

SAR TEST REPORT

Report No.: BCTC2412348613-14E

Applicant: SHENZHEN YUNJI INTELLIGENT TECHNOLOGY
CO.,LTD

Product Name: Smart Phone

Test Model: WP23 Plus

Tested Date: 2023-01-11 to 2023-02-07

Issued Date: 2024-12-26

Shenzhen **BCTC** Testing Co., Ltd.



Product Name: Smart Phone

Trademark: OUKITEL

Model/Type reference: WP23 Plus
WP23, WP23 S, WP23 Pro, WP23 Ultra

Prepared For: SHENZHEN YUNJI INTELLIGENT TECHNOLOGY CO.,LTD

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Manufacturer: SHENZHEN YUNJI INTELLIGENT TECHNOLOGY CO.,LTD

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Sample Received Date: 2023-01-11

Sample tested Date: 2023-01-11 to 2023-02-07

Issue Date: 2024-12-26

Report No.: BCTC2412348613-14E

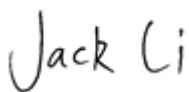
SAR Max. Values is: 0.540W/kg (10g) for Head and 0.549 W/kg (10g) for Body. 0.779 W/kg (10g) for
Limb worn.

Test Standards: EN50663:2017&EN50566:2017&EN62209-1:2016&EN62209-2:2010+A1:2019&
EN 62479:2010&EN 50360:2017

Test Results: PASS

Remark: This is SAR test report

Tested by:



Jack Li/Project Handler

Approved by:



Zero Zhou/Reviewer

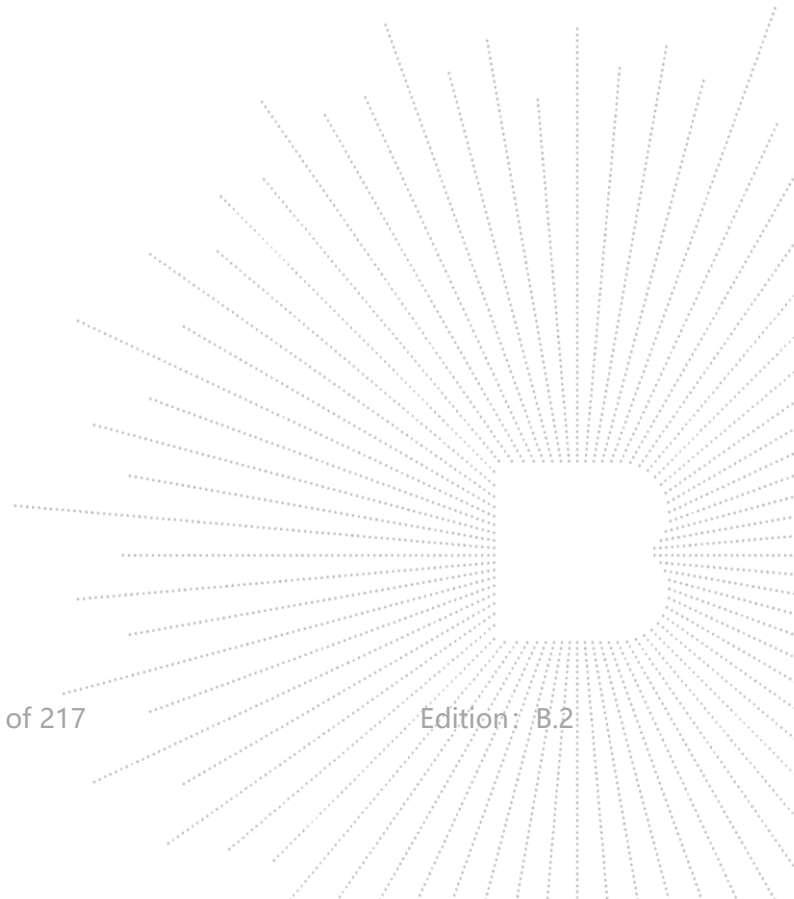
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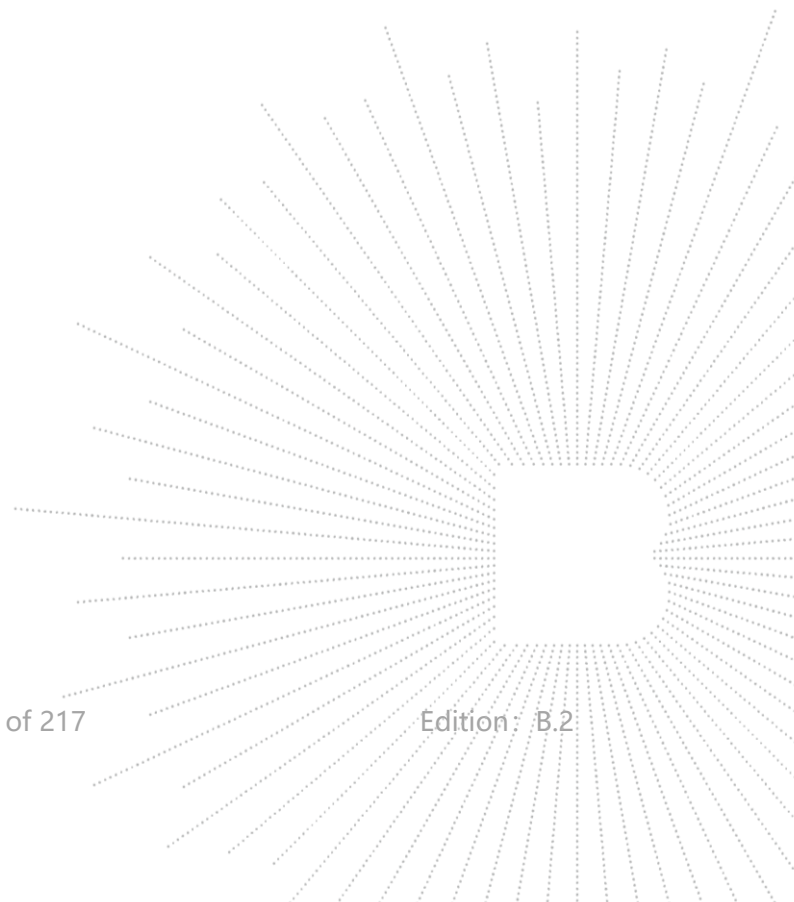
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(Note: N/A Means Not Applicable)



1. Version

Report No.	Issue Date	Description	Approved
BCTC2412348613-14E	2024-12-26	Original	Valid



2. Test Standards

The tests were performed according to following standards:

EN 50360:2017:Product standard to demonstrate the compliance of wireless communication devices, with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 300 MHz to 6 GHz: devices used next to the ear

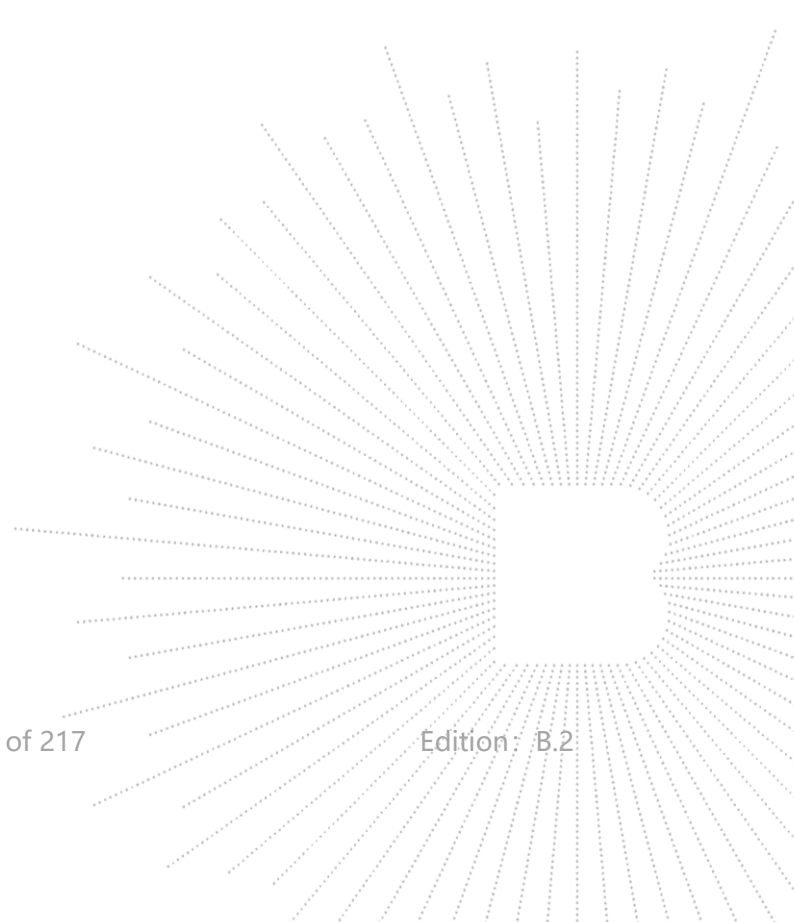
EN 62209-1:2016: Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz)

EN 62209-2:2010+A1:2019:Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices. Human models, instrumentation, and procedures. Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)

EN 50663:2017:Generic standard for assessment of low power electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (10 MHz - 300 GHz)

EN 50566:2017:Product standard to demonstrate the compliance of wireless communication devices with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 30 MHz to 6 GHz: hand-held and body mounted devices in close proximity to the human body

EN 62479:2010:Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)



3. Test Summary

The maximum results of Specific Absorption Rate (SAR) have found during testing are as follows:

Frequency Band	Head SAR	Body (5mm Gap)	Limb worn(0mm Gap)	SAR _{10g} Limit (W/kg)
	Maximum SAR _{10g} (W/kg)	Maximum SAR _{10g} (W/kg)	Maximum SAR _{10g} (W/kg)	
GSM	0.540	0.233	0.412	2.0/4.0
WCDMA	0.372	0.222	0.394	2.0/4.0
LTE	0.323	0.228	0.779	2.0/4.0
WIFI	0.336	0.549	0.602	2.0/4.0

The device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (2.0 W/kg) specified in Annex II of Council Recommendation 1999/519/EC, and had been tested in accordance with the measurement methods and procedure specified in IEEE 1528-2013 and EN 62209-2. Limb worn SAR limits (4.0 W/kg)

Highest simultaneous SAR

Exposure Position	Classment Class	Highest Simultaneous Transmission SAR _{10-g} (W/kg)
Head	GSM	0.876
	WIFI	

Exposure Position	Classment Class	Highest Simultaneous Transmission SAR _{10-g} (W/kg)
Limb worn	LTE	1.381
	WIFI	

Remark:

Based on the following changes in the original test report (BCTC2301220661-14E), No changes were made to the product.

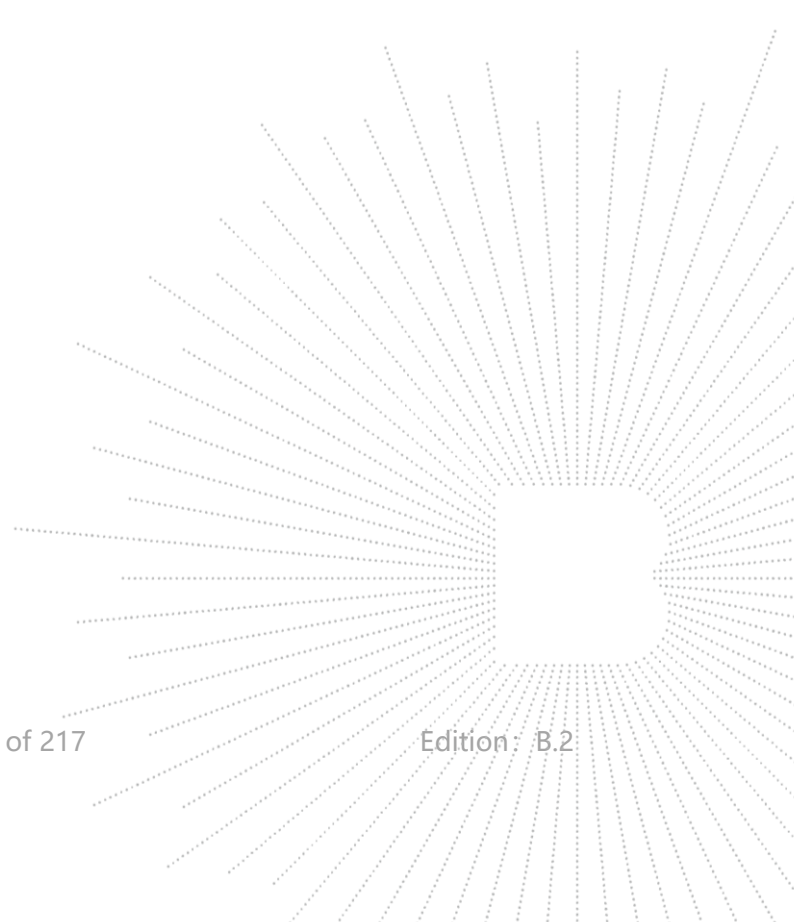
Only changes Model/Type reference.

4. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in IEEE 1528, IEC/IEEE 62209-1528/ EN IEC/IEEE 62209-1528, IEC/EN 62209-1, IEC/EN 62209-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Uncertainty Component	Tol (+-%)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Veff
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	√3	$\sqrt{1 - C_p}$	$\sqrt{1 - C_p}$	1.43	1.43	∞
Hemispherical Isotropy	5.9	R	√3	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
Linearity	4.7	R	√3	1	1	2.71	2.71	∞
System detection limits	1.0	R	√3	1	1	0.58	0.58	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Response Time	0.0	R	√3	1	1	0.00	0.00	∞
Integration Time	1.4	R	√3	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3.0	R	√3	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3.0	R	√3	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	√3	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	√3	1	1	0.81	0.81	∞
Max. SAR Evaluation	1.0	R	√3	1	1	0.6	0.6	∞
Test sample Related								
Device positioning	2.6	N	1	1	1	2.6	2.6	11
Device holder	3.0	N	1	1	1	3.0	3.0	7
Drift of output power	5.0	N	√3	1	1	2.89	2.89	∞
Phantom and Tissue Parameters								
Phantom uncertainty	4.00	R	√3	1	1	2.31	2.31	∞
Liquid conductivity (target)	2.50	N	1	0.78	0.71	1.95	1.78	5
Liquid conductivity (meas)	4.00	N	1	0.23	0.26	0.92	1.04	5
Liquid Permittivity (target)	2.50	N	1	0.78	0.71	1.95	1.78	∞
Liquid Permittivity (meas)	5.00	N	1	0.23	0.26	1.15	1.30	∞
Combined Standard		RSS	$u_c = \sqrt{\sum_{i=1}^n C_i^2 U_i^2}$			10.63 %	10.54%	

Expanded Uncertainty (95% Confidence interval)	$U = k \text{ UC}, k=2$	21.26 %	21.08%	
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5. Product Information And Test Setup

5.1 Product Information

Model/Type Ref.:	WP23 WP23 S, WP23 Pro, WP23 Ultra
Model differences:	All the model are the same circuit and RF module, except model names.
Bluetooth Version:	5.0
GSM Band(s):	GSM/GPRS/EGPRS 900/1800MHz
GPRS Class:	12
WCDMA Band(s):	FDD Band I/VIII
LTE Band(s):	FDD Band 1, Band 3, Band 7, Band 8, Band 20
Technologies:	Tagging systems
FM:	Support
GPS:	Support
Hardware Version:	HCT-M605MB-A1
Software Version:	OUKITEL_WP23_EEA_V01
	Bluetooth(EDR+BLE): 2402-2480MHz
	WIFI(2.4GHz): IEEE 802.11b/g/n HT20: 2412MHz-2472MHz IEEE 802.11n HT40: 2422MHz-2462MHz
	WIFI(5.1GHz): IEEE 802.11a/n/ac HT20:5180MHz-5240MHz IEEE 802.11n/ac HT40:5190MHz-5230MHz
	WIFI(5.8GHz): IEEE 802.11a/n/ac HT20:5745MHz-5825MHz IEEE 802.11n/ac HT40:5755 MHz-5795MHz IEEE 802.11ac HT80:5775MHz
	GSM/GPRS/EGPRS 900: Tx: 880-915MHz, Rx: 925-960MHz
	GSM/GPRS/EGPRS 1800: Tx: 1710-1785MHz, Rx: 1805-1880MHz
	WCDMA Band I: Tx: 1920-1980MHz, Rx: 2110-2170MHz
	WCDMA Band VIII: Tx: 880-915MHz, Rx: 925-960MHz
Operation Frequency:	LTE Band 1: (UL)1920MHz~1980MHz (DL)2110MHz~2170MHz
	LTE Band 3: (UL)1710MHz~1785MHz (UL)1805MHz~1880MHz
	LTE Band 7: (UL)2500MHz~2570MHz (DL)2620MHz~2690MHz
	LTE Band 8: (UL)880MHz~915MHz (DL)925MHz~960MHz
	LTE Band 20: (UL)832MHz~862MHz (DL)791MHz~821MHz
	NFC; 13.56MHz
	FM (Receiver): 87.5-108MHz
	GPS: 1.57542GHz
Max. RF output power:	Bluetooth(EDR): 2.5 dBm
	Bluetooth(BLE): 0.24 dBm

	WIFI(2.4GHz) :	14.3 dBm
	WIFI(5.1GHz):	12.76 dBm
	WIFI(5.8GHz):	9.69 dBm
	GSM/GPRS/EGPRS 900:	33.71 dBm
	GSM/GPRS/EGPRS 1800:	30.62 dBm
	WCDMA Band I:	22.25 dBm
	WCDMA Band VIII:	23.84 dBm
	LTE Band 1:	21.78 dBm
	LTE Band 3:	22.65 dBm
	LTE Band 7:	21.78 dBm
	LTE Band 8:	23.44 dBm
	LTE Band 20:	22.37 dBm
	Bluetooth(EDR):	GFSK, $\pi/4$ DQPSK, 8DPSK
	Bluetooth(BLE):	GFSK
Type of Modulation:	WIFI(2.4GHz+5.1GHz+5.8GHz):	DSSS, OFDM
	GSM/GPRS/EGPRS:	GMSK
	WCDMA:	QPSK, 16QAM, 64QAM, BPSK
	LTE:	QPSK, 16-QAM
Antenna installation:	Internal antenna	
Product Class:	1	
	Bluetooth(EDR+BLE+2.4GHz):	0.33 dBi
	WIFI(5.1GHz+5.8GHz):	0.24 dBi
	GSM/GPRS/EGPRS 900:	1.2 dBi
	GSM/GPRS/EGPRS 1800:	0.03 dBi
	WCDMA Band I:	1.2 dBi
Antenna Gain:	WCDMA Band VIII:	0.52 dBi
	LTE band 1:	0.52 dBi
	LTE Band 3:	0.03 dBi
	LTE Band 7:	0.22 dBi
	LTE Band 8:	1.2 dBi
	LTE Band 20:	-0.15 dBi
	GPS	1.15 dBi
Ratings:	AC 230V/50Hz/DC 3.87V from battery	
	Model: HJ-FC017K7-EU	
	Input: 100-240V~50/60Hz 0.6A	
Adapter Information:	Output: DC 5.0V 2.0A	
	OR: DC 7.0V 2.0A	
	OR: DC 9.0V 2.0A	
	OR: DC 12.0V 1.5A 18.0W	

5.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

5.3 Support Equipment

Cable of Product

No.	Cable Type	Quantity	Provider	Length (m)	Shielded	Note
1	--	--	Applicant	---	Yes/No	--
2	--	--	BCTC	--	Yes/No	--

No.	Device Type	Brand	Model	Series No.	Note
1.	---	---	---	---	---
2.	--	--	--	--	--

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

5.4 Test Environment

1. Normal Test Conditions:

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Temperature(°C):	22

2. Extreme Test Conditions:

N/A

6. Test Facility And Test Instrument Used

6.1 Test Facility

All measurement facilities used to collect the measurement data are located at Shenzhen BCTC Testing Co., Ltd. Address: 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

6.2 Test Instrument Used

Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.
PC	DELL	\	\	N/A	N/A
SAR Measurement system	SATIMO	\	\	N/A	N/A
Signal Generator	Agilent	83712A	\	May 24, 2022	May 23, 2023
Multimeter	Keithley	1160271	\	Nov. 10, 2022	Nov 09, 2023
S-parameter Network Analyzer	R&S	ZVB 8	101353	Dec. 07, 2022	Dec. 06, 2023
Wideband Radio Communication Tester	R&S	CMW500	\	Nov. 10, 2022	Nov 09, 2023
E SAR PROBE 6GHz	MVG	SSE2	SN EPGO373	June 29, 2022	June 28, 2023
DIPOLE 900	SATIMO	SID 900	SN 47/21 DIP 0G900-622	Nov. 20, 2021	Nov. 19, 2024
DIPOLE 1800	SATIMO	SID 1800	SN 47/21 DIP 1G800-623	Nov. 20, 2021	Nov. 19, 2024
DIPOLE 2100	SATIMO	SID 2100	SN 47/21 DIP 2G100-625	Nov. 20, 2021	Nov. 19, 2024
DIPOLE 2450	SATIMO	SID 2450	SN 47/21 DIP 2G450-627	Nov. 20, 2021	Nov. 19, 2024
DIPOLE 5000	SATIMO	SID5000	SN 47/21 DIP 5G000-629	Nov. 20, 2021	Nov. 19, 2024
COMOSAR OPENCoaxial Probe	SATIMO	\	\	Nov. 18, 2022	Nov. 17, 2023
SAR Locator	SATIMO	\	\	Nov. 18, 2022	Nov. 17, 2023
Communication Antenna	SATIMO	\	\	Nov. 18, 2022	Nov. 17, 2023
FEATURE PHONEPOSITIONING DEVICE	SATIMO	\	\	N/A	N/A
DUMMY PROBE	SATIMO	\	\	N/A	N/A
SAM Phantom	MVG	\	SN 13/09 SAM68	N/A	N/A
Liquid measurement Kit	HP	85033D	3423A08186	Nov. 20, 2021	Nov. 19, 2022
Power meter	Agilent	E4419	\	May 24, 2022	May 23, 2023
Power meter	Agilent	E4419	\	May 24, 2022	May 23, 2023
Power sensor	Agilent	E9300A	\	May 24, 2022	May 23, 2023
Power sensor	Agilent	E9300A	\	May 24, 2022	May 23, 2023
Directional Coupler	Krytar 158020	131467	\	Nov. 10, 2022	Nov 09, 2023

7. Specific Absorption Rate (SAR)

7.1 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.

7.2 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:

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

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

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

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

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

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

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.

8. SAR Measurement System

8.1 The Measurement System

Comosar is a system that is able to determine the SAR distribution inside a phantom of human being according to different standards. The Comosar 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

The following figure shows the system.



The EUT under test operating at the maximum power level is placed in the phone holder, under the phantom, which is filled with head simulating liquid. The E-Field probe measures the electric field inside the phantom. The OpenSAR software computes the results to give a SAR value in a 1g or 10g mass.

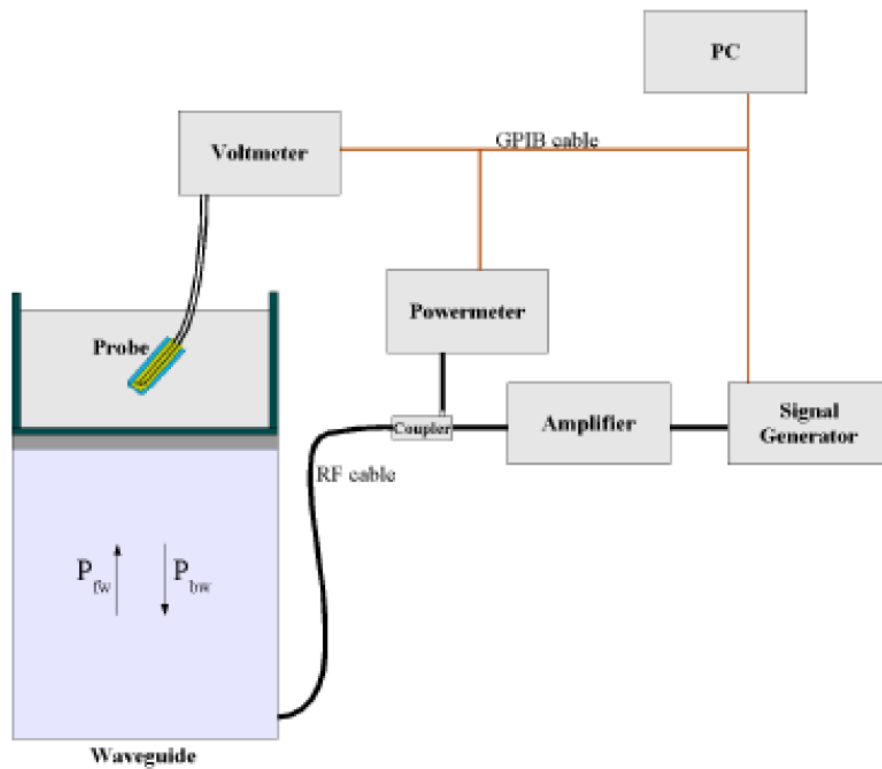
8.2 Probe

For the measurements the Specific Dosimetric E-Field Probe SN 46/21 EPG0362 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter : 5 mm
- Distance between probe tip and sensor center: 2.10mm
- Distance between sensor center and the inner phantom surface: 4 mm (repeatability better than +/- 1mm)
- Probe linearity: <0.25 dB
- Axial Isotropy: <0.25 dB
- Spherical Isotropy: <0.50 dB
- Calibration range: 835 to 2500MHz for head & body simulating liquid.

Angle between probe axis (evaluation axis) and surface normal line: less than 30°

Probe calibration is realized, in compliance with EN 62209-1 and IEEE 1528 STD, with CALISAR, Antenna proprietary calibration system. The calibration is performed with the EN 62209-1 annex technique using reference guide at the five frequencies.



$$SAR = \frac{4(p_{fw} - p_{pbw})}{ab\delta} \cos^2 \left(\pi \frac{y}{a} \right) c^{(2\pi/\delta)}$$

Where :

P_{fw} = Forward Power

P_{bw} = Backward Power

a and b = Waveguide dimensions

l = Skin depth

Keithley configuration:

Rate = Medium; Filter = ON; RDGS = 10; Filter type = Moving Average; Range auto after each calibration, a SAR measurement is 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:

$$CF(N) = SAR(N)/V_{lin}(N) \quad (N=1,2,3)$$

The linearised output voltage V_{lin}(N) is obtained from the displayed output voltage V(N) using

$$V_{lin}(N) = V(N) * (1 + V(N)/DCP(N)) \quad (N=1,2,3)$$

where DCP is the diode compression point in mV.

8.3 Test Procedure

Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. SATIMO Probe calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm²) using an with CALISAR, Antenna proprietary calibration system.

Free Space Assessment Procedure

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1mW/cm².

Temperature Assessment Procedure

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated head tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Where:

$$SAR = C \frac{\Delta T}{\Delta t}$$

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

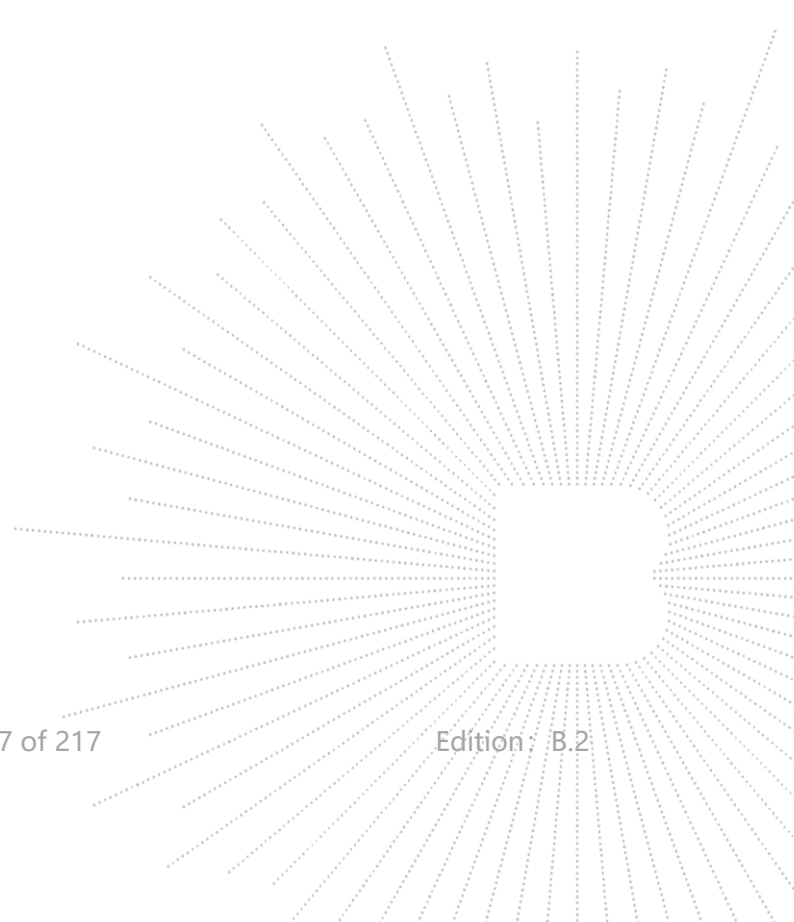
SAR is proportional to $\Delta T/\Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

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

Where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm³ for brain tissue)

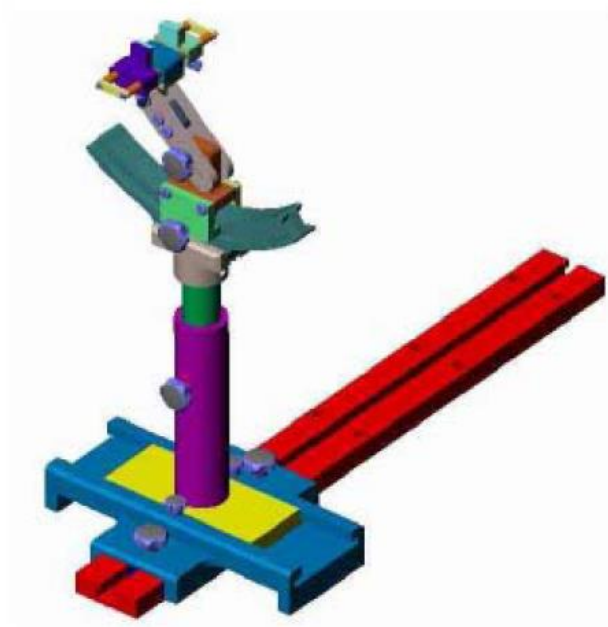


8.4 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

8.5 Phantom

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than 1°.



System Material	Permittivity	Loss Tangent
Delrin	3.7	0.005

9. Tissue Simulating Liquids

9.1 Composition of Tissue Simulating Liquid

For the measurement of the field distribution inside the SAM phantom with SMTIMO, 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. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. Please see the following photos for the liquid height.



Liquid Height for Body SAR

The Composition of Tissue Simulating Liquid

Frequency (MHz)	Water (%)	Salt (%)	1,2-Propane diol (%)	HEC (%)	Preventol (%)	DGBE (%)
Head/Body						
835	40.3	1.4	57.9	0.2	0.2	0
900	40.3	1.4	57.9	0.2	0.2	0
1800-2000	55.2	0.3	0	0	0	44.5
2450	55.0	0.1	0	0	0	44.9
2600	54.9	0.1	0	0	0	45.0

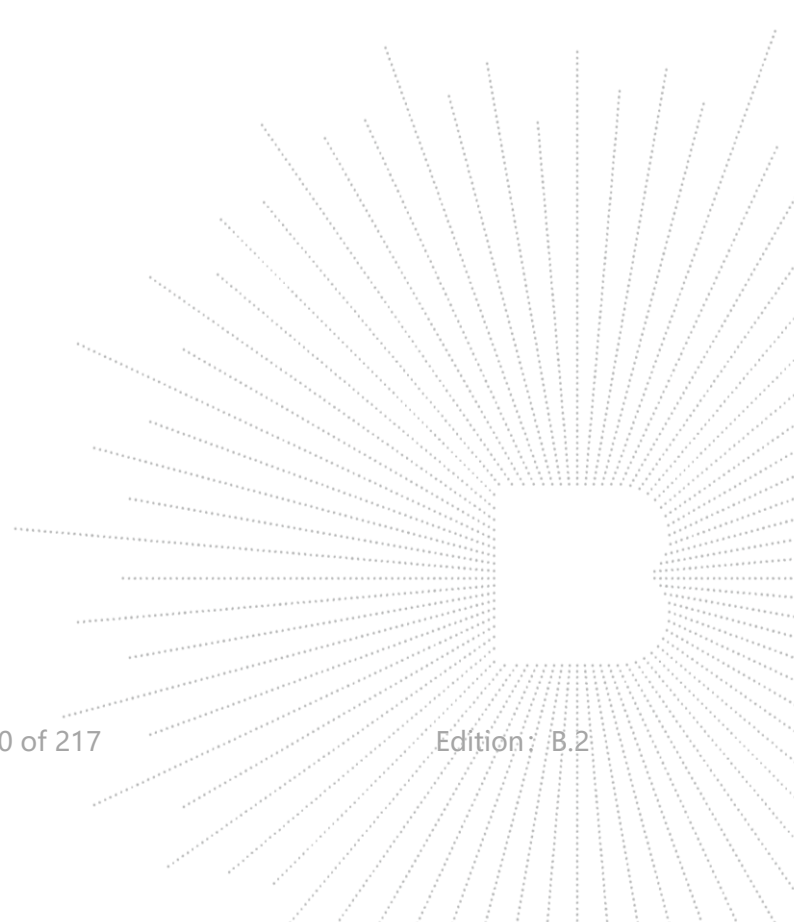
Frequency (MHz)	Water (%)	Hexyl Carbitol (%)	Triton X-100 (%)
Head/Body			
5000-6000	65.52	17.24	17.24

9.2 Limit

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters

computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Target Frequency (MHz)	Head/Body	
	Conductivity (σ)	Permittivity (ϵ_r)
150	0.76	52.3
300	0.87	45.3
450	0.87	43.5
750	0.89	41.9
835	0.90	41.5
900	0.97	41.5
915	0.98	41.5
1450	1.20	40.5
1610	1.29	40.3
1800-2000	1.40	40.0
2450	1.80	39.2
2600	1.96	39.0
3000	2.40	38.5
5200	4.66	36.0
5400	4.86	35.8
5600	5.07	35.5
5800	5.27	35.3



9.3 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an R&S ZVB 8. Dielectric Probe Kit and an Agilent Network Analyzer.

Calibration Result for Dielectric Parameters of Tissue Simulating Liquid

Frequency(MHz)	Liquid	Target Permittivity (F/m)	Target Conductivity (S/m)	Measured Permittivity (F/m)	Measured Conductivity (S/m)	Deviation Perm. Cond.(%)	Date	Temp. Ambient TSL (°C)
900	Head	41.5	0.97	40.9	1.05	-1.45% 8.25%	01/11/2023	20.0
1800	Head	40.0	1.40	39.2	1.52	-2.00% 8.57%	01/13/2023	20.0
2100	Head	39.8	1.49	38.5	1.61	-3.27% 8.05%	01/16/2023	20.0
2450	Head	39.2	1.80	38.6	1.95	-1.53% 8.33%	01/30/2023	20.0
5200	Head	36.0	4.66	35.7	4.52	-0.83% -3.00%	02/02/2023	20.0
5800	Head	35.3	5.27	34.9	5.17	-1.13% -1.90%	02/07/2023	20.0

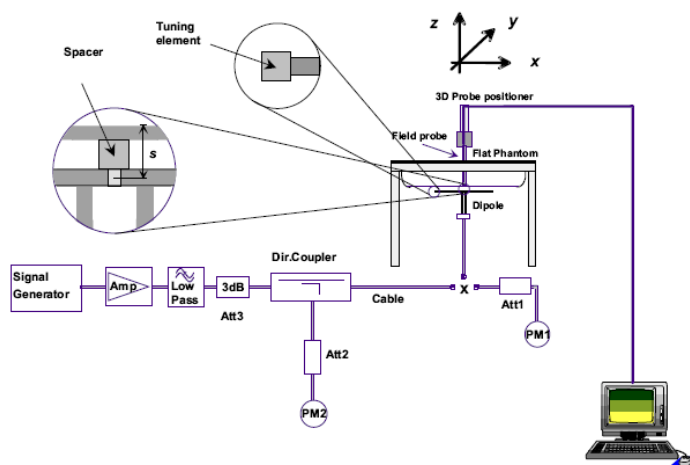
10. SAR Measurement Evaluation

10.1 Purpose of System Performance Check

At the device test frequencies. System check verifies the measurement repeatability of a SAR system before compliance testing and is not a validation of all system specifications. The latter is not required for testing a device but is mandatory before the system is deployed. The system check detects possible short-term drift and unacceptable measurement errors or uncertainties in the system.

10.2 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 which comes from a signal generator at frequency 850MHz,900 MHz,1800MHz,2000MHz, 2450MHz,2600MHz. 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 output power on dipole port must be calibrated to 24 dBm (250 mW) before dipole is connected.



10.3 Validation Results

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10 %. The following table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion.

Mixture Type	Frequency (MHz)	Power	SAR1g (W/Kg)	SAR10g (W/Kg)	Drift (%)	1W Target		Difference percentage		Liquid Temp	Date
						SAR1g (W/Kg)	SAR10g (W/Kg)	1g	10g		
Head	900	100 mW	1.124	0.719	-0.36	10.9	6.99	3.12%	2.86%	20.0	01/11/2023
		Normalize to 1 Watt	11.24	7.19							
Head	1800	100 mW	3.940	1.995	0.07	38.4	20.1	2.60%	-0.50%	20.0	01/13/2023
		Normalize to 1 Watt	39.4	20.0							
Head	2100	100 mW	4.458	2.155	0.10	43.6	21.9	2.29%	-1.37%	20.0	01/16/2023

		Normalize to 1 Watt	44.6	21.6							
Head	2450	100 mW	5.085	2.457	0.36	52.4	24	-2.86%	2.50%	20.0	01/30/2023
		Normalize to 1 Watt	50.9	24.6							
Head	5200	100 mW	6.953	2.041	0.43	76.5	21.6	-9.15%	-5.56%	20.0	02/02/2023
		Normalize to 1 Watt	69.5	20.4							
Head	5800	100 mW	7.125	2.063	0.43	78.0	21.9	-8.59%	-5.94%	20.0	02/07/2023
		Normalize to 1 Watt	71.3	20.6							

11. EUT Testing Position

11.1 Define Two Imaginary Lines on The Handset

(a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width w_t of the handset at the level of the acoustic output, and the midpoint of the width w_b of the bottom of the handset.

(b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

(c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.

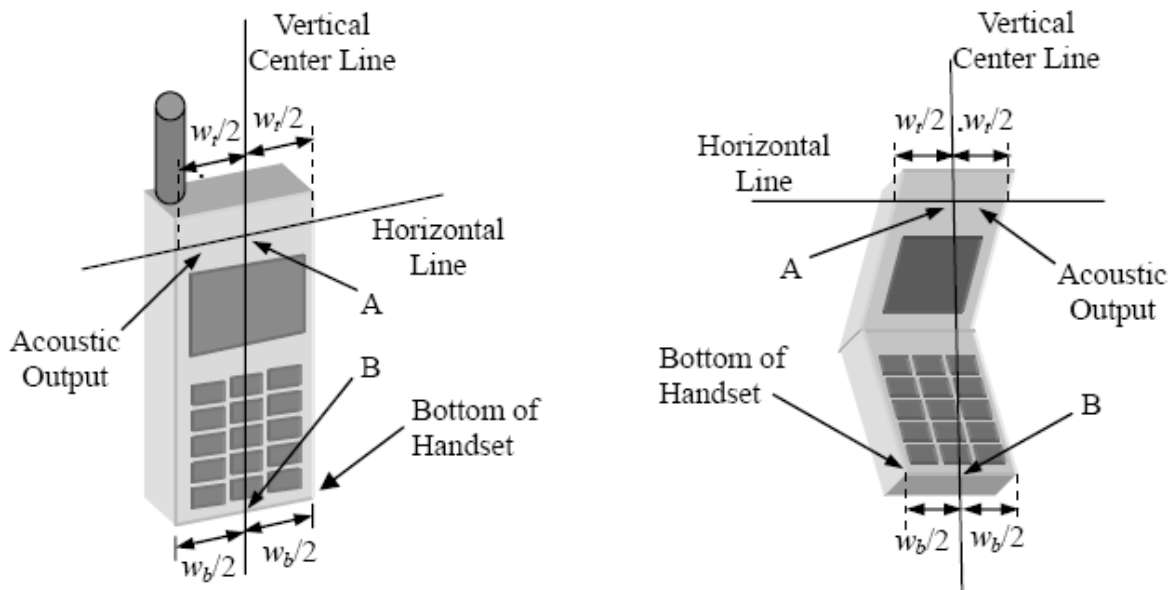


Illustration for Handset Vertical and Horizontal Reference Lines

11.2 Cheek Position

(a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see below).

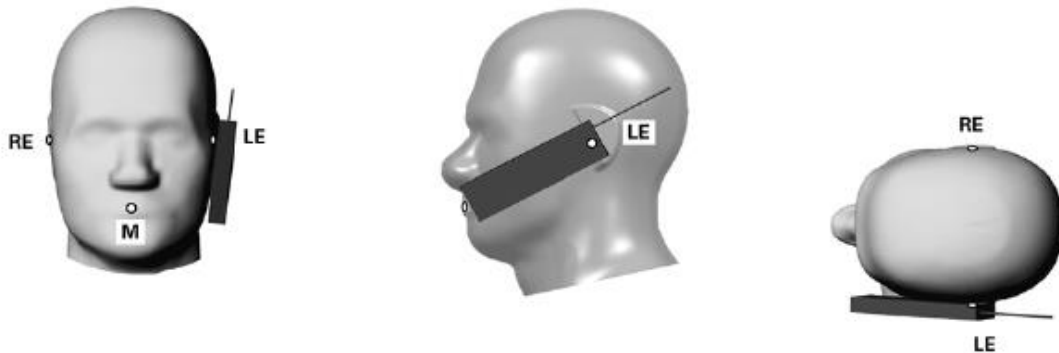


Illustration for Cheek Position

11.3 Tilted Position

(a) To position the device in the “cheek” position described above.

(b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see below).

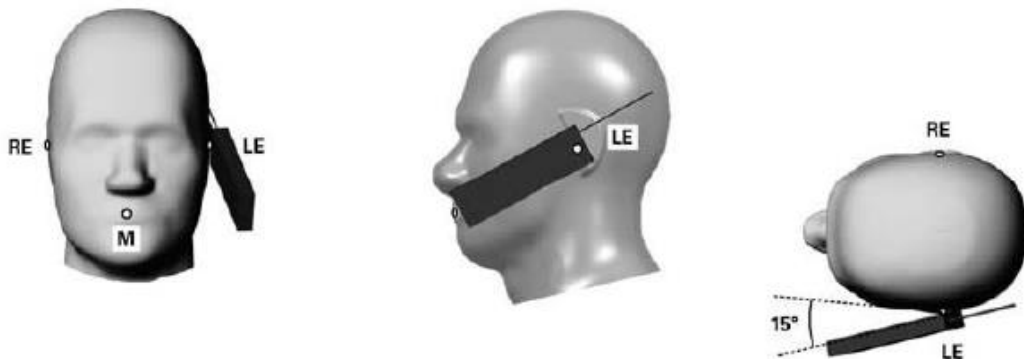
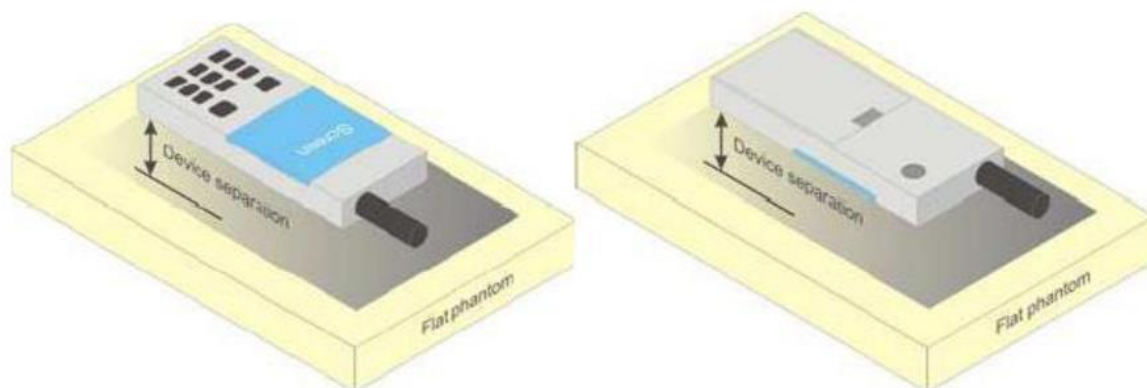


Illustration for Tilted Position

11.4 Body Position

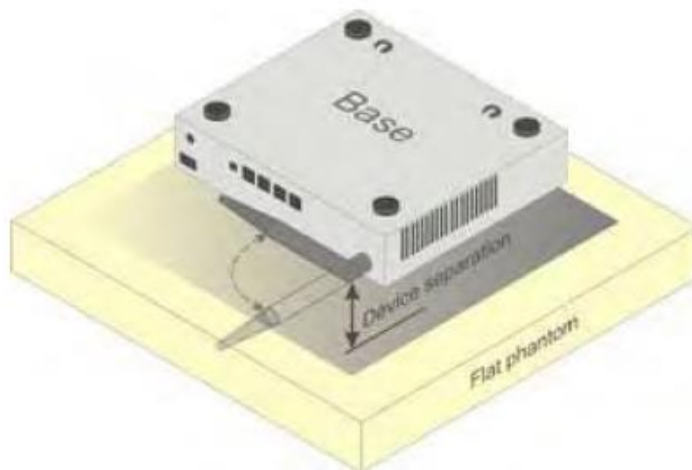
A typical example of a body-worn device is a Mobile Phone , wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.



Test positions for body-worn devices

Devices with hinged or swivel antenna(s)

For devices that employ one or more external antennas with variable positions (e.g. antenna extended, retracted, rotated), these shall be positioned in accordance with the user instructions provided by the manufacturer. For a device with only one antenna, if no intended antenna position is specified, tests shall be performed if applicable in both the horizontal and vertical positions relative to the phantom, and with the antenna oriented away from the body of the DUT and/or with the antenna extended and retracted such as to obtain the highest exposure condition. For antennas that may be rotated through one or two planes, an evaluation should be made and documented in the measurement report to the highest exposure scenario and only that position(s) need(s) to be tested. For devices with multiple detachable antennas see provisions of 6.2.2.



Device with swivel antenna (example of desktop device)

Body-supported device

A typical example of a body supported device is a wireless enabled laptop device that among other orientations may be supported on the thighs of a sitting user. To represent this orientation, the device shall be positioned with its base against the flat phantom. Other orientations may be specified by the manufacturer in the user instructions. If the intended use is not specified, the device shall be tested directly against the flat phantom in all usable orientations.

The screen portion of the device shall be in an open position at a 90° angle as seen in Figure 6a (left side), or at an operating angle specified for intended use by the manufacturer in the operating instructions. Where a body supported device has an integral screen required for normal operation,

then the screen-side will not need to be tested if the antenna(s) integrated in it ordinarily remain(s) 200 mm from the body. Where a screen mounted antenna is present, the measurement shall be performed with the screen against the flat phantom as shown in right side), if operating the screen against the body is consistent with the intended use.

Other devices that fall into this category include tablet type portable computers and credit card transaction authorisation terminals, point-of-sale and/or inventory terminals. Where these devices may be torso or limb-supported, the same principles for body-supported devices are applied.

The example shows a tablet form factor portable computer for which SAR should be separately assessed with

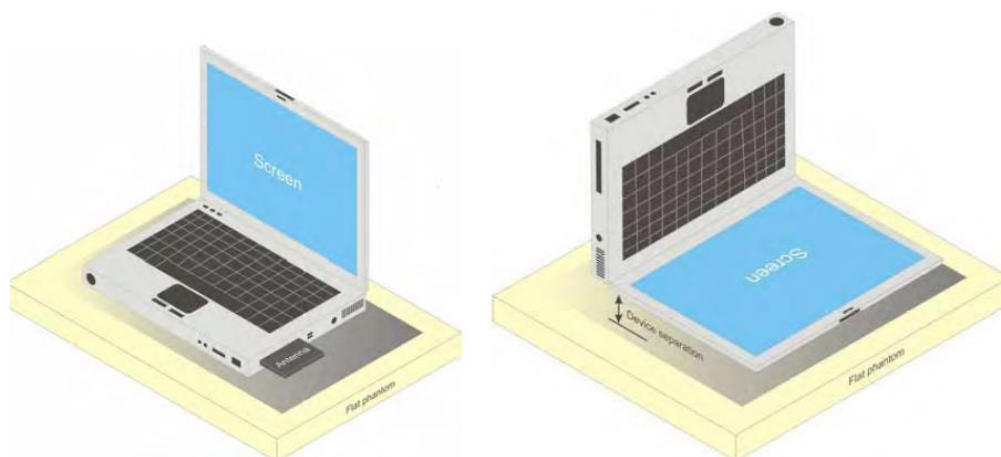
c). each surface and

d). the separation distances

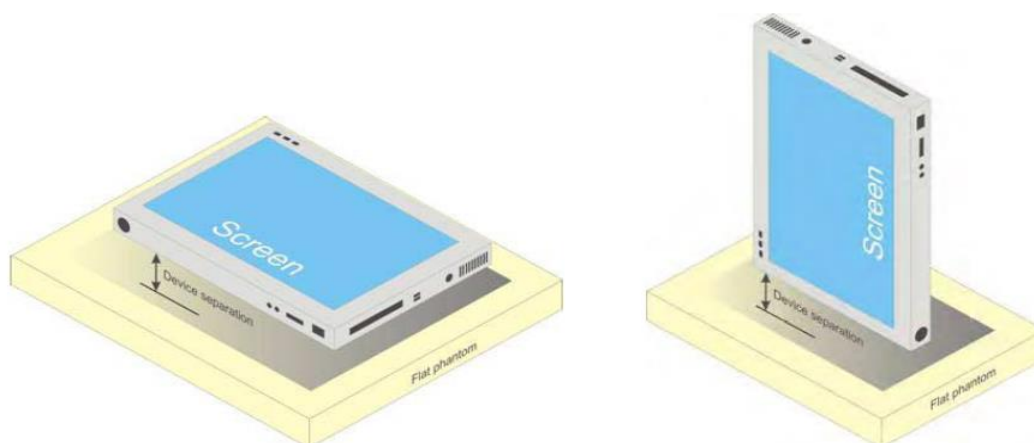
positioned against the flat phantom that correspond to the intended use as specified by the manufacturer. If the intended use is not specified in the user instructions, the device shall be tested directly against the flat phantom in all usable orientations.

Some body-supported devices may allow testing with an external power supply (e.g. a.c. adapter) supplemental to the battery, but it shall be verified and documented in the measurement report that SAR is still conservative.

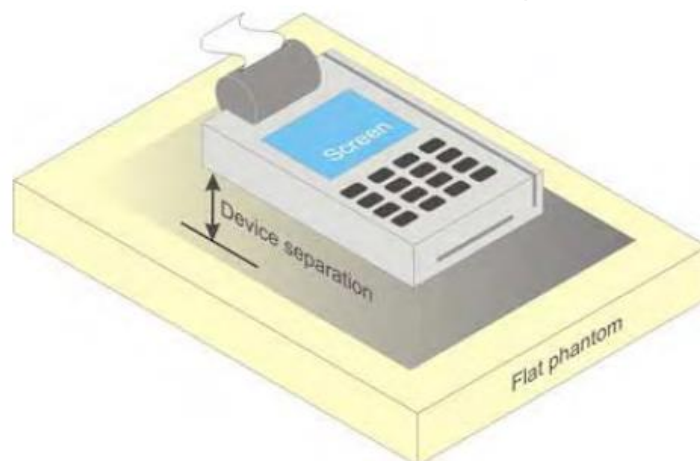
For devices that employ an external antenna with variable positions (e.g. swivel antenna), see 6.1.4.5.



a) Portable computer with external antenna plug-in-radio-card (left side) or with internal antenna located in screen section (right side)



b) TABLET form factor portable computer



c) Wireless credit card transaction authorisation terminal

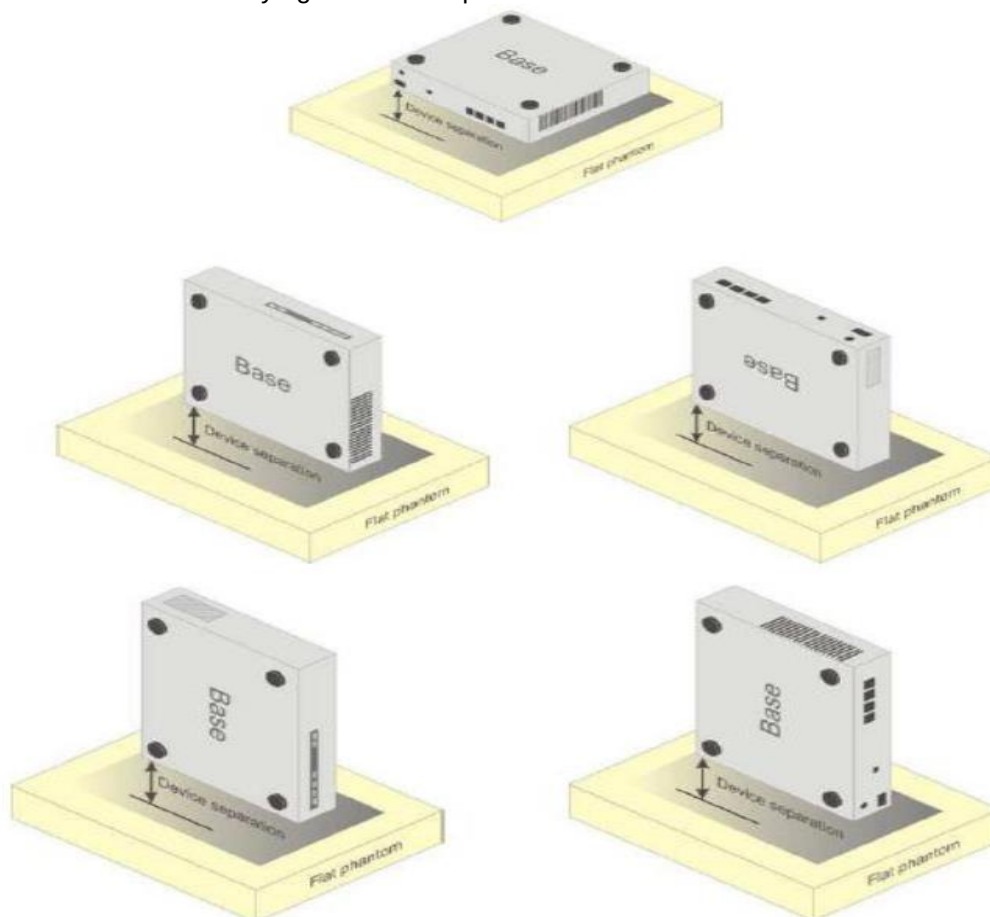
Test positions for body supported devices

Desktop device

A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.

The DUT shall be positioned at the distance and in the orientation to the phantom that corresponds to the intended use as specified by the manufacturer in the user instructions. For devices that employ an external antenna with variable positions, tests shall be performed for all antenna positions specified.

Picture 14 shows positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.

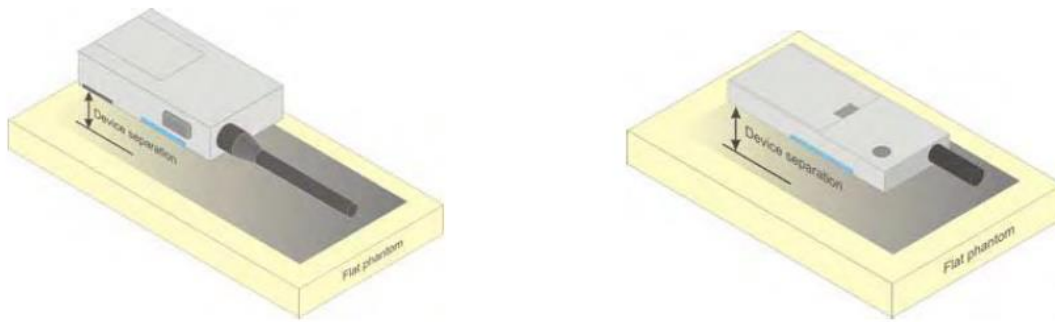


Test positions for desktop devices

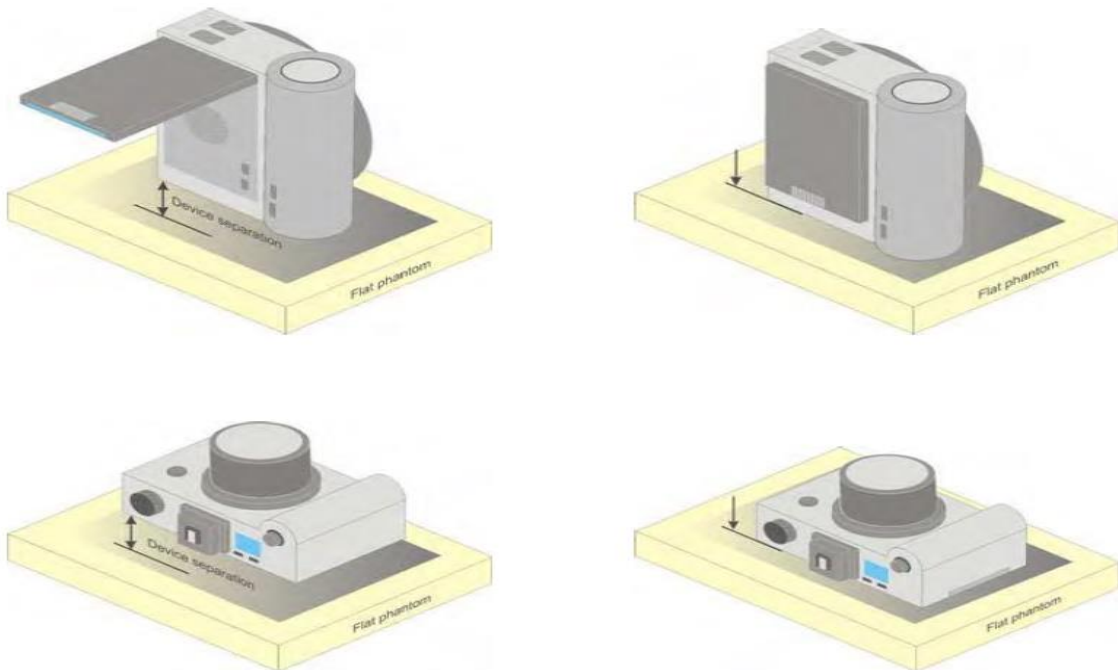
Front-of-face device

A typical example of a front-of-face device is a two-way radio that is held at a distance from the face of the user when transmitting. In these cases the device under test shall be positioned at the distance to the

phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions. If the intended use is not specified, a separation distance of 25 mm between the phantom surface and the device shall be used.



a) Two-way radios



b) Still cameras and video cameras

Test positions for front-of-face devices

Other devices that fall into this category include wireless-enabled still cameras and video cameras that can send data to a network or other device. In the case of a device whose intended use requires a separation distance from the user (e.g., device with a viewing screen), this shall be positioned at the distance to the phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions (left side). If the intended use is not specified, a separation distance of 25 mm between the phantom surface and the device shall be used. For a device whose intended use requires the user's face to be in contact with the device (e.g., device with an optical viewfinder), this shall be placed directly against the phantom (right side).

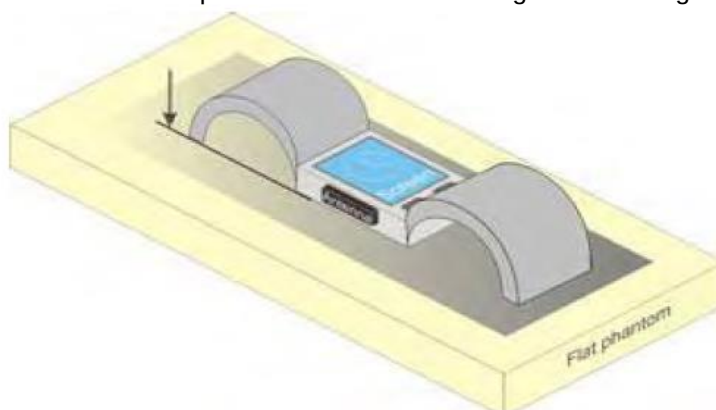
Hand-held usage of the device, not at the head or torso

Additional studies remain needed for devising a representative method for evaluating SAR in the hand of hand-held devices. Future versions of this standard are intended to contain a test method based on scientific data and rationale. Annex J presents the currently available test procedure.

Limb-worn device

A limb-worn device is a unit whose intended use includes being strapped to the arm or leg of the user while transmitting (except in idle mode). It is similar to a body-worn device. Therefore, the test positions of 6.1.4.4 also apply. The strap shall be opened so that it is divided into two parts as shown in Figure 9. The device shall be positioned directly against the phantom surface with the strap straightened as much as possible and the back of the device towards the phantom.

If the strap cannot normally be opened to allow placing in direct contact with the phantom surface, it may be necessary to break the strap of the device but ensuring to not damage the antenna.

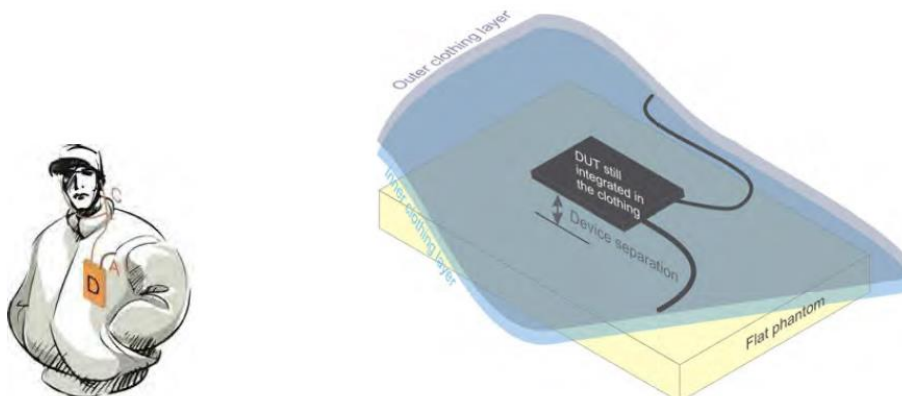


Test position for limb-worn devices

Clothing-integrated device

A typical example of a clothing-integrated device is a wireless device (Mobile Phone) integrated into a jacket to provide voice communications through an embedded speaker and microphone. This category also includes headgear with integrated wireless devices.

All wireless or RF transmitting components shall be placed in the orientation and at the separation distance to the phantom surface that correspond to intended use of the device when it is integrated into the clothing.



Test position for clothing-integrated wireless devices

12. SAR Measurement Procedures

12.1 Measurement Procedures

The measurement procedures are as follows:

- (a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the highest power channel.
- (b) Keep EUT to radiate maximum output power or 100% factor (if applicable)
- (c) Measure output power through RF cable and power meter.
- (d) Place the EUT in the positions as Annex D demonstrates.
- (e) Set scan area, grid size and other setting on the SATIMO software.
- (f) Measure SAR results for the highest power channel on each testing position.
- (g) Find out the largest SAR result on these testing positions of each band
- (h) Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

12.2 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 SATIMO 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 10g 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 the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

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

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 measures 5x5x7 points with step size 8, 8 and 5 mm for 300 MHz to 3 GHz, and 8x8x8 points with step size 4, 4 and 2.5 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

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 (step-size is 4, 4 and 2.5 mm). 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

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

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10g and 1 g requires a very fine resolution in the three dimensional scanned data array.

12.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In SATIMO measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

13. SAR Test Result

13.1 Conducted RF Output Power

GSM - Burst Average Power (dBm)						
Band	GSM900			GSM1800		
Channel	975	62	124	512	698	885
Frequency (MHz)	880.2	902.4	914.8	1710.2	1747.4	1784.8
GSM	33.71	32.61	32.28	29.18	30.62	29.95
GPRS (1 slot)	31.41	31.36	31.34	28.44	29.15	28.84
GPRS (2 slots)	30.58	30.22	30.55	27.56	27.71	27.84
GPRS (3 slots)	28.32	28.14	28.85	25.61	24.66	25.66
GPRS (4 slots)	26.61	25.89	25.66	22.27	20.27	23.31
EGPRS (1 slot)	23.47	23.45	23.48	20.22	20.00	20.92
EGPRS (2 slots)	22.76	22.07	22.31	18.46	19.42	19.53
EGPRS (3 slots)	20.62	19.64	19.52	16.64	15.84	17.06
EGPRS (4 slots)	17.28	17.28	17.75	14.75	13.32	14.78

GSM - Source-Based Time-Average Power (dBm)						
Band	GSM900			GSM1800		
Channel	975	62	124	512	698	885
Frequency (MHz)	880.2	902.4	914.8	1710.2	1747.4	1783.8
GSM	24.68	23.58	23.25	20.15	21.59	20.92
GPRS (1 slot)	22.38	22.33	22.31	19.41	20.12	19.81
GPRS (2 slots)	24.56	24.20	24.53	21.54	21.69	21.82
GPRS (3 slots)	24.06	23.88	24.59	21.35	20.40	21.40
GPRS (4 slots)	23.60	22.88	22.65	19.26	17.26	20.30
EGPRS (1 slot)	14.44	14.42	14.45	11.19	10.97	11.89
EGPRS (2 slots)	16.74	16.05	16.29	12.44	13.40	13.51
EGPRS (3 slots)	16.36	15.38	15.26	12.38	11.58	12.80
EGPRS (4 slots)	14.27	14.27	14.74	11.74	10.31	11.77

Note: The source-based time-averaged power is linearly scaled the maximum burst averaged power based on time slots. The calculated method are shown as below:

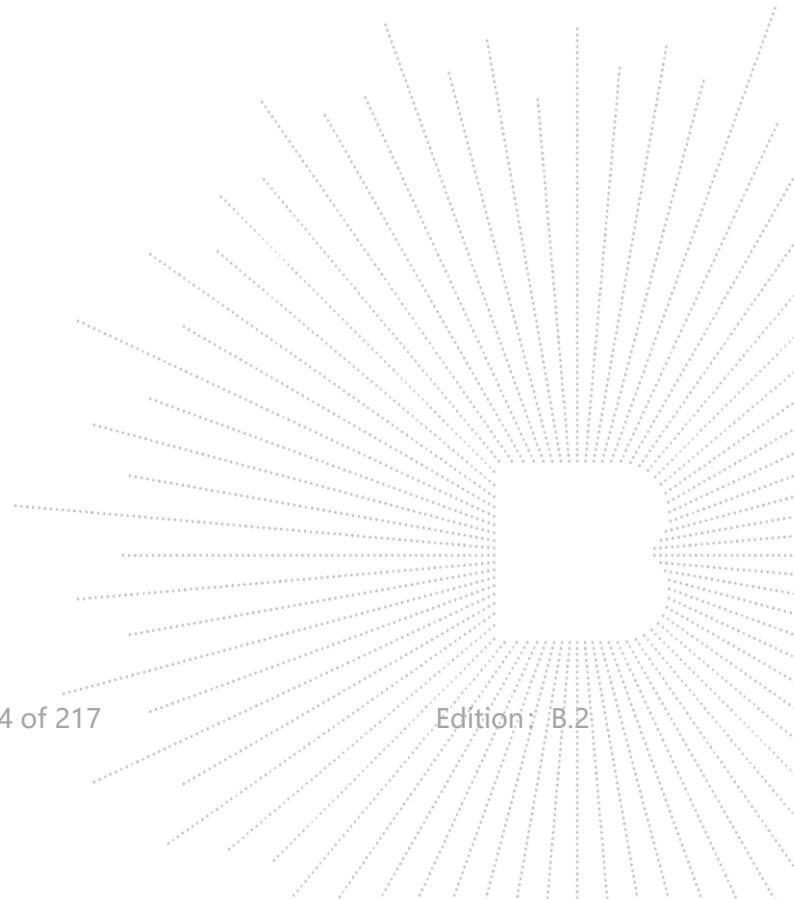
Source based time-average power = Burst averaged power - Duty cycle factor in dB

Duty cycle factor = 9 dB for 1 Tx slot, 6 dB for 2 Tx slots, 4.25 dB for 3 Tx slots, 3 dB for 4 Tx slots

Remark:

- For Body SAR testing, GPRS should be evaluated, therefore the EUT was set in GPRS (2Tx slots) for GSM900 and GPRS (2Tx slots) for GSM1800 due to its highest source-based time-average power.
- The DUT do not support DTM function.

WCDMA - Average Power (dBm)						
Band	WCDMA Band I			WCDMA Band VIII		
Channel	9612	9750	9888	2712	2788	2863
Frequency (MHz)	1922.4	1950	1977.6	882.4	897.6	912.6
RMC	22.25	22.06	22.03	23.60	23.47	23.84
HSDPA Subtest-1	22.19	22.02	21.92	23.37	23.32	23.74
HSDPA Subtest-2	22.02	21.80	21.91	23.15	23.25	23.63
HSDPA Subtest-3	21.97	21.72	21.69	22.95	23.09	23.50
HSDPA Subtest-4	21.95	21.48	21.49	22.67	23.07	23.44
HSUPA Subtest-1	21.94	21.21	21.16	22.40	22.93	23.38
HSUPA Subtest-2	21.80	21.19	20.84	22.09	22.90	23.24
HSUPA Subtest-3	21.65	20.99	20.75	21.74	22.74	23.20
HSUPA Subtest-4	21.57	20.83	20.52	21.42	22.72	23.09
HSUPA Subtest-5	21.44	20.77	20.44	21.42	22.61	22.96



Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Power (dBm)
Band1	5	18025	1	#0	QPSK	21.72
Band1	5	18025	1	#Max	QPSK	21.65
Band1	5	18025	8	#0	QPSK	21.78
Band1	5	18025	8	#Max	QPSK	21.70
Band1	5	18300	1	#0	QPSK	21.32
Band1	5	18300	1	#Max	QPSK	21.42
Band1	5	18300	8	#0	QPSK	21.38
Band1	5	18300	8	#Max	QPSK	21.47
Band1	5	18575	1	#0	QPSK	21.42
Band1	5	18575	1	#Max	QPSK	21.38
Band1	5	18575	8	#0	QPSK	21.46
Band1	5	18575	8	#Max	QPSK	21.44
Band1	20	18100	1	#0	QPSK	21.53
Band1	20	18100	1	#Max	QPSK	21.08
Band1	20	18100	18	#0	QPSK	21.66
Band1	20	18100	18	#Max	QPSK	21.22
Band1	20	18300	1	#0	QPSK	21.21
Band1	20	18300	1	#Max	QPSK	21.50
Band1	20	18300	18	#0	QPSK	21.25
Band1	20	18300	18	#Max	QPSK	21.47
Band1	20	18500	1	#0	QPSK	21.43
Band1	20	18500	1	#Max	QPSK	21.24
Band1	20	18500	18	#0	QPSK	21.58
Band1	20	18500	18	#Max	QPSK	21.37

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Power (dBm)
Band3	1.4	19207	1	#0	QPSK	22.63
Band3	1.4	19207	1	#Max	QPSK	22.61
Band3	1.4	19207	5	#0	QPSK	22.65
Band3	1.4	19207	5	#Max	QPSK	22.64
Band3	1.4	19575	1	#0	QPSK	22.43
Band3	1.4	19575	1	#Max	QPSK	22.43
Band3	1.4	19575	5	#0	QPSK	22.47
Band3	1.4	19575	5	#Max	QPSK	22.47
Band3	1.4	19943	1	#0	QPSK	22.23
Band3	1.4	19943	1	#Max	QPSK	22.25
Band3	1.4	19943	5	#0	QPSK	22.25
Band3	1.4	19943	5	#Max	QPSK	22.25
Band3	5	19225	1	#0	QPSK	22.47
Band3	5	19225	1	#Max	QPSK	22.36
Band3	5	19225	8	#0	QPSK	22.52
Band3	5	19225	8	#Max	QPSK	22.51
Band3	5	19575	1	#0	QPSK	22.36
Band3	5	19575	1	#Max	QPSK	22.40
Band3	5	19575	8	#0	QPSK	22.42
Band3	5	19575	8	#Max	QPSK	22.38
Band3	5	19925	1	#0	QPSK	22.02
Band3	5	19925	1	#Max	QPSK	22.03
Band3	5	19925	8	#0	QPSK	22.13
Band3	5	19925	8	#Max	QPSK	22.20
Band3	20	19300	1	#0	QPSK	22.28
Band3	20	19300	1	#Max	QPSK	22.10
Band3	20	19300	18	#0	QPSK	22.31
Band3	20	19300	18	#Max	QPSK	22.20
Band3	20	19575	1	#0	QPSK	22.22
Band3	20	19575	1	#Max	QPSK	22.10
Band3	20	19575	18	#0	QPSK	22.31
Band3	20	19575	18	#Max	QPSK	22.28
Band3	20	19850	1	#0	QPSK	21.76
Band3	20	19850	1	#Max	QPSK	22.04
Band3	20	19850	18	#0	QPSK	21.94
Band3	20	19850	18	#Max	QPSK	22.15

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Power (dBm)
Band7	5	20775	1	#0	QPSK	21.40
Band7	5	20775	1	#Max	QPSK	21.39
Band7	5	20775	8	#0	QPSK	21.57
Band7	5	20775	8	#Max	QPSK	21.50
Band7	5	21100	1	#0	QPSK	21.67
Band7	5	21100	1	#Max	QPSK	21.66
Band7	5	21100	8	#0	QPSK	21.76
Band7	5	21100	8	#Max	QPSK	21.78
Band7	5	21425	1	#0	QPSK	21.57
Band7	5	21425	1	#Max	QPSK	21.66
Band7	5	21425	8	#0	QPSK	21.58
Band7	5	21425	8	#Max	QPSK	21.73
Band7	20	20850	1	#0	QPSK	21.38
Band7	20	20850	1	#Max	QPSK	21.35
Band7	20	20850	18	#0	QPSK	21.47
Band7	20	20850	18	#Max	QPSK	21.45
Band7	20	21100	1	#0	QPSK	21.43
Band7	20	21100	1	#Max	QPSK	21.64
Band7	20	21100	18	#0	QPSK	21.50
Band7	20	21100	18	#Max	QPSK	21.59
Band7	20	21350	1	#0	QPSK	21.29
Band7	20	21350	1	#Max	QPSK	21.50
Band7	20	21350	18	#0	QPSK	21.29
Band7	20	21350	18	#Max	QPSK	21.55

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Power (dBm)
Band8	1.4	21457	1	#0	QPSK	23.21
Band8	1.4	21457	1	#Max	QPSK	23.22
Band8	1.4	21457	5	#0	QPSK	23.22
Band8	1.4	21457	5	#Max	QPSK	23.21
Band8	1.4	21625	1	#0	QPSK	23.00
Band8	1.4	21625	1	#Max	QPSK	22.97
Band8	1.4	21625	5	#0	QPSK	22.99
Band8	1.4	21625	5	#Max	QPSK	23.01
Band8	1.4	21793	1	#0	QPSK	23.39
Band8	1.4	21793	1	#Max	QPSK	23.42
Band8	1.4	21793	5	#0	QPSK	23.38
Band8	1.4	21793	5	#Max	QPSK	23.40
Band8	5	21475	1	#0	QPSK	23.04
Band8	5	21475	1	#Max	QPSK	23.11
Band8	5	21475	8	#0	QPSK	23.15
Band8	5	21475	8	#Max	QPSK	23.13
Band8	5	21625	1	#0	QPSK	22.90
Band8	5	21625	1	#Max	QPSK	22.92
Band8	5	21625	8	#0	QPSK	22.92
Band8	5	21625	8	#Max	QPSK	23.01
Band8	5	21775	1	#0	QPSK	23.11
Band8	5	21775	1	#Max	QPSK	23.24
Band8	5	21775	8	#0	QPSK	23.31
Band8	5	21775	8	#Max	QPSK	23.38
Band8	10	21500	1	#0	QPSK	23.10
Band8	10	21500	1	#Max	QPSK	23.09
Band8	10	21500	12	#0	QPSK	23.13
Band8	10	21500	12	#Max	QPSK	23.13
Band8	10	21625	1	#0	QPSK	22.98
Band8	10	21625	1	#Max	QPSK	23.06
Band8	10	21625	12	#0	QPSK	23.01
Band8	10	21625	12	#Max	QPSK	23.07
Band8	10	21750	1	#0	QPSK	23.19
Band8	10	21750	1	#Max	QPSK	23.44
Band8	10	21750	12	#0	QPSK	23.21
Band8	10	21750	12	#Max	QPSK	23.40

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Power (dBm)
Band20	5	24175	1	#0	QPSK	22.36
Band20	5	24175	1	#Max	QPSK	22.26
Band20	5	24175	8	#0	QPSK	22.24
Band20	5	24175	8	#Max	QPSK	22.37
Band20	5	24300	1	#0	QPSK	22.14
Band20	5	24300	1	#Max	QPSK	22.03
Band20	5	24300	8	#0	QPSK	22.20
Band20	5	24300	8	#Max	QPSK	22.09
Band20	5	24425	1	#0	QPSK	21.87
Band20	5	24425	1	#Max	QPSK	21.94
Band20	5	24425	8	#0	QPSK	22.03
Band20	5	24425	8	#Max	QPSK	22.01
Band20	20	24250	1	#0	QPSK	21.97
Band20	20	24250	1	#Max	QPSK	21.87
Band20	20	24250	18	#0	QPSK	22.08
Band20	20	24250	18	#Max	QPSK	22.00
Band20	20	24300	1	#0	QPSK	22.09
Band20	20	24300	1	#Max	QPSK	21.91
Band20	20	24300	18	#0	QPSK	22.16
Band20	20	24300	18	#Max	QPSK	21.99
Band20	20	24350	1	#0	QPSK	21.97
Band20	20	24350	1	#Max	QPSK	21.82
Band20	20	24350	18	#0	QPSK	22.04
Band20	20	24350	18	#Max	QPSK	21.82

WLAN(2.4G) - Conducted Power				
Test Mode	Data Rate	Channel	Frequency (MHz)	Average Power (dBm)
802.11b	1Mbps	CH 01	2412	14.3
		CH 07	2442	13.83
		CH 13	2472	14.26
802.11g	6Mbps	CH 01	2412	12.07
		CH 07	2442	11.71
		CH 13	2472	11.49
802.11n (20MHz)	6.5Mbps	CH 01	2412	11.15
		CH 07	2442	10.71
		CH 13	2472	10.47
802.11n (40MHz)	13.5Mbps	CH 01	2412	10.27
		CH 07	2442	11.02
		CH 13	2472	10.88

WLAN(5.1G) - Conducted Power				
Test Mode	Data Rate	Channel	Frequency (MHz)	Average Power (dBm)
802.11a	6Mbps	CH 36	5180	11.83
		CH 40	5200	12.12
		CH 48	5240	12.76
802.11n HT20	6.5Mbps	CH 36	5180	10.6
		CH 40	5200	11
		CH 48	5240	11.83
802.11n HT40	13.5Mbps	CH 38	5190	9.73
		/	/	/
		CH 46	5230	10.56
802.11ac ac20	6.5Mbps	CH 36	5180	10.46
		CH 40	5200	11.02
		CH 48	5240	11.74
802.11ac HT40	13.5Mbps	CH 38	5190	10.35
		/	/	/
		CH 46	5230	11.21
802.11ac HT80	29.3Mbps	/	/	/
		42	5210	9.84
		/	/	/

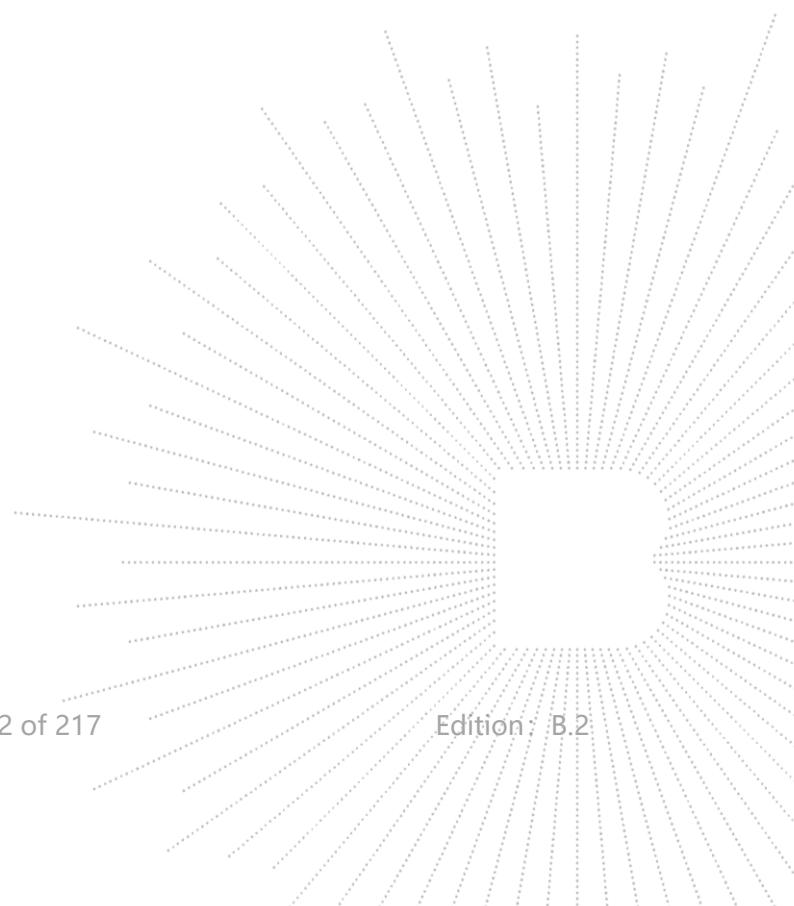
WLAN(5.8G) - Conducted Power				
Test Mode	Data Rate	Channel	Frequency (MHz)	Average Power (dBm)
802.11a	6Mbps	CH 149	5745	9.69
		CH 157	5785	9.28
		CH 165	5825	8.40
802.11n(HT20)	6.5Mbps	CH 149	5745	8.86
		CH 157	5785	8.43
		CH 165	5825	7.62
802.11n(HT40)	13.5Mbps	CH 151	5755	7.64
		/	/	/
		CH 159	5795	7.03
802.11ac(HT20)	6.5Mbps	CH 149	5745	8.84
		CH 157	5785	8.38
		CH 165	5825	7.52
802.11ac(HT40)	13.5Mbps	CH 151	5755	7.44
		/	/	/
		CH 159	5795	7.14
802.11ac(HT80)	29.3Mbps	/	/	/
		CH 155	5775	7.26
		/	/	/

Mode	Frequency (MHz)	Conducted Power (dBm)
1-DH1	2402	2.5
1-DH1	2441	-0.52
1-DH1	2480	-0.5
2-DH1	2402	2.04
2-DH1	2441	-1.40
2-DH1	2480	-1.25
3-DH1	2402	1.09
3-DH1	2441	-2.30
3-DH1	2480	-1.98

	Frequency	Maximum Conducted Output Power(PK)
	(MHz)	(dBm)
GFSK 1Mbps	2402	0.21
	2440	0.06
	2480	-0.07
GFSK 2Mbps	2402	0.24
	2440	0.07
	2480	-0.07

Remark:

1. Since EIRP power of WIF/BT at worse case is: 2.5dBm(1.78mW) which not exceed the exempt condition, 20mW specified in EN 62479. It is deemed to full fit the requirement of RF exposure basic restriction specified in EC Council Recommendation (1999/519/EC).



13.2 Test Results for Standalone SAR Test

GSM900 –Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
1	GSM	Left Touch	62	902.4	32.61	33.00	1.094	0.540	0.591
	GSM	Left Tilt	62	902.4	32.61	33.00	1.094	0.245	0.268
	GSM	Right Touch	62	902.4	32.61	33.00	1.094	0.512	0.560
	GSM	Right t Tilt	62	902.4	32.61	33.00	1.094	0.203	0.222

GSM900 –Body SAR Test(5mm, Limb worn 0mm)									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
2	GSM	Back Face	62	902.4	30.22	30.50	1.067	0.233	0.249
	GSM	Front Face	62	902.4	30.22	30.50	1.067	0.200	0.213
3	GSM	Limb worn	62	902.4	30.22	30.50	1.067	0.412	0.439

GSM1800 – Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
4	GSM	Left Touch	698	1747.4	30.62	31.00	1.091	0.240	0.262
	GSM	Left Tilt	698	1747.4	30.62	31.00	1.091	0.156	0.170
	GSM	Right Touch	698	1747.4	30.62	31.00	1.091	0.211	0.230
	GSM	Right t Tilt	698	1747.4	30.62	31.00	1.091	0.123	0.134

GSM1800 –Body SAR Test(5mm, Limb worn 0mm)									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
5	GSM	Back Face	698	1747.4	27.71	28.00	1.091	0.120	0.131
	GSM	Front Face	698	1747.4	27.71	28.00	1.091	0.105	0.115
6	GSM	Limb worn	698	1747.4	27.71	28.00	1.091	0.232	0.253

WCDMA Band I – Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
7	RMC	Left Touch	9750	1956.0	22.06	22.50	1.107	0.257	0.284
	RMC	Left Tilt	9750	1956.0	22.06	22.50	1.107	0.158	0.175
	RMC	Right Touch	9750	1956.0	22.06	22.50	1.107	0.221	0.245
	RMC	Right t Tilt	9750	1956.0	22.06	22.50	1.107	0.137	0.152

WCDMA Band I– Body SAR Test(5mm, Limb worn 0mm)									
Plot No.	Mode	Test Position	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g
			CH.	MHz					

		Body							(W/kg)
8	RMC	Back Face	9750	1956.0	22.06	22.50	1.107	0.208	0.230
	RMC	Front Face	9750	1956.0	22.06	22.50	1.107	0.178	0.197
9	RMC	Limb worn	9750	1956.0	22.06	22.50	1.107	0.330	0.365

WCDMA Band VIII – Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
10	RMC	Left Touch	2788	897.6	23.47	23.50	1.007	0.372	0.375
	RMC	Left Tilt	2788	897.6	23.47	23.50	1.007	0.189	0.190
	RMC	Right Touch	2788	897.6	23.47	23.50	1.007	0.346	0.348
	RMC	Right t Tilt	2788	897.6	23.47	23.50	1.007	0.150	0.151

WCDMA Band VIII– Body SAR Test(5mm, Limb worn 0mm)									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10 g (W/kg)	Scaled SAR10 g (W/kg)
			CH.	MHz					
11	RMC	Back Face	2788	897.6	23.47	23.50	1.007	0.222	0.224
	RMC	Front Face	2788	897.6	23.47	23.50	1.007	0.177	0.178
12	RMC	Limb worn	2788	897.6	23.47	23.50	1.007	0.394	0.397

WIFI5.1G – Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
13	802.11a	Left Touch	40	5200	12.12	12.50	1.091	0.336	0.367
	802.11a	Left Tilt	40	5200	12.12	12.50	1.091	0.162	0.177
	802.11a	Right Touch	40	5200	12.12	12.50	1.091	0.310	0.338
	802.11a	Right t Tilt	40	5200	12.12	12.50	1.091	0.147	0.160

WIFI5.1G– Body SAR Test(5mm, Limb worn 0mm)								
Plot No.	Mode	Test Position Body	Frequency (MHz)	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10 g (W/kg)	Scaled SAR10 g (W/kg)
	Modulation, Bandwidth							
14	802.11a	Back Face	5200	12.12	12.50	1.091	0.129	0.141
	802.11a	Front Face	5200	12.12	12.50	1.091	0.112	0.122
15	802.11a	Limb worn	5200	12.12	12.50	1.091	0.172	0.188

WIFI5.8G – Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
16	802.11a	Left Touch	157	5785	9.28	9.50	1.052	0.273	0.287
	802.11a	Left Tilt	157	5785	9.28	9.50	1.052	0.156	0.164
	802.11a	Right Touch	157	5785	9.28	9.50	1.052	0.241	0.254
	802.11a	Right t Tilt	157	5785	9.28	9.50	1.052	0.120	0.126

WIFI5.8G– Body SAR Test(5mm, Limb worn 0mm)								
Plot No.	Mode	Test Position Body	Frequency (MHz)	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10 g (W/kg)	Scaled SAR10 g (W/kg)
	Modulation, Bandwidth							
17	802.11a	Back Face	5785	9.28	9.50	1.052	0.225	0.237
	802.11a	Front Face	5785	9.28	9.50	1.052	0.214	0.225
18	802.11a	Limb worn	5785	9.28	9.50	1.052	0.279	0.293

WIFI2.4G – Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
19	802.11b	Left Touch	7	2442	13.83	14.00	1.040	0.083	0.086
	802.11b	Left Tilt	7	2442	13.83	14.00	1.040	0.045	0.047
	802.11b	Right Touch	7	2442	13.83	14.00	1.040	0.071	0.074
	802.11b	Right t Tilt	7	2442	13.83	14.00	1.040	0.038	0.040

WIFI2.4G– Body SAR Test(5mm, Limb worn 0mm)								
Plot No.	Mode	Test Position Body	Frequency (MHz)	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10 g (W/kg)	Scaled SAR10 g (W/kg)
	Modulation, Bandwidth							
20	802.11b	Back Face	2442	13.83	14.00	1.040	0.549	0.571
	802.11b	Front Face	2442	13.83	14.00	1.040	0.512	0.532
21	802.11b	Limb worn	2442	13.83	14.00	1.040	0.602	0.626

FDD-LTE Band 1– Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
22	QPSK,20MHz	Left Touch	18300	1950	21.50	21.50	1.000	0.323	0.323
	QPSK,20MHz	Left Tilt	18300	1950	21.50	21.50	1.000	0.165	0.165
	QPSK,20MHz	Right Touch	18300	1950	21.50	21.50	1.000	0.306	0.306
	QPSK,20MHz	Right t Tilt	18300	1950	21.50	21.50	1.000	0.127	0.127

FDD-LTE Band 1– Body SAR Test(5mm, Limb worn 0mm)								
Plot No.	Mode	Test Position	Frequency	Output Power	Rated Limit	Scaling Factor	SAR10 g	Scaled SAR10
	Modulation, Bandwidth		(MHz)	(dBm)	(dBm)		(W/kg)	g

		Body						(W/kg)
23	QPSK,20MHz	Back Face	1950	21.50	21.50	1.000	0.228	0.228
	QPSK,20MHz	Front Face	1950	21.50	21.50	1.000	0.185	0.185
24	QPSK,20MHz	Limb worn	1950	21.50	21.50	1.000	0.492	0.492

FDD-LTE Band 3– Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
25	QPSK,20MHz	Left Touch	19575	1747.5	22.31	22.50	1.045	0.170	0.178
	QPSK,20MHz	Left Tilt	19575	1747.5	22.31	22.50	1.045	0.095	0.099
	QPSK,20MHz	Right Touch	19575	1747.5	22.31	22.50	1.045	0.142	0.148
	QPSK,20MHz	Right t Tilt	19575	1747.5	22.31	22.50	1.045	0.074	0.077

FDD-LTE Band 3– Body SAR Test(5mm, Limb worn 0mm)								
Plot No.	Mode	Test Position Body	Frequency (MHz)	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10 g (W/kg)	Scaled SAR10 g (W/kg)
	Modulation, Bandwidth							
26	QPSK,20MHz	Back Face	1747.5	22.31	22.50	1.045	0.105	0.110
	QPSK,20MHz	Front Face	1747.5	22.31	22.50	1.045	0.078	0.081
27	OPSK,20MHz	Limb worn	1747.5	22.31	22.50	1.045	0.299	0.312

FDD-LTE Band 7– Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
28	QPSK,20MHz	Left Touch	21100	2535	21.64	22.00	1.086	0.168	0.183
	QPSK,20MHz	Left Tilt	21100	2535	21.64	22.00	1.086	0.098	0.106
	QPSK,20MHz	Right Touch	21100	2535	21.64	22.00	1.086	0.141	0.153
	QPSK,20MHz	Right t Tilt	21100	2535	21.64	22.00	1.086	0.081	0.088

FDD-LTE Band 7– Body SAR Test(5mm, Limb worn 0mm)								
Plot No.	Mode	Test Position Body	Frequency (MHz)	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10 g (W/kg)	Scaled SAR10 g (W/kg)
	Modulation, Bandwidth							
29	QPSK,20MHz	Back Face	2535	21.64	22.00	1.086	0.075	0.081
	QPSK,20MHz	Front Face	2535	21.64	22.00	1.086	0.070	0.076
30	QPSK,20MHz	Limb worn	2535	21.64	22.00	1.086	0.779	0.846

FDD-LTE Band 8 – Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
31	QPSK,10MHz	Left Touch	21625	897.5	23.07	23.50	1.104	0.250	0.276
	QPSK,10MHz	Left Tilt	21625	897.5	23.07	23.50	1.104	0.162	0.179
	QPSK,10MHz	Right Touch	21625	897.5	23.07	23.50	1.104	0.213	0.235
	QPSK,10MHz	Right t Tilt	21625	897.5	23.07	23.50	1.104	0.135	0.149

FDD-LTE Band 8– Body SAR Test(5mm, Limb worn 0mm)								
Plot No.	Mode	Test Position Body	Frequency (MHz)	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10 g (W/kg)	Scaled SAR10 g (W/kg)
	Modulation, Bandwidth							
32	QPSK,10MHz	Back Face	897.5	23.07	23.50	1.104	0.200	0.221
	QPSK,10MHz	Front Face	897.5	23.07	23.50	1.104	0.165	0.182
33	QPSK,10MHz	Limb worn	897.5	23.07	23.50	1.104	0.271	0.299

FDD-LTE Band 20– Head SAR Test									
Plot No.	Mode	Test Position Body	Frequency		Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10g (W/kg)	Scaled SAR10g (W/kg)
			CH.	MHz					
34	QPSK,20MHz	Left Touch	24300	847	22.16	22.50	1.081	0.248	0.268
	QPSK,20MHz	Left Tilt	24300	847	22.16	22.50	1.081	0.182	0.197
	QPSK,20MHz	Right Touch	24300	847	22.16	22.50	1.081	0.211	0.228
	QPSK,20MHz	Right t Tilt	24300	847	22.16	22.50	1.081	0.142	0.154

FDD-LTE Band 20– Body SAR Test(5mm, Limb worn 0mm)								
Plot No.	Mode	Test Position Body	Frequency (MHz)	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR10 g (W/kg)	Scaled SAR10 g (W/kg)
	Modulation, Bandwidth							
35	QPSK,20MHz	Back Face	847	22.16	22.50	1.081	0.185	0.200
	QPSK,20MHz	Front Face	847	22.16	22.50	1.081	0.148	0.160
36	QPSK,20MHz	Limb worn	847	22.16	22.50	1.081	0.316	0.342

13.3 Simultaneous Multi-band Transmission SAR Analysis

List of Mode for Simultaneous Multi-band Transmission

No.	Configurations	Head SAR	Body SAR	Limb SAR
1	GSM(Voice/Data) + WLAN(2.4G)(Data)	Yes	Yes	Yes
2	WCDMA (Voice/Data)+ WLAN (2.4G)(Data)	Yes	Yes	Yes
3	LTE(Data) + WLAN (2.4G)(Data)	Yes	Yes	Yes
4	GSM(Voice/Data) + WLAN(5G)(Data)	Yes	Yes	Yes
5	WCDMA (Voice/Data)+ WLAN (5G)(Data)	Yes	Yes	Yes
6	LTE(Data) + WLAN (5G)(Data)	Yes	Yes	Yes
7	GSM(Voice/Data) + Bluetooth(Data)	Yes	Yes	Yes
8	WCDMA (Voice/Data) + Bluetooth(Data)	Yes	Yes	Yes
9	LTE(Data) + Bluetooth(Data)	Yes	Yes	Yes

Remark:

1. GSM, WCDMA and LTE share the same antenna, and cannot transmit simultaneously.
2. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
3. The maximum SAR summation is calculated based on the same configuration and test position.
4. If 10g-SAR scalar summation < 2.0W/kg, simultaneous SAR measurement is not necessary.
5. One way of determining the threshold power level available to the secondary transmitter ($P_{available}$) is to calculate it from the measured peak spatial-average SAR of the primary transmitter (SAR_1) according to the equation:

$$P_{available} = P_{th,m} \times (SAR_{lim} - SAR_1) / SAR_{lim}$$

where $P_{th,m}$ is the threshold exclusion power level taken from Annex B of IEC 62479⁷ for the frequency of the secondary transmitter at the separation distance used in the testing.

For simultaneous transmission analysis, Bluetooth/5.2G WLAN/5.8G SRD SAR is below:

Bluetooth:

Average Power (dBm)	Output Power (mW)	$P_{th,m}$ (mw)	SAR_{lim} (W/kg)	SAR_1 (W/kg)	$P_{available}$ (mw)
2.5	1.78	20	2	0.571	14.29

WLAN 2.4G:

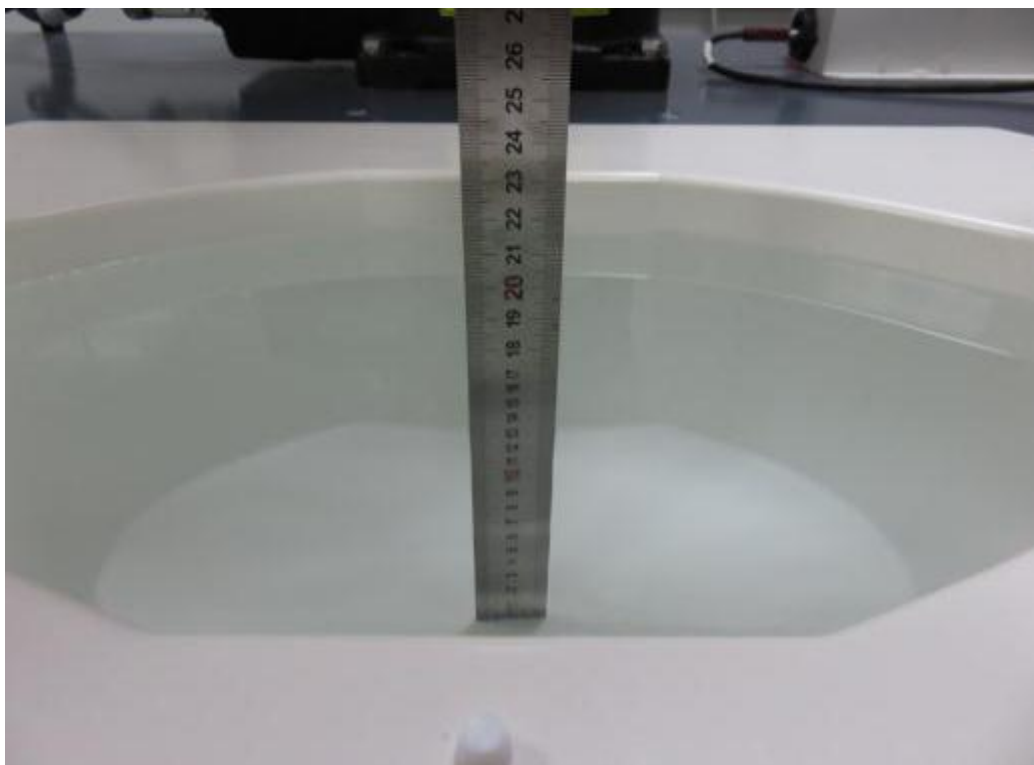
Average Power (dBm)	Output Power (mW)	$P_{th,m}$ (mw)	SAR_{lim} (W/kg)	SAR_1 (W/kg)	$P_{available}$ (mw)
N/A	N/A	20	2	N/A	N/A

WLAN 5G:

Average Power (dBm)	Output Power (mW)	$P_{th,m}$ (mw)	SAR_{lim} (W/kg)	SAR_1 (W/kg)	$P_{available}$ (mw)
N/A	N/A	20	2	N/A	N/A

The Bluetooth/WIFI output power of the secondary transmitter is less than $P_{available}$, So SAR measurement for the secondary transmitter is not necessary.

The maximum SAR overlay value is 0.571W/kg. The maximum SAR overlay value is 0.846W/kg For Limb worn.

14. Photographs Of The Liquid

Photograph of the depth in the Body Phantom (600-10000MHz, 16.2cm depth)

15. Test Plots

15.1 System Performance Check

System check at 900 MHz

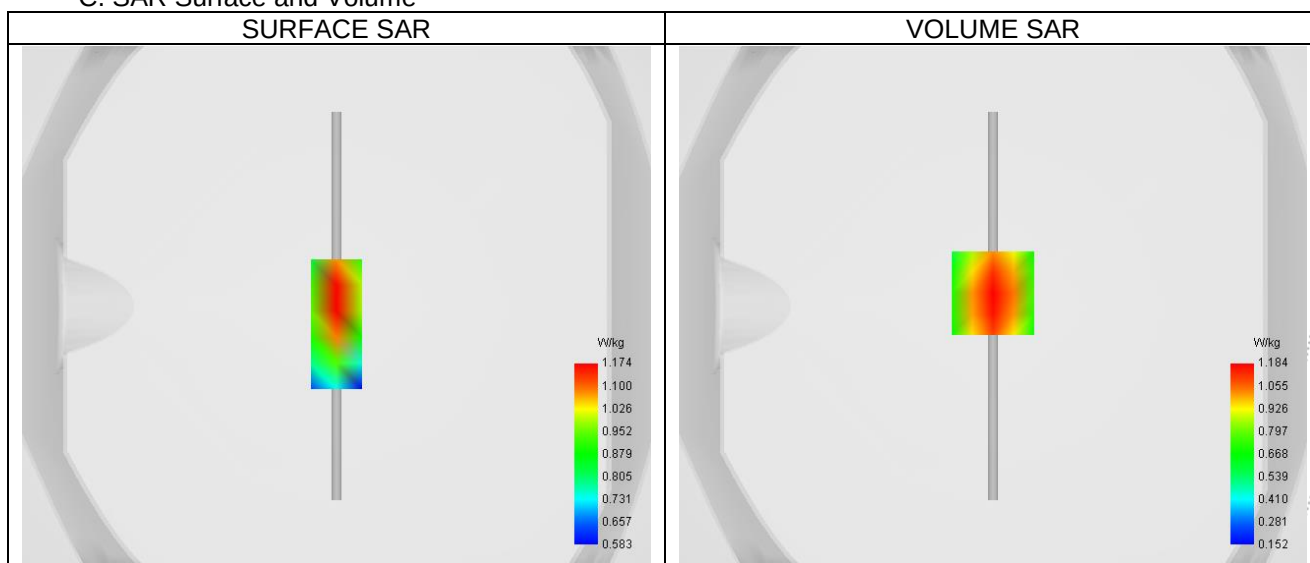
A. Experimental conditions.

Probe	SN EPG0373
ConvF	23.97
Area Scan	dx=10mm dy=10mm, Adaptive 2 max
Zoom Scan	5x5x7, dx=8mm dy=8mm dz=5mm, Very fast
Phantom	Validation plane
Device Position	Dipole
Band	CW900
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	900.000
Relative permittivity (real part)	40.900
Relative permittivity (imaginary part)	21.000
Conductivity (S/m)	1.050

C. SAR Surface and Volume

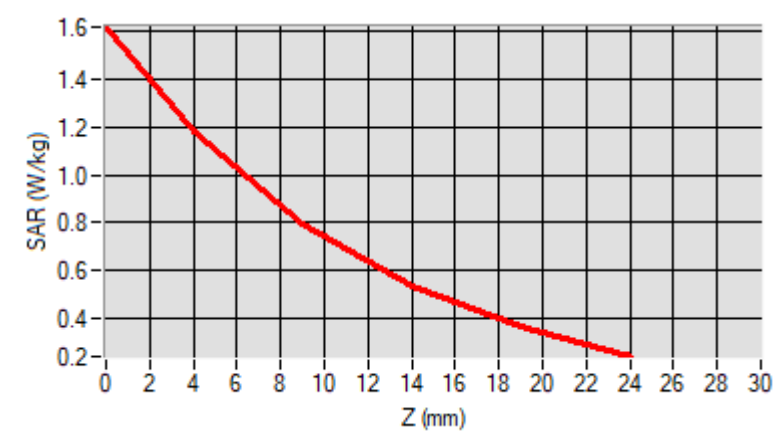


D. SAR 1g & 10g

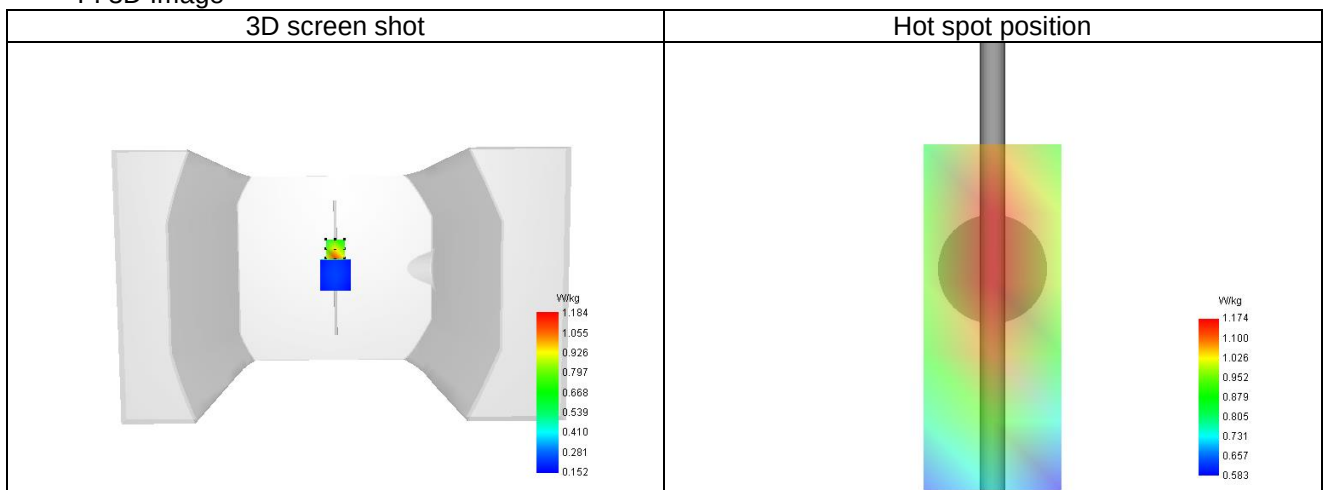
SAR 10g (W/Kg)	0.719
SAR 1g (W/Kg)	1.124
Variation (%)	-0.360
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.616	1.184	0.796	0.537	0.366



F. 3D Image



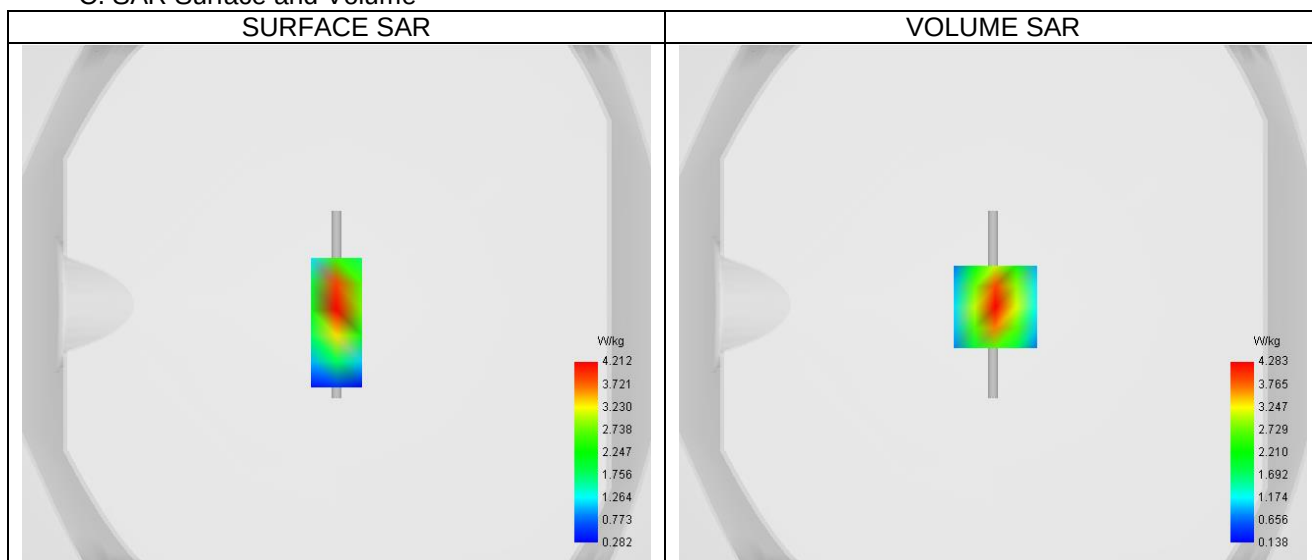
A. Experimental conditions.

Probe	SN EPG0373
ConvF	24.68
Area Scan	dx=10mm dy=10mm, Adaptative 2 max
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Very fast
Phantom	Validation plane
Device Position	Dipole
Band	CW1800
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1800.000
Relative permittivity (real part)	39.200
Relative permittivity (imaginary part)	15.200
Conductivity (S/m)	1.520

C. SAR Surface and Volume

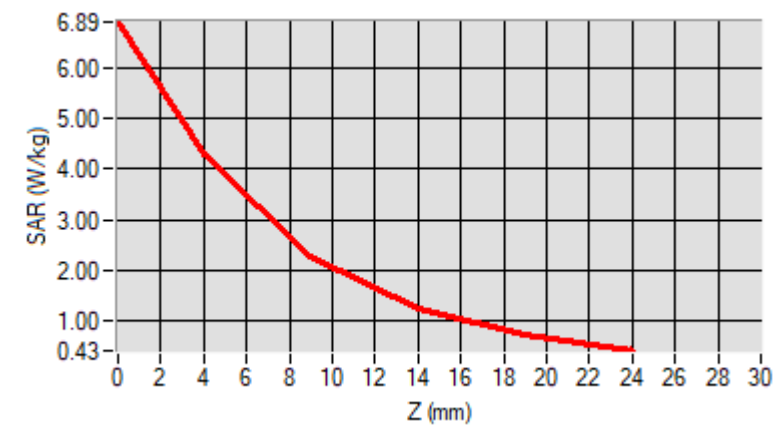


D. SAR 1g & 10g

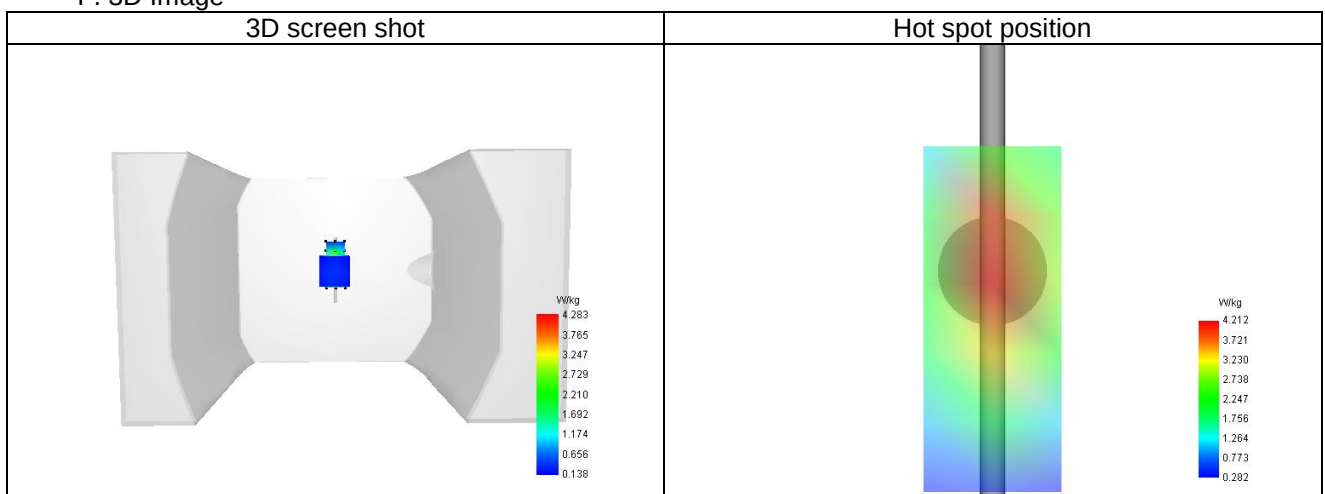
SAR 10g (W/Kg)	1.995
SAR 1g (W/Kg)	3.940
Variation (%)	0.070
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	6.889	4.283	2.298	1.249	0.726



F. 3D Image



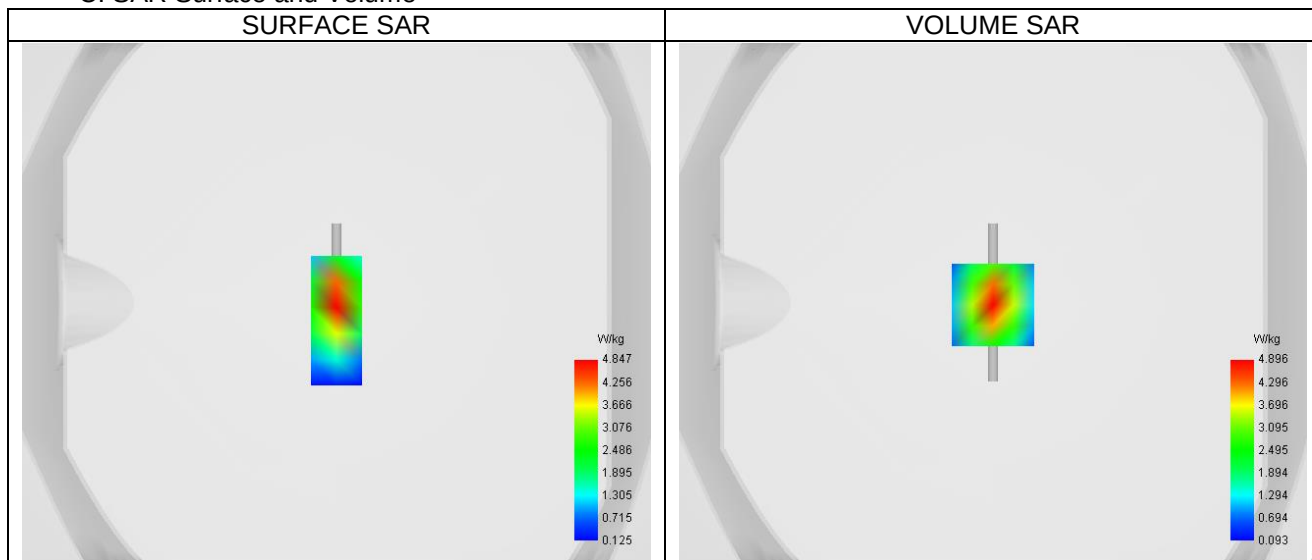
A. Experimental conditions.

Probe	SN EPG0373
ConvF	26.52
Area Scan	dx=10mm dy=10mm, Adaptative 2 max
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Very fast
Phantom	Validation plane
Device Position	Dipole
Band	CW2100
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2100.000
Relative permittivity (real part)	38.521
Relative permittivity (imaginary part)	13.824
Conductivity (S/m)	1.613

C. SAR Surface and Volume

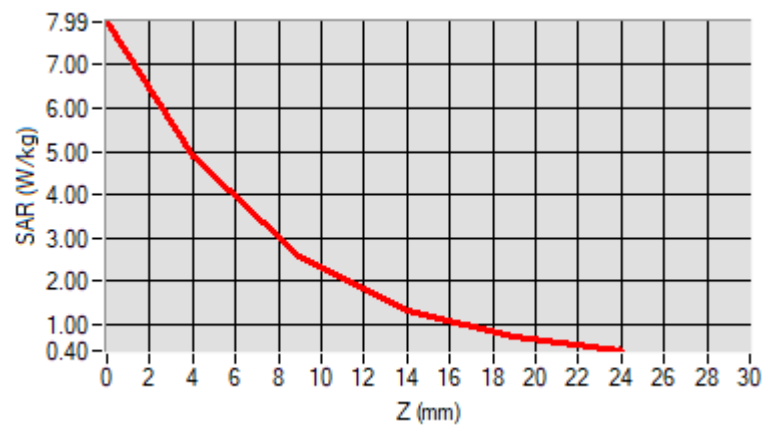


D. SAR 1g & 10g

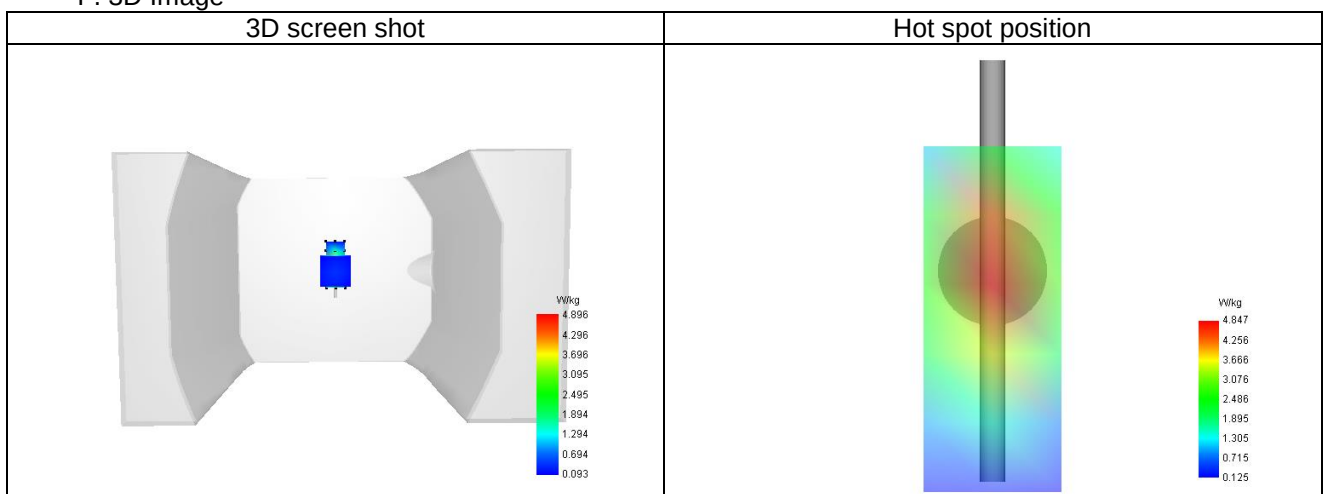
SAR 10g (W/Kg)	2.155
SAR 1g (W/Kg)	4.458
Variation (%)	0.100
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	7.987	4.896	2.558	1.335	0.733



F. 3D Image



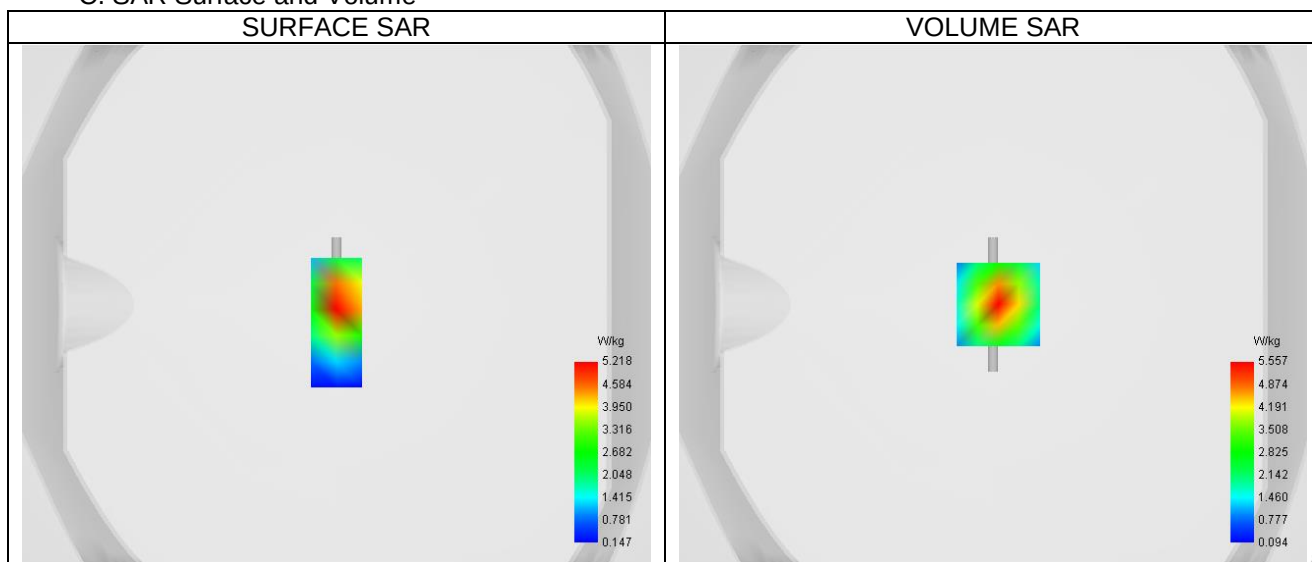
A. Experimental conditions.

Probe	SN EPG0373
ConvF	26.43
Area Scan	dx=10mm dy=10mm, Adaptative 2 max
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Very fast
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2450.000
Relative permittivity (real part)	38.600
Relative permittivity (imaginary part)	14.330
Conductivity (S/m)	1.950

C. SAR Surface and Volume



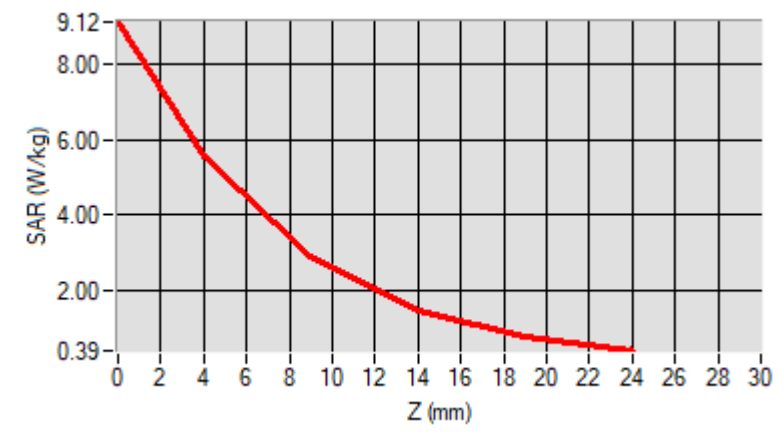
Maximum location: X=2.00, Y=0.00 ; SAR Peak: 9.11 W/kg

D. SAR 1g & 10g

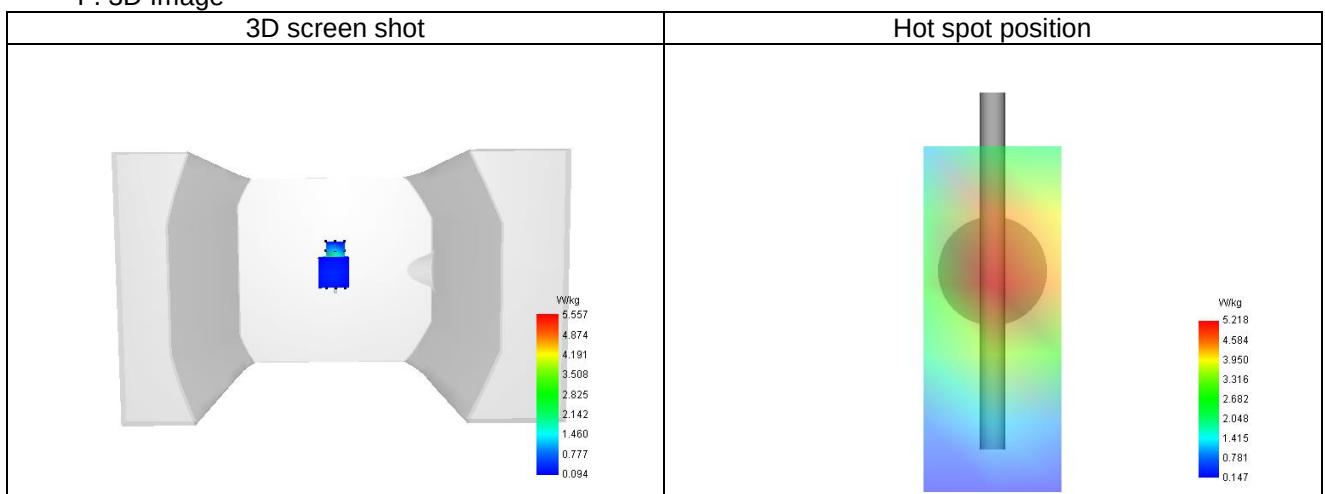
SAR 10g (W/Kg)	2.457
SAR 1g (W/Kg)	5.085
Variation (%)	0.360
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	9.121	5.557	2.866	1.459	0.770



F. 3D Image



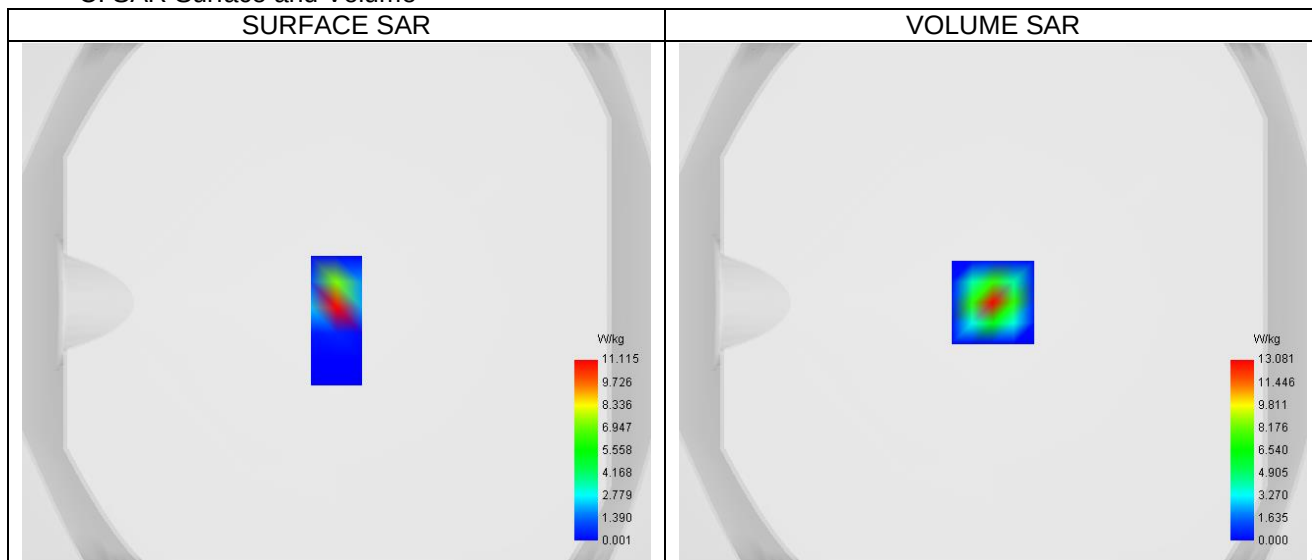
A. Experimental conditions.

Probe	SN EPGO373
ConvF	21.98
Area Scan	dx=10mm dy=10mm, Adaptative 2 max
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Very fast
Phantom	Validation plane
Device Position	Dipole
Band	CW5200
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	35.726
Relative permittivity (imaginary part)	18.140
Conductivity (S/m)	4.521

C. SAR Surface and Volume



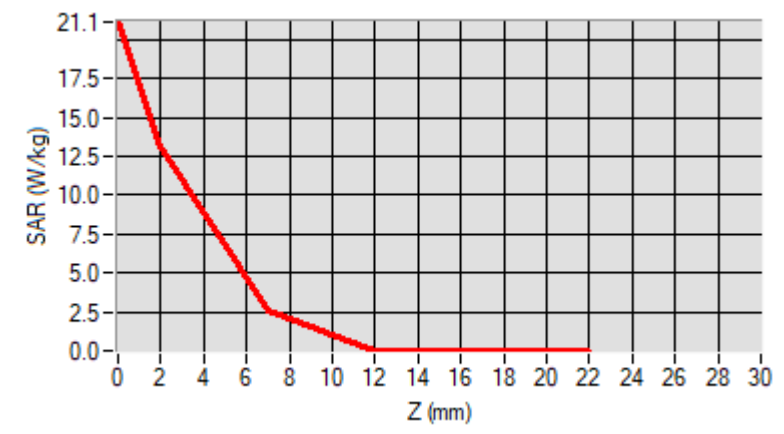
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 22.28 W/kg

D. SAR 1g & 10g

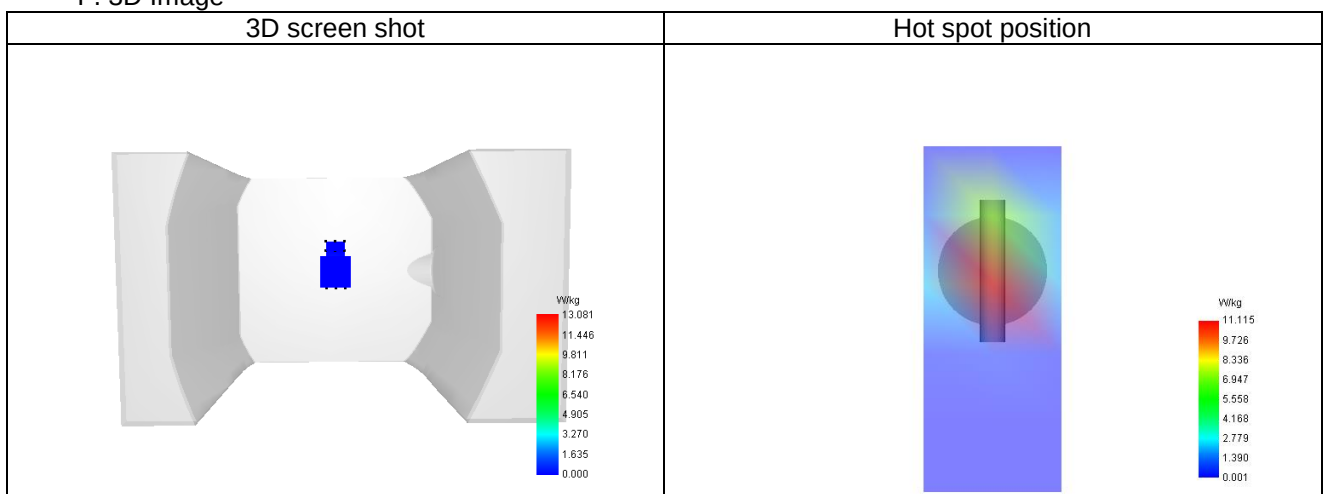
SAR 10g (W/Kg)	2.041
SAR 1g (W/Kg)	6.953
Variation (%)	0.430
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	21.117	13.081	2.622	0.000	0.003



F. 3D Image



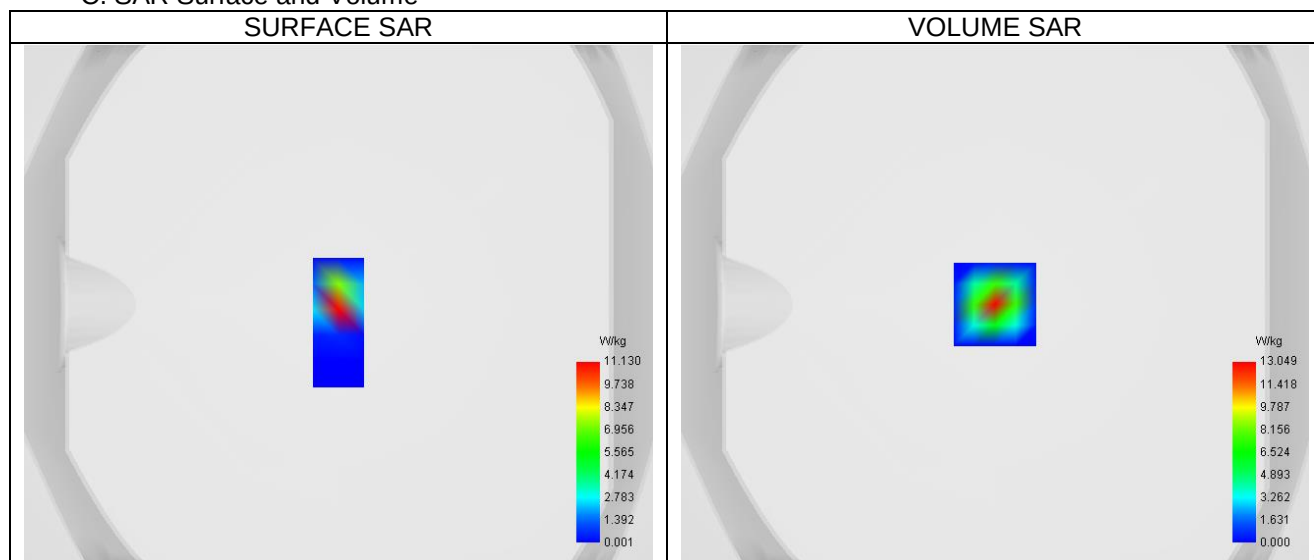
A. Experimental conditions.

Probe	SN EPG0373
ConvF	21.00
Area Scan	dx=10mm dy=10mm, Adaptative 2 max
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Very fast
Phantom	Validation plane
Device Position	Dipole
Band	CW5800
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5800.000
Relative permittivity (real part)	34.900
Relative permittivity (imaginary part)	18.620
Conductivity (S/m)	5.170

C. SAR Surface and Volume



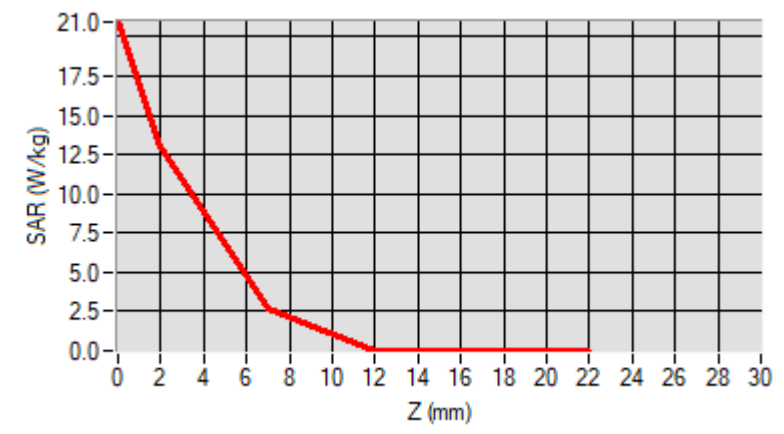
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 22.11 W/kg

D. SAR 1g & 10g

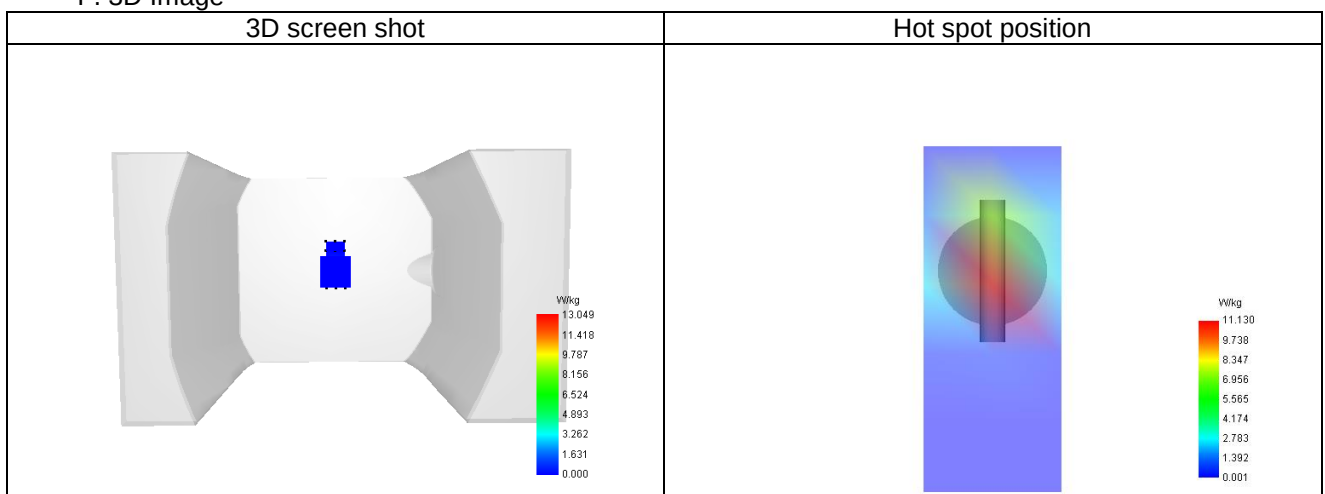
SAR 10g (W/Kg)	2.063
SAR 1g (W/Kg)	7.125
Variation (%)	0.430
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	2.00	7.00	12.00	17.00
SAR (W/Kg)	20.951	13.049	2.674	0.012	0.003



F. 3D Image



15.2 SAR Test Graph Results

Plot 1

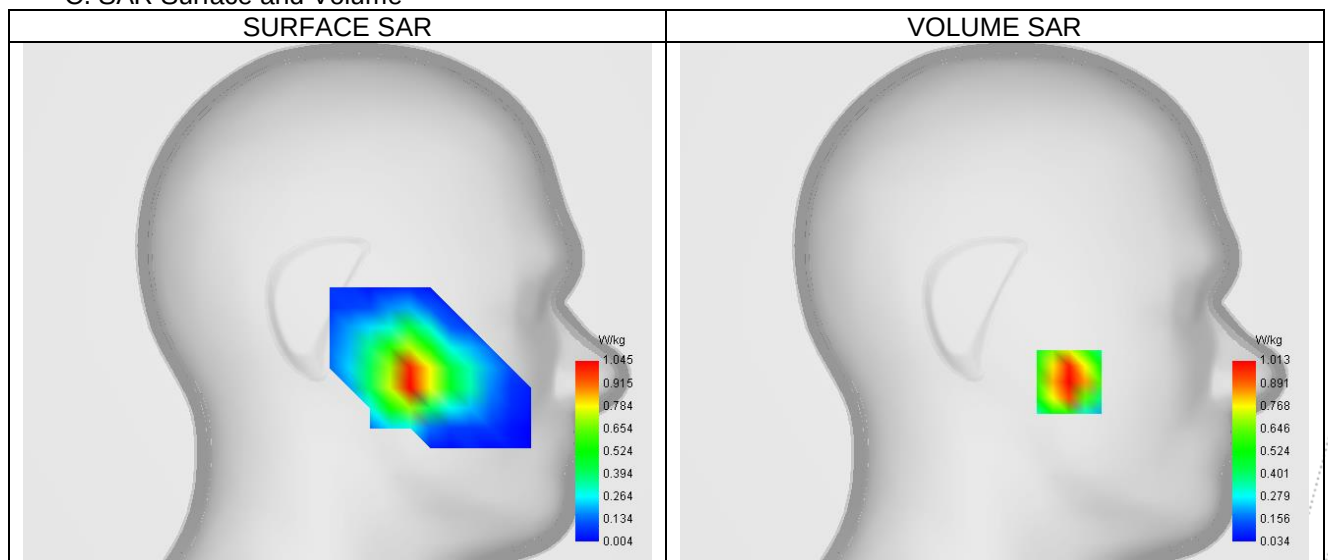
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	GSM900
Channels	Middle (62)
Signal	TDMA (Crest factor: 8.0)

B. Permittivity

Frequency (MHz)	902.400
Relative permittivity (real part)	41.496
Relative permittivity (imaginary part)	19.380
Conductivity (S/m)	0.972

C. SAR Surface and Volume



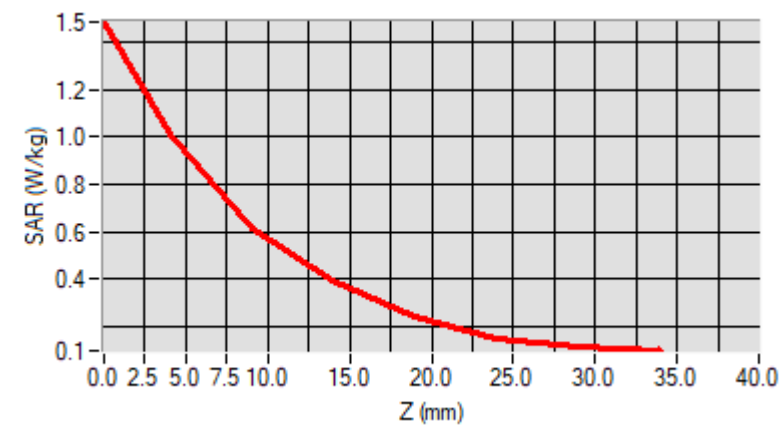
Maximum location: X=-37.00, Y=-39.00 ; SAR Peak: 1.58 W/kg

D. SAR 1g & 10g

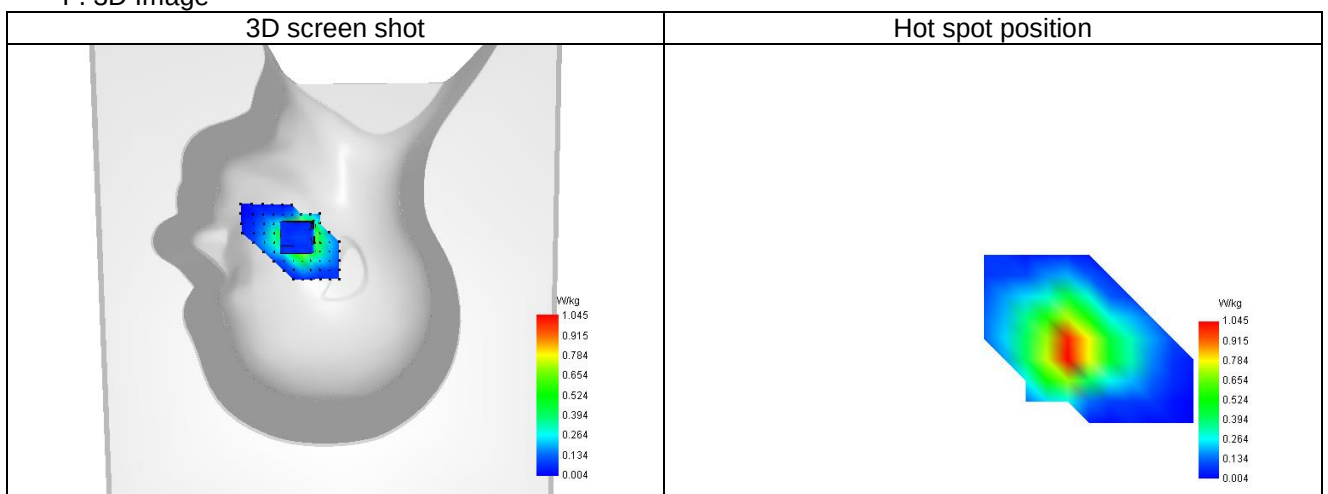
SAR 10g (W/Kg)	0.540
SAR 1g (W/Kg)	0.961
Variation (%)	-2.700
Horizontal validation criteria: minimum distance (mm)	17.888544
Vertical validation criteria: SAR ratio M2/M1 (%)	60.526536

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.484	1.013	0.613	0.397	0.240	0.154	0.118



F. 3D Image



Plot 2

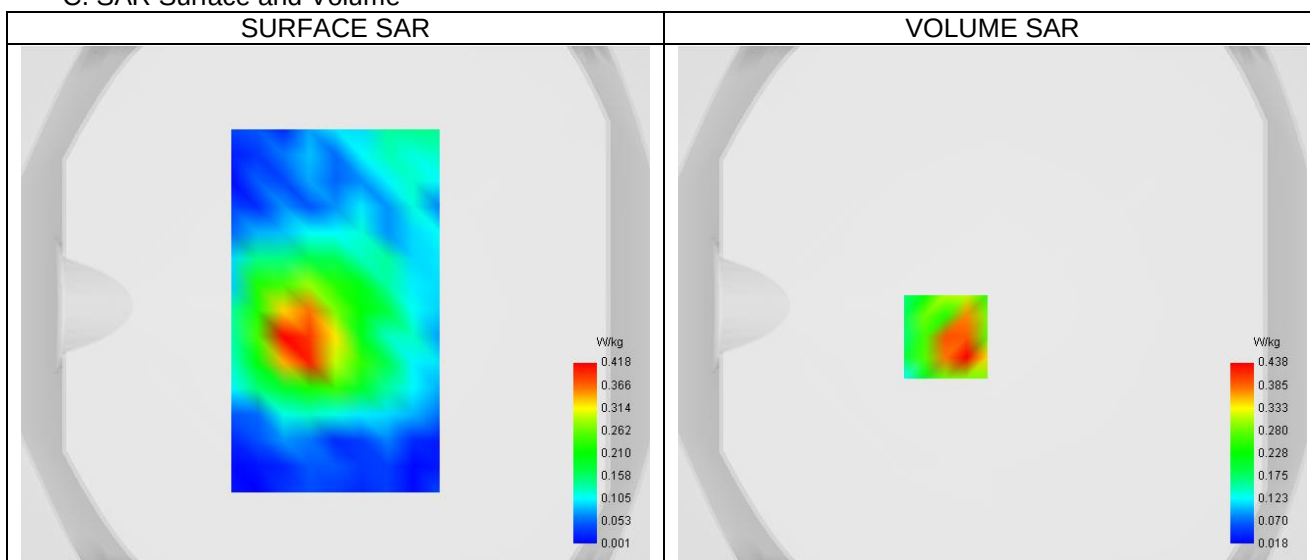
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	GSM900
Channels	Middle (62)
Signal	TDMA (Crest factor: 8.0)

B. Permittivity

Frequency (MHz)	902.400
Relative permittivity (real part)	41.496
Relative permittivity (imaginary part)	19.380
Conductivity (S/m)	0.972

C. SAR Surface and Volume

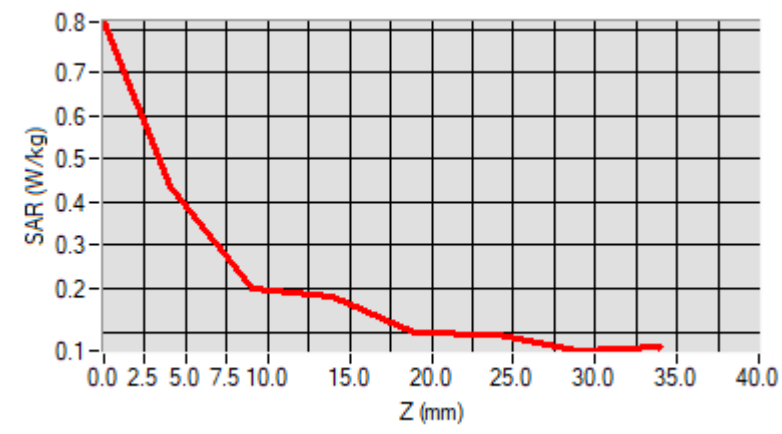


D. SAR 1g & 10g

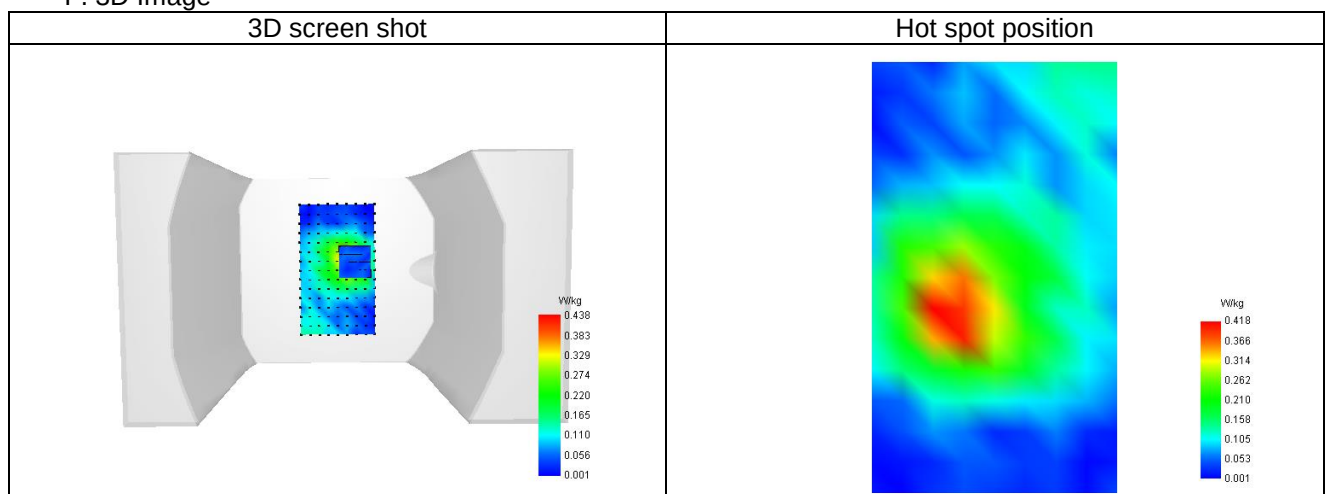
SAR 10g (W/Kg)	0.233
SAR 1g (W/Kg)	0.415
Variation (%)	-2.350
Horizontal validation criteria: minimum distance (mm)	17.888544
Vertical validation criteria: SAR ratio M2/M1 (%)	63.060223

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.817	0.438	0.198	0.181	0.099	0.092	0.056



F. 3D Image



Plot 3

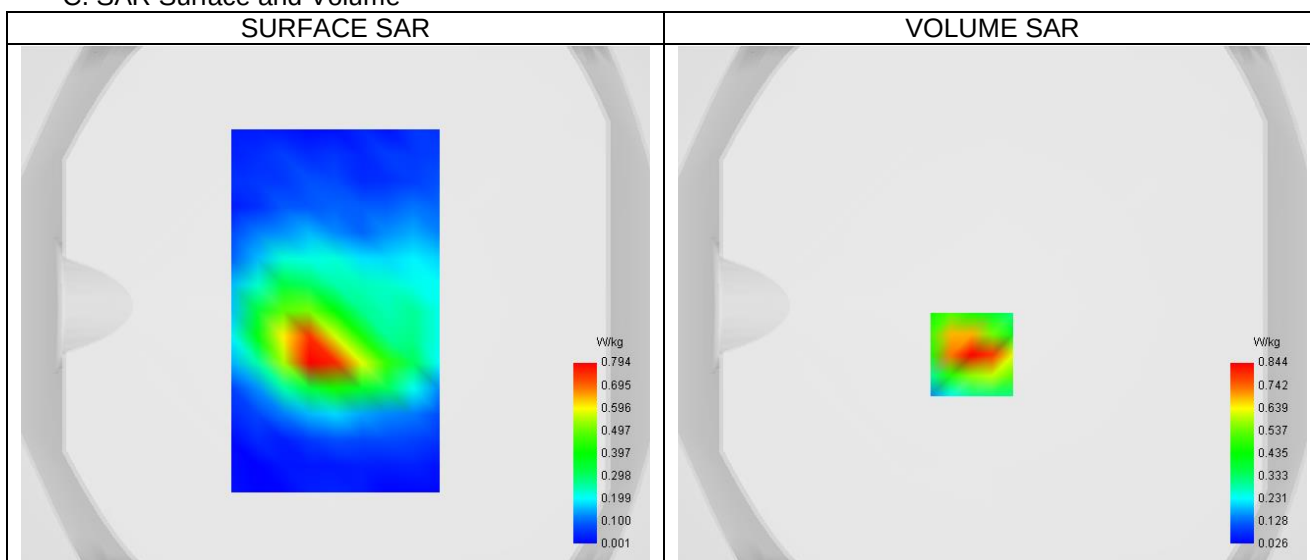
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	GSM900
Channels	Middle (62)
Signal	TDMA (Crest factor: 8.0)

B. Permittivity

Frequency (MHz)	902.400
Relative permittivity (real part)	41.496
Relative permittivity (imaginary part)	19.380
Conductivity (S/m)	0.972

C. SAR Surface and Volume

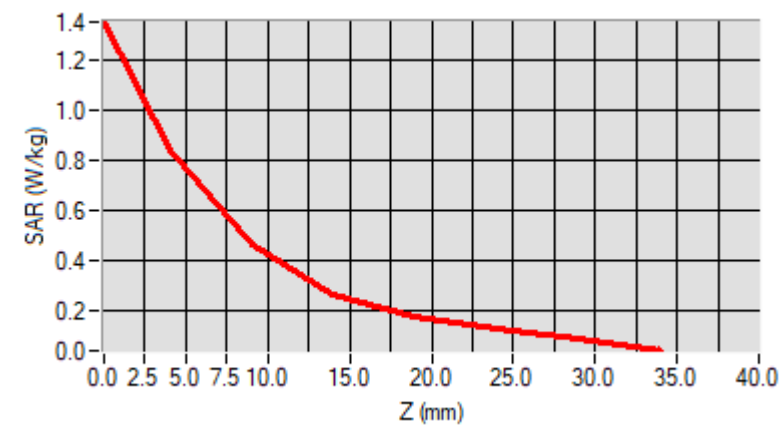


D. SAR 1g & 10g

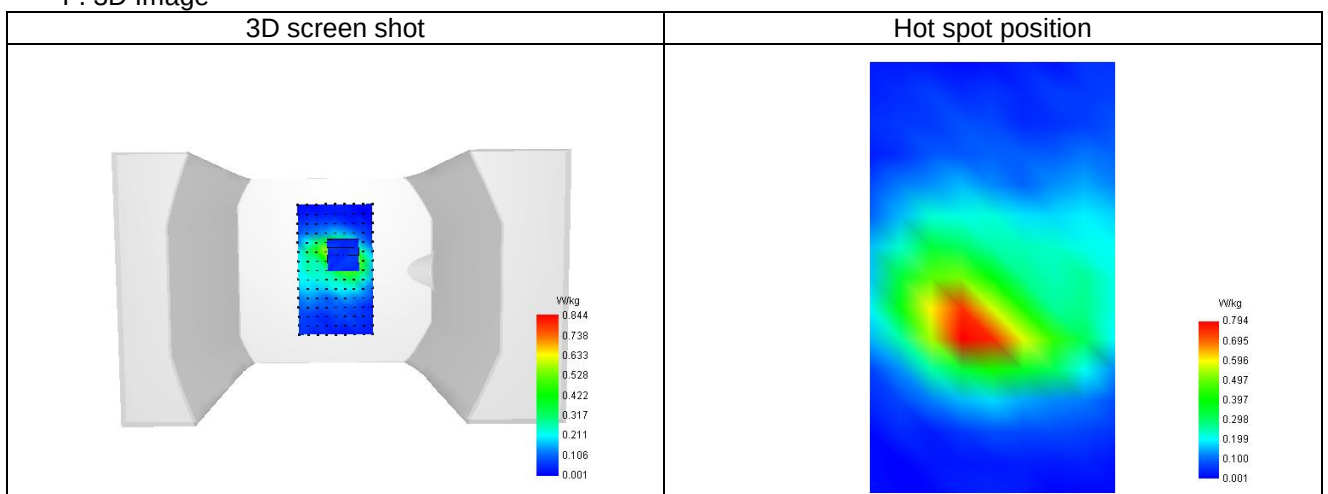
SAR 10g (W/Kg)	0.412
SAR 1g (W/Kg)	0.795
Variation (%)	-1.030
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	54.851604

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.357	0.844	0.463	0.263	0.174	0.124	0.082



F. 3D Image



Plot 4

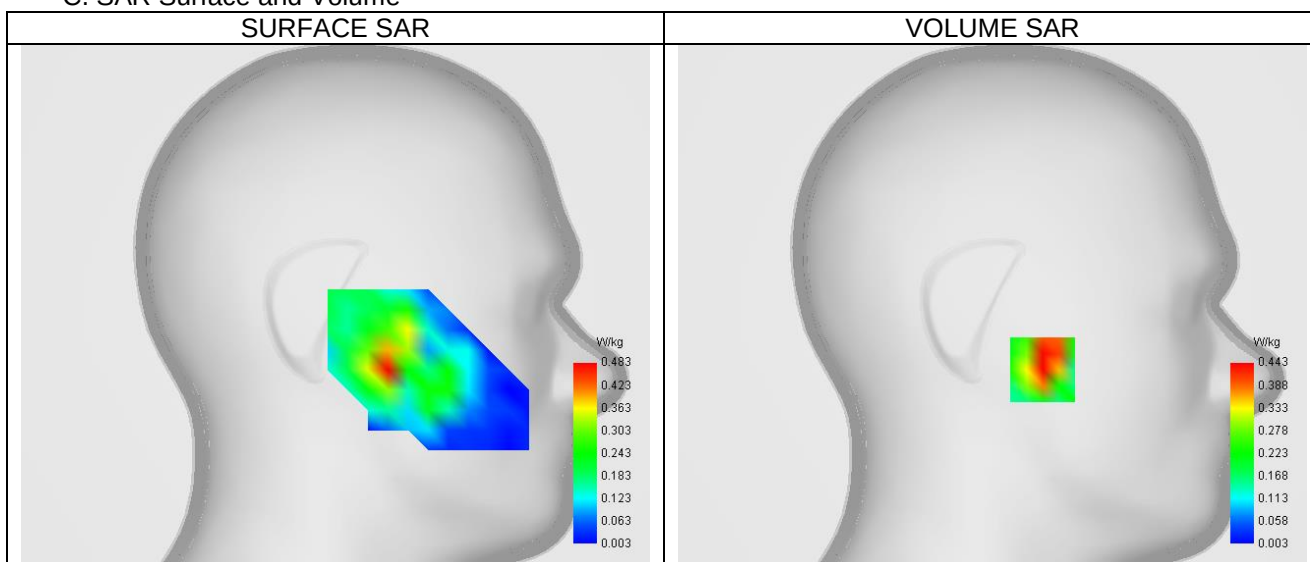
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.35
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	GSM1800
Channels	Middle (700)
Signal	TDMA (Crest factor: 8.0)

B. Permittivity

Frequency (MHz)	1747.800
Relative permittivity (real part)	40.102
Relative permittivity (imaginary part)	14.096
Conductivity (S/m)	1.369

C. SAR Surface and Volume

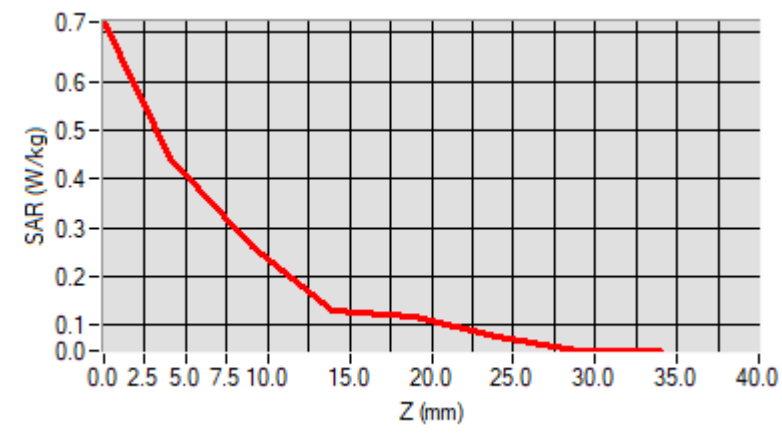


D. SAR 1g & 10g

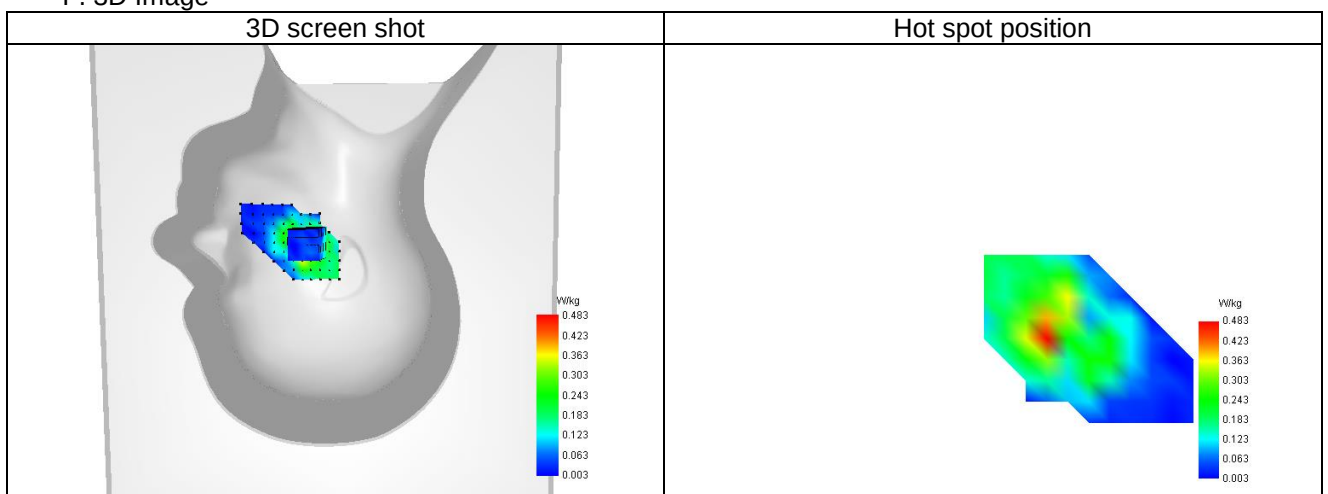
SAR 10g (W/Kg)	0.240
SAR 1g (W/Kg)	0.450
Variation (%)	-3.210
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	59.104875

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.723	0.443	0.262	0.128	0.117	0.075	0.047



F. 3D Image



Plot 5

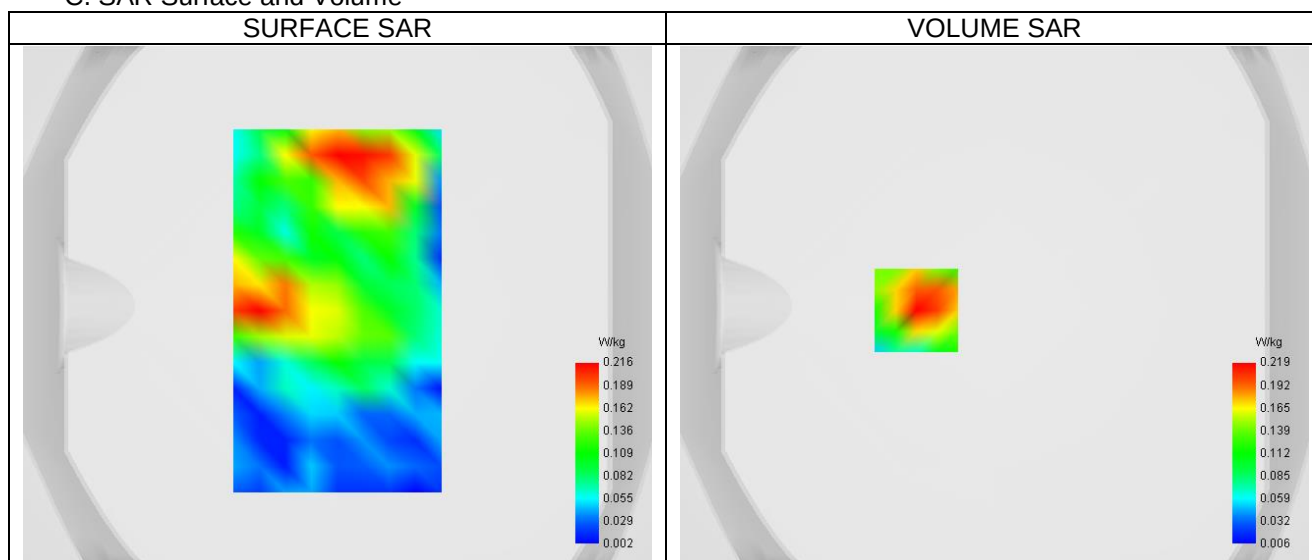
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.35
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	GSM1800
Channels	Middle (700)
Signal	TDMA (Crest factor: 8.0)

B. Permittivity

Frequency (MHz)	1747.800
Relative permittivity (real part)	40.102
Relative permittivity (imaginary part)	14.096
Conductivity (S/m)	1.369

C. SAR Surface and Volume

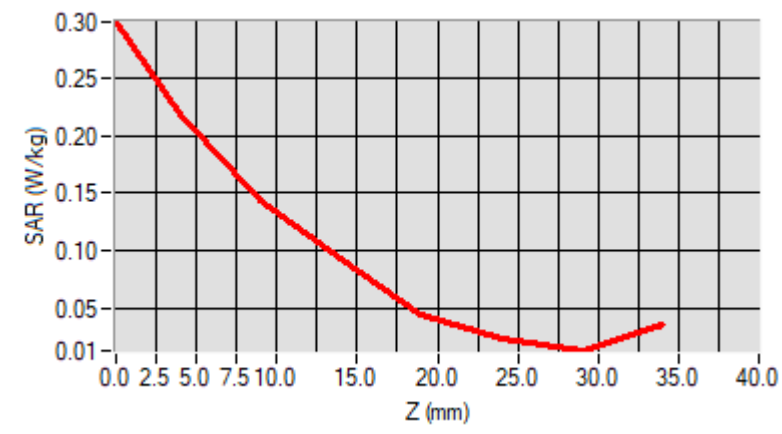


D. SAR 1g & 10g

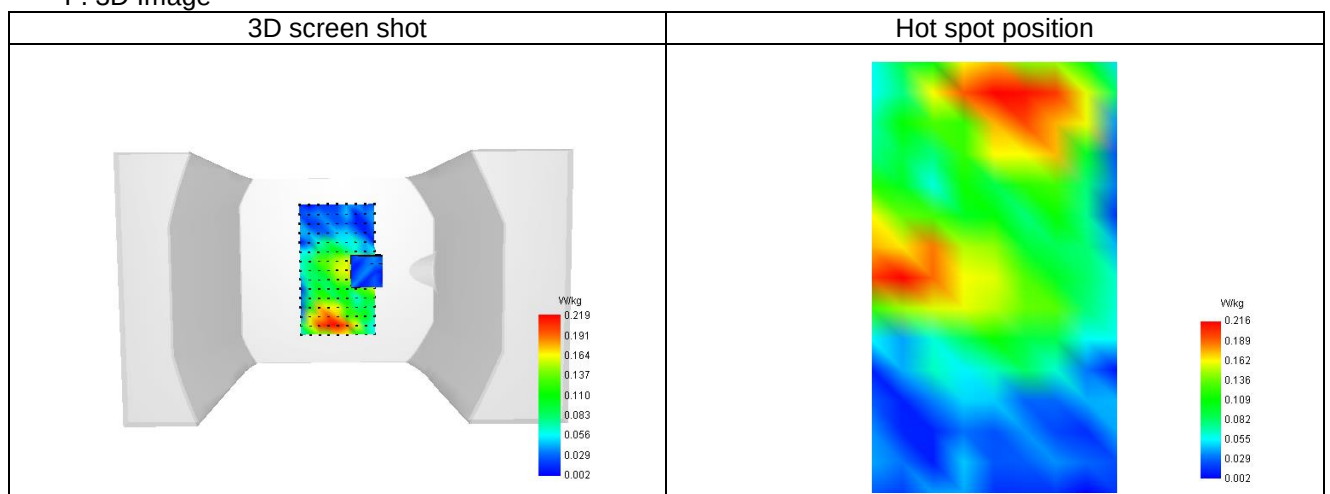
SAR 10g (W/Kg)	0.120
SAR 1g (W/Kg)	0.201
Variation (%)	-1.210
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	65.464777

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.298	0.219	0.143	0.094	0.046	0.025	0.014



F. 3D Image



Plot 6

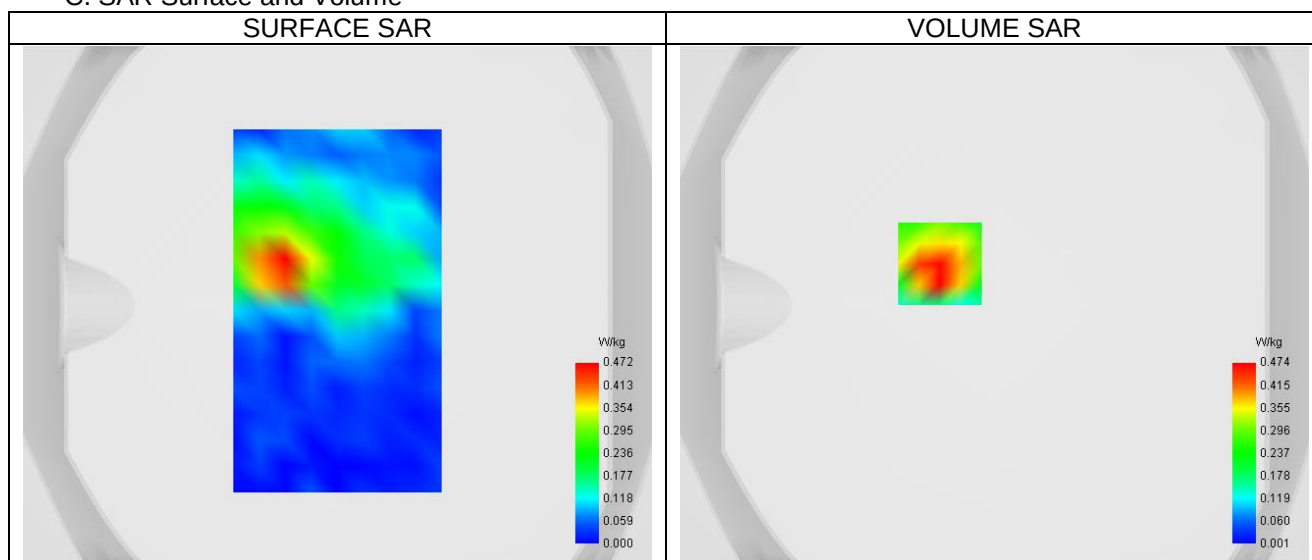
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.35
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	GSM1800
Channels	Middle (700)
Signal	TDMA (Crest factor: 8.0)

B. Permittivity

Frequency (MHz)	1747.800
Relative permittivity (real part)	40.102
Relative permittivity (imaginary part)	14.096
Conductivity (S/m)	1.369

C. SAR Surface and Volume



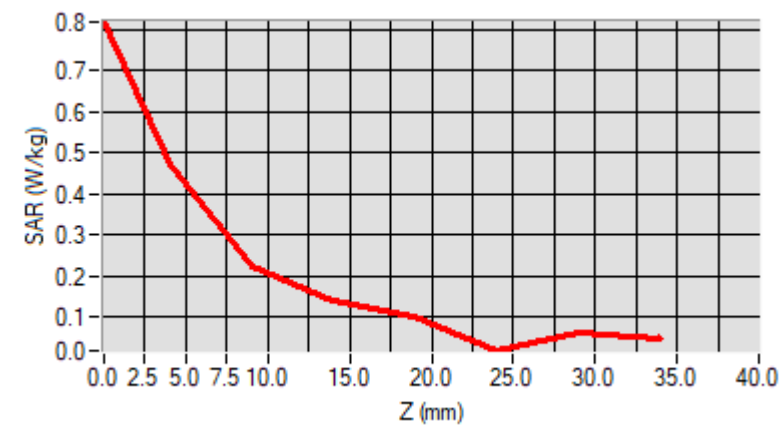
Maximum location: X=-21.00, Y=16.00 ; SAR Peak: 0.84 W/kg

D. SAR 1g & 10g

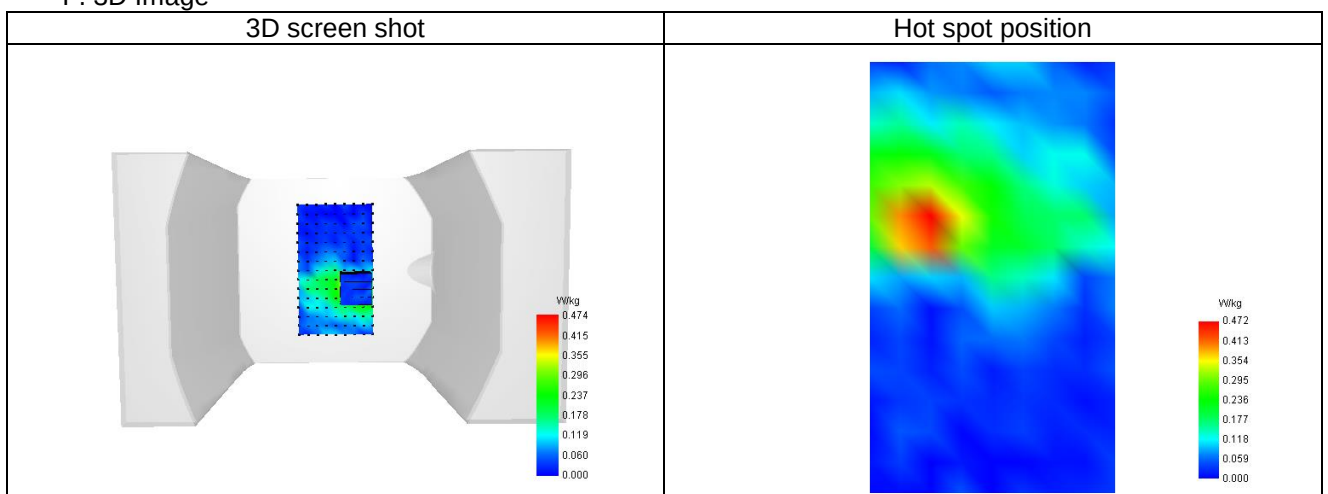
SAR 10g (W/Kg)	0.232
SAR 1g (W/Kg)	0.463
Variation (%)	-3.850
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	52.436616

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.818	0.474	0.222	0.142	0.103	0.019	0.063



F. 3D Image



Plot 7

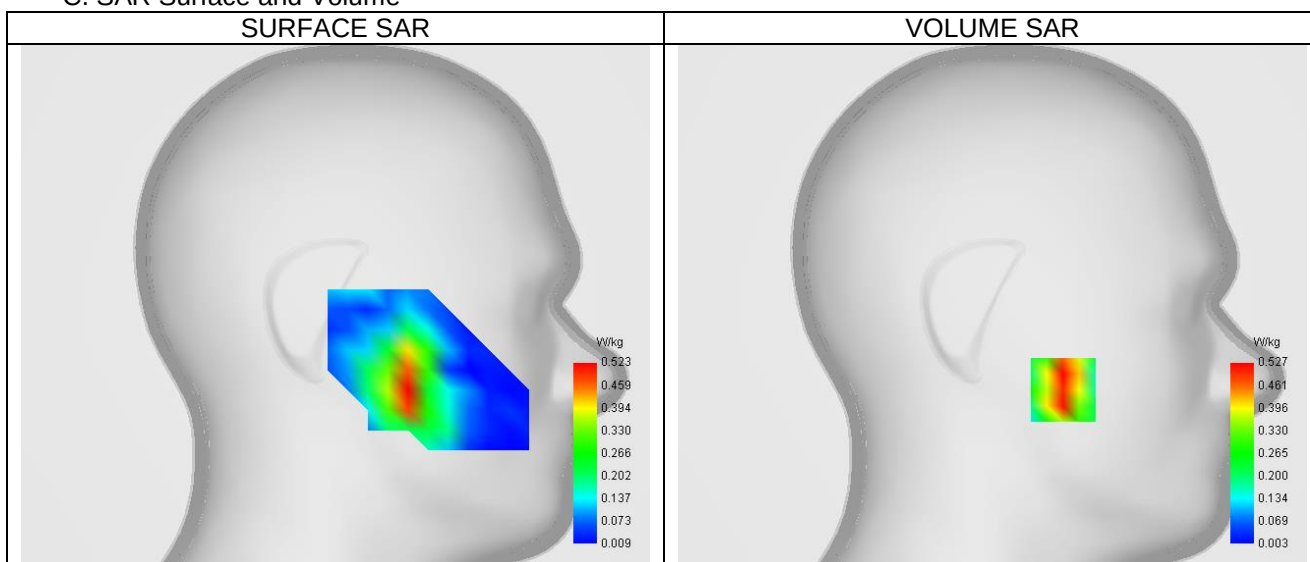
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.27
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	Band1 UMTS
Channels	Middle (9750)
Signal	WCDMA (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1950.000
Relative permittivity (real part)	40.000
Relative permittivity (imaginary part)	12.930
Conductivity (S/m)	1.401

C. SAR Surface and Volume

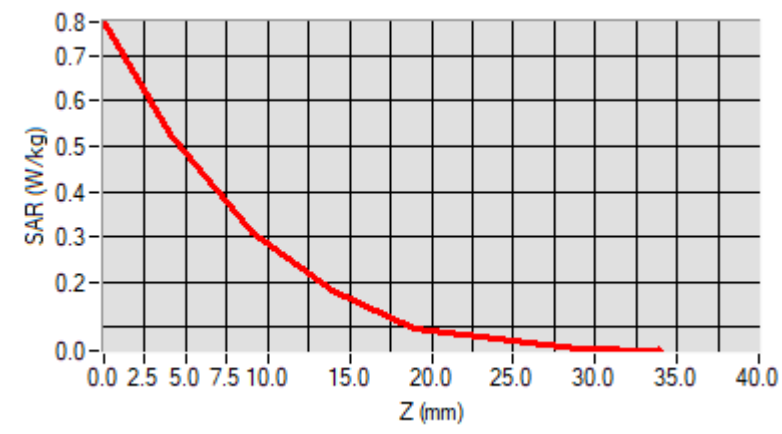


D. SAR 1g & 10g

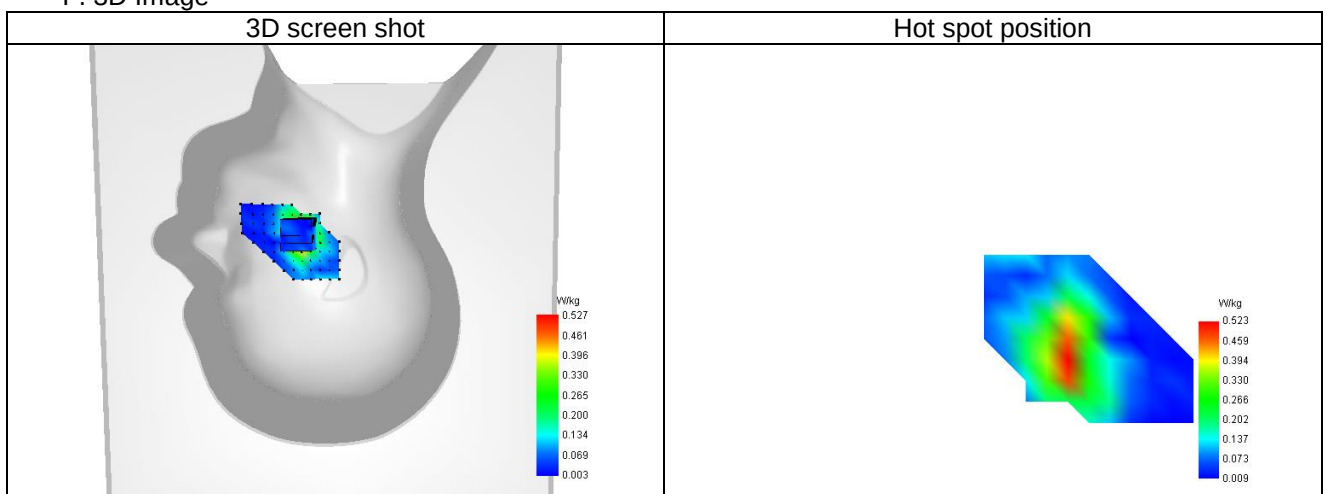
SAR 10g (W/Kg)	0.257
SAR 1g (W/Kg)	0.474
Variation (%)	0.900
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	60.209568

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.775	0.527	0.309	0.182	0.098	0.074	0.054



F. 3D Image



Plot 8

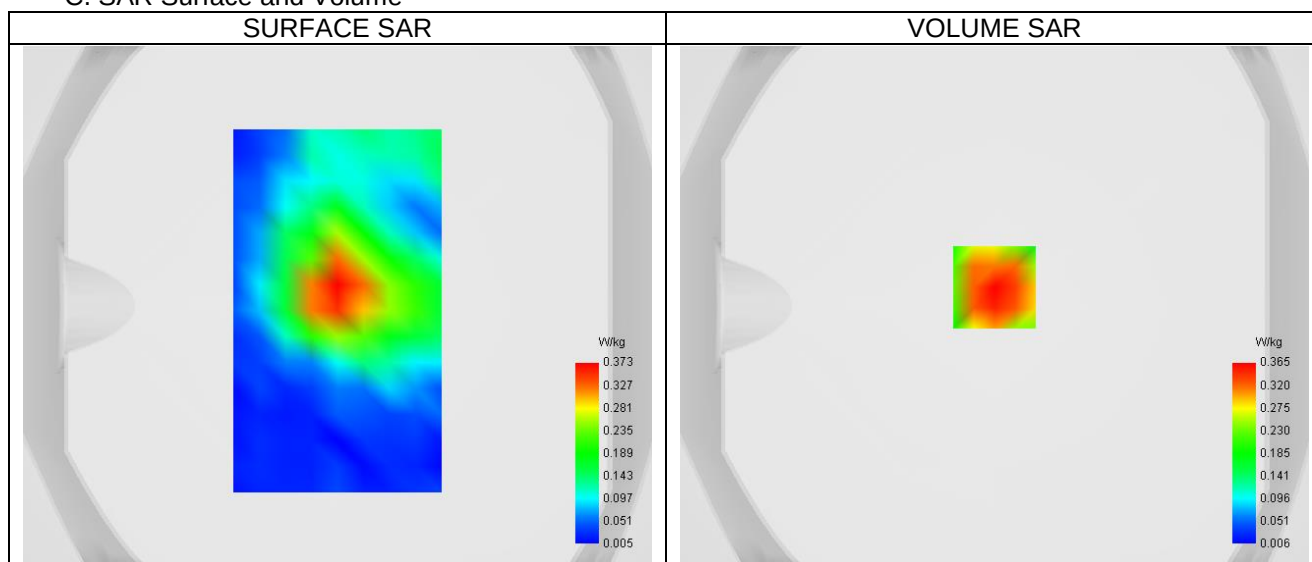
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.27
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	Band1 UMTS
Channels	Middle (9750)
Signal	WCDMA (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1950.000
Relative permittivity (real part)	40.000
Relative permittivity (imaginary part)	12.930
Conductivity (S/m)	1.401

C. SAR Surface and Volume



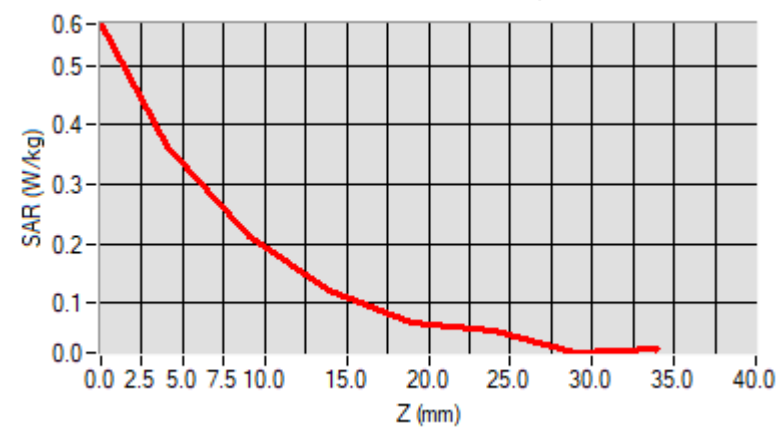
Maximum location: X=0.00, Y=7.00 ; SAR Peak: 0.57 W/kg

D. SAR 1g & 10g

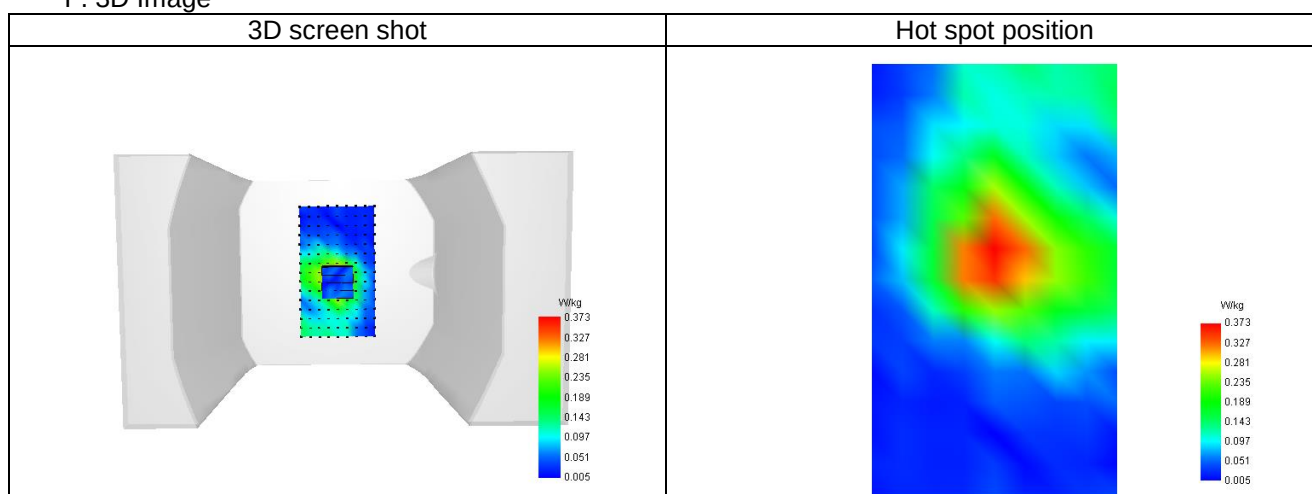
SAR 10g (W/Kg)	0.208
SAR 1g (W/Kg)	0.351
Variation (%)	-0.590
Horizontal validation criteria: minimum distance (mm)	22.627417
Vertical validation criteria: SAR ratio M2/M1 (%)	57.986567

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.569	0.365	0.212	0.123	0.067	0.054	0.017



F. 3D Image



Plot 9

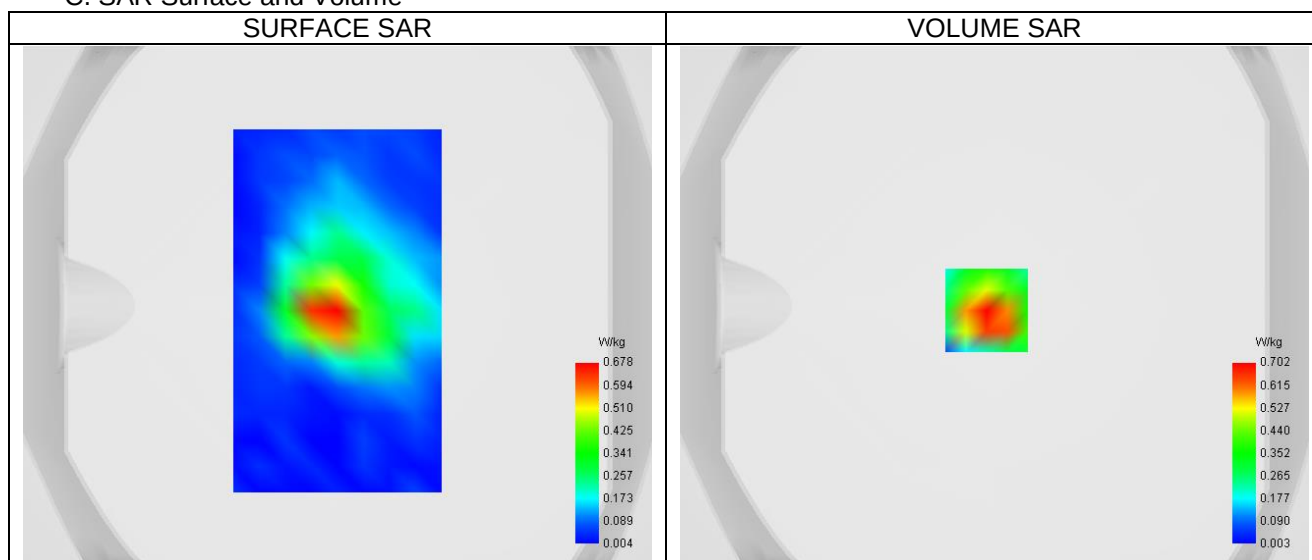
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.27
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	Band1 UMTS
Channels	Middle (9750)
Signal	WCDMA (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1950.000
Relative permittivity (real part)	40.000
Relative permittivity (imaginary part)	12.930
Conductivity (S/m)	1.401

C. SAR Surface and Volume



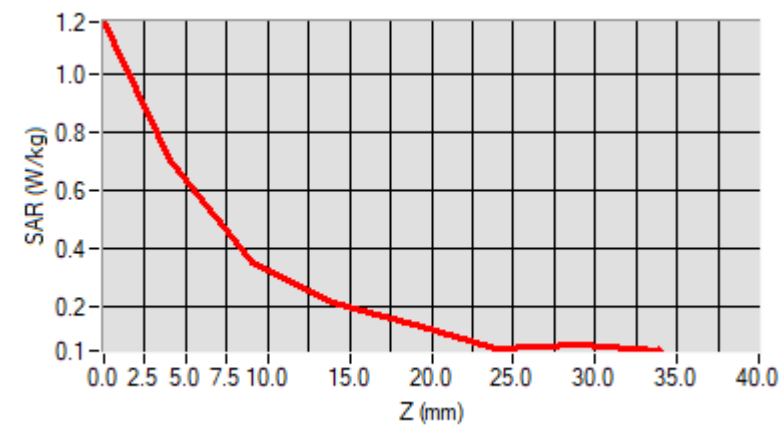
Maximum location: X=-3.00, Y=-2.00 ; SAR Peak: 1.32 W/kg

D. SAR 1g & 10g

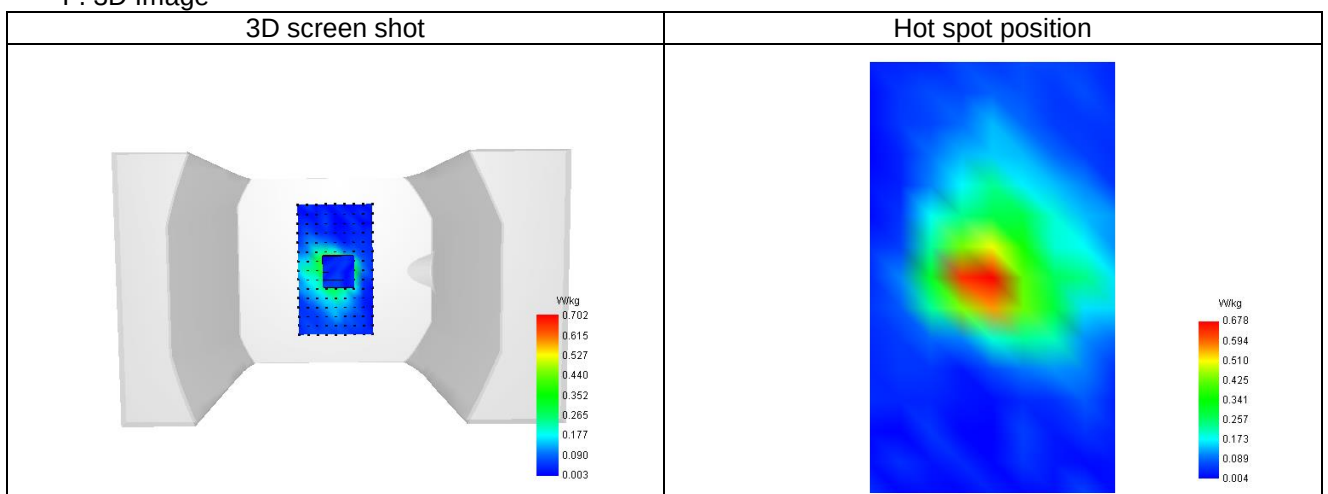
SAR 10g (W/Kg)	0.330
SAR 1g (W/Kg)	0.696
Variation (%)	1.350
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	49.927804

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.180	0.702	0.350	0.213	0.137	0.058	0.071



F. 3D Image



Plot 10

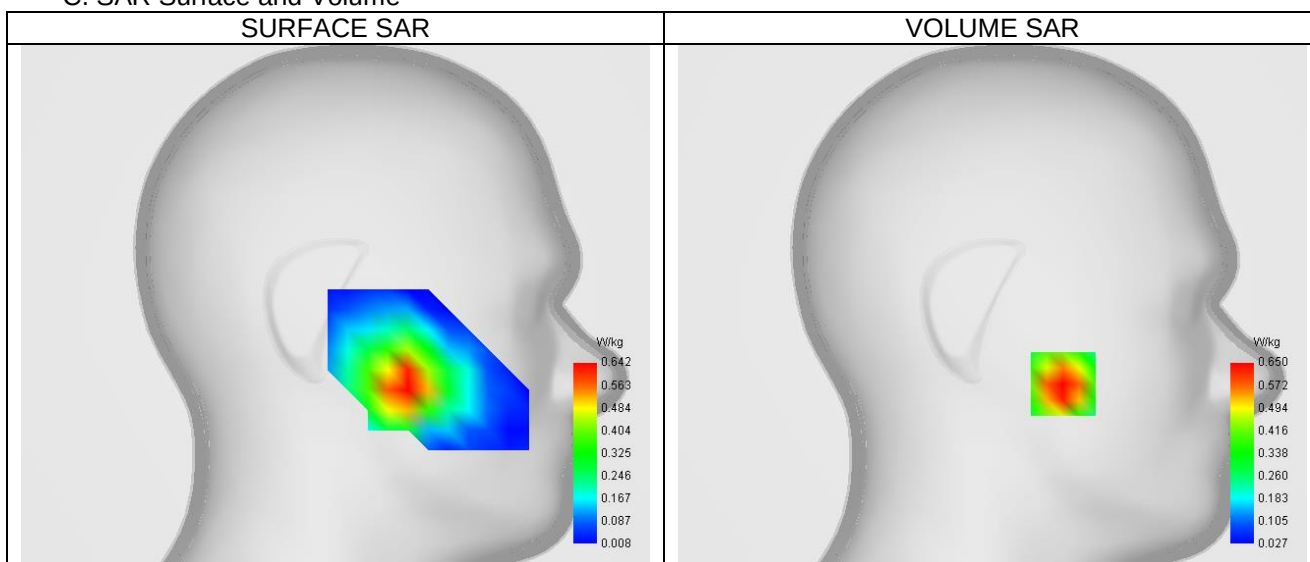
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	Band8_WCDMA900
Channels	Middle (2788)
Signal	WCDMA (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	897.600
Relative permittivity (real part)	41.500
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.967

C. SAR Surface and Volume

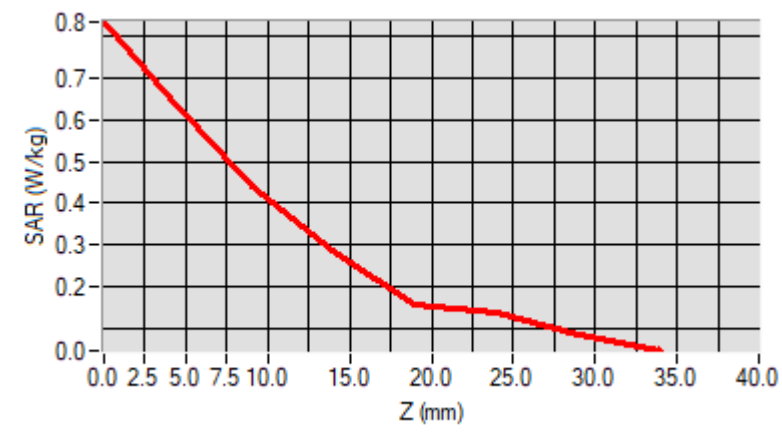


D. SAR 1g & 10g

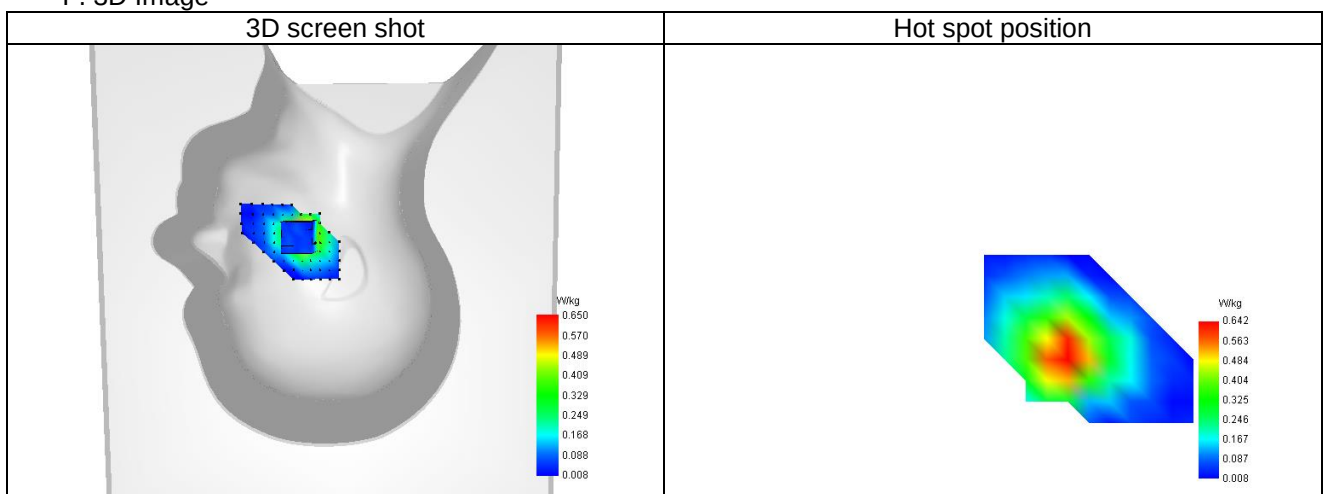
SAR 10g (W/Kg)	0.372
SAR 1g (W/Kg)	0.625
Variation (%)	-4.210
Horizontal validation criteria: minimum distance (mm)	22.355759
Vertical validation criteria: SAR ratio M2/M1 (%)	67.535137

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.834	0.650	0.439	0.289	0.159	0.139	0.085



F. 3D Image



Plot 11

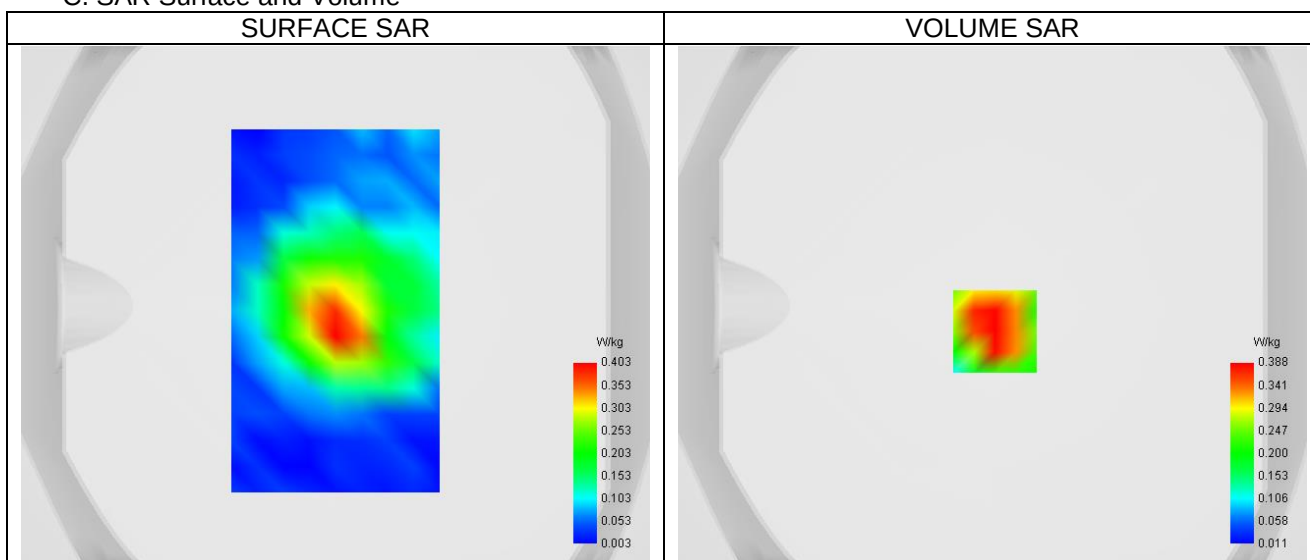
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	Band8_WCDMA900
Channels	Middle (2788)
Signal	WCDMA (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	897.600
Relative permittivity (real part)	41.500
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.967

C. SAR Surface and Volume



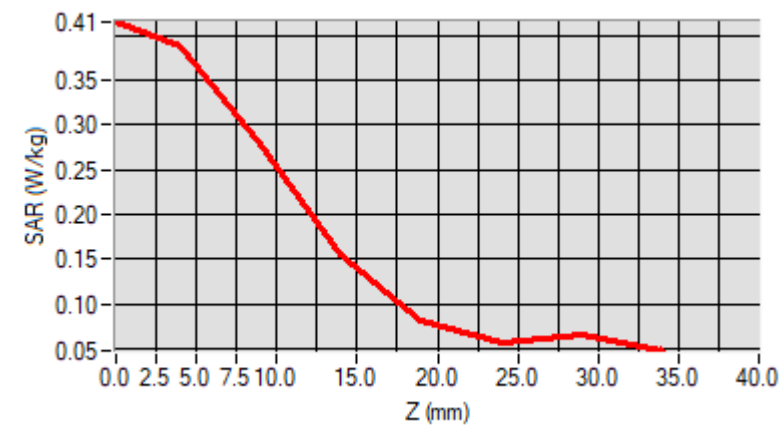
Maximum location: X=1.00, Y=-10.00 ; SAR Peak: 0.59 W/kg

D. SAR 1g & 10g

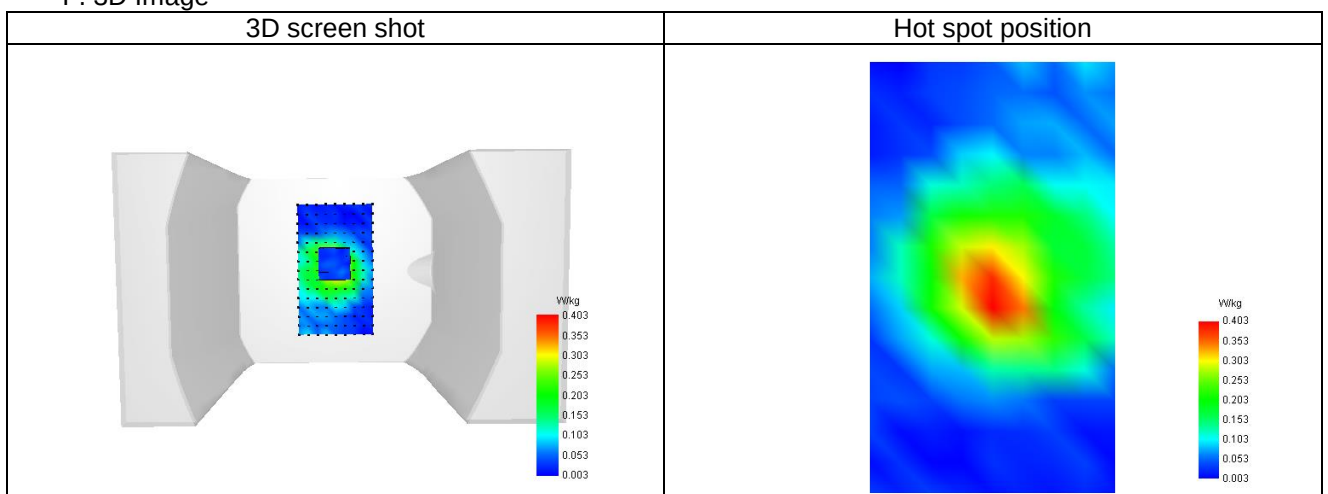
SAR 10g (W/Kg)	0.222
SAR 1g (W/Kg)	0.368
Variation (%)	-0.890
Horizontal validation criteria: minimum distance (mm)	17.888544
Vertical validation criteria: SAR ratio M2/M1 (%)	71.711380

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.415	0.388	0.278	0.157	0.082	0.057	0.067



F. 3D Image



Plot 12

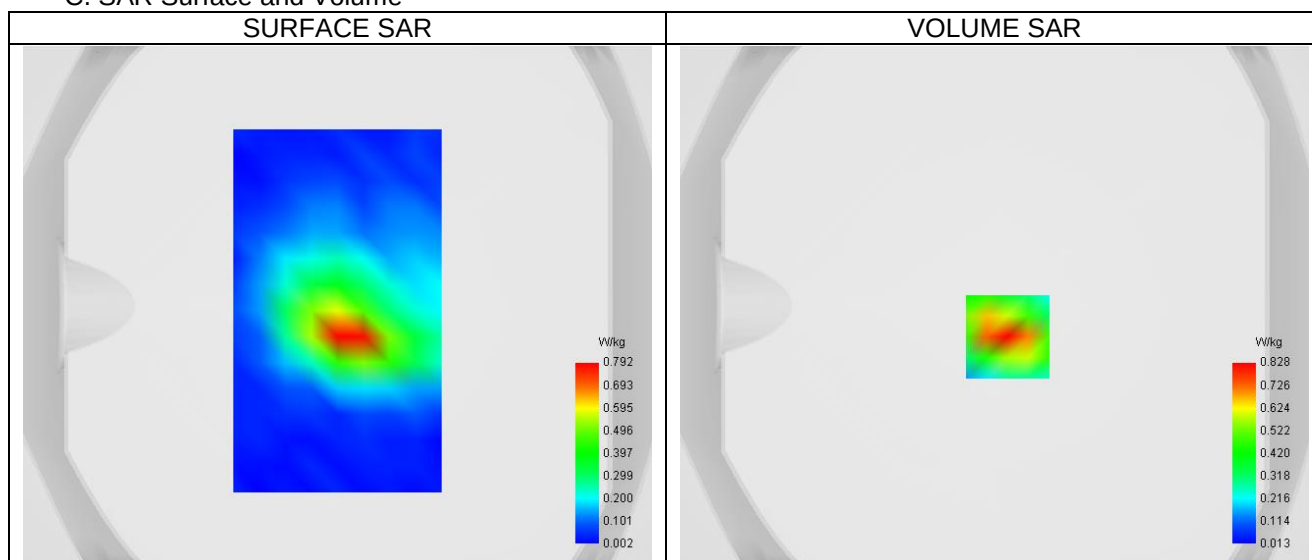
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	Band8_WCDMA900
Channels	Middle (2788)
Signal	WCDMA (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	897.600
Relative permittivity (real part)	41.500
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.967

C. SAR Surface and Volume



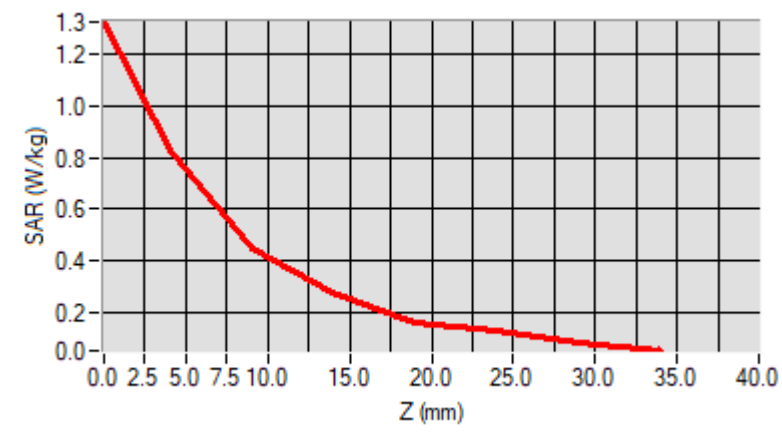
Maximum location: X=5.00, Y=-12.00 ; SAR Peak: 1.32 W/kg

D. SAR 1g & 10g

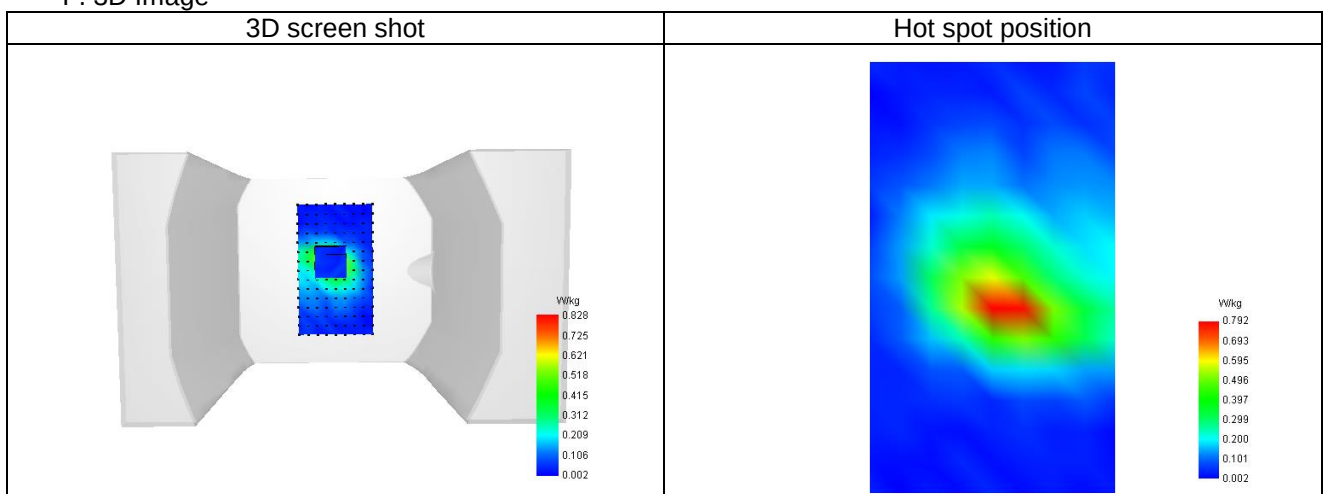
SAR 10g (W/Kg)	0.394
SAR 1g (W/Kg)	0.755
Variation (%)	1.990
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	53.905152

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.328	0.828	0.446	0.277	0.160	0.126	0.083



F. 3D Image



Plot 13

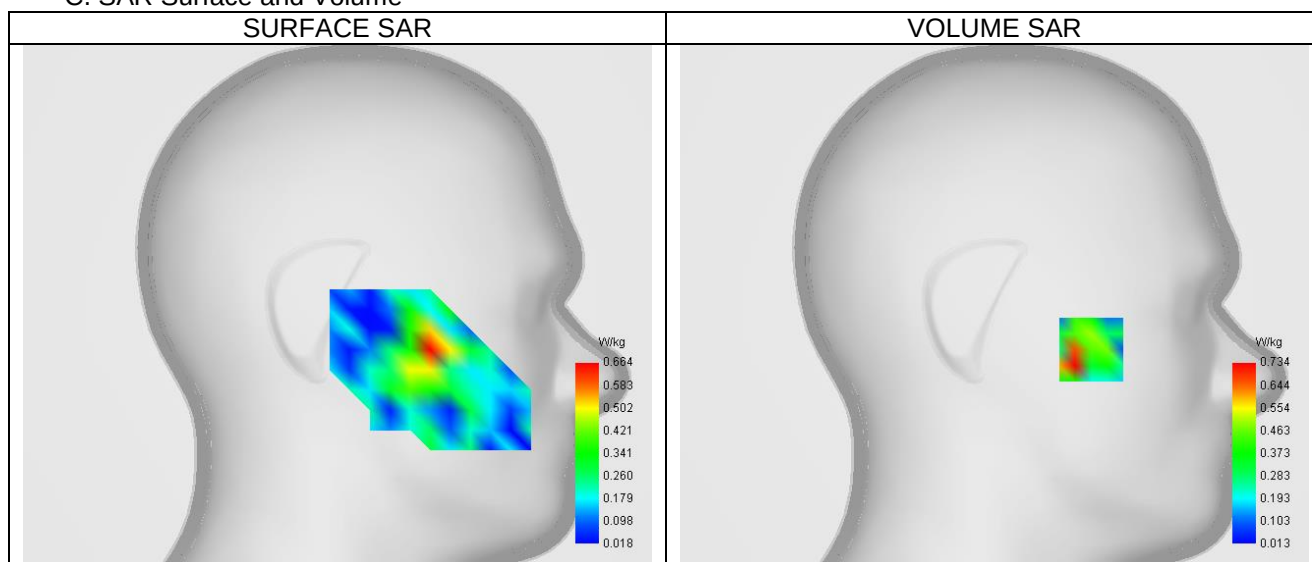
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	2.92
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11a
Channels	Middle (40)
Signal	IEEE802.a (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	35.650
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	4.965

C. SAR Surface and Volume



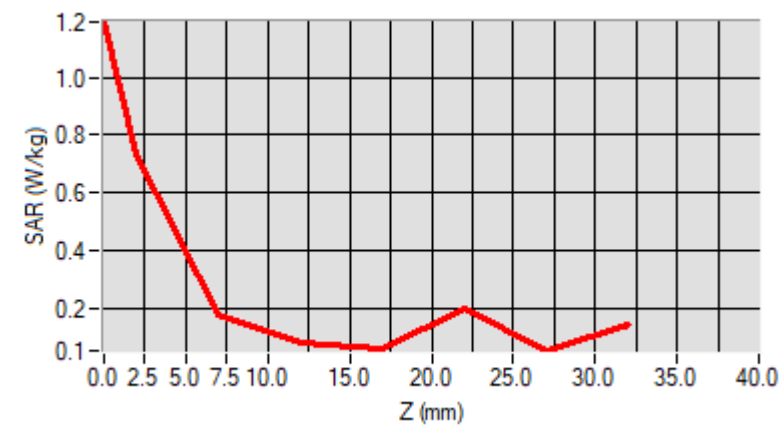
Maximum location: X=-48.00, Y=-22.00 ; SAR Peak: 1.55 W/kg

D. SAR 1g & 10g

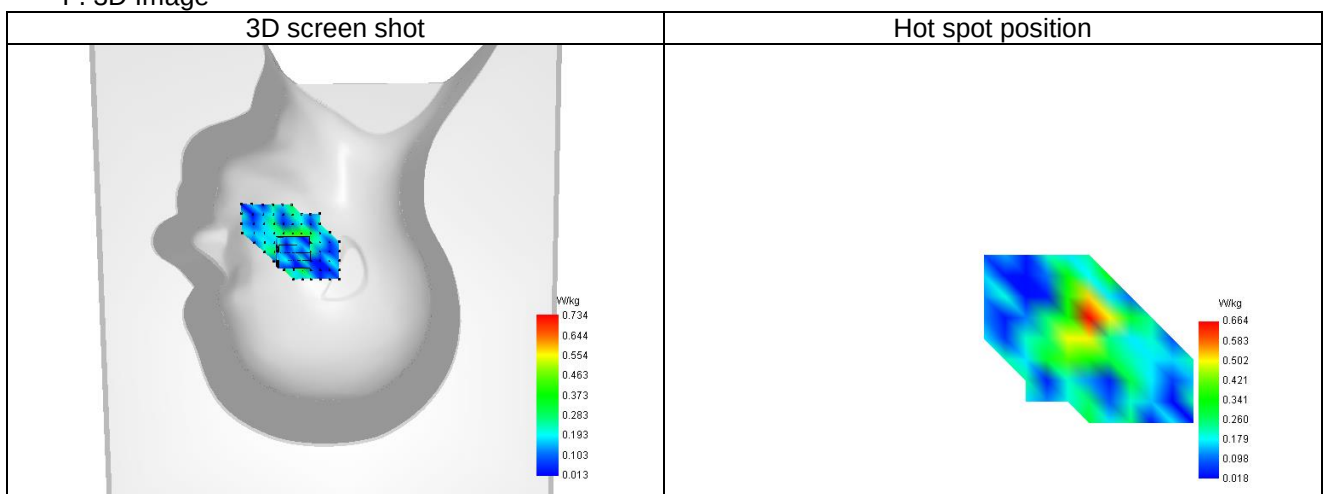
SAR 10g (W/Kg)	0.336
SAR 1g (W/Kg)	0.674
Variation (%)	4.720
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	57.751274

E. Z Axis Scan

Z (mm)	0.00	2.00	7.00	12.00	17.00	22.00	27.00
SAR (W/Kg)	1.191	0.734	0.180	0.080	0.056	0.196	0.052



F. 3D Image



Plot 14

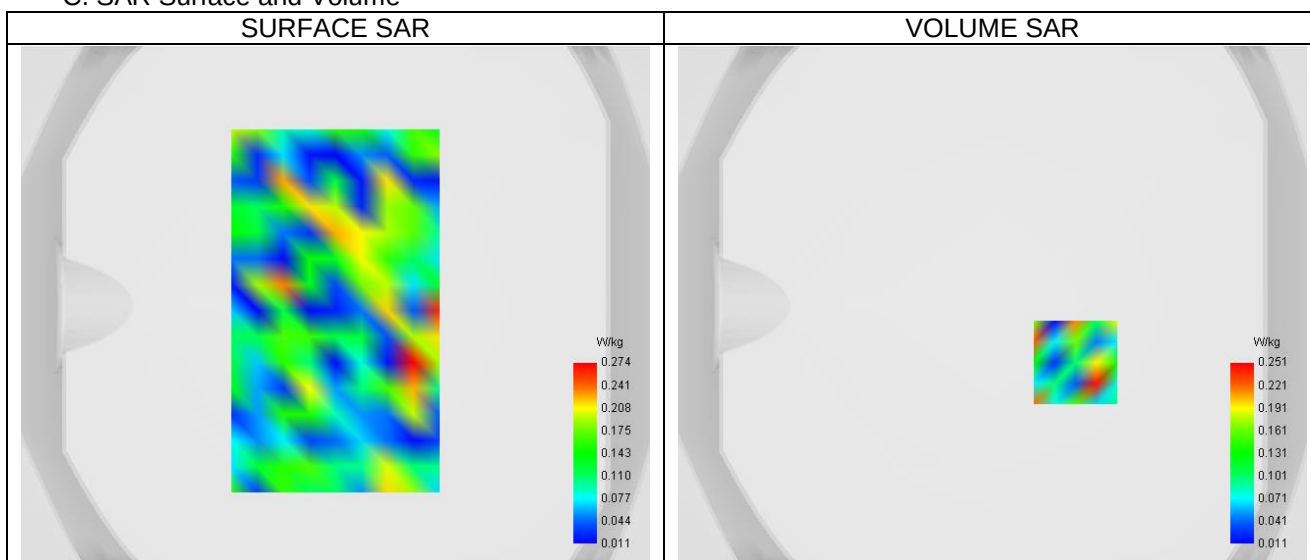
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	2.92
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII
Channels	Middle (40)
Signal	IEEE802.a (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	35.650
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	4.965

C. SAR Surface and Volume



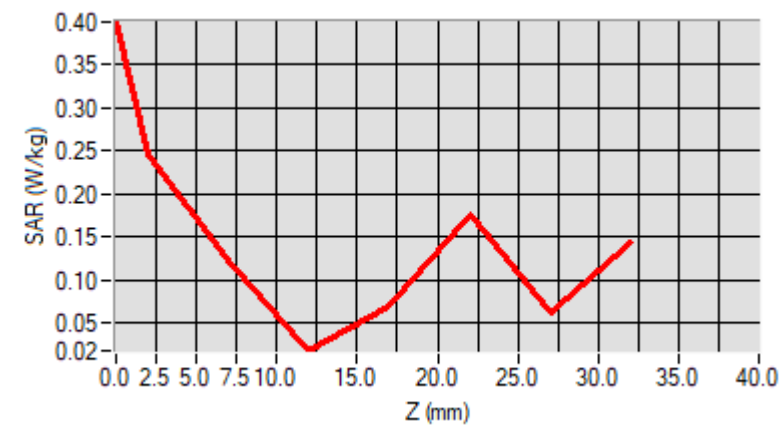
Maximum location: X=32.00, Y=-22.00 ; SAR Peak: 0.37 W/kg

D. SAR 1g & 10g

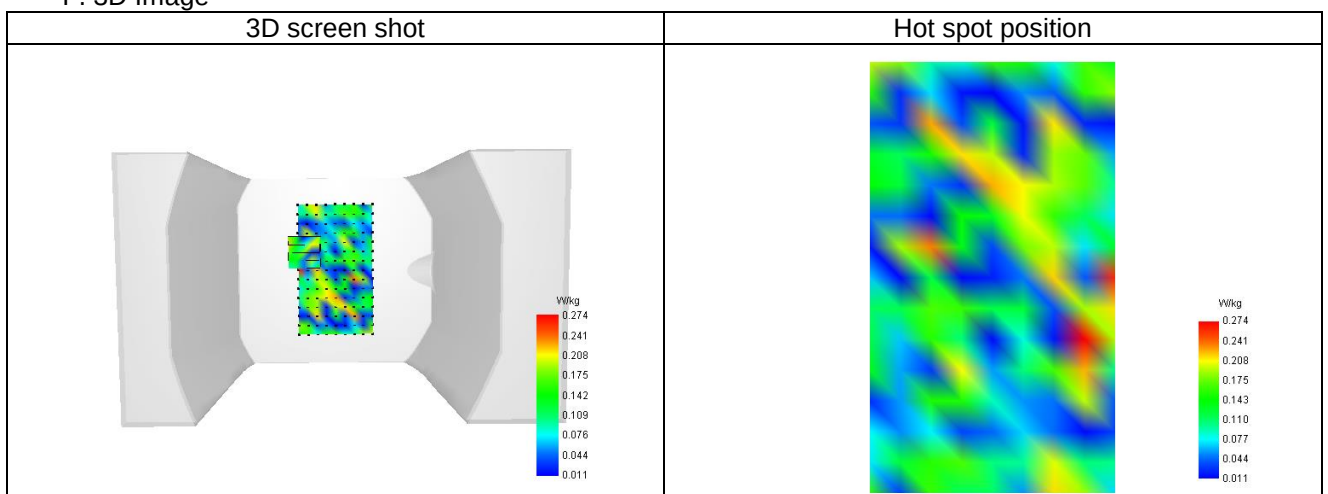
SAR 10g (W/Kg)	0.129
SAR 1g (W/Kg)	0.143
Variation (%)	0.770
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	87.309163

E. Z Axis Scan

Z (mm)	0.00	2.00	7.00	12.00	17.00	22.00	27.00
SAR (W/Kg)	0.399	0.246	0.122	0.018	0.070	0.177	0.062



F. 3D Image



Plot 15

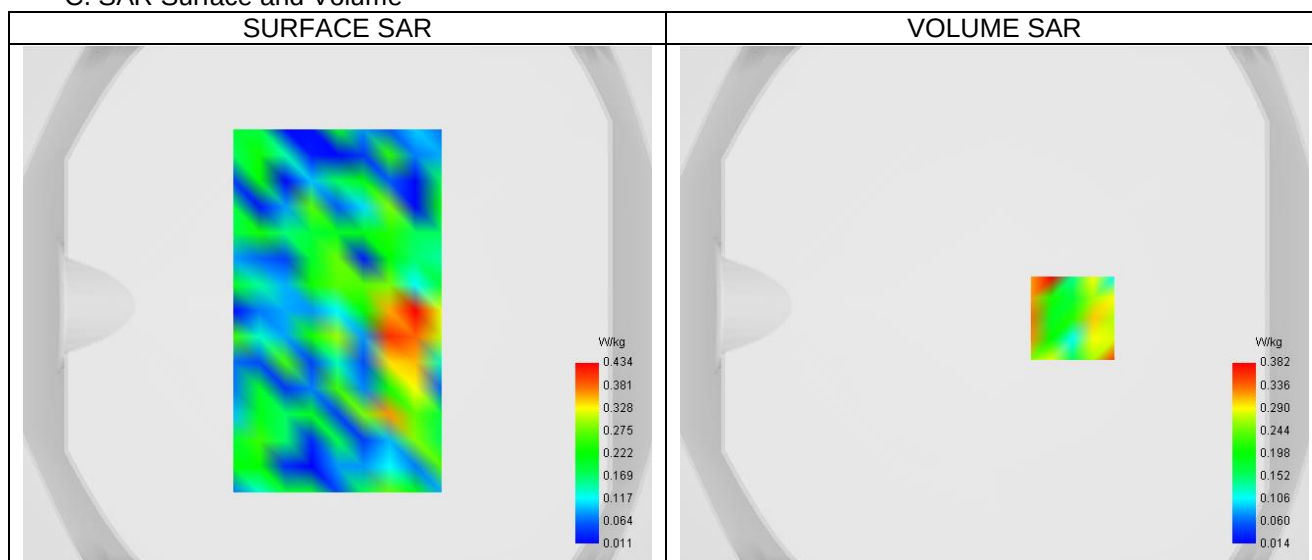
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	2.92
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII
Channels	Middle (40)
Signal	IEEE802.a (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	35.650
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	4.965

C. SAR Surface and Volume



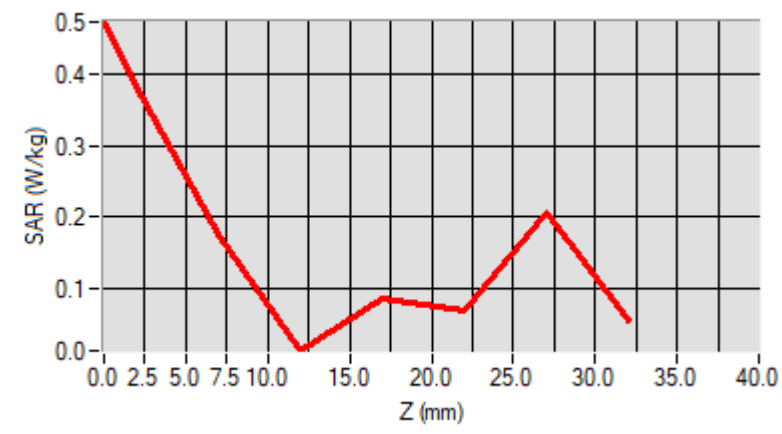
Maximum location: X=30.00, Y=-5.00 ; SAR Peak: 0.65 W/kg

D. SAR 1g & 10g

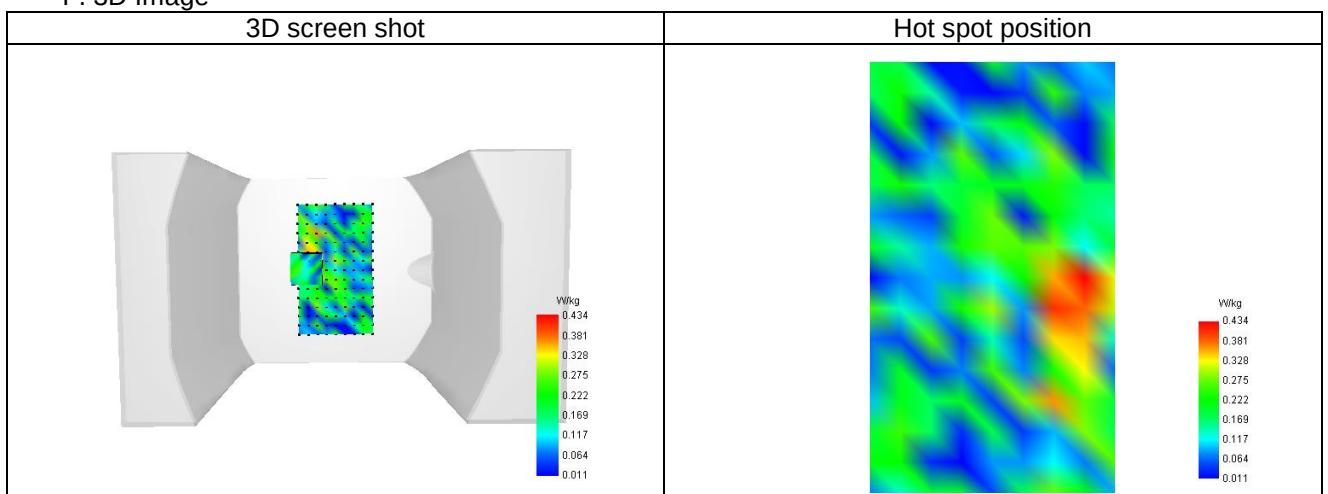
SAR 10g (W/Kg)	0.172
SAR 1g (W/Kg)	0.273
Variation (%)	0.010
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	7.311296

E. Z Axis Scan

Z (mm)	0.00	2.00	7.00	12.00	17.00	22.00	27.00
SAR (W/Kg)	0.472	0.382	0.175	0.014	0.086	0.069	0.208



F. 3D Image



Plot 16

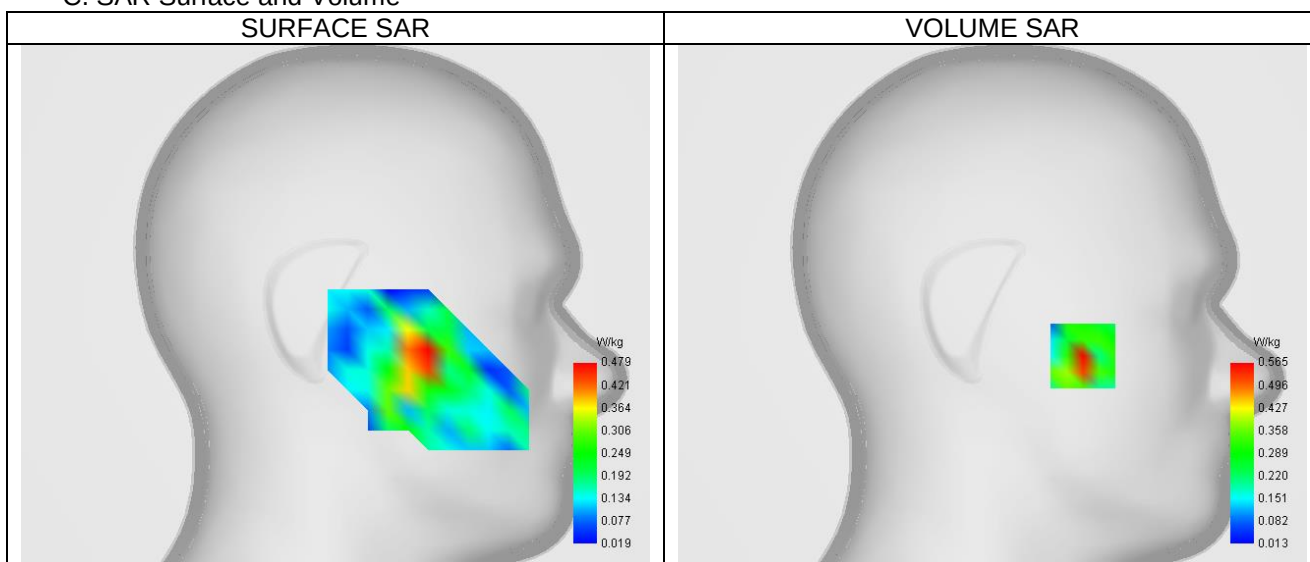
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	2.92
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11a U-NII
Channels	Middle (40)
Signal	IEEE802.a (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	35.650
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	4.965

C. SAR Surface and Volume

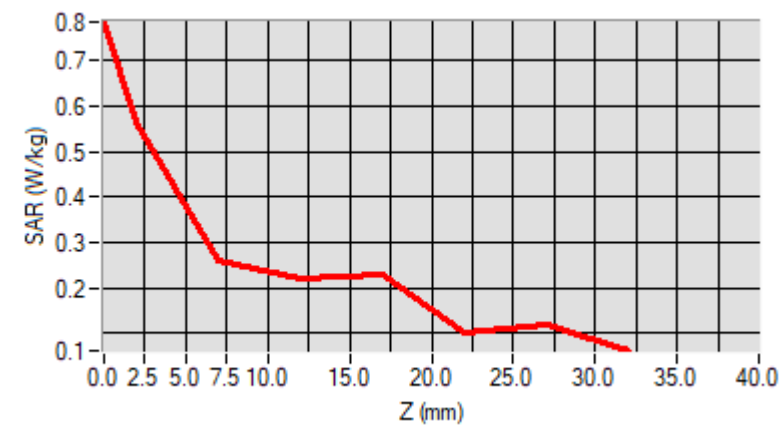


D. SAR 1g & 10g

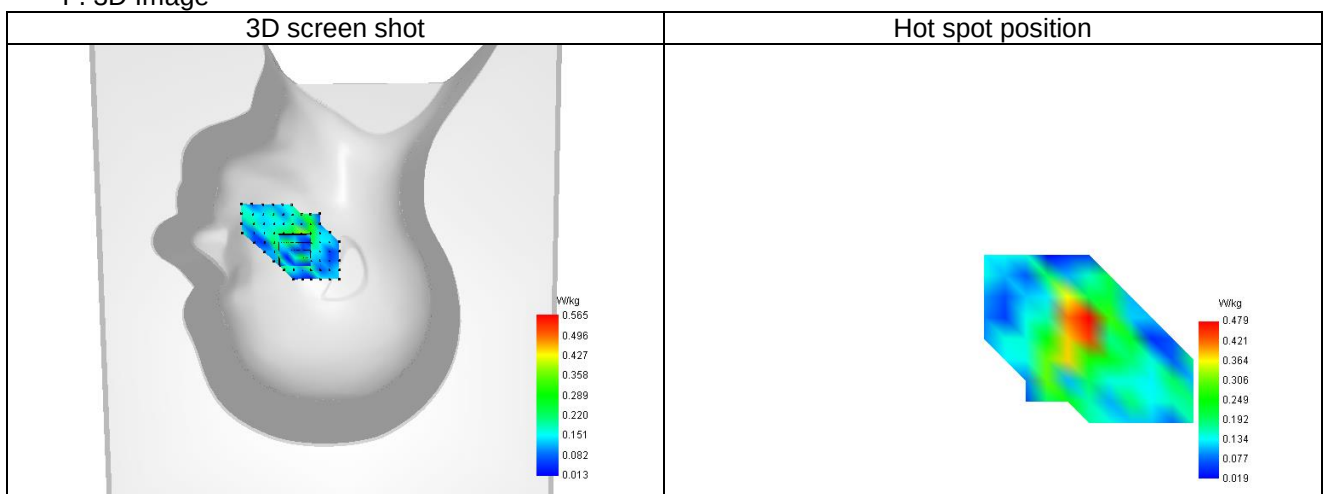
SAR 10g (W/Kg)	0.273
SAR 1g (W/Kg)	0.562
Variation (%)	0.220
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	46.393043

E. Z Axis Scan

Z (mm)	0.00	2.00	7.00	12.00	17.00	22.00	27.00
SAR (W/Kg)	0.786	0.565	0.262	0.222	0.231	0.099	0.119



F. 3D Image



Plot 17

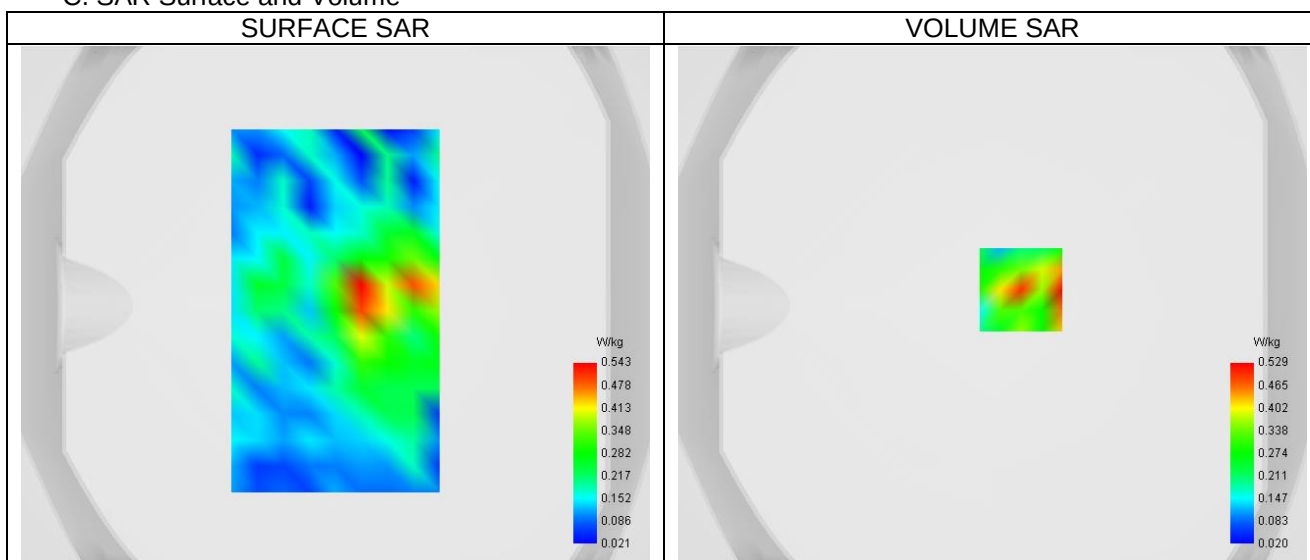
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	2.92
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a
Channels	Middle (157)
Signal	IEEE802.a (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5785.000
Relative permittivity (real part)	35.650
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	4.965

C. SAR Surface and Volume



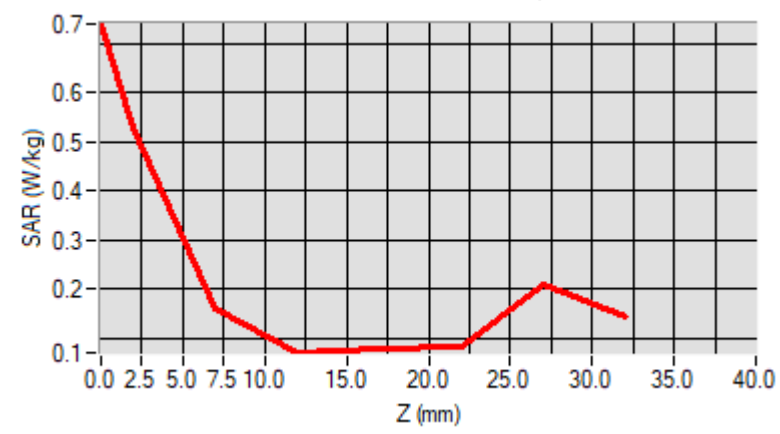
Maximum location: X=11.00, Y=6.00 ; SAR Peak: 0.72 W/kg

D. SAR 1g & 10g

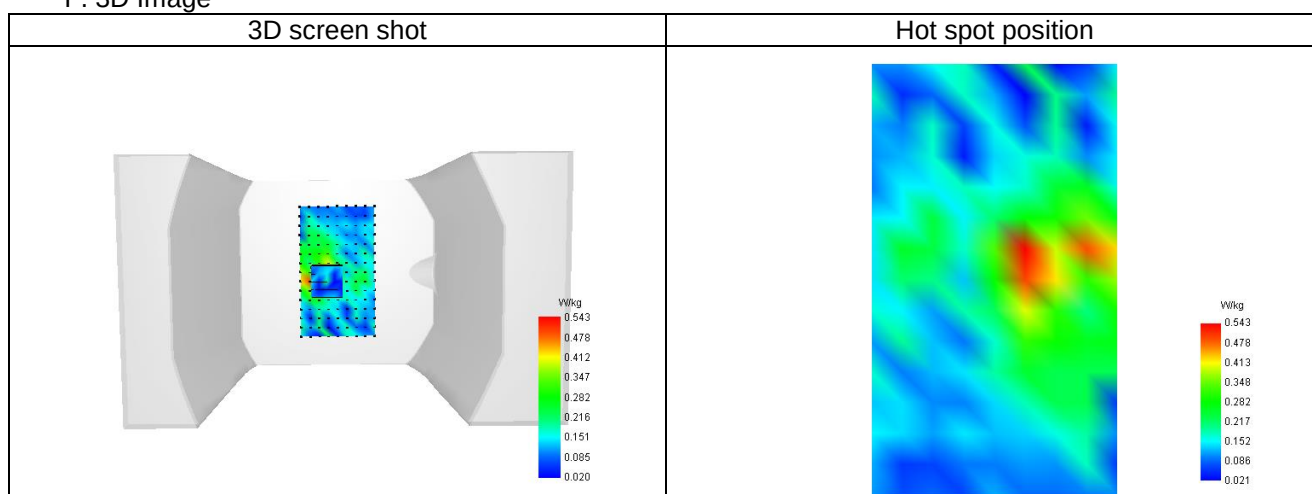
SAR 10g (W/Kg)	0.225
SAR 1g (W/Kg)	0.398
Variation (%)	2.540
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	57.692724

E. Z Axis Scan

Z (mm)	0.00	2.00	7.00	12.00	17.00	22.00	27.00
SAR (W/Kg)	0.740	0.529	0.162	0.070	0.080	0.083	0.209



F. 3D Image



Plot 18

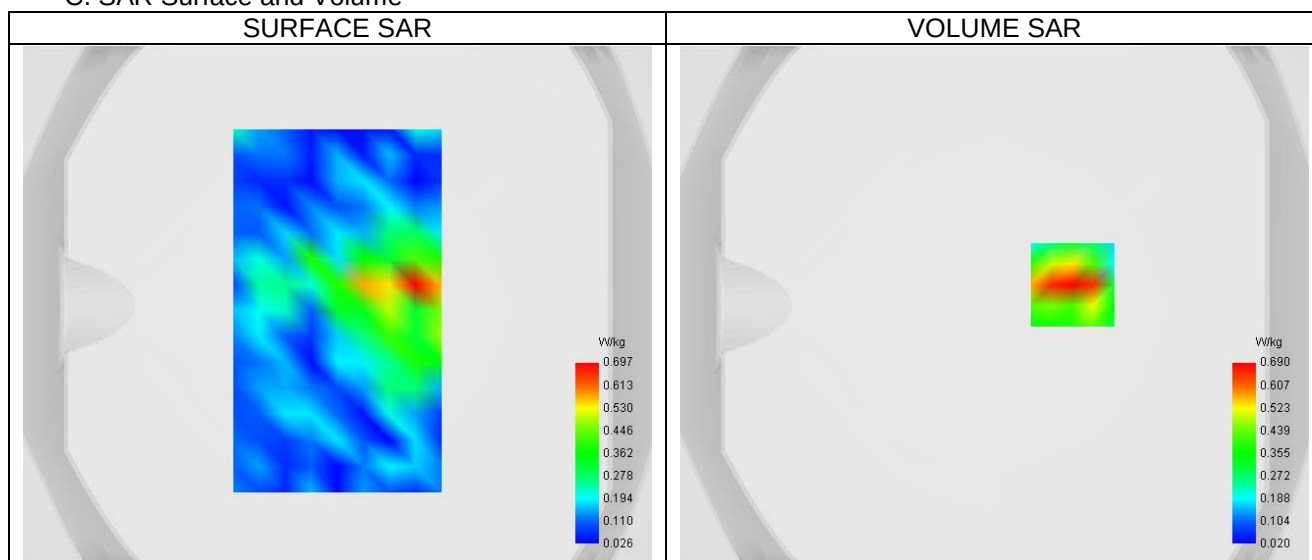
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	2.92
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII
Channels	Middle (157)
Signal	IEEE802.a (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	5785.000
Relative permittivity (real part)	35.650
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	4.965

C. SAR Surface and Volume



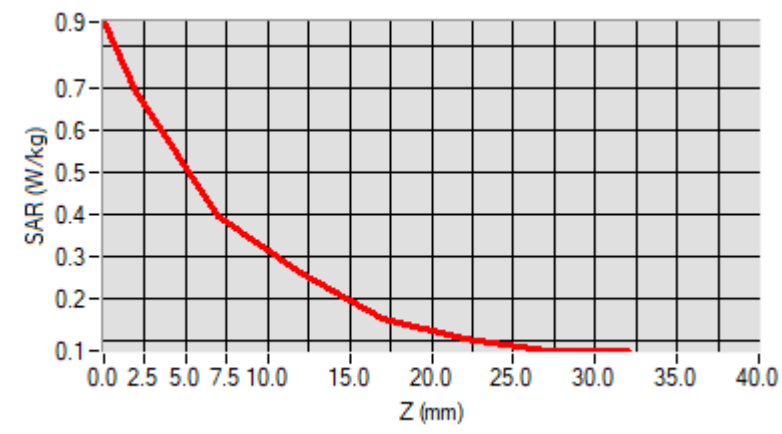
Maximum location: X=30.00, Y=8.00 ; SAR Peak: 0.93 W/kg

D. SAR 1g & 10g

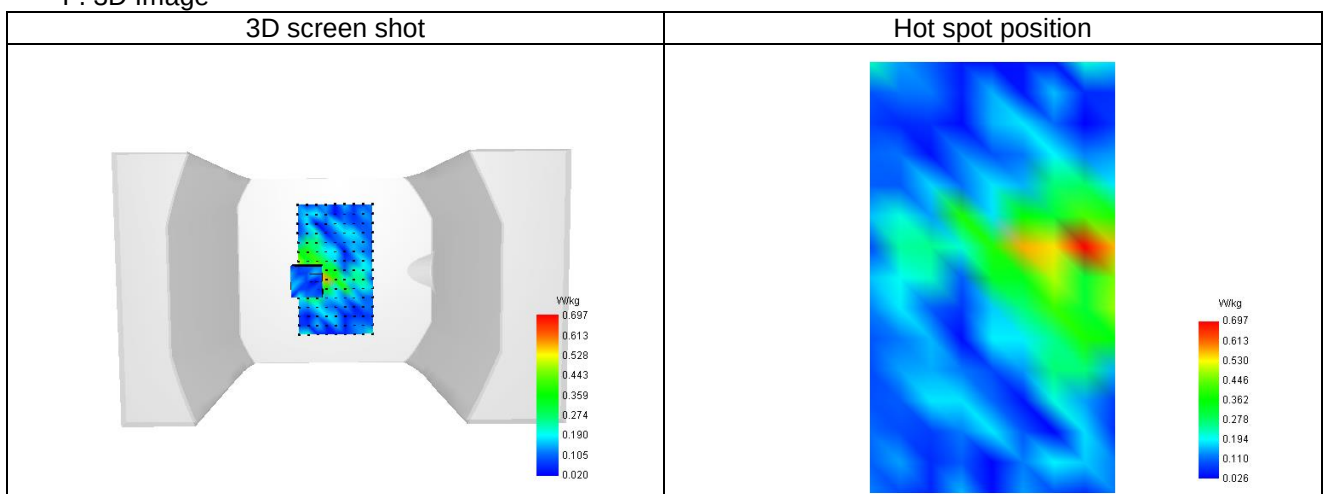
SAR 10g (W/Kg)	0.279
SAR 1g (W/Kg)	0.520
Variation (%)	4.880
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	57.191019

E. Z Axis Scan

Z (mm)	0.00	2.00	7.00	12.00	17.00	22.00	27.00
SAR (W/Kg)	0.857	0.690	0.395	0.261	0.150	0.102	0.075



F. 3D Image



Plot 19

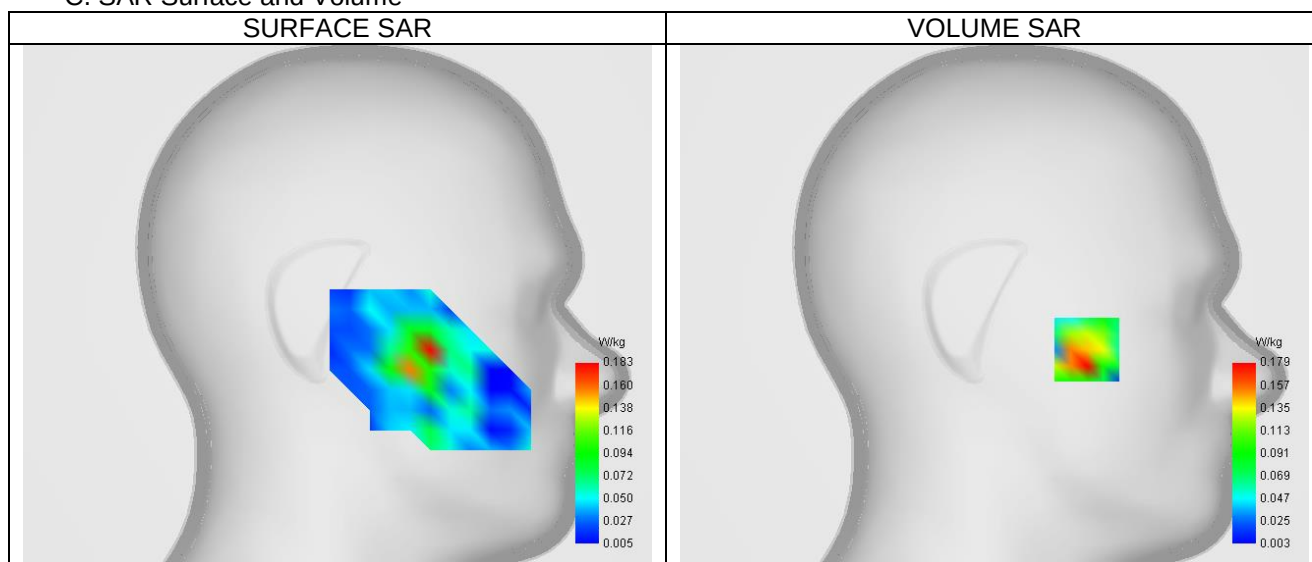
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.96
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	IEEE 802.11b ISM
Channels	Middle (7)
Signal	IEEE802.b (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2442.000
Relative permittivity (real part)	39.226
Relative permittivity (imaginary part)	13.207
Conductivity (S/m)	1.788

C. SAR Surface and Volume

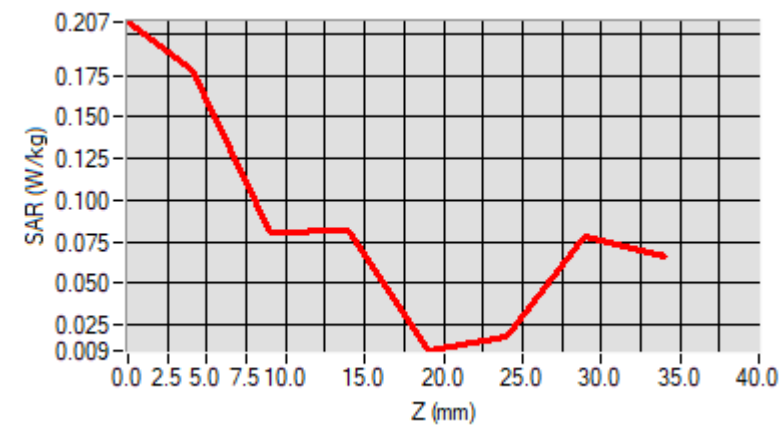


D. SAR 1g & 10g

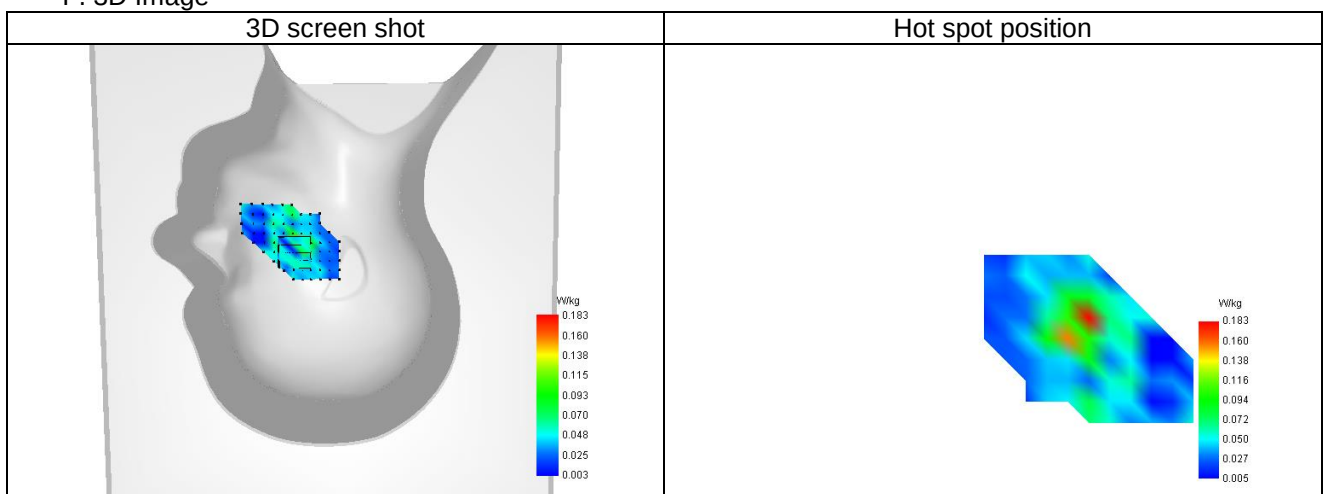
SAR 10g (W/Kg)	0.083
SAR 1g (W/Kg)	0.180
Variation (%)	-0.060
Horizontal validation criteria: minimum distance (mm)	11.313708
Vertical validation criteria: SAR ratio M2/M1 (%)	31.556143

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.207	0.179	0.080	0.082	0.009	0.018	0.078



F. 3D Image



Plot 20

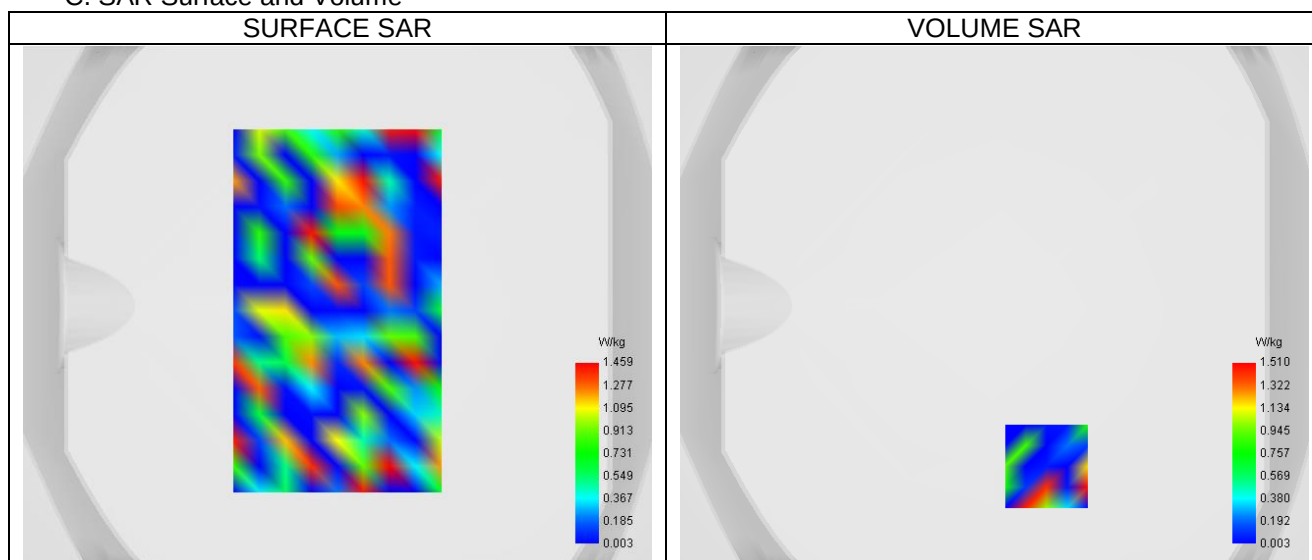
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.96
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	Middle (7)
Signal	IEEE802.b (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2442.000
Relative permittivity (real part)	39.226
Relative permittivity (imaginary part)	13.207
Conductivity (S/m)	1.788

C. SAR Surface and Volume

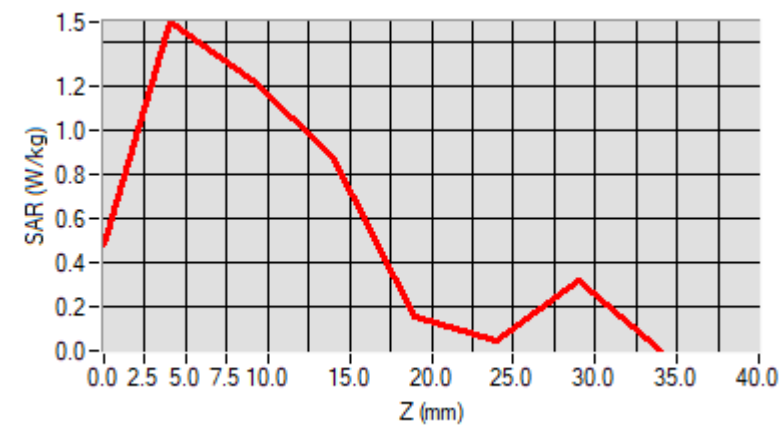


D. SAR 1g & 10g

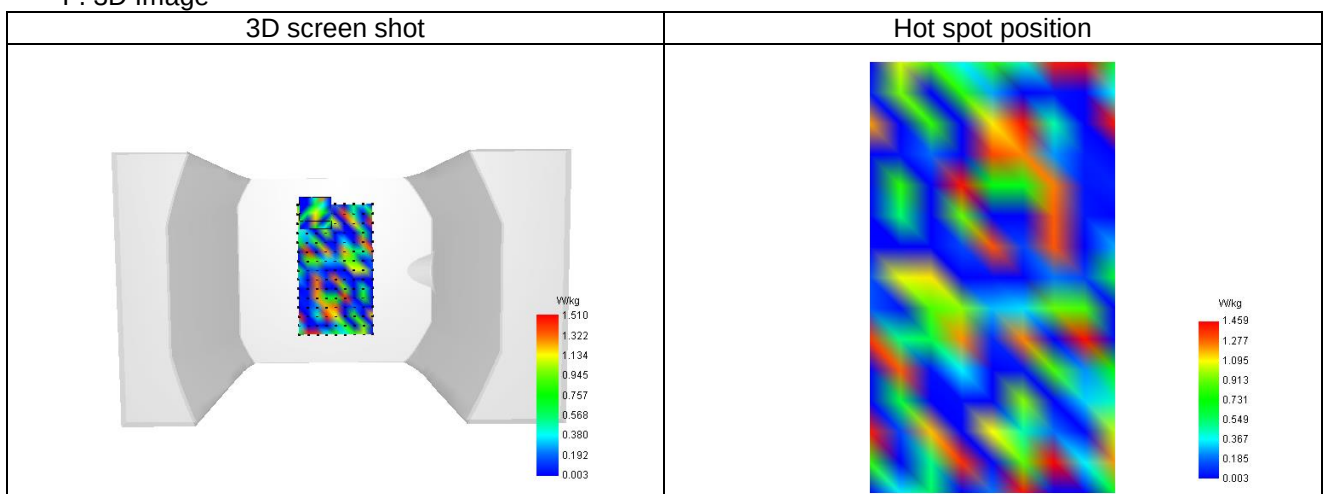
SAR 10g (W/Kg)	0.549
SAR 1g (W/Kg)	0.727
Variation (%)	2.040
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	32.889900

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.488	1.490	1.223	0.881	0.153	0.046	0.325



F. 3D Image



Plot 21

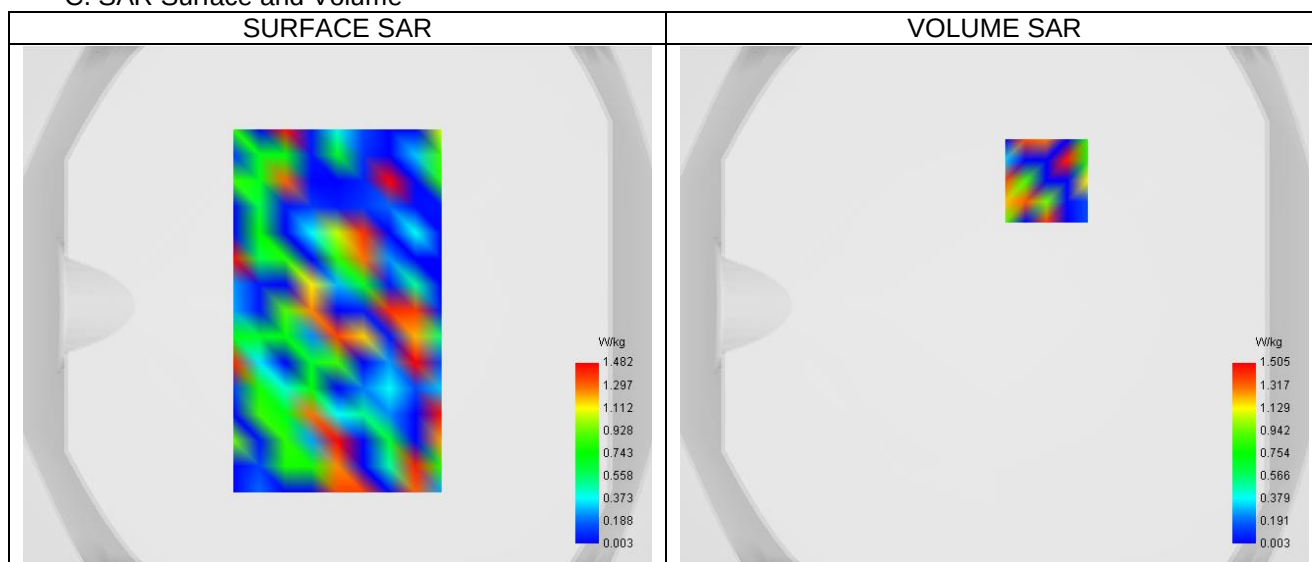
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.96
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	Middle (7)
Signal	IEEE802.b (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2442.000
Relative permittivity (real part)	39.226
Relative permittivity (imaginary part)	13.207
Conductivity (S/m)	1.788

C. SAR Surface and Volume



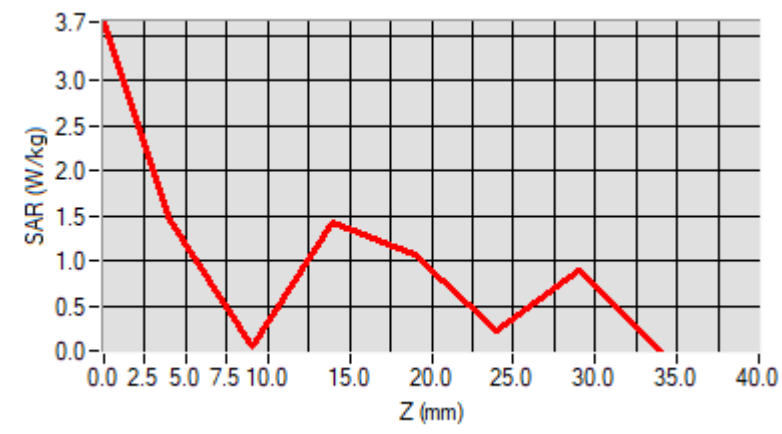
Maximum location: X=20.00, Y=48.00 ; SAR Peak: 4.79 W/kg

D. SAR 1g & 10g

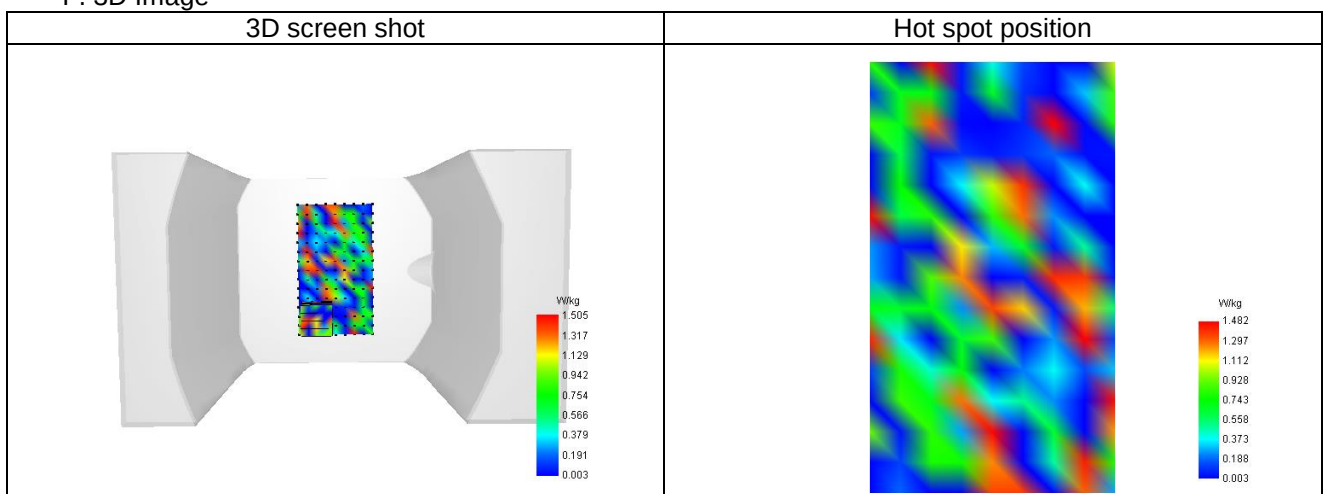
SAR 10g (W/Kg)	0.602
SAR 1g (W/Kg)	1.158
Variation (%)	-4.450
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	36.306272

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	3.651	1.453	0.052	1.417	1.075	0.227	0.900



F. 3D Image



Plot 22

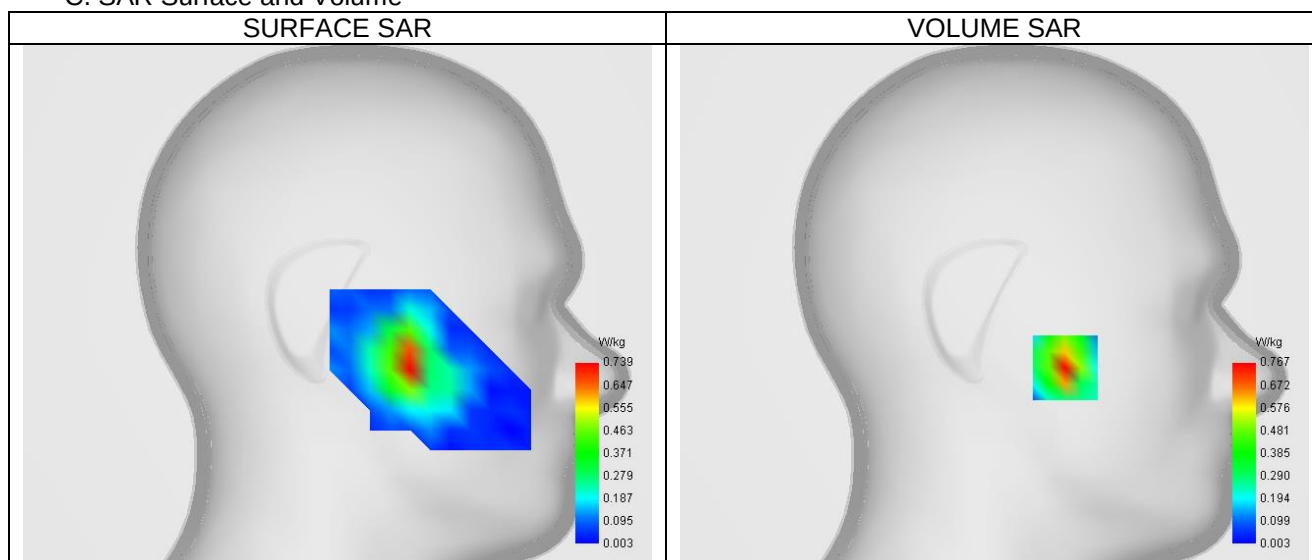
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.27
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	LTE band 1
Channels	Middle (18300)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1950.000
Relative permittivity (real part)	40.000
Relative permittivity (imaginary part)	12.930
Conductivity (S/m)	1.401

C. SAR Surface and Volume

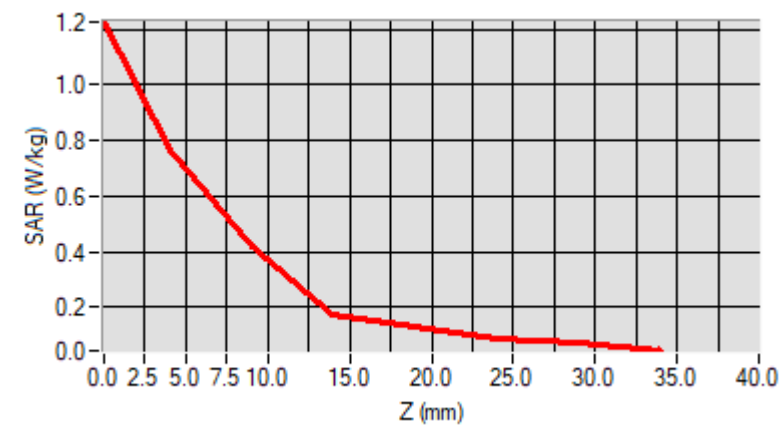


D. SAR 1g & 10g

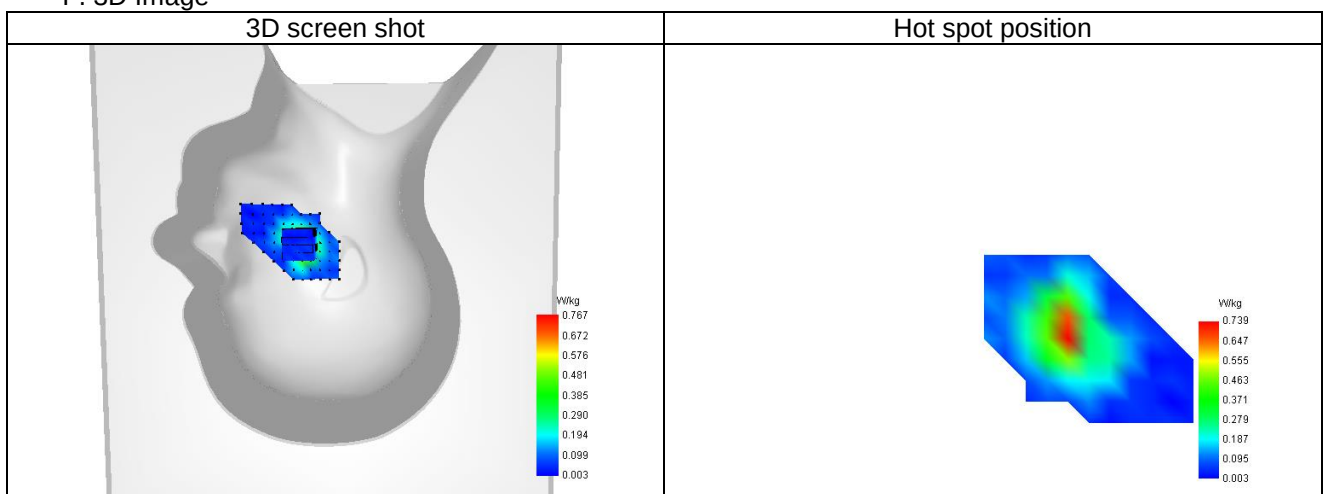
SAR 10g (W/Kg)	0.323
SAR 1g (W/Kg)	0.687
Variation (%)	-3.760
Horizontal validation criteria: minimum distance (mm)	11.313708
Vertical validation criteria: SAR ratio M2/M1 (%)	54.583922

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.226	0.767	0.419	0.173	0.128	0.091	0.071



F. 3D Image



Plot 23

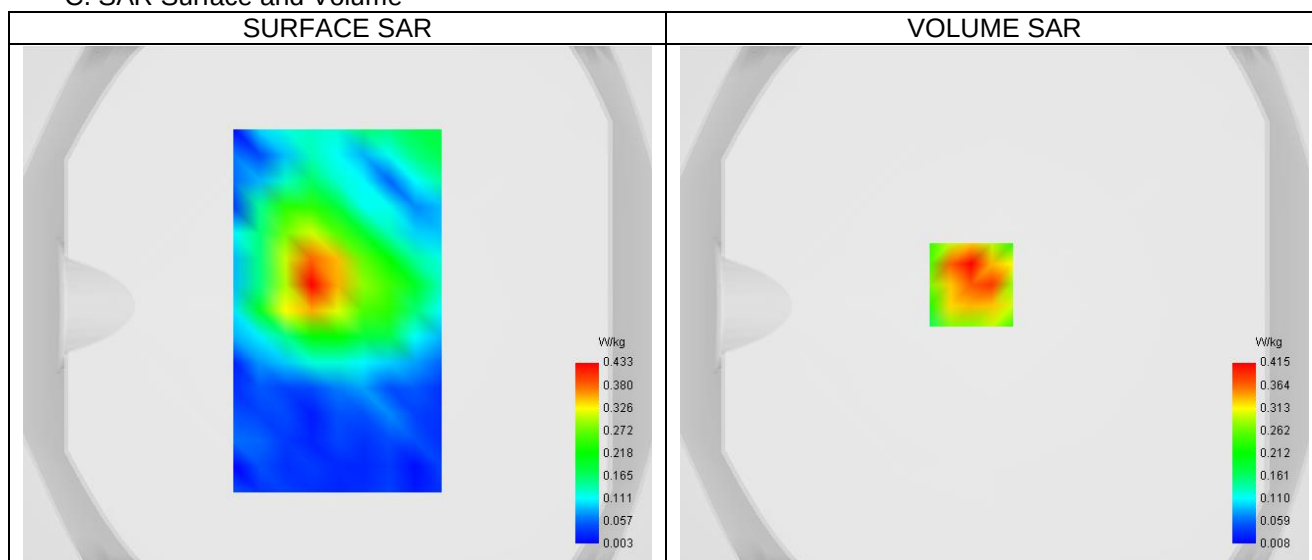
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.27
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 1
Channels	Middle (18300)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1950.000
Relative permittivity (real part)	40.000
Relative permittivity (imaginary part)	12.930
Conductivity (S/m)	1.401

C. SAR Surface and Volume



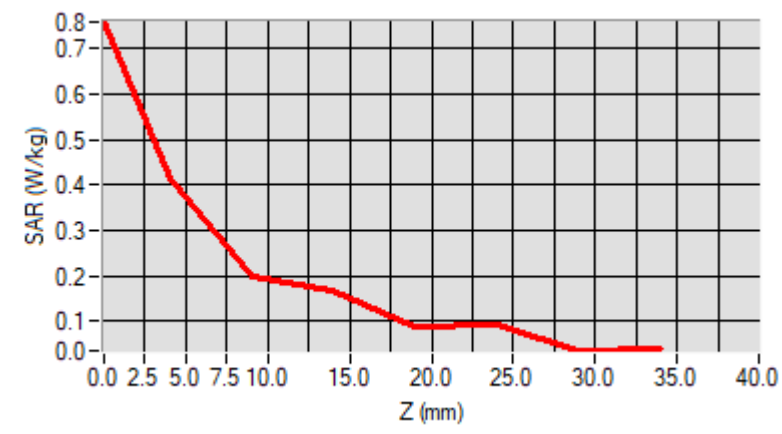
Maximum location: X=-9.00, Y=8.00 ; SAR Peak: 0.65 W/kg

D. SAR 1g & 10g

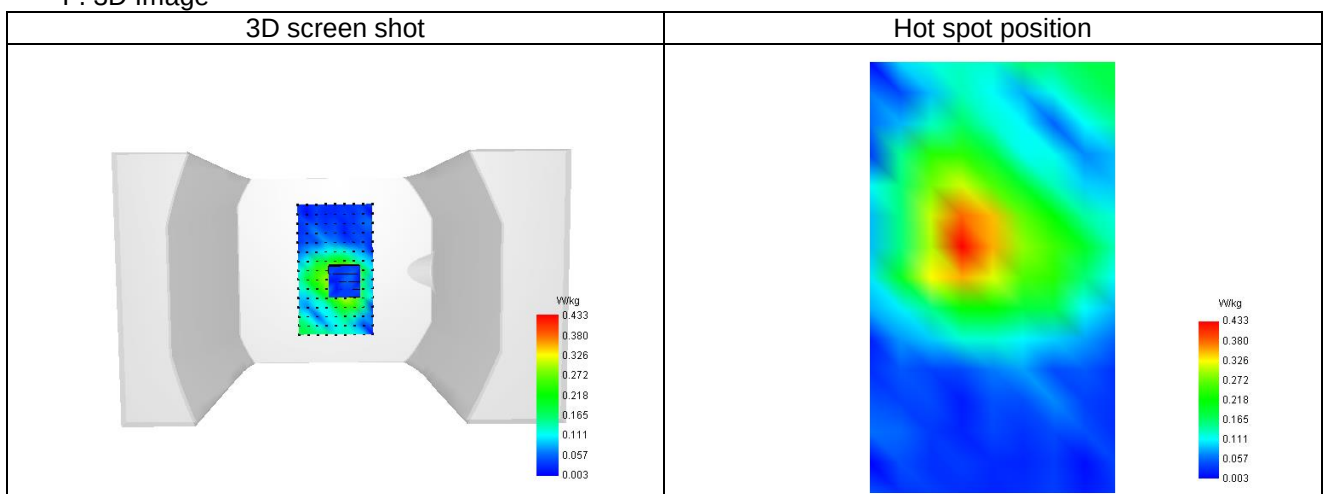
SAR 10g (W/Kg)	0.228
SAR 1g (W/Kg)	0.386
Variation (%)	-4.660
Horizontal validation criteria: minimum distance (mm)	17.888544
Vertical validation criteria: SAR ratio M2/M1 (%)	59.675653

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.760	0.415	0.201	0.169	0.090	0.093	0.035



F. 3D Image



Plot 24

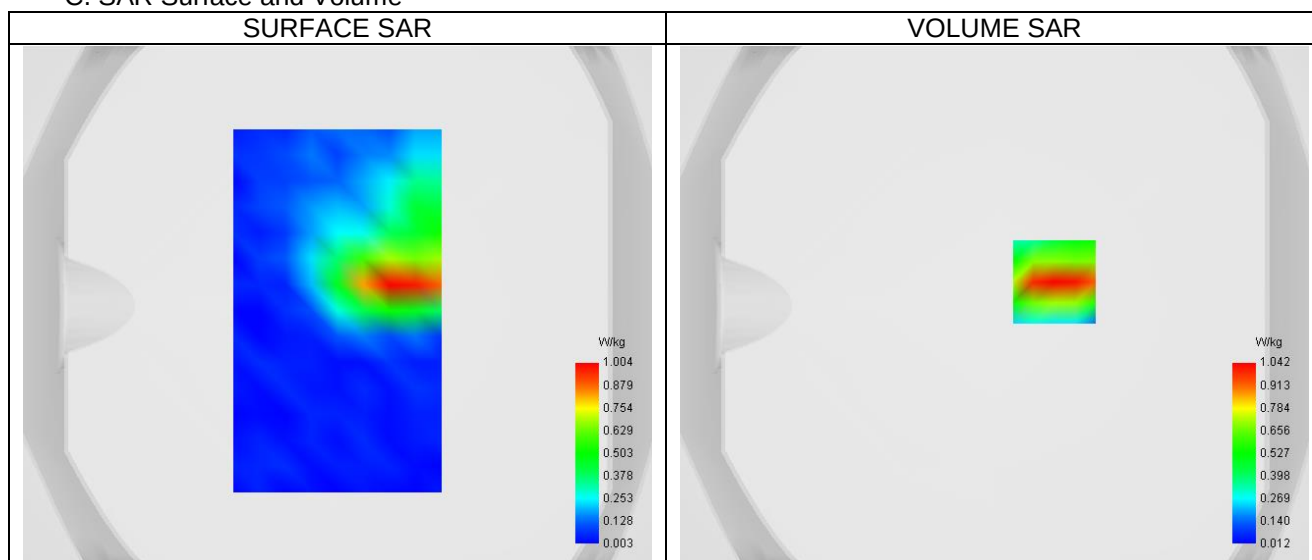
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.27
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 1
Channels	Middle (18300)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1950.000
Relative permittivity (real part)	40.000
Relative permittivity (imaginary part)	12.930
Conductivity (S/m)	1.401

C. SAR Surface and Volume



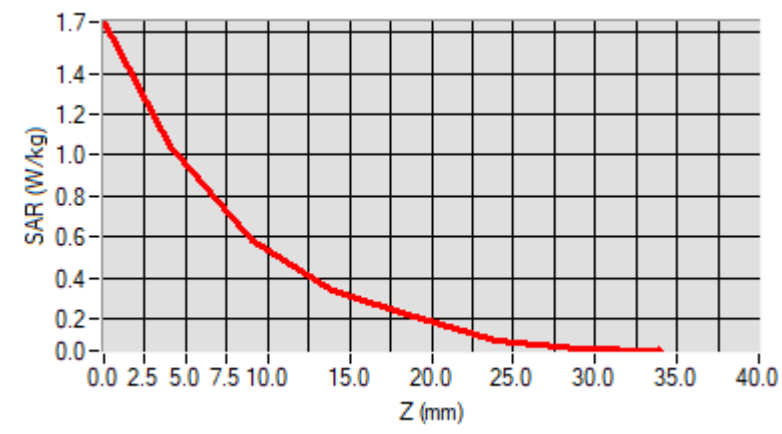
Maximum location: X=23.00, Y=9.00 ; SAR Peak: 1.75 W/kg

D. SAR 1g & 10g

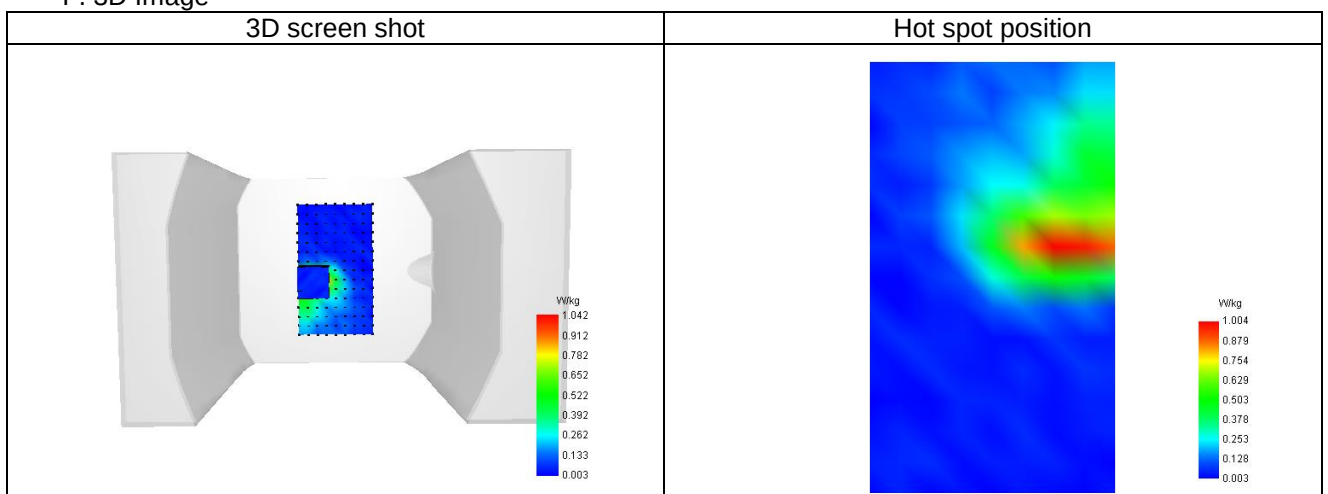
SAR 10g (W/Kg)	0.492
SAR 1g (W/Kg)	0.974
Variation (%)	0.500
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	55.824009

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.650	1.042	0.582	0.332	0.207	0.089	0.057



F. 3D Image



Plot 25

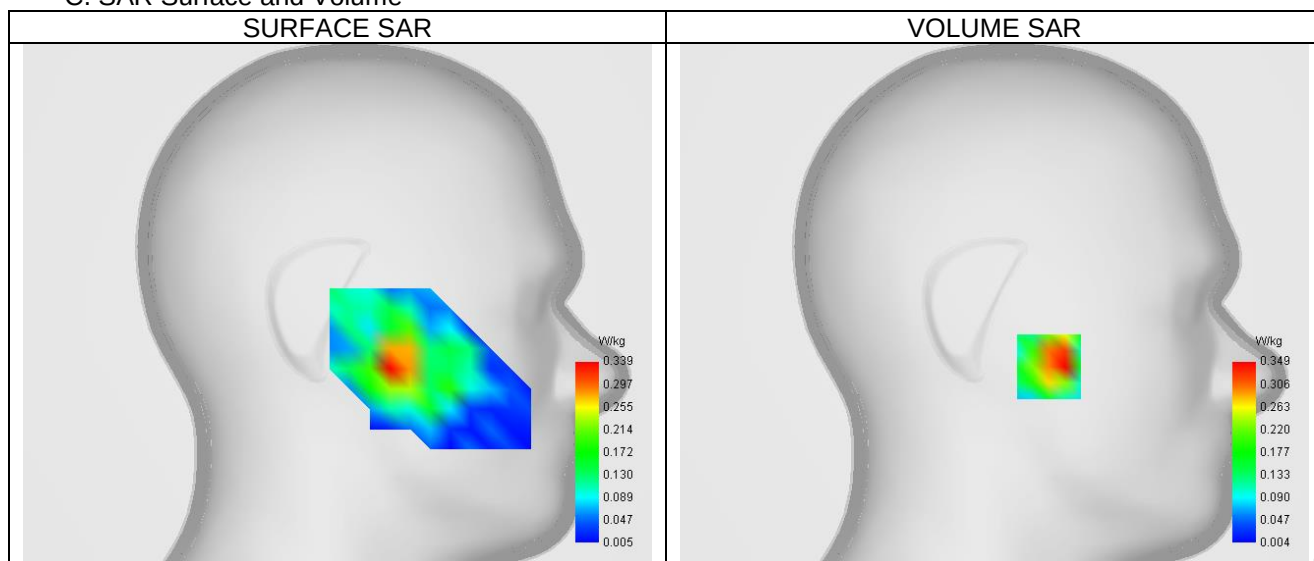
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.35
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	LTE band 3
Channels	Middle (19575)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1747.500
Relative permittivity (real part)	40.102
Relative permittivity (imaginary part)	14.097
Conductivity (S/m)	1.369

C. SAR Surface and Volume



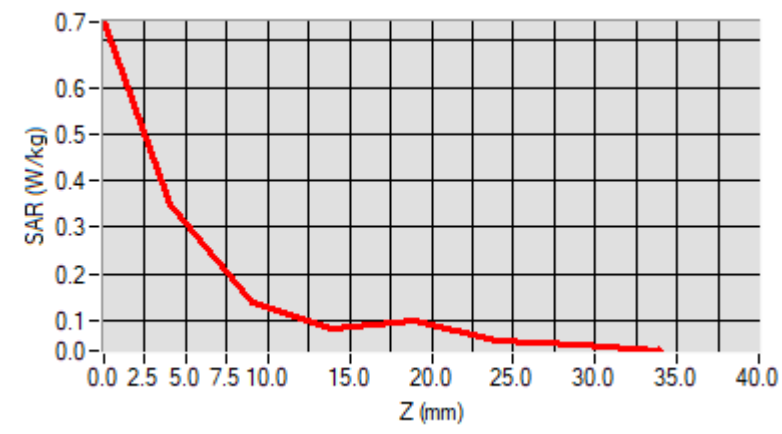
Maximum location: X=-27.00, Y=-31.00 ; SAR Peak: 0.58 W/kg

D. SAR 1g & 10g

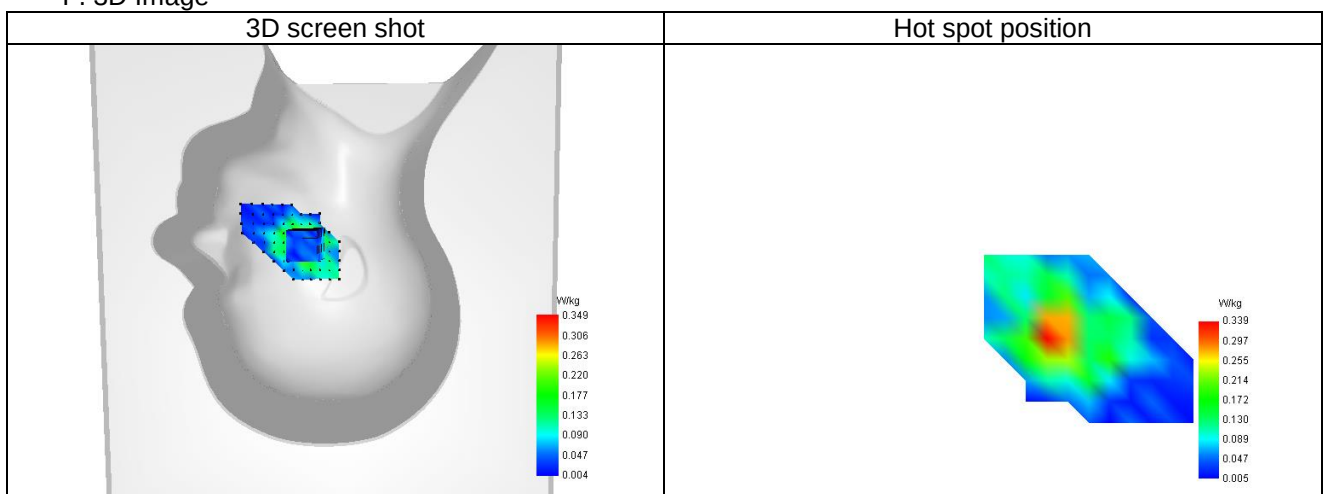
SAR 10g (W/Kg)	0.170
SAR 1g (W/Kg)	0.329
Variation (%)	4.820
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	57.336723

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.740	0.349	0.139	0.080	0.100	0.055	0.048



F. 3D Image



Plot 26

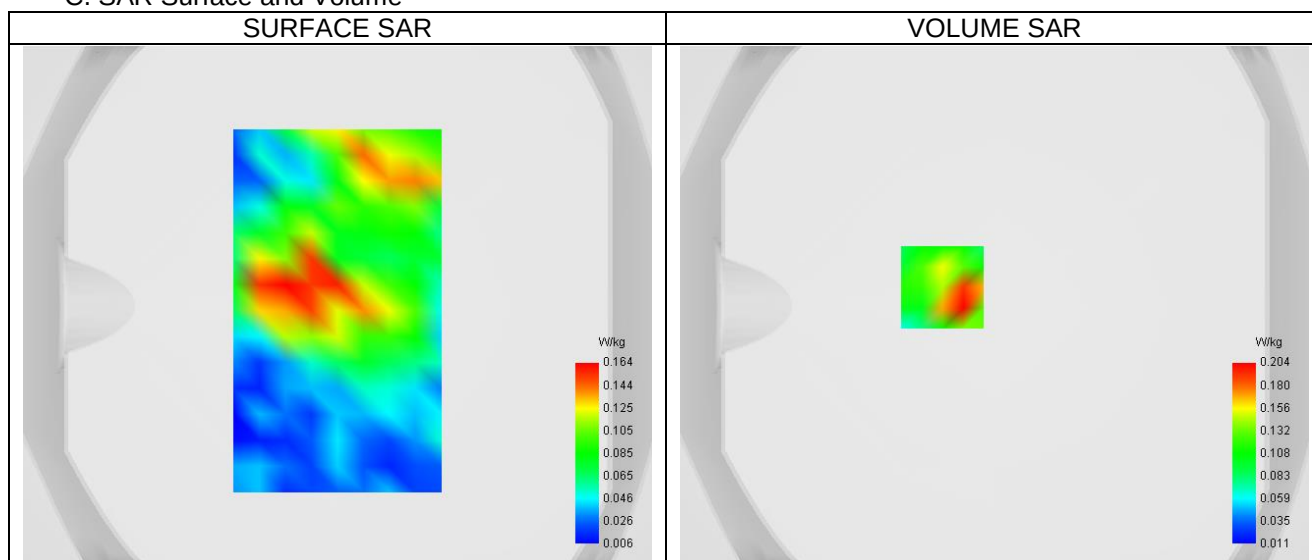
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.35
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 3
Channels	Middle (19575)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1747.500
Relative permittivity (real part)	40.102
Relative permittivity (imaginary part)	14.097
Conductivity (S/m)	1.369

C. SAR Surface and Volume



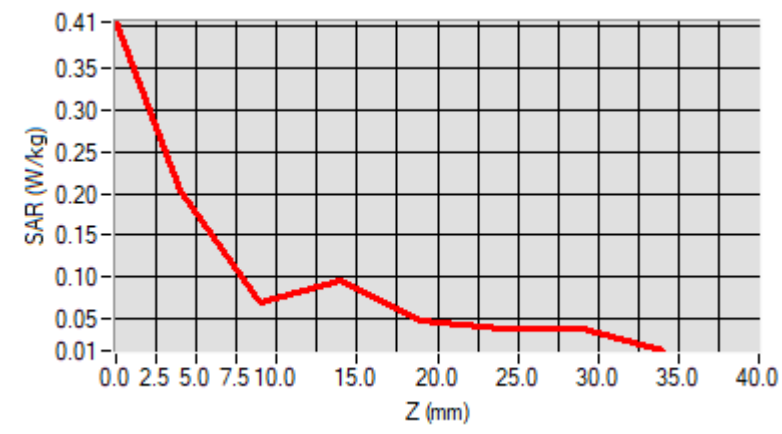
Maximum location: X=-20.00, Y=7.00 ; SAR Peak: 0.38 W/kg

D. SAR 1g & 10g

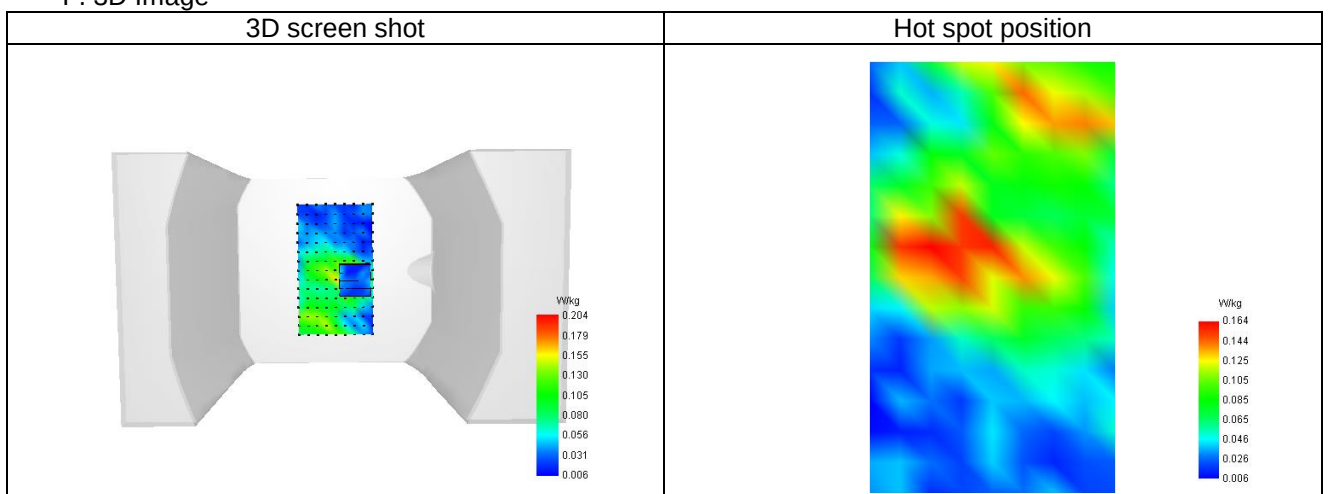
SAR 10g (W/Kg)	0.105
SAR 1g (W/Kg)	0.193
Variation (%)	3.090
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	55.235329

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.405	0.204	0.070	0.095	0.047	0.038	0.037



F. 3D Image



Plot 27

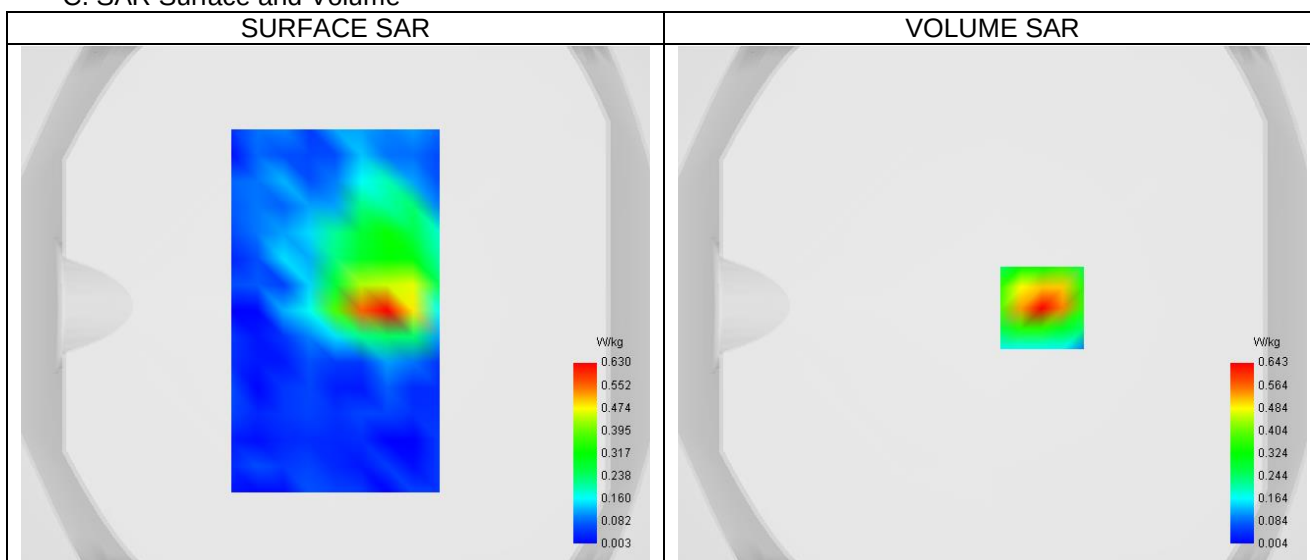
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.35
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 3
Channels	Middle (19575)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1747.500
Relative permittivity (real part)	40.102
Relative permittivity (imaginary part)	14.097
Conductivity (S/m)	1.369

C. SAR Surface and Volume



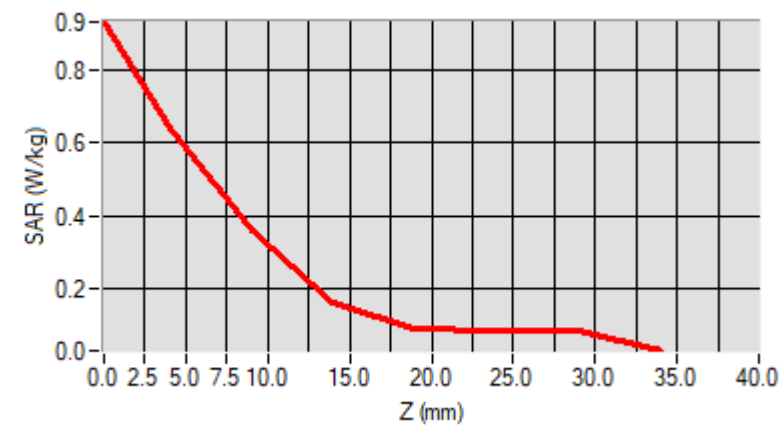
Maximum location: X=19.00, Y=-1.00 ; SAR Peak: 0.97 W/kg

D. SAR 1g & 10g

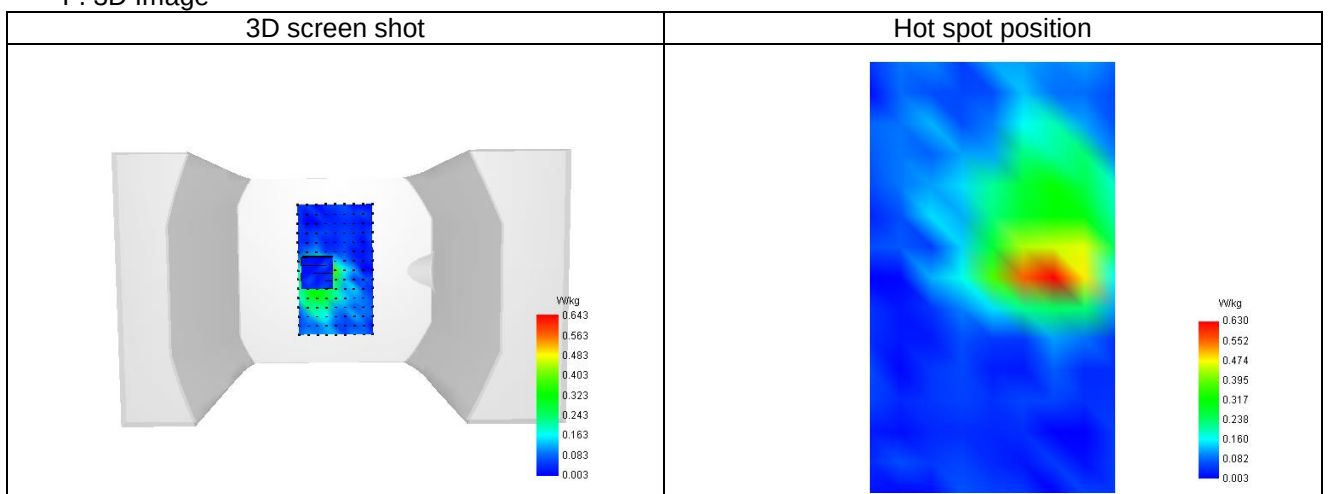
SAR 10g (W/Kg)	0.299
SAR 1g (W/Kg)	0.570
Variation (%)	3.380
Horizontal validation criteria: minimum distance (mm)	11.313708
Vertical validation criteria: SAR ratio M2/M1 (%)	56.273384

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.935	0.643	0.362	0.160	0.089	0.086	0.082



F. 3D Image



Plot 28

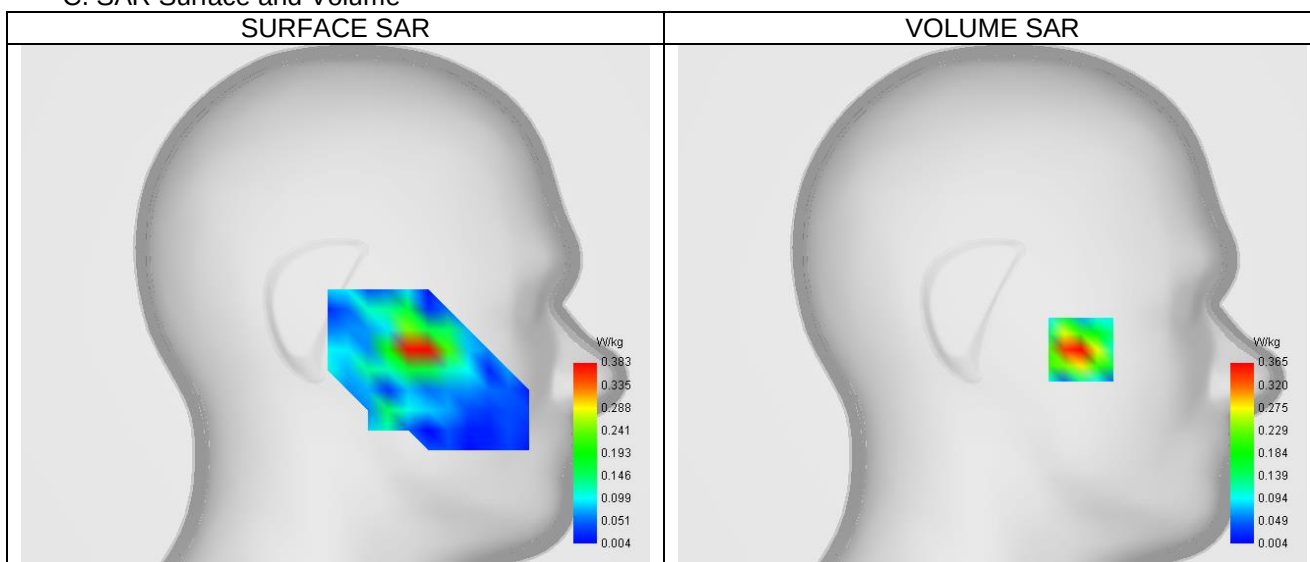
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.63
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	LTE band 7
Channels	Middle (21100)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2535.000
Relative permittivity (real part)	39.087
Relative permittivity (imaginary part)	13.418
Conductivity (S/m)	1.890

C. SAR Surface and Volume

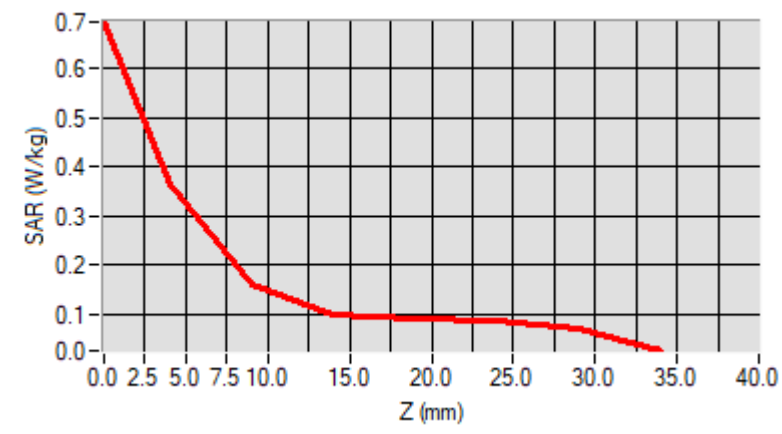


D. SAR 1g & 10g

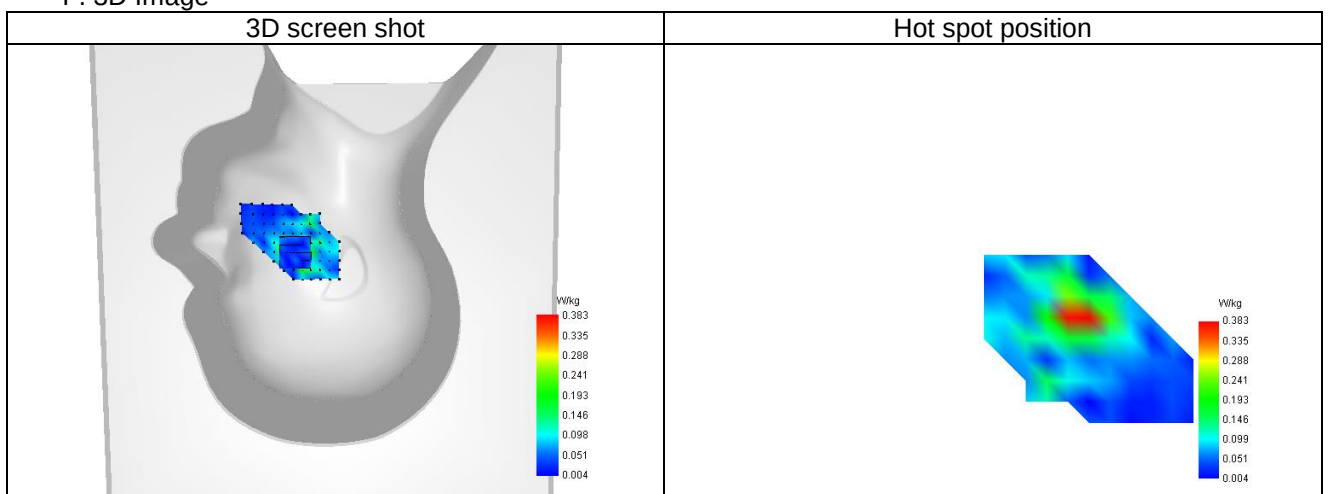
SAR 10g (W/Kg)	0.168
SAR 1g (W/Kg)	0.353
Variation (%)	-1.460
Horizontal validation criteria: minimum distance (mm)	11.313708
Vertical validation criteria: SAR ratio M2/M1 (%)	43.601734

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.694	0.365	0.159	0.099	0.090	0.085	0.072



F. 3D Image



Plot 29

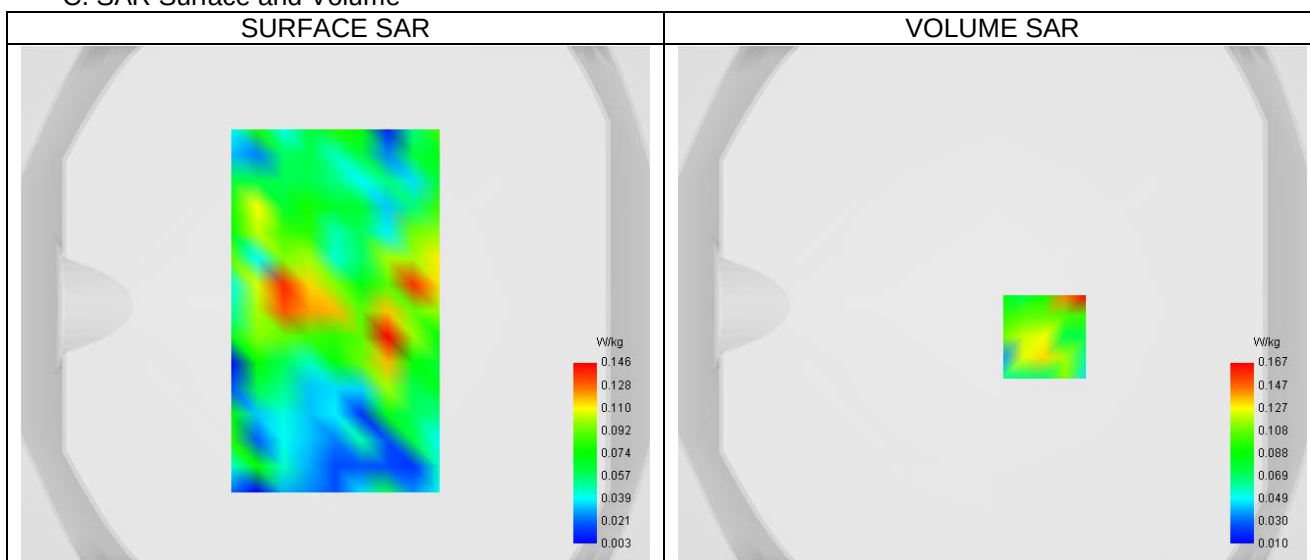
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.63
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	Middle (21100)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2535.000
Relative permittivity (real part)	39.087
Relative permittivity (imaginary part)	13.418
Conductivity (S/m)	1.890

C. SAR Surface and Volume



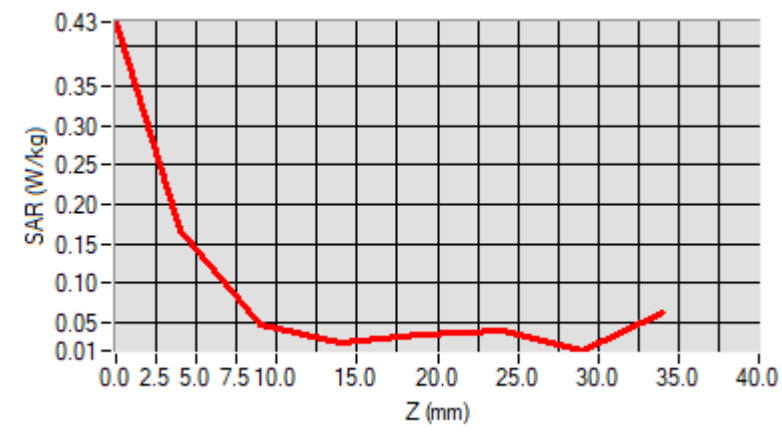
Maximum location: X=20.00, Y=-12.00 ; SAR Peak: 0.33 W/kg

D. SAR 1g & 10g

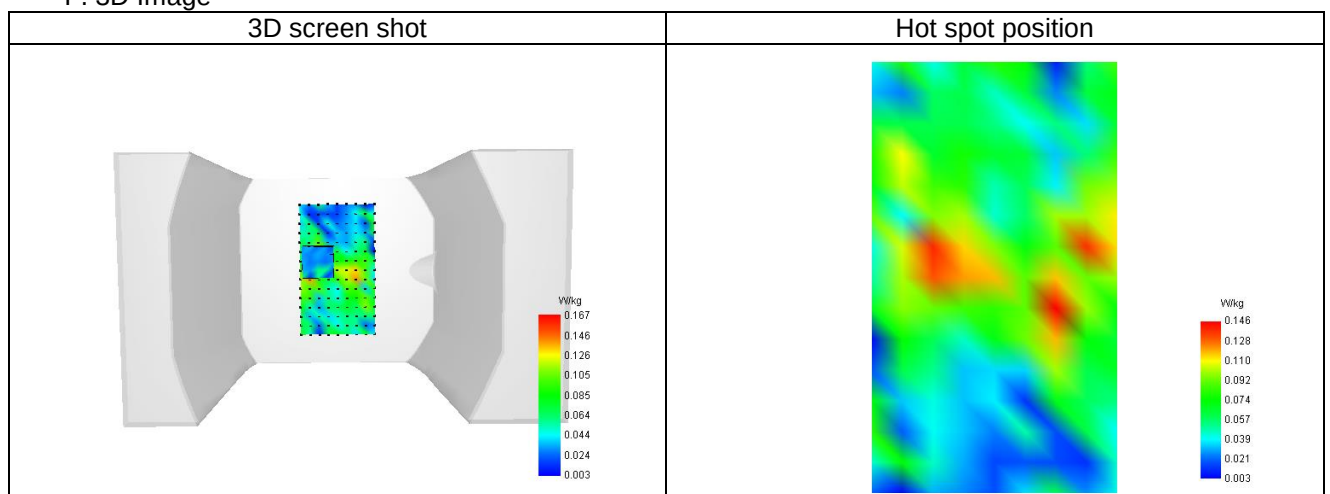
SAR 10g (W/Kg)	0.075
SAR 1g (W/Kg)	0.127
Variation (%)	-1.140
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	49.368964

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.431	0.167	0.049	0.026	0.036	0.039	0.015



F. 3D Image



Plot 30

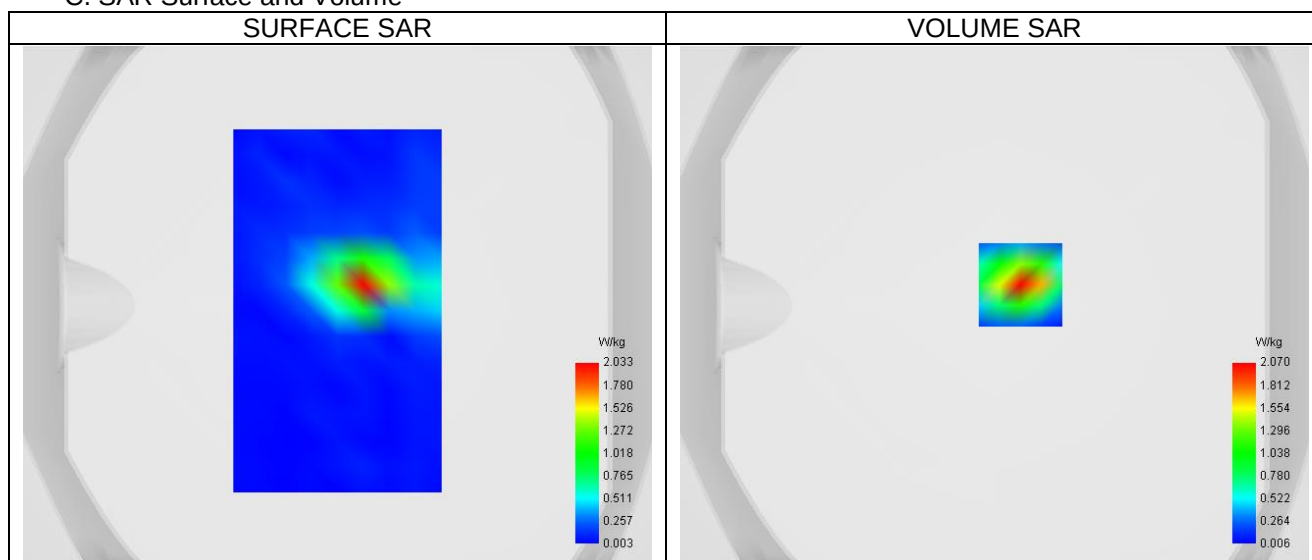
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.63
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	Middle (21100)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2535.000
Relative permittivity (real part)	39.087
Relative permittivity (imaginary part)	13.418
Conductivity (S/m)	1.890

C. SAR Surface and Volume



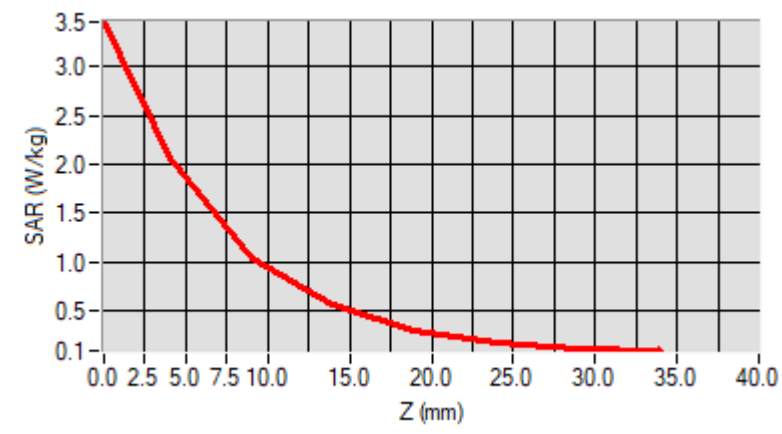
Maximum location: X=10.00, Y=8.00 ; SAR Peak: 3.56 W/kg

D. SAR 1g & 10g

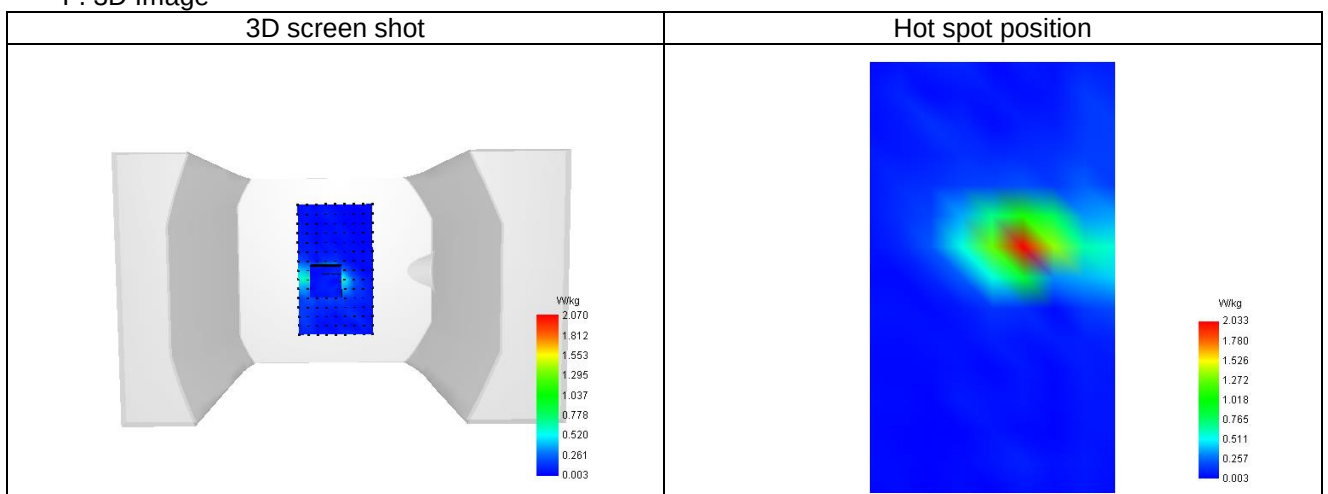
SAR 10g (W/Kg)	0.779
SAR 1g (W/Kg)	1.863
Variation (%)	-0.440
Horizontal validation criteria: minimum distance (mm)	11.313708
Vertical validation criteria: SAR ratio M2/M1 (%)	49.960387

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	3.460	2.070	1.034	0.555	0.290	0.176	0.116



F. 3D Image



Plot 31

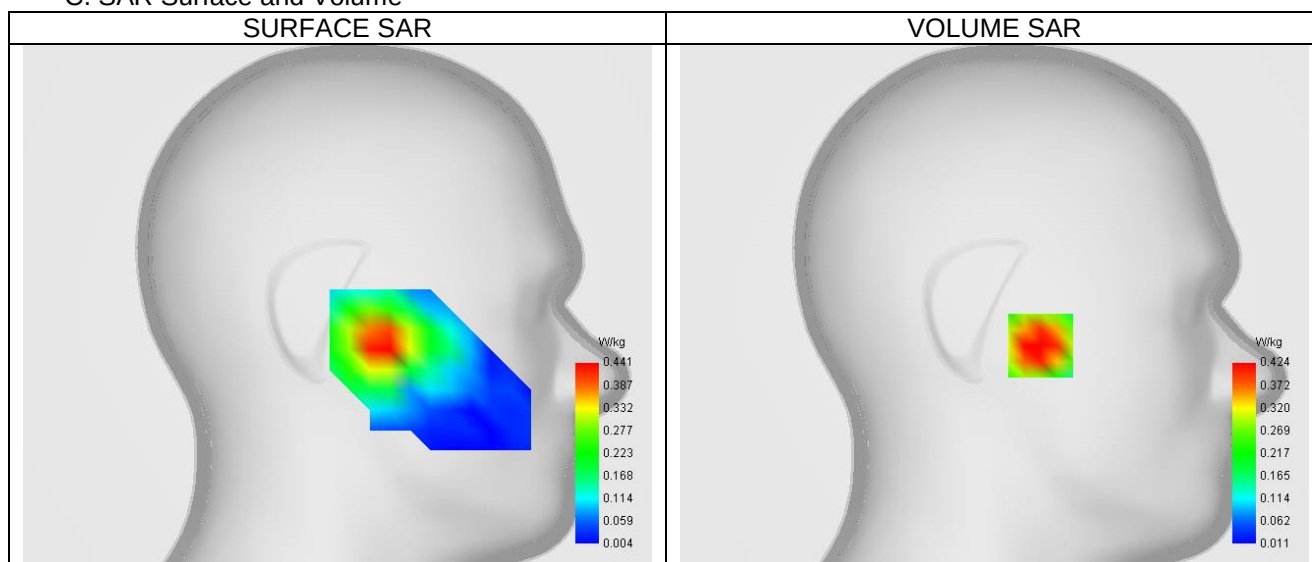
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	LTE band 8
Channels	Middle (21625)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	897.500
Relative permittivity (real part)	41.500
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.967

C. SAR Surface and Volume

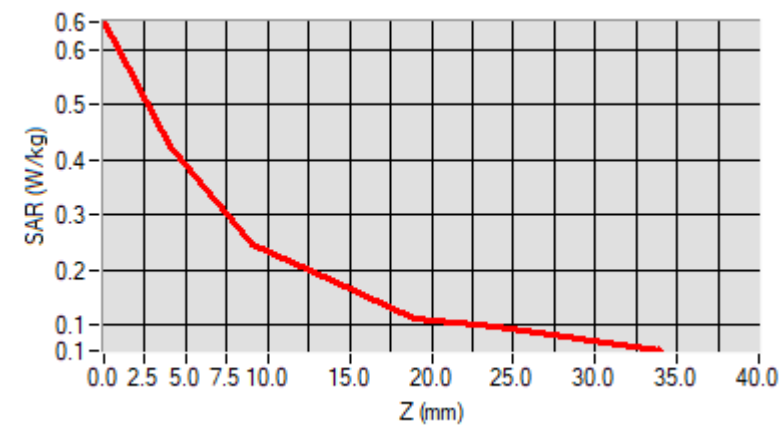


D. SAR 1g & 10g

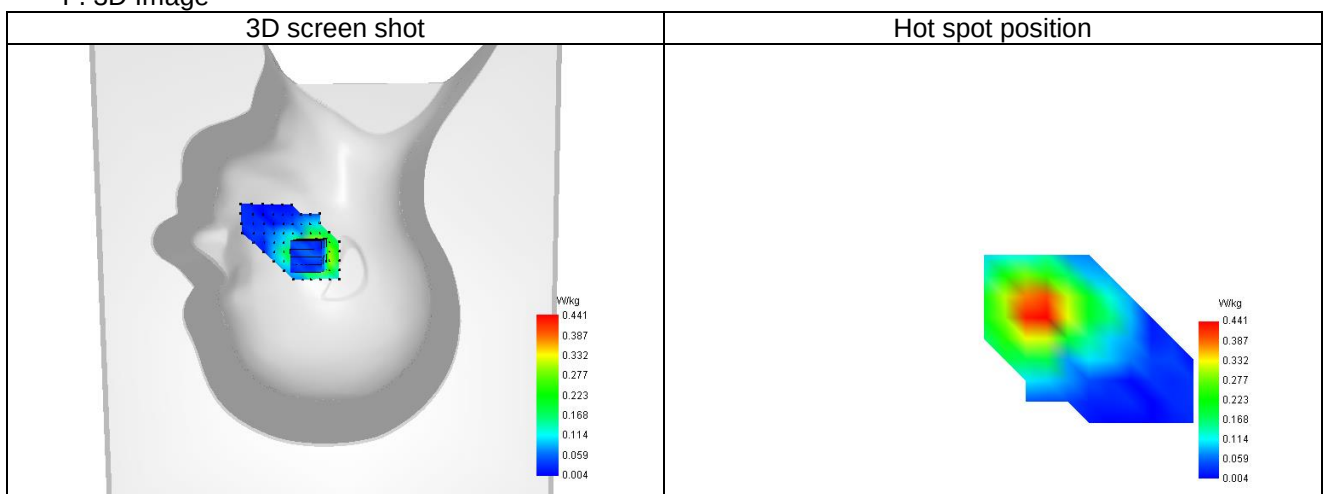
SAR 10g (W/Kg)	0.250
SAR 1g (W/Kg)	0.434
Variation (%)	-3.300
Horizontal validation criteria: minimum distance (mm)	22.090722
Vertical validation criteria: SAR ratio M2/M1 (%)	57.942494

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.650	0.424	0.245	0.181	0.113	0.098	0.075



F. 3D Image



Plot 32

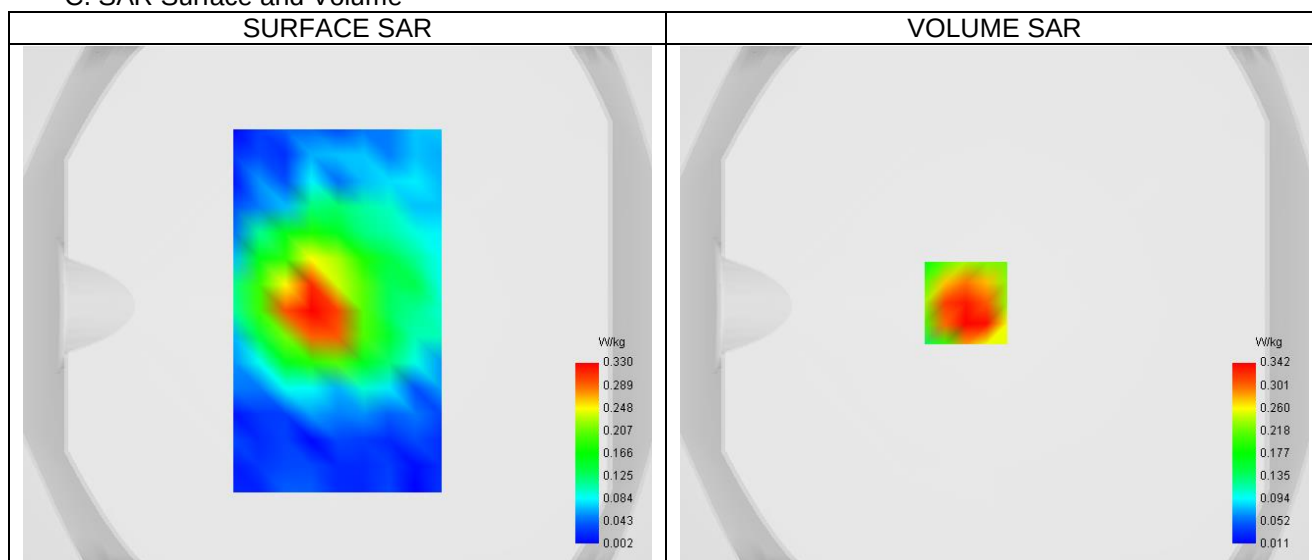
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
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 8
Channels	Middle (21625)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	897.500
Relative permittivity (real part)	41.500
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.967

C. SAR Surface and Volume



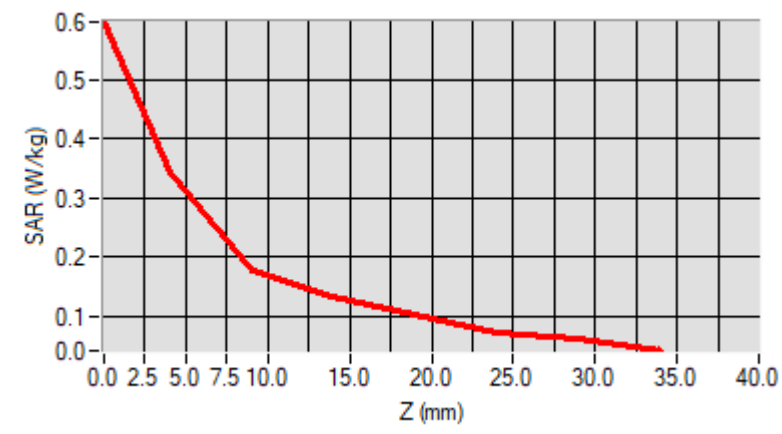
Maximum location: X=-11.00, Y=1.00 ; SAR Peak: 0.55 W/kg

D. SAR 1g & 10g

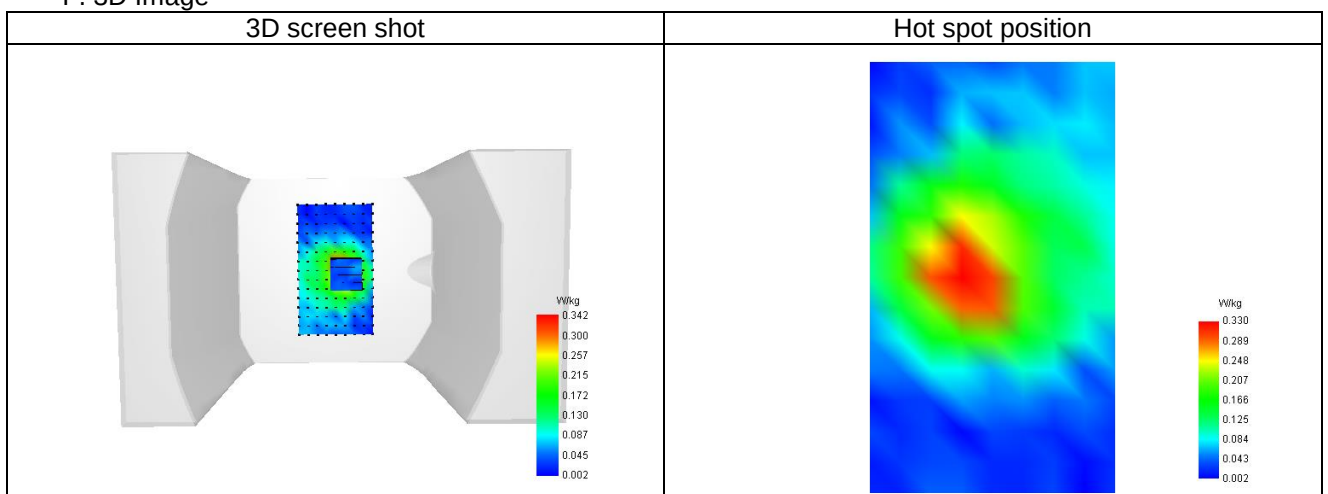
SAR 10g (W/Kg)	0.200
SAR 1g (W/Kg)	0.328
Variation (%)	-4.040
Horizontal validation criteria: minimum distance (mm)	17.888544
Vertical validation criteria: SAR ratio M2/M1 (%)	67.161828

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.597	0.342	0.178	0.133	0.105	0.073	0.063



F. 3D Image



Plot 33

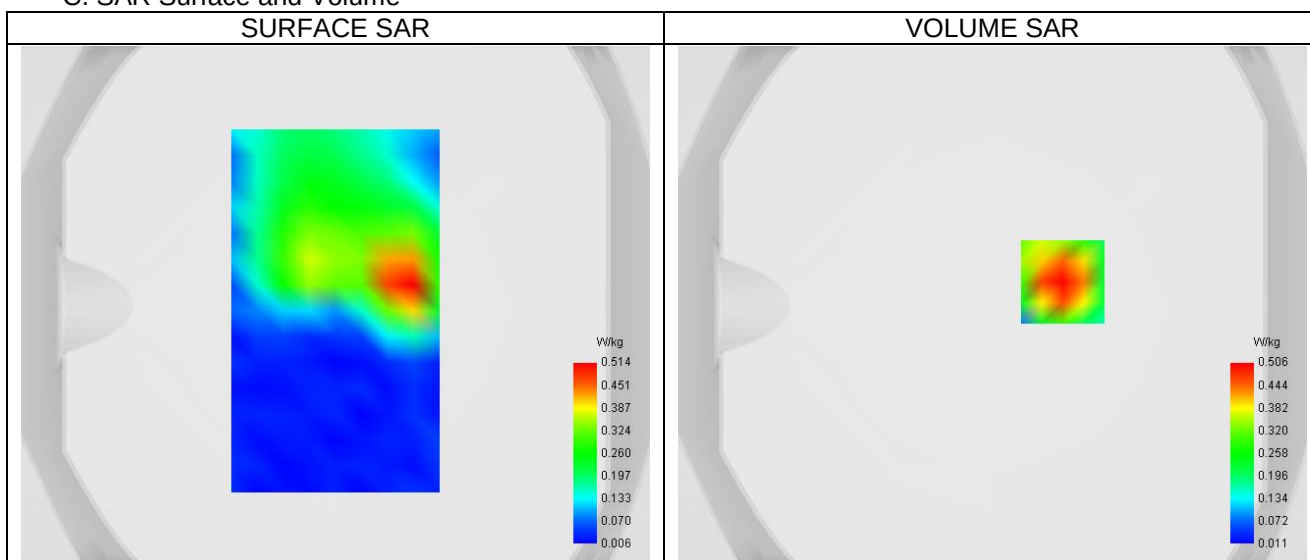
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.08
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 8
Channels	Middle (21625)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	897.500
Relative permittivity (real part)	41.500
Relative permittivity (imaginary part)	19.400
Conductivity (S/m)	0.967

C. SAR Surface and Volume



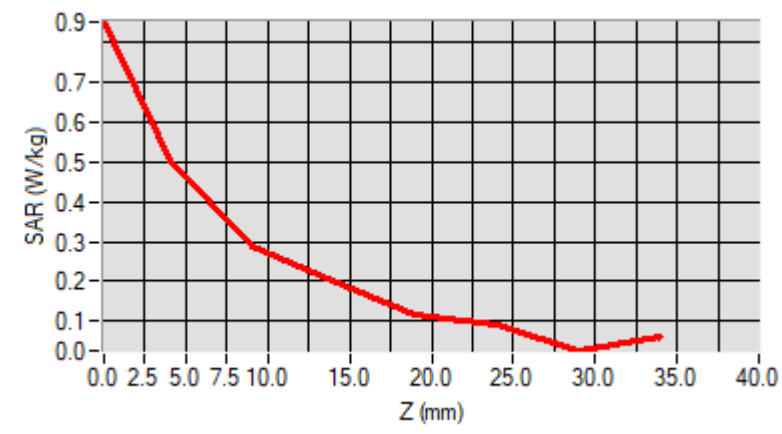
Maximum location: X=27.00, Y=9.00 ; SAR Peak: 0.86 W/kg

D. SAR 1g & 10g

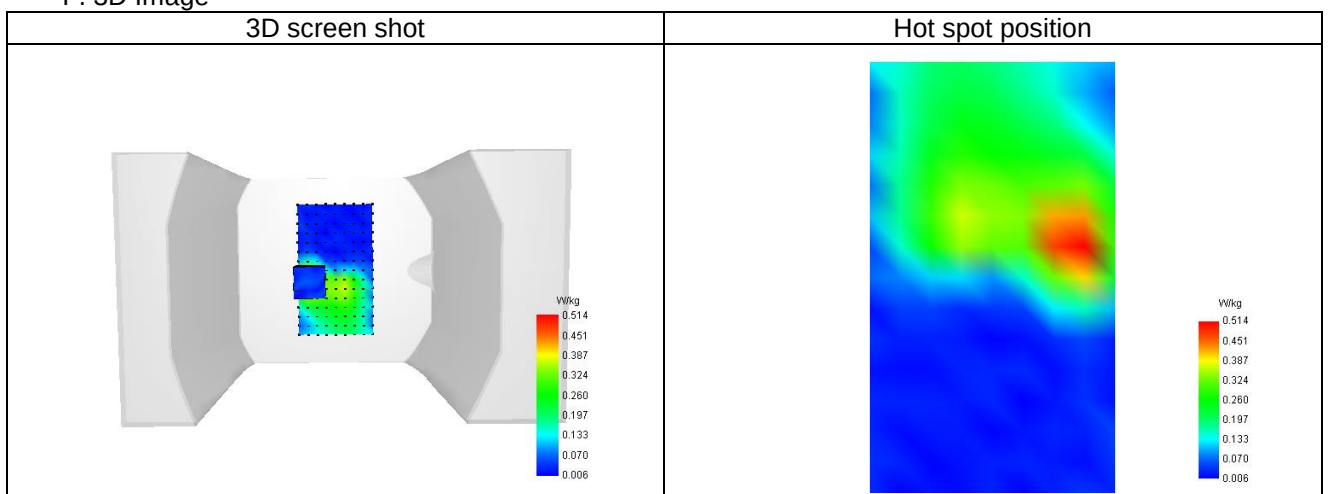
SAR 10g (W/Kg)	0.271
SAR 1g (W/Kg)	0.501
Variation (%)	-3.900
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	56.571457

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.852	0.506	0.286	0.202	0.117	0.094	0.026



F. 3D Image



Plot 34

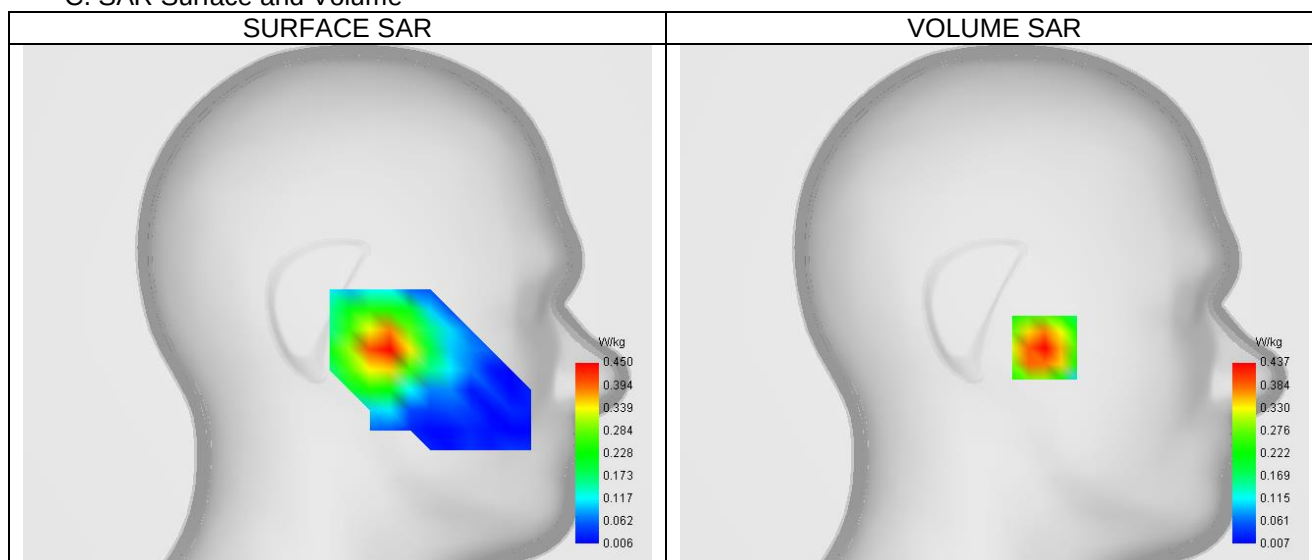
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.01
Area Scan	sam_direct_droit2_surf8mm.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Left head
Device Position	Cheek
Band	LTE band 20
Channels	Middle (24300)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	847.000
Relative permittivity (real part)	42.190
Relative permittivity (imaginary part)	20.108
Conductivity (S/m)	0.946

C. SAR Surface and Volume

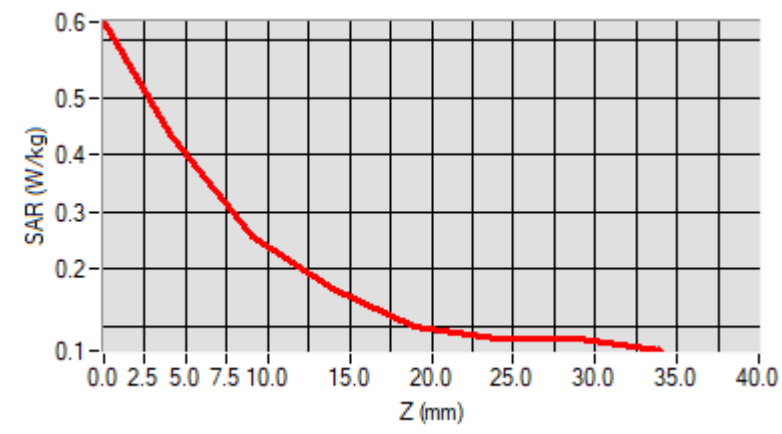


D. SAR 1g & 10g

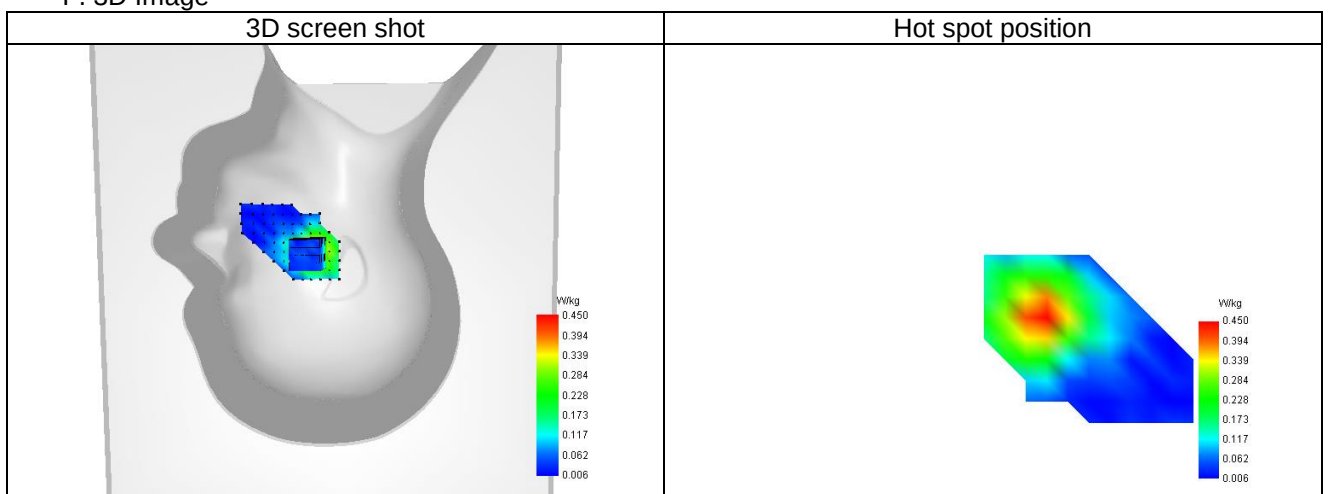
SAR 10g (W/Kg)	0.248
SAR 1g (W/Kg)	0.418
Variation (%)	-4.710
Horizontal validation criteria: minimum distance (mm)	22.083931
Vertical validation criteria: SAR ratio M2/M1 (%)	59.073963

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.633	0.437	0.258	0.165	0.100	0.079	0.077



F. 3D Image



Plot 35

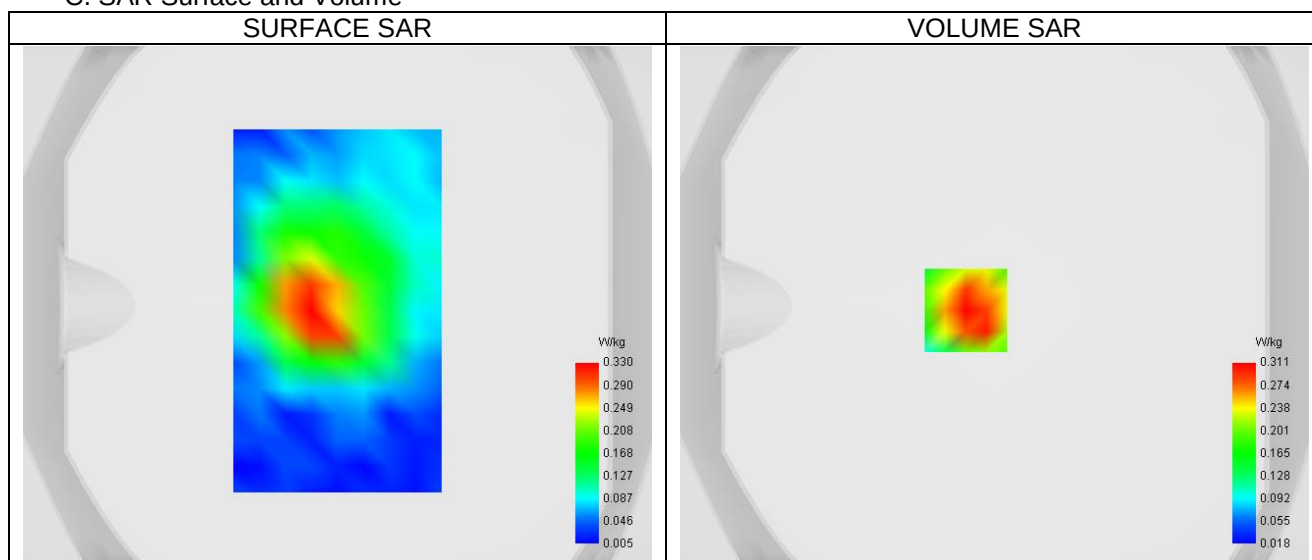
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.01
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 20
Channels	Middle (24300)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	847.000
Relative permittivity (real part)	42.190
Relative permittivity (imaginary part)	20.108
Conductivity (S/m)	0.946

C. SAR Surface and Volume

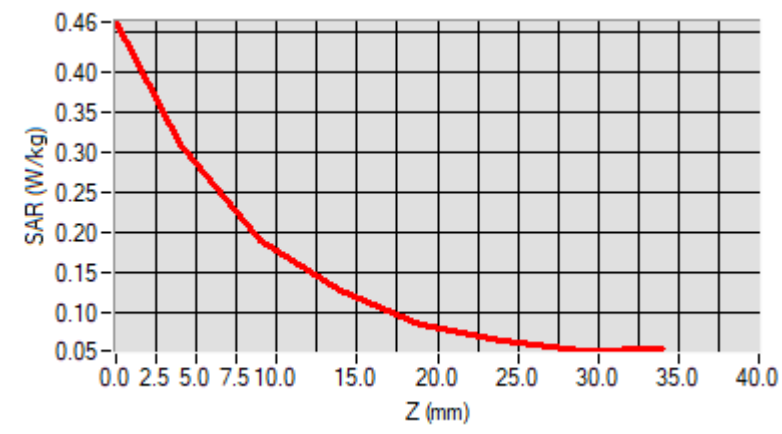


D. SAR 1g & 10g

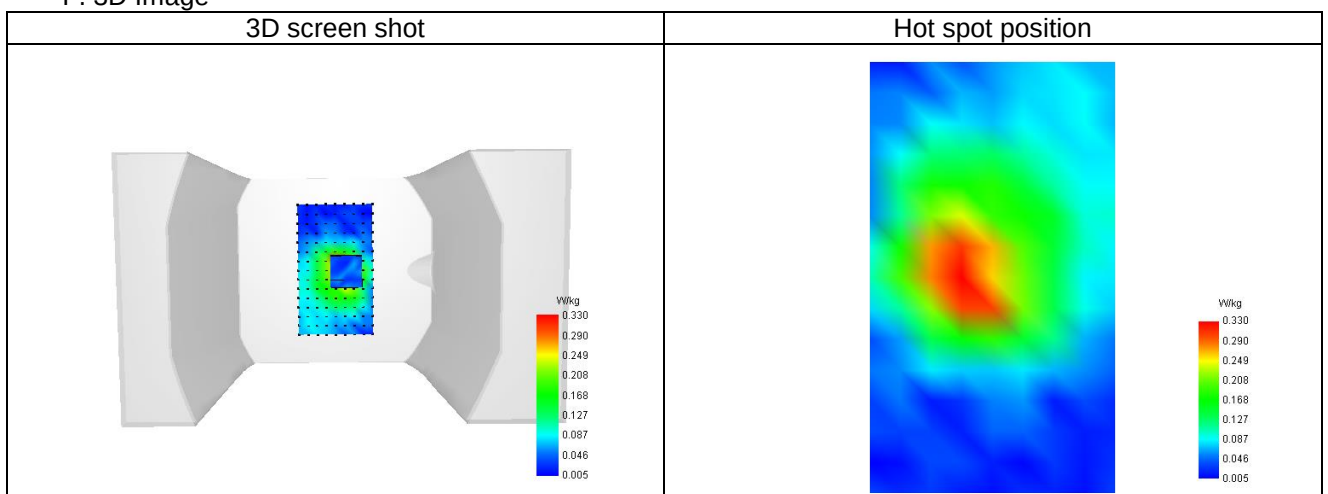
SAR 10g (W/Kg)	0.185
SAR 1g (W/Kg)	0.304
Variation (%)	-0.150
Horizontal validation criteria: minimum distance (mm)	17.888544
Vertical validation criteria: SAR ratio M2/M1 (%)	61.324052

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.464	0.311	0.191	0.127	0.085	0.065	0.052



F. 3D Image



Plot 36

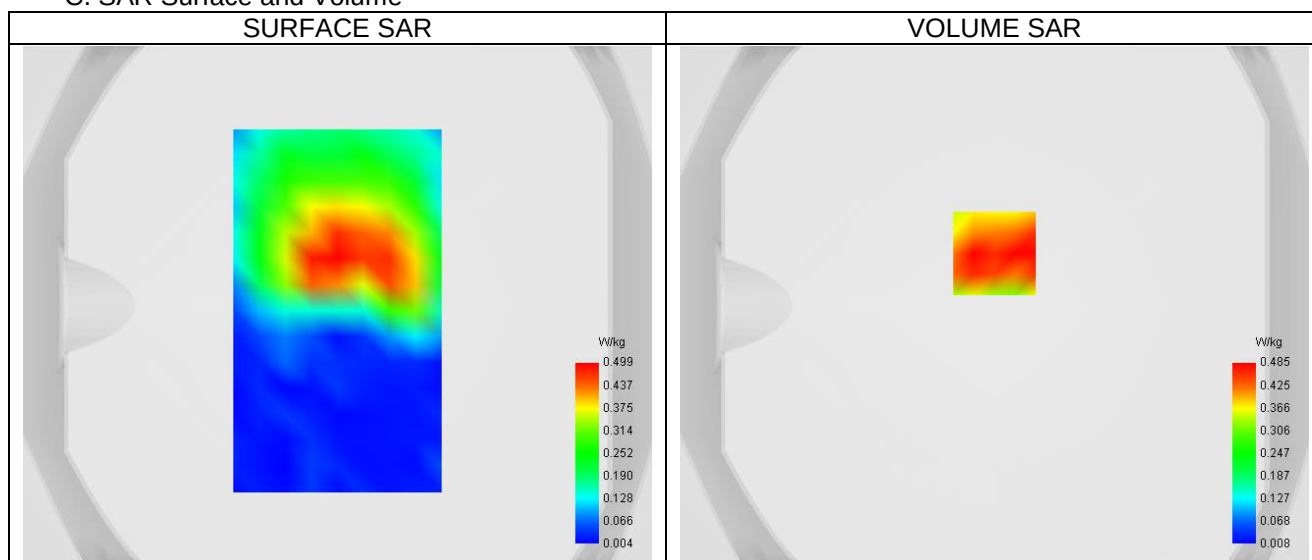
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.01
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 20
Channels	Middle (24300)
Signal	LTE (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	847.000
Relative permittivity (real part)	42.190
Relative permittivity (imaginary part)	20.108
Conductivity (S/m)	0.946

C. SAR Surface and Volume



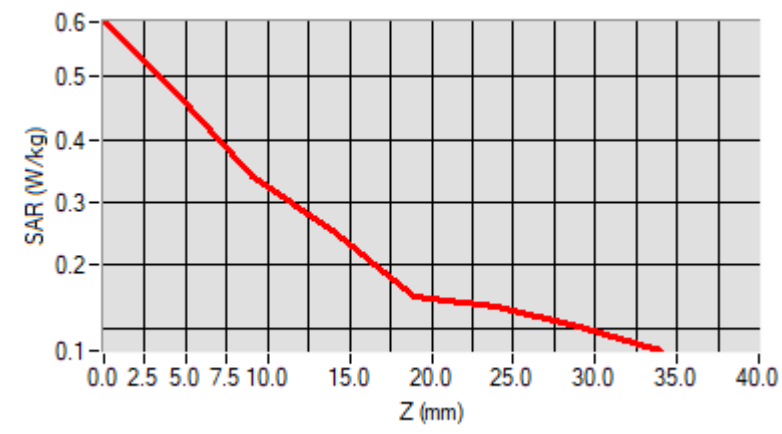
Maximum location: X=0.00, Y=20.00 ; SAR Peak: 0.77 W/kg

D. SAR 1g & 10g

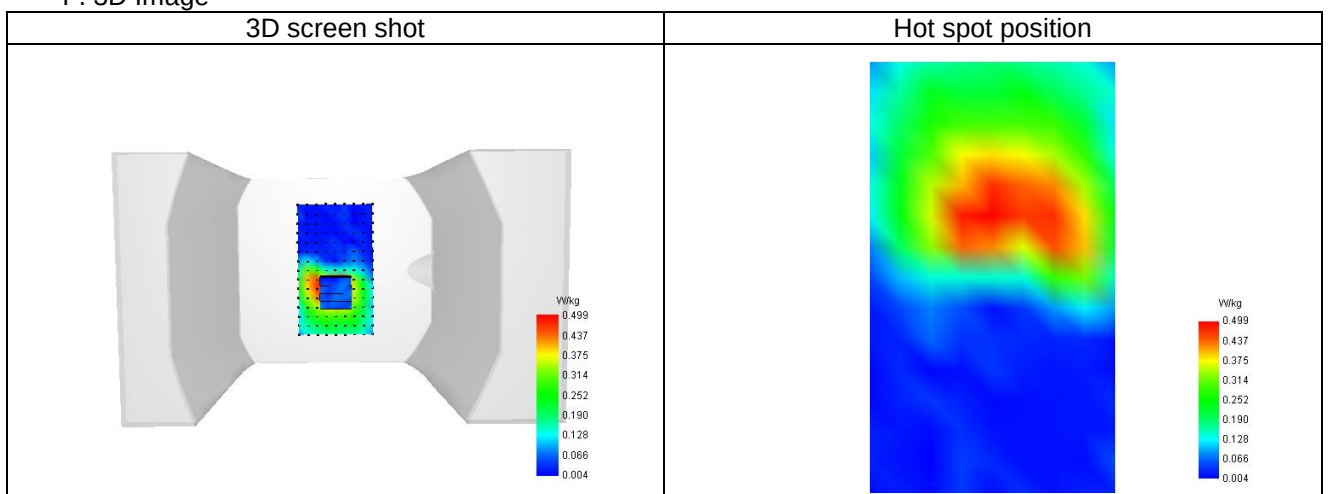
SAR 10g (W/Kg)	0.316
SAR 1g (W/Kg)	0.483
Variation (%)	-0.920
Horizontal validation criteria: minimum distance (mm)	-1.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	76.491524

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.587	0.485	0.343	0.256	0.152	0.135	0.102



F. 3D Image



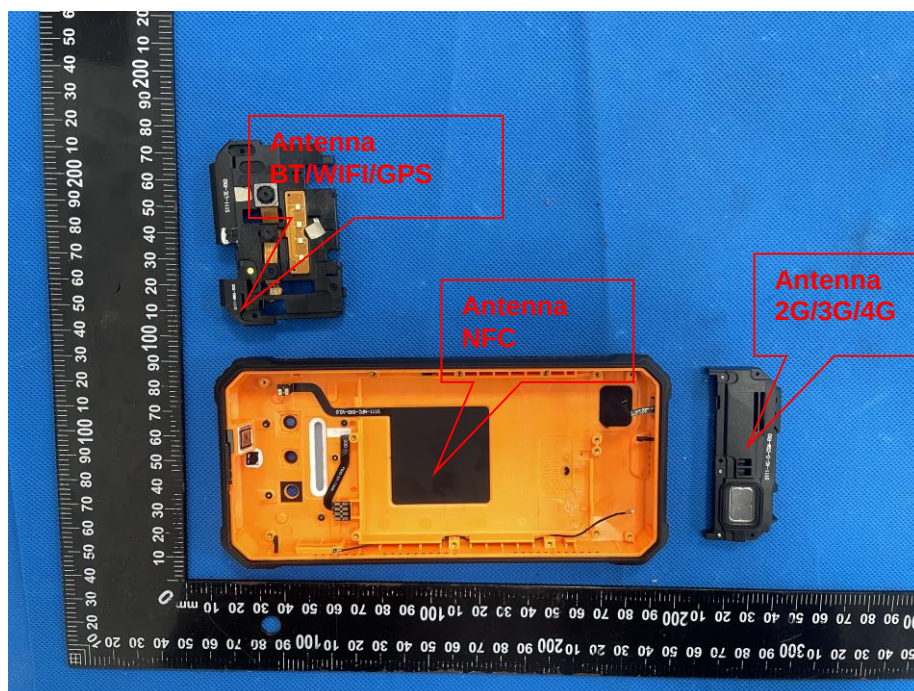
16. EUT Photographs

EUT Front View



EUT Back View

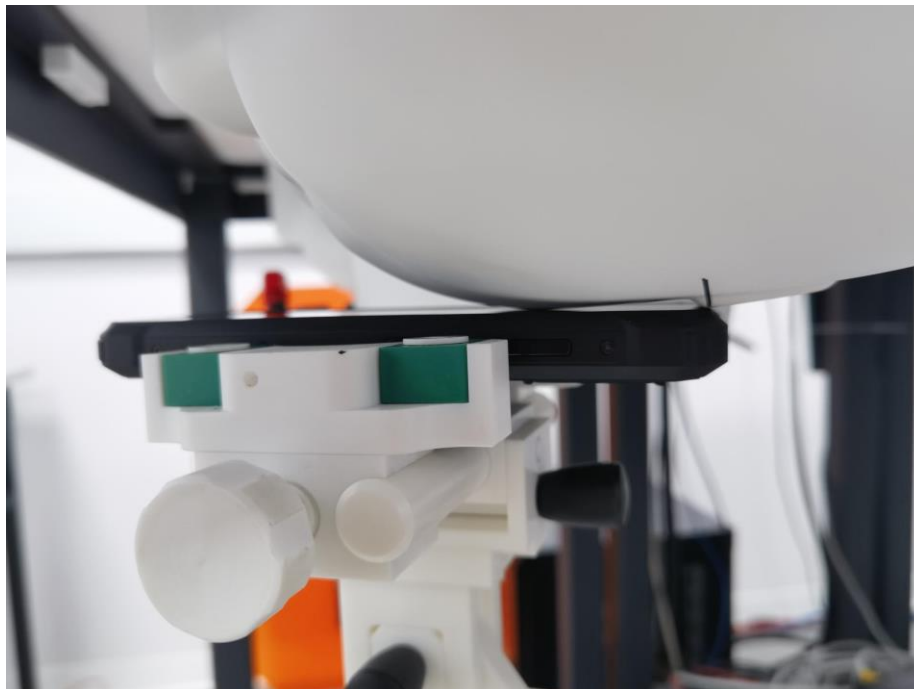


Antenna View

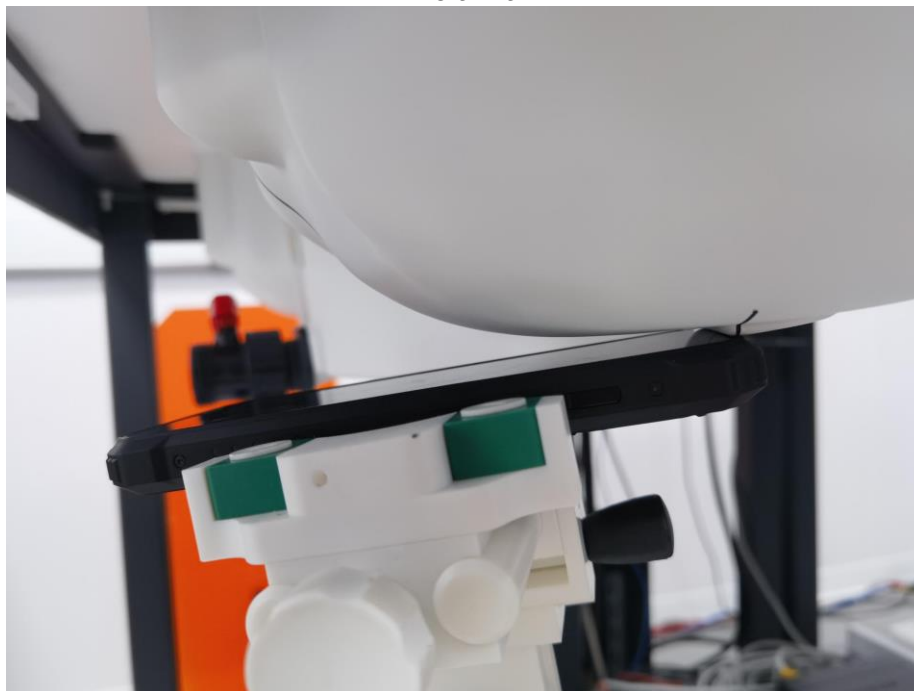
17. EUT Test Setup Photographs

Head mode Exposure Conditions

Left Cheek



Left Tilt



Right Cheek



Right Tilt



Front



Back



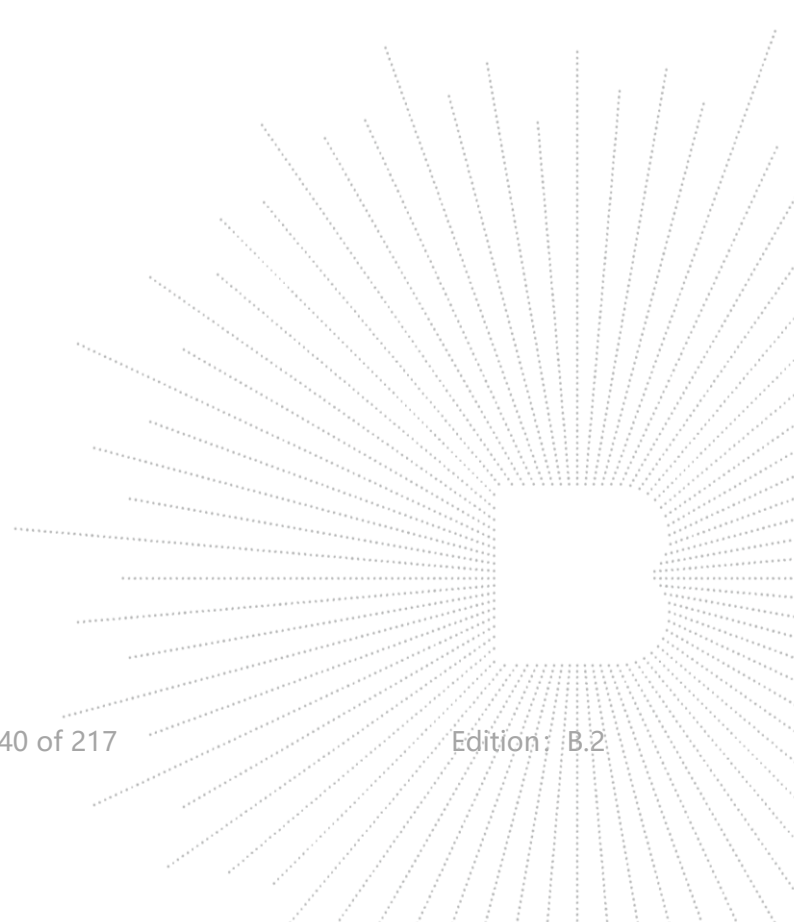
Test distance: 0mm

Limb worn



18. Calibration Certificate

Probe-EPGO373 Calibration Certificate
SID900Dipole Calibration Certificate
SID1800Dipole Calibration Certificate
SID2100Dipole Calibration Certificate
SID2450Dipole Calibration Certificate
SID5000Dipole Calibration Certificate



**COMOSAR E-Field Probe Calibration Report**

Ref : ACR.180.5.22.BES.A

SHENZHEN BCTC TECHNOLOGY CO., LTD.
1 ~2/ F, NO. B FACTORY BUILDING, PENGZHOU INDUSTRIAL
PARK, FUYUAN 1ST ROAD,
TANGWEI COMMUNITY, FUHAI STREET, BAO'AN DISTRICT,
SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 25/22 EPG0373

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

Calibration date: 06/29/2022

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

The use of the Cofrac brand and the accreditation references is prohibited from any reproduction.

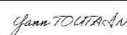
Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric 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).

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.5.22.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme Le Gall	Measurement Responsible	6/30/2022	
<i>Checked & approved by:</i>	Jérôme Luc	Technical Manager	6/30/2022	
<i>Authorized by:</i>	Yann Toutain	Laboratory Director	6/30/2022	

2022.06.30
13:38:42 +02'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen BCTC Technology Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme Le Gall	6/30/2022	Initial release

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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 25/22 EPGO373
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.234 MΩ Dipole 2: R2=0.195 MΩ Dipole 3: R3=0.250 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

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



Figure 1 – MVG COMOSAR Dosimetric E field Probe

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 IEC/IEEE 62209-1528 and FCC KDB865664 D01 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.

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3.3 LOWER DETECTION LIMIT

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

3.4 ISOTROPY

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

3.1 BOUNDARY EFFECT

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

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

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

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest <i>zoom-scan</i> measurement point, in millimetre
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., $\delta \approx 14 \text{ mm}$ at 3 GHz,
ΔSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.

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



4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 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 (μV/(V/m) ²)	Normy dipole 2 (μV/(V/m) ²)	Normz dipole 3 (μV/(V/m) ²)
1.19	0.77	1.05

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
108	109	110

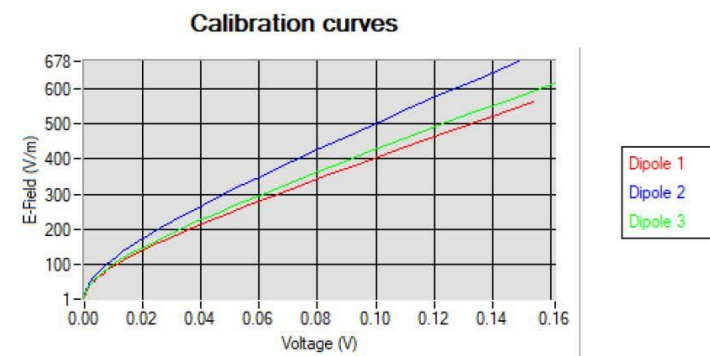
Calibration curves $e_i=f(V)$ (i=1,2,3) allow to obtain E-field value using the formula:

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

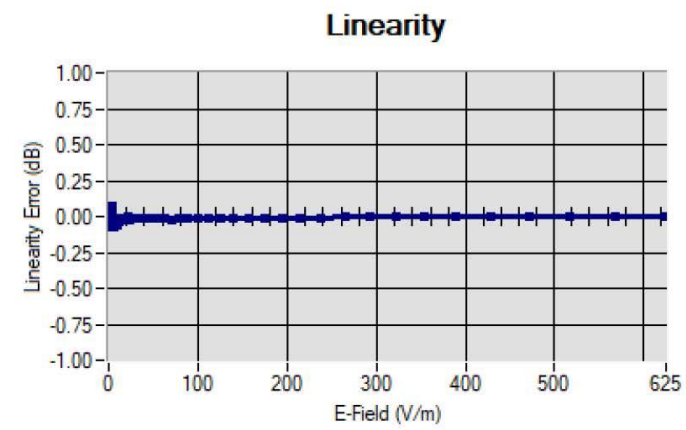
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5.2 LINEARITY



Linearity: $\pm 1.77\%$ ($\pm 0.08\text{dB}$)

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5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	ConvF
HL450*	450*	3.00*
BL450*	450*	2.83*
HL750	750	2.96
BL750	750	3.07
HL850	835	3.01
BL850	835	3.13
HL900	900	3.08
BL900	900	3.18
HL1800	1800	3.35
BL1800	1800	3.42
HL1900	1900	3.27
BL1900	1900	3.55
HL2100	2100	3.77
BL2100	2100	3.92
HL2300	2300	3.77
BL2300	2300	3.94
HL2450	2450	3.96
BL2450	2450	4.13
HL2600	2600	3.63
BL2600	2600	3.79
HL5200	5200	2.72
BL5200	5200	2.45
HL5400	5400	2.92
BL5400	5400	2.74
HL5600	5600	3.09
BL5600	5600	2.90
HL5800	5800	2.86
BL5800	5800	2.72

* Frequency not cover by COFRAC scope, calibration not accredited

LOWER DETECTION LIMIT: 7mW/kg

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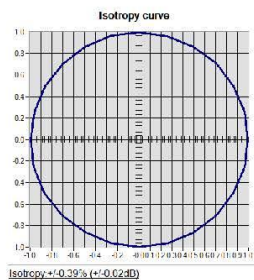
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5.4 ISOTROPY

HL1800 MHz



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6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2022
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2019	11/2022
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.5.22.BES.A

Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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SAR Reference Dipole Calibration Report

Ref : ACR.329.10.21.BES.A

SHENZHEN BCTC TECHNOLOGY CO., LTD.

**1 ~2/ F, NO. B FACTORY BUILDING, PENGZHOU
INDUSTRIAL PARK, FUYUAN 1ST ROAD,
TANGWEI COMMUNITY, FUHAI STREET, BAO'AN
DISTRICT, SHENZHEN, GUANGDONG, CHINA**

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 900 MHZ

SERIAL NO.: SN 47/21 DIP 0G900-622

Calibrated at MVG

Z.I. de la pointe du diable

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

Calibration date: 11/25/2021



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

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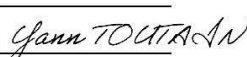
Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.10.21.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme Le Gall	Measurement Responsible	11/25/2021	
<i>Checked by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Approved by :</i>	Yann Toutain	Laboratory Director	11/25/2021	 2021.11.25 11:53:05 +01'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen BCTC Technology Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme Luc	11/25/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 900 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID900
Serial Number	SN 47/21 DIP 0G900-622
Product Condition (new / used)	New

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

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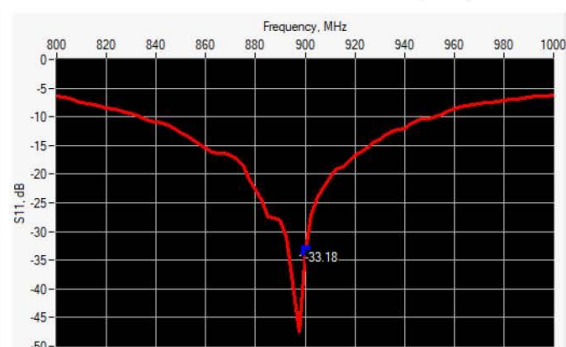
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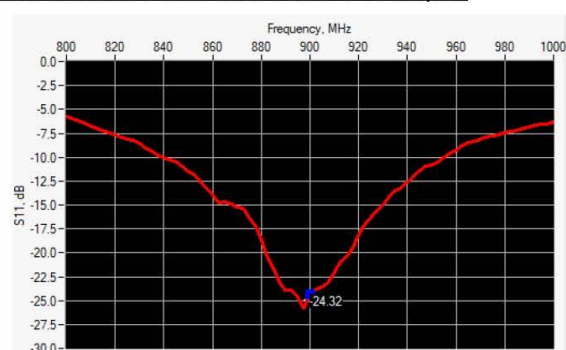

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.10.21.BES.A

Scan Volume	Expanded Uncertainty
1 g	19 % (SAR)
10 g	19 % (SAR)

6 CALIBRATION MEASUREMENT RESULTS
6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID


Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
900	-33.18	-20	$52.1 \Omega + 0.7 j\Omega$

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID


Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
900	-24.32	-20	$52.6 \Omega + 5.5 j\Omega$

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6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ± 1 %		250.0 ± 1 %		6.35 ± 1 %	
450	290.0 ± 1 %		166.7 ± 1 %		6.35 ± 1 %	
750	176.0 ± 1 %		100.0 ± 1 %		6.35 ± 1 %	
835	161.0 ± 1 %		89.8 ± 1 %		3.6 ± 1 %	
900	149.0 ± 1 %	149.49	83.3 ± 1 %	83.01	3.6 ± 1 %	3.59
1450	89.1 ± 1 %		51.7 ± 1 %		3.6 ± 1 %	
1500	86.2 ± 1 %		50.0 ± 1 %		3.6 ± 1 %	
1640	79.0 ± 1 %		45.7 ± 1 %		3.6 ± 1 %	
1750	75.2 ± 1 %		42.9 ± 1 %		3.6 ± 1 %	
1800	72.0 ± 1 %		41.7 ± 1 %		3.6 ± 1 %	
1900	68.0 ± 1 %		39.5 ± 1 %		3.6 ± 1 %	
1950	66.3 ± 1 %		38.5 ± 1 %		3.6 ± 1 %	
2000	64.5 ± 1 %		37.5 ± 1 %		3.6 ± 1 %	
2100	61.0 ± 1 %		35.7 ± 1 %		3.6 ± 1 %	
2300	55.5 ± 1 %		32.6 ± 1 %		3.6 ± 1 %	
2450	51.5 ± 1 %		30.4 ± 1 %		3.6 ± 1 %	
2600	48.5 ± 1 %		28.8 ± 1 %		3.6 ± 1 %	
3000	41.5 ± 1 %		25.0 ± 1 %		3.6 ± 1 %	
3300	-		-		-	
3500	37.0 ± 1 %		26.4 ± 1 %		3.6 ± 1 %	
3700	34.7 ± 1 %		26.4 ± 1 %		3.6 ± 1 %	
3900	-		-		-	
4200	-		-		-	
4600	-		-		-	
4900	-		-		-	

7 VALIDATION MEASUREMENT

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

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7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 10 %		0.87 $\pm$ 10 %	
450	43.5 $\pm$ 10 %		0.87 $\pm$ 10 %	
750	41.9 $\pm$ 10 %		0.89 $\pm$ 10 %	
835	41.5 $\pm$ 10 %		0.90 $\pm$ 10 %	
900	41.5 $\pm$ 10 %	39.1	0.97 $\pm$ 10 %	0.98
1450	40.5 $\pm$ 10 %		1.20 $\pm$ 10 %	
1500	40.4 $\pm$ 10 %		1.23 $\pm$ 10 %	
1640	40.2 $\pm$ 10 %		1.31 $\pm$ 10 %	
1750	40.1 $\pm$ 10 %		1.37 $\pm$ 10 %	
1800	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1900	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1950	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2000	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2100	39.8 $\pm$ 10 %		1.49 $\pm$ 10 %	
2300	39.5 $\pm$ 10 %		1.67 $\pm$ 10 %	
2450	39.2 $\pm$ 10 %		1.80 $\pm$ 10 %	
2600	39.0 $\pm$ 10 %		1.96 $\pm$ 10 %	
3000	38.5 $\pm$ 10 %		2.40 $\pm$ 10 %	
3300	38.2 $\pm$ 10 %		2.71 $\pm$ 10 %	
3500	37.9 $\pm$ 10 %		2.91 $\pm$ 10 %	
3700	37.7 $\pm$ 10 %		3.12 $\pm$ 10 %	
3900	37.5 $\pm$ 10 %		3.32 $\pm$ 10 %	
4200	37.1 $\pm$ 10 %		3.63 $\pm$ 10 %	
4600	36.7 $\pm$ 10 %		4.04 $\pm$ 10 %	
4900	36.3 $\pm$ 10 %		4.35 $\pm$ 10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.10.21.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: ϵ_{ps}^* : 39.1 σ : 0.98
Distance between dipole center and liquid	15.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9	11.39 (1.14)	6.99	6.96 (0.70)
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3300	-		-	
3500	67.1		25	
3700	67.4		24.2	
3900	-		-	
4200	-		-	
4600	-		-	
4900	-		-	

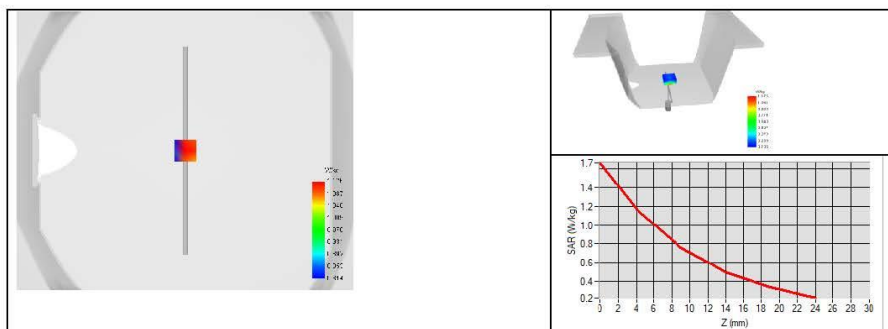
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.10.21.BES.A



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7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ± 10 %		0.80 ± 10 %	
300	58.2 ± 10 %		0.92 ± 10 %	
450	56.7 ± 10 %		0.94 ± 10 %	
750	55.5 ± 10 %		0.96 ± 10 %	
835	55.2 ± 10 %		0.97 ± 10 %	
900	55.0 ± 10 %	51.7	1.05 ± 10 %	1.01
915	55.0 ± 10 %		1.06 ± 10 %	
1450	54.0 ± 10 %		1.30 ± 10 %	
1610	53.8 ± 10 %		1.40 ± 10 %	
1800	53.3 ± 10 %		1.52 ± 10 %	
1900	53.3 ± 10 %		1.52 ± 10 %	
2000	53.3 ± 10 %		1.52 ± 10 %	
2100	53.2 ± 10 %		1.62 ± 10 %	
2300	52.9 ± 10 %		1.81 ± 10 %	
2450	52.7 ± 10 %		1.95 ± 10 %	
2600	52.5 ± 10 %		2.16 ± 10 %	
3000	52.0 ± 10 %		2.73 ± 10 %	
3300	51.6 ± 10 %		3.08 ± 10 %	
3500	51.3 ± 10 %		3.31 ± 10 %	
3700	51.0 ± 10 %		3.55 ± 10 %	
3900	50.8 ± 10 %		3.78 ± 10 %	
4200	50.4 ± 10 %		4.13 ± 10 %	
4600	49.8 ± 10 %		4.60 ± 10 %	
4900	49.4 ± 10 %		4.95 ± 10 %	
5200	49.0 ± 10 %		5.30 ± 10 %	
5300	48.9 ± 10 %		5.42 ± 10 %	
5400	48.7 ± 10 %		5.53 ± 10 %	
5500	48.6 ± 10 %		5.65 ± 10 %	
5600	48.5 ± 10 %		5.77 ± 10 %	
5800	48.2 ± 10 %		6.00 ± 10 %	

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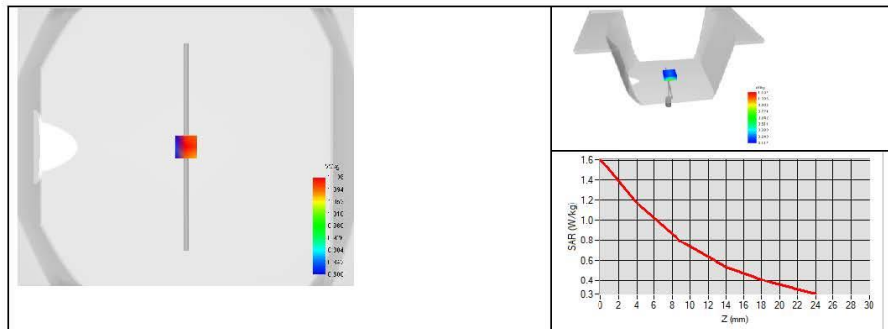

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.10.21.BES.A

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Body Liquid Values: $\epsilon_p' : 51.7$ $\sigma : 1.01$
Distance between dipole center and liquid	15.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
900	11.03 (1.10)	6.96 (0.70)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Calipers	Mitutoyo	SN 0009732	10/2019	10/2022
Reference Probe	MVG	SN 41/18 EPG0333	10/2021	10/2022
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2019	11/2022
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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**SAR Reference Dipole Calibration Report**

Ref : ACR.329.11.21.BES.A

SHENZHEN BCTC TECHNOLOGY CO., LTD.

**1 ~2/ F, NO. B FACTORY BUILDING, PENGZHOU
INDUSTRIAL PARK, FUYUAN 1ST ROAD,
TANGWEI COMMUNITY, FUHAI STREET, BAO'AN
DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE**

FREQUENCY: 1800 MHZ**SERIAL NO.: SN 47/21 DIP 1G800-623****Calibrated at MVG****Z.I. de la pointe du diable**

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

Calibration date: 11/25/2021

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

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Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.11.21.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Checked by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Approved by :</i>	Yann Toutain	Laboratory Director	11/25/2021	

2021.11.25
11:53:42 +01'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen BCTC Technology Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme Luc	11/25/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1800
Serial Number	SN 47/21 DIP 1G800-623
Product Condition (new / used)	New

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

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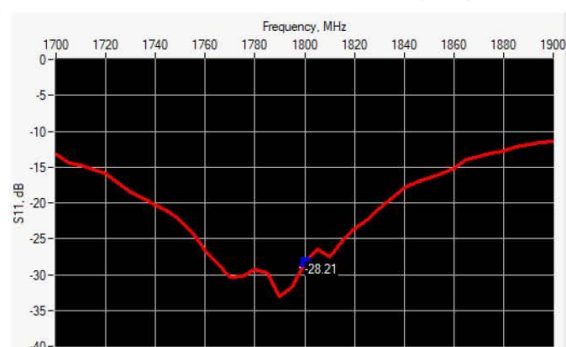
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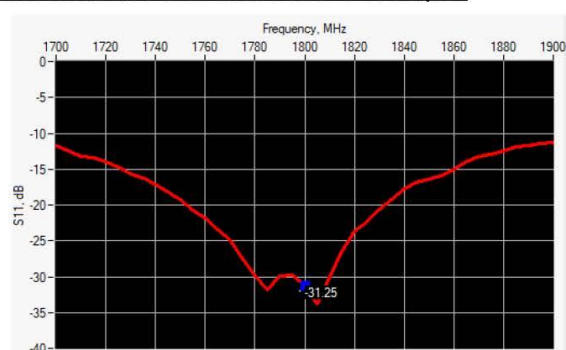

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.11.21.BES.A

Scan Volume	Expanded Uncertainty
1 g	19 % (SAR)
10 g	19 % (SAR)

6 CALIBRATION MEASUREMENT RESULTS
6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID


Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-28.21	-20	$49.8 \Omega + 3.9 j\Omega$

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID


Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-31.25	-20	$47.7 \Omega - 1.4 j\Omega$

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6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ± 1 %		250.0 ± 1 %		6.35 ± 1 %	
450	290.0 ± 1 %		166.7 ± 1 %		6.35 ± 1 %	
750	176.0 ± 1 %		100.0 ± 1 %		6.35 ± 1 %	
835	161.0 ± 1 %		89.8 ± 1 %		3.6 ± 1 %	
900	149.0 ± 1 %		83.3 ± 1 %		3.6 ± 1 %	
1450	89.1 ± 1 %		51.7 ± 1 %		3.6 ± 1 %	
1500	86.2 ± 1 %		50.0 ± 1 %		3.6 ± 1 %	
1640	79.0 ± 1 %		45.7 ± 1 %		3.6 ± 1 %	
1750	75.2 ± 1 %		42.9 ± 1 %		3.6 ± 1 %	
1800	72.0 ± 1 %	72.31	41.7 ± 1 %	41.63	3.6 ± 1 %	3.59
1900	68.0 ± 1 %		39.5 ± 1 %		3.6 ± 1 %	
1950	66.3 ± 1 %		38.5 ± 1 %		3.6 ± 1 %	
2000	64.5 ± 1 %		37.5 ± 1 %		3.6 ± 1 %	
2100	61.0 ± 1 %		35.7 ± 1 %		3.6 ± 1 %	
2300	55.5 ± 1 %		32.6 ± 1 %		3.6 ± 1 %	
2450	51.5 ± 1 %		30.4 ± 1 %		3.6 ± 1 %	
2600	48.5 ± 1 %		28.8 ± 1 %		3.6 ± 1 %	
3000	41.5 ± 1 %		25.0 ± 1 %		3.6 ± 1 %	
3300	-		-		-	
3500	37.0 ± 1 %		26.4 ± 1 %		3.6 ± 1 %	
3700	34.7 ± 1 %		26.4 ± 1 %		3.6 ± 1 %	
3900	-		-		-	
4200	-		-		-	
4600	-		-		-	
4900	-		-		-	

7 VALIDATION MEASUREMENT

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

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7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 10 %		0.87 $\pm$ 10 %	
450	43.5 $\pm$ 10 %		0.87 $\pm$ 10 %	
750	41.9 $\pm$ 10 %		0.89 $\pm$ 10 %	
835	41.5 $\pm$ 10 %		0.90 $\pm$ 10 %	
900	41.5 $\pm$ 10 %		0.97 $\pm$ 10 %	
1450	40.5 $\pm$ 10 %		1.20 $\pm$ 10 %	
1500	40.4 $\pm$ 10 %		1.23 $\pm$ 10 %	
1640	40.2 $\pm$ 10 %		1.31 $\pm$ 10 %	
1750	40.1 $\pm$ 10 %		1.37 $\pm$ 10 %	
1800	40.0 $\pm$ 10 %	38.4	1.40 $\pm$ 10 %	1.36
1900	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1950	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2000	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2100	39.8 $\pm$ 10 %		1.49 $\pm$ 10 %	
2300	39.5 $\pm$ 10 %		1.67 $\pm$ 10 %	
2450	39.2 $\pm$ 10 %		1.80 $\pm$ 10 %	
2600	39.0 $\pm$ 10 %		1.96 $\pm$ 10 %	
3000	38.5 $\pm$ 10 %		2.40 $\pm$ 10 %	
3300	38.2 $\pm$ 10 %		2.71 $\pm$ 10 %	
3500	37.9 $\pm$ 10 %		2.91 $\pm$ 10 %	
3700	37.7 $\pm$ 10 %		3.12 $\pm$ 10 %	
3900	37.5 $\pm$ 10 %		3.32 $\pm$ 10 %	
4200	37.1 $\pm$ 10 %		3.63 $\pm$ 10 %	
4600	36.7 $\pm$ 10 %		4.04 $\pm$ 10 %	
4900	36.3 $\pm$ 10 %		4.35 $\pm$ 10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.11.21.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: ϵ_{ps}^* : 38.4 σ : 1.36
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	39.74 (3.97)	20.1	20.82 (2.08)
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3300	-		-	
3500	67.1		25	
3700	67.4		24.2	
3900	-		-	
4200	-		-	
4600	-		-	
4900	-		-	

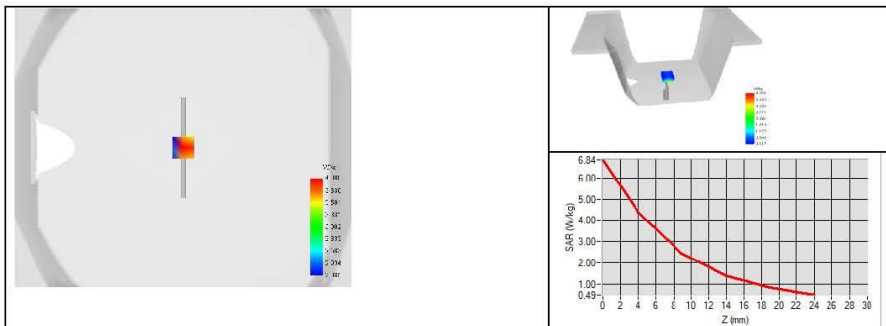
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.11.21.BES.A



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7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ± 10 %		0.80 ± 10 %	
300	58.2 ± 10 %		0.92 ± 10 %	
450	56.7 ± 10 %		0.94 ± 10 %	
750	55.5 ± 10 %		0.96 ± 10 %	
835	55.2 ± 10 %		0.97 ± 10 %	
900	55.0 ± 10 %		1.05 ± 10 %	
915	55.0 ± 10 %		1.06 ± 10 %	
1450	54.0 ± 10 %		1.30 ± 10 %	
1610	53.8 ± 10 %		1.40 ± 10 %	
1800	53.3 ± 10 %	55.3	1.52 ± 10 %	1.49
1900	53.3 ± 10 %		1.52 ± 10 %	
2000	53.3 ± 10 %		1.52 ± 10 %	
2100	53.2 ± 10 %		1.62 ± 10 %	
2300	52.9 ± 10 %		1.81 ± 10 %	
2450	52.7 ± 10 %		1.95 ± 10 %	
2600	52.5 ± 10 %		2.16 ± 10 %	
3000	52.0 ± 10 %		2.73 ± 10 %	
3300	51.6 ± 10 %		3.08 ± 10 %	
3500	51.3 ± 10 %		3.31 ± 10 %	
3700	51.0 ± 10 %		3.55 ± 10 %	
3900	50.8 ± 10 %		3.78 ± 10 %	
4200	50.4 ± 10 %		4.13 ± 10 %	
4600	49.8 ± 10 %		4.60 ± 10 %	
4900	49.4 ± 10 %		4.95 ± 10 %	
5200	49.0 ± 10 %		5.30 ± 10 %	
5300	48.9 ± 10 %		5.42 ± 10 %	
5400	48.7 ± 10 %		5.53 ± 10 %	
5500	48.6 ± 10 %		5.65 ± 10 %	
5600	48.5 ± 10 %		5.77 ± 10 %	
5800	48.2 ± 10 %		6.00 ± 10 %	

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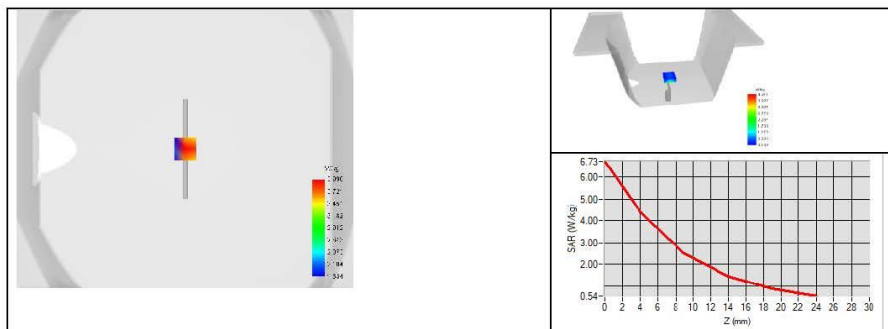

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.11.21.BES.A

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Body Liquid Values: $\epsilon_{ps}' : 55.3$ $\sigma : 1.49$
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	39.54 (3.95)	20.63 (2.06)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Calipers	Mitutoyo	SN 0009732	10/2019	10/2022
Reference Probe	MVG	SN 41/18 EPG0333	10/2021	10/2022
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2019	11/2022
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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**SAR Reference Dipole Calibration Report**

Ref : ACR.329.13.21.BES.A

SHENZHEN BCTC TECHNOLOGY CO., LTD.

**1 ~2/ F, NO. B FACTORY BUILDING, PENGZHOU
INDUSTRIAL PARK, FUYUAN 1ST ROAD,
TANGWEI COMMUNITY, FUHAI STREET, BAO'AN
DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE**

FREQUENCY: 2100 MHZ**SERIAL NO.: SN 47/21 DIP 2G100-625****Calibrated at MVG****Z.I. de la pointe du diable**

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

Calibration date: 11/25/2021

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

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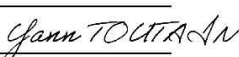
Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.13.21.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Checked by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Approved by :</i>	Yann Toutain	Laboratory Director	11/25/2021	 2021.11.25 11:55:25 +01'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen BCTC Technology Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme Luc	11/25/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2100 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2100
Serial Number	SN 47/21 DIP 2G100-625
Product Condition (new / used)	New

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

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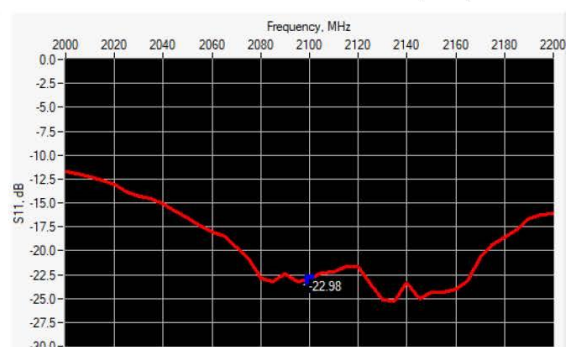

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.13.21.BES.A

Scan Volume	Expanded Uncertainty
1 g	19 % (SAR)
10 g	19 % (SAR)

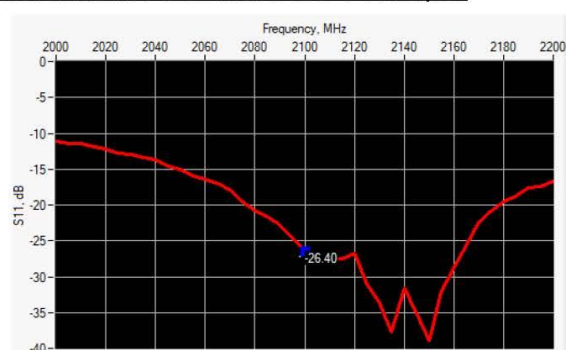
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2100	-22.98	-20	$48.9 \Omega + 7.0 j\Omega$

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2100	-26.40	-20	$53.3 \Omega + 3.5 j\Omega$

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6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ± 1 %		250.0 ± 1 %		6.35 ± 1 %	
450	290.0 ± 1 %		166.7 ± 1 %		6.35 ± 1 %	
750	176.0 ± 1 %		100.0 ± 1 %		6.35 ± 1 %	
835	161.0 ± 1 %		89.8 ± 1 %		3.6 ± 1 %	
900	149.0 ± 1 %		83.3 ± 1 %		3.6 ± 1 %	
1450	89.1 ± 1 %		51.7 ± 1 %		3.6 ± 1 %	
1500	86.2 ± 1 %		50.0 ± 1 %		3.6 ± 1 %	
1640	79.0 ± 1 %		45.7 ± 1 %		3.6 ± 1 %	
1750	75.2 ± 1 %		42.9 ± 1 %		3.6 ± 1 %	
1800	72.0 ± 1 %		41.7 ± 1 %		3.6 ± 1 %	
1900	68.0 ± 1 %		39.5 ± 1 %		3.6 ± 1 %	
1950	66.3 ± 1 %		38.5 ± 1 %		3.6 ± 1 %	
2000	64.5 ± 1 %		37.5 ± 1 %		3.6 ± 1 %	
2100	61.0 ± 1 %	60.73	35.7 ± 1 %	35.97	3.6 ± 1 %	3.62
2300	55.5 ± 1 %		32.6 ± 1 %		3.6 ± 1 %	
2450	51.5 ± 1 %		30.4 ± 1 %		3.6 ± 1 %	
2600	48.5 ± 1 %		28.8 ± 1 %		3.6 ± 1 %	
3000	41.5 ± 1 %		25.0 ± 1 %		3.6 ± 1 %	
3300	-		-		-	
3500	37.0 ± 1 %		26.4 ± 1 %		3.6 ± 1 %	
3700	34.7 ± 1 %		26.4 ± 1 %		3.6 ± 1 %	
3900	-		-		-	
4200	-		-		-	
4600	-		-		-	
4900	-		-		-	

7 VALIDATION MEASUREMENT

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

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7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 10 %		0.87 $\pm$ 10 %	
450	43.5 $\pm$ 10 %		0.87 $\pm$ 10 %	
750	41.9 $\pm$ 10 %		0.89 $\pm$ 10 %	
835	41.5 $\pm$ 10 %		0.90 $\pm$ 10 %	
900	41.5 $\pm$ 10 %		0.97 $\pm$ 10 %	
1450	40.5 $\pm$ 10 %		1.20 $\pm$ 10 %	
1500	40.4 $\pm$ 10 %		1.23 $\pm$ 10 %	
1640	40.2 $\pm$ 10 %		1.31 $\pm$ 10 %	
1750	40.1 $\pm$ 10 %		1.37 $\pm$ 10 %	
1800	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1900	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1950	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2000	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2100	39.8 $\pm$ 10 %	37.7	1.49 $\pm$ 10 %	1.61
2300	39.5 $\pm$ 10 %		1.67 $\pm$ 10 %	
2450	39.2 $\pm$ 10 %		1.80 $\pm$ 10 %	
2600	39.0 $\pm$ 10 %		1.96 $\pm$ 10 %	
3000	38.5 $\pm$ 10 %		2.40 $\pm$ 10 %	
3300	38.2 $\pm$ 10 %		2.71 $\pm$ 10 %	
3500	37.9 $\pm$ 10 %		2.91 $\pm$ 10 %	
3700	37.7 $\pm$ 10 %		3.12 $\pm$ 10 %	
3900	37.5 $\pm$ 10 %		3.32 $\pm$ 10 %	
4200	37.1 $\pm$ 10 %		3.63 $\pm$ 10 %	
4600	36.7 $\pm$ 10 %		4.04 $\pm$ 10 %	
4900	36.3 $\pm$ 10 %		4.35 $\pm$ 10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.13.21.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: ϵ_{ps}^* : 37.7 σ : 1.61
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=5mm$
Frequency	2100 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6	45.63 (4.56)	21.9	21.80 (2.18)
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3300	-		-	
3500	67.1		25	
3700	67.4		24.2	
3900	-		-	
4200	-		-	
4600	-		-	
4900	-		-	

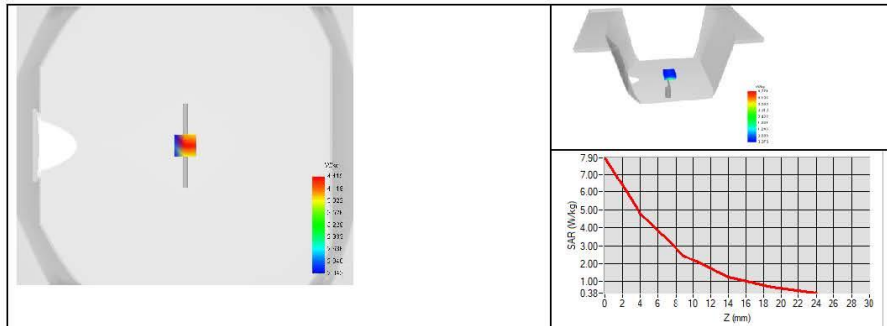
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.13.21.BES.A



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7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ± 10 %		0.80 ± 10 %	
300	58.2 ± 10 %		0.92 ± 10 %	
450	56.7 ± 10 %		0.94 ± 10 %	
750	55.5 ± 10 %		0.96 ± 10 %	
835	55.2 ± 10 %		0.97 ± 10 %	
900	55.0 ± 10 %		1.05 ± 10 %	
915	55.0 ± 10 %		1.06 ± 10 %	
1450	54.0 ± 10 %		1.30 ± 10 %	
1610	53.8 ± 10 %		1.40 ± 10 %	
1800	53.3 ± 10 %		1.52 ± 10 %	
1900	53.3 ± 10 %		1.52 ± 10 %	
2000	53.3 ± 10 %		1.52 ± 10 %	
2100	53.2 ± 10 %	55.1	1.62 ± 10 %	1.77
2300	52.9 ± 10 %		1.81 ± 10 %	
2450	52.7 ± 10 %		1.95 ± 10 %	
2600	52.5 ± 10 %		2.16 ± 10 %	
3000	52.0 ± 10 %		2.73 ± 10 %	
3300	51.6 ± 10 %		3.08 ± 10 %	
3500	51.3 ± 10 %		3.31 ± 10 %	
3700	51.0 ± 10 %		3.55 ± 10 %	
3900	50.8 ± 10 %		3.78 ± 10 %	
4200	50.4 ± 10 %		4.13 ± 10 %	
4600	49.8 ± 10 %		4.60 ± 10 %	
4900	49.4 ± 10 %		4.95 ± 10 %	
5200	49.0 ± 10 %		5.30 ± 10 %	
5300	48.9 ± 10 %		5.42 ± 10 %	
5400	48.7 ± 10 %		5.53 ± 10 %	
5500	48.6 ± 10 %		5.65 ± 10 %	
5600	48.5 ± 10 %		5.77 ± 10 %	
5800	48.2 ± 10 %		6.00 ± 10 %	

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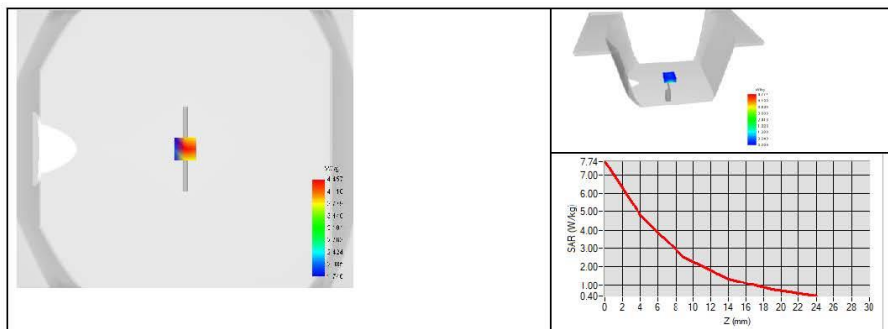

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.13.21.BES.A

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Body Liquid Values: $\epsilon_{ps}' : 55.1$ $\sigma : 1.77$
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=5mm$
Frequency	2100 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2100	45.05 (4.51)	21.33 (2.13)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Calipers	Mitutoyo	SN 0009732	10/2019	10/2022
Reference Probe	MVG	SN 41/18 EPGO333	10/2021	10/2022
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2019	11/2022
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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**SAR Reference Dipole Calibration Report**

Ref : ACR.329.15.21.BES.A

SHENZHEN BCTC TECHNOLOGY CO., LTD.

**1 ~2/ F, NO. B FACTORY BUILDING, PENGZHOU
INDUSTRIAL PARK, FUYUAN 1ST ROAD,
TANGWEI COMMUNITY, FUHAI STREET, BAO'AN
DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE**

FREQUENCY: 2450 MHZ**SERIAL NO.: SN 47/21 DIP 2G450-627****Calibrated at MVG****Z.I. de la pointe du diable**

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

Calibration date: 11/25/2021

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

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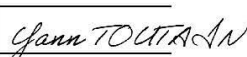
Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.15.21.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Checked by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Approved by :</i>	Yann Toutain	Laboratory Director	11/25/2021	 2021.11.25 11:56:55 +01'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen BCTC Technology Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme Luc	11/25/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2450
Serial Number	SN 47/21 DIP 2G450-627
Product Condition (new / used)	New

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

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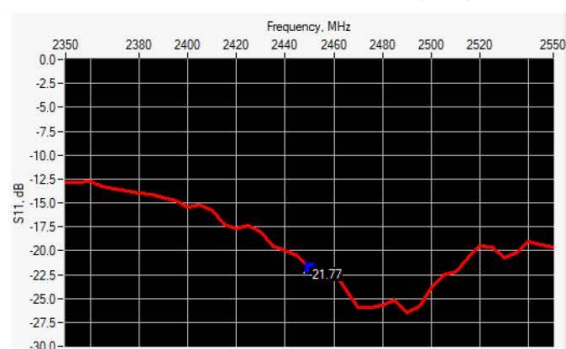

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Ref: ACR.329.15.21.BES.A

Scan Volume	Expanded Uncertainty
1 g	19 % (SAR)
10 g	19 % (SAR)

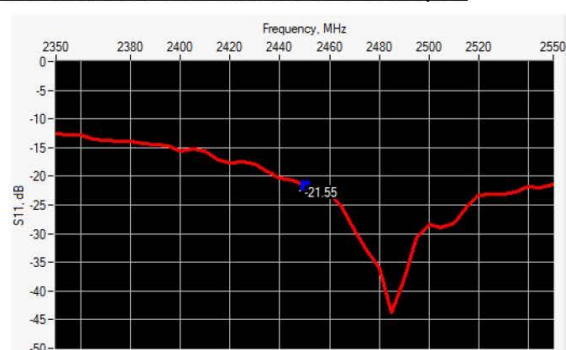
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-21.77	-20	$49.1 \Omega + 8.1 j\Omega$

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-21.55	-20	$54.7 \Omega + 6.8 j\Omega$

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6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ± 1 %		250.0 ± 1 %		6.35 ± 1 %	
450	290.0 ± 1 %		166.7 ± 1 %		6.35 ± 1 %	
750	176.0 ± 1 %		100.0 ± 1 %		6.35 ± 1 %	
835	161.0 ± 1 %		89.8 ± 1 %		3.6 ± 1 %	
900	149.0 ± 1 %		83.3 ± 1 %		3.6 ± 1 %	
1450	89.1 ± 1 %		51.7 ± 1 %		3.6 ± 1 %	
1500	86.2 ± 1 %		50.0 ± 1 %		3.6 ± 1 %	
1640	79.0 ± 1 %		45.7 ± 1 %		3.6 ± 1 %	
1750	75.2 ± 1 %		42.9 ± 1 %		3.6 ± 1 %	
1800	72.0 ± 1 %		41.7 ± 1 %		3.6 ± 1 %	
1900	68.0 ± 1 %		39.5 ± 1 %		3.6 ± 1 %	
1950	66.3 ± 1 %		38.5 ± 1 %		3.6 ± 1 %	
2000	64.5 ± 1 %		37.5 ± 1 %		3.6 ± 1 %	
2100	61.0 ± 1 %		35.7 ± 1 %		3.6 ± 1 %	
2300	55.5 ± 1 %		32.6 ± 1 %		3.6 ± 1 %	
2450	51.5 ± 1 %	51.37	30.4 ± 1 %	30.45	3.6 ± 1 %	3.60
2600	48.5 ± 1 %		28.8 ± 1 %		3.6 ± 1 %	
3000	41.5 ± 1 %		25.0 ± 1 %		3.6 ± 1 %	
3300	-		-		-	
3500	37.0 ± 1 %		26.4 ± 1 %		3.6 ± 1 %	
3700	34.7 ± 1 %		26.4 ± 1 %		3.6 ± 1 %	
3900	-		-		-	
4200	-		-		-	
4600	-		-		-	
4900	-		-		-	

7 VALIDATION MEASUREMENT

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

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7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 10 %		0.87 $\pm$ 10 %	
450	43.5 $\pm$ 10 %		0.87 $\pm$ 10 %	
750	41.9 $\pm$ 10 %		0.89 $\pm$ 10 %	
835	41.5 $\pm$ 10 %		0.90 $\pm$ 10 %	
900	41.5 $\pm$ 10 %		0.97 $\pm$ 10 %	
1450	40.5 $\pm$ 10 %		1.20 $\pm$ 10 %	
1500	40.4 $\pm$ 10 %		1.23 $\pm$ 10 %	
1640	40.2 $\pm$ 10 %		1.31 $\pm$ 10 %	
1750	40.1 $\pm$ 10 %		1.37 $\pm$ 10 %	
1800	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1900	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
1950	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2000	40.0 $\pm$ 10 %		1.40 $\pm$ 10 %	
2100	39.8 $\pm$ 10 %		1.49 $\pm$ 10 %	
2300	39.5 $\pm$ 10 %		1.67 $\pm$ 10 %	
2450	39.2 $\pm$ 10 %	36.4	1.80 $\pm$ 10 %	1.96
2600	39.0 $\pm$ 10 %		1.96 $\pm$ 10 %	
3000	38.5 $\pm$ 10 %		2.40 $\pm$ 10 %	
3300	38.2 $\pm$ 10 %		2.71 $\pm$ 10 %	
3500	37.9 $\pm$ 10 %		2.91 $\pm$ 10 %	
3700	37.7 $\pm$ 10 %		3.12 $\pm$ 10 %	
3900	37.5 $\pm$ 10 %		3.32 $\pm$ 10 %	
4200	37.1 $\pm$ 10 %		3.63 $\pm$ 10 %	
4600	36.7 $\pm$ 10 %		4.04 $\pm$ 10 %	
4900	36.3 $\pm$ 10 %		4.35 $\pm$ 10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.15.21.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: ϵ_{ps}^* : 36.4 σ : 1.96
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=5mm$
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4	55.16 (5.52)	24	24.15 (2.41)
2600	55.3		24.6	
3000	63.8		25.7	
3300	-		-	
3500	67.1		25	
3700	67.4		24.2	
3900	-		-	
4200	-		-	
4600	-		-	
4900	-		-	

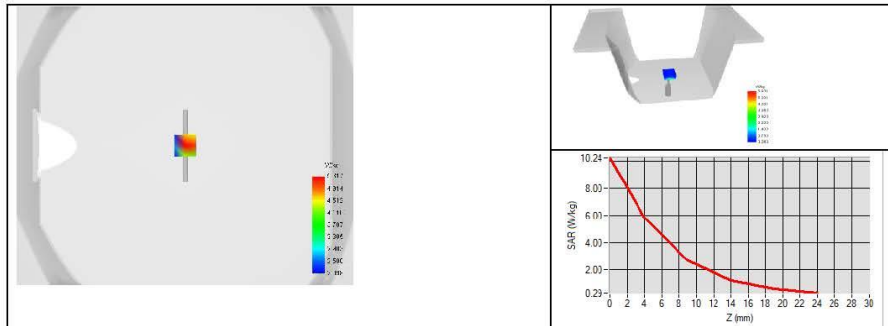
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7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ± 10 %		0.80 ± 10 %	
300	58.2 ± 10 %		0.92 ± 10 %	
450	56.7 ± 10 %		0.94 ± 10 %	
750	55.5 ± 10 %		0.96 ± 10 %	
835	55.2 ± 10 %		0.97 ± 10 %	
900	55.0 ± 10 %		1.05 ± 10 %	
915	55.0 ± 10 %		1.06 ± 10 %	
1450	54.0 ± 10 %		1.30 ± 10 %	
1610	53.8 ± 10 %		1.40 ± 10 %	
1800	53.3 ± 10 %		1.52 ± 10 %	
1900	53.3 ± 10 %		1.52 ± 10 %	
2000	53.3 ± 10 %		1.52 ± 10 %	
2100	53.2 ± 10 %		1.62 ± 10 %	
2300	52.9 ± 10 %		1.81 ± 10 %	
2450	52.7 ± 10 %	53.4	1.95 ± 10 %	2.14
2600	52.5 ± 10 %		2.16 ± 10 %	
3000	52.0 ± 10 %		2.73 ± 10 %	
3300	51.6 ± 10 %		3.08 ± 10 %	
3500	51.3 ± 10 %		3.31 ± 10 %	
3700	51.0 ± 10 %		3.55 ± 10 %	
3900	50.8 ± 10 %		3.78 ± 10 %	
4200	50.4 ± 10 %		4.13 ± 10 %	
4600	49.8 ± 10 %		4.60 ± 10 %	
4900	49.4 ± 10 %		4.95 ± 10 %	
5200	49.0 ± 10 %		5.30 ± 10 %	
5300	48.9 ± 10 %		5.42 ± 10 %	
5400	48.7 ± 10 %		5.53 ± 10 %	
5500	48.6 ± 10 %		5.65 ± 10 %	
5600	48.5 ± 10 %		5.77 ± 10 %	
5800	48.2 ± 10 %		6.00 ± 10 %	

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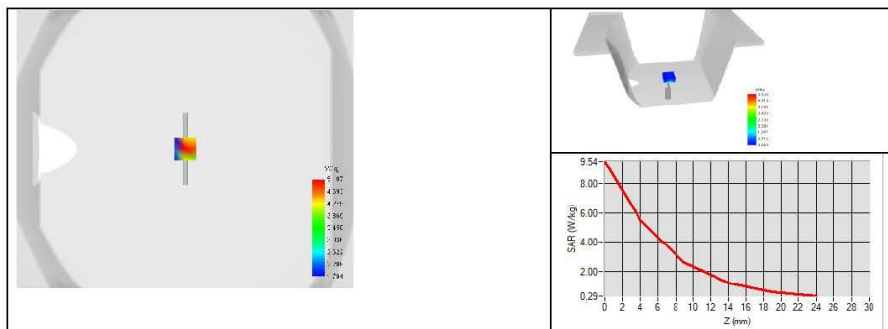

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.15.21.BES.A

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Body Liquid Values: eps' : 53.4 sigma : 2.14
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2450	52.28 (5.23)	22.68 (2.27)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Calipers	Mitutoyo	SN 0009732	10/2019	10/2022
Reference Probe	MVG	SN 41/18 EPG0333	10/2021	10/2022
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2019	11/2022
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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**SAR Reference Dipole Calibration Report**

Ref : ACR.329.17.21.BES.A

SHENZHEN BCTC TECHNOLOGY CO., LTD.
1 ~2/ F, NO. B FACTORY BUILDING, PENGZHOU
INDUSTRIAL PARK, FUYUAN 1ST ROAD, TANGWEI
COMMUNITY, FUHAI STREET, BAO'AN DISTRICT,
SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR
REFERENCE DIPOLE
FREQUENCY: 5200-5800 MHZ
SERIAL NO.: SN 47/21 DIP 5G000-629

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

Calibration date: 11/25/2021



Accreditations #2-6789 and #2-6814
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Summary:

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.329.17.21.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Checked by :</i>	Jérôme Luc	Technical Manager	11/25/2021	
<i>Approved by :</i>	Yann Toutain	Laboratory Director	11/25/2021	 2021.11.25 11:58:11 +01'00'

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen BCTC Technology Co., Ltd.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Jérôme Luc	11/25/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 5200-5800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID5000
Serial Number	SN 47/21 DIP 5G000-629
Product Condition (new / used)	New

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.08 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	19 % (SAR)
10 g	19 % (SAR)

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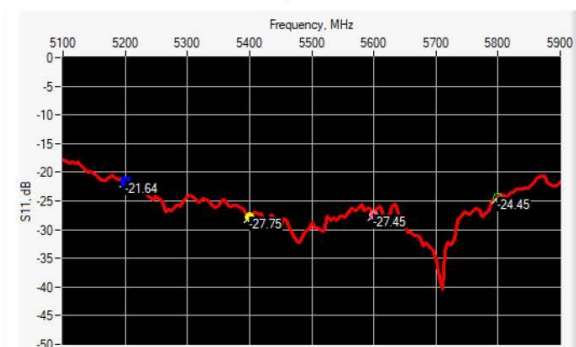
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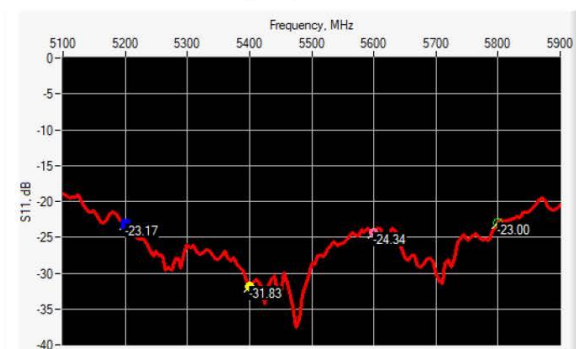
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-21.64	-20	$54.48 \Omega - 6.92 j\Omega$
5400	-27.75	-20	$50.97 \Omega + 3.98 j\Omega$
5600	-27.45	-20	$54.05 \Omega + 1.24 j\Omega$
5800	-24.45	-20	$45.31 \Omega + 3.71 j\Omega$

6.2 RETURN LOSS IN BODY LIQUID



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SAR REFERENCE DIPOLE CALIBRATION REPORT

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Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-23.17	-20	54.03 Ω - 5.62 j Ω
5400	-31.83	-20	51.01 Ω + 2.35 j Ω
5600	-24.34	-20	55.50 Ω + 2.51 j Ω
5800	-23.00	-20	43.65 Ω + 3.06 j Ω

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
5000 to 6000	20.6 $\pm$ 1 %	20.62	40.3 $\pm$ 1 %	40.45	3.6 $\pm$ 1 %	3.61

7 VALIDATION MEASUREMENT

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
5000	36.2 $\pm$ 10 %		4.45 $\pm$ 10 %	
5100	36.1 $\pm$ 10 %		4.56 $\pm$ 10 %	
5200	36.0 $\pm$ 10 %	34.44	4.66 $\pm$ 10 %	4.64
5300	35.9 $\pm$ 10 %		4.76 $\pm$ 10 %	
5400	35.8 $\pm$ 10 %	33.63	4.86 $\pm$ 10 %	4.88
5500	35.6 $\pm$ 10 %		4.97 $\pm$ 10 %	
5600	35.5 $\pm$ 10 %	32.80	5.07 $\pm$ 10 %	5.12
5700	35.4 $\pm$ 10 %		5.17 $\pm$ 10 %	
5800	35.3 $\pm$ 10 %	32.63	5.27 $\pm$ 10 %	5.31
5900	35.2 $\pm$ 10 %		5.38 $\pm$ 10 %	
6000	35.1 $\pm$ 10 %		5.48 $\pm$ 10 %	

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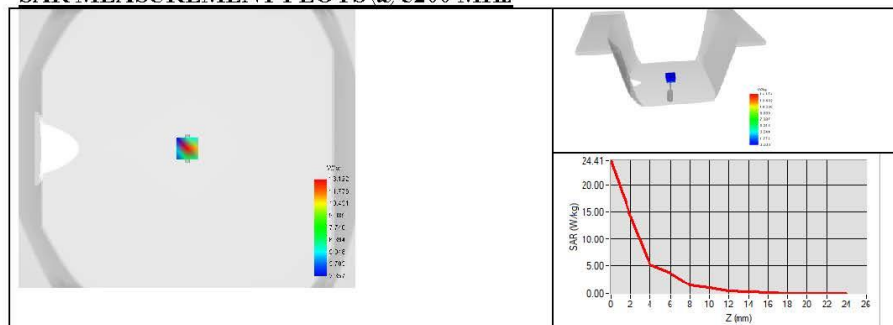
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7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

At those frequencies, the target SAR value can not be generic. Hereunder is the target SAR value defined by MVG, within the uncertainty for the system validation. All SAR values are normalized to 1 W net power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values 5200 MHz: eps' :34.44 sigma : 4.64 Head Liquid Values 5400 MHz: eps' :33.63 sigma : 4.88 Head Liquid Values 5600 MHz: eps' :32.80 sigma : 5.12 Head Liquid Values 5800 MHz: eps' :32.63 sigma : 5.31
Distance between dipole and liquid	10 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency (MHz)	1 g SAR (W/kg)		10 g SAR (W/kg)	
	required	measured	required	measured
5200	76.50	76.41 (7.64)	21.60	21.86 (2.19)
5400	-	80.52 (8.05)	-	22.91 (2.29)
5600	-	79.08 (7.91)	-	22.73 (2.27)
5800	78.00	76.49 (7.65)	21.90	22.03 (2.20)

SAR MEASUREMENT PLOTS @ 5200 MHz


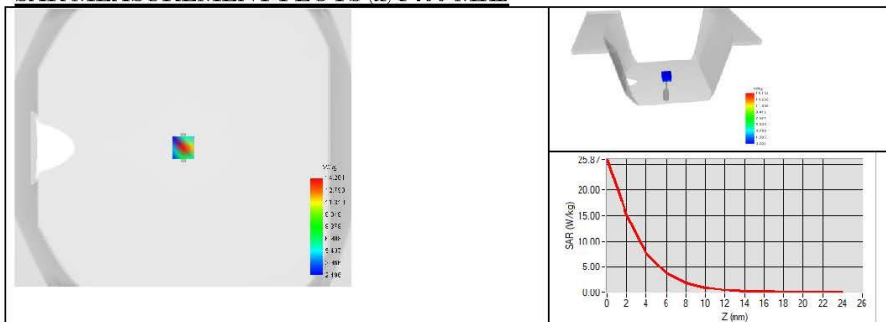
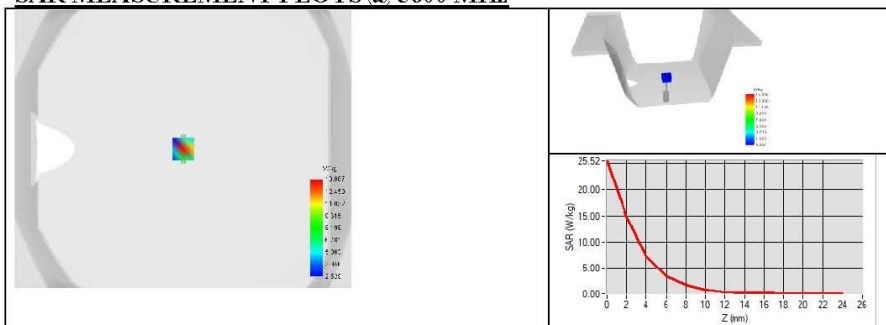
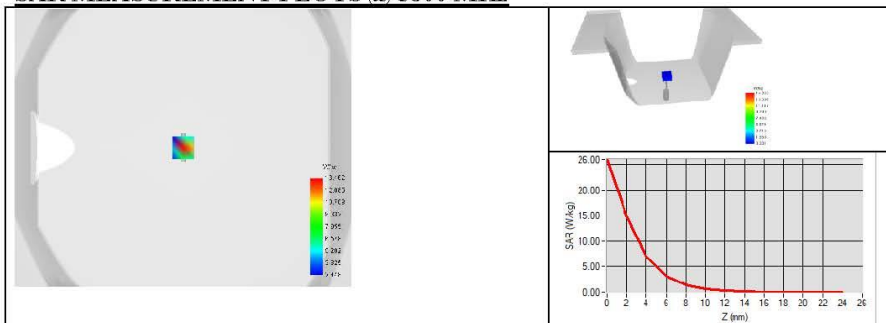
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SAR REFERENCE DIPOLE CALIBRATION REPORT

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SAR MEASUREMENT PLOTS @ 5400 MHz

SAR MEASUREMENT PLOTS @ 5600 MHz

SAR MEASUREMENT PLOTS @ 5800 MHz


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7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
5200	49.0 ± 10 %	45.50	5.30 ± 10 %	5.63
5300	48.9 ± 10 %		5.42 ± 10 %	
5400	48.7 ± 10 %	44.78	5.53 ± 10 %	5.95
5500	48.6 ± 10 %		5.65 ± 10 %	
5600	48.5 ± 10 %	44.85	5.77 ± 10 %	6.26
5800	48.2 ± 10 %	44.45	6.00 ± 10 %	6.58

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Body Liquid Values 5200 MHz: ϵ_r :45.50 sigma : 5.63 Body Liquid Values 5400 MHz: ϵ_r :44.78 sigma : 5.95 Body Liquid Values 5600 MHz: ϵ_r :44.85 sigma : 6.26 Body Liquid Values 5800 MHz: ϵ_r :44.45 sigma : 6.58
Distance between dipole and liquid	10 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency (MHz)	1 g SAR (W/kg)	10 g SAR (W/kg)
	measured	measured
5200	73.02 (7.30)	20.58 (2.06)
5400	77.86 (7.79)	21.85 (2.19)
5600	79.90 (7.99)	22.73 (2.27)
5800	71.90 (7.19)	20.50 (2.05)

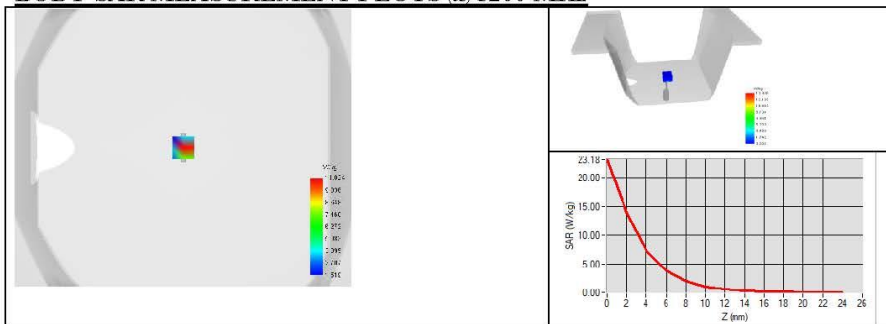
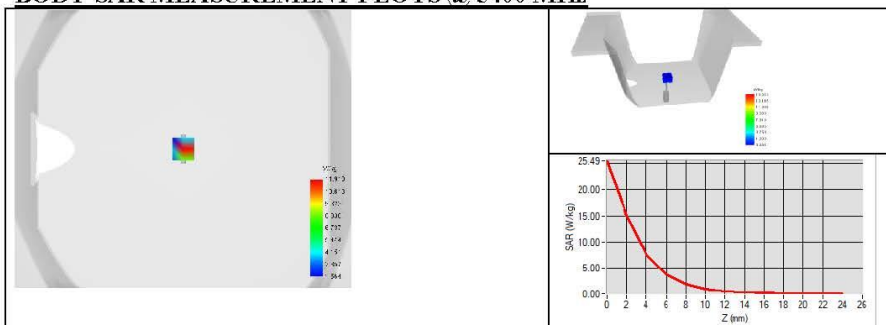
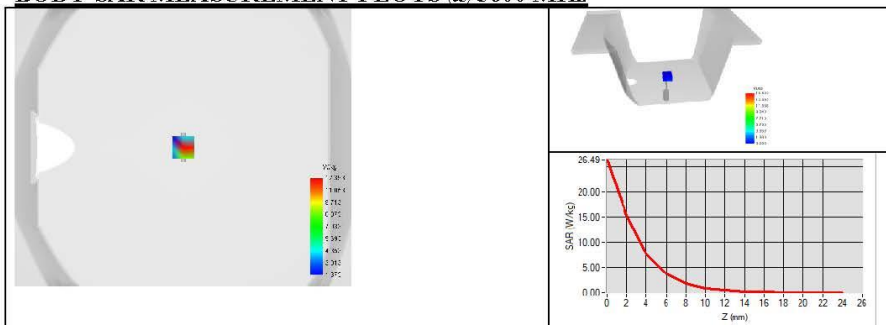
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BODY SAR MEASUREMENT PLOTS @ 5200 MHz

BODY SAR MEASUREMENT PLOTS @ 5400 MHz

BODY SAR MEASUREMENT PLOTS @ 5600 MHz


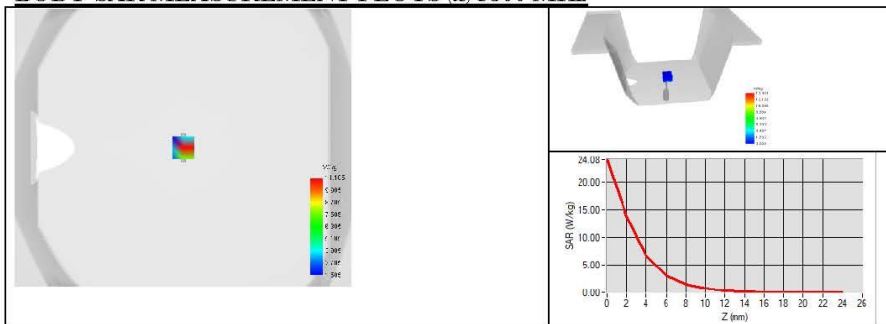
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BODY SAR MEASUREMENT PLOTS @ 5800 MHz



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2022
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	05/2019	05/2022
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Calipers	Mitutoyo	SN 0009732	10/2019	10/2022
Reference Probe	MVG	SN 41/18 EPG0333	10/2021	10/2022
Multimeter	Keithley 2000	1160271	02/2020	02/2023
Signal Generator	Rohde & Schwarz SMB	106589	04/2019	04/2022
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2019	11/2022
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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STATEMENT

1. The equipment lists are traceable to the national reference standards.
2. The test report can not be partially copied unless prior written approval is issued from our lab.
3. The test report is invalid without the "special seal for inspection and testing".
4. The test report is invalid without the signature of the approver.
5. The test process and test result is only related to the Unit Under Test.
6. Sample information is provided by the client and the laboratory is not responsible for its authenticity.
7. The quality system of our laboratory is in accordance with ISO/IEC17025.
8. If there is any objection to this test report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

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***** END *****

