

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 : 4G Tablet

Trademark : LOGIC, ISWAG, UNONU

Model Name : T10L PLUS

Family Model : Grad, Slate

FCC ID : O551001923

Report No. : STR230329003008E

Prepared for

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TEST RESULT CERTIFICATION**Applicant's name**.....: SWAGTEK

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Manufacturer's Name.....: SWAGTEK

Address.....: 10205 NW 19th Street STE101 Miami, FL 33172, United States

Product description

Product name.....: 4G Tablet

Trademark.....: LOGIC, ISWAG, UNONU

Model Name.....: T10L PLUS

Family Model.....: Grad, Slate

FCC 47 CFR Part 2(2.1093)

ANSI/IEEE C95.1-1992

Standards.....: 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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Test Sample Number..... T230329002R003

Date of Test

Date (s) of performance of tests.....: Apr. 12, 2023 ~ Apr. 28, 2023

Date of Issue.....: May 27, 2023

Test Result.....: **Pass**Prepared By
(Test Engineer): 
(Jack Li)Approved By
(Lab Manager): 
(Alex Li)

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	May 27, 2023	Jack Li

TABLE OF CONTENTS

1. General Information	6
1.1. RF exposure limits.....	6
1.2. Statement of Compliance	7
1.3. EUT Description	7
1.4. Test specification(s)	9
1.5. Ambient Condition.....	9
2. SAR Measurement System	10
2.1. SATIMO SAR Measurement Set-up Diagram	10
2.2. Robot	11
2.3. E-Field Probe.....	12
2.3.1. E-Field Probe Calibration	12
2.4. SAM phantoms	13
2.4.1. Technical Data	14
2.5. Device Holder	15
2.6. Test Equipment List	16
3. SAR Measurement Procedures	19
3.1. Power Reference	19
3.2. Area scan & Zoom scan.....	19
3.3. Description of interpolation/extrapolation scheme	21
3.4. Volumetric Scan	21
3.5. Power Drift	21
4. System Verification Procedure	22
4.1. Tissue Verification	22
4.1.1. Tissue Dielectric Parameter Check Results	23
4.2. System Verification Procedure	24
4.2.1. System Verification Results	25
5. SAR Measurement variability and uncertainty	26
5.1. SAR measurement variability.....	26
5.2. SAR measurement uncertainty	26
6. RF Exposure Positions	27
1.3. Tablet host platform exposure conditions.....	27
7. RF Output Power	28
7.1. GSM Conducted Power	28
7.2. WCDMA Conducted Power	29
7.3. LTE Conducted Power	29
7.4. WLAN & Bluetooth Output Power	41
7.4.1. Output Power Results Of WLAN	41
7.4.2. Output Power Results Of Bluetooth.....	43
8. Antenna Location.....	44

9. Stand-alone SAR test exclusion.....	52
10. SAR Results	53
10.1. SAR measurement results	53
10.1.1. SAR measurement Result of GSM850.....	53
10.1.2. SAR measurement Result of GSM1900.....	53
10.1.3. SAR measurement Result of WCDMA Band 2.....	54
10.1.4. SAR measurement Result of WCDMA Band 5.....	55
10.1.5. SAR measurement Result of LTE Band 2	56
10.1.6. SAR measurement Result of LTE Band 4	57
10.1.7. SAR measurement Result of LTE Band 5	58
10.1.8. SAR measurement Result of LTE Band 7	59
10.1.9. SAR measurement Result of LTE Band 12	60
10.1.10. SAR measurement Result of LTE Band 17	62
10.1.11. SAR measurement Result of WLAN 2.4G	63
10.1.12. SAR measurement Result of WLAN 5.2G	64
10.1.13. SAR measurement Result of WLAN 5.8G	64
10.2. SAR Summation Scenario.....	65
11. Appendix A. Photo documentation	66
12. Appendix B. System Check Plots.....	67
13. Appendix C. Plots of High SAR Measurement.....	84
14. Appendix D. Calibration Certificate	111

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
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 RT5 are as follows.

RF Exposure Conditions		Max Reported SAR Value(W/kg)
1-g Body-Worn (Separation distance of 0mm)		1.191
1-g Hotspot (Separation distance of 0mm)		1.191
Max Simultaneous Tx	Body-Worn	1.523
	Hotspot	1.523

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 & KDB 865664 D01.

1.3. EUT Description

Device Information			
Product Name	4G Tablet		
Trade Name	LOGIC, ISWAG, UNONU		
Model Name	T10L PLUS		
Family Model	Grad, Slate		
Model Difference	All the model are the same circuit and RF module,except the model names.		
FCC ID	O551001923		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna	PIFA Antenna		
Battery	DC 3.8V, 5000mAh, 19Wh		
Hardware version	S30DL_V1.1X		
Software version	LOGIC_LT10L_PLUS_TIGO_GT_V1.0		
Device Operating Configurations			
Supporting Mode(s)	GSM 850/1900, WCDMA Band 2/5, LTE Band 2/4/5/7/12/17, WLAN 2.4G/5G, Bluetooth		
Test Modulation	GSM(GMSK/8PSK), WCDMA(QPSK), LTE(QPSK/16QAM), WLAN(DSSS/OFDM), Bluetooth(GFSK, $\pi/4$ -DQPSK, 8DPSK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM 850	824-849	869-894
	GSM 1900	1850-1910	1930-1990

	WCDMA Band 2	1850-1910	1930-1990
	WCDMA Band 5	824-849	869-894
	LTE Band 2	1850-1910	1930-1990
	LTE Band 4	1710-1755	2110-2155
	LTE Band 5	824-849	869-894
	LTE Band 7	2500-2570	2620-2690
	LTE Band 12	699-716	729-746
	LTE Band 17	704-716	734-746
	WLAN 2.4G	2412-2462	
	WLAN 5.2G	5180-5240	
	WLAN 5.8G	5745-5825	
	Bluetooth	2402-2480	
GPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
EGPRS Multislot Class(12)	Max Number of Timeslots in Uplink		4
	Max Number of Timeslots in Downlink		4
	Max Total Timeslot		5
Power Class	4, tested with power level 5(GSM 850)		
	1, tested with power level 0(GSM 1900)		
	3, tested with power control "all 1"(WCDMA Band 2)		
	3, tested with power control "all 1"(WCDMA Band 5)		
	3, tested with power control all Max.(LTE Band 2)		
	3, tested with power control all Max.(LTE Band 4)		
	3, tested with power control all Max.(LTE Band 5)		
	3, tested with power control all Max.(LTE Band 7)		
	3, tested with power control all Max.(LTE Band 12)		
	3, tested with power control all Max.(LTE Band 17)		

1.4. Test specification(s)

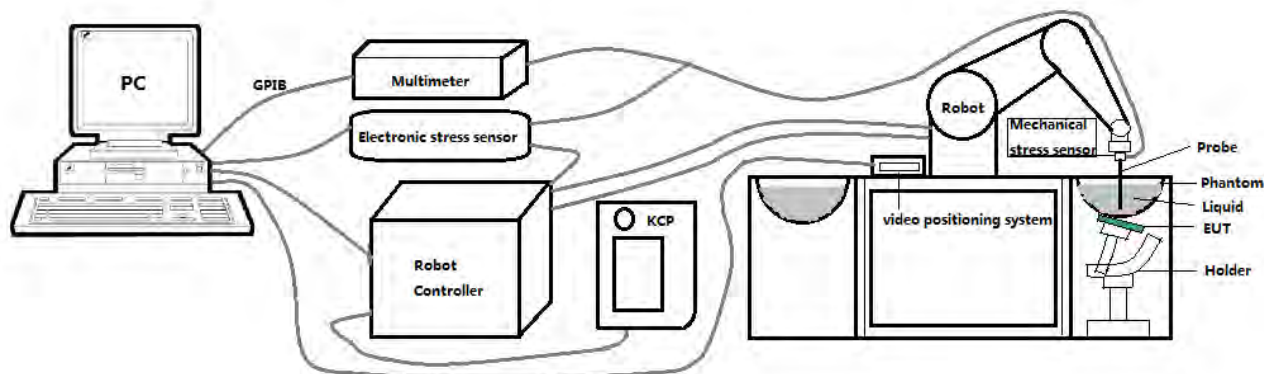
FCC 47 CFR Part 2(2.1093)
ANSI/IEEE C95.1-1992
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting
KDB 447498 D01 General RF Exposure Guidance
KDB 248227 D01 802.11 Wi-Fi SAR
KDB 941225 D01 3G SAR Procedures
KDB 941225 D05 SAR for LTE Devices
KDB 616217 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: ± 0.01 dB
 - Hemispherical Isotropy: ± 0.01 dB
 - Calibration range: 650MHz to 5900MHz for head & body simulating liquid.
 - Lower detection limit: 8mW/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 $\pm 10\%$. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (Norm X, Norm Y, and Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe are tested. The calibration data can be referred to appendix D of this report.

2.4. SAM phantoms

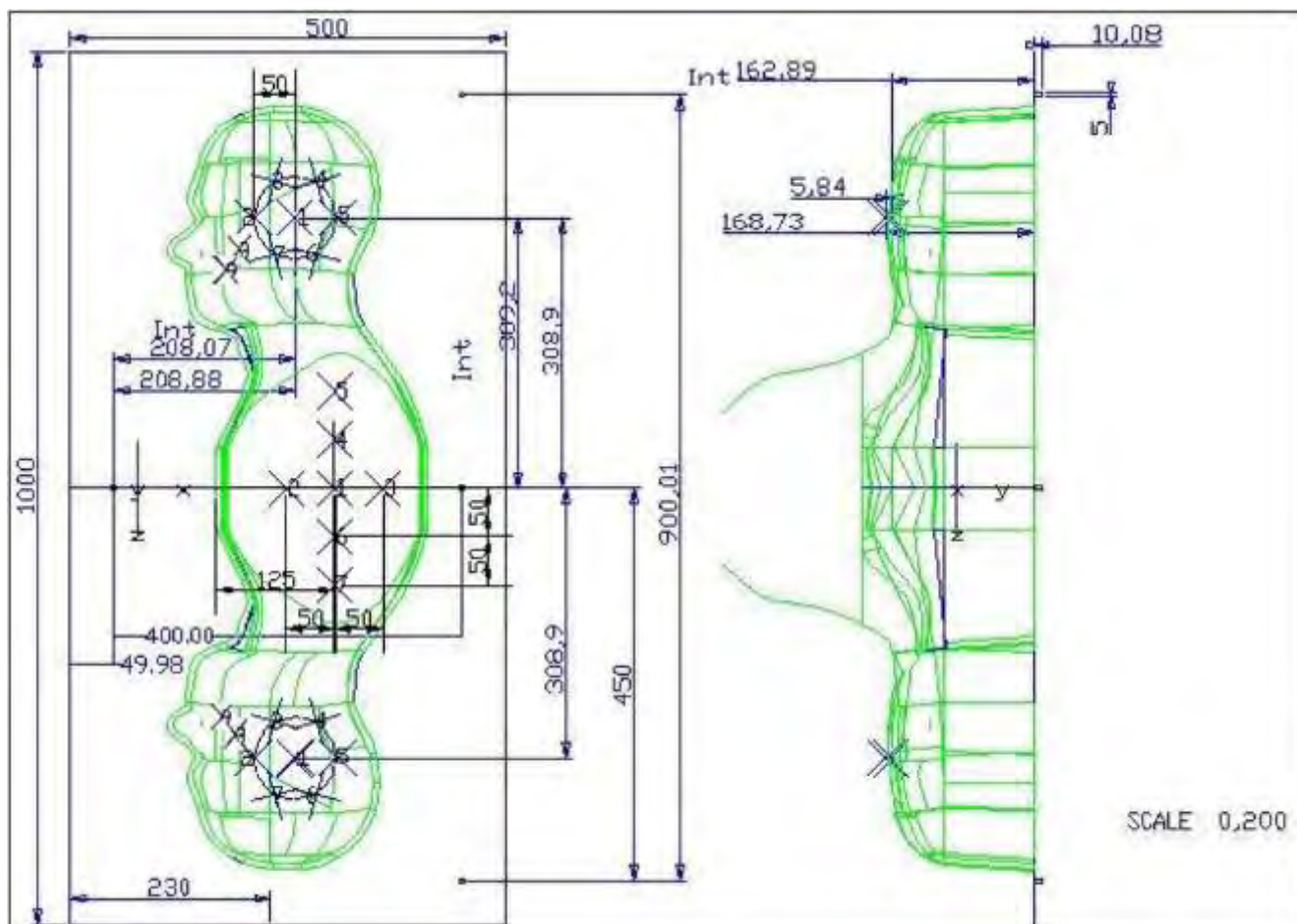
Photo of SAM phantom SN 16/15 SAM119



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

2.4.1. Technical Data

Serial Number	Shell thickness	Filling volume	Dimensions	Positionner Material	Permittivity	Loss Tangent
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

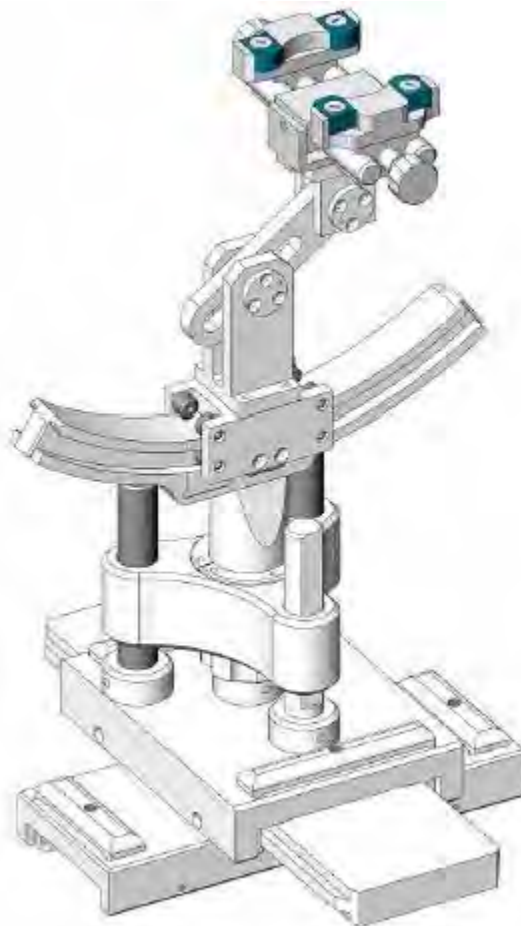


Serial Number	Left Head(mm)		Right Head(mm)		Flat Part(mm)	
SN 16/15 SAM119	2	2.02	2	2.08	1	2.09
	3	2.05	3	2.06	2	2.06
	4	2.07	4	2.07	3	2.08
	5	2.08	5	2.08	4	2.10
	6	2.05	6	2.07	5	2.10
	7	2.05	7	2.05	6	2.07
	8	2.07	8	2.06	7	2.07
	9	2.08	9	2.06	-	-

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	Jan. 10, 2023	Jan. 09, 2024
☒	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Mar. 01, 2021	Feb. 28, 2024
☐	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Mar. 01, 2021	Feb. 28, 2024
☐	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Mar. 01, 2021	Feb. 28, 2024
☐	MVG	2300 MHz Dipole	SID2300	SN 03/16 DIP 2G300-358	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Mar. 01, 2021	Feb. 28, 2024
☒	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Mar. 01, 2021	Feb. 28, 2024
☒	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	Jun. 17, 2022	Jun. 16, 2023
☒	R&S	Wideband radio communication tester	CMW500	103917	Jun. 17, 2022	Jun. 16, 2023
☒	HP	Network	8753D	3410J01136	Jun. 17,	Jun. 16,

		Analyzer			2022	2023
☒	Agilent	MXG Vector Signal Generator	N5182A	MY47070317	Jun. 16, 2022	Jun. 15, 2023
☒	Agilent	Power meter	E4419B	MY45102538	Jun. 17, 2022	Jun. 16, 2023
☒	Agilent	Power sensor	E9301A	MY41495644	Jun. 17, 2022	Jun. 16, 2023
☒	Agilent	Power sensor	E9301A	US39212148	Jun. 17, 2022	Jun. 16, 2023
☒	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Jul. 17, 2020	Jul. 16, 2023
☒	N/A	Thermometer	N/A	LES-085	Mar. 27, 2023	Mar. 26, 2026
☒	MVG	SAM Phantom	SSM2	SN 16/15 SAM119	NCR	NCR
☒	MVG	Device Holder	SMPPD	SN 16/15 MSH100	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 750	Head 750	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 835	Head 835	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 1800	Head 1800	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 1900	Head 1900	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 2450	Head 2450	NCR	NCR
☒	Shenzhen	Human	Head 2600	Head 2600	NCR	NCR

	Tianxu Communication Technology Co., Ltd.	Simulating Liquid				
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 5200	Head 5200	NCR	NCR
☒	Shenzhen Tianxu Communication Technology Co., Ltd.	Human Simulating Liquid	Head 5800	Head 5800	NCR	NCR

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.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5 \text{ mm}$
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	≤ 1.5 · $\Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

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

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

3.3. Description of interpolation/extrapolation scheme

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

An extrapolation is used to determine 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 for 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 defined 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 $\pm 5\%$, the SAR will be retested.

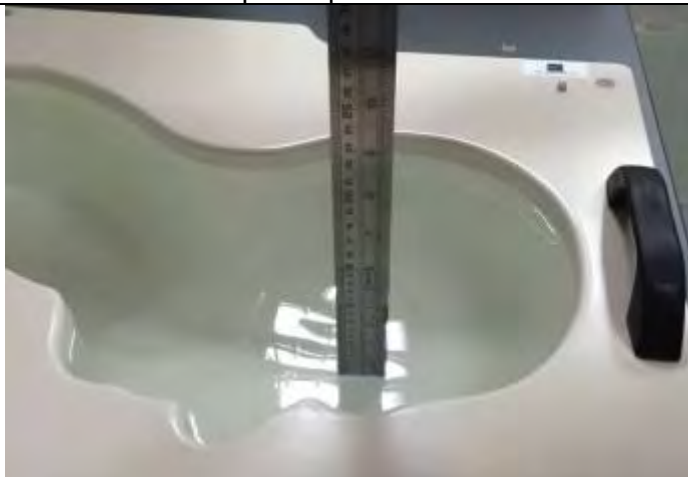
4. System Verification Procedure

4.1. Tissue Verification

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

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

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid depth from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm.

Photo of Liquid depth for Head Position	Photo of Liquid depth for Body Position
	

4.1.1. Tissue Dielectric Parameter Check Results

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

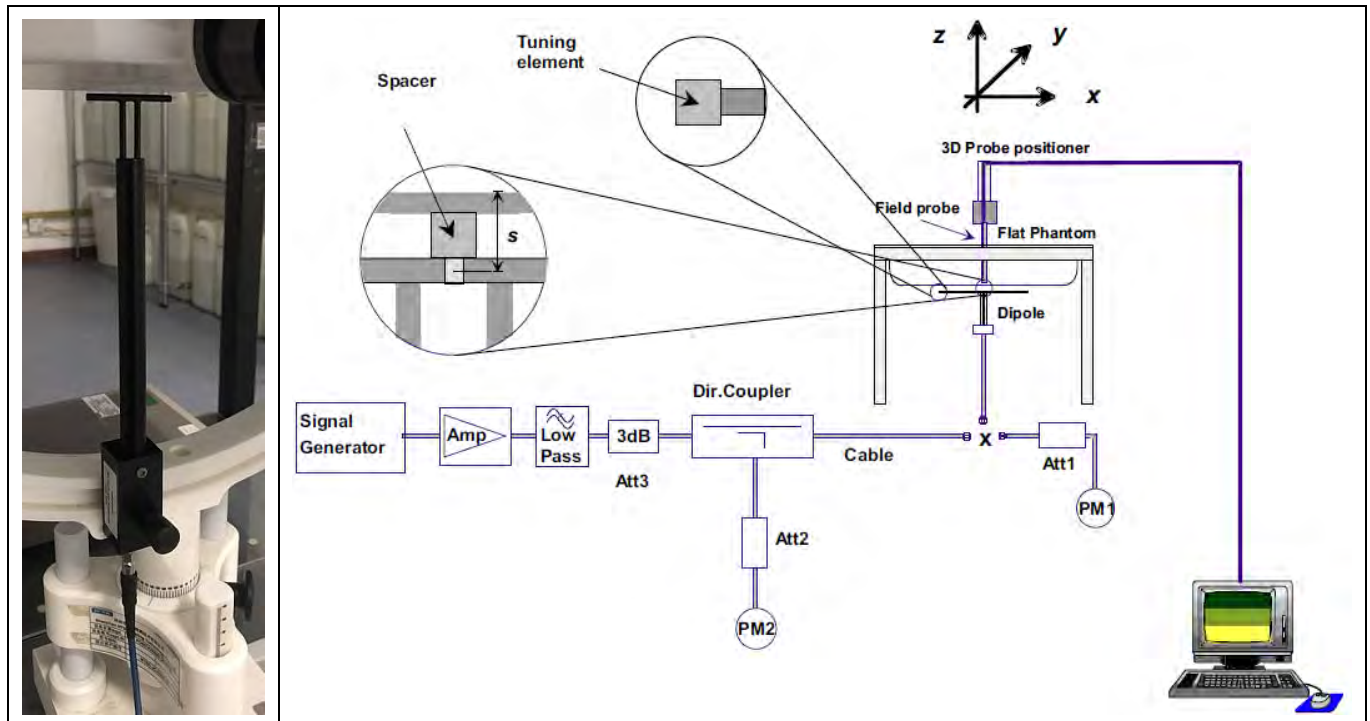
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		$\epsilon_r (\pm 5\%)$	σ (S/m) ($\pm 5\%$)	ϵ_r	σ (S/m)		
Head 750	750	41.96 (39.86~44.06)	0.89 (0.85~0.93)	40.61	0.91	21.7 °C	Apr. 19, 2023
Head 850	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	41.00	0.91	21.4 °C	Apr. 24, 2023
Head 1800	1800	40.00 (38.00~42.00)	1.40 (1.33~1.47)	38.54	1.37	21.2 °C	Apr. 27, 2023
Head 1900	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	38.40	1.43	21.8 °C	Apr. 21, 2023
Head 2450	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	38.22	1.78	21.1 °C	Apr. 20, 2023
Head 2600	2600	39.01 (37.06~40.96)	1.96 (1.86~2.06)	37.60	1.93	21.6 °C	Apr. 28, 2023
Head 5200	5200	36.00 (34.20~37.80)	4.66 (4.43~4.89)	35.69	4.67	21.6 °C	Apr. 13, 2023
Head 5800	5800	35.30 (33.54~37.07)	5.27 (5.01~5.53)	34.27	5.18	21.3 °C	Apr. 12, 2023

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

4.2. System Verification Procedure

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

The system verification is shown as below picture:



4.2.1. System Verification Results

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

System Verification	Target SAR (1W)		Measured SAR		Liquid Temp.	Delta (%)		Test Date
	(±10%)		(Normalized to 1W)					
	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)		1-g (±10%)	10-g (±10%)	
750MHz	8.53	5.56	8.4	5.1	21.7 °C	-1.52%	-8.27%	Apr. 19, 2023
	(7.68~9.38)	(5.01~6.11)						
835MHz	9.84	6.22	10.21	5.72	21.4 °C	3.76%	-8.04%	Apr. 24, 2023
	(8.86~10.82)	(5.60~6.84)						
1800MHz	37.96	19.81	41.19	20.85	21.2 °C	8.51%	5.25%	Apr. 27, 2023
	(34.17~41.75)	(17.83~21.79)						
1900MHz	40.37	20.48	39.04	21.21	21.8 °C	-3.29%	3.56%	Apr. 21, 2023
	(36.34~44.40)	(18.44~22.52)						
2450MHz	53.69	23.94	58	24.36	21.1 °C	8.03%	1.75%	Apr. 20, 2023
	(48.33~59.05)	(21.55~26.33)						
2600MHz	55.83	24.19	55.78	25.14	21.6 °C	-0.09%	3.93%	Apr. 28, 2023
	(50.25~61.41)	(21.78~26.60)						
5200MHz	162.34	55.42	150.37	59.6	21.6 °C	-7.37%	7.54%	Apr. 13, 2023
	(146.11~178.57)	(49.88~60.96)						
5800MHz	178.89	59.32	171.34	60.62	21.3 °C	-4.22%	2.19%	Apr. 12, 2023
	(161.01~196.77)	(53.39~65.25)						

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 ($\sim 10\%$ 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

1.3. 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 ≤ 5 mm 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. GSM Conducted Power

Band GSM850	Burst-Averaged output Power (dBm)				Frame-Averaged output Power (dBm)			
Tx Channel	Tune - up (dBm)	128	189	251	Tune - up (dBm)	128	189	251
Frequency (MHz)		824.2	836.4	848.8		824.2	836.4	848.8
GSM (GMSK)	33.50	33.19	33.06	32.83	24.47	24.16	24.03	23.80
GPRS(GMSK, 1 TS)	33.50	33.30	33.23	33.01	24.47	24.27	24.20	23.98
GPRS(GMSK, 2 TS)	31.50	31.16	31.11	30.86	25.48	25.14	25.09	24.84
GPRS(GMSK, 3 TS)	29.50	29.35	29.31	29.07	25.24	25.09	25.05	24.81
GPRS(GMSK, 4 TS)	27.50	27.07	27.08	26.89	24.49	24.06	24.07	23.88
EGPRS(8PSK, 1 TS)	27.50	26.76	27.29	26.80	18.47	17.73	18.26	17.77
EGPRS(8PSK, 2 TS)	27.00	25.60	26.62	25.41	20.98	19.58	20.60	19.39
EGPRS(8PSK, 3 TS)	24.50	23.08	24.03	23.35	20.24	18.82	19.77	19.09
EGPRS(8PSK, 4 TS)	21.50	20.56	21.21	20.61	18.49	17.55	18.20	17.60
Band GSM1900	Burst-Averaged output Power (dBm)				Frame-Averaged output Power (dBm)			
Tx Channel	Tune - up (dBm)	512	661	810	Tune - up (dBm)	512	661	810
Frequency (MHz)		1850.2	1880	1909.8		1850.2	1880	1909.8
GSM (GMSK)	30.50	30.37	30.42	30.40	21.47	21.34	21.39	21.37
GPRS(GMSK, 1 TS)	31.00	30.57	30.64	30.62	21.97	21.54	21.61	21.59
GPRS(GMSK, 2 TS)	29.00	28.63	28.42	28.19	22.98	22.61	22.40	22.17
GPRS(GMSK, 3 TS)	27.50	27.06	26.81	26.51	23.24	22.80	22.55	22.25
GPRS(GMSK, 4 TS)	25.00	24.97	24.69	24.37	21.99	21.96	21.68	21.36
EGPRS(8PSK, 1 TS)	27.50	27.48	27.06	27.35	18.47	18.45	18.03	18.32
EGPRS(8PSK, 2 TS)	26.50	25.99	26.12	25.86	20.48	19.97	20.10	19.84
EGPRS(8PSK, 3 TS)	24.50	24.01	23.73	23.76	20.24	19.75	19.47	19.50
EGPRS(8PSK, 4 TS)	22.50	22.27	22.08	22.18	19.49	19.26	19.07	19.17

Note: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots. The calculated method are shown as below:

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

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

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

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

7.2. WCDMA Conducted Power

WCDMA Band 2		Burst-Averaged output Power (dBm)			
Tx Channel	Frequency (MHz)	Tune-up (dBm)	9262	9400	9538
			1852.4	1880	1907.6
RMC12.2K		24.00	23.81	23.78	23.83
HSDPA Sub 1		24.00	23.71	23.60	23.80
HSDPA Sub 2		24.00	23.40	23.34	23.53
HSDPA Sub 3		23.50	23.06	22.99	23.22
HSDPA Sub 4		23.50	23.09	22.98	23.09
HSUPA Sub 1		24.00	23.42	23.48	23.55
HSUPA Sub 2		24.00	23.60	23.53	23.72
HSUPA Sub 3		24.00	23.51	23.26	23.18
HSUPA Sub 4		24.00	23.61	23.46	23.73
HSUPA Sub 5		23.50	23.32	23.32	23.27
WCDMA Band 5		Burst-Averaged output Power (dBm)			
Tx Channel	Frequency (MHz)	Tune-up (dBm)	4132	4182	4233
			826.4	836.4	846.6
RMC12.2K		24.00	23.61	23.62	23.49
HSDPA Sub 1		24.00	23.59	23.60	23.39
HSDPA Sub 2		23.50	23.29	23.33	23.14
HSDPA Sub 3		23.50	23.06	22.87	22.65
HSDPA Sub 4		23.00	22.85	22.92	22.58
HSUPA Sub 1		23.50	23.31	23.32	23.34
HSUPA Sub 2		24.00	23.49	23.55	23.36
HSUPA Sub 3		23.50	22.89	23.02	23.22
HSUPA Sub 4		24.00	23.39	23.52	23.34
HSUPA Sub 5		23.50	23.26	23.48	23.23

7.3. LTE Conducted Power

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18607/1850.7	18900/1880	19193/1909.3
LTE Band 2	1.4MHz	QPSK	1	0	24.50	24.07	24.30	24.21
			1	2	24.50	24.22	24.45	24.16
			1	5	24.50	24.18	24.21	24.16

			3	0	24.50	24.22	24.06	23.98
			3	1	24.50	24.30	24.10	24.03
			3	2	24.50	24.25	24.12	24.03
			6	0	23.50	23.31	23.06	22.88
		16QAM	1	0	24.00	23.79	22.43	22.88
			1	2	24.00	23.81	22.44	22.84
			1	5	24.00	23.78	22.46	22.96
			3	0	24.00	23.58	22.88	23.12
			3	1	24.00	23.52	23.17	23.14
			3	2	24.00	23.53	23.19	23.19
6	0	22.50	22.04	21.78	21.86			
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18615/1851.5	18900/1880	19185/1908.5
LTE Band 2	3MHz	QPSK	1	0	24.50	24.25	24.23	24.02
			1	7	24.50	24.23	24.25	23.92
			1	14	24.50	24.17	24.22	23.94
			8	0	23.50	23.16	22.99	22.97
			8	4	23.50	23.25	22.99	22.91
			8	7	23.50	23.09	23.10	22.92
			15	0	23.50	23.22	23.08	22.89
		16QAM	1	0	24.00	23.79	23.06	23.56
			1	7	24.00	23.75	23.04	23.54
			1	14	24.00	23.71	23.04	23.43
			8	0	22.50	22.43	22.18	22.16
			8	4	22.50	22.40	22.12	22.10
			8	7	22.50	22.37	22.10	22.07
			15	0	22.50	22.33	22.09	22.04
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18625/1852.5	18900/1880	19175/1907.5
LTE Band 2	5MHz	QPSK	1	0	25.00	24.56	24.37	24.16
			1	12	25.00	24.45	24.47	24.24
			1	24	25.00	24.40	24.40	24.20
			12	0	23.50	23.26	23.04	23.05
			12	6	23.50	23.21	22.99	23.02
			12	11	23.50	23.44	23.11	22.99
			25	0	24.00	23.54	22.98	23.01

			16QAM	1	0	24.00	23.86	23.62	23.04
				1	12	24.00	23.77	23.58	23.09
				1	24	24.00	23.67	23.60	22.86
				12	0	22.50	22.40	22.15	22.14
				12	6	22.50	22.24	22.12	22.12
				12	11	22.50	22.32	22.00	22.11
				25	0	22.50	22.18	22.00	22.19
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)			
			RB Size	RB Offset		18650/1855	18900/1880	19150/1905	
LTE Band 2	10MHz	QPSK	1	0	24.50	24.25	24.10	23.97	
			1	24	24.50	24.22	24.06	24.04	
			1	49	24.50	24.19	24.09	24.05	
			25	0	23.50	23.21	23.05	22.92	
			25	12	23.50	23.05	22.93	22.88	
			25	24	23.50	23.06	22.95	22.94	
			50	0	23.50	23.22	22.99	22.87	
		16QAM	1	0	24.00	23.82	23.59	23.51	
			1	24	24.00	23.76	23.63	23.49	
			1	49	24.00	23.71	23.44	23.57	
			25	0	22.50	22.22	22.06	21.89	
			25	12	22.50	22.13	21.99	21.96	
			25	24	22.50	22.17	21.99	21.95	
			50	0	22.50	22.24	22.04	21.93	
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)			
			RB Size	RB Offset		18675/1857.5	18900/1880	19125/1902.5	
LTE Band 2	15MHz	QPSK	1	0	25.00	24.56	24.39	24.02	
			1	37	25.00	24.40	24.28	24.01	
			1	74	25.00	24.43	24.20	23.94	
			36	0	23.50	23.16	23.17	23.01	
			36	18	23.50	23.11	23.03	22.92	
			36	37	23.50	23.13	22.90	22.94	
			75	0	23.50	23.03	22.99	23.06	
		16QAM	1	0	24.00	23.28	23.08	23.65	
			1	37	24.00	23.15	23.66	23.52	
			1	74	24.00	23.08	23.63	23.66	
			36	0	22.50	22.25	22.15	21.90	

			36	18	22.50	22.15	22.06	21.98
			36	37	22.50	22.12	21.97	22.09
			75	0	22.50	22.26	22.24	22.15
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		18700/1860	18900/1880	19100/1900
LTE Band 2	20MHz	QPSK	1	0	25.00	24.56	24.41	24.35
			1	49	25.00	24.42	24.36	24.21
			1	99	25.00	24.38	24.15	24.24
			50	0	23.50	23.10	23.17	22.99
			50	24	23.50	23.19	23.00	23.01
			50	49	23.50	23.05	23.09	23.00
			100	0	23.50	23.05	23.13	22.94
		16QAM	1	0	24.00	23.43	22.59	23.62
			1	49	24.00	23.22	22.66	23.47
			1	99	24.00	23.15	22.53	23.60
			50	0	22.50	22.23	22.20	22.08
			50	24	22.50	22.20	22.15	21.97
			50	49	22.50	22.13	22.16	21.99
			100	0	22.50	22.19	22.10	21.98

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		19957/1710.7	20175/1732.5	20393/1754.3
LTE Band 4	1.4MHz	QPSK	1	0	24.50	23.06	24.06	23.87
			1	2	24.50	23.24	24.14	23.98
			1	5	24.50	23.24	24.10	23.90
			3	0	24.00	23.35	23.94	23.84
			3	1	24.00	23.31	23.87	23.89
			3	2	24.00	23.25	23.82	23.72
			6	0	23.00	22.23	22.69	22.76
		16QAM	1	0	23.50	22.57	23.16	23.00
			1	2	23.50	22.58	23.17	23.16
			1	5	23.50	22.71	23.15	22.97
			3	0	23.50	22.39	22.92	23.14
			3	1	23.50	22.41	22.95	22.99
			3	2	23.50	22.43	23.02	23.15
			6	0	22.00	21.17	21.73	21.76

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		19965/1711.5	20175/1732.5	20385/1753.5
LTE Band 4	3MHz	QPSK	1	0	24.00	23.60	23.78	23.87
			1	7	24.00	23.60	23.83	23.99
			1	14	24.00	23.31	23.85	23.93
			8	0	23.00	22.26	22.71	22.90
			8	4	23.00	22.37	22.74	22.82
			8	7	23.00	22.32	22.83	22.80
			15	0	23.00	22.26	22.86	22.79
		16QAM	1	0	24.00	22.80	23.30	23.51
			1	7	24.00	22.94	23.29	23.45
			1	14	24.00	23.04	23.31	23.56
			8	0	22.50	21.49	21.90	21.96
			8	4	22.50	21.49	21.96	22.07
			8	7	22.50	21.50	22.00	22.04
			15	0	22.50	21.42	21.87	22.02
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		19975/1712.5	20175/1732.5	20375/1752.5
LTE Band 4	5MHz	QPSK	1	0	24.50	23.57	24.03	23.99
			1	12	24.50	23.63	23.87	24.02
			1	24	24.50	23.67	23.85	24.03
			12	0	23.00	22.35	22.68	22.79
			12	6	23.00	22.32	22.78	22.73
			12	11	23.00	22.33	22.82	22.74
			25	0	23.00	22.38	22.87	22.73
		16QAM	1	0	23.50	22.73	23.27	23.22
			1	12	23.50	22.85	23.27	23.17
			1	24	23.50	22.80	23.44	23.16
			12	0	22.00	21.42	21.88	21.84
			12	6	22.00	21.42	21.91	21.75
			12	11	22.00	21.48	21.88	21.75
			25	0	22.00	21.69	21.79	21.76
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20000/1715	20175/1732.5	20350/1750

LTE Band 4	10MHz	QPSK	1	0	24.00	23.54	23.84	23.72
			1	24	24.00	23.65	23.84	23.75
			1	49	24.00	23.85	23.80	23.70
			25	0	23.00	22.26	22.67	22.73
			25	12	23.00	22.45	22.79	22.80
			25	24	23.00	22.55	22.87	22.67
			50	0	23.00	22.33	22.72	22.81
		16QAM	1	0	24.00	22.68	23.29	23.38
			1	24	24.00	22.67	23.41	23.49
			1	49	24.00	23.03	23.25	23.54
			25	0	22.00	21.67	21.74	21.79
			25	12	22.00	21.68	21.75	21.87
			25	24	22.00	21.81	21.82	21.85
			50	0	22.00	21.47	21.79	21.91
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20025/1717.5	20175/1732.5	20325/1747.5
LTE Band 4	15MHz	QPSK	1	0	24.00	23.54	23.75	23.91
			1	37	24.00	23.67	23.83	23.89
			1	74	24.00	23.92	23.92	23.87
			36	0	23.00	22.32	22.73	22.75
			36	18	23.00	22.52	22.88	22.77
			36	37	23.00	22.55	22.86	22.76
			75	0	23.00	22.50	22.79	22.69
		16QAM	1	0	23.50	22.68	23.14	22.96
			1	37	23.50	22.82	23.25	23.11
			1	74	23.50	23.04	23.08	23.14
			36	0	22.00	21.55	22.00	21.84
			36	18	22.00	21.66	21.88	21.92
			36	37	22.00	21.70	21.93	21.88
			75	0	22.00	21.61	21.81	21.72
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20050/1720	20175/1732.5	20300/1745
LTE Band 4	20MHz	QPSK	1	0	24.50	23.57	24.03	23.69
			1	49	24.50	23.78	24.12	23.81
			1	99	24.50	24.07	24.17	23.93
			50	0	23.00	22.39	22.76	22.58

			50	24	23.00	22.57	22.84	22.66
			50	49	23.00	22.68	22.78	22.79
			100	0	23.00	22.48	22.78	22.73
		16QAM	1	0	23.50	22.53	23.05	22.81
			1	49	23.50	22.93	23.12	22.93
			1	99	23.50	23.15	23.24	22.94
			50	0	22.00	21.49	21.86	21.73
			50	24	22.00	21.62	21.89	21.84
			50	49	22.00	21.69	21.89	21.97
			100	0	22.00	21.71	21.93	21.84

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20407/824.7	20525/836.5	20643/848.3
LTE Band 5	1.4MHz	QPSK	1	0	24.00	23.36	23.60	23.63
			1	2	24.00	23.36	23.62	23.68
			1	5	24.00	23.37	23.60	23.65
			3	0	24.00	23.53	23.51	23.54
			3	1	24.00	23.57	23.45	23.56
			3	2	24.00	23.49	23.40	23.65
			6	0	23.00	22.48	22.27	22.61
		16QAM	1	0	23.00	22.84	22.57	22.98
			1	2	23.00	22.85	22.61	22.82
			1	5	23.00	22.92	22.66	22.93
			3	0	23.00	22.72	22.70	22.62
			3	1	23.00	22.64	22.61	22.80
			3	2	23.00	22.71	22.57	22.59
			6	0	22.00	21.61	21.13	21.25
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20415/825.5	20525/836.5	20635/847.5
LTE Band 5	3MHz	QPSK	1	0	24.00	23.50	23.43	23.67
			1	7	24.00	23.46	23.33	23.62
			1	14	24.00	23.49	23.35	23.65
			8	0	23.00	22.42	22.31	22.56
			8	4	23.00	22.40	22.43	22.52
			8	7	23.00	22.50	22.44	22.64
			15	0	23.00	22.50	22.39	22.50

			16QAM	1	0	23.00	22.81	22.92	22.68
			16QAM	1	7	23.00	22.92	22.78	22.72
			16QAM	1	14	23.00	22.93	22.71	22.75
			16QAM	8	0	22.50	21.94	21.27	22.07
			16QAM	8	4	22.50	21.90	21.43	22.00
			16QAM	8	7	22.50	21.53	21.42	21.67
			16QAM	15	0	22.00	21.94	21.37	21.96
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)			
			RB Size	RB Offset		20425/826.5	20525/836.5	20625/846.5	
LTE Band 5	5MHz	QPSK	1	0	24.00	23.58	23.79	23.82	
			1	12	24.00	23.44	23.68	23.82	
			1	24	24.00	23.51	23.65	23.80	
			12	0	23.00	22.54	22.41	22.47	
			12	6	23.00	22.59	22.39	22.56	
			12	11	23.00	22.39	22.28	22.51	
			25	0	23.00	22.49	22.41	22.53	
		16QAM	1	0	23.00	22.69	22.78	22.88	
			1	12	23.00	22.92	22.90	22.86	
			1	24	23.00	22.76	22.91	22.99	
			12	0	22.00	21.89	21.27	21.48	
			12	6	22.00	21.51	21.29	21.92	
			12	11	22.00	21.43	21.33	21.86	
			25	0	22.50	21.69	21.36	22.18	
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)			
			RB Size	RB Offset		20450/829	20525/836.5	20600/844	
LTE Band 5	10MHz	QPSK	1	0	24.00	23.82	23.44	23.44	
			1	24	24.00	23.70	23.40	23.58	
			1	49	24.00	23.59	23.52	23.61	
			25	0	23.00	22.50	22.43	22.35	
			25	12	23.00	22.45	22.38	22.51	
			25	24	23.00	22.41	22.40	22.45	
			50	0	23.00	22.47	22.44	22.52	
		16QAM	1	0	23.00	22.81	22.84	23.00	
			1	24	23.00	22.76	22.84	22.98	
			1	49	23.00	22.64	22.93	22.96	
			25	0	22.50	21.71	21.24	21.44	

			25	12	22.50	21.62	21.30	21.45
			25	24	22.50	22.04	21.37	21.93
			50	0	21.50	21.45	21.36	21.49

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20775/2502.5	21100/2535	21425/2567.5
LTE Band 7	5MHz	QPSK	1	0	23.50	22.59	23.22	23.42
			1	12	23.50	22.99	23.27	23.24
			1	24	23.50	22.91	23.22	23.26
			12	0	22.50	21.96	21.94	22.02
			12	6	22.50	22.12	21.94	22.10
			12	11	22.50	22.03	22.03	22.16
			25	0	22.50	22.03	22.05	21.97
		16QAM	1	0	23.00	22.61	22.44	22.62
			1	12	23.00	22.61	22.38	22.39
			1	24	23.00	22.65	22.28	22.46
			12	0	21.50	21.08	21.03	21.16
			12	6	21.50	21.19	21.16	21.13
			12	11	21.50	21.17	21.12	21.15
			25	0	21.50	21.07	21.27	21.06

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20800/2505	21100/2535	21400/2565
LTE Band 7	10MHz	QPSK	1	0	23.50	23.02	22.92	23.08
			1	24	23.50	23.08	23.06	23.18
			1	49	23.50	22.98	23.08	23.00
			25	0	22.50	22.13	21.98	22.10
			25	12	22.50	22.10	22.01	22.11
			25	24	22.50	22.00	22.02	22.01
			50	0	22.50	22.14	21.94	22.13
		16QAM	1	0	23.00	22.63	22.49	22.70
			1	24	23.00	22.68	22.55	22.78
			1	49	23.00	22.56	22.49	22.63
			25	0	21.50	21.14	21.05	21.15
			25	12	21.50	21.16	21.05	21.24
			25	24	21.50	21.08	21.10	21.11
			50	0	21.50	21.10	21.01	21.29

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20825/2507.5	21100/2535	21375/2562.5
LTE Band 7	15MHz	QPSK	1	0	23.50	23.22	23.03	23.13
			1	37	23.50	23.27	23.24	23.26
			1	74	23.50	23.06	23.10	23.20
			36	0	22.50	22.14	21.80	21.96
			36	18	22.50	22.01	21.99	22.03
			36	37	22.50	21.94	21.86	21.94
			75	0	22.00	21.95	21.96	21.95
		16QAM	1	0	22.50	22.33	22.19	22.29
			1	37	22.50	22.36	22.37	22.45
			1	74	22.50	22.26	22.19	22.34
			36	0	21.50	21.27	21.13	21.15
			36	18	21.50	21.26	21.19	21.25
			36	37	21.50	21.16	21.19	21.16
			75	0	21.50	21.00	20.98	21.01
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		20850/2510	21100/2535	21350/2560
LTE Band 7	20MHz	QPSK	1	0	23.50	23.23	22.96	22.98
			1	49	23.50	23.06	23.14	23.09
			1	99	23.50	22.81	23.12	23.07
			50	0	22.50	22.05	21.94	21.90
			50	24	22.50	22.05	21.97	21.89
			50	49	22.50	21.91	22.04	22.11
			100	0	22.00	21.92	21.96	21.99
		16QAM	1	0	22.50	22.23	22.18	22.13
			1	49	22.50	22.19	22.27	22.15
			1	99	22.50	22.03	22.15	22.16
			50	0	21.50	21.17	21.04	20.99
			50	24	21.50	21.11	21.03	21.04
			50	49	21.50	21.00	21.13	21.12
			100	0	21.50	21.03	21.04	21.04

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB	RB		23017/699.7	23095/707.5	23173/715.3

Band	Band Width	Modulation	Size	Offset	Tune-up (dBm)	Channel/Frequency(MHz)		
LTE Band 12	1.4MHz	QPSK	1	0	24.50	23.81	24.00	23.85
			1	2	24.50	23.81	24.05	23.93
			1	5	24.50	23.82	23.91	23.85
			3	0	24.50	24.04	23.77	23.77
			3	1	24.50	24.06	23.87	23.78
			3	2	24.50	24.02	23.75	23.90
		16QAM	6	0	23.00	22.86	22.64	22.62
			1	0	23.00	22.70	22.64	22.57
			1	2	23.00	22.84	22.69	22.69
			1	5	23.00	22.69	22.77	22.59
			3	0	23.50	22.92	22.85	22.87
			3	1	23.50	23.20	22.93	22.92
			3	2	23.50	23.08	23.01	22.85
			6	0	22.50	21.62	22.01	21.50
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		23025/700.5	23095/707.5	23165/714.5
LTE Band 12	3MHz	QPSK	1	0	24.50	24.19	23.86	23.62
			1	7	24.50	24.09	23.80	23.66
			1	14	24.50	23.94	23.80	23.89
			8	0	23.00	22.89	22.76	22.74
			8	4	23.00	22.78	22.73	22.79
			8	7	23.00	22.92	22.83	22.71
			15	0	23.00	22.83	22.67	22.77
		16QAM	1	0	23.50	22.87	23.22	23.10
			1	7	23.50	22.82	23.06	23.23
			1	14	23.50	22.70	22.96	23.12
			8	0	22.50	21.90	21.79	22.31
			8	4	22.50	21.83	22.29	22.31
			8	7	22.50	22.05	22.28	21.74
			15	0	22.50	22.00	22.35	22.28
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		23035/701.5	23095/707.5	23155/713.5
LTE Band 12	5MHz	QPSK	1	0	24.50	24.28	24.10	24.04
			1	12	24.50	24.07	24.04	23.76
			1	24	24.50	24.08	24.08	23.89

				12	0	23.00	22.94	22.77	22.62
				12	6	23.00	22.93	22.77	22.74
				12	11	23.00	22.87	22.74	22.70
				25	0	23.00	22.90	22.92	22.70
			16QAM	1	0	23.50	23.31	23.19	23.18
				1	12	23.50	23.27	23.09	23.14
				1	24	23.50	23.25	23.07	23.21
				12	0	22.50	21.89	21.79	21.79
				12	6	22.50	21.84	22.16	22.16
				12	11	22.50	21.94	22.13	22.16
				25	0	22.50	21.88	22.17	22.18
			Band	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
				RB Size	RB Offset		23060/704	23095/707.5	23130/711
LTE Band 12	10MHz	QPSK		1	0	24.50	24.22	23.89	23.77
				1	24	24.50	23.99	23.98	23.78
				1	49	24.50	23.99	23.76	24.08
				25	0	23.00	22.97	22.85	22.74
				25	12	23.00	22.84	22.78	22.75
				25	24	23.00	22.71	22.77	22.57
				50	0	23.00	22.86	22.75	22.77
		16QAM		1	0	23.50	22.87	23.25	22.73
				1	24	23.50	22.82	23.08	22.73
				1	49	23.50	22.72	23.01	22.64
				25	0	22.50	22.17	21.60	22.34
				25	12	22.50	22.48	22.17	21.98
				25	24	22.50	21.97	21.78	22.42
				50	0	22.50	22.28	22.28	21.81

Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		23755/706.5	23790/710	23825/713.5
LTE Band 17	5MHz	QPSK	1	0	24.50	22.98	23.98	23.99
			1	12	24.50	23.59	23.90	24.04
			1	24	24.50	23.64	23.89	24.22
			12	0	23.00	22.74	22.76	22.73
			12	6	23.00	22.67	22.70	22.66
			12	11	23.00	22.66	22.78	22.62

			25	0	23.00	22.66	22.76	22.76
		16QAM	1	0	23.50	23.19	22.78	22.59
			1	12	23.50	23.15	22.65	22.71
			1	24	23.50	23.12	22.53	22.65
			12	0	22.50	21.77	22.20	21.70
			12	6	22.50	21.68	21.75	22.14
			12	11	22.50	22.16	21.64	22.17
			25	0	22.50	21.66	22.03	22.35
Band	Band Width	Modulation	RB Configuration		Tune-up (dBm)	Channel/Frequency(MHz)		
			RB Size	RB Offset		23780/709	23790/710	23800/711
LTE Band 17	10MHz	QPSK	1	0	24.00	23.77	23.76	23.75
			1	24	24.00	23.68	23.71	23.81
			1	49	24.00	23.68	23.72	23.94
			25	0	23.00	22.66	22.85	22.80
			25	12	23.00	22.60	22.78	22.79
			25	24	23.00	22.67	22.71	22.61
			50	0	23.00	22.71	22.84	22.83
		16QAM	1	0	23.50	23.32	23.11	23.19
			1	24	23.50	23.10	23.19	23.04
			1	49	23.50	23.02	23.08	23.14
			25	0	22.50	21.69	22.14	22.08
			25	12	22.50	22.03	21.72	21.83
			25	24	22.50	21.60	21.61	22.08
			50	0	22.50	22.21	21.84	21.82

7.4. WLAN & Bluetooth Output Power

7.4.1. Output Power Results Of WLAN

Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)
802.11b	1	2412	17.00	15.93
	6	2437	17.00	16.36
	11	2462	17.00	16.56
802.11g	1	2412	14.50	13.44
	6	2437	14.50	13.90
	11	2462	14.50	14.21

802.11n HT20	1	2412	12.50	11.43
	6	2437	12.50	12.17
	11	2462	12.50	12.21
802.11n HT40	3	2422	12.00	11.50
	6	2437	12.00	11.27
	9	2452	12.00	11.74

NOTE: Power measurement results of WLAN 2.4G.

Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)
802.11a	36	5180	10.50	9.55
	40	5200	10.50	10.04
	48	5240	10.50	9.72
802.11n HT20	36	5180	10.50	9.50
	40	5200	10.50	10.02
	48	5240	10.50	9.84
802.11n HT40	38	5190	10.00	9.81
	46	5230	10.00	9.99
802.11ac VHT20	36	5180	10.50	9.48
	40	5200	10.50	10.04
	48	5240	10.50	9.90
802.11ac VHT40	38	5190	10.00	9.84
	46	5230	10.00	9.99
802.11ac VHT80	42	5210	10.00	9.62

NOTE: Power measurement results of WLAN 5.2G.

Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)
802.11a	149	5745	11.00	10.73
	157	5785	11.00	9.52
	165	5825	11.00	9.47
802.11n HT20	149	5745	10.50	10.10
	157	5785	10.50	9.53
	165	5825	10.50	9.54
802.11n HT40	151	5755	10.00	9.88
	159	5795	10.00	9.91
802.11ac VHT20	149	5745	10.50	10.07
	157	5785	10.50	9.54
	165	5825	10.50	9.56
802.11ac VHT40	151	5755	10.00	9.88

	159	5795	10.00	8.79
802.11ac VHT80	155	5775	9.50	9.41

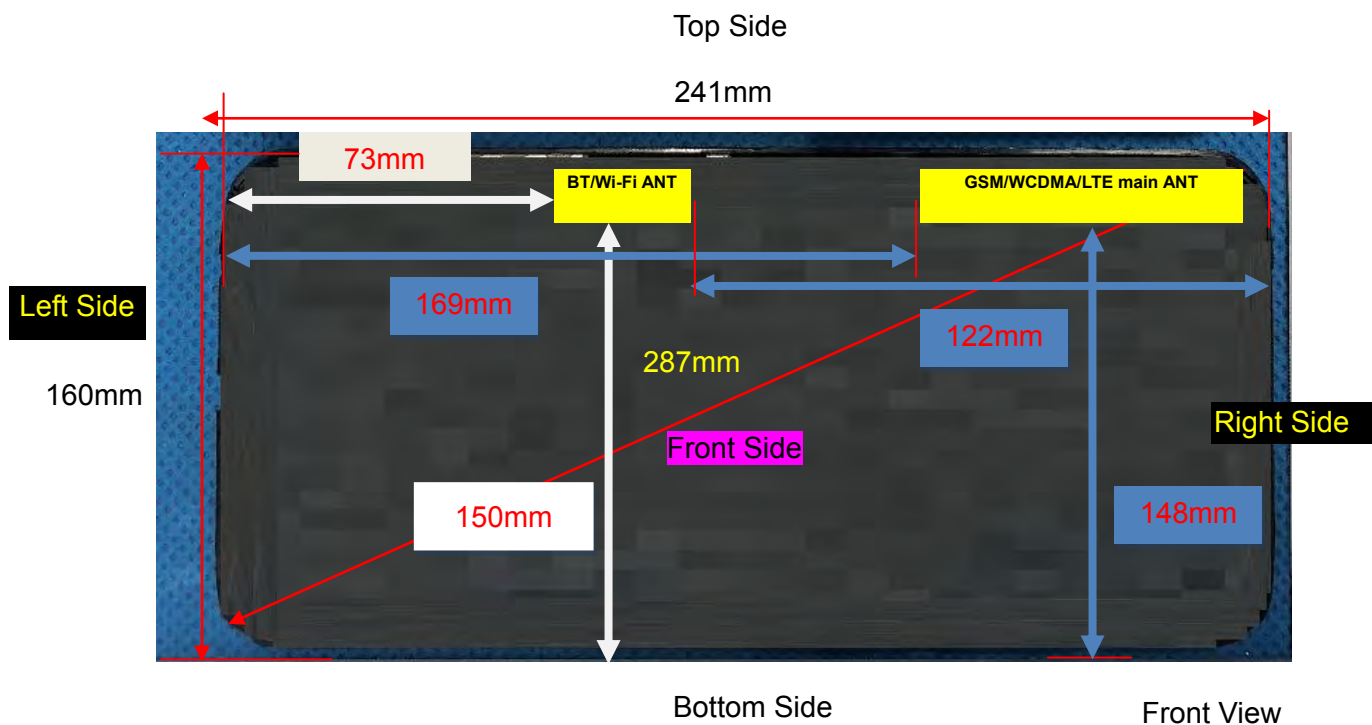
NOTE: Power measurement results of WLAN 5.8G.

7.4.2. Output Power Results Of Bluetooth

BR+EDR	Output Power (dBm)				
	Channel	Tune-up (dBm)	Data Rates		
			1M	2M	3M
	0CH	9	7.60	7.94	8.02
	39CH	7	6.63	6.78	6.87
	78CH	7	6.19	6.71	6.79

BLE	Channel	Tune-up (dBm)	Output Power (dBm)	
			1M	2M
	0CH	0.00	-0.61	-0.72
	19CH	-1.00	-1.21	-1.35
	39CH	-1.00	-1.43	-1.63

8. Antenna Location



Note: Since the confidentiality request of EUT, the antenna location example diagram see as above.

Distance of the Antenna to the EUT surface/edge						
Antennas	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
WWAN Main	5	5	169	5	5	148
WLAN & Bluetooth	5	5	73	122	5	150

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

Positions for SAR tests		
Test separation distances $\leq$ 50 mm		
Exposure Positions	Tune-up Maximum power of WLAN 2.4G	
	17.00dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	15.73
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	15.73
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	15.73
	SAR testing required?	YES

Exposure Positions	Tune-up Maximum power of WLAN 5.2G	
	10.50dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	5.14
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	5.14
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	5.14
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of WLAN 5.8G	
	11.00dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	6.82
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	6.82
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	6.82
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of GSM 850	
	31.50dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	260.15
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	260.15
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	260.15
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	260.15
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of GSM 1900	
	27.50dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	155.39

	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	155.39
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	155.39
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	155.39
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of WCDMA Band 2	
	24.00dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	69.39
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	69.39
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	69.39
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	69.39
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of WCDMA Band 5	
	24.00dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	46.21
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	46.21
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	46.21
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	46.21
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of LTE Band 2	
	25.00dBm	

Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	87.18
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	87.18
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	87.18
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	87.18
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of LTE Band 4	
	24.50dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	74.46
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	74.46
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	74.46
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	74.46
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of LTE Band 5	
	24.00dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	42.40
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	42.40
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	42.40
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	42.40
	SAR testing required?	YES

Exposure Positions	Tune-up Maximum power of LTE Band 7	
	23.50dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	37.79
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	37.79
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	37.79
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	37.79
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of LTE Band 12	
	24.50dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	39.85
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	39.85
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	39.85
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5
	SAR exclusion threshold	39.85
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of LTE Band 17	
	25.00dBm	
Front Side	Antenna to user(mm)	5
	SAR exclusion threshold	35.52
	SAR testing required?	YES
Back Side	Antenna to user(mm)	5
	SAR exclusion threshold	35.52
	SAR testing required?	YES
Right Side	Antenna to user(mm)	5
	SAR exclusion threshold	35.52
	SAR testing required?	YES
Top Side	Antenna to user(mm)	5

	SAR exclusion threshold	35.52
	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 WLAN 2.4G	
	17.00 dBm	50.12 mW
Left Side	Antenna to user(mm)	73
	SAR exclusion threshold(mW)	326
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	150
	SAR exclusion threshold(mW)	1096
	SAR testing required?	NO
Right Side	Antenna to user(mm)	122
	SAR exclusion threshold(mW)	816
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WLAN 5.2G	
	10.50 dBm	11.22 mW
Left Side	Antenna to user(mm)	73
	SAR exclusion threshold(mW)	296
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	150
	SAR exclusion threshold(mW)	1066
	SAR testing required?	NO
Right Side	Antenna to user(mm)	122
	SAR exclusion threshold(mW)	786
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WLAN 5.8G	
	11.00 dBm	12.59 mW
Left Side	Antenna to user(mm)	73
	SAR exclusion threshold(mW)	292
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	150
	SAR exclusion threshold(mW)	1062
	SAR testing required?	NO
Right Side	Antenna to user(mm)	122
	SAR exclusion threshold(mW)	782
	SAR testing required?	NO

Exposure Positions	Tune-up Maximum power of GSM 850	
	31.50 dBm	1412.538 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	826
	SAR testing required?	YES
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	710
	SAR testing required?	YES
Exposure Positions	Tune-up Maximum power of GSM 1900	
	26.50 dBm	562.34 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	1299
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	1089
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WCDMA Band 2	
	24.00 dBm	251.19 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	1299
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	1089
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of WCDMA Band 5	
	24.00 dBm	251.19 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	828
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	710
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of LTE Band 2	
	25.00 dBm	316.23 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	1299
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	1089
	SAR testing required?	NO

Exposure Positions	Tune-up Maximum power of LTE Band 4	
	24.50 dBm	281.84 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	1299
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	1089
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of LTE Band 5	
	24.00 dBm	251.19 mW
Left Side	Antenna to user(mm)	828
	SAR exclusion threshold(mW)	NO
	SAR testing required?	148
Bottom Side	Antenna to user(mm)	710
	SAR exclusion threshold(mW)	NO
	SAR testing required?	828
Exposure Positions	Tune-up Maximum power of LTE Band 7	
	23.50 dBm	223.87 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	1286
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	1076
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of LTE Band 12	
	24.50 dBm	281.84 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	1354
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	1144
	SAR testing required?	NO
Exposure Positions	Tune-up Maximum power of LTE Band 17	
	25.00 dBm	316.23 mW
Left Side	Antenna to user(mm)	169
	SAR exclusion threshold(mW)	1354
	SAR testing required?	NO
Bottom Side	Antenna to user(mm)	148
	SAR exclusion threshold(mW)	1144
	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:

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

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

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

Mode	P_{max} (dBm)	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
Bluetooth	9.00	7.94	5	2.480	2.49	3	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:

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

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

Mode	Position	P_{max} (dBm)	P_{max} (mW)	Distance (mm)	f (GHz)	x	Estimated SAR (W/Kg)
Bluetooth	Body	9.00	7.94	5	2.48	7.5	0.332
Bluetooth	Hotspot	9.00	7.94	5	2.48	7.5	0.332

NOTE: Estimated SAR calculation for Bluetooth

10. SAR Results

10.1. SAR measurement results

10.1.1. SAR measurement Result of GSM850

Test Position of Body-Worn 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)	Date	Plot
			1g	10g						
Front Side	189/836.4	GPRS(GMSK 2TS)	0.330	0.173	-1.26	31.11	31.50	0.361	2023/4/24	
Back Side	189/836.4	GPRS(GMSK 2TS)	0.534	0.289	1.88	31.11	31.50	0.584	2023/4/24	1#

NOTE: Body-Worn SAR test results of GSM850

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	189/836.4	GPRS(GMSK 2TS)	0.330	0.173	-1.26	31.11	31.50	0.361	2023/4/24	
Back Side	189/836.4	GPRS(GMSK 2TS)	0.534	0.289	1.88	31.11	31.50	0.584	2023/4/24	1#
Left Side	189/836.4	GPRS(GMSK 2TS)	0.174	0.092	1.72	31.11	31.50	0.190	2023/4/24	
Right Side	189/836.4	GPRS(GMSK 2TS)	0.171	0.093	-3.43	31.11	31.50	0.187	2023/4/24	
Top Side	189/836.4	GPRS(GMSK 2TS)	0.123	0.065	1.20	31.11	31.50	0.135	2023/4/24	
Bottom Side	189/836.4	GPRS(GMSK 2TS)	0.270	0.142	0.95	31.11	31.50	0.295	2023/4/24	

NOTE: Hotspot SAR test results of GSM850

10.1.2. SAR measurement Result of GSM1900

Test Position of Body-Worn 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)	Date	Plot
			1g	10g						

Front Side	661/1880	GPRS(GMSK 3TS)	0.618	0.262	-3.00	26.81	27.50	0.724	2023/4/21	
Back Side	661/1880	GPRS(GMSK 3TS)	1.016	0.440	4.30	26.81	27.50	1.191	2023/4/21	2#
Back Side	512/1850.2	GPRS(GMSK 3TS)	0.956	0.442	-1.38	27.06	27.50	1.058	2023/4/21	
Back Side	810/1909.8	GPRS(GMSK 3TS)	0.941	0.409	0.48	26.51	27.50	1.182	2023/4/21	
BackSide Repeated	661/1880	GPRS(GMSK 3TS)	1.001	0.432	1.20	26.81	27.50	1.173	2023/4/21	

NOTE: Body-Worn SAR test results of GSM1900

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	661/1880	GPRS(GMSK 3TS)	0.618	0.262	-3.00	26.81	27.50	0.724	2023/4/21	
Back Side	661/1880	GPRS(GMSK 3TS)	1.016	0.440	4.30	26.81	27.50	1.191	2023/4/21	2#
Right Side	661/1880	GPRS(GMSK 3TS)	0.315	0.135	-3.11	26.81	27.50	0.369	2023/4/21	
Top Side	661/1880	GPRS(GMSK 3TS)	0.312	0.132	-3.86	26.81	27.50	0.366	2023/4/21	
Back Side	512/1850.2	GPRS(GMSK 3TS)	0.956	0.442	-1.38	27.06	27.50	1.058	2023/4/21	
Back Side	810/1909.8	GPRS(GMSK 3TS)	0.941	0.409	0.48	26.51	27.50	1.182	2023/4/21	
BackSide Repeated	661/1880	GPRS(GMSK 3TS)	1.001	0.432	1.20	26.81	27.50	1.173	2023/4/21	

NOTE: Hotspot SAR test results of GSM1900

10.1.3. SAR measurement Result of WCDMA Band 2

Test Position of Body-Worn 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)	Date	Plot
			1g	10g						
Front Side	9400/1880	RMC12.2K	0.408	0.195	-2.28	23.78	24.00	0.429	2023/4/21	
Back Side	9400/1880	RMC12.2K	0.631	0.307	-0.92	23.78	24.00	0.664	2023/4/21	3#

NOTE: Body-Worn SAR test results of WCDMA Band 2

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	9400/1880	RMC12.2K	0.408	0.195	-2.28	23.78	24.00	0.429	2023/4/21	
Back Side	9400/1880	RMC12.2K	0.631	0.307	-0.92	23.78	24.00	0.664	2023/4/21	3#
Right Side	9400/1880	RMC12.2K	0.198	0.096	-2.06	23.78	24.00	0.208	2023/4/21	
Top Side	9400/1880	RMC12.2K	0.192	0.089	-2.45	23.78	24.00	0.202	2023/4/21	

NOTE: Hotspot SAR test results of WCDMA Band 2

10.1.4. SAR measurement Result of WCDMA Band 5

Test Position of Body-Worn 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)	Date	Plot
			1g	10g						
Front Side	4182/836.4	RMC12.2K	0.468	0.270	-3.86	23.62	24.00	0.511	2023/4/24	
Back Side	4182/836.4	RMC12.2K	0.731	0.421	-0.20	23.62	24.00	0.798	2023/4/24	4#

NOTE: Body-Worn SAR test results of WCDMA Band 5

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	4182/836.4	RMC12.2K	0.468	0.270	-3.86	23.62	24.00	0.511	2023/4/24	
Back Side	4182/836.4	RMC12.2K	0.731	0.421	-0.20	23.62	24.00	0.798	2023/4/24	4#
Right Side	4182/836.4	RMC12.2K	0.231	0.130	-3.38	23.62	24.00	0.252	2023/4/24	
Top Side	4182/836.4	RMC12.2K	0.234	0.129	-3.13	23.62	24.00	0.255	2023/4/24	

NOTE: Hotspot SAR test results of WCDMA Band 5

10.1.5. SAR measurement Result of LTE Band 2

Test Position of Body-Worn 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)	Date	Plot
			1-g	10-g						
1RB										
Front Side	18900/1880	20M QPSK(1,0)	0.492	0.235	2.44	24.41	25.00	0.564	2023/4/21	
Back Side	18900/1880	20M QPSK(1,0)	0.774	0.381	-0.20	24.41	25.00	0.887	2023/4/21	8#
Back Side	18700/1860	20M QPSK(1,0)	0.750	0.352	0.21	24.56	25.00	0.830	2023/4/21	
Back Side	19100/1900	20M QPSK(1,0)	0.742	0.347	0.56	24.35	25.00	0.862	2023/4/21	
BackSide Repeated	18900/1880	20M QPSK(1,0)	0.765	0.374	3.21	24.41	25.00	0.876	2023/4/21	
50%RB										
Front Side	18900/1880	20M QPSK(50,24)	0.284	0.140	-2.90	23.00	23.50	0.319	2023/4/21	
Back Side	18900/1880	20M QPSK(50,24)	0.403	0.218	0.85	23.00	23.50	0.452	2023/4/21	

NOTE: Body-Worn SAR test results of LTE Band 2

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										
Front Side	18900/1880	20M QPSK(1,0)	0.492	0.235	2.44	24.41	25.00	0.564	2023/4/21	
Back Side	18900/1880	20M QPSK(1,0)	0.774	0.381	-0.20	24.41	25.00	0.887	2023/4/21	8#
Right Side	18900/1880	20M QPSK(1,0)	0.240	0.117	-2.49	24.41	25.00	0.275	2023/4/21	
Top Side	18900/1880	20M QPSK(1,0)	0.243	0.114	-3.14	24.41	25.00	0.278	2023/4/21	
Back Side	18700/1860	20M QPSK(1,0)	0.750	0.352	0.21	24.56	25.00	0.830	2023/4/21	
Back	19100/1900	20M	0.742	0.347	0.56	24.35	25.00	0.862	2023/4/21	

Side		QPSK(1,0)								
BackSide Repeated	18900/1880	20M QPSK(1,0)	0.765	0.374	3.21	24.41	25.00	0.876	2023/4/21	
50%RB										
Front Side	18900/1880	20M QPSK(50,24)	0.284	0.140	-2.90	23.00	23.50	0.319	2023/4/21	
Back Side	18900/1880	20M QPSK(50,24)	0.403	0.218	0.85	23.00	23.50	0.452	2023/4/21	
Right Side	18900/1880	20M QPSK(50,24)	0.137	0.068	-2.54	23.00	23.50	0.154	2023/4/21	
Top Side	18900/1880	20M QPSK(50,24)	0.127	0.066	1.66	23.00	23.50	0.142	2023/4/21	
100%RB										
Back Side	18900/1880	20M QPSK(100,0)	0.387	0.200	0.36	23.13	23.50	0.421	2023/4/21	

NOTE: Hotspot SAR test results of LTE Band 2

10.1.6. SAR measurement Result of LTE Band 4

Test Position of Body-Worn 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)	Date	Plot
			1-g	10-g						
1RB										
Front Side	20175/1732.5	20M QPSK(1,99)	0.378	0.202	-2.10	24.17	24.50	0.408	2023/4/27	
Back Side	20175/1732.5	20M QPSK(1,99)	0.603	0.332	-0.82	24.17	24.50	0.651	2023/4/27	9#
50%RB										
Front Side	20175/1732.5	20M QPSK(50,24)	0.219	0.103	0.57	22.84	23.00	0.227	2023/4/27	
Back Side	20175/1732.5	20M QPSK(50,24)	0.313	0.166	-0.68	22.84	23.00	0.325	2023/4/27	

NOTE: Body-Worn SAR test results of LTE Band 4

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										

Front Side	20175/1732.5	20M QPSK(1,99)	0.378	0.202	-2.10	24.17	24.50	0.408	2023/4/27	
Back Side	20175/1732.5	20M QPSK(1,99)	0.603	0.332	-0.82	24.17	24.50	0.651	2023/4/27	9#
Right Side	20175/1732.5	20M QPSK(1,99)	0.186	0.102	3.70	24.17	24.50	0.201	2023/4/27	
Top Side	20175/1732.5	20M QPSK(1,99)	0.195	0.103	1.50	24.17	24.50	0.210	2023/4/27	
50%RB										
Front Side	20175/1732.5	20M QPSK(50,24)	0.219	0.103	0.57	22.84	23.00	0.227	2023/4/27	
Back Side	20175/1732.5	20M QPSK(50,24)	0.313	0.166	-0.68	22.84	23.00	0.325	2023/4/27	
Right Side	20175/1732.5	20M QPSK(50,24)	0.104	0.059	2.58	22.84	23.00	0.108	2023/4/27	
Top Side	20175/1732.5	20M QPSK(50,24)	0.112	0.058	-1.47	22.84	23.00	0.116	2023/4/27	

NOTE: Hotspot SAR test results of LTE Band 4

10.1.7. SAR measurement Result of LTE Band 5

Test Position of Body-Worn 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)	Date	Plot
			1-g	10-g						
1RB										
Front Side	20525/836.5	10M QPSK(1,0)	0.498	0.289	-2.11	23.44	24.00	0.567	2023/4/24	
Back Side	20525/836.5	10M QPSK(1,0)	0.800	0.464	0.05	23.44	24.00	0.910	2023/4/24	10#
Back Side	20450/829	10M QPSK(1,0)	0.861	0.492	0.19	23.82	24.00	0.897	2023/4/24	
Back Side	20600/844	10M QPSK(1,0)	0.777	0.445	0.90	23.44	24.00	0.884	2023/4/24	
BackSide Repeated	20450/829	10M QPSK(1,0)	0.840	0.472	2.03	23.82	24.00	0.876	2023/4/24	
50%RB										
Front Side	20525/836.5	10M QPSK(25,12)	0.278	0.150	-1.51	22.38	23.00	0.321	2023/4/24	
Back Side	20525/836.5	10M	0.434	0.263	3.23	22.38	23.00	0.501	2023/4/24	

		QPSK(25,12)								
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NOTE: Body-Worn SAR test results of LTE Band 5

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										
Front Side	20525/836.5	10M QPSK(1,0)	0.498	0.289	-2.11	23.44	24.00	0.567	2023/4/24	
Back Side	20525/836.5	10M QPSK(1,0)	0.800	0.464	0.05	23.44	24.00	0.910	2023/4/24	10#
Right Side	20525/836.5	10M QPSK(1,0)	0.240	0.132	-0.32	23.44	24.00	0.273	2023/4/24	
Top Side	20525/836.5	10M QPSK(1,0)	0.249	0.137	-3.96	23.44	24.00	0.283	2023/4/24	
Back Side	20450/829	10M QPSK(1,0)	0.861	0.492	0.19	23.82	24.00	0.897	2023/4/24	
Back Side	20600/844	10M QPSK(1,0)	0.777	0.445	0.90	23.44	24.00	0.884	2023/4/24	
BackSide Repeated	20450/829	10M QPSK(1,0)	0.840	0.472	2.03	23.82	24.00	0.876	2023/4/24	
50%RB										
Front Side	20525/836.5	10M QPSK(25,12)	0.278	0.150	-1.51	22.38	23.00	0.321	2023/4/24	
Back Side	20525/836.5	10M QPSK(25,12)	0.434	0.263	3.23	22.38	23.00	0.501	2023/4/24	
Right Side	20525/836.5	10M QPSK(25,12)	0.131	0.074	-2.39	22.38	23.00	0.151	2023/4/24	
Top Side	20525/836.5	10M QPSK(25,12)	0.133	0.072	-2.13	22.38	23.00	0.153	2023/4/24	
100%RB										
Back Side	20525/836.5	10M QPSK(50,0)	0.409	0.256	-1.20	22.44	23.00	0.465	2023/4/24	

NOTE: Hotspot SAR test results of LTE Band 5

10.1.8. SAR measurement Result of LTE Band 7

Test Position of Body-Worn	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (±5%)	Conducted power (dBm)	Tune-up power (dBm)	Scaled SAR 1g	Date	Plot
			1-g	10-g						

with 0mm								(W/Kg)		
1RB										
Front Side	21100/2535	20M QPSK(1,0)	0.342	0.147	-3.50	22.96	23.50	0.387	2023/4/28	
Back Side	21100/2535	20M QPSK(1,0)	0.531	0.237	0.17	22.96	23.50	0.601	2023/4/28	11#
50%RB										
Front Side	21100/2535	20M QPSK(50,49)	0.195	0.087	3.84	22.04	22.50	0.217	2023/4/28	
Back Side	21100/2535	20M QPSK(50,49)	0.268	0.133	-4.63	22.04	22.50	0.298	2023/4/28	

NOTE: Body-Worn SAR test results of LTE Band 7

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										
Front Side	21100/2535	20M QPSK(1,0)	0.342	0.147	-3.50	22.96	23.50	0.387	2023/4/28	
Back Side	21100/2535	20M QPSK(1,0)	0.531	0.237	0.17	22.96	23.50	0.601	2023/4/28	11#
Right Side	21100/2535	20M QPSK(1,0)	0.165	0.074	1.06	22.96	23.50	0.187	2023/4/28	
Top Side	21100/2535	20M QPSK(1,0)	0.168	0.072	1.41	22.96	23.50	0.190	2023/4/28	
50%RB										
Front Side	21100/2535	20M QPSK(50,49)	0.195	0.087	3.84	22.04	22.50	0.217	2023/4/28	
Back Side	21100/2535	20M QPSK(50,49)	0.268	0.133	-4.63	22.04	22.50	0.298	2023/4/28	
Right Side	21100/2535	20M QPSK(50,49)	0.094	0.040	-0.74	22.04	22.50	0.105	2023/4/28	
Top Side	21100/2535	20M QPSK(50,49)	0.089	0.036	2.79	22.04	22.50	0.099	2023/4/28	

NOTE: Hotspot SAR test results of LTE Band 7

10.1.9. SAR measurement Result of LTE Band 12

Test Position of Body-Worn 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)	Date	Plot
			1-g	10-g						
1RB										
Front Side	23095/707.5	10M QPSK(1,0)	0.468	0.271	1.70	23.89	24.50	0.539	2023/4/19	
Back Side	23095/707.5	10M QPSK(1,0)	0.748	0.442	-0.14	23.89	24.50	0.861	2023/4/19	12#
Back Side	23060/704	10M QPSK(1,0)	0.654	0.398	0.25	24.22	24.50	0.698	2023/4/19	
Back Side	23130/711	10M QPSK(1,0)	0.621	0.381	2.01	23.77	24.50	0.735	2023/4/19	
BackSide Repeated	23095/707.5	10M QPSK(1,0)	0.720	0.430	0.63	23.89	24.50	0.829	2023/4/19	
50%RB										
Front Side	23095/707.5	10M QPSK(25,0)	0.259	0.146	-0.79	22.85	23.00	0.268	2023/4/19	
Back Side	23095/707.5	10M QPSK(25,0)	0.384	0.246	-0.24	22.85	23.00	0.397	2023/4/19	

NOTE: Body-Worn SAR test results of LTE Band 12

Test Position of Hotspot with 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
1RB										
Front Side	23095/707.5	10M QPSK(1,0)	0.468	0.271	1.70	23.89	24.50	0.539	2023/4/19	
Back Side	23095/707.5	10M QPSK(1,0)	0.748	0.442	-0.14	23.89	24.50	0.861	2023/4/19	12#
Right Side	23095/707.5	10M QPSK(1,0)	0.225	0.129	-3.90	23.89	24.50	0.259	2023/4/19	
Top Side	23095/707.5	10M QPSK(1,0)	0.228	0.128	1.56	23.89	24.50	0.262	2023/4/19	
Back Side	23060/704	10M QPSK(1,0)	0.654	0.398	0.25	24.22	24.50	0.698	2023/4/19	
Back Side	23130/711	10M QPSK(1,0)	0.621	0.381	2.01	23.77	24.50	0.735	2023/4/19	
BackSide Repeated	23095/707.5	10M QPSK(1,0)	0.720	0.430	0.63	23.89	24.50	0.829	2023/4/19	

50%RB										
Front Side	23095/707.5	10M QPSK(25,0)	0.259	0.146	-0.79	22.85	23.00	0.268	2023/4/19	
Back Side	23095/707.5	10M QPSK(25,0)	0.384	0.246	-0.24	22.85	23.00	0.397	2023/4/19	
Right Side	23095/707.5	10M QPSK(25,0)	0.122	0.077	-1.77	22.85	23.00	0.126	2023/4/19	
Top Side	23095/707.5	10M QPSK(25,0)	0.124	0.070	-4.06	22.85	23.00	0.128	2023/4/19	
100%RB										
Back Side	23095/707.5	10M QPSK(50,0)	0.350	0.312	0.54	22.75	23.00	0.371	2023/4/19	

NOTE: Hotspot SAR test results of LTE Band 12

10.1.10. SAR measurement Result of LTE Band 17

Test Position of Body-Worn 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)	Date	Plot
			1-g	10-g						
1RB										
Front Side	23790/710	10M QPSK(1,49)	0.522	0.305	-0.08	23.72	24.00	0.557	2023/4/19	
Back Side	23790/710	10M QPSK(1,49)	0.835	0.488	-0.54	23.72	24.00	0.891	2023/4/19	13#
Back Side	23780/709	10M QPSK(1,49)	0.789	0.465	1.02	23.68	24.00	0.849	2023/4/19	
Back Side	23800/711	10M QPSK(1,49)	0.765	0.455	2.31	23.94	24.00	0.776	2023/4/19	
BackSide Repeated	23790/710	10M QPSK(1,49)	0.820	0.478	1.20	23.72	24.00	0.875	2023/4/19	
50%RB										
Front Side	23790/710	10M QPSK(25,0)	0.285	0.153	4.33	22.85	23.00	0.295	2023/4/19	
Back Side	23790/710	10M QPSK(25,0)	0.452	0.286	4.57	22.85	23.00	0.468	2023/4/19	

NOTE: Body-Worn SAR test results of LTE Band 17

Test Position of Hotspot	Test channel /Freq.	Mode	SAR Value		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g	Date	Plot
			(W/kg)							
			1-g	10-g						

with 0mm								(W/Kg)		
1RB										
Front Side	23790/710	10M QPSK(1,49)	0.522	0.305	-0.08	23.72	24.00	0.557	2023/4/19	
Back Side	23790/710	10M QPSK(1,49)	0.835	0.488	-0.54	23.72	24.00	0.891	2023/4/19	13#
Right Side	23790/710	10M QPSK(1,49)	0.252	0.146	3.31	23.72	24.00	0.269	2023/4/19	
Top Side	23790/710	10M QPSK(1,49)	0.258	0.146	-0.56	23.72	24.00	0.275	2023/4/19	
Back Side	23780/709	10M QPSK(1,49)	0.789	0.465	1.02	23.68	24.00	0.849	2023/4/19	
Back Side	23800/711	10M QPSK(1,49)	0.765	0.455	2.31	23.94	24.00	0.776	2023/4/19	
BackSide Repeated	23790/710	10M QPSK(1,49)	0.820	0.478	1.20	23.72	24.00	0.875	2023/4/19	
50%RB										
Front Side	23790/710	10M QPSK(25,0)	0.285	0.153	4.33	22.85	23.00	0.295	2023/4/19	
Back Side	23790/710	10M QPSK(25,0)	0.452	0.286	4.57	22.85	23.00	0.468	2023/4/19	
Right Side	23790/710	10M QPSK(25,0)	0.141	0.086	0.85	22.85	23.00	0.146	2023/4/19	
Top Side	23790/710	10M QPSK(25,0)	0.151	0.085	1.41	22.85	23.00	0.156	2023/4/19	
100%RB										
Back Side	23790/710	10M QPSK(50,0)	0.362	0.210	0.36	22.84	23.00	0.376	2023/4/19	

NOTE: Hotspot SAR test results of LTE Band 17

10.1.11. SAR measurement Result of WLAN 2.4G

Test Position of Body-Worn 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)	Date	Plot
			1-g	10-g						
Front Side	11/2462	802.11b	0.192	0.090	1.81	16.56	17.00	0.212	2023/4/20	
Back Side	11/2462	802.11b	0.270	0.127	0.10	16.56	17.00	0.299	2023/4/20	5#

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

Test Position	Test	Mode	SAR Value	Power	Conducted	Tune-up	Scaled	Date	Plot
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of Hotspot with 10mm	channel /Freq.		(W/kg)		Drift(%)	Power (dBm)	Power (dBm)	SAR 1-g (W/Kg)		
			1-g	10-g						
Front Side	11/2462	802.11b	0.192	0.090	1.81	16.56	17.00	0.212	2023/4/20	
Back Side	11/2462	802.11b	0.270	0.127	0.10	16.56	17.00	0.299	2023/4/20	5#
Top Side	11/2462	802.11b	0.093	0.044	1.18	16.56	17.00	0.103	2023/4/20	

NOTE: Hotspot SAR test results of WLAN 2.4G

10.1.12. SAR measurement Result of WLAN 5.2G

Test Position of Body-Worn with 0mm	Test channel /Freq	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	40/5200	802.11a	0.114	0.028	-0.25	10.04	10.50	0.127	2023/4/13	
Back Side	40/5200	802.11a	0.181	0.045	0.55	10.04	10.50	0.201	2023/4/13	6#

NOTE: Body-Worn SAR test results of WLAN 5.2G

Test Position of Hotspot with 0mm	Test channel /Freq	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	40/5200	802.11a	0.114	0.028	-0.25	10.04	10.50	0.127	2023/4/13	
Back Side	40/5200	802.11a	0.181	0.045	0.55	10.04	10.50	0.201	2023/4/13	6#
Top Side	40/5200	802.11a	0.063	0.016	3.33	10.04	10.50	0.070	2023/4/13	

NOTE: Hotspot SAR test results of WLAN 5.2G

10.1.13. SAR measurement Result of WLAN 5.8G

Test Position of Body-Worn with 0mm	Test channel /Freq	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Front Side	149/5745	802.11a	0.060	0.015	1.77	10.73	11.00	0.064	2023/4/12	
Back Side	149/5745	802.11a	0.065	0.017	4.11	10.73	11.00	0.069	2023/4/12	7#

NOTE: Body-Worn SAR test results of WLAN 5.8G

Test	Test	Mode	SAR Value	Power	Conducted	Tune-up	Scaled	Date	Plot
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Position of Hotspot with 0mm	channel /Freq		(W/kg)		Drift(%)	Power (dBm)	Power (dBm)	SAR 1-g (W/Kg)		
			1-g	10-g						
Front Side	149/5745	802.11a	0.060	0.015	1.77	10.73	11.00	0.064	2023/4/12	
Back Side	149/5745	802.11a	0.065	0.017	4.11	10.73	11.00	0.069	2023/4/12	7#
Top Side	149/5745	802.11a	0.021	0.005	3.63	10.73	11.00	0.022	2023/4/12	

NOTE: Hotspot SAR test results of WLAN 5.8G

10.2. SAR Summation Scenario

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

- Scalar SAR summation $< 1.6\text{W/kg}$.
- $\text{SPLSR} = (\text{SAR}_1 + \text{SAR}_2)^{1.5} / (\text{min. separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan. If $\text{SPLSR} \leq 0.04$, simultaneously transmission SAR measurement is not necessary.

Test Position		Scaled SAR _{MAX}		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		WWAN	DTS			
Body-Worn	Front Side	0.724	0.212	0.936	N/A	N/A
	Back Side	1.191	0.299	1.490	N/A	N/A
Hotspot	Front Side	0.724	0.212	0.936	N/A	N/A
	Back Side	1.191	0.299	1.490	N/A	N/A
	Left Side	0.190	N/A	0.190	N/A	N/A
	Right Side	0.369	N/A	0.369	N/A	N/A
	Top Side	0.366	0.103	0.469	N/A	N/A
	Bottom Side	0.295	N/A	0.295	N/A	N/A

Test Position		Scaled SAR _{MAX}		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		WWAN	NII			
Body-Worn	Front Side	0.724	0.127	0.851	N/A	N/A
	Back Side	1.191	0.201	1.392	N/A	N/A
Hotspot	Front Side	0.724	0.127	0.851	N/A	N/A
	Back Side	1.191	0.201	1.392	N/A	N/A
	Left Side	0.190	N/A	0.190	N/A	N/A

	Right Side	0.369	N/A	0.369	N/A	N/A
	Top Side	0.366	0.070	0.436	N/A	N/A
	Bottom Side	0.295	N/A	0.295	N/A	N/A

Test Position		Scaled SAR _{MAX}		Σ 1-g SAR (W/Kg)	SPLSR	Remark
		WWAN	DSS			
Body-Worn	Front Side	0.724	0.332	1.056	N/A	N/A
	Back Side	1.191	0.332	1.523	N/A	N/A
Hotspot	Front Side	0.724	0.332	1.056	N/A	N/A
	Back Side	1.191	0.332	1.523	N/A	N/A
	Left Side	0.190	N/A	0.190	N/A	N/A
	Right Side	0.369	N/A	0.369	N/A	N/A
	Top Side	0.366	0.332	0.698	N/A	N/A
	Bottom Side	0.295	N/A	0.295	N/A	N/A

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 - 2600MHz
MEASUREMENT 7 System Performance Check - 5200MHz
MEASUREMENT 8 System Performance Check - 5800MHz

MEASUREMENT 1

Date of measurement: 19/4/2023

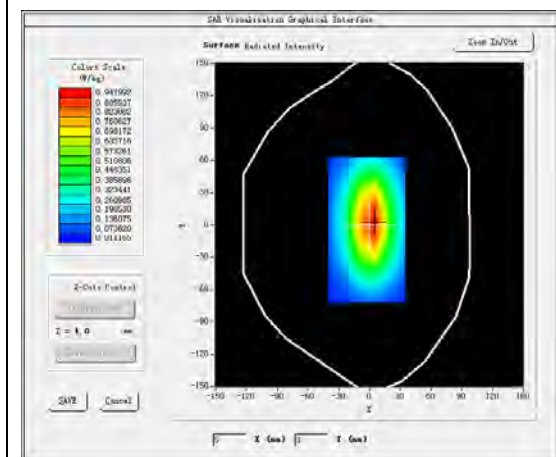
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW750</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.49</u>

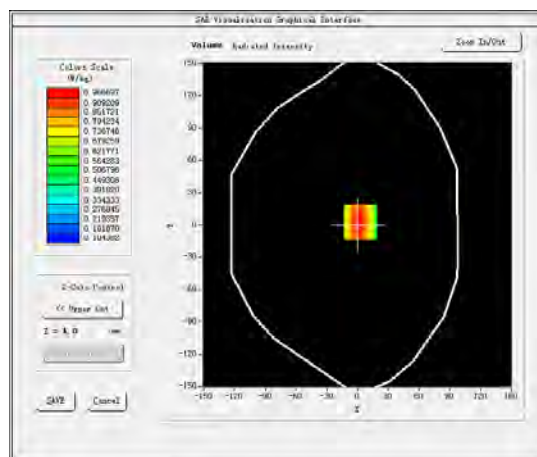
B. SAR Measurement Results

Frequency (MHz)	750.000000
Relative permittivity (real part)	40.610298
Relative permittivity (imaginary part)	21.736444
Conductivity (S/m)	0.905685
Variation (%)	2.730000

SURFACE SAR



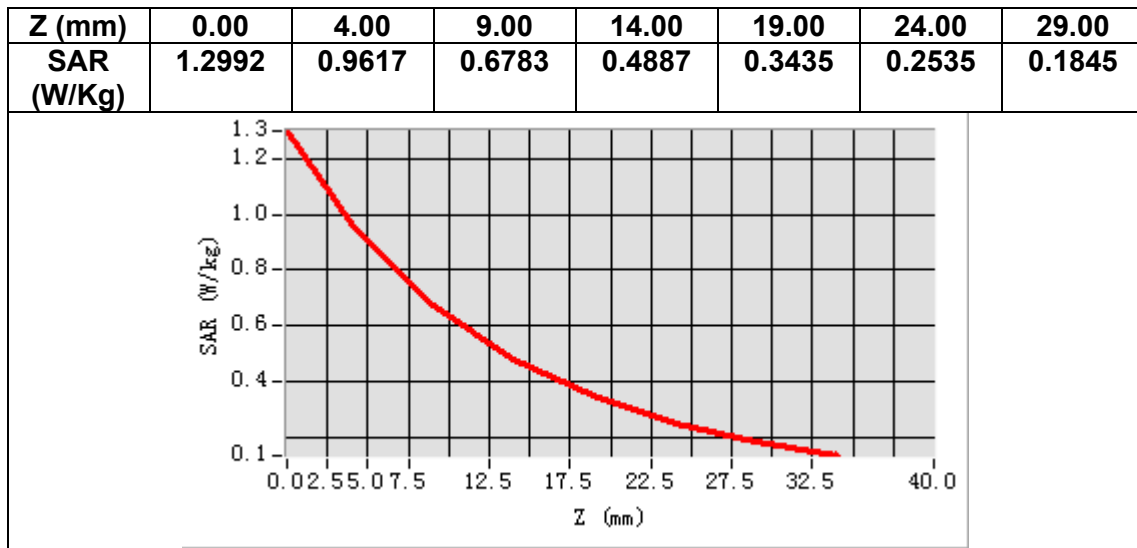
VOLUME SAR



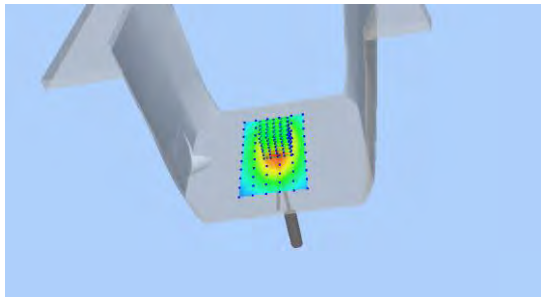
Maximum location: X=3.00, Y=3.00

SAR Peak: 1.30 W/kg

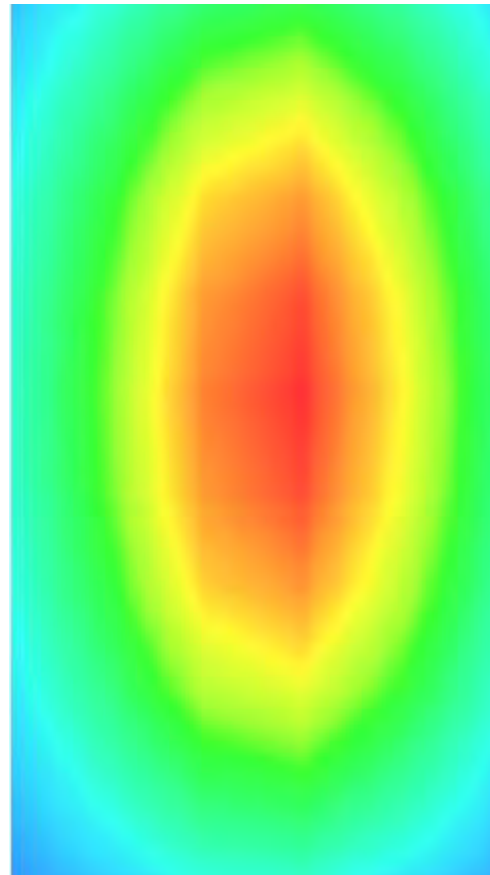
SAR 10g (W/Kg)	0.510332
SAR 1g (W/Kg)	0.840321



3D screen shot



Hot spot position



MEASUREMENT 2

Date of measurement: 24/4/2023

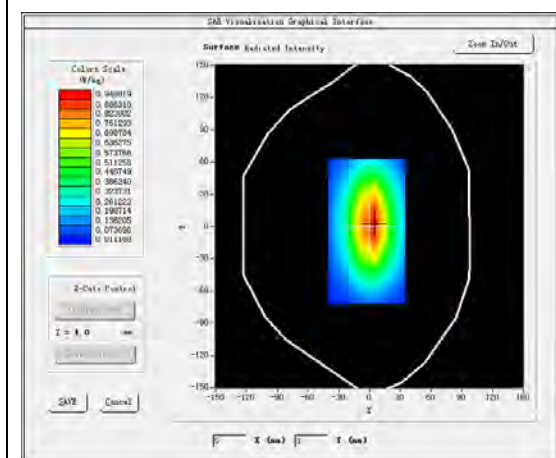
A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7,dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Dipole</u>
Band	<u>CW835</u>
Channels	<u>Middle</u>
Signal	<u>CW (Crest factor: 1.0)</u>
ConvF	<u>1.50</u>

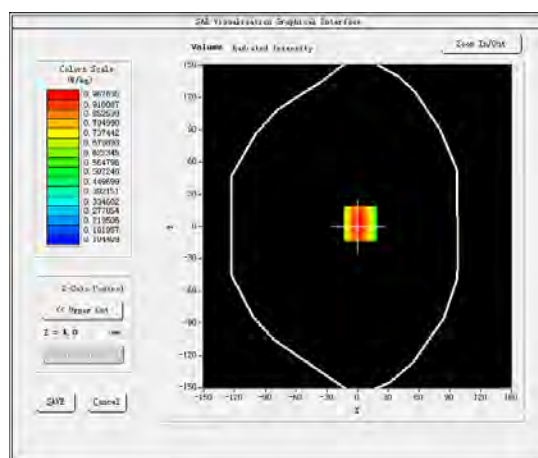
B. SAR Measurement Results

Frequency (MHz)	835.000000
Relative permittivity (real part)	40.998534
Relative permittivity (imaginary part)	19.684925
Conductivity (S/m)	0.913162
Variation (%)	-2.720000

SURFACE SAR



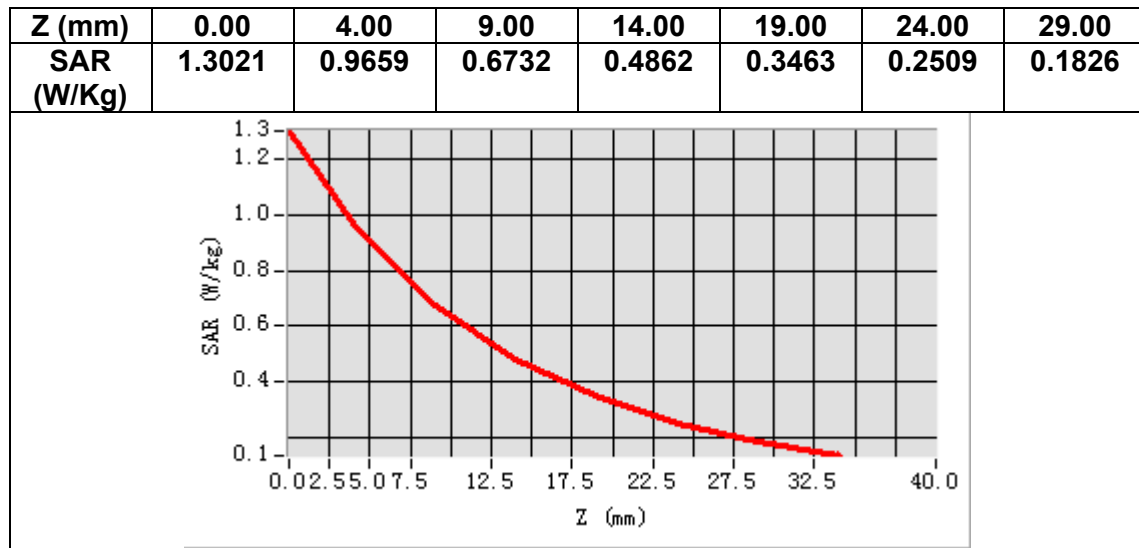
VOLUME SAR



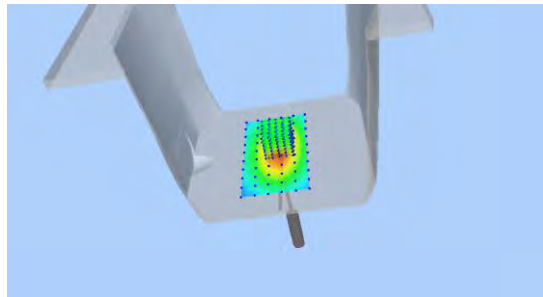
Maximum location: X=3.00, Y=3.00

SAR Peak: 1.30 W/kg

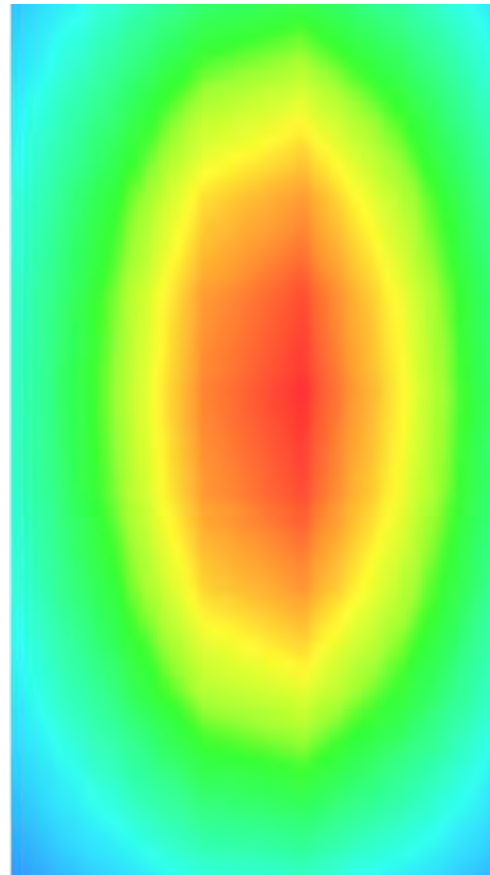
SAR 10g (W/Kg)	0.572333
SAR 1g (W/Kg)	1.021172



3D screen shot



Hot spot position



MEASUREMENT 3

Date of measurement: 27/4/2023

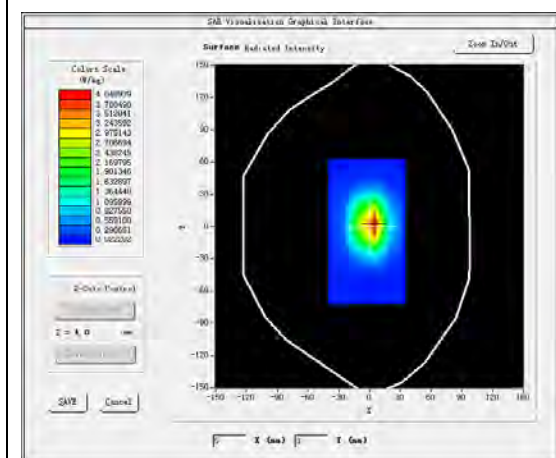
A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Dipole</u>
Band	<u>CW1800</u>
Channels	<u>Middle</u>
Signal	<u>CW (Crest factor: 1.0)</u>
ConvF	<u>1.73</u>

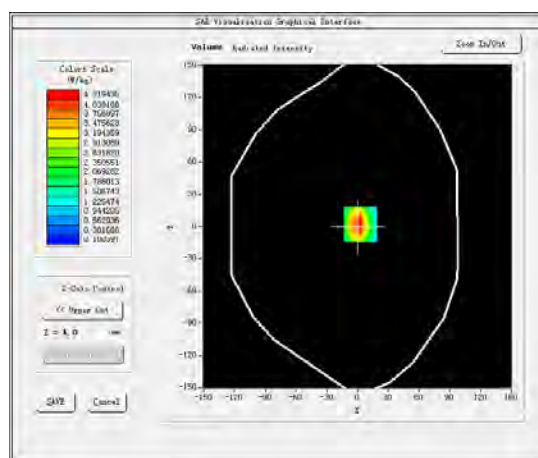
B. SAR Measurement Results

Frequency (MHz)	1800.000000
Relative permittivity (real part)	38.539563
Relative permittivity (imaginary part)	13.681262
Conductivity (S/m)	1.368126
Variation (%)	2.980000

SURFACE SAR



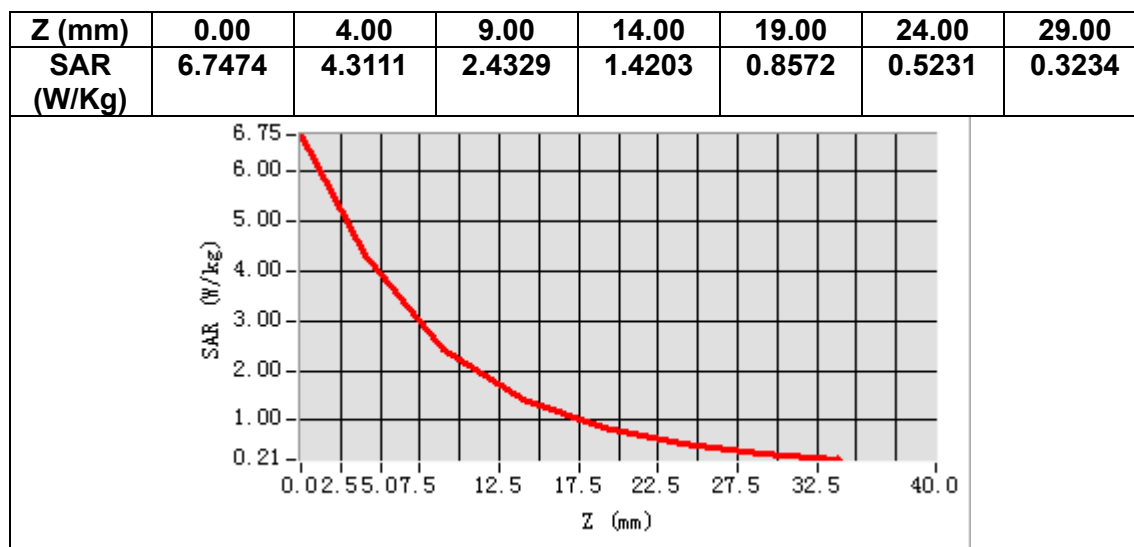
VOLUME SAR



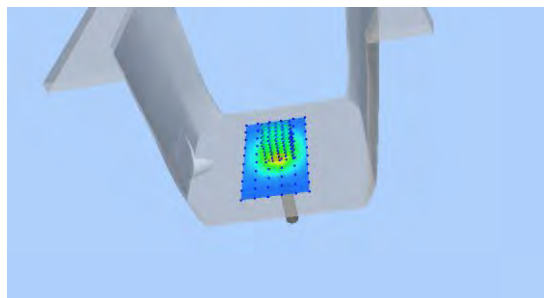
Maximum location: X=3.00, Y=2.00

SAR Peak: 6.82 W/kg

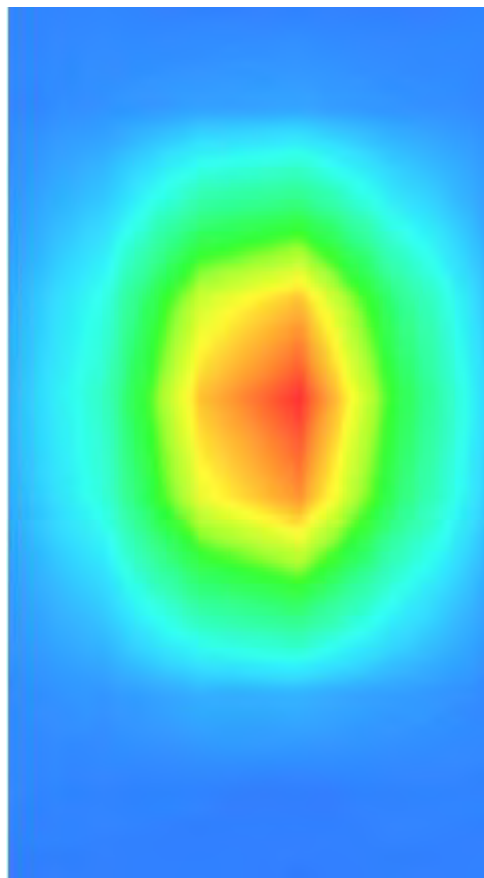
SAR 10g (W/Kg)	2.085307
SAR 1g (W/Kg)	4.119066



3D screen shot



Hot spot position



MEASUREMENT 4

Date of measurement: 21/4/2023

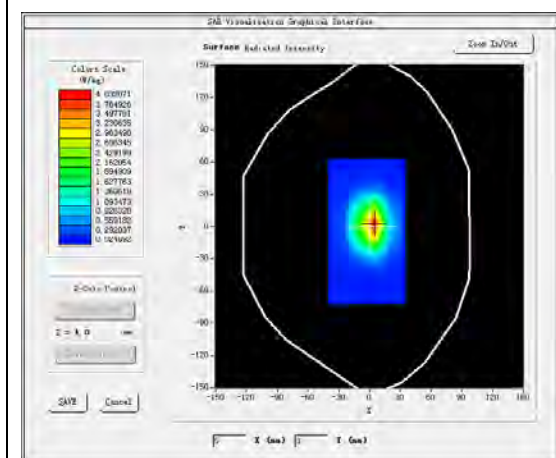
A. Experimental conditions.

Area Scan	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
ZoomScan	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Dipole</u>
Band	<u>CW1900</u>
Channels	<u>Middle</u>
Signal	<u>CW (Crest factor: 1.0)</u>
ConvF	<u>1.91</u>

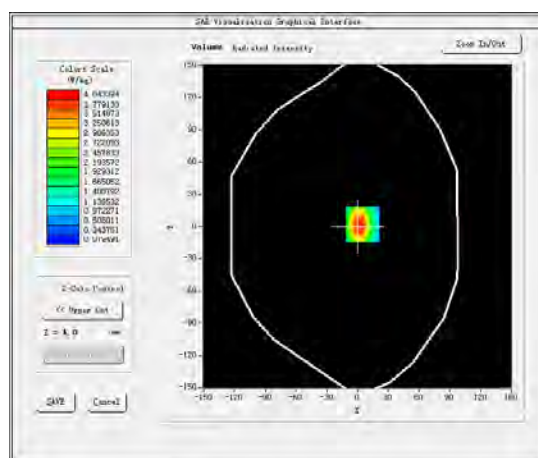
B. SAR Measurement Results

Frequency (MHz)	1900.000000
Relative permittivity (real part)	38.403148
Relative permittivity (imaginary part)	13.512378
Conductivity (S/m)	1.426307
Variation (%)	2.220000

SURFACE SAR



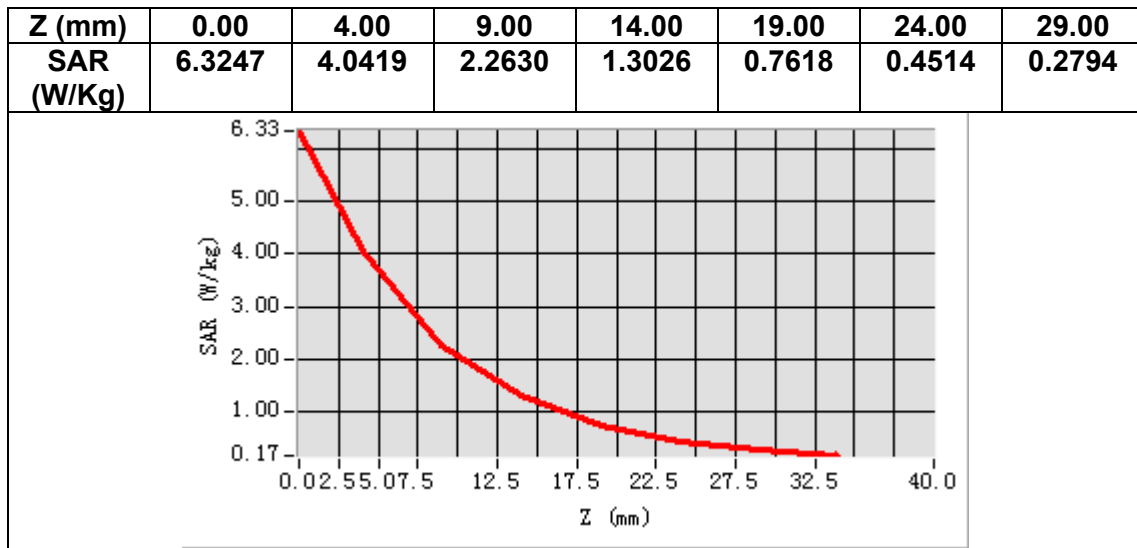
VOLUME SAR



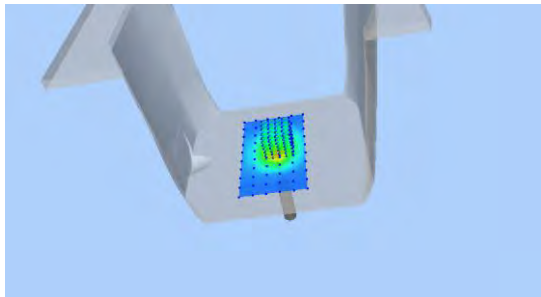
Maximum location: X=5.00, Y=2.00

SAR Peak: 6.70 W/kg

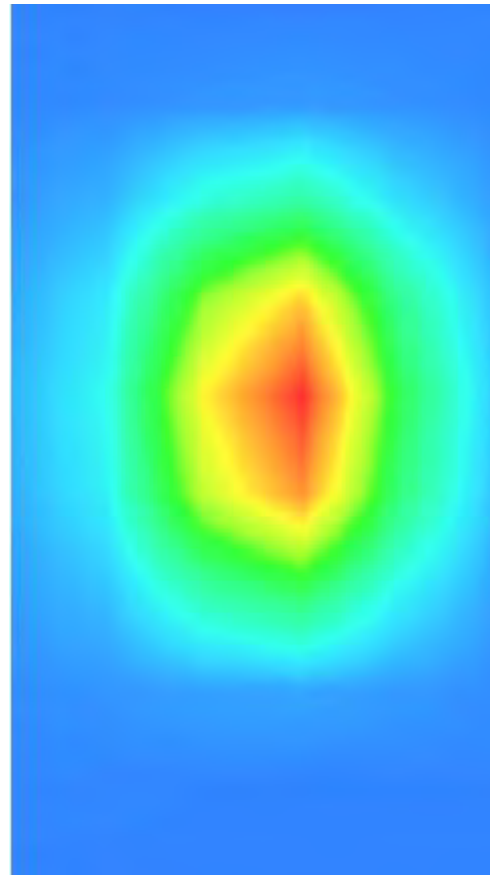
SAR 10g (W/Kg)	2.121347
SAR 1g (W/Kg)	3.904221



3D screen shot



Hot spot position



MEASUREMENT 5

Date of measurement: 20/4/2023

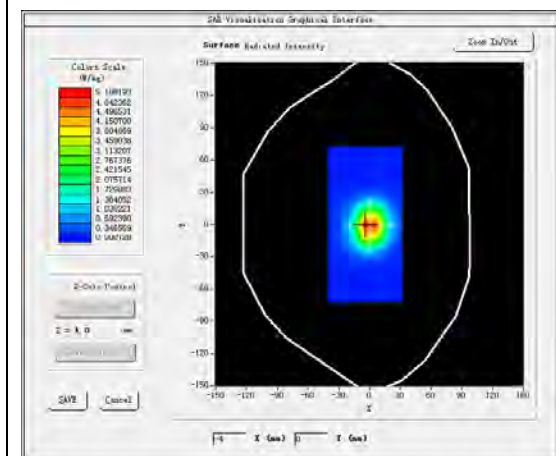
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW2450</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.98</u>

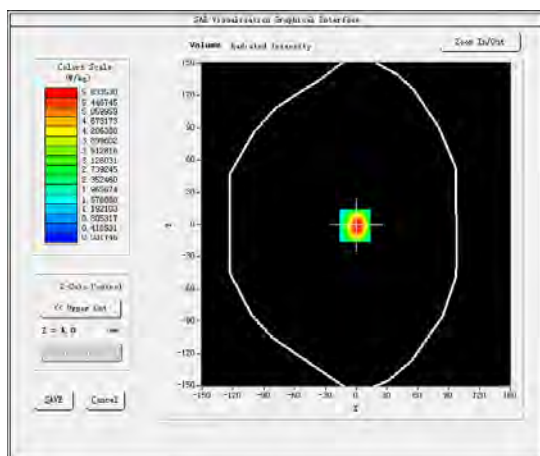
B. SAR Measurement Results

Frequency (MHz)	2450.000000
Relative permittivity (real part)	38.217934
Relative permittivity (imaginary part)	13.096037
Conductivity (S/m)	1.782516
Variation (%)	1.290000

SURFACE SAR



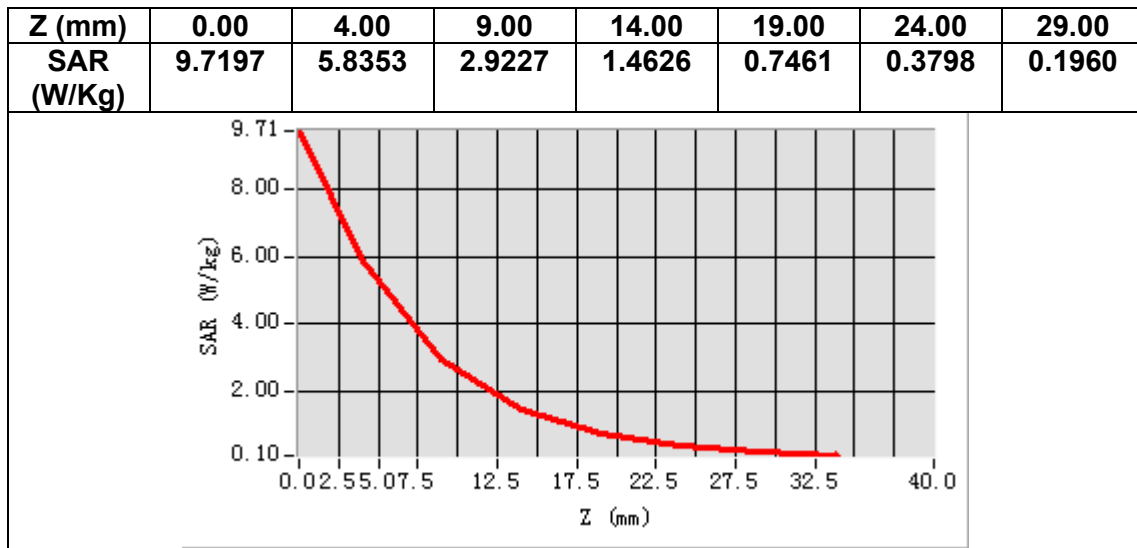
VOLUME SAR



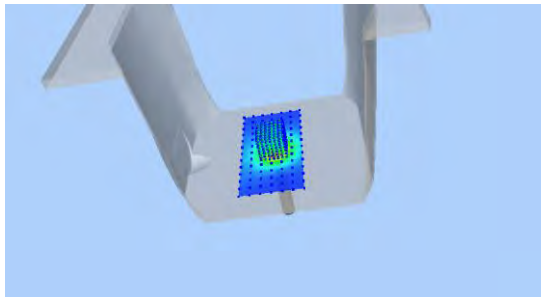
Maximum location: X=-1.00, Y=-1.00

SAR Peak: 9.83 W/kg

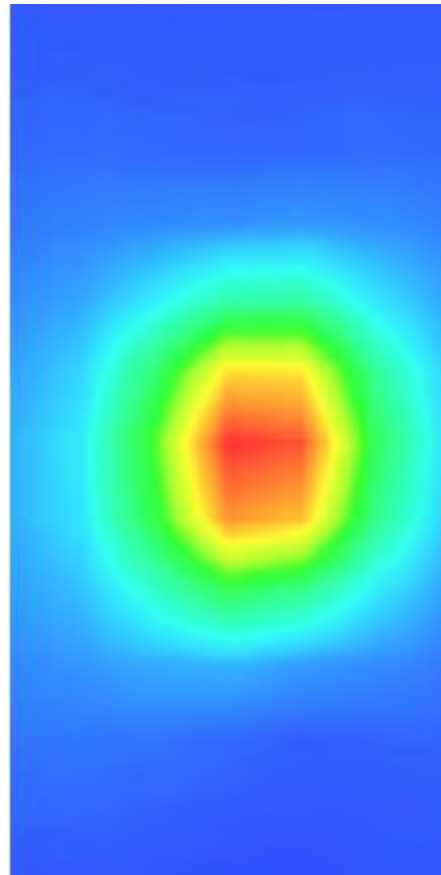
SAR 10g (W/Kg)	2.436106
SAR 1g (W/Kg)	5.800340



3D screen shot



Hot spot position



MEASUREMENT 6

Date of measurement: 28/4/2023

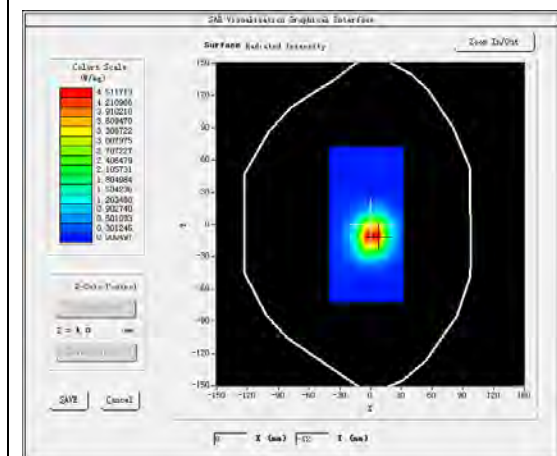
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW2600</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.87</u>

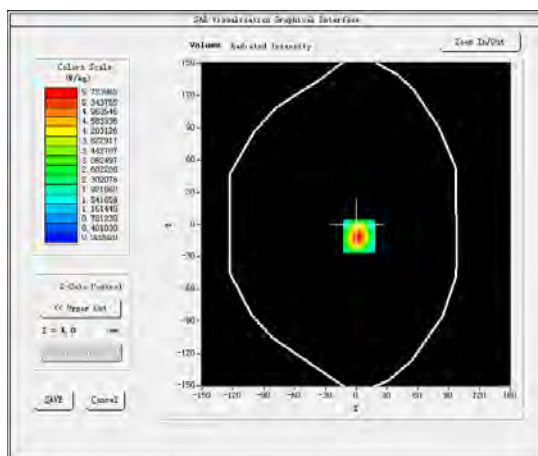
B. SAR Measurement Results

Frequency (MHz)	2600.000000
Relative permittivity (real part)	37.603742
Relative permittivity (imaginary part)	13.362449
Conductivity (S/m)	1.930132
Variation (%)	0.250000

SURFACE SAR



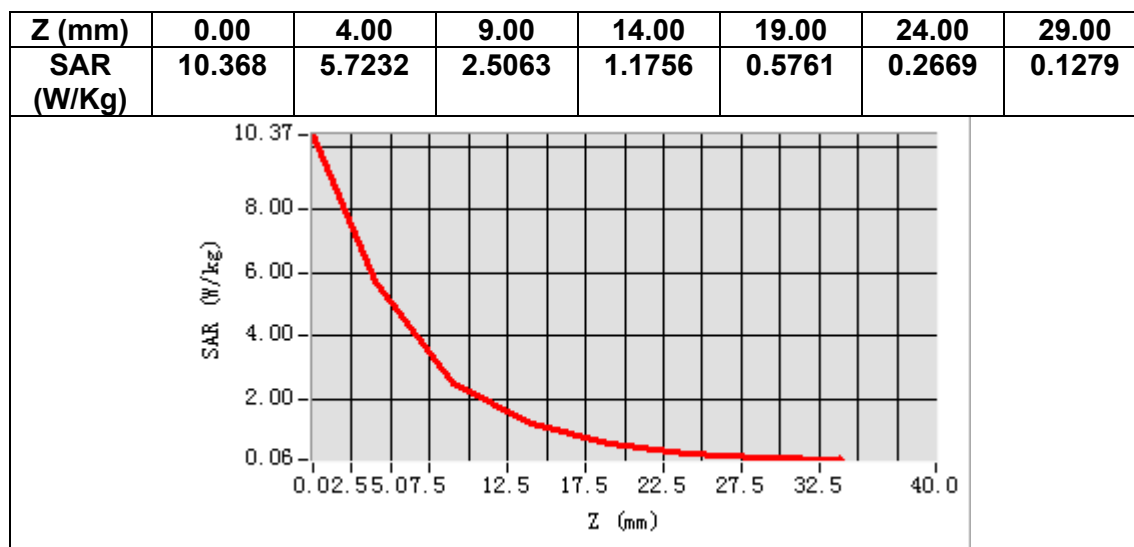
VOLUME SAR



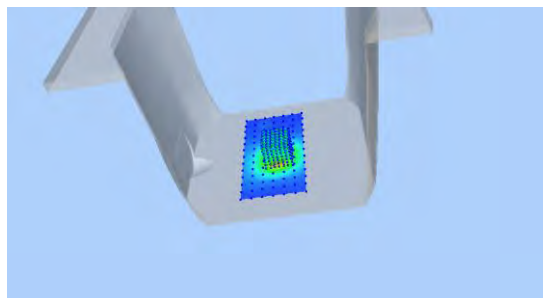
Maximum location: X=3.00, Y=-11.00

SAR Peak: 10.29 W/kg

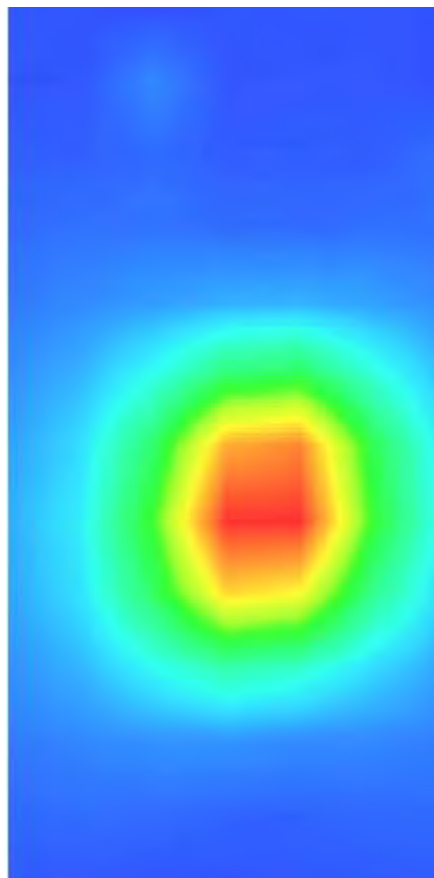
SAR 10g (W/Kg)	2.514037
SAR 1g (W/Kg)	5.578199



3D screen shot



Hot spot position



MEASUREMENT 7

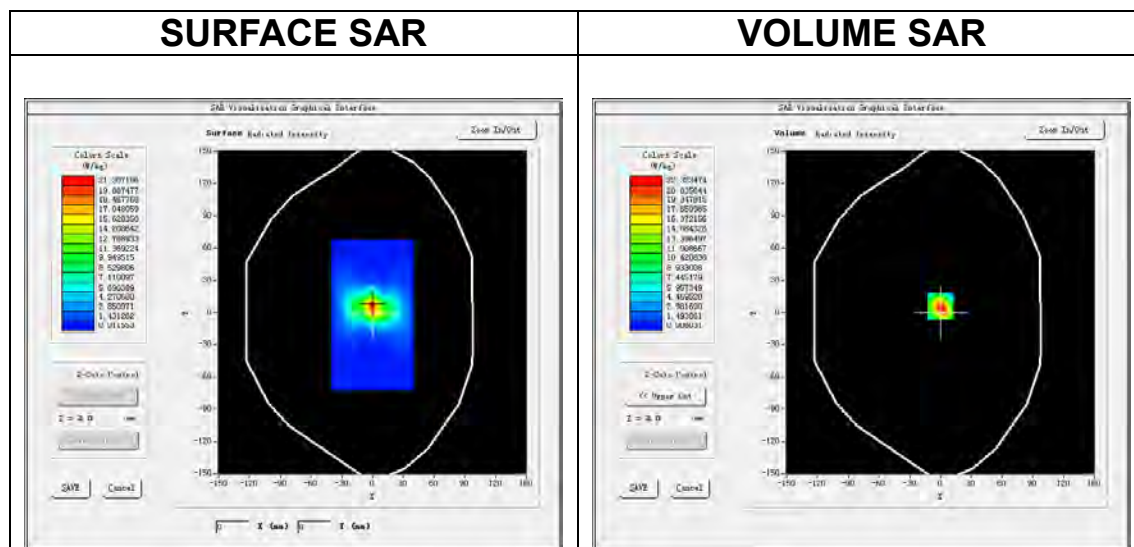
Date of measurement: 13/4/2023

A. Experimental conditions.

Area Scan	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
ZoomScan	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Dipole</u>
Band	<u>CW5200</u>
Channels	<u>Middle</u>
Signal	<u>CW (Crest factor: 1.0)</u>
ConvF	<u>1.80</u>

B. SAR Measurement Results

Frequency (MHz)	5200.000000
Relative permittivity (real part)	35.687162
Relative permittivity (imaginary part)	16.161724
Conductivity (S/m)	4.668942
Variation (%)	2.800000

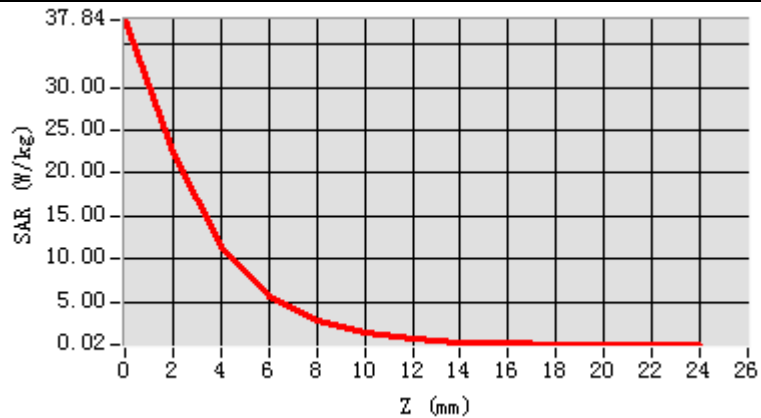


Maximum location: X=0.00, Y=6.00

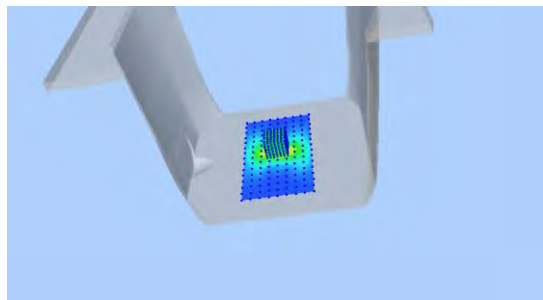
SAR Peak: 40.06 W/kg

SAR 10g (W/Kg)	5.960162
SAR 1g (W/Kg)	15.037032

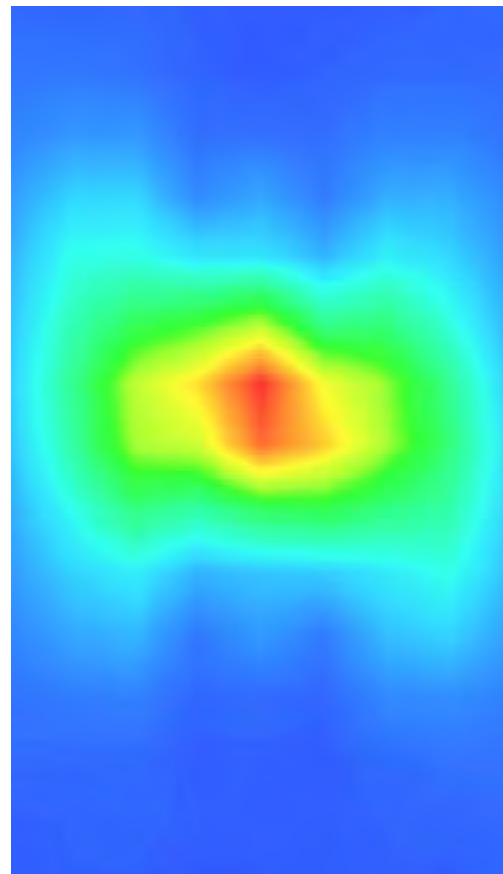
Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0 0	12.0 0	14.0 0	16.0 0	18.0 0	20.0 0	22.0 0
SAR (W/ Kg)	37.8 91	22.3 91	11.3 77	5.66 94	2.82 91	1.40 43	0.71 50	0.36 37	0.18 02	0.10 08	0.05 27	0.03 97



3D screen shot



Hot spot position



MEASUREMENT 8

Date of measurement: 12/4/2023

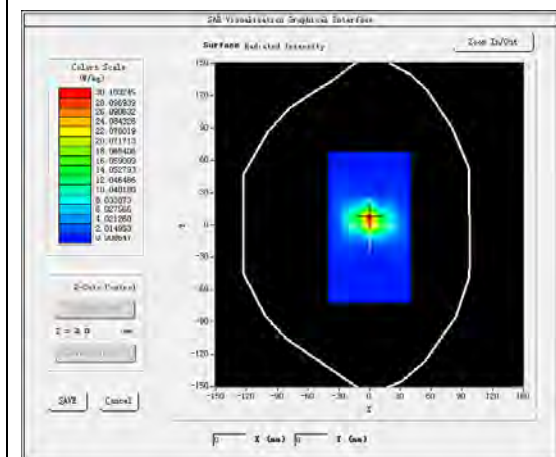
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Dipole</u>
<u>Band</u>	<u>CW5800</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>CW (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.07</u>

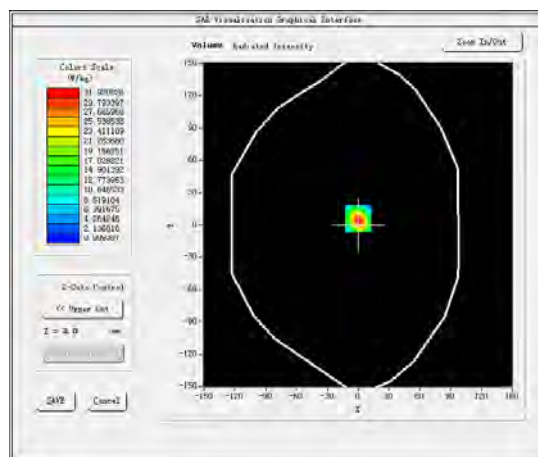
B. SAR Measurement Results

Frequency (MHz)	5800.000000
Relative permittivity (real part)	34.266079
Relative permittivity (imaginary part)	16.063285
Conductivity (S/m)	5.175947
Variation (%)	-0.500000

SURFACE SAR



VOLUME SAR

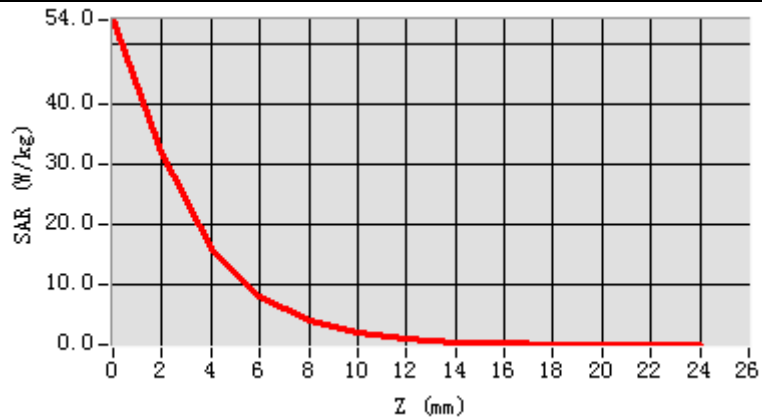


Maximum location: X=0.00, Y=6.00

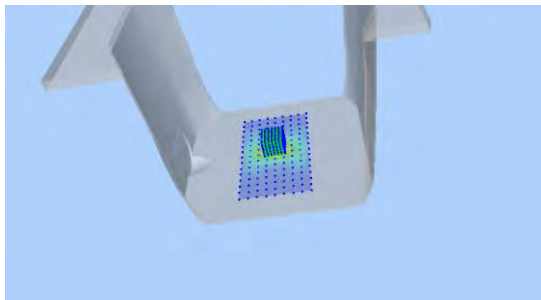
SAR Peak: 57.37 W/kg

SAR 10g (W/Kg)	6.062228
SAR 1g (W/Kg)	17.134190

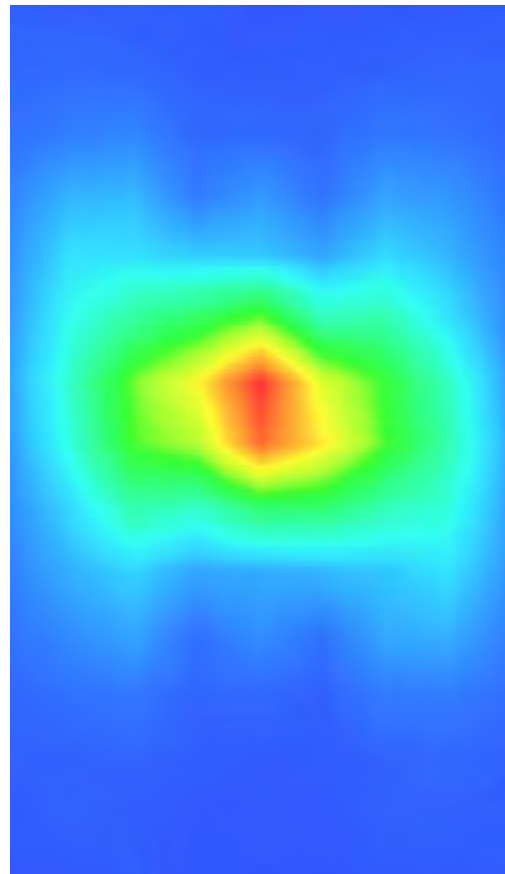
Z (m m)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
SAR (W/ Kg)	54.0 36	31.9 48	16.1 44	8.17 66	4.08 90	2.05 50	1.03 61	0.51 44	0.27 95	0.15 72	0.07 88	0.04 38



3D screen shot



Hot spot position



13. Appendix C. Plots of High SAR Measurement

Table of contents
MEASUREMENT 1 GSM 850 Hotspot
MEASUREMENT 2 GSM 1900 Hotspot
MEASUREMENT 3 WCDMA Band 2 Hotspot
MEASUREMENT 4 WCDMA Band 5 Hotspot
MEASUREMENT 5 WLAN 2.4G Hotspot
MEASUREMENT 6 WLAN 5.2G Hotspot
MEASUREMENT 7 WLAN 5.8G Hotspot
MEASUREMENT 8 LTE Band 2 Hotspot
MEASUREMENT 9 LTE Band 4 Hotspot
MEASUREMENT 10 LTE Band 5 Hotspot
MEASUREMENT 11 LTE Band 7 Hotspot
MEASUREMENT 12 LTE Band 12 Hotspot
MEASUREMENT 13 LTE Band 17 Hotspot

MEASUREMENT 1

Date of measurement: 24/4/2023

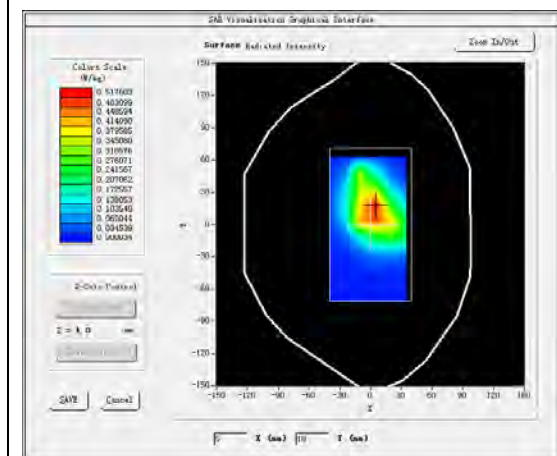
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>GSM850</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 8.0)</u>
<u>ConvF</u>	<u>1.50</u>

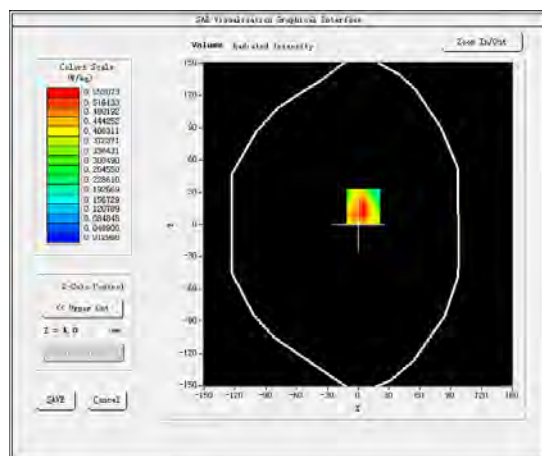
B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	40.914192
Relative permittivity (imaginary part)	19.710766
Conductivity (S/m)	0.915894
Variation (%)	1.880000

SURFACE SAR



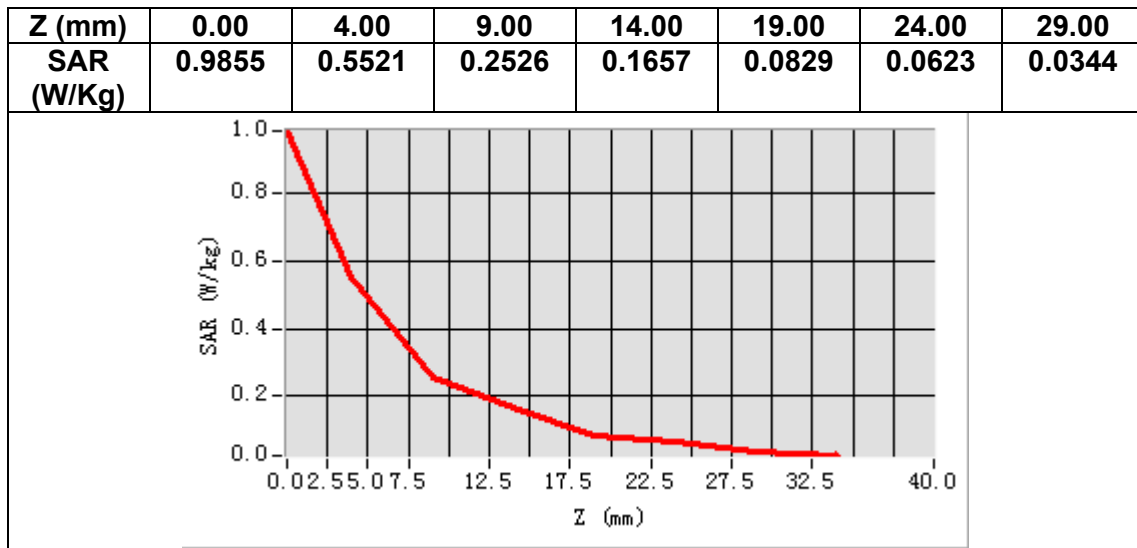
VOLUME SAR



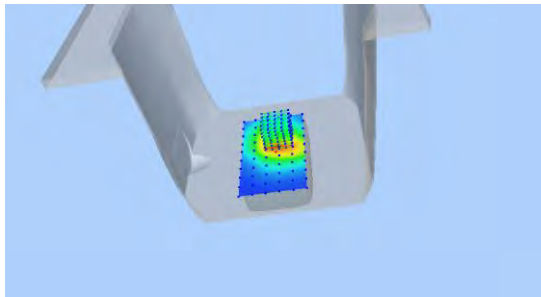
Maximum location: X=5.00, Y=17.00

SAR Peak: 0.93 W/kg

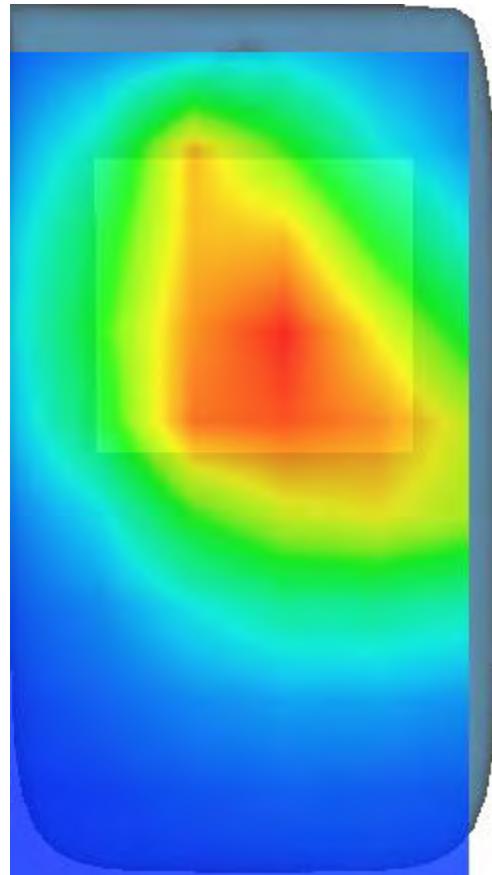
SAR 10g (W/Kg)	0.289216
SAR 1g (W/Kg)	0.534334



3D screen shot



Hot spot position



MEASUREMENT 2

Date of measurement: 21/4/2023

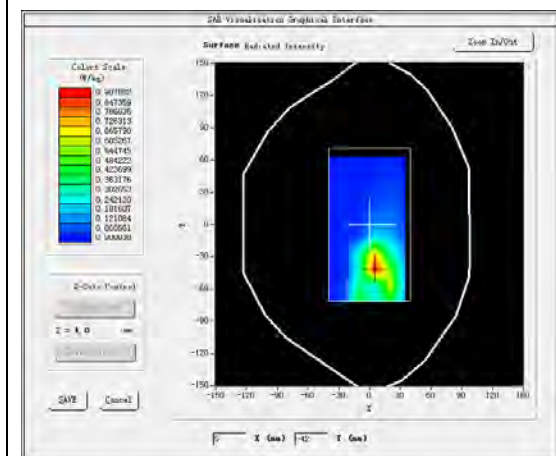
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>GSM1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>TDMA (Crest factor: 8.0)</u>
<u>ConvF</u>	<u>1.91</u>

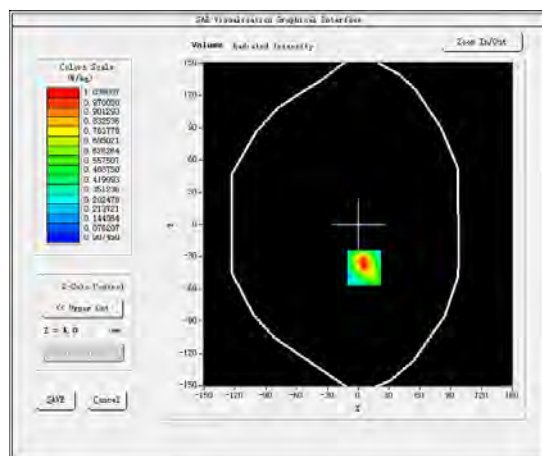
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.489548
Relative permittivity (imaginary part)	13.530178
Conductivity (S/m)	1.413152
Variation (%)	4.300000

SURFACE SAR



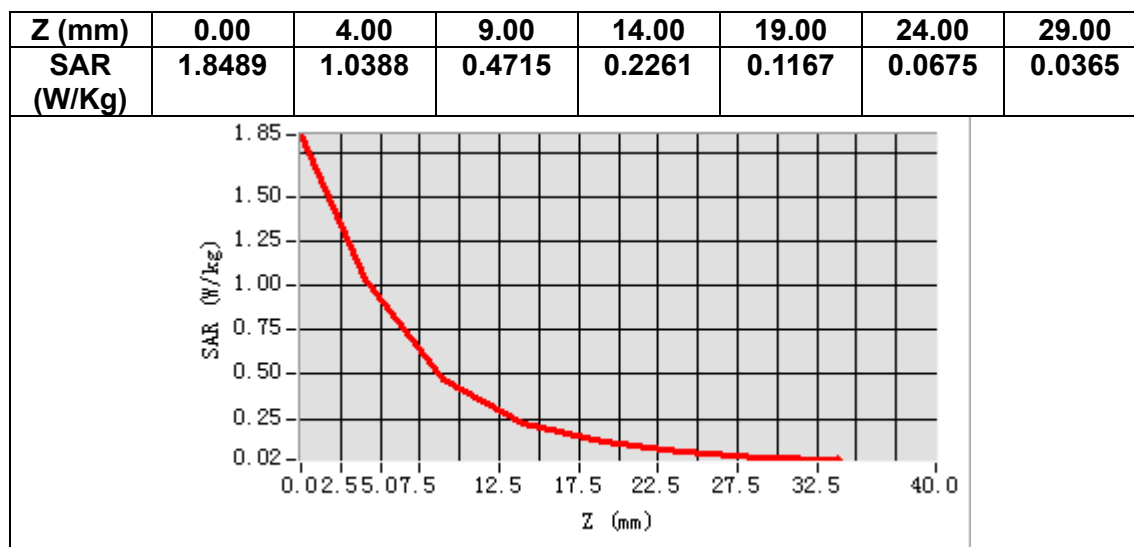
VOLUME SAR



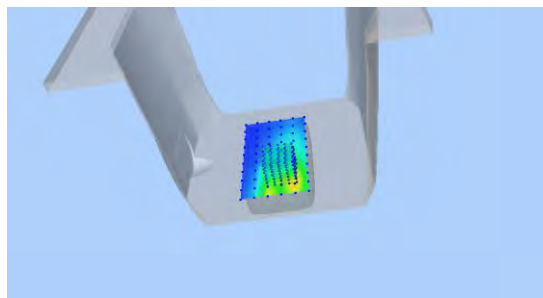
Maximum location: X=6.00, Y=-40.00

SAR Peak: 1.97 W/kg

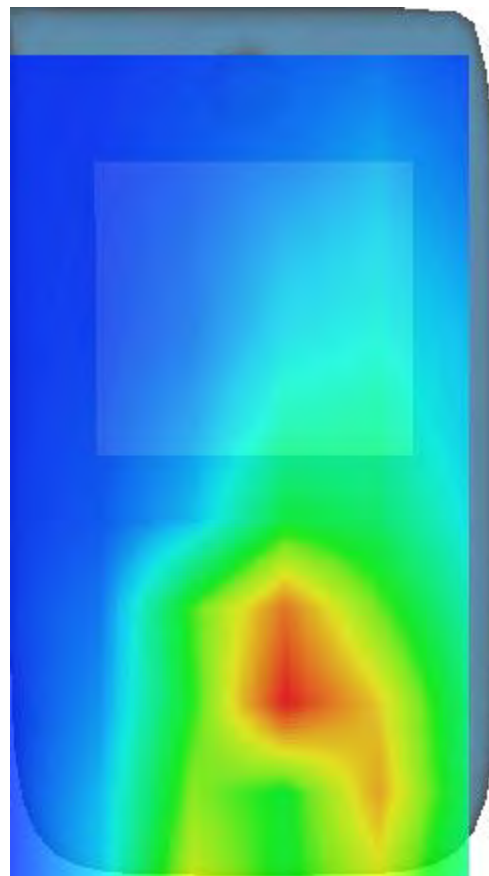
SAR 10g (W/Kg)	0.440016
SAR 1g (W/Kg)	1.015858



3D screen shot



Hot spot position



MEASUREMENT 3

Date of measurement: 21/4/2023

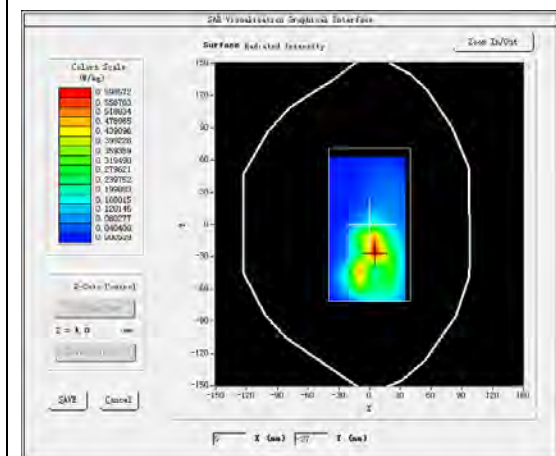
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>Band2 WCDMA1900</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.91</u>

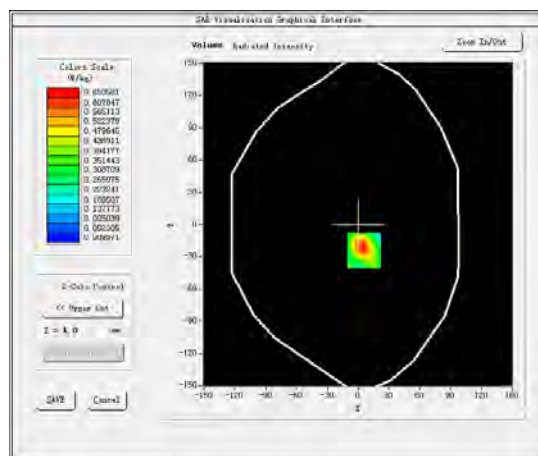
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.489548
Relative permittivity (imaginary part)	13.530178
Conductivity (S/m)	1.413152
Variation (%)	-0.920000

SURFACE SAR



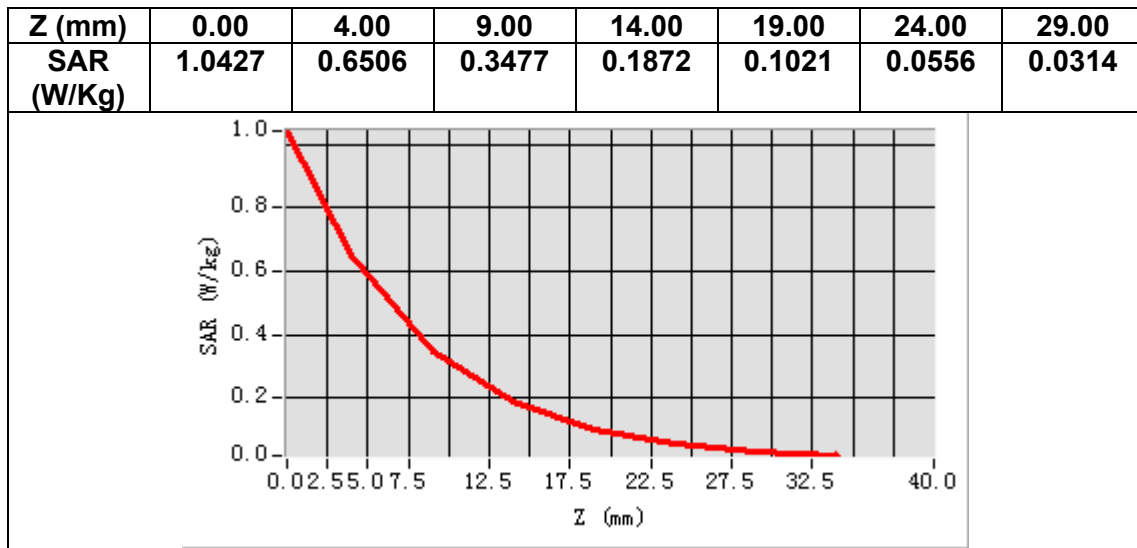
VOLUME SAR



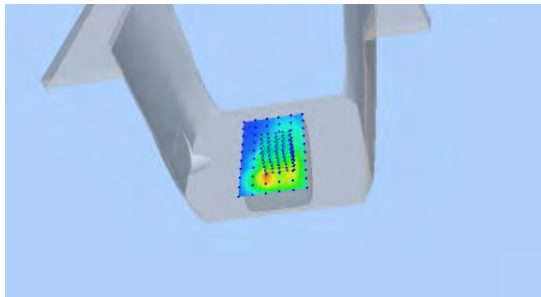
Maximum location: X=6.00, Y=-24.00

SAR Peak: 1.09 W/kg

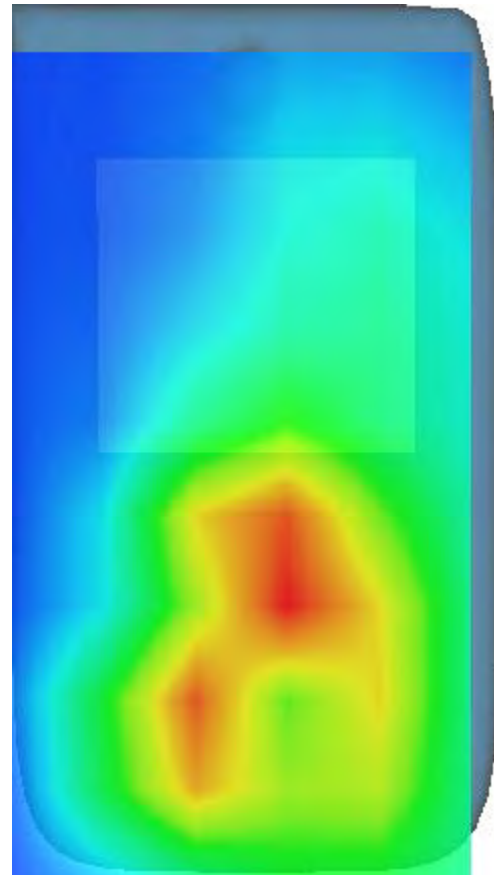
SAR 10g (W/Kg)	0.306707
SAR 1g (W/Kg)	0.630939



3D screen shot



Hot spot position



MEASUREMENT 4

Date of measurement: 24/4/2023

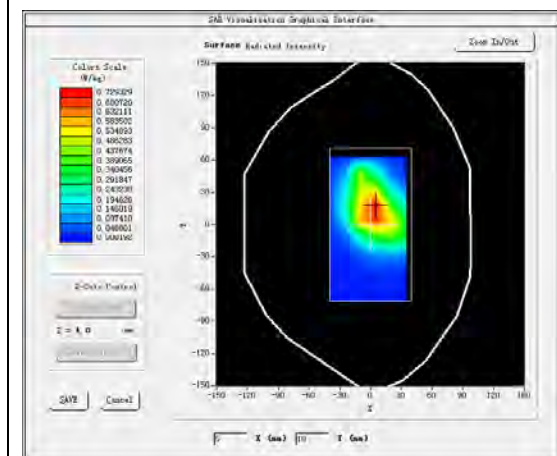
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>Band5 WCDMA850</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>WCDMA (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.50</u>

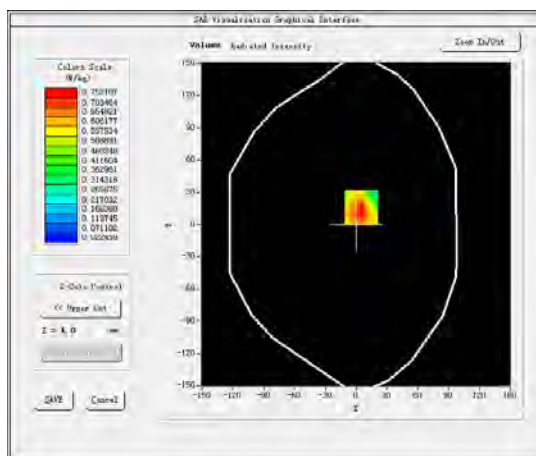
B. SAR Measurement Results

Frequency (MHz)	836.400000
Relative permittivity (real part)	40.914192
Relative permittivity (imaginary part)	19.710766
Conductivity (S/m)	0.915894
Variation (%)	-0.200000

SURFACE SAR



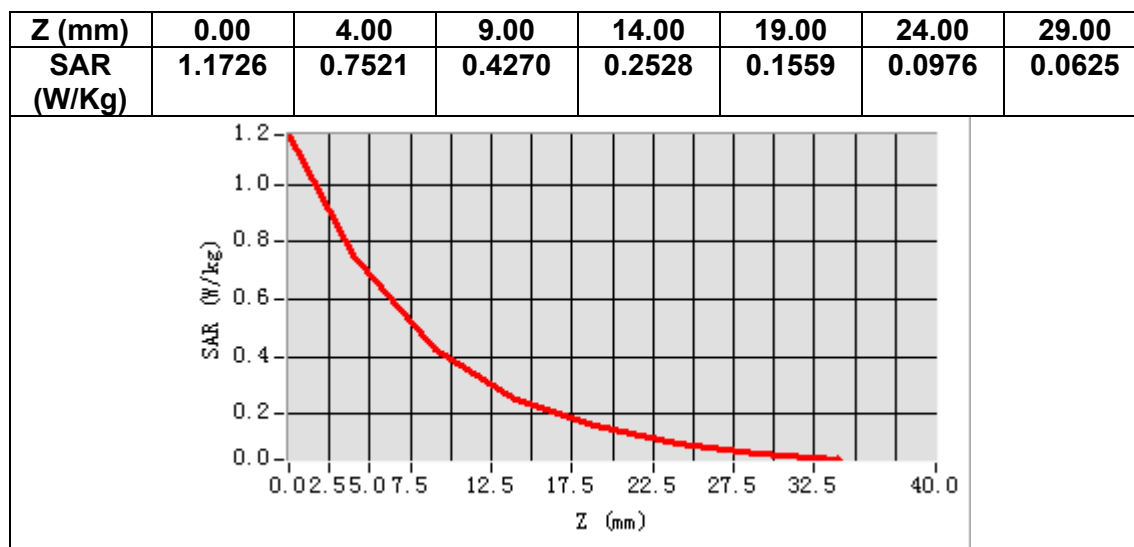
VOLUME SAR



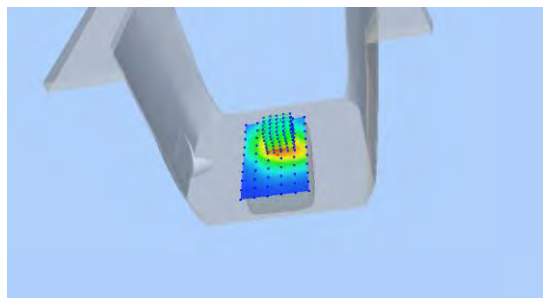
Maximum location: X=5.00, Y=16.00

SAR Peak: 1.19 W/kg

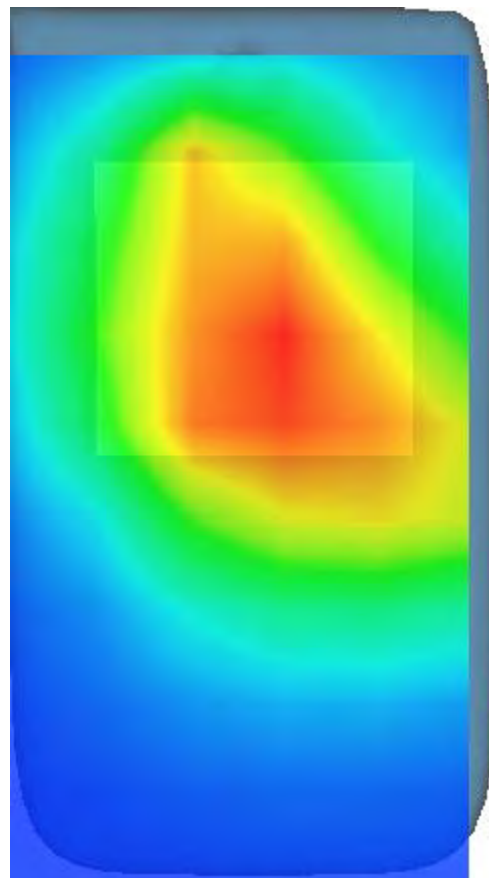
SAR 10g (W/Kg)	0.420575
SAR 1g (W/Kg)	0.730801



3D screen shot



Hot spot position



MEASUREMENT 5

Date of measurement: 20/4/2023

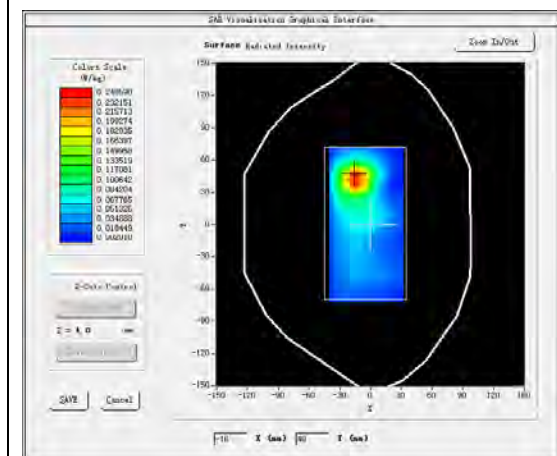
A. Experimental conditions.

Area Scan	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
ZoomScan	<u>7x7x7,dx=5mm dy=5mm dz=5mm</u>
Phantom	<u>Validation plane</u>
Device Position	<u>Body</u>
Band	<u>IEEE 802.11b ISM</u>
Channels	<u>High</u>
Signal	<u>IEEE802.b (Crest factor: 1.0)</u>
ConvF	<u>1.98</u>

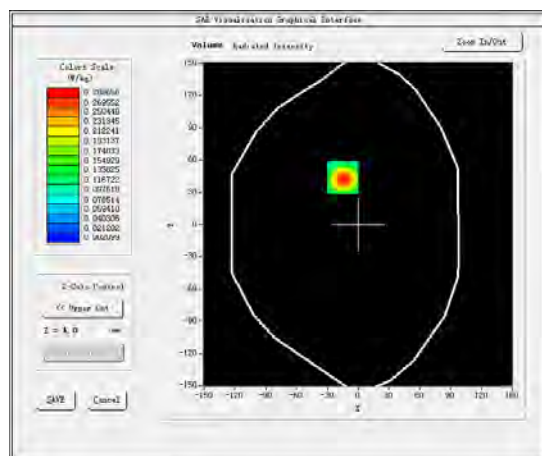
B. SAR Measurement Results

Frequency (MHz)	2462.000000
Relative permittivity (real part)	38.193934
Relative permittivity (imaginary part)	13.155337
Conductivity (S/m)	1.799358
Variation (%)	0.100000

SURFACE SAR



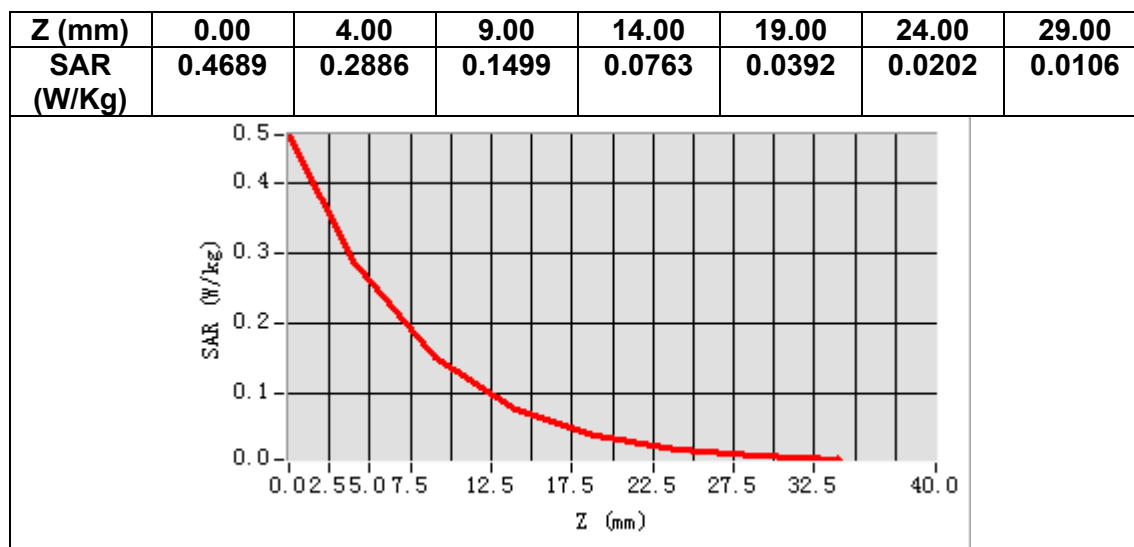
VOLUME SAR



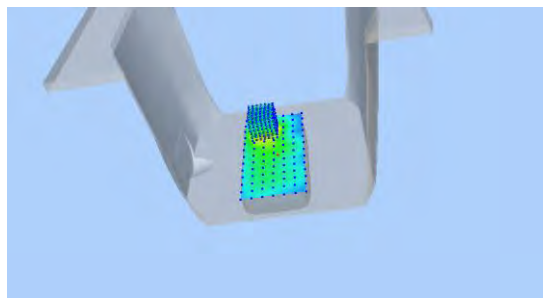
Maximum location: X=-15.00, Y=44.00

SAR Peak: 0.47 W/kg

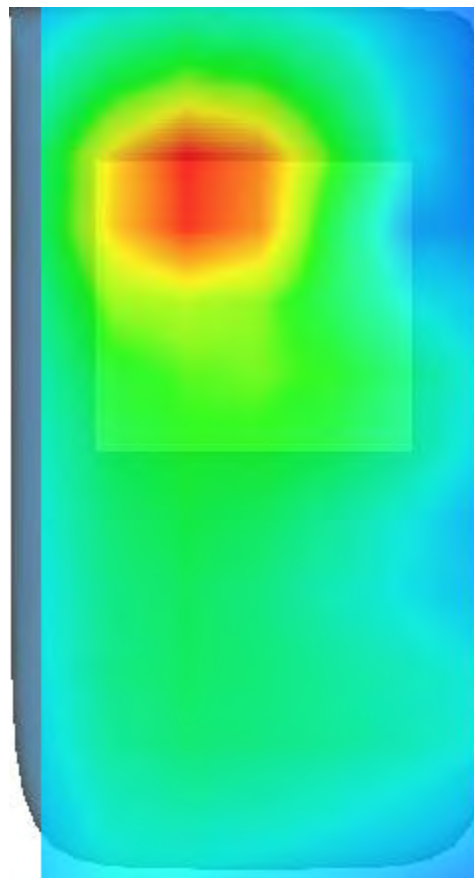
SAR 10g (W/Kg)	0.127125
SAR 1g (W/Kg)	0.270123



3D screen shot



Hot spot position



MEASUREMENT 6

Date of measurement: 13/4/2023

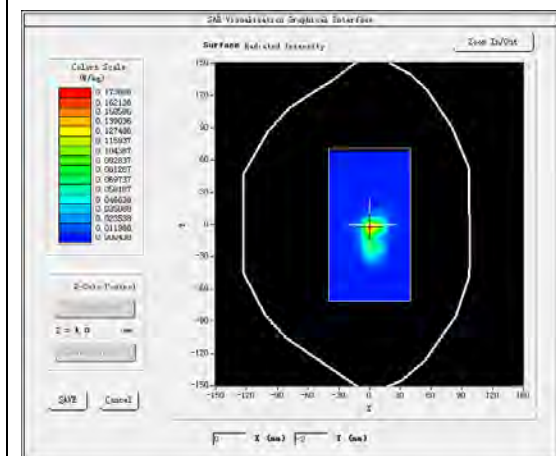
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11a U-NII</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>IEEE802.11a (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.80</u>

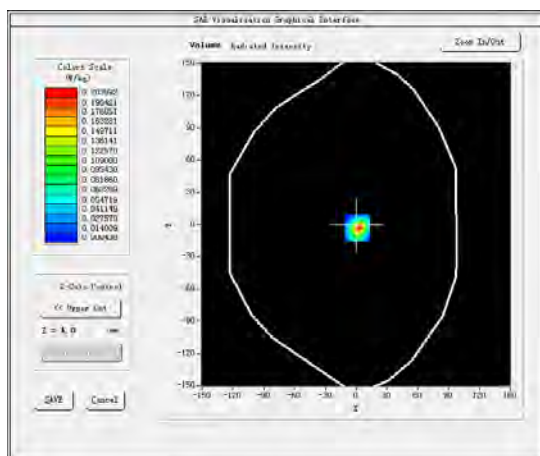
B. SAR Measurement Results

Frequency (MHz)	5200.000000
Relative permittivity (real part)	35.687162
Relative permittivity (imaginary part)	16.161724
Conductivity (S/m)	4.668942
Variation (%)	0.550000

SURFACE SAR



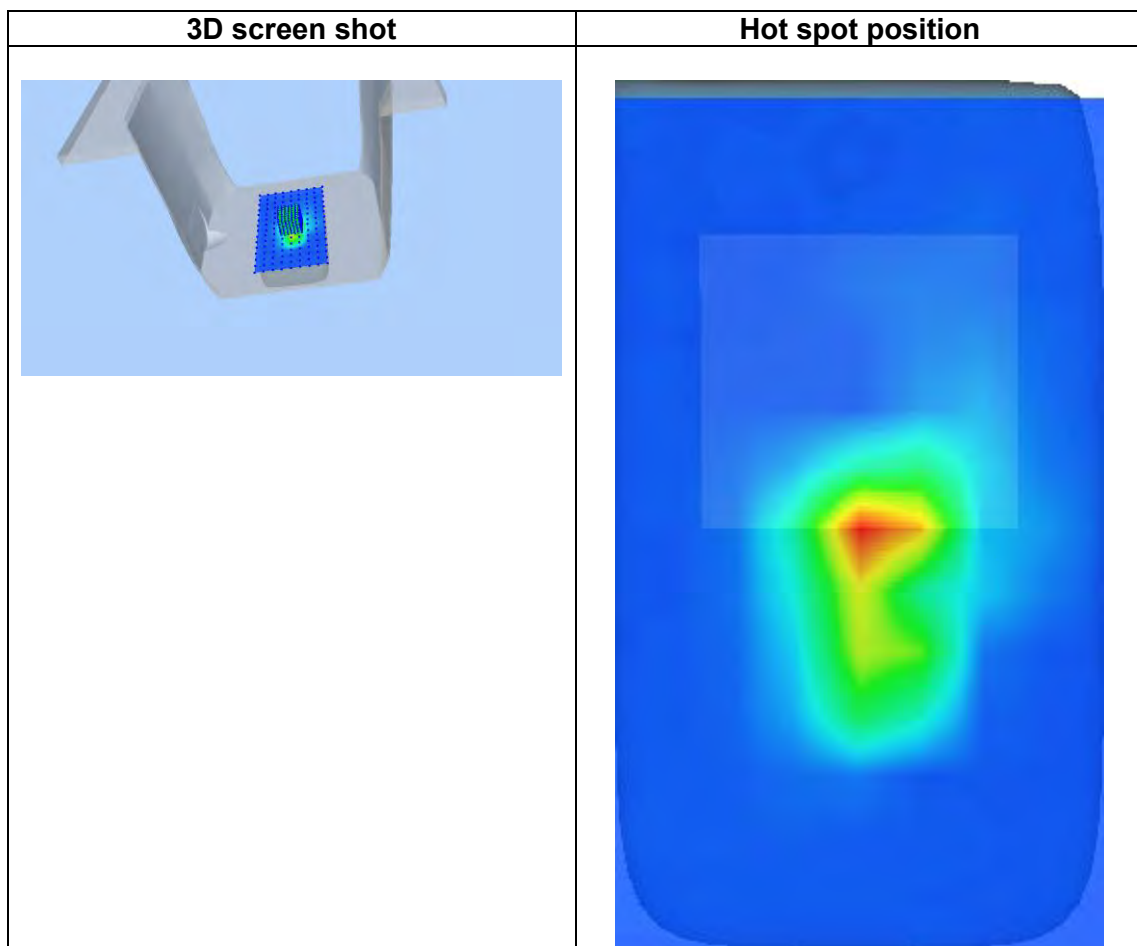
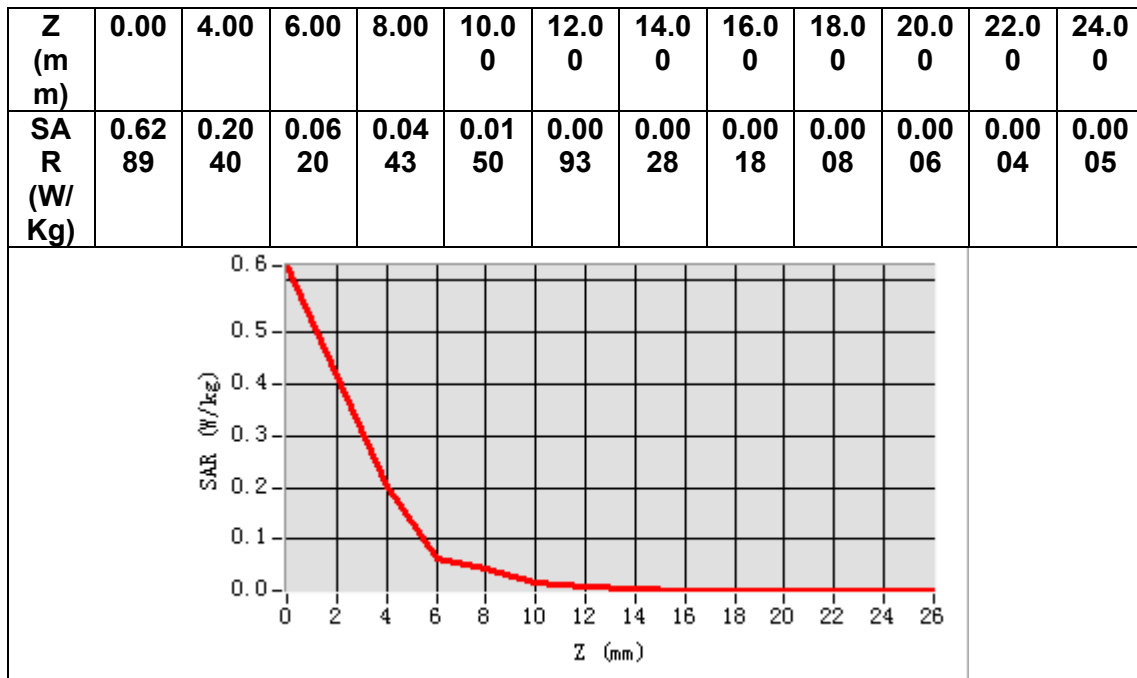
VOLUME SAR



Maximum location: X=1.00, Y=-3.00

SAR Peak: 0.59 W/kg

SAR 10g (W/Kg)	0.044516
SAR 1g (W/Kg)	0.181045



MEASUREMENT 7

Date of measurement: 12/4/2023

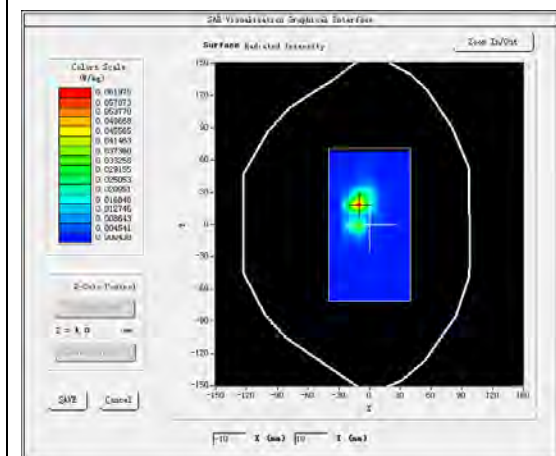
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=10mm dy=10mm, h= 2.00 mm</u>
<u>ZoomScan</u>	<u>7x7x12,dx=4mm dy=4mm dz=2mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>IEEE 802.11a U-NII</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>IEEE802.11a (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>2.07</u>

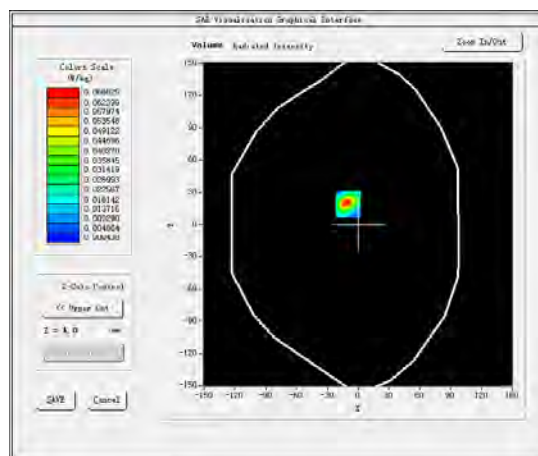
B. SAR Measurement Results

Frequency (MHz)	5745.000000
Relative permittivity (real part)	34.396301
Relative permittivity (imaginary part)	16.102642
Conductivity (S/m)	5.139427
Variation (%)	4.110000

SURFACE SAR



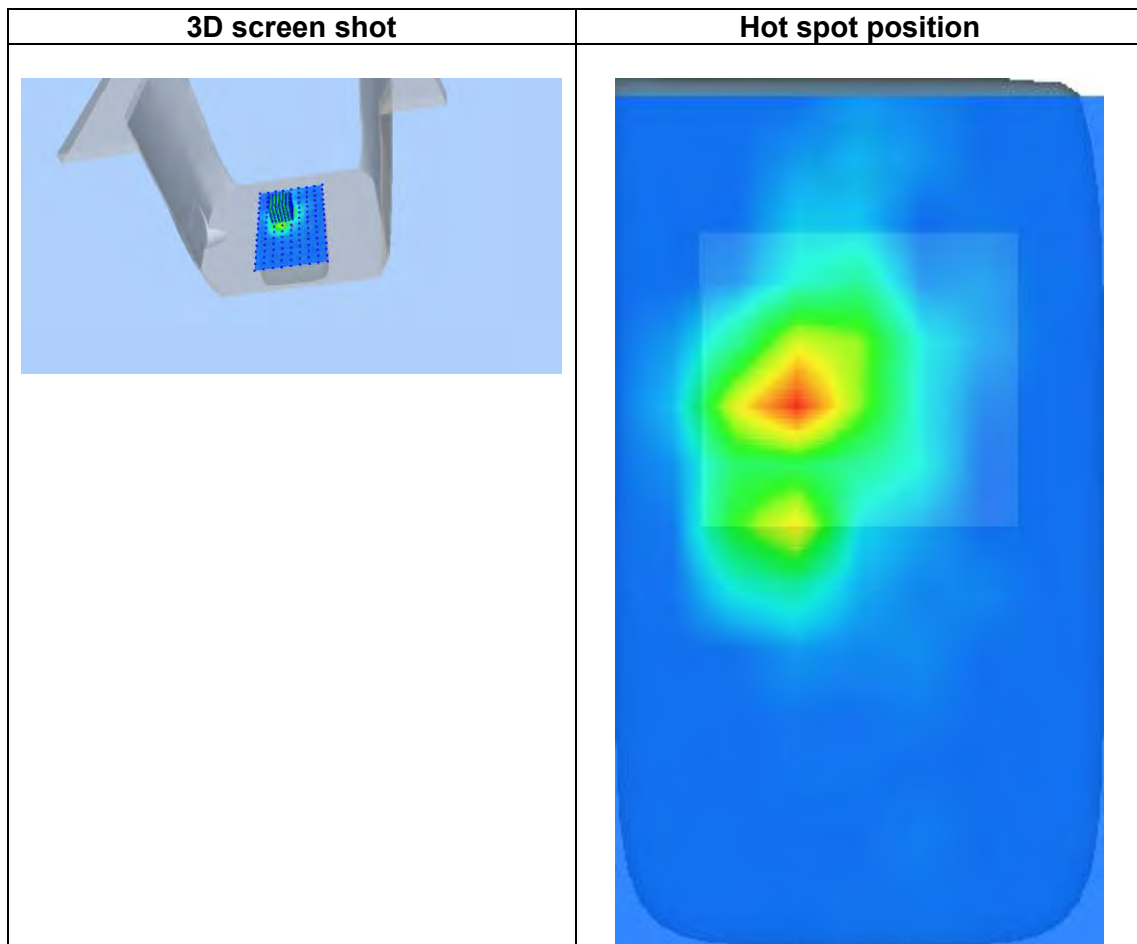
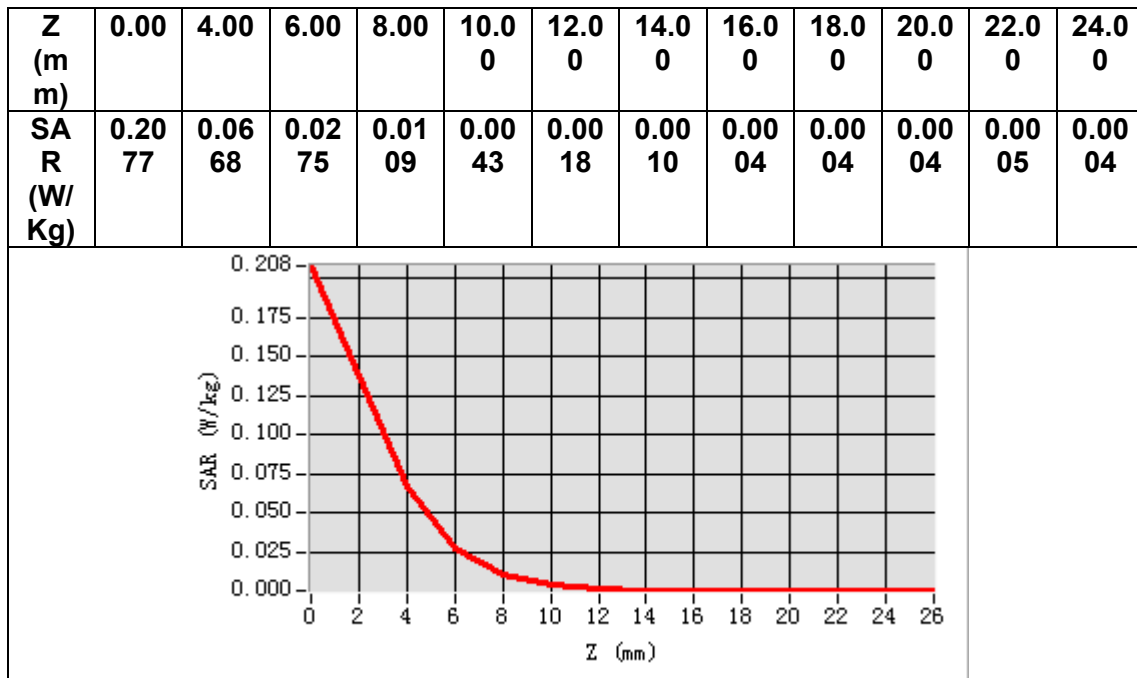
VOLUME SAR



Maximum location: X=-10.00, Y=19.00

SAR Peak: 0.21 W/kg

SAR 10g (W/Kg)	0.017147
SAR 1g (W/Kg)	0.064677



MEASUREMENT 8

Date of measurement: 21/4/2023

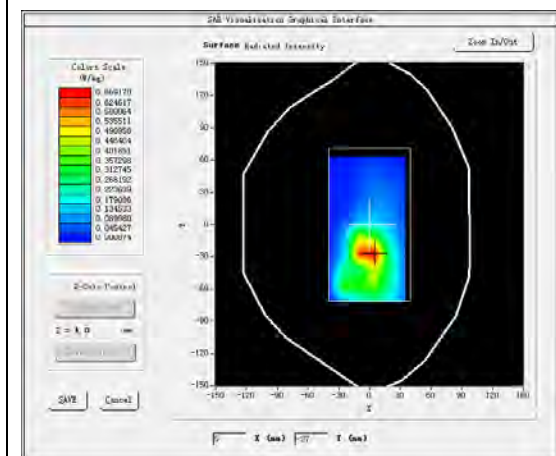
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 2</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.91</u>

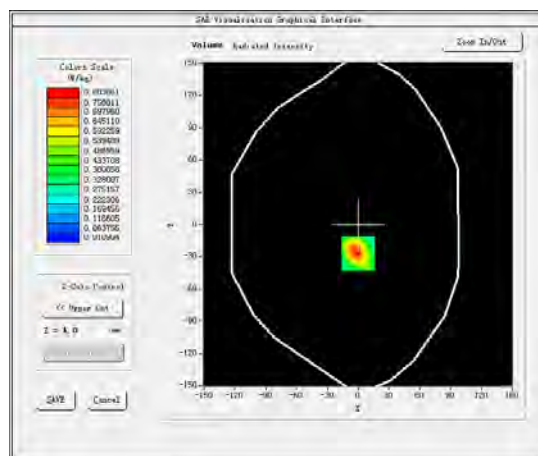
B. SAR Measurement Results

Frequency (MHz)	1880.000000
Relative permittivity (real part)	38.489548
Relative permittivity (imaginary part)	13.530178
Conductivity (S/m)	1.413152
Variation (%)	-0.200000

SURFACE SAR



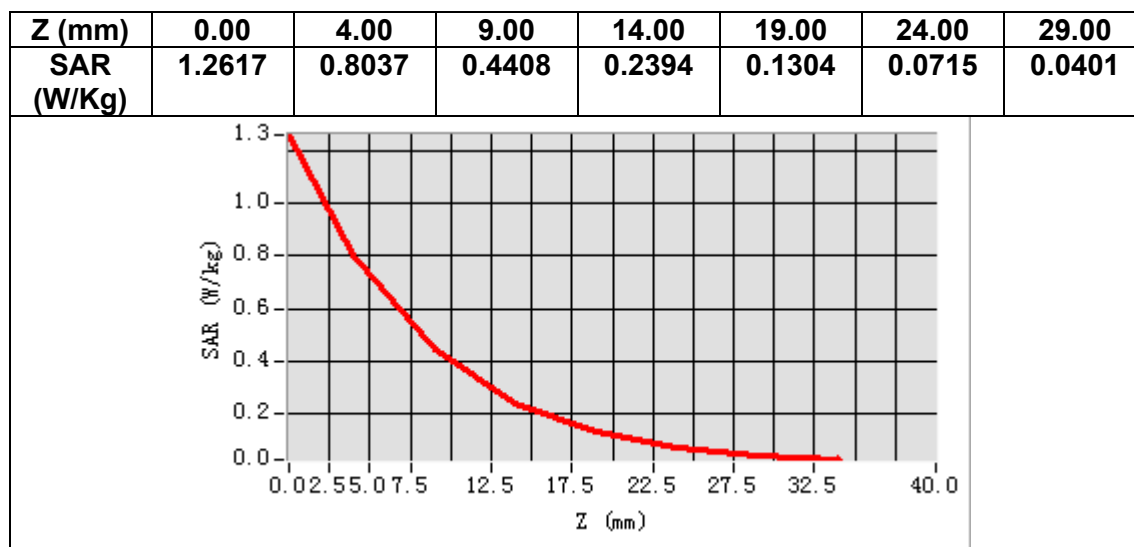
VOLUME SAR



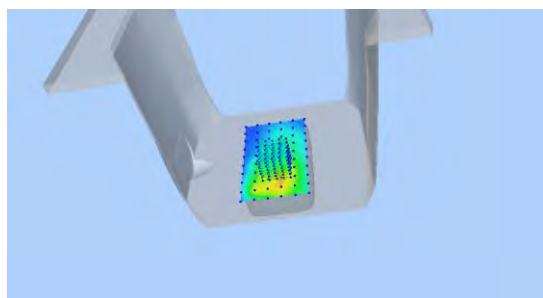
Maximum location: X=0.00, Y=-27.00

SAR Peak: 1.32 W/kg

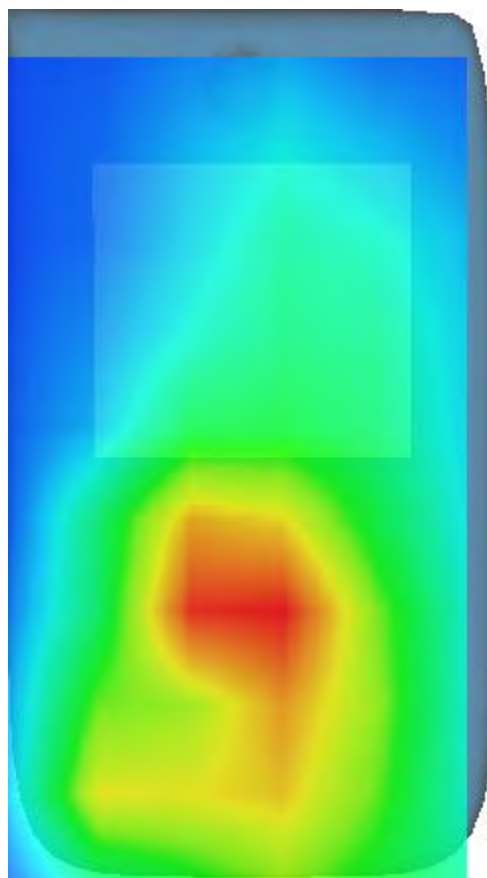
SAR 10g (W/Kg)	0.381356
SAR 1g (W/Kg)	0.773744



3D screen shot



Hot spot position



MEASUREMENT 9

Date of measurement: 27/4/2023

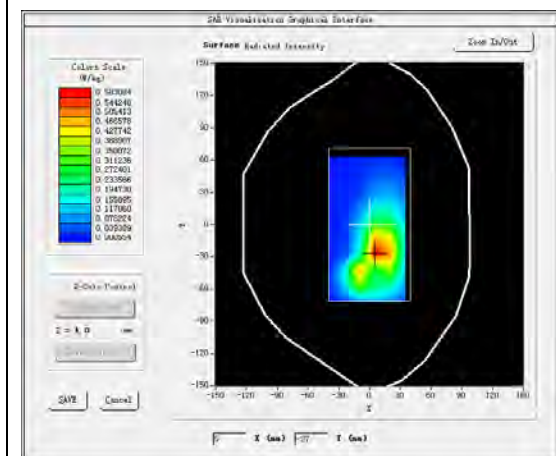
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 4</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.73</u>

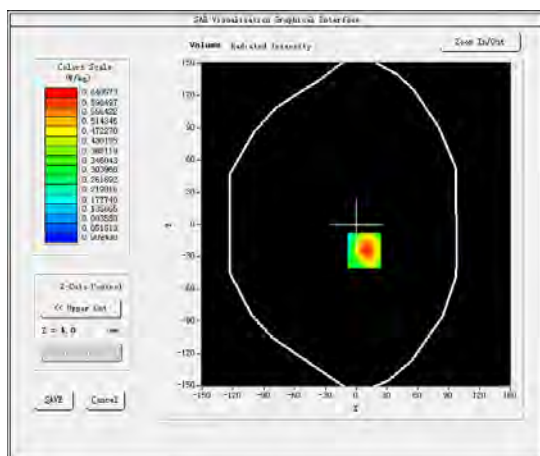
B. SAR Measurement Results

Frequency (MHz)	1732.500000
Relative permittivity (real part)	39.007164
Relative permittivity (imaginary part)	13.618412
Conductivity (S/m)	1.310772
Variation (%)	-0.820000

SURFACE SAR



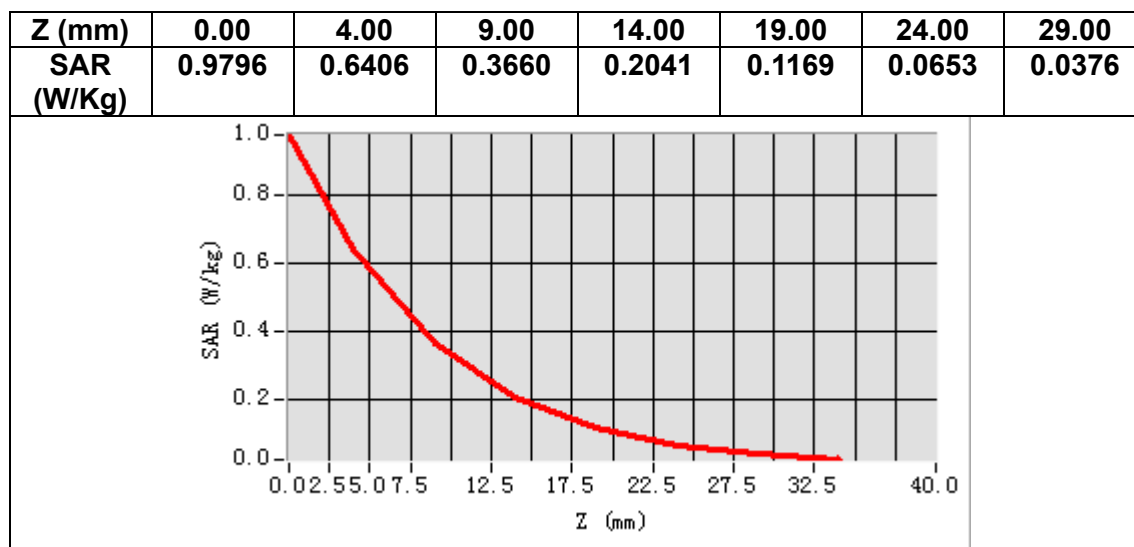
VOLUME SAR



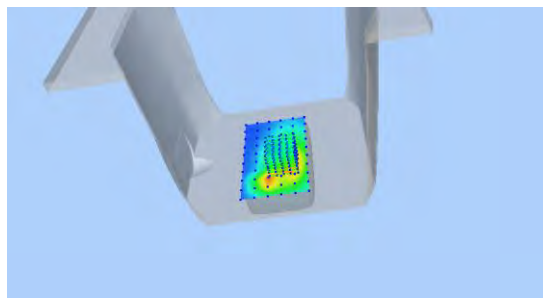
Maximum location: X=8.00, Y=-24.00

SAR Peak: 0.97 W/kg

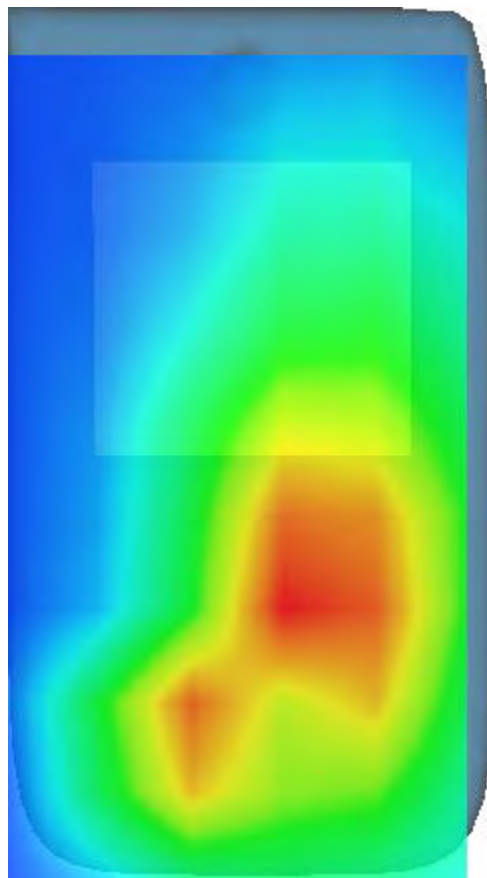
SAR 10g (W/Kg)	0.331627
SAR 1g (W/Kg)	0.603125



3D screen shot



Hot spot position



MEASUREMENT 10

Date of measurement: 24/4/2023

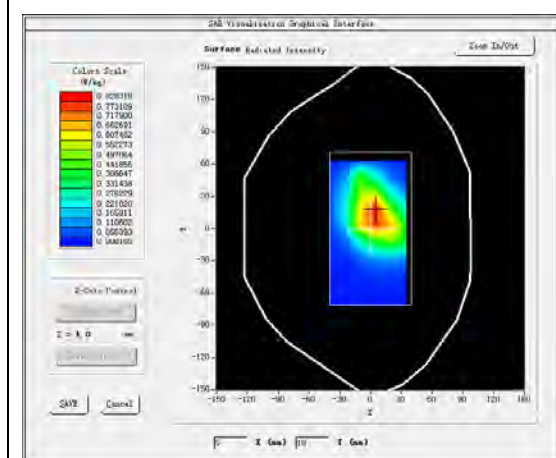
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 5</u>
<u>Channels</u>	<u>Low</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.50</u>

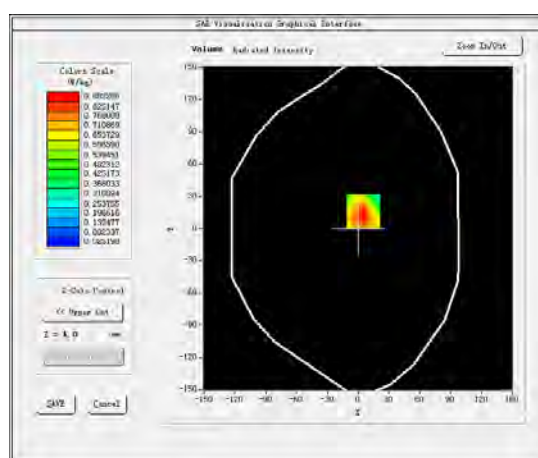
B. SAR Measurement Results

Frequency (MHz)	829.000000
Relative permittivity (real part)	41.016134
Relative permittivity (imaginary part)	19.700525
Conductivity (S/m)	0.907319
Variation (%)	0.190000

SURFACE SAR



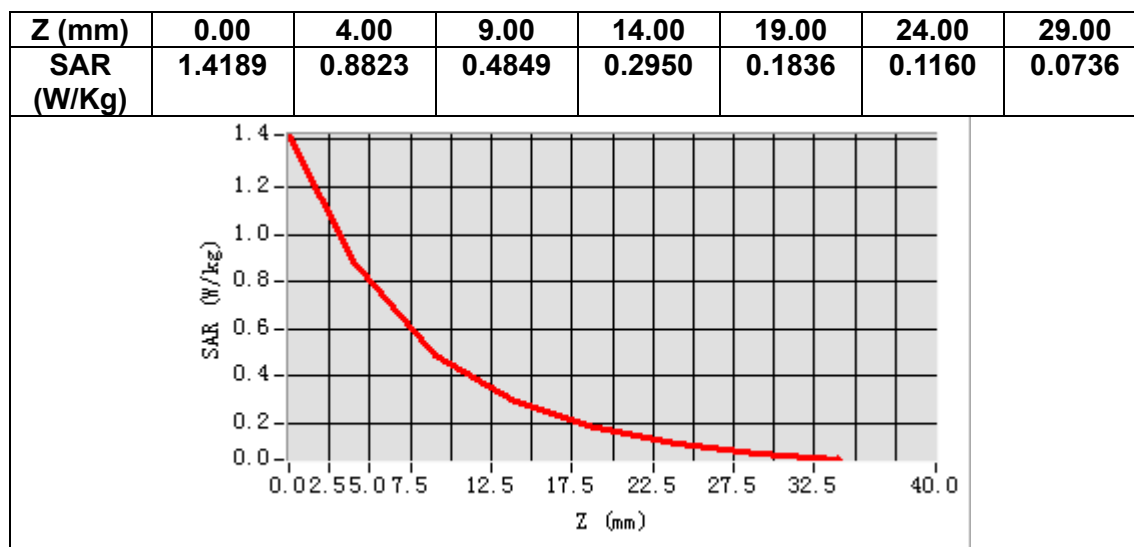
VOLUME SAR



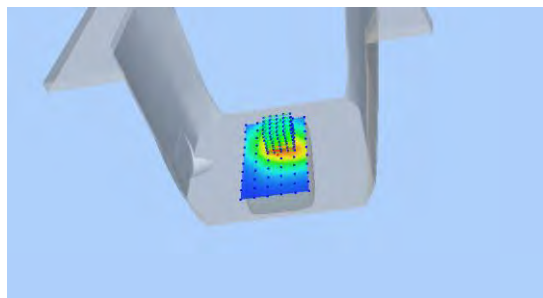
Maximum location: X=5.00, Y=16.00

SAR Peak: 1.44 W/kg

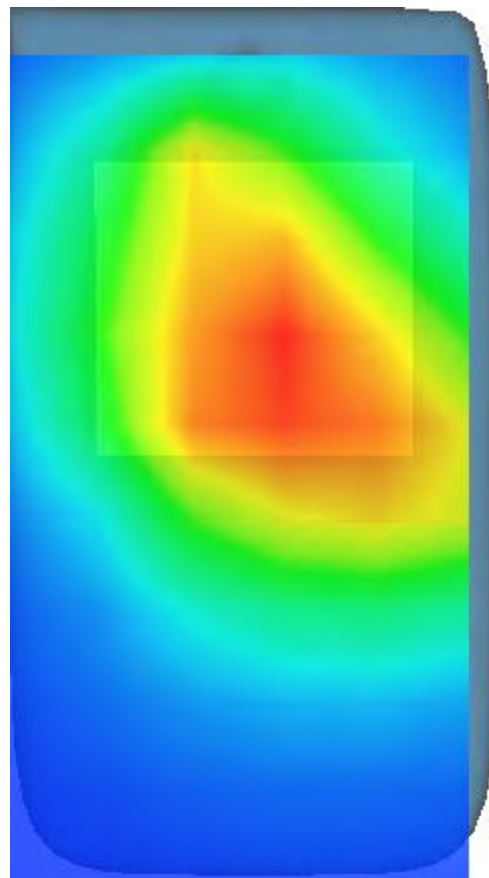
SAR 10g (W/Kg)	0.491761
SAR 1g (W/Kg)	0.860771



3D screen shot



Hot spot position



MEASUREMENT 11

Date of measurement: 28/4/2023

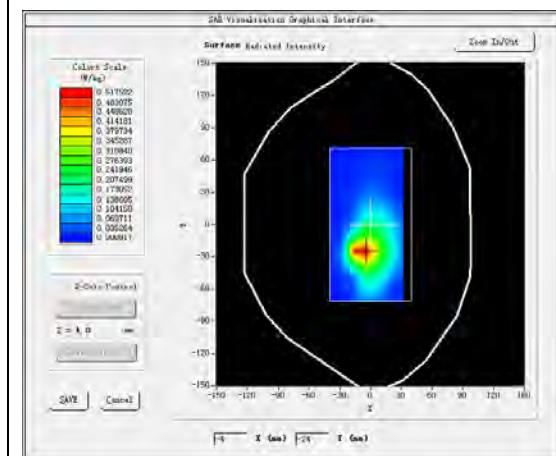
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=12mm dy=12mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>7x7x7, dx=5mm dy=5mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 7</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.87</u>

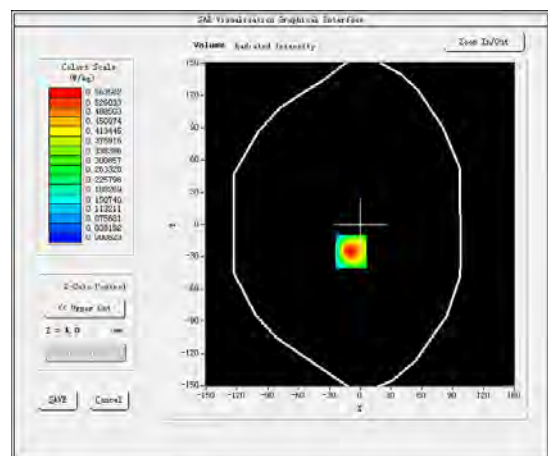
B. SAR Measurement Results

Frequency (MHz)	2535.000000
Relative permittivity (real part)	37.939041
Relative permittivity (imaginary part)	13.230349
Conductivity (S/m)	1.863274
Variation (%)	0.170000

SURFACE SAR



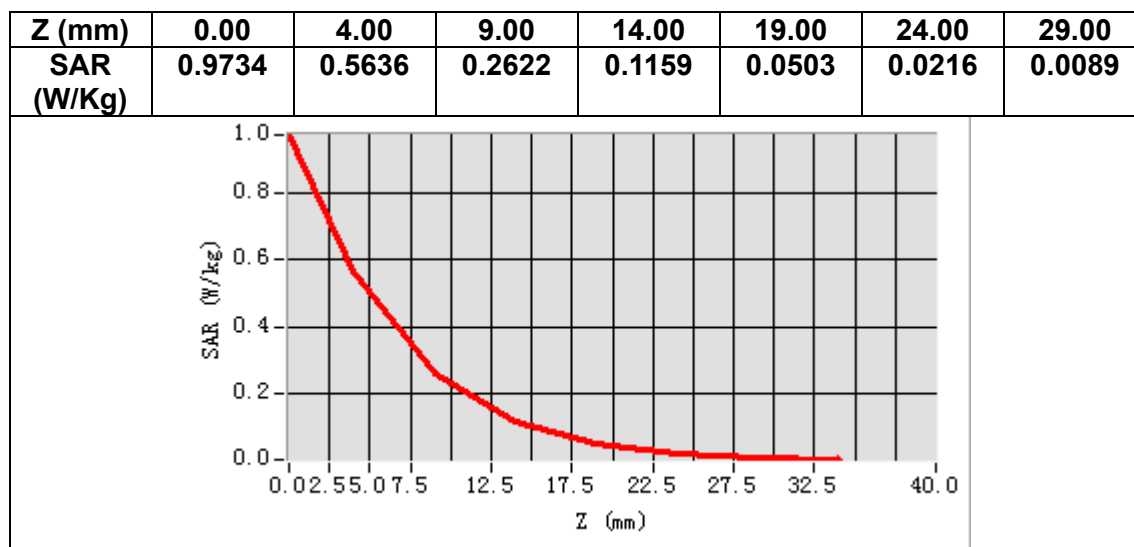
VOLUME SAR



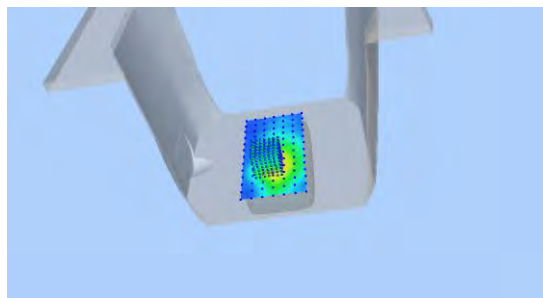
Maximum location: X=-9.00, Y=-25.00

SAR Peak: 1.01 W/kg

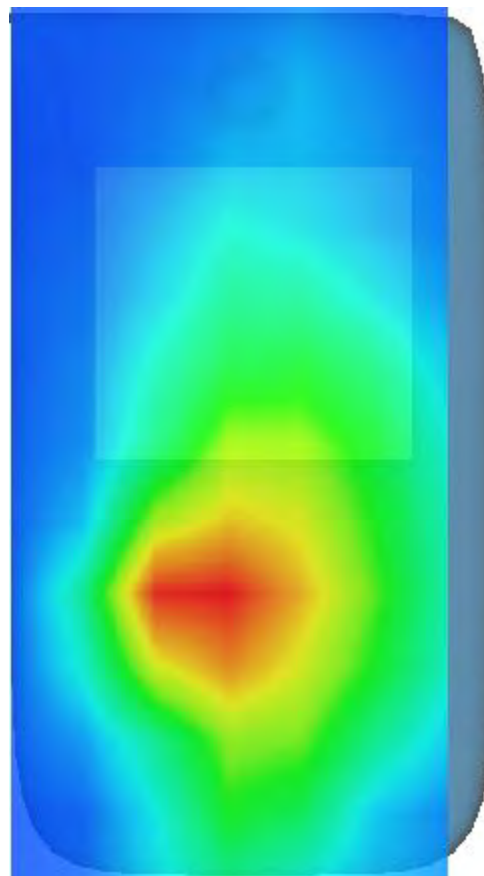
SAR 10g (W/Kg)	0.237462
SAR 1g (W/Kg)	0.531433



3D screen shot



Hot spot position



MEASUREMENT 12

Date of measurement: 19/4/2023

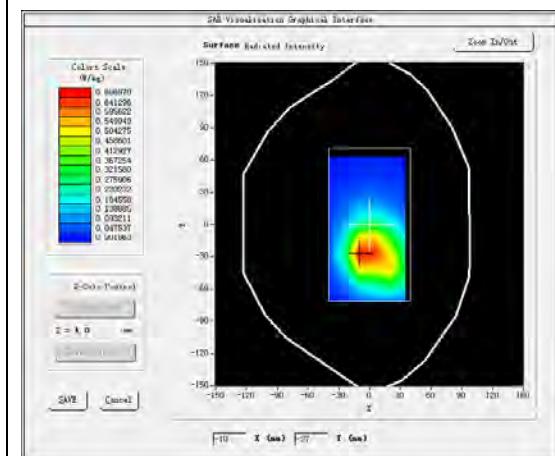
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 12</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.49</u>

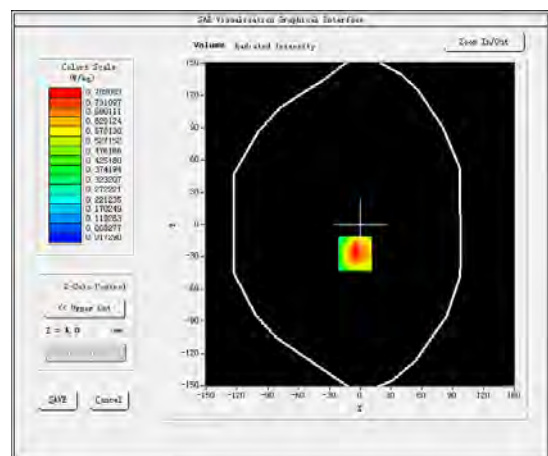
B. SAR Measurement Results

Frequency (MHz)	707.500000
Relative permittivity (real part)	41.152946
Relative permittivity (imaginary part)	22.048195
Conductivity (S/m)	0.866617
Variation (%)	-0.140000

SURFACE SAR



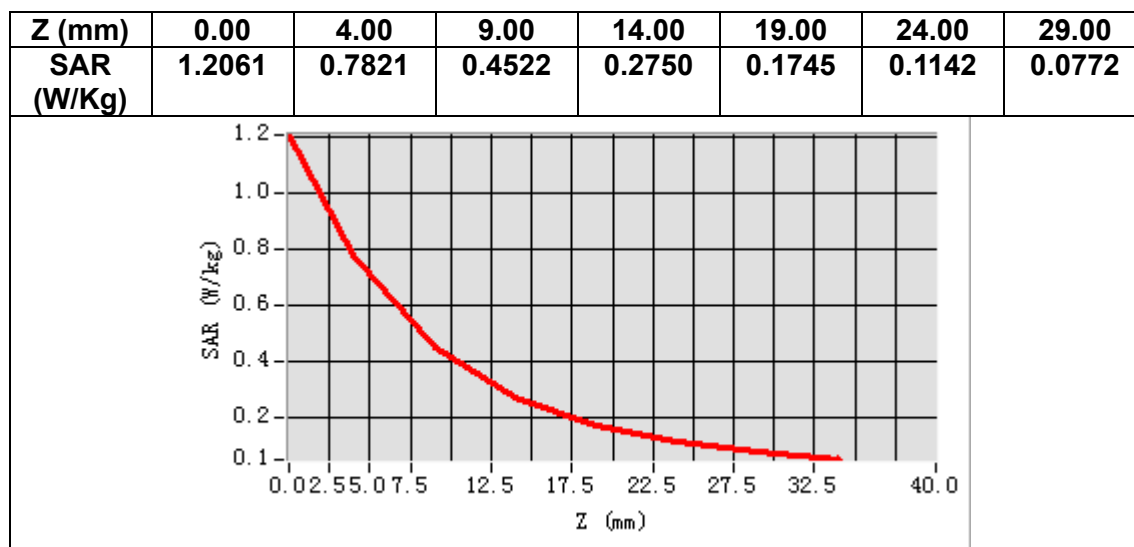
VOLUME SAR



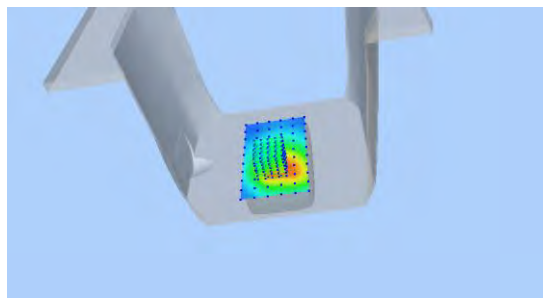
Maximum location: X=-5.00, Y=-27.00

SAR Peak: 1.20 W/kg

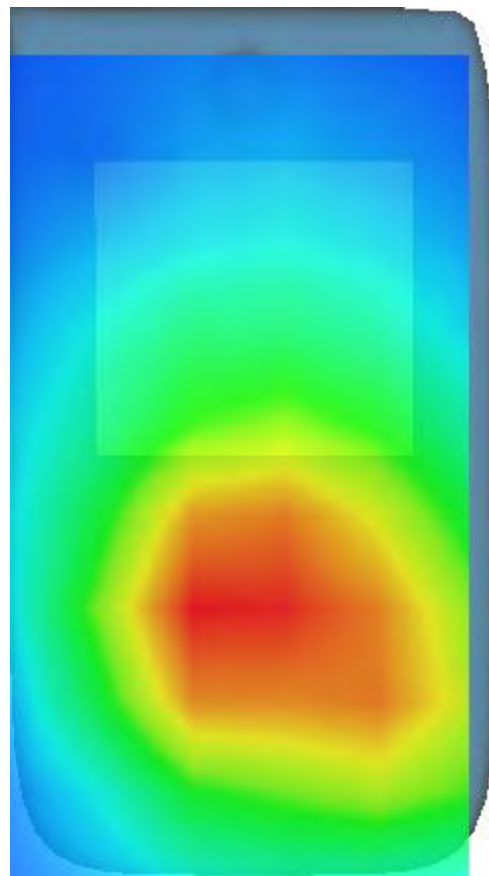
SAR 10g (W/Kg)	0.441511
SAR 1g (W/Kg)	0.748176



3D screen shot



Hot spot position



MEASUREMENT 13

Date of measurement: 19/4/2023

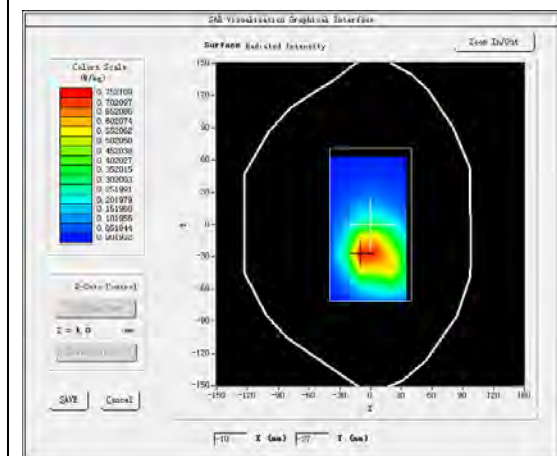
A. Experimental conditions.

<u>Area Scan</u>	<u>dx=15mm dy=15mm, h= 5.00 mm</u>
<u>ZoomScan</u>	<u>5x5x7, dx=8mm dy=8mm dz=5mm</u>
<u>Phantom</u>	<u>Validation plane</u>
<u>Device Position</u>	<u>Body</u>
<u>Band</u>	<u>LTE band 17</u>
<u>Channels</u>	<u>Middle</u>
<u>Signal</u>	<u>LTE (Crest factor: 1.0)</u>
<u>ConvF</u>	<u>1.49</u>

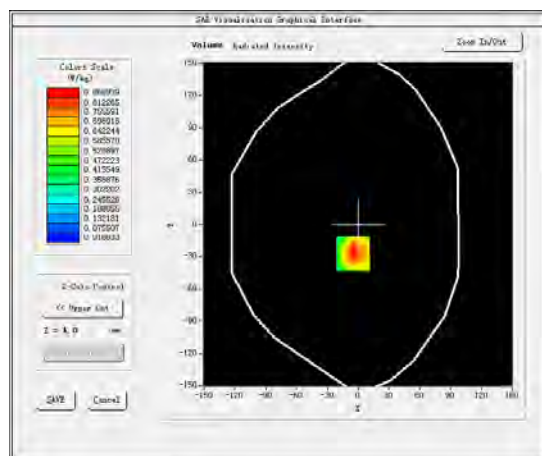
B. SAR Measurement Results

Frequency (MHz)	710.000000
Relative permittivity (real part)	41.137596
Relative permittivity (imaginary part)	21.988644
Conductivity (S/m)	0.867330
Variation (%)	-0.540000

SURFACE SAR



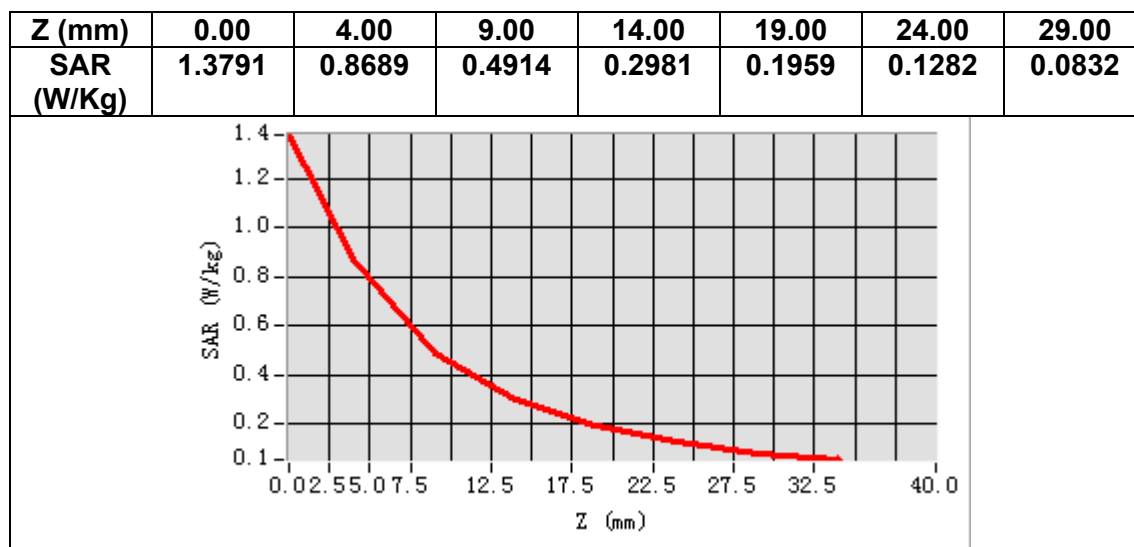
VOLUME SAR



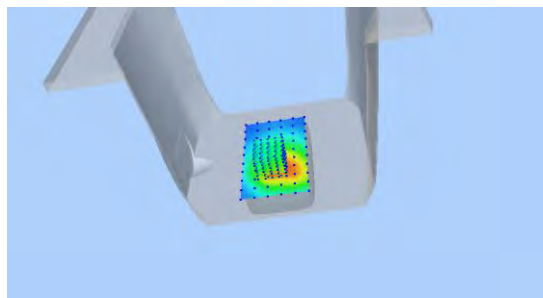
Maximum location: X=-5.00, Y=-27.00

SAR Peak: 1.37 W/kg

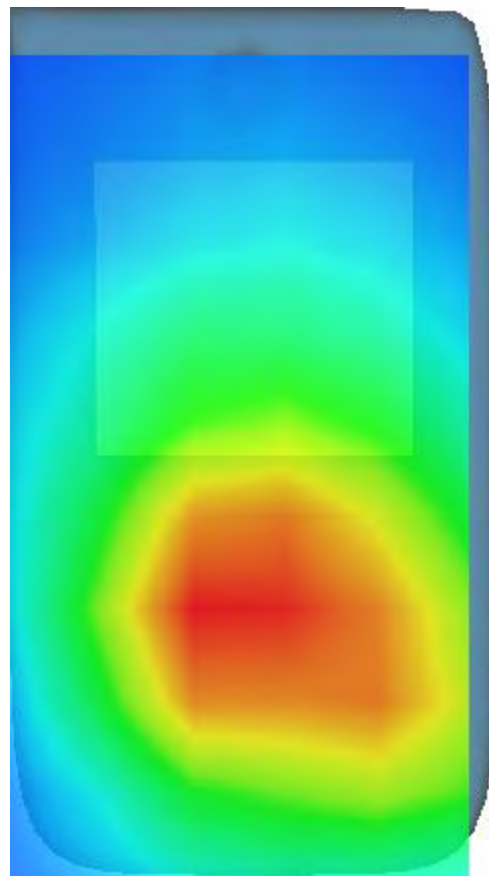
SAR 10g (W/Kg)	0.487863
SAR 1g (W/Kg)	0.834656



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
2600 MHz Dipole - SN 03/15 DIP 2G600-356
5000-6000 MHz Dipole - SN 13/14 WGA 33
Extended Calibration Certificate



COMOSAR E-Field Probe Calibration Report

Ref : ACR.60.1.21.MVGB.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 EPG0287

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

Calibration date: 01/10/2023



Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

Summary:

This document presents the method and results from an accredited COMOSAR E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Luc	Technical Manager	1/10/2023	<i>JS</i>
Checked by :	Jérôme Luc	Technical Manager	1/10/2023	<i>JS</i>
Approved by :	Yann Toutain	Laboratory Director	1/10/2023	<i>Yann Toutain</i>

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

Issue	Name	Date	Modifications
A	Jérôme Luc	1/10/2023	Initial release



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

TABLE OF CONTENTS

1	Device Under Test	4
2	Product Description	4
2.1	General Information	4
3	Measurement Method	4
3.1	Linearity	4
3.2	Sensitivity	5
3.3	Lower Detection Limit	5
3.4	Isotropy	5
3.1	Boundary Effect	5
4	Measurement Uncertainty	6
5	Calibration Measurement Results	6
5.1	Sensitivity in air	6
5.2	Linearity	7
5.3	Sensitivity in liquid	8
5.4	Isotropy	9
6	List of Equipment	10



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 08/16 EPGO287
Product Condition (new / used)	Used
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.211 MΩ Dipole 2: R2=0.199 MΩ Dipole 3: R3=0.199 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEEE 1528, FCC KDB865664 D01, CENELEC EN62209 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, FCC KDB865664 D01, CENELEC EN62209 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.



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

3.2 SENSITIVITY

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

3.3 LOWER DETECTION LIMIT

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

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 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°).

3.1 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.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be} + d_{step}$ along lines that are approximately normal to the surface:

$$SAR_{uncertainty} [\%] = \delta SAR_{be} \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{(e^{-d_{be}/\delta} - e^{-d_{be} + d_{step}/\delta})}{\delta/2} \quad \text{for } (d_{be} + d_{step}) < 10 \text{ mm}$$

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest <i>zoom-scan</i> measurement point, in millimetre
d_{step}	is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible
δ	is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx 14 \text{ mm}$ at 3 GHz;
δSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

The measured worst case boundary effect SARuncertainty[%] for scanning distances larger than 4mm is 1.0% Limit .2%).

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 (%)
Expanded uncertainty 95 % confidence level k = 2					14 %

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$)
0.72	0.66	0.77

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
107	110	110

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

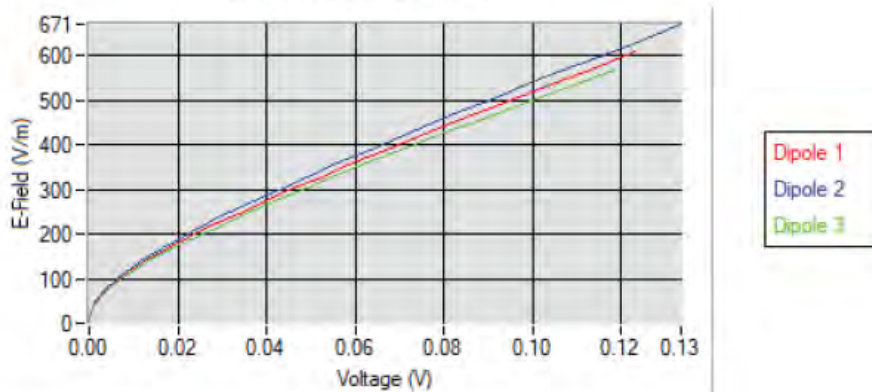
$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



COMOSAR E-FIELD PROBE CALIBRATION REPORT

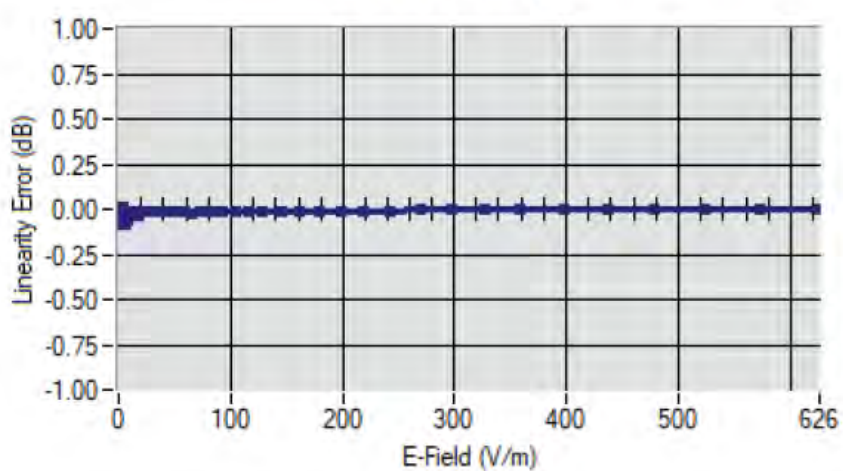
Ref: ACR.60.1.21.MVGB.A

Calibration curves



5.2 LINEARITY

Linearity



Linearity: +/- 1.90% (+/- 0.08dB)



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

5.3 SENSITIVITY IN LIQUID

<u>Liquid</u>	<u>Frequency</u> <u>(MHz +/-</u> <u>100MHz)</u>	<u>ConvF</u>
HL750	750	1.49
HL850	835	1.50
HL900	900	1.61
HL1800	1800	1.73
HL1900	1900	1.91
HL2000	2000	1.97
HL2300	2300	1.92
HL2450	2450	1.98
HL2600	2600	1.87
HL3300	3300	1.79
HL3500	3500	1.85
HL3700	3700	1.79
HL3900	3900	2.07
HL4200	4200	2.21
HL4600	4600	2.25
HL4900	4900	2.05
HL5200	5200	1.80
HL5400	5400	2.05
HL5600	5600	2.16
HL5800	5800	2.07

LOWER DETECTION LIMIT: 8mW/kg

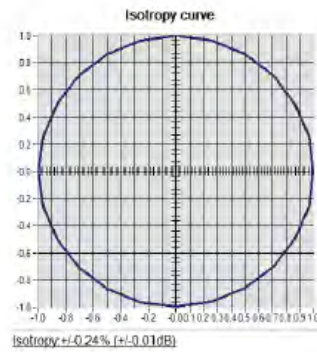


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

5.4 ISOTROPY

HL1800 MHz





COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.60.1.21.MVGB.A

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	05/2022	05/2025
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2022	05/2025
Multimeter	Keithley 2000	1160271	02/2022	02/2025
Signal Generator	Rohde & Schwarz SMB	106589	04/2022	04/2025
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	05/2022	05/2025
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	Testo 184 H1	44220687	05/2020	05/2023



SAR Reference Dipole Calibration Report

Ref : ACR.60.2.21.MVGB.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 DIP0G750-355

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 03/01/2021



Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

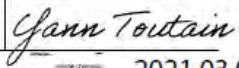
Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed at MVG, using the COMOSAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.2.21.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Luc	Technical Manager	3/1/2021	
Checked by :	Jérôme Luc	Technical Manager	3/1/2021	
Approved by :	Yann Toutain	Laboratory Director	3/1/2021	

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

Issue	Name	Date	Modifications
A	Jérôme Luc	3/1/2021	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.2.21.MVGB.A

TABLE OF CONTENTS

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.2.21.MVGB.A

1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 750 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID750
Serial Number	SN 03/15 DIP0G750-355
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.2.21.MVGB.A

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

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 dimension's 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. A direct method is used with a ISO17025 calibrated caliper.

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	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
0 - 300	0.20 mm
300 - 450	0.44 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
-------------	----------------------

Page: 5/10

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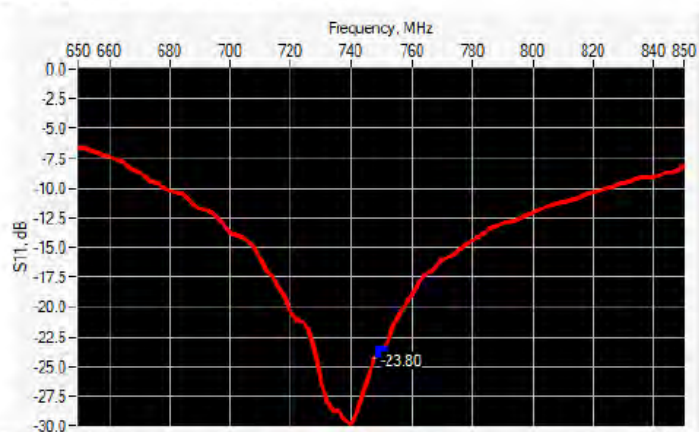
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.2.21.MVGB.A

1 g	19 % (SAR)
10 g	19 % (SAR)

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-23.80	-20	56.4 Ω - 0.1 j Ω

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %		250.0 $\pm$ 1 %		6.35 $\pm$ 1 %	
450	290.0 $\pm$ 1 %		166.7 $\pm$ 1 %		6.35 $\pm$ 1 %	
750	176.0 $\pm$ 1 %	-	100.0 $\pm$ 1 %	-	6.35 $\pm$ 1 %	-
835	161.0 $\pm$ 1 %		89.8 $\pm$ 1 %		3.6 $\pm$ 1 %	
900	149.0 $\pm$ 1 %		83.3 $\pm$ 1 %		3.6 $\pm$ 1 %	
1450	89.1 $\pm$ 1 %		51.7 $\pm$ 1 %		3.6 $\pm$ 1 %	
1500	80.5 $\pm$ 1 %		50.0 $\pm$ 1 %		3.6 $\pm$ 1 %	
1640	79.0 $\pm$ 1 %		45.7 $\pm$ 1 %		3.6 $\pm$ 1 %	
1750	75.2 $\pm$ 1 %		42.9 $\pm$ 1 %		3.6 $\pm$ 1 %	
1800	72.0 $\pm$ 1 %		41.7 $\pm$ 1 %		3.6 $\pm$ 1 %	
1900	68.0 $\pm$ 1 %		39.5 $\pm$ 1 %		3.6 $\pm$ 1 %	
1950	66.3 $\pm$ 1 %		38.5 $\pm$ 1 %		3.6 $\pm$ 1 %	
2000	64.5 $\pm$ 1 %		37.5 $\pm$ 1 %		3.6 $\pm$ 1 %	
2100	61.0 $\pm$ 1 %		35.7 $\pm$ 1 %		3.6 $\pm$ 1 %	
2300	55.5 $\pm$ 1 %		32.6 $\pm$ 1 %		3.6 $\pm$ 1 %	
2450	51.5 $\pm$ 1 %		30.4 $\pm$ 1 %		3.6 $\pm$ 1 %	

Page: 6/10

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.2.21.MVGB.A

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 MEASUREMENT CONDITION

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: ϵ_r' : 41.8 σ : 0.82
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	750750 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

7.2 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±10 %		0.87 ±10 %	
450	43.5 ±10 %		0.87 ±10 %	
750	41.9 ±10 %	41.8	0.89 ±10 %	0.82
835	41.5 ±10 %		0.90 ±10 %	
900	41.5 ±10 %		0.97 ±10 %	
1450	40.5 ±10 %		1.20 ±10 %	
1500	40.4 ±10 %		1.23 ±10 %	
1640	40.2 ±10 %		1.31 ±10 %	
1750	40.1 ±10 %		1.37 ±10 %	
1800	40.0 ±10 %		1.40 ±10 %	
1900	40.0 ±10 %		1.40 ±10 %	
1950	40.0 ±10 %		1.40 ±10 %	
2000	40.0 ±10 %		1.40 ±10 %	

Page: 7/10

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.2.21 MVGB.A

2100	39.8 ±10 %		1.49 ±10 %	
2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
2600	39.0 ±10 %		1.96 ±10 %	
3000	38.5 ±10 %		2.40 ±10 %	
3500	37.9 ±10 %		2.91 ±10 %	

7.3 MEASUREMENT RESULT

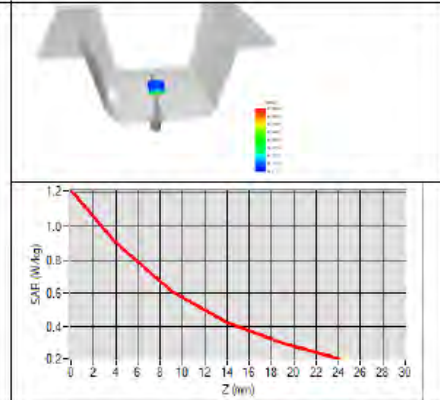
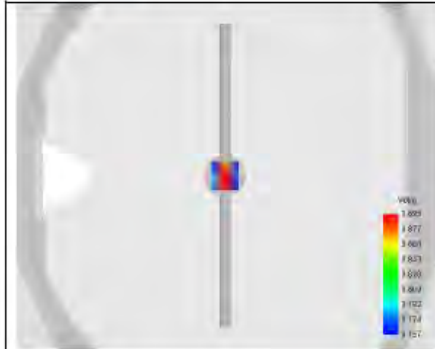
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is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

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	8.53 (0.85)	5.55	5.56 (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	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.2.21.MVGB.A





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.2.21.MVGB.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-13/09-SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	05/2019	05/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Calipers	Mitutoyo	SN 0009732	10/2019	10/2022
Reference Probe	MVG	EPGO333 SN 41/18	05/2020	05/2021
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	05/2019	05/2022
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44220687	05/2020	05/2023



SAR Reference Dipole Calibration Report

Ref : ACR.60.3.21.MVGB.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 DIP0G835-347

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 03/01/2021



Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed at MVG, using the COMOSAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.3.21.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Luc	Technical Manager	3/1/2021	<i>JL</i>
Checked by :	Jérôme Luc	Technical Manager	3/1/2021	<i>JL</i>
Approved by :	Yann Toutain	Laboratory Director	3/1/2021	<i>Yann Toutain</i>

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

Issue	Name	Date	Modifications
A	Jérôme Luc	3/1/2021	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.3.21.MVGB.A

TABLE OF CONTENTS

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.3.21.MVGB.A

1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 835 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID835
Serial Number	SN 03/15 DIP0G835-347
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.3.21.MVGB.A

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

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 dimension's 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. A direct method is used with a ISO17025 calibrated caliper.

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	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
0 - 300	0.20 mm
300 - 450	0.44 mm

5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
-------------	----------------------



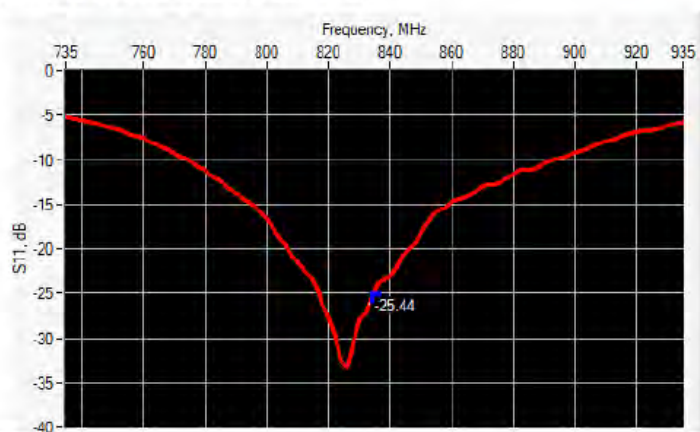
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.3.21.MVGB.A

1 g	19 % (SAR)
10 g	19 % (SAR)

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-25.44	-20	54.4 Ω - 2.9 j Ω

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %.		250.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
450	290.0 $\pm$ 1 %.		166.7 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
750	176.0 $\pm$ 1 %.		100.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
835	161.0 $\pm$ 1 %.	-	89.8 $\pm$ 1 %.	-	3.6 $\pm$ 1 %.	-
900	149.0 $\pm$ 1 %.		83.3 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1450	89.1 $\pm$ 1 %.		51.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1500	80.5 $\pm$ 1 %.		50.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1640	79.0 $\pm$ 1 %.		45.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1750	75.2 $\pm$ 1 %.		42.9 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1800	72.0 $\pm$ 1 %.		41.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1900	68.0 $\pm$ 1 %.		39.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1950	66.3 $\pm$ 1 %.		38.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2000	64.5 $\pm$ 1 %.		37.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2100	61.0 $\pm$ 1 %.		35.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2300	55.5 $\pm$ 1 %.		32.6 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2450	51.5 $\pm$ 1 %.		30.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	

Page: 6/10

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.3.21.MVGB.A

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 MEASUREMENT CONDITION

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: ϵ_r' : 40.6 sigma : 0.89
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	835835 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

7.2 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±10 %		0.87 ±10 %	
450	43.5 ±10 %		0.87 ±10 %	
750	41.9 ±10 %		0.89 ±10 %	
835	41.5 ±10 %	40.6	0.90 ±10 %	0.89
900	41.5 ±10 %		0.97 ±10 %	
1450	40.5 ±10 %		1.20 ±10 %	
1500	40.4 ±10 %		1.23 ±10 %	
1640	40.2 ±10 %		1.31 ±10 %	
1750	40.1 ±10 %		1.37 ±10 %	
1800	40.0 ±10 %		1.40 ±10 %	
1900	40.0 ±10 %		1.40 ±10 %	
1950	40.0 ±10 %		1.40 ±10 %	
2000	40.0 ±10 %		1.40 ±10 %	

Page: 7/10

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.3.21.MVGB.A

2100	39.8 ±10 %		1.49 ±10 %	
2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
2600	39.0 ±10 %		1.96 ±10 %	
3000	38.5 ±10 %		2.40 ±10 %	
3500	37.9 ±10 %		2.91 ±10 %	

7.3 MEASUREMENT RESULT

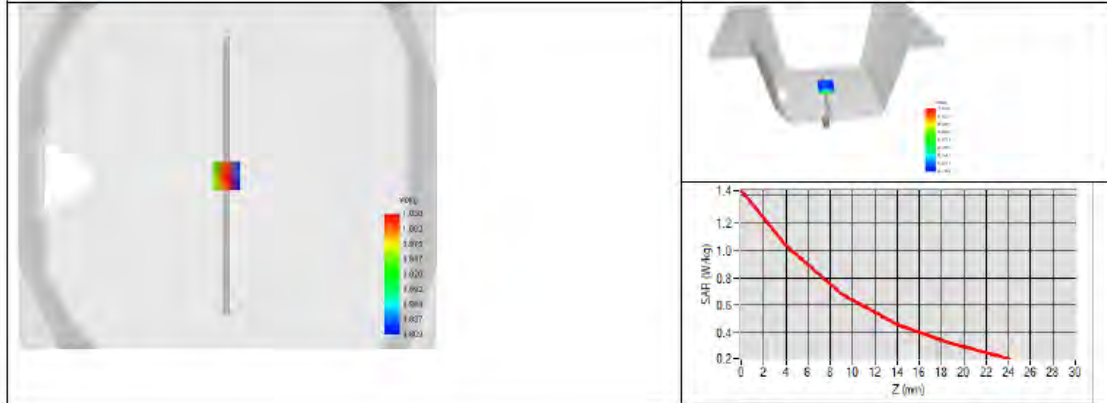
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is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

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	9.84 (0.98)	6.22	6.22 (0.62)
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
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	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.3.21.MVGB.A





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.3.21.MVGB.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-13/09-SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	05/2019	05/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Calipers	Mitutoyo	SN 0009732	10/2019	10/2022
Reference Probe	MVG	EPGO333 SN 41/18	05/2020	05/2021
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	05/2019	05/2022
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44220687	05/2020	05/2023



SAR Reference Dipole Calibration Report

Ref : ACR.60.5.21.MVGB.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: 1800 MHZ

SERIAL NO.: SN 03/15 DIP1G800-349

Calibrated at MVG

Z.I. de la pointe du diable

**Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE**

Calibration date: 03/01/2021



Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

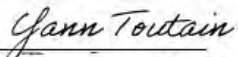
Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed at MVG, using the COMOSAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.5.21.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Luc	Technical Manager	3/1/2021	
Checked by :	Jérôme Luc	Technical Manager	3/1/2021	
Approved by :	Yann Toutain	Laboratory Director	3/1/2021	
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	Customer Name
Distribution :	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

Issue	Name	Date	Modifications
A	Jérôme Luc	3/1/2021	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.5.21.MVGB.A

TABLE OF CONTENTS

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.5.21.MVGB.A

1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1800
Serial Number	SN 03/15 DIP1G800-349
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.5.21.MVGB.A

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

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 dimension's 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. A direct method is used with a ISO17025 calibrated caliper.

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	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
0 - 300	0.20 mm
300 - 450	0.44 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
-------------	----------------------

Page: 5/10

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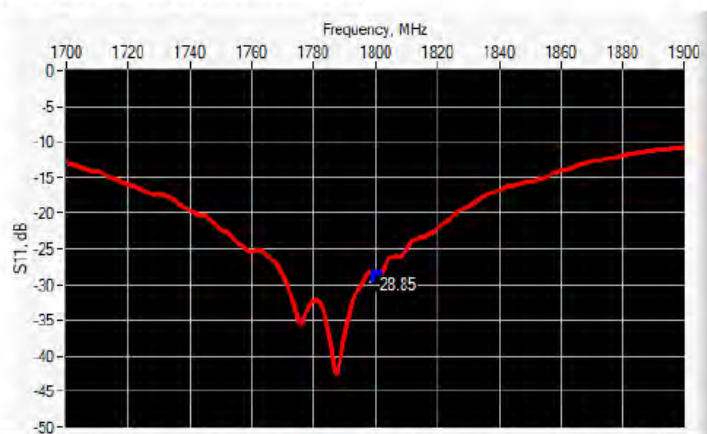
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.5.21.MVGB.A

1 g	19 % (SAR)
10 g	19 % (SAR)

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-28.85	-20	$47.9 \Omega + 2.9 j\Omega$

6.2 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 %.		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 %.	

Page: 6/10

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.60.5.21.MVGB.A

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 MEASUREMENT CONDITION

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: ϵ_r' : 43.7 σ : 1.34
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	1800/1800 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

7.2 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±10 %		0.87 ±10 %	
450	43.5 ±10 %		0.87 ±10 %	
750	41.9 ±10 %		0.89 ±10 %	
835	41.5 ±10 %		0.90 ±10 %	
900	41.5 ±10 %		0.97 ±10 %	
1450	40.5 ±10 %		1.20 ±10 %	
1500	40.4 ±10 %		1.23 ±10 %	
1640	40.2 ±10 %		1.31 ±10 %	
1750	40.1 ±10 %		1.37 ±10 %	
1800	40.0 ±10 %	43.7	1.40 ±10 %	1.34
1900	40.0 ±10 %		1.40 ±10 %	
1950	40.0 ±10 %		1.40 ±10 %	
2000	40.0 ±10 %		1.40 ±10 %	

Page: 7/10

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.5.21.MVGB.A

2100	39.8 ±10 %		1.49 ±10 %	
2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
2600	39.0 ±10 %		1.96 ±10 %	
3000	38.5 ±10 %		2.40 ±10 %	
3500	37.9 ±10 %		2.91 ±10 %	

7.3 MEASUREMENT RESULT

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.

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	37.96 (3.80)	20.1	19.81 (1.98)
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	



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.60.5.21.MVGB.A

