FCC SAR REPORT

Applicant: Advanced Sport Instruments SA

Address of Applicant: Avenue de Beaumont 5, 1012 Lausanne, Switzerland

Equipment Under Test (EUT)

Product Name: ASI5010

Model No.: ASI5010

Trade mark ASI

FCC ID: 2AZLFASI5010

Applicable standards: FCC 47 CFR Part 2.1093

Date of Test: 22 Aug., 2022~ 02 Sep., 2022

Test Result: Maximum Reported 1-g SAR (W/kg)
Body: 0.387

Authorized Signature:

Bruce Zhang
Laboratory Manager

2 Version

Version No.	Date	Description
00	*23 Sep., 2022*	*Original*

Tested by:	Zora . Huang	***Date:***	*23 Sep., 2022*
	Test Engineer		
Reviewed by:	Wiby Zhang	***Date:***	*23 Sep., 2022*
	Project Engineer		

3 Contents

4 SAR Results Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:

<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Equipment Class	Highest Reported 1-g SAR (W/kg)
Body (0 mm Gap)	GSM 850	0.387	PCB	0.387
	PCS 1900	0.317		
	LTE Band 2	0.127		
	LTE Band 4	0.099		
	LTE Band 12	0.055		
	LTE Band 13	0.117		
	Bluetooth	0.028	DSS	

<Highest Reported simultaneous SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Equipment Class	Highest Reported Simultaneous Transmission 1-g SAR (W/kg)
Front	GPRS 850 3Slot	0.387	PCB	0.415
	Bluetooth	0.028	DSS	

Note:

1. The highest simultaneous transmission is scalar summation of Reported standalone SAR per FCC KDB 690783 D01 v01r03, and scalar SAR summation of all possible simultaneous transmission scenarios are < 1.6W/kg.
2. This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

5 General Information

5.1 Client Information

Applicant:	Advanced Sport Instruments SA
Address:	Avenue de Beaumont 5, 1012 Lausanne, Switzerland
Manufacturer:	Advanced Sport Instruments SA
Address:	Avenue de Beaumont 5, 1012 Lausanne, Switzerland
Factory:	Optima International Inc.
Address:	4F, No. 51, Wugong 6th Road, Wugu, Taipei 24891 Taiwan ROC

5.2 General Description of EUT

Product Name:	ASI5010			
Model No.:	ASI5010			
Category of device	Portable device			
Operation Frequency:	GSM :	GSM850: 824.2~848.8 MHz	PCS 1900: 1850.2~1909.8 MHz	
	LTE :	Band 2:1850MHz~1910MHz	Band 4:1710MHz~1755MHz	
		Band 12: 699MHz~716MHz	Band 13: 777MHz~787MHz	
	Bluetooth: 2402 MHz ~ 2480 MHz			
Modulation technology:	GSM:	☒Voice(GMSK)	☒GPRS(GMSK)	☒EGPRS(GMSK, 8PSK)
	LTE:	☒QPSK	☒16QAM	
	Bluetooth:	☒LE(GFSK)		
Antenna Type:	Internal Antenna			
Antenna Gain:	GSM 850: 2.3 dBi; PCS 1900: 2.3 dBi LTE Band 2: 2.3 dBi; LTE Band 4: 2.3 dBi LTE Band 12: 2.3 dBi; LTE Band 13: 2.3 dBi Bluetooth: 1.0 dBi;			
(E)GPRS Class:	(E)GPRS Class: 12			
Dimensions (L*W*H):	80 mm (L)× 50 mm (W)× 20 mm (H)			
Accessories information:	Battery: Rechargeable Li-ion Battery DC3.7V, 1600mAh			

5.3 Maximum RF Output Power

Mode	Average Power (dBm)	
	GSM 850	PCS 1900
GSM (Voice)	32.24	29.83
GPRS (1 TX Slot)	32.20	29.80
GPRS (2 TX Slots)	31.12	28.71
GPRS (3 TX Slots)	29.51	27.90
GPRS (4 TX Slots)	28.13	26.26
EGPRS (1 TX Slot)	25.07	25.23
EGPRS (2 TX Slots)	24.32	24.20
EGPRS (3 TX Slots)	22.42	22.45
EGPRS (4 TX Slots)	21.03	21.23

Mode	Average Power (dBm)			
	LTE Band 2	LTE Band 4	LTE Band 12	LTE Band 13
BW/1.4 MHz	20.92	20.83	20.46	/
BW/3.0 MHz	20.38	20.41	20.25	/
BW/5.0 MHz	20.08	20.39	20.19	20.53
BW/10 MHz	20.07	20.38	20.23	20.53
BW/15 MHz	20.22	20.33	/	/
BW/20 MHz	20.17	20.32	/	/

Bluetooth Average Power (dBm)	
Mode/Band	LE (BT 4.0)
Bluetooth	7.07

5.4 Environment of Test Site

Temperature:	18°C ~25 °C
Humidity:	35%~75% RH
Atmospheric Pressure:	1010 mbar

5.5 Test Sample Plan

Sample Number	Used for Test Items
1#	SAR

***Remark**: JianYan Testing Group Shenzhen Co., Ltd. is only responsible for the test project data of the above samples, and will keep the above samples for a month.*

5.6 Test Location

JianYan Testing Group Shenzhen Co., Ltd.
No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community,Xinqiao Street, Bao'an District, Shenzhen, Guangdong,People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
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6 Introduction

6.1 Introduction

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

6.2 SAR Definition

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

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

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

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

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

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength. However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

7 RF Exposure Limits

7.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

7.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

7.3 RF Exposure Limits

SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

Note:

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

8 SAR Measurement System

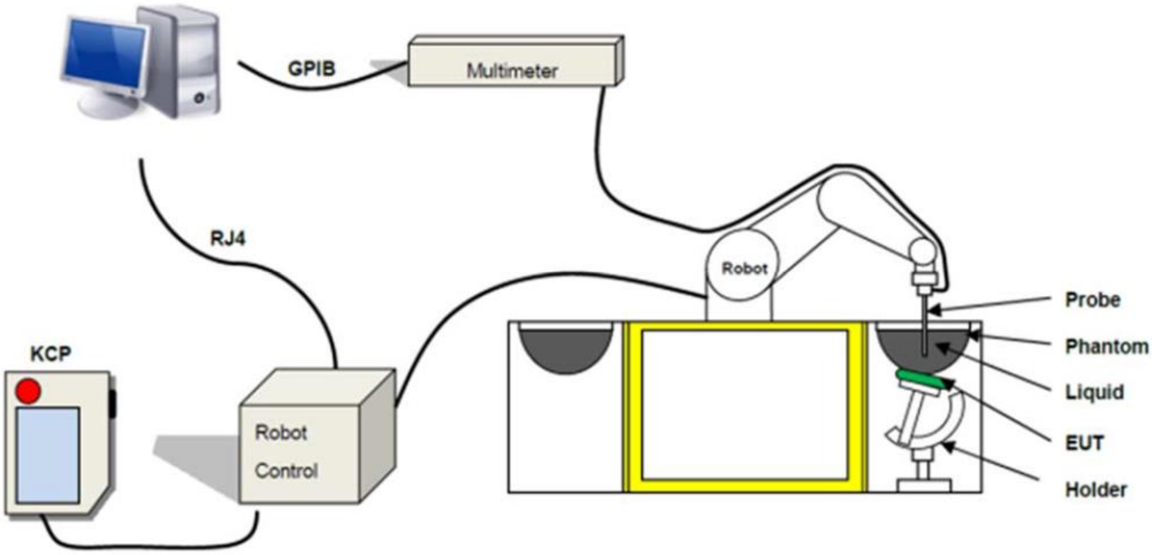


Fig. 8.1 MVG COMOSAR System Configurations

These measurements were performed with the automated near-field scanning system COMOSAR from MVG. The system is based on a high precision robot (working range: 850 mm), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

The SAR measurements were conducted with dosimetric probe (manufactured by MVG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in SAR standard with accuracy of better than ±10%.The spherical isotropy was evaluated with the procedure described in SAR standard and found to be better than ±0.25 dB. The phantom used was the SAM Phantom as described in FCC supplement C, IEEE P1528.

The MVG COMOSAR system for performance compliance tests is illustrated above graphically. This system consists of the following items:

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

8.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by MVG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

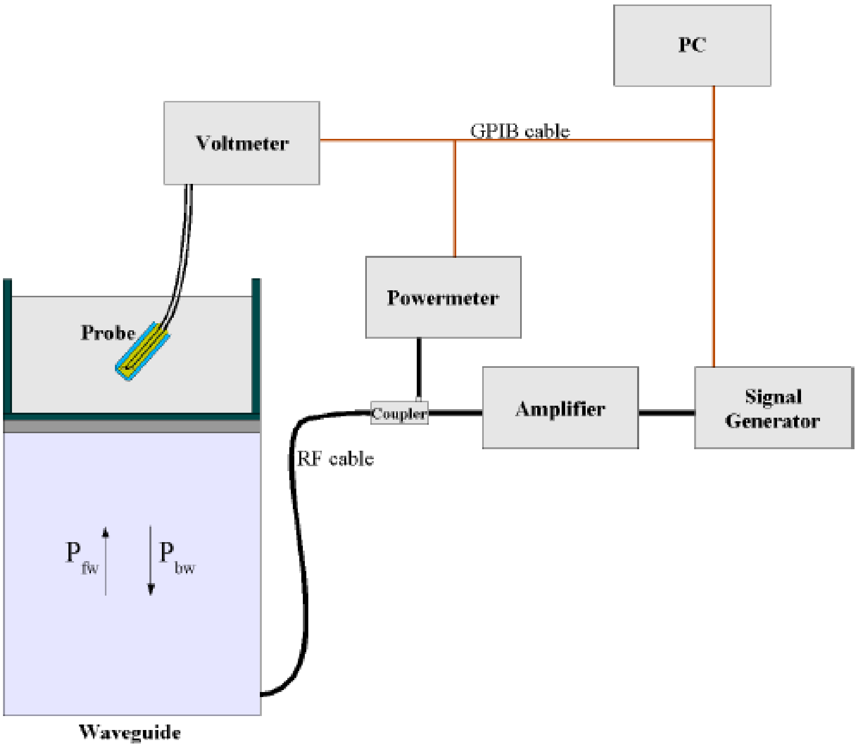
➢ **E-Field Probe Specification**

Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Model	SSE2
Frequency Range	150 MHz to 6 GHz
Dynamic Range	0.01W/kg to 100W/kg
Probe linearity	<0.25dB
Dimensions	Overall length: 330 mm Tip diameter: 2.5 mm Distance between dipoles / probe extremity: 1 mm

Fig. 8.2 Photo of E-Field Probe

➢ **E-Field Probe Calibration**

Probe calibration is realized, in compliance with EN/IEC 62209-1/-2 and IEEE 1528 std, with CALISAR, MVG proprietary calibration system. The calibration is performed with the technique using reference waveguide.



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

Where :

Pfw	=	Forward Power
Pbw	=	Backward Power
a and b	=	Waveguide Dimensions
ı	=	Skin Depth

Keithley configuration

Rate=Medium; Filter=ON; RDGS=10; FILTER TYPE=MOVING AVERAGE; RANGE AUTO

After each calibration, a SAR measurement performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

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

CF(N)=SAR(N)/Vlin(N)   (N=1,2,3)

The linearized output voltage Vlin(N) is obtained from the displayed output voltage V(N) using

Vlin(N)=V(N)*(1+V(N)/DCP(N))   N=1,2,3

Where the DCP is the dipole compression point in mV

8.2 Robot

The COMOSAR system uses the high precision robots from KUKA. For the 6-axis controller system, the robot controller version (KUKA-KRC2sr) from KUKA is used. The KUKA robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

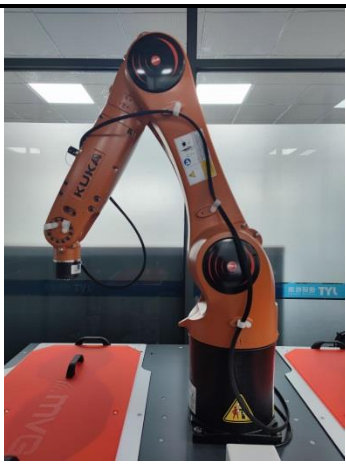


Fig. 8.4 Photo of Robot

8.3 Phantom

<SAM Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume Dimensions	Approx. 27 liters Length: 1000mm; Width: 500mm; Height: 200mm
Material	Fiberglass based
Relative permittivity	3-4
Loss tangent	0.02
Measurement Areas	Left Head, Right Head, Flat phantom

Fig. 8.7 Photo of SAM Phantom

The phantom developed by MVG is produced in accordance with the specified in the standards. It has been designed to fit the COMOSAR phantom tables and is delivered with a plastic cover to prevent liquid evaporation.

8.4 Device Holder

The positioning system is made of an extremely stable material, which ensures easy handling and reproducible positioning. It also allows correct positioning of the dipoles referenced by the IEEE, ANSI and IEC.

<Device Holder for SAM Phantom>

Model	Handset Positioning System
Material properties	The positioning system is made of PETP. This material offers a low permittivity of 3.2 and low loss, with a loss tangent of 0.005 to minimize the influence of the DUT on measurement results.
Mechanical properties	The positioning system developed by MVG allows a positioning resolution better than 1 mm. The system is fixed on a bottom rail “x axis” so that the positioning system can be quickly moved from the right to the left part of the phantom. In addition, it can be moved on a perpendicular “y axis” and the height can be adapted. The system is also composed of three rotation points for accurate positioning of the device’s acoustical output.
Accuracy and precision	A curved rail on the top part allows the fast switch from the cheek to the tilt position. The required 15° angle for the tilt position can be easily checked thanks to a printed scale on the curved rail with a tolerance of ± 1°

Fig. 8.9 Photo of Device Holder

8.5 Test Equipment List

Manufacturer	Equipment Description	Model	Management Number	Cal. Information	
				Last Cal.	Due Date
MVG	COMOSAR DOSIMETRIC E FIELD PROBE	SSE2	WXJ076	06.30.2022	06.29.2023
MVG	COMOSAR 750 MHz REFERENCE DIPOLE	SID750	WXJ076-4	01.14.2021	01.13.2024
MVG	COMOSAR 835 MHz REFERENCE DIPOLE	SID835	WXJ076-5	01.14.2021	01.13.2024
MVG	COMOSAR 1750 MHz REFERENCE DIPOLE	SID1750	WXJ076-8	01.14.2021	01.13.2024
MVG	COMOSAR 1900 MHz REFERENCE DIPOLE	SID1900	WXJ076-9	01.14.2021	01.13.2024
MVG	COMOSAR 2450 MHz REFERENCE DIPOLE	SID2450	WXJ076-12	01.14.2021	01.13.2024
KEITHLEY	DIGIT MULTIMETER	DMM6500	WXJ076-1	12.17.2019	12.16.2022
MVG	MVG Measurement Software	OpenSAR	Version: V5_01_09	N.C.R	N.C.R
MVG	COMOSAR IEEE SAM PHANTOM	N/A	WXG009-2	N.C.R	N.C.R
MVG	COMOSAR IEEE SAM PHANTOM	N/A	WXG009-3	N.C.R	N.C.R
MVG	MOBILE PHONE POSITIONNING SYSTEM	N/A	WXG009-4	N.C.R	N.C.R
KUKA	Robot	KR 6 R900 sixx	WXG009-1	N.C.R	N.C.R
Anritsu	Universal Radio Communication Analyzer	MT8820C	WXJ008-5	03.03.2021	03.02.2023
R&S	Universal Radio Communication Tester	CMU200	WXJ008-2	03.30.2022	03.29.2024
KEYSIGHT	Network Analyzer	E5071C	WXJ091	03.30.2022	03.29.2023
KEYSIGHT	EPM Series Power Meter	N1914A	WXJ075	06.29.2022	06.28.2023
KEYSIGHT	E-Series Power Sensor	E9300H	WXJ075-1	06.29.2022	06.28.2023
KEYSIGHT	E-Series Power Sensor	E9300H	WXJ075-2	06.29.2022	06.28.2023
KEYSIGHT	Signal Generator	N5173B	WXJ006-3	06.29.2022	06.28.2023
Huber Suhner	RF Cable	SUCOFLEX	WXG008-13	See Note 3	
Huber Suhner	RF Cable	SUCOFLEX	WXG008-14	See Note 3	
Huber Suhner	RF Cable	SUCOFLEX	WXG008-15	See Note 3	
Weinschel	Attenuator	23-3-34	WXG008-16	See Note 3	
Anritsu	Directional Coupler	MP654A	WXG008-17	See Note 3	
MVG	LIMESAR DIELECTRIC PROBE	SCLMP	WXG009-5	See Note 4	
TXC	Broadband Amplifier	BBA018000	WXG008-11	See Note 5	

Note:

1. The calibration certificate of MVG can be referred to appendix C of this report.
2. Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
4. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by MVG.
5. In system check we need to monitor the level on the spectrum analyzer, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1 W input power according to the ratio of 1 W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the spectrum analyzer is critical and we do have calibration for it
6. Attenuator insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.
7. N.C.R means No Calibration Requirement.

9 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 9.1, for body SAR testing, the liquid height from the center of the flat phantom to liquid top surface is larger than 15 cm, which is shown in Fig. 9.2.

Fig. 9.1 Photo of Liquid Height for Head SAR (depth>15cm)

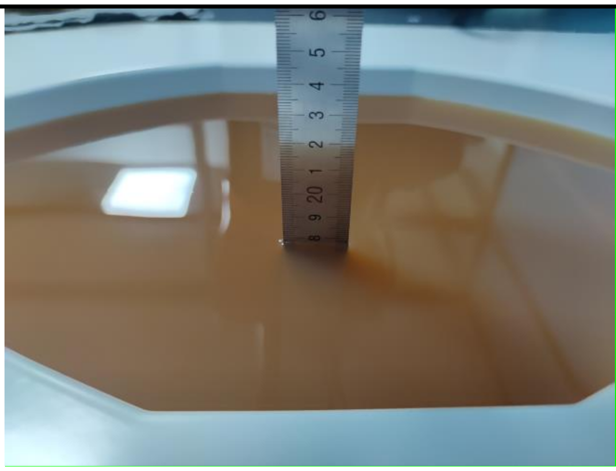


Fig. 9.2 Photo of Liquid Height for Body SAR (depth>15cm)

The relative permittivity and conductivity of the tissue material should be within ±5% of the values given in the table below recommended by the FCC OET 65 supplement C and RSS 102 Issue 5.

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

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m

The dielectric parameters of liquids were verified prior to the SAR evaluation using a MVG Liquid measurement Kit and an Agilent Network Analyzer.
The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (εr)	Conductivity Target(σ)	Permittivity Target(εr)	Delta (σ)%	Delta (εr)%	Limit (%)	Date (mm/dd/yy)
750	22.5	0.90	41.14	0.89	41.90	1.12	-1.81	±5	08.22.2022
835	22.6	0.91	41.37	0.90	41.50	1.11	-0.31	±5	08.22.2022
1750	22.3	1.38	40.39	1.37	40.10	0.73	0.72	±5	08.28.2022
1900	22.5	1.41	39.85	1.40	40.00	0.71	-0.37	±5	08.28.2022
2450	22.7	1.82	38.96	1.80	39.20	1.11	-0.61	±5	09.02.2022

10 SAR System Verification

Each ComoSAR system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the OpenSAR software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

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

- **System Setup**

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

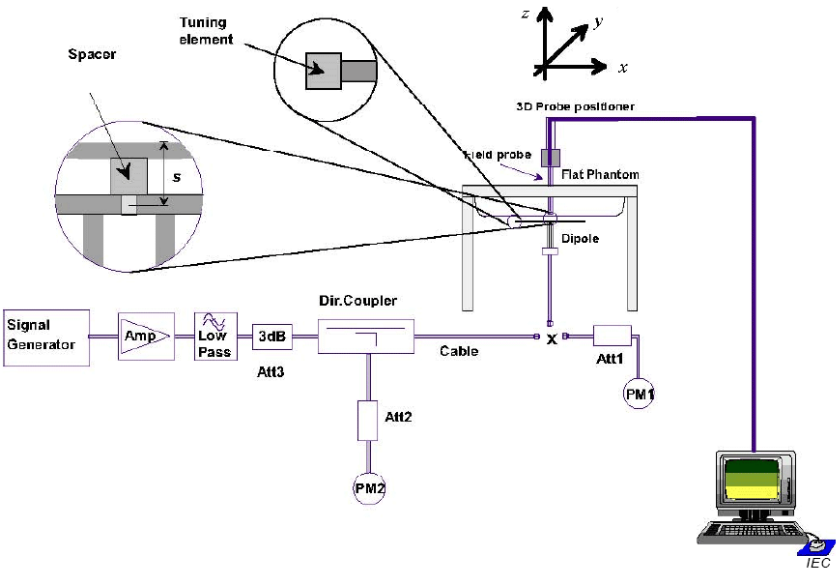


Fig.10.1 System Verification Setup Diagram

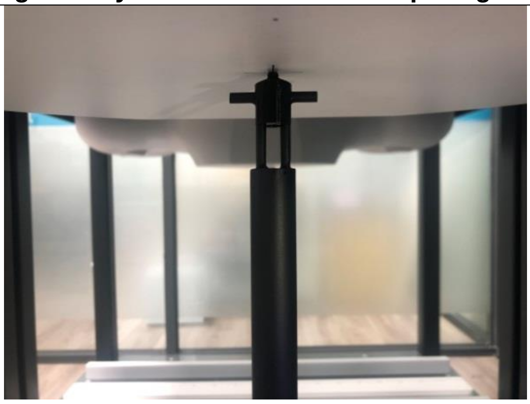


Fig.10.2 Photo of Dipole setup

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- **System Verification Results**

  Comparing to the original SAR value provided by MVG, the verification data should be within its specification of 10%. The table as below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix C of this report.

Date (mm/dd/yy)	Frequency (MHz)	Power fed onto dipole (mW)	Measured 1g SAR (W/kg)	Normalized to 1W 1g SAR (W/kg)	1W Target 1g SAR (W/kg)	Deviation (%)
08.22.2022	750	100	0.834	8.34	8.57	-2.68
08.22.2022	835	100	0.956	9.56	9.57	-0.10
08.28.2022	1750	100	3.600	36.00	36.5	-1.37
08.28.2022	1900	100	3.830	38.30	39.6	-3.28
09.02.2022	2450	100	5.190	51.90	52.92	-1.93

11 EUT Testing Position

This EUT was tested in five different positions. They are Front/Back/ Left /Right /Top of the EUT with phantom 0 mm gap, as illustrated below, please refer to Appendix B for the test setup photos.

11.1 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones.
Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04v01r03. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR locations identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

11.2 Body Worn Accessory Configurations

- To position the device parallel to the phantom surface with either keypad up or down.
- To adjust the device parallel to the flat phantom.
- To adjust the distance between the device surface and the flat phantom to 0 mm or holster surface and the flat phantom to 0 mm.

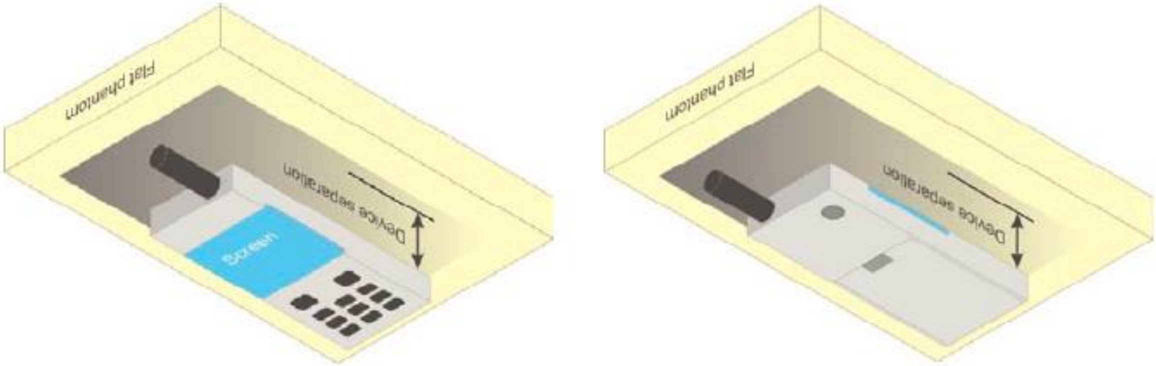


Fig.11.5 Illustration for Body Worn Position

11.3 Wireless Router (Hotspot) Configurations

Some battery-operated handsets have the capability to transmit and receive internet connectivity through simultaneous transmission of WIFI in conjunction with a separate licensed transmitter. The FCC has provided guidance in KDB Publication 941225 D06 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device with antennas 2.5 cm or closer to the edge of the device, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions. Therefore, SAR must be evaluated for each frequency transmission and mode separately and summed with the WIFI transmitter according to KDB 648474 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

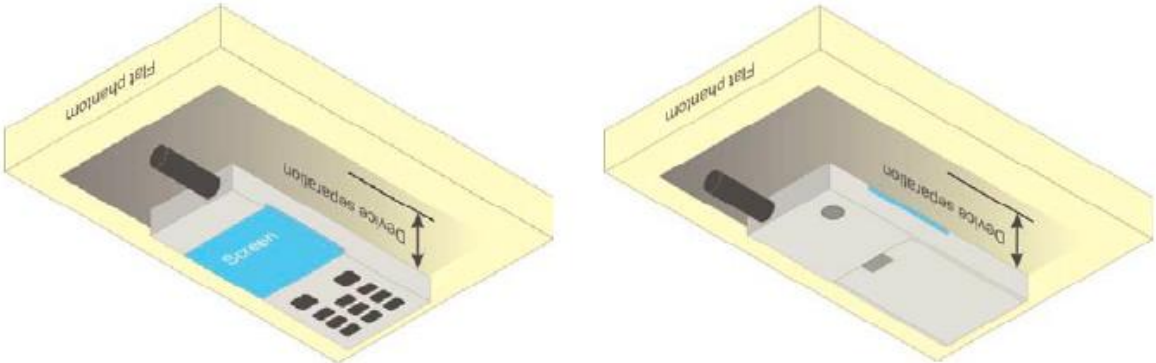


Fig.11.6 Illustration for Hotspot Position

12 Measurement Procedures

The measurement procedures are as bellows:

<Conducted power measurement>

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

<Conducted power measurement>

- Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- Place the EUT in positions as Appendix B demonstrates.
- Set scan area, grid size and other setting on the OpenSAR software.
- Measure SAR results for the highest power channel on each testing position.
- Find out the largest SAR result on these testing positions of each band.
- Measure SAR results for other channels in worst SAR testing position if the Reported SAR or 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:

- Power reference measurement
- Area scan
- Zoom scan
- Power drift measurement

12.1 Spatial Peak SAR Evaluation

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

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

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

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

12.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement 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.

12.3 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r04 quoted below.

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

12.4 Volume Scan Procedures

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

12.5 SAR Averaged Methods

In COMOSAR system, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1g and 10g cubes, the extrapolation distance should not be larger than 5 mm.

12.6 Power Drift Monitoring

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. If the power drifts more than 5%, the SAR will be retested.

13 Conducted RF Output Power

13.1 GSM Conducted Power

Band: GSM 850	Burst Average Power (dBm)			Frame-Average Power(dBm)		
Channel	128	190	251	128	190	251
Frequency (MHz)	824.2	836.6	848.8	824.2	836.6	848.8
GSM (GMSK, Voice)	32.13	32.20	**32.24**	23.10	23.17	23.21
GPRS (GMSK, 1 TX slot)	32.20	32.05	32.07	23.17	23.02	23.04
GPRS (GMSK, 2 TX slots)	31.05	31.10	31.12	25.03	25.08	25.10
GPRS (GMSK, 3 TX slots)	**29.51**	29.10	29.14	**25.25**	24.84	24.88
GPRS (GMSK, 4 TX slots)	27.97	28.10	28.13	24.96	25.09	25.12
EGPRS (8PSK, 1 TX slot)	25.07	25.01	25.00	16.04	15.98	15.97
EGPRS (8PSK, 2 TX slots)	24.32	24.12	24.20	18.30	18.10	18.18
EGPRS (8PSK, 3 TX slots)	22.16	22.07	22.42	17.90	17.81	18.16
EGPRS (8PSK, 4 TX slots)	20.87	21.02	21.03	17.86	18.01	18.02

Remark:

1. The frame-averaged power is linearly reported the maximum burst averaged power over 8 time slots. The calculated method are shown as below:
   The duty cycle "x" of different time slots as below:
   1 TX slot is 1/8, 2 TX slots is 2/8, 3 TX slots is 3/8 and 4 TX slots is 4/8
   Based on the calculation formula:
   Frame-averaged power = Burst averaged power + 10 1og (x)
   So,
   Frame-averaged power (1 TX slot) = Burst averaged power (1 TX slot)– 9.03
   Frame-averaged power (2 TX slots) = Burst averaged power (2 TX slots)– 6.02
   Frame-averaged power (3 TX slots) = Burst averaged power (3 TX slots)– 4.26
   Frame-averaged power (4 TX slots) = Burst averaged power (4 TX slots) – 3.01
2. CS1 coding scheme was used in GPRS conducted power measurements and SAR testing, MCS5 coding scheme was used in EGPRS conducted power measurements and SAR testing (if necessary).

Note:

1. For Head SAR testing, GSM Voice mode should be evaluated, therefore the EUT was set in GSM 850 Voice mode.
2. For Body worn SAR testing, GSM Voice mode should be evaluated, therefore the EUT was set in GSM 850 Voice mode.
3. For Hotspot mode SAR testing, GPRS and EGPRS mode should be evaluated, therefore the EUT was set in GPRS 3 TX slots mode due to the highest frame-averaged power.
4. For GPRS multi time slots SAR measurement, when the measured maximum output power levels are within 0.25 dB of each other, test the configuration with the most number of time slots.
5. Per KDB447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
6. The EUT do not support DTM and VoIP function.

Band: PCS 1900	Burst Average Power (dBm)			Frame-Average Power(dBm)		
Channel	512	661	810	512	661	810
Frequency (MHz)	1850.2	1880.0	1909.8	1850.2	1880.0	1909.8
GSM (GMSK, Voice)	**29.83**	29.74	29.71	20.80	20.71	20.68
GPRS (GMSK, 1 TX slot)	29.80	29.66	29.59	20.77	20.63	20.56
GPRS (GMSK, 2 TX slots)	28.56	28.71	28.50	22.54	22.69	22.48
GPRS (GMSK, 3 TX slots)	**27.90**	27.53	27.22	**23.64**	23.27	22.96
GPRS (GMSK, 4 TX slots)	26.26	25.87	25.56	23.25	22.86	22.55
EGPRS (8PSK, 1 TX slot)	25.23	25.17	24.78	16.20	16.14	15.75
EGPRS (8PSK, 2 TX slots)	24.20	24.04	24.01	18.18	18.02	17.99
EGPRS (8PSK, 3 TX slots)	22.45	22.01	21.94	18.19	17.75	17.68
EGPRS (8PSK, 4 TX slots)	21.23	21.02	20.74	18.22	18.01	17.73

Remark:

3. The frame-averaged power is linearly reported the maximum burst averaged power over 8 time slots. The calculated method are shown as below:
   The duty cycle "x" of different time slots as below:
   1 TX slot is 1/8, 2 TX slots is 2/8, 3 TX slots is 3/8 and 4 TX slots is 4/8
   Based on the calculation formula:
   Frame-averaged power = Burst averaged power + 10 1og (x)
   So,
   Frame-averaged power (1 TX slot) = Burst averaged power (1 TX slot)– 9.03
   Frame-averaged power (2 TX slots) = Burst averaged power (2 TX slots)– 6.02
   Frame-averaged power (3 TX slots) = Burst averaged power (3 TX slots)– 4.26
   Frame-averaged power (4 TX slots) = Burst averaged power (4 TX slots) – 3.01
4. CS1 coding scheme was used in GPRS conducted power measurements and SAR testing, MCS5 coding scheme was used in EGPRS conducted power measurements and SAR testing (if necessary).

Note:

1. For Head SAR testing, GSM Voice mode should be evaluated, therefore the EUT was set in PCS 1900 Voice mode.
2. For Body worn SAR testing, GSM Voice mode should be evaluated, therefore the EUT was set in GSM Voice 1900 mode.
3. For Hotspot mode SAR testing, GPRS and EGPRS mode should be evaluated, therefore the EUT was set in GPRS 3 TX slots mode due to the highest frame-averaged power.
4. Per KDB447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
5. The EUT do not support DTM and VoIP function.

13.2 WCDMA Conducted Power

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

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Rohde & Schwarz CMU200 referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

Table 1

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	CM (dB) (2)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 (3)	15/15 (3)	64	12/15 (3)	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

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

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$.

Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

HSDPA Sub-test setup configuration

HSUPA Setup Configuration:

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

Table 2

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (2) (dB)	MPR (dB)	AG (4) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}: 47/15 β_{ed2}: 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (4)	15/15 (4)	64	15/15 (4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ ⇔ $\beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.
Note 6: β_{ed} cannot be set directly; it is set by Absolute Grant Value.

HSUPA Sub-test setup configuration

13.3 LTE Conducted Power

13.3.1 Largest channel bandwidth standalone SAR test requirements

QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel.8 When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

QPSK with 50% RB allocation

The procedures required for 1 RB allocation in section 4.2.1 are applied to measure the SAR for QPSK with 50% RB allocation.9

QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in sections 4.2.1 and 4.2.2 are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in sections 4.2.1, 5.2.2 and 4.2.3 to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

13.3.2 Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section 4.2 to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg. The equivalent channel configuration for the RB allocation, RB offset and modulation etc. is determined for the smaller channel bandwidth according to the same number of RB allocated in the largest channel bandwidth. For example, 50 RB in 10 MHz channel bandwidth does not apply to 5 MHz channel bandwidth; therefore, this cannot be tested in the smaller channel bandwidth. However, 50% RB allocation in 10 MHz channel bandwidth is equivalent to 100% RB allocation in 5 MHz channel bandwidth; therefore, these are the equivalent configurations to be compared to determine the specific channel and configuration in the smaller channel bandwidth that need SAR testing.

13.3.3 TDD LTE configuration setup for SAR measurement

According to KDB 941225 D05v02r03 and April 2013 TCB workshop slides, SAR must be tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

- see 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
- “special subframe S” contains both uplink and downlink transmissions and must be taken into consideration to determine the transmission duty factor
  – according to the worst case uplink and downlink cyclic prefix requirements for UpPTS to determine the highest SAR test duty factor

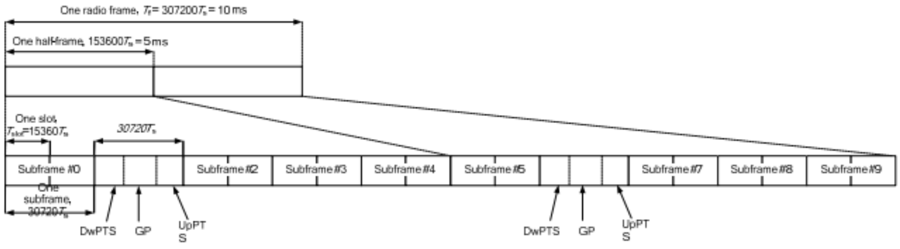


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity)

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-

Per 3GPP 36.211 section 4.2, each radio frame of length T_f=37200·T_s = 10 ms consists of two half-frames of length 153600·Ts = 5ms each. Each half-frame consists of five subframes of length 30720 ·T_s = 1ms. So, the uplink duty factor in special subframe as below:

Special Subframe configuration	Normal cyclic prefix in downlink		Extended cyclic prefix in downlink	
	Duty factor of Uplink		Duty factor of Uplink	
	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	7.14%	8.33%	7.14%	8.33%
1	7.14%	8.33%	7.14%	8.33%
2	7.14%	8.33%	7.14%	8.33%
3	7.14%	8.33%	7.14%	8.33%
4	7.14%	8.33%	14.27%	16.67%
5	14.27%	16.67%	14.27%	16.67%
6	14.27%	16.67%	14.27%	16.67%
7	14.27%	16.67%	14.27%	16.67%
8	14.27%	16.67%	/	/
9	14.27%	16.67%	/	/

Table 4.2-2: Uplink-downlink configurations

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

According to above table:

1. The highest duty factor is configuration 0;
2. The duty factor of uplink in one half-frame with normal cyclic prefix is: (3ms + 0.143ms)/5ms=62.86%;
3. The duty factor of uplink in one half-frame with extended cyclic prefix is: (3ms + 0.167ms)/5ms=63.34%;
4. For purpose to get the worst case SAR test duty factor, the duty factor of normal cyclic prefix in uplink scaled-up to the extended cyclic prefix in uplink, the scaling factor is 63.34%/62.86%=1.008, and the scaling factor will be taken into the final measured SAR.

LTE Band 2	Channel/ Frequency(MHz)	Index	RB# RBstar	Conducted Power (dBm)	
				QPSK	16QAM
1.4MHz	18607/1850.7	0	1#0	20.92	19.64
		0	6#0	18.71	19.02
	18900/1880	0	1#0	19.87	19.61
		0	6#0	18.38	18.19
	19193/1909.3	0	1#5	20.17	19.08
		0	6#0	18.35	18.68
3MHz	18615/1851.5	0	1#0	20.38	19.68
		0	6#0	18.78	18.91
	18900/1880	0	1#0	20.21	19.27
		0	6#0	18.45	18.73
	19185/1908.5	1	1#5	20.02	19.11
		1	6#0	18.41	18.74
5MHz	18625/1852.5	0	1#0	20.08	20.29
		0	6#0	19.47	19.66
	18900/1880	0	1#0	20.05	19.71
		0	6#0	19.24	19.38
	19175/1907.5	0	1#5	19.68	20.02
		3	6#0	19.28	19.40
10MHz	18650/1855	3	1#0	19.92	20.19
		0	4#0	20.07	19.83
	18900/1880	0	1#0	19.96	19.83
		0	4#0	19.78	20.11
	19150/1905	4	1#5	19.88	19.51
		7	4#2	20.01	20.14
15MHz	18675/1857.5	3	1#0	20.22	20.11
		0	6#0	20.13	20.26
	18900/1880	0	1#0	20.14	19.81
		0	6#0	20.05	19.95
	19125/1902.5	8	1#5	19.95	19.51
		11	6#0	19.88	19.87
20MHz	18700/1860	3	1#0	20.17	19.96
		0	6#0	20.08	20.01
	18900/1880	0	1#0	19.90	19.59
		0	6#0	19.86	19.97
	19100/1900	12	1#5	19.76	19.34
		15	6#0	19.83	20.04

LTE Band 4	Channel/ Frequency(MHz)	Index	RB# RBstar	Conducted Power (dBm)	
				QPSK	16QAM
1.4MHz	19957/1710.7	0	1#0	20.83	19.76
		0	6#0	18.78	19.04
	20175/1732.5	0	1#0	20.57	19.62
		0	6#0	18.52	18.54
	20393/1754.3	0	1#5	19.92	19.75
		0	6#0	18.63	18.48
3MHz	19965/1711.5	0	1#0	20.41	20.02
		0	6#0	18.71	18.78
	19965/1711.5	0	1#0	20.32	19.37
		0	6#0	18.71	18.94
	20385/1753.5	1	1#5	20.15	19.15
		1	6#0	18.81	19.01
5MHz	19975/1712.5	0	1#0	20.39	20.51
		0	6#0	19.81	19.91
	20175/1732.5	0	1#0	20.28	20.39
		0	6#0	19.73	19.67
	20375/1752.5	3	1#5	20.11	20.17
		3	6#0	19.72	19.69
10MHz	20000/1715	0	1#0	20.38	20.49
		0	4#0	20.27	20.14
	20175/1732.5	0	1#0	20.16	20.24
		0	4#0	20.12	19.98
	20350/1750	7	1#5	19.94	20.07
		7	4#2	20.04	19.91
15MHz	20025/1717.5	0	1#0	20.33	20.48
		0	6#0	20.27	20.42
	20175/1732.5	0	1#0	20.16	20.31
		0	6#0	20.12	20.24
	20325/1747.5	11	1#5	19.97	20.11
		11	6#0	20.04	20.11
20MHz	20050/1720	0	1#0	20.32	20.46
		0	6#0	20.19	20.36
	20175/1732.5	0	1#0	20.24	20.38
		0	6#0	20.09	20.21
	20300/1745	15	1#5	20.11	20.14
		15	6#0	20.11	20.16

LTE Band 12	Channel/ Frequency(MHz)	Index	RB# RBstar	Conducted Power (dBm)	
				QPSK	16QAM
1.4MHz	23017/699.7	0	1#0	20.02	19.76
		0	6#0	18.64	18.62
	23095/707.5	0	1#0	19.85	19.73
		0	6#0	18.51	18.42
	23173/715.3	0	1#5	20.46	19.32
		0	6#0	18.56	19.03
3MHz	23025/700.5	0	1#0	20.25	19.76
		0	6#0	18.69	18.61
	23095/707.5	0	1#0	20.22	20.01
		0	6#0	18.47	18.58
	23165/714.5	1	1#5	20.21	19.81
		1	6#0	18.55	18.63
5MHz	23035/701.5	3	1#0	20.19	20.39
		0	6#0	19.67	19.82
	23095/707.5	0	1#0	20.01	20.21
		0	6#0	19.60	19.73
	23155/713.5	0	1#5	19.96	20.19
		3	6#0	19.61	19.77
10MHz	23060/704	3	1#0	20.21	20.41
		0	4#0	20.23	20.07
	23095/707.5	0	1#0	20.16	20.30
		0	4#0	20.07	19.95
	23130/711	4	1#5	19.91	20.13
		7	4#2	20.15	19.90

LTE Band 13	Channel/ Frequency(MHz)	Index	RB# RBstar	Conducted Power (dBm)	
				QPSK	16QAM
5MHz	23205/779.5	0	1#0	20.18	20.53
		0	6#0	19.95	20.03
	23230/782	0	1#0	20.31	19.91
		0	6#0	19.81	20.02
	23255/784.5	3	1#5	20.02	20.43
		3	6#0	19.82	19.84
10MHz	23230/782	0	1#0	20.11	20.53
		0	4#0	19.84	19.57

13.4 Bluetooth Conducted Power

Average Power (dBm)		
Channel	Frequency (MHz)	BLE
CH 00	2402	6.62
CH 20	2442	7.03
CH 39	2480	**7.07**

Note:

1. SAR test of Bluetooth is performed and the mode with highest average power is selected for SAR testing.
2. Per KDB 447498 D04v01 section 2.1.2: 1-mW Test Exemption, SAR test for BLE is not required.
3. The output power of all data rate were pre-scan, just the worst case of all mode were shown in report.
4. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode, the actual duty cycle is 100%, so the duty cycle factor is 1.

14 Exposure Positions Consideration

Distance of Antennas to EUT edge/surface Test distance: 0mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
2G/4G High Band ANT	<25mm	<25mm	<25mm	57mm	26mm	<25mm
2G/4G Low Band ANT	<25mm	<25mm	<25mm	55mm	<25mm	<25mm
Bluetooth	<25mm	<25mm	<25mm	38mm	45mm	<25mm

Test Positions Test distance: 0mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
2G/4G High Band ANT	Yes	Yes	Yes	No	No	Yes
2G/4G Low Band ANT	Yes	Yes	Yes	No	Yes	Yes
Bluetooth	Yes	Yes	Yes	No	No	Yes

14.1 EUT Antenna Locations EUT Antenna Locations

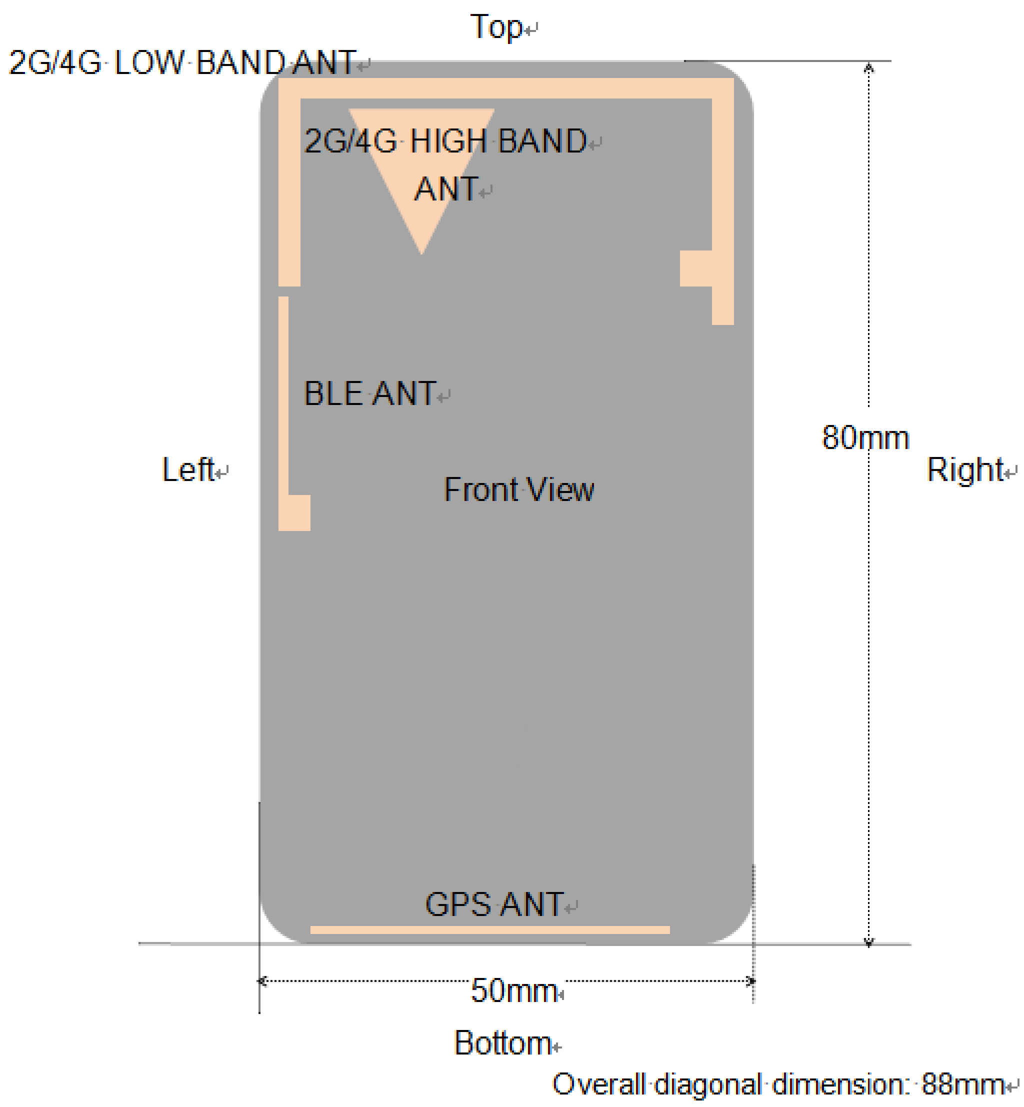


Fig.14.1 EUT Antenna Locations

Note: This antenna diagram is only used as a reference for the distance from the antenna to each edge. For the specific shape of the antenna, please refer to the physical photo.

15 SAR Test Results Summary

15.1 Standalone Body SAR

➢ GSM Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Variation (%)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
1	GPRS850/3 slots	Front	128	824.2	29.51	-0.12	30.0	**0.346**	1.119	0.387
	GPRS850/3 slots	Back	128	824.2	29.51	-3.86	30.0	0.112	1.119	0.125
	GPRS850/3 slots	Left	128	824.2	29.51	1.42	30.0	0.084	1.119	0.094
	GPRS850/3 slots	Right	128	824.2	29.51	0.93	30.0	0.069	1.119	0.077
	GPRS850/3 slots	Top	128	824.2	29.51	1.21	30.0	0.102	1.119	0.114
2	GPRS1900/3 slots	Front	512	1850.2	27.90	-0.91	28.0	**0.310**	1.023	0.317
	GPRS1900/3 slots	Back	512	1850.2	27.90	-0.40	28.0	0.232	1.023	0.237
	GPRS1900/3 slots	Left	512	1850.2	27.90	0.17	28.0	0.152	1.023	0.155
	GPRS1900/3 slots	Top	512	1850.2	27.90	2.34	28.0	0.182	1.023	0.186
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ FDD-LTE Band 2(20MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Variation (%)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
3	Band2/1RB#0	Front	18700	1860	20.17	-0.26	20.5	**0.118**	1.079	0.127
	Band2/1RB#0	Back	18700	1860	20.17	-0.88	20.5	0.117	1.079	0.126
	Band2/1RB#0	Left	18700	1860	20.17	0.51	20.5	0.075	1.079	0.081
	Band2/1RB#0	Top	18700	1860	20.17	2.12	20.5	0.092	1.079	0.099
	Band2/6RB#0	Front	18700	1860	20.08	-1.41	20.5	0.108	1.102	0.119
	Band2/6RB#0	Back	18700	1860	20.08	-0.54	20.5	0.106	1.102	0.117
	Band2/6RB#0	Left	18700	1860	20.08	1.21	20.5	0.072	1.102	0.079
	Band2/6RB#0	Top	18700	1860	20.08	0.35	20.5	0.088	1.102	0.097
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ FDD-LTE Band 4(20MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Variation (%)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
	Band4/1RB#0	Front	20050	1720	20.32	-0.67	20.5	0.045	1.042	0.047
4	Band4/1RB#0	Back	20050	1720	20.32	0.53	20.5	**0.095**	1.042	0.099
	Band4/1RB#0	Left	20050	1720	20.32	0.34	20.5	0.053	1.042	0.055
	Band4/1RB#0	Top	20050	1720	20.32	0.71	20.5	0.071	1.042	0.074
	Band4/6RB#0	Front	20050	1720	20.19	1.57	20.5	0.042	1.074	0.045
	Band4/6RB#0	Back	20050	1720	20.19	-1.85	20.5	0.093	1.074	0.100
	Band4/6RB#0	Left	20050	1720	20.19	1.64	20.5	0.051	1.074	0.055
	Band4/6RB#0	Top	20050	1720	20.19	0.65	20.5	0.069	1.074	0.074
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ FDD-LTE Band 12(10MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Variation (%)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
5	Band12/1RB#0	Front	23060	704	20.21	-0.61	20.5	**0.051**	1.069	0.055
	Band12/1RB#0	Back	23060	704	20.21	-1.33	20.5	0.027	1.069	0.029
	Band12/1RB#0	Left	23060	704	20.21	0.45	20.5	0.034	1.069	0.036
	Band12/1RB#0	Right	23060	704	20.21	0.84	20.5	0.025	1.069	0.027
	Band12/1RB#0	Top	23060	704	20.21	1.34	20.5	0.041	1.069	0.044
	Band12/4RB#0	Front	23060	704	20.23	-0.88	20.5	0.048	1.064	0.051
	Band12/4RB#0	Back	23060	704	20.23	1.72	20.5	0.025	1.064	0.027
	Band12/4RB#0	Left	23060	704	20.23	-1.08	20.5	0.032	1.064	0.034
	Band12/4RB#0	Right	23060	704	20.23	0.55	20.5	0.022	1.064	0.023
	Band12/4RB#0	Top	23060	704	20.23	0.68	20.5	0.039	1.064	0.041
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ FDD-LTE Band 13(10MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Variation (%)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
6	Band13/1RB#0	Front	23230	782	20.11	-4.99	21.0	**0.095**	1.227	0.117
	Band13/1RB#0	Back	23230	782	20.11	4.78	21.0	0.046	1.227	0.056
	Band13/1RB#0	Left	23230	782	20.11	0.51	21.0	0.054	1.227	0.066
	Band13/1RB#0	Right	23230	782	20.11	1.16	21.0	0.047	1.227	0.058
	Band13/1RB#0	Top	23230	782	20.11	2.23	21.0	0.074	1.227	0.091
	Band13/4RB#0	Front	23230	782	19.84	1.41	20.0	0.092	1.038	0.095
	Band13/4RB#0	Back	23230	782	19.84	0.56	20.0	0.043	1.038	0.045
	Band13/4RB#0	Left	23230	782	19.84	1.03	20.0	0.052	1.038	0.054
	Band13/4RB#0	Right	23230	782	19.84	0.72	20.0	0.044	1.038	0.046
	Band13/4RB#0	Top	23230	782	19.84	-0.35	20.0	0.072	1.038	0.075
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ Bluetooth Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Variation (%)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
7	BT/BLE	Front	78	2480	7.07	1.98	7.5	**0.025**	1.104	1.000	0.028
	BT/BLE	Back	78	2480	7.07	-2.30	7.5	0.023	1.104	1.000	0.025
	BT/BLE	Left	78	2480	7.07	0.44	7.5	0.009	1.104	1.000	0.010
	BT/BLE	Top	78	2480	7.07	0.21	7.5	0.016	1.104	1.000	0.018
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

Note:

1. Per KDB 447498 D01v06, for each exposure position, if the highest output channel Reported SAR ≤0.8W/kg, other channels SAR testing is not necessary.
2. Additional WLAN SAR testing was performed for simultaneous transmission analysis.
3. For Hotspot SAR testing, per KDB 941225 D06v02r01, for EUT dimension ≥ 9cm*5cm, the test distance is 10mm. SAR must be measured for all surfaces and sides with a transmitting antenna located within 2.5cm from that surface or edge.
4. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA output power is < 0.25dB higher than RMC 12.2kbps, or Reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA SAR evaluation can be excluded.
5. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥0.8W/kg.
6. Per KDB 648474 D04v01r03, when the Reported SAR for a body-worn accessory measured without a headset connected to the handset is ＞ 1.2 W/kg, SAR testing with a headset connected to the handset is required.
7. Per KDB 941225 D05v02r05, 100% RB allocation SAR measurement is not required when the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel.
8. According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.
9. Highlight part of test data means repeated test.

15.2 Multi-Band Simultaneous Transmission Considerations

➢ **Simultaneous Transmission Capabilities**

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the EUT are shown in below Figure and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

Fig.15.1 Simultaneous Transmission Paths

➢ **Multi-Band simultaneous Transmission Consideration**

	Position	Applicable Combination
	Body	WWAN (Voice) + Bluetooth

Note:

1. GSM/LTE shares the same antenna, and cannot transmit simultaneously.
2. The Report SAR summation is calculated based on the same configuration and test position.
3. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i. Scalar SAR summation < 1.6 W/kg.
   ii. SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*), and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary
   iii. Simultaneously transmission SAR measurement, and the Reported multi-band SAR < 1.6 W/kg

15.3 SAR Simultaneous Transmission Analysis

➢ **Body mode Simultaneous Transmission**

Position		Standalone SAR(W/kg)		Σ SAR_{1g} (W/kg)
		1	4	1+4
		WWAN	BT	
Body	Front	0.387	0.028	0.415
	Back	0.237	0.025	0.262
	Left	0.155	0.010	0.165
	Right	0.077	/	0.077
	Top	0.112	0.018	0.130
	Bottom	/	/	/

➢ **Simultaneous Transmission Conclusion**

The above numerical summed SAR results for all the case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06.

15.4 Measurement Uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04, 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.

16 Reference

[1]. FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2]. ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3]. IEEE Std. 1528-2013, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, September2013

[4]. OpenSAR V5 Software User Manual

[5]. FCC KDB 248227 D01 v02r02, “SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS”, October 2015

[6]. FCC KDB 447498 D01 v06, “RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES”, October 2015

[7]. FCC KDB 648474 D04 v01r03, “SAR EVALUATION CONSIDERATIONS FOR WIRELESS HANDSETS”, October 2015

[8]. FCC KDB 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, October 2015

[9]. FCC KDB 941225 D05 v02r05, “SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES”, Dec 2015

[10]. FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE”, December 2008

[11]. FCC KDB 941225 D06 v02r01, " SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES", October 2015

[12]. FCC KDB 865664 D01 v01r04, “SAR MEASUREMENT REQUIREMENTS FOR 100 MHz TO 6 GHz”, August 2015

Appendix A: Plots of SAR System Check

System check at 750 MHz

Date of measurement: 22/8/2022

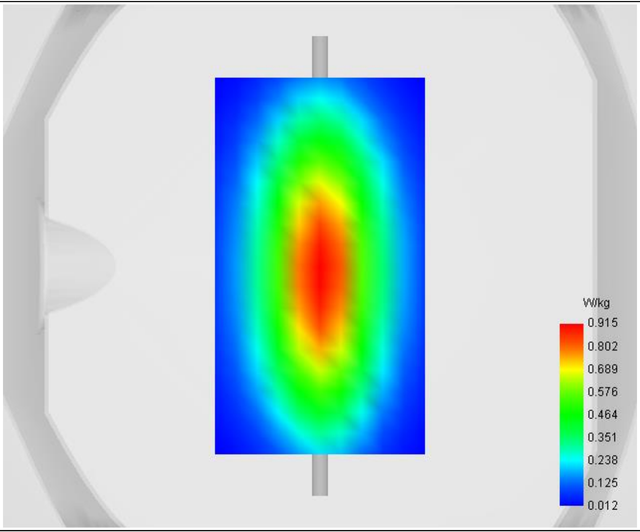
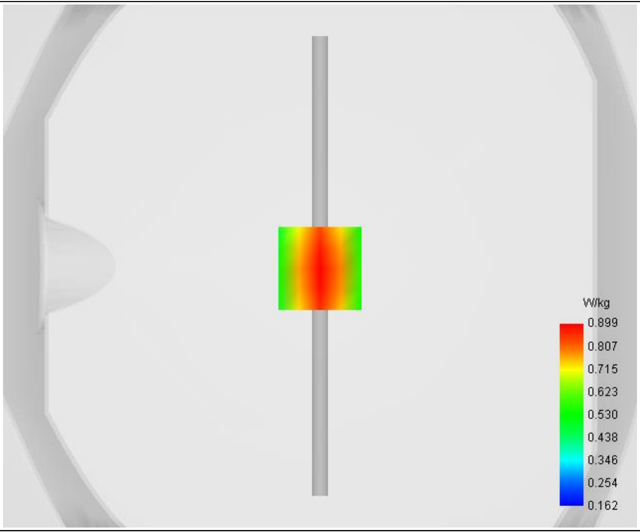
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	1.73
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW750
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	750.000000
Relative permittivity (real part)	41.142314
Conductivity (S/m)	0.903375

C. SAR Surface and Volume

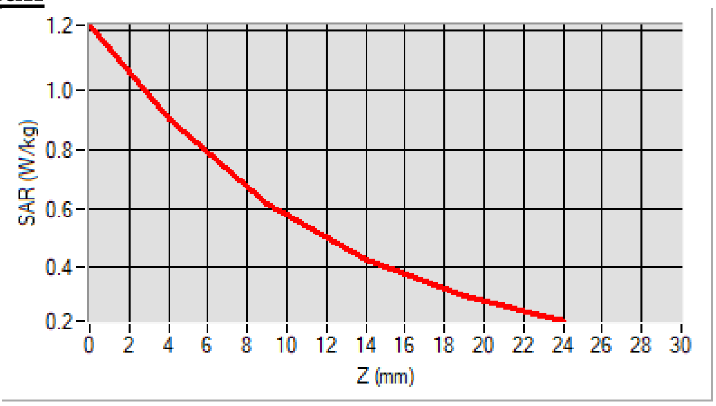
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00; SAR Peak: 1.17 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.552353
SAR 1g (W/Kg)	0.833854
Variation (%)	3.240000

E. Z Axis Scan



System check at 835 MHz

Date of measurement: 22/8/2022

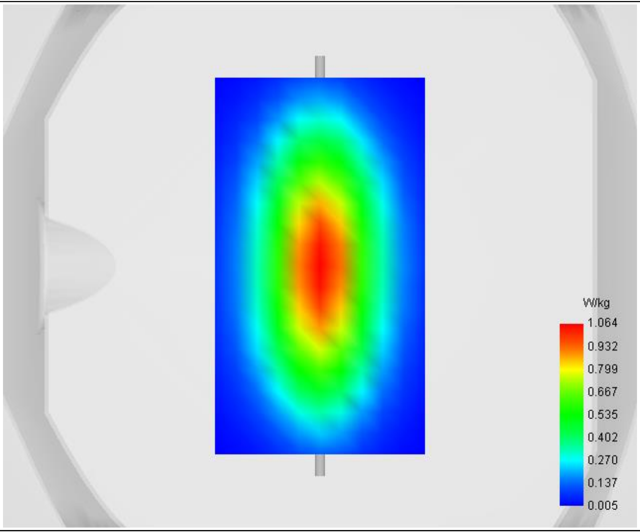
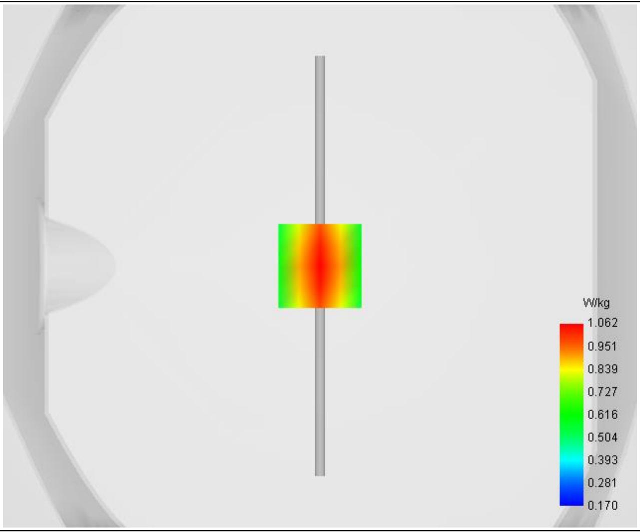
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	1.68
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW835
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	835.000000
Relative permitivity (real part)	41.373526
Conductivity (S/m)	0.912826

C. SAR Surface and Volume

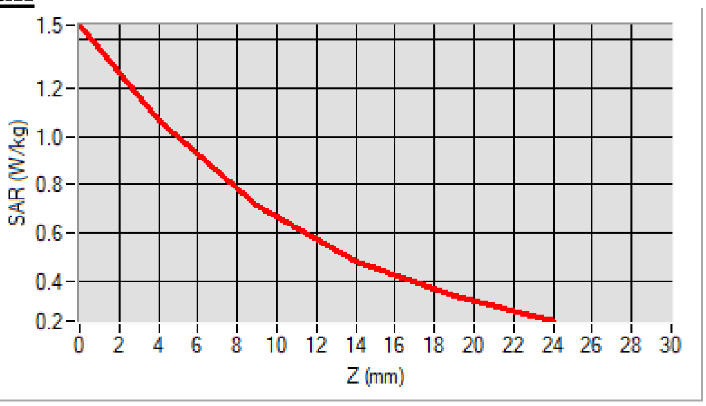
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00; SAR Peak: 1.45 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.607145
SAR 1g (W/Kg)	0.956214
Variation (%)	0.630000

E. Z Axis Scan



System check at 1750 MHz

Date of measurement: 28/8/2022

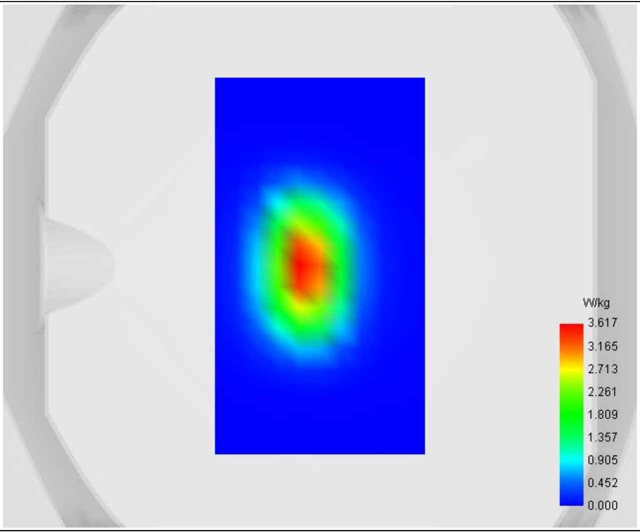
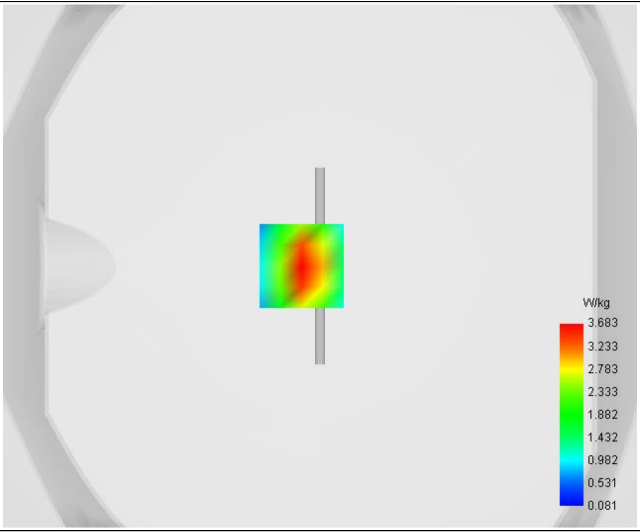
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	2.07
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW1750
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1750.000000
Relative permitivity (real part)	40.393521
Conductivity (S/m)	1.381647

C. SAR Surface and Volume

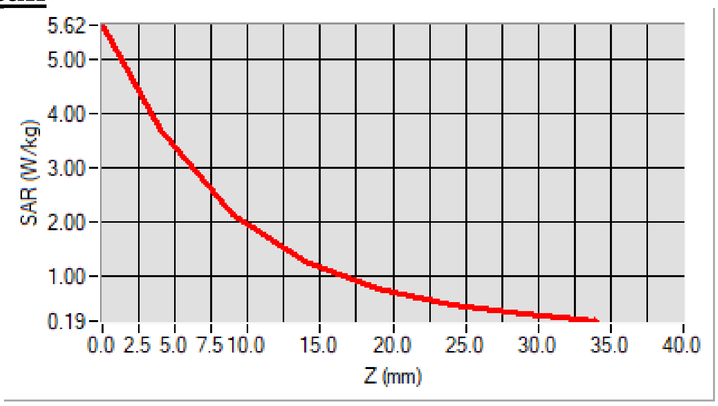
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-7.00, Y=0.00; SAR Peak: 5.8 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	1.883432
SAR 1g (W/Kg)	3.600214
Variation (%)	-2.530000

E. Z Axis Scan



System check at 1900 MHz

Date of measurement: 28/8/2022

A. Experimental conditions.

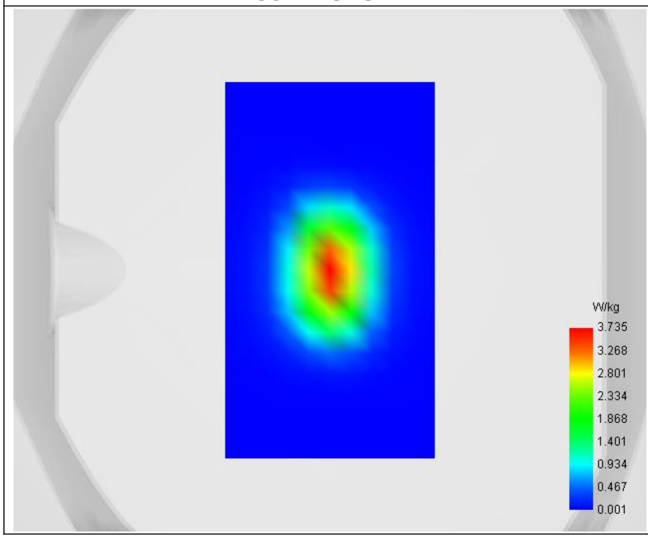
Probe	SN 36/20 EPGO354
ConvF	2.14
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW1900
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

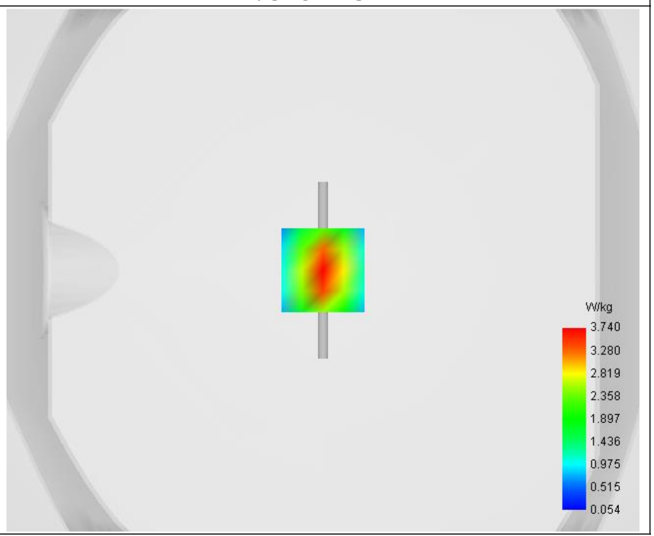
Frequency (MHz)	1900.000000
Relative permitivity (real part)	39.850652
Conductivity (S/m)	1.411326

C. SAR Surface and Volume

SURFACE SAR



VOLUME SAR

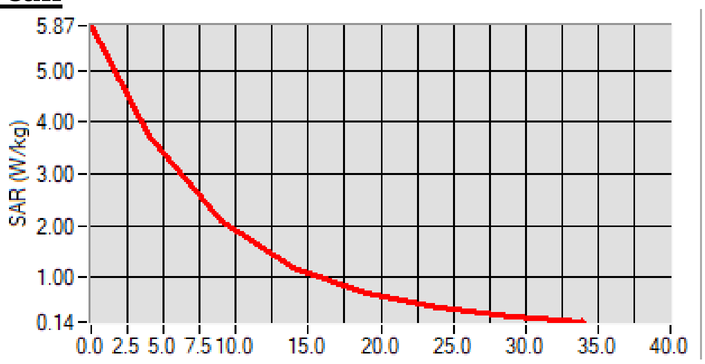


Maximum location: X=0.00, Y=0.00; SAR Peak: 5.91 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	1.980332
SAR 1g (W/Kg)	3.830423
Variation (%)	0.560000

E. Z Axis Scan



System check at 2450 MHz

Date of measurement: 2/9/2022

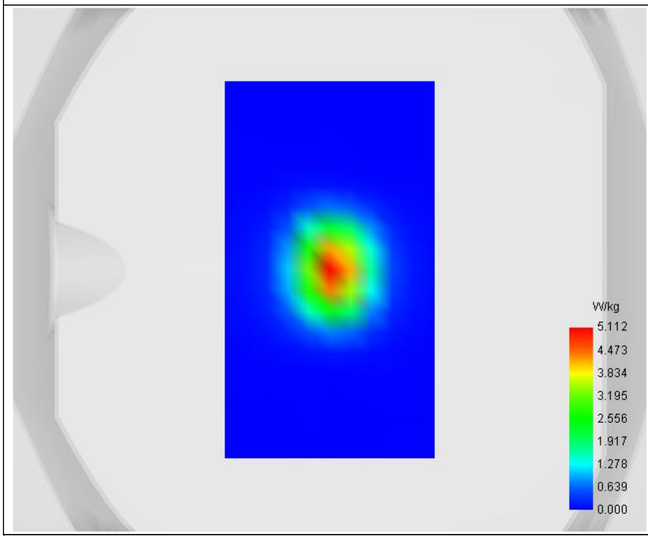
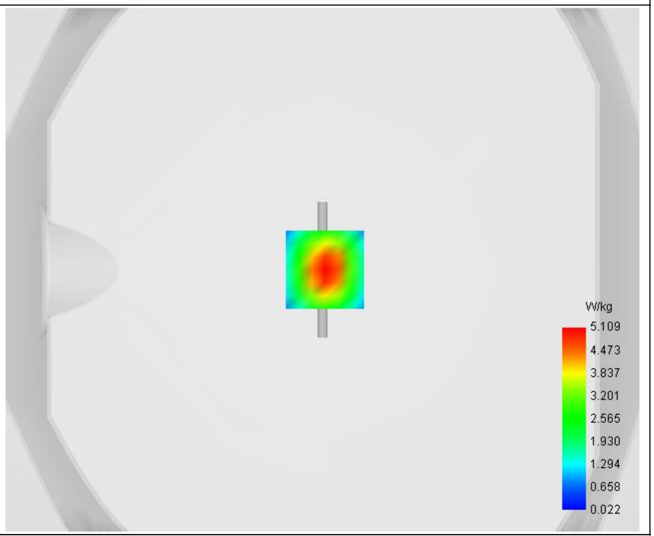
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	2.23
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2450.000000
Relative permitivity (real part)	38.959261
Conductivity (S/m)	1.823534

C. SAR Surface and Volume

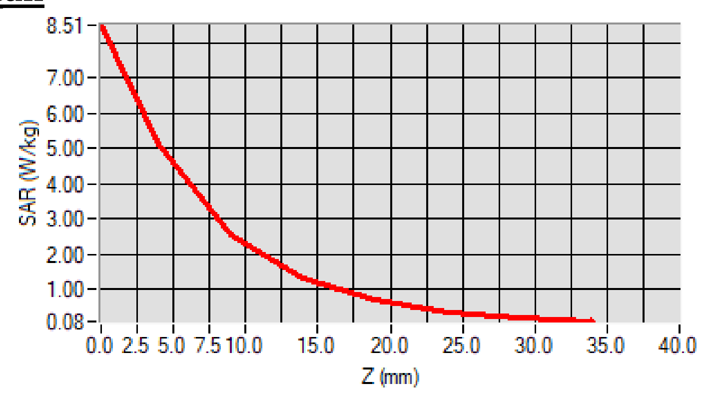
SURFACE SAR	VOLUME SAR
	

Maximum location: X=1.00, Y=0.00; SAR Peak: 8.18 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	2.350543
SAR 1g (W/Kg)	5.190658
Variation (%)	-1.810000

E. Z Axis Scan



Appendix B: Plots of SAR Test Data

SAR Measurement at CUSTOM (GPRS8503Txslot) (Body, Validation Plane)

Date of measurement: 22/8/2022

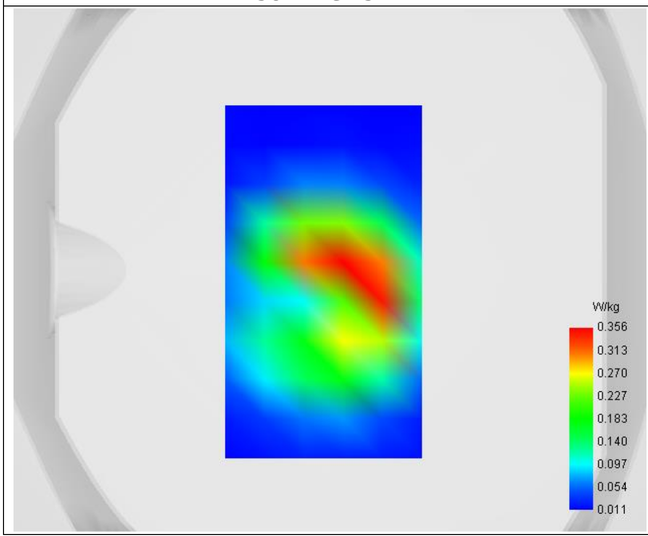
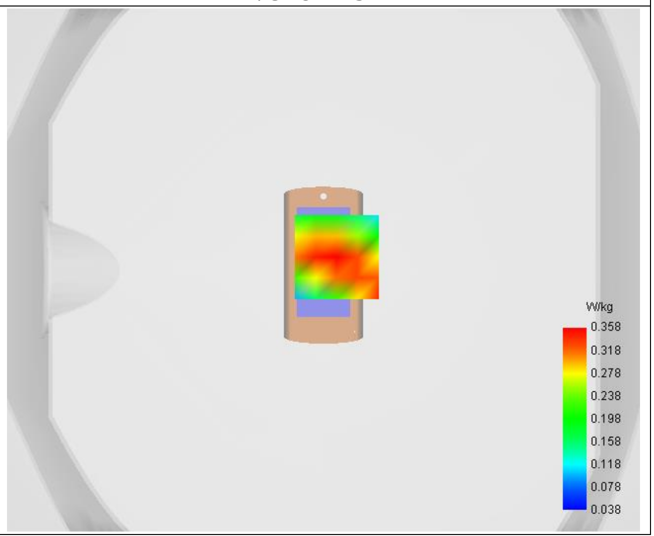
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	1.70
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	GSM850
Channels	Low
Signal	TDMA (Crest factor: 2.7)

B. Permitivity

Frequency (MHz)	824.201976
Relative permitivity (real part)	41.136322
Conductivity (S/m)	0.901115

C. SAR Surface and Volume

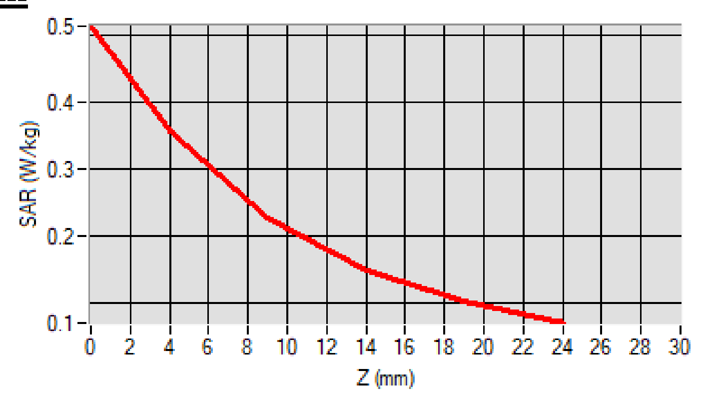
SURFACE SAR	VOLUME SAR
	

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

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.211789
SAR 1g (W/Kg)	0.345757
Variation (%)	-0.120000

E. Z Axis Scan



SAR Measurement at CUSTOM (GPRS19003Txslot) (Body, Validation Plane)

Date of measurement: 28/8/2022

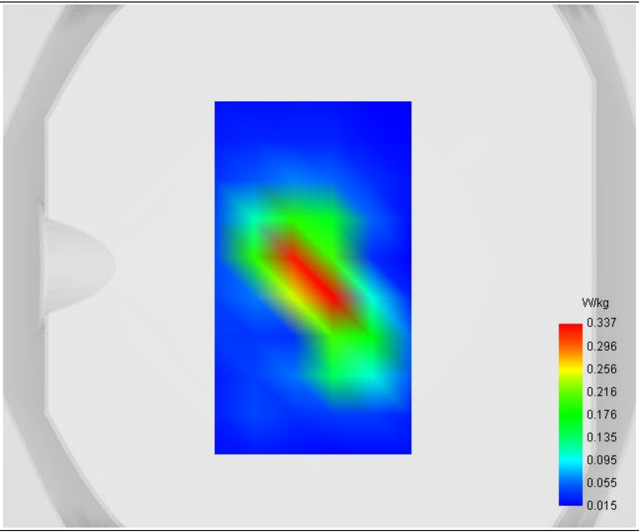
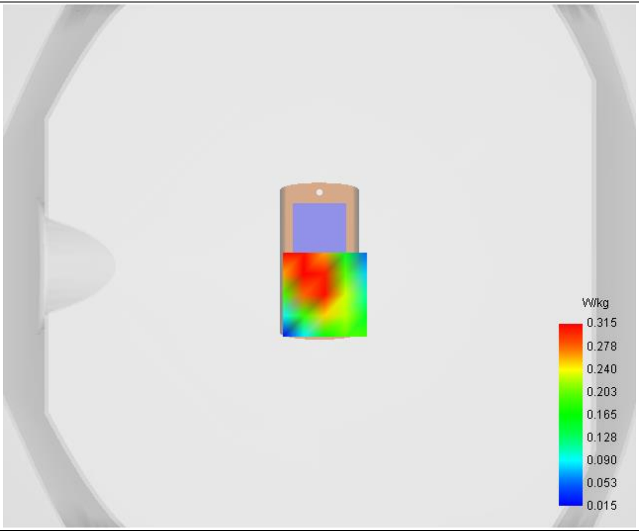
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	2.00
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	PCS1900
Channels	Low
Signal	TDMA (Crest factor: 2.7)

B. Permitivity

Frequency (MHz)	1850.200000
Relative permitivity (real part)	39.871252
Conductivity (S/m)	1.400391

C. SAR Surface and Volume

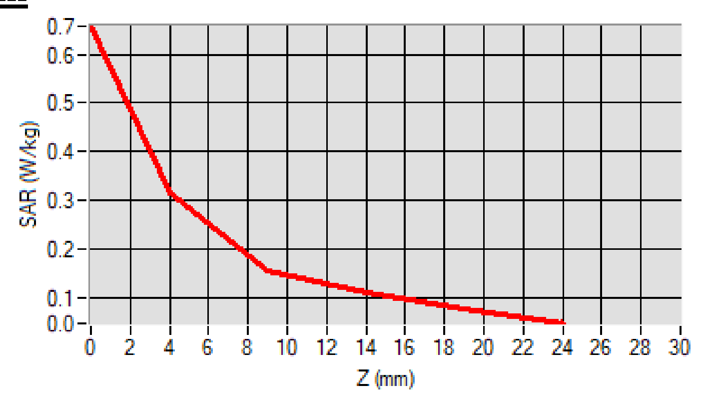
SURFACE SAR	VOLUME SAR
	

Maximum location: X=2.00, Y=-11.00 ; SAR Peak: 0.51 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.180708
SAR 1g (W/Kg)	0.310001
Variation (%)	-0.910000

E. Z Axis Scan



SAR Measurement at LTE band 2 (Body, Validation Plane)

Date of measurement: 28/8/2022

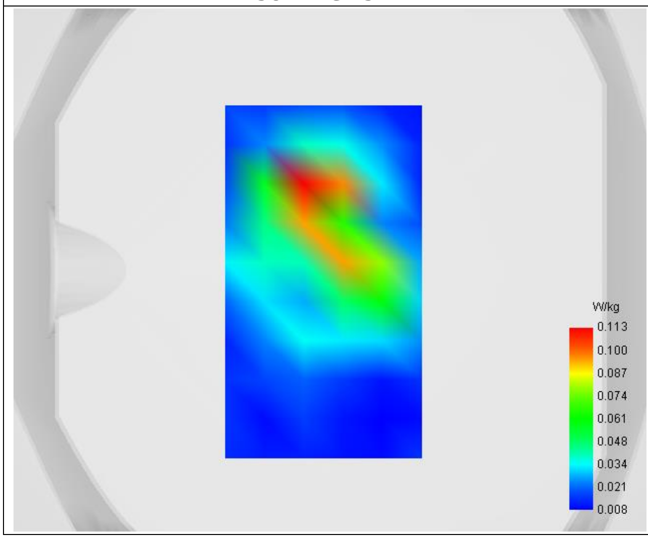
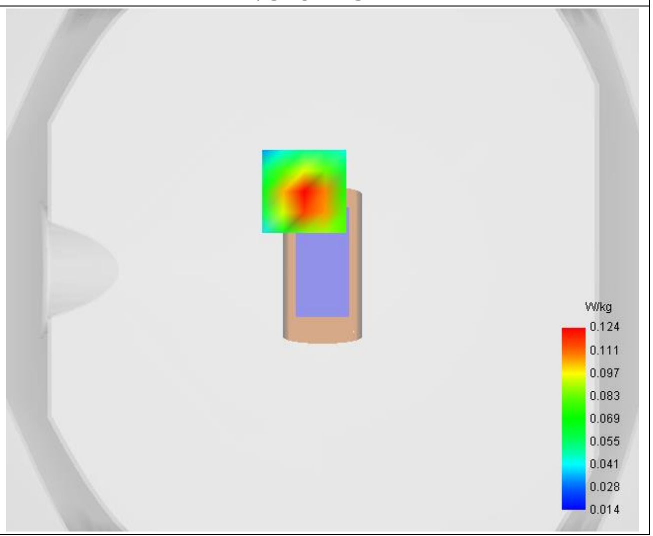
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	2.00
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	LTE band 2
Channels	Low
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1860.000000
Relative permitivity (real part)	39.871213
Conductivity (S/m)	1.400311

C. SAR Surface and Volume

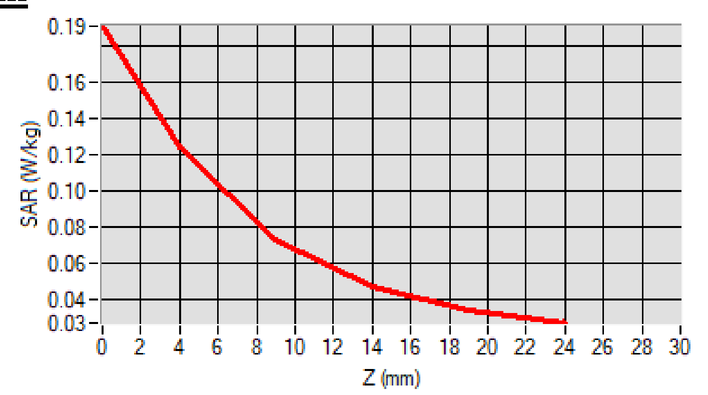
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-7.00, Y=30.00 ; SAR Peak: 0.19 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.068226
SAR 1g (W/Kg)	0.117540
Variation (%)	-0.260000

E. Z Axis Scan



SAR Measurement at CUSTOM (LTE_Band_4) (Body, Validation Plane)

Date of measurement: 28/8/2022

A. Experimental conditions.

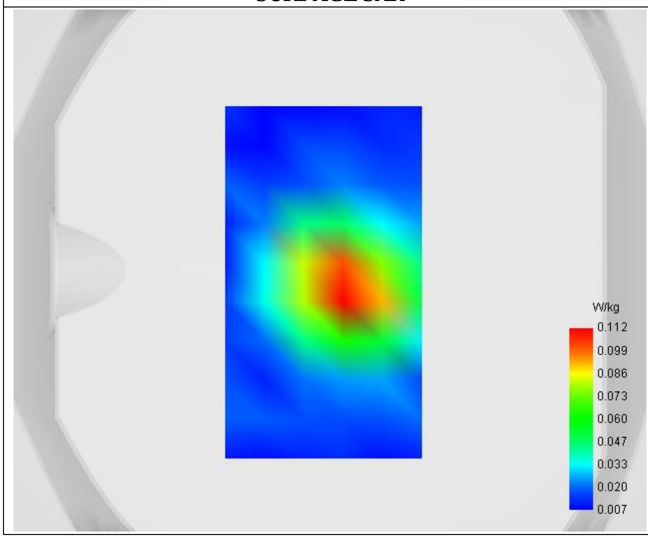
Probe	SN 18/21 EPGO354
ConvF	2.05
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	LTE band 4
Channels	Low
Signal	LTE (Crest factor: 1.0)

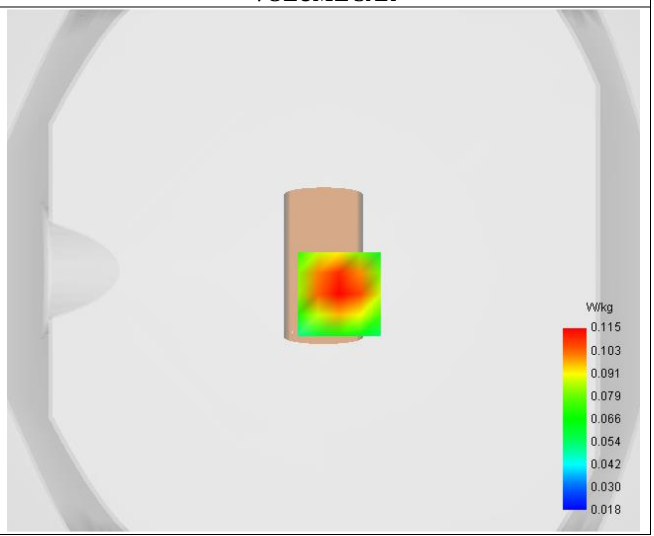
B. Permitivity

Frequency (MHz)	1720.000000
Relative permitivity (real part)	40.110610
Conductivity (S/m)	1.360601

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR



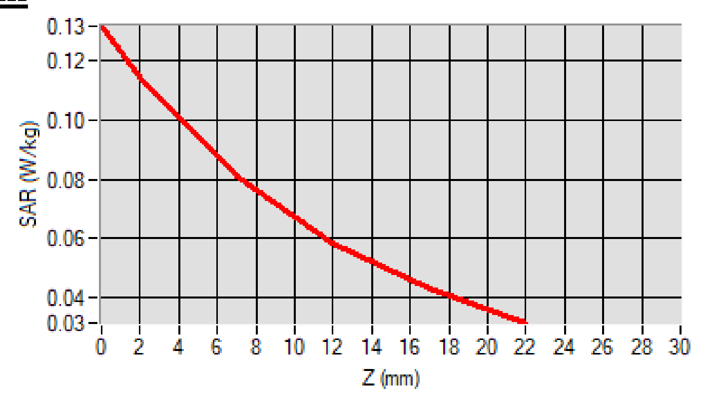


Maximum location: X=6.00, Y=-9.00 ; SAR Peak: 0.13 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.063011
SAR 1g (W/Kg)	0.095070
Variation (%)	0.530001

E. Z Axis Scan



SAR Measurement at LTE band 12 (Body, Validation Plane)

Date of measurement: 22/8/2022

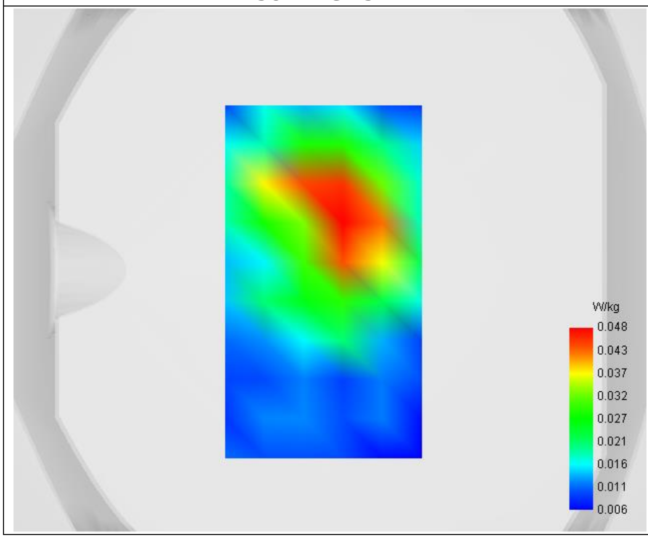
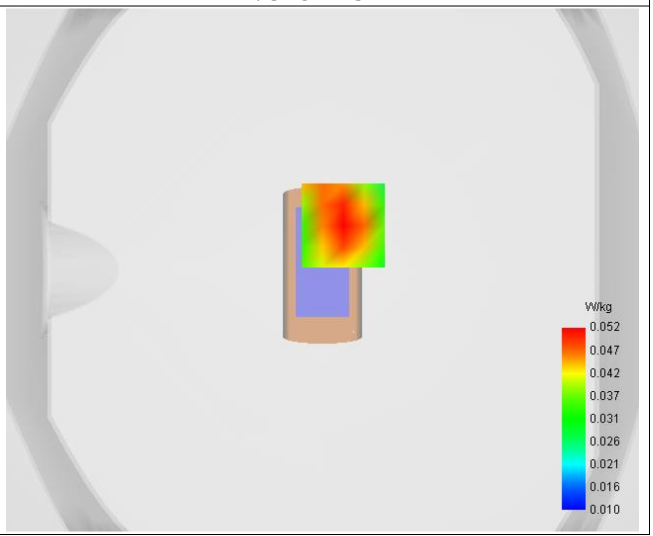
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	1.70
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	LTE band 12
Channels	Low
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	704.000000
Relative permitivity (real part)	42.123367
Conductivity (S/m)	0.914004

C. SAR Surface and Volume

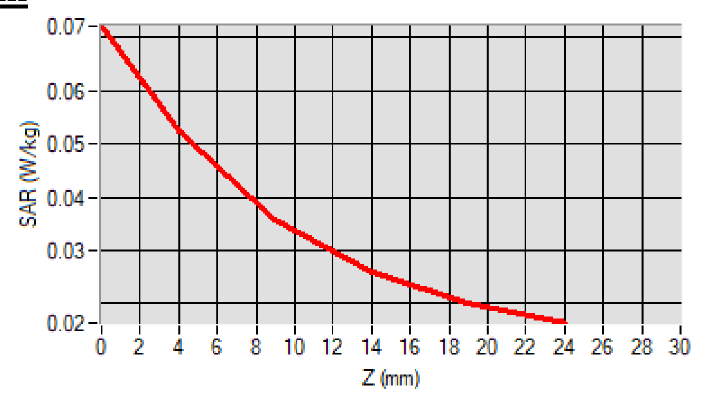
SURFACE SAR	VOLUME SAR
	

Maximum location: X=8.00, Y=17.00 ; SAR Peak: 0.07 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.034536
SAR 1g (W/Kg)	0.051064
Variation (%)	-0.610000

E. Z Axis Scan



SAR Measurement at LTE band 13 (Body, Validation Plane)

Date of measurement: 22/8/2022

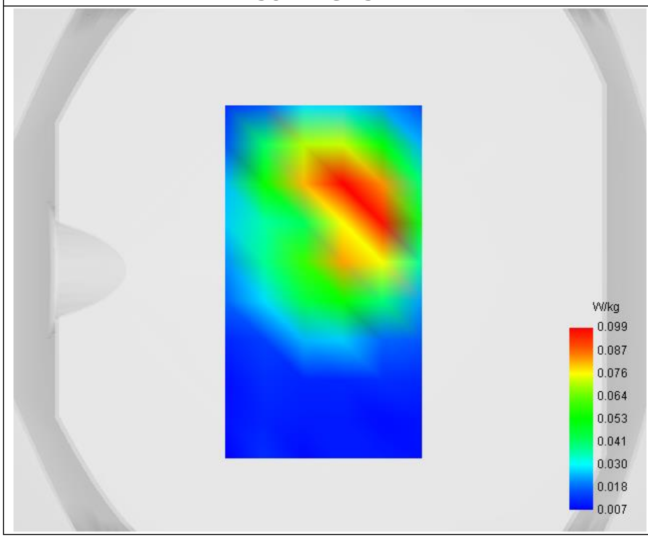
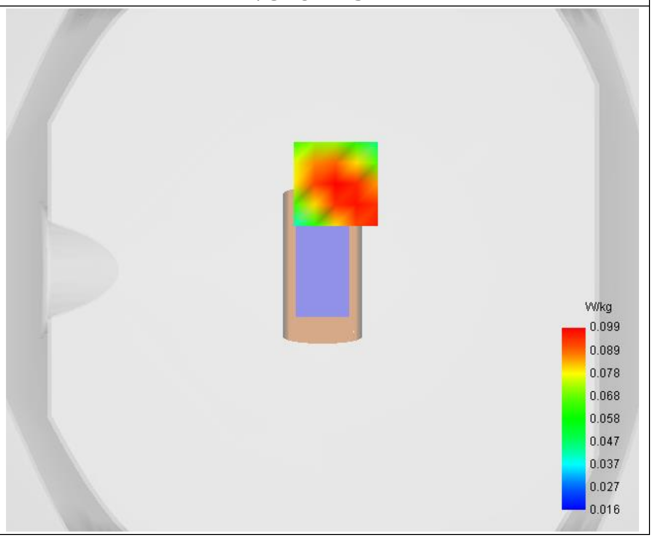
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	1.70
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	LTE band 13
Channels	Middle
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	782.000000
Relative permitivity (real part)	41.149413
Conductivity (S/m)	0.895416

C. SAR Surface and Volume

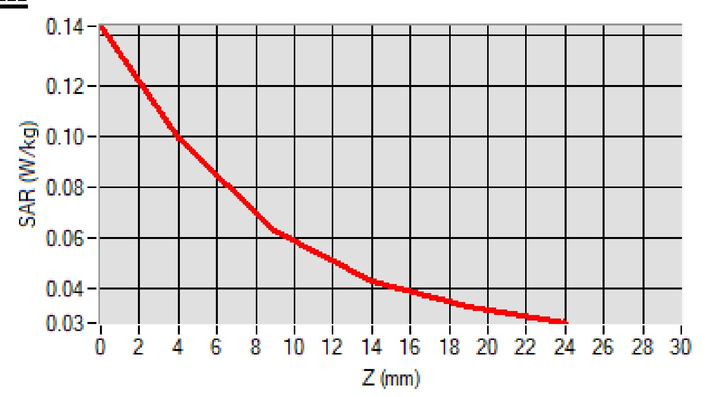
SURFACE SAR	VOLUME SAR
	

Maximum location: X=5.00, Y=33.00 ; SAR Peak: 0.15 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.062415
SAR 1g (W/Kg)	0.095294
Variation (%)	-4.990000

E. Z Axis Scan



SAR Measurement at Bluetooth (Body, Validation Plane)

Date of measurement: 2/9/2022

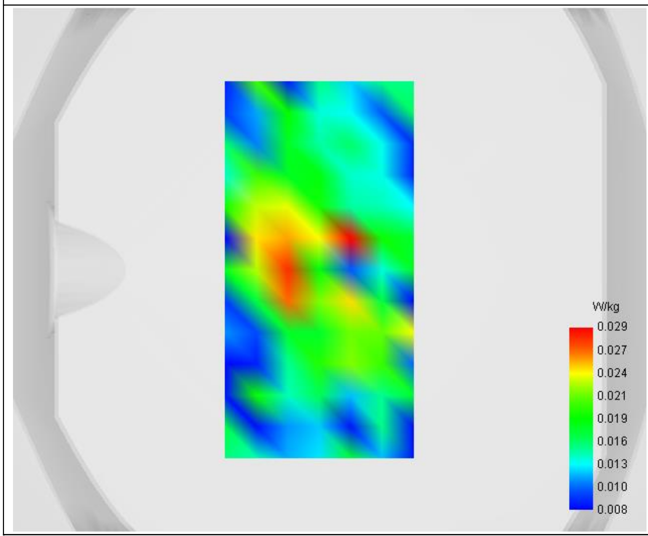
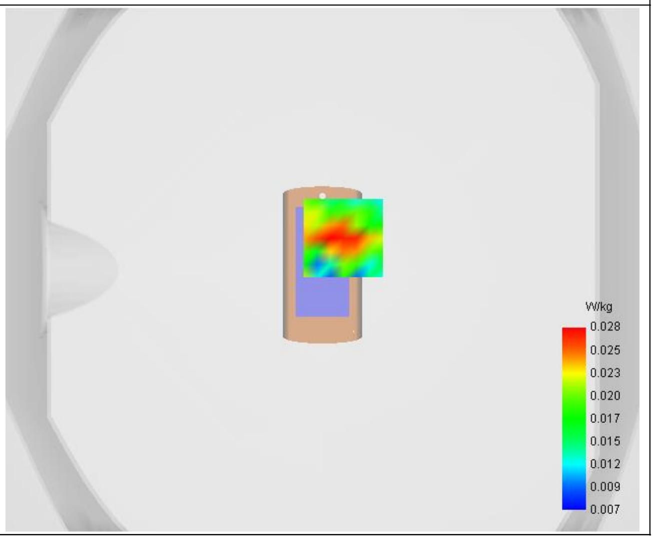
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	2.46
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	Bluetooth
Channels	High
Signal	Bluetooth (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2480.000000
Relative permitivity (real part)	39.017039
Conductivity (S/m)	1.791508

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR
	

Maximum location: X=8.00, Y=12.00 ; SAR Peak: 0.05 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.018306
SAR 1g (W/Kg)	0.025027
Variation (%)	1.980000

E. Z Axis Scan