JianYan Testing Group Shenzhen Co., Ltd.

Report No: JYTSZB-R14-2100236

FCC SAR REPORT

Applicant:	Smartmatic International Corporation
Address of Applicant:	Pine Lodge, #26 Pine Road St. Michael, W.I. BB Barbados
Equipment Under Test (EUT)	
Product Name:	Voter Identification Unit
Model No.:	VIU-500 Model 700
Trade mark	SMARTMATIC
FCC ID:	2AGVK-VIU-500A70
Applicable standards:	FCC 47 CFR Part 2.1093
Date of Test:	08 Oct., 2021 ~ 20 Oct., 2021
Test Result:	Maximum Reported 1-g SAR (W/kg) Body: 0.991

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 the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	*26 Oct., 2021*	*Original*

Tested by:	Vieta Zhang ***Test Engineer***	***Date:***	*26 Oct., 2021*
Reviewed by:	Wiby Zhang ***Project Engineer***	***Date:***	*26 Oct., 2021*

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	0.991	PCB	0.991
	GSM 1900	0.907		
	WCDMA Band V	0.382		
	WCDMA Band II	0.780		
	LTE Band 2	0.939		
	LTE Band 4	0.286		
	LTE Band 5	0.370		
	LTE Band 7	0.790		
	WLAN 2.4GHz	0.456	DTS	
	WLAN 5.2 GHz	0.547	NII	

<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)
Body/Right	GPRS 850 4Slot	0.991	PCB	1.538
	WLAN 5.2 GHz	0.547	NII	

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:	Smartmatic International Corporation
Address of Applicant:	Pine Lodge, #26 Pine Road St. Michael, W.I. BB Barbados
Manufacturer:	Aratek Biometrics Co., Ltd.
Address of Manufacturer:	2F, T2-A Building, ShenZhen Software Park, South Area, Hi-Tech Park, Shenzhen, Guangdong, China

5.2 General Description of EUT

Product Name:	Voter Identification Unit			
Model No.:	VIU-500 Model 700			
Category of device	Portable device			
Operation Frequency:	2G :	GSM850: 824.2~848.8 MHz	PCS 1900: 1850.2~1909.8 MHz	
	3G :	Band II: 1852.4~1907.6 MHz	Band V: 826.4~846.6 MHz	
	4G :	Band 2 :1850MHz~1910MHz	Band 4 :1710MHz~1755MHz	
		Band 5 :824MHz~849MHz	Band 7: 2500MHz~2570MHz	
	Wi-Fi:	2412MHz~2462MHz	5150MHz-5250MHz	
	Bluetooth: 2402 MHz ~ 2480 MHz			
Modulation technology:	2G:	☒Voice(GMSK)	☒GPRS(GMSK)	☒EGPRS(GMSK, 8PSK)
	3G:	☒RCM(QPSK)	☒HSUPA(QPSK)	☒HSDPA(QPSK,16QAM)
	4G:	☒QPSK	☒16QAM	☒64QAM
	Wi-Fi:	☒802.11b(DSSS)	☒802.11a/g/n/ac (OFDM)	
	Bluetooth:	☒BDR(GFSK)	☒EDR(π/4-DQPSK, 8DPSK)	☒LE(GFSK)
Antenna Type:	Internal Antenna			
(E)GPRS Class:	(E)GPRS Class: 12			
Dimensions (L*W*H):	701 mm (L)× 82 mm (W)× 44 mm (H)			
Accessories information:	Adapter: Model: ES568U050200XYF Input:100-240V AC,50/60Hz 0.15A Output:5.0V DC 2000mA	Battery: Rechargeable Li-ion Battery 3.7V/10000mAh		
		Headset: Support headset		

5.3 Maximum RF Output Power

Mode	Average Power (dBm)	
	GSM 850	GSM 1900
GSM (Voice)	32.53	29.63
GPRS (1 TX Slot)	32.51	29.57
GPRS (2 TX Slots)	31.98	29.10
GPRS (3 TX Slots)	30.44	27.84
GPRS (4 TX Slots)	29.27	27.08

Mode	Average Power (dBm)	
	WCDMA Band V	WCDMA Band II
AMR 12.2 kbps	25.89	23.53
RMC 12.2 kbps	25.92	23.60
HSDPA Sub-test 1	24.96	22.40
HSDPA Sub-test 2	24.58	22.07
HSDPA Sub-test 3	24.52	21.91
HSDPA Sub-test 4	24.48	21.78
HSUPA Sub-test 1	22.95	20.51
HSUPA Sub-test 2	23.48	20.89
HSUPA Sub-test 3	23.98	21.36
HSUPA Sub-test 4	23.01	20.47
HSUPA Sub-test 5	24.95	22.37

Mode	Average Power (dBm)			
	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7
BW/1.4 MHz	24.61	24.14	24.17	/
BW/3.0 MHz	24.33	24.02	24.11	/
BW/5.0 MHz	24.45	24.09	24.25	22.90
BW/10 MHz	24.27	23.87	24.14	22.05
BW/15 MHz	24.23	23.70	/	22.15
BW/20 MHz	24.33	23.76	/	22.29

WLAN 2.4 GHz Band Average Power (dBm)				
Mode/Band	b	g	n (HT-20)	n (HT-40)
WLAN 2.4GHz	12.92	10.01	9.98	9.53

WLAN 5.2 GHz Band Average Power (dBm)					
Mode/Band	a	ac 20	ac 40	n 20	n 40
WLAN 5.2GHz	11.68	11.74	11.49	11.63	12.06

Bluetooth Average Power (dBm)				
Mode/Band	1 Mbps(GFSK)	2 Mbps(π/4DQPSK)	3 Mbps (8DPSK)	LE (BT 4.0)
Bluetooth	3.757	4.420	4.846	0.716

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
3#	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,
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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

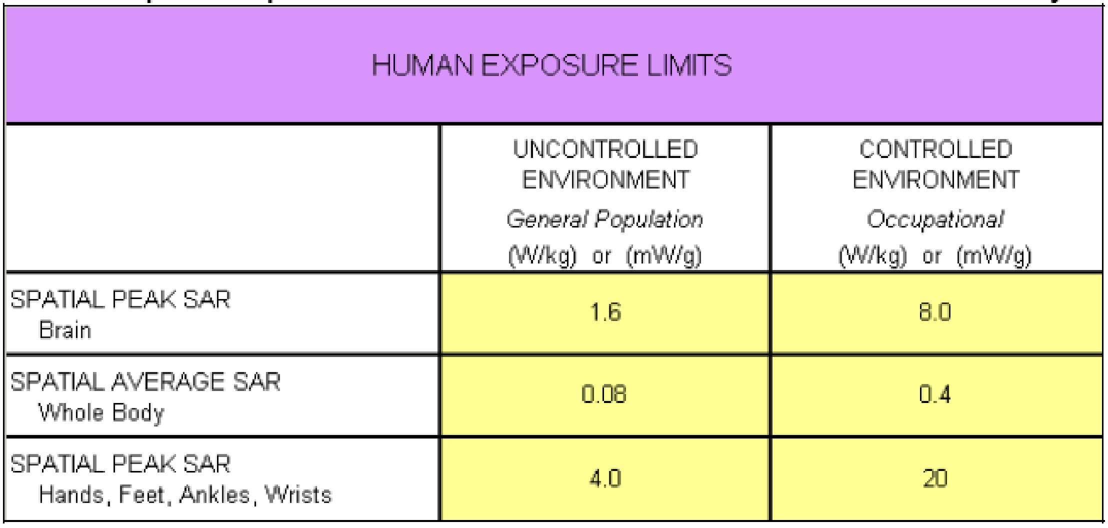
Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed 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

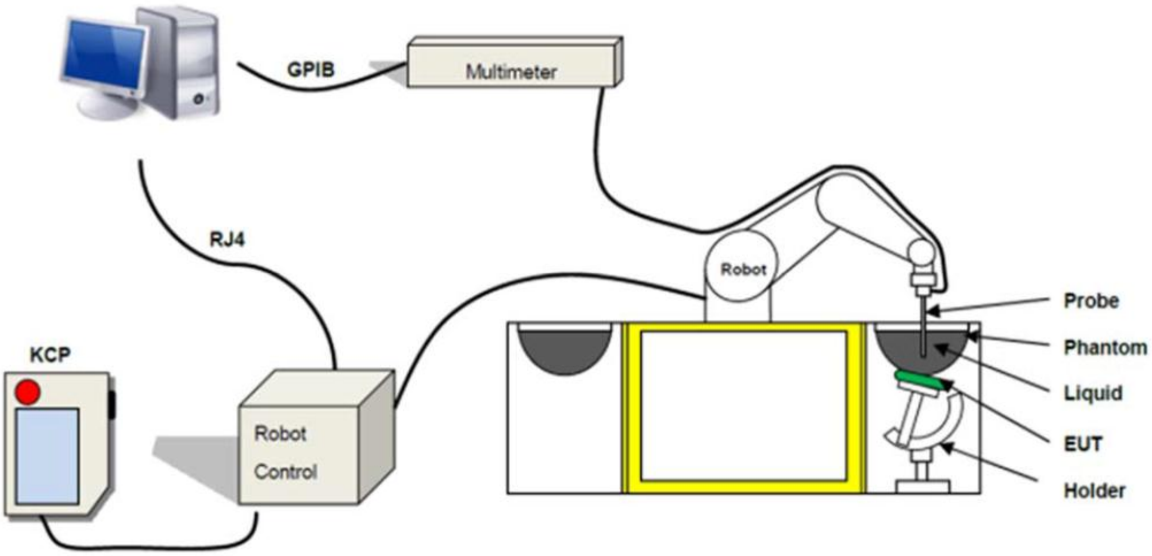


Fig. 8.1 MVG COMOSAR System Configurations

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

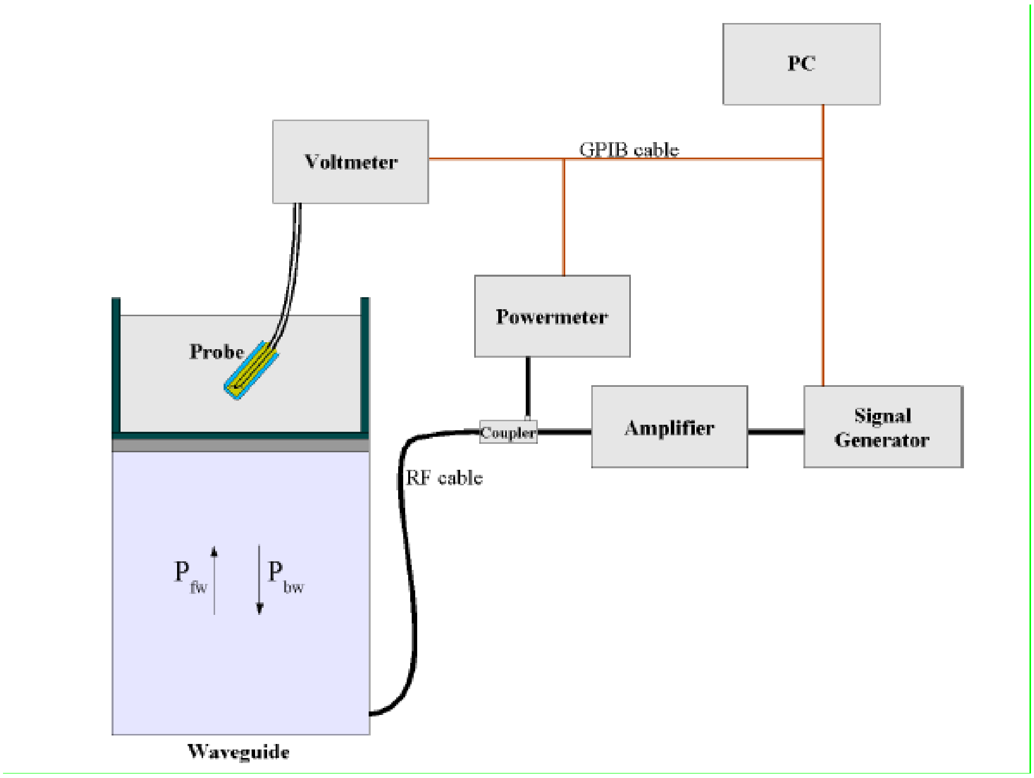
The SAR measurement is conducted with the dosimetric probe (manufactured by MVG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection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



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

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)

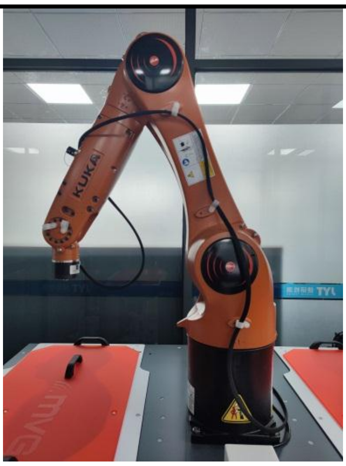


Fig. 8.4 Photo of Robot

8.3 Phantom

<SAM Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	 Fig. 8.7 Photo of SAM Phantom
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 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	 Fig. 8.9 Photo of Device Holder
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°	

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 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
MVG	COMOSAR 2600 MHz REFERENCE DIPOLE	SID2600	WXJ076-13	01.14.2021	01.13.2024
MVG	COMOSAR 5200-5800 MHz REFERENCE DIPOLE	SID5000	WXJ076-21	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	03.02.2022
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	WXJ006-7	03.25.2021	03.24.2022
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. 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)

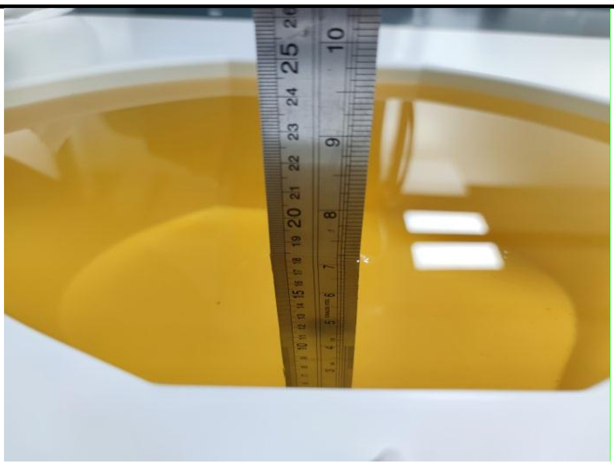


Fig. 9.2 Photo of Liquid Height for Body SAR (depth>15cm)

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)
835	21.5	0.91	41.68	0.90	41.50	1.11	0.43	±5	10.08.2021
1750	21.4	1.38	40.35	1.37	40.10	0.73	0.62	±5	10.12.2020
1900	21.3	1.41	41.22	1.40	40.00	0.71	3.05	±5	10.12.2021
2450	21.6	1.82	39.95	1.80	39.20	1.11	1.91	±5	10.18.2021
2600	21.0	1.98	39.26	1.96	39.00	1.02	0.67	±5	10.18.2022
5200	23.1	4.62	35.43	4.67	35.96	-0.86	-1.58	±5	10.20.2022

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:

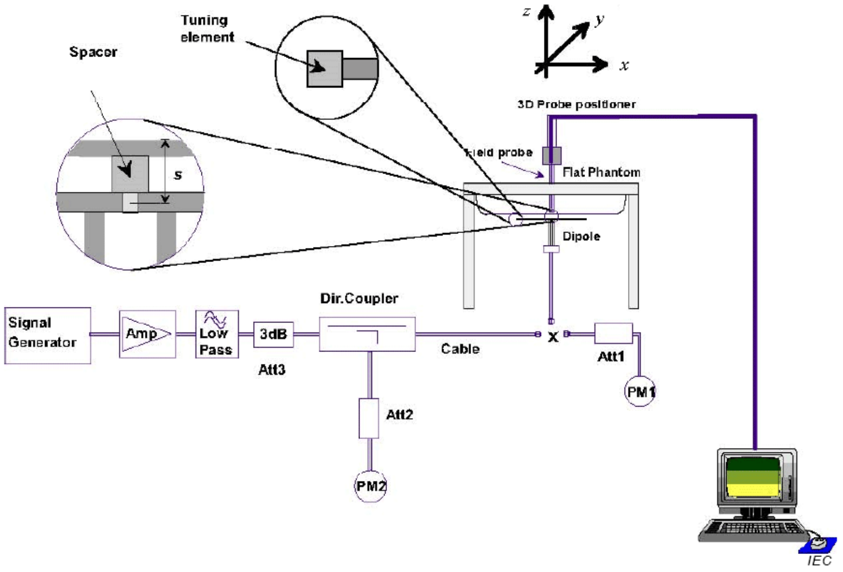


Fig.10.1 System Verification Setup Diagram

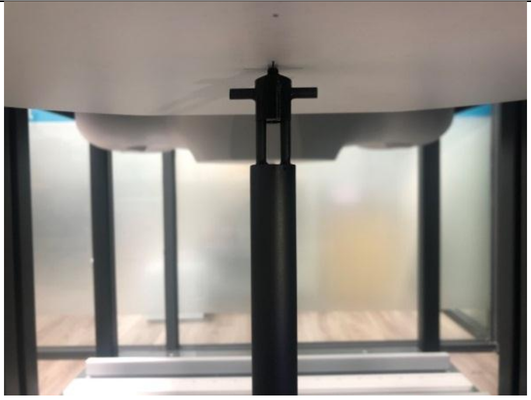


Fig.10.2 Photo of Dipole setup

➢

- **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 (%)
10.08.2021	835	100	0.932	9.32	9.57	-2.61
10.12.2020	1750	100	3.482	34.82	36.50	-4.60
10.12.2021	1900	100	4.032	40.32	39.60	1.82
10.18.2021	2450	100	5.411	54.11	52.92	2.25
10.18.2022	2600	100	5.243	52.43	55.47	-5.48
10.20.2022	5200	100	6.624	66.24	76.67	-7.88

11 EUT Testing Position

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

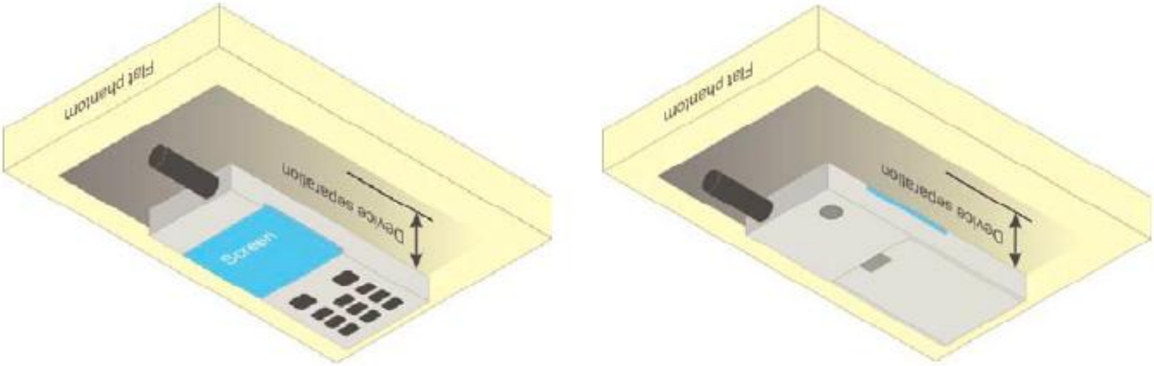


Fig.11.6 Illustration for Body Position

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:

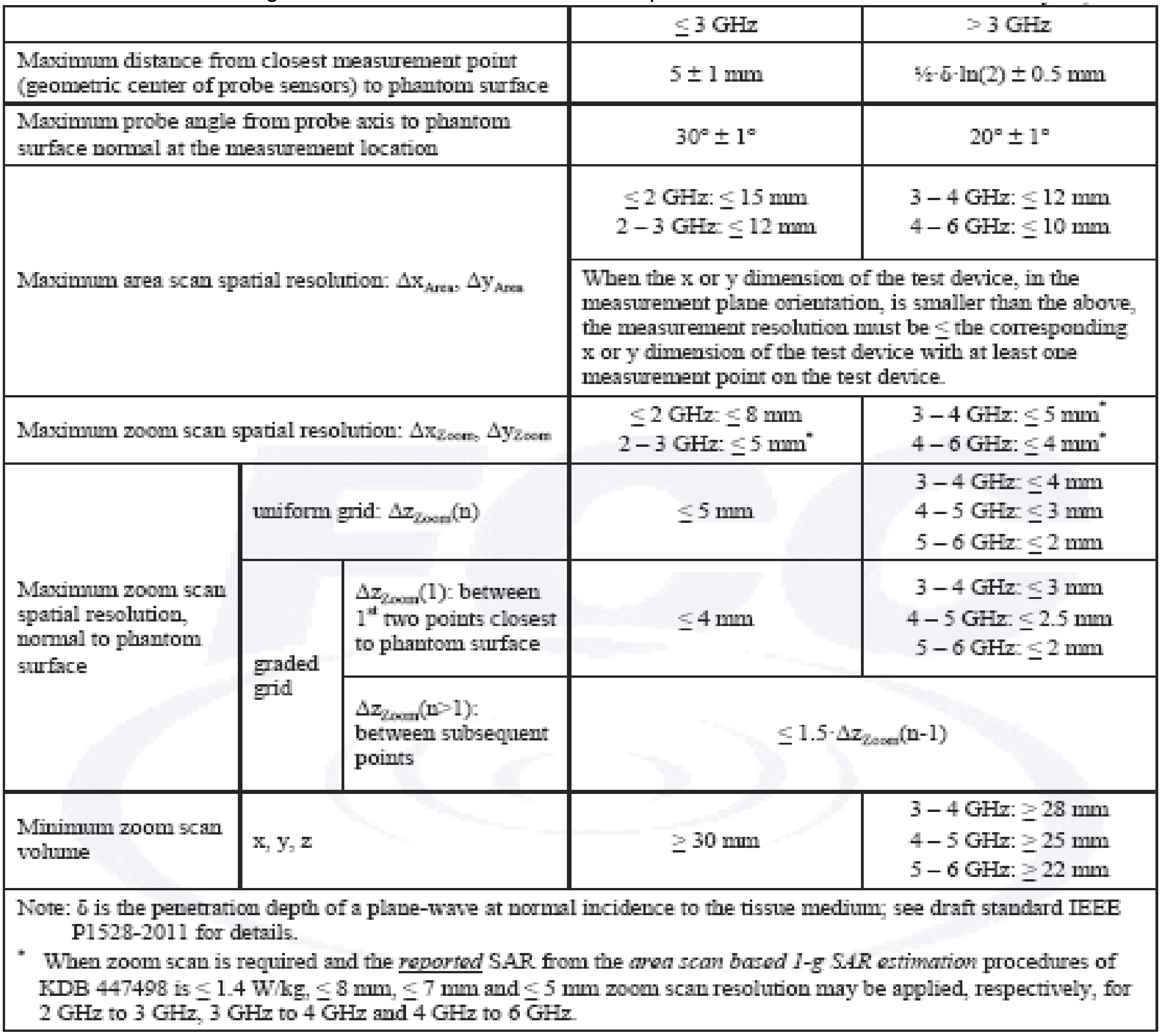
- Extraction of the measured data (grid and values) from the Zoom Scan.
- Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters).
- Generation of a high-resolution mesh within the measured volume.
- Interpolation of all measured values 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>$\frac{1}{2}\cdot\delta\cdot\ln(2) \pm 0.5$ 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)	32.50	32.53	32.52	23.47	23.50	23.49
GPRS (GMSK, 1 TX slot)	32.50	32.48	32.51	23.47	23.45	23.48
GPRS (GMSK, 2 TX slots)	31.94	31.94	31.98	25.92	25.92	25.96
GPRS (GMSK, 3 TX slots)	30.44	30.42	30.43	26.18	26.16	26.17
GPRS (GMSK, 4 TX slots)	29.27	29.27	29.24	26.26	**26.26**	26.23

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).

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)	29.51	29.61	29.63	20.48	20.58	20.60
GPRS (GMSK, 1 TX slot)	29.46	29.57	29.56	20.43	20.54	20.53
GPRS (GMSK, 2 TX slots)	28.65	29.01	29.10	22.63	22.99	23.08
GPRS (GMSK, 3 TX slots)	26.98	27.40	27.84	22.72	23.14	23.58
GPRS (GMSK, 4 TX slots)	26.72	26.78	26.74	23.71	**23.77**	23.73

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 Hotspot mode SAR testing, GPRS mode should be evaluated, therefore the EUT was set in GPRS 4 TX slots mode due to the highest frame-averaged power.
2. 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.
3. Per KDB447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
4. The EUT do not support DTM 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.

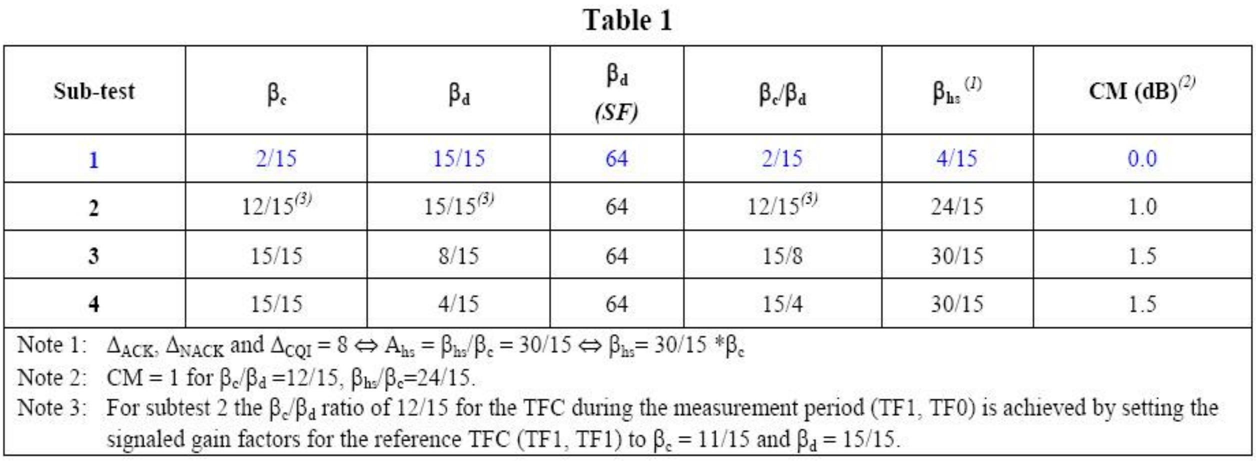


Table 1

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 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.

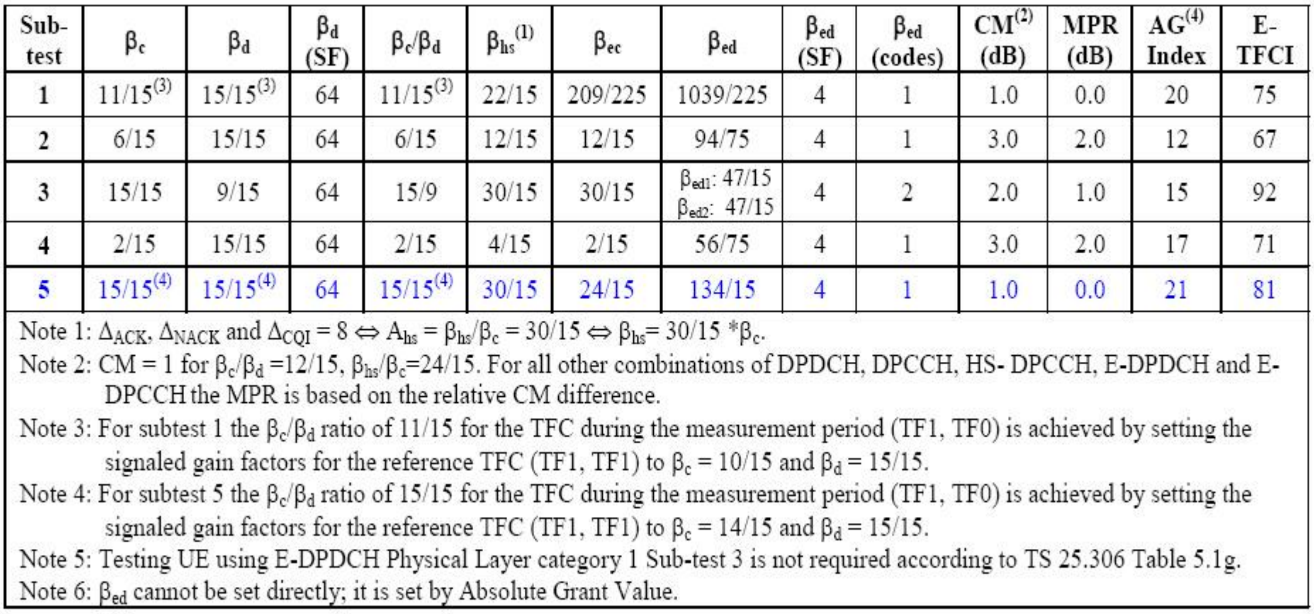
Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

HSDPA Sub-test setup configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Rohde & Schwarz 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

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	25.08	25.89	25.08
RMC 12.2 kbps	25.15	**25.92**	25.11
HSDPA Sub-test 1	24.12	24.96	24.13
HSDPA Sub-test 2	23.79	24.58	23.79
HSDPA Sub-test 3	23.6	24.52	23.72
HSDPA Sub-test 4	23.55	24.48	23.68
HSUPA Sub-test 1	22.14	22.95	22.2
HSUPA Sub-test 2	22.65	23.48	22.69
HSUPA Sub-test 3	23.14	23.98	23.14
HSUPA Sub-test 4	22.18	23.01	22.17
HSUPA Sub-test 5	24.09	24.95	24.13

WCDMA Average power (dBm)			
Band	WCDMA Band II		
Channel	9262	9400	9538
Frequency (MHz)	1852.4	1880.0	1907.6
AMR 12.2 kbps	23.44	23.53	22.53
RMC 12.2 kbps	23.49	**23.60**	22.75
HSDPA Sub-test 1	22.4	21.72	20.26
HSDPA Sub-test 2	22.07	21.45	19.95
HSDPA Sub-test 3	21.91	21.05	19.59
HSDPA Sub-test 4	21.78	20.94	19.58
HSUPA Sub-test 1	20.44	20.51	19.84
HSUPA Sub-test 2	20.89	20.41	18.95
HSUPA Sub-test 3	21.36	20.89	19.42
HSUPA Sub-test 4	20.47	19.96	18.5
HSUPA Sub-test 5	22.37	22.02	20.5

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 12.2 kbps power is < 0.25dB higher than RMC 12.2kbps, SAR tests with AMR 12.2 kbps can be excluded.
3. AMR, HSDPA RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.

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

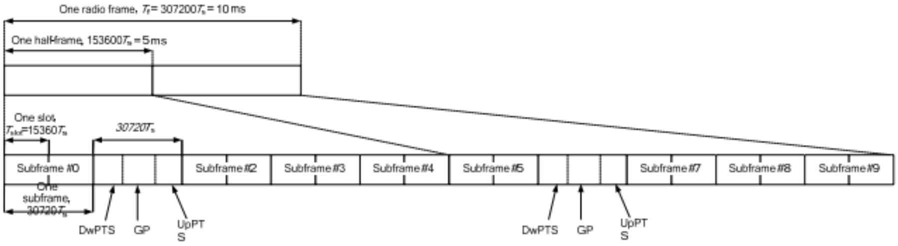
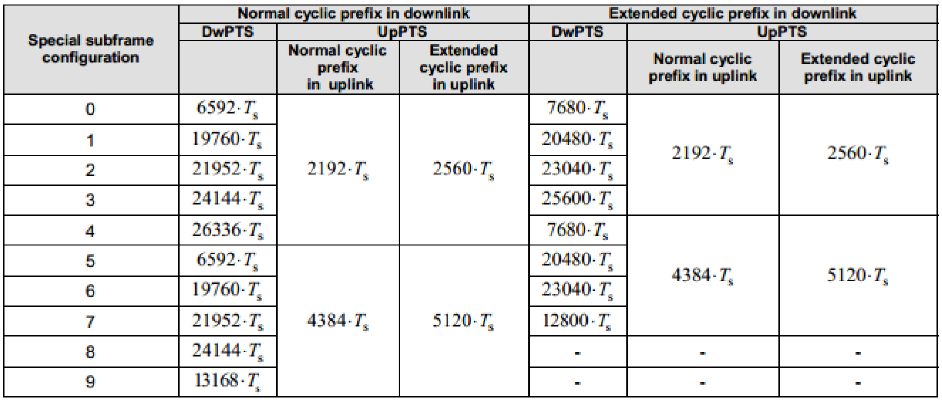


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity)

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

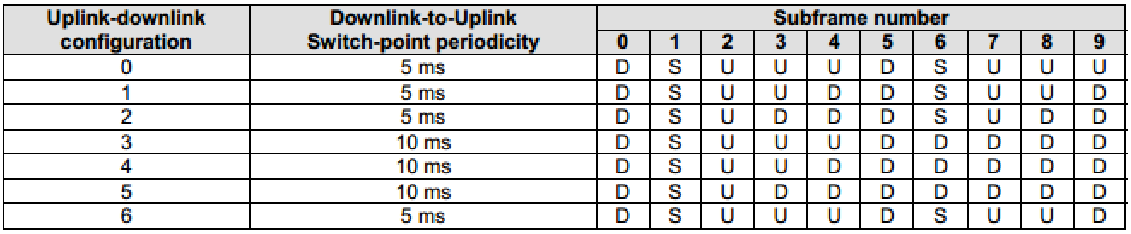


Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
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·*Ts* = 10 ms consists of two half-frames of length 153600·Ts = 5ms each. Each half-frame consists of five subframes of length 30720 ·*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 2 part

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18607	18900	19193
					1850.7MHz	1880.0MHz	1909.3MHz
Band 2	1.4	QPSK	1	0	24.55	24.26	24.45
			1	2	24.61	24.05	24.30
			1	5	24.56	24.14	24.29
			3	0	24.43	24.22	24.10
			3	1	24.42	24.21	24.09
			3	2	24.41	24.22	24.09
			6	0	23.45	23.15	23.11
		16QAM	1	0	23.36	23.14	23.01
			1	2	23.47	23.22	23.02
			1	5	23.38	23.20	23.00
			3	0	23.26	23.07	22.89
			3	1	23.26	23.07	22.89
			3	2	23.25	23.07	22.88
			6	0	22.30	22.04	22.10

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18615	18900	19185
					1851.5MHz	1880.0MHz	1908.5MHz
Band 2	3	QPSK	1	0	24.27	24.12	24.01
			1	7	24.33	23.92	24.08
			1	14	24.22	24.00	24.04
			8	0	23.45	23.23	23.16
			8	4	23.44	23.24	23.16
			8	7	23.40	23.13	23.16
			15	0	23.43	23.23	23.13
		16QAM	1	0	23.44	23.24	22.90
			1	7	23.46	23.15	22.99
			1	14	23.37	23.20	22.92
			8	0	22.48	22.27	22.15
			8	4	22.47	22.27	22.15
			8	7	22.45	22.21	22.14
			15	0	22.44	22.20	22.08

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18625	18900	19175
					1852.5MHz	1880.0MHz	1907.5MHz
Band 2	5	QPSK	1	0	24.45	24.16	24.14
			1	12	24.42	23.38	24.12
			1	24	24.32	23.72	24.17
			12	0	23.47	22.66	23.15
			12	6	23.48	22.70	23.16
			12	11	23.46	22.72	23.16
			25	0	23.42	22.63	23.11
		16QAM	1	0	23.41	23.30	23.10
			1	12	23.37	22.64	23.13
			1	24	23.30	22.96	23.12
			12	0	22.49	21.79	22.20
			12	6	22.49	21.82	22.20
			12	11	22.49	21.82	22.19
			25	0	22.44	21.65	22.17

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18650	18900	19150
					1855.0MHz	1880.0MHz	1905.0MHz
Band 2	10	QPSK	1	0	23.99	23.71	24.12
			1	24	24.27	23.25	24.10
			1	49	24.11	23.16	23.68
			25	0	23.41	22.60	23.14
			25	12	23.41	22.64	23.14
			25	24	23.41	22.64	23.14
			50	0	23.35	22.55	23.17
		16QAM	1	0	23.27	22.85	23.06
			1	24	23.45	22.49	23.03
			1	49	23.27	22.39	22.76
			25	0	22.39	21.70	22.19
			25	12	22.40	21.71	22.20
			25	24	22.40	21.72	22.19
			50	0	22.34	21.61	22.18

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18675	18900	19125
					1857.5MHz	1880.0MHz	1902.5MHz
Band 2	15	QPSK	1	0	24.20	24.06	24.23
			1	37	24.17	23.15	24.14
			1	74	24.04	23.57	23.91
			36	0	23.49	22.70	23.32
			36	16	23.49	22.76	23.32
			36	35	23.50	22.77	23.33
			75	0	23.42	22.61	23.30
		16QAM	1	0	23.46	23.29	23.15
			1	37	23.33	22.50	23.05
			1	74	23.23	22.91	22.97
			36	0	22.44	21.84	22.25
			36	16	22.43	21.86	22.25
			36	35	22.44	21.86	22.25
			75	0	22.33	21.65	22.26

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18700	18900	19100
					1860.0MHz	1880.0MHz	1900.0MHz
Band 2	20	QPSK	1	0	24.21	24.33	24.20
			1	49	24.27	23.26	24.09
			1	99	24.16	23.82	23.78
			50	0	23.37	22.80	23.26
			50	24	23.37	22.85	23.28
			50	49	23.37	22.86	23.27
			100	0	23.27	22.73	23.24
		16QAM	1	0	23.32	23.36	23.30
			1	49	23.26	22.47	23.16
			1	99	23.18	23.02	23.04
			50	0	22.36	21.89	22.34
			50	24	22.37	21.91	22.33
			50	49	22.37	21.92	22.34
			100	0	22.26	21.77	22.27

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	23.87	23.59	23.38
			1	2	23.94	23.82	22.70
			1	5	23.80	23.82	22.47
			3	0	24.09	23.52	22.61
			3	1	24.01	23.20	23.17
			3	2	24.14	23.48	23.16
			6	0	23.35	22.84	22.21
		16QAM	1	0	22.95	22.61	22.33
			1	2	23.38	23.28	22.29
			1	5	23.39	22.48	22.21
			3	0	22.88	21.92	22.67
			3	1	22.81	21.88	22.04
			3	2	22.72	22.52	21.95
			6	0	22.17	21.99	21.44

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	24.02	23.57	23.33
			1	7	23.05	22.79	22.52
			1	14	23.59	22.72	22.17
			8	0	22.41	21.77	21.56
			8	4	22.39	21.78	21.65
			8	7	22.66	21.48	21.75
			15	0	23.15	21.58	22.26
		16QAM	1	0	22.33	21.97	21.24
			1	7	22.10	21.96	21.12
			1	14	22.14	21.83	21.49
			8	0	21.61	20.66	20.80
			8	4	21.60	21.22	21.25
			8	7	21.07	21.03	20.27
			15	0	21.71	20.92	20.01

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	24.09	23.72	23.46
			1	12	23.46	22.71	22.63
			1	24	23.32	22.81	22.63
			12	0	22.27	21.86	21.56
			12	6	22.25	21.85	21.41
			12	11	22.40	21.68	21.40
			25	0	22.42	21.80	21.62
		16QAM	1	0	22.34	22.29	21.60
			1	12	22.10	22.03	21.61
			1	24	21.96	22.01	21.63
			12	0	21.61	20.93	20.60
			12	6	20.84	20.93	20.65
			12	11	20.95	20.93	20.46
			25	0	21.98	20.62	20.33

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	23.87	23.27	23.78
			1	24	22.81	22.84	22.52
			1	49	22.88	22.80	22.51
			25	0	21.84	21.80	21.54
			25	12	22.04	21.81	21.54
			25	24	22.42	21.63	21.54
			50	0	22.21	21.80	21.52
		16QAM	1	0	22.15	22.05	21.52
			1	24	22.11	22.00	21.43
			1	49	22.06	21.94	21.44
			25	0	20.97	20.86	20.58
			25	12	21.45	20.86	20.59
			25	24	21.45	20.87	20.59
			50	0	21.14	20.84	20.54

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	22.97	23.70	22.79
			1	37	22.86	22.77	22.59
			1	74	22.76	22.78	22.55
			36	0	22.05	21.89	21.72
			36	16	22.05	21.90	21.72
			36	35	22.05	21.91	21.71
			75	0	22.01	21.89	21.66
		16QAM	1	0	22.20	22.09	21.69
			1	37	22.02	22.04	21.47
			1	74	21.97	22.05	21.47
			36	0	21.01	20.93	20.68
			36	16	21.02	20.93	20.68
			36	35	21.02	20.93	20.68
			75	0	20.94	20.88	20.63

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	23.11	23.76	22.82
			1	49	22.91	22.91	22.59
			1	99	22.92	22.81	22.50
			50	0	21.94	21.84	21.78
			50	24	21.94	21.85	21.78
			50	49	21.94	21.85	21.78
			100	0	21.87	21.84	21.68
		16QAM	1	0	22.12	22.01	21.87
			1	49	21.91	22.06	21.68
			1	99	21.92	21.99	21.63
			50	0	20.95	20.87	20.84
			50	24	20.95	20.88	20.84
			50	49	20.95	20.88	20.84
			100	0	20.89	20.85	20.71

LTE Band 5 part:

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20407	20525	20643
					824.7MHz	836.5MHz	848.3MHz
Band 5	1.4	QPSK	1	0	24.16	23.93	24.10
			1	2	24.16	23.98	24.06
			1	5	24.17	23.90	24.11
			3	0	24.07	23.95	24.02
			3	1	24.08	23.94	24.01
			3	2	24.08	23.94	24.01
			6	0	23.26	22.94	23.22
		16QAM	1	0	23.04	22.95	22.91
			1	2	23.14	23.08	23.01
			1	5	23.09	22.92	22.90
			3	0	22.88	22.80	22.76
			3	1	22.87	22.80	22.76
			3	2	22.87	22.79	22.76
			6	0	22.01	21.97	22.09

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20415	20525	20635
					825.5MHz	836.5MHz	847.5MHz
Band 5	3	QPSK	1	0	24.10	23.90	24.04
			1	7	24.11	23.89	24.09
			1	14	24.03	23.87	24.07
			8	0	23.24	22.96	23.16
			8	4	23.25	22.97	23.16
			8	7	23.18	22.95	23.18
			15	0	23.11	22.91	23.04
		16QAM	1	0	23.11	22.98	22.84
			1	7	23.10	22.96	22.93
			1	14	23.04	22.90	22.90
			8	0	22.14	21.94	22.04
			8	4	22.14	21.94	22.04
			8	7	22.10	21.94	22.05
			15	0	22.04	21.83	21.89

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20425	20525	20625
					826.5MHz	836.5MHz	846.5MHz
Band 5	5	QPSK	1	0	24.25	24.03	24.07
			1	12	24.19	23.98	24.08
			1	24	24.08	23.93	24.17
			12	0	23.18	22.99	22.99
			12	6	23.17	22.98	22.98
			12	11	23.17	22.98	22.98
			25	0	23.10	22.92	22.96
		16QAM	1	0	23.08	23.17	22.93
			1	12	23.07	23.12	23.04
			1	24	23.00	23.05	23.01
			12	0	22.10	22.00	21.94
			12	6	22.08	22.00	21.94
			12	11	22.09	22.01	21.94
			25	0	22.04	21.88	21.95

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20450	20525	20600
					829MHz	836.5MHz	844MHz
Band 5	10	QPSK	1	0	24.14	24.03	23.92
			1	24	23.99	23.96	23.96
			1	49	23.90	23.99	23.97
			25	0	23.05	22.97	22.90
			25	12	23.03	22.99	22.90
			25	24	23.04	22.99	22.91
			50	0	23.01	22.94	22.91
		16QAM	1	0	23.15	23.13	22.80
			1	24	23.11	23.05	22.83
			1	49	23.04	23.04	22.94
			25	0	21.98	22.00	21.88
			25	12	21.98	22.00	21.89
			25	24	21.98	21.99	21.89
			50	0	21.96	21.95	21.88

LTE Band 7 part:

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20775	21100	21425
					2502.5MHz	2535.0MHz	2567.5MHz
Band 7	5	QPSK	1	0	22.90	22.09	21.62
			1	12	22.71	22.03	21.60
			1	24	22.72	21.95	21.54
			12	0	21.71	21.02	20.58
			12	6	21.71	21.03	20.59
			12	11	21.68	21.03	20.58
			25	0	21.63	20.98	20.54
		16QAM	1	0	21.79	21.19	20.62
			1	12	21.78	21.20	20.59
			1	24	21.54	21.15	20.52
			12	0	20.73	20.09	19.63
			12	6	20.70	20.09	19.62
			12	11	20.67	20.09	19.62
			25	0	20.64	19.96	19.59

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20800	21100	21400
					2505.0MHz	2535.0MHz	2565.0MHz
Band 7	10	QPSK	1	0	21.92	22.04	21.59
			1	24	22.05	22.01	21.55
			1	49	21.74	21.97	21.51
			25	0	21.26	21.03	20.58
			25	12	21.27	21.04	20.59
			25	24	21.28	21.03	20.59
			50	0	21.23	21.02	20.58
		16QAM	1	0	21.20	21.17	20.52
			1	24	21.32	21.13	20.48
			1	49	20.99	21.10	20.38
			25	0	20.29	20.05	19.62
			25	12	20.30	20.05	19.63
			25	24	20.30	20.05	19.62
			50	0	20.29	20.04	19.60

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20825	21100	21375
					2507.5MHz	2535.0MHz	2562.5MHz
Band 7	15	QPSK	1	0	22.12	22.15	21.76
			1	37	21.93	22.02	21.66
			1	74	21.41	22.01	21.64
			36	0	21.20	21.20	20.81
			36	16	21.22	21.20	20.81
			36	35	21.22	21.21	20.82
			75	0	21.04	21.15	20.77
		16QAM	1	0	21.36	21.35	20.57
			1	37	21.15	21.24	20.56
			1	74	20.67	21.26	20.53
			36	0	20.23	20.19	19.73
			36	16	20.23	20.19	19.74
			36	35	20.24	20.19	19.74
			75	0	20.04	20.11	19.73

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20850	21100	21350
					2510.0MHz	2535.0MHz	2560.0MHz
Band 7	20	QPSK	1	0	22.29	22.25	22.27
			1	49	21.76	22.12	21.63
			1	99	21.66	22.12	21.58
			50	0	21.07	21.11	20.63
			50	24	21.11	21.11	20.66
			50	49	21.12	21.11	20.67
			100	0	20.87	21.06	20.74
		16QAM	1	0	21.37	21.24	20.45
			1	49	20.87	21.19	20.73
			1	99	20.68	21.23	20.68
			50	0	20.12	20.13	19.76
			50	24	20.14	20.12	19.77
			50	49	20.15	20.13	19.77
			100	0	19.89	20.07	19.74

13.4 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	**12.92**	9.92	9.80
CH 06	2437	12.28	10.01	9.98
CH 11	2462	10.76	8.52	8.52

Average Power (dBm)		
Channel	Frequency (MHz)	802.11n (HT40)
CH 03	2422	9.53
CH 06	2437	9.19
CH 09	2452	9.25

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 for 1-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 01	2.412	13.5	22.4	5	6.9	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.

13.5 WLAN 5.2GHz Band Conducted Power

Average Power (dBm)				
Channel	Frequency (MHz)	802.11 a	802.11 ac20	802.11 n20
CH 36	5180	10.86	11.28	11.08
CH 40	5200	11.68	11.13	11.63
CH 48	5240	11.30	11.74	11.21

Average Power (dBm)			
Channel	Frequency (MHz)	802.11 ac40	802.11 n40
CH 38	5190	11.46	10.88
CH 46	5230	11.49	**12.06**

Note:

7. 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 for 1-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 36	5.180	12.5	17.78	5	8.11	3.0

8. Base on the result of note1, RF exposure evaluation of 802.11 a mode is not required.
9. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
10. 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.
11. 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.

13.6 Bluetooth Conducted Power

Average Power (dBm)				
Channel	Frequency (MHz)	GFSK	π/4-DQPSK	8DPSK
CH 00	2402	1.322	1.702	2.152
CH 39	2441	3.757	4.420	**4.846**
CH 78	2480	2.305	2.905	3.248

Average Power (dBm)		
Channel	Frequency (MHz)	BLE
CH 00	2402	-2.011
CH 20	2442	0.716
CH 39	2480	-0.737

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 for 1-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	3.16	5	0.99	3.0

2. The max. tune-up power was provided 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 EUT Antenna Locations

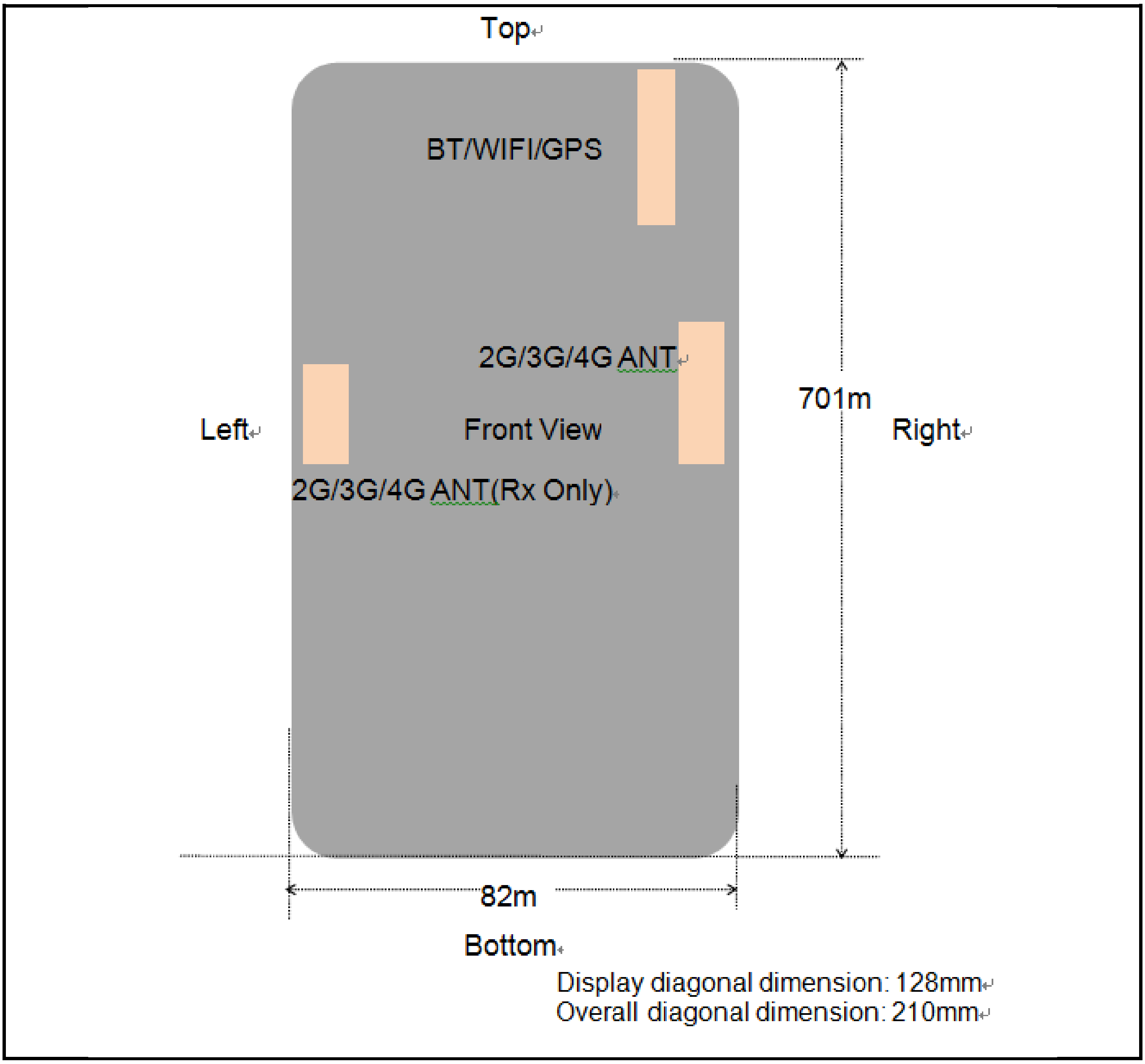


Fig.14.1 EUT Antenna Locations

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

Distance of Antennas to EUT edge/surface Test distance: 0mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
2G/3G/4G	<25mm	<25mm	62mm	102mm	<25mm	57mm
WLAN & Bluetooth	35mm	<25mm	<25mm	158mm	<25mm	60mm

Test Positions Test distance: 0mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
2G/3G/4G	Yes	Yes	No	No	Yes	No
WLAN & Bluetooth	No	Yes	Yes	No	Yes	No

Note:

1. Body SAR assessments are required.
2. Referring to KDB 941225 D06 v02r01,SAR was measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge and the test distance is 0mm.

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)
	GPRS850/4 slots	Front	190	836.6	29.27	-1.73	29.5	0.171	1.054	0.180
	GPRS850/4 slots	Back	190	836.6	29.27	-1.53	29.5	0.056	1.054	0.059
	GPRS850/4 slots	Right	190	836.6	29.27	1.63	29.5	0.904	1.054	0.953
1	GPRS850/4 slots	Right	128	824.2	29.27	2.00	29.5	**0.940**	1.054	0.991
	GPRS850/4 slots	Right	251	848.8	29.24	1.54	29.5	0.924	1.062	0.981
	GPRS850/4 slots	**Right**	**128**	**824.2**	**29.27**	**1.29**	**29.5**	**0.932**	**1.054**	**0.982**
	GPRS1900/4 slots	Front	661	1909.8	26.78	0.11	27.0	0.156	1.052	0.164
	GPRS1900/4 slots	Back	661	1909.8	26.78	0.48	27.0	0.049	1.052	0.052
2	GPRS1900/4 slots	Right	661	1909.8	26.78	-1.38	27.0	**0.862**	1.052	0.907
	GPRS1900/4 slots	Right	512	1850.2	26.72	-1.12	27.0	0.812	1.067	0.866
	GPRS1900/4 slots	Right	810	1909.8	26.74	0.89	27.0	0.789	1.062	0.838
	GPRS1900/4 slots	**Right**	**661**	**1880**	**26.78**	**1.35**	**27.0**	**0.854**	**1.052**	**0.898**
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ 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)
	Band V/RMC	Front	4183	836.6	25.92	-2.00	26.0	0.084	1.019	0.086
	Band V/RMC	Back	4183	836.6	25.92	-1.27	26.0	0.022	1.019	0.022
3	Band V/RMC	Right	4183	836.6	25.92	-1.70	26.0	**0.375**	1.019	0.382
	Band II/RMC	Front	9400	1880	23.60	0.94	24.0	0.121	1.096	0.133
	Band II/RMC	Back	9400	1880	23.60	0.47	24.0	0.048	1.096	0.053
4	Band II/RMC	Right	9400	1880	23.60	-3.51	24.0	**0.712**	1.096	0.780
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)
	Band2/1RB#0	Front	18900	1880	24.33	-1.40	24.5	0.165	1.040	0.172
	Band2/1RB#0	Back	18900	1880	24.33	-0.62	24.5	0.077	1.040	0.080
5	Band2/1RB#0	Right	18900	1880	24.33	3.52	24.5	**0.903**	1.040	0.939
	Band2/1RB#0	Right	18700	1860	24.21	1.75	24.5	0.877	1.069	0.938
	Band2/1RB#0	Right	19100	1900	24.20	0.56	24.5	0.865	1.072	0.927
	Band2/50%RB#0	Front	18700	1860	23.37	0.49	23.5	0.121	1.030	0.125
	Band2/50%RB#0	Back	18700	1860	23.37	0.58	23.5	0.046	1.030	0.047
	Band2/50%RB#0	Right	18700	1860	23.37	0.33	23.5	0.712	1.030	0.733
	Band2/100%RB#0	Front	18700	1860	23.27	0.48	23.5	0.105	1.054	0.111
	Band2/100%RB#0	Back	18700	1860	23.27	-1.66	23.5	0.036	1.054	0.038
	Band2/100%RB#0	Right	18700	1860	23.27	-1.28	23.5	0.688	1.054	0.725
	Band2/1RB#0	**Right**	**18900**	**1880**	**24.33**	**1.06**	**24.5**	**0.899**	**1.040**	**0.935**
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	20175	1732.5	23.76	0.55	24.5	0.088	1.186	0.104
	Band4/1RB#0	Back	20175	1732.5	23.76	-1.17	24.5	0.023	1.186	0.027
6	Band4/1RB#0	Right	20175	1732.5	23.76	1.52	24.5	**0.241**	1.186	0.286
	Band4/50RB#0	Front	20050	1720	21.94	0.96	22.0	0.072	1.014	0.073
	Band4/50RB#0	Back	20050	1720	21.94	-0.94	22.0	0.021	1.014	0.021
	Band4/50RB#0	Right	20050	1720	21.94	0.60	22.0	0.205	1.014	0.208
ANSI / IEEE C95.1 – SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**1.6 W/kg (mW/g)** **Averaged over 1g**					

- FDD-LTE Band 5(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)
	Band5/1RB#0	Front	20450	829	24.14	1.07	24.50	0.092	1.086	0.100
	Band5/1RB#0	Back	20450	829	24.14	1.04	24.50	0.021	1.086	0.023
7	Band5/1RB#0	Right	20450	829	24.14	2.1	24.50	**0.341**	1.086	0.370
	Band5/25RB#0	Front	20450	829	23.05	0.05	23.50	0.041	1.109	0.045
	Band5/25RB#0	Back	20450	829	23.05	1.06	23.50	0.015	1.109	0.017
	Band5/25RB#0	Right	20450	829	23.05	-1.36	23.50	0.311	1.109	0.345
ANSI / IEEE C95.1 – SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**1.6 W/kg (mW/g)** **Averaged over 1g**					

- FDD-LTE Band 7(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)
	Band7/1RB#0	Front	20850	2510	22.29	-1.31	22.5	0.125	1.050	0.131
	Band7/1RB#0	Back	20850	2510	22.29	1.36	22.5	0.034	1.050	0.036
8	Band7/1RB#0	Right	20850	2510	22.29	4.85	22.5	**0.752**	1.050	0.790
	Band7/50RB#49	Front	20850	2510	21.12	0.06	21.5	0.102	1.091	0.111
	Band7/50RB#49	Back	20850	2510	21.12	1.31	21.5	0.031	1.091	0.034
	Band7/50RB#49	Right	20850	2510	21.12	-1.12	21.5	0.684	1.091	0.746
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)
	2.4GHz/802.11b	Front	1	2412	12.92	1.03	13.5	0.349	1.143	1	0.399
9	2.4GHz/802.11b	Right	1	2412	12.92	-0.89	13.5	**0.399**	1.143	1	0.456
	2.4GHz/802.11b	Top	1	2412	12.92	0.36	13.5	0.245	1.143	1	0.280
ANSI / IEEE C95.1 – SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**					**1.6 W/kg (mW/g)** **Averaged over 1g**						

- WLAN 5.2GHz 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)
	5.2GHz/802.11a	Front	40	5200	11.68	-1.09	12.5	0.414	1.208	1	0.500
10	5.2GHz/802.11a	Right	40	5200	11.68	3.43	12.5	**0.453**	1.208	1	0.547
	5.2GHz/802.11a	Top	40	5200	11.68	1.16	12.5	0.312	1.208	1	0.377
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. 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.
4. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥0.8W/kg.
5. 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.
6. According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.
7. Highlight part of test data means repeated test.

15.2 Repeated SAR measurement

Band/ Mode	Test Position	CH.	Freq. (MHz)	Measured SAR (W/kg)				
				Original	1st Repeated		2nd Repeated	
					Value	Ratio	Value	Ratio
GPRS850/4 slots	Body Right	128	824.2	0.94	0.932	1.01	/	/
GPRS1900/4 slots	Body Right	661	1880	0.862	0.854	1.01	/	/
LTE Band II /QPSK/20MHz /1RB#0	Body Right	18900	1880	0.903	0.899	1.00	/	/
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 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8 W/kg
2. Per KDB 865664 D01v01r04, if the ratio of *original* and *repeated* is ≤ 1.2 and the measured SAR <1.45 W/kg, only one repeated measurement is required.

15.3 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

- **Simultaneous Transmission Procedures**

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v06, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6 W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v06 4.3.2), the following equation must be used to estimate the standalone 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)	0
Bluetooth	5	Estimated SAR (W/kg)	0.132

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**

Position	Applicable Combination
Body	WWAN + WLAN 2.4 GHz/5.2GHz
	WWAN + Bluetooth

Note:

1. WLAN 2.4GHz Band, WLAN 5.2GHz 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 < 1.6 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

15.4 SAR Simultaneous Transmission Analysis

Position		Standalone SAR(W/kg)				Σ SAR$_{1g}$ (W/kg)		
		1	2	3	4	1+2	1+3	1+4
		WWAN	2.4G WLAN	5G WLAN	BT			
Body	Front	0.180	0.399	0.500	0.132	0.579	0.680	0.312
	Back	0.080	0.000	0.000	0.132	0.080	0.080	0.212
	Left	0.000	0.000	0.000	0.132	0.000	0.000	0.132
	Right	0.991	0.456	0.547	0.132	1.447	**1.538**	1.123
	Top	0.000	0.280	0.377	0.132	0.280	0.377	0.132
	Bottom	0.000	0.000	0.000	0.132	0.000	0.000	0.132

- **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.

15.5 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 835 MHz

Date of measurement: 8/10/2021

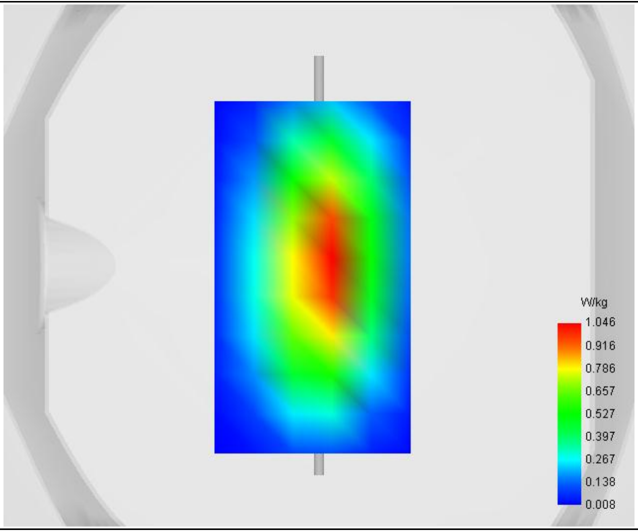
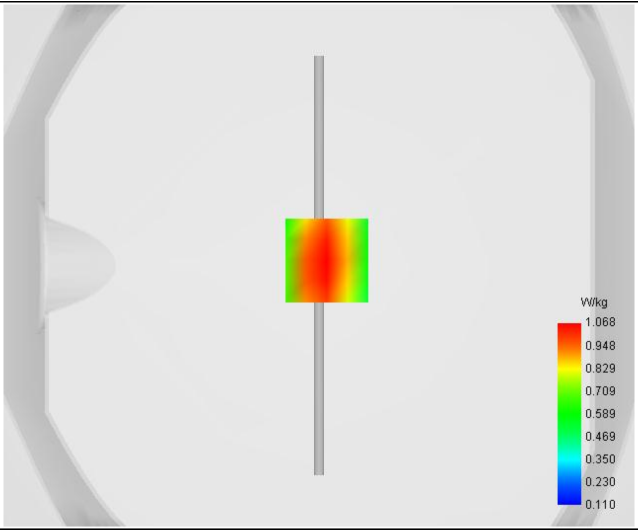
A. Experimental conditions.

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)	41.683742
Conductivity (S/m)	0.911243

C. SAR Surface and Volume

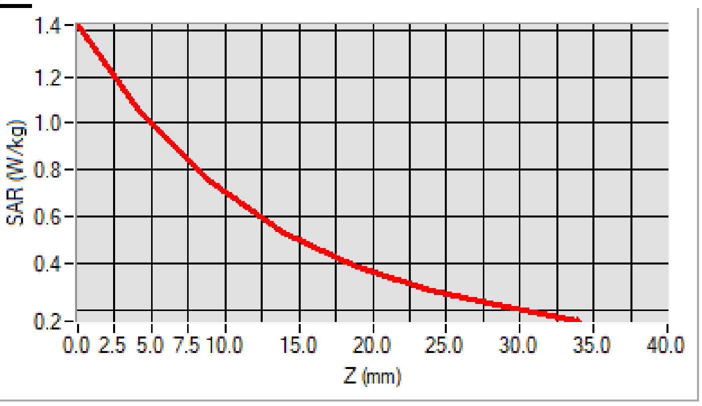
SURFACE SAR	VOLUME SAR
	

Maximum location: X=3.00, Y=2.00 ; SAR Peak: 1.39 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.643304
SAR 1g (W/Kg)	0.932143
Variation (%)	-1.450000

E. Z Axis Scan



System check at 1750 MHz

Date of measurement: 12/10/2021

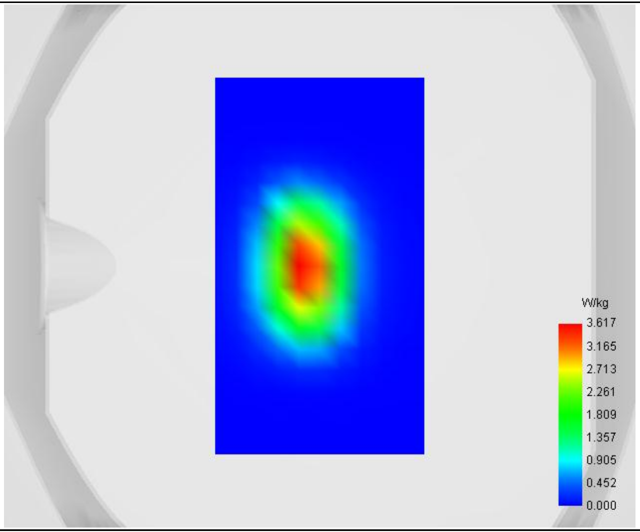
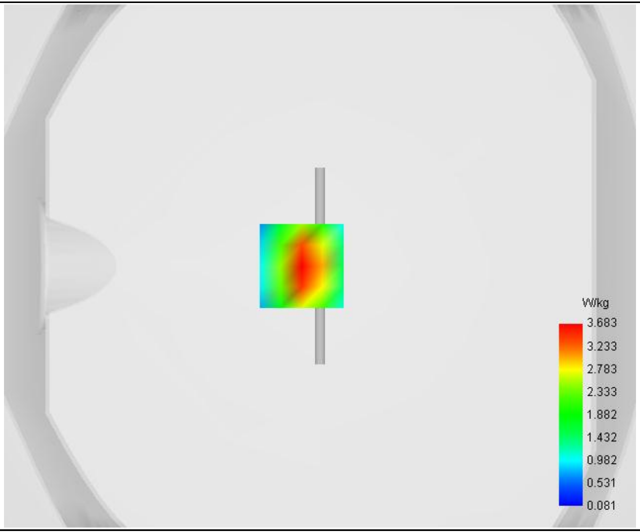
A. Experimental conditions.

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)	40.351236
Conductivity (S/m)	1.383452

C. SAR Surface and Volume

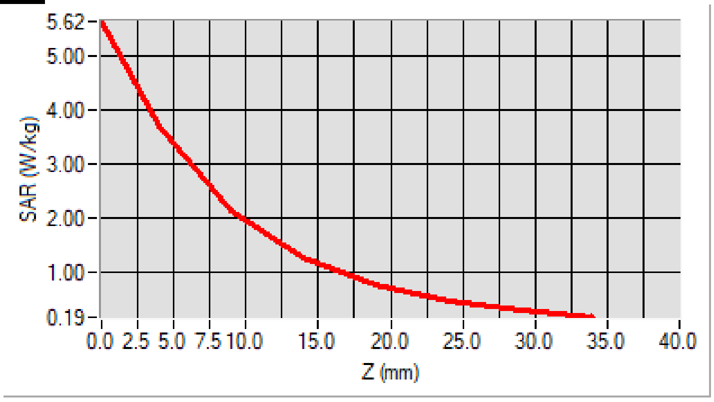
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-7.00, Y=0.00; SAR Peak: 5.61 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	1.874126
SAR 1g (W/Kg)	3.482316
Variation (%)	1.210000

E. Z Axis Scan



System check at 1900 MHz

Date of measurement: 12/10/2021

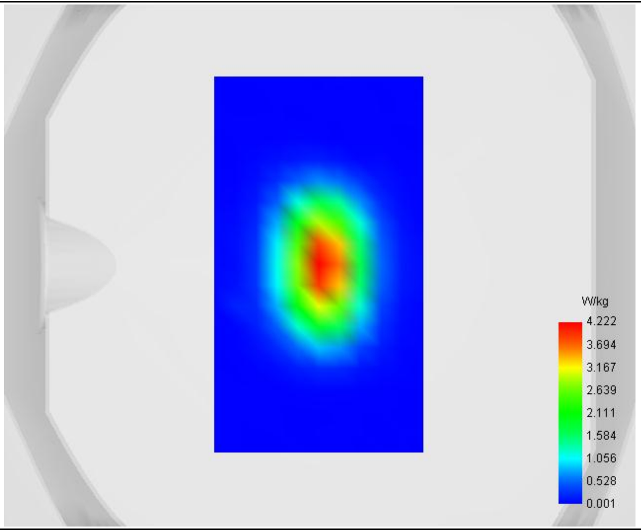
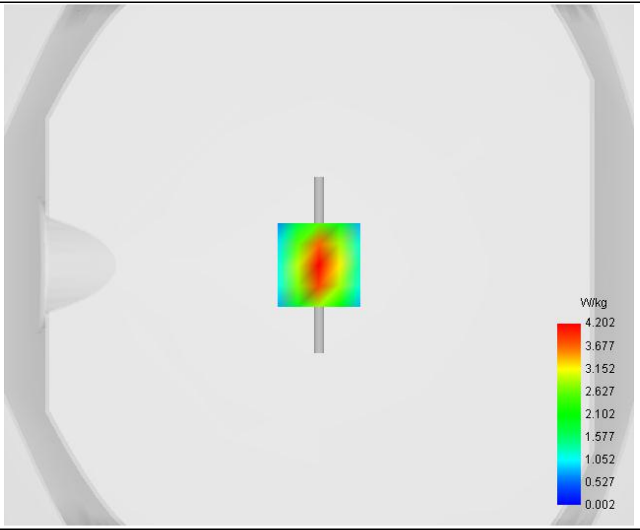
A. Experimental conditions.

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	Dipole
Band	CW1900
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1900.000000
Relative permitivity (real part)	41.225701
Conductivity (S/m)	1.412293

C. SAR Surface and Volume

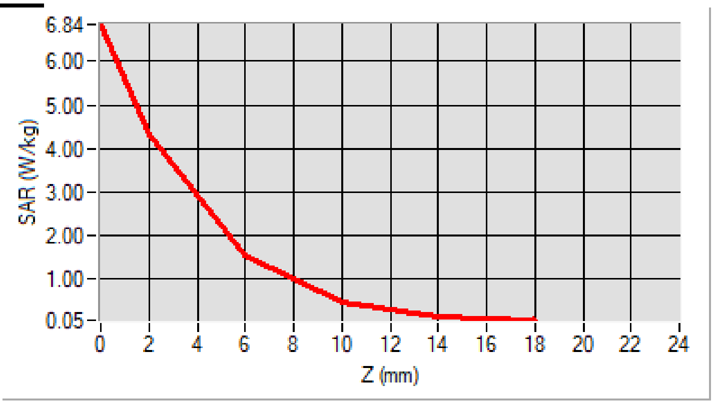
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00; SAR Peak: 6.89 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	2.087453
SAR 1g (W/Kg)	4.032318
Variation (%)	0.450000

E. Z Axis Scan



System check at 2450 MHz

Date of measurement: 18/10/2021

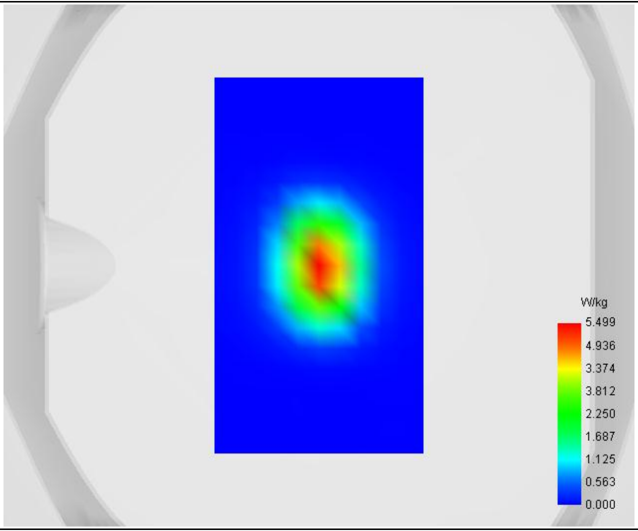
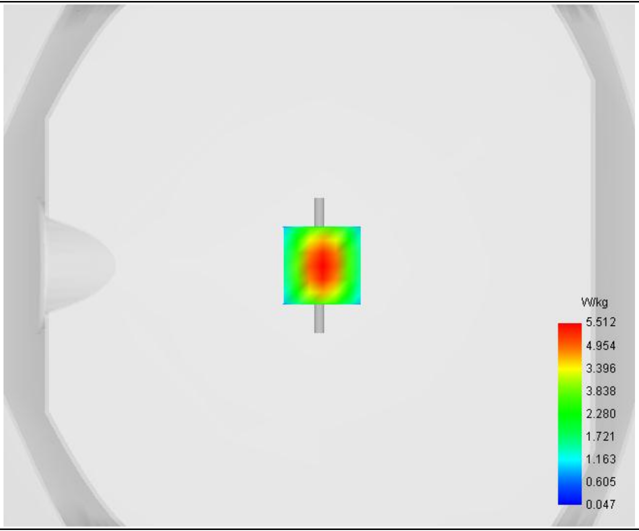
A. Experimental conditions.

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	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2450.000000
Relative permitivity (real part)	39.951044
Conductivity (S/m)	1.820732

C. SAR Surface and Volume

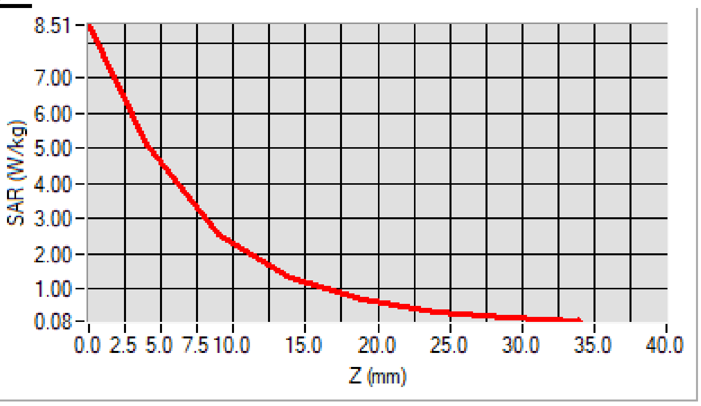
<table>
<tr><th>SURFACE SAR</th><th>VOLUME SAR</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Maximum location: X=1.00, Y=-1.00; SAR Peak: 8.75 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	2.384153
SAR 1g (W/Kg)	5.411381
Variation (%)	-2.080000

E. Z Axis Scan



System check at 2600 MHz

Date of measurement: 18/10/2021

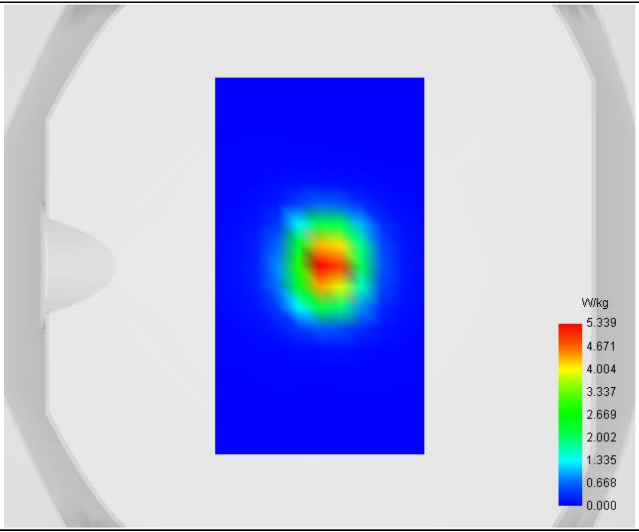
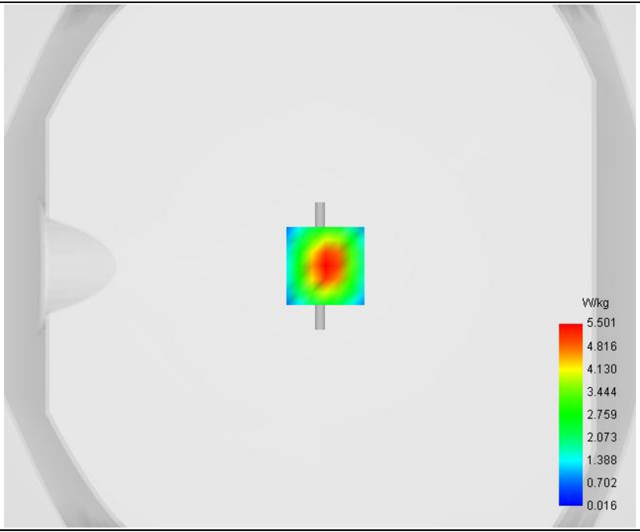
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	2.15
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW2600
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2600.000000
Relative permitivity (real part)	39.261284
Conductivity (S/m)	1.982107

C. SAR Surface and Volume

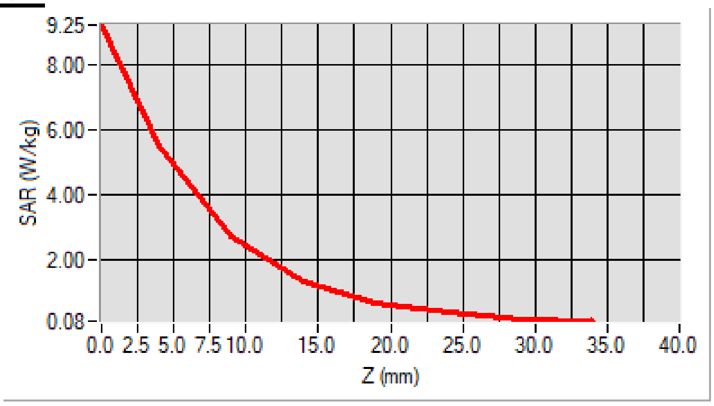
SURFACE SAR	VOLUME SAR
	

Maximum location: X=2.00, Y=0.00; SAR Peak: 9.23 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	2.324451
SAR 1g (W/Kg)	5.243263
Variation (%)	-0.540000

E. Z Axis Scan



System check at 5200 MHz

Date of measurement: 20/10/2021

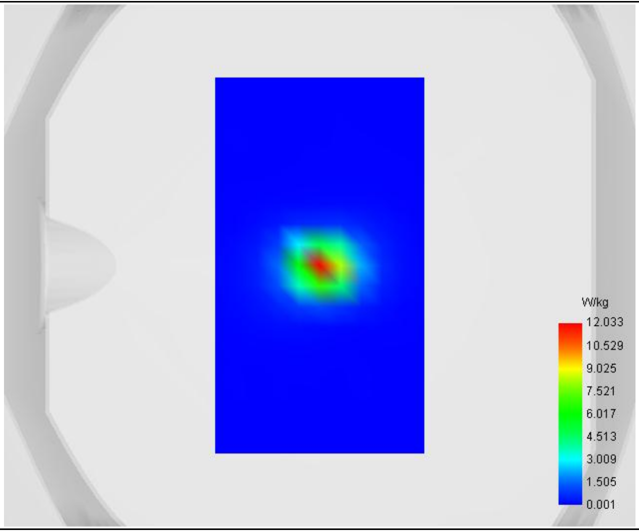
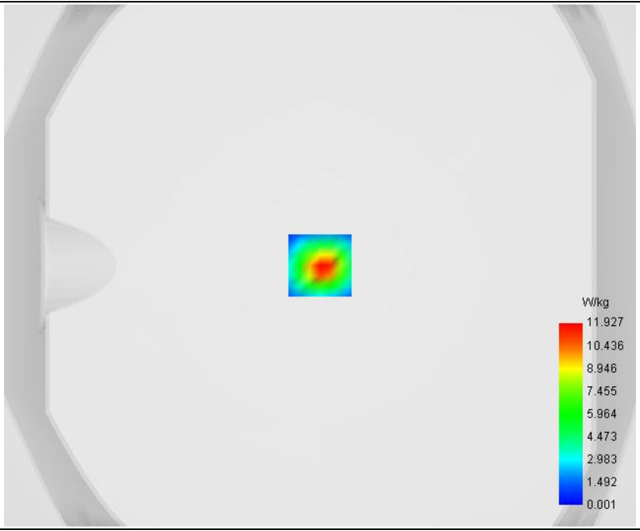
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	1.86
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW5200
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	5200.000000
Relative permittivity (real part)	35.432416
Conductivity (S/m)	4.621324

C. SAR Surface and Volume

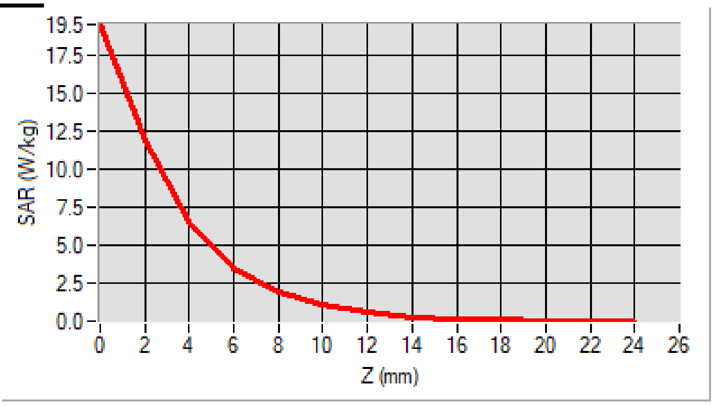
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00; SAR Peak: 20.74 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	1.982328
SAR 1g (W/Kg)	6.624126
Variation (%)	1.020000

E. Z Axis Scan



Appendix B: Plots of SAR Test Data

SAR Measurement at GPRS850 4slots (Body, Validation Plane)

Date of measurement: 08/10/2021

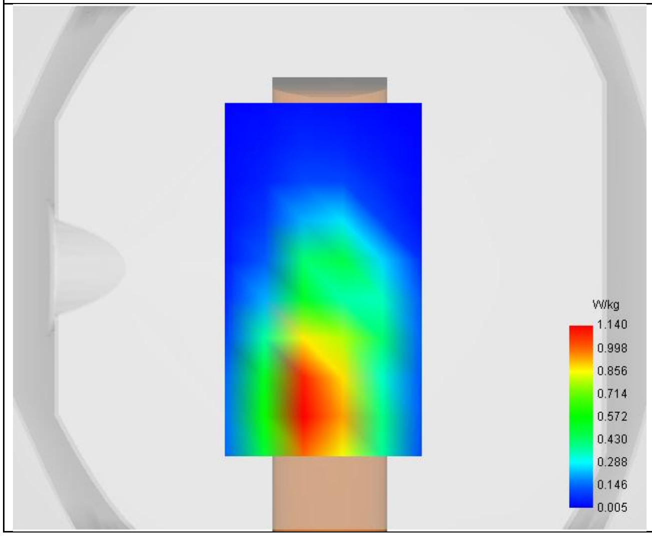
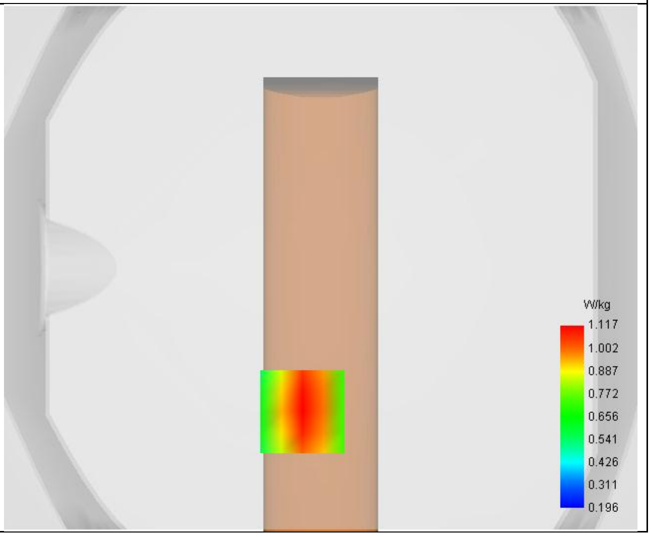
A. Experimental conditions.

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	GSM850
Channels	Low
Signal	TDMA (Crest factor: 2.0)

B. Permitivity

Frequency (MHz)	824.199976
Relative permitivity (real part)	41.500000
Conductivity (S/m)	0.901669

C. SAR Surface and Volume

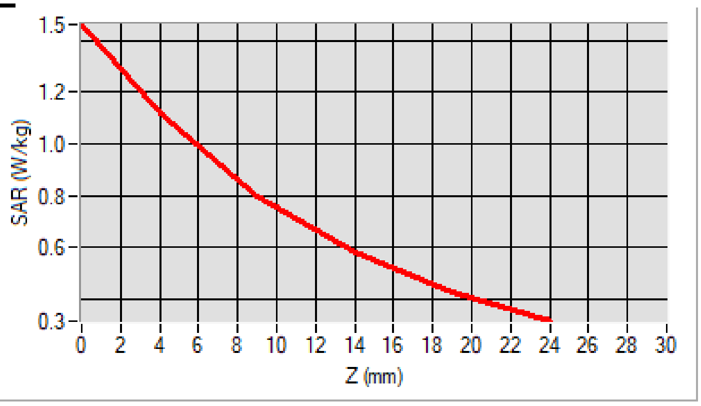
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-7.00, Y=-55.00 ; SAR Peak: 1.47 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.724297
SAR 1g (W/Kg)	0.940040
Variation (%)	2.000000

E. Z Axis Scan



SAR Measurement at GPRS1900 4slots (Body, Validation Plane)

Date of measurement: 12/10/2021

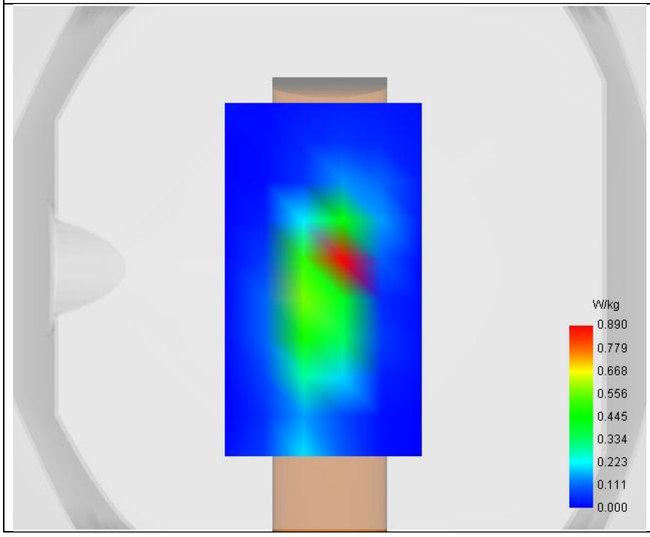
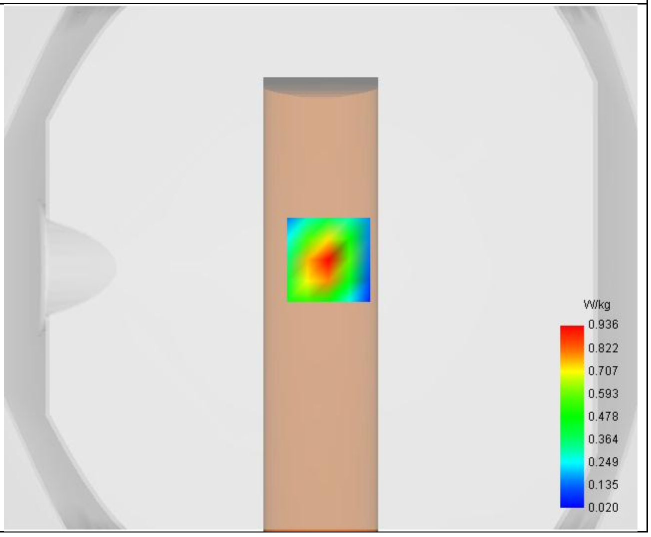
A. Experimental conditions.

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	GSM1900
Channels	Middle
Signal	TDMA (Crest factor: 8.0)

B. Permitivity

Frequency (MHz)	1880.000000
Relative permitivity (real part)	40.000000
Conductivity (S/m)	1.400391

C. SAR Surface and Volume

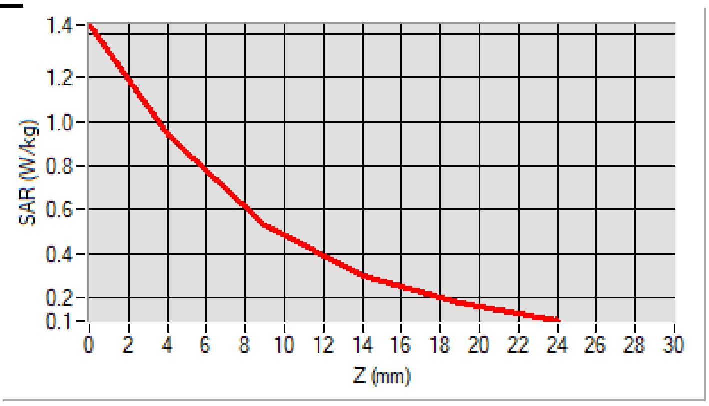
SURFACE SAR	VOLUME SAR
	

Maximum location: X=3.00, Y=3.00 ; SAR Peak: 1.46 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.432324
SAR 1g (W/Kg)	0.861579
Variation (%)	-1.379999

E. Z Axis Scan



SAR Measurement at Band5_WCDMA850 (Body, Validation Plane)

Date of measurement: 08/10/2021

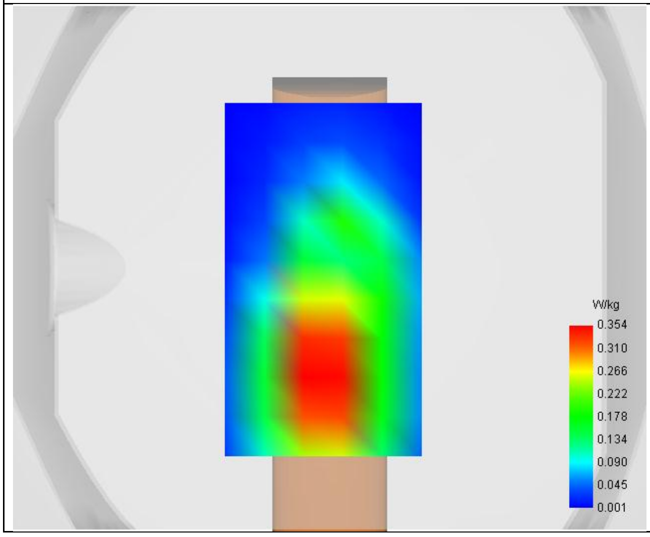
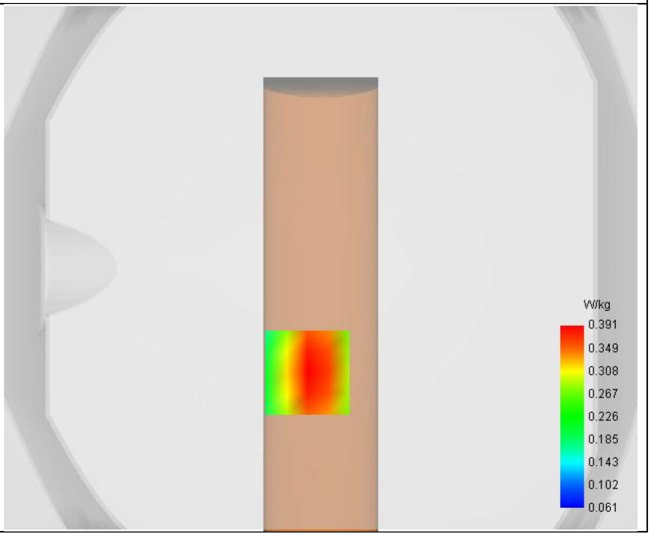
A. Experimental conditions.

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)	41.660123
Conductivity (S/m)	0.901669

C. SAR Surface and Volume

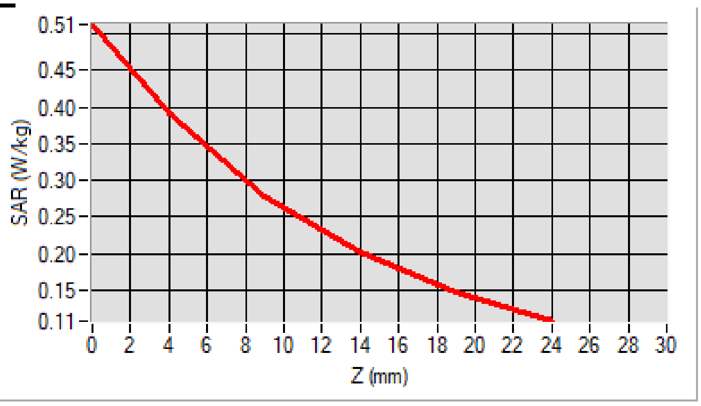
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-5.00, Y=-40.00 ; SAR Peak: 0.52 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.254328
SAR 1g (W/Kg)	0.374519
Variation (%)	-1.7000000

E. Z Axis Scan



SAR Measurement at Band2_WCDMA1900 (Body, Validation Plane)

Date of measurement: 12/10/2021

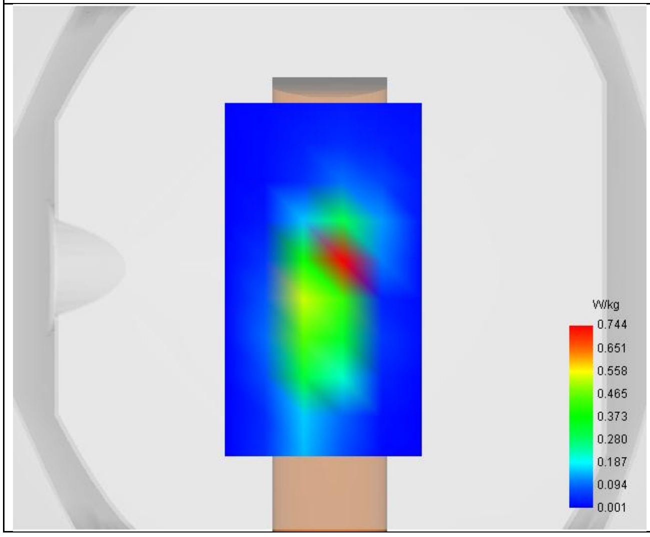
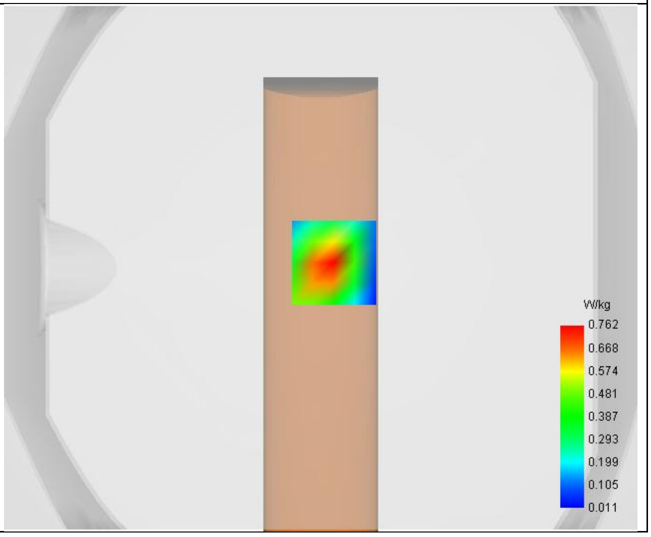
A. Experimental conditions.

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	Middle
Signal	WCDMA (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1880.000000
Relative permitivity (real part)	40.000000
Conductivity (S/m)	1.400391

C. SAR Surface and Volume

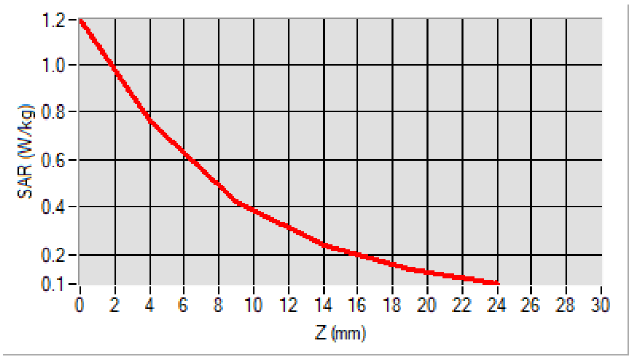
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=5.00, Y=2.00 ; SAR Peak: 1.22 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.358306
SAR 1g (W/Kg)	0.711715
Variation (%)	-3.510000

E. Z Axis Scan



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

Date of measurement: 12/10/2021

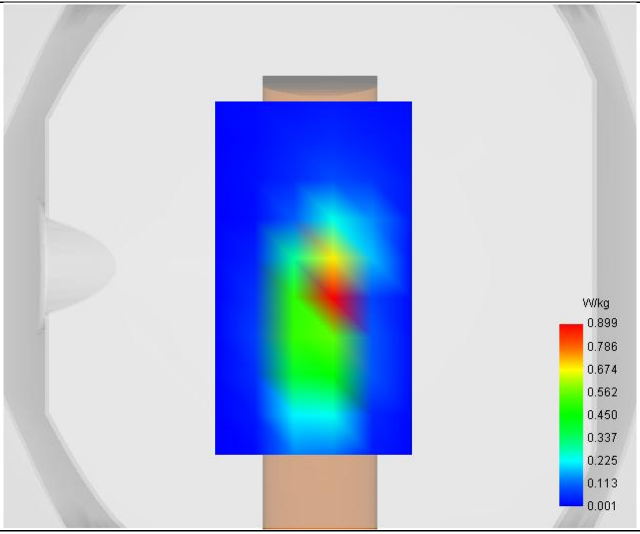
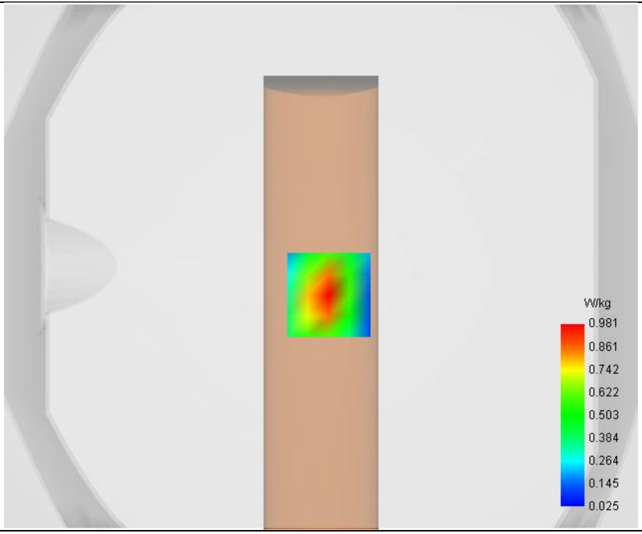
A. Experimental conditions.

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	LTE band 2
Channels	Middle
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1880.000000
Relative permitivity (real part)	40.000000
Conductivity (S/m)	1.400391

C. SAR Surface and Volume

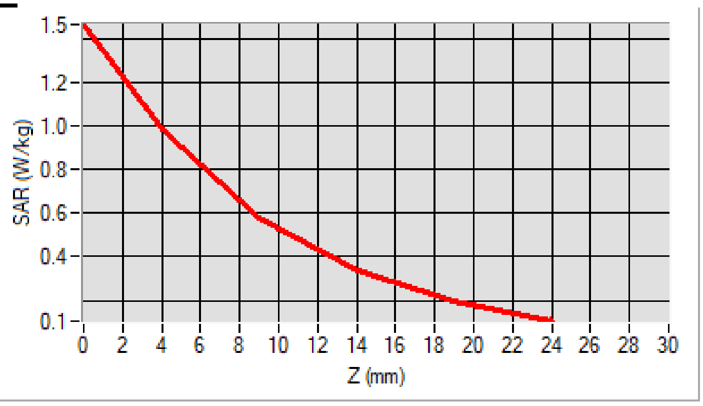
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=3.00, Y=-11.00 ; SAR Peak: 1.48 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.464445
SAR 1g (W/Kg)	0.903252
Variation (%)	3.520000

E. Z Axis Scan



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

Date of measurement: 12/10/2021

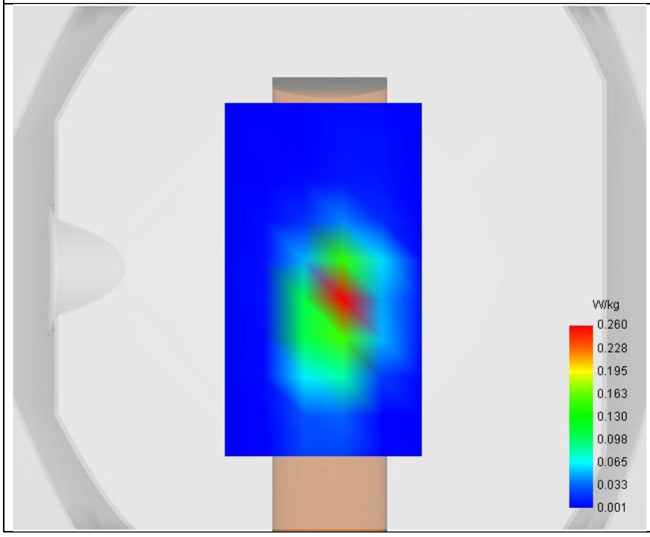
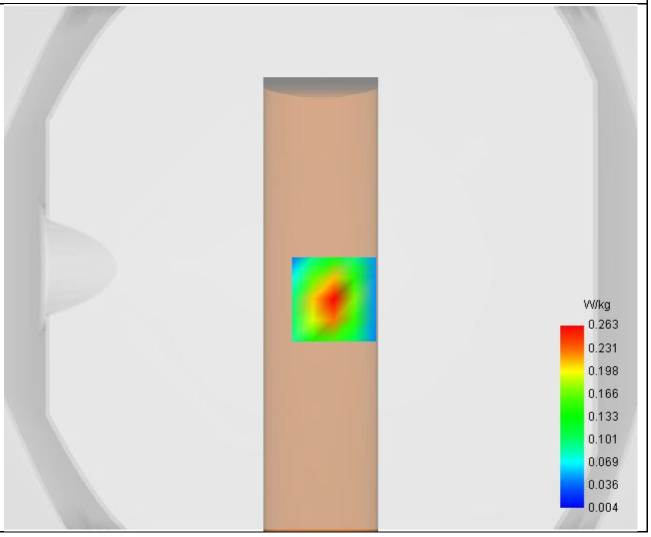
A. Experimental conditions.

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)	40.115910
Conductivity (S/m)	1.360603

C. SAR Surface and Volume

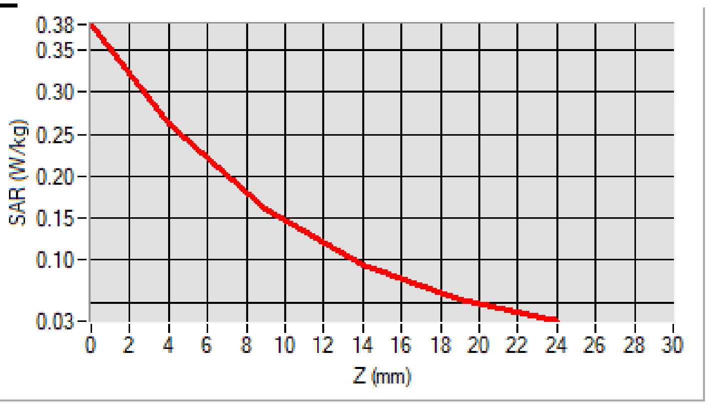
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=5.00, Y=-12.00 ; SAR Peak: 0.38 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.125012
SAR 1g (W/Kg)	0.240774
Variation (%)	1.520000

E. Z Axis Scan



SAR Measurement at LTE band 5 (Body, Validation Plane)

Date of measurement: 08/10/2021

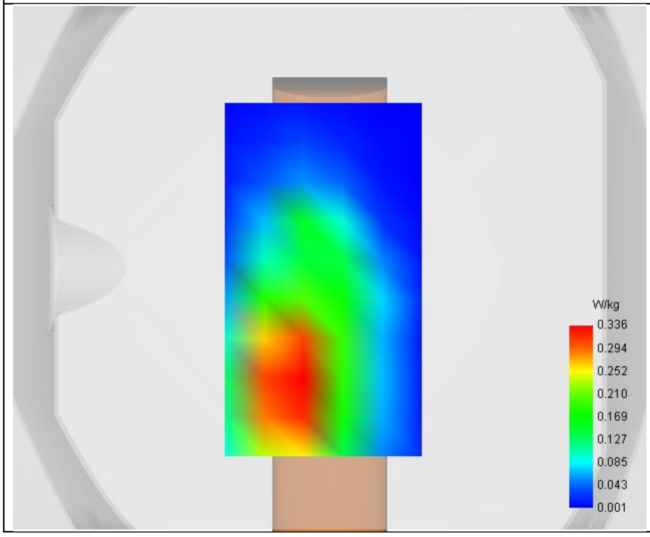
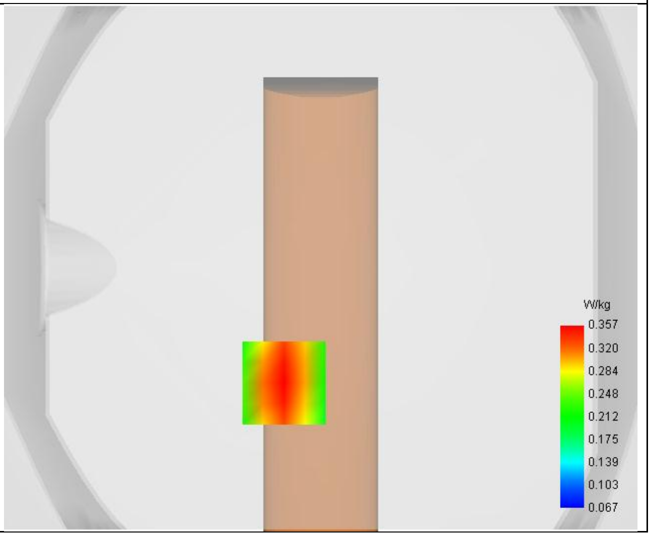
A. Experimental conditions.

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	LTE band 5
Channels	Low
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	829.000000
Relative permitivity (real part)	41.440000
Conductivity (S/m)	0.901432

C. SAR Surface and Volume

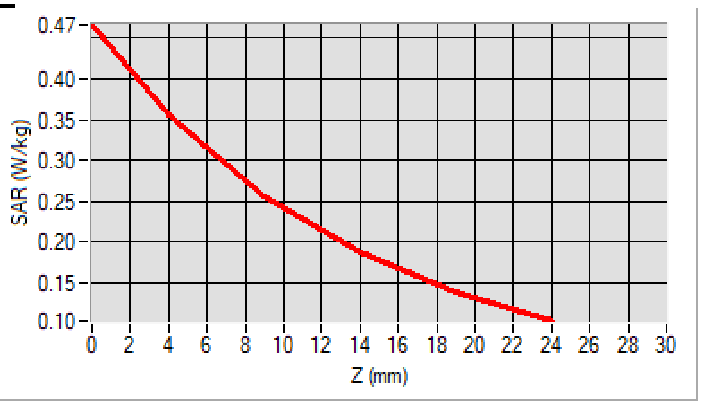
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-14.00, Y=-44.00 ; SAR Peak: 0.47 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.234179
SAR 1g (W/Kg)	0.340530
Variation (%)	2.100000

E. Z Axis Scan



SAR Measurement at LTE band 7 (Body, Validation Plane)

Date of measurement: 18/10/2021

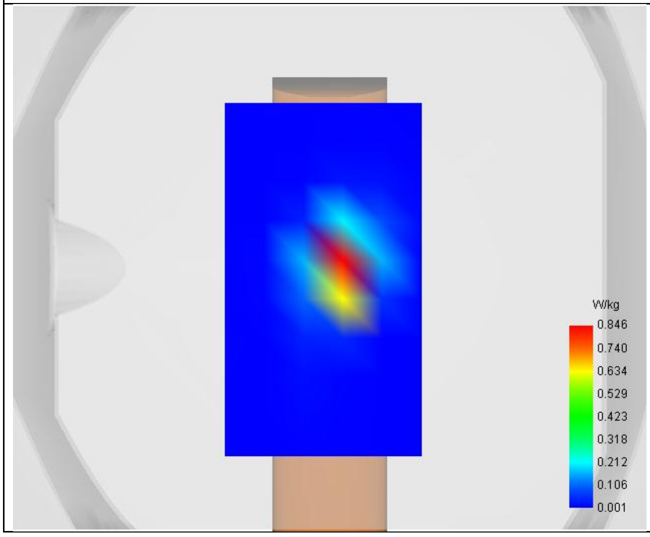
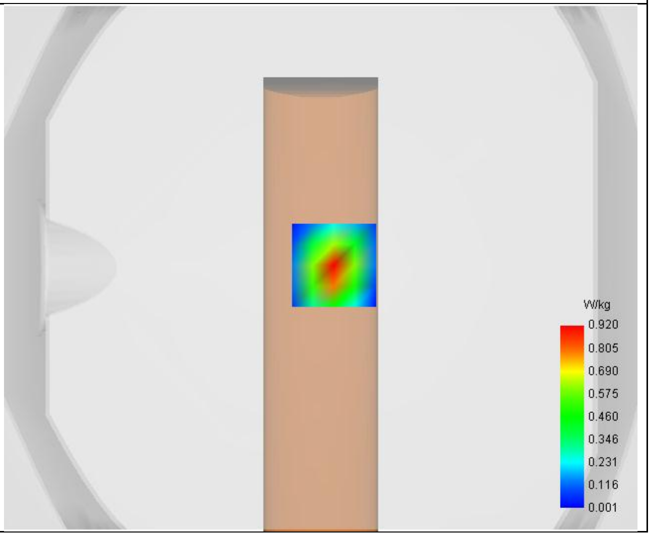
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	2.15
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 7
Channels	Low
Signal	LTE (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2510.000000
Relative permitivity (real part)	39.119999
Conductivity (S/m)	1.862978

C. SAR Surface and Volume

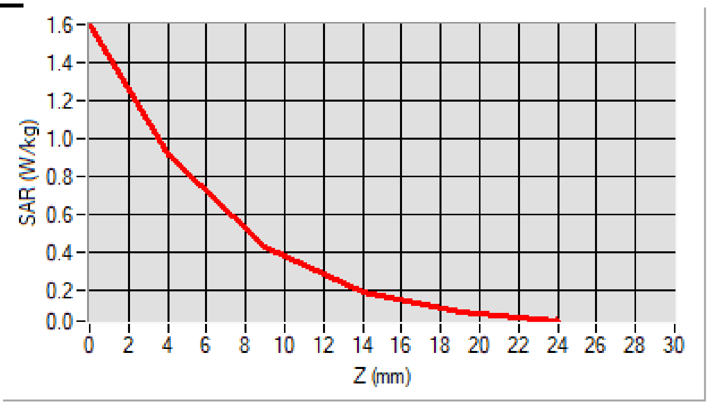
SURFACE SAR	VOLUME SAR
	

Maximum location: X=5.00, Y=1.00 ; SAR Peak: 1.62 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.351506
SAR 1g (W/Kg)	0.752153
Variation (%)	4.850000

E. Z Axis Scan



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

Date of measurement: 18/10/2021

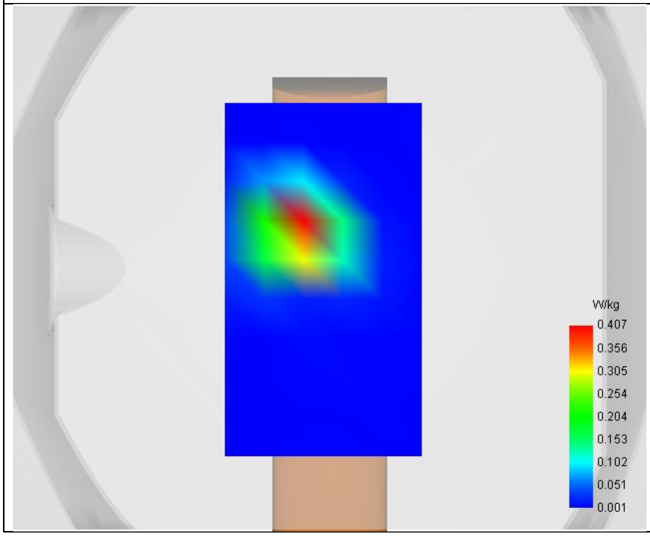
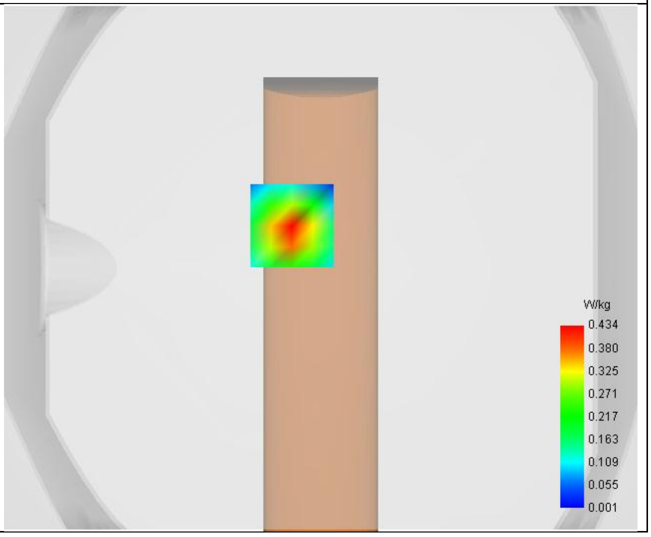
A. Experimental conditions.

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	Low
Signal	IEEE802.b (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	2412.000000
Relative permitivity (real part)	39.226002
Conductivity (S/m)	1.788081

C. SAR Surface and Volume

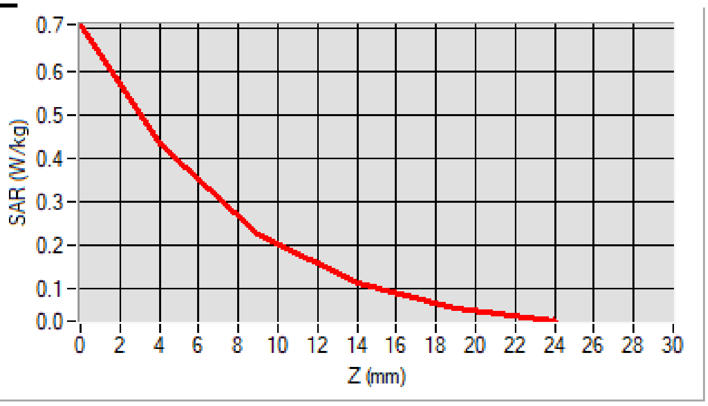
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-11.00, Y=16.00 ; SAR Peak: 0.71 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	0.188391
SAR 1g (W/Kg)	0.399354
Variation (%)	-0.890000

E. Z Axis Scan



SAR Measurement at CUSTOM (5.2GHz_802.11a) (Body, Validation Plane)

Date of measurement: 20/10/2021

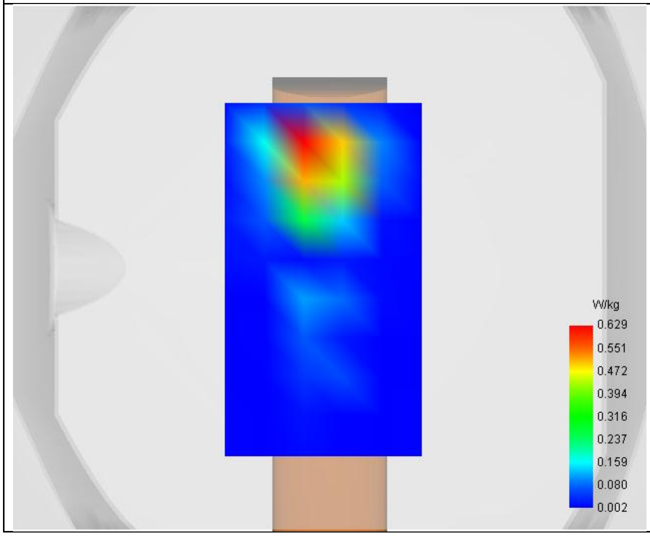
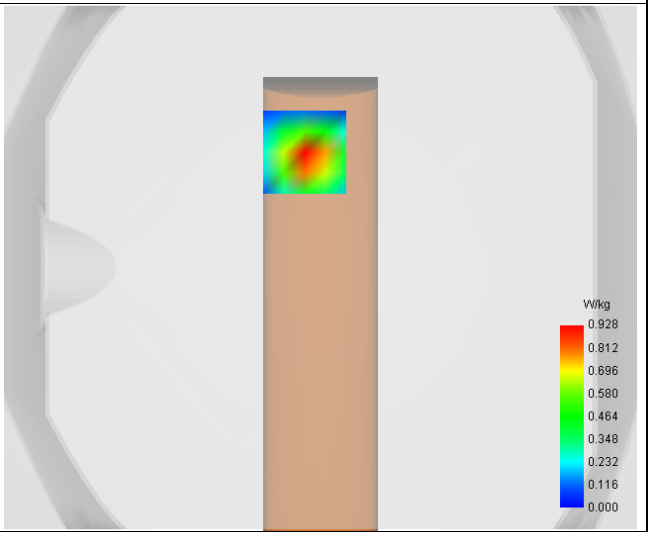
A. Experimental conditions.

Probe	SN 18/21 EPGO354
ConvF	1.86
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a
Channels	Middle
Signal	IEEE802.11a (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	5200.000000
Relative permitivity (real part)	35.432416
Conductivity (S/m)	4.621324

C. SAR Surface and Volume

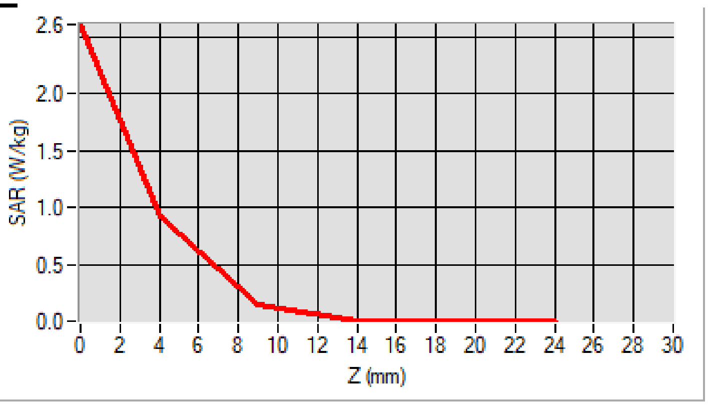
<table>
<tr><th>SURFACE SAR</th><th>VOLUME SAR</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Maximum location: X=-6.00, Y=44.00 ; SAR Peak: 1.73 W/kg

D. SAR 1g & 10g

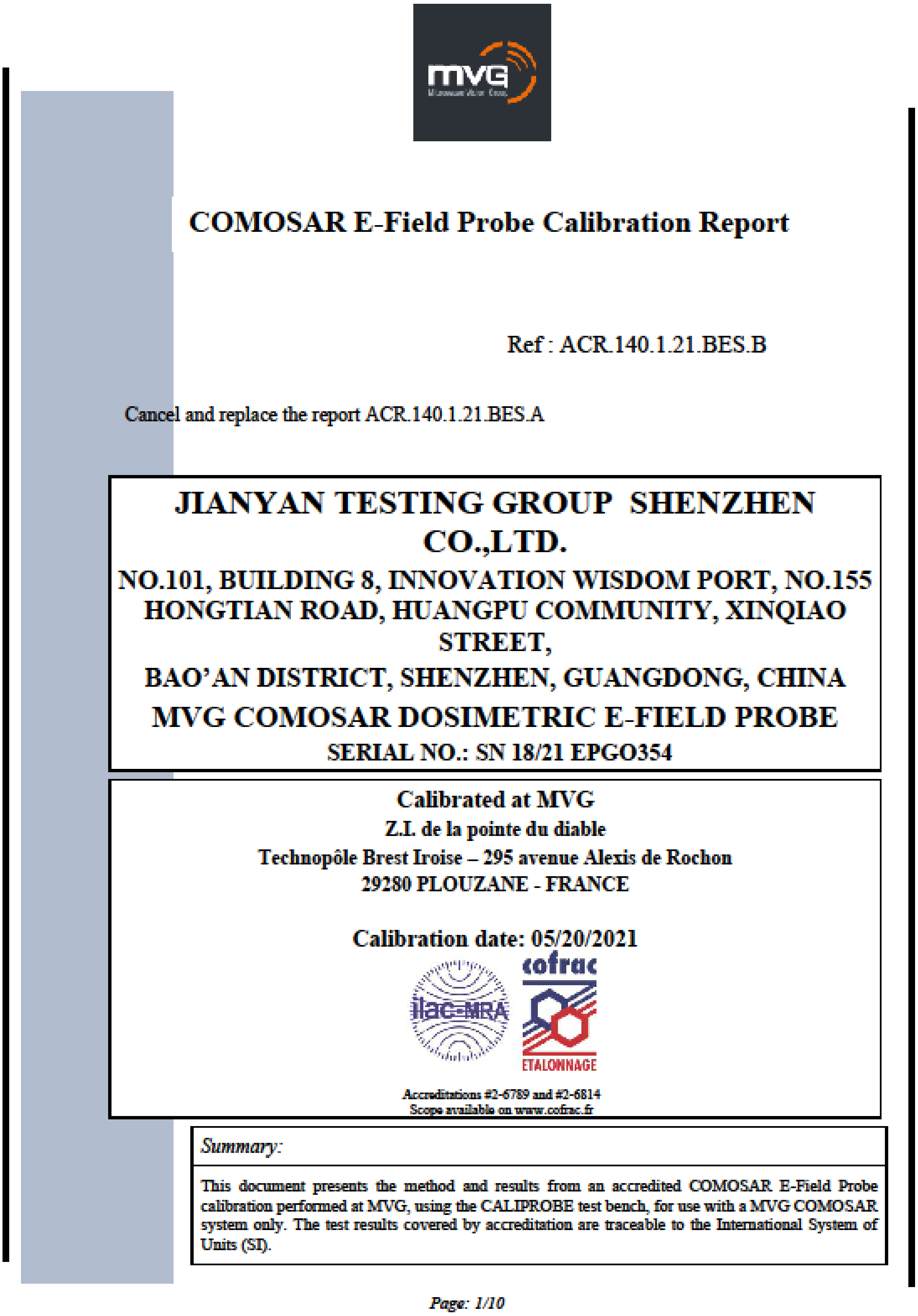
SAR 10g (W/Kg)	0.195863
SAR 1g (W/Kg)	0.452813
Variation (%)	3.430000

E. Z Axis Scan



Appendix C: System Calibration Certificate

Calibration information for E-field probes



COMOSAR E-Field Probe Calibration Report

Ref : ACR.140.1.21.BES.B

Cancel and replace the report ACR.140.1.21.BES.A

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, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 18/21 EPGO354

Calibrated at MVG
Z.I. de la pointe du diable
Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

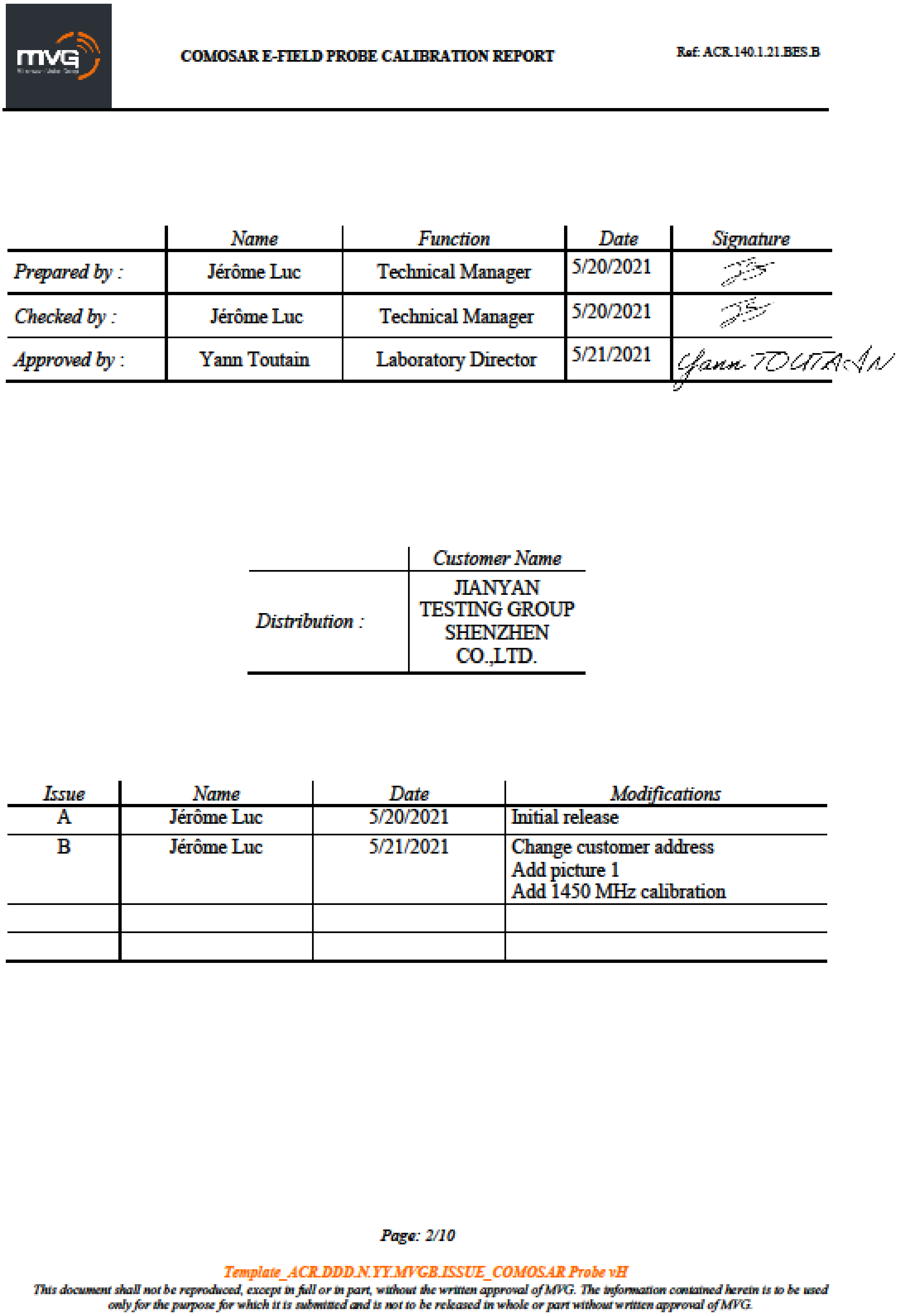
Calibration date: 05/20/2021

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

Summary:

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

Page: 1/10



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.140.1.21.BES.B

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme Luc	Technical Manager	5/20/2021	
Checked by :	Jérôme Luc	Technical Manager	5/20/2021	
Approved by :	Yann Toutain	Laboratory Director	5/21/2021	Yann TOUTAIN

	Customer Name
Distribution :	JIANYAN TESTING GROUP SHENZHEN CO.,LTD.

Issue	*Name*	*Date*	*Modifications*
A	Jérôme Luc	5/20/2021	Initial release
B	Jérôme Luc	5/21/2021	Change customer address Add picture 1 Add 1450 MHz calibration

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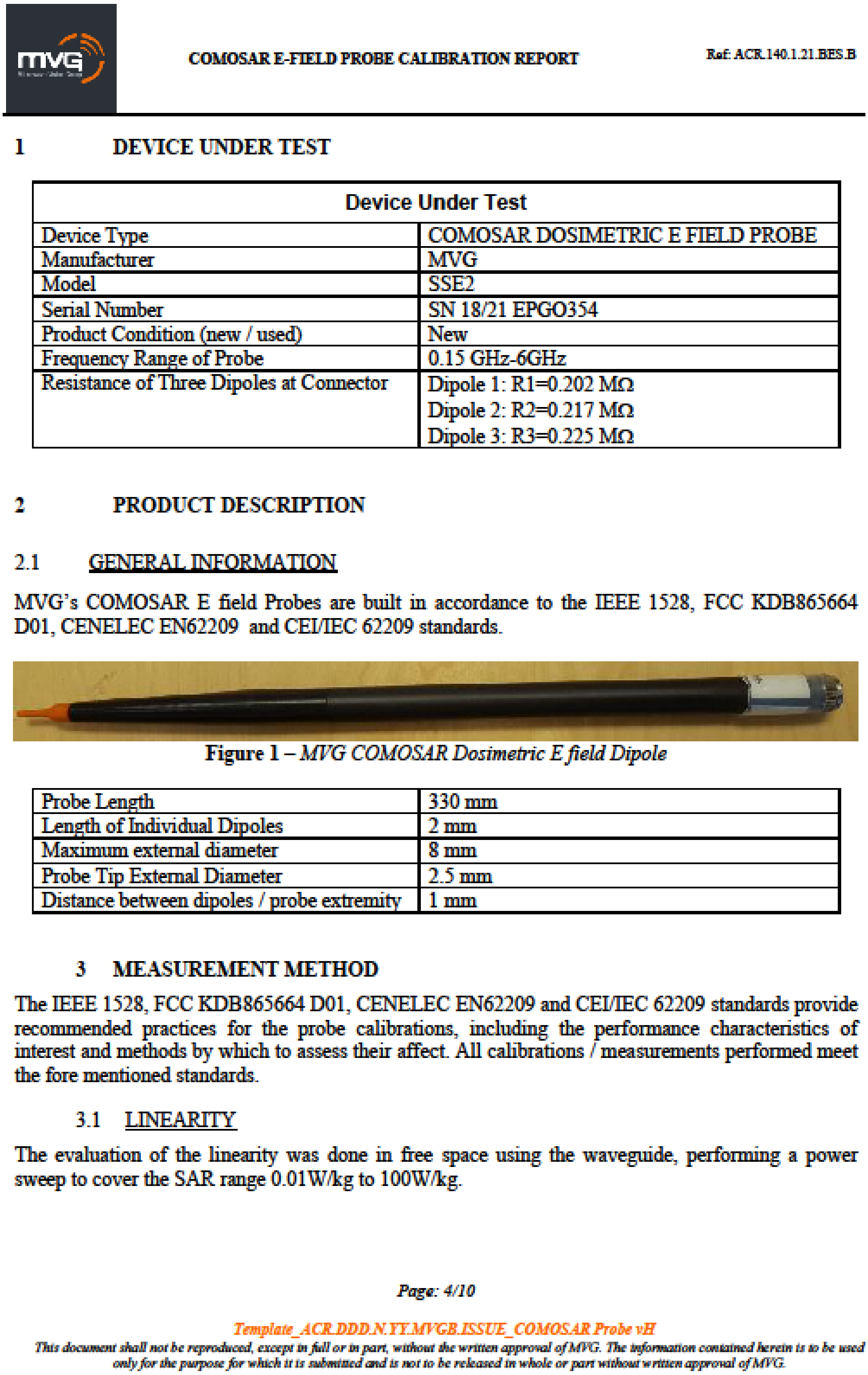


1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 18/21 EPGO354
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.202 MΩ Dipole 2: R2=0.217 MΩ Dipole 3: R3=0.225 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEEE 1528, FCC KDB865664 D01, CENELEC EN62209 and CEI/IEC 62209 standards.

Figure 1 – *MVG COMOSAR Dosimetric E field Dipole*

Probe Length	330 mm
Length of Individual Dipoles	2 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.5 mm
Distance between dipoles / probe extremity	1 mm

3 MEASUREMENT METHOD

The IEEE 1528, FCC KDB865664 D01, CENELEC EN62209 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.2 SENSITIVITY

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

3.3 LOWER DETECTION LIMIT

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

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.1 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

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

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

where

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

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

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	**Uncertainty value (%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (%)**
Expanded uncertainty 95 % confidence level k = 2					14 %

5 CALIBRATION MEASUREMENT RESULTS

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

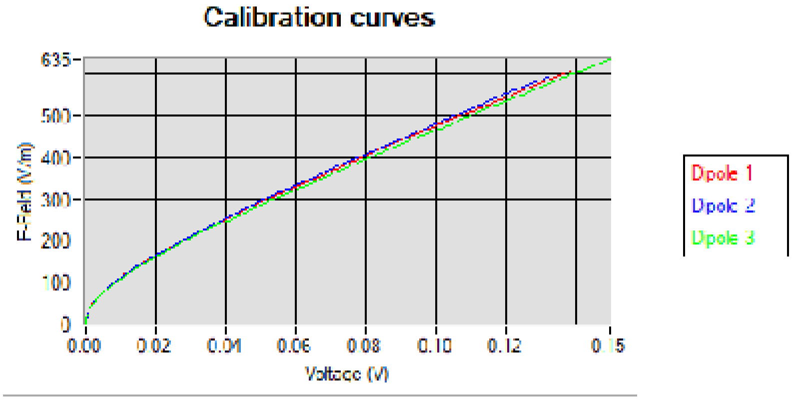
5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
0.86	0.87	0.90

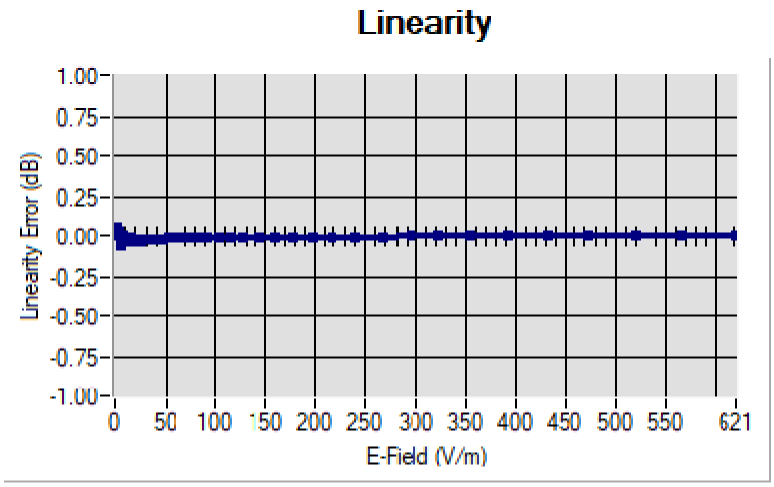
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
107	101	105

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

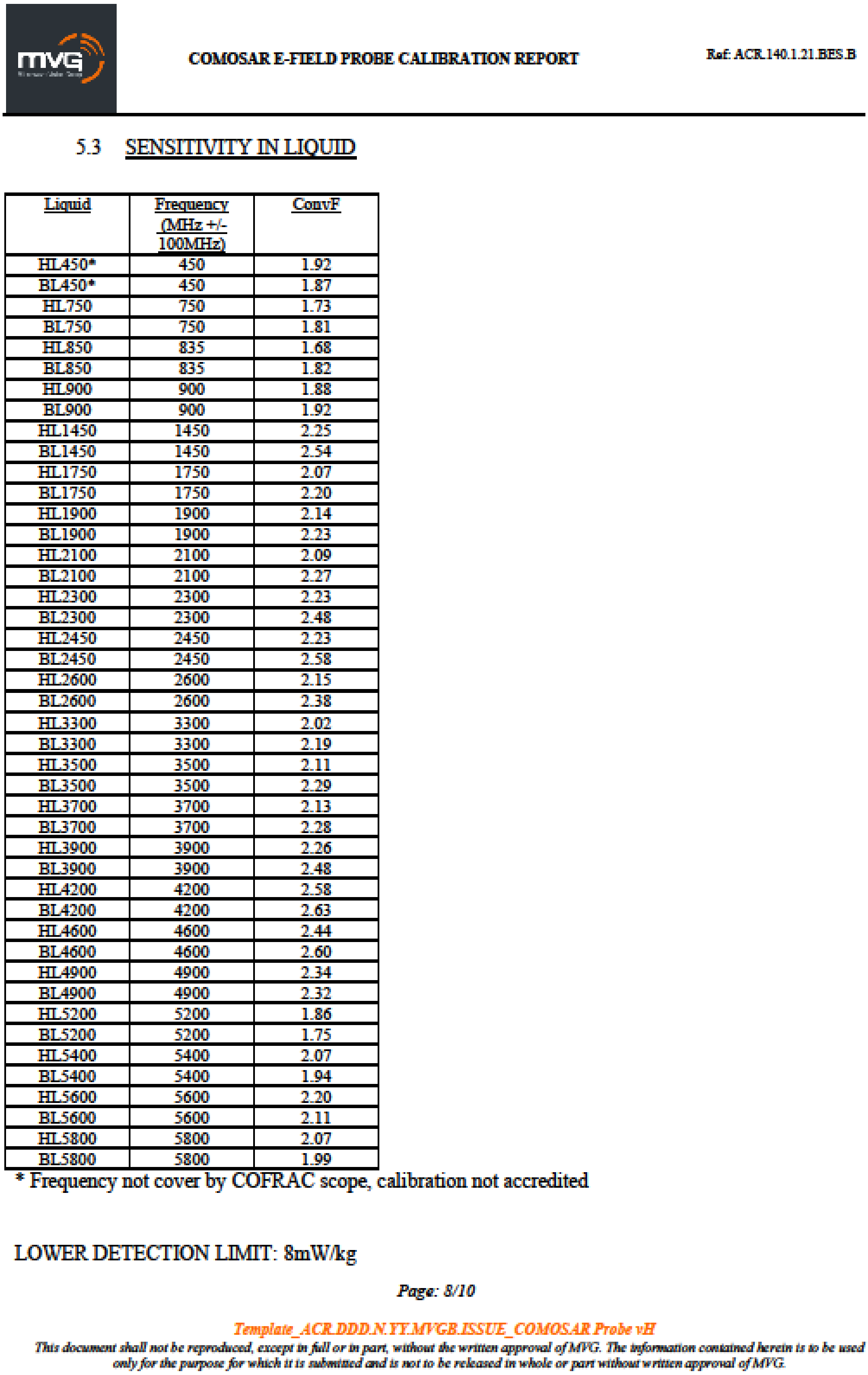
$$E = \sqrt{E_1^{\,2} + E_2^{\,2} + E_3^{\,2}}$$



5.2 LINEARITY



Linearity:+/-1.55% (+/-0.07dB)



5.3 SENSITIVITY IN LIQUID

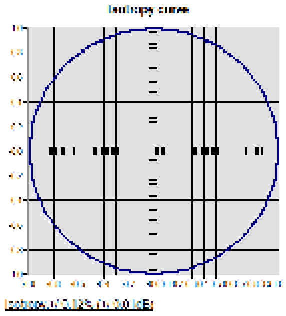
Liquid	Frequency (MHz +/- 100MHz)	ConvF
HL450*	450	1.92
BL450*	450	1.87
HL750	750	1.73
BL750	750	1.81
HL850	835	1.68
BL850	835	1.82
HL900	900	1.88
BL900	900	1.92
HL1450	1450	2.25
BL1450	1450	2.54
HL1750	1750	2.07
BL1750	1750	2.20
HL1900	1900	2.14
BL1900	1900	2.23
HL2100	2100	2.09
BL2100	2100	2.27
HL2300	2300	2.23
BL2300	2300	2.48
HL2450	2450	2.23
BL2450	2450	2.58
HL2600	2600	2.15
BL2600	2600	2.38
HL3300	3300	2.02
BL3300	3300	2.19
HL3500	3500	2.11
BL3500	3500	2.29
HL3700	3700	2.13
BL3700	3700	2.28
HL3900	3900	2.26
BL3900	3900	2.48
HL4200	4200	2.58
BL4200	4200	2.63
HL4600	4600	2.44
BL4600	4600	2.60
HL4900	4900	2.34
BL4900	4900	2.32
HL5200	5200	1.86
BL5200	5200	1.75
HL5400	5400	2.07
BL5400	5400	1.94
HL5600	5600	2.20
BL5600	5600	2.11
HL5800	5800	2.07
BL5800	5800	1.99

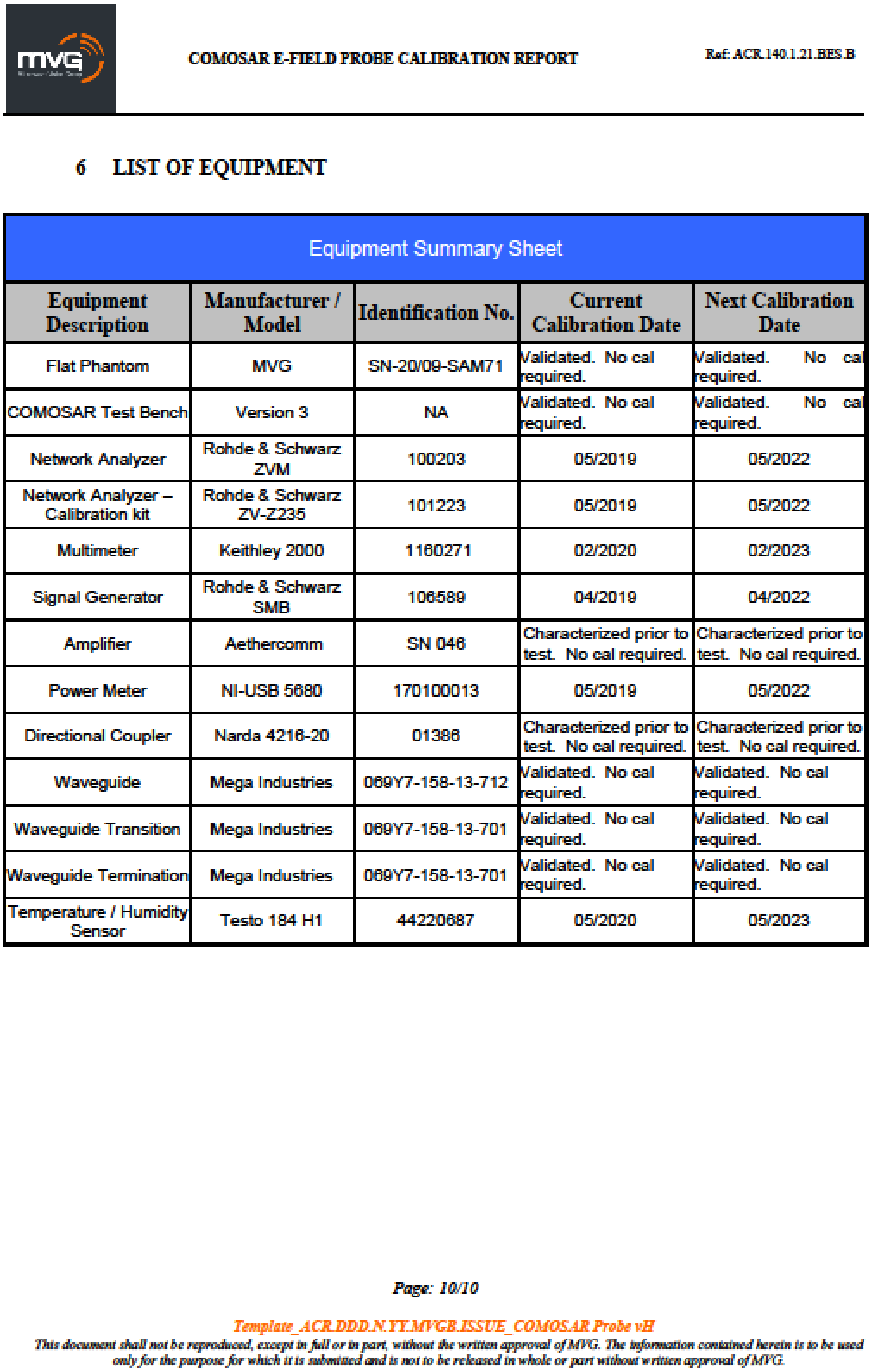
* Frequency not cover by COFRAC scope, calibration not accredited

LOWER DETECTION LIMIT: 8mW/kg

5.4 ISOTROPY

HL1900 MHz





6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	05/2019	05/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	05/2019	05/2022
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44220687	05/2020	05/2023