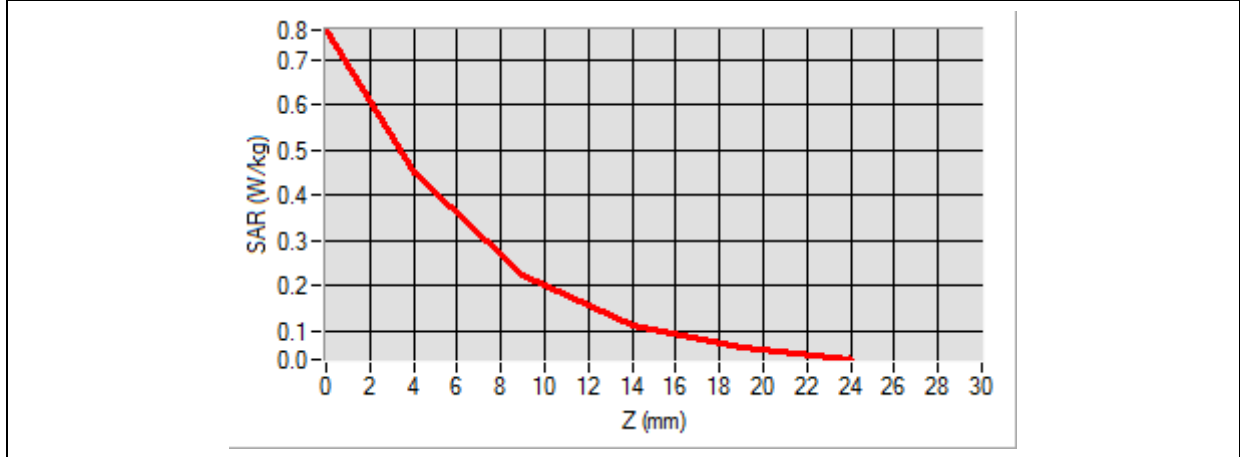


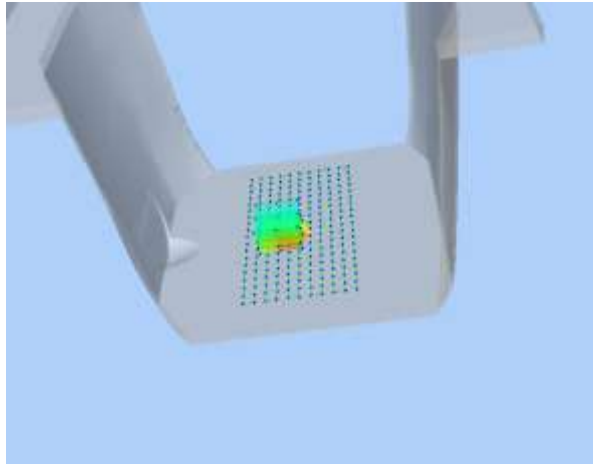
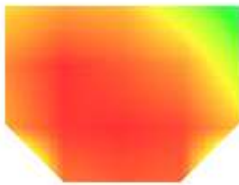
**Maximum location: X=-14.00, Y=-5.00**

**SAR Peak: 0.78 W/kg**

<b>SAR 10g (W/Kg)</b>	<b>0.226723</b>
<b>SAR 1g (W/Kg)</b>	<b>0.430604</b>

<b>Z (mm)</b>	<b>0.00</b>	<b>4.00</b>	<b>9.00</b>	<b>14.00</b>	<b>19.00</b>
<b>SAR (W/Kg)</b>	<b>0.7648</b>	<b>0.4501</b>	<b>0.2224</b>	<b>0.1115</b>	<b>0.0620</b>



3D screen shot	Hot spot position
	

## MEASUREMENT 18

Type: Phone measurement (Complete)

Date of measurement: 12/11/2018

Measurement duration: 12 minutes 3 seconds

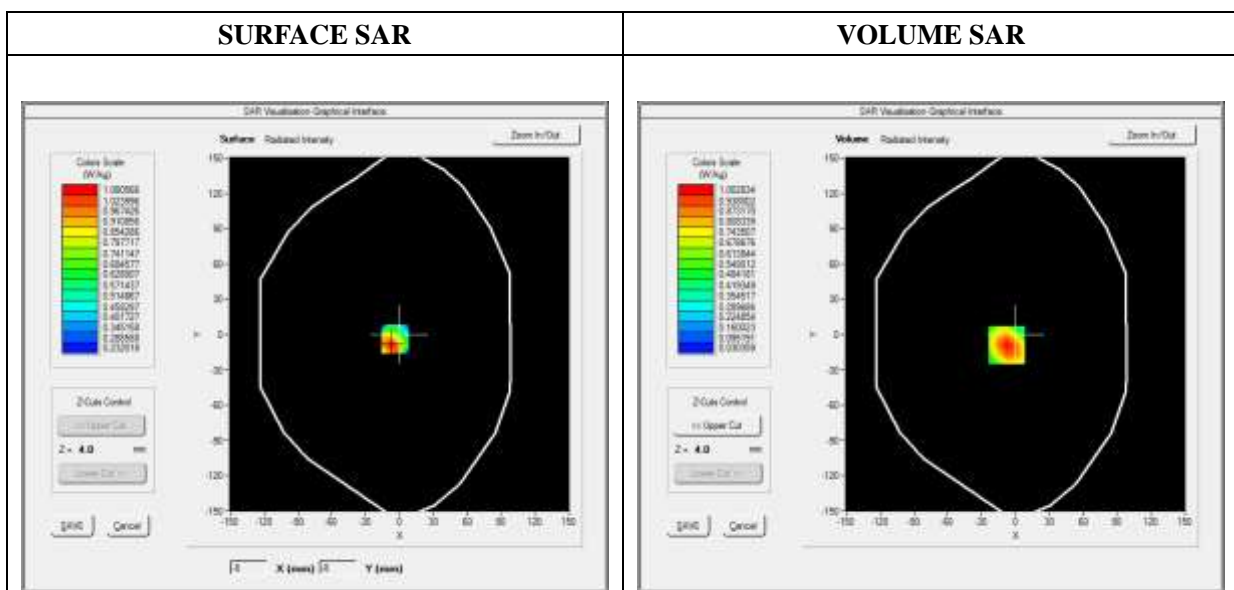
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.55; Calibrated: 06/01/2018

### A. Experimental conditions

<b>Area Scan</b>	dx=8mm dy=8mm
<b>Zoom Scan</b>	dx=8mm dy=8mm dz=5mm
<b>Phantom</b>	Flat plane
<b>Device Position</b>	Back side
<b>Band</b>	GPRS1900_3TX
<b>Channels</b>	High
<b>Signal</b>	Duty Cycle: 1:2.66

### B. SAR Measurement Results

<b>Frequency (MHz)</b>	1909.800000
<b>Relative Permittivity (real part)</b>	52.420415
<b>Conductivity (S/m)</b>	1.501966
<b>Power Variation (%)</b>	0.986340
<b>Ambient Temperature</b>	21.1
<b>Liquid Temperature</b>	21.3

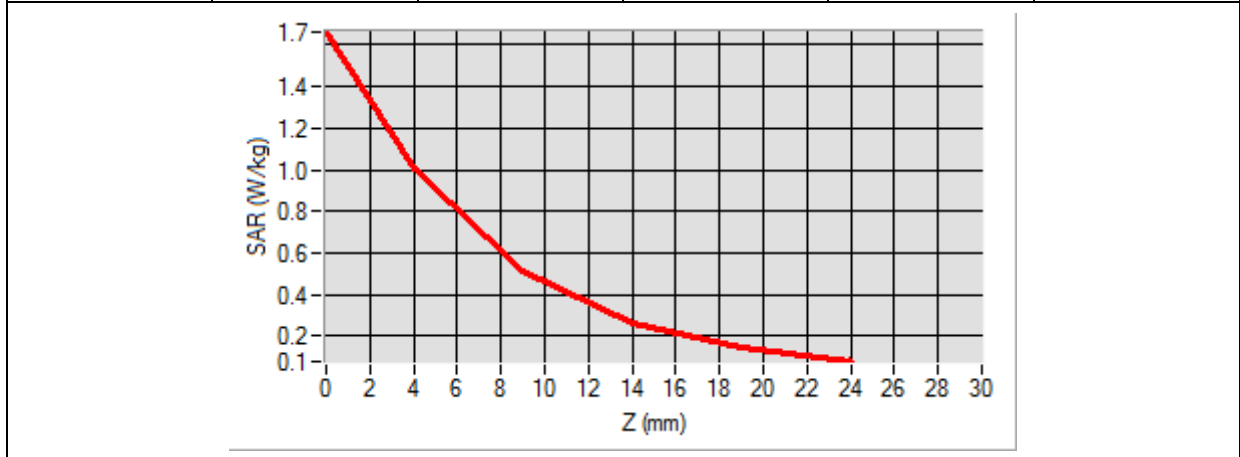


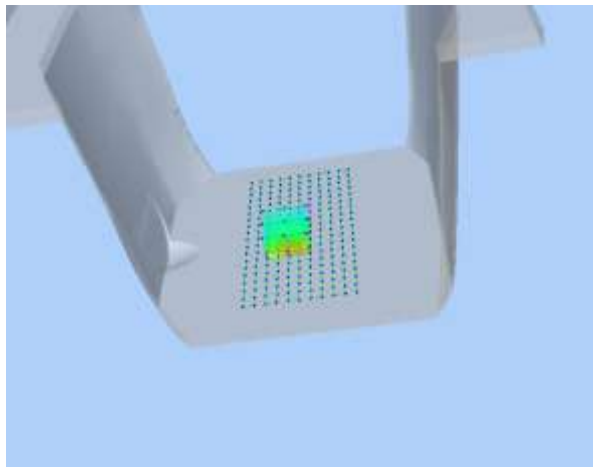
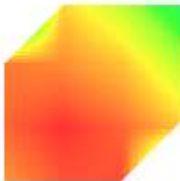
**Maximum location: X=-8.00, Y=-9.00**

**SAR Peak: 1.67 W/kg**

<b>SAR 10g (W/Kg)</b>	<b>0.505845</b>
<b>SAR 1g (W/Kg)</b>	<b>0.947815</b>

<b>Z (mm)</b>	<b>0.00</b>	<b>4.00</b>	<b>9.00</b>	<b>14.00</b>	<b>19.00</b>
<b>SAR (W/Kg)</b>	<b>1.6627</b>	<b>1.0028</b>	<b>0.5122</b>	<b>0.2624</b>	<b>0.1438</b>



3D screen shot	Hot spot position
	

## Annex C. EUT Photos

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### EUT View 1

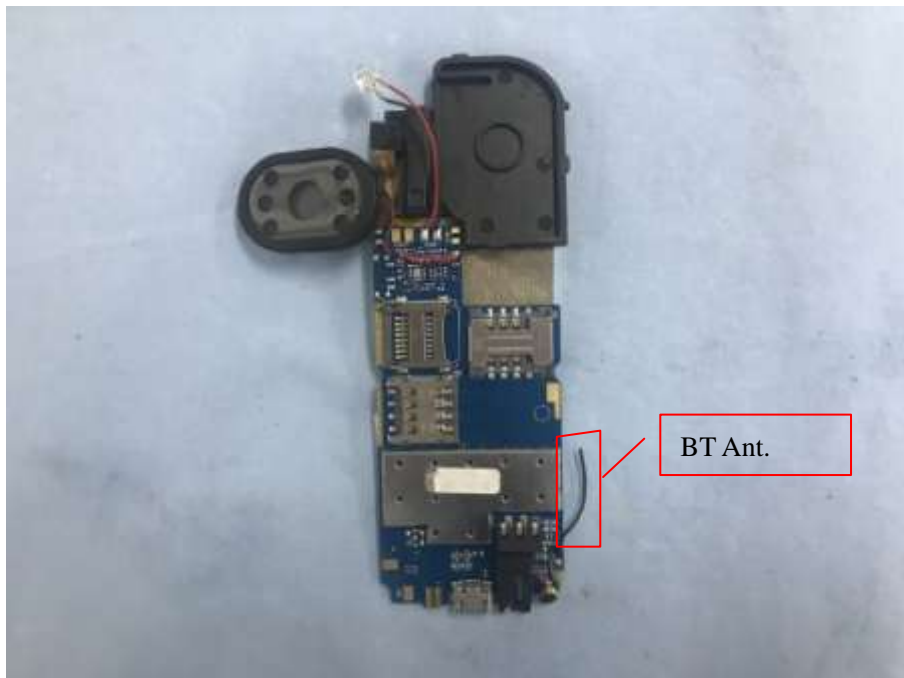


### EUT View 2





## Antenna View

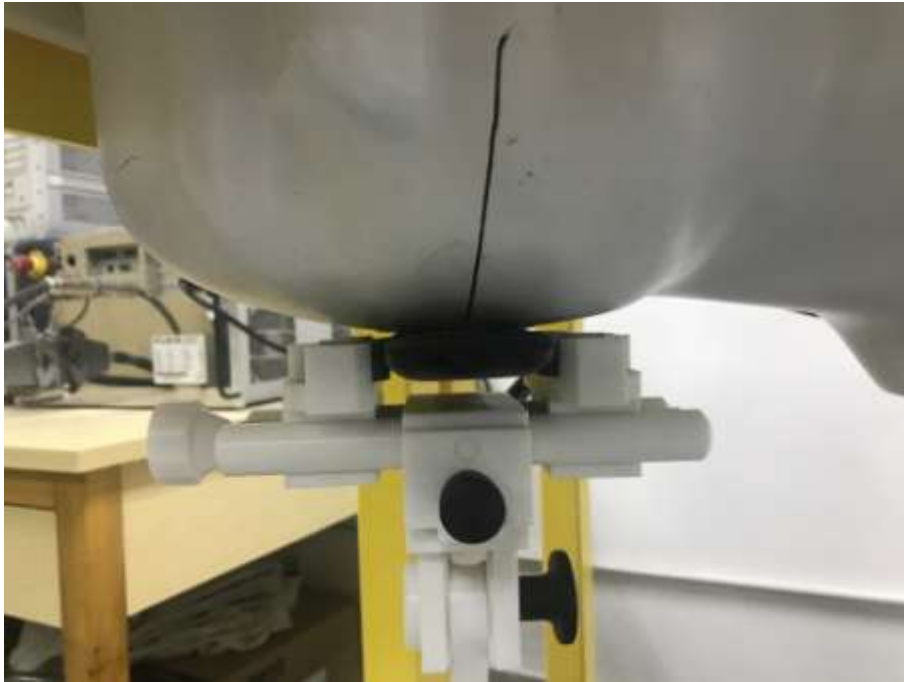


## Annex D. Test Setup Photos

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### Head Exposure Conditions

**Cheek**



**Tilt**



**Cheek**



**Tilt**



## Body mode Exposure Conditions

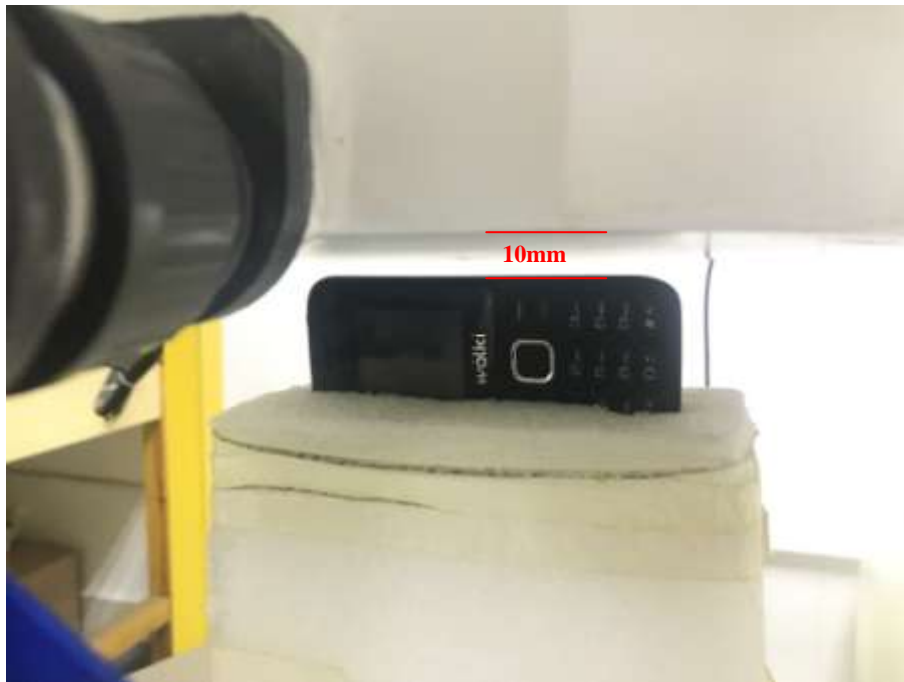
### Body Front



### Body Back



### Body Right



### Body Left



### Body Bottom



## Annex E. Calibration Certificate

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**Please refer to the Exhibit for the Calibration Certificate**

**\*\*\*\*\* END OF REPORT \*\*\*\*\***