FCC SAR REPORT

Applicant:	NU-ERA TELECOMMUNICATIONS INC
Address of Applicant:	848 Brickell Av. Suite 1015, Miami, Florida, United States 33131
Equipment Under Test (EUT)	
Product Name:	4G Tablet
Model No.:	X8A
Trade mark	XMOBILE
FCC ID:	2A5WBXMOX8A
Applicable standards:	FCC 47 CFR Part 2.1093
Date of Test:	01 Apr., 2022~06 Apr., 2022
Test Result:	Maximum Reported 1-g SAR (W/kg) Body: 0.785

Authorized Signature:

Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of theJYTproduct certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

2 Version

Version No.	Date	Description
00	*25 May., 2022*	*Original*

Tested by:	Vieta Zhang	***Date:***	*25 May., 2022*
	Test Engineer		
Reviewed by:	Wiby Zhang	***Date:***	*25 May., 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)	WCDMA Band V	0.762	PCB	0.785
	WCDMA Band IV	0.694		
	WCDMA Band II	0.728		
	LTE Band 4	0.785		
	LTE Band 12	0.666		
	LTE Band 17	0.626		
	WLAN 2.4GHz	0.704	DTS	

<Highest Reportedsimultaneous SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Equipment Class	Highest ReportedSimultaneous Transmission 1-g SAR (W/kg)
Back	LTE Band 4	0.785	PCB	1.489
	WLAN 2.4GHz	0.704	DTS	

Note:

1. The highest simultaneous transmission is scalar summation of Reported standalone SAR per FCCKDB 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/uncontrolledexposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and hadbeen tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

5 General Information

5.1 Client Information

Applicant:	NU-ERA TELECOMMUNICATIONS INC
Address of Applicant:	848 Brickell Av. Suite 1015, Miami, Florida, United States 33131
Manufacturer:	NU-ERA TELECOMMUNICATIONS INC
Address of Manufacturer:	848 Brickell Av. Suite 1015, Miami, Florida, United States 33131

5.2 General Description of EUT

Product Name:	4G Tablet			
Model No.:	X8A			
Category of device	Portable device			
Operation Frequency:	3G :	Band II: 1852.4~1907.6 MHz	Band V: 826.4~846.6 MHz	
		Band IV: 1712.4~1752.6 MHz		
	4G :	Band 4 :1710MHz~1755MHz	Band 12: 698MHz~716MHz	
		Band 17: 704MHz~716MHz		
	Wi-Fi:	2412MHz~2462MHz		
	Bluetooth: 2402 MHz ~ 2480 MHz			
	3G:	☒RMC(QPSK)	☒HSUPA(QPSK)	☒HSDPA(QPSK,16QAM)
	4G:	☒QPSK	☒16QAM	☒64QAM
	Wi-Fi:	☒802.11b(DSSS)	☒802.11g/n (OFDM)	
	Bluetooth:	☒BDR(GFSK)	☒EDR(π/4-DQPSK, 8DPSK)	☒LE(GFSK)
Antenna Type:	Internal Antenna			
Antenna Gain:	WCDMA Band V: -1.4 dBi ;WCDMA Band II: -1.9 dBi; WCDMA Band IV: -1.6 dBi LTE Band 4: -1.6 dBi; LTE Band 12: -1.8 dBi LTE Band 17: -1.8 dBi Bluetooth: -1.3 dBi; 2.4G Wi-Fi: -1.3 dBi			
Dimensions (L*W*H):	208mm (L)× 125mm (W)× 10mm (H)			
Accessories information:	Adapter: Input: AC100-240V, 50/60Hz, 0.2A Output: DC 5.0V, 1000mA	Battery: Rechargeable Li-ion Battery 3.7V/4000mAh		
		Headset: Support headset (Shipped without)		

5.3 Maximum RF Output Power

Mode	Average Power (dBm)		
	WCDMA Band V	WCDMA Band IV	WCDMA Band II
AMR 12.2 kbps	22.81	22.09	22.24
RMC 12.2 kbps	22.72	22.10	22.23
HSDPA Sub-test 1	21.75	21.15	21.28
HSDPA Sub-test 2	21.23	20.66	20.70
HSDPA Sub-test 3	21.27	20.68	20.77
HSDPA Sub-test 4	21.24	20.64	20.75
HSUPA Sub-test 1	19.79	19.16	19.23
HSUPA Sub-test 2	20.30	19.66	19.73
HSUPA Sub-test 3	20.77	20.16	20.26
HSUPA Sub-test 4	19.82	19.16	19.24
HSUPA Sub-test 5	21.79	21.19	21.23

Mode	Average Power (dBm)		
	LTE Band 4	LTE Band 12	LTE Band 17
BW/1.4 MHz	22.53	22.77	/
BW/3.0 MHz	22.01	22.70	/
BW/5.0 MHz	22.09	22.75	22.73
BW/10 MHz	22.15	22.76	22.85
BW/15 MHz	21.99	/	/
BW/20 MHz	22.09	/	/

WLAN 2.4 GHz Band Average Power (dBm)				
Mode/Band	b	g	n (HT-20)	n (HT-40)
WLAN 2.4GHz	13.4	14.06	14.34	17.92

Bluetooth Average Power (dBm)				
Mode/Band	1 Mbps(GFSK)	2 Mbps(π/4DQPSK)	3 Mbps (8DPSK)	LE (BT 4.0)
Bluetooth	5.29	4.59	4.82	5.29

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
Email: info-JYTee@lets.com, Website: http://jyt.lets.com

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 SARdistribution in a biological body is complicated and is usually carried out by experimental techniques or numericalmodeling. The standard recommends limits for two tiers of groups, occupational/controlled and generalpopulation/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. Ingeneral, 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) anincremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is asbelow:

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

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 theelectrical 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 individualswho have no knowledge or control of their exposure. The general population/uncontrolled exposure limitsare applicable to situations in which the general public may be exposed or in which persons who areexposed as a consequence of their employment may not be made fully aware of the potential forexposure or cannot exercise control over their exposure. Members of the general public would comeunder this category when exposure is not employment-related; for example, in the case of a wirelesstransmitter that exposes persons in its vicinity.

7.2 Controlled Environment

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

8 SAR Measurement System

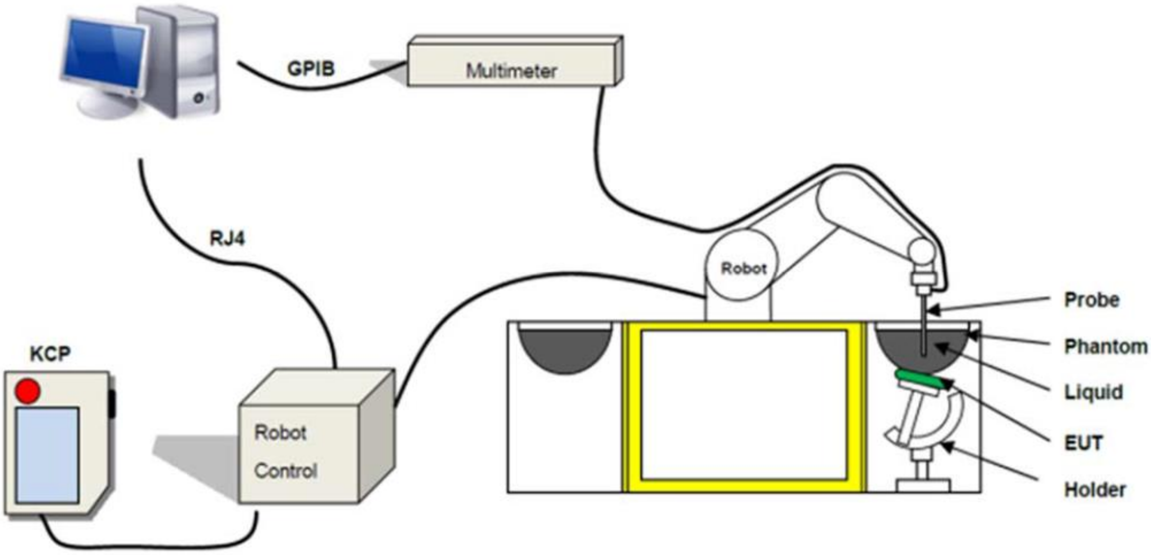


Fig.8.1 MVGCOMOSAR System Configurations

Thesemeasurements 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 MVGCOMOSAR system for performance compliance tests is illustrated above graphically. This system consists of thefollowing 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.

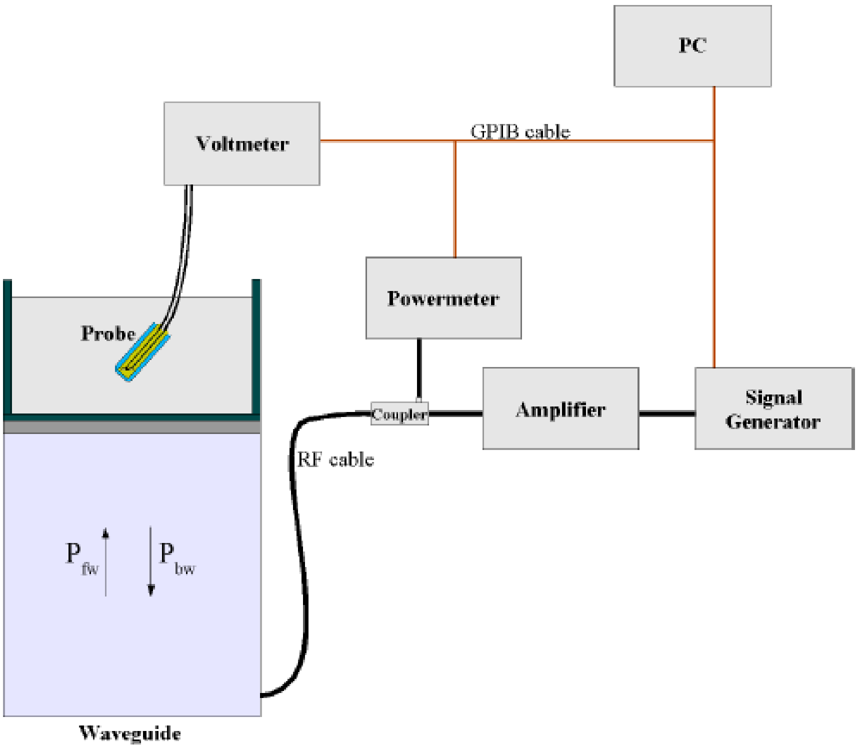
➢ **E-Field Probe Specification**

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; nobelt drives)
- Jerk-free straight movements
- Low ELF interference (motor control fields shielded via the closed metallic constructionshields)

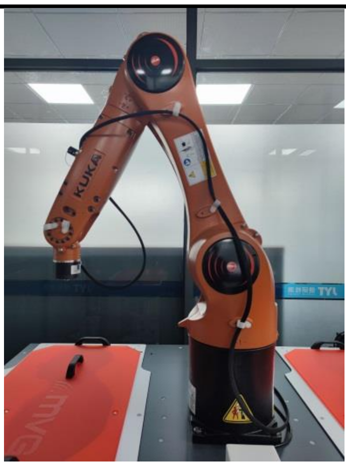


Fig. 8.4 Photo of Robot

8.3 Phantom

<SAM Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	 **Fig. 8.7Photo of SAMPhantom**
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	

The phantom developed by MVG is produced in accordance with the specified in the standards. It has beendesigned 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 andreproducible positioning. It also allows correct positioning of the dipoles referenced by the IEEE, ANSIand IEC.

<Device Holder for SAM Phantom>

Model	Handset Positioning System	 **Fig. 8.9 Photo of Device Holder**
Material properties	The positioning system is made ofPETP. This material offers a low permittivity of 3.2 and lowloss, with a loss tangent of 0.005 to minimize the influenceof the DUT on measurement results.	
Mechanical properties	The positioning system developedby MVG allows a positioning resolution better than1 mm. The system is fixed on a bottom rail “x axis” sothat the positioning system can be quickly moved from theright 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 composedof three rotation points for accurate positioning ofthe device’s acoustical output.	
Accuracy and precision	A curved rail on the top partallows the fast switch from the cheek to the tilt position.The required 15° angle for the tilt position can be easilychecked thanks to a printed scale on the curved rail witha tolerance of ± 1°	

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	05.20.2021	05.19.2022
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	06.18.2020	06.17.2022
HP	Network Analyzer	8753D	WXJ024	06.18.2020	06.17.2022
KEYSIGHT	EPM Series Power Meter	N1914A	WXJ075	08.29.2021	08.28.2022
KEYSIGHT	E-Series Power Sensor	E9300H	WXJ075-1	08.29.2021	08.28.2022
KEYSIGHT	E-Series Power Sensor	E9300H	WXJ075-2	08.29.2021	08.28.2022
KEYSIGHT	Signal Generator	N5173B	WXJ006-3	10.27.2021	10.26.2022
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. Thedipoles 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 networkanalyzer and compensated during system check.
4. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in purewater) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure andcalibration 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 haveprecise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not criticallyrequired for correct measurement; the spectrumanalyzer 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 systemcheck.
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)

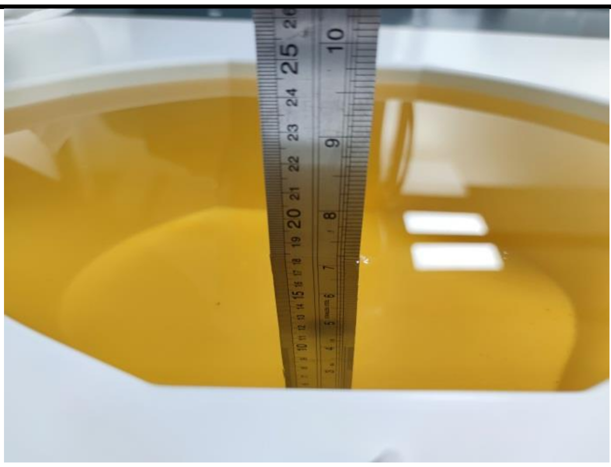


Fig. 9.2 Photo of Liquid Height for Body SAR (depth>15cm)

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 65supplement 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	22.1	0.90	41.68	0.89	41.90	1.12	-0.53	±5	04.01.2022
835	22.1	0.93	41.66	0.90	41.50	3.33	0.39	±5	04.01.2022
1750	22.5	1.32	41.18	1.37	40.10	-3.65	2.69	±5	04.03.2022
1900	22.5	1.39	39.81	1.40	40.00	-0.71	-0.47	±5	04.03.2022
2450	22.1	1.85	39.50	1.80	39.20	2.78	0.77	±5	04.06.2022

10 SAR System Verification

Each ComoSARsystemis 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:

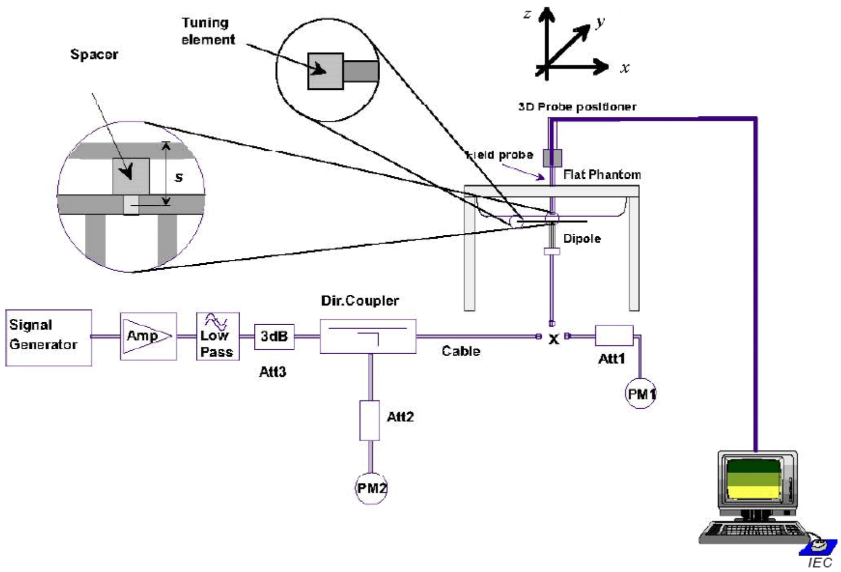


Fig.10.1 System Verification Setup Diagram

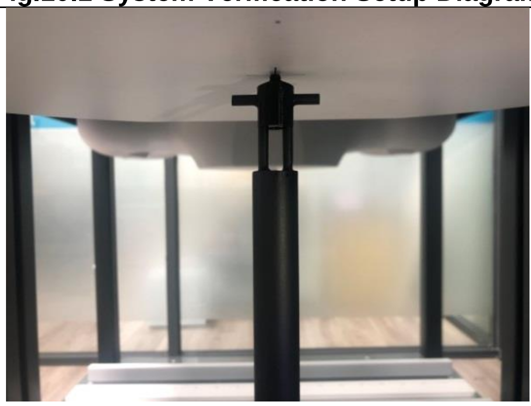


Fig.10.2 Photo of Dipole setup

-

- **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 to1W 1g SAR (W/kg)	1W Target 1g SAR (W/kg)	Deviation (%)
04.01.2022	750	100	0.862	8.62	8.57	0.58
04.01.2022	835	100	0.956	9.56	9.57	-0.10
04.03.2022	1750	100	3.562	35.62	36.5	-2.41
04.03.2022	1900	100	3.872	38.72	39.6	-2.22
04.06.2022	2450	100	5.412	54.10	52.92	2.23

11 EUT Testing Position

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

11.1 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 10 mm or holster surface and the flat phantom to 0 mm.

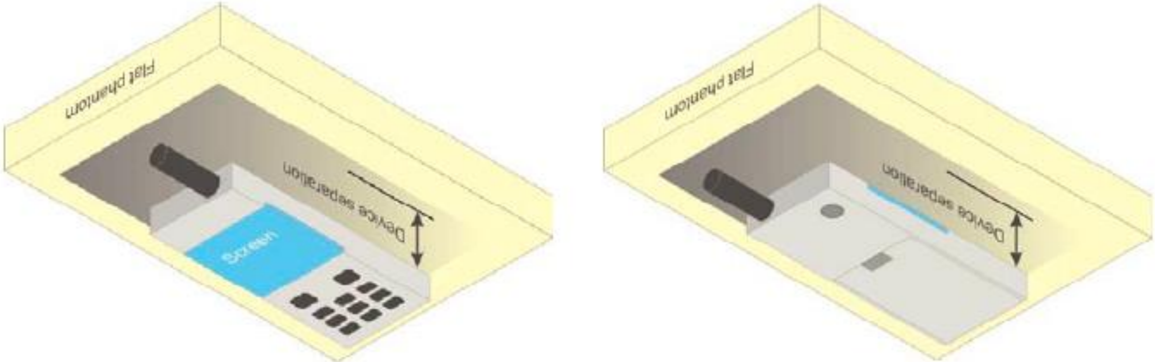


Fig.11.5 Illustration for Body Worn Position

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>$\leq$ 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>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 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 $\leq$ 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>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 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>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 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>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 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>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 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 $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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 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 SetupConfiguration.
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 β_c/β_d =12/15, β_{hs}/β_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 β_c = 11/15 and β_d = 15/15.

HSDPA Sub-test setup configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Rohde & Schwarz CMU200referred to the SetupConfiguration.
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 inthe 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 $\Leftrightarrow$ A_{hs} = β_{hs}/β_c = 30/15 $\Leftrightarrow$ β_{hs}= 30/15 *β_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

WCDMA Conducted Power:

WCDMA Average power (dBm)			
Band	WCDMA Band V		
Channel	4132	4183	4233
Frequency (MHz)	826.4	836.6	846.6
AMR 12.2 kbps	22.75	22.81	22.75
RMC 12.2 kbps	22.64	**22.72**	22.66
HSDPA Sub-test 1	21.70	21.73	21.75
HSDPA Sub-test 2	21.16	21.23	21.23
HSDPA Sub-test 3	21.19	21.27	21.23
HSDPA Sub-test 4	21.14	21.21	21.24
HSUPA Sub-test 1	19.72	19.79	19.78
HSUPA Sub-test 2	20.24	20.28	20.30
HSUPA Sub-test 3	20.71	20.77	20.72
HSUPA Sub-test 4	19.75	19.82	19.79
HSUPA Sub-test 5	21.72	21.79	21.75

WCDMA Average power (dBm)			
Band	WCDMA Band IV		
Channel	1312	1413	1513
Frequency (MHz)	1712.4	1732.6	1752.6
AMR 12.2 kbps	21.84	22.09	21.92
RMC 12.2 kbps	21.85	**22.10**	21.98
HSDPA Sub-test 1	20.90	21.15	21.02
HSDPA Sub-test 2	20.37	20.66	20.53
HSDPA Sub-test 3	20.44	20.68	20.53
HSDPA Sub-test 4	20.40	20.64	20.55
HSUPA Sub-test 1	18.90	19.16	19.01
HSUPA Sub-test 2	19.44	19.66	19.53
HSUPA Sub-test 3	19.93	20.16	20.01
HSUPA Sub-test 4	18.93	19.16	19.06
HSUPA Sub-test 5	20.93	21.19	21.05

WCDMA Average power (dBm)			
Band	WCDMA Band II		
Channel	9262	9400	9538
Frequency (MHz)	1852.4	1880.0	1907.6
AMR 12.2 kbps	22.23	22.24	22.14
RMC 12.2 kbps	**22.23**	22.22	22.19
HSDPA Sub-test 1	21.28	21.27	21.25
HSDPA Sub-test 2	20.70	20.69	20.68
HSDPA Sub-test 3	20.77	20.73	20.73
HSDPA Sub-test 4	20.72	20.66	20.75
HSUPA Sub-test 1	19.23	19.19	19.19
HSUPA Sub-test 2	19.72	19.73	19.73
HSUPA Sub-test 3	20.26	20.21	20.19
HSUPA Sub-test 4	19.24	19.23	19.21
HSUPA Sub-test 5	21.23	21.23	21.19

Note:

1. Applying the subtest setup in Table C.11.1.3 of 3GPP TS 34.121-1
2. Per KDB 941225 D01, RMC 12.2kbps mode is used to evaluate SAR due the highest output power. If AMR 12.2kbps power is < 0.25dB higherthan RMC 12.2kbps, SAR tests with AMR 12.2kbps can be excluded.
3. AMR, HSDPA RF power will not be larger than RMC 12.2kbps, detailed information is included inTune-up Procure exhibit.

13.2 LTE Conducted Power

13.2.1 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.

13.2.2 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 factoraccording 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 todetermine 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

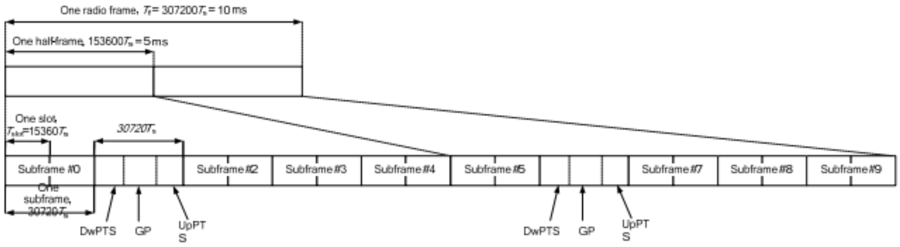


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity)

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·Ts = 10 ms consists of two half-frames of length 153600·Ts = 5ms each. Each half-frame consists of five subframes of length30720 ·Ts =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 4 part

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					19957	20175	20393
					1710.7MHz	1732.5MHz	1754.3MHz
Band 4	1.4	QPSK	1	0	22.10	22.39	22.20
			1	2	22.32	22.53	22.01
			1	5	22.11	22.43	21.79
			3	0	22.16	22.47	21.83
			3	1	22.20	22.51	21.88
			3	2	22.18	22.52	21.89
			6	0	21.13	21.45	20.82
		16QAM	1	0	21.21	21.57	20.71
			1	2	21.39	21.75	20.95
			1	5	21.20	21.53	20.70
			3	0	21.10	21.45	20.74
			3	1	21.11	21.48	20.72
			3	2	21.09	21.42	20.78
			6	0	20.24	20.38	19.87

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					19965	20175	20385
					1711.5MHz	1732.5MHz	1753.5MHz
Band 4	3	QPSK	1	0	21.64	21.97	21.91
			1	7	21.64	22.01	21.97
			1	14	21.65	21.99	21.93
			8	0	20.66	20.95	20.88
			8	4	20.68	20.96	20.89
			8	7	20.69	20.93	20.89
			15	0	20.64	20.97	20.84
		16QAM	1	0	20.89	21.21	20.78
			1	7	20.87	21.13	20.76
			1	14	20.88	21.10	20.81
			8	0	19.78	20.06	19.94
			8	4	19.75	20.08	19.97
			8	7	19.75	20.02	19.91
			15	0	21.64	21.97	21.91

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					19975	20175	20375
					1712.5MHz	1732.5MHz	1752.5MHz
Band 4	5	QPSK	1	0	21.66	21.93	21.85
			1	12	21.77	22.09	21.96
			1	24	21.66	21.99	21.87
			12	0	20.59	20.97	20.78
			12	6	20.61	21.01	20.81
			12	11	20.65	20.97	20.78
			25	0	20.68	20.99	20.87
		16QAM	1	0	20.64	21.18	20.80
			1	12	20.78	21.27	20.95
			1	24	20.70	21.13	20.86
			12	0	19.76	20.11	19.93
			12	6	19.72	20.12	19.94
			12	11	19.68	20.13	19.92
			25	0	21.66	21.93	21.85

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20000	20175	20350
					1715.0MHz	1732.5MHz	1750.0MHz
Band 4	10	QPSK	1	0	21.58	21.92	21.84
			1	24	21.95	22.15	21.94
			1	49	21.75	21.96	21.84
			25	0	20.68	21.06	20.97
			25	12	20.70	21.08	20.96
			25	24	20.65	21.06	20.94
			50	0	20.78	21.02	20.90
		16QAM	1	0	20.79	21.13	20.66
			1	24	21.02	21.23	20.79
			1	49	20.93	21.11	20.75
			25	0	19.78	20.16	20.01
			25	12	19.77	20.20	20.10
			25	24	19.75	20.22	20.05
			50	0	19.87	20.10	19.95

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20025	20175	20325
					1717.5MHz	1732.5MHz	1747.5MHz
Band 4	15	QPSK	1	0	21.53	21.81	21.83
			1	37	21.79	21.99	21.89
			1	74	21.77	21.86	21.80
			36	0	20.66	21.00	20.98
			36	16	20.69	20.97	21.00
			36	35	20.66	20.99	20.99
			75	0	20.84	20.98	20.93
		16QAM	1	0	20.76	21.11	20.70
			1	37	20.96	21.31	20.76
			1	74	20.95	21.15	20.69
			36	0	19.69	20.12	19.97
			36	16	19.71	20.11	20.00
			36	35	19.71	20.13	20.00
			75	0	19.87	20.07	19.98

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20050	20175	20300
					1720.0MHz	1732.5MHz	1745.0MHz
Band 4	20	QPSK	1	0	21.44	21.66	21.59
			1	49	21.92	22.09	21.96
			1	99	21.79	21.74	21.58
			50	0	20.57	20.91	21.09
			50	24	20.56	20.88	21.10
			50	49	20.56	20.95	21.10
			100	0	20.79	20.86	20.96
		16QAM	1	0	20.46	20.85	20.71
			1	49	21.00	21.30	20.92
			1	99	20.81	20.92	20.66
			50	0	19.57	19.99	20.21
			50	24	19.59	20.00	20.22
			50	49	19.57	20.02	20.18
			100	0	19.86	19.94	20.07

LTE Band 12 part:

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23017	23095	23175
					699.7MHz	707.5MHz	715.3MHz
Band 12	1.4	QPSK	1	0	22.66	22.63	22.60
			1	2	22.77	22.72	22.66
			1	5	22.64	22.51	22.55
			3	0	22.71	22.68	22.63
			3	1	22.67	22.66	22.68
			3	2	22.74	22.67	22.67
			6	0	21.64	21.62	21.60
		16QAM	1	0	21.76	21.76	21.44
			1	2	21.96	21.89	21.67
			1	5	21.73	21.70	21.43
			3	0	21.61	21.60	21.54
			3	1	21.65	21.61	21.51
			3	2	21.62	21.62	21.54
			6	0	20.70	20.51	20.63

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23025	23095	23165
					700.5MHz	707.5MHz	714.5MHz
Band 12	3	QPSK	1	0	22.55	22.56	22.58
			1	7	22.63	22.58	22.70
			1	14	22.65	22.56	22.52
			8	0	21.57	21.50	21.66
			8	4	21.53	21.53	21.61
			8	7	21.59	21.56	21.63
			15	0	21.57	21.57	21.59
		16QAM	1	0	21.79	21.76	21.50
			1	7	21.70	21.72	21.49
			1	14	21.76	21.69	21.42
			8	0	20.68	20.67	20.68
			8	4	20.69	20.64	20.70
			8	7	20.69	20.61	20.68
			15	0	20.63	20.58	20.60

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23035	23095	23155
					701.5MHz	707.5MHz	713.5MHz
Band 12	5	QPSK	1	0	22.62	22.57	22.56
			1	12	22.75	22.69	22.73
			1	24	22.63	22.57	22.56
			12	0	21.55	21.54	21.55
			12	6	21.52	21.59	21.62
			12	11	21.53	21.55	21.62
			25	0	21.55	21.62	21.60
		16QAM	1	0	21.60	21.75	21.55
			1	12	21.69	21.90	21.78
			1	24	21.59	21.78	21.57
			12	0	20.59	20.64	20.69
			12	6	20.63	20.66	20.72
			12	11	20.64	20.67	20.67
			25	0	20.66	20.66	20.69

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23060	23095	23130
					704MHz	707.5MHz	711MHz
Band 12	10	QPSK	1	0	22.57	22.53	22.60
			1	24	22.76	22.74	22.76
			1	49	22.60	22.60	22.64
			25	0	21.70	21.66	21.62
			25	12	21.65	21.67	21.62
			25	24	21.68	21.65	21.65
			50	0	21.63	21.64	21.61
		16QAM	1	0	21.75	21.72	21.47
			1	24	21.95	21.91	21.55
			1	49	21.76	21.80	21.44
			25	0	20.77	20.74	20.72
			25	12	20.75	20.74	20.66
			25	24	20.75	20.75	20.68
			50	0	20.68	20.74	20.63

LTE Band 17 part:

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23755	23790	23825
					706.5MHz	710.0MHz	713.5MHz
Band 17	5	QPSK	1	0	22.51	22.61	22.50
			1	12	22.70	22.72	22.73
			1	24	22.56	22.62	22.57
			12	0	21.49	21.56	21.60
			12	6	21.60	21.57	21.60
			12	11	21.56	21.55	21.58
			25	0	21.63	21.62	21.68
		16QAM	1	0	21.73	21.61	21.59
			1	12	21.86	21.76	21.69
			1	24	21.77	21.59	21.57
			12	0	20.68	20.68	20.69
			12	6	20.69	20.64	20.65
			12	11	20.69	20.60	20.69
			25	0	20.67	20.73	20.66

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23780	23790	23800
					709.0MHz	710.0MHz	711.0MHz
Band 17	10	QPSK	1	0	22.47	22.49	22.61
			1	24	22.65	22.70	22.85
			1	49	22.57	22.58	22.63
			25	0	21.57	21.57	21.62
			25	12	21.53	21.52	21.59
			25	24	21.57	21.54	21.58
			50	0	21.62	21.56	21.58
		16QAM	1	0	21.64	21.69	21.44
			1	24	21.86	21.81	21.58
			1	49	21.73	21.76	21.53
			25	0	20.58	20.65	20.63
			25	12	20.61	20.67	20.64
			25	24	20.63	20.67	20.61
			50	0	20.63	20.54	20.64

13.3 WLAN 2.4 GHz Band Conducted Power

Average Power (dBm)				
Channel	Frequency (MHz)	802.11 b	802.11 g	802.11n (HT20)
CH 01	2412	13.08	13.00	14.07
CH 06	2437	**13.40**	12.96	14.34
CH 11	2462	13.05	14.06	14.05

Average Power (dBm)		
Channel	Frequency (MHz)	802.11n (HT40)
CH 03	2422	**14.92**
CH 06	2437	14.64
CH 09	2452	14.76

Note:

1. Per KDB 447498 D01v06, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/ (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for1-g SAR, where
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Result	exclusion thresholds for 1-g SAR
b/CH 06	2.437	14.0	25.1	5	7.8	3.0
n (HT40)/CH 03	2.422	15.5	35.5	5	11.1	3.0

2. Base on the result of note1, RF exposure evaluation of 802.11 b mode is required.
3. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
4. Per KDB 248227 D01v02r02, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements.SAR is not required for the following 2.4 GHz OFDM conditions:
   1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
   2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
5. The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all mode were shown in report.
6. 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.

13.4 Bluetooth Conducted Power

Average Power (dBm)				
Channel	Frequency (MHz)	GFSK	π/4-DQPSK	8DPSK
CH 00	2402	5.22	4.37	4.69
CH 39	2441	**5.29**	4.59	4.82
CH 78	2480	4.57	3.76	4.11

Average Power (dBm)		
Channel	Frequency (MHz)	BLE
CH 00	2402	5.26
CH 20	2442	5.29
CH 39	2480	4.60

Note:

1. Per KDB 447498 D01v06, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/ (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for1-g SAR, where
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Channel	Frequency (GHz)	Max. tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Result	exclusion thresholds for 1-g SAR
CH 39	2.441	5.5	3.5	5	1.1	3.0

2. The max. tune-uppower wasprovided by manufacturer,base on the result of note 1, RF exposure evaluation 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. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according is applied to determine SAR test exclusion.

14 Exposure Positions Consideration

14.1 EUT Antenna Locations

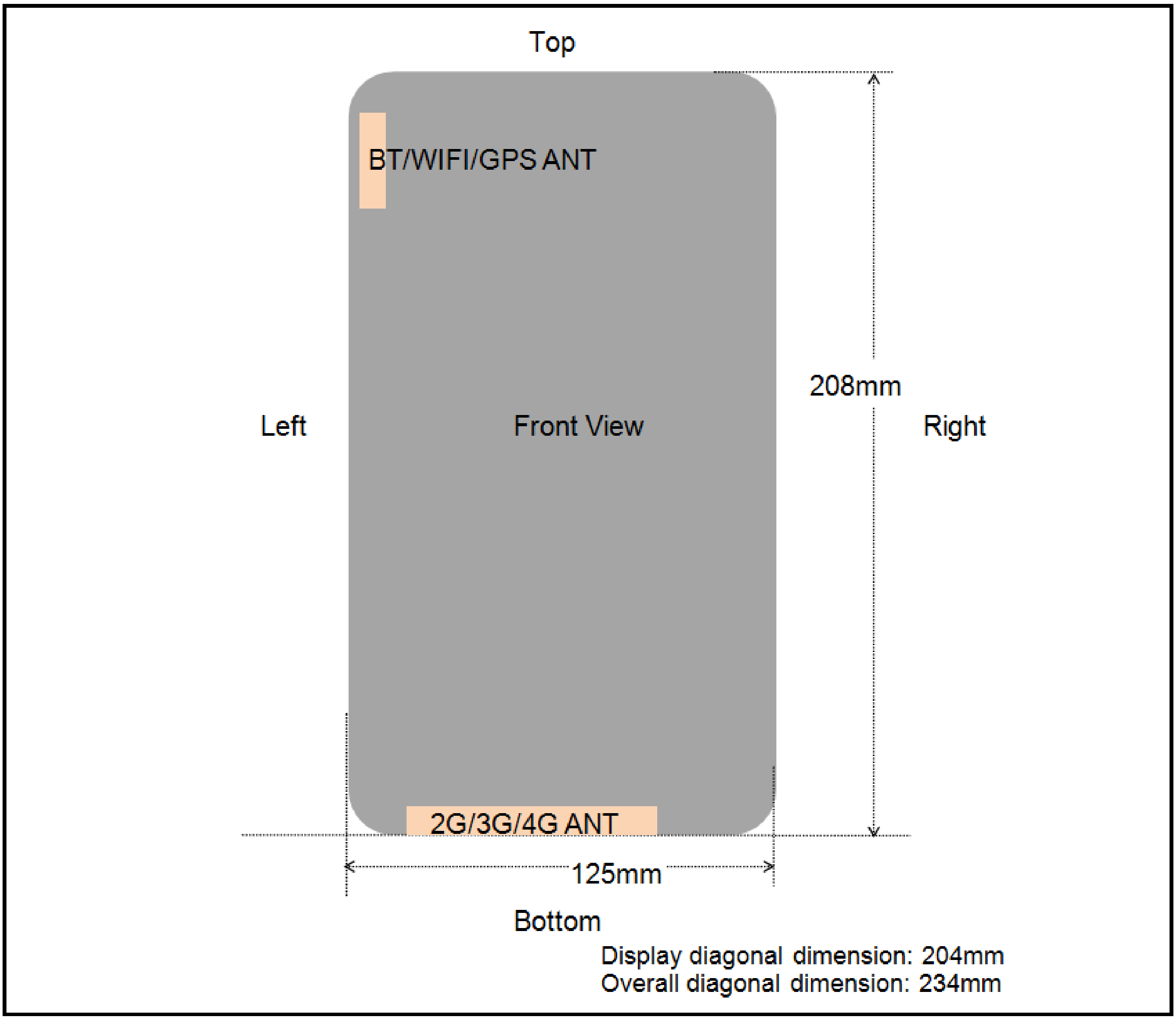


Fig.14.1 EUT Antenna Locations

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.

14.2 Test Positions Consideration

SAR exclusion calculations for antenna < 50mm from the user														
Antennas	Freq. (MHz)	Max. tune-up Power		Distance of Antennas to EUT edge/surface (mm)					Calculated Threshold Value (≦3.0 SAR is not required)					
		dBm	mW	Back	Top	Bott.	Right	Left	Back	Top	Bott.	Right	Left
WCDMA 850	836.6	23.0	199.5	5	198	5	34	20	36.3	>50mm	36.3	5.3	9.1
WCDMA 1700	1732.6	22.5	177.8	5	198	5	34	20	46.9	>50mm	46.9	6.9	11.7
WCDMA 1900	1852.4	22.5	177.8	5	198	5	34	20	48.4	>50mm	48.4	7.1	12.1
LTE Band 4	1732.5	23.0	199.5	5	198	5	34	20	52.7	>50mm	52.7	7.7	13.2
LTE Band 12	704	23.0	199.5	5	198	5	34	20	33.5	>50mm	33.5	4.9	8.4
LTE Band 17	711	23.0	199.5	5	198	5	34	20	33.5	>50mm	33.5	4.9	8.4
802.11b	2437	13.5	22.4	5	5	182	114	5	7.0	7.0	>50mm	>50mm	7.0
802.11n	2422	15.5	35.5	5	5	182	114	5	11.1	11.1	>50mm	>50mm	11.1
Bluetooth	2441	5.5	3.5	5	5	182	114	5	1.1	1.1	>50mm	>50mm	1.1

SAR exclusion calculations for antenna > 50mm from the user													
Antennas	Freq. (MHz)	Max. tune-up Power		Distance of Antennas to EUT edge/surface (mm)					Calculated Threshold Value (SAR test exclusion power,mW)				
		dBm	mW	Back	Top	Bott.	Right	Left	Back	Top	Bott.	Right	Left
WCDMA 850	836.6	23.0	199.5	5	198	5	34	20	/	990.3	/	/	/
WCDMA 1700	1732.6	22.5	177.8	5	198	5	34	20	/	1593.6	/	/	/
WCDMA 1900	1852.4	22.5	177.8	5	198	5	34	20	/	1590.3	/	/	/
LTE Band 4	1732.5	23.0	199.5	5	198	5	34	20	/	1593.6	/	/	/
LTE Band 12	704	23.0	199.5	5	198	5	34	20	/	873.2	/	/	/
LTE Band 17	711	23.0	199.5	5	198	5	34	20	/	880.1	/	/	/
802.11b	2437	13.5	22.4	5	5	182	114	5	/	/	1416.2	736.2	/
802.11n	2422	15.5	35.5	5	5	182	114	5	/	/	1416.2	736.2	/
Bluetooth	2441	5.5	3.5	5	5	182	114	5	/	/	1416.2	736.2	/

Test Positions					
Antennas	Back	Top Side	Bottom Side	Right Side	LeftSide
WCDMA 850	Yes	No	Yes	Yes	Yes
WCDMA 1700	Yes	No	Yes	Yes	Yes
WCDMA 1900	Yes	No	Yes	Yes	Yes
LTE Band 4	Yes	No	Yes	Yes	Yes
LTE Band 12	Yes	No	Yes	Yes	Yes
LTE Band 17	Yes	No	Yes	Yes	Yes
802.11b	Yes	Yes	No	No	Yes
802.11g	Yes	Yes	No	No	Yes
Bluetooth	Yes	Yes	No	No	Yes

Note:

1. Referring to KDB 616217 D04v01r02, when the overall diagonal dimension ofdisplayis > 20 cm, the test distance is 0 mm;the SAR Test Exclusion Threshold in KDB 447498 section 4.3.1 can beapplied to determine SAR test exclusion for adjacent edge configurations.
2. The frame-average power was used for the SAR Test Exclusion Threshold calculated for GSM mode.
3. Per KDB 616217 D04v01r02, SAR evaluation for the front surface of tablet display screens isgenerally not necessary.
4. Per KDB 616217 D04v01r02, additional testing for hotspot SAR is not required.
5. Per KDB 616217 D04v01r02, when thereported SAR with the protrusions in place is > 1.2 W/kg, a KDB inquiry is required to determine ifadditional SAR measurements in more conservative test configurations are necessary

15 SAR Test Results Summary

15.1 Standalone Body SAR

➢ WCDMA 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	Band V/RMC	Back	4183	836.6	22.72	-0.07	23.0	**0.714**	1.067	0.762
	Band V/RMC	Left	4183	836.6	22.72	-1.37	23.0	0.213	1.067	0.227
	Band V/RMC	Right	4183	836.6	22.72	1.88	23.0	0.089	1.067	0.095
	Band V/RMC	Bottom	4183	836.6	22.72	-3.81	23.0	0.539	1.067	0.575
2	Band IV/RMC	Back	1413	1732.6	22.10	-2.61	22.5	**0.633**	1.096	0.694
	Band IV/RMC	Left	1413	1732.6	22.10	1.86	22.5	0.197	1.096	0.216
	Band IV/RMC	Right	1413	1732.6	22.10	0.59	22.5	0.066	1.096	0.072
	Band IV/RMC	Bottom	1413	1732.6	22.10	-0.98	22.5	0.284	1.096	0.311
3	Band II/RMC	Back	9262	1852.4	22.23	-2.33	22.5	**0.684**	1.064	0.728
	Band II/RMC	Left	9262	1852.4	22.23	0.98	22.5	0.223	1.064	0.237
	Band II/RMC	Right	9262	1852.4	22.23	1.28	22.5	0.092	1.064	0.098
	Band II/RMC	Bottom	9262	1852.4	22.23	0.74	22.5	0.176	1.064	0.187
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)
4	Band4/1RB#49	Back	20175	1732.5	22.09	-0.57	23.0	**0.637**	1.233	0.785
	Band4/1RB#49	Left	20175	1732.5	22.09	-0.27	23.0	0.207	1.233	0.255
	Band4/1RB#49	Right	20175	1732.5	22.09	-1.89	23.0	0.103	1.233	0.127
	Band4/1RB#49	Bottom	20175	1732.5	22.09	-0.38	23.0	0.301	1.233	0.371
	Band4/50%RB#24	Back	20300	1745	21.10	-0.03	21.5	0.523	1.096	0.573
	Band4/50%RB#24	Left	20300	1745	21.10	-1.57	21.5	0.154	1.096	0.169
	Band4/50%RB#24	Right	20300	1745	21.10	-0.65	21.5	0.067	1.096	0.073
	Band4/50%RB#24	Bottom	20300	1745	21.10	0.68	21.5	0.216	1.096	0.237
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#24	Back	23060	704	22.76	0.07	23.0	**0.630**	1.057	0.666
	Band12/1RB#24	Left	23060	704	22.76	-0.09	23.0	0.218	1.057	0.230
	Band12/1RB#24	Right	23060	704	22.76	-0.02	23.0	0.088	1.057	0.093
	Band12/1RB#24	Bottom	23060	704	22.76	-0.74	23.0	0.382	1.057	0.404
	Band12/50%RB#0	Back	23060	704	21.70	0.20	22.0	0.516	1.072	0.553
	Band12/50%RB#0	Left	23060	704	21.70	1.59	22.0	0.147	1.072	0.158
	Band12/50%RB#0	Right	23060	704	21.70	0.52	22.0	0.075	1.072	0.080
	Band12/50%RB#0	Bottom	23060	704	21.70	-0.90	22.0	0.302	1.072	0.324
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**1.6 W/kg (mW/g) Averaged over 1g**				

➢ FDD-LTE Band 17(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	Band17/1RB#24	Back	23800	711	22.85	-1.48	23.0	**0.605**	1.035	0.626
	Band17/1RB#24	Left	23800	711	22.85	-1.58	23.0	0.189	1.035	0.196
	Band17/1RB#24	Right	23800	711	22.85	-1.07	23.0	0.059	1.035	0.061
	Band17/1RB#24	Bottom	23800	711	22.85	-0.94	23.0	0.368	1.035	0.381
	Band17/50%RB#0	Back	23800	711	21.62	-0.02	22.0	0.497	1.091	0.542
	Band17/50%RB#0	Left	23800	711	21.62	-0.27	22.0	0.144	1.091	0.157
	Band17/50%RB#0	Right	23800	711	21.62	0.22	22.0	0.038	1.091	0.041
	Band17/50%RB#0	Bottom	23800	711	21.62	-1.48	22.0	0.299	1.091	0.326
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ WLAN 2.4GHz 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	2.4GHz/802.11b	Back	6	2437	13.40	-0.49	13.5	**0.688**	1.023	1.000	0.704
	2.4GHz/802.11b	Left	6	2437	13.40	0.26	13.5	0.421	1.023	1.000	0.431
	2.4GHz/802.11b	Top	6	2437	13.40	0.11	13.5	0.508	1.023	1.000	0.520
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 mustbe 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 evaluationcan 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 connectedto 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 toKDB 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.
10. Per KDB248227 D01v02r02, OFDM SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg. Cuz the maximum output power specified for OFDM and DSSS are 35.48mW(15.5dBm) and 25.12mW(14.0dBm), the scaled SAR would be 0.704×(35.48/25.12)=0.994W/Kg<1.2 W/kg, therefore, SAR is not required for OFDM.

15.2 Multi-Band Simultaneous Transmission Considerations

➢ **Simultaneous Transmission Capabilities**

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

Path 1	Path 2
GSM/WCDMA/LTE	Bluetooth/WLAN

Fig.15.1 Simultaneous Transmission Paths

➢ **Simultaneous Transmission Procedures**

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmissionanalysis is required. Per FCC KDB 447498 D01v06, simultaneous transmission SAR testexclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas ina specific a physical test configuration is ≤1.6 W/kg. When standalone SAR is not required to bemeasured, per FCC KDB 447498 D01v06 4.3.2), the following equation must be used to estimate thestandalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$\text{Estimated SAR} = \frac{\sqrt{f(GHz)}}{7.5} \cdot \frac{\text{Max. power of channel, mW}}{\text{Min. Separation Distance, mm}}$$

Mode	Max. tune-up Power (dBm)	Exposure Position	Body
		Test Distance (mm)	5
Bluetooth	5.5	Estimated SAR (W/kg)	0.148

Note:

1. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according is applied to determine estimated SAR.

➢ **Multi-Band simultaneous Transmission Consideration**

Simultaneous Transmission Consideration	Position	Applicable Combination
	Body	WWAN + WLAN 2.4 GHz
		WWAN + Bluetooth

Note:

1. WLAN 2.4GHz Band and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. GSM/WCDMA/LTE shares the same antenna, and cannot transmit simultaneously.
3. The Report SAR summation is calculated based on the same configuration and test position.
4. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i. Scalar SAR summation < 1.6W/kg.
   ii. SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*), and the peak separation distance is determinedfrom 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 theextrapolated peak SAR locations in the zoom scanIf SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary
   iii. Simultaneously transmission SAR measurement, and the Reported multi-band SAR < 1.6W/kg

15.3 SAR Simultaneous Transmission Analysis

➢ **Body mode Simultaneous Transmission**

Position		Standalone SAR(W/kg)			Σ SAR_{1g}(W/kg)	
		1	2	4	1+2	1+3
		WWAN	2.4G WLAN	BT		
Body	Back	0.785	0.704	0.148	**1.489**	0.933
	Left	0.255	0.431	0.148	0.686	0.403
	Right	0.127	/	0.148	0.127	0.275
	Top	/	0.520	0.148	0.520	0.148
	Bottom	0.575	/	0.148	0.575	0.723

➢ **Simultaneous Transmission Conclusion**

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

15.4 Measurement Uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHzv01r04, 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 andRegulations”

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

[3]. IEEE Std. 1528-2013, “Recommended Practice for Determining the Peak Spatial-AverageSpecific 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 D05v02r05, “SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES”, Dec 2015

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

[11]. FCC KDB 865664 D01 v01r04, “SAR MEASUREMENT REQUIREMENTS FOR 100 MHz TO 6 GHz”, August2015

Appendix A: Plots of SAR System Check

System check at 750 MHz

Date of measurement: 1/4/2022

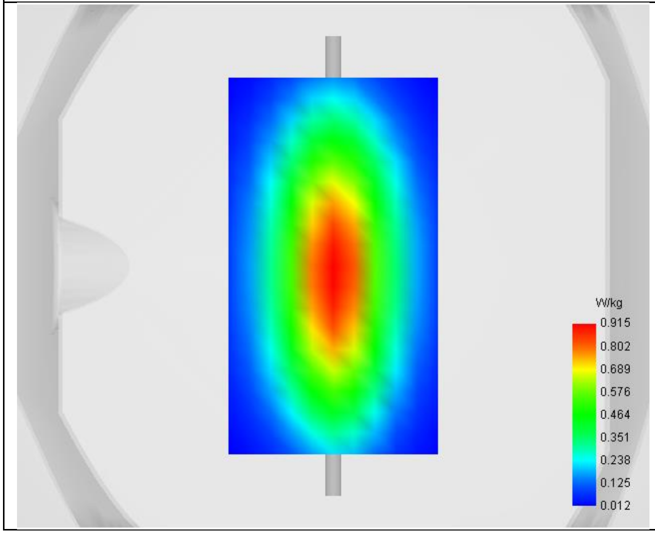
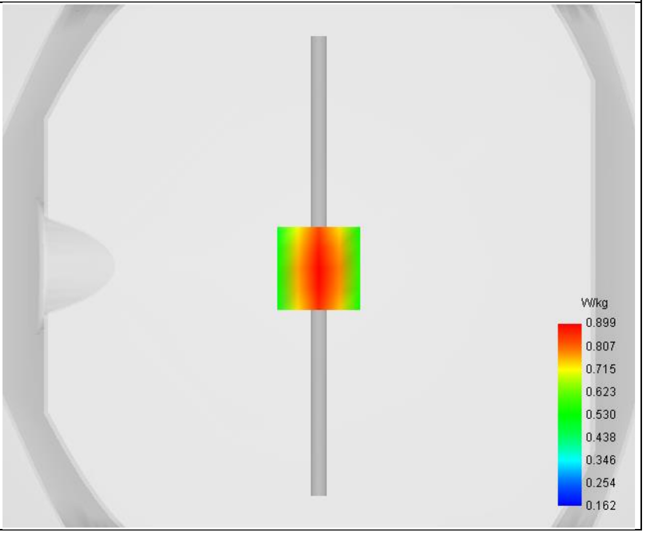
A. Experimental conditions.

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 permitivity (real part)	41.680918
Conductivity (S/m)	0.902862

C. SAR Surface and Volume

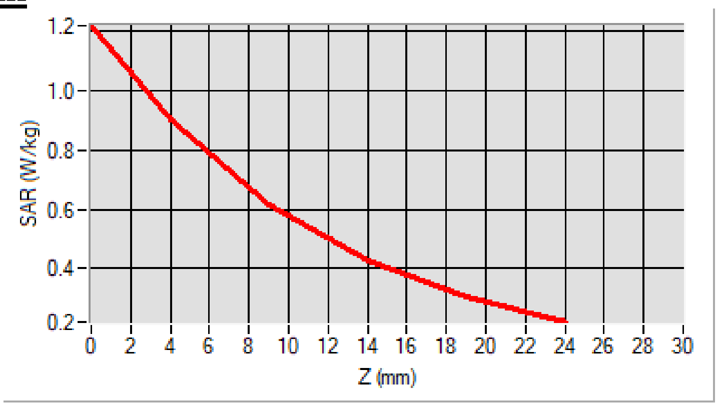
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00; SAR Peak: 1.19 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.566233
SAR 1g (W/Kg)	0.862886
Variation (%)	-2.210000

E. Z Axis Scan



System check at 835 MHz

Date of measurement: 1/4/2022

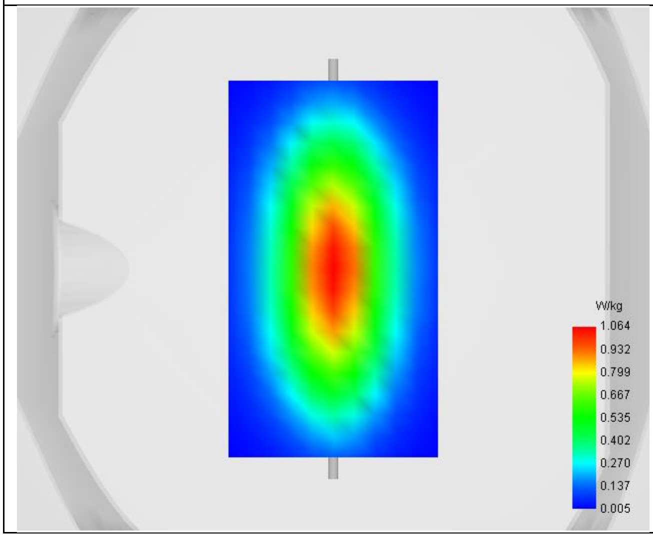
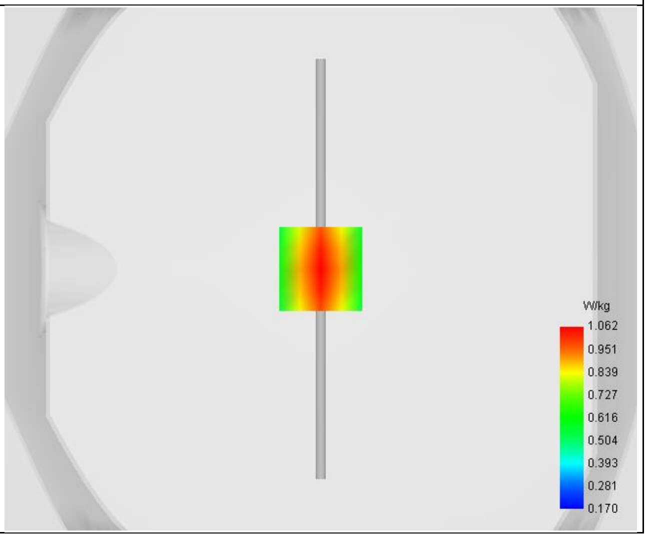
A. Experimental conditions.

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)	41.661423
Conductivity (S/m)	0.931235

C. SAR Surface and Volume

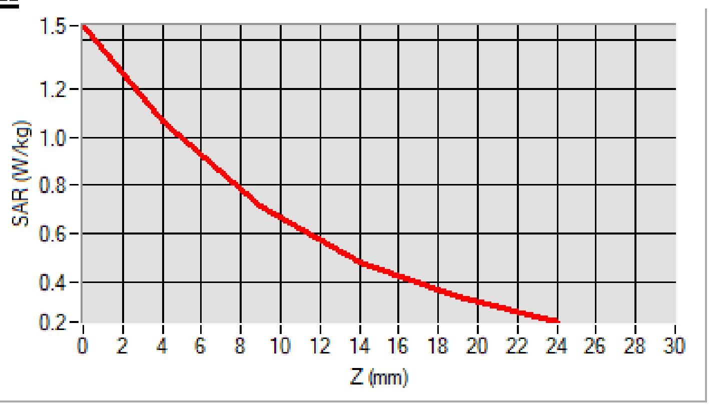
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00; SAR Peak: 1.48 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.621221
SAR 1g (W/Kg)	0.956123
Variation (%)	0.150000

E. Z Axis Scan



System check at 1750 MHz

Date of measurement: 3/4/2022

A. Experimental conditions.

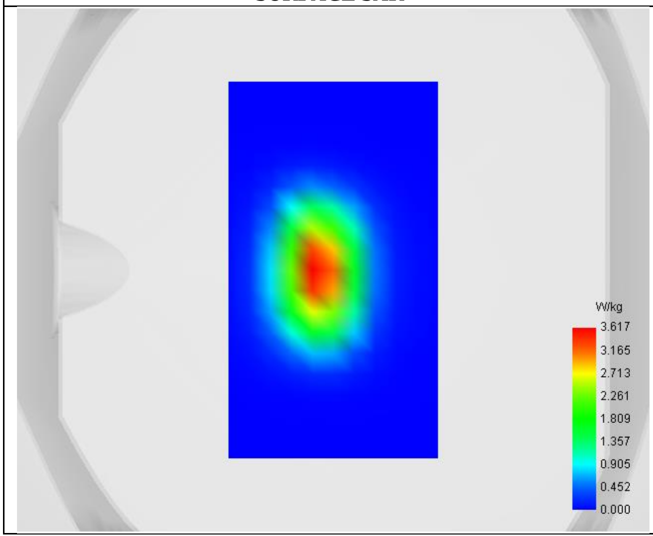
Probe	SN 18/21 EPGO354
ConvF	2.07
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW1750
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

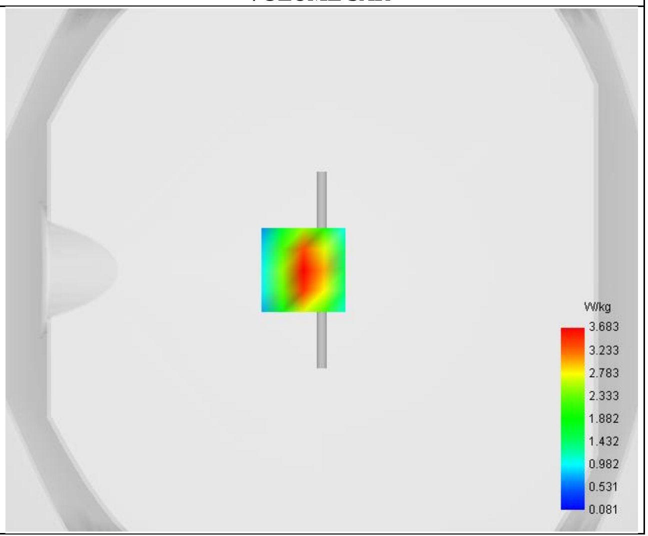
Frequency (MHz)	1750.000000
Relative permitivity (real part)	41.182617
Conductivity (S/m)	1.322862

C. SAR Surface and Volume

SURFACE SAR



VOLUME SAR

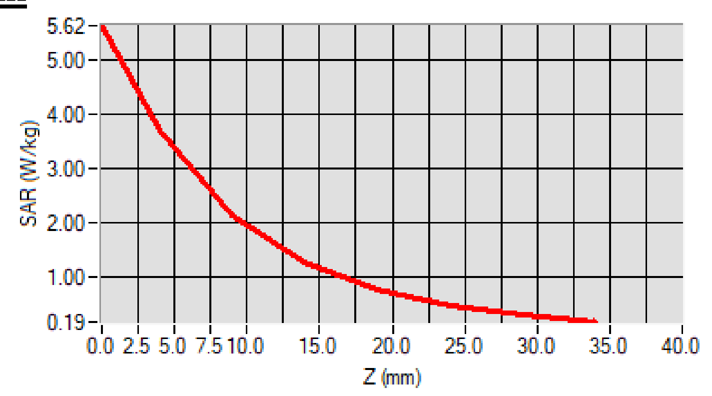


Maximum location: X=-7.00, Y=0.00; SAR Peak: 5.79 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	1.826024
SAR 1g (W/Kg)	3.562231
Variation (%)	-1.820000

E. Z Axis Scan



System check at 1900 MHz

Date of measurement: 3/4/2022

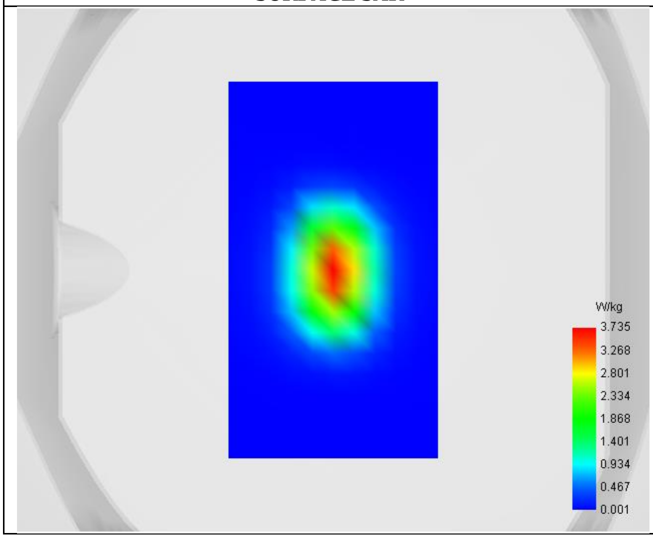
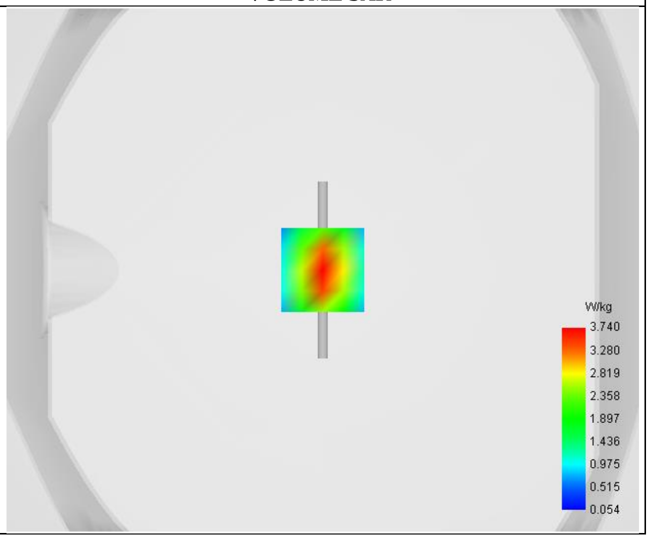
A. Experimental conditions.

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)	39.811286
Conductivity (S/m)	1.391623

C. SAR Surface and Volume

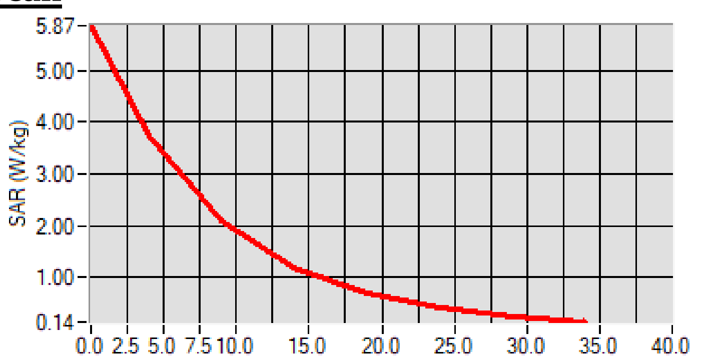
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00; SAR Peak: 5.86 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	2.012271
SAR 1g (W/Kg)	3.872358
Variation (%)	-0.720000

E. Z Axis Scan



System check at 2450 MHz

Date of measurement: 6/4/2022

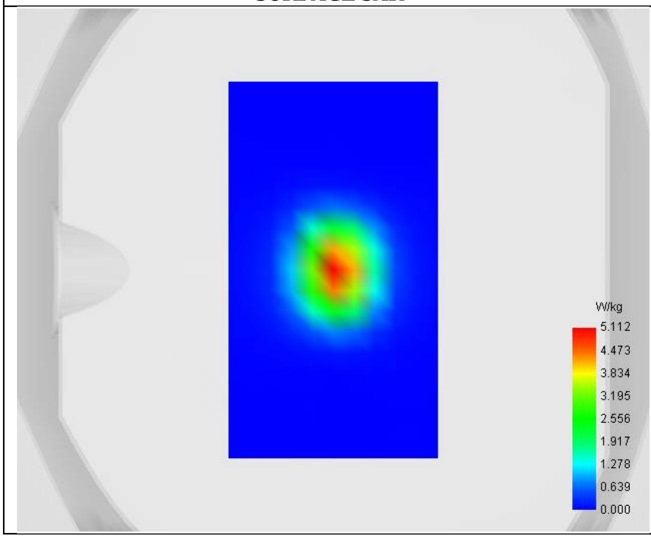
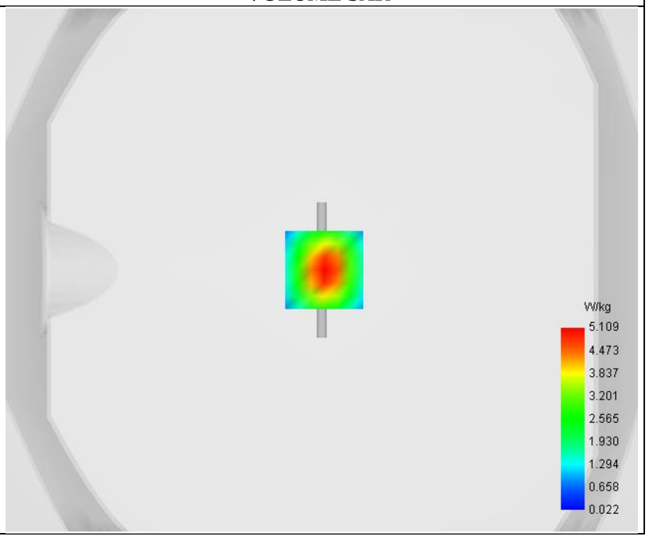
A. Experimental conditions.

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 permittivity (real part)	39.502435
Conductivity (S/m)	1.852162

C. SAR Surface and Volume

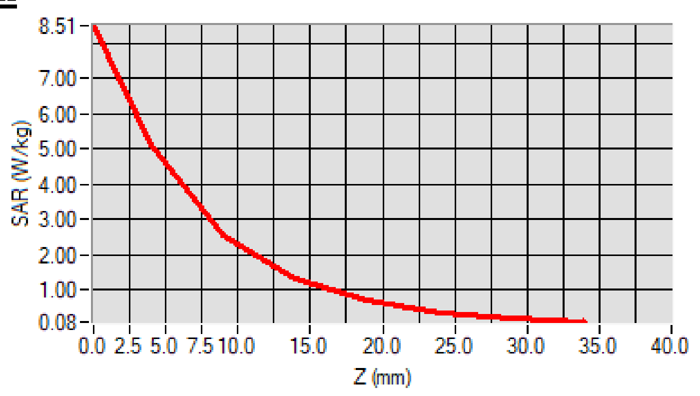
SURFACE SAR	VOLUME SAR
	

Maximum location: X=1.00, Y=0.00; SAR Peak: 8.43 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	2.382123
SAR 1g (W/Kg)	5.412034
Variation (%)	-1.110000

E. Z Axis Scan



Appendix B: Plots of SAR Test Data

SAR Measurement at Band5_WCDMA850 (Body, Validation Plane)

Date of measurement: 1/4/2022

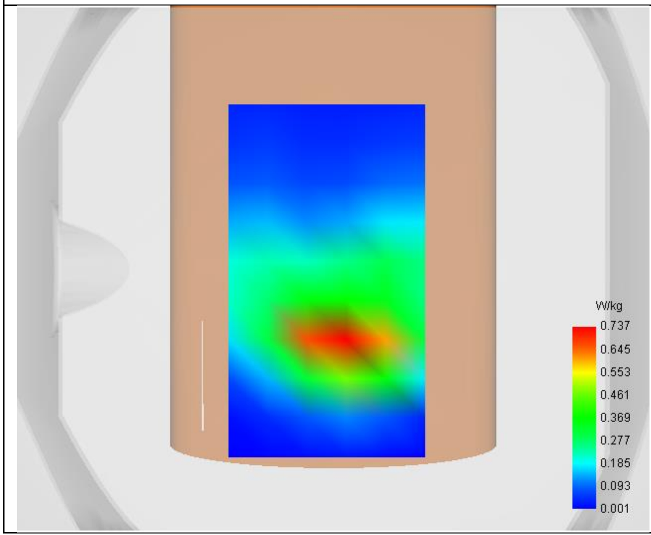
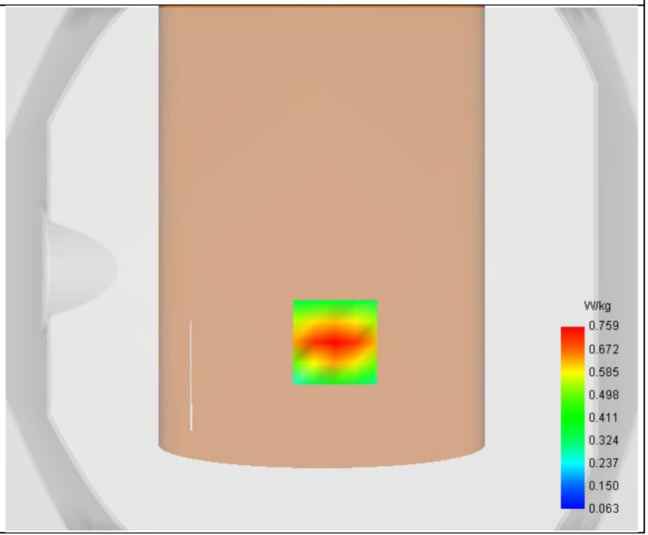
A. Experimental conditions.

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	Body
Band	Band5_WCDMA850
Channels	Middle
Signal	WCDMA (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	836.599976
Relative permitivity (real part)	41.670000
Conductivity (S/m)	0.901610

C. SAR Surface and Volume

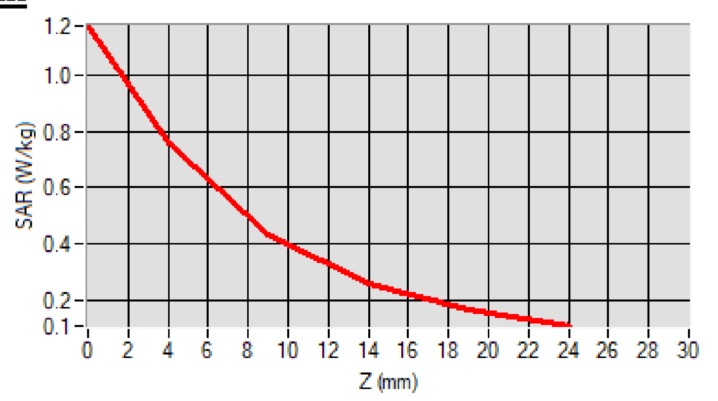
SURFACE SAR	VOLUME SAR
	

Maximum location: X=5.00, Y=-28.00 ; SAR Peak: 1.17 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.408918
SAR 1g (W/Kg)	0.713500
Variation (%)	-0.070000

E. Z Axis Scan



SAR Measurement at Band4_WCDMA1700 (Body, Validation Plane)

Date of measurement: 3/4/2022

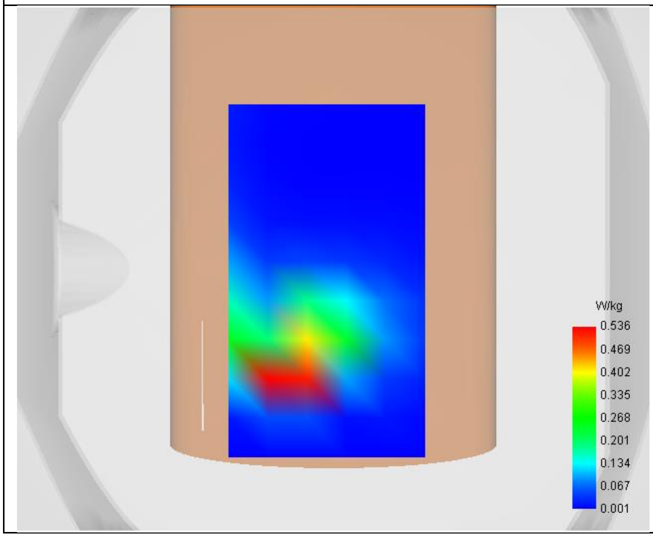
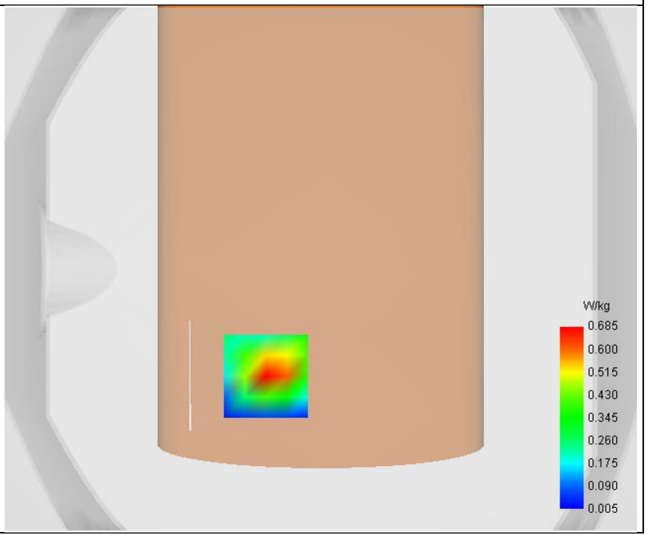
A. Experimental conditions.

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	Body
Band	Band4_WCDMA1700
Channels	Middle
Signal	WCDMA (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1732.599976
Relative permitivity (real part)	40.175818
Conductivity (S/m)	1.330156

C. SAR Surface and Volume

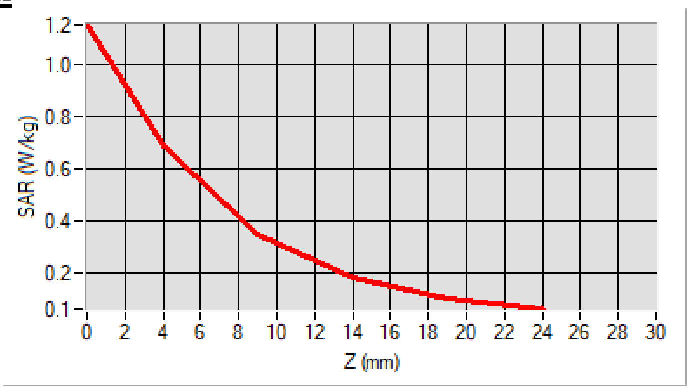
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-21.00, Y=-41.00 ; SAR Peak: 1.18 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.297372
SAR 1g (W/Kg)	0.632890
Variation (%)	-2.610000

E. Z Axis Scan



SAR Measurement at Band2_WCDMA1900 (Body, Validation Plane)

Date of measurement: 3/4/2022

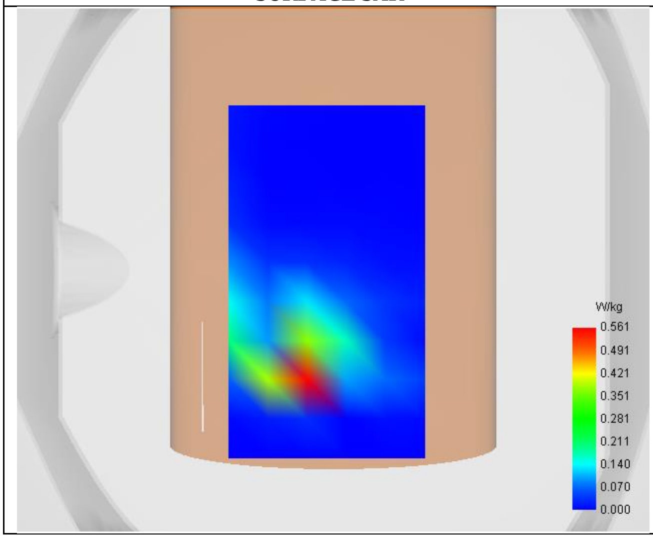
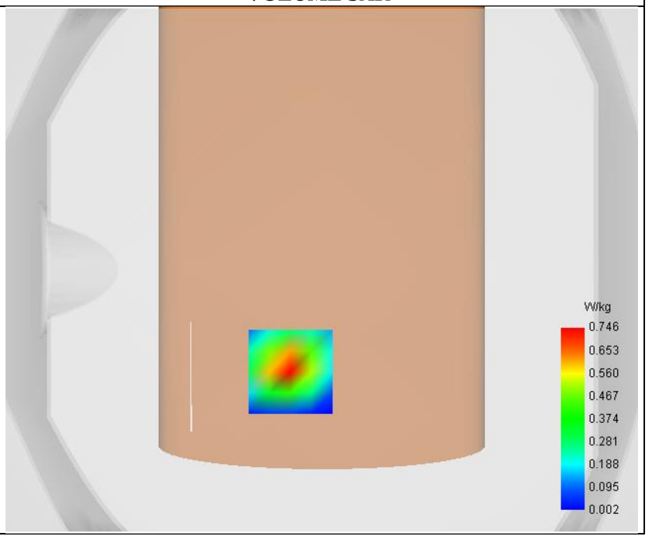
A. Experimental conditions.

Probe	SN 18/21 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	Body
Band	Band2_WCDMA1900
Channels	Low
Signal	WCDMA (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1852.400000
Relative permitivity (real part)	39.800000
Conductivity (S/m)	1.400211

C. SAR Surface and Volume

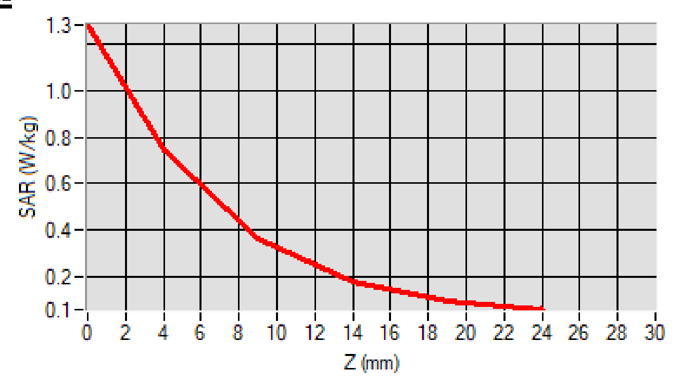
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-12.00, Y=-39.00 ; SAR Peak: 1.31 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.304166
SAR 1g (W/Kg)	0.683547
Variation (%)	-2.330000

E. Z Axis Scan



SAR Measurement at LTE band 4 (Body, Validation Plane)

Date of measurement: 3/4/2022

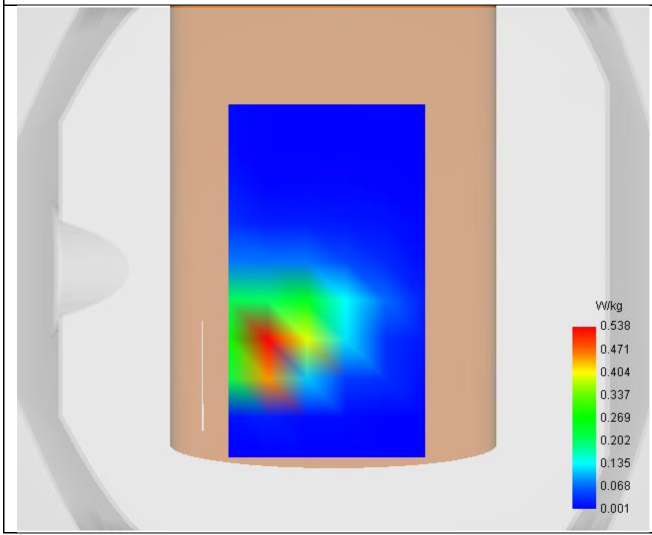
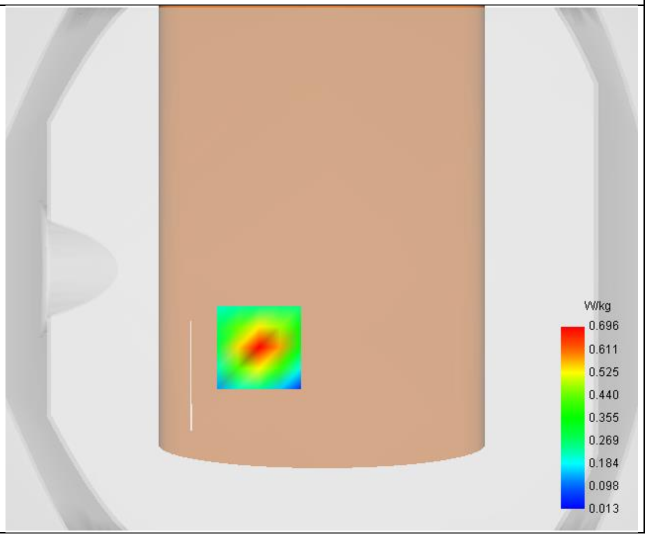
A. Experimental conditions.

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	Body
Band	LTE band 4
Channels	Middle
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1732.500000
Relative permitivity (real part)	41.145910
Conductivity (S/m)	1.310003

C. SAR Surface and Volume

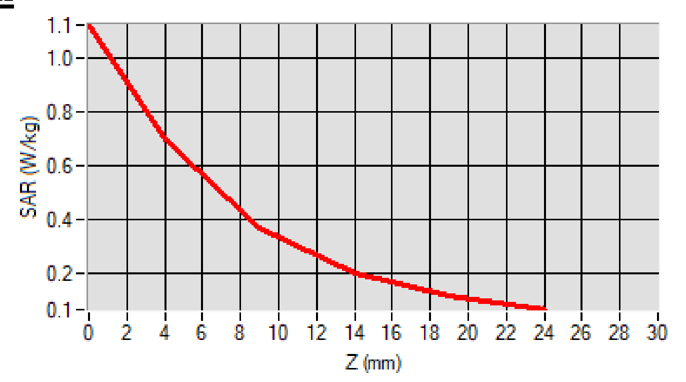
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-24.00, Y=-30.00 ; SAR Peak: 1.12 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.318509
SAR 1g (W/Kg)	0.636682
Variation (%)	-0.570000

E. Z Axis Scan



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

Date of measurement: 1/4/2022

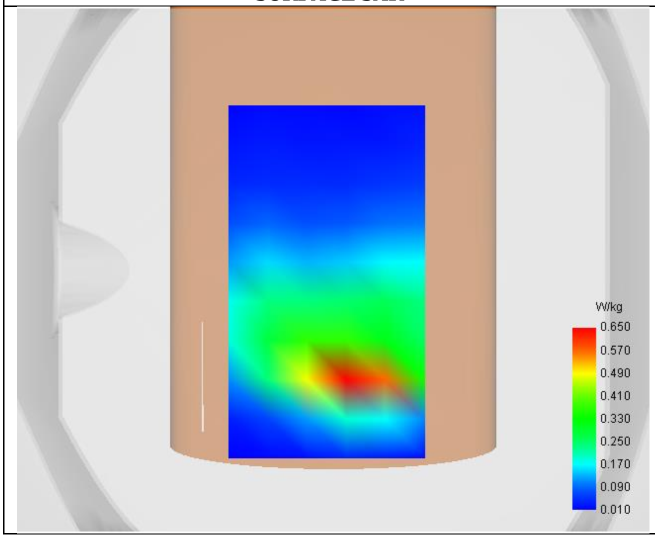
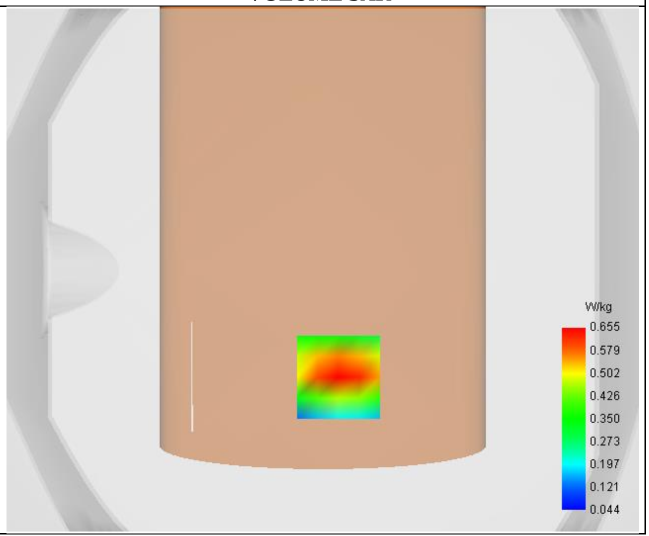
A. Experimental conditions.

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	Body
Band	LTE band 12
Channels	Low
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	704.000000
Relative permitivity (real part)	42.110667
Conductivity (S/m)	0.914204

C. SAR Surface and Volume

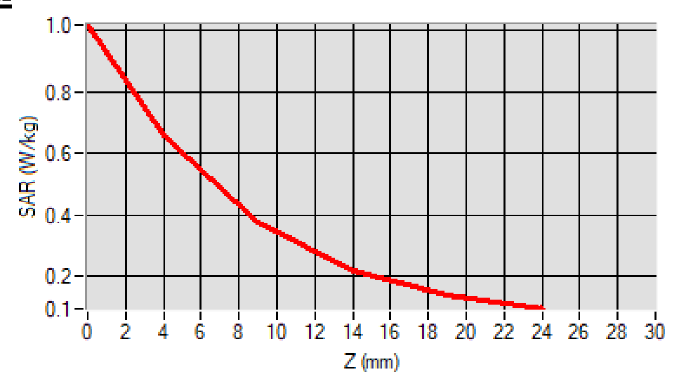
SURFACE SAR	VOLUME SAR
	

Maximum location: X=6.00, Y=-41.00 ; SAR Peak: 1.03 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.355356
SAR 1g (W/Kg)	0.629883
Variation (%)	0.070000

E. Z Axis Scan



SAR Measurement at LTE band 17 (Body, Validation Plane)

Date of measurement: 1/4/2022

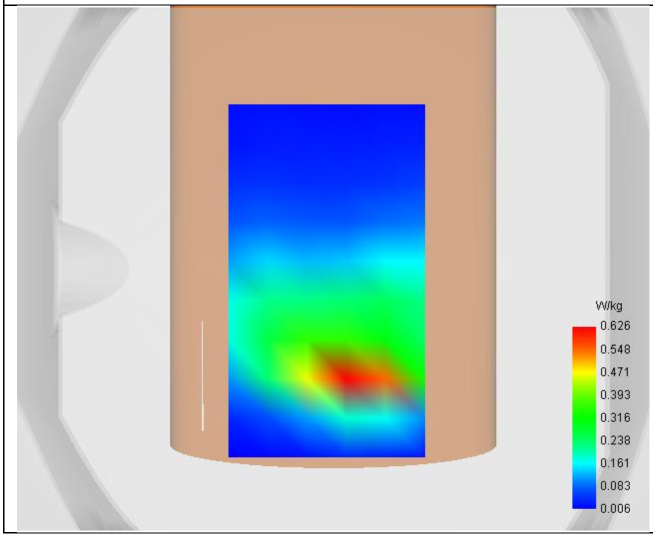
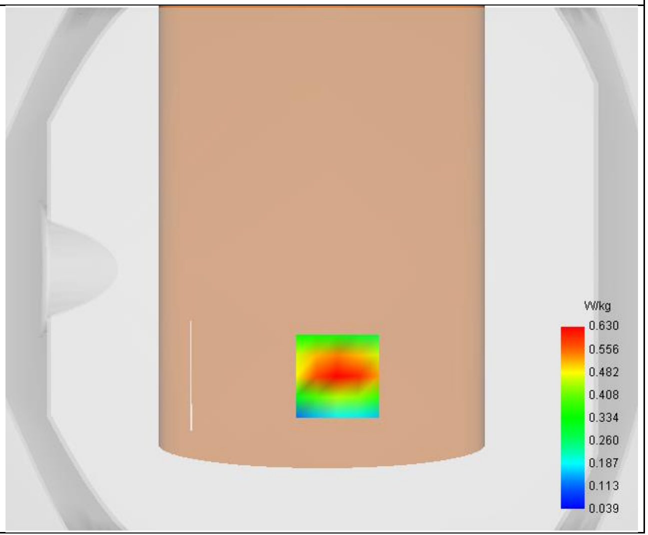
A. Experimental conditions.

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	Body
Band	LTE band 17
Channels	High
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	711.000000
Relative permittivity (real part)	42.111335
Conductivity (S/m)	0.910218

C. SAR Surface and Volume

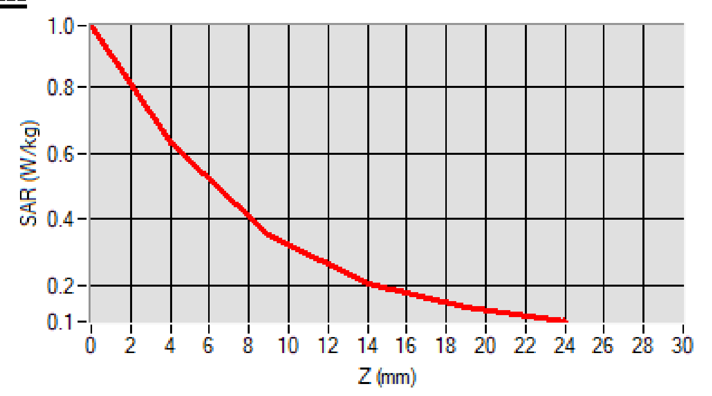
SURFACE SAR	VOLUME SAR
	

Maximum location: X=6.00, Y=-41.00 ; SAR Peak: 1.00 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.339436
SAR 1g (W/Kg)	0.604551
Variation (%)	-1.480000

E. Z Axis Scan



SAR Measurement at IEEE 802.11b ISM (Body, Validation Plane)

Date of measurement: 6/4/2022

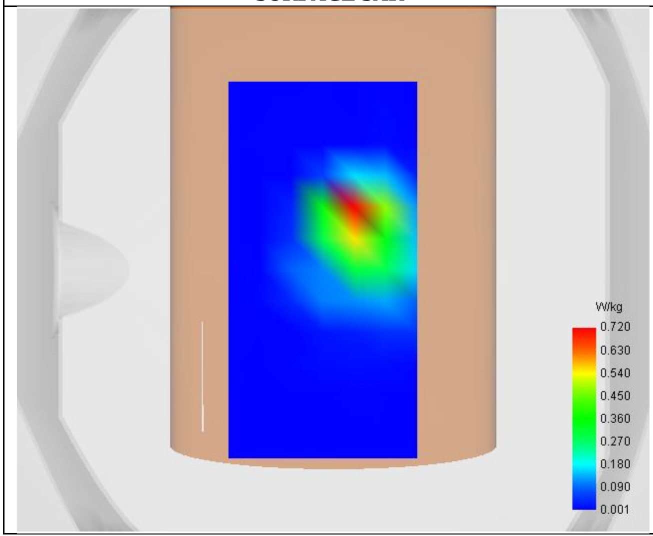
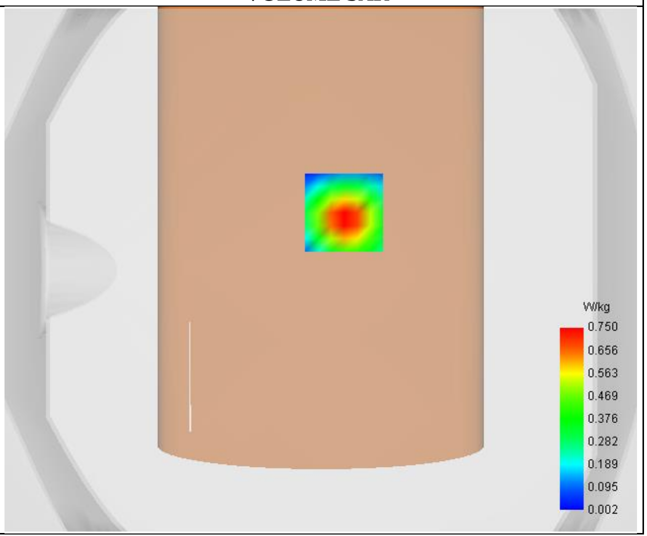
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	2.23
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	Middle
Signal	IEEE802.b (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2437.000000
Relative permitivity (real part)	39.424002
Conductivity (S/m)	1.828081

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR
	

Maximum location: X=9.00, Y=22.00 ; SAR Peak: 1.31 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.316065
SAR 1g (W/Kg)	0.687608
Variation (%)	-0.490000

E. Z Axis Scan