

# FCC SAR EVALUATION REPORT

In accordance with the requirements of  
FCC 47 CFR Part 2(2.1093), ANSI/IEEE C95.1-1992 and  
IEEE Std 1528-2013

**Product Name :** Smart Phone

**Trademark :** Haier

**Model Name :** HM-G552-FL

**Serial Model :** G7

**Report No. :** SER171017742006E

**FCC ID :** SG7201710G552

**Prepared for**

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## TEST RESULT CERTIFICATION

**Applicant's name** .....: Haier telecom(Qingdao) Co.,Ltd  
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**Manufacturer's Name**.....: Haier telecom(Qingdao) Co.,Ltd  
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### Product description

**Product name**.....: Smart Phone  
**Trademark** .....: Haier  
**Model and/or type reference** .: HM-G552-FL  
**Serial Model**.....: G7

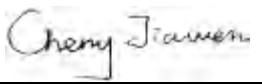
**Standards** .....: FCC 47 CFR Part 2(2.1093)  
ANSI/IEEE C95.1-1992  
IEEE Std 1528-2013  
Published RF exposure KDB procedures


This device described above has been tested by Shenzhen NTEK. In accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 and KDB 865664 D01. Testing has shown that this device is capable of compliance with localized specific absorption rate (SAR) specified in FCC 47 CFR Part 2(2.1093) and ANSI/IEEE C95.1-1992. The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

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### Date of Test

**Date (s) of performance of tests** .....: Oct. 20, 2017 ~ Oct. 31, 2017  
**Date of Issue** .....: Nov. 24, 2017  
**Test Result**.....: **Pass**

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(Cheng Jiawen)

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※ ※ **Revision History** ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Nov. 24, 2017	Cheng Jiawen

## TABLE OF CONTENTS

1. General Information .....	6
1.1. RF exposure limits .....	6
1.2. Statement of Compliance.....	7
1.3. EUT Description .....	8
1.4. Test specification(s) .....	10
1.5. Ambient Condition.....	10
2. SAR Measurement System .....	11
2.1. SATIMO SAR Measurement Set-up Diagram .....	11
2.2. Robot .....	12
2.3. E-Field Probe.....	13
2.3.1. E-Field Probe Calibration.....	13
2.4. SAM phantoms .....	14
2.4.1. Technical Data .....	14
2.5. Device Holder .....	16
2.6. Test Equipment List .....	17
3. SAR Measurement Procedures .....	19
3.1. Power Reference.....	19
3.2. Area scan & Zoom scan .....	19
3.3. Description of interpolation/extrapolation scheme .....	21
3.4. Volumetric Scan .....	21
3.5. Power Drift .....	21
4. System Verification Procedure.....	22
4.1. Tissue Verification.....	22
4.1.1. Tissue Dielectric Parameter Check Results .....	23
4.2. System Verification Procedure .....	24
4.2.1. System Verification Results .....	25
5. SAR Measurement variability and uncertainty.....	26
5.1. SAR measurement variability .....	26
5.2. SAR measurement uncertainty.....	26
6. RF Exposure Positions .....	27
6.1. Ear and handset reference point.....	27
6.2. Definition of the cheek position .....	27
6.3. Definition of the tilt position.....	29
6.4. Body Worn Accessory .....	29
6.5. Wireless Router Devices.....	30
7. RF Output Power .....	31
7.1. Maximum Tune-up Limit .....	31
7.2. GSM Conducted Power .....	36
7.3. WCDMA Conducted Power.....	37

7.4. LTE Conducted Power.....	39
7.5. WLAN & BT Output Power.....	49
7.5.1. Output Power Results Of WLAN .....	49
7.5.2. Output Power Results Of BT .....	49
8. Antenna Location.....	50
9. Stand-alone SAR test exclusion.....	51
10. SAR Measurement Results.....	52
10.1. SAR measurement results .....	52
10.1.1. SAR measurement Result of GSM850.....	53
10.1.2. SAR measurement Result of GSM1900.....	54
10.1.3. SAR measurement Result of WCDMA Band V.....	55
10.1.4. SAR measurement Result of WCDMA Band II.....	56
10.1.5. SAR measurement Result of LTE Band V .....	57
10.1.6. SAR measurement Result of LTE Band IV .....	58
10.1.7. SAR measurement Result of LTE Band II .....	61
10.1.8. SAR measurement Result of LTE Band VII .....	62
10.1.9. SAR measurement Result of WLAN 2.4G.....	64
10.2. Simultaneous Transmission Possibilities.....	65
10.3. SAR Summation Scenario .....	66
11. Appendix A. Photo documentation.....	73
12. Appendix B. System Check Plots .....	80
13. Appendix C. Plots of High SAR Measurement .....	91
14. Appendix D. Calibration Certificate.....	110

# 1. General Information

## 1.1. RF exposure limits

(A).Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

(B).Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

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

### 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).

### General Population/Uncontrolled Environments:

Are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

NOTE  
 HEAD AND TRUNK LIMIT  
 1.6 W/kg  
 APPLIED TO THIS EUT

## 1.2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for HM-G552-FL are as follows.

Band	Max Reported SAR Value(W/kg)			Max. SAR Summation
	1-g Head	1-g Body-Worn (Separation distance of 10mm)	1-g Hotspot (Separation distance of 10mm)	
GSM 850	0.430	0.637	0.637	1.590
GSM 1900	0.477	0.613	0.613	
WCDMA Band V	0.309	0.433	0.433	
WCDMA Band II	0.452	0.590	0.590	
LTE Band V	0.564	0.567	0.494	
LTE Band IV	0.541	1.192	1.192	
LTE Band II	0.555	0.737	0.737	
LTE Band VII	0.139	0.406	0.406	
WLAN 2.4G	1.035	0.272	0.272	

NOTE: The Max. SAR Summation is calculated based on the same configuration and test position. 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 C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 & KDB 865664 D01.

### 1.3. EUT Description

Device Information			
Product Name	Smart Phone		
Trade Name	Haier		
Model Name	HM-G552-FL		
Serial Model	G7		
FCC ID	SG7201710G552		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna	FPCB Antenna		
Battery Information	DC 3.8V, 2200mAh		
Device Operating Configurations			
Supporting Mode(s)	GSM 850/1900, WCDMA Band V/II, LTE Band V/IV/III/VII, WLAN 2.4G, BT		
Test Modulation	GSM(GMSK/8PSK), WCDMA(QPSK), LTE(QPSK/16QAM), WLAN(DSSS/OFDM)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM 850	824-849	869-894
	GSM 1900	1850-1910	1930-1990
	WCDMA Band V	824-849	869-894
	WCDMA Band II	1850-1910	1930-1990
	LTE Band V	824-849	869-894
	LTE Band IV	1710-1755	2110-2155
	LTE Band II	1850-1910	1930-1990
	LTE Band VII	2500-2570	2620-2690
	WLAN 2.4G	2412-2462	
	BT	2402-2480	
GPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
EDGE Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
HSDPA UE Category	14		
HSUPA UE Category	6		
Power Class	4, tested with power level 5(GSM 850)		
	1, tested with power level 0(GSM 1900)		
	3, tested with power control -all 1"(WCDMA Band V)		



	3, tested with power control -all 1”(WCDMA Band II)
	3, tested with power control all Max.(LTE Band V)
	3, tested with power control all Max.(LTE Band IV)
	3, tested with power control all Max.(LTE Band II)
	3, tested with power control all Max.(LTE Band VII)
Test Channels (low-mid-high)	128-189-251(GSM 850)
	512-661-810(GSM 1900)
	4132-4182-4233(WCDMA Band V)
	9262-9400-9538(WCDMA Band II)
	20407-20525-20643(LTE Band V BW=1.4MHz)
	20415-20525-20635(LTE Band V BW=3MHz)
	20425-20525-20625(LTE Band V BW=5MHz)
	20450-20525-20600(LTE Band V BW=10MHz)
	19957-20175-20393(LTE Band IV BW=1.4MHz)
	19965-20175-20385(LTE Band IV BW=3MHz)
	19975-20175-20375(LTE Band IV BW=5MHz)
	20000-20175-20350(LTE Band IV BW=10MHz)
	20025-20175-20325(LTE Band IV BW=15MHz)
	20050-20175-20300(LTE Band IV BW=20MHz)
	18607-18900-19193(LTE Band II BW=1.4MHz)
	18615-18900-19185(LTE Band II BW=3MHz)
	18625-18900-19175(LTE Band II BW=5MHz)
	18650-18900-19150(LTE Band II BW=10MHz)
	18675-18900-19125(LTE Band II BW=15MHz)
	18700-18900-19100(LTE Band II BW=20MHz)
	20775-21100-21425(LTE Band VII BW=5MHz)
	20800-21100-21400(LTE Band VII BW=10MHz)
	20825-21100-21375(LTE Band VII BW=15MHz)
20850-21100-21350(LTE Band VII BW=20MHz)	
802.11 b/g/n:1-6-11(WLAN 2.4G)	

#### 1.4. Test specification(s)

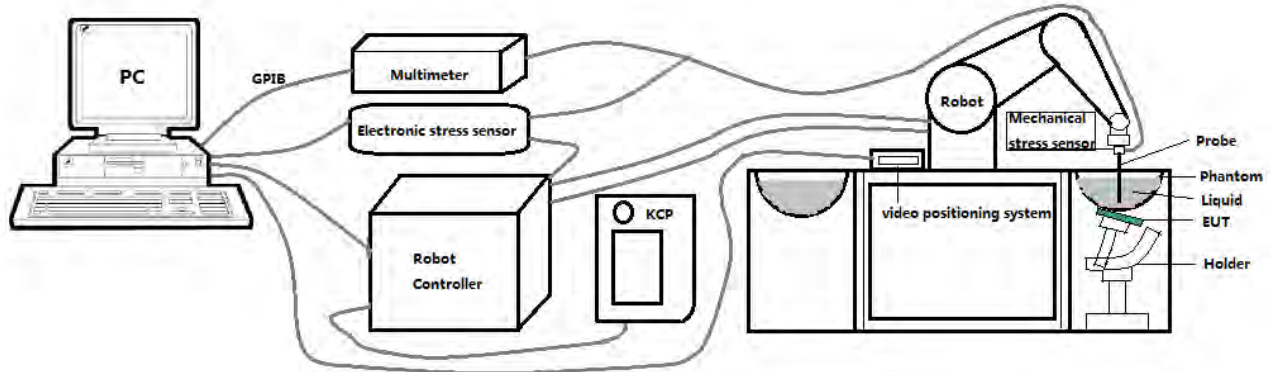
FCC 47 CFR Part 2(2.1093)
ANSI/IEEE C95.1-1992
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting
KDB 447498 D01 General RF Exposure Guidance
KDB 248227 D01 802.11 WLAN SAR
KDB 941225 D01 3G SAR Procedures
KDB 941225 D05 SAR for LTE Devices
KDB 941225 D06 Hotspot SAR
KDB 648474 D04 Handset SAR

#### 1.5. Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

## 2. SAR Measurement System

### 2.1. SATIMO SAR Measurement Set-up Diagram



These measurements were performed with the automated near-field scanning system OPENSAR from SATIMO. The system is based on a high precision robot (working range: 901 mm), which positions the probes with a positional repeatability of better than  $\pm 0.03$  mm. The SAR measurements were conducted with dosimetric probe (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation.

The first step of the field measurement is the evaluation of the voltages induced on the probe by the device under test. Probe diode detectors are nonlinear. Below the diode compression point, the output voltage is proportional to the square of the applied E-field; above the diode compression point, it is linear to the applied E-field. The compression point depends on the diode, and a calibration procedure is necessary for each sensor of the probe.

The Keithley multimeter reads the voltage of each sensor and send these three values to the PC. The corresponding E field value is calculated using the probe calibration factors, which are stored in the working directory. This evaluation includes linearization of the diode characteristics. The field calculation is done separately for each sensor. Each component of the E field is displayed on the "Dipole Area Scan Interface" and the total E field is displayed on the "3D Interface"

## 2.2. Robot

The SATIMO SAR system uses the high precision robots from KUKA. For the 6-axis controller system, the robot controller version (KUKA) from KUKA is used. The KUKA robot series have many features that are important for our application:



- High precision (repeatability  $\pm 0.03$  mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

### 2.3. E-Field Probe

This E-field detection probe is composed of three orthogonal dipoles linked to special Schottky diodes with low detection thresholds. The probe allows the measurement of electric fields in liquids such as the one defined in the IEEE and CENELEC standards.

For the measurements the Specific Dosimetric E-Field Probe SN 08/16 EPGO287 with following specifications is used



- Dynamic range: 0.01-100 W/kg
  - Tip Diameter : 2.5 mm
  - Distance between probe tip and sensor center: 1 mm
  - Distance between sensor center and the inner phantom surface: 2 mm (repeatability better than  $\pm 1$  mm).
  - Probe linearity:  $\pm 0.08$  dB
  - Axial isotropy:  $< 0.25$  dB
  - Hemispherical Isotropy:  $< 0.50$  dB
  - Calibration range: 650MHz to 5900MHz for head & body simulating liquid.
  - Lower detection limit: 7mW/kg
- Angle between probe axis (evaluation axis) and surface normal line: less than  $30^\circ$ .

#### 2.3.1. E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy shall be evaluated and within  $\pm 0.25$ dB. The sensitivity parameters (Norm X, Norm Y, and Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe are tested. The calibration data can be referred to appendix D of this report.

**2.4. SAM phantoms**

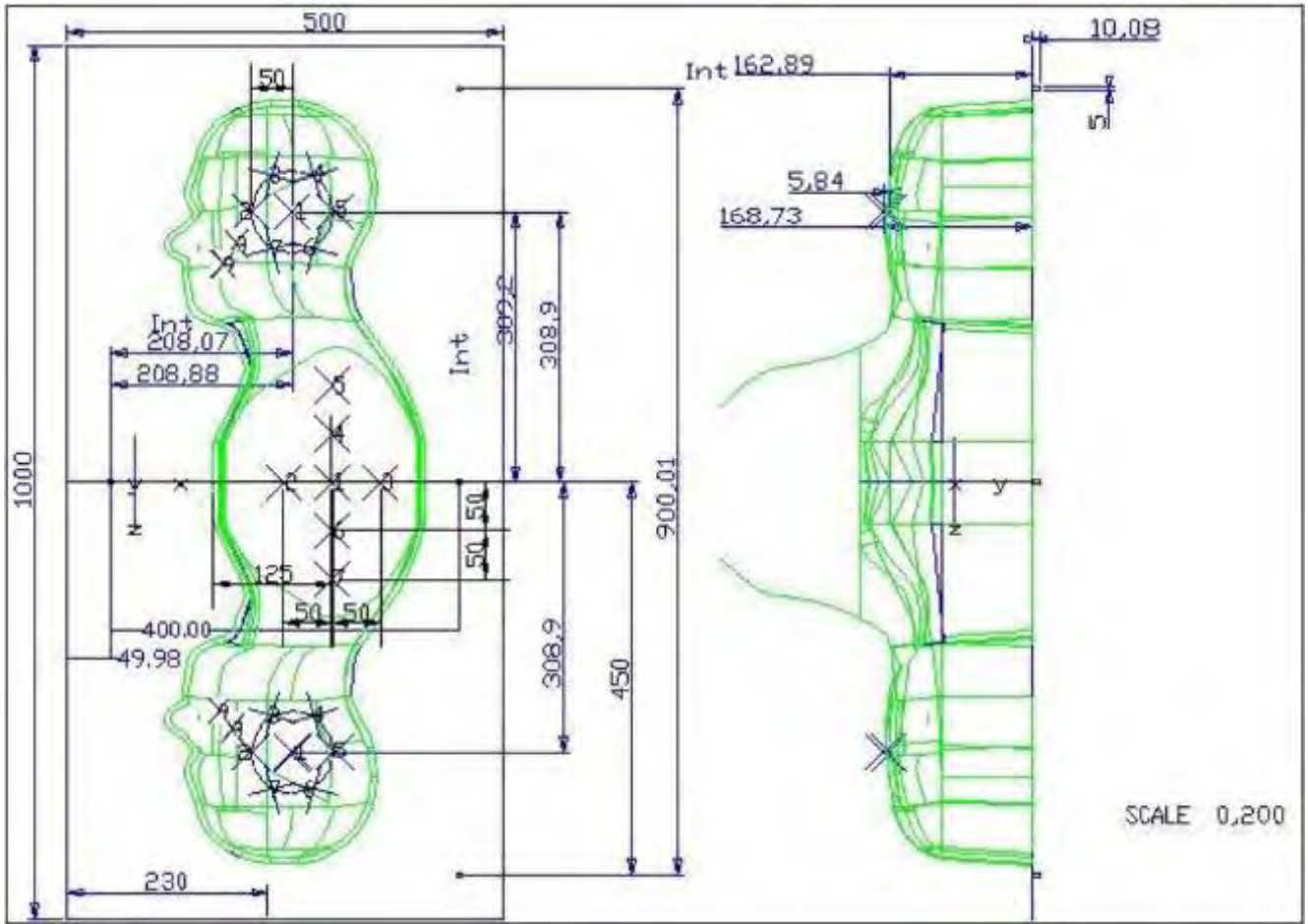
Photo of SAM phantom SN 16/15 SAM119



The SAM phantom is used to measure the SAR relative to people exposed to electro-magnetic field radiated by mobile phones.

**2.4.1. Technical Data**

Serial Number	Shell thickness	Filling volume	Dimensions	Positionner Material	Permittivity	Loss Tangent
<b>SN 16/15 SAM119</b>	2 mm ±0.2 mm	27 liters	Length:1000 mm Width:500 mm Height:200 mm	Gelcoat with fiberglass	3.4	0.02

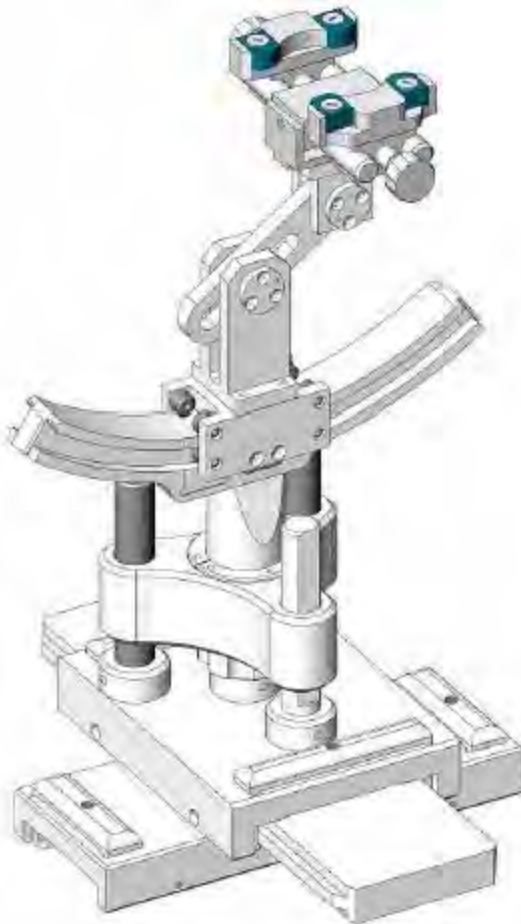


Serial Number	Left Head		Right Head		Flat Part	
<b>SN 16/15 SAM119</b>	2	2.02	2	2.08	1	2.09
	3	2.05	3	2.06	2	2.06
	4	2.07	4	2.07	3	2.08
	5	2.08	5	2.08	4	2.10
	6	2.05	6	2.07	5	2.10
	7	2.05	7	2.05	6	2.07
	8	2.07	8	2.06	7	2.07
	9	2.08	9	2.06	-	-

The test, based on ultrasonic system, allows measuring the thickness with an accuracy of 10 µm.

### 2.5. 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 degree.



Serial Number	Holder Material	Permittivity	Loss Tangent
SN 16/15 MSH100	Delrin	3.7	0.005



## 2.6. Test Equipment List

This table gives a complete overview of the SAR measurement equipment.

Devices used during the test described are marked

	Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
					Last Cal.	Due Date
<input checked="" type="checkbox"/>	MVG	E FIELD PROBE	SSE2	SN 08/16 EPGO287	Sep. 18, 2017	Sep. 17, 2018
<input type="checkbox"/>	MVG	450 MHz Dipole	SID450	SN 03/15 DIP 0G450-345	Apr. 06, 2015	Apr. 05, 2018
<input type="checkbox"/>	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Apr. 06, 2015	Apr. 05, 2018
<input checked="" type="checkbox"/>	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Apr. 06, 2015	Apr. 05, 2018
<input type="checkbox"/>	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Apr. 06, 2015	Apr. 05, 2018
<input checked="" type="checkbox"/>	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Apr. 06, 2015	Apr. 05, 2018
<input checked="" type="checkbox"/>	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Apr. 06, 2015	Apr. 05, 2018
<input type="checkbox"/>	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Apr. 06, 2015	Apr. 05, 2018
<input checked="" type="checkbox"/>	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Apr. 06, 2015	Apr. 05, 2018
<input checked="" type="checkbox"/>	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Apr. 06, 2015	Apr. 05, 2018
<input type="checkbox"/>	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Apr. 06, 2015	Apr. 05, 2018
<input checked="" type="checkbox"/>	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	NCR	NCR
<input checked="" type="checkbox"/>	MVG	Power Amplifier	N.A	AMPLISAR_28/14_003	NCR	NCR
<input checked="" type="checkbox"/>	KEITHLEY	Millivoltmeter	2000	4072790	NCR	NCR
<input checked="" type="checkbox"/>	R&S	Universal radio communication tester	CMU200	117858	Aug. 07, 2017	Aug. 06, 2018
<input checked="" type="checkbox"/>	R&S	Wideband radio communication tester	CMW500	148500	Jun. 06, 2017	Jun. 05, 2018
<input checked="" type="checkbox"/>	HP	Network Analyzer	8753D	3410J01136	Aug. 07, 2017	Aug. 06, 2018

<input checked="" type="checkbox"/>	Agilent	PSG Analog Signal Generator	E8257D	MY51110112	Aug. 07, 2017	Aug. 06, 2018
<input checked="" type="checkbox"/>	Agilent	Power meter	E4419B	MY45102538	Aug. 07, 2017	Aug. 06, 2018
<input checked="" type="checkbox"/>	Agilent	Power sensor	E9301A	MY41495644	Aug. 07, 2017	Aug. 06, 2018
<input checked="" type="checkbox"/>	Agilent	Power sensor	E9301A	US39212148	Aug. 07, 2017	Aug. 06, 2018
<input checked="" type="checkbox"/>	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Aug. 07, 2017	Aug. 06, 2018

### 3. SAR Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) 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.
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power.

<SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix A demonstrates.
- (c) Set scan area, grid size and other setting on the OPENSAR software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band.
- (f) Measure SAR results for other channels in worst SAR testing position if the reported 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

#### 3.1. Power Reference

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

#### 3.2. Area scan & Zoom scan

The area scan is a 2D scan to find the hot spot location on the DUT. The zoom scan is a 3D scan above the hot spot to calculate the 1g and 10g SAR value.

Measurement of the SAR distribution with a grid of 8 to 16 mm \* 8 to 16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme. Around this point, a cube of 30 \* 30 \* 30 mm or 32 \* 32 \* 32 mm is assessed by measuring 5 or 8 \* 5 or 8 \* 4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that will not be within the zoom scan of other peaks; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR compliance limit (e.g., 1 W/kg for 1,6 W/kg 1 g limit, or 1,26 W/kg for 2 W/kg, 10 g limit).

Area scan & Zoom scan scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

		≤ 3 GHz	> 3 GHz	
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 ± 1 mm	½·δ·ln(2) ± 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: Δx <sub>Area</sub> , Δy <sub>Area</sub>		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 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.		
Maximum zoom scan spatial resolution: Δx <sub>Zoom</sub> , Δy <sub>Zoom</sub>		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: Δz <sub>Zoom</sub> (n)	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm	
	graded grid	Δz <sub>Zoom</sub> (1): between 1 <sup>st</sup> two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		Δz <sub>Zoom</sub> (n>1): between subsequent points	≤ 1.5·Δz <sub>Zoom</sub> (n-1)	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm	

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

\* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 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.

### 3.3. Description of interpolation/extrapolation scheme

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 minimise measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is used to determine these 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 1 mm 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 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

### 3.4. Volumetric Scan

The volumetric scan consists of a full 3D scan over a specific area. This 3D scan is useful for multi Tx SAR measurement. Indeed, it is possible with OpenSAR to add, point by point, several volumetric scans to calculate the SAR value of the combined measurement as it is defined in the standard IEEE1528 and IEC62209.

### 3.5. Power Drift

All SAR testing is under the EUT installed with a full charged battery and transmit maximum output power. In OpenSAR 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 V/m. If the power drifts more than  $\pm 5\%$ , the SAR will be retested.

## 4. System Verification Procedure

### 4.1. Tissue Verification

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

<b>Ingredients</b> (% of weight)	<b>Head Tissue</b>							
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600
Water	34.40	34.40	34.40	55.36	55.36	57.87	57.87	57.87
NaCl	0.79	0.79	0.79	0.35	0.35	0.16	0.16	0.16
1,2-Propanediol	64.81	64.81	64.81	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	30.45	30.45	19.97	19.97	19.97
DGBE	0.00	0.00	0.00	13.84	13.84	22.00	22.00	22.00
<b>Ingredients</b> (% of weight)	<b>Body Tissue</b>							
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600
Water	50.30	50.30	50.30	69.91	69.91	71.88	71.88	71.88
NaCl	0.60	0.60	0.60	0.13	0.13	0.16	0.16	0.16
1,2-Propanediol	49.10	49.10	49.10	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	9.99	9.99	19.97	19.97	19.97
DGBE	0.00	0.00	0.00	19.97	19.97	7.99	7.99	7.99

#### 4.1.1. Tissue Dielectric Parameter Check Results

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within  $\pm 5\%$  of the target values.

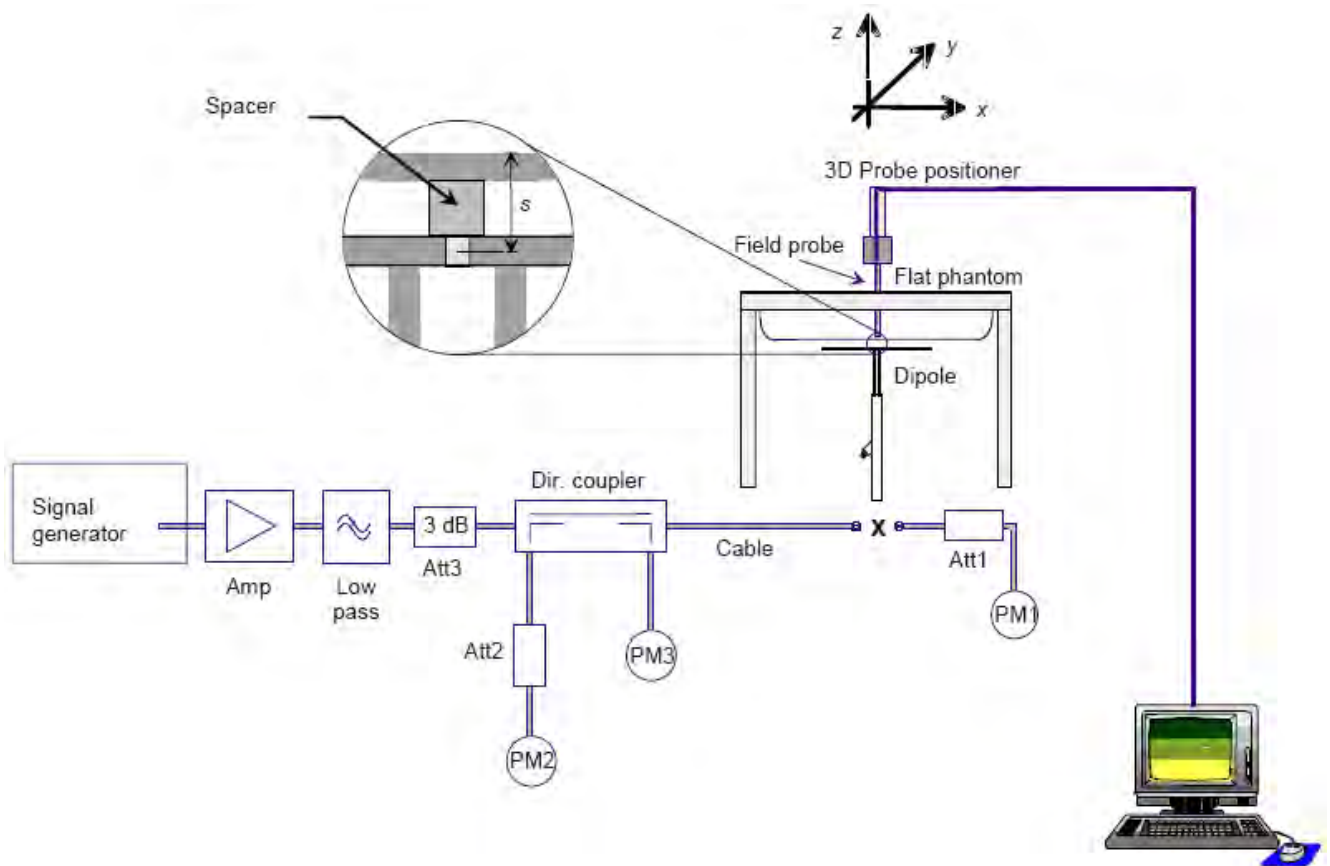
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		$\epsilon_r$ ( $\pm 5\%$ )	$\sigma$ (S/m) ( $\pm 5\%$ )	$\epsilon_r$	$\sigma$ (S/m)		
Head 850	835	41.50 (39.43~43.57)	0.90 (0.86~0.94)	42.92	0.89	21.4 °C	Oct. 20, 2017
Body 850	835	55.20 (52.44~57.96)	0.97 (0.92~1.01)	55.16	0.98	21.5 °C	Oct. 21, 2017
Head 1800	1800	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.64	1.40	21.3 °C	Oct. 25, 2017
Body 1800	1800	53.30 (50.64~55.96)	1.52 (1.44~1.59)	53.89	1.52	21.4 °C	Oct. 27, 2017
Head 1900	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.29	1.44	21.6 °C	Oct. 23, 2017
Body 1900	1900	53.30 (50.64~55.96)	1.52 (1.44~1.59)	53.49	1.56	21.2 °C	Oct. 24, 2017
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	39.49	1.78	21.4 °C	Oct. 27, 2017
Body 2450	2450	52.70 (50.07~55.33)	1.95 (1.85~2.04)	52.73	1.98	21.6 °C	Oct. 30, 2017
Head 2600	2600	39.00 (37.05~40.95)	1.96 (1.86~2.05)	39.18	1.97	21.3 °C	Oct. 30, 2017
Body 2600	2600	52.50 (49.88~55.13)	2.16 (2.05~2.27)	53.54	2.17	21.5 °C	Oct. 31, 2017

NOTE: The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.

### 4.2. System Verification Procedure

The system verification is performed for verifying the accuracy of the complete measurement system and performance of the software. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 100mW (below 5GHz) or 100mW (above 5GHz). To adjust this power a power meter is used. The power sensor is connected to the cable before the system verification to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system verification to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).

The system verification is shown as below picture:





#### 4.2.1. System Verification Results

Comparing to the original SAR value provided by SATIMO, the verification data should be within its specification of  $\pm 10\%$ . Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance verification can meet the variation criterion and the plots can be referred to Appendix B of this report.

System Verification	Target SAR (1W) ( $\pm 10\%$ )		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)		
835MHz Head	9.56 (8.60~10.51)	6.22 (5.60~6.84)	9.38	6.26	21.4 °C	Oct. 20, 2017
835MHz Body	9.48 (8.53~10.42)	6.29 (5.66~6.91)	9.29	6.21	21.5 °C	Oct. 21, 2017
1800MHz Head	38.40 (34.56~42.24)	20.10 (18.09~22.11)	38.16	19.87	21.3 °C	Oct. 25, 2017
1800MHz Body	37.04 (33.34~40.74)	20.26 (18.23~22.29)	37.47	19.53	21.4 °C	Oct. 27, 2017
1900MHz Head	39.70 (35.73~43.67)	20.50 (18.45~22.55)	39.67	20.43	21.6 °C	Oct. 23, 2017
1900MHz Body	38.43 (34.59~42.27)	20.34 (18.31~22.37)	37.87	19.47	21.2 °C	Oct. 24, 2017
2450MHz Head	52.40 (47.16~57.64)	24.00 (21.60~26.40)	50.53	25.61	21.4 °C	Oct. 27, 2017
2450MHz Body	49.32 (44.39~54.25)	22.89 (20.60~25.17)	47.51	22.01	21.6 °C	Oct. 30, 2017
2600MHz Head	55.30 (49.77~60.83)	24.60 (22.14~27.06)	57.63	25.23	21.3 °C	Oct. 30, 2017
2600MHz Body	52.95 (47.66~58.25)	23.64 (21.28~26.00)	55.13	24.59	21.5 °C	Oct. 31, 2017

## 5. SAR Measurement variability and uncertainty

### 5.1. SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 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  $> 1.20$ .

### 5.2. SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is  $< 1.5$  W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

## 6. RF Exposure Positions

### 6.1. Ear and handset reference point

Figure 6.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled "M", the left ear reference point (ERP) is marked "LE", and the right ERP is marked "RE".



Fig 6.1.1 Front, back, and side views of SAM phantom

### 6.2. Definition of the cheek position

1. Define two imaginary lines on the handset, the vertical centerline and the horizontal line. 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 (point A in Figure 6.2.1 and Figure 6.2.2), and the midpoint of the width  $w_b$  of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 6.2.1). 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 (see Figure 6.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
2. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 6.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
3. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP
4. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
5. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.

6. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 6.2.3. The actual rotation angles should be documented in the test report.

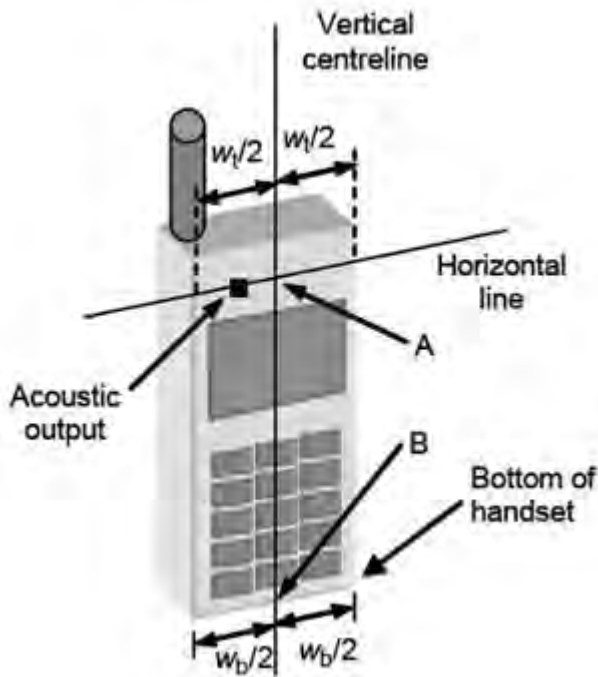


Fig 6.2.1 Handset vertical and horizontal reference lines—fixed case

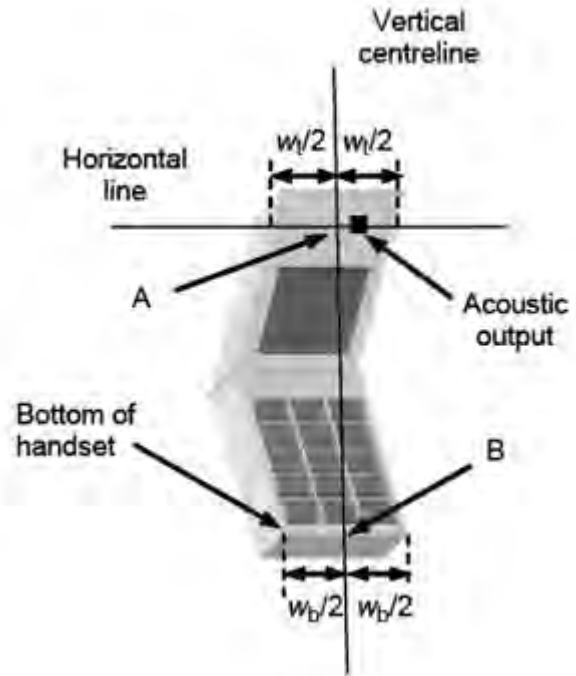


Fig 6.2.2 Handset vertical and horizontal reference lines—“clam-shell case”

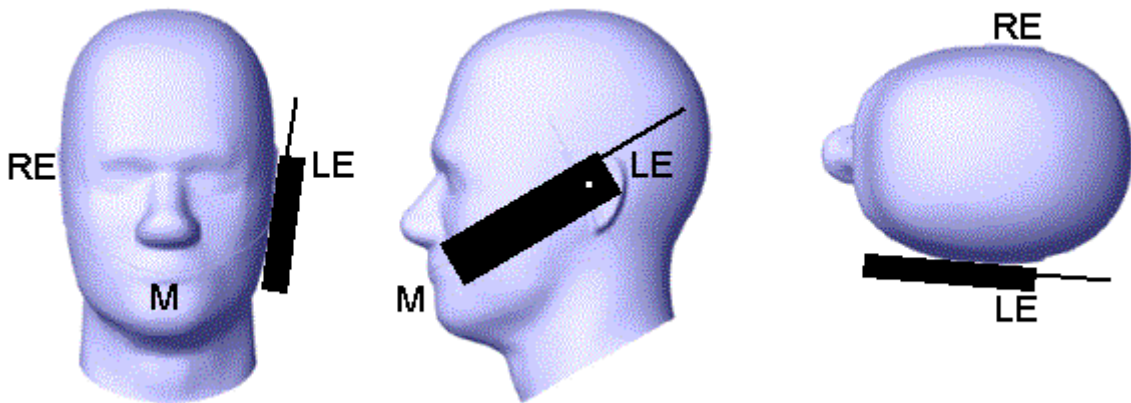


Fig 6.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

### 6.3. Definition of the tilt position

1. While maintaining the orientation of the handset, retract the handset parallel to the reference plane far enough away from the phantom to enable a rotation of the device by 15 degree.
2. Rotate the Handset around the horizontal line by 15 degree (see Figure 6.3.1).
3. While maintaining the orientation of the handset, move the handset towards the phantom on a line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, e.g., the antenna with the back of the phantom head, the angle of the handset shall be reduced. In this case, the tilt position is obtained if any part of the handset is in contact with the pinna as well as a second part of the handset is in contact with the phantom, e.g., the antenna with the back of the head.

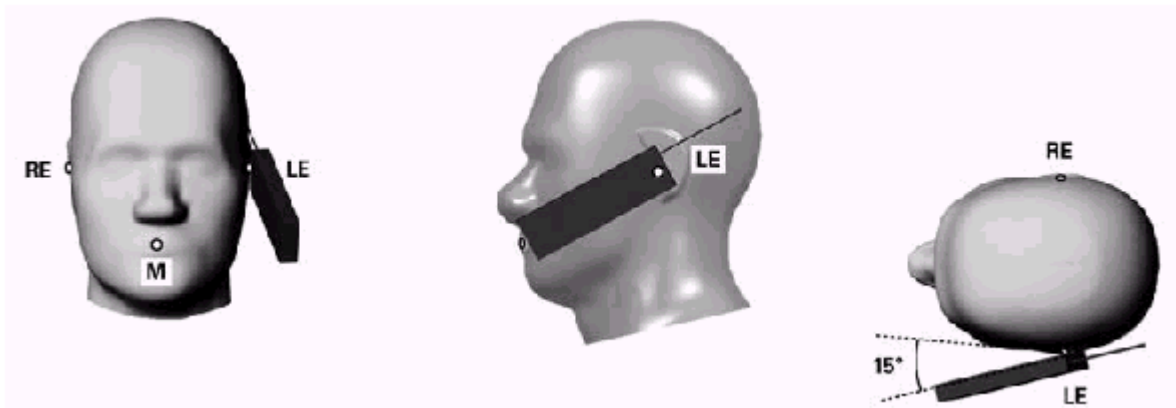


Figure 6.3.1 – Tilt position of the wireless device on the left side of SAM

### 6.4. Body Worn Accessory

1. Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6.4.1). Per KDB 648474 D04, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is  $< 1.2$  W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.
2. Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest

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

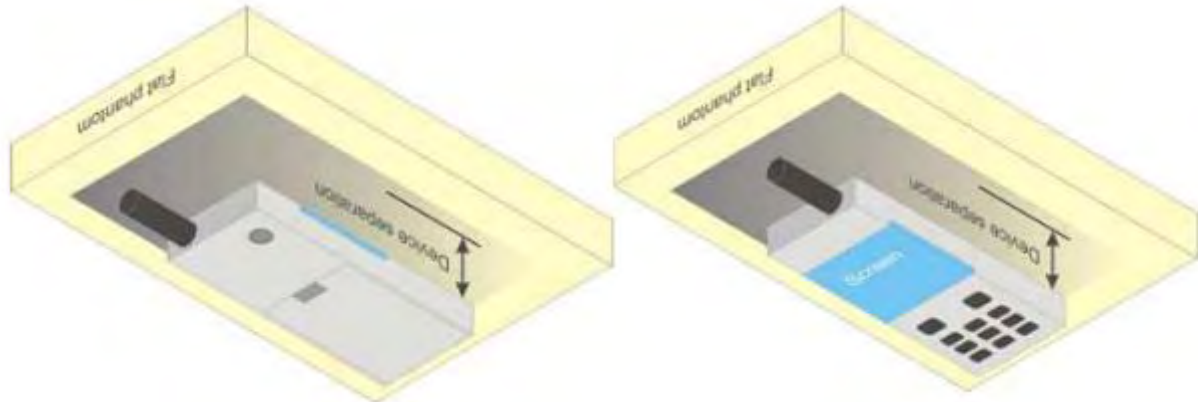


Figure 6.4.1 – Test positions for body-worn devices

### 6.5. Wireless Router Devices

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WLAN simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC HDB Publication 941225 D06 where SAR test considerations for handsets ( $L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$ ) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WLAN transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WLAN transmitter according to FCC KDB Publication 447498 D01 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

## 7. RF Output Power

### 7.1. Maximum Tune-up Limit

Band	Mode	The Tune-up Maximum Power (Customer Declared)(dBm)	Range	Measured Maximum Output Power(dBm)
GSM 850	GSM (GMSK)	32.5±1	31.5~33.5	33.21
	GPRS(GMSK, 1 Tx slot)	32.5±1	31.5~33.5	33.29
	GPRS(GMSK, 2 Tx slot)	31.5±1	30.5~32.5	32.06
	GPRS(GMSK, 3 Tx slot)	29.5±1	28.5~30.5	29.86
	GPRS(GMSK, 4 Tx slot)	28.5±1	27.5~29.5	29.19
	EDGE(8PSK, 1 Tx slot)	25.5±1	24.5~26.5	26.48
	EDGE(8PSK, 2 Tx slot)	24.5±1	23.5~25.5	25.22
	EDGE(8PSK, 3 Tx slot)	22.5±1	21.5~23.5	22.98
	EDGE(8PSK, 4 Tx slot)	20.5±1	19.5~21.5	21.40
GSM 1900	GSM (GMSK)	29.5±1	28.5~30.5	30.31
	GPRS(GMSK, 1 Tx slot)	29.5±1	28.5~30.5	30.32
	GPRS(GMSK, 2 Tx slot)	28.5±1	27.5~29.5	29.18
	GPRS(GMSK, 3 Tx slot)	26.5±1	25.5~27.5	27.05
	GPRS(GMSK, 4 Tx slot)	25.5±1	24.5~26.5	26.23
	EDGE(8PSK, 1 Tx slot)	25.5±1	24.5~26.5	26.47
	EDGE(8PSK, 2 Tx slot)	24.5±1	23.5~25.5	25.42
	EDGE(8PSK, 3 Tx slot)	22.5±1	21.5~23.5	23.23
	EDGE(8PSK, 4 Tx slot)	21.5±1	20.5~22.5	21.84
WCDMA Band V	RMC 12.2Kbps	22±1	21~23	22.91
	HSDPA Subtest-1	22±1	21~23	22.25
	HSDPA Subtest-2	21±1	20~22	21.80
	HSDPA Subtest-3	21±1	20~22	21.82
	HSDPA Subtest-4	21±1	20~22	21.80
	HSUPA Subtest-1	21±1	20~22	21.80
	HSUPA Subtest-2	21±1	20~22	21.77
	HSUPA Subtest-3	21±1	20~22	21.75
	HSUPA Subtest-4	21±1	20~22	21.76
	HSUPA Subtest-5	22±1	21~23	22.25
WCDMA Band II	RMC 12.2Kbps	22.5±1	21.5~23.5	23.48
	HSDPA Subtest-1	21.5±1	20.5~22.5	22.47
	HSDPA Subtest-2	21.5±1	20.5~22.5	22.01
	HSDPA Subtest-3	21.5±1	20.5~22.5	22.04
	HSDPA Subtest-4	21.5±1	20.5~22.5	21.97

	HSUPA Subtest-1	21.5±1	20.5~22.5	22.01
	HSUPA Subtest-2	21.5±1	20.5~22.5	21.94
	HSUPA Subtest-3	21.5±1	20.5~22.5	21.99
	HSUPA Subtest-4	21.5±1	20.5~22.5	21.95
	HSUPA Subtest-5	21.5±1	20.5~22.5	22.42
LTE Band V	1.4M QPSK 1RB	23±1	22~24	23.24
	1.4M QPSK 3RB	23±1	22~24	23.78
	1.4M QPSK 6RB	22±1	21~23	22.14
	1.4M 16QAM 1RB	23±1	22~24	22.95
	1.4M 16QAM 3RB	23±1	22~24	23.75
	1.4M 16QAM 6RB	21±1	20~22	21.00
	3M QPSK 1RB	23±1	22~24	23.25
	3M QPSK 8RB	23±1	22~24	23.73
	3M QPSK 15RB	22±1	21~23	22.15
	3M 16QAM 1RB	23±1	22~24	22.63
	3M 16QAM 8RB	23±1	22~24	23.13
	3M 16QAM 15RB	21±1	20~22	21.17
	5M QPSK 1RB	23±1	22~24	23.27
	5M QPSK 12RB	23±1	22~24	22.81
	5M QPSK 25RB	22±1	21~23	22.11
	5M 16QAM 1RB	23±1	22~24	22.98
	5M 16QAM 12RB	23±1	22~24	22.71
	5M 16QAM 25RB	21±1	20~22	21.13
	10M QPSK 1RB	23±1	22~24	23.22
	10M QPSK 25RB	23±1	22~24	22.96
	10M QPSK 50RB	22±1	21~23	22.11
	10M 16QAM 1RB	23±1	22~24	22.96
10M 16QAM 25RB	23±1	22~24	22.75	
10M 16QAM 50RB	21±1	20~22	21.16	
LTE Band IV	1.4M QPSK 1RB	23±1	22~24	23.40
	1.4M QPSK 3RB	23±1	22~24	23.92
	1.4M QPSK 6RB	23±1	22~24	22.99
	1.4M 16QAM 1RB	23±1	22~24	22.97
	1.4M 16QAM 3RB	23±1	22~24	23.91
	1.4M 16QAM 6RB	21±1	20~22	21.21
	3M QPSK 1RB	23±1	22~24	23.40
	3M QPSK 8RB	23±1	22~24	23.89
	3M QPSK 15RB	23±1	22~24	22.28
	3M 16QAM 1RB	23±1	22~24	22.92
	3M 16QAM 8RB	23±1	22~24	23.12



	3M 16QAM 15RB	21±1	20~22	21.29
	5M QPSK 1RB	23±1	22~24	23.42
	5M QPSK 12RB	23±1	22~24	22.92
	5M QPSK 25RB	23±1	22~24	22.83
	5M 16QAM 1RB	23±1	22~24	22.94
	5M 16QAM 12RB	23±1	22~24	22.89
	5M 16QAM 25RB	21±1	20~22	21.29
	10M QPSK 1RB	23±1	22~24	23.49
	10M QPSK 25RB	23±1	22~24	22.89
	10M QPSK 50RB	23±1	22~24	22.85
	10M 16QAM 1RB	23±1	22~24	22.74
	10M 16QAM 25RB	23±1	22~24	22.84
	10M 16QAM 50RB	21±1	20~22	21.24
	15M QPSK 1RB	23±1	22~24	23.54
	15M QPSK 36RB	23±1	22~24	22.95
	15M QPSK 75RB	23±1	22~24	22.38
	15M 16QAM 1RB	23±1	22~24	22.67
	15M 16QAM 36RB	23±1	22~24	22.95
	15M 16QAM 75RB	21±1	20~22	21.33
	20M QPSK 1RB	23±1	22~24	23.59
	20M QPSK 50RB	23±1	22~24	23.23
	20M QPSK 100RB	23±1	22~24	23.13
	20M 16QAM 1RB	23±1	22~24	22.71
	20M 16QAM 50RB	23±1	22~24	22.81
	20M 16QAM 100RB	21±1	20~22	21.13
LTE Band II	1.4M QPSK 1RB	23±1	22~24	23.24
	1.4M QPSK 3RB	22±1	21~23	22.88
	1.4M QPSK 6RB	22±1	21~23	22.73
	1.4M 16QAM 1RB	22±1	21~23	22.22
	1.4M 16QAM 3RB	22±1	21~23	22.94
	1.4M 16QAM 6RB	21±1	20~22	21.08
	3M QPSK 1RB	23±1	22~24	23.20
	3M QPSK 8RB	22±1	21~23	22.95
	3M QPSK 15RB	22±1	21~23	22.16
	3M 16QAM 1RB	22±1	21~23	22.20
	3M 16QAM 8RB	22±1	21~23	22.79
	3M 16QAM 15RB	21±1	20~22	21.01
	5M QPSK 1RB	23±1	22~24	23.24
	5M QPSK 12RB	22±1	21~23	22.78
	5M QPSK 25RB	22±1	21~23	22.11

	5M 16QAM 1RB	22±1	21~23	22.31
	5M 16QAM 12RB	22±1	21~23	22.81
	5M 16QAM 25RB	21±1	20~22	21.03
	10M QPSK 1RB	23±1	22~24	23.24
	10M QPSK 25RB	22±1	21~23	22.74
	10M QPSK 50RB	22±1	21~23	22.11
	10M 16QAM 1RB	22±1	21~23	22.37
	10M 16QAM 25RB	22±1	21~23	22.75
	10M 16QAM 50RB	21±1	20~22	21.05
	15M QPSK 1RB	23±1	22~24	23.23
	15M QPSK 36RB	22±1	21~23	22.82
	15M QPSK 75RB	22±1	21~23	22.30
	15M 16QAM 1RB	22±1	21~23	22.43
	15M 16QAM 36RB	22±1	21~23	22.89
	15M 16QAM 75RB	21±1	20~22	21.21
	20M QPSK 1RB	23±1	22~24	23.36
	20M QPSK 50RB	22±1	21~23	22.90
	20M QPSK 100RB	22±1	21~23	22.22
	20M 16QAM 1RB	22±1	21~23	22.72
	20M 16QAM 50RB	22±1	21~23	22.77
	20M 16QAM 100RB	21±1	20~22	21.16
LTE Band VII	5M QPSK 1RB	22±1	21~23	22.68
	5M QPSK 12RB	22±1	21~23	22.17
	5M QPSK 25RB	22±1	21~23	21.51
	5M 16QAM 1RB	22±1	21~23	21.72
	5M 16QAM 12RB	22±1	21~23	21.97
	5M 16QAM 25RB	21±1	20~22	20.57
	10M QPSK 1RB	22±1	21~23	22.25
	10M QPSK 25RB	22±1	21~23	21.89
	10M QPSK 50RB	22±1	21~23	21.29
	10M 16QAM 1RB	22±1	21~23	21.87
	10M 16QAM 25RB	22±1	21~23	21.95
	10M 16QAM 50RB	21±1	20~22	20.43
	15M QPSK 1RB	22±1	21~23	22.32
	15M QPSK 36RB	22±1	21~23	21.95
	15M QPSK 75RB	22±1	21~23	21.17
	15M 16QAM 1RB	22±1	21~23	21.70
	15M 16QAM 36RB	22±1	21~23	21.98
	15M 16QAM 75RB	21±1	20~22	20.32
	20M QPSK 1RB	22±1	21~23	22.35

	20M QPSK 50RB	22±1	21~23	22.13
	20M QPSK 100RB	22±1	21~23	21.19
	20M 16QAM 1RB	22±1	21~23	21.80
	20M 16QAM 50RB	22±1	21~23	21.98
	20M 16QAM 100RB	21±1	20~22	20.33
WLAN 2.4G	802.11b	12.5±1	11.5~13.5	13.2
	802.11g	9±1	8~10	9.4
	802.11n-HT20	9±1	8~10	9.4
	802.11n-HT40	9±1	8~10	9.3
BT	3.0	5±1	4~6	5.88
	4.0	5±1	4~6	-0.85

### 7.2. GSM Conducted Power

Refer to KDB 447498 D01, the maximum output power (including tune-up tolerance) channel is used for SAR testing and for further SAR test reduction. Therefore, the EUT was set in GSM850 GPRS (4TS) and GSM1900 GPRS (4TS).

Band GSM850		Burst-Averaged output Power (dBm)			Frame-Averaged output Power (dBm)			
Tx Channel	Tune-up	128	189	251	Tune-up	128	189	251
Frequency (MHz)	(dBm)	824.2	836.4	848.8	(dBm)	824.2	836.4	848.8
GSM (GMSK)	33.50	33.21	33.19	33.16	24.47	24.18	24.16	24.13
GPRS(GMSK, 1 TS)	33.50	33.29	33.27	33.23	24.47	24.26	24.24	24.20
GPRS(GMSK, 2 TS)	32.50	32.06	32.01	31.97	26.48	26.04	25.99	25.95
GPRS(GMSK, 3 TS)	30.50	29.86	29.84	29.82	26.24	25.60	25.58	25.56
GPRS(GMSK, 4 TS)	29.50	29.19	29.13	29.12	26.49	26.18	26.12	26.11
EDGE(8PSK, 1 TS)	26.50	26.41	26.48	26.38	17.47	17.38	17.45	17.35
EDGE(8PSK, 2 TS)	25.50	25.22	25.11	25.03	19.48	19.20	19.09	19.01
EDGE(8PSK, 3 TS)	23.50	22.98	22.72	22.53	19.24	18.72	18.46	18.27
EDGE(8PSK, 4 TS)	21.50	21.40	21.30	21.12	18.49	18.39	18.29	18.11
Band GSM1900		Burst-Averaged output Power (dBm)			Frame-Averaged output Power (dBm)			
Tx Channel	Tune-up	512	661	810	Tune-up	512	661	810
Frequency (MHz)	(dBm)	1850.2	1880.0	1909.8	(dBm)	1850.2	1880.0	1909.8
GSM (GMSK)	30.50	30.31	30.17	30.07	21.47	21.28	21.14	21.04
GPRS(GMSK, 1 TS)	30.50	30.32	30.21	30.09	21.47	21.29	21.18	21.06
GPRS(GMSK, 2 TS)	29.50	29.18	29.06	28.94	23.48	23.16	23.04	22.92
GPRS(GMSK, 3 TS)	27.50	27.05	26.97	26.87	23.24	22.79	22.71	22.61
GPRS(GMSK, 4 TS)	26.50	26.23	26.07	26.01	23.49	23.22	23.06	23.00
EDGE(8PSK, 1 TS)	26.50	26.47	26.22	25.65	17.47	17.44	17.19	16.62
EDGE(8PSK, 2 TS)	25.50	25.42	25.02	24.51	19.48	19.40	19.00	18.49
EDGE(8PSK, 3 TS)	23.50	23.23	22.72	22.07	19.24	18.97	18.46	17.81
EDGE(8PSK, 4 TS)	22.50	21.84	21.34	20.80	19.49	18.83	18.33	17.79

Note: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.

The calculated method are shown as below:

Frame-averaged power = Maximum burst averaged power (1 TS) - 9.03 dB

Frame-averaged power = Maximum burst averaged power (2 TS) - 6.02 dB

Frame-averaged power = Maximum burst averaged power (3 TS) - 4.26 dB

Frame-averaged power = Maximum burst averaged power (4 TS) - 3.01 dB

### 7.3. WCDMA 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:

#### 1. Release99 Setup Configuration

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	$\beta_c/\beta_d$	8/15

#### 2. HSDPA Setup Configuration

Mode	HSDPA	HSDPA	HSDPA	HSDPA	
Subtest	1	2	3	4	
WCDMA General Settings	Loopback Mode				Test Mode 1
	Rel99 RMC				12.2kbps RMC
	HSDPA FRC				H-Set1
	Power Control Algorithm				Algorithm 2
	$\beta_c$	2/15	12/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
	$\beta_{hs}$	4/15	24/15	30/15	30/15
HSDPA Specific Settings	$D_{ACK}$				8
	$D_{NAK}$				8
	DCQI				8
	Ack-Nack repetition factor				3
	CQI Feedback (Table 5.2B.4)				4ms
	CQI Repetition Factor (Table 5.2B.4)				2
	$A_{hs} = \beta_{hs}/\beta_c$				30/15

#### 3. HSUPA Setup Configuration

Mode	HSUPA	HSUPA	HSUPA	HSUPA	HSUPA	
Subtest	1	2	3	4	5	
WCDMA General Settings	Loopback Mode					Test Mode 1
	Rel99 RMC					12.2kbps RMC
	HSDPA FRC					H-Set1
	HSUPA Test					HSUPA Loopback
	Power Control Algorithm					Algorithm2
	$\beta_c$	11/15	6/15	15/15	2/15	15/15
	$\beta_d$	15/15	15/15	9/15	15/15	15/15
	$\beta_{ec}$	209/225	12/15	30/15	2/15	24/15
	$\beta_c/\beta_d$	11/15	6/15	15/9	2/15	15/15
	$\beta_{hs}$	22/15	12/15	30/15	4/15	30/15
	$\beta_{ed}$	1309/225	94/75	47/15 47/15	56/75	134/15
CM (dB)	1.0	3.0	2.0	3.0	1.0	
HSDPA Specific Settings	$D_{ACK}$					8
	$D_{NAK}$					8
	DCQI					8
	Ack-Nack repetition factor					3
	CQI Feedback (Table 5.2B.4)					4ms

HSUPA Specific Settings	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = $\beta_{hs}/\beta_c$	30/15				
	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9	

4. WCDMA Conducted Power Results

- 1) Refer to KDB 941225 D01, SAR for Head / Hotspot / Body-worn exposure is measured using a 12.2 kbps RMC with TPC bits configured to all -4's".
- 2) Refer to KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA is  $\leq \frac{1}{4}$  dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC12.2Kbps and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for HSDPA / HSUPA.

Band	WCDMA Band V			
Tx Channel	Tune-up	4132	4182	4233
Frequency (MHz)		826.4	836.4	846.6
RMC 12.2Kbps	23.00	22.70	22.91	22.84
HSDPA Subtest-1	23.00	22.15	22.25	22.23
HSDPA Subtest-2	22.00	21.65	21.79	21.80
HSDPA Subtest-3	22.00	21.68	21.79	21.82
HSDPA Subtest-4	22.00	21.67	21.80	21.80
HSUPA Subtest-1	22.00	21.70	21.79	21.80
HSUPA Subtest-2	22.00	21.67	21.69	21.77
HSUPA Subtest-3	22.00	21.65	21.75	21.74
HSUPA Subtest-4	22.00	21.72	21.68	21.76
HSUPA Subtest-5	23.00	22.11	22.21	22.25
Band	WCDMA Band II			
Tx Channel	Tune-up	9262	9400	9538
Frequency (MHz)		1852.4	1880	1907.6
RMC 12.2Kbps	23.50	23.40	23.48	23.47
HSDPA Subtest-1	22.50	22.39	22.41	22.47
HSDPA Subtest-2	22.50	21.89	21.94	22.01
HSDPA Subtest-3	22.50	21.87	21.96	22.04
HSDPA Subtest-4	22.50	21.92	21.95	21.97
HSUPA Subtest-1	22.50	21.92	21.91	22.01

HSUPA Subtest-2	22.50	21.87	21.85	21.94
HSUPA Subtest-3	22.50	21.88	21.95	21.99
HSUPA Subtest-4	22.50	21.95	21.79	21.95
HSUPA Subtest-5	22.50	22.35	22.42	22.37

**7.4. LTE Conducted Power**

R&S CMW500 base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.

<LTE Band V>

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20407/824.7	20525/836.5	20643/848.3
LTE Band V	1.4MHz	QPSK	1	0	24.00	22.93	23.24	22.39
			1	2	24.00	22.91	23.21	22.32
			1	5	24.00	22.95	23.20	22.32
			3	0	24.00	23.02	23.17	22.41
			3	1	24.00	23.62	23.78	23.01
			3	2	24.00	23.00	23.12	22.35
			6	0	23.00	21.94	22.14	21.34
		16QAM	1	0	24.00	22.95	22.11	22.50
			1	2	24.00	22.95	22.08	22.44
			1	5	24.00	22.00	22.10	22.42
			3	0	24.00	23.00	23.12	22.35
			3	1	24.00	23.62	23.75	22.97
			3	2	24.00	23.01	23.14	22.35
			6	0	22.00	20.98	21.00	20.37
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20415/825.5	20525/836.5	20635/847.5
LTE Band V	3MHz	QPSK	1	0	24.00	22.91	23.25	22.49
			1	7	24.00	22.94	23.24	22.39
			1	14	24.00	22.91	23.11	22.28
			8	0	24.00	22.94	23.12	22.27
			8	4	24.00	23.58	23.73	22.91
			8	7	24.00	22.95	23.11	22.28

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)				
			RB Size	RB Offset		20425/826.5	20525/836.5	20625/846.5		
		16QAM	15	0	23.00	22.05	22.15	21.47		
			1	0	24.00	22.48	22.10	22.63		
			1	7	24.00	22.53	22.09	22.52		
			1	14	24.00	22.49	22.02	22.40		
			8	0	24.00	22.49	22.01	22.40		
			8	4	24.00	23.13	22.66	22.02		
			8	7	24.00	22.48	22.02	22.39		
			15	0	22.00	21.17	21.16	20.46		
LTE Band V	5MHz	QPSK	1	0	24.00	22.99	23.27	22.71		
			1	12	24.00	23.05	23.22	22.53		
			1	24	24.00	23.00	23.08	22.34		
			12	0	24.00	22.06	22.22	22.65		
			12	6	24.00	22.69	22.81	22.16		
			12	11	24.00	22.11	22.12	22.45		
		16QAM	25	0	23.00	22.03	22.11	21.51		
			1	0	24.00	22.87	22.22	22.98		
			1	12	24.00	22.96	22.18	22.81		
			1	24	24.00	22.91	22.07	22.58		
			12	0	24.00	22.10	22.14	22.46		
			12	6	24.00	22.71	22.69	22.08		
			12	11	24.00	22.10	22.15	22.46		
			25	0	22.00	21.13	21.12	20.56		
		Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
					RB Size	RB Offset		20450/829	20525/836.5	20600/844
LTE Band V	10MHz	QPSK	1	0	24.00	22.97	23.22	23.07		
			1	24	24.00	23.05	23.22	22.66		
			1	49	24.00	23.20	22.99	22.35		
			25	0	24.00	22.07	22.96	22.89		
			25	12	24.00	22.68	22.78	22.46		
			25	24	24.00	22.14	22.05	22.57		
			50	0	23.00	22.11	22.11	21.72		
		16QAM	1	0	24.00	22.56	22.15	22.16		
			1	24	24.00	22.56	22.06	22.80		
			1	49	24.00	22.57	22.96	22.50		



			25	0	24.00	22.14	22.06	22.56
			25	12	24.00	22.75	22.68	22.11
			25	24	24.00	22.13	22.04	22.57
			50	0	22.00	21.16	21.14	20.76

<LTE Band IV>

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		19957/1710.7	20175/1732.5	20393/1754.3
LTE Band IV	1.4MHz	QPSK	1	0	24.00	22.17	23.03	23.07
			1	2	24.00	23.40	23.16	23.19
			1	5	24.00	23.39	23.12	23.22
			3	0	24.00	23.32	23.13	23.17
			3	1	24.00	23.92	23.75	23.81
			3	2	24.00	23.30	23.15	23.25
			6	0	24.00	22.27	22.99	22.06
		16QAM	1	0	24.00	22.17	22.97	22.10
			1	2	24.00	22.19	22.09	22.22
			1	5	24.00	22.17	22.05	22.25
			3	0	24.00	23.30	23.16	23.25
			3	1	24.00	23.91	23.76	23.85
			3	2	24.00	23.30	23.15	23.25
			6	0	22.00	21.21	20.96	21.08
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		19965/1711.5	20175/1732.5	20385/1753.5
LTE Band IV	3MHz	QPSK	1	0	24.00	23.39	22.92	22.79
			1	7	24.00	23.40	23.12	23.07
			1	14	24.00	23.34	23.08	23.19
			8	0	24.00	23.34	23.10	23.19
			8	4	24.00	23.89	23.67	23.81
			8	7	24.00	23.33	23.10	23.20
			15	0	24.00	22.28	22.06	22.02
		16QAM	1	0	24.00	22.61	22.92	22.88
			1	7	24.00	22.59	22.04	22.09
			1	14	24.00	22.53	22.00	22.20
			8	0	24.00	22.53	22.01	22.20
8	4	24.00	23.12	22.62	22.81			

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		19975/1712.5	20175/1732.5	20375/1752.5
			8	7	24.00	22.53	22.00	22.19
			15	0	22.00	21.29	21.14	20.98
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		19975/1712.5	20175/1732.5	20375/1752.5
LTE Band IV	5MHz	QPSK	1	0	24.00	23.42	22.90	22.63
			1	12	24.00	23.38	23.15	22.91
			1	24	24.00	23.30	23.11	23.21
			12	0	24.00	22.32	22.03	22.71
			12	6	24.00	22.92	22.66	22.46
			12	11	24.00	22.28	22.10	22.05
			25	0	24.00	22.24	22.05	22.83
		16QAM	1	0	24.00	22.12	22.94	22.78
			1	12	24.00	22.09	22.09	22.12
			1	24	24.00	22.03	22.05	22.35
			12	0	24.00	22.29	22.10	22.06
			12	6	24.00	22.89	22.71	22.65
			12	11	24.00	22.29	22.09	22.06
			25	0	22.00	21.29	21.08	20.85
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20000/1715	20175/1732.5	20350/1750
LTE Band IV	10MHz	QPSK	1	0	24.00	23.49	22.72	23.28
			1	24	24.00	23.43	23.21	22.66
			1	49	24.00	23.33	23.20	23.20
			25	0	24.00	22.27	22.88	22.89
			25	12	24.00	22.87	22.59	22.49
			25	24	24.00	22.21	22.07	22.84
			50	0	24.00	22.24	22.00	22.85
		16QAM	1	0	24.00	22.66	22.74	22.16
			1	24	24.00	22.62	22.05	22.69
			1	49	24.00	22.58	22.03	22.21
			25	0	24.00	22.21	22.06	22.83
			25	12	24.00	22.82	22.68	22.44
			25	24	24.00	22.22	22.07	22.84
			50	0	22.00	21.24	21.06	20.85
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20000/1715	20175/1732.5	20350/1750



LTE Band II	1.4MHz	QPSK	1	0	24.00	22.75	22.78	23.17
			1	2	24.00	22.82	22.81	23.24
			1	5	24.00	22.73	22.78	23.18
			3	0	23.00	22.75	22.88	22.12
			3	1	23.00	22.43	22.56	22.74
			3	2	23.00	22.82	22.85	22.13
			6	0	23.00	22.73	21.73	22.19
		16QAM	1	0	23.00	21.79	21.89	22.18
			1	2	23.00	21.88	21.95	22.22
			1	5	23.00	21.81	21.84	22.18
			3	0	23.00	22.88	22.94	22.12
			3	1	23.00	22.45	22.56	22.73
			3	2	23.00	22.88	22.93	22.12
			6	0	22.00	20.70	20.74	21.08
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18615/1851.5	18900/1880	19185/1908.5
LTE Band II	3MHz	QPSK	1	0	24.00	22.73	22.91	23.16
			1	7	24.00	22.75	22.99	23.20
			1	14	24.00	22.72	22.94	23.14
			8	0	23.00	22.72	22.94	22.16
			8	4	23.00	22.34	22.56	22.79
			8	7	23.00	22.72	22.95	22.18
			15	0	23.00	21.77	21.89	22.16
		16QAM	1	0	23.00	22.15	21.79	22.14
			1	7	23.00	22.20	21.84	22.18
			1	14	23.00	22.16	21.83	22.16
			8	0	23.00	22.16	21.82	22.16
			8	4	23.00	22.79	22.43	22.78
			8	7	23.00	22.16	21.82	22.16
			15	0	22.00	20.85	20.94	21.01
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18625/1852.5	18900/1880	19175/1907.5
LTE Band II	5MHz	QPSK	1	0	24.00	22.80	22.90	23.24
			1	12	24.00	22.83	22.98	23.24
			1	24	24.00	22.81	22.96	23.21
			12	0	23.00	21.83	21.89	22.16

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18650/1855	18900/1880	19150/1905
		16QAM	12	6	23.00	22.46	22.55	22.78
			12	11	23.00	21.85	21.95	22.18
			25	0	23.00	21.79	21.86	22.11
			1	0	23.00	21.62	21.86	22.30
			1	12	23.00	21.67	21.92	22.31
			1	24	23.00	21.66	21.91	22.30
			12	0	23.00	21.85	21.93	22.18
			12	6	23.00	22.48	22.54	22.81
			12	11	23.00	21.85	21.93	22.19
			25	0	22.00	20.88	20.89	21.03
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18675/1857.5	18900/1880	19125/1902.5
LTE Band II	10MHz	QPSK	1	0	24.00	22.83	22.93	23.16
			1	24	24.00	22.88	23.05	23.24
			1	49	24.00	22.75	23.11	22.90
			25	0	23.00	21.84	21.82	22.11
			25	12	23.00	22.48	22.51	22.74
			25	24	23.00	21.88	21.94	22.14
			50	0	23.00	21.86	21.89	22.11
		16QAM	1	0	23.00	22.26	21.79	22.23
			1	24	23.00	22.36	21.90	22.21
			1	49	23.00	22.37	21.98	22.22
			25	0	23.00	21.88	21.94	22.13
			25	12	23.00	22.51	22.55	22.75
			25	24	23.00	21.89	21.93	22.13
			50	0	22.00	20.89	20.93	21.05
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18675/1857.5	18900/1880	19125/1902.5
LTE Band II	15MHz	QPSK	1	0	24.00	22.90	22.96	23.19
			1	37	24.00	22.93	23.07	22.98
			1	74	24.00	22.87	23.23	22.98
			36	0	23.00	21.98	21.98	22.17
			36	18	23.00	22.59	22.69	22.82
			36	37	23.00	21.98	22.17	22.32
			75	0	23.00	22.01	22.07	22.30
		16QAM	1	0	23.00	22.33	22.09	22.22

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18700/1860	18900/1880	19100/1900
			1	37	23.00	22.41	22.18	22.21
			1	74	23.00	22.37	22.43	22.26
			36	0	23.00	21.98	22.17	22.33
			36	18	23.00	22.59	22.81	22.89
			36	37	23.00	21.97	22.19	22.33
			75	0	22.00	21.01	20.99	21.21
LTE Band II	20MHz	QPSK	1	0	24.00	22.98	22.97	23.36
			1	49	24.00	22.95	23.05	23.02
			1	99	24.00	22.95	23.25	23.04
			50	0	23.00	21.94	21.88	22.90
			50	24	23.00	22.55	22.56	22.79
			50	49	23.00	21.91	22.06	22.14
			100	0	23.00	21.92	21.94	22.22
		16QAM	1	0	23.00	22.15	22.33	22.48
			1	49	23.00	22.24	22.35	22.21
			1	99	23.00	22.08	22.72	22.29
			50	0	23.00	21.91	22.06	22.14
			50	24	23.00	22.55	22.65	22.77
			50	49	23.00	21.91	22.06	22.14
			100	0	22.00	20.97	20.96	21.16

<LTE Band VII>

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20775/2502.5	21100/2535	21425/2567.5
LTE Band VII	5MHz	QPSK	1	0	23.00	21.65	22.52	22.43
			1	12	23.00	22.55	22.00	21.74
			1	24	23.00	22.68	22.40	21.78
			12	0	23.00	21.60	21.34	21.18
			12	6	23.00	22.17	21.97	21.76
			12	11	23.00	21.57	21.35	21.91
			25	0	23.00	21.51	21.33	21.03
		16QAM	1	0	23.00	21.62	21.72	21.71
			1	12	23.00	21.24	21.25	21.16
1	24		23.00	21.60	21.63	21.22		

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20800/2505	21100/2535	21400/2565
			12	0	23.00	21.49	21.36	21.89
			12	6	23.00	21.11	21.97	21.51
			12	11	23.00	21.48	21.36	21.90
			25	0	22.00	20.57	20.53	20.23
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20800/2505	21100/2535	21400/2565
LTE Band VII	10MHz	QPSK	1	0	23.00	22.25	22.00	22.02
			1	24	23.00	22.20	21.91	21.91
			1	49	23.00	22.00	21.71	21.24
			25	0	23.00	21.21	21.22	21.22
			25	12	23.00	21.89	21.77	21.69
			25	24	23.00	21.33	21.14	21.00
			50	0	23.00	21.29	21.23	21.13
		16QAM	1	0	23.00	21.58	21.22	21.20
			1	24	23.00	21.67	21.08	21.25
			1	49	23.00	21.61	21.87	21.59
			25	0	23.00	21.31	21.17	21.02
			25	12	23.00	21.95	21.77	21.64
			25	24	23.00	21.30	21.16	21.01
			50	0	22.00	20.35	20.43	20.32
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20825/2507.5	21100/2535	21375/2562.5
LTE Band VII	15MHz	QPSK	1	0	23.00	22.32	22.05	22.02
			1	37	23.00	22.19	21.86	21.88
			1	74	23.00	22.15	21.76	21.27
			36	0	23.00	21.16	21.20	21.16
			36	18	23.00	21.78	21.81	21.75
			36	37	23.00	21.20	21.01	21.95
			75	0	23.00	21.17	21.12	21.07
		16QAM	1	0	23.00	21.63	21.54	21.18
			1	37	23.00	21.65	21.39	21.19
			1	74	23.00	21.70	21.29	21.61
			36	0	23.00	21.19	21.04	21.98
			36	18	23.00	21.81	21.66	21.62
			36	37	23.00	21.18	21.05	21.98
			75	0	22.00	20.27	20.31	20.32

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20850/2510	21100/2535	21350/2560
LTE Band VII	20MHz	QPSK	1	0	23.00	22.35	22.16	21.87
			1	49	23.00	22.10	21.76	21.90
			1	99	23.00	22.16	21.58	21.26
			50	0	23.00	22.13	21.18	21.99
			50	24	23.00	21.79	21.67	21.59
			50	49	23.00	21.26	21.92	21.93
			100	0	23.00	21.19	21.12	21.02
		16QAM	1	0	23.00	21.51	21.80	21.03
			1	49	23.00	21.43	21.45	21.19
			1	99	23.00	21.48	21.32	21.58
			50	0	23.00	21.26	21.95	21.98
			50	24	23.00	21.88	21.58	21.61
			50	49	23.00	21.25	21.96	21.98
			100	0	22.00	20.33	20.33	20.23



## 7.5. WLAN & BT Output Power

### 7.5.1. Output Power Results Of WLAN

The output power of WLAN is as following:

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)
802.11b	1	2412	13.5	13.2
	6	2437	13.5	12.6
	11	2462	13.5	12.7
802.11g	1	2412	10.0	9.3
	6	2437	10.0	9.3
	11	2462	10.0	9.4
802.11n (HT20)	1	2412	10.0	9.3
	6	2437	10.0	9.3
	11	2462	10.0	9.4
802.11n (HT40)	3	2422	10.0	9.3
	6	2437	10.0	9.3
	9	2452	10.0	9.3

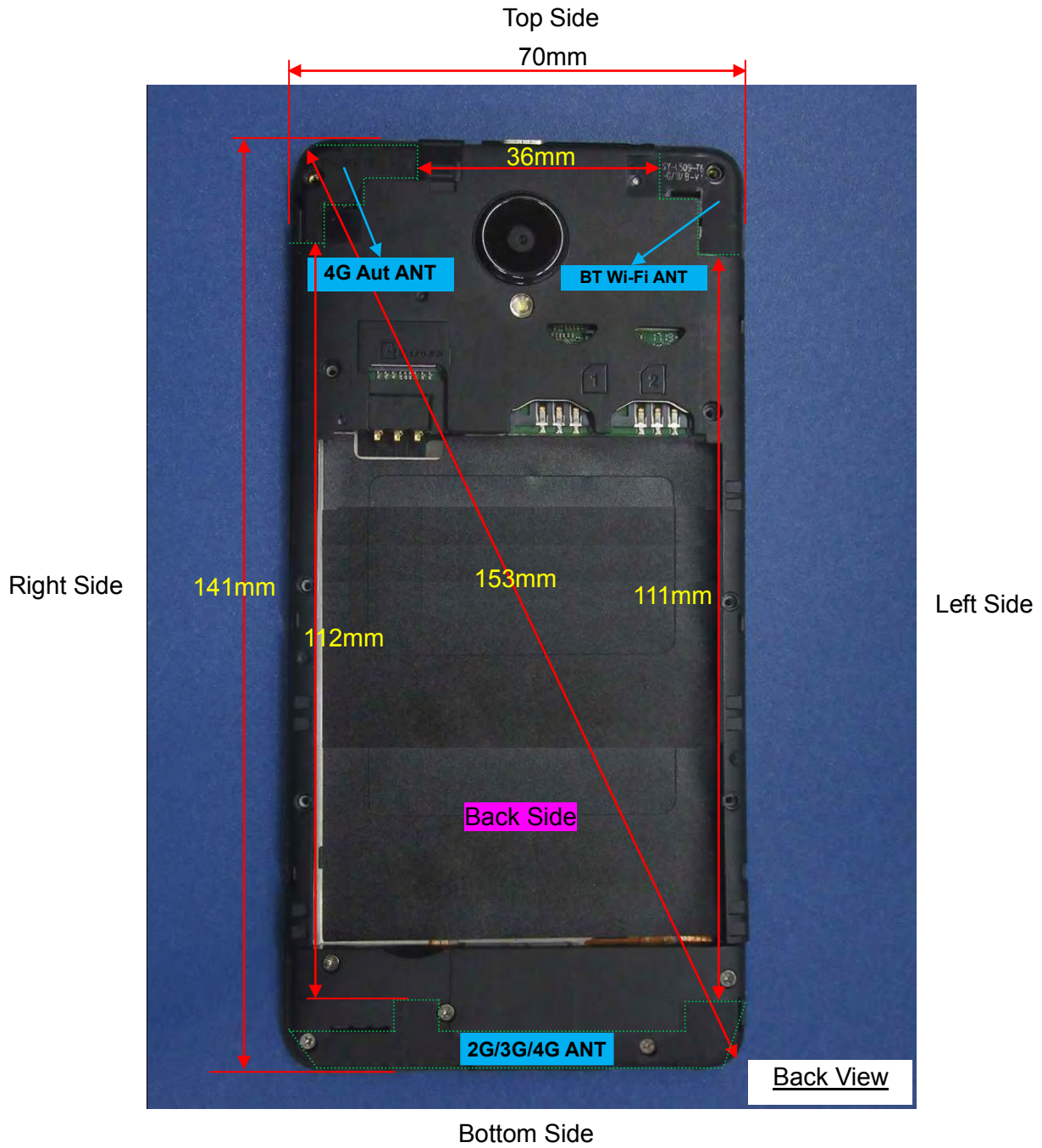
### 7.5.2. Output Power Results Of BT

The output power of BT is as following:

BT(3.0)	Output Power (dBm)				
	Data Rates	Tune-up	Channel		
			0CH	39CH	78CH
	1M	6.00	5.75	5.88	5.29
	2M	6.00	4.62	4.77	4.17
	3M	6.00	4.92	5.08	4.52

BT(4.0)	Channel	Tune-up	Output Power (dBm)
	0CH	0.00	-1.03
	19CH	0.00	-0.85
	39CH	0.00	-1.57

### 8. Antenna Location



Distance of the Antenna to the EUT surface/edge						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
WWAN Main	≤ 25mm	≤ 25mm	≤ 25mm	≤ 25mm	>25mm	≤ 25mm
WLAN & BT	≤ 25mm	≤ 25mm	≤ 25mm	>25mm	≤ 25mm	>25mm

Positions for SAR tests						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
WWAN Main	Yes	Yes	Yes	Yes	NO	Yes
WLAN & BT	Yes	Yes	Yes	NO	Yes	NO

### 9. Stand-alone SAR test exclusion

Refer to FCC KDB 447498D01, the 1-g SAR 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, where:

- $f_{\text{(GHz)}}$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

Mode	$P_{\text{max}}$ (dBm)	$P_{\text{max}}$ (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
BT	6	3.98	5	2.480	1.25	3.0	Yes

NOTE: Standalone SAR test exclusion for BT

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:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}/x}] \text{ W/kg}$  for test separation distances  $\leq 50\text{mm}$ , where  $x = 7.5$  for 1-g SAR and  $x = 18.75$  for 10-g SAR.

When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

Mode	Position	$P_{\text{max}}$ (dBm)	$P_{\text{max}}$ (mW)	Distance (mm)	f (GHz)	x	Estimated SAR (W/Kg)
BT	Head	6	3.98	5	2.480	7.5	0.167
BT	Body	6	3.98	10	2.480	7.5	0.084
BT	Hotspot	6	3.98	10	2.480	7.5	0.084

NOTE: Estimated SAR calculation for BT

## 10. SAR Measurement Results

### 10.1. SAR measurement results

General Notes:

- 1) Refer to KDB447498 D01, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
- 2) Refer to KDB447498 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. When the maximum output power variation across the required test channels is  $> \frac{1}{2}$  dB, instead of the middle channel, the highest output power channel must be used.
- 3) Refer to KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8$  W/kg; if the deviation among the repeated measurement is  $\leq 20\%$ , and the measured SAR  $< 1.45$  W/kg, only one repeated measurement is required.
- 4) Refer to KDB648474 D04, SAR is evaluated without a headset connected to the device. When the standalone reported Body-Worn SAR is  $\leq 1.2$  W/kg, no additional SAR evaluations using a headset are required.
- 5) Refer to KDB865664 D02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is  $> 1.5$  W/kg, or  $> 7.0$  W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing (Refer to appendix C for details).
- 6) Refer to KDB 941225 D05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
- 7) Refer to KDB 941225 D05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
- 8) Refer to KDB 941225 D05, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are  $\leq 0.8$  W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is  $> 1.45$  W/kg, the remaining required test channels must also be tested.
- 9) Refer to KDB 941225 D05, 16QAM output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB 941225 D05, 16QAM SAR testing is not required.
- 10) Refer to KDB 941225 D05, Smaller bandwidth output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; Per KDB 941225 D05, smaller bandwidth SAR testing is not required.

**10.1.1. SAR measurement Result of GSM850**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Left Cheek	128/824.2	GPRS(GMSK 4TS)	0.400	0.300	-0.10	29.19	29.50	0.430
Left Tilt 15 Degree	128/824.2	GPRS(GMSK 4TS)	0.305	0.222	4.12	29.19	29.50	0.328
Right Cheek	128/824.2	GPRS(GMSK 4TS)	0.397	0.299	0.15	29.19	29.50	0.426
Right Tilt 15 Degree	128/824.2	GPRS(GMSK 4TS)	0.287	0.203	1.42	29.19	29.50	0.308

NOTE: Head SAR test results of GSM850.

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	128/824.2	GPRS(GMSK 4TS)	0.441	0.334	-1.10	29.19	29.50	0.474
Back Side	128/824.2	GPRS(GMSK 4TS)	0.593	0.454	0.49	29.19	29.50	0.637

NOTE: Body-Worn SAR test results of GSM850

Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	128/824.2	GPRS(GMSK 4TS)	0.441	0.334	-1.10	29.19	29.50	0.474
Back Side	128/824.2	GPRS(GMSK 4TS)	0.593	0.454	0.49	29.19	29.50	0.637
Left Side	128/824.2	GPRS(GMSK 4TS)	0.500	0.353	2.81	29.19	29.50	0.537
Right Side	128/824.2	GPRS(GMSK 4TS)	0.334	0.234	-1.80	29.19	29.50	0.359
Bottom Side	128/824.2	GPRS(GMSK 4TS)	0.085	0.050	0.36	29.19	29.50	0.091

NOTE: Hotspot SAR test results of GSM850

**10.1.2. SAR measurement Result of GSM1900**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Left Cheek	512/1850.2	GPRS(GMSK 4TS)	0.340	0.211	1.97	26.23	26.50	0.362
Left Tilt 15 Degree	512/1850.2	GPRS(GMSK 4TS)	0.154	0.092	1.42	26.23	26.50	0.164
Right Cheek	512/1850.2	GPRS(GMSK 4TS)	0.448	0.272	-1.09	26.23	26.50	0.477
Right Tilt 15 Degree	512/1850.2	GPRS(GMSK 4TS)	0.195	0.132	2.27	26.23	26.50	0.208

NOTE: Head SAR test results of GSM1900

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	512/1850.2	GPRS(GMSK 4TS)	0.576	0.359	-1.44	26.23	26.50	0.613
Back Side	512/1850.2	GPRS(GMSK 4TS)	0.549	0.351	-0.35	26.23	26.50	0.584

NOTE: Body-Worn SAR test results of GSM1900

Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	512/1850.2	GPRS(GMSK 4TS)	0.576	0.359	-1.44	26.23	26.50	0.613
Back Side	512/1850.2	GPRS(GMSK 4TS)	0.549	0.351	-0.35	26.23	26.50	0.584
Left Side	512/1850.2	GPRS(GMSK 4TS)	0.341	0.213	1.11	26.23	26.50	0.363
Right Side	512/1850.2	GPRS(GMSK 4TS)	0.317	0.204	-2.64	26.23	26.50	0.337
Bottom Side	512/1850.2	GPRS(GMSK 4TS)	0.263	0.151	-0.66	26.23	26.50	0.280

NOTE: Hotspot SAR test results of GSM1900

**10.1.3. SAR measurement Result of WCDMA Band V**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Left Cheek	4182/836.4	RMC12.2K	0.303	0.218	2.54	22.91	23.00	0.309
Left Tilt 15 Degree	4182/836.4	RMC12.2K	0.177	0.130	3.04	22.91	23.00	0.181
Right Cheek	4182/836.4	RMC12.2K	0.270	0.169	1.45	22.91	23.00	0.276
Right Tilt 15 Degree	4182/836.4	RMC12.2K	0.127	0.086	1.08	22.91	23.00	0.130

NOTE: Head SAR test results of WCDMA Band V

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	4182/836.4	RMC12.2K	0.297	0.227	-0.45	22.91	23.00	0.303
Back Side	4182/836.4	RMC12.2K	0.424	0.318	-1.26	22.91	23.00	0.433

NOTE: Body-Worn SAR test results of WCDMA Band V

Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	4182/836.4	RMC12.2K	0.297	0.227	-0.45	22.91	23.00	0.303
Back Side	4182/836.4	RMC12.2K	0.424	0.318	-1.26	22.91	23.00	0.433
Left Side	4182/836.4	RMC12.2K	0.205	0.142	2.33	22.91	23.00	0.209
Right Side	4182/836.4	RMC12.2K	0.186	0.117	1.07	22.91	23.00	0.190
Bottom Side	4182/836.4	RMC12.2K	0.062	0.036	-3.45	22.91	23.00	0.063

NOTE: Hotspot SAR test results of WCDMA Band V

**10.1.4. SAR measurement Result of WCDMA Band II**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Left Cheek	9400/1880	RMC12.2K	0.282	0.182	-1.05	23.48	23.50	0.283
Left Tilt 15 Degree	9400/1880	RMC12.2K	0.102	0.068	2.17	23.48	23.50	0.102
Right Cheek	9400/1880	RMC12.2K	0.450	0.270	-2.66	23.48	23.50	0.452
Right Tilt 15 Degree	9400/1880	RMC12.2K	0.233	0.151	2.03	23.48	23.50	0.234

NOTE: Head SAR test results of WCDMA Band II

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	9400/1880	RMC12.2K	0.519	0.318	0.26	23.48	23.50	0.521
Back Side	9400/1880	RMC12.2K	0.587	0.375	-0.27	23.48	23.50	0.590

NOTE: Body-Worn SAR test results of WCDMA Band II

Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	9400/1880	RMC12.2K	0.519	0.318	0.26	23.48	23.50	0.521
Back Side	9400/1880	RMC12.2K	0.587	0.375	-0.27	23.48	23.50	0.590
Left Side	9400/1880	RMC12.2K	0.113	0.067	-1.90	23.48	23.50	0.114
Right Side	9400/1880	RMC12.2K	0.319	0.175	1.63	23.48	23.50	0.320
Bottom Side	9400/1880	RMC12.2K	0.236	0.128	-0.56	23.48	23.50	0.237

NOTE: Hotspot SAR test results of WCDMA Band II



**10.1.5. SAR measurement Result of LTE Band V**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
<b>1RB</b>								
Left Cheek	20525/836.5	10M QPSK(1,0)	0.471	0.449	-2.40	23.22	24.00	0.564
Left Tilt 15 Degree	20525/836.5	10M QPSK(1,0)	0.188	0.103	2.16	23.22	24.00	0.225
Right Cheek	20525/836.5	10M QPSK(1,0)	0.450	0.375	2.93	23.22	24.00	0.539
Right Tilt 15 Degree	20525/836.5	10M QPSK(1,0)	0.151	0.094	1.36	23.22	24.00	0.181
<b>50%RB</b>								
Left Cheek	20525/836.5	10M QPSK(25,0)	0.398	0.202	1.17	22.96	24.00	0.506
Left Tilt 15 Degree	20525/836.5	10M QPSK(25,0)	0.143	0.086	1.16	22.96	24.00	0.182
Right Cheek	20525/836.5	10M QPSK(25,0)	0.404	0.223	1.85	22.96	24.00	0.513
Right Tilt 15 Degree	20525/836.5	10M QPSK(25,0)	0.131	0.081	2.39	22.96	24.00	0.166

NOTE: Head SAR test results of LTE Band V

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
<b>1RB</b>								
Front Side	20525/836.5	10M QPSK(1,0)	0.361	0.273	-0.70	23.22	24.00	0.432
Back Side	20525/836.5	10M QPSK(1,0)	0.474	0.356	-1.83	23.22	24.00	0.567
<b>50%RB</b>								
Front Side	20525/836.5	10M QPSK(25,0)	0.244	0.183	1.08	22.96	24.00	0.310
Back Side	20525/836.5	10M	0.369	0.279	-0.65	22.96	24.00	0.469

		QPSK(25,0)						
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NOTE: Body-Worn SAR test results of LTE Band V

Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Front Side	20525/836.5	10M QPSK(1,0)	0.361	0.273	-0.70	23.22	24.00	0.432
Back Side	20525/836.5	10M QPSK(1,0)	0.474	0.356	-1.83	23.22	24.00	0.567
Left Side	20525/836.5	10M QPSK(1,0)	0.334	0.233	0.39	23.22	24.00	0.400
Right Side	20525/836.5	10M QPSK(1,0)	0.206	0.143	-0.07	23.22	24.00	0.247
Bottom Side	20525/836.5	10M QPSK(1,0)	0.251	0.173	2.06	23.22	24.00	0.300
50%RB								
Front Side	20525/836.5	10M QPSK(25,0)	0.244	0.183	1.08	22.96	24.00	0.310
Back Side	20525/836.5	10M QPSK(25,0)	0.369	0.279	-0.65	22.96	24.00	0.469
Left Side	20525/836.5	10M QPSK(25,0)	0.389	0.231	0.89	22.96	24.00	0.494
Right Side	20525/836.5	10M QPSK(25,0)	0.143	0.089	2.13	22.96	24.00	0.182
Bottom Side	20525/836.5	10M QPSK(25,0)	0.201	0.126	-3.54	22.96	24.00	0.255

NOTE: Hotspot SAR test results of LTE Band V

**10.1.6. SAR measurement Result of LTE Band IV**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Left Cheek	20050/1720	20M QPSK(1,0)	0.423	0.252	-4.58	23.59	24.00	0.465
Left Tilt	20050/1720	20M QPSK(1,0)	0.163	0.092	2.17	23.59	24.00	0.179

15 Degree								
Right Cheek	20050/1720	20M QPSK(1,0)	0.492	0.339	1.16	23.59	24.00	0.541
Right Tilt 15 Degree	20050/1720	20M QPSK(1,0)	0.186	0.105	-1.32	23.59	24.00	0.204
50%RB								
Left Cheek	20050/1720	20M QPSK(50,0)	0.307	0.173	2.11	23.23	24.00	0.367
Left Tilt 15 Degree	20050/1720	20M QPSK(50,0)	0.115	0.062	1.71	23.23	24.00	0.137
Right Cheek	20050/1720	20M QPSK(50,0)	0.415	0.269	0.30	23.23	24.00	0.496
Right Tilt 15 Degree	20050/1720	20M QPSK(50,0)	0.137	0.078	-1.15	23.23	24.00	0.164

NOTE: Head SAR test results of LTE Band IV

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tuning power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Front Side	20050/1720	20M QPSK(1,0)	0.711	0.492	4.78	23.59	24.00	0.781
Back Side	20050/1720	20M QPSK(1,0)	0.972	0.601	4.60	23.59	24.00	1.068
Back Side	20175/1732.5	20M QPSK(1,0)	0.980	0.628	4.38	23.41	24.00	1.123
Back Side	20300/1745	20M QPSK(1,0)	0.985	0.655	1.00	23.17	24.00	1.192
Back Side - Repeated	20300/1745	20M QPSK(1,0)	0.976	0.654	-1.37	23.17	24.00	1.182
50%RB								
Front Side	20050/1720	20M QPSK(50,0)	0.572	0.307	1.14	23.23	24.00	0.683
Back Side	20050/1720	20M QPSK(50,0)	0.757	0.470	0.25	23.23	24.00	0.904
Back Side	20175/1732.5	20M QPSK(50,0)	0.836	0.501	3.43	22.94	24.00	1.067
Back Side - Repeated	20175/1732.5	20M QPSK(50,0)	0.823	0.498	-2.11	22.94	24.00	1.051
Back Side	20300/1745	20M QPSK(50,0)	0.805	0.489	-1.10	23.03	24.00	1.006
100%RB								

Back Side	20050/1720	20M QPSK(100,0)	0.627	0.414	0.14	23.13	24.00	0.766
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NOTE: Body-Worn SAR test results of LTE Band IV

Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Front Side	20050/1720	20M QPSK(1,0)	0.711	0.492	4.78	23.59	24.00	0.781
Back Side	20050/1720	20M QPSK(1,0)	0.972	0.601	4.60	23.59	24.00	1.068
Left Side	20050/1720	20M QPSK(1,0)	0.110	0.065	4.07	23.59	24.00	0.121
Right Side	20050/1720	20M QPSK(1,0)	0.518	0.298	4.21	23.59	24.00	0.569
Bottom Side	20050/1720	20M QPSK(1,0)	0.454	0.252	1.06	23.59	24.00	0.499
Back Side	20175/1732.5	20M QPSK(1,0)	0.980	0.628	4.38	23.41	24.00	1.123
Back Side	20300/1745	20M QPSK(1,0)	0.985	0.655	1.00	23.17	24.00	1.192
Back Side - Repeated	20300/1745	20M QPSK(1,0)	0.976	0.654	-1.37	23.17	24.00	1.182
50%RB								
Front Side	20050/1720	20M QPSK(50,0)	0.572	0.307	1.14	23.23	24.00	0.683
Back Side	20050/1720	20M QPSK(50,0)	0.757	0.470	0.25	23.23	24.00	0.904
Left Side	20050/1720	20M QPSK(50,0)	0.083	0.052	-1.43	23.23	24.00	0.099
Right Side	20050/1720	20M QPSK(50,0)	0.423	0.244	-4.12	23.23	24.00	0.505
Bottom Side	20050/1720	20M QPSK(50,0)	0.305	0.168	-2.17	23.23	24.00	0.364
Back Side	20175/1732.5	20M QPSK(50,0)	0.836	0.501	3.43	22.94	24.00	1.067
Back Side - Repeated	20175/1732.5	20M QPSK(50,0)	0.823	0.498	-2.11	22.94	24.00	1.051
Back Side	20300/1745	20M QPSK(50,0)	0.805	0.489	-1.10	23.03	24.00	1.006
100%RB								
Back Side	20050/1720	20M QPSK(100,0)	0.627	0.414	0.14	23.13	24.00	0.766

NOTE: Hotspot SAR test results of LTE Band IV

**10.1.7. SAR measurement Result of LTE Band II**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Left Cheek	19100/1900	20M QPSK(1,0)	0.373	0.217	2.14	23.36	24.00	0.432
Left Tilt 15 Degree	19100/1900	20M QPSK(1,0)	0.172	0.105	3.10	23.36	24.00	0.199
Right Cheek	19100/1900	20M QPSK(1,0)	0.479	0.310	0.43	23.36	24.00	0.555
Right Tilt 15 Degree	19100/1900	20M QPSK(1,0)	0.227	0.142	-1.05	23.36	24.00	0.263
50%RB								
Left Cheek	19100/1900	20M QPSK(50,0)	0.243	0.155	-1.04	22.90	23.00	0.249
Left Tilt 15 Degree	19100/1900	20M QPSK(50,0)	0.103	0.064	2.15	22.90	23.00	0.105
Right Cheek	19100/1900	20M QPSK(50,0)	0.406	0.243	-4.87	22.90	23.00	0.415
Right Tilt 15 Degree	19100/1900	20M QPSK(50,0)	0.162	0.097	1.17	22.90	23.00	0.166

NOTE: Head SAR test results of LTE Band II

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Front Side	19100/1900	20M QPSK(1,0)	0.572	0.362	0.89	23.36	24.00	0.663
Back Side	19100/1900	20M QPSK(1,0)	0.636	0.383	-3.67	23.36	24.00	0.737
50%RB								
Front Side	19100/1900	20M QPSK(50,0)	0.409	0.258	-3.01	22.90	23.00	0.419
Back Side	19100/1900	20M QPSK(50,0)	0.527	0.304	0.72	22.90	23.00	0.539

NOTE: Body-Worn SAR test results of LTE Band II

Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Front Side	19100/1900	20M QPSK(1,0)	0.572	0.362	0.89	23.36	24.00	0.663
Back Side	19100/1900	20M QPSK(1,0)	0.636	0.383	-3.67	23.36	24.00	0.737
Left Side	19100/1900	20M QPSK(1,0)	0.195	0.091	4.15	23.36	24.00	0.226
Right Side	19100/1900	20M QPSK(1,0)	0.359	0.188	-4.08	23.36	24.00	0.416
Bottom Side	19100/1900	20M QPSK(1,0)	0.248	0.132	-2.37	23.36	24.00	0.287
50%RB								
Front Side	19100/1900	20M QPSK (50,0)	0.409	0.258	-3.01	22.90	23.00	0.419
Back Side	19100/1900	20M QPSK (50,0)	0.527	0.304	0.72	22.90	23.00	0.539
Left Side	19100/1900	20M QPSK (50,0)	0.133	0.081	0.21	22.90	23.00	0.136
Right Side	19100/1900	20M QPSK (50,0)	0.246	0.152	2.14	22.90	23.00	0.252
Bottom Side	19100/1900	20M QPSK (50,0)	0.176	0.102	1.74	22.90	23.00	0.180

NOTE: Hotspot SAR test results of LTE Band II

**10.1.8. SAR measurement Result of LTE Band VII**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Left Cheek	20850/2510	20M QPSK(1,0)	0.063	0.032	0.94	22.35	23.00	0.073
Left Tilt 15 Degree	20850/2510	20M QPSK(1,0)	0.031	0.018	2.04	22.35	23.00	0.036
Right Cheek	20850/2510	20M QPSK(1,0)	0.120	0.076	-4.56	22.35	23.00	0.139
Right	20850/2510	20M QPSK(1,0)	0.054	0.029	1.07	22.35	23.00	0.063

Tilt 15 Degree									
50%RB									
Left Cheek	20850/2510	20M QPSK(50,0)	0.037	0.022	1.35	22.13	23.00	0.045	
Left Tilt 15 Degree	20850/2510	20M QPSK(50,0)	0.020	0.013	2.04	22.13	23.00	0.024	
Right Cheek	20850/2510	20M QPSK(50,0)	0.100	0.063	-3.73	22.13	23.00	0.122	
Right Tilt 15 Degree	20850/2510	20M QPSK(50,0)	0.038	0.026	1.16	22.13	23.00	0.046	

NOTE: Head SAR test results of LTE Band VII

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Front Side	20850/2510	20M QPSK(1,0)	0.289	0.154	-0.32	22.35	23.00	0.336
Back Side	20850/2510	20M QPSK(1,0)	0.342	0.189	-0.62	22.35	23.00	0.397
50%RB								
Front Side	20850/2510	20M QPSK(50,0)	0.248	0.129	2.17	22.13	23.00	0.303
Back Side	20850/2510	20M QPSK(50,0)	0.332	0.155	4.46	22.13	23.00	0.406

NOTE: Body-Worn SAR test results of LTE Band VII

Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
1RB								
Front Side	20850/2510	20M QPSK(1,0)	0.289	0.154	-0.32	22.35	23.00	0.336
Back Side	20850/2510	20M QPSK(1,0)	0.342	0.189	-0.62	22.35	23.00	0.397
Left Side	20850/2510	20M QPSK(1,0)	0.094	0.051	2.17	22.35	23.00	0.109
Right Side	20850/2510	20M QPSK(1,0)	0.144	0.082	4.88	22.35	23.00	0.167
Bottom Side	20850/2510	20M QPSK(1,0)	0.228	0.097	-3.48	22.35	23.00	0.265
50%RB								
Front Side	20850/2510	20M QPSK(50,0)	0.248	0.129	2.17	22.13	23.00	0.303

Back Side	20850/2510	20M QPSK(50,0)	0.332	0.155	4.46	22.13	23.00	0.406
Left Side	20850/2510	20M QPSK(50,0)	0.061	0.037	0.02	22.13	23.00	0.075
Right Side	20850/2510	20M QPSK(50,0)	0.102	0.061	1.73	22.13	23.00	0.125
Bottom Side	20850/2510	20M QPSK(50,0)	0.187	0.082	1.07	22.13	23.00	0.228

NOTE: Hotspot SAR test results of LTE Band VII

**10.1.9. SAR measurement Result of WLAN 2.4G**

Test Position of Head	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Left Cheek	1/2412	802.11 b	0.662	0.354	1.17	13.20	13.50	0.709
Left Tilt 15 Degree	1/2412	802.11 b	0.459	0.317	-1.59	13.20	13.50	0.492
Right Cheek	1/2412	802.11 b	0.966	0.505	-0.23	13.20	13.50	1.035
Right Cheek - Repeated	1/2412	802.11 b	0.950	0.493	-1.17	13.20	13.50	1.018
Right Tilt 15 Degree	1/2412	802.11 b	0.705	0.437	1.56	13.20	13.50	0.755
Right Cheek	6/2437	802.11 b	0.818	0.411	4.41	12.60	13.50	1.006
Right Cheek	13/2462	802.11 b	0.798	0.394	-0.86	12.70	13.50	0.959

NOTE: Head SAR test results of WLAN 2.4G

Test Position of Body-Worn with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	1/2412	802.11 b	0.102	0.064	2.63	13.20	13.50	0.109
Back Side	1/2412	802.11 b	0.254	0.094	2.61	13.20	13.50	0.272

NOTE: Body-Worn SAR test results of WLAN 2.4G



Test Position of Hotspot with 10mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g (W/Kg)
			1g	10g				
Front Side	1/2412	802.11 b	0.102	0.064	2.63	13.20	13.50	0.109
Back Side	1/2412	802.11 b	0.254	0.094	2.61	13.20	13.50	0.272
Left Side	1/2412	802.11 b	0.037	0.022	-1.59	13.20	13.50	0.040
Top Side	1/2412	802.11 b	0.057	0.030	-1.92	13.20	13.50	0.061

NOTE: Hotspot SAR test results of WLAN 2.4G

### 10.2. Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities of this device are as below:

No.	Configuration	Head	Body	Hotspot	Note
1	GSM(Voice) + WLAN 2.4GHz(data)	Yes	Yes	N/A	
2	WCDMA(Voice) + WLAN 2.4GHz(data)	Yes	Yes	N/A	
3	GSM(Voice) + BT(data)	Yes	Yes	N/A	
4	WCDMA(Voice) + BT(data)	Yes	Yes	N/A	
5	GPRS/EDGE(data) + WLAN 2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
6	WCDMA(data) + WLAN 2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
7	LTE(data) + WLAN 2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
8	GPRS/EDGE(data) + BT(data)	Yes	Yes	Yes	BT Tethering
9	WCDMA(data) + BT(data)	Yes	Yes	Yes	BT Tethering
10	LTE(data) + BT(data)	Yes	Yes	Yes	BT Tethering

NOTE:

- 1) This device supported VoIP in GPRS/EDGE, WCDMA and LTE(e.g. 3rd party VoIP).
- 2) This device WLAN 2.4GHz supports Hotspot operation.
- 3) WLAN 2.4GHz and BT share the same antenna, and cannot transmit simultaneously.
- 4) EUT will choose each GSM, WCDMA and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
- 5) The Scaled SAR summation is calculated based on the same configuration and test position.

### 10.3. SAR Summation Scenario

Per KDB 447498 D01, simultaneous transmission SAR is compliant if,

- 1) Scalar SAR summation < 1.6W/kg.
- 2)  $SPLSR = (SAR_1 + SAR_2)^{1.5} / (\text{min. separation distance, mm})$ , and the peak separation distance is determined from the square root of  $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$ , where  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  are the coordinates of the extrapolated peak SAR locations in the zoom scan. If  $SPLSR \leq 0.04$ , simultaneously transmission SAR measurement is not necessary.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		GSM 850	WLAN 2.4G			
Head	Left Cheek	0.430	0.709	1.139	N/A	N/A
	Left Tilt 15 Degree	0.328	0.492	0.819	N/A	N/A
	Right Cheek	0.426	1.035	1.461	N/A	N/A
	Right Tilt 15 Degree	0.308	0.755	1.064	N/A	N/A
Body-Worn	Front Side	0.474	0.109	0.583	N/A	N/A
	Back Side	0.637	0.272	0.909	N/A	N/A
Hotspot	Front Side	0.474	0.109	0.583	N/A	N/A
	Back Side	0.637	0.272	0.909	N/A	N/A
	Left Side	0.537	0.040	0.577	N/A	N/A
	Right Side	0.359	N/A	0.359	N/A	N/A
	Top Side	N/A	0.061	0.061	N/A	N/A
	Bottom Side	0.091	N/A	0.091	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of GSM850 and WLAN 2.4G.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		GSM 1900	WLAN 2.4G			
Head	Left Cheek	0.362	0.709	1.071	N/A	N/A
	Left Tilt 15 Degree	0.164	0.492	0.656	N/A	N/A
	Right Cheek	0.477	1.035	1.512	N/A	N/A
	Right Tilt 15 Degree	0.208	0.755	0.963	N/A	N/A
Body-Worn	Front Side	0.613	0.109	0.722	N/A	N/A
	Back Side	0.584	0.272	0.856	N/A	N/A
Hotspot	Front Side	0.613	0.109	0.722	N/A	N/A
	Back Side	0.584	0.272	0.856	N/A	N/A
	Left Side	0.363	0.040	0.403	N/A	N/A
	Right Side	0.337	N/A	0.337	N/A	N/A
	Top Side	N/A	0.061	0.061	N/A	N/A
	Bottom Side	0.280	N/A	0.280	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of GSM1900 and WLAN 2.4G.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		WCDMA Band V	WLAN 2.4G			
Head	Left Cheek	0.309	0.709	1.019	N/A	N/A
	Left Tilt 15 Degree	0.181	0.492	0.673	N/A	N/A
	Right Cheek	0.276	1.035	1.311	N/A	N/A
	Right Tilt 15 Degree	0.130	0.755	0.885	N/A	N/A
Body-Worn	Front Side	0.303	0.109	0.413	N/A	N/A
	Back Side	0.433	0.272	0.705	N/A	N/A
Hotspot	Front Side	0.303	0.109	0.413	N/A	N/A
	Back Side	0.433	0.272	0.705	N/A	N/A
	Left Side	0.209	0.040	0.249	N/A	N/A
	Right Side	0.190	N/A	0.190	N/A	N/A
	Top Side	N/A	0.061	0.061	N/A	N/A
	Bottom Side	0.063	N/A	0.063	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of WCDMA Band V and WLAN 2.4G.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		WCDMA Band II	WLAN 2.4G			
Head	Left Cheek	0.283	0.709	0.993	N/A	N/A
	Left Tilt 15 Degree	0.102	0.492	0.594	N/A	N/A
	Right Cheek	0.452	1.035	1.487	N/A	N/A
	Right Tilt 15 Degree	0.234	0.755	0.989	N/A	N/A
Body-Worn	Front Side	0.521	0.109	0.631	N/A	N/A
	Back Side	0.590	0.272	0.862	N/A	N/A
Hotspot	Front Side	0.521	0.109	0.631	N/A	N/A
	Back Side	0.590	0.272	0.862	N/A	N/A
	Left Side	0.114	0.040	0.153	N/A	N/A
	Right Side	0.320	N/A	0.320	N/A	N/A
	Top Side	N/A	0.061	0.061	N/A	N/A
	Bottom Side	0.237	N/A	0.237	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of WCDMA Band II and WLAN 2.4G.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band V	WLAN 2.4G			
Head	Left Cheek	0.564	0.709	1.273	N/A	N/A
	Left Tilt 15 Degree	0.225	0.492	0.717	N/A	N/A

	Right Cheek	0.539	1.035	1.574	N/A	N/A
	Right Tilt 15 Degree	0.181	0.755	0.936	N/A	N/A
Body-Worn	Front Side	0.432	0.109	0.541	N/A	N/A
	Back Side	0.567	0.272	0.839	N/A	N/A
Hotspot	Front Side	0.432	0.109	0.541	N/A	N/A
	Back Side	0.567	0.272	0.839	N/A	N/A
	Left Side	0.494	0.040	0.534	N/A	N/A
	Right Side	0.247	N/A	0.247	N/A	N/A
	Top Side	N/A	0.061	0.061	N/A	N/A
	Bottom Side	0.300	N/A	0.300	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of LTE Band V and WLAN 2.4G.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band IV	WLAN 2.4G			
Head	Left Cheek	0.465	0.709	1.174	N/A	N/A
	Left Tilt 15 Degree	0.179	0.492	0.671	N/A	N/A
	Right Cheek	0.541	1.035	1.576	N/A	N/A
	Right Tilt 15 Degree	0.204	0.755	0.960	N/A	N/A
Body-Worn	Front Side	0.781	0.109	0.891	N/A	N/A
	Back Side	1.192	0.272	1.465	N/A	N/A
Hotspot	Front Side	0.781	0.109	0.891	N/A	N/A
	Back Side	1.192	0.272	1.465	N/A	N/A
	Left Side	0.121	0.040	0.161	N/A	N/A
	Right Side	0.569	N/A	0.569	N/A	N/A
	Top Side	N/A	0.061	0.061	N/A	N/A
	Bottom Side	0.499	N/A	0.499	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of LTE Band IV and WLAN 2.4G.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band II	WLAN 2.4G			
Head	Left Cheek	0.432	0.709	1.142	N/A	N/A
	Left Tilt 15 Degree	0.199	0.492	0.691	N/A	N/A
	Right Cheek	0.555	1.035	1.590	N/A	N/A
	Right Tilt 15 Degree	0.263	0.755	1.018	N/A	N/A
Body-Worn	Front Side	0.663	0.109	0.772	N/A	N/A
	Back Side	0.737	0.272	1.009	N/A	N/A
Hotspot	Front Side	0.663	0.109	0.772	N/A	N/A
	Back Side	0.737	0.272	1.009	N/A	N/A
	Left Side	0.226	0.040	0.266	N/A	N/A

	Right Side	0.416	N/A	0.416	N/A	N/A
	Top Side	N/A	0.061	0.061	N/A	N/A
	Bottom Side	0.287	N/A	0.287	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of LTE Band II and WLAN 2.4G.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band VII	WLAN 2.4G			
Head	Left Cheek	0.073	0.709	0.783	N/A	N/A
	Left Tilt 15 Degree	0.036	0.492	0.528	N/A	N/A
	Right Cheek	0.139	1.035	1.174	N/A	N/A
	Right Tilt 15 Degree	0.063	0.755	0.818	N/A	N/A
Body-Worn	Front Side	0.336	0.109	0.445	N/A	N/A
	Back Side	0.406	0.272	0.678	N/A	N/A
Hotspot	Front Side	0.336	0.109	0.445	N/A	N/A
	Back Side	0.406	0.272	0.678	N/A	N/A
	Left Side	0.109	0.040	0.149	N/A	N/A
	Right Side	0.167	N/A	0.167	N/A	N/A
	Top Side	N/A	0.061	0.061	N/A	N/A
	Bottom Side	0.265	N/A	0.265	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of LTE Band VII and WLAN 2.4G.

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		GSM 850	BT			
Head	Left Cheek	0.430	0.167	0.597	N/A	N/A
	Left Tilt 15 Degree	0.328	0.167	0.495	N/A	N/A
	Right Cheek	0.426	0.167	0.594	N/A	N/A
	Right Tilt 15 Degree	0.308	0.167	0.475	N/A	N/A
Body-Worn	Front Side	0.474	0.084	0.557	N/A	N/A
	Back Side	0.637	0.084	0.720	N/A	N/A
Hotspot	Front Side	0.474	0.084	0.557	N/A	N/A
	Back Side	0.637	0.084	0.720	N/A	N/A
	Left Side	0.537	0.084	0.621	N/A	N/A
	Right Side	0.359	N/A	0.359	N/A	N/A
	Top Side	N/A	0.084	0.084	N/A	N/A
	Bottom Side	0.091	N/A	0.091	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of GSM850 and BT

Test Position	Scaled SAR <sub>MAX</sub>		Σ 1-g SAR	SPLSR	Remark
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		GSM 1900	BT	(W/Kg)		
Head	Left Cheek	0.362	0.167	0.529	N/A	N/A
	Left Tilt 15 Degree	0.164	0.167	0.331	N/A	N/A
	Right Cheek	0.477	0.167	0.644	N/A	N/A
	Right Tilt 15 Degree	0.208	0.167	0.375	N/A	N/A
Body-Worn	Front Side	0.613	0.084	0.697	N/A	N/A
	Back Side	0.584	0.084	0.668	N/A	N/A
Hotspot	Front Side	0.613	0.084	0.697	N/A	N/A
	Back Side	0.584	0.084	0.668	N/A	N/A
	Left Side	0.363	0.084	0.446	N/A	N/A
	Right Side	0.337	N/A	0.337	N/A	N/A
	Top Side	N/A	0.084	0.084	N/A	N/A
	Bottom Side	0.280	N/A	0.280	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of GSM1900 and BT

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		WCDMA Band V	BT			
Head	Left Cheek	0.309	0.167	0.477	N/A	N/A
	Left Tilt 15 Degree	0.181	0.167	0.348	N/A	N/A
	Right Cheek	0.276	0.167	0.443	N/A	N/A
	Right Tilt 15 Degree	0.130	0.167	0.297	N/A	N/A
Body-Worn	Front Side	0.303	0.084	0.387	N/A	N/A
	Back Side	0.433	0.084	0.516	N/A	N/A
Hotspot	Front Side	0.303	0.084	0.387	N/A	N/A
	Back Side	0.433	0.084	0.516	N/A	N/A
	Left Side	0.209	0.084	0.293	N/A	N/A
	Right Side	0.190	N/A	0.190	N/A	N/A
	Top Side	N/A	0.084	0.084	N/A	N/A
	Bottom Side	0.063	N/A	0.063	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of WCDMA Band V and BT

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		WCDMA Band II	BT			
Head	Left Cheek	0.283	0.167	0.450	N/A	N/A
	Left Tilt 15 Degree	0.102	0.167	0.270	N/A	N/A
	Right Cheek	0.452	0.167	0.619	N/A	N/A
	Right Tilt 15 Degree	0.234	0.167	0.401	N/A	N/A

Body-Worn	Front Side	0.521	0.084	0.605	N/A	N/A
	Back Side	0.590	0.084	0.673	N/A	N/A
Hotspot	Front Side	0.521	0.084	0.605	N/A	N/A
	Back Side	0.590	0.084	0.673	N/A	N/A
	Left Side	0.114	0.084	0.197	N/A	N/A
	Right Side	0.320	N/A	0.320	N/A	N/A
	Top Side	N/A	0.084	0.084	N/A	N/A
	Bottom Side	0.237	N/A	0.237	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of WCDMA Band II and BT

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band V	BT			
Head	Left Cheek	0.564	0.167	0.731	N/A	N/A
	Left Tilt 15 Degree	0.225	0.167	0.392	N/A	N/A
	Right Cheek	0.539	0.167	0.706	N/A	N/A
	Right Tilt 15 Degree	0.181	0.167	0.348	N/A	N/A
Body-Worn	Front Side	0.432	0.084	0.516	N/A	N/A
	Back Side	0.567	0.084	0.651	N/A	N/A
Hotspot	Front Side	0.432	0.084	0.516	N/A	N/A
	Back Side	0.567	0.084	0.651	N/A	N/A
	Left Side	0.494	0.084	0.578	N/A	N/A
	Right Side	0.247	N/A	0.247	N/A	N/A
	Top Side	N/A	0.084	0.084	N/A	N/A
	Bottom Side	0.300	N/A	0.300	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of LTE Band V and BT

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band IV	BT			
Head	Left Cheek	0.465	0.167	0.632	N/A	N/A
	Left Tilt 15 Degree	0.179	0.167	0.346	N/A	N/A
	Right Cheek	0.541	0.167	0.708	N/A	N/A
	Right Tilt 15 Degree	0.204	0.167	0.372	N/A	N/A
Body-Worn	Front Side	0.781	0.084	0.865	N/A	N/A
	Back Side	1.192	0.084	1.276	N/A	N/A
Hotspot	Front Side	0.781	0.084	0.865	N/A	N/A
	Back Side	1.192	0.084	1.276	N/A	N/A
	Left Side	0.121	0.084	0.204	N/A	N/A
	Right Side	0.569	N/A	0.569	N/A	N/A
	Top Side	N/A	0.084	0.084	N/A	N/A

	Bottom Side	0.499	N/A	0.499	N/A	N/A
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NOTE: 1-g SAR Simultaneous Tx Combination of LTE Band IV and BT

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band II	BT			
Head	Left Cheek	0.432	0.167	0.599	N/A	N/A
	Left Tilt 15 Degree	0.199	0.167	0.366	N/A	N/A
	Right Cheek	0.555	0.167	0.722	N/A	N/A
	Right Tilt 15 Degree	0.263	0.167	0.430	N/A	N/A
Body-Worn	Front Side	0.663	0.084	0.746	N/A	N/A
	Back Side	0.737	0.084	0.821	N/A	N/A
Hotspot	Front Side	0.663	0.084	0.746	N/A	N/A
	Back Side	0.737	0.084	0.821	N/A	N/A
	Left Side	0.226	0.084	0.310	N/A	N/A
	Right Side	0.416	N/A	0.416	N/A	N/A
	Top Side	N/A	0.084	0.084	N/A	N/A
	Bottom Side	0.287	N/A	0.287	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of LTE Band II and BT

Test Position		Scaled SAR <sub>MAX</sub>		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band VII	BT			
Head	Left Cheek	0.073	0.167	0.240	N/A	N/A
	Left Tilt 15 Degree	0.036	0.167	0.203	N/A	N/A
	Right Cheek	0.139	0.167	0.307	N/A	N/A
	Right Tilt 15 Degree	0.063	0.167	0.230	N/A	N/A
Body-Worn	Front Side	0.336	0.084	0.419	N/A	N/A
	Back Side	0.406	0.084	0.489	N/A	N/A
Hotspot	Front Side	0.336	0.084	0.419	N/A	N/A
	Back Side	0.406	0.084	0.489	N/A	N/A
	Left Side	0.109	0.084	0.193	N/A	N/A
	Right Side	0.167	N/A	0.167	N/A	N/A
	Top Side	N/A	0.084	0.084	N/A	N/A
	Bottom Side	0.265	N/A	0.265	N/A	N/A

NOTE: 1-g SAR Simultaneous Tx Combination of LTE Band VII and BT



## 11. Appendix A. Photo documentation

Table of contents
Test Facility
Product Photo
Test Positions
Liquid depth

**Test Facility**

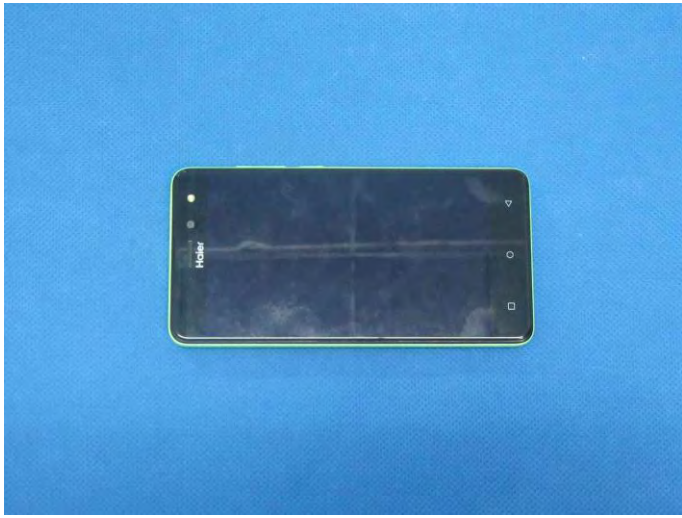
Measurement System SATIMO



**Product Photo**

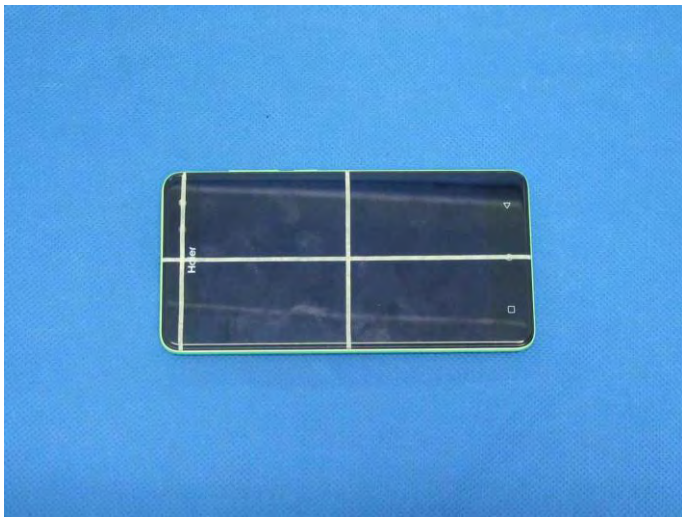
Front View

Back View



Reference Line

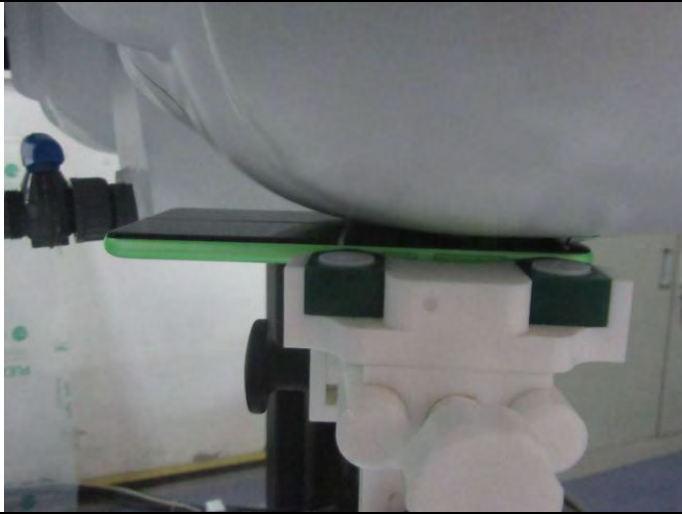
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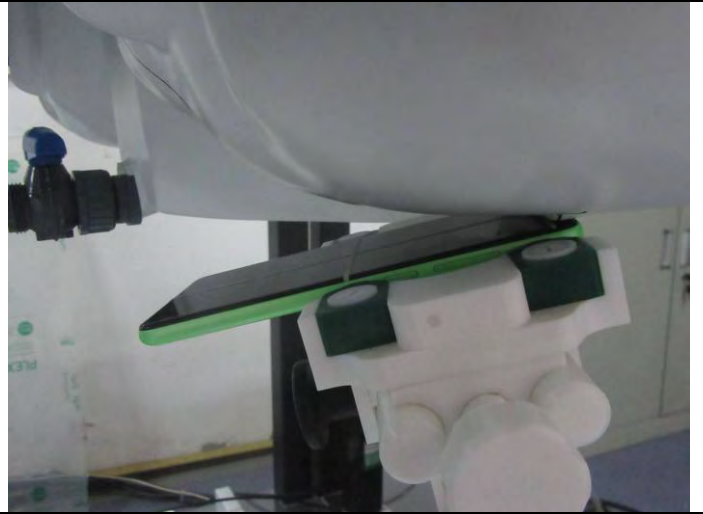
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**Test Positions**

Left Cheek



Left Tilt 15 Degree



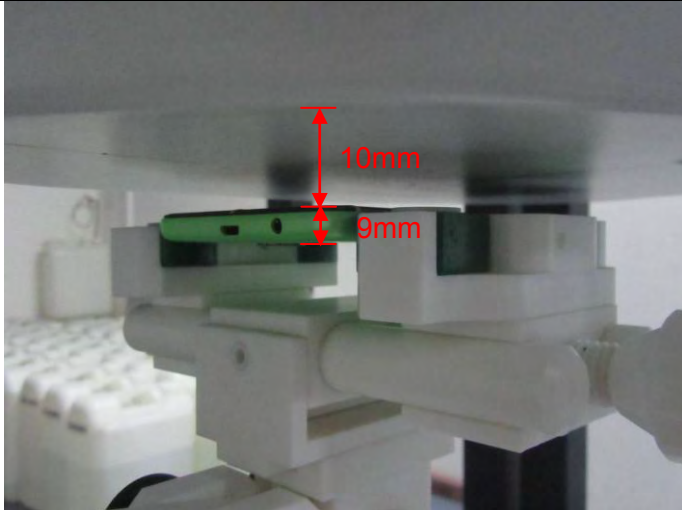
Right Cheek



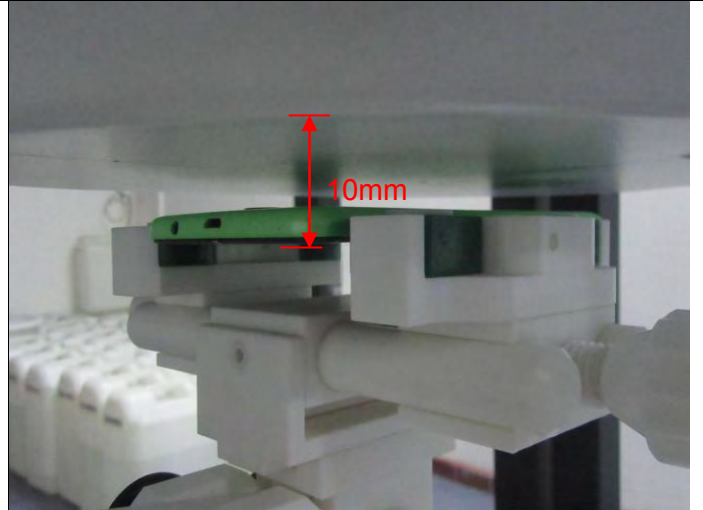
Right Tilt 15 Degree



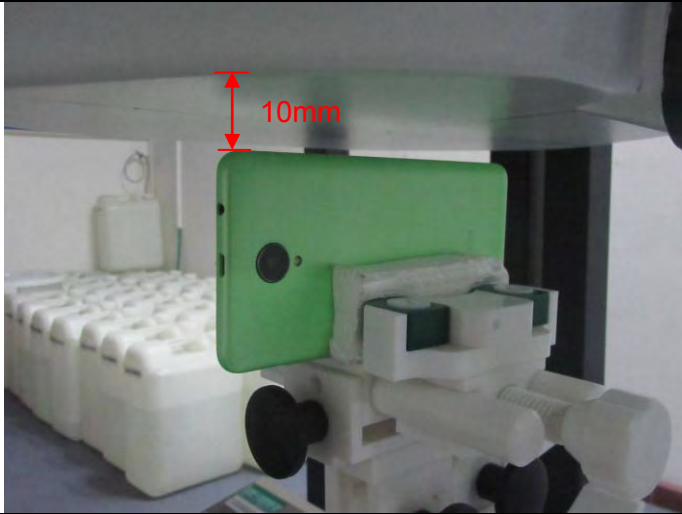
Front Side  
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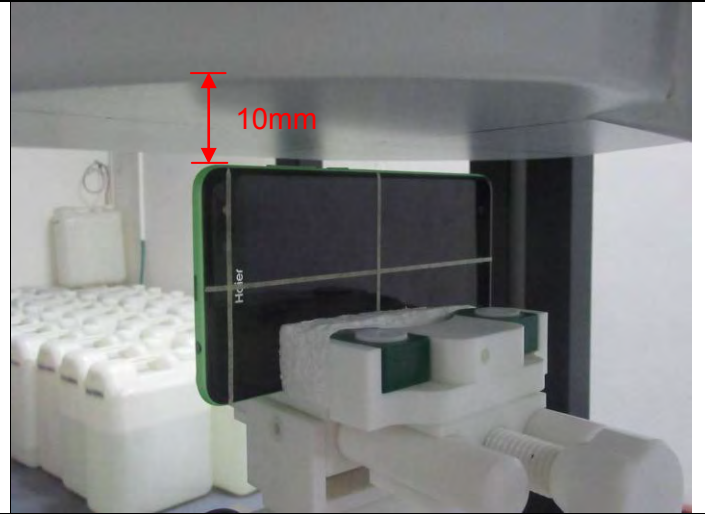
Back Side  
(Separation distance of 10mm)



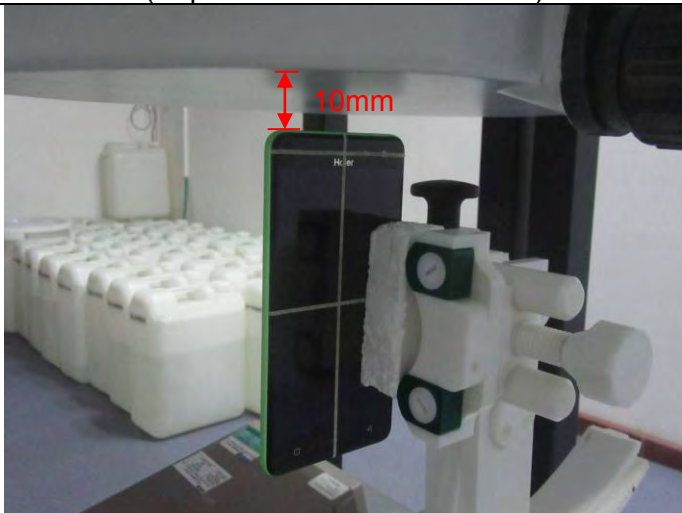
Left Side  
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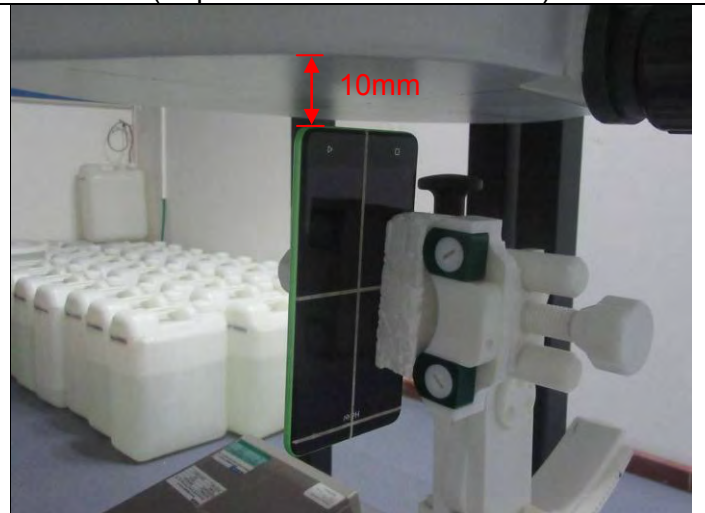
Right Side  
(Separation distance of 10mm)



Top Side  
(Separation distance of 10mm)

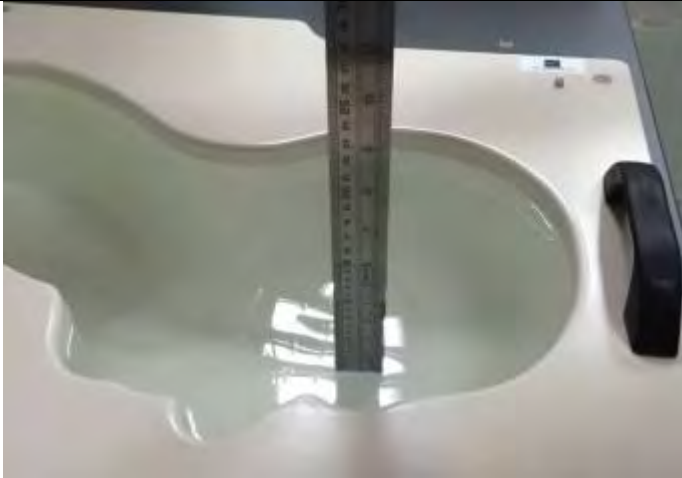


Bottom Side  
(Separation distance of 10mm)



**Liquid depth**

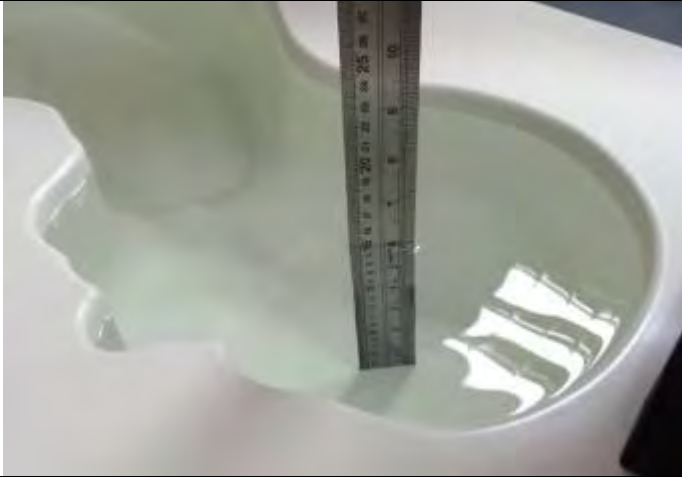
Head 850MHz depth (15.2cm)



Body 850MHz depth (15.3cm)



Head 1800MHz depth (15.1cm)



Body 1800MHz depth (15.4cm)



Head 1900MHz depth (15.2cm)



Body 1900MHz depth (15.3cm)



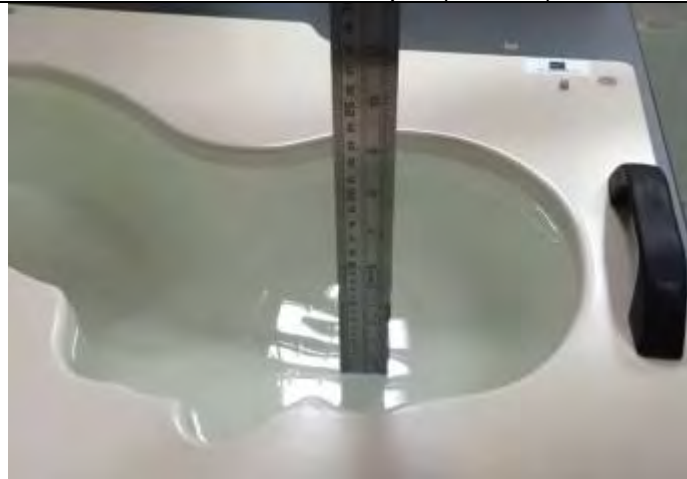
Head 2450MHz depth (15.3cm)



Body 2450MHz depth (15.1cm)



Head 2600MHz depth (15.2cm)



Body 2600MHz depth (15.1cm)



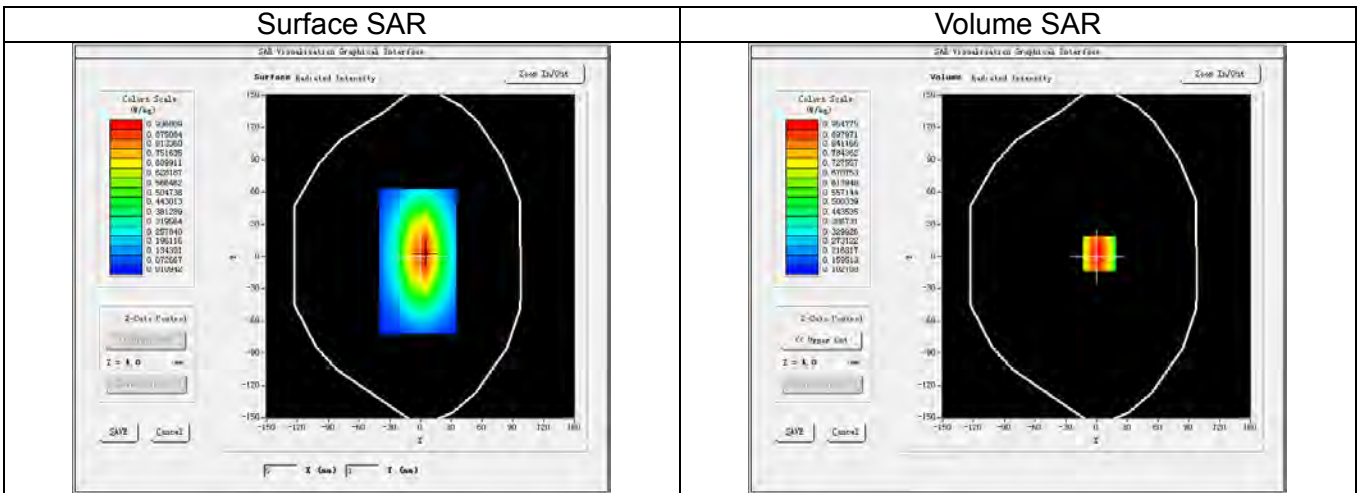
## 12. Appendix B. System Check Plots

<b>Table of contents</b>
<b>System Performance Check - SID835 - Head</b>
<b>System Performance Check - SID835 - Body</b>
<b>System Performance Check - SID1800 - Head</b>
<b>System Performance Check - SID1800 - Body</b>
<b>System Performance Check - SID1900 - Head</b>
<b>System Performance Check - SID1900 - Body</b>
<b>System Performance Check - SID2450 - Head</b>
<b>System Performance Check - SID2450 - Body</b>
<b>System Performance Check - SID2600 - Head</b>
<b>System Performance Check - SID2600 - Body</b>



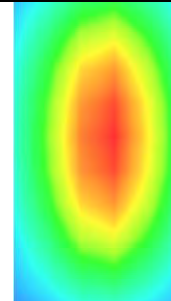
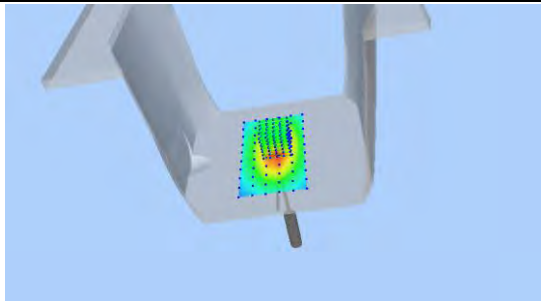
### System Performance Check - SID835-Head

Date of measurement:	Oct. 20, 2017
Signal:	Communication System: CW; Frequency: 835.00MHz; Duty Cycle: 1:1.00
ConvF:	1.48
Liquid Parameters:	Relative permittivity (real part): 42.92; Conductivity (S/m): 0.89;
Device Position:	Dipole
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



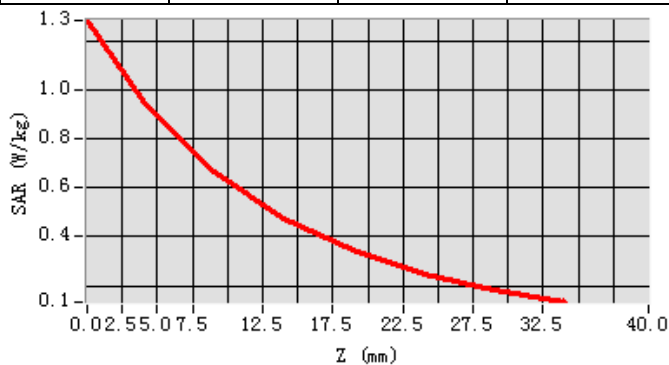
3D screen shot

Hot spot position



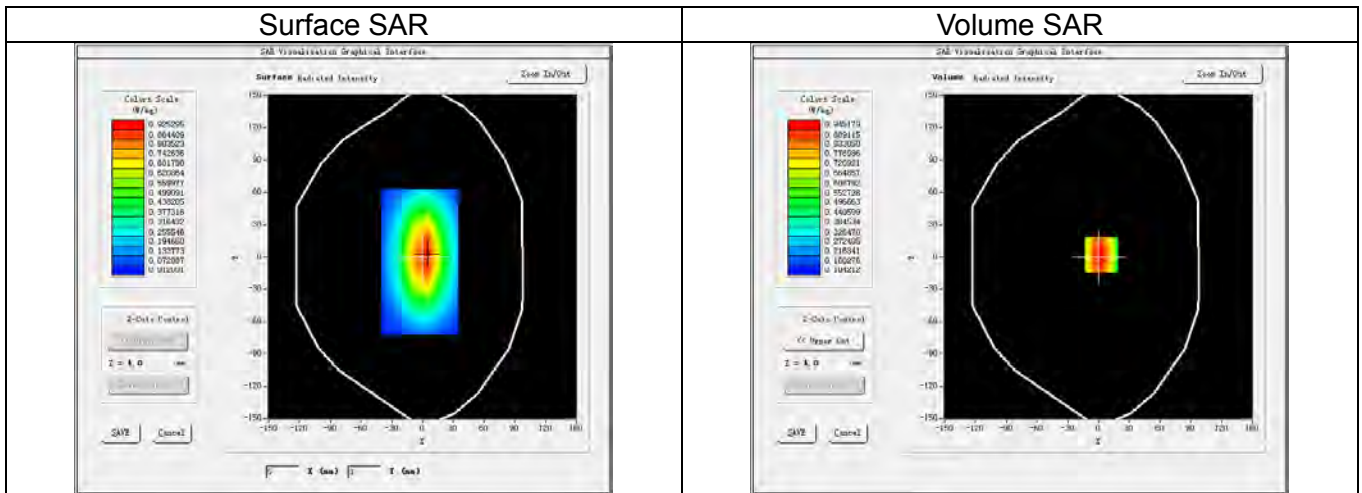
Maximum location: X=3.00, Y=3.00  
SAR Peak: 1.28 W/kg

SAR 1g (W/Kg)		0.938					
SAR 10g (W/Kg)		0.626					
Power Drift (±5%):		0.07					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.2826	0.9548	0.6659	0.4755	0.3430	0.2493	0.1821



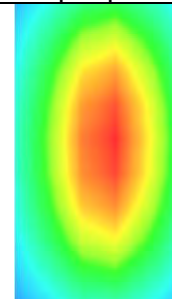
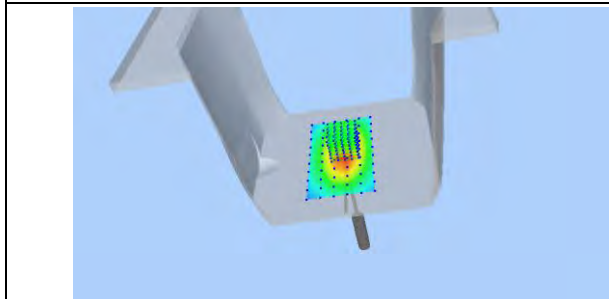
### System Performance Check - SID835-Body

Date of measurement:	Oct. 21, 2017
Signal:	Communication System: CW; Frequency: 835.00MHz; Duty Cycle: 1:1.00
ConvF:	1.53
Liquid Parameters:	Relative permittivity (real part): 55.16; Conductivity (S/m): 0.98;
Device Position:	Dipole
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



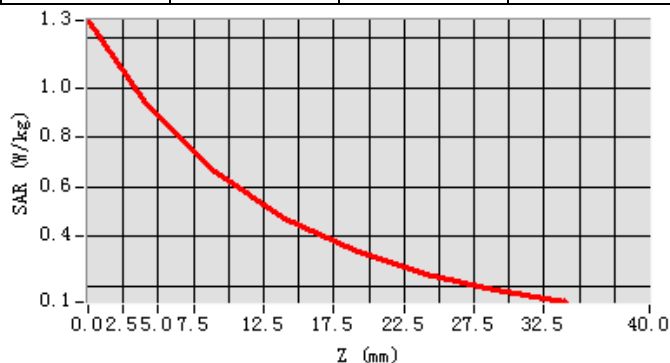
3D screen shot

Hot spot position



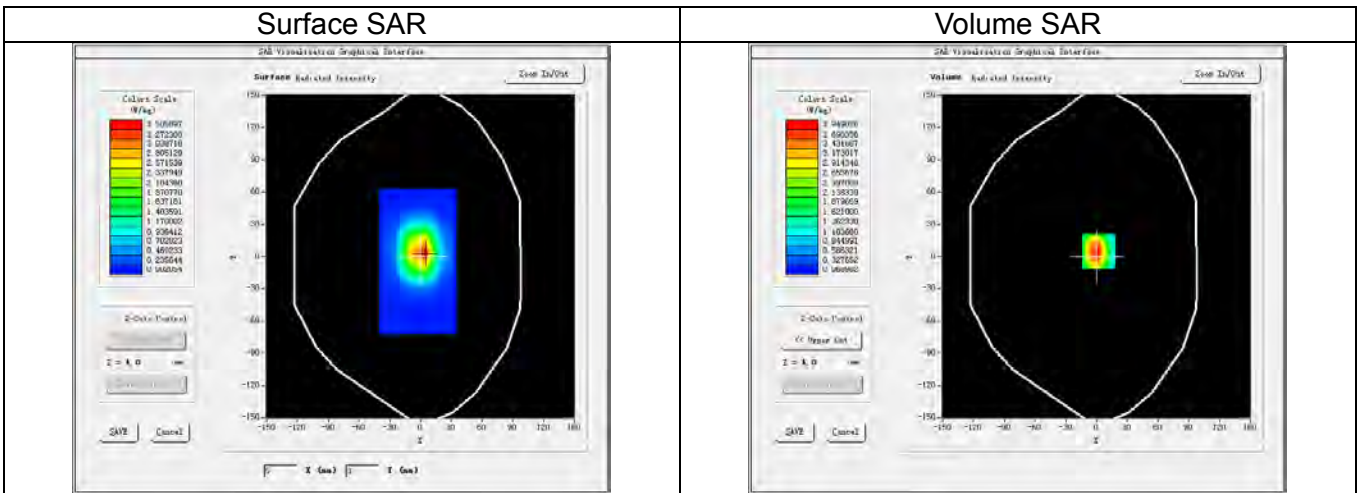
Maximum location: X=3.00, Y=2.00  
SAR Peak: 1.28 W/kg

SAR 1g (W/Kg)		0.929					
SAR 10g (W/Kg)		0.621					
Power Drift (±5%):		-0.17					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.2708	0.9452	0.6600	0.4736	0.3435	0.2513	0.1845



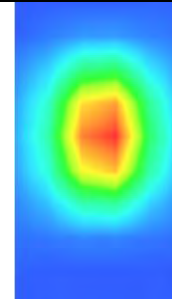
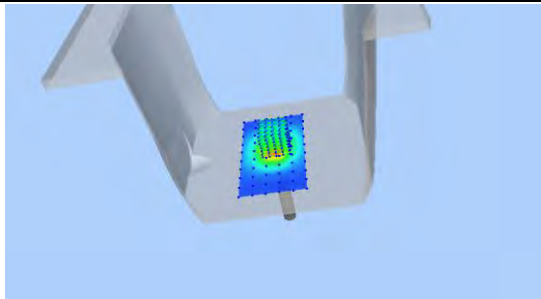
### System Performance Check - SID1800-Head

Date of measurement:	Oct. 25, 2017
Signal:	Communication System: CW; Frequency: 1800.00MHz; Duty Cycle: 1:1.00
ConvF:	1.75
Liquid Parameters:	Relative permittivity (real part): 39.64; Conductivity (S/m): 1.40;
Device Position:	Dipole
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



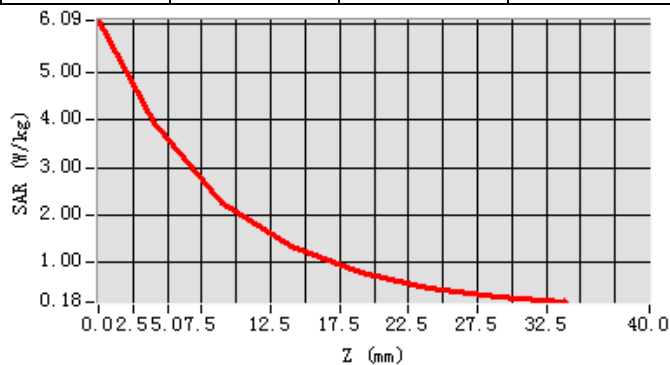
3D screen shot

Hot spot position



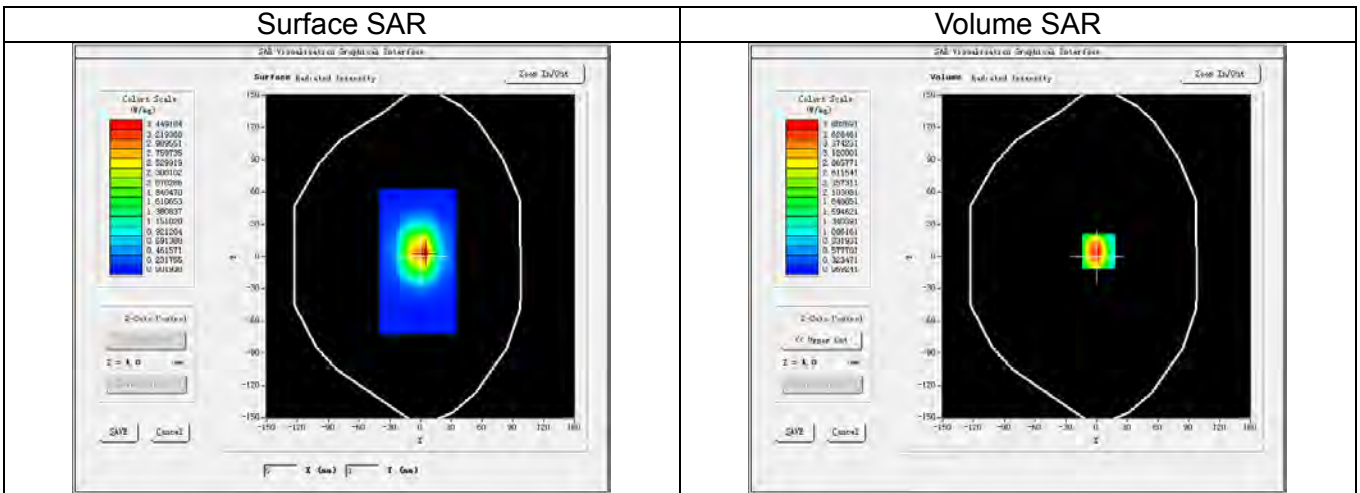
Maximum location: X=2.00, Y=5.00  
SAR Peak: 6.27 W/kg

SAR 1g (W/Kg)		3.816					
SAR 10g (W/Kg)		1.987					
Power Drift (±5%):		0.36					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	6.0852	3.9490	2.2639	1.3349	0.7965	0.4831	0.2886

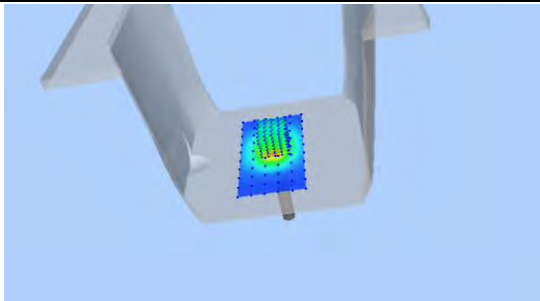


### System Performance Check - SID1800-Body

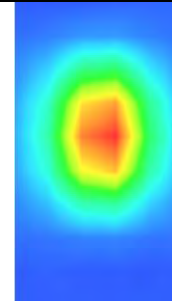
Date of measurement:	Oct. 27, 2017
Signal:	Communication System: CW; Frequency: 1800.00MHz; Duty Cycle: 1:1.00
ConvF:	1.79
Liquid Parameters:	Relative permittivity (real part): 53.89; Conductivity (S/m): 1.52;
Device Position:	Dipole
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



3D screen shot

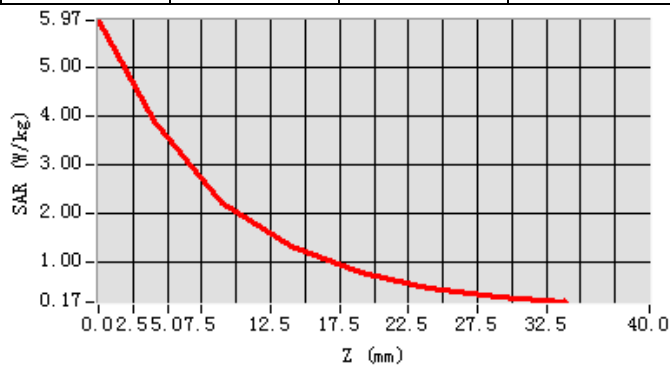


Hot spot position



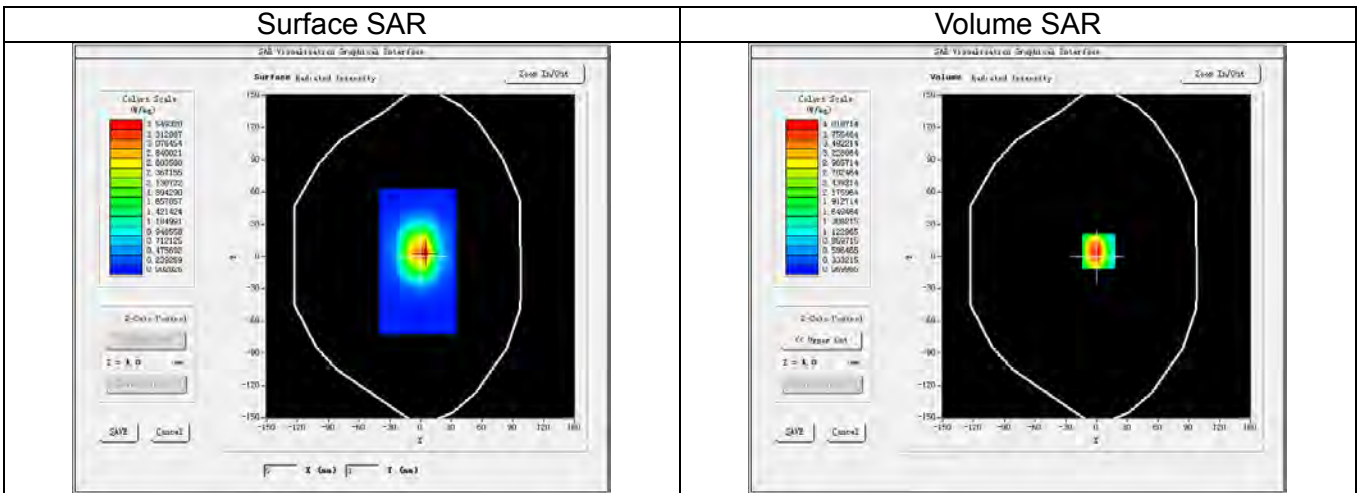
Maximum location: X=2.00, Y=5.00  
SAR Peak: 6.15 W/kg

SAR 1g (W/Kg)		3.747					
SAR 10g (W/Kg)		1.953					
Power Drift (±5%):		-0.96					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	5.9685	3.8827	2.2274	1.3148	0.7819	0.4698	0.2858



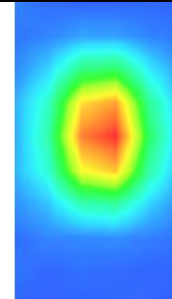
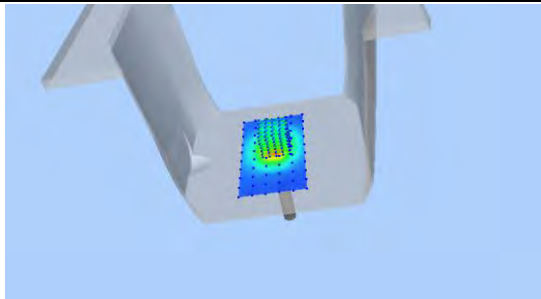
### System Performance Check - SID1900-Head

Date of measurement:	Oct. 23, 2017
Signal:	Communication System: CW; Frequency: 1900.00MHz; Duty Cycle: 1:1.00
ConvF:	2.00
Liquid Parameters:	Relative permittivity (real part):39.29; Conductivity (S/m): 1.44;
Device Position:	Dipole
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



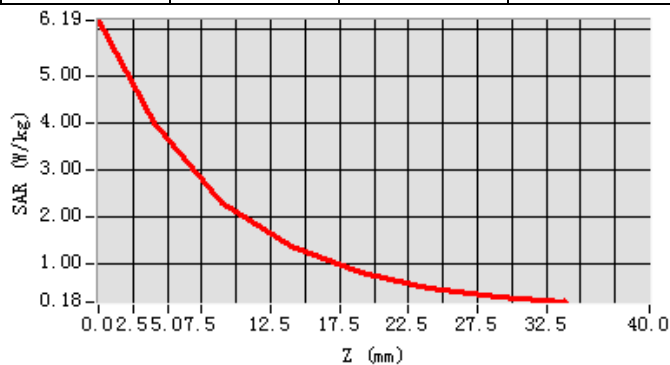
3D screen shot

Hot spot position



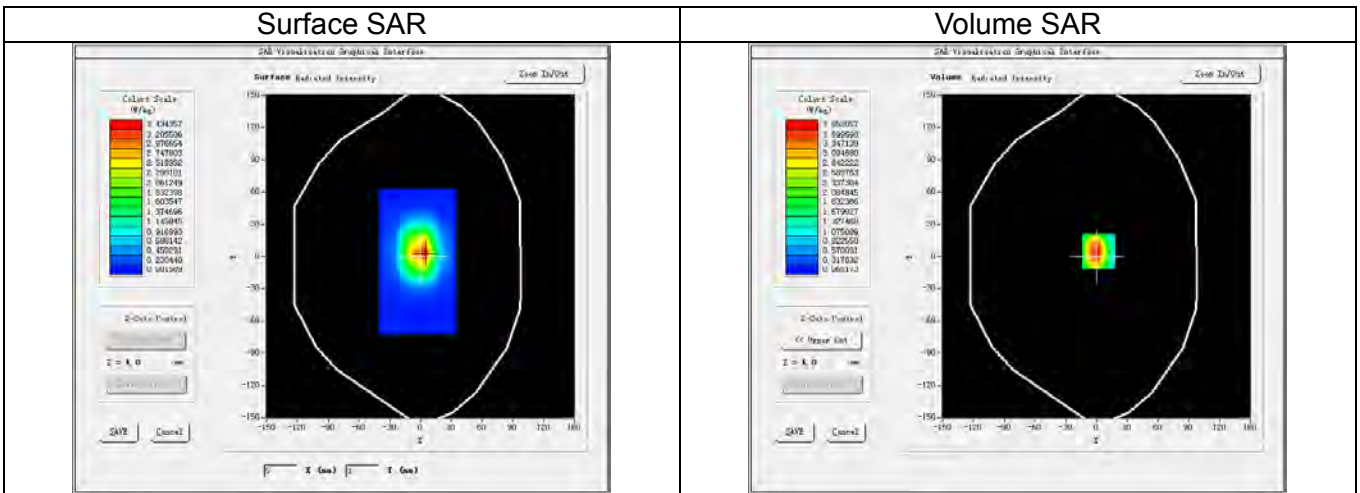
Maximum location: X=2.00, Y=5.00  
SAR Peak: 6.41 W/kg

SAR 1g (W/Kg)		3.967					
SAR 10g (W/Kg)		2.043					
Power Drift (±5%):		-0.07					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	6.1908	4.0187	2.2993	1.3557	0.8025	0.4868	0.2929



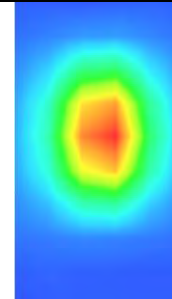
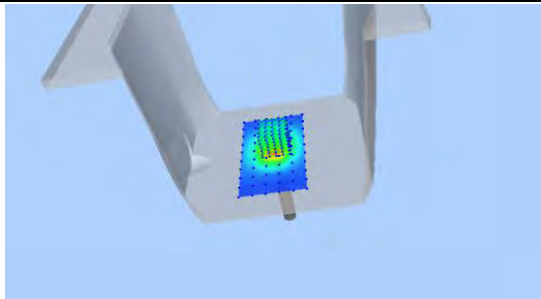
### System Performance Check - SID1900-Body

Date of measurement:	Oct. 24, 2017
Signal:	Communication System: CW; Frequency: 1900.00MHz; Duty Cycle: 1:1.00
ConvF:	2.07
Liquid Parameters:	Relative permittivity (real part): 53.49; Conductivity (S/m): 1.56;
Device Position:	Dipole
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



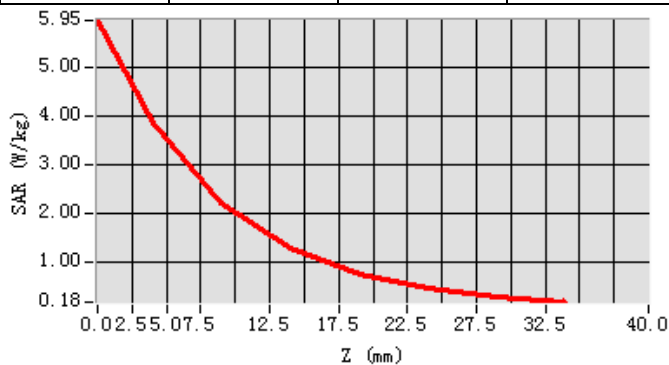
3D screen shot

Hot spot position



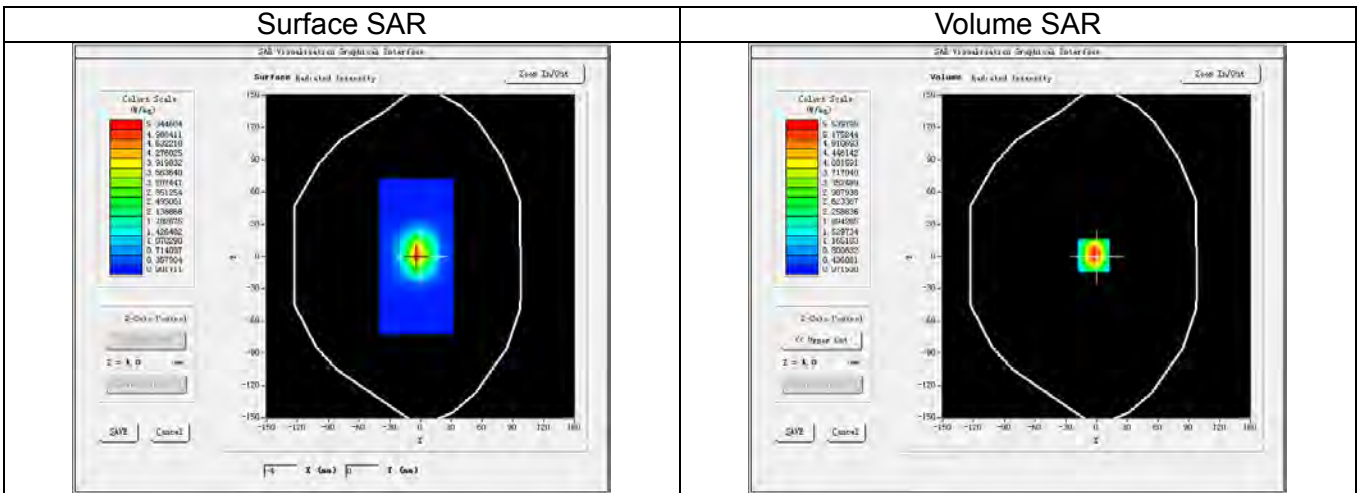
Maximum location: X=2.00, Y=5.00  
SAR Peak: 6.12 W/kg

SAR 1g (W/Kg)		3.787					
SAR 10g (W/Kg)		1.947					
Power Drift (±5%):		0.07					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	5.9512	3.8521	2.2003	1.2866	0.7649	0.4585	0.2746



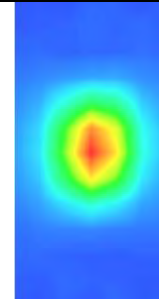
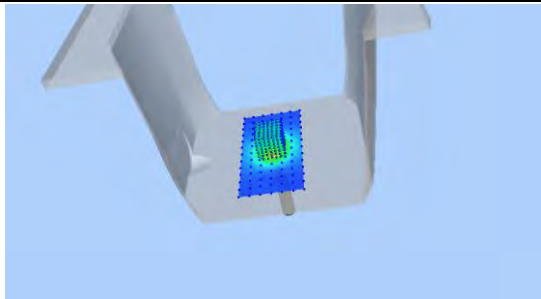
### System Performance Check - SID2450-Head

Date of measurement:	Oct. 27, 2017
Signal:	Communication System: CW; Frequency: 2450.00MHz; Duty Cycle: 1:1.00
ConvF:	2.18
Liquid Parameters:	Relative permittivity (real part): 39.49; Conductivity (S/m): 1.78;
Device Position:	Dipole
Area Scan:	dx=12mm dy=12mm, h=5.00mm
Zoom Scan:	7x7x7, dx=5mm dy=5mm dz=5mm, h=5.00mm



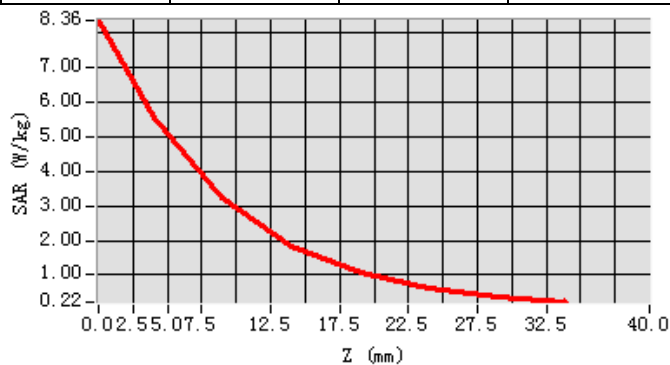
3D screen shot

Hot spot position



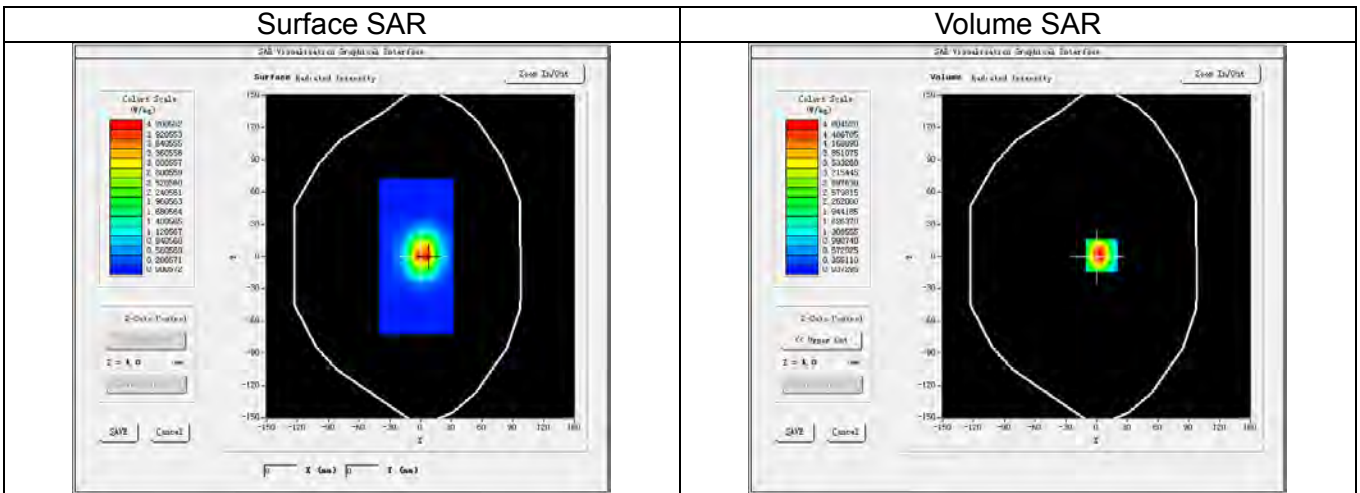
Maximum location: X=-3.00, Y=1.00  
SAR Peak: 8.42 W/kg

SAR 1g (W/Kg)		5.053					
SAR 10g (W/Kg)		2.561					
Power Drift (±5%):		1.19					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	8.3588	5.5398	3.2309	1.8344	1.0720	0.6228	0.3641



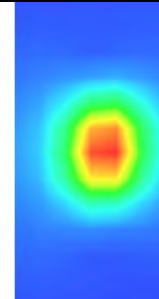
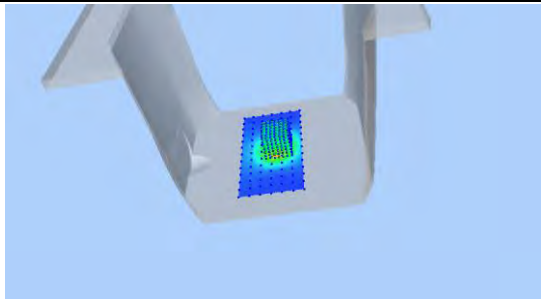
### System Performance Check - SID2450-Body

Date of measurement:	Oct. 30, 2017
Signal:	Communication System: CW; Frequency: 2450.00MHz; Duty Cycle: 1:1.00
ConvF:	2.27
Liquid Parameters:	Relative permittivity (real part): 52.73; Conductivity (S/m): 1.98;
Device Position:	Dipole
Area Scan:	dx=12mm dy=12mm, h=5.00mm
Zoom Scan:	7x7x7, dx=5mm dy=5mm dz=5mm, h=5.00mm



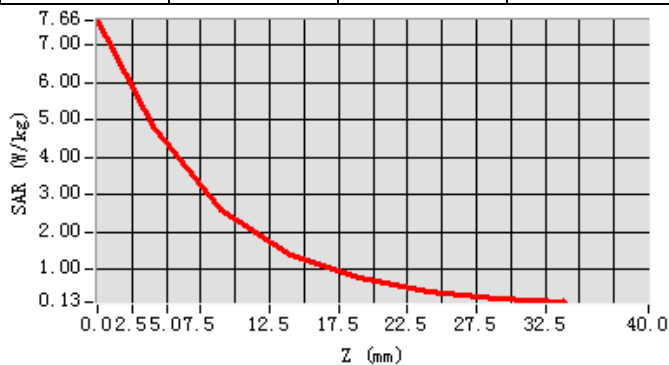
3D screen shot

Hot spot position



Maximum location: X=5.00, Y=1.00  
SAR Peak: 7.90 W/kg

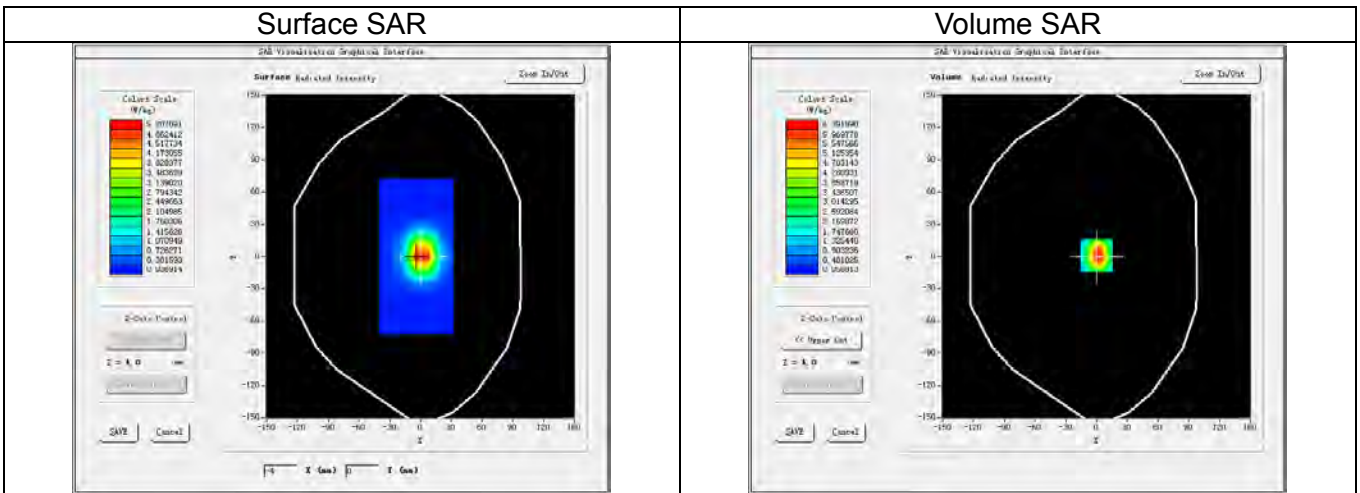
SAR 1g (W/Kg)		4.751					
SAR 10g (W/Kg)		2.201					
Power Drift (±5%):		-0.54					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	7.6640	4.8045	2.5910	1.4025	0.7740	0.4229	0.2343





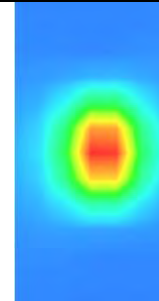
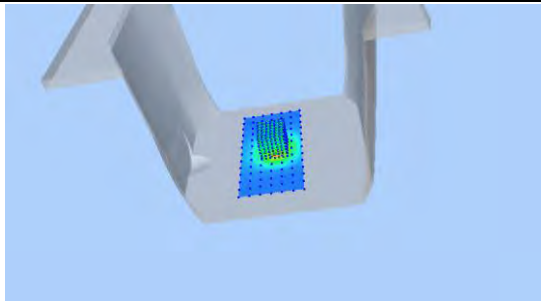
### System Performance Check - SID2600-Head

Date of measurement:	Oct. 30, 2017
Signal:	Communication System: CW; Frequency: 2600.00MHz; Duty Cycle: 1:1.00
ConvF:	2.15
Liquid Parameters:	Relative permittivity (real part): 39.18; Conductivity (S/m): 1.97;
Device Position:	Dipole
Area Scan:	dx=12mm dy=12mm, h=5.00mm
Zoom Scan:	7x7x7, dx=5mm dy=5mm dz=5mm, h=5.00mm



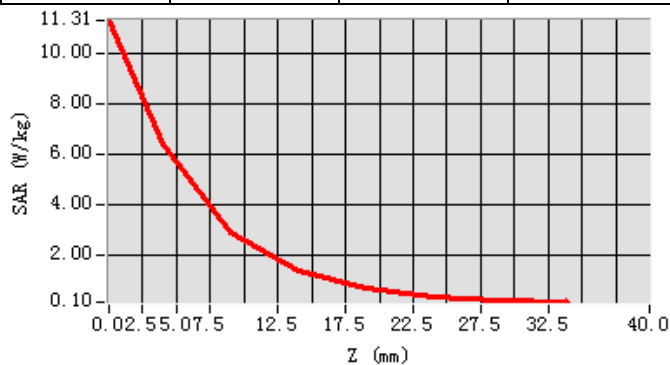
3D screen shot

Hot spot position



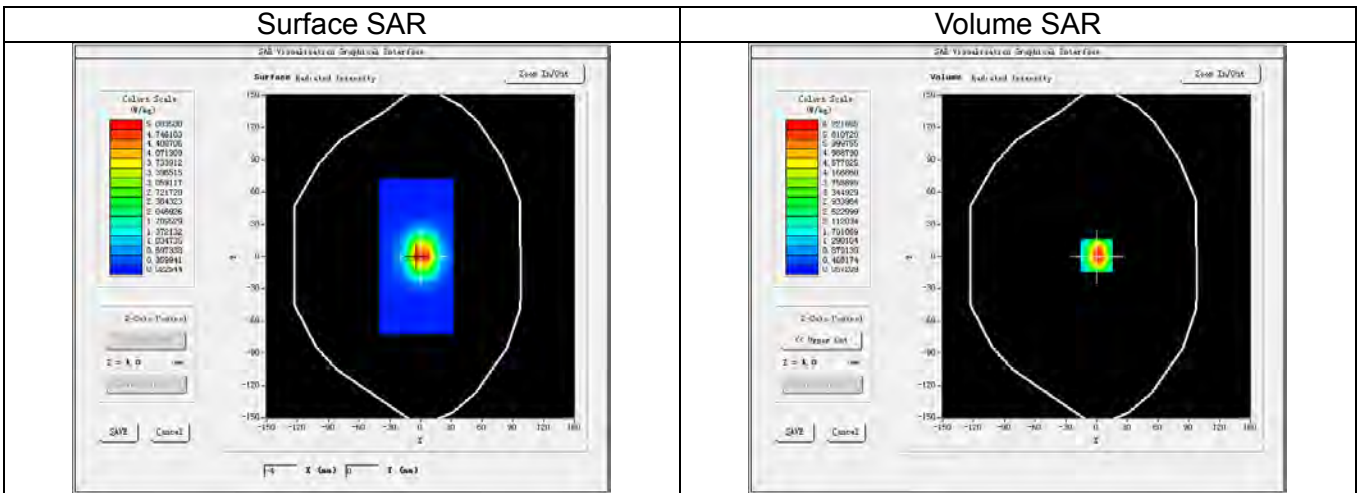
Maximum location: X=0.00, Y=1.00  
SAR Peak: 11.35 W/kg

SAR 1g (W/Kg)		5.763					
SAR 10g (W/Kg)		2.523					
Power Drift (±5%):		-0.06					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	11.3051	6.3920	2.8988	1.3466	0.6483	0.3210	0.1700



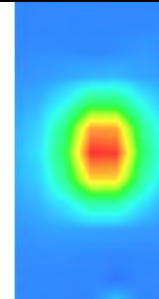
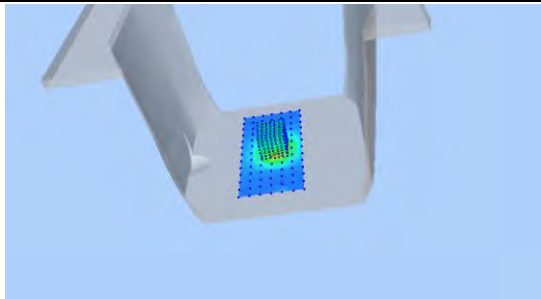
### System Performance Check - SID2600-Body

Date of measurement:	Oct. 31, 2017
Signal:	Communication System: CW; Frequency: 2600.00MHz; Duty Cycle: 1:1.00
ConvF:	2.19
Liquid Parameters:	Relative permittivity (real part): 53.54; Conductivity (S/m): 2.17;
Device Position:	Dipole
Area Scan:	dx=12mm dy=12mm, h=5.00mm
Zoom Scan:	7x7x7, dx=5mm dy=5mm dz=5mm, h=5.00mm



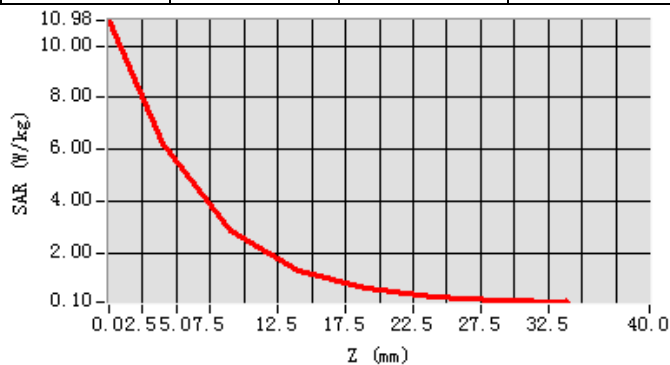
3D screen shot

Hot spot position



Maximum location: X=0.00, Y=1.00  
SAR Peak: 11.04 W/kg

SAR 1g (W/Kg)		5.513					
SAR 10g (W/Kg)		2.459					
Power Drift (±5%):		-0.18					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	10.9805	6.2217	2.8310	1.3148	0.6321	0.3138	0.1661

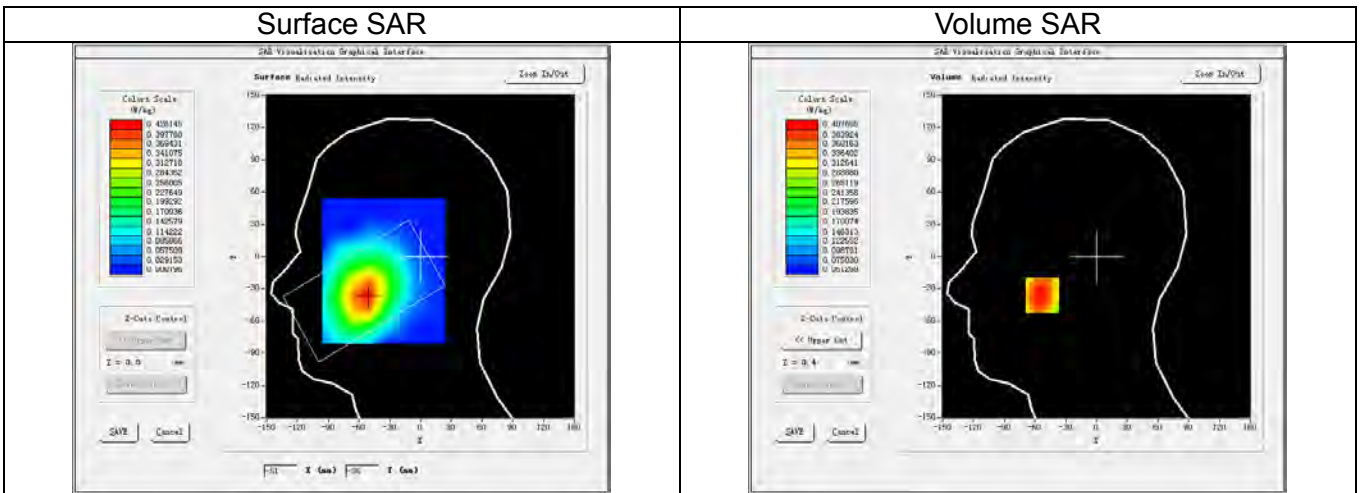


### 13. Appendix C. Plots of High SAR Measurement

Table of contents
GSM 850 Head
GSM 850 Body
GSM 1900 Head
GSM 1900 Body
WCDMA Band V Head
WCDMA Band V Body
WCDMA Band II Head
WCDMA Band II Body
LTE Band V Head
LTE Band V Body
LTE Band IV Head
LTE Band IV Body
LTE Band II Head
LTE Band II Body
LTE Band VII Head
LTE Band VII Body
WLAN 2.4G Head
WLAN 2.4G Body

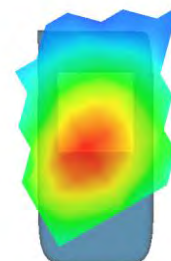
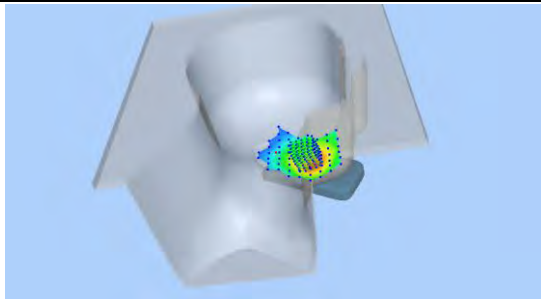
**GSM850\_GPRS(GMSK 4TS)\_Ch128\_Left Cheek**

Date of measurement:	Oct. 20, 2017
Signal:	Communication System: GPRS(GMSK 4TS); Frequency: 824.20MHz; Duty Cycle: 1:2.08
ConvF:	1.48
Liquid Parameters:	Relative permittivity (real part): 43.03; Conductivity (S/m): 0.88;
Device Position:	Cheek
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



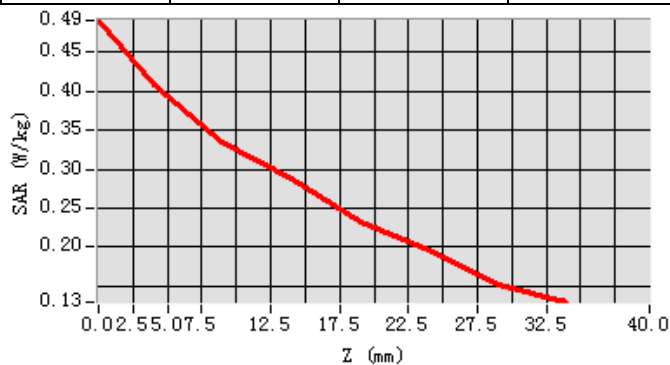
3D screen shot

Hot spot position



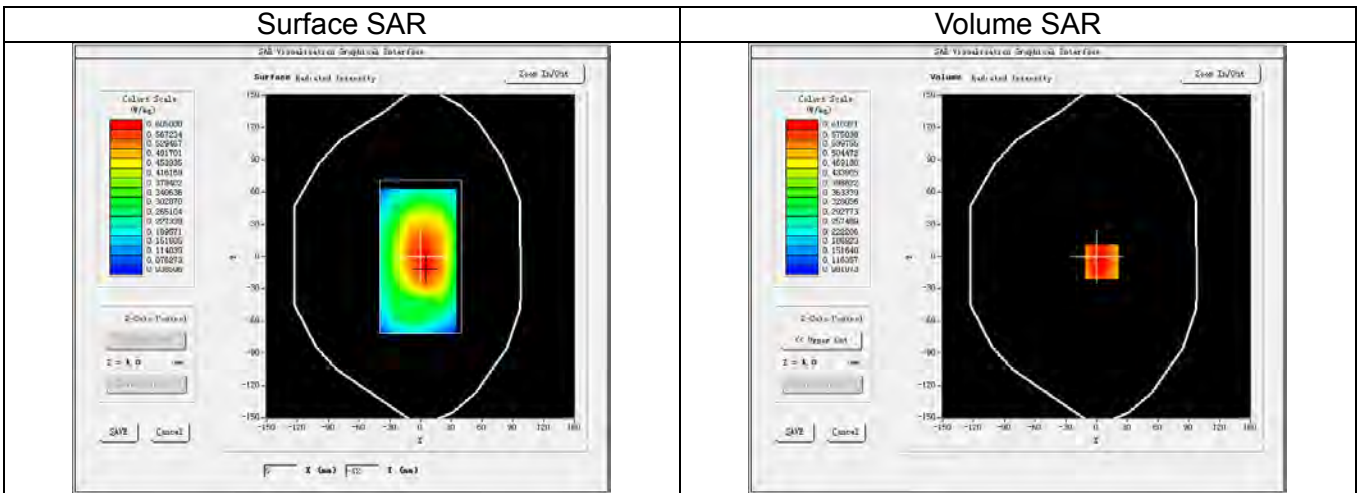
Maximum location: X=-53.00, Y=-36.00  
SAR Peak: 0.58 W/kg

SAR 1g (W/Kg)		0.400					
SAR 10g (W/Kg)		0.300					
Power Drift (±5%):		-0.10					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.4907	0.4077	0.3356	0.2872	0.2331	0.1973	0.1515



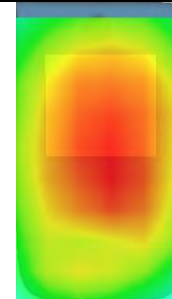
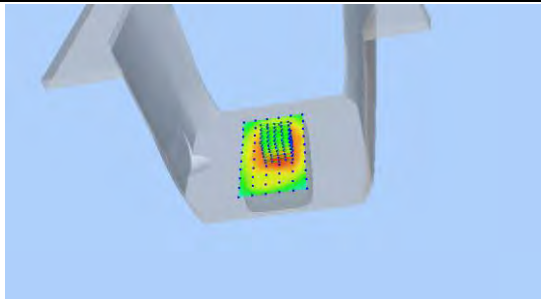
**GSM850\_GPRS(GMSK 4TS)\_Ch128\_Back Side\_10mm**

Date of measurement:	Oct. 21, 2017
Signal:	Communication System: GPRS(GMSK 4TS); Frequency: 824.20MHz; Duty Cycle: 1:2.08
ConvF:	1.53
Liquid Parameters:	Relative permittivity (real part): 55.20; Conductivity (S/m): 0.97;
Device Position:	Body
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



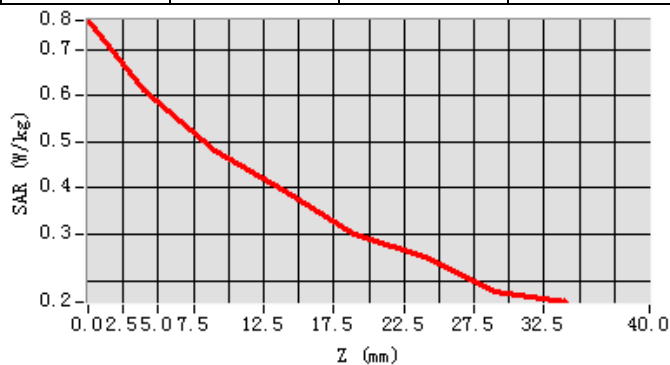
3D screen shot

Hot spot position



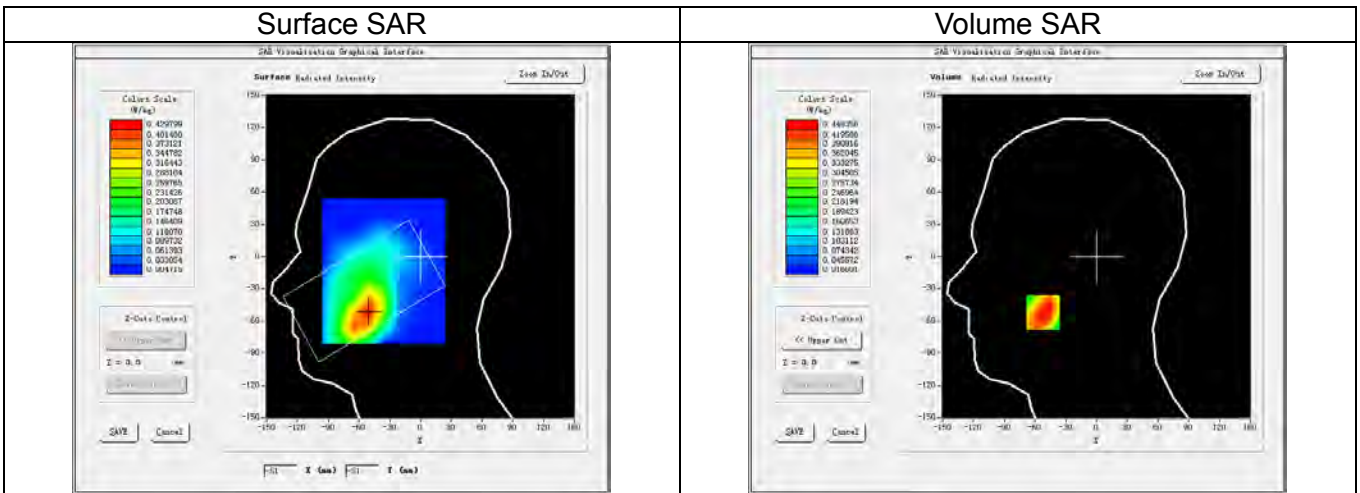
Maximum location: X=5.00, Y=-5.00  
SAR Peak: 0.75 W/kg

SAR 1g (W/Kg)		0.593					
SAR 10g (W/Kg)		0.454					
Power Drift (±5%):		0.49					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.7620	0.6103	0.4818	0.3945	0.3009	0.2528	0.1749



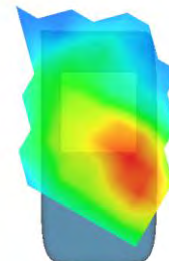
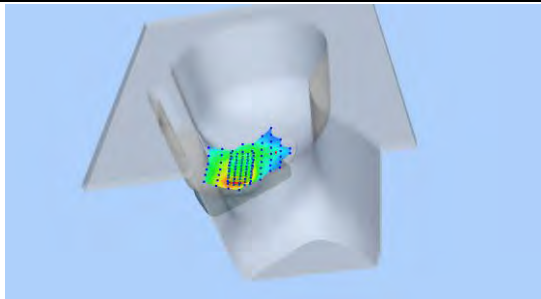
**GSM1900\_GPRS(GMSK 4TS)\_Ch512\_Right Cheek**

Date of measurement:	Oct. 23, 2017
Signal:	Communication System: GPRS(GMSK 4TS); Frequency: 1850.20MHz; Duty Cycle: 1:2.08
ConvF:	2.00
Liquid Parameters:	Relative permittivity (real part): 39.54; Conductivity (S/m): 1.41;
Device Position:	Cheek
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



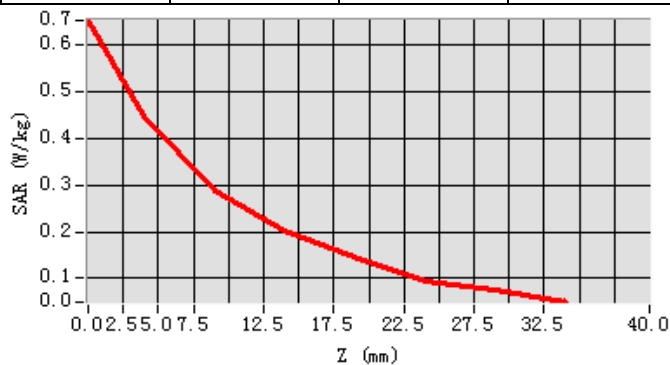
3D screen shot

Hot spot position



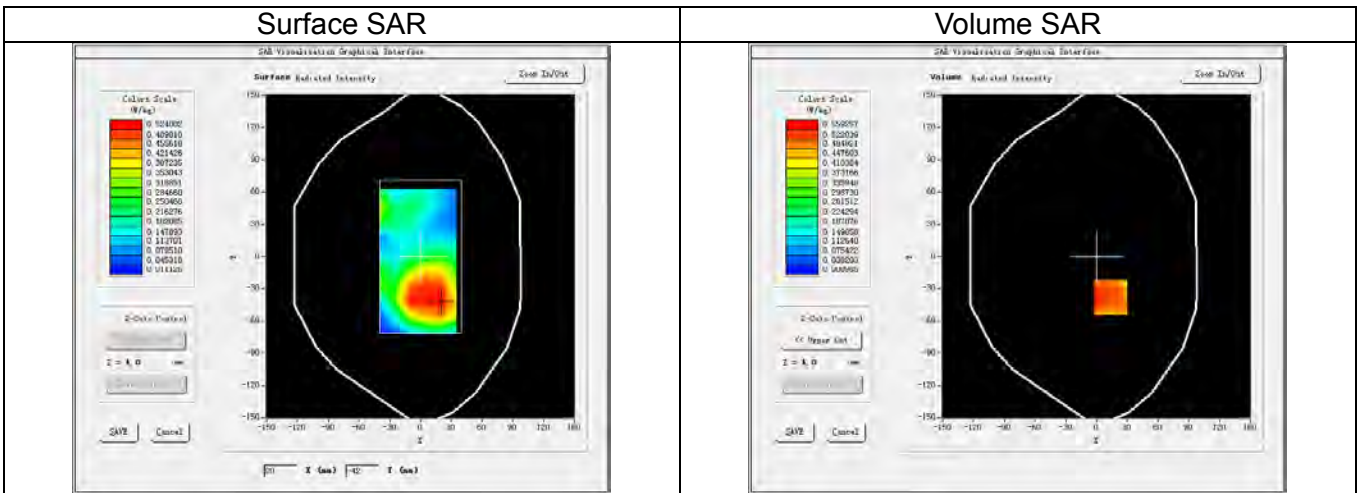
Maximum location: X=-52.00, Y=-52.00  
SAR Peak: 0.70 W/kg

SAR 1g (W/Kg)		0.448					
SAR 10g (W/Kg)		0.272					
Power Drift (±5%):		-1.09					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.6539	0.4484	0.2871	0.2016	0.1474	0.0955	0.0736



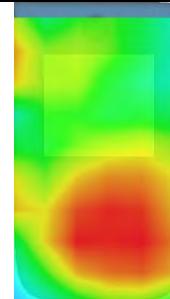
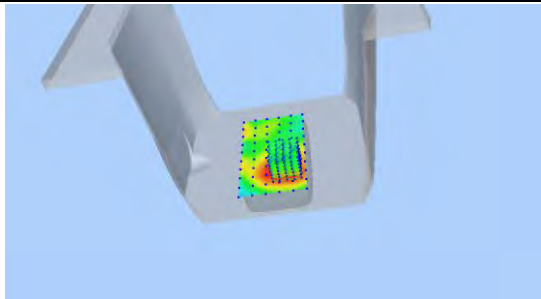
**GSM1900\_GPRS(GMSK 4TS)\_Ch512\_Front Side\_10mm**

Date of measurement:	Oct. 24, 2017
Signal:	Communication System: GPRS(GMSK 4TS); Frequency: 1850.20MHz; Duty Cycle: 1:2.08
ConvF:	2.07
Liquid Parameters:	Relative permittivity (real part): 53.68; Conductivity (S/m): 1.54;
Device Position:	Body
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



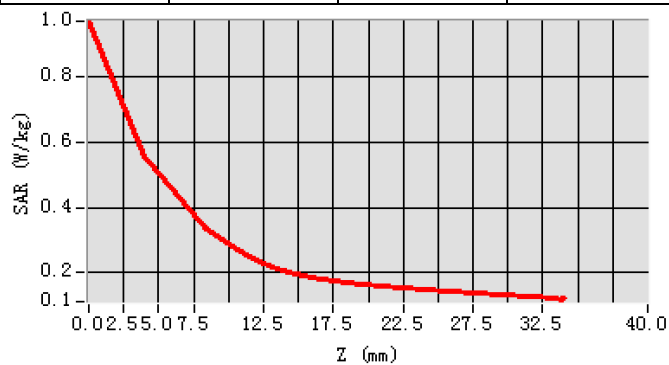
3D screen shot

Hot spot position



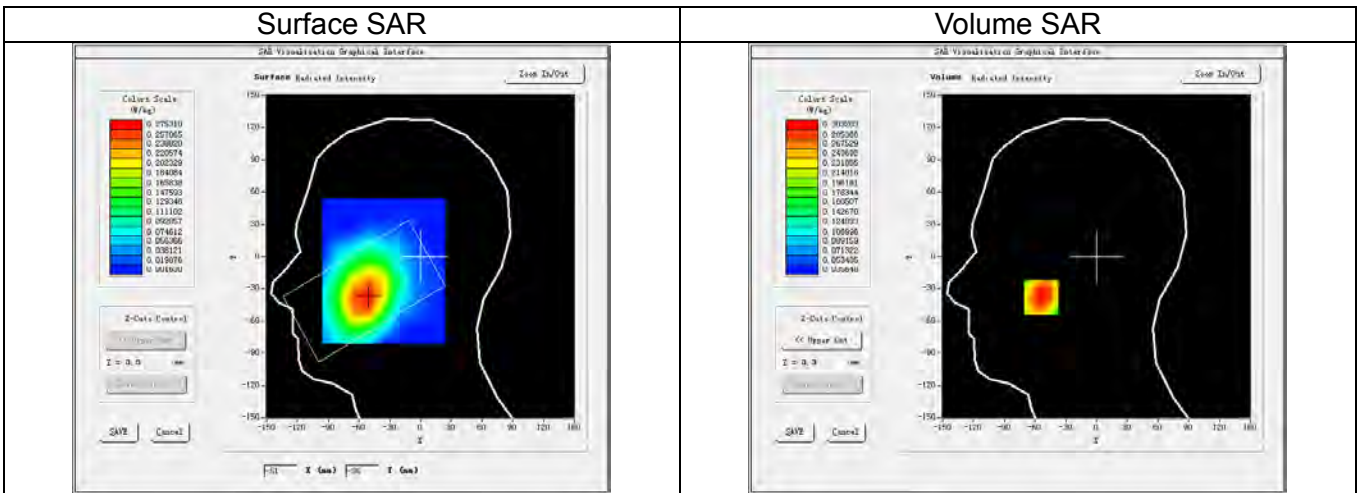
Maximum location: X=14.00, Y=-38.00  
SAR Peak: 0.95 W/kg

SAR 1g (W/Kg)		0.576					
SAR 10g (W/Kg)		0.359					
Power Drift (±5%):		-1.44					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.9711	0.5593	0.3035	0.2084	0.1609	0.1402	0.1118



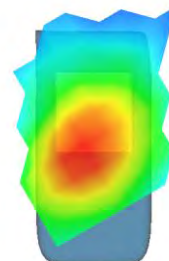
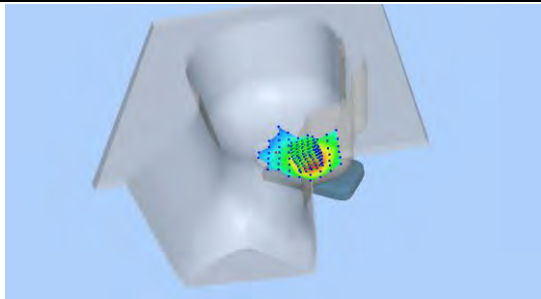
**WCDMA Band V\_RMC 12.2Kbps\_Ch4182\_Left Cheek**

Date of measurement:	Oct. 20, 2017
Signal:	Communication System: WCDMA-FDD(WCDMA); Frequency: 836.4MHz; Duty Cycle: 1:1.00
ConvF:	1.48
Liquid Parameters:	Relative permittivity (real part): 42.88 Conductivity (S/m): 0.89
Device Position:	Cheek
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



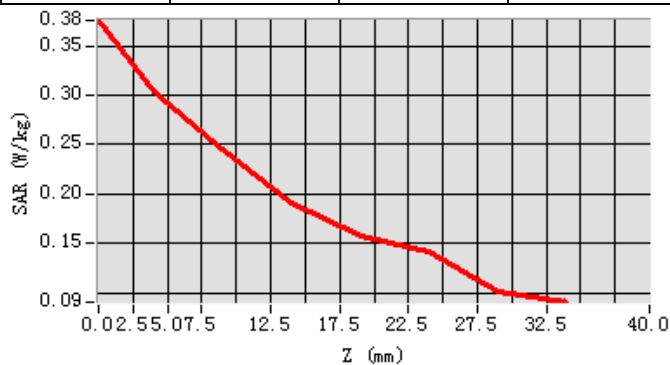
3D screen shot

Hot spot position



Maximum location: X=-54.00, Y=-38.00  
SAR Peak: 0.41 W/kg

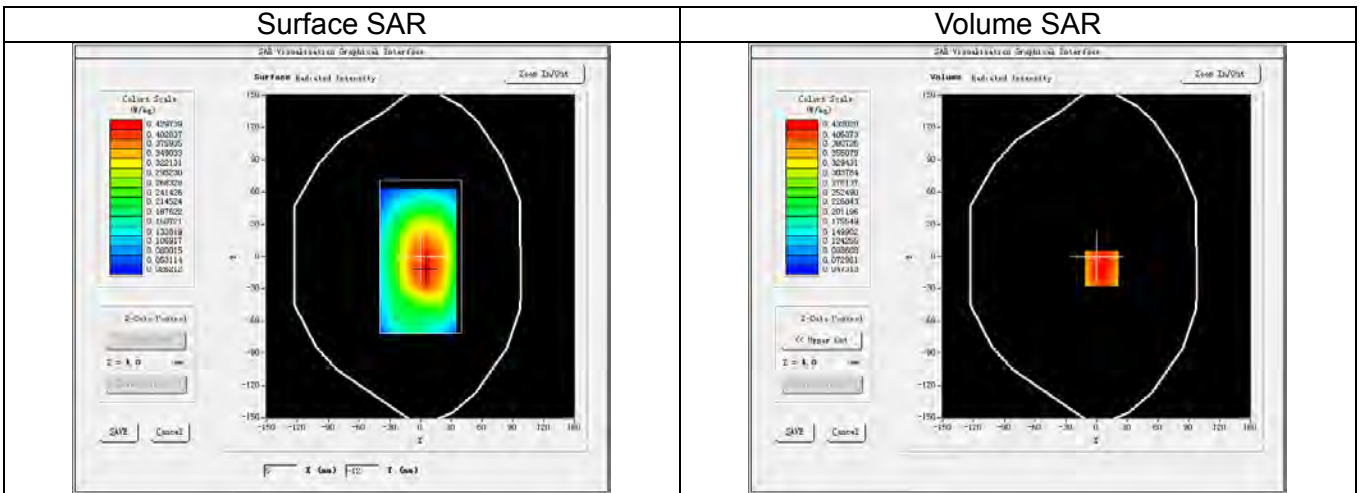
SAR 1g (W/Kg)		0.303					
SAR 10g (W/Kg)		0.218					
Power Drift (±5%):		2.54					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.3758	0.3032	0.2454	0.1899	0.1576	0.1415	0.1014





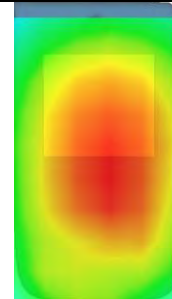
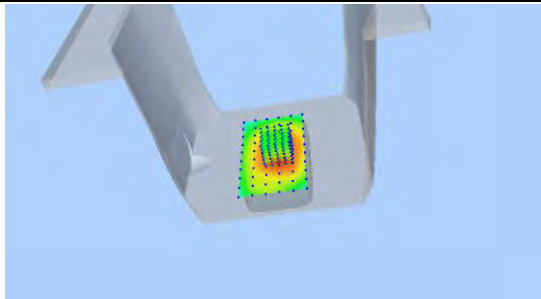
**WCDMA Band V\_RMC 12.2Kbps\_Ch4182\_Back Side\_10mm**

Date of measurement:	Oct. 21, 2017
Signal:	Communication System: WCDMA-FDD(WCDMA); Frequency: 836.40MHz; Duty Cycle: 1:1.00
ConvF:	1.53
Liquid Parameters:	Relative permittivity (real part): 55.12; Conductivity (S/m): 0.99;
Device Position:	Body
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



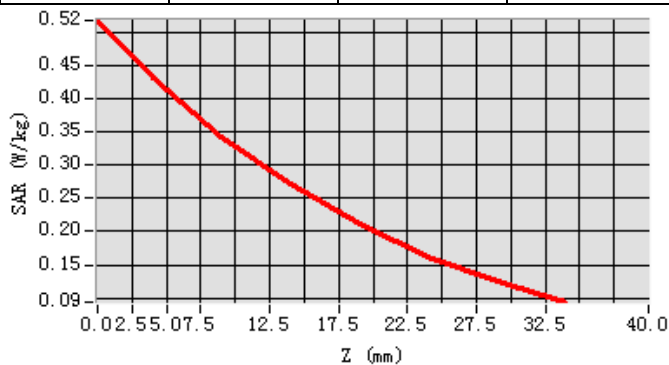
3D screen shot

Hot spot position



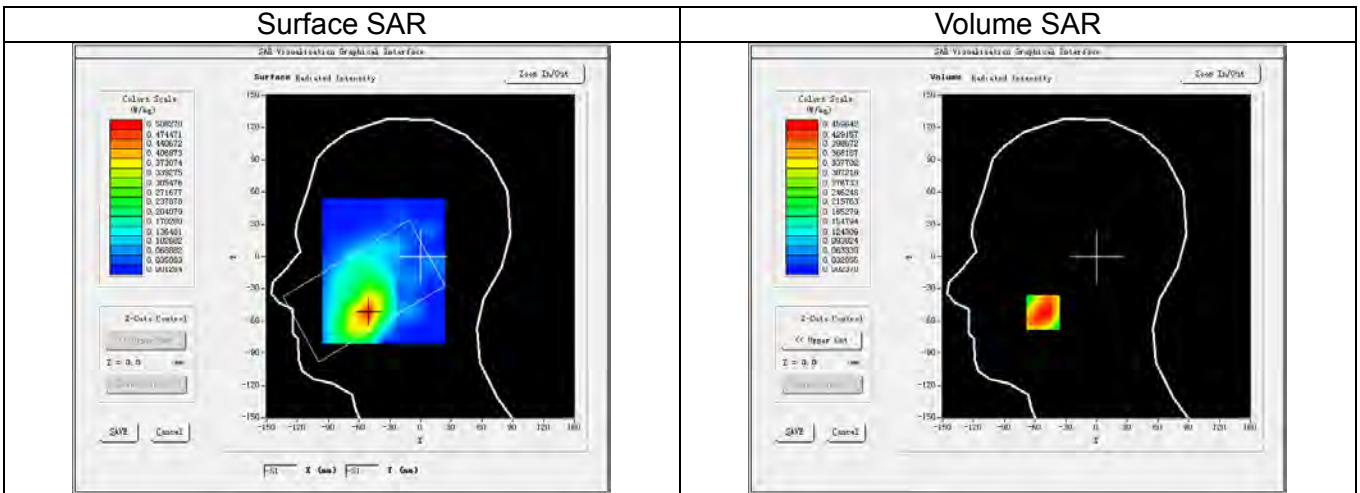
Maximum location: X=5.00, Y=-11.00  
SAR Peak: 0.52 W/kg

SAR 1g (W/Kg)		0.424					
SAR 10g (W/Kg)		0.318					
Power Drift (±5%):		-1.26					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.5180	0.4320	0.3416	0.2723	0.2106	0.1613	0.1242



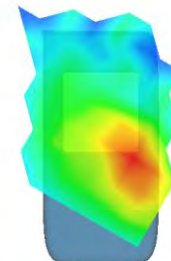
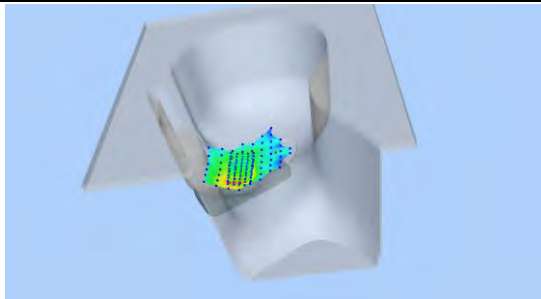
**WCDMA Band II\_RMC 12.2Kbps\_Ch9400\_Right Cheek**

Date of measurement:	Oct. 23, 2017
Signal:	Communication System: WCDMA-FDD(WCDMA); Frequency: 1880.00MHz; Duty Cycle: 1:1.00
ConvF:	2.00
Liquid Parameters:	Relative permittivity (real part): 39.37; Conductivity (S/m): 1.43;
Device Position:	Cheek
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



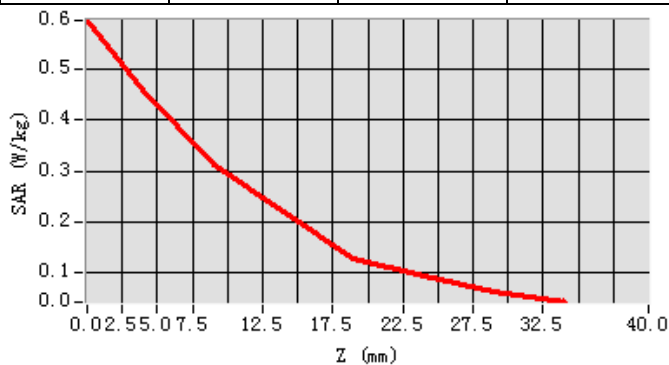
3D screen shot

Hot spot position



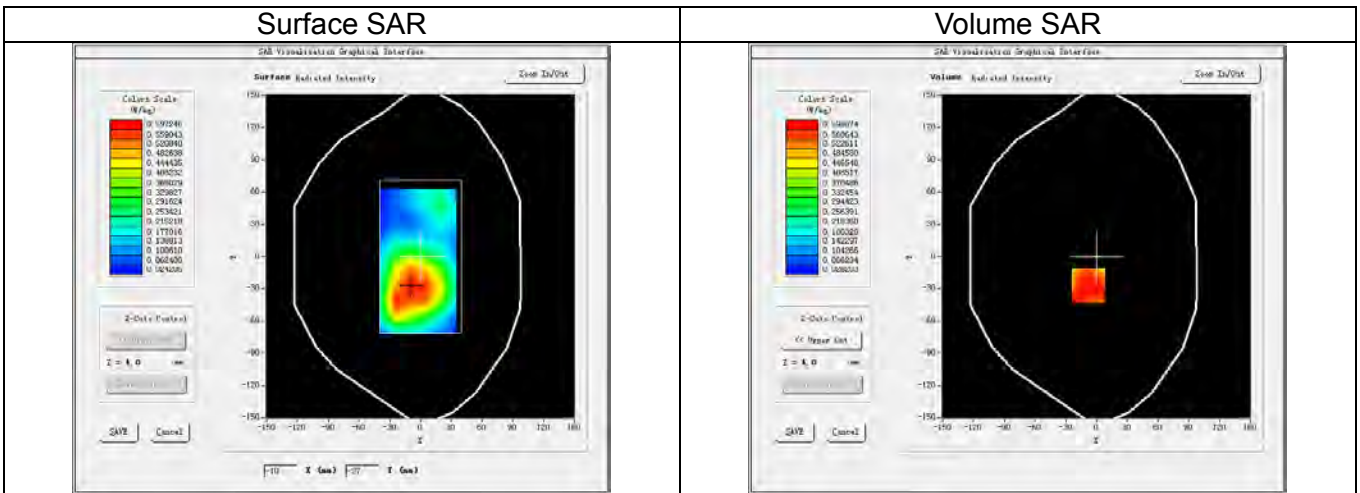
Maximum location: X=-52.00, Y=-52.00  
SAR Peak: 0.68 W/kg

SAR 1g (W/Kg)		0.450					
SAR 10g (W/Kg)		0.270					
Power Drift (±5%):		-2.66					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.5966	0.4596	0.3132	0.2193	0.1282	0.0944	0.0611



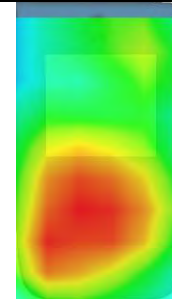
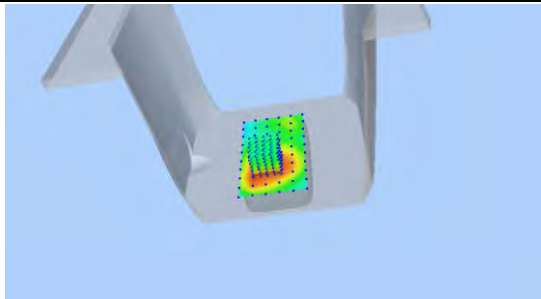
**WCDMA Band II\_RMC 12.2Kbps\_Ch9400\_Back Side\_10mm**

Date of measurement:	Oct. 24, 2017
Signal:	Communication System: WCDMA-FDD(WCDMA); Frequency: 1880.00MHz; Duty Cycle: 1:1.00
ConvF:	2.07
Liquid Parameters:	Relative permittivity (real part): 53.56 Conductivity (S/m): 1.56;
Device Position:	Body
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



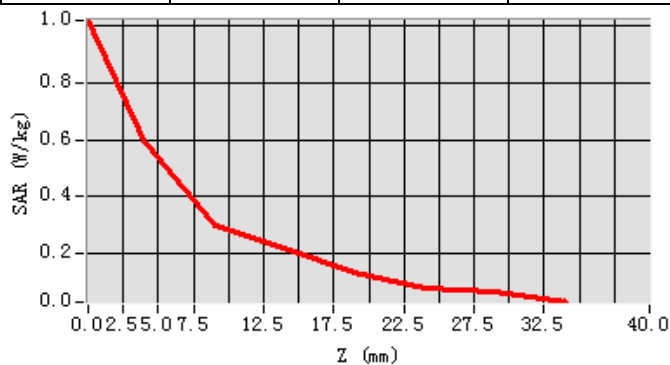
3D screen shot

Hot spot position



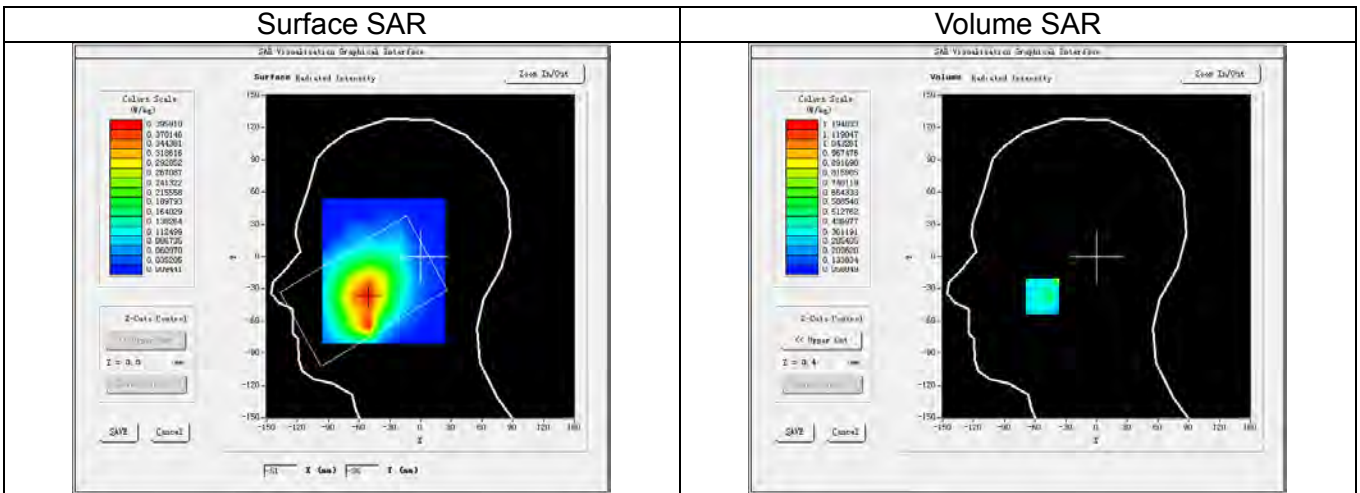
Maximum location: X=-8.00, Y=-27.00  
SAR Peak: 0.89 W/kg

SAR 1g (W/Kg)		0.587					
SAR 10g (W/Kg)		0.375					
Power Drift (±5%):		-0.27					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.0194	0.5987	0.2961	0.2201	0.1316	0.0777	0.0651



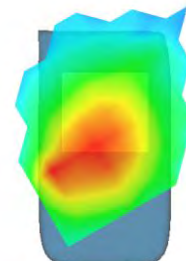
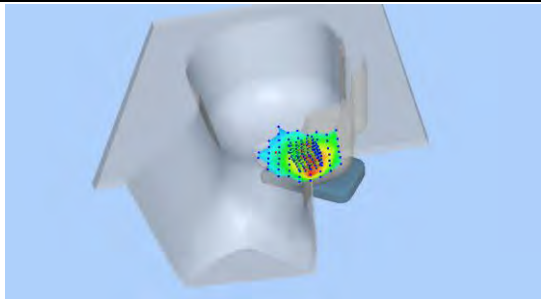
**LTE Band V\_10M\_QPSK(1,0)\_Ch20525\_Left Cheek**

Date of measurement:	Oct. 20, 2017
Signal:	Communication System: LTE-FDD(SC-FDMA QPSK/16-QAM); Frequency: 836.50MHz; Duty Cycle: 1:1.00
ConvF:	1.48
Liquid Parameters:	Relative permittivity (real part): 42.89; Conductivity (S/m): 0.89;
Device Position:	Cheek
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



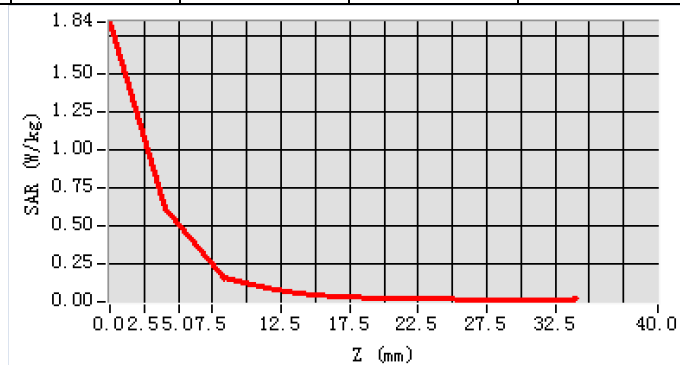
3D screen shot

Hot spot position



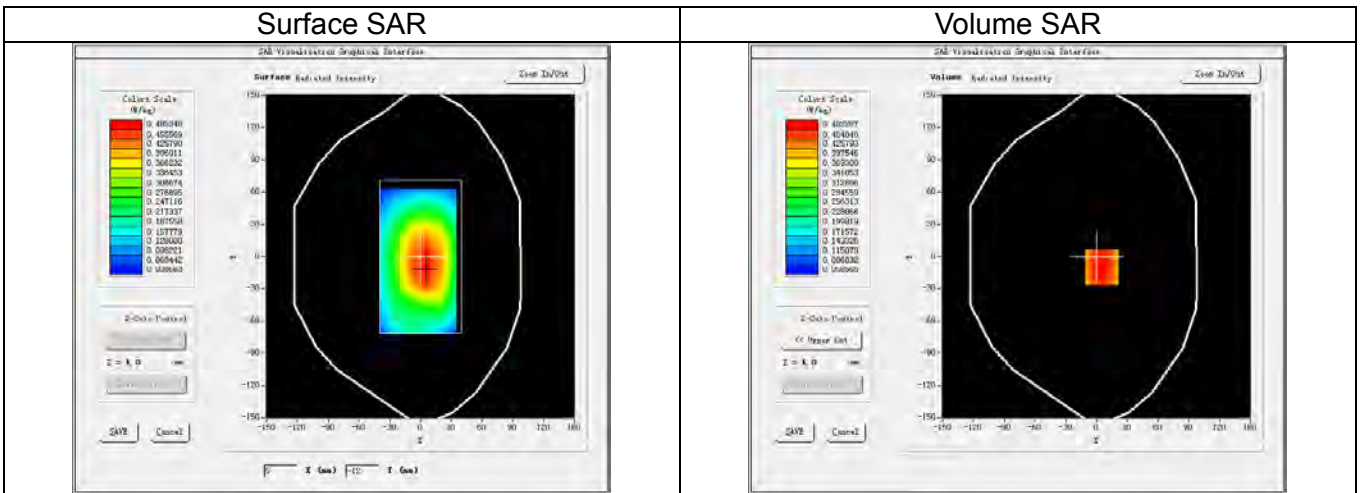
Maximum location: X=-53.00, Y=-37.00  
SAR Peak: 1.84 W/kg

SAR 1g (W/Kg)		0.471					
SAR 10g (W/Kg)		0.449					
Power Drift (±5%):		-2.40					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.8402	0.6161	0.1526	0.1389	0.1258	0.1024	0.0039



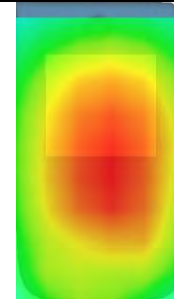
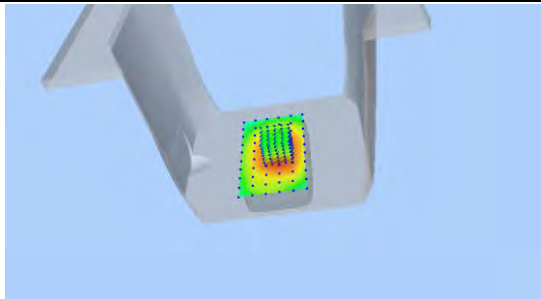
**LTE Band V\_10M\_QPSK(1,0)\_Ch20525\_Back Side\_10mm**

Date of measurement:	Oct. 21, 2017
Signal:	Communication System: LTE-FDD(SC-FDMA QPSK/16-QAM); Frequency: 836.50MHz; Duty Cycle: 1:1.00
ConvF:	1.53
Liquid Parameters:	Relative permittivity (real part): 55.12; Conductivity (S/m):0.99;
Device Position:	Body
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



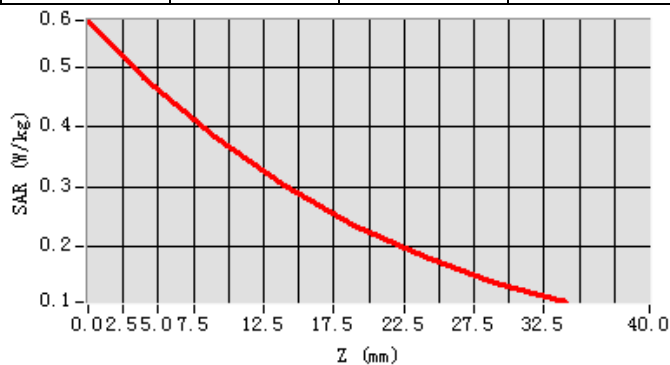
3D screen shot

Hot spot position



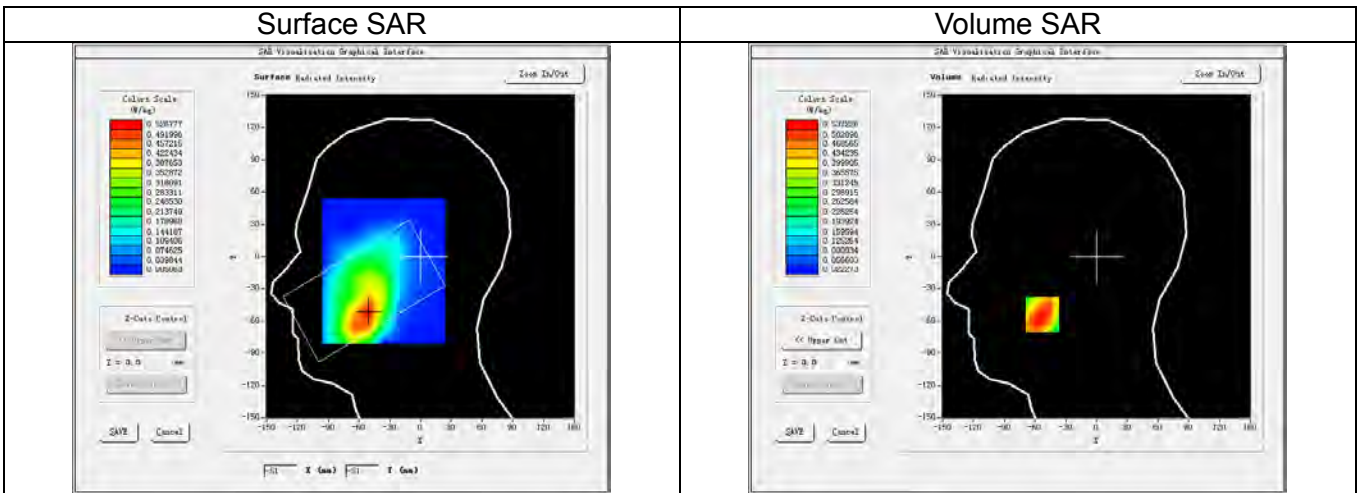
Maximum location: X=5.00, Y=-10.00  
SAR Peak: 0.58 W/kg

SAR 1g (W/Kg)		0.474					
SAR 10g (W/Kg)		0.356					
Power Drift (±5%):		-1.83					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.5776	0.4823	0.3828	0.3013	0.2348	0.1818	0.1388



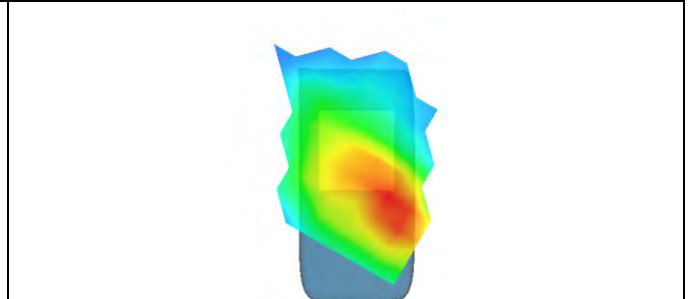
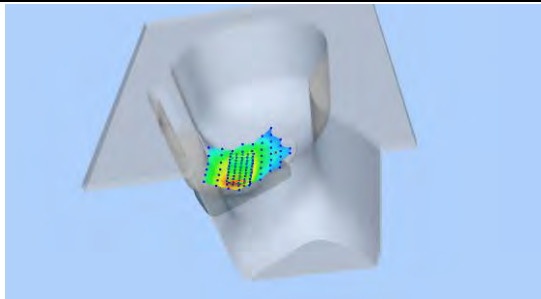
**LTE Band IV\_20M\_QPSK(1,0)\_Ch20050\_Right Cheek**

Date of measurement:	Oct. 25, 2017
Signal:	Communication System: LTE-FDD(SC-FDMA QPSK/16-QAM); Frequency: 1720.00MHz; Duty Cycle: 1:1.00
ConvF:	1.75
Liquid Parameters:	Relative permittivity (real part): 40.23; Conductivity (S/m): 1.33;
Device Position:	Cheek
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



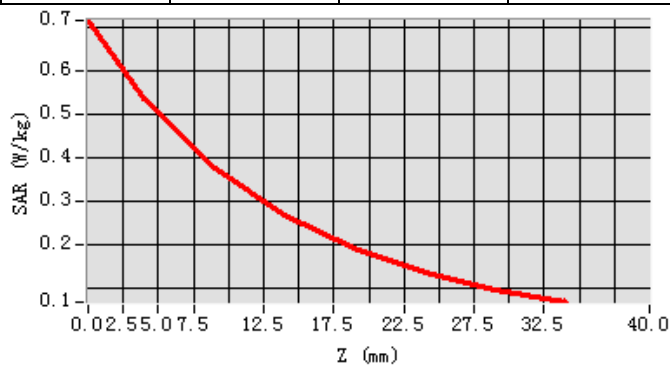
3D screen shot

Hot spot position



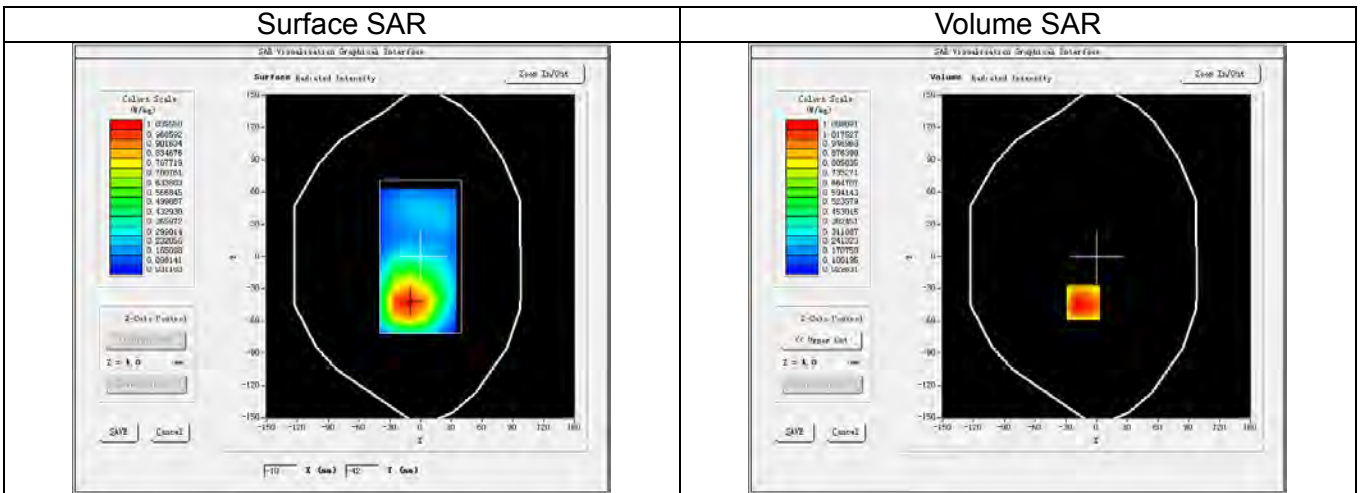
Maximum location: X=-53.00, Y=-54.00  
SAR Peak: 0.73 W/kg

SAR 1g (W/Kg)		0.492					
SAR 10g (W/Kg)		0.339					
Power Drift (±5%):		1.16					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.7163	0.5372	0.3762	0.2665	0.1902	0.1336	0.0953



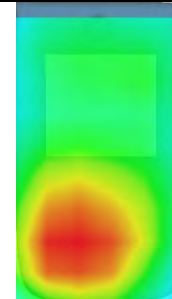
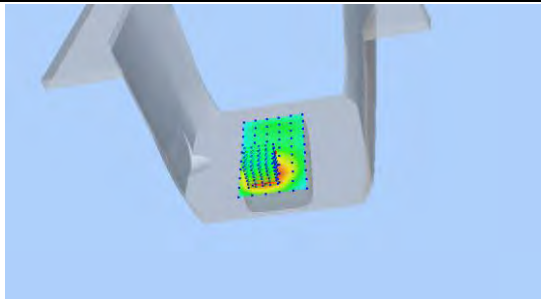
**LTE Band IV\_20M\_QPSK(1,0)\_Ch20300\_Back Side\_10mm**

Date of measurement:	Oct. 27, 2017
Signal:	Communication System: LTE-FDD(SC-FDMA QPSK/16-QAM); Frequency: 1745.00MHz; Duty Cycle: 1:1.00
ConvF:	1.79
Liquid Parameters:	Relative permittivity (real part): 54.21; Conductivity (S/m): 1.48;
Device Position:	Body
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



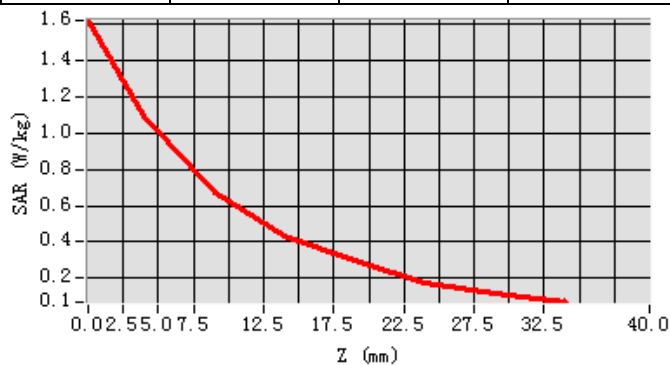
3D screen shot

Hot spot position



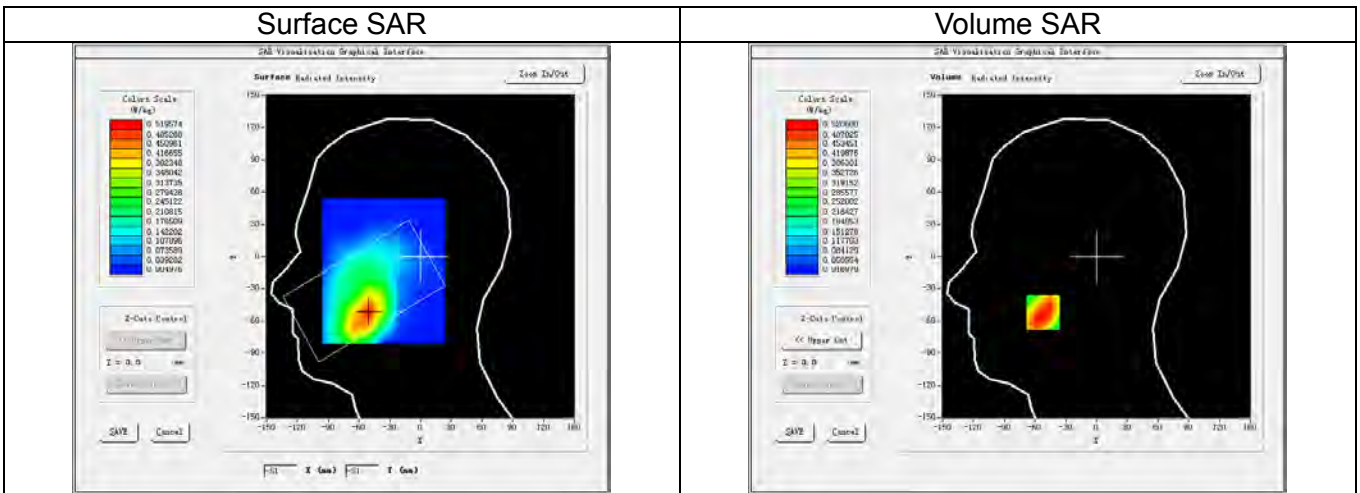
Maximum location: X=-13.00, Y=-43.00  
SAR Peak: 1.68 W/kg

SAR 1g (W/Kg)		0.985					
SAR 10g (W/Kg)		0.655					
Power Drift (±5%):		1.00					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.6185	1.0881	0.6714	0.4319	0.2974	0.1788	0.1205



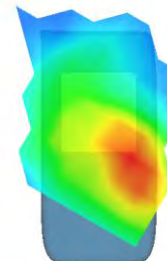
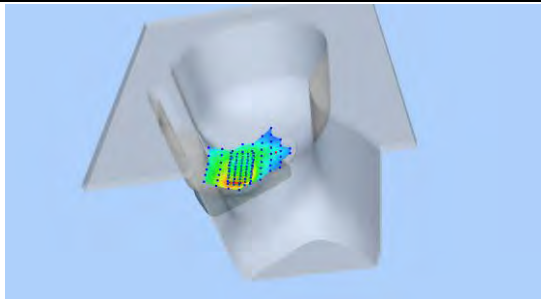
**LTE Band II\_20M\_QPSK(1,0)\_Ch19100\_Right Cheek**

Date of measurement:	Oct. 23, 2017
Signal:	Communication System: LTE-FDD(SC-FDMA QPSK/16-QAM); Frequency: 1900.00MHz; Duty Cycle: 1:1.00
ConvF:	2.00
Liquid Parameters:	Relative permittivity (real part): 39.29; Conductivity (S/m): 1.44;
Device Position:	Cheek
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



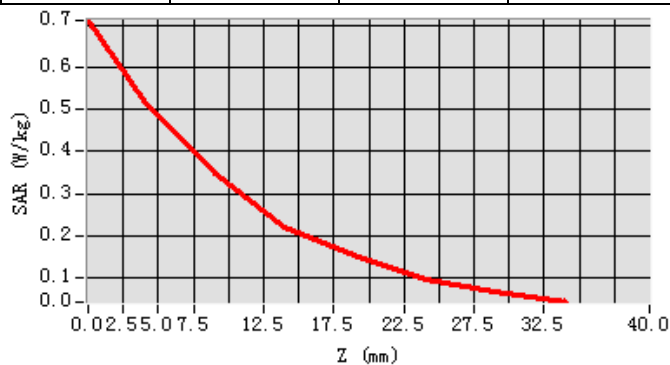
3D screen shot

Hot spot position



Maximum location: X=-52.00, Y=-52.00  
SAR Peak: 0.78 W/kg

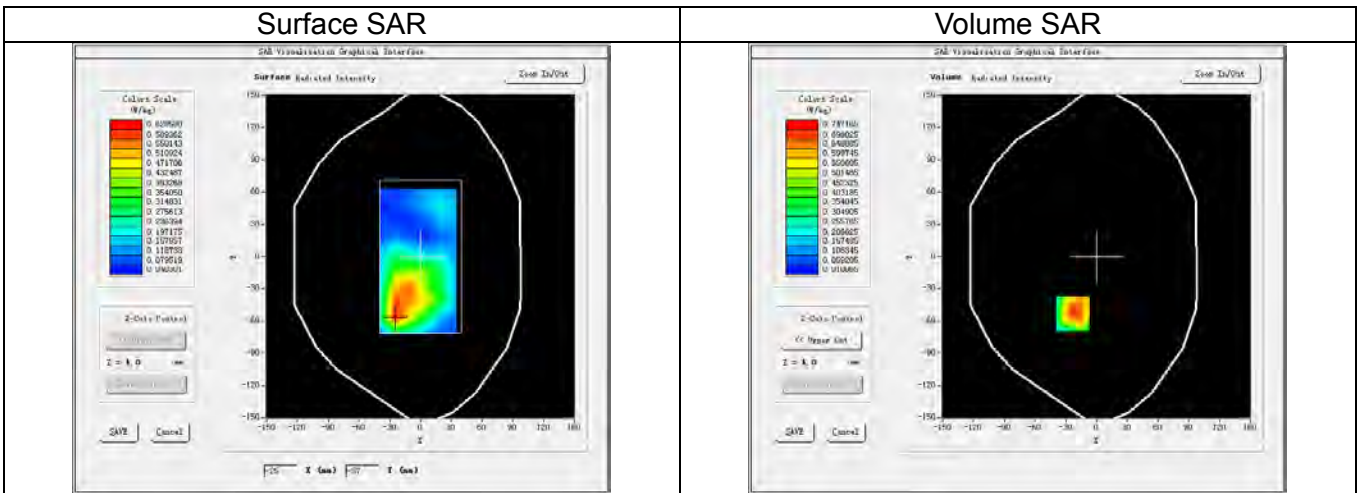
SAR 1g (W/Kg)		0.479					
SAR 10g (W/Kg)		0.310					
Power Drift (±5%):		0.43					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.7112	0.5206	0.3486	0.2217	0.1531	0.0963	0.0673





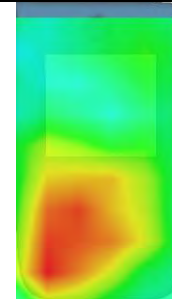
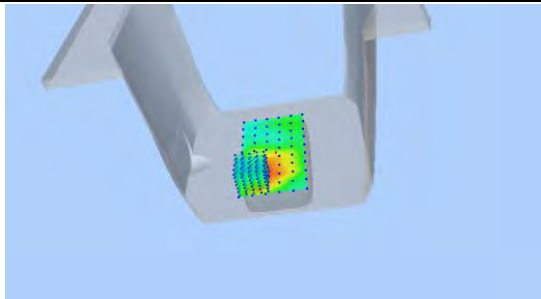
**LTE Band II\_20M\_QPSK(1,0)\_Ch19100\_Back Side\_10mm**

Date of measurement:	Oct. 24, 2017
Signal:	Communication System: LTE-FDD(SC-FDMA QPSK/16-QAM); Frequency:1900.00MHz; Duty Cycle: 1:1.00
ConvF:	2.07
Liquid Parameters:	Relative permittivity (real part): 53.49; Conductivity (S/m): 1.56;
Device Position:	Body
Area Scan:	dx=15mm dy=15mm, h=5.00mm
Zoom Scan:	5x5x7, dx=8mm dy=8mm dz=5mm, h=5.00mm



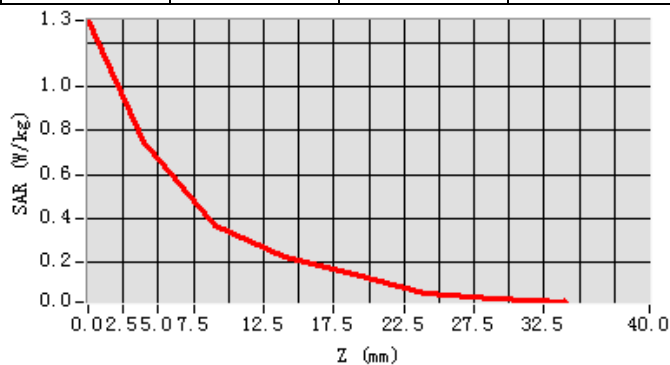
3D screen shot

Hot spot position



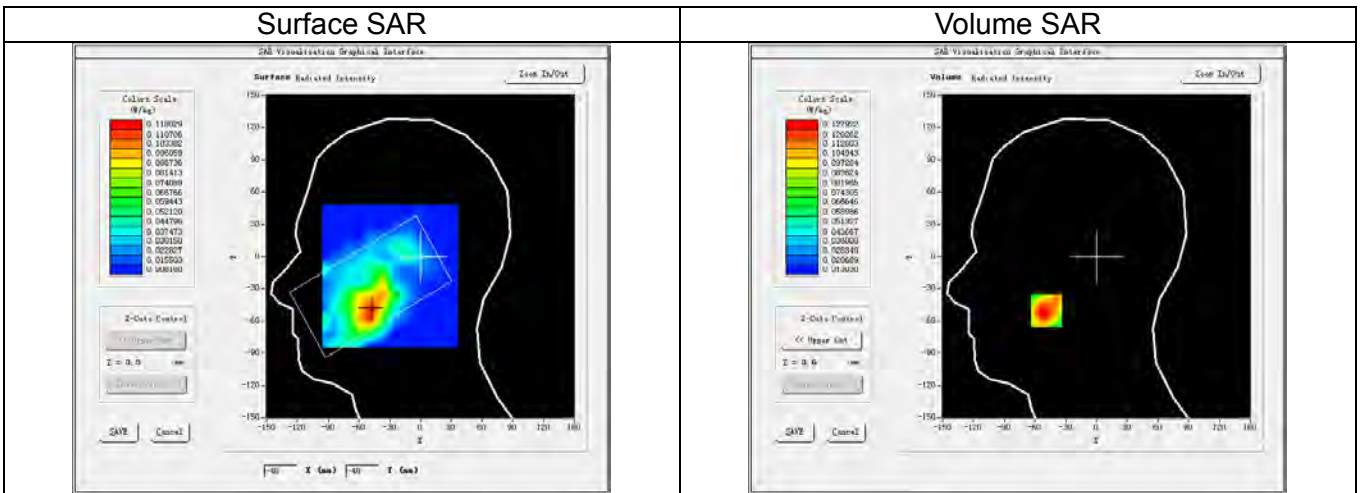
Maximum location: X=-23.00, Y=-53.00  
SAR Peak: 1.28 W/kg

SAR 1g (W/Kg)		0.636					
SAR 10g (W/Kg)		0.383					
Power Drift (±5%):		-3.67					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.3045	0.7472	0.3660	0.2235	0.1414	0.0529	0.0343



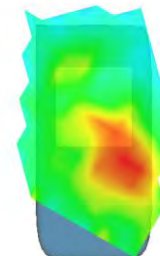
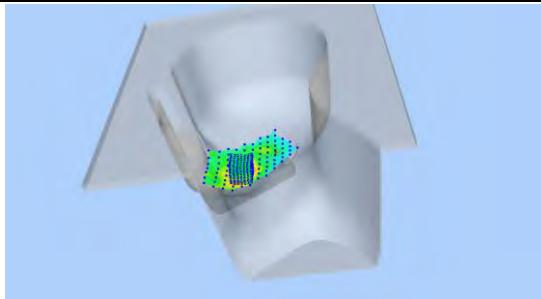
**LTE Band VII\_20M\_QPSK(1,0)\_Ch20850\_Right Cheek**

Date of measurement:	Oct. 30, 2017
Signal:	Communication System: LTE-FDD(SC-FDMA QPSK/16-QAM); Frequency: 2510.00MHz; Duty Cycle: 1:1.00
ConvF:	2.15
Liquid Parameters:	Relative permittivity (real part): 39.63; Conductivity (S/m): 1.88;
Device Position:	Cheek
Area Scan:	dx=12mm dy=12mm, h=5.00mm
Zoom Scan:	7x7x7, dx=5mm dy=5mm dz=5mm, h=5.00mm



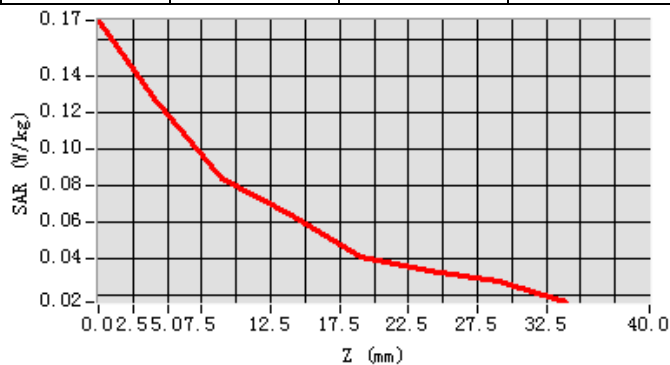
3D screen shot

Hot spot position



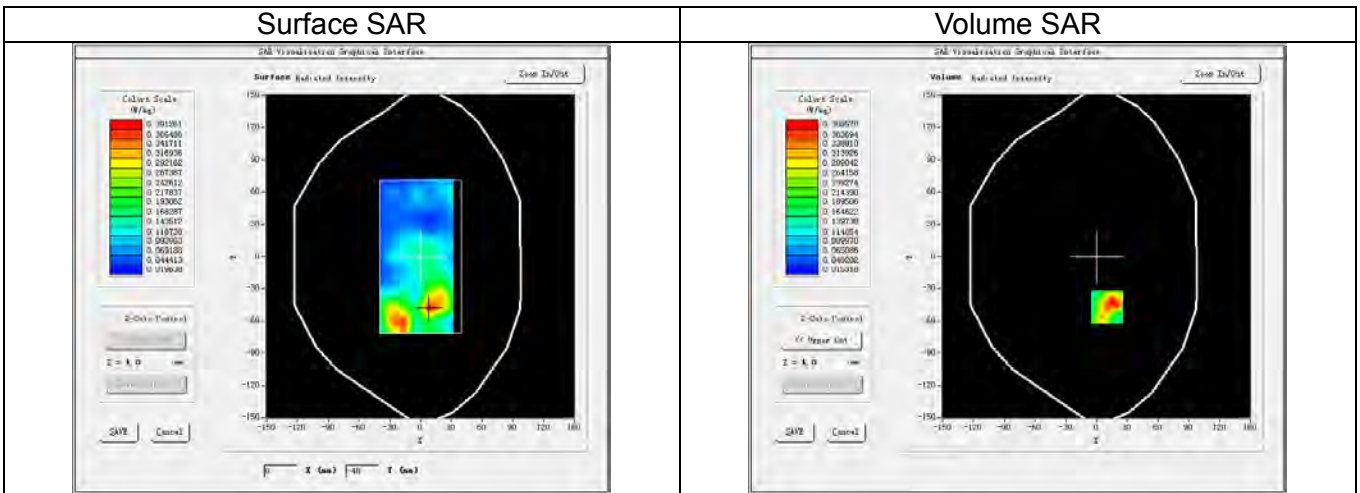
Maximum location: X=-49.00, Y=-50.00  
SAR Peak: 0.17 W/kg

SAR 1g (W/Kg)		0.120					
SAR 10g (W/Kg)		0.076					
Power Drift (±5%):		-4.56					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1708	0.1279	0.0838	0.0638	0.0404	0.0329	0.0278



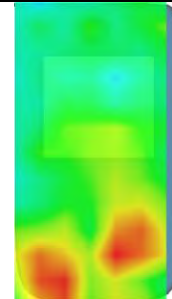
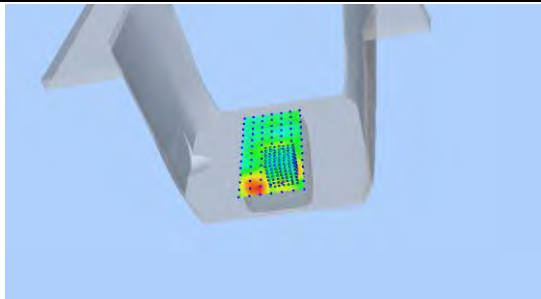
**LTE Band VII\_20M\_QPSK(1,0)\_Ch20850\_Back Side\_10mm**

Date of measurement:	Oct. 31, 2017
Signal:	Communication System: LTE-FDD(SC-FDMA QPSK/16-QAM); Frequency: 2510.00MHz; Duty Cycle: 1:1.00
ConvF:	2.19
Liquid Parameters:	Relative permittivity (real part): 53.99; Conductivity (S/m):2.07;
Device Position:	Body
Area Scan:	dx=12mm dy=12mm, h=5.00mm
Zoom Scan:	7x7x7, dx=5mm dy=5mm dz=5mm, h=5.00mm



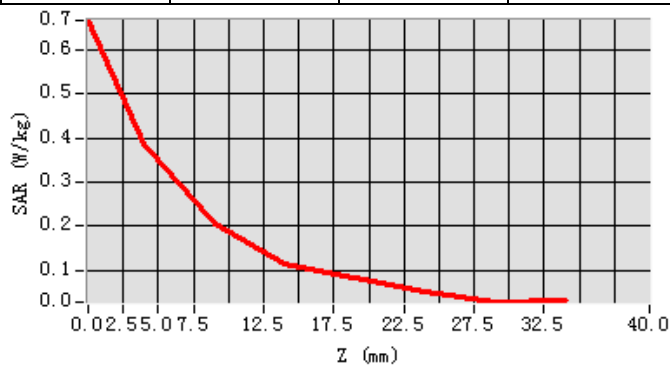
3D screen shot

Hot spot position



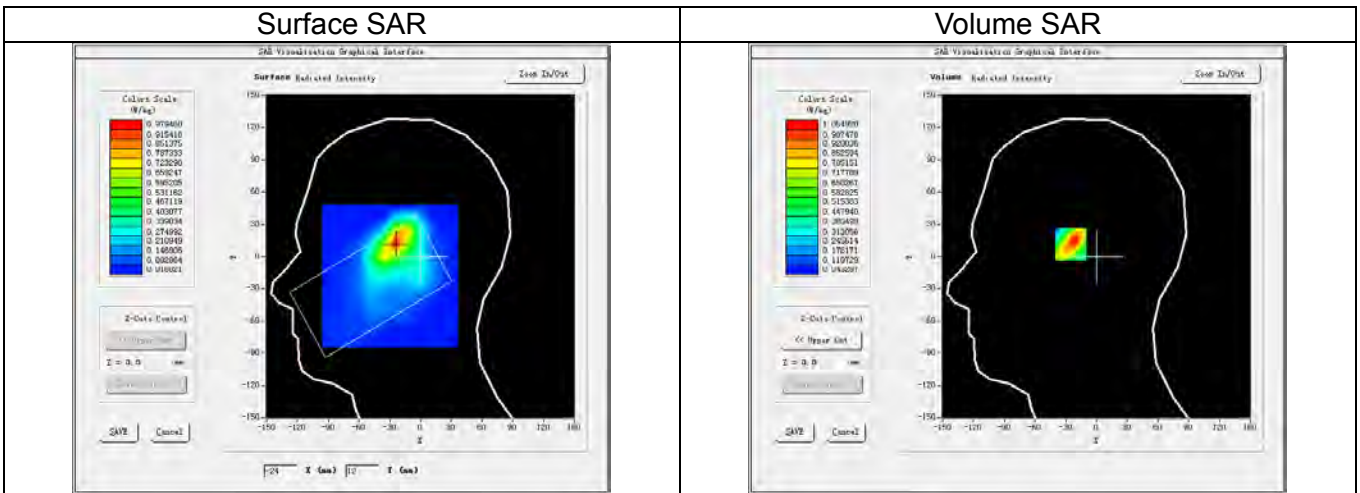
Maximum location: X=10.00, Y=-47.00  
SAR Peak: 0.63 W/kg

SAR 1g (W/Kg)		0.342					
SAR 10g (W/Kg)		0.189					
Power Drift (±5%):		-0.62					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.6665	0.3886	0.2072	0.1153	0.0848	0.0508	0.0287



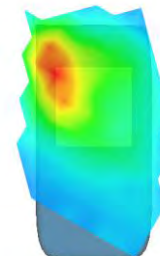
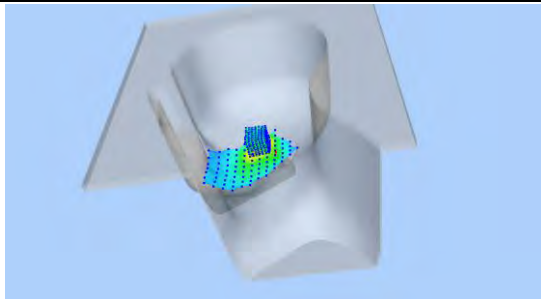
### WLAN 2.4G\_802.11b\_Ch1\_Right Cheek

Date of measurement:	Oct. 27, 2017
Signal:	Communication System: WLAN 802.11a/b/g/n/ac; Frequency: 2412.00MHz; Duty Cycle: 1:1.00
ConvF:	2.18
Liquid Parameters:	Relative permittivity (real part): 39.58; Conductivity (S/m): 1.74;
Device Position:	Cheek
Area Scan:	dx=12mm dy=12mm, h=5.00mm
Zoom Scan:	7x7x7, dx=5mm dy=5mm dz=5mm, h=5.00mm



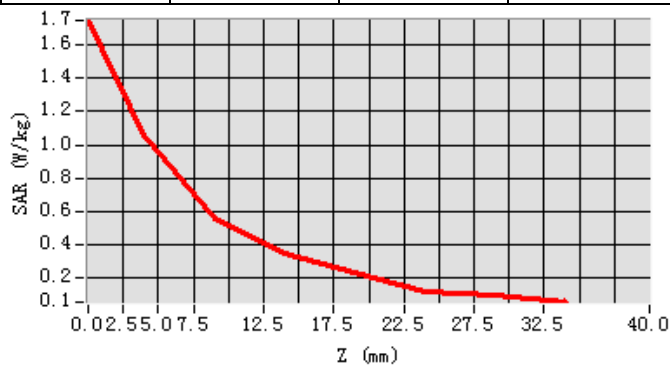
3D screen shot

Hot spot position



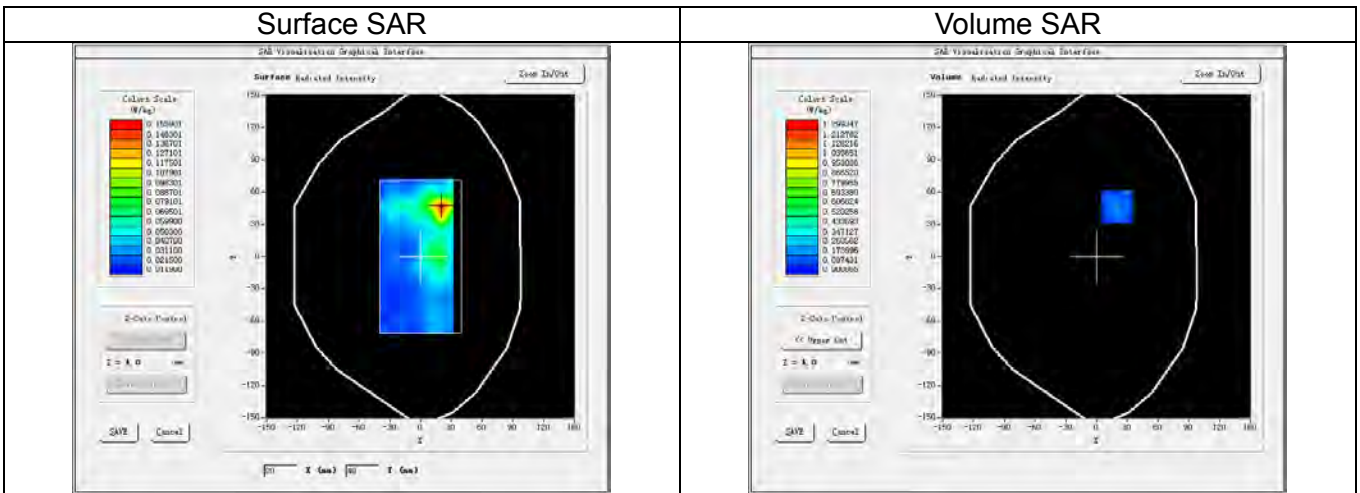
Maximum location: X=-24.00, Y=13.00  
SAR Peak: 1.61 W/kg

SAR 1g (W/Kg)		0.966					
SAR 10g (W/Kg)		0.505					
Power Drift (±5%):		-0.23					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.7461	1.0549	0.5568	0.3488	0.2347	0.1211	0.1011



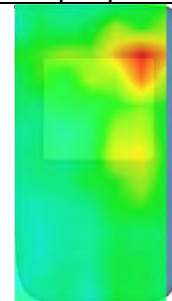
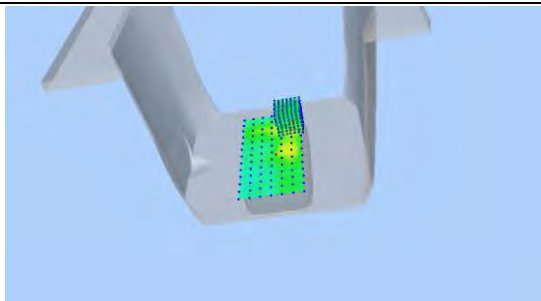
**WLAN 2.4G\_802.11b\_Ch1\_Back Side \_10mm**

Date of measurement:	Oct. 30, 2017
Signal:	Communication System: WLAN 802.11a/b/g/n/ac; Frequency: 2412.00MHz; Duty Cycle: 1:1.00
ConvF:	2.27
Liquid Parameters:	Relative permittivity (real part): 52.93; Conductivity (S/m): 1.93;
Device Position:	Body
Area Scan:	dx=12mm dy=12mm, h=5.00mm
Zoom Scan:	7x7x7, dx=5mm dy=5mm dz=5mm, h=5.00mm



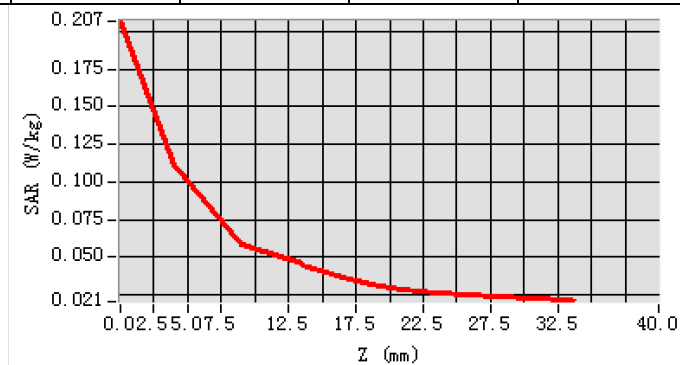
3D screen shot

Hot spot position



Maximum location: X=20.00, Y=46.00  
SAR Peak: 1.61 W/kg

SAR 1g (W/Kg)		0.254					
SAR 10g (W/Kg)		0.094					
Power Drift (±5%):		2.61					
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.1032	1.2993	0.0592	0.0384	0.0262	0.0240	0.0224



## 14. Appendix D. Calibration Certificate

<b>Table of contents</b>
E Field Probe - SN 08/16 EPGO287
835 MHz Dipole - SN 03/15 DIP 0G835-347
1800 MHz Dipole - SN 03/15 DIP 1G800-349
1900 MHz Dipole - SN 03/15 DIP 1G900-350
2450 MHz Dipole - SN 03/15 DIP 2G450-352
2600 MHz Dipole - SN 03/15 DIP 2G600-356
Extended Calibration Certificate



## COMOSAR E-Field Probe Calibration Report

Ref : ACR.261.2.17.SATU.A

**Shenzhen NTEK Testing Technology Co., Ltd.**  
**BUILDING E, FENDA SCIENCE PARK,**  
**SANWEI COMMUNITY, XIXIANG STREET,**  
**BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA**  
**MVG COMOSAR DOSIMETRIC E-FIELD PROBE**  
**SERIAL NO.: SN 08/16 EPGO287**

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



**Calibration Date: 09/18/2017**

### *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.261.2.17.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	9/18/2017	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	9/18/2017	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	9/18/2017	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	NTEK TESTING TECHNOLOGY CO., LTD.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	9/18/2017	Initial release





COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

TABLE OF CONTENTS

1 DEVICE UNDER TEST .....4

2 PRODUCT DESCRIPTION GENERAL INFORMATION .....4

3 MEASUREMENT METHOD .....4

    3.1 Linearity .....4

    3.2 Sensitivity .....4

    3.3 Lower Detection Limit .....5

    3.4 Isotropy .....5

    3.5 Boundary Effect .....5

4 MEASUREMENT UNCERTAINTY .....5

5 CALIBRATION MEASUREMENT RESULTS .....6

    5.1 Sensitivity in air .....6

    5.2 Linearity .....7

    5.3 Sensitivity in liquid .....7

    5.4 Isotropy .....8

6 LIST OF EQUIPMENT ..... 10



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

**1 DEVICE UNDER TEST**

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 08/16 EPGO287
Product Condition (new / used)	Used
Frequency Range of Probe	0.4 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.208 MΩ Dipole 2: R2=0.196 MΩ Dipole 3: R3=0.196 MΩ

A yearly calibration interval is recommended.

**2 PRODUCT DESCRIPTION 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.

**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.

Page: 4/10

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATUA

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



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

5 CALIBRATION MEASUREMENT RESULTS

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

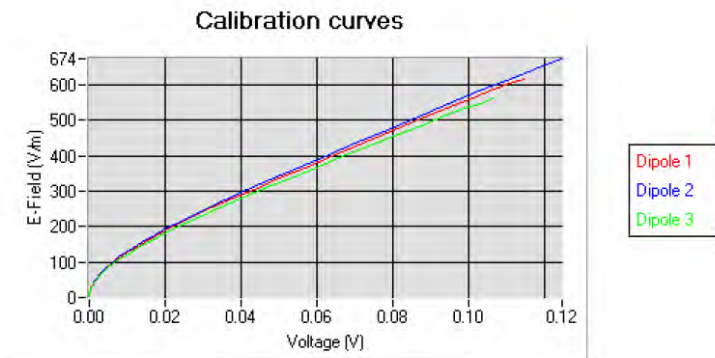
5.1 SENSITIVITY IN AIR

Normx dipole 1 (µV/(V/m) <sup>2</sup> )	Normy dipole 2 (µV/(V/m) <sup>2</sup> )	Normz dipole 3 (µV/(V/m) <sup>2</sup> )
0.69	0.78	0.61

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
92	90	96

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

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

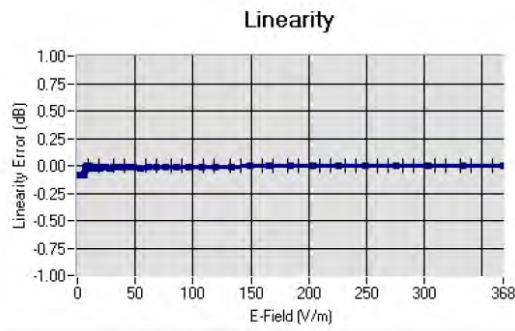




COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

5.2 LINEARITY



Linearity:  $\pm 1.86\%$  ( $\pm 0.08\text{dB}$ )

5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL750	750	42.09	0.91	1.44
BL750	750	55.69	0.95	1.49
HL850	835	42.71	0.89	1.48
BL850	835	57.52	1.03	1.53
HL900	900	41.94	0.93	1.50
BL900	900	52.87	1.09	1.54
HL1800	1800	40.62	1.39	1.75
BL1800	1800	53.22	1.47	1.79
HL1900	1900	41.22	1.37	2.00
BL1900	1900	50.99	1.52	2.07
HL2000	2000	40.39	1.36	1.93
BL2000	2000	54.39	1.54	1.99
HL2450	2450	40.46	1.87	2.18
BL2450	2450	54.62	1.95	2.27
HL2600	2600	38.46	2.01	2.15
BL2600	2600	51.98	2.16	2.19
HL5200	5200	35.14	4.74	2.37
BL5200	5200	49.01	5.27	2.46
HL5400	5400	34.52	4.77	2.33
BL5400	5400	49.67	5.45	2.41
HL5600	5600	37.08	5.03	2.47
BL5600	5600	47.57	5.69	2.54
HL5800	5800	34.64	5.19	2.51
BL5800	5800	49.82	5.94	2.57

LOWER DETECTION LIMIT: 7mW/kg



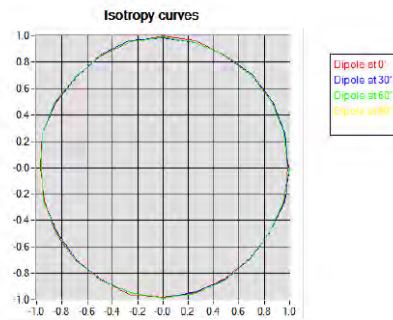
## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

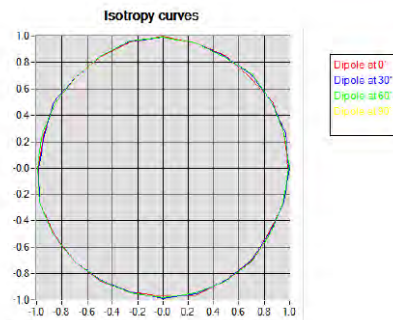
## 5.4 ISOTROPY

**HL900 MHz**

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.06 dB

**HL1800 MHz**

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.08 dB



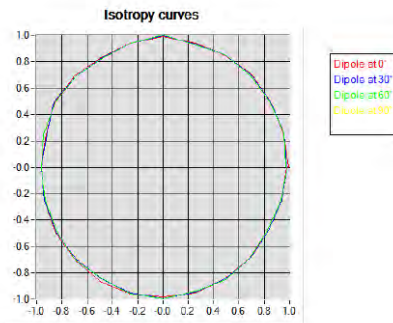


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.SATU.A

**HL5600 MHz**

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





COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.261.2.17.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	02/2016	02/2019
Reference Probe	MVG	EP 94 SN 37/08	10/2016	10/2017
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
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	10/2015	10/2017





## SAR Reference Dipole Calibration Report

Ref : ACR.139.4.15.SATU.A

**NTEK TESTING TECHNOLOGY CO., LTD.**  
**BUILDING E, FENDA SCIENCE PARK, SANWEI**  
**COMMUNITY, XIXIANG STREET,**  
**BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA**  
**MVG COMOSAR REFERENCE DIPOLE**  
**FREQUENCY: 835 MHZ**  
**SERIAL NO.: SN 03/15 DIP 0G835-347**

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



**04/06/2015**

### *Summary:*

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

PaF ACR 1994 15 SATUA

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	5/19/2015	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	5/19/2015	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	5/19/2015	<i>(Kim Rutkowski)</i>

<i>Distribution :</i>	<i>Customer Name</i> NTEK TESTING TECHNOLOGY CO., LTD.
-----------------------	-----------------------------------------------------------------

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	5/19/2015	Initial release



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.4.15.SATU.A

## TABLE OF CONTENTS

1	Introduction .....	4
2	Device Under Test .....	4
3	Product Description .....	4
3.1	General Information .....	4
4	Measurement Method .....	5
4.1	Return Loss Requirements .....	5
4.2	Mechanical Requirements .....	5
5	Measurement Uncertainty .....	5
5.1	Return Loss .....	5
5.2	Dimension Measurement .....	5
5.3	Validation Measurement .....	5
6	Calibration Measurement Results .....	6
6.1	Return Loss and Impedance In Head Liquid .....	6
6.2	Return Loss and Impedance In Body Liquid .....	6
6.3	Mechanical Dimensions .....	6
7	Validation measurement .....	7
7.1	Head Liquid Measurement .....	7
7.2	SAR Measurement Result With Head Liquid .....	8
7.3	Body Liquid Measurement .....	9
7.4	SAR Measurement Result With Body Liquid .....	10
8	List of Equipment .....	12



**SAR REFERENCE DIPOLE CALIBRATION REPORT**

Ref: ACR.139.4.15.SATU.A

**1 INTRODUCTION**

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs 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	MVG
Model	SID835
Serial Number	SN 03/15 DIP 0G835-347
Product Condition (new / used)	New

A yearly calibration interval is recommended.

**3 PRODUCT DESCRIPTION**

**3.1 GENERAL INFORMATION**

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



**Figure 1 – MVG COMOSAR Validation Dipole**



#### 4 MEASUREMENT METHOD

The IEEE 1528, FCC KDBs 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, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty



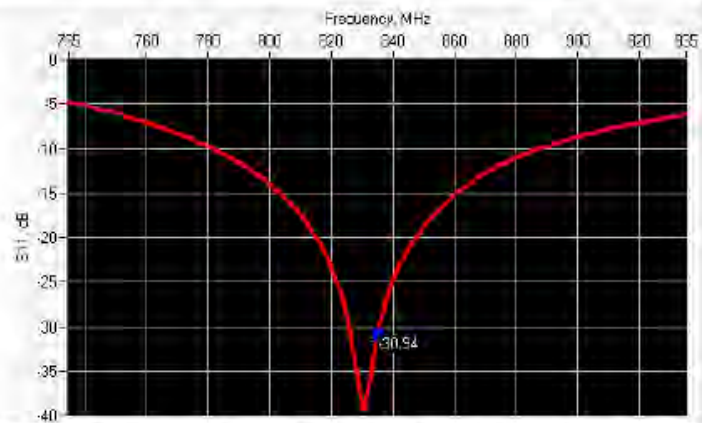
**SAR REFERENCE DIPOLE CALIBRATION REPORT**

Ref: ACR.1394.15.SATU.A

1 g	20.3 %
10 g	20.1 %

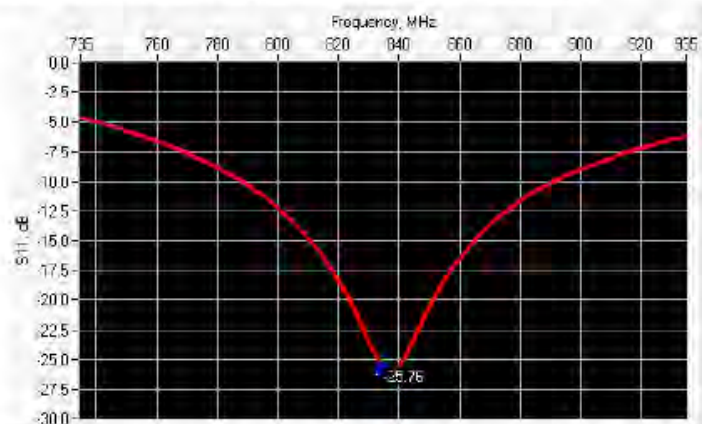
**6 CALIBRATION MEASUREMENT RESULTS**

**6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID**



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-30.94	-20	52.6 Ω + 1.1 jΩ

**6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID**



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-25.76	-20	47.7 Ω + 4.6 jΩ

**6.3 MECHANICAL DIMENSIONS**

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.4.15.SATU.A

300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.	PASS	89.8 ±1 %.	PASS	3.6 ±1 %.	PASS
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε <sub>r</sub> )		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %	PASS	0.90 ±5 %	PASS
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.4.15.SATU.A

1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 42.3 sigma : 0.92
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56	9.60 (0.96)	6.22	6.24 (0.62)
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	

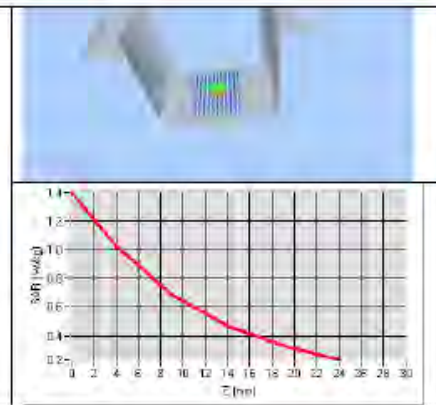
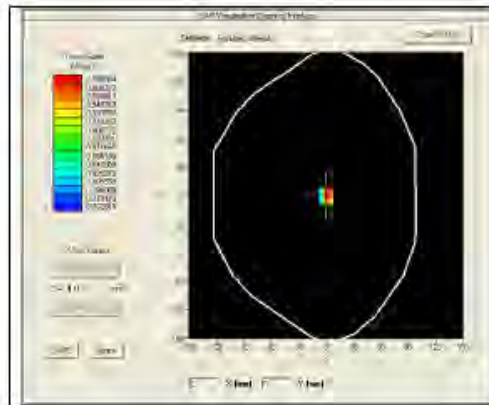




**SAR REFERENCE DIPOLE CALIBRATION REPORT**

Ref: ACR.1394.15.SATU.A

1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



**7.3 BODY LIQUID MEASUREMENT**

Frequency MHz	Relative permittivity ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %	PASS	0.97 ±5 %	PASS
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.4.15.SATU.A

2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

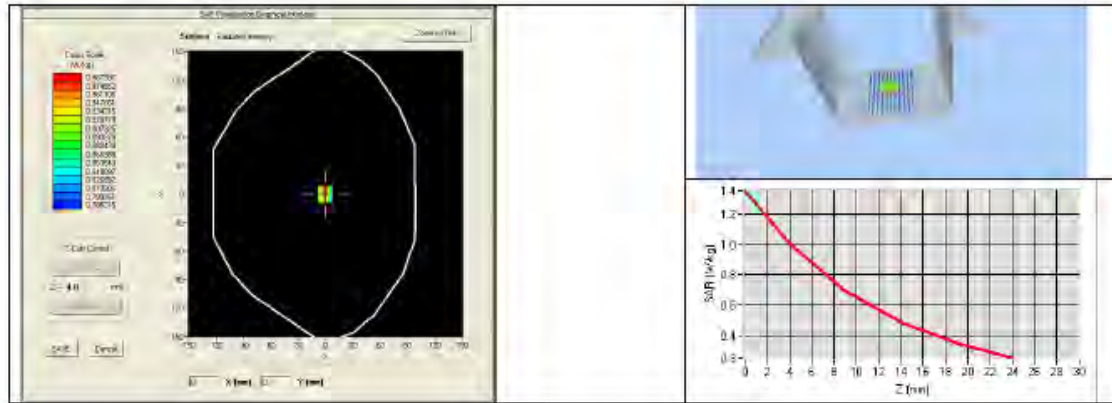
Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 53.3 sigma : 0.97
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
835	9.48 (0.95)	6.29 (0.63)



### SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.139.4.15.SATU.A





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.139.4.15.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM 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	Rhoda & Schwarz ZVA	SN100132	02/2013	02/2016
Calipers	Carrera	CALIPER-01	12/2013	12/2016
Reference Probe	MVG	EPG122 SN 18/11	10/2014	10/2015
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015



## SAR Reference Dipole Calibration Report

Ref : ACR.139.6.15.SATU.A

**NTEK TESTING TECHNOLOGY CO., LTD.**  
**BUILDING E, FENDA SCIENCE PARK, SANWEI**  
**COMMUNITY, XIXIANG STREET,**  
**BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA**  
**MVG COMOSAR REFERENCE DIPOLE**  
**FREQUENCY: 1800 MHZ**  
**SERIAL NO.: SN 03/15 DIP 1G800-349**

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



**04/06/2015**

### *Summary:*

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.6.15.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	5/19/2015	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	5/19/2015	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	5/19/2015	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	NTEK TESTING TECHNOLOGY CO., LTD.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	5/19/2015	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.6.15.SATU.A

TABLE OF CONTENTS

1	Introduction.....	4
2	Device Under Test .....	4
3	Product Description .....	4
3.1	General Information .....	4
4	Measurement Method .....	5
4.1	Return Loss Requirements .....	5
4.2	Mechanical Requirements .....	5
5	Measurement Uncertainty.....	5
5.1	Return Loss .....	5
5.2	Dimension Measurement .....	5
5.3	Validation Measurement .....	5
6	Calibration Measurement Results.....	6
6.1	Return Loss and Impedance In Head Liquid .....	6
6.2	Return Loss and Impedance In Body Liquid .....	6
6.3	Mechanical Dimensions .....	6
7	Validation measurement .....	7
7.1	Head Liquid Measurement .....	7
7.2	SAR Measurement Result With Head Liquid .....	8
7.3	Body Liquid Measurement .....	9
7.4	SAR Measurement Result With Body Liquid .....	10
8	List of Equipment .....	11



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.6.15.SATU.A

**1 INTRODUCTION**

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs 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 1800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1800
Serial Number	SN 03/15 DIP 1G800-349
Product Condition (new / used)	New

A yearly calibration interval is recommended.

**3 PRODUCT DESCRIPTION**

**3.1 GENERAL INFORMATION**

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



**Figure 1 – MVG COMOSAR Validation Dipole**





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.6.15.SATU.A

**4 MEASUREMENT METHOD**

The IEEE 1528, FCC KDBs 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, FCC KDBs, 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 %



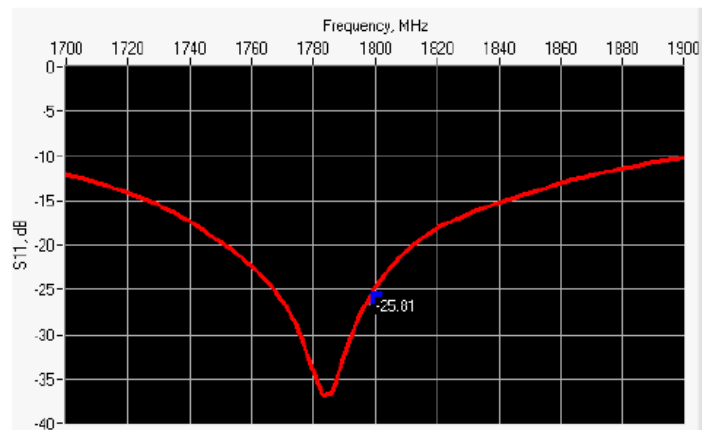
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.139.6.15.SATU.A

10 g	20.1 %
------	--------

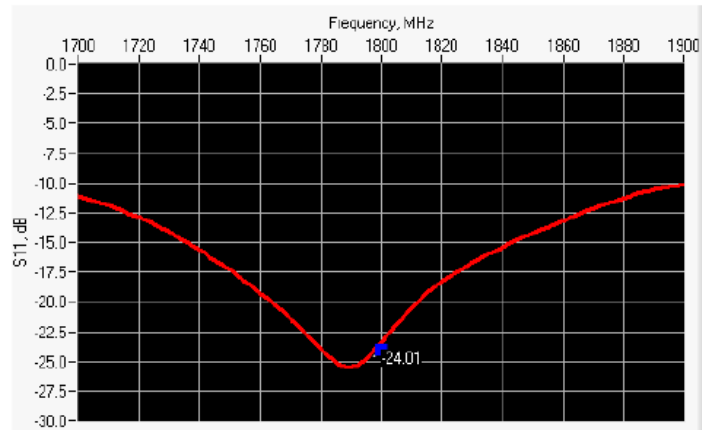
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-25.81	-20	45.1 Ω + 1.3 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-24.01	-20	44.5 Ω - 3.0 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %		250.0 ±1 %		6.35 ±1 %	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.139.6.15.SATU.A

450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.	PASS	41.7 ±1 %.	PASS	3.6 ±1 %.	PASS
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε <sub>r</sub> )		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.139.6.15.SATU.A

1800	40.0 ±5 %	PASS	1.40 ±5 %	PASS
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 41.8 sigma : 1.38
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

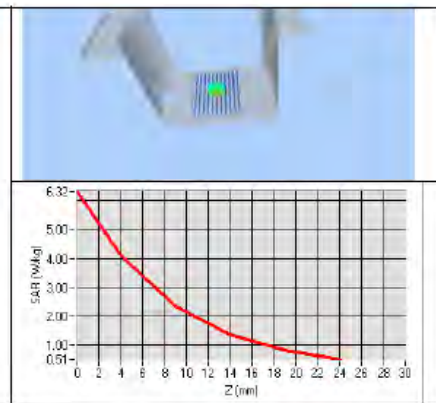
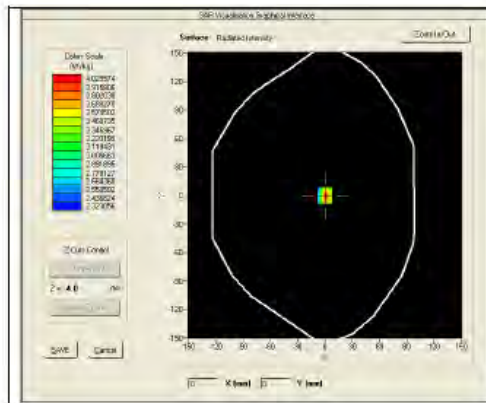
Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	37.53 (3.75)	20.1	20.16 (2.02)



SAR REFERENCE DIPOLE C CALIBRATION REPORT

Ref: ACR.139.6.15.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %	PASS	1.52 ±5 %	PASS
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	



SAR REFERENCE DIPOLE CALIBRATION REPORT

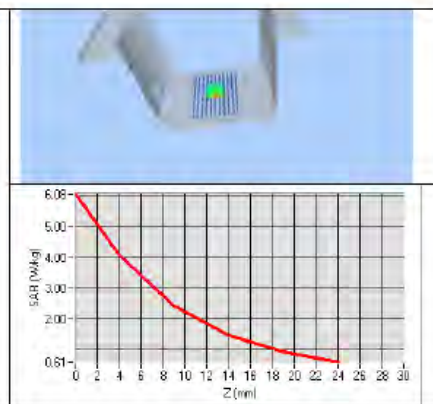
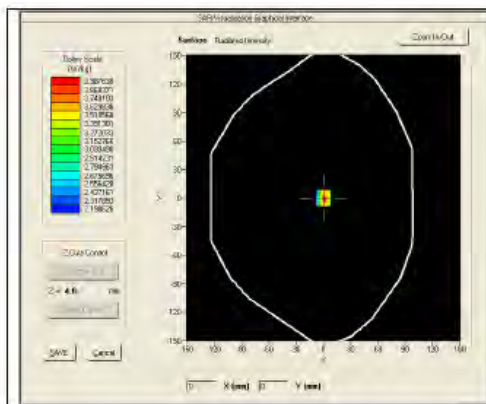
Ref. ACR.139.6.15.SATU.A

2600	52.5 ±5 %		2.16 ±5 %
3000	52.0 ±5 %		2.73 ±5 %
3500	51.3 ±5 %		3.31 ±5 %
5200	49.0 ±10 %		5.30 ±10 %
5300	48.9 ±10 %		5.42 ±10 %
5400	48.7 ±10 %		5.53 ±10 %
5500	48.6 ±10 %		5.65 ±10 %
5600	48.5 ±10 %		5.77 ±10 %
5800	48.2 ±10 %		6.00 ±10 %

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: $\epsilon_{ps}$ : 53.0 $\sigma$ : 1.52
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	37.04 (3.70)	20.26 (2.03)





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.6.15.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM 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	02/2013	02/2016
Calipers	Carrera	CALIPER-01	12/2013	12/2016
Reference Probe	MVG	EPG122 SN 18/11	10/2014	10/2015
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015



## SAR Reference Dipole Calibration Report

Ref : ACR.139.7.15.SATU.A

**NTEK TESTING TECHNOLOGY CO., LTD.**  
**BUILDING E, FENDA SCIENCE PARK, SANWEI**  
**COMMUNITY, XIXIANG STREET,**  
**BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA**  
**MVG COMOSAR REFERENCE DIPOLE**  
**FREQUENCY: 1900 MHZ**  
**SERIAL NO.: SN 03/15 DIP 1G900-350**

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



**04/06/2015**

*Summary:*




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





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139 715.SATULA

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	5/19/2015	
<i>Checked by :</i>	Jérôme LUC	Product Manager	5/19/2015	
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	5/19/2015	

	<i>Customer Name</i>
<i>Distribution :</i>	NTEK TESTING TECHNOLOGY CO., LTD.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	5/19/2015	Initial release



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.7.15.SATU.A

## TABLE OF CONTENTS

1	Introduction.....	4
2	Device Under Test.....	4
3	Product Description.....	4
3.1	General Information.....	4
4	Measurement Method.....	5
4.1	Return Loss Requirements.....	5
4.2	Mechanical Requirements.....	5
5	Measurement Uncertainty.....	5
5.1	Return Loss.....	5
5.2	Dimension Measurement.....	5
5.3	Validation Measurement.....	5
6	Calibration Measurement Results.....	6
6.1	Return Loss and Impedance In Head Liquid.....	6
6.2	Return Loss and Impedance In Body Liquid.....	6
6.3	Mechanical Dimensions.....	6
7	Validation measurement.....	7
7.1	Head Liquid Measurement.....	7
7.2	SAR Measurement Result With Head Liquid.....	8
7.3	Body Liquid Measurement.....	9
7.4	SAR Measurement Result With Body Liquid.....	10
8	List of Equipment.....	11



**SAR REFERENCE DIPOLE CALIBRATION REPORT**

Ref: ACR.139.7.15.SATU.A

**1 INTRODUCTION**

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs 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 1900 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1900
Serial Number	SN 03/15 DIP 1G900-350
Product Condition (new / used)	New

A yearly calibration interval is recommended.

**3 PRODUCT DESCRIPTION**

**3.1 GENERAL INFORMATION**

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



**Figure 1 – MVG COMOSAR Validation Dipole**



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref ACR.139.7.15.SATU.A

**4 MEASUREMENT METHOD**

The IEEE 1528, FCC KDBs 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, FCC KDBs, 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 %



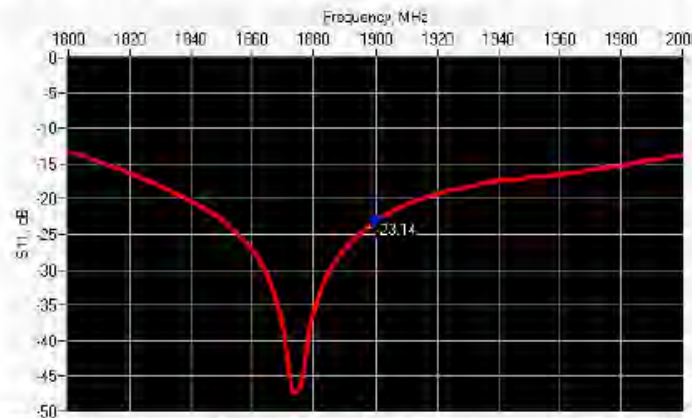
**SAR REFERENCE DIPOLE CALIBRATION REPORT**

Ref. ACR.139 7.15.5ATU.A

10 g	20,1 %
------	--------

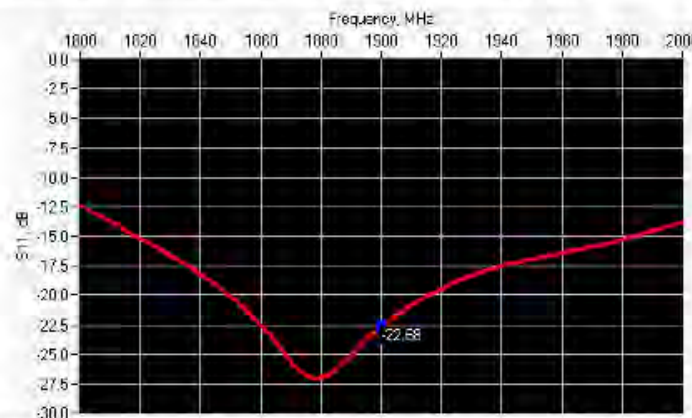
**6 CALIBRATION MEASUREMENT RESULTS**

**6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID**



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1900	-23.14	-20	53.6 Ω + 5.9 jΩ

**6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID**



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1900	-22.68	-20	49.3 Ω + 7.3 jΩ

**6.3 MECHANICAL DIMENSIONS**

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %		250.0 ±1 %		6.35 ±1 %	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref ACR.139.7.15.SATU.A

450	290.0 ±1 %		166.7 ±1 %		6.35 ±1 %	
750	176.0 ±1 %		100.0 ±1 %		6.35 ±1 %	
835	161.0 ±1 %		89.8 ±1 %		3.6 ±1 %	
900	149.0 ±1 %		83.3 ±1 %		3.6 ±1 %	
1450	89.1 ±1 %		51.7 ±1 %		3.6 ±1 %	
1500	80.5 ±1 %		50.0 ±1 %		3.6 ±1 %	
1640	79.0 ±1 %		45.7 ±1 %		3.6 ±1 %	
1750	75.2 ±1 %		42.9 ±1 %		3.6 ±1 %	
1800	72.0 ±1 %		41.7 ±1 %		3.6 ±1 %	
1900	68.0 ±1 %	PASS	39.5 ±1 %	PASS	3.6 ±1 %	PASS
1950	66.3 ±1 %		38.5 ±1 %		3.6 ±1 %	
2000	64.5 ±1 %		37.5 ±1 %		3.6 ±1 %	
2100	61.0 ±1 %		35.7 ±1 %		3.6 ±1 %	
2300	55.5 ±1 %		32.6 ±1 %		3.6 ±1 %	
2450	51.5 ±1 %		30.4 ±1 %		3.6 ±1 %	
2600	48.5 ±1 %		28.8 ±1 %		3.6 ±1 %	
3000	41.5 ±1 %		25.0 ±1 %		3.6 ±1 %	
3500	37.0 ±1 %		26.4 ±1 %		3.6 ±1 %	
3700	34.7 ±1 %		26.4 ±1 %		3.6 ±1 %	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	