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： 8-Inch Fully Ruggedized Tablet

Trademark： N/A

Model Name： SV-86H

Serial Model： N/A

Report No.： SER180517703001E

FCC ID： 2AQAC-SV-86H

Prepared for

Zephyr Sleep Technologies

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Prepared by

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TEST RESULT CERTIFICATION

Applicant's name.....: Zephyr Sleep Technologies

Address.....: #102, 701 64th Avenue S.E., Calgary, Alberta, T2H 2C3 Canada

Manufacturer's Name.....: Sinicvision Technology Co., Ltd.

Address.....: Flat C, 23/F, Lucky Plaza, 315 - 321 Lockhart Road, Wan Chai, HK, P.R.China

Product description

Product name.....: 8-Inch Fully Ruggedized Tablet

Trademark .....: N/A

Model and/or type reference : SV-86H

Serial Model .....: N/A

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..... : May 25, 2018 ~ Jun. 01, 2018

Date of Issue ..... : Jul. 03, 2018

Test Result ..... : **Pass**

Prepared By (Test Engineer) : Cheng Jiawen

(Cheng Jiawen)

Approved By (Lab Manager) : Sam Chen

(Sam Chen)

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Jul. 03, 2018	Cheng Jiawen

TABLE OF CONTENTS

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 SV-86H are as follows.

Band	Max Reported SAR Value(W/kg)	
	1-g Body (Separation distance of 0mm)	Max Simultaneous Tx
WCDMA Band V	0.799	1.462
WCDMA Band IV	1.156	
WCDMA Band II	1.140	
LTE Band XII	1.004	
LTE Band IV	1.039	
LTE Band II	0.903	
WLAN 2.4G	0.375	
WLAN 5.8G	0.351	

NOTE: The Max Simultaneous Tx 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 & Published RF exposure KDB procedures.

1.3. EUT Description

Device Information			
Product Name	8-Inch Fully Ruggedized Tablet		
Trademark	N/A		
Model Name	SV-86H		
Serial Model	N/A		
FCC ID	2AQAC-SV-86H		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	FPCB Antenna		
Battery Information	DC 3.7V, 7800mAh		
Device Operating Configurations			
Supporting Mode(s)	WCDMA Band V/IV/II, LTE Band XII/IV/II, WLAN 2.4G/5.8G, Bluetooth		
Test Modulation	WCDMA(QPSK), LTE(QPSK/16QAM), WLAN(DSSS/OFDM), Bluetooth(GFSK, π/4-DQPSK, 8DPSK)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WCDMA Band V	824-849	869-894
	WCDMA Band IV	1710-1755	2110-2155
	WCDMA Band II	1850-1910	1930-1990
	LTE Band XII	699-716	729-746
	LTE Band IV	1710-1755	2110-2155
	LTE Band II	1850-1910	1930-1990
	WLAN 2.4G	2412-2462	
	WLAN 5.8G	5745-5825	
	Bluetooth	2402-2480	
Power Class	3, tested with power control “all 1”(WCDMA Band V)		
	3, tested with power control “all 1”(WCDMA Band IV)		
	3, tested with power control “all 1”(WCDMA Band II)		
	3, tested with power control all Max.(LTE Band XII)		
	3, tested with power control all Max.(LTE Band IV)		
	3, tested with power control all Max.(LTE Band II)		
Test Channels (low-mid-high)	4132-4182-4233(WCDMA Band V)		
	1312-1413-1513 (WCDMA Band IV)		
	9262-9400-9538(WCDMA Band II)		
	23017-23095-23173 (LTE Band XII BW=1.4MHz)		
	23025-23095-23165 (LTE Band XII BW=3MHz)		
	23035-23095-23155 (LTE Band XII BW=5MHz)		
	23060-23095-23130 (LTE Band XII 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)
	1-3-6-9-11(WLAN 2.4G)
	149-151-155-157-159-165(WLAN 5.8G)

Note: The LTE and WCDMA module have been fully module certification and that FCC ID is XMR201605EC25A.

1.4. Test specification(s)

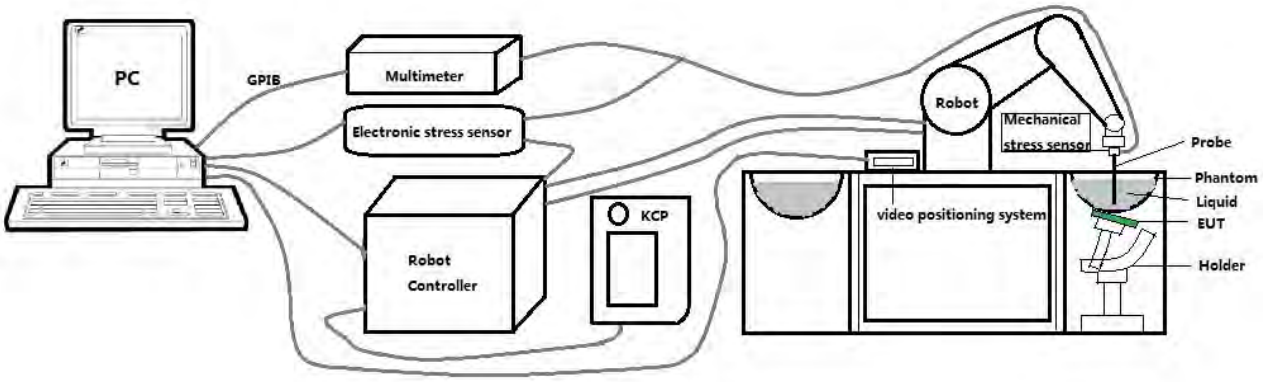
FCC 47 CFR Part 2(2.1093)
ANSI/IEEE C95.1-1992
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting
KDB 447498 D01 General RF Exposure Guidance
KDB 248227 D01 802.11 Wi-Fi SAR
KDB 941225 D01 3G SAR Procedures
KDB 941225 D05 SAR for LTE Devices
KDB 616217 D04 SAR for laptop and tablets

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 ±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 ±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 ±1 mm).
- Probe linearity: ±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°.

2.3.1. E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ±10%. The spherical isotropy shall be evaluated and within ±0.25dB. 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.

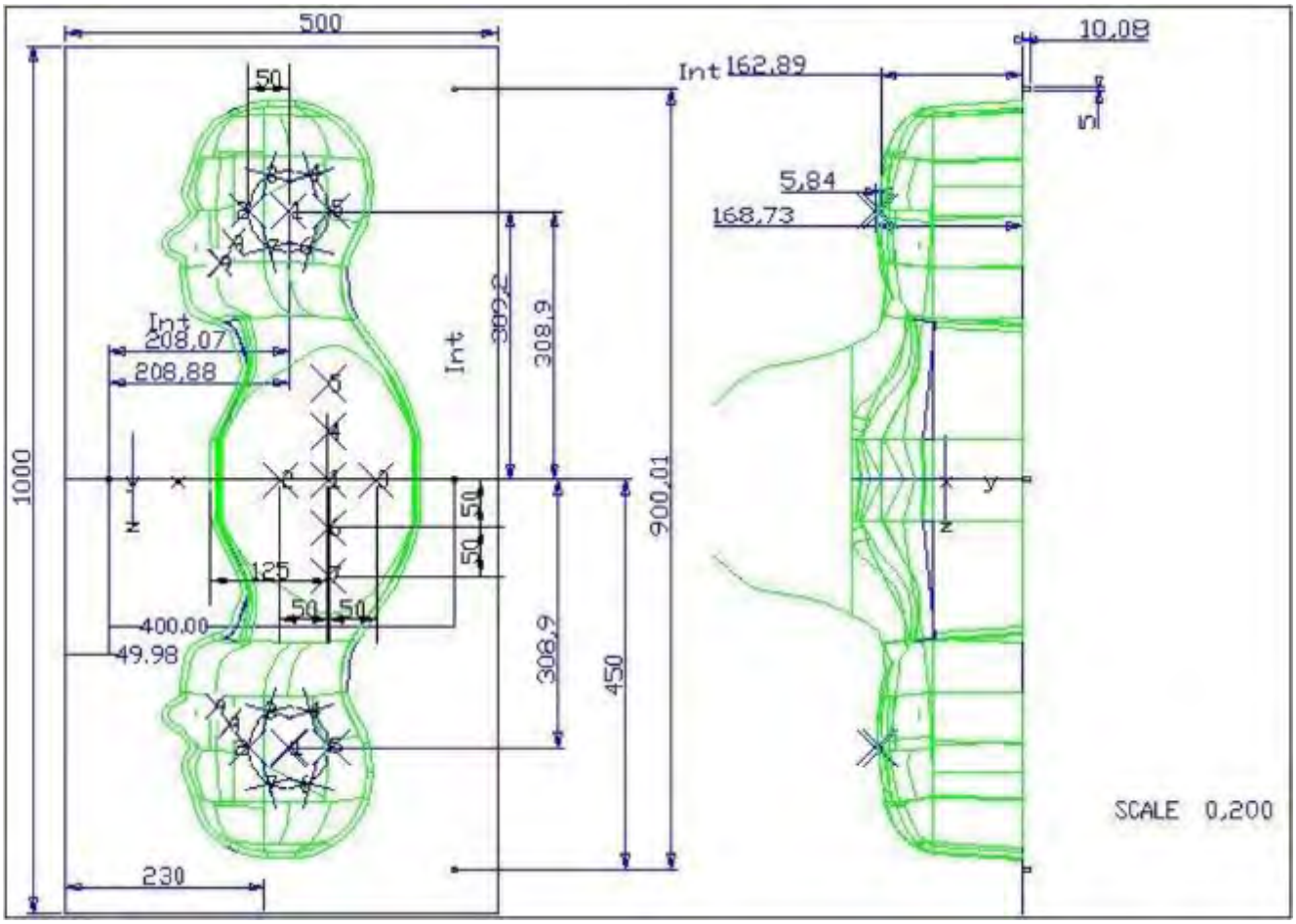
2.4. SAM phantoms

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
SN 16/15 SAM119	2 mm ±0.2 mm	27 liters	Length:1000 mm Width:500 mm Height:200 mm	Gelcoat with fiberglass	3.4	0.02

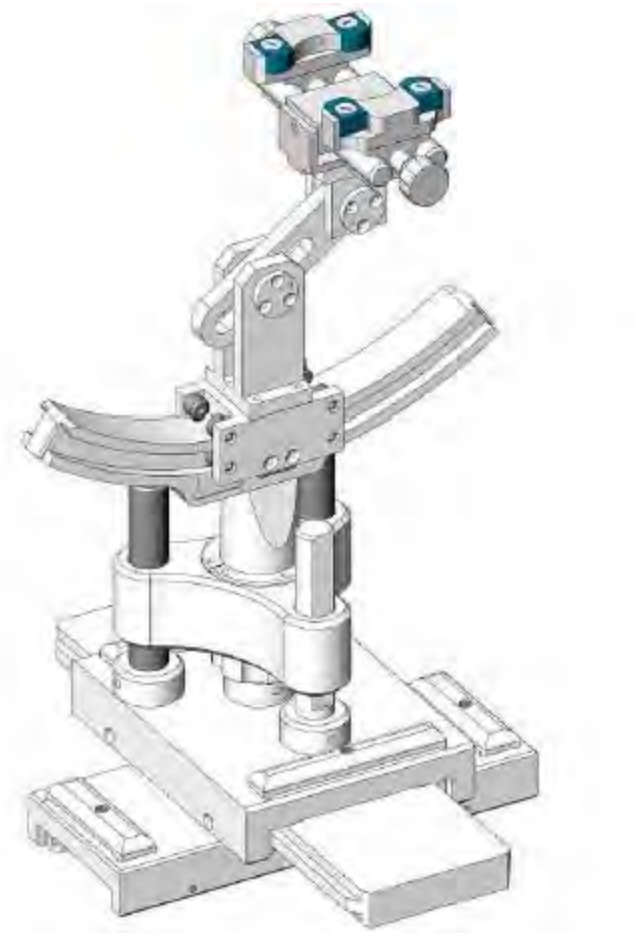


Serial Number	Left Head		Right Head		Flat Part	
SN 16/15 SAM119	2	2.02	2	2.08	1	2.09
	3	2.05	3	2.06	2	2.06
	4	2.07	4	2.07	3	2.08
	5	2.08	5	2.08	4	2.10
	6	2.05	6	2.07	5	2.10
	7	2.05	7	2.05	6	2.07
	8	2.07	8	2.06	7	2.07
	9	2.08	9	2.06	-	-

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
☒	MVG	E FIELD PROBE	SSE2	SN 08/16 EPGO287	Sep. 18, 2017	Sep. 17, 2018
☒	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Apr. 19, 2018	Apr. 18, 2021
☒	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Apr. 19, 2018	Apr. 18, 2021
☐	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Apr. 19, 2018	Apr. 18, 2021
☒	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Apr. 19, 2018	Apr. 18, 2021
☒	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Apr. 19, 2018	Apr. 18, 2021
☐	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Apr. 19, 2018	Apr. 18, 2021
☒	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Apr. 19, 2018	Apr. 18, 2021
☐	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Apr. 19, 2018	Apr. 18, 2021
☒	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Apr. 19, 2018	Apr. 18, 2021
☒	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	NCR	NCR
☒	MVG	Power Amplifier	N.A	AMPLISAR_28/14_003	NCR	NCR
☒	KEITHLEY	Millivoltmeter	2000	4072790	NCR	NCR
☒	R&S	Universal radio communication tester	CMU200	117858	Aug. 07, 2017	Aug. 06, 2018
☒	R&S	Wideband radio communication tester	CMW500	103917	Oct. 26, 2017	Oct. 25, 2018
☒	HP	Network Analyzer	8753D	3410J01136	Aug. 07, 2017	Aug. 06, 2018
☒	Agilent	PSG Analog Signal Generator	E8257D	MY51110112	Aug. 07, 2017	Aug. 06, 2018

☒	Agilent	Power meter	E4419B	MY45102538	Aug. 07, 2017	Aug. 06, 2018
☒	Agilent	Power sensor	E9301A	MY41495644	Aug. 07, 2017	Aug. 06, 2018
☒	Agilent	Power sensor	E9301A	US39212148	Aug. 07, 2017	Aug. 06, 2018
☒	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/Bluetooth power measurement, use engineering software to configure EUT WLAN/Bluetooth 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/Bluetooth output power.

<SAR measurement>
(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/Bluetooth 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.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">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.</td></tr>
</table>

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 using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 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 to a full 3D scan over a specific area. This 3D scan is useful form multi Tx SAR measurement. Indeed, it is possible with OpenSAR to add, point by point, several volumetric scan to calculate the SAR value of the combined measurement as it is define in the standard IEEE1528 and IEC62209.

3.5. Power Drift

All SAR testing is under the EUT install 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 ±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.

Ingredients (% of weight)	Head Tissue									
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600	5200	5800
Water	34.40	34.40	34.40	55.36	55.36	57.87	57.87	57.87	65.53	65.53
NaCl	0.79	0.79	0.79	0.35	0.35	0.16	0.16	0.16	0.00	0.00
1,2-Propanediol	64.81	64.81	64.81	0.00	0.00	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	24.24	24.24
DGBE	0.00	0.00	0.00	13.84	13.84	22.00	22.00	22.00	10.23	10.23
Ingredients (% of weight)	Body Tissue									
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600	5200	5800
Water	50.30	50.30	50.30	69.91	69.91	71.88	71.88	71.88	79.54	79.54
NaCl	0.60	0.60	0.60	0.13	0.13	0.16	0.16	0.16	0.00	0.00
1,2-Propanediol	49.10	49.10	49.10	0.00	0.00	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	11.24	11.24
DGBE	0.00	0.00	0.00	19.97	19.97	7.99	7.99	7.99	9.22	9.22

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 of the dielectric parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ±5% of the target values.

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (±5%)	σ (S/m) (±5%)	εr	σ (S/m)		
Body 750	750	55.50 (52.73~58.27)	0.96 (0.91~1.01)	55.33	0.98	21.3 °C	Jun. 01, 2018
Body 850	835	55.20 (52.44~57.96)	0.97 (0.92~1.01)	55.14	0.97	21.7 °C	May 31, 2018
Body 1800	1800	53.30 (50.64~55.96)	1.52 (1.44~1.59)	53.53	1.55	21.3 °C	May 29, 2018

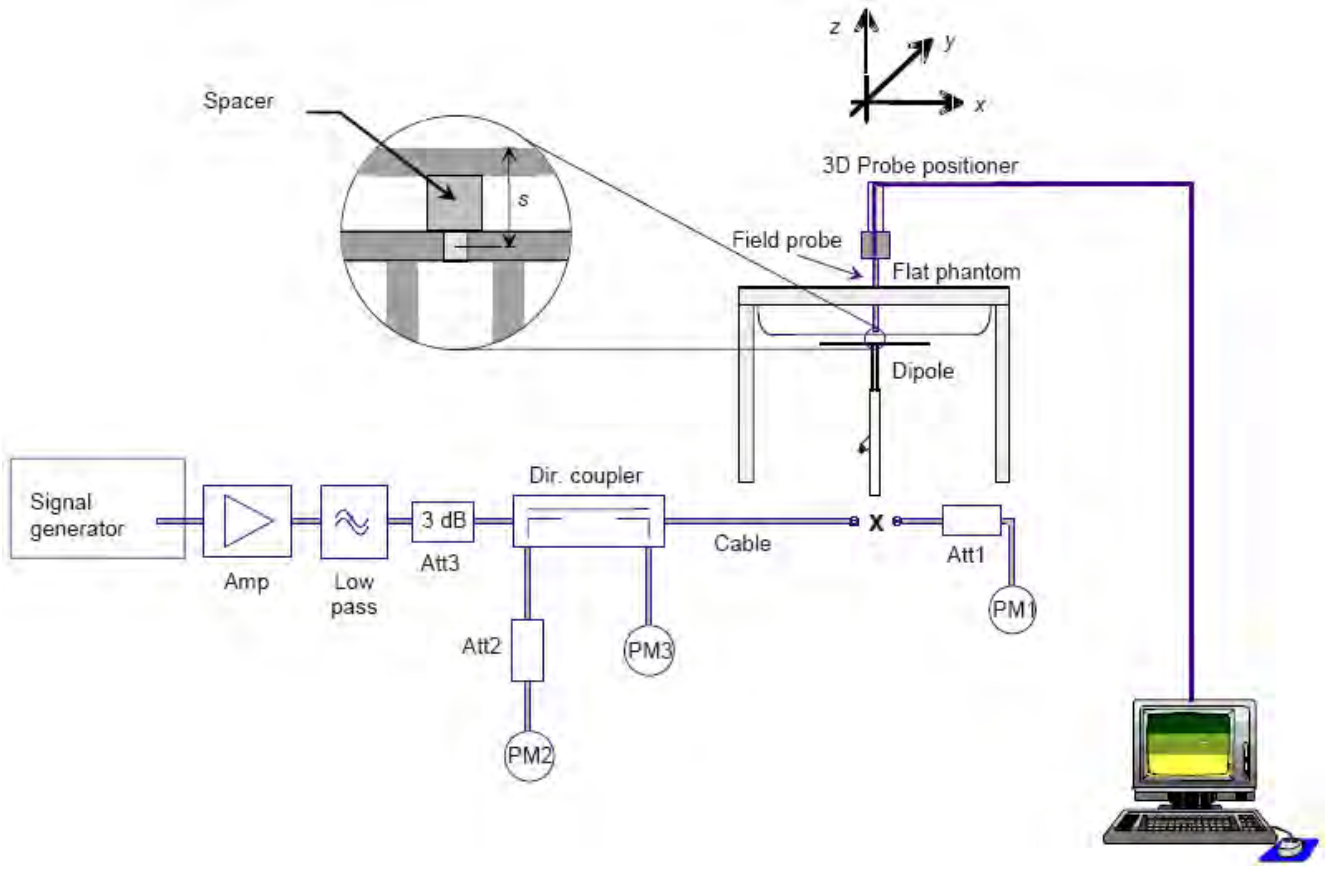
Body 1900	1900	53.30 (50.64~55.96)	1.52 (1.44~1.59)	53.30	1.55	21.6 °C	May 28, 2018
Body 2450	2450	52.70 (50.07~55.33)	1.95 (1.85~2.04)	52.54	1.96	21.3 °C	May 25, 2018
Body 5000	5800	48.20 (43.38~53.02)	6.00 (5.40~6.60)	48.49	6.00	21.5 °C	Jun. 01, 2018

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 ±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) (±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)		
750MHz Body	8.55 (7.69~9.41)	5.75 (5.17~6.33)	8.60	5.92	21.3 °C	Jun. 01, 2018
835MHz Body	9.48 (8.53~10.42)	6.29 (5.66~6.91)	9.72	6.69	21.7 °C	May 31, 2018
1800MHz Body	37.04 (33.34~40.74)	20.26 (18.23~22.29)	36.96	19.81	21.3 °C	May 29, 2018
1900MHz Body	38.43 (34.59~42.27)	20.34 (18.31~22.37)	40.72	19.57	21.6 °C	May 28, 2018
2450MHz Body	49.32 (44.39~54.25)	22.89 (20.60~25.17)	48.14	22.77	21.3 °C	May 25, 2018
5800MHz Body	173.64 (156.28~191.00)	59.29 (53.36~65.22)	179.48	61.43	21.5 °C	Jun. 01, 2018

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 ≥ 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 ≥ 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 ≥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. Tablet host platform exposure conditions

Refer to KDB616217 D04, when the modular approach is used, transmitters and modules must be initially tested for standalone operations in generic host conditions according to the following minimum test separation distance and antenna installation requirements for incorporation in the tablet platform. The separation distance required for incorporation in qualified hosts is described in KDB 447498; item 5) of section 4.1 and item 1) of section 5.2.2 etc.

- ≤ 5 mm between the antenna and user for both back surface and edge exposure conditions
- the antennas used by the host must have been tested for equipment approval or qualify for SAR test exclusion
- the antenna polarization, physical orientation, rotation and installation configurations used by the host must have been tested for compliance or qualify for test exclusion
- when the *SAR Test Exclusion Threshold* in KDB 447498 applies, a *test separation distance* of 5 mm is required to determine test exclusion for the tablet platform

The antennas embedded in tablets are typically ≤ 5mm from the outer housing. The required antenna to user test separation distance is a “not to exceed test” distance required to apply the modular approach. Instead of the typical zero gap tablet edge test requirement between the edge of a tablet and the user, when an antenna has been tested at ≤ 5 mm according to the modular approach it can be incorporated into tablets with at least twice the tested distance from the outer housing of the tablet edge; otherwise, the tablet edge zero gap test requirement applies. When the dedicated host approach is applied, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom.

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)
WCDMA Band V	Rel 99		22.5±1	21.5~23.5	22.96
	HSDPA		22.5±1	21.5~23.5	23.21
	HSUPA		22.5±1	21.5~23.5	23.05
	HSPA+		22.5±1	21.5~23.5	23.05
WCDMA Band IV	Rel 99		22.5±1	21.5~23.5	22.53
	HSDPA		22.5±1	21.5~23.5	22.58
	HSUPA		22.5±1	21.5~23.5	22.59
	HSPA+		22.5±1	21.5~23.5	22.51
WCDMA Band II	Rel 99		22.5±1	21.5~23.5	22.96
	HSDPA		22.5±1	21.5~23.5	23.12
	HSUPA		22.5±1	21.5~23.5	22.92
	HSPA+		22.5±1	21.5~23.5	23.10
LTE Band XII	QPSK		23±1	22~24	23.87
	16QAM		23±1	22~24	23.14
LTE Band IV	QPSK		23±1	22~24	23.81
	16QAM		23±1	22~24	23.22
LTE Band II	QPSK		23±1	22~24	23.88
	16QAM		23±1	22~24	23.02
WLAN 2.4G	802.11b		13±1	12~14	13.5
	802.11g		11±1	10~12	12.0
	802.11n-HT20		11±1	10~12	11.8
	802.11n-HT40		10±1	9~11	10.6
WLAN 5.8G	802.11a		9.5±1	8.5~10.5	10.1
	802.11n-HT20		8.5±1	7.5~9.5	8.8
	802.11n-HT40		9.5±1	8.5~10.5	9.7
	802.11ac-HT20		7.5±1	6.5~8.5	7.7
	802.11ac-HT40		7.5±1	6.5~8.5	7.6
	802.11ac-HT80		6.5±1	5.5~7.5	6.7
Bluetooth	BR+EDR	1M	3.5±1	2.5~4.5	4.37
		2M	0.5±1	-0.5~1.5	1.19
		3M	1.5±1	0.5~2.5	1.62
	BLE		-1.5±1	-2.5~-0.5	-0.67

Note: The data of LTE and WCDMA is reference in the module report of FCC ID: XMR201605EC25A.

7.2. WCDMA Conducted Power

Band	WCDMA Band V			
Tx Channel	Tune-up	4132	4182	4233
Frequency (MHz)		826.4	836.4	846.6
RMC 12.2Kbps	23.50	22.96	22.81	22.87
HSDPA Subtest-1	23.50	23.21	23.18	23.10
HSDPA Subtest-2	23.50	23.02	22.86	22.95
HSDPA Subtest-3	23.50	22.88	22.79	22.85
HSDPA Subtest-4	23.50	22.82	22.73	22.83
HSUPA Subtest-1	23.50	23.03	23.05	23.04
HSUPA Subtest-2	23.50	22.86	22.73	22.69
HSUPA Subtest-3	23.50	22.88	22.72	22.82
HSUPA Subtest-4	23.50	22.82	22.69	22.72
HSUPA Subtest-5	23.50	22.85	22.68	22.76
HSPA+	23.50	23.05	22.54	22.76
Band	WCDMA Band IV			
Tx Channel	Tune-up	1313	1413	1512
Frequency (MHz)		1712.4	1732.6	1752.6
RMC 12.2Kbps	23.50	22.53	22.33	22.40
HSDPA Subtest-1	23.50	22.33	22.42	22.45
HSDPA Subtest-2	23.50	22.52	22.32	22.58
HSDPA Subtest-3	23.50	22.36	22.45	22.58
HSDPA Subtest-4	23.50	22.44	22.53	22.42
HSUPA Subtest-1	23.50	22.35	22.36	22.46
HSUPA Subtest-2	23.50	22.40	22.45	22.40
HSUPA Subtest-3	23.50	22.30	22.32	22.49
HSUPA Subtest-4	23.50	22.41	22.52	22.53
HSUPA Subtest-5	23.50	22.34	22.47	22.59
HSPA+	23.50	22.37	22.44	22.51
Band	WCDMA Band II			
Tx Channel	Tune-up	9262	9400	9538
Frequency (MHz)		1852.4	1880	1907.6
RMC 12.2Kbps	23.50	22.96	22.92	22.92
HSDPA Subtest-1	23.50	23.12	22.81	22.96
HSDPA Subtest-2	23.50	23.03	22.91	22.88
HSDPA Subtest-3	23.50	22.68	22.75	22.84
HSDPA Subtest-4	23.50	22.58	22.77	22.63
HSUPA Subtest-1	23.50	22.77	22.92	22.87
HSUPA Subtest-2	23.50	22.81	22.72	22.65

HSUPA Subtest-3	23.50	22.73	22.53	22.76
HSUPA Subtest-4	23.50	22.89	22.77	22.54
HSUPA Subtest-5	23.50	22.81	22.75	22.57
HSPA+	23.50	23.10	22.83	22.97

Note: The data of WCDMA is reference in the module report of FCC ID: XMR201605EC25A.

7.3. LTE Conducted Power

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		23017/699.7	23095/707.5	23173/715.3
LTE Band XII	1.4MHz	QPSK	1	0	24.00	23.52	23.37	23.29
			1	2	24.00	23.46	23.25	23.35
			1	5	24.00	23.55	23.31	23.30
			3	0	24.00	23.21	22.90	23.04
			3	1	24.00	23.26	22.96	23.07
			3	2	24.00	23.17	22.92	22.99
			6	0	23.00	22.61	22.73	22.12
		16QAM	1	0	23.00	22.83	22.81	22.62
			1	2	23.00	22.77	22.78	22.68
			1	5	23.00	22.75	22.76	22.76
			3	0	23.00	22.31	22.41	22.35
			3	1	23.00	22.36	22.46	22.41
			3	2	23.00	22.57	22.68	22.36
			6	0	23.00	22.30	22.44	22.49
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		23025/700.5	23095/707.5	23165/714.5
LTE Band XII	3MHz	QPSK	1	0	24.00	23.58	23.71	23.41
			1	7	24.00	23.63	23.77	23.36
			1	14	24.00	23.66	23.65	23.44
			8	0	24.00	23.16	23.22	23.04
			8	4	24.00	23.08	23.27	23.06
			8	7	24.00	23.13	23.31	23.12
			15	0	23.00	22.92	22.89	22.62
		16QAM	1	0	24.00	22.88	23.03	22.67
			1	7	24.00	22.91	22.96	22.71
			1	14	24.00	22.94	22.98	22.66

			8	0	23.00	22.39	22.53	22.20
			8	4	23.00	22.35	22.59	22.17
			8	7	23.00	22.40	22.56	22.15
			15	0	23.00	22.47	22.41	22.43
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		23035/701.5	23095/707.5	23155/713.5
LTE Band XII	5MHz	QPSK	1	0	24.00	23.67	23.64	23.61
			1	12	24.00	23.75	23.61	23.69
			1	24	24.00	23.70	23.65	23.66
			12	0	24.00	23.26	23.48	23.28
			12	6	24.00	23.21	23.44	23.19
			12	11	24.00	23.25	23.47	23.24
			25	0	23.00	22.58	22.59	22.41
		16QAM	1	0	24.00	22.89	23.00	22.56
			1	12	24.00	22.81	22.96	22.48
			1	24	24.00	22.84	23.04	22.52
			12	0	23.00	22.44	22.71	22.25
			12	6	23.00	22.49	22.66	22.31
			12	11	23.00	22.41	22.63	22.22
			25	0	23.00	22.39	22.39	22.49
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		23060/704	23095/707.5	23130/711
LTE Band XII	10MHz	QPSK	1	0	24.00	23.52	23.84	23.43
			1	24	24.00	23.47	23.82	23.51
			1	49	24.00	23.56	23.87	23.46
			25	0	24.00	23.20	23.40	22.99
			25	12	24.00	23.22	23.48	22.92
			25	24	24.00	23.16	23.41	22.95
			50	0	23.00	22.49	22.70	22.28
		16QAM	1	0	24.00	22.96	23.09	22.73
			1	24	24.00	23.03	23.14	22.65
			1	49	24.00	22.99	23.10	22.69
			25	0	23.00	22.56	22.74	22.26
			25	12	23.00	22.50	22.79	22.30
			25	24	23.00	22.53	22.71	22.24
			50	0	23.00	22.42	22.46	22.44

Note: The data of LTE Band XII is reference in the module report of FCC ID: XMR201605EC25A.

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	23.74	23.67	23.78
			1	2	24.00	23.71	23.61	23.81
			1	5	24.00	23.67	23.63	23.75
			3	0	24.00	23.49	23.47	23.64
			3	1	24.00	23.53	23.40	23.47
			3	2	24.00	23.45	23.45	23.55
			6	0	23.00	22.75	22.50	22.81
		16QAM	1	0	24.00	23.07	23.02	23.14
			1	2	24.00	23.15	22.95	23.22
			1	5	24.00	23.20	22.99	23.16
			3	0	23.00	22.70	22.56	22.73
			3	1	23.00	22.67	22.60	22.68
			3	2	23.00	22.74	22.58	22.75
			6	0	23.00	22.21	22.06	22.17
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	23.65	23.48	23.74
			1	7	24.00	23.63	23.45	23.67
			1	14	24.00	23.72	23.49	23.72
			8	0	24.00	23.31	23.22	23.41
			8	4	24.00	23.35	23.14	23.35
			8	7	24.00	23.40	23.10	23.32
			15	0	23.00	22.64	22.47	22.88
		16QAM	1	0	24.00	22.96	22.91	23.02
			1	7	24.00	22.92	22.86	22.97
			1	14	24.00	22.88	22.90	23.05
			8	0	23.00	22.54	22.54	22.75
			8	4	23.00	22.58	22.42	22.66
			8	7	23.00	22.62	22.50	22.80
			15	0	23.00	22.43	22.41	22.48
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	23.69	23.20	23.51
			1	12	24.00	23.67	23.14	23.44
			1	24	24.00	23.74	23.16	23.49
			12	0	24.00	23.36	22.83	23.07
			12	6	24.00	23.32	22.79	23.22
			12	11	24.00	23.27	22.77	23.15
			25	0	23.00	22.52	22.39	22.70
		16QAM	1	0	24.00	23.01	22.80	22.97
			1	12	24.00	23.04	22.83	22.92
			1	24	24.00	22.97	22.89	22.95
			12	0	23.00	22.70	22.45	22.58
			12	6	23.00	22.62	22.43	22.56
			12	11	23.00	22.64	22.36	22.63
			25	0	23.00	22.47	22.45	22.06
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	23.67	23.33	23.55
			1	24	24.00	23.63	23.39	23.47
			1	49	24.00	23.72	23.45	23.54
			25	0	24.00	23.27	22.96	23.17
			25	12	24.00	23.21	22.84	23.24
			25	24	24.00	23.18	22.93	23.20
			50	0	23.00	22.62	22.54	22.73
		16QAM	1	0	23.00	22.89	22.81	22.92
			1	24	23.00	22.82	22.75	22.90
			1	49	23.00	22.86	22.78	22.97
			25	0	23.00	22.59	22.47	22.60
			25	12	23.00	22.64	22.55	22.65
			25	24	23.00	22.65	22.48	22.69
			50	0	23.00	22.44	22.48	22.45
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20025/1717.5	20175/1732.5	20325/1747.5
LTE Band	15MHz	QPSK	1	0	24.00	23.64	23.32	23.61
			1	37	24.00	23.71	23.39	23.67

IV			1	74	24.00	23.68	23.27	23.55
			36	0	24.00	23.27	22.97	23.28
			36	18	24.00	23.33	22.93	23.33
			36	37	24.00	23.24	22.88	23.31
			75	0	23.00	22.47	22.15	22.61
		16QAM	1	0	23.00	22.84	22.68	22.86
			1	37	23.00	22.79	22.74	22.73
			1	74	23.00	22.72	22.66	22.79
			36	0	23.00	22.43	22.24	22.44
			36	18	23.00	22.47	22.20	22.42
			36	37	23.00	22.40	22.28	22.51
			75	0	23.00	22.53	22.56	22.53

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20050/1720	20175/1732.5	20300/1745
LTE Band IV	20MHz	QPSK	1	0	24.00	23.46	22.98	23.26
			1	49	24.00	23.50	22.92	23.20
			1	99	24.00	23.44	22.96	23.14
			50	0	24.00	23.03	22.60	22.85
			50	24	24.00	22.98	22.54	22.82
			50	49	24.00	23.07	22.48	22.77
			100	0	23.00	22.34	22.00	22.27
		16QAM	1	0	24.00	22.95	22.82	23.01
			1	49	24.00	22.92	22.77	22.98
			1	99	24.00	22.99	22.85	22.92
			50	0	23.00	22.73	22.40	22.52
			50	24	23.00	22.66	22.35	22.54
			50	49	23.00	22.79	22.38	22.60
			100	0	23.00	22.47	22.44	22.45

Note: The data of LTE Band IV is reference in the module report of FCC ID: XMR201605EC25A.

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18607/1850.7	18900/1880	19193/1909.3
LTE Band II	1.4MHz	QPSK	1	0	24.00	23.55	23.84	23.62
			1	2	24.00	23.48	23.76	23.56
			1	5	24.00	23.59	23.78	23.69
			3	0	24.00	23.33	23.43	23.37

			3	1	24.00	23.27	23.49	23.30
			3	2	24.00	23.21	23.38	23.26
			6	0	23.00	22.73	22.74	22.58
		16QAM	1	0	24.00	23.02	22.66	22.94
			1	2	24.00	22.93	22.60	22.87
			1	5	24.00	22.97	22.57	22.81
			3	0	23.00	22.57	22.34	22.46
			3	1	23.00	22.63	22.42	22.55
			3	2	23.00	22.61	22.37	22.51
			6	0	23.00	22.58	22.54	22.55

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	23.74	23.80	23.87
			1	7	24.00	23.79	23.69	23.82
			1	14	24.00	23.75	23.66	23.84
			8	0	24.00	23.39	23.33	23.40
			8	4	24.00	23.44	23.37	23.34
			8	7	24.00	23.38	23.40	23.38
			15	0	23.00	22.80	22.67	22.79
		16QAM	1	0	23.00	22.98	22.78	22.90
			1	7	23.00	22.92	22.61	22.85
			1	14	23.00	22.94	22.68	22.99
			8	0	23.00	22.63	22.64	22.44
			8	4	23.00	22.62	22.59	22.51
			8	7	23.00	22.55	22.62	22.48
			15	0	23.00	22.00	22.56	22.93

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	23.75	23.81	23.67
			1	12	24.00	23.80	23.73	23.63
			1	24	24.00	23.67	23.79	23.69
			12	0	24.00	23.38	23.42	23.46
			12	6	24.00	23.41	23.37	23.33
			12	11	24.00	23.34	23.29	23.39
			25	0	23.00	22.69	22.85	22.67
		16QAM	1	0	23.00	22.79	22.78	22.46

			1	12	23.00	22.72	22.80	22.49
			1	24	23.00	22.78	22.82	22.53
			12	0	23.00	22.48	22.46	22.22
			12	6	23.00	22.37	22.43	22.28
			12	11	23.00	22.43	22.38	22.26
			25	0	22.00	21.97	21.94	21.85
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18650/1855	18900/1880	19150/1905
LTE Band II	10MHz	QPSK	1	0	24.00	23.72	23.88	23.72
			1	24	24.00	23.66	23.69	23.80
			1	49	24.00	23.69	23.77	23.69
			25	0	24.00	23.47	23.55	23.48
			25	12	24.00	23.49	23.58	23.47
			25	24	24.00	23.55	23.52	23.50
			50	0	23.00	22.72	22.86	22.84
		16QAM	1	0	23.00	22.78	22.62	22.56
			1	24	23.00	22.83	22.51	22.48
			1	49	23.00	22.77	22.47	22.63
			25	0	23.00	22.58	22.32	22.28
			25	12	23.00	22.46	22.29	22.20
			25	24	23.00	22.33	22.36	22.29
			50	0	23.00	22.44	22.49	22.11
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	23.71	23.72	23.65
			1	37	24.00	23.60	23.69	23.62
			1	74	24.00	23.66	23.64	23.69
			36	0	24.00	23.40	23.31	23.26
			36	18	24.00	23.31	23.36	23.20
			36	37	24.00	23.38	23.32	23.27
			75	0	23.00	22.78	22.92	22.81
		16QAM	1	0	23.00	22.60	22.73	22.58
			1	37	23.00	22.65	22.77	22.51
			1	74	23.00	22.71	22.79	22.57
			36	0	23.00	22.26	22.45	22.29
			36	18	23.00	22.19	22.49	22.21

			36	37	23.00	22.13	22.43	22.18
			75	0	23.00	22.42	22.60	22.56
Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18700/1860	18900/1880	19100/1900
LTE Band II	20MHz	QPSK	1	0	24.00	23.57	23.71	23.60
			1	49	24.00	23.62	23.59	23.55
			1	99	24.00	23.64	23.68	23.69
			50	0	24.00	23.39	23.38	23.48
			50	24	24.00	23.28	23.33	23.40
			50	49	24.00	23.32	23.39	23.41
			100	0	23.00	22.91	22.97	22.60
		16QAM	1	0	23.00	22.69	22.62	22.85
			1	49	23.00	22.64	22.61	22.81
			1	99	23.00	22.62	22.58	22.78
			50	0	23.00	22.27	22.32	22.46
			50	24	23.00	22.30	22.27	22.42
			50	49	23.00	22.34	22.30	22.39
			100	0	23.00	22.37	22.28	22.33

Note: The data of LTE Band II is reference in the module report of FCC ID: XMR201605EC25A.

7.4. WLAN Output Power

Mode	Channel	Frequency (MHz)	Tune-up	Output Power (dBm)
802.11b	1	2412	14.0	13.5
	6	2437	14.0	13.5
	11	2462	14.0	13.4
802.11g	1	2412	12.0	11.9
	6	2437	12.0	12.0
	11	2462	12.0	12.0
802.11n (HT20)	1	2412	12.0	11.6
	6	2437	12.0	11.7
	11	2462	12.0	11.8
802.11n (HT40)	3	2422	11.0	10.6
	6	2437	11.0	10.6
	9	2452	11.0	10.5
802.11a	149	5745	10.5	10.1
	157	5785	10.5	9.9
	165	5825	10.5	9.8
802.11n	149	5745	9.5	8.8

(20M)	157	5785	9.5	8.7
	165	5825	9.5	8.6
802.11n (40M)	151	5755	10.5	9.7
	159	5795	10.5	9.5
802.11ac (20M)	149	5745	8.5	7.7
	157	5785	8.5	7.5
	165	5825	8.5	7.2
802.11ac (40M)	151	5755	8.5	7.6
	159	5795	8.5	7.4
802.11ac (80M)	155	5775	7.5	6.7

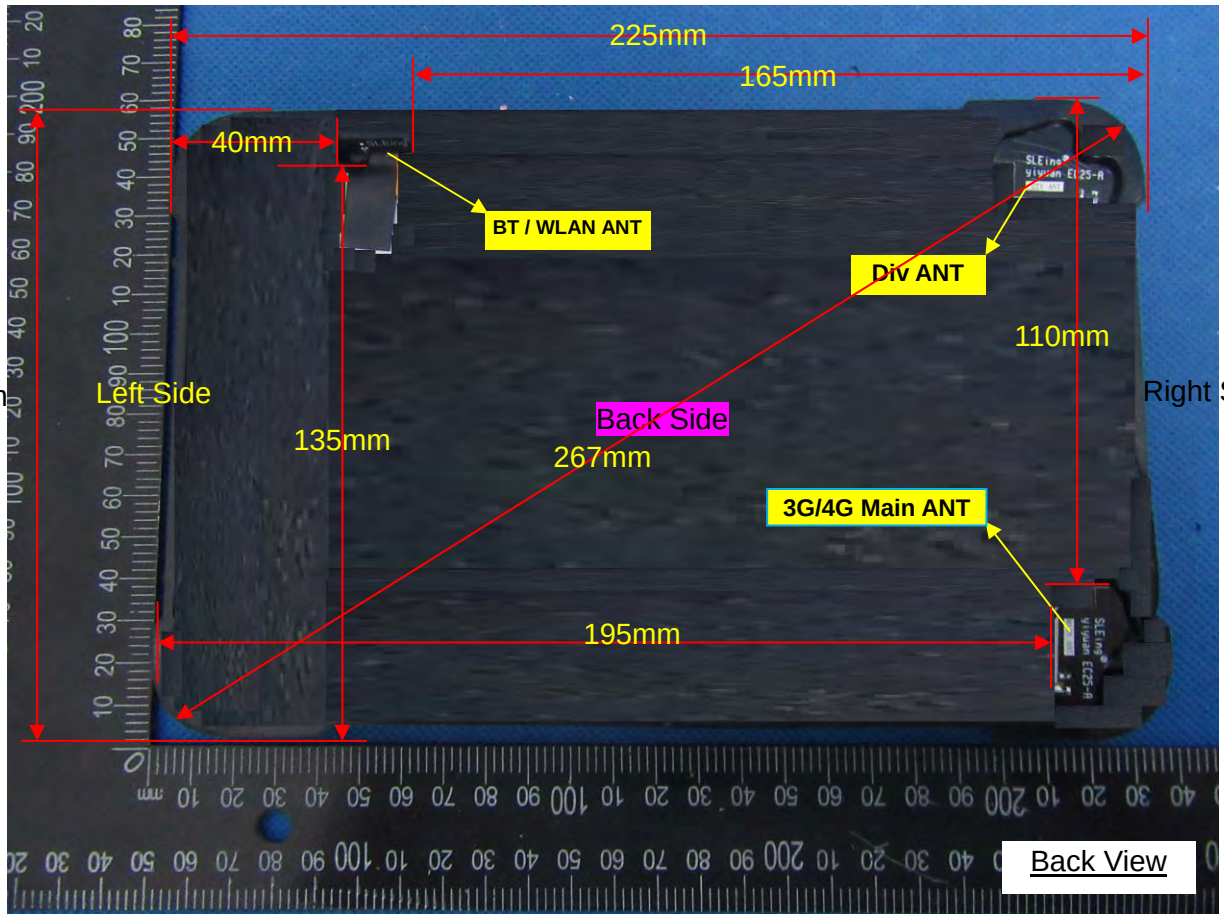
7.5. Bluetooth Output Power

	Data Rates	Output Power (dBm)			
		Tune-up	Channel		
			0	39	78
BR+EDR	1M	4.50	3.81	4.28	4.37
	2M	1.50	0.82	1.19	1.02
	3M	2.50	1.22	1.62	1.45

	Channel	Tune-up	Output Power (dBm)
BLE	0	-0.50	-2.07
	19	-0.50	-0.67
	39	-0.50	-2.03

8. Antenna Location

Bottom Side



Top Side

Distance of the Antenna to the EUT surface/edge						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
3G&4G Main ANT	10mm	5mm	195mm	5mm	5mm	110mm
Bluetooth & WLAN ANT	10mm	5mm	40mm	165mm	135mm	5mm

Positions for SAR tests		
Test separation distances ≤ 50 mm		
Exposure Positions	Tune-up Maximum power of WCDMA Band V	
	23.5dBm	
Front Side	Antenna to user(mm)	10
	SAR exclusion threshold	21
	SAR testing required?	**YES**
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	41
	SAR testing required?	**YES**
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	41
	SAR testing required?	**YES**
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	41
	SAR testing required?	**YES**
Exposure Positions	Tune-up Maximum power of WCDMA Band IV	
	23.5dBm	
Front Side	Antenna to user(mm)	10
	SAR exclusion threshold	30
	SAR testing required?	**YES**
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	59
	SAR testing required?	**YES**
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	59
	SAR testing required?	**YES**
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	59
	SAR testing required?	**YES**
Exposure Positions	Tune-up Maximum power of WCDMA Band II	
	23.5dBm	
Front Side	Antenna to user(mm)	10
	SAR exclusion threshold	31
	SAR testing required?	**YES**
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	62
	SAR testing required?	**YES**
Right Side	Antenna to user(mm)	5

	SAR exclusion threshold	62
	SAR testing required?	**YES**
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	62
	SAR testing required?	**YES**
Exposure Positions	Tune-up Maximum power of LTE Band XII	
	24dBm	
Front Side	Antenna to user(mm)	10
	SAR exclusion threshold	21
	SAR testing required?	**YES**
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	42
	SAR testing required?	**YES**
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	42
	SAR testing required?	**YES**
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	42
	SAR testing required?	**YES**
Exposure Positions	Tune-up Maximum power of LTE Band IV	
	24dBm	
Front Side	Antenna to user(mm)	10
	SAR exclusion threshold	33
	SAR testing required?	**YES**
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	67
	SAR testing required?	**YES**
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	67
	SAR testing required?	**YES**
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	67
	SAR testing required?	**YES**
Exposure Positions	Tune-up Maximum power of LTE Band II	
	24dBm	
Front Side	Antenna to user(mm)	10
	SAR exclusion threshold	35
	SAR testing required?	**YES**
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	69

	SAR testing required?	**YES**
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	69
	SAR testing required?	**YES**
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	69
	SAR testing required?	**YES**
Exposure Positions	Tune-up Maximum power of WLAN 2.4G	
	14dBm	
Front Side	Antenna to user(mm)	10
	SAR exclusion threshold	4
	SAR testing required?	**YES**
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	8
	SAR testing required?	**YES**
Left Side	Antenna to user(mm)	40
	SAR exclusion threshold	1
	SAR testing required?	**NO**
Bottom Side	Antenna to user(mm)	5
	SAR exclusion threshold	8
	SAR testing required?	**YES**
Exposure Positions	Tune-up Maximum power of WLAN 5.8G	
	10.5dBm	
Front Side	Antenna to user(mm)	10
	SAR exclusion threshold	3
	SAR testing required?	**YES**
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	5
	SAR testing required?	**YES**
Left Side	Antenna to user(mm)	40
	SAR exclusion threshold	1
	SAR testing required?	**NO**
Bottom Side	Antenna to user(mm)	5
	SAR exclusion threshold	5
	SAR testing required?	**YES**

NOTE: Refer to section 4.3.1 of KDB 447498 D01.

Positions for SAR tests		
Test separation distances > 50 mm		
Exposure Positions	Tune-up Maximum power of WCDMA Band V	
	23.5dBm	224mW
Left Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	957
	SAR testing required?	**NO**
Bottom Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	489
	SAR testing required?	**NO**
Exposure Positions	Tune-up Maximum power of WCDMA Band IV	
	23.5dBm	224mW
Left Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	1559
	SAR testing required?	**NO**
Bottom Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	709
	SAR testing required?	**NO**
Exposure Positions	Tune-up Maximum power of WCDMA Band II	
	23.5dBm	224mW
Left Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	1559
	SAR testing required?	**NO**
Bottom Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	709
	SAR testing required?	**NO**
Exposure Positions	Tune-up Maximum power of LTE Band XII	
	24dBm	251mW
Left Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	834
	SAR testing required?	**NO**
Bottom Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	438
	SAR testing required?	**NO**
Exposure Positions	Tune-up Maximum power of LTE Band IV	
	24dBm	251mW
Left Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	1559
	SAR testing required?	**NO**

Bottom Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	709
	SAR testing required?	**NO**
Exposure Positions	Tune-up Maximum power of LTE Band II	
	24dBm	251mW
Left Side	Antenna to user(mm)	195
	SAR exclusion threshold(mW)	1559
	SAR testing required?	**NO**
Bottom Side	Antenna to user(mm)	110
	SAR exclusion threshold(mW)	709
	SAR testing required?	**NO**
Exposure Positions	Tune-up Maximum power of WLAN 2.4G	
	14dBm	25mW
Right Side	Antenna to user(mm)	165
	SAR exclusion threshold(mW)	1246
	SAR testing required?	**NO**
Top Side	Antenna to user(mm)	135
	SAR exclusion threshold(mW)	946
	SAR testing required?	**NO**
Exposure Positions	Tune-up Maximum power of WLAN 5.8G	
	10.5dBm	11mW
Right Side	Antenna to user(mm)	165
	SAR exclusion threshold(mW)	1212
	SAR testing required?	**NO**
Top Side	Antenna to user(mm)	135
	SAR exclusion threshold(mW)	912
	SAR testing required?	**NO**

NOTE: Refer to section 4.3.1 of KDB 447498 D01.

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 ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[$\sqrt{f_{(GHZ)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

- $f_{(GHZ)}$ 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_{max} (dBm)	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
Bluetooth	4.5	2.82	5	2.480	0.89	3.0	Yes

NOTE: Standalone SAR test exclusion for Bluetooth

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] * [$\sqrt{f_{(GHZ)}}$/x] W/kg for test separation distances ≤ 50mm, 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_{max} (dBm)	P_{max} (mW)	Distance (mm)	f (GHz)	x	Estimated SAR (W/Kg)
Bluetooth	Body	4.5	2.82	5	2.480	7.5	0.118

NOTE: Estimated SAR calculation for Bluetooth

10. SAR Results

10.1. SAR measurement results

10.1.1. SAR measurement Result of WCDMA Band V

Test Position of Body with 0mm	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	0.287	0.157	0.22	22.81	23.50	0.336
Back Side	4182/836.4	RMC12.2K	0.682	0.370	-2.80	22.81	23.50	0.799
Right Side	4182/836.4	RMC12.2K	0.095	0.047	-1.15	22.81	23.50	0.111
Top Side	4182/836.4	RMC12.2K	0.112	0.054	0.58	22.81	23.50	0.131

NOTE: Body SAR test results of WCDMA Band V

10.1.2. SAR measurement Result of WCDMA Band IV

Test Position of Body with 0mm	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	1413/1732.6	RMC12.2K	0.462	0.286	-2.13	22.33	23.50	0.605
Back Side	1413/1732.6	RMC12.2K	0.847	0.567	1.36	22.33	23.50	1.109
Right Side	1413/1732.6	RMC12.2K	0.357	0.204	1.17	22.33	23.50	0.467
Top Side	1413/1732.6	RMC12.2K	0.347	0.216	-2.70	22.33	23.50	0.454
Back Side	1312/1712.4	RMC12.2K	0.822	0.566	-1.41	22.53	23.50	1.028
Back Side	1513/1752.6	RMC12.2K	0.897	0.622	-1.78	22.40	23.50	1.156
Back Side - Repeated	1513/1752.6	RMC12.2K	0.896	0.623	-0.25	22.40	23.50	1.154

NOTE: Body SAR test results of WCDMA Band IV

10.1.3. SAR measurement Result of WCDMA Band II

Test Position of Body with 0mm	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	0.671	0.372	1.41	22.92	23.50	0.767
Back Side	9400/1880	RMC12.2K	0.767	0.377	-1.72	22.92	23.50	0.877
Right Side	9400/1880	RMC12.2K	0.315	0.204	-2.34	22.92	23.50	0.360
Top Side	9400/1880	RMC12.2K	0.266	0.152	0.97	22.92	23.50	0.304
Back Side	9262/1852.4	RMC12.2K	1.007	0.535	3.10	22.96	23.50	1.140
Back Side - Repeated	9262/1852.4	RMC12.2K	0.986	0.517	2.13	22.96	23.50	1.117
Back Side	9538/1907.6	RMC12.2K	0.766	0.366	-0.03	22.92	23.50	0.875

NOTE: Body SAR test results of WCDMA Band II

10.1.4. SAR measurement Result of LTE Band XII

Test Position of Body with 0mm	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	23095/707.5	10M QPSK(1,49)	0.341	0.205	-1.60	23.87	24.00	0.351
Back Side	23095/707.5	10M QPSK(1,49)	0.828	0.448	1.31	23.87	24.00	0.853
Right Side	23095/707.5	10M QPSK(1,49)	0.286	0.157	0.51	23.87	24.00	0.295
Top Side	23095/707.5	10M QPSK(1,49)	0.153	0.082	2.30	23.87	24.00	0.158
Back Side	23060/704	10M QPSK(1,49)	0.797	0.428	-0.72	23.56	24.00	0.882
Back Side	23130/711	10M QPSK(1,49)	0.887	0.464	-0.54	23.46	24.00	1.004
Back Side - Repeated	23130/711	10M QPSK(1,49)	0.861	0.458	1.13	23.46	24.00	0.975
50%RB								
Front Side	23095/707.5	10M QPSK(25,12)	0.284	0.176	1.10	23.48	24.00	0.320
Back Side	23095/707.5	10M QPSK(25,12)	0.658	0.386	0.59	23.48	24.00	0.742
Right Side	23095/707.5	10M QPSK(25,12)	0.189	0.110	2.06	23.48	24.00	0.213
Top Side	23095/707.5	10M QPSK(25,12)	0.115	0.075	0.57	23.48	24.00	0.130
100%RB								
Back Side	23095/707.5	10M QPSK(50,0)	0.511	0.282	0.13	22.70	23.00	0.548

NOTE: Body SAR test results of LTE Band XII

10.1.5. SAR measurement Result of LTE Band IV

Test Position of Body with 0mm	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(1,49)	0.430	0.240	1.13	23.50	24.00	0.482
Back Side	20050/1720	20M QPSK(1,49)	0.758	0.410	2.80	23.50	24.00	0.850
Right Side	20050/1720	20M QPSK(1,49)	0.264	0.153	1.10	23.50	24.00	0.296
Top Side	20050/1720	20M QPSK(1,49)	0.176	0.084	-2.10	23.50	24.00	0.197
Back Side	20175/1732.	20M QPSK(1,49)	0.634	0.365	-0.46	22.92	24.00	0.813

	5							
Back Side	20300/1745	20M QPSK(1,49)	0.864	0.453	0.11	23.20	24.00	1.039
Back Side - Repeated	20300/1745	20M QPSK(1,49)	0.834	0.426	-1.54	23.20	24.00	1.003
50%RB								
Front Side	20050/1720	20M QPSK(50,49)	0.384	0.225	1.13	23.07	24.00	0.476
Back Side	20050/1720	20M QPSK(50,49)	0.695	0.341	-1.08	23.07	24.00	0.861
Right Side	20050/1720	20M QPSK(50,49)	0.186	0.095	2.13	23.07	24.00	0.230
Top Side	20050/1720	20M QPSK(50,49)	0.123	0.075	-1.56	23.07	24.00	0.152
Back Side	20175/1732.5	20M QPSK(50,49)	0.654	0.375	1.97	22.48	24.00	0.928
Back Side	20300/1745	20M QPSK(50,49)	0.583	0.351	-0.22	22.77	24.00	0.774
100%RB								
Back Side	20175/1732.5	20M QPSK(100,0)	0.615	0.289	-2.00	22.00	23.00	0.774

NOTE: Body SAR test results of LTE Band IV

10.1.6. SAR measurement Result of LTE Band II

Test Position of Body with 0mm	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	18900/1880	20M QPSK(1,0)	0.372	0.196	2.13	23.71	24.00	0.398
Back Side	18900/1880	20M QPSK(1,0)	0.766	0.376	-1.26	23.71	24.00	0.819
Right Side	18900/1880	20M QPSK(1,0)	0.182	0.113	-1.95	23.71	24.00	0.195
Top Side	18900/1880	20M QPSK(1,0)	0.089	0.057	-1.30	23.71	24.00	0.095
Back Side	18700/1860	20M QPSK(1,0)	0.818	0.408	-2.87	23.57	24.00	0.903
Back Side - Repeated	18700/1860	20M QPSK(1,0)	0.804	0.405	-1.14	23.57	24.00	0.888
Back Side	19100/1900	20M QPSK(1,0)	0.613	0.306	-0.74	23.60	24.00	0.672
50%RB								
Front Side	18900/1880	20M QPSK(50,0)	0.220	0.135	-1.94	23.38	24.00	0.254
Back Side	18900/1880	20M QPSK(50,0)	0.537	0.274	0.32	23.38	24.00	0.619
Right Side	18900/1880	20M QPSK(50,0)	0.095	0.057	1.13	23.38	24.00	0.110

Top Side	18900/1880	20M QPSK(50,0)	0.076	0.040	-3.80	23.38	24.00	0.088
100%RB								
Back Side	18900/1880	20M QPSK(100,0)	0.724	0.352	-1.43	22.97	23.00	0.729

NOTE: Body SAR test results of LTE Band II

10.1.7. SAR measurement Result of WLAN 2.4G

Test Position of Body with 0mm	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	6/2437	802.11b	0.209	0.104	-3.40	13.5	14.0	0.235
Back Side	6/2437	802.11b	0.273	0.151	-0.03	13.5	14.0	0.306
Bottom Side	6/2437	802.11b	0.334	0.159	-0.36	13.5	14.0	0.375

NOTE: Body SAR test results of WLAN 2.4G

10.1.8. SAR measurement Result of WLAN 5.8G

Test Position of Body with 0mm	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	157/5785	802.11a	0.100	0.051	-1.32	9.9	10.5	0.115
Back Side	157/5785	802.11a	0.281	0.153	-2.35	9.9	10.5	0.323
Bottom Side	157/5785	802.11a	0.306	0.119	-4.47	9.9	10.5	0.351

NOTE: Body SAR test results of WLAN 5.8G

10.2. Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities of this device are as below:

No.	Configuration	Body	Note
1	WCDMA(data) + WLAN 2.4GHz(data)	Yes	2.4GHz Hotspot
2	LTE(data) + WLAN 2.4GHz(data)	Yes	2.4GHz Hotspot

NOTE:

1) This device WLAN 2.4GHz supports Hotspot operation.
2) This device WLAN 5.8GHz not supports Hotspot operation.
3) This device Bluetooth not supports Bluetooth Tethering operation.

10.3. SAR Summation Scenario

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

1) Scalar SAR summation < 1.6W/kg.
2) SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (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 ≤ 0.04, simultaneously transmission SAR measurement is not necessary.

Test Position		Scaled SAR_{MAX}		∑1-g SAR (W/Kg)	SPLSR	Remark
		WCDMA Band V	WLAN 2.4G			
Body	Front Side	0.336	0.235	0.571	N/A	N/A
	Back Side	0.799	0.306	1.106	N/A	N/A
	Right Side	0.111	N/A	0.111	N/A	N/A
	Top Side	0.131	N/A	0.131	N/A	N/A
	Bottom Side	N/A	0.375	0.375	N/A	N/A

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

Test Position		Scaled SAR_{MAX}		∑1-g SAR (W/Kg)	SPLSR	Remark
		WCDMA Band IV	WLAN 2.4G			
Body	Front Side	0.605	0.235	0.839	N/A	N/A
	Back Side	1.156	0.306	1.462	N/A	N/A
	Right Side	0.467	N/A	0.467	N/A	N/A
	Top Side	0.454	N/A	0.454	N/A	N/A
	Bottom Side	N/A	0.375	0.375	N/A	N/A

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

Test Position		Scaled SAR_{MAX}		∑1-g SAR (W/Kg)	SPLSR	Remark
		WCDMA Band II	WLAN 2.4G			
Head	Front Side	0.767	0.235	1.001	N/A	N/A
	Back Side	1.140	0.306	1.447	N/A	N/A
	Right Side	0.360	N/A	0.360	N/A	N/A
	Top Side	0.304	N/A	0.304	N/A	N/A
	Bottom Side	N/A	0.375	0.375	N/A	N/A

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

Test Position		Scaled SAR_{MAX}		∑1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band XII	WLAN 2.4G			
Head	Front Side	0.351	0.235	0.586	N/A	N/A
	Back Side	1.004	0.306	1.311	N/A	N/A
	Right Side	0.295	N/A	0.295	N/A	N/A
	Top Side	0.158	N/A	0.158	N/A	N/A
	Bottom Side	N/A	0.375	0.375	N/A	N/A

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

Test Position		Scaled SAR_{MAX}		∑1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band IV	WLAN 2.4G			
Head	Front Side	0.482	0.235	0.717	N/A	N/A
	Back Side	1.039	0.306	1.345	N/A	N/A
	Right Side	0.296	N/A	0.296	N/A	N/A
	Top Side	0.197	N/A	0.197	N/A	N/A
	Bottom Side	N/A	0.375	0.375	N/A	N/A

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

Test Position		Scaled SAR_{MAX}		∑1-g SAR (W/Kg)	SPLSR	Remark
		LTE Band II	WLAN 2.4G			
Head	Front Side	0.398	0.235	0.633	N/A	N/A
	Back Side	0.903	0.306	1.209	N/A	N/A
	Right Side	0.195	N/A	0.195	N/A	N/A
	Top Side	0.095	N/A	0.095	N/A	N/A
	Bottom Side	N/A	0.375	0.375	N/A	N/A

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

11. Appendix A. Photo documentation

Refer to appendix Test Setup photo---SAR

12. Appendix B. System Check Plots

Table of contents
MEASUREMENT 1 - System Performance Check - 750MHz
MEASUREMENT 2 - System Performance Check - 835MHz
MEASUREMENT 3 - System Performance Check - 1800MHz
MEASUREMENT 4 - System Performance Check - 1900MHz
MEASUREMENT 5 - System Performance Check - 2450MHz
MEASUREMENT 6 - System Performance Check - 5800MHz

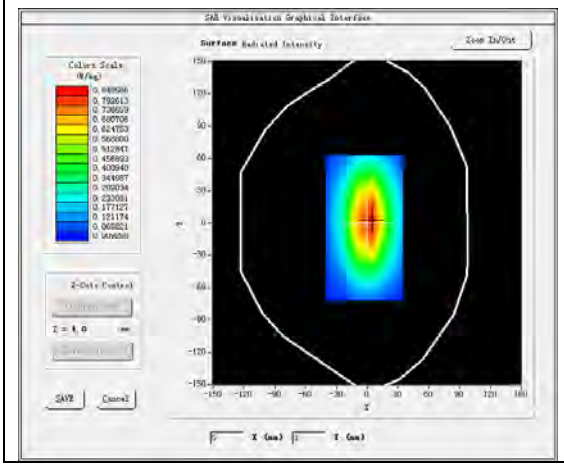
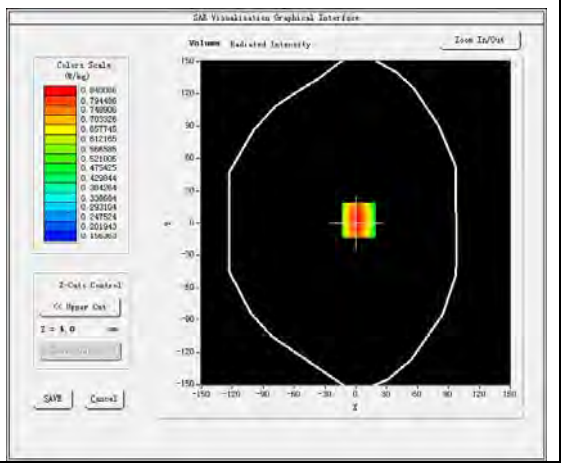
MEASUREMENT 1

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Dipole
Band	CW750
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. SAR Measurement Results

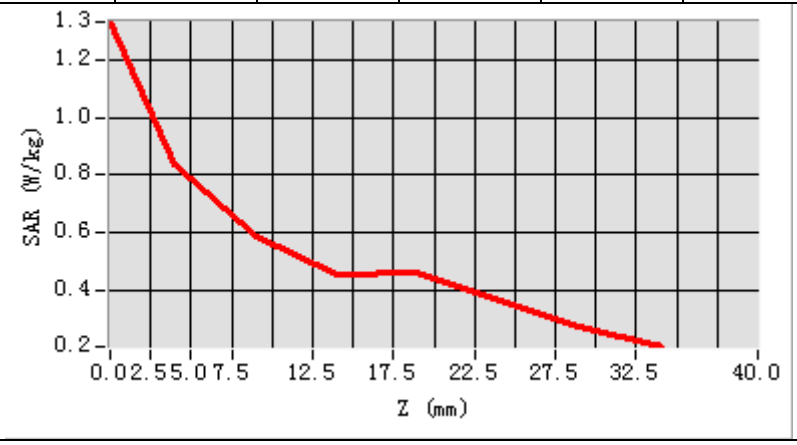
Frequency (MHz)	750.000000
Relative permittivity (real part)	55.330000
Relative permittivity (imaginary part)	19.400000
Conductivity (S/m)	0.979944
Variation (%)	0.120001

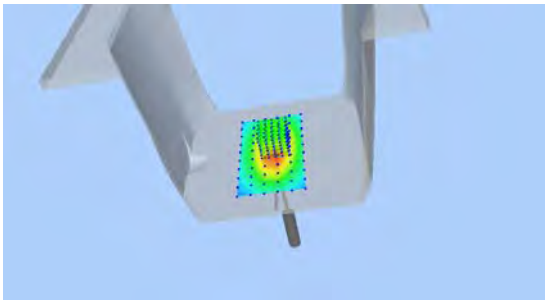
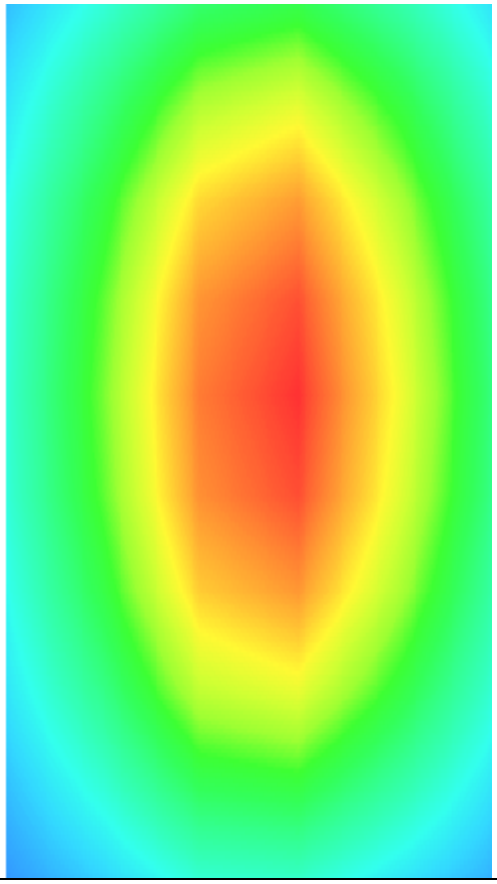
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=3.00, Y=3.00
SAR Peak: 1.31 W/kg

SAR 10g (W/Kg)	0.592068
SAR 1g (W/Kg)	0.860348

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.3350	0.8401	0.5836	0.4510	0.4630	0.3621	0.2705



3D screen shot	Hot spot position
	

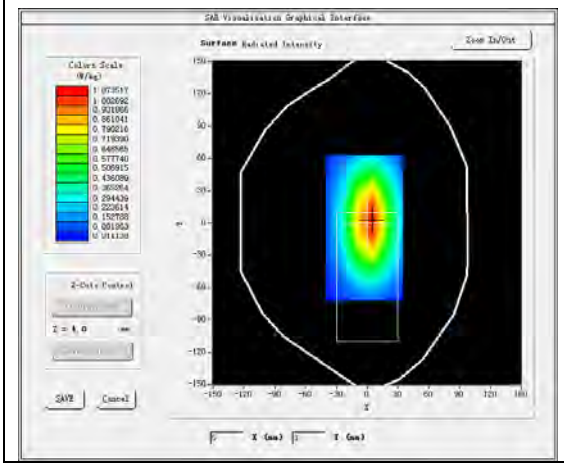
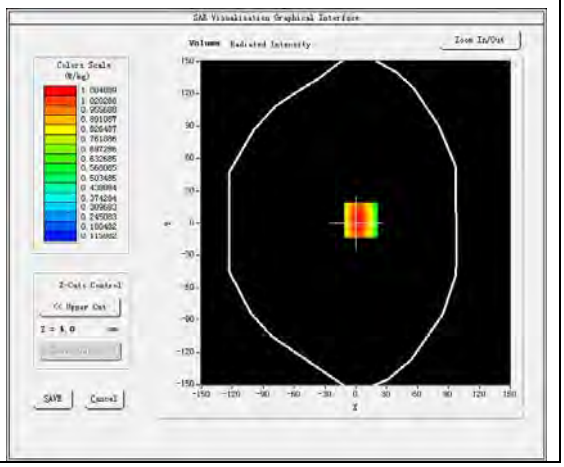
MEASUREMENT 2

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Dipole
Band	CW835
Channels	Low
Signal	CW (Crest factor: 1.0)

B. SAR Measurement Results

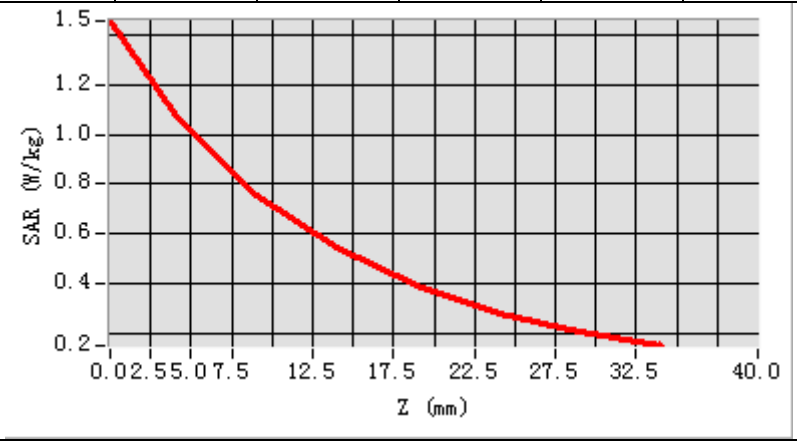
Frequency (MHz)	835.000000
Relative permittivity (real part)	55.140000
Relative permittivity (imaginary part)	19.400000
Conductivity (S/m)	0.969944
Variation (%)	1.670000

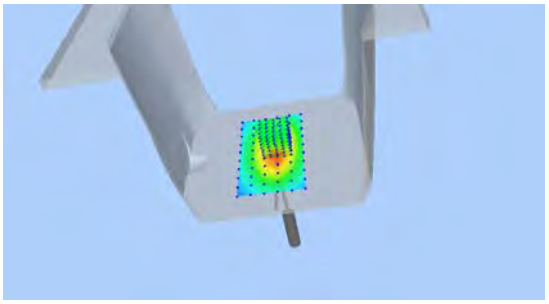
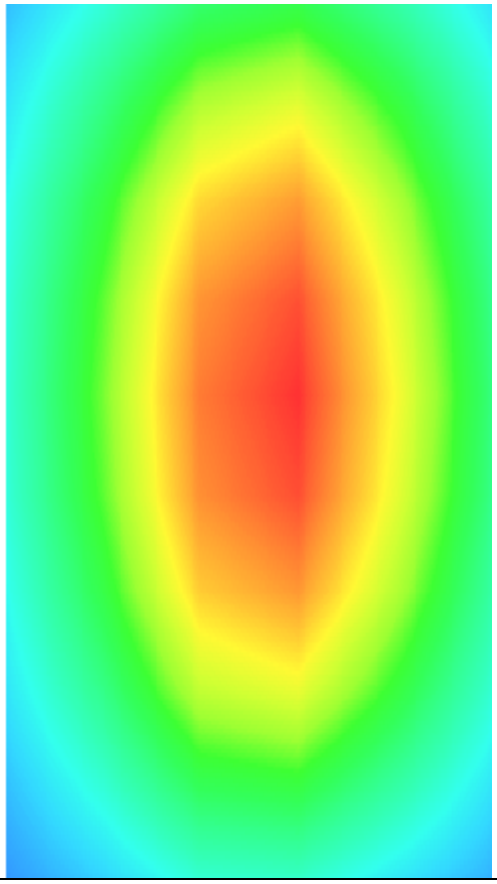
SURFACE SAR	VOLUME SAR
	

Maximum location: X=5.00, Y=3.00
SAR Peak: 1.47 W/kg

SAR 10g (W/Kg)	0.668611
SAR 1g (W/Kg)	0.972095

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.4537	1.0849	0.7587	0.5434	0.3921	0.2851	0.2084



3D screen shot	Hot spot position
	

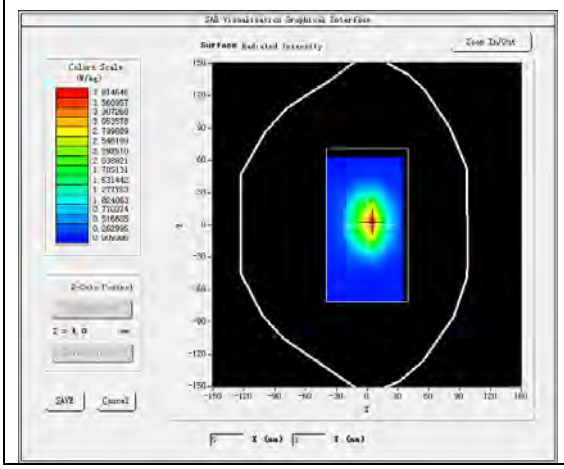
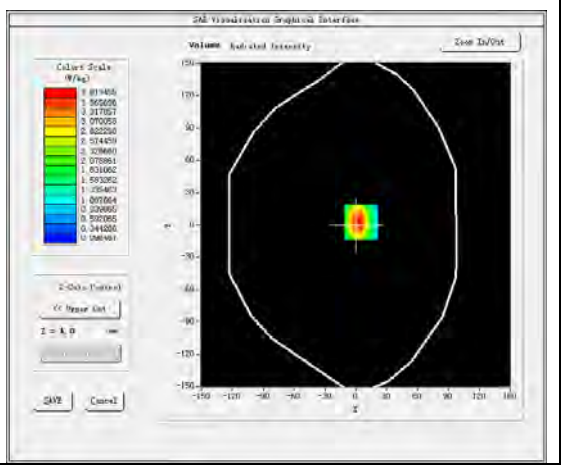
MEASUREMENT 3

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1800
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. SAR Measurement Results

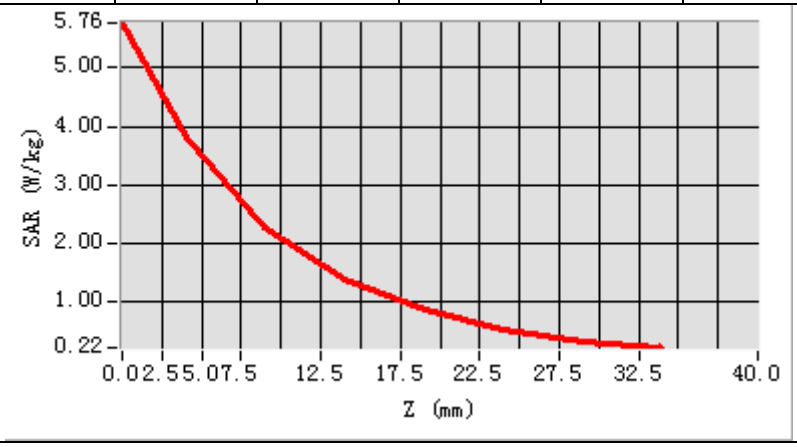
Frequency (MHz)	1800.000000
Relative permittivity (real part)	53.530041
Relative permittivity (imaginary part)	14.000140
Conductivity (S/m)	1.550347
Variation (%)	-0.600001

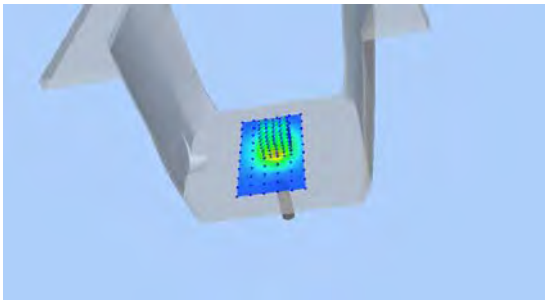
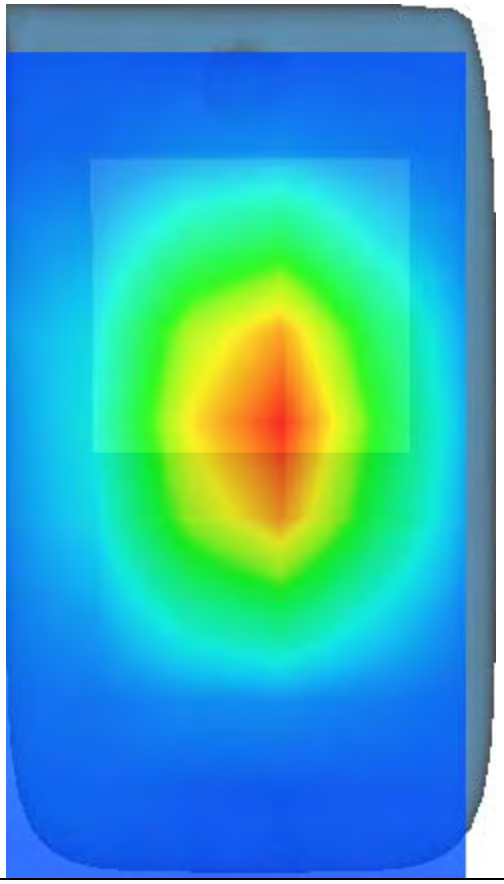
SURFACE SAR	VOLUME SAR
	

Maximum location: X=5.00, Y=3.00
SAR Peak: 5.96 W/kg

SAR 10g (W/Kg)	1.980994
SAR 1g (W/Kg)	3.695977

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	5.7639	3.8135	2.2560	1.3721	0.8516	0.5300	0.3332



3D screen shot	Hot spot position
	

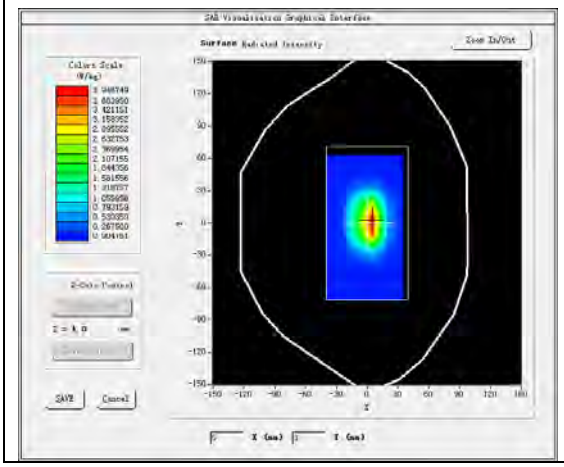
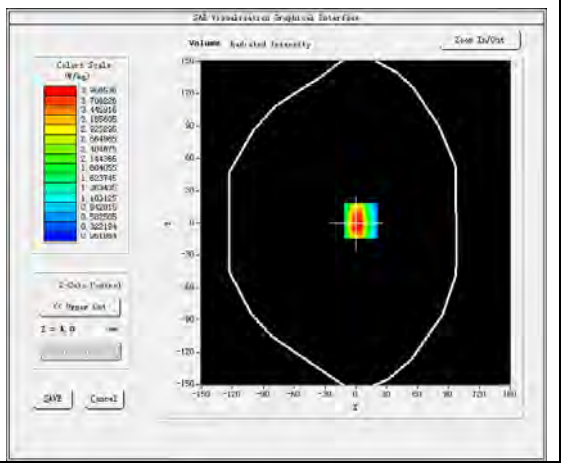
MEASUREMENT 4

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1900
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. SAR Measurement Results

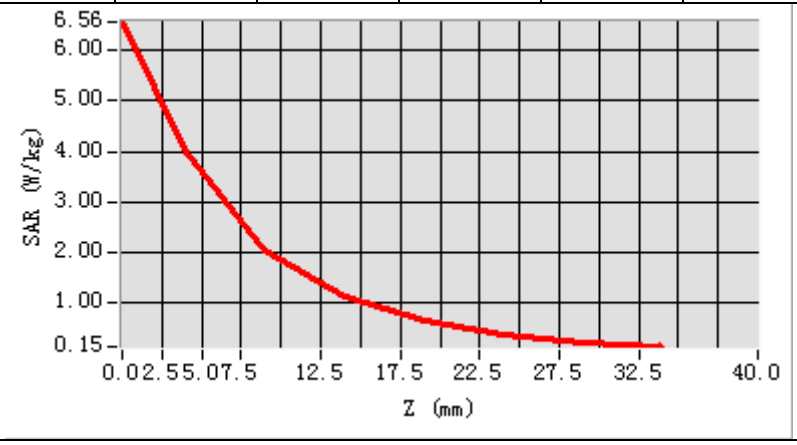
Frequency (MHz)	1900.000000
Relative permittivity (real part)	53.298698
Relative permittivity (imaginary part)	13.820600
Conductivity (S/m)	1.548841
Variation (%)	-0.520000

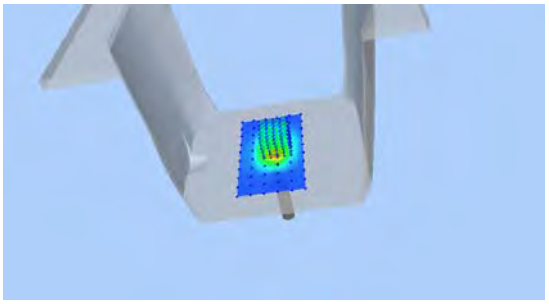
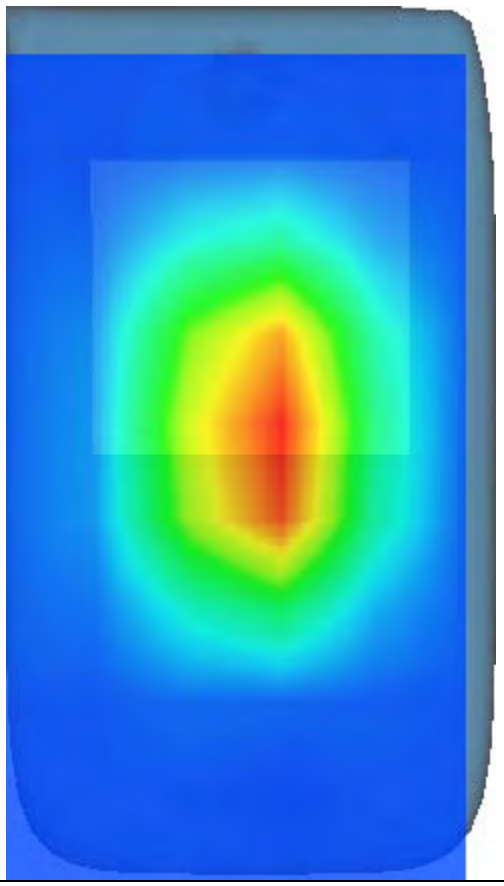
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=5.00, Y=2.00
SAR Peak: 7.23 W/kg

SAR 10g (W/Kg)	1.956776
SAR 1g (W/Kg)	4.072197

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	6.5587	3.9665	2.0593	1.1488	0.6678	0.3944	0.2395



3D screen shot	Hot spot position
	

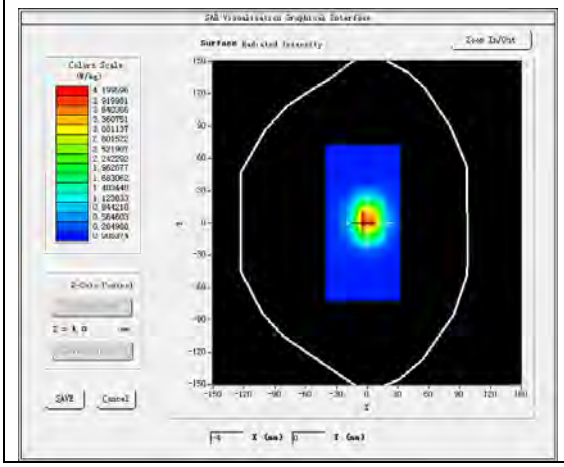
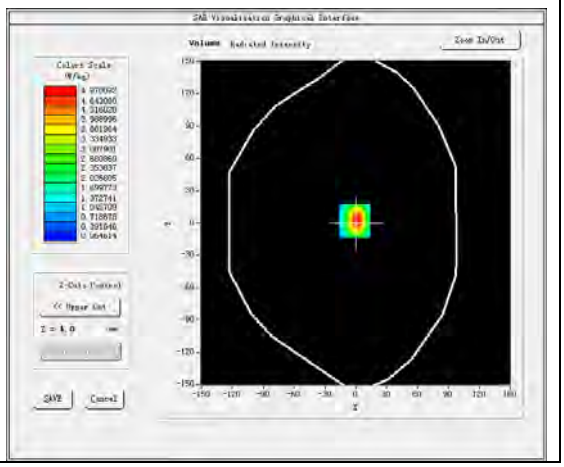
MEASUREMENT 5

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. SAR Measurement Results

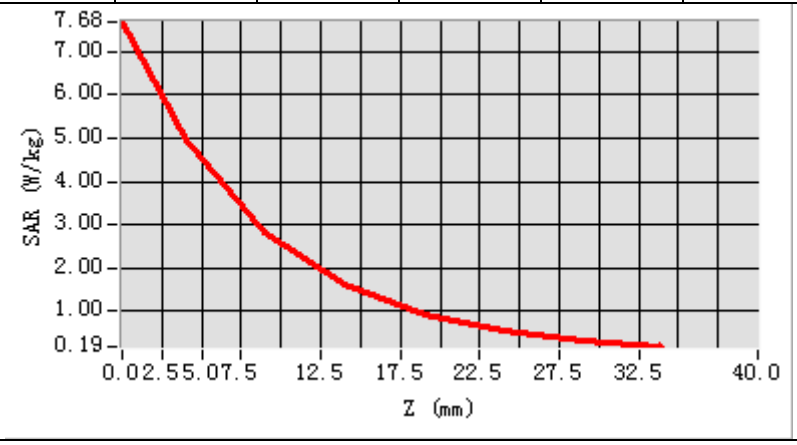
Frequency (MHz)	2450.000000
Relative permittivity (real part)	52.542801
Relative permittivity (imaginary part)	13.869800
Conductivity (S/m)	1.957834
Variation (%)	-1.500004

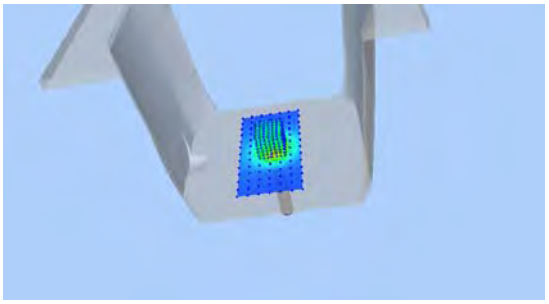
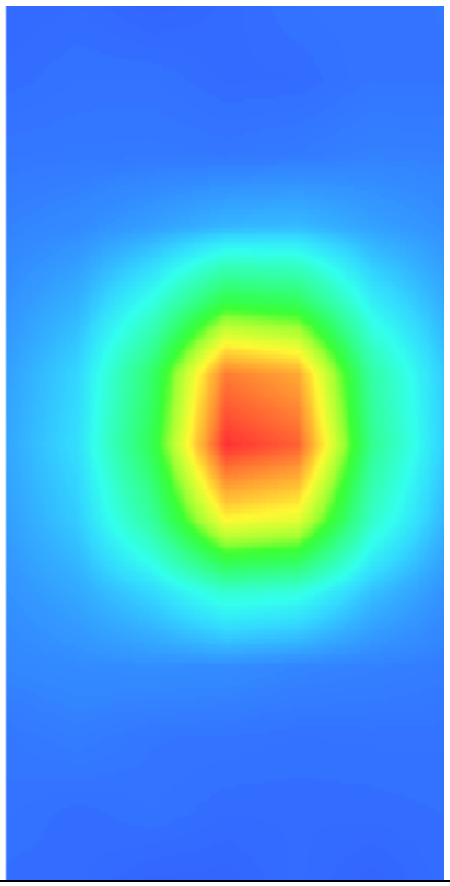
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-1.00, Y=2.00
SAR Peak: 7.88 W/kg

SAR 10g (W/Kg)	2.276783
SAR 1g (W/Kg)	4.814111

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	7.6816	4.9701	2.8166	1.6030	0.9288	0.5417	0.3150



3D screen shot	Hot spot position
	

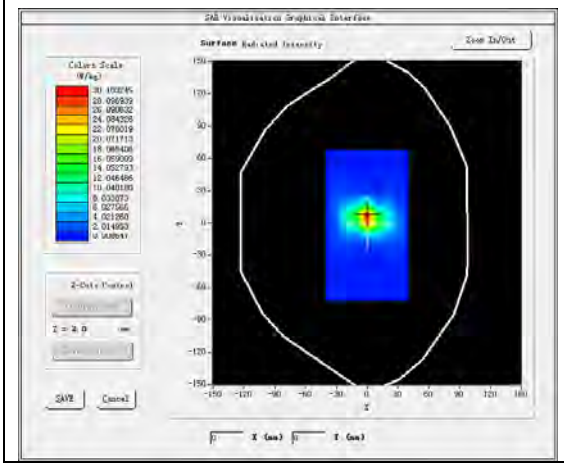
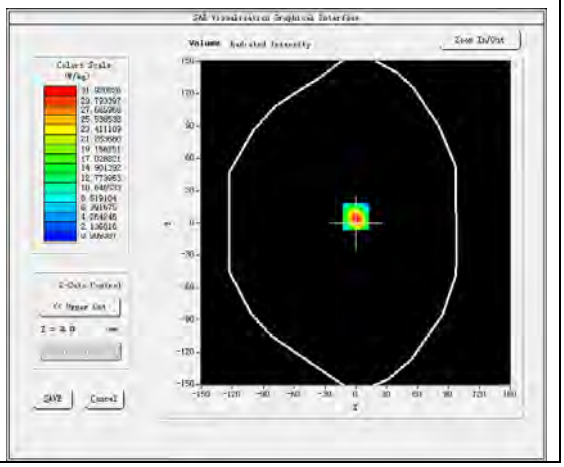
MEASUREMENT 6

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete/nsurf_sam_plan.txt, h= 2.00 mm
Phantom	Validation plane
Device Position	Dipole
Band	CW5800
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. SAR Measurement Results

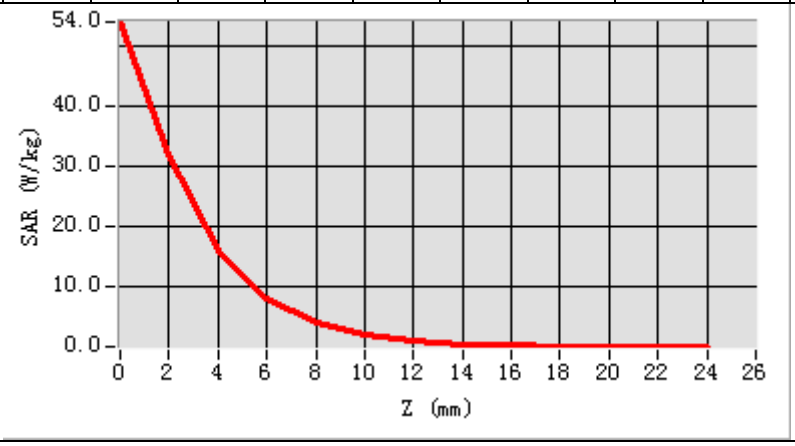
Frequency (MHz)	5800.000000
Relative permittivity (real part)	48.485237
Relative permittivity (imaginary part)	16.041710
Conductivity (S/m)	6.004271
Variation (%)	-0.400000

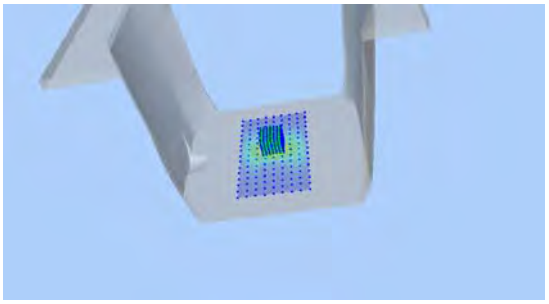
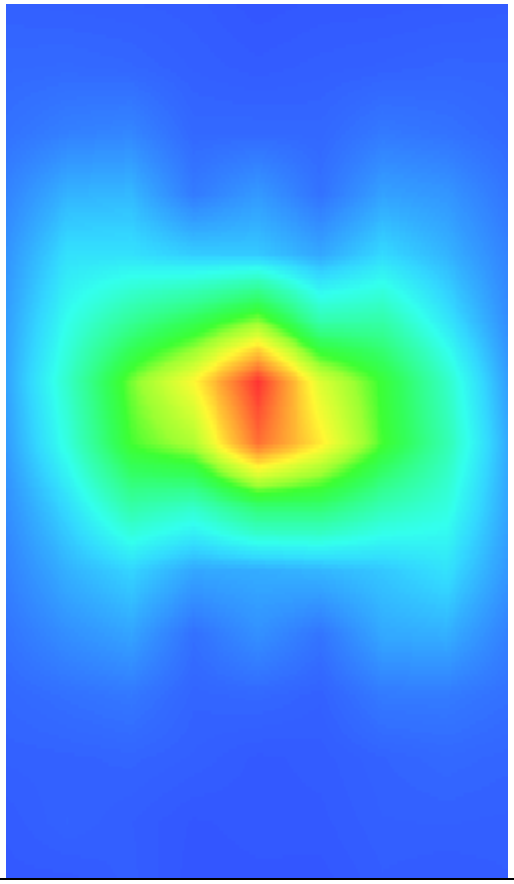
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=6.00
SAR Peak: 57.37 W/kg

SAR 10g (W/Kg)	6.142533
SAR 1g (W/Kg)	17.948044

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
SAR (W/Kg)	54.0380	31.9208	16.1706	8.1717	4.0861	2.0547	1.0345	0.5170	0.2766	0.1563	0.0791	0.0469



3D screen shot	Hot spot position
	

13. Appendix C. Plots of High SAR Measurement

Table of contents
MEASUREMENT 1 - WCDMA Band II
MEASUREMENT 2 - WCDMA Band IV
MEASUREMENT 3 - WCDMA Band V
MEASUREMENT 4 - WLAN 2.4G
MEASUREMENT 5 - LTE Band II
MEASUREMENT 6 - LTE Band IV
MEASUREMENT 7 - LTE Band XII
MEASUREMENT 8 - WLAN 5.8G

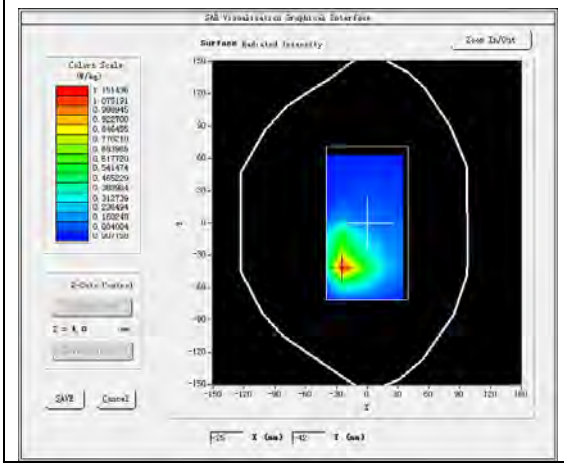
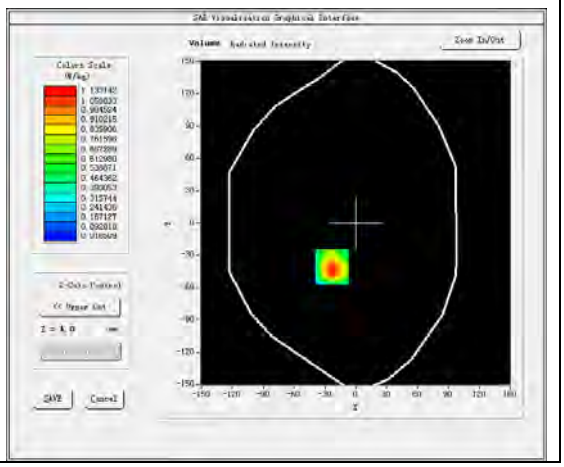
MEASUREMENT 1

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Body
Band	Band2_WCDMA1900
Channels	Low
Signal	WCDMA (Crest factor: 1.0)

B. SAR Measurement Results

Frequency (MHz)	1852.400000
Relative permittivity (real part)	53.486060
Relative permittivity (imaginary part)	14.683240
Conductivity (S/m)	1.531069
Variation (%)	3.100000

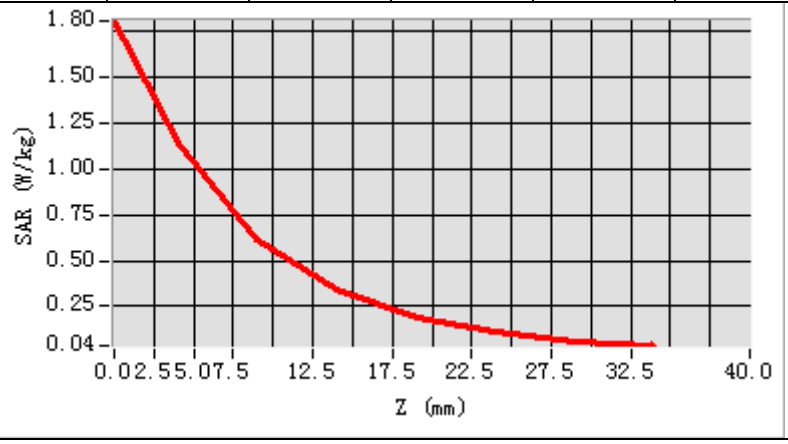
SURFACE SAR	VOLUME SAR
	

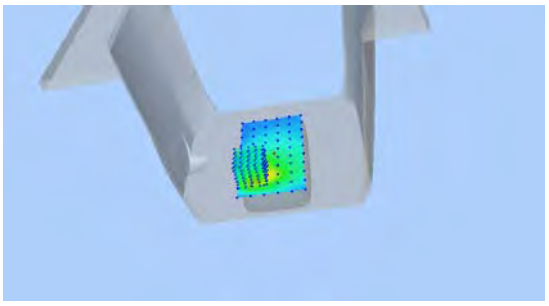
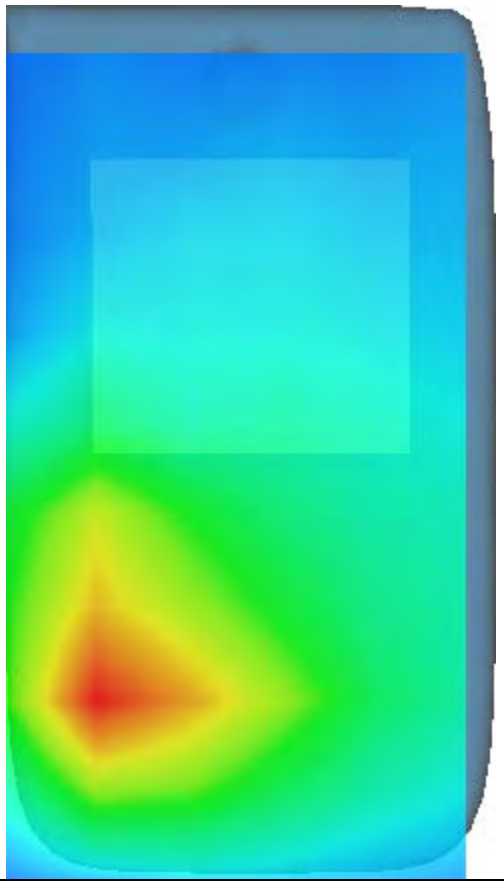
Maximum location: X=-23.00, Y=-41.00

SAR Peak: 1.93 W/kg

SAR 10g (W/Kg)	0.535035
SAR 1g (W/Kg)	1.007357

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.8022	1.1331	0.6160	0.3405	0.1897	0.1097	0.0610



3D screen shot	Hot spot position
	

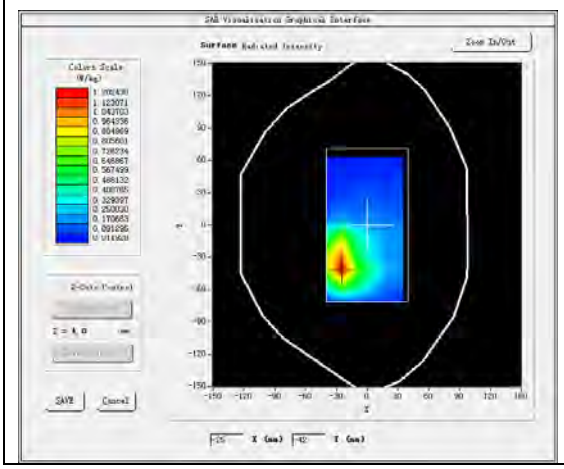
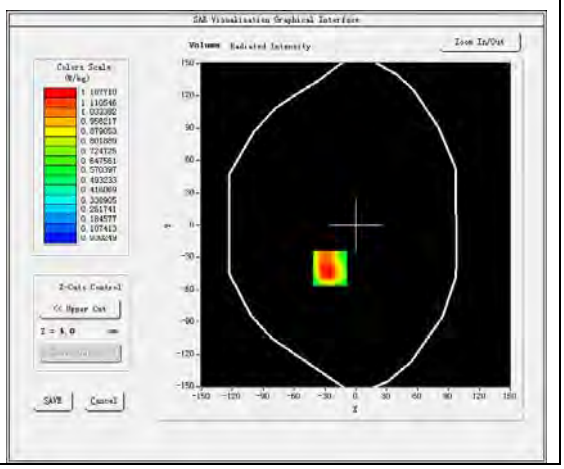
MEASUREMENT 2

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Body
Band	Band4_WCDMA1700
Channels	High
Signal	WCDMA (Crest factor: 1.0)

B. SAR Measurement Results

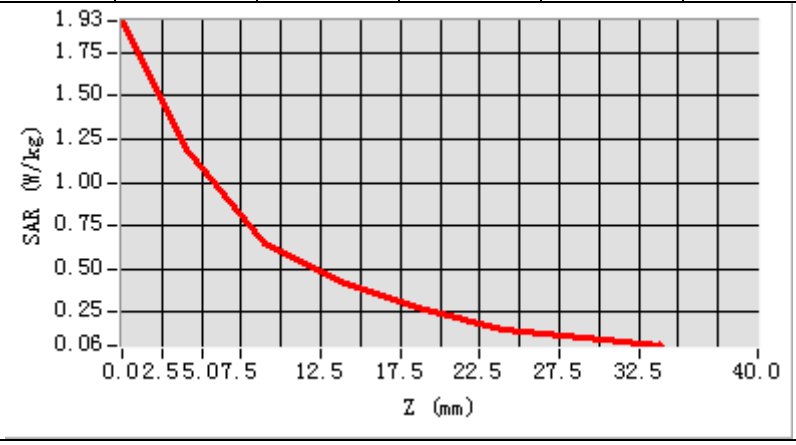
Frequency (MHz)	1752.600000
Relative permittivity (real part)	53.776366
Relative permittivity (imaginary part)	15.378170
Conductivity (S/m)	1.506809
Variation (%)	-1.780000

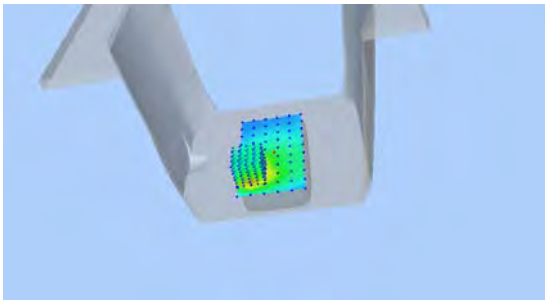
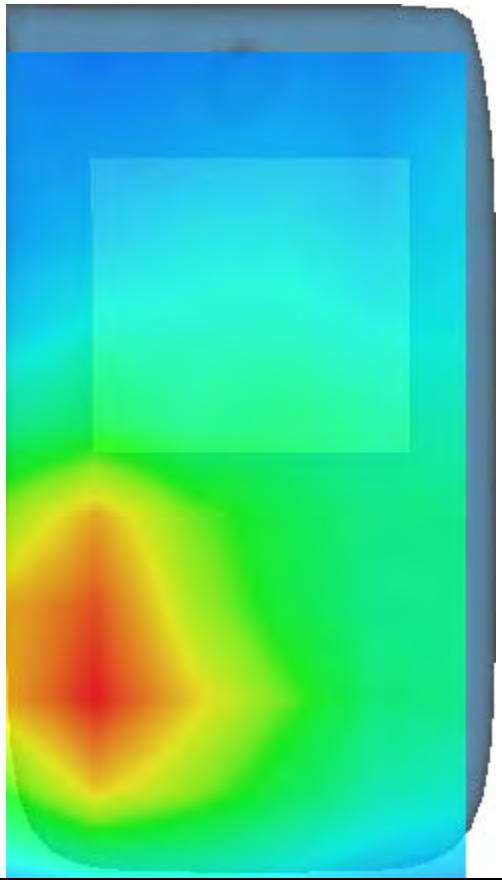
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=-25.00, Y=-40.00
SAR Peak: 2.03 W/kg

SAR 10g (W/Kg)	0.621608
SAR 1g (W/Kg)	0.897020

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.9342	1.1877	0.6411	0.4103	0.2595	0.1460	0.1015



3D screen shot	Hot spot position
	

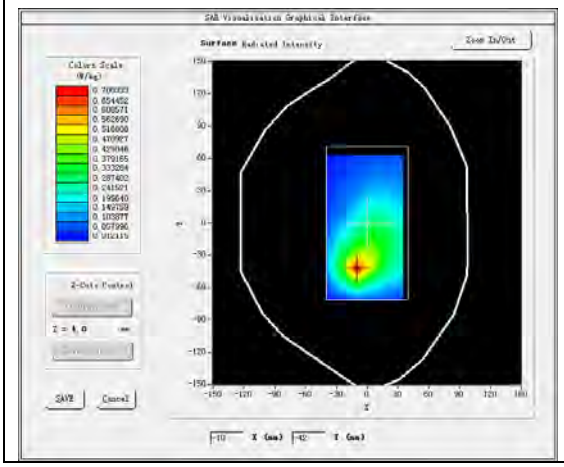
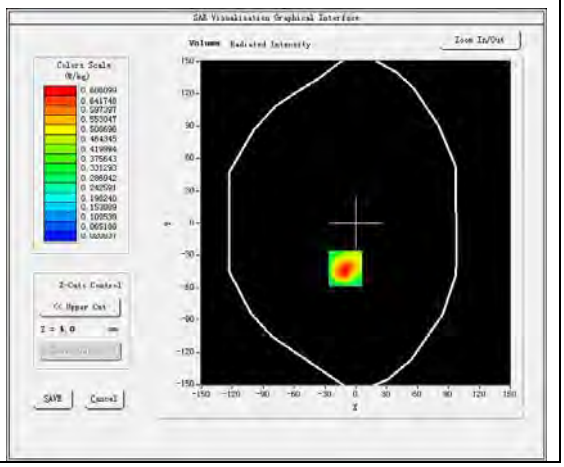
MEASUREMENT 3

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Cheek
Band	Band5_WCDMA850
Channels	Middle
Signal	WCDMA (Crest factor: 1.0)

C. SAR Measurement Results

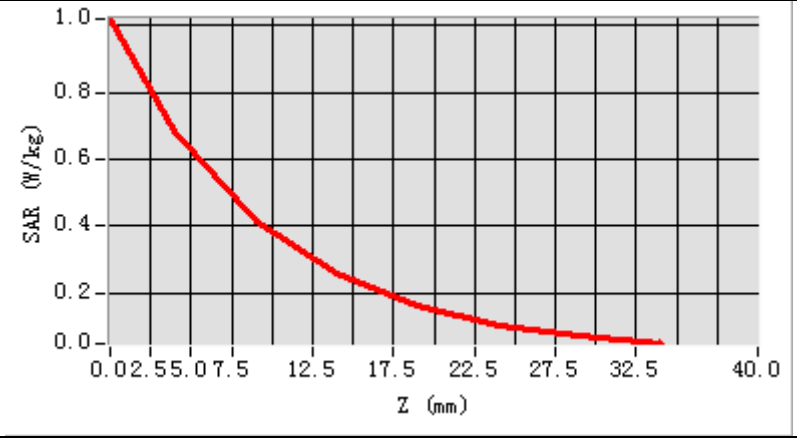
Frequency (MHz)	836.400000
Relative permittivity (real part)	55.145444
Relative permittivity (imaginary part)	21.178061
Conductivity (S/m)	0.974074
Variation (%)	-2.800000

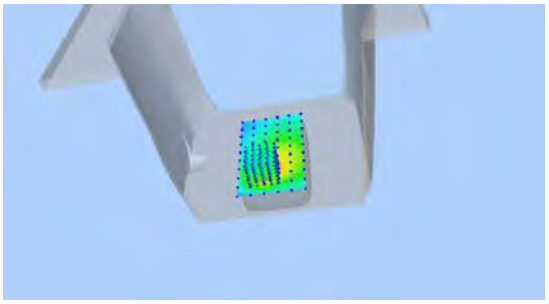
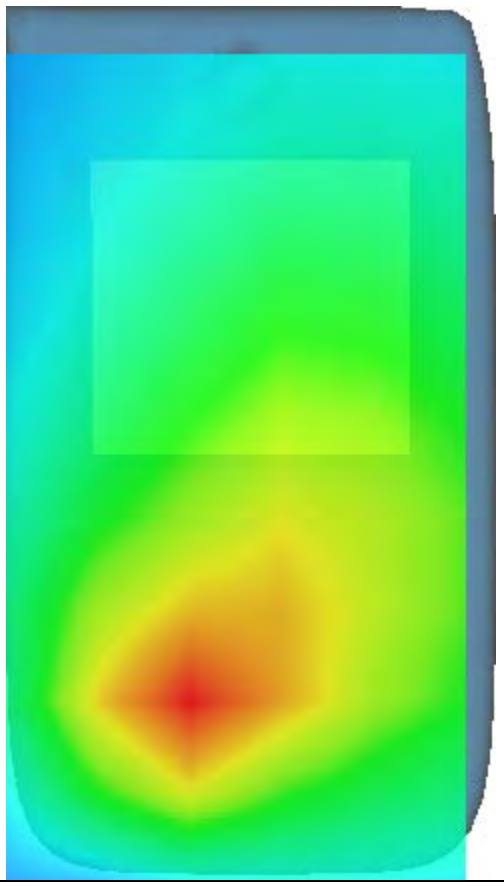
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=-10.00, Y=-42.00
SAR Peak: 1.17 W/kg

SAR 10g (W/Kg)	0.369816
SAR 1g (W/Kg)	0.681823

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.0188	0.6861	0.4129	0.2572	0.1608	0.1049	0.0719



3D screen shot	Hot spot position
	

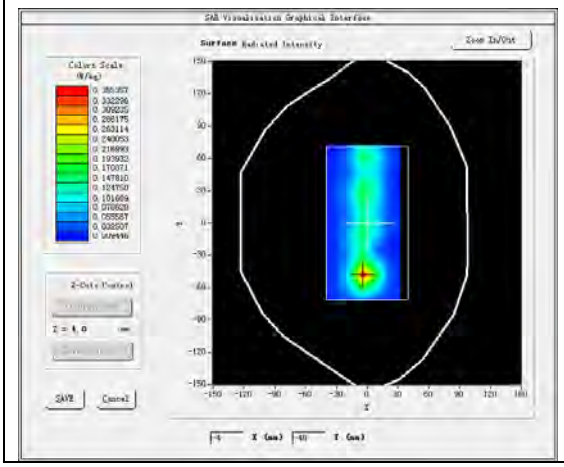
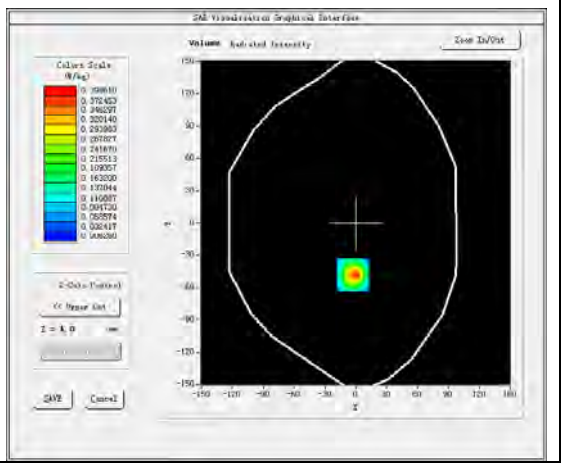
MEASUREMENT 4

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Dipole
Band	IEEE 802.11b ISM
Channels	Middle
Signal	IEEE802.b (Crest factor: 1.0)

C. SAR Measurement Results

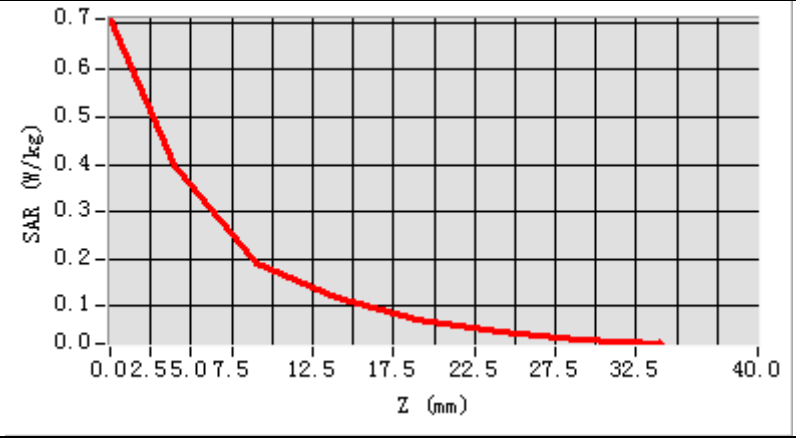
Frequency (MHz)	2437.000000
Relative permittivity (real part)	52.603698
Relative permittivity (imaginary part)	13.944400
Conductivity (S/m)	1.947917
Variation (%)	-0.360000

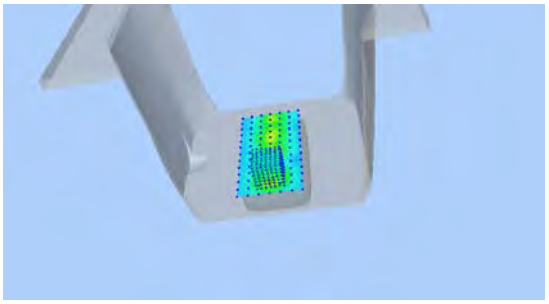
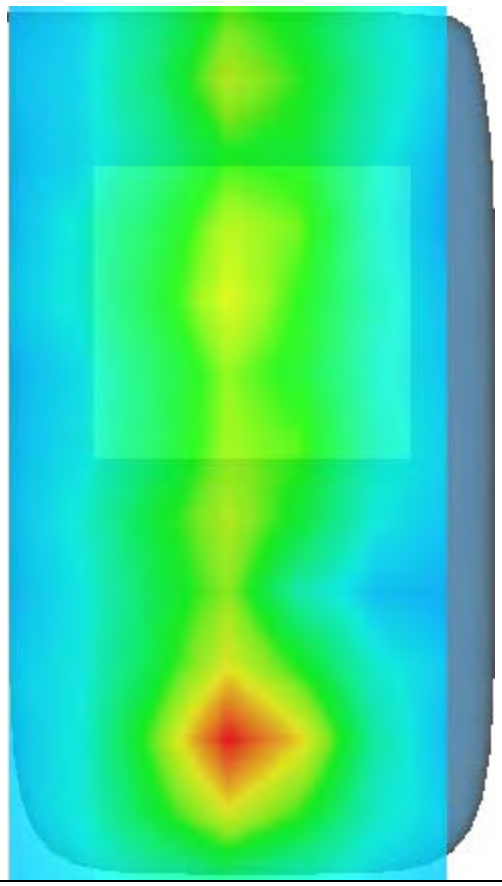
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-3.00, Y=-48.00
SAR Peak: 0.68 W/kg

SAR 10g (W/Kg)	0.159400
SAR 1g (W/Kg)	0.333798

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.7084	0.3986	0.1895	0.1193	0.0707	0.0449	0.0268



3D screen shot	Hot spot position
	

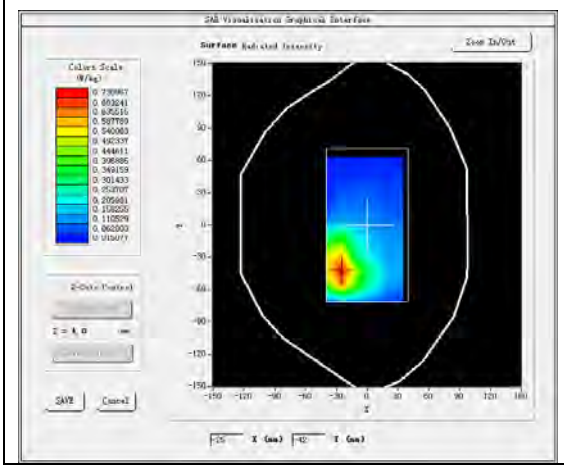
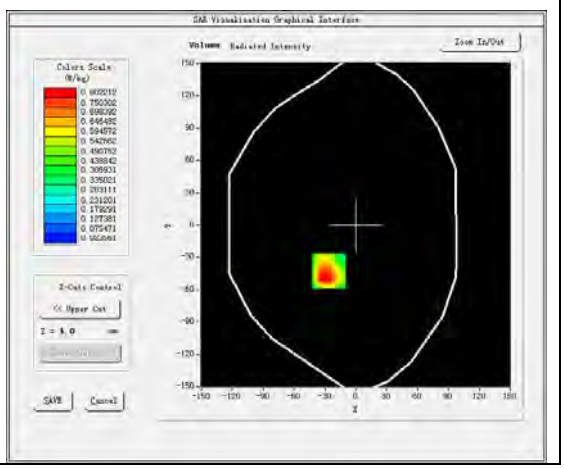
MEASUREMENT 5

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 2
Channels	Low
Signal	LTE (Crest factor: 1.0)

B. SAR Measurement Results

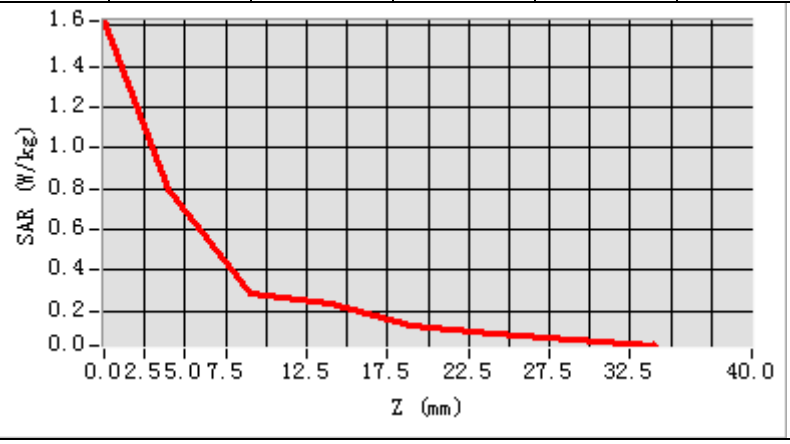
Frequency (MHz)	1860.000000
Relative permittivity (real part)	53.443549
Relative permittivity (imaginary part)	13.476900
Conductivity (S/m)	1.538495
Variation (%)	-2.870000

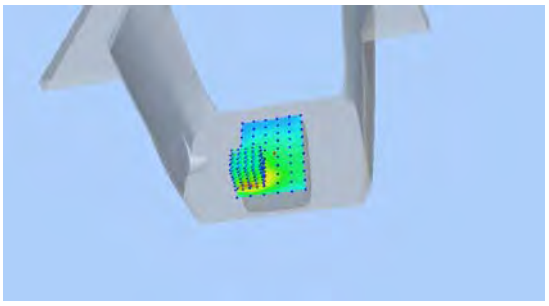
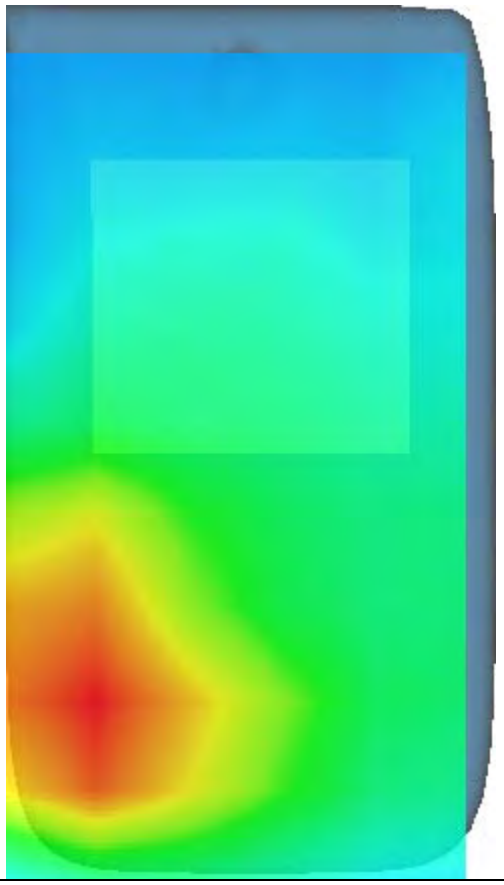
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-26.00, Y=-43.00
SAR Peak: 1.45 W/kg

SAR 10g (W/Kg)	0.408207
SAR 1g (W/Kg)	0.817831

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.6242	0.8022	0.2892	0.2421	0.1284	0.0868	0.0564



3D screen shot	Hot spot position
	

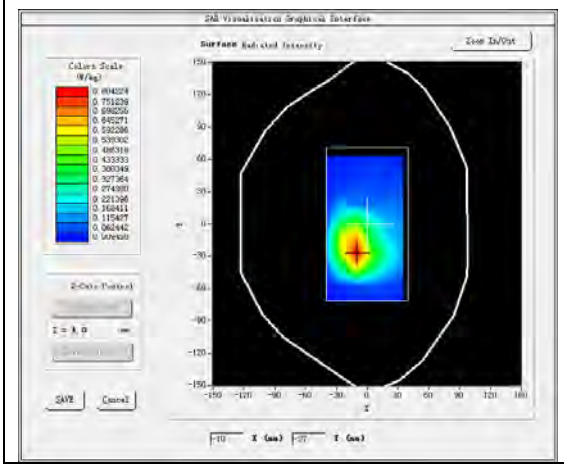
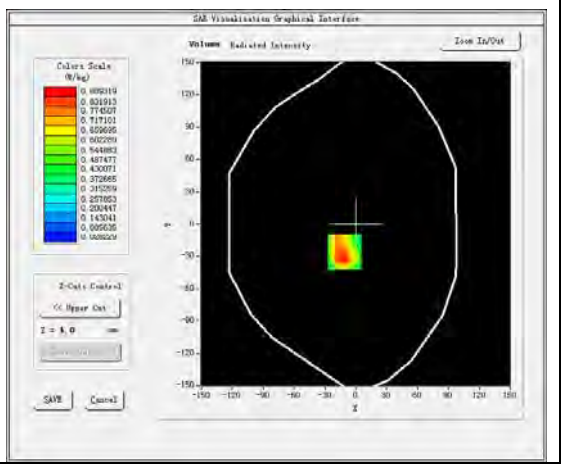
MEASUREMENT 6

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Body
Band	LTE band 4
Channels	High
Signal	LTE (Crest factor: 1.0)

B. SAR Measurement Results

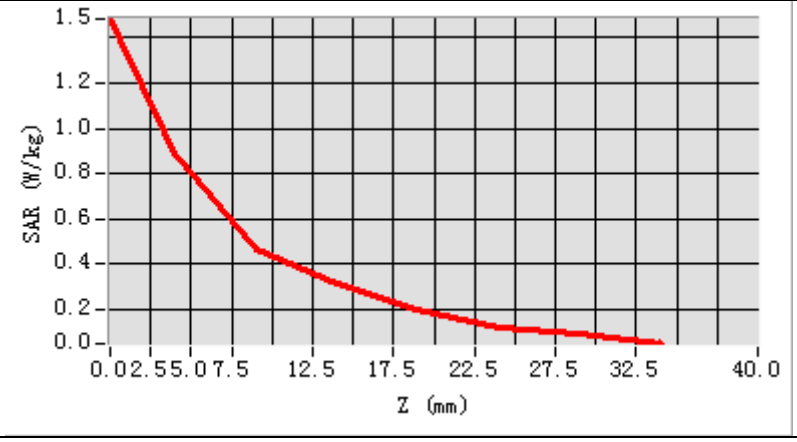
Frequency (MHz)	1745.000000
Relative permittivity (real part)	53.839991
Relative permittivity (imaginary part)	13.931642
Conductivity (S/m)	1.504078
Variation (%)	0.110000

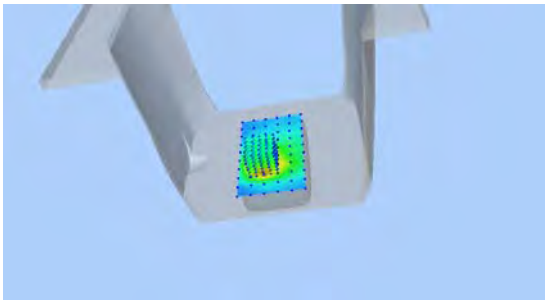
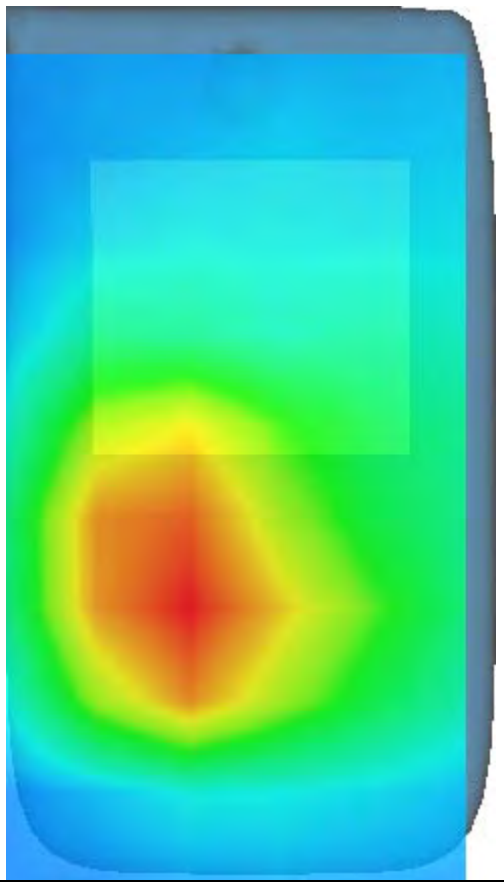
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-11.00, Y=-26.00
SAR Peak: 1.47 W/kg

SAR 10g (W/Kg)	0.452975
SAR 1g (W/Kg)	0.864443

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.4841	0.8893	0.4623	0.3120	0.2000	0.1151	0.0908



3D screen shot	Hot spot position
	

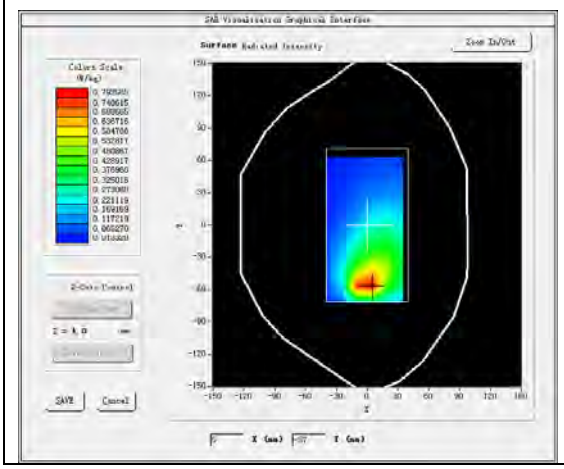
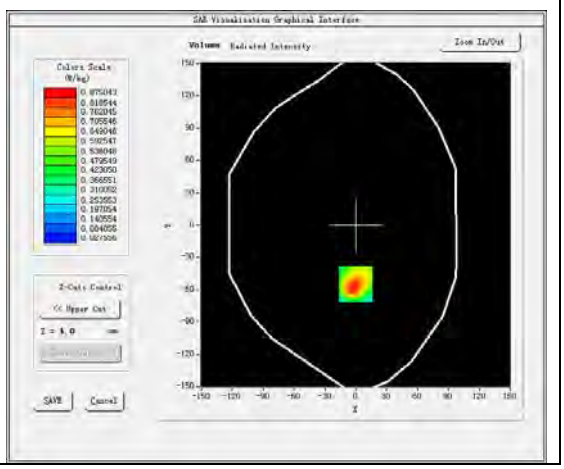
MEASUREMENT 7

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Cheek
Band	LTE band 12
Channels	High
Signal	LTE (Crest factor: 1.0)

B. SAR Measurement Results

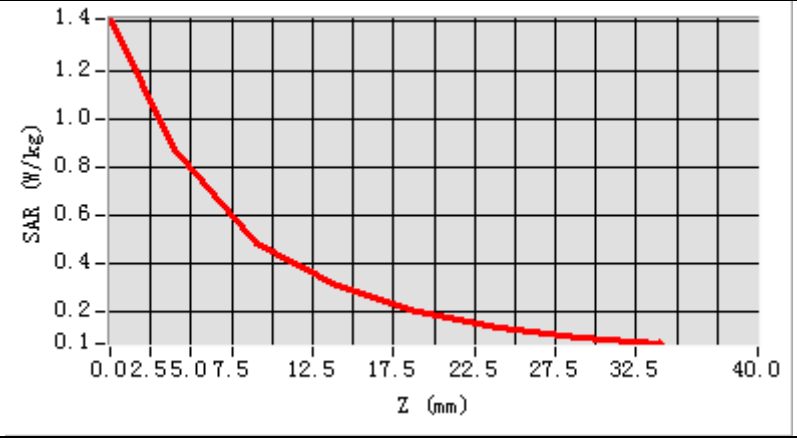
Frequency (MHz)	711.000000
Relative permittivity (real part)	55.473661
Relative permittivity (imaginary part)	23.530199
Conductivity (S/m)	0.928789
Variation (%)	-0.540000

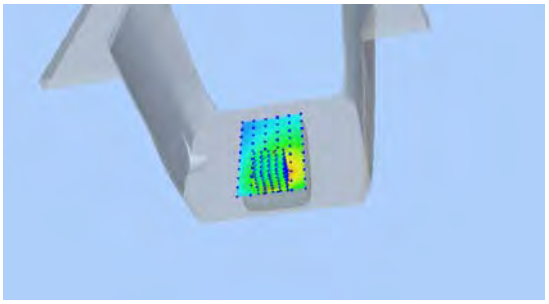
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=-55.00
SAR Peak: 1.64 W/kg

SAR 10g (W/Kg)	0.463646
SAR 1g (W/Kg)	0.886784

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.4122	0.8750	0.4826	0.3105	0.2008	0.1391	0.0976



3D screen shot	Hot spot position
	

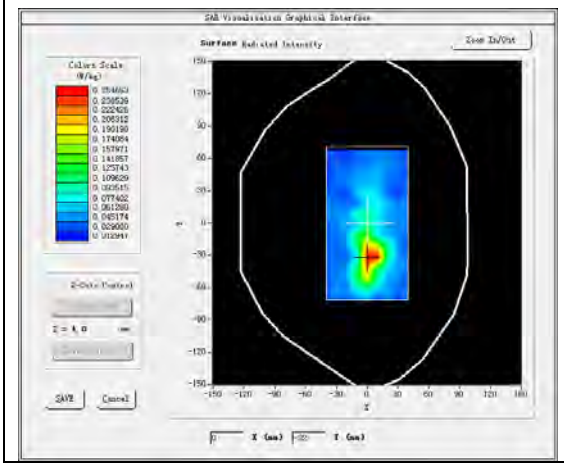
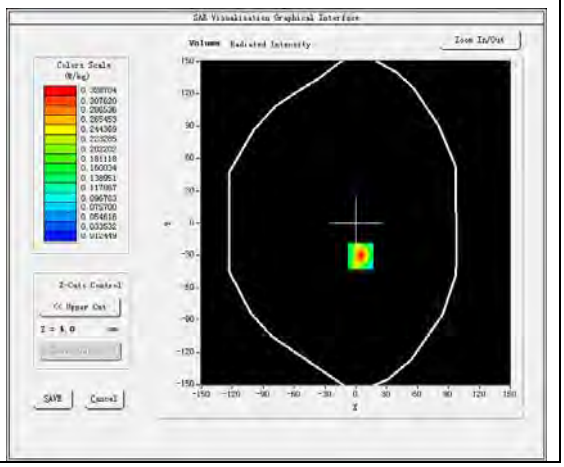
MEASUREMENT 8

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 2.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete/nsurf_sam_plan.txt, h= 2.00 mm
Phantom	Validation plane
Device Position	Body
Band	CUSTOM (5.8Ga)
Channels	Middle
Signal	Duty Cycle: 1.00 (Crest factor: 1.0)

B. SAR Measurement Results

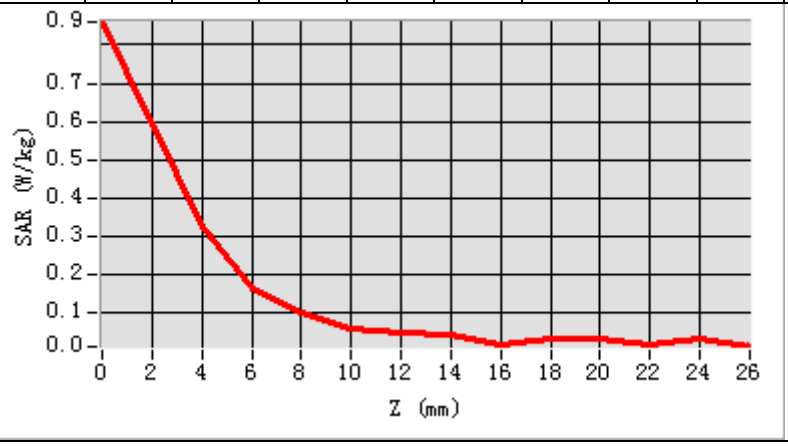
Frequency (MHz)	5785.000000
Relative permittivity (real part)	48.559359
Relative permittivity (imaginary part)	18.372267
Conductivity (S/m)	5.944642
Variation (%)	-4.470000

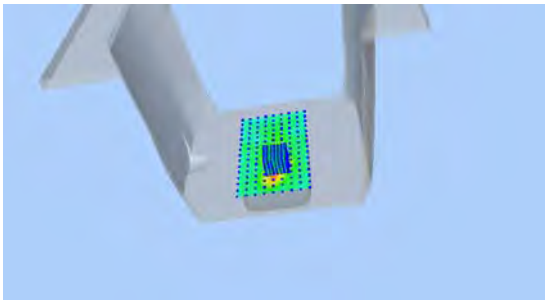
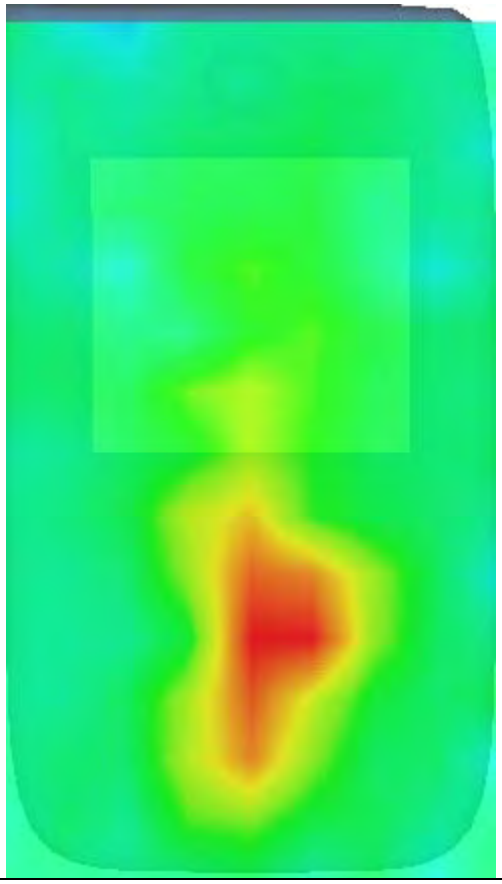
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=5.00, Y=-31.00
SAR Peak: 0.84 W/kg

SAR 10g (W/Kg)	0.119084
SAR 1g (W/Kg)	0.306388

Z (mm)	0.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00
SAR (W/Kg)	0.8599	0.3287	0.1637	0.1024	0.0583	0.0507	0.0438	0.0192	0.0353	0.0344	0.0193	0.0337



3D screen shot	Hot spot position
	

14. Appendix D. Calibration Certificate

Table of contents
E Field Probe - SN 08/16 EPGO287
750 MHz Dipole - SN 03/15 DIP 0G750-355
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
5000-6000 MHz Dipole - SN 13/14 WGA 33

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

ACCREDITED
Calibration CERT #2246-02

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.

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

	Customer Name
Distribution :	NTEK TESTING TECHNOLOGY CO., LTD.

Issue	Date	Modifications
A	9/18/2017	Initial release

TABLE OF CONTENTS

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.

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%
Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

5 CALIBRATION MEASUREMENT RESULTS

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

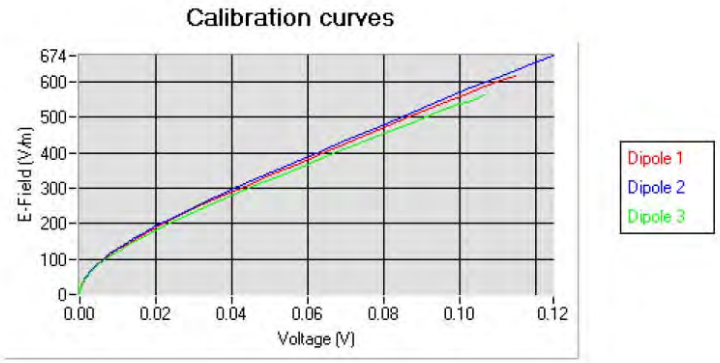
5.1 SENSITIVITY IN AIR

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

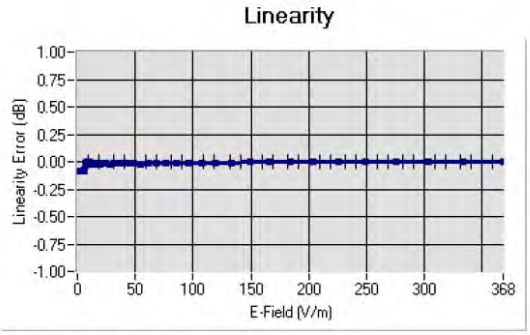
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
92	90	96

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

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



5.2 LINEARITY



Linearity: +/-1.86% (+/-0.08dB)

5.3 SENSITIVITY IN LIQUID

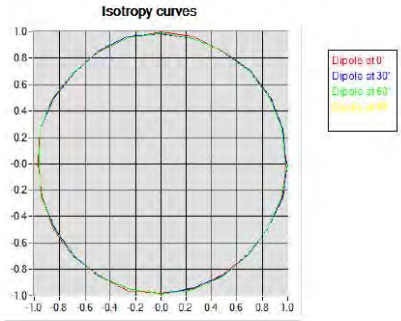
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL750	750	42.09	0.91	1.44
BL750	750	55.69	0.95	1.49
HL850	835	42.71	0.89	1.48
BL850	835	57.52	1.03	1.53
HL900	900	41.94	0.93	1.50
BL900	900	52.87	1.09	1.54
HL1800	1800	40.62	1.39	1.75
BL1800	1800	53.22	1.47	1.79
HL1900	1900	41.22	1.37	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

5.4 ISOTROPY

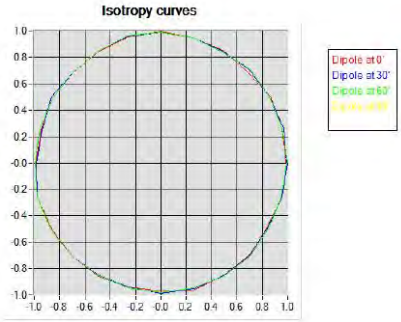
HL900 MHz

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



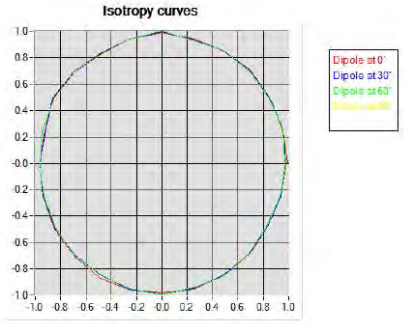
HL1800 MHz

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



HL5600 MHz

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



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.109.1.18.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 REFERENCE DIPOLE

FREQUENCY: 750 MHZ

SERIAL NO.: SN 03/15 DIP 0G750-355

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED

Calibration CERT #2246-02

Calibration Date: 04/19/2018

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.109.1.18.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	4/19/2018	
Checked by :	Jérôme LUC	Product Manager	4/19/2018	
Approved by :	Kim RUTKOWSKI	Quality Manager	4/19/2018	

	Customer Name
Distribution :	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

Issue	*Date*	*Modifications*
A	4/19/2018	Initial release

TABLE OF CONTENTS

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 750 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID750
Serial Number	SN 03/15 DIP 0G750-355
Product Condition (new / used)	Used

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

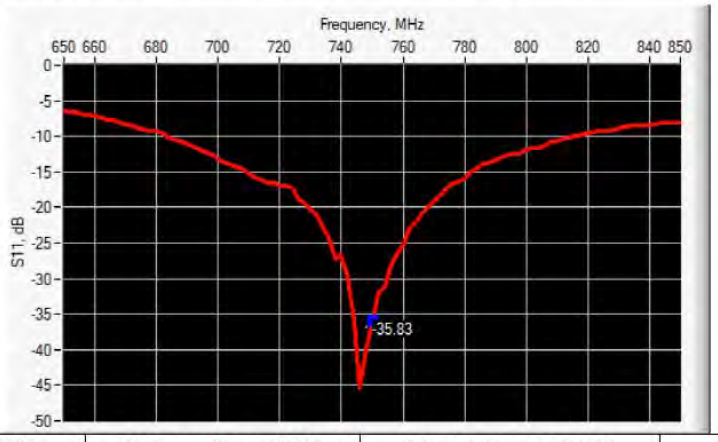
The guidelines outlined in the IEEE 1528, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %

10 g	20.1 %

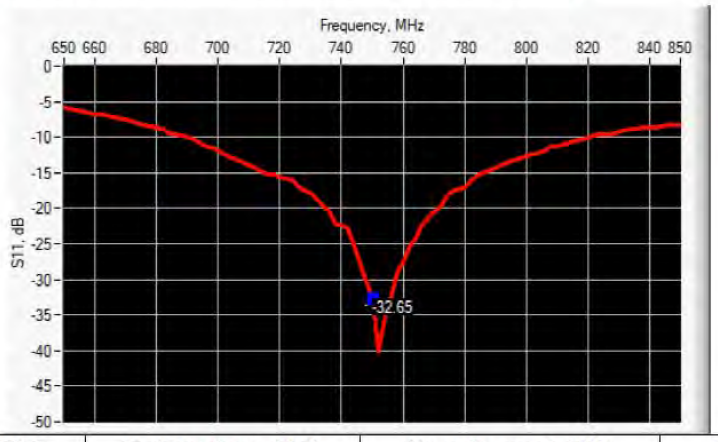
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-35.83	-20	51.3 Ω - 1.2 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-32.65	-20	50.8 Ω + 2.3 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 %.	

450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.	PASS	100.0 ±1 %.	PASS	6.35 ±1 %.	PASS
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 %.		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_r')		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 %	PASS	0.89 ±5 %	PASS
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 %	

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 %	

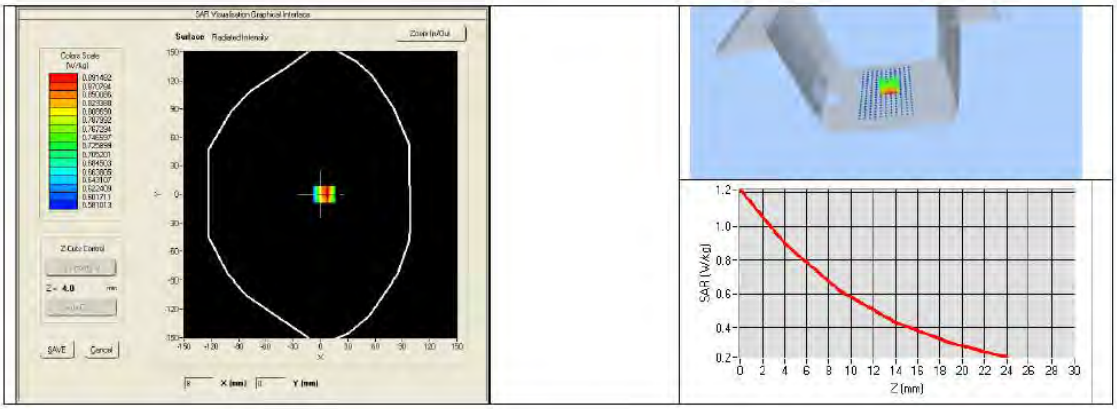
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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' : 40.0 sigma : 0.93
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	750 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	8.56 (0.86)	5.55	5.61 (0.56)
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		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	
3700	67.4		24.2	



7.3 BODY LIQUID MEASUREMENT

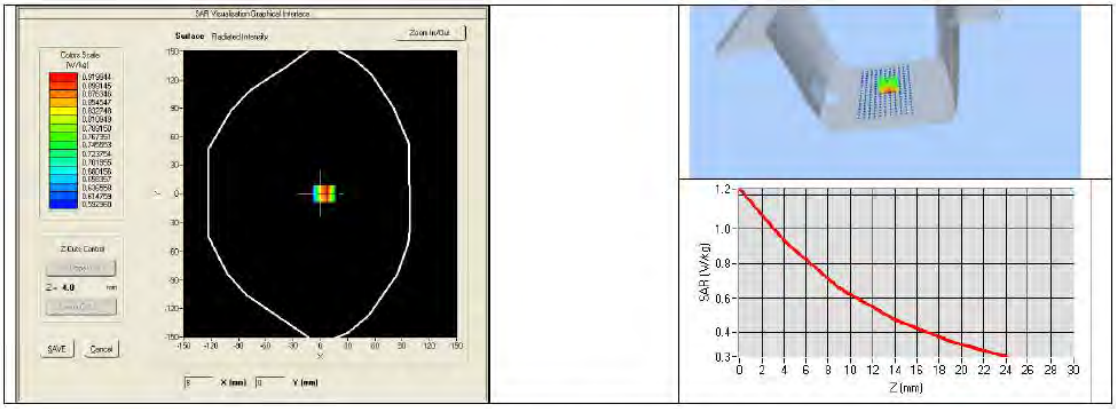
Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %	PASS	0.96 ±5 %	PASS
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0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

2300	52.9 ±5 %		1.81 ±5 %	
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 %	
3700	51.0 ±5 %		3.55 ±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' : 56.8 sigma : 1.00
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	750 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
750	8.85 (0.89)	5.91 (0.59)



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	02/2016	02/2019
Calipers	Carrera	CALIPER-01	01/2017	01/2020
Reference Probe	MVG	EPG122 SN 18/11	10/2017	10/2018
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.
Temperature and Humidity Sensor	Control Company	150798832	11/2017	11/2020

SAR Reference Dipole Calibration Report

Ref : ACR.109.2.18.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 REFERENCE DIPOLE

FREQUENCY: 835 MHZ

SERIAL NO.: SN 03/15 DIP 0G835-347

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED

Calibration CERT #2246-02

Calibration Date: 04/19/2018

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.109.2.18.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	4/19/2018	
Checked by :	Jérôme LUC	Product Manager	4/19/2018	
Approved by :	Kim RUTKOWSKI	Quality Manager	4/19/2018	

	Customer Name
Distribution :	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

Issue	*Date*	*Modifications*
A	4/19/2018	Initial release

TABLE OF CONTENTS

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)	Used

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

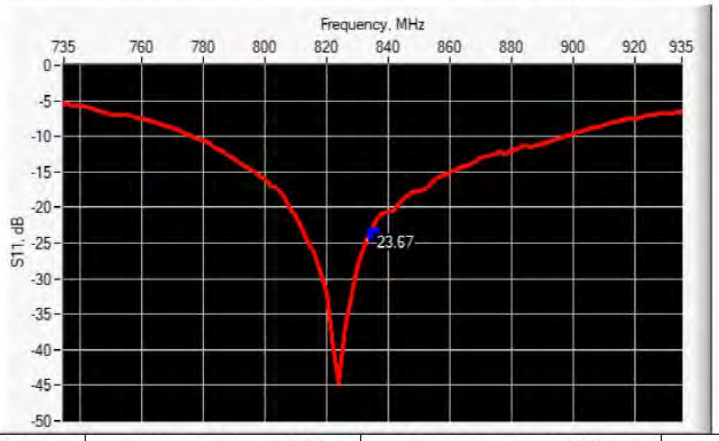
The guidelines outlined in the IEEE 1528, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %

10 g	20.1 %

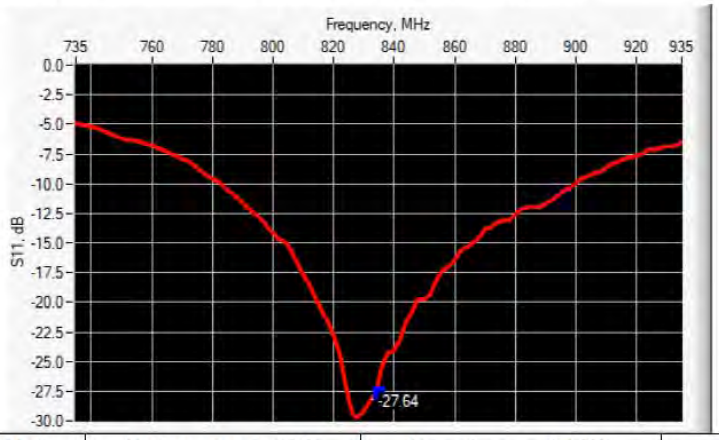
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-23.67	-20	56.8 Ω - 1.5 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-27.64	-20	53.5 Ω + 2.3 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 %.	

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_r')		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 %	
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 %	

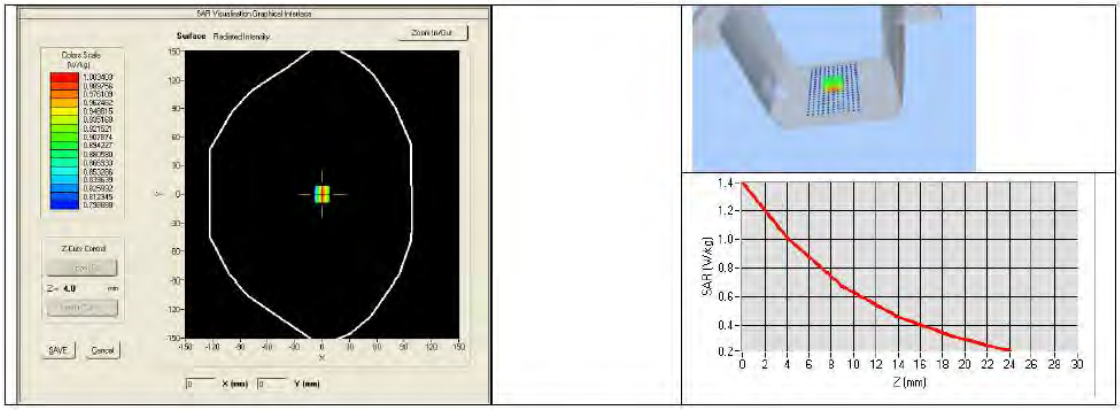
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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' : 40.0 sigma : 0.90
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	9.55 (0.95)	6.22	6.10 (0.61)
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		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	
3700	67.4		24.2	



7.3 BODY LIQUID MEASUREMENT

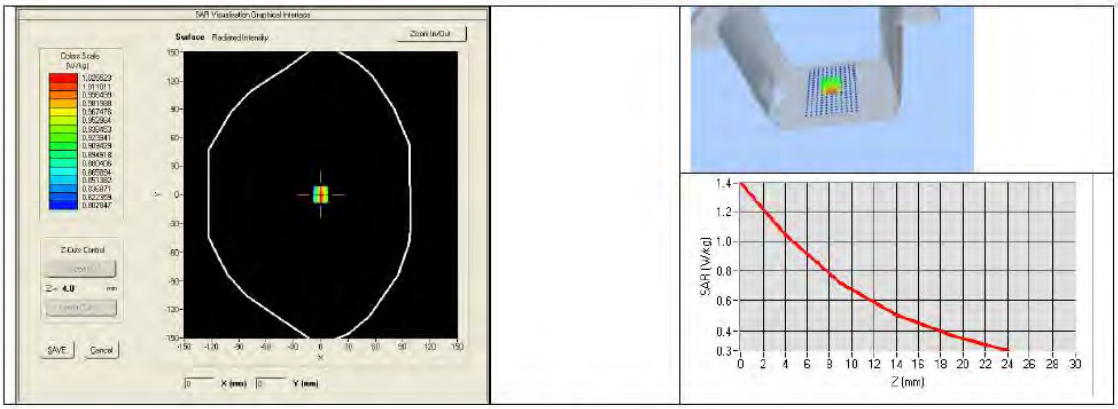
Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %	PASS	0.97 ±5 %	PASS
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±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 %	

2300	52.9 ±5 %		1.81 ±5 %	
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 %	
3700	51.0 ±5 %		3.55 ±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' : 57.5 sigma : 0.96
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	9.83 (0.98)	6.45 (0.64)



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	02/2016	02/2019
Calipers	Carrera	CALIPER-01	01/2017	01/2020
Reference Probe	MVG	EPG122 SN 18/11	10/2017	10/2018
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.
Temperature and Humidity Sensor	Control Company	150798832	11/2017	11/2020