BCTC

SAR TEST REPORT

Report No.:	BCTC2212286468-1E
Applicant:	Telecell Mobile (H.K) Ltd.
Product Name:	3G Deskphone
Model/Type Ref.:	FPW385
Tested Date:	2022-12-08 to 2023-01-10
Issued Date:	2023-01-11

Shenzhen BCTC Testing Co., Ltd.

BCTC TESTING CO., LTD SHENZHEN BCTC APPROVED 倍测检测

FCC ID: 2ADX3FPW385

Product Name:	3G Deskphone
Trademark:	gtt
Model/Type Ref.:	FPW385
Applicant:	Telecell Mobile (H.K) Ltd.
Address:	RM 801 Metro Ctr II, 21 Lam Hing Street. Kln Bay, Hong Kong
Manufacturer:	Telecell Mobile (H.K) Ltd.
Address:	RM 801 Metro Ctr II, 21 Lam Hing Street. Kln Bay, Hong Kong
Prepared By:	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
Sample Received Date:	2022-12-08
Sample tested Date:	2022-12-08 to 2023-01-10
Issue Date:	2023-01-11
Test Standards:	IEEE Std C95.1, 2019/ IEEE Std 1528™-2013/FCC Part 2.1093
Test Results:	PASS
Remark:	This is SAR test report

Tested by:	Approved by:
Jack Li	
Jack Li/Project Handler	Zero Zhou/Reviewer

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Table Of Content

(Note: N/A Means Not Applicable)

1. Version

Report No.	Issue Date	Description	Approved
BCTC2212286468-1E	2023-01-11	Original	Valid

2. Test Standards

IEEE Std C95.1-2019: IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz.It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.
IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.
FCC Part 2.1093 Radiofrequency Radiation Exposure Evaluation:Portable Devices
KDB447498 D01 General RF Exposure Guidance v06 : Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB447498 D02 SAR Procedures for Dongle Xmtr v02r01: SAR Measurement Procedures For USB Dongle Transmitters.
KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 : SAR Measurement Requirements for 100 MHz to 6 GHz
KDB865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations
KDB941225 D01 3G SAR Procedures: 3G SAR MEAUREMENT PROCEDURES
KDB 616217 D04 SAR for laptop and tablets v01r02: SAR EVALUATION CONSIDERATIONS FOR LAPTOP, NOTEBOOK, NETBOOK AND TABLET COMPUTERS

3. Test Summary

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

Frequency Band	Head SAR	Body (0mm Gap)	SAR_{1g} Limit (W/kg)
	Report SAR_{1g} (W/kg)	Report SAR_{1g} (W/kg)	
GSM 850	N/A	0.107	1.6
GSM1900	N/A	0.171	1.6
WCDMA Band V	N/A	0.118	1.6
WCDMA Band II	N/A	**0.185**	1.6

The device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2019, and had been tested in accordance with the measurement methods and procedure specified in IEEE 1528-2013.

4. SAR Limits

FCC Limit (1g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average(averaged over the whole body)	0.08	0.4
Spatial Peak(averaged over any 1 g of tissue)	1.6	8.0
Spatial Peak(hands/wrists/ feet/anklesaveraged over 10 g)	4.0	20.0

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.
Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

5. Measurement Uncertainty

Not required as SAR measurement uncertainty analysis is required in SAR reports only when the highestmeasured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR accoridng to KDB865664D01.

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 UC , k=2					21.26 %	21.08%	

6. Product Information And Test Setup

6.1 Product Information

Model/Type Ref.:	FPW385
Model differences:	N/A
Connecting I/O Port(s)	Please refer to the User's Manual
Hardware Version:	N/A
Software Version:	N/A
Ratings:	DC 5V from adapter, DC 3.7V from battery
Adapter:	Model No.: FPW385 Input: AC 100-240V, 50/60Hz Output: DC 5V 0.5A

2,3G

Operation Frequency:	GSM/GPRS/EGPRS 850: TX: 824~849MHz; RX: 869~894MHz; GSM/GPRS/EGPRS 1900: TX:1850~1910MHz; RX:1930~1990MHz; WCDMA Band II: TX: 1852.40~1907.60MHz; Rx: 1932.60~1987.40MHz; WCDMA Band V: TX: 826.40~846.60MHz; RX: 871.40~ 891.60MHz;
GPRS Class:	Class 12
Max RF Output Power:	GSM/GPRS/EGPRS 850: 32.00dBm, GSM/GPRS/EGPRS 1900: 28.58dBm WCDMA Band II: 22.26 dBm WCDMA Band V: 22.71 dBm
Type of Modulation:	GSM with GMSK Modulation WCDMA Mode with BPSK Modulation HSDPA Mode with QPSK, 16QAM Modulation HSUPA Mode with QPSK, 16QAM Modulation
Type of Emission:	GSM/GPRS 850: 250KGXW EGPRS 850: 258KG7W GSM/GPRS 1900: 250KGXW EGPRS 1900: 254KG7W WCDMA Band II: 4M11F9W WCDMA Band V: 4M12F9W
Antenna installation:	External antenna
Antenna Gain:	GSM850: 2 dBi GSM1900: 2 dBi WCDMA Band II: 2 dBi WCDMA Band V: 2 dBi
Remark:	The antenna gain of the product is provided by the customer, and the test data is affected by the customer information.

6.2 Test Setup Configuration

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

6.3 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.

6.4 Test Environment

1. Normal Test Conditions:

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

2.Extreme Test Conditions:
N/A

7. Test Facility And Test Instrument Used

7.1 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.

7.2 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	Nov. 18, 2022	Nov. 17, 2023
DIPOLE 835	SATIMO	SID 835	SN 47/21 DIP 0G835-621	Nov. 20, 2021	Nov. 19, 2024
DIPOLE 1800	SATIMO	SID 1800	SN 47/21 DIP 1G800-623	Nov. 20, 2021	Nov. 19, 2024
COMOSAR OPENCoaxial Probe	SATIMO	\	\	Nov. 20, 2021	Nov. 19, 2022
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. 18, 2022	Nov. 17, 2023
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

Note:
Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three year extended calibration interval. Each measured dipole is expected to evalute with following criteria at least on annual interval.

5 There is no physical damage on the dipole;
6 System check with specific dipole is within 10% of calibrated values;

7 The most recent return-loss results,measued at least annually,deviates by no more than 20% from the previous measurement;

8 The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the provious measurement.

Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

8. Specific Absorption Rate (SAR)

8.1 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 techiques 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.

8.2 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:

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

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

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

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

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

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

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.

9. SAR Measurement System

9.1 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

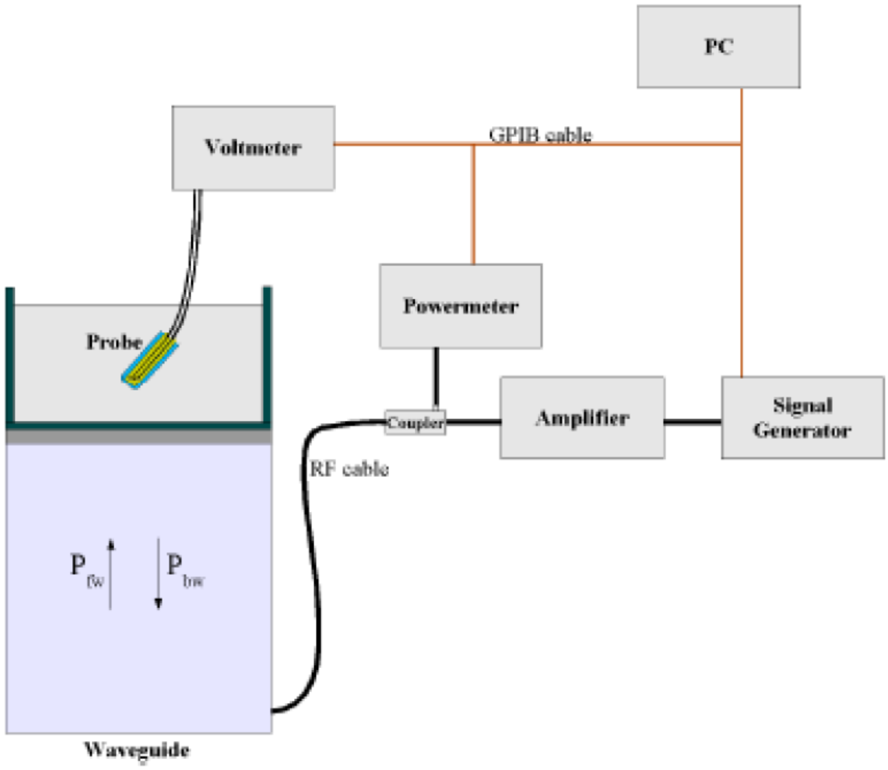
The following figure shows the system.

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.

9.2 Probe

For the measurements the Specific Dosimetric E-Field Probe SN 46/21 EPGO362 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:1ess than 30°
Probe calibration is realized, in compliance with EN 62209-1 and IEEE 1528 STD, with CALISAR, Antennessa 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 :
Pfw = Forward Power
Pbw = 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)/Vlin(N) (N=1,2,3)

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

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

where DCP is the diode compression point in mV.

9.3 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.

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

Where:

Δt = exposure time (30 seconds),

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

ΔT = temperature increase due to RF exposure.

SAR is proportional to ΔT/Δt, 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,

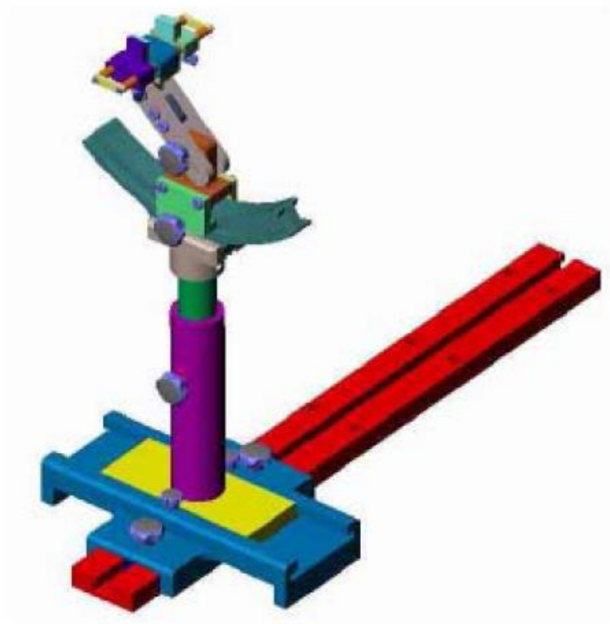
ρ = Tissue density (1.25 g/cm3 for brain tissue)

9.4 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.

9.5 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

10. Tissue Simulating Liquids

10.1 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

10.2 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

10.3 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 Permitivity (F/m)	Target Conductivity (S/m)	Measured Permitivity (F/m)	Measured Conductivity (S/m)	Deviation Perm.|Cond.(%)	Date	Temp. Ambient|TSL (°C)
835	Head	41.5	0.90	40.8	0.97	-1.69|7.78	12/08/2022	20.0
1800	Head	40.0	1.40	39.2	1.52	-2.00|8.57	12/28/2022	20.0

11. SAR Measurement Evaluation

11.1 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.

11.2 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.

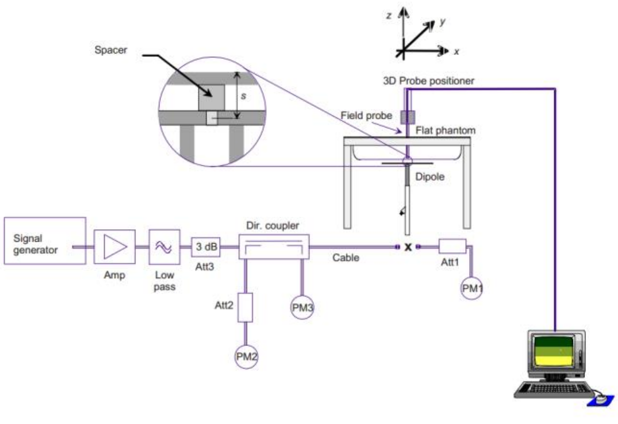


Figure B.1 – Set-up for the system check

11.3 Validation Results

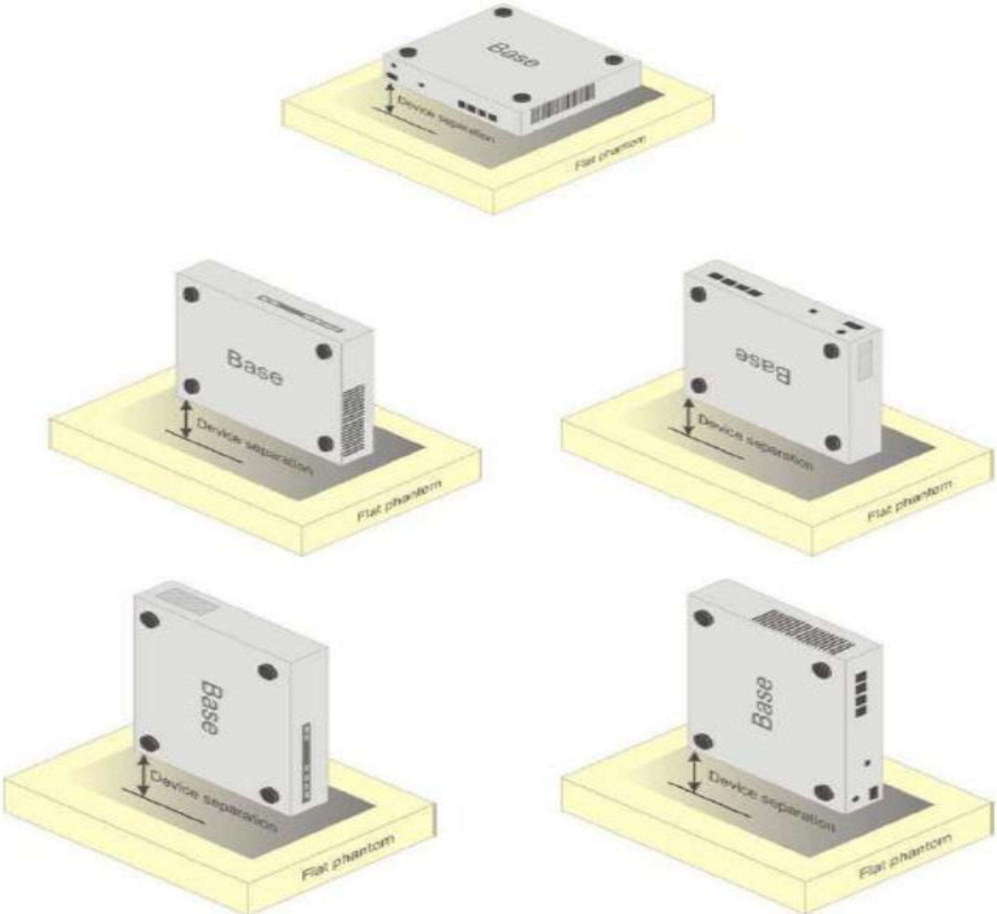
Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10 %. The following table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion.

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	835	100 mW	0.987	0.638	-0.33	9.56	6.22	3.24%	2.57%	20.0	12/08/2022
		Normalize to 1 Watt	9.87	6.38							
Head	1800	100 mW	3.940	1.995	0.07	38.4	20.1	2.60%	-0.50%	20.0	12/28/2022
		Normalize to 1 Watt	39.4	20.0							

12. EUT Testing Position

12.1 Body Position

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

13. SAR Measurement Procedures

13.1 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

13.2 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 form 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

13.3 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.

13.4 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.

13.5 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.

13.6 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.

14. SAR Test Result

14.1 Conducted RF Output Power

According KDB 447498 D01 General RF Exposure Guidance v06 Section 4.1 2) states that “Unless it is specified differently in the published RF exposure KDB procedures, these requirements also apply to test reduction and test exclusion considerations. Time-averaged maximum conducted output power applies to SAR and, as required by § 2.1091(c), time-averaged ERP applies to MPE. When an antenna port is not available on the device to support conducted power measurement, such as FRS and certain Part 15 transmitters with built-in integral antennas, the maximum output power allowed for production units should be used to determine RF exposure test exclusion and compliance.”

<GSM Conducted Power>
General Note:
1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. According to October 2013TCB Workshop, for GSM / GPRS / EGPRS, the number of time slots to test for SAR should correspond to the highest frame-average maximum output power configuration, considering the possibility of e.g. 3rd party VoIP operation for head and body-worn SAR testing, the EUT was set in GPRS (4Tx slot) for GSM850/GSM1900 band due to their highest frame-average power.
3. For hotspot mode SAR testing, GPRS should be evaluated, therefore the EUT was set in GPRS (4 Tx slots) for GSM850/GSM1900 band due to its highest frame-average power.

Conducted power measurement results for GSM850/PCS1900

GSM 850		Tune-up	Burst Conducted power (dBm)			Division Factors	Tune-up	Average power (dBm)		
			Channel/Frequency(MHz)					Channel/Frequency(MHz)		
		Max	128/ 824.2	190/ 836.6	251/ 848.8		Max	128/ 824.2	190/ 836.6	251/8 48.8
GSM		32.00	32.00	31.97	31.90	-9.03dB	22.97	22.97	22.94	22.87
GPRS (GMSK)	1TX slot	32.00	31.57	31.52	31.45	-9.03dB	22.97	22.54	22.49	22.42
	2TX slot	**30.00**	**29.91**	**29.85**	**29.80**	**-6.02dB**	**23.98**	**23.89**	**23.83**	**23.78**
	3TX slot	28.50	28.03	28.01	27.95	-4.26dB	24.24	23.77	23.75	23.69
	4TX slot	26.50	26.01	25.96	25.94	-3.01dB	23.49	23.00	22.95	22.93
EGPRS (8PSK)	1TX slot	29.00	28.97	28.82	28.90	-9.03dB	19.97	19.94	19.79	19.87
	2TX slot	28.50	28.12	28.34	28.46	-6.02dB	22.48	22.10	22.32	22.44
	3TX slot	27.00	26.98	26.66	26.57	-4.26dB	22.74	22.72	22.40	22.31
	4TX slot	25.00	24.01	24.41	24.96	-3.01dB	21.99	21.00	21.40	21.95
GSM 1900		Tune-up	Burst Conducted power (dBm)			Division Factors	Tune-up	Average power (dBm)		
			Channel/Frequency(MHz)					Channel/Frequency(MHz)		
		Max	512/ 1850.2	661/ 1880	810/ 1909.8		Max.	512/ 1850.2	661/ 1880	810/ 1909. 8
GSM		29.00	28.58	28.40	28.31	-9.03dB	19.97	19.55	19.37	19.28
GPRS (GMSK)	1TX slot	28.50	28.03	27.90	27.77	-9.03dB	19.47	19.00	18.87	18.74
	2TX slot	25.50	25.49	25.36	25.28	-6.02dB	19.48	19.47	19.34	19.26
	3TX slot	**25.00**	**24.61**	**24.46**	**24.44**	**-4.26dB**	**20.74**	**20.35**	**20.20**	**20.18**
	4TX slot	23.00	22.60	22.48	22.42	-3.01dB	19.99	19.59	19.47	19.41
EGPRS (8PSK)	1TX slot	23.00	22.56	21.86	22.08	-9.03dB	13.97	13.53	12.83	13.05
	2TX slot	23.00	22.64	21.23	21.45	-6.02dB	16.98	16.62	15.21	15.43
	3TX slot	20.50	20.42	18.97	19.34	-4.26dB	16.24	16.16	14.71	15.08

	4TX slot	18.50	18.03	16.50	16.79	-3.01dB	15.49	15.02	13.49	13.78

Notes:
1. Division Factors
To average the power, the division factor is as follows:
1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.00dB
2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.00dB
3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB
4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.00dB
2. According to the conducted power as above, the GPRS measurements are performed with 2Txslot for GPRS850 and 3Txslot GPRS1900.
<UMTS Conducted Power>
The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.A summary of these settings are illustrated below:

HSDPA Setup Configuration:
a. The EUT was connected to Base Station E5515C referred to theSetup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (βc and βd) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c , and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c .
Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configuration:
a. The EUT was connected to Base StationR&S CMU200 referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.

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

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

General Note
1. Per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If AMR 12.2kbps power is < 0.25dB higher than RMC 12.2kbps, SAR tests with AMR 12.2kbps can be excluded.
2. By design, AMR and HSDPA/HSUPA RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.
3. It is expected by the manufacturer that MPR for some HSDPA/HSUPA subtests may differ from the specification of 3GPP, according to the chipset implementation in this model. The implementation and expected deviation are detailed in tune-up procedure exhibit.

Conducted Power Measurement Results(WCDMA Band II/V)

Band	**WCDMA Band II**		
Channel	**9262**	**9400**	**9538**
Frequency(MHz)	**1852.4**	**1880.0**	**1907.6**
WCDMA RMC 12.2K	**22.26**	20.89	20.01
HSDPA Subtest-1	20.81	19.48	18.71
HSDPA Subtest-2	20.15	19.06	18.49
HSDPA Subtest-3	19.96	18.71	17.92

HSDPA Subtest-4	19.95	19.04	18.27
HSUPA Subtest-1	20.28	19.00	18.30
HSUPA Subtest-2	20.17	19.22	18.40
HSUPA Subtest-3	19.86	19.19	18.37
HSUPA Subtest-4	20.18	19.15	18.55
HSUPA Subtest-5	19.97	19.22	18.47

Band	**WCDMA Band V**		
Channel	**4132**	**4182**	**4233**
Frequency(MHz)	**826.4**	**836.4**	**846.6**
WCDMA RMC 12.2K	22.63	**22.71**	22.24
HSDPA Subtest-1	21.84	21.74	21.81
HSDPA Subtest-2	21.56	21.35	21.24
HSDPA Subtest-3	21.13	20.58	21.22
HSDPA Subtest-4	21.07	21.09	20.91
HSUPA Subtest-1	21.25	21.10	20.91
HSUPA Subtest-2	21.42	21.26	21.52
HSUPA Subtest-3	21.03	21.04	21.03
HSUPA Subtest-4	21.61	21.54	21.68
HSUPA Subtest-5	21.14	21.34	21.07

Note:1.When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤1/2dB higher than the primary mode (RMC12.2kbps) or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

14.3 Test Results for Standalone SAR Test

The calculated SAR is obtained by the following formula:

Reported SAR=Measured SAR*10(Ptarget-Pmeasured))/10
Scaling factor=10(Ptarget-Pmeasured))/10
Reported SAR= Measured SAR* Scaling factor

Where
Ptarget is the power of manufacturing upper limit;
Pmeasured is the measured power;
Measured SAR is measured SAR at measured power which including power drift)
Reported SAR which including Power Drift and Scaling factor

Duty Cycle

Test Mode	Duty Cycle
GSM	2:8
UMTS	1:1

SAR Values [GSM 850]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR1-g results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers - Body (hotspot open, distance 0mm)										
128	824.2	2Txslots	Position 1	29.91	30.00	N/A	1.021	0.084	0.086	
128	824.2	2Txslots	Position 2	29.91	30.00	N/A	1.021	**0.105**	**0.107**	**Plot 1**
128	824.2	2Txslots	Position 3	29.91	30.00	N/A	1.021	0.070	0.071	
128	824.2	2Txslots	Position 4	29.91	30.00	N/A	1.021	0.061	0.062	
128	824.2	2Txslots	Position 5	29.91	30.00	N/A	1.021	0.050	0.051	

Remark:
1. The value with black color is the maximum SAR Value of each test band.
2. The frame average of GPRS (4Tx slots) higher than GSM and sample can support VoIP function, tested at GPRS (4Tx slots) mode for head.
3. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).

SAR Values [GSM 1900]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR1-g results(W/kg)		Graph Results
								Measured	*Reported*	
measured / reported SAR numbers - Body (hotspot open, distance 0mm)										
512	1850.2	3Txslots	Position 1	24.61	25.00	N/A	1.094	0.120	0.131	
512	1850.2	3Txslots	Position 2	24.61	25.00	N/A	1.094	**0.156**	**0.171**	**Plot 2**
512	1850.2	3Txslots	Position 3	24.61	25.00	N/A	1.094	0.103	0.113	
512	1850.2	3Txslots	Position 4	24.61	25.00	N/A	1.094	0.085	0.093	
512	1850.2	3Txslots	Position 5	24.61	25.00	N/A	1.094	0.076	0.083	

Remark:
1. The value with black color is the maximum SAR Value of each test band.
2. The frame average of GPRS (4Tx slots) higher than GSM and sample can support VoIP function, tested at GPRS (4Tx slots) mode for head.

3. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).

SAR Values [WCDMA Band II]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR1-g results(W/kg)		Graph Results
								Measured	*Reported*	
measured / reported SAR numbers - Body (hotspot open, distance 0mm)										
9262	1852.4	RMC*	Position 1	22.26	22.50	N/A	1.057	0.130	0.137	
9262	1852.4	RMC*	Position 2	22.26	22.50	N/A	1.057	**0.175**	**0.185**	**Plot 3**
9262	1852.4	RMC*	Position 3	22.26	22.50	N/A	1.057	0.112	0.118	
9262	1852.4	RMC*	Position 4	22.26	22.50	N/A	1.057	0.093	0.098	
9262	1852.4	RMC*	Position 5	22.26	22.50	N/A	1.057	0.080	0.085	

Remark:
1. The value with black color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. RMC - RMC 12.2kbps mode;*

SAR Values [WCDMA Band V]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR1-g results(W/kg)		Graph Results
								Measured	*Reported*	
measured / reported SAR numbers - Body (hotspot open, distance 0mm)										
4183	836.6	RMC*	Position 1	22.71	23.00	N/A	1.069	0.089	0.095	
4183	836.6	RMC*	Position 2	22.71	23.00	N/A	1.069	**0.110**	**0.118**	**Plot 4**
4183	836.6	RMC*	Position 3	22.71	23.00	N/A	1.069	0.076	0.081	
4183	836.6	RMC*	Position 4	22.71	23.00	N/A	1.069	0.064	0.068	
4183	836.6	RMC*	Position 5	22.71	23.00	N/A	1.069	0.055	0.059	

Remark:
1. The value with black color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. RMC - RMC 12.2kbps mode;*

14.4 Standalone SAR Test Exclusion Considerations and Estimated SAR

Per KDB447498 requires when the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion;

● (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√ f(GHz)/x] W/kg for test separation distances ≤ 50 mm;

where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.

● 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm

Per FCC KD B447498 D01,simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the transmitting antenna in a specific a physical test configuration is ≤1.6 W/Kg.When the sum is greater than the SAR limit,SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio}=\frac{(\text{SAR}_1+\text{SAR}_2)^{1.5}}{(\text{peak location separation,mm})}<0.04$$

Estimated stand alone SAR					
Communication system	Frequency (MHz)	Configuration	Maximum Power (dBm)	Separation Distance (mm)	Estimated SAR1-g (W/kg)
Bluetooth*	2450	Body-worn	N/A	5	N/A

Remark:

1. Bluetooth*- Including Lower power Bluetooth
2. Maximum average power including tune-up tolerance;
3. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion
4. Body as body use distance is 5mm from manufacturer declaration of user manual

14.5 Simultaneous TX SAR Considerations

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmiting antenna.The device has 1 antenna, WWAN main antenna.;

Application Simultaneous Transmission information:

Combination No.	Mode
1	N/A

14.6 SAR Measurement Variability

According to KDB865664, Repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg. If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with ≤ 20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required. The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.19 The repeated measurement results must be clearly identified in the SAR report. All measured SAR, including the repeated results, must be considered to determine compliance and for reporting according to KDB 690783.Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

1) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
2) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20

Frequency Band (MHz)	Air Interface	RF Exposure Configuration	Test Position	Repeated SAR (yes/no)	Highest Measured SAR1-g (W/Kg)	First Repeated	
						Measued SAR1-g (W/Kg)	Largest to Smallest SAR Ratio
850	GSM 850	Standalone	Position 2	no	0.105	n/a	n/a
	WCDMA Band V	Standalone	Position 2	no	0.110	n/a	n/a
1900	GSM 1900	Standalone	Position 2	no	0.156	n/a	n/a
	WCDMA Band II	Standalone	Position 2	no	0.175	n/a	n/a

Remark:
1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the orignal and first repeated measurement is not > 1.20 or 3 (1-g or 10-g respectively)

14.7 General description of test procedures

1. The DUT is tested using CMU 200 communications testers as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted peak power.
2. Test positions as described in the tables above are in accordance with the specified test standard.
3. Tests in body position were performed in that configuration, which generates the highest time based averaged output power (see conducted power results).
4. Tests in head position with GSM were performed in voice mode with 1 timeslot unless GPRS/EGPRS/DTM function allows parallel voice and data traffic on 2 or more timeslots.
5. UMTS was tested in RMC mode with 12.2 kbit/s and TPC bits set to ‘all 1’.
6. WiFi was tested in 802.11b/g/n mode with 1 Mbit/s and 6 Mbit/s. According to KDB 248227 the SAR testing for 802.11g/n is not required since When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
7. Required WiFi test channels were selected according to KDB 248227
8. According to FCC KDB pub 248227 D01, When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement and when there are multiple test channels with the same measured maximum output power and equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.
9. According to FCC KDB pub 941225 D06 this device has been tested with 10 mm distance to the phantom for operation in WiFi hot spot mode.

10. Per FCC KDB pub 941225 D06 the edges with antennas within 2.5 cm are required to be evaluated for SAR to cover WiFi hot spot function.
11. According to IEEE 1528 the SAR test shall be performed at middle channel. Testing of top and bottom channel is optional.
12. According to KDB 447498 D01 testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
    - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
    - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
    - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
13. IEEE 1528 require the middle channel to be tested first. This generally applies to wireless devices that are designed to operate in technologies with tight tolerances for maximum output power variations across channels in the band.
14. Per KDB648474 D04 require when the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is < 1.2 W/kg.
15. Per KDB648474 D04 require when the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, using the same wireless mode test configuration for voice and data, such as UMTS, LTE and Wi-Fi, and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface)
16. 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g SAR > 1.2 W/kg.
17. Per KDB648474 D04 require for phablet SAR test considerations，For Smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.
18. 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g SAR > 1.2 W/kg.

15. Test Plots

15.1 System Performance Check

System check at 835 MHz

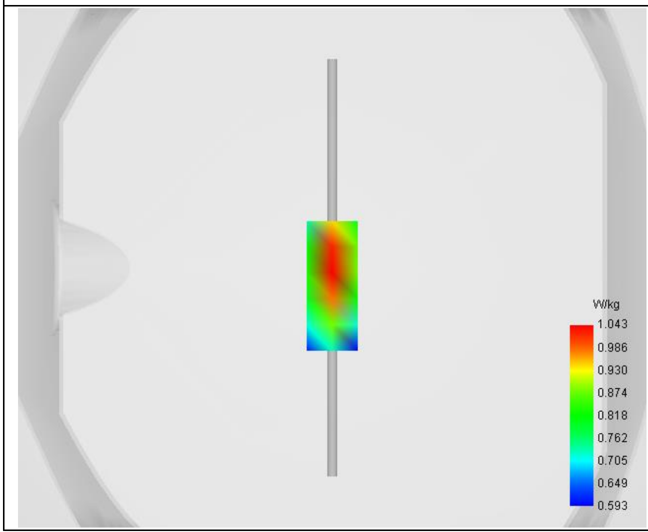
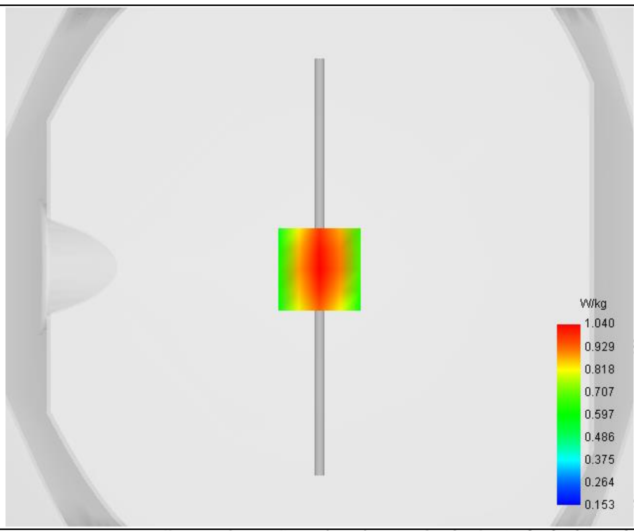
A. Experimental conditions.

Probe	SN EPGO373
ConvF	25.00
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	CW835
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	835.000
Relative permitivity (real part)	40.830
Relative permitivity (imaginary part)	20.910
Conductivity (S/m)	0.970

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR
	

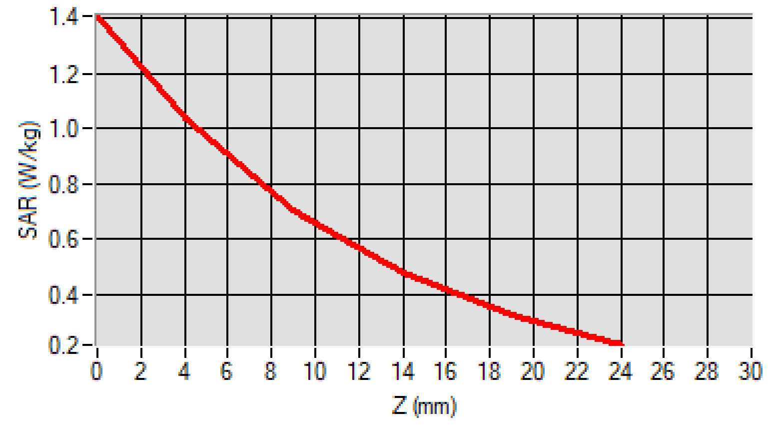
Maximum location: X=0.00, Y=-1.00 ; SAR Peak: 1.41 W/kg

D. SAR 1g & 10g

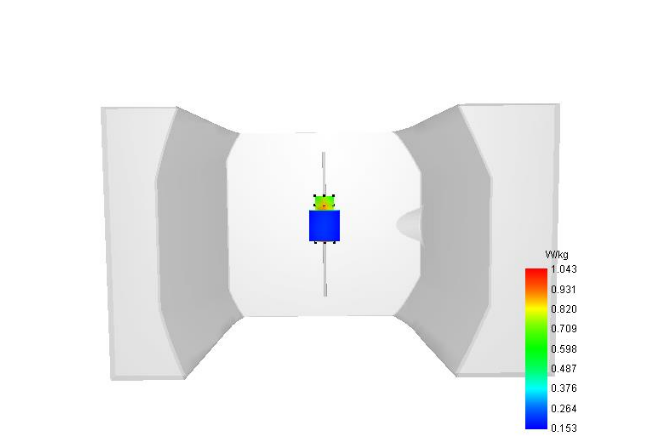
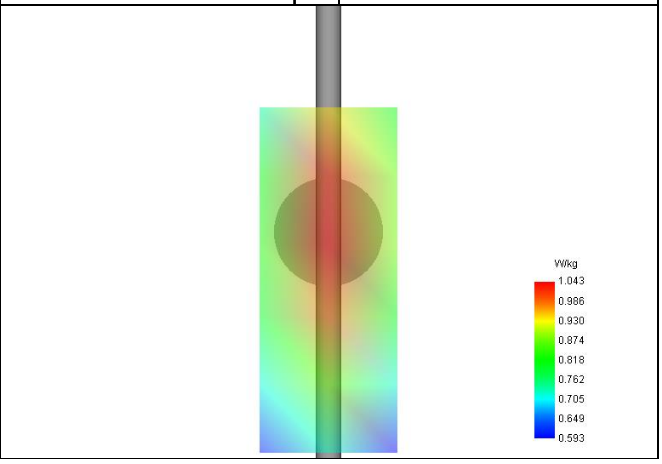
SAR 10g (W/Kg)	0.638
SAR 1g (W/Kg)	0.987
Variation (%)	-0.330
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.411	1.040	0.704	0.477	0.325



F. 3D Image

3D screen shot	Hot spot position
	

System check at 1800 MHz

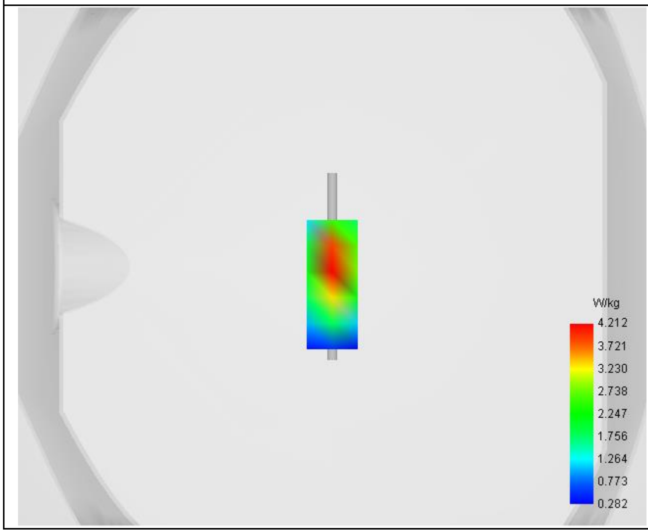
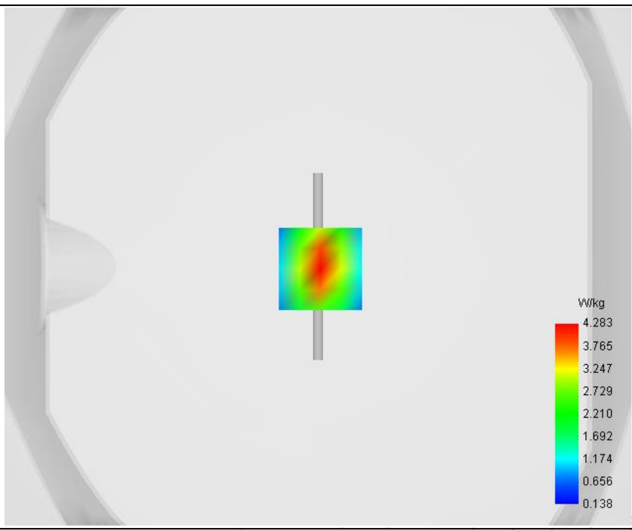
A. Experimental conditions.

Probe	SN EPGO373
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. Permitivity

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

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR
	

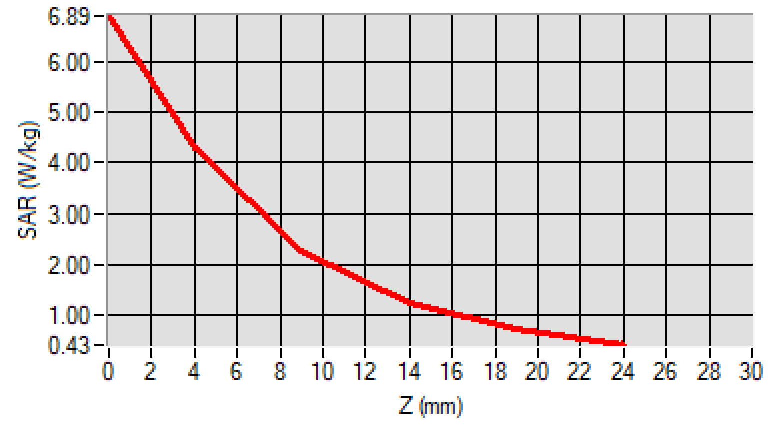
Maximum location: X=1.00, Y=-1.00 ; SAR Peak: 6.89 W/kg

D. SAR 1g & 10g

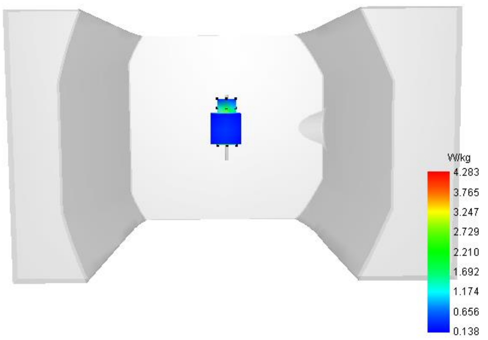
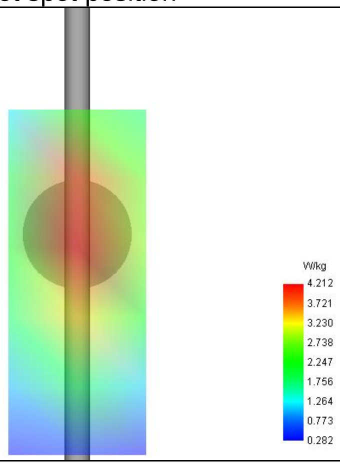
SAR 10g (W/Kg)	1.995
SAR 1g (W/Kg)	3.940
Variation (%)	0.070
Horizontal validation criteria: minimum distance (mm)	0.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	0.000000

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

3D screen shot	Hot spot position
	

15.2 SAR Test Graph Results

SAR plots for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02

Plot 1

A. Experimental conditions.

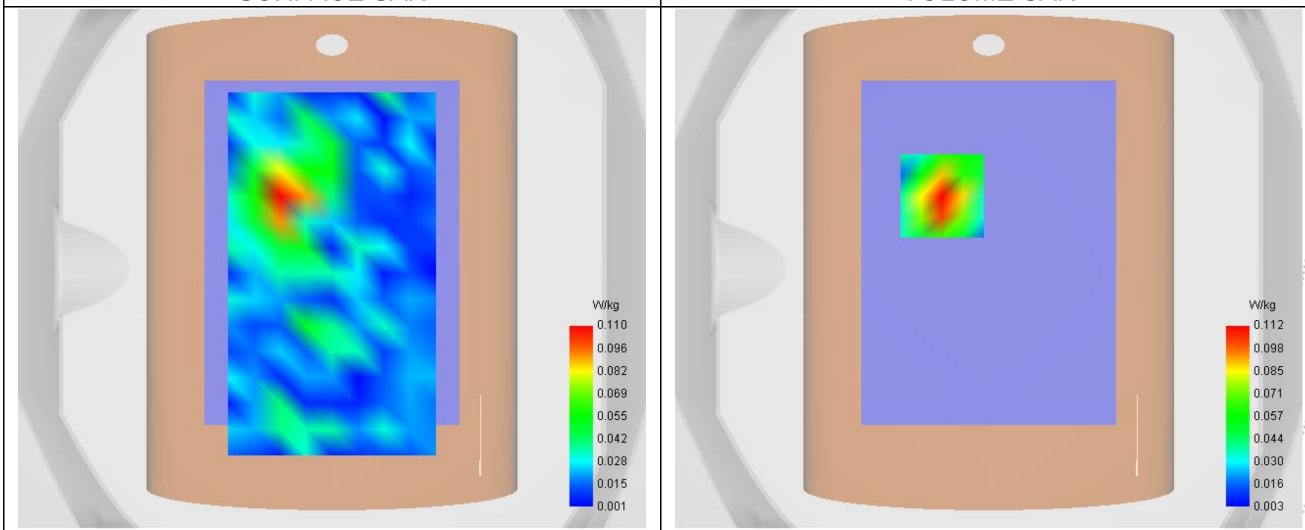
Probe	SN 25/22 EPGO373
ConvF	3.01
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	GSM850
Channels	Low (128)
Signal	TDMA (Crest factor: 8.0)

B. Permitivity

Frequency (MHz)	824.200
Relative permitivity (real part)	41.500
Relative permitivity (imaginary part)	19.400
Conductivity (S/m)	0.902

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR



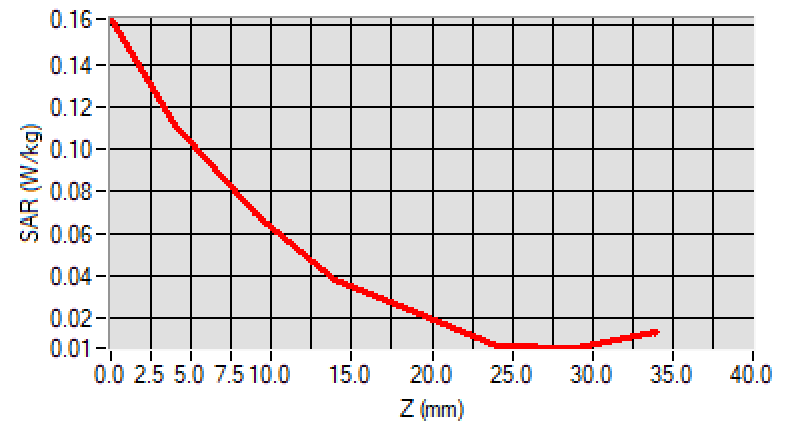
Maximum location: X=-18.00, Y=28.00 ; SAR Peak: 0.19 W/kg

D. SAR 1g & 10g

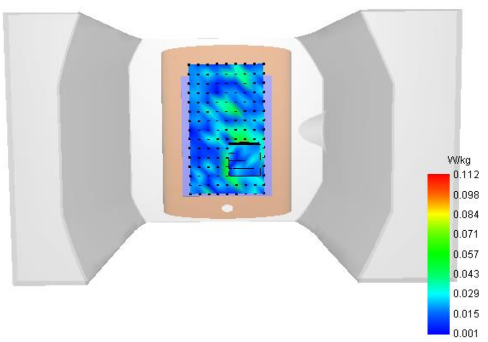
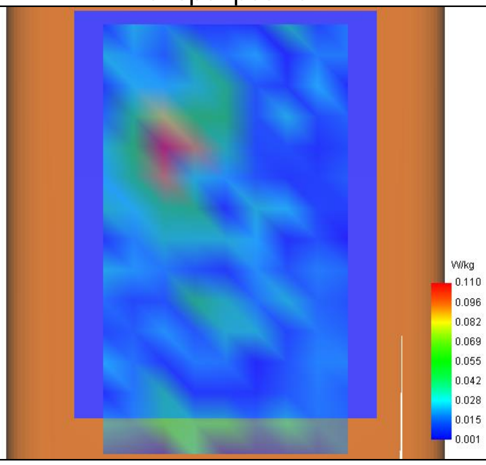
SAR 10g (W/Kg)	0.054
SAR 1g (W/Kg)	0.105
Variation (%)	-2.740
Horizontal validation criteria: minimum distance (mm)	11.313708
Vertical validation criteria: SAR ratio M2/M1 (%)	61.671797

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.162	0.112	0.069	0.038	0.022	0.007	0.005



F. 3D Image

3D screen shot	Hot spot position
	

Plot 2

A. Experimental conditions.

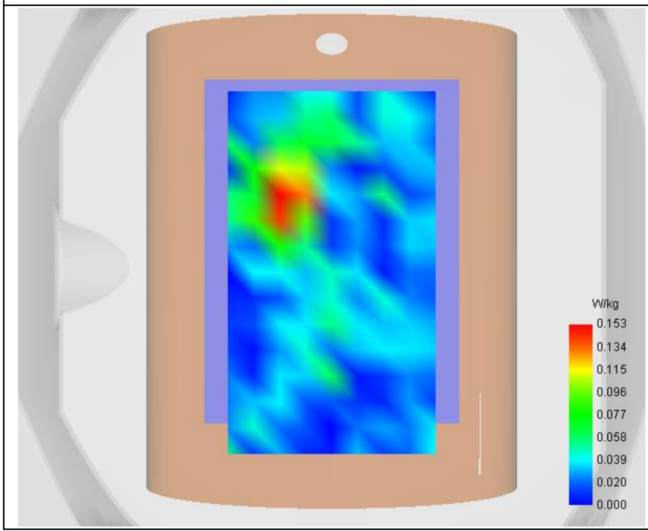
Probe	SN 25/22 EPGO373
ConvF	3.27
Area Scan	surf_sam_plan.txt
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Body
Band	GSM1900
Channels	Low (512)
Signal	TDMA (Crest factor: 8.0)

B. Permitivity

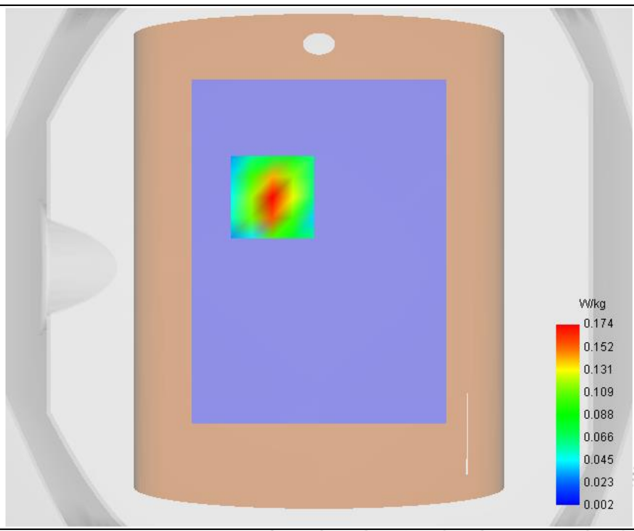
Frequency (MHz)	1850.200
Relative permitivity (real part)	40.000
Relative permitivity (imaginary part)	13.408
Conductivity (S/m)	1.400

C. SAR Surface and Volume

SURFACE SAR



VOLUME SAR



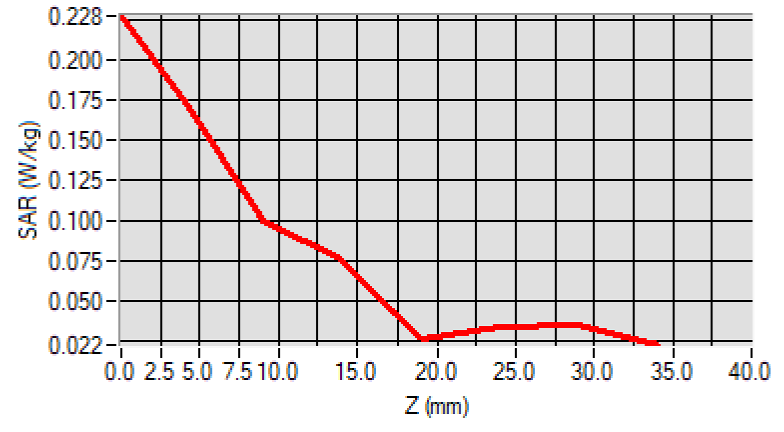
Maximum location: X=-18.00, Y=27.00 ; SAR Peak: 0.28 W/kg

D. SAR 1g & 10g

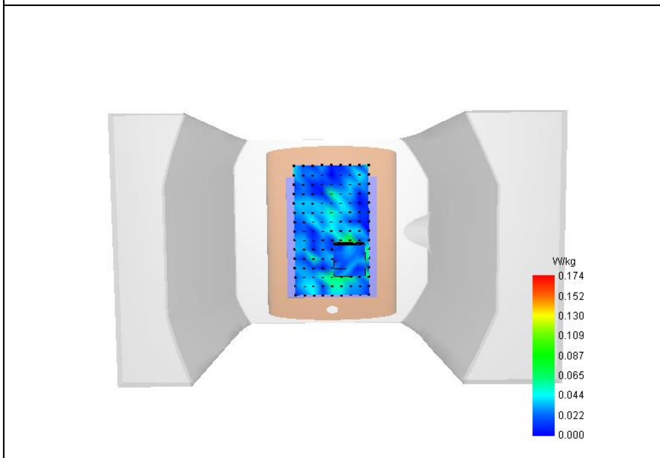
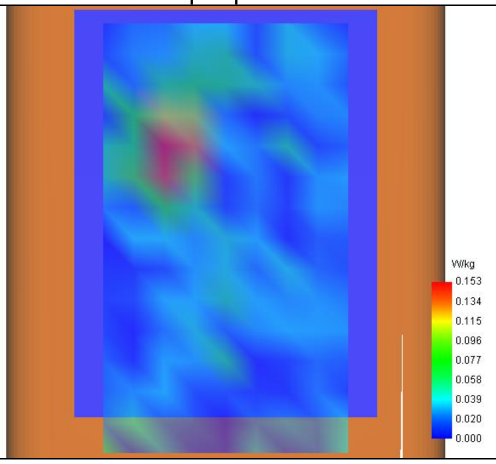
SAR 10g (W/Kg)	0.082
SAR 1g (W/Kg)	0.156
Variation (%)	0.380
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	57.406915

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.228	0.174	0.100	0.076	0.026	0.033	0.035



F. 3D Image

3D screen shot	Hot spot position
	

Plot 3

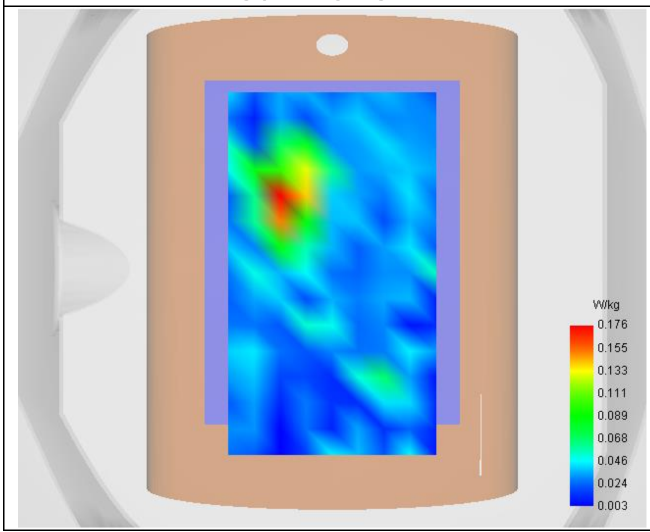
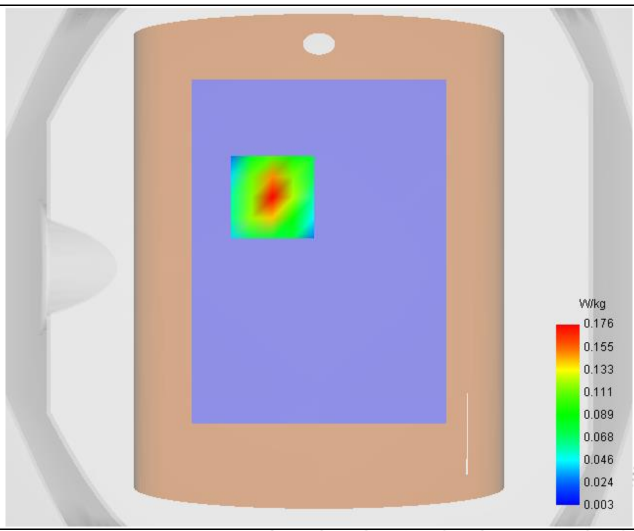
A. Experimental conditions.

Probe	SN 25/22 EPGO373
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	Band2_WCDMA1900
Channels	Low (9262)
Signal	WCDMA (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	1852.400
Relative permitivity (real part)	40.000
Relative permitivity (imaginary part)	13.408
Conductivity (S/m)	1.400

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR
	

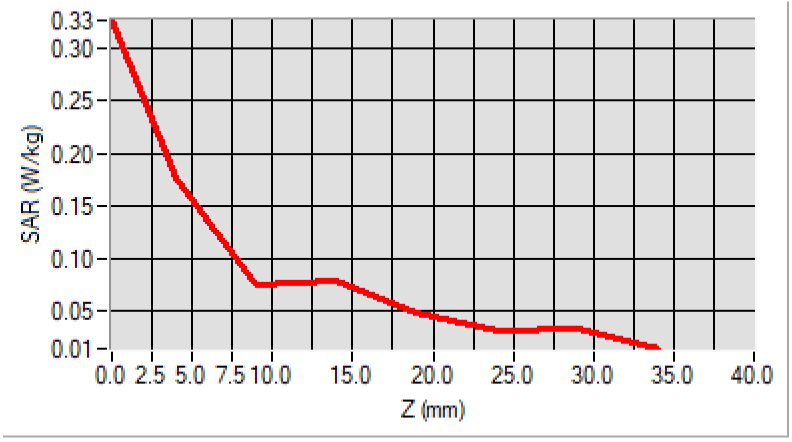
Maximum location: X=-18.00, Y=27.00 ; SAR Peak: 0.35 W/kg

D. SAR 1g & 10g

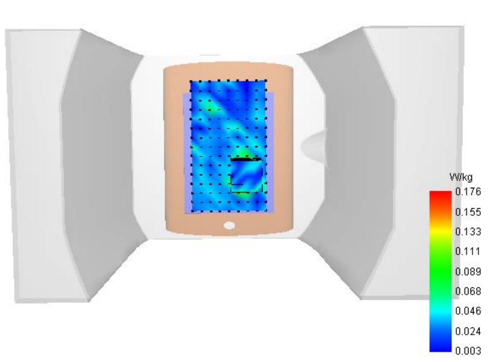
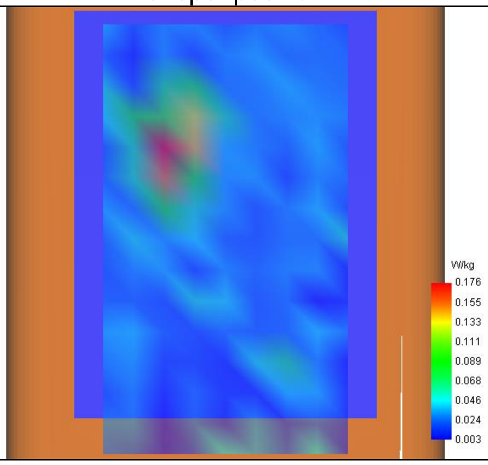
SAR 10g (W/Kg)	0.087
SAR 1g (W/Kg)	0.175
Variation (%)	2.080
Horizontal validation criteria: minimum distance (mm)	16.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	42.636346

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.327	0.176	0.075	0.079	0.049	0.032	0.032



F. 3D Image

3D screen shot	Hot spot position
	

Plot 4

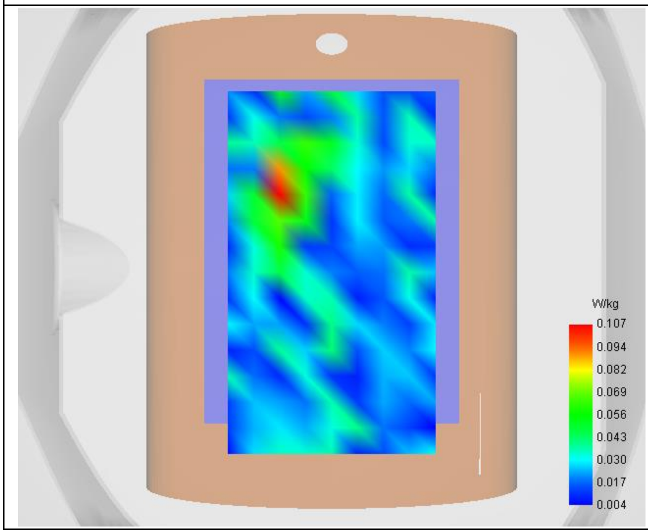
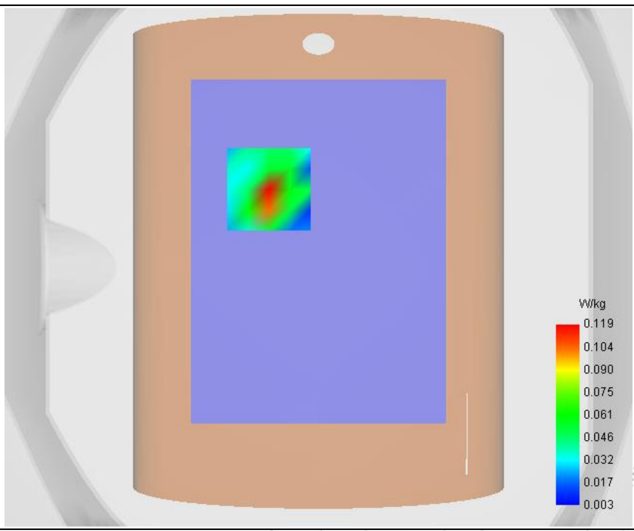
A. Experimental conditions.

Probe	SN 25/22 EPGO373
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	Band5_WCDMA850
Channels	Middle (4183)
Signal	WCDMA (Crest factor: 1.0)

B. Permitivity

Frequency (MHz)	836.600
Relative permitivity (real part)	42.285
Relative permitivity (imaginary part)	20.226
Conductivity (S/m)	0.940

C. SAR Surface and Volume

SURFACE SAR	VOLUME SAR
	

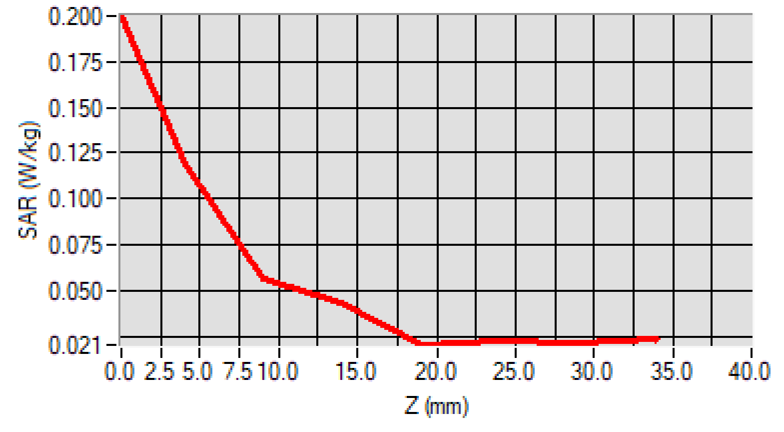
Maximum location: X=-19.00, Y=30.00 ; SAR Peak: 0.22 W/kg

D. SAR 1g & 10g

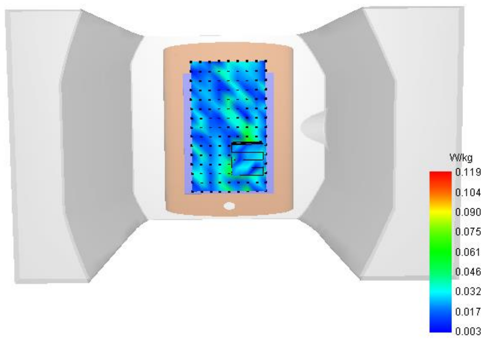
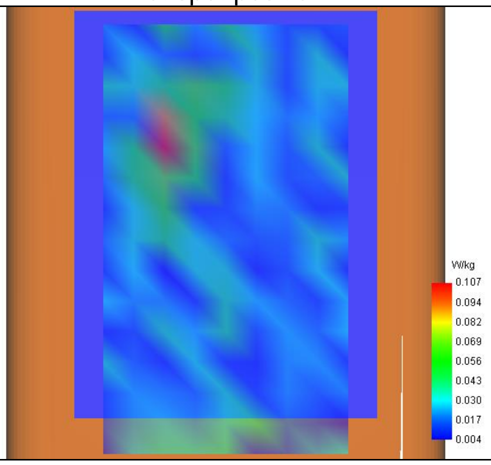
SAR 10g (W/Kg)	0.049
SAR 1g (W/Kg)	0.110
Variation (%)	35.110
Horizontal validation criteria: minimum distance (mm)	8.000000
Vertical validation criteria: SAR ratio M2/M1 (%)	47.793622

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.200	0.119	0.057	0.044	0.021	0.023	0.022



F. 3D Image

3D screen shot	Hot spot position
	

16. CALIBRATION CERTIFICATES

Probe-EPGO373 Calibration Certificate
SID835Dipole Calibration Ceriticate
SID1800Dipole Calibration Ceriticate

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 EPGO373

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

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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