

FCC SAR TEST REPORT

Report No.: BCTC2304875804-8E

Applicant: Shenzhen Qichang Intelligent Technology Co., Ltd

Product Name: smartphone

Model/Type Ref.: F102

Tested Date: 2023-06-12 to 2023-06-21

Issued Date: 2023-06-26

Shenzhen BCTC Testing Co., Ltd.



FCC ID: 2BAK2-F102

Product Name: smartphone

Trademark: Fossibot

Model/Type Ref.: F102
F102+, F102PLUS, F102PRO, F102S

Applicant: Shenzhen Qichang Intelligent Technology Co., Ltd

Address: Room 510, Building 7, Yunli Intelligent Park, No. 7, Bantian Street, Longgang ,
Shenzhen

Manufacturer: Shenzhen Qichang Intelligent Technology Co., Ltd

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Shenzhen

Prepared By: Shenzhen BCTC Testing Co., Ltd.

Address: 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng,
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Sample Received Date: 2023-04-27

Sample tested Date: 2023-06-12 to 2023-06-21

Issue Date: 2023-06-26

SAR Max. Values is : 0.541 W/kg (1g) for Head
0.548 W/kg (1g) for Body
0.548 W/kg (1g) for Hotspot

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:



Hubery Cai/Project Handler

Approved by:



Zero Zhou/Reviewer

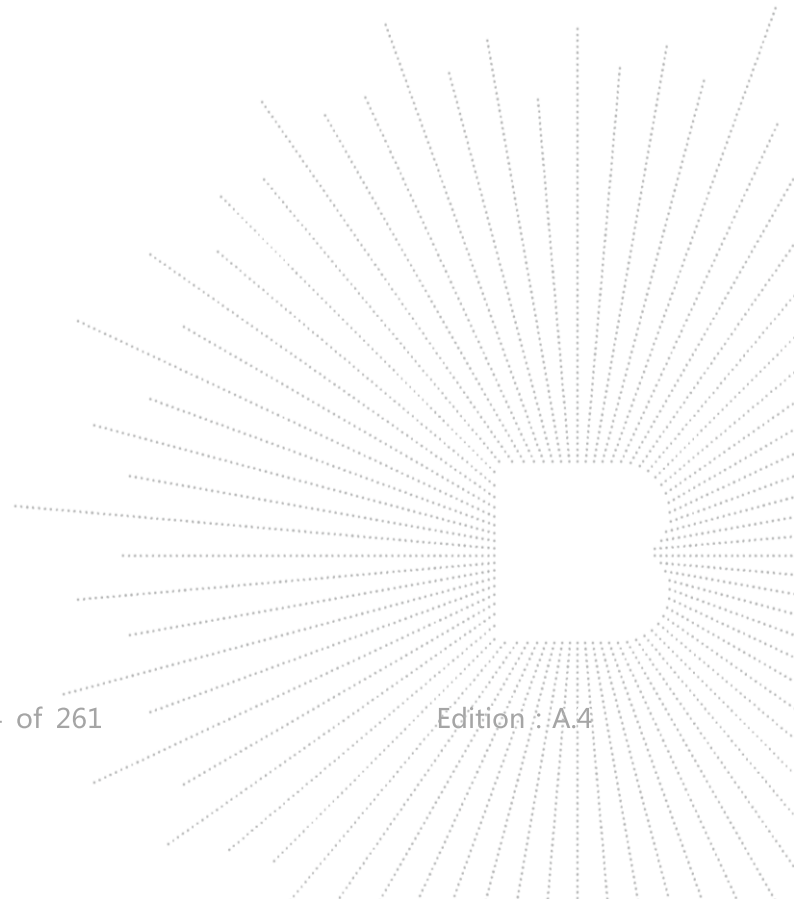
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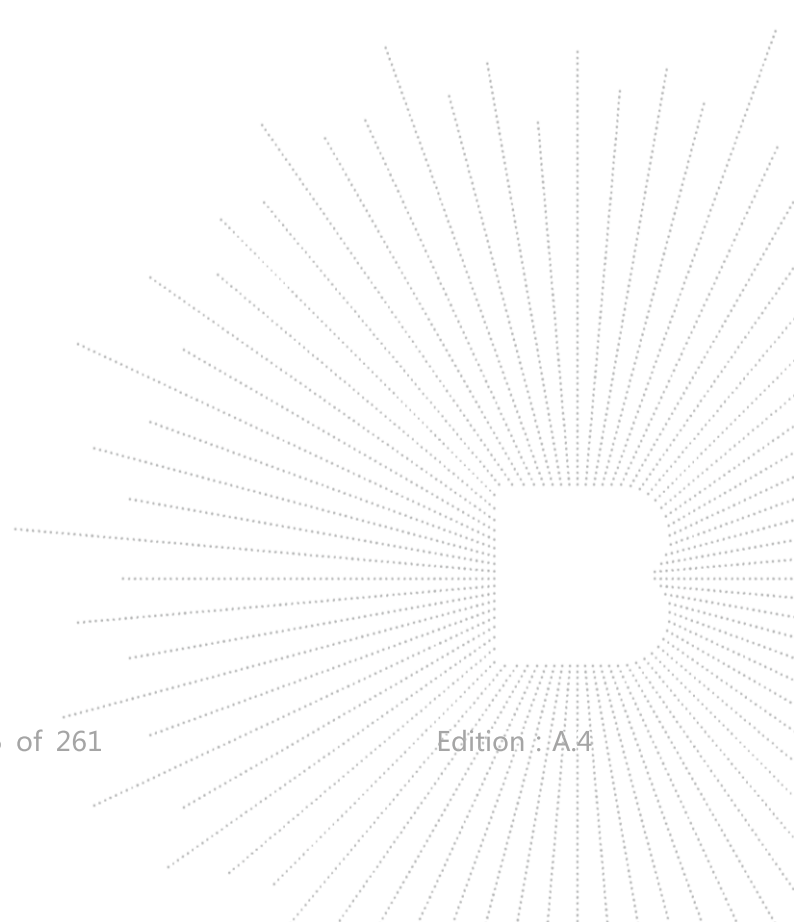
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(Note: N/A Means Not Applicable)



1. Version

Report No.	Issue Date	Description	Approved
BCTC2304875804-8E	2023-06-26	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

KDB 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz

KDB 865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

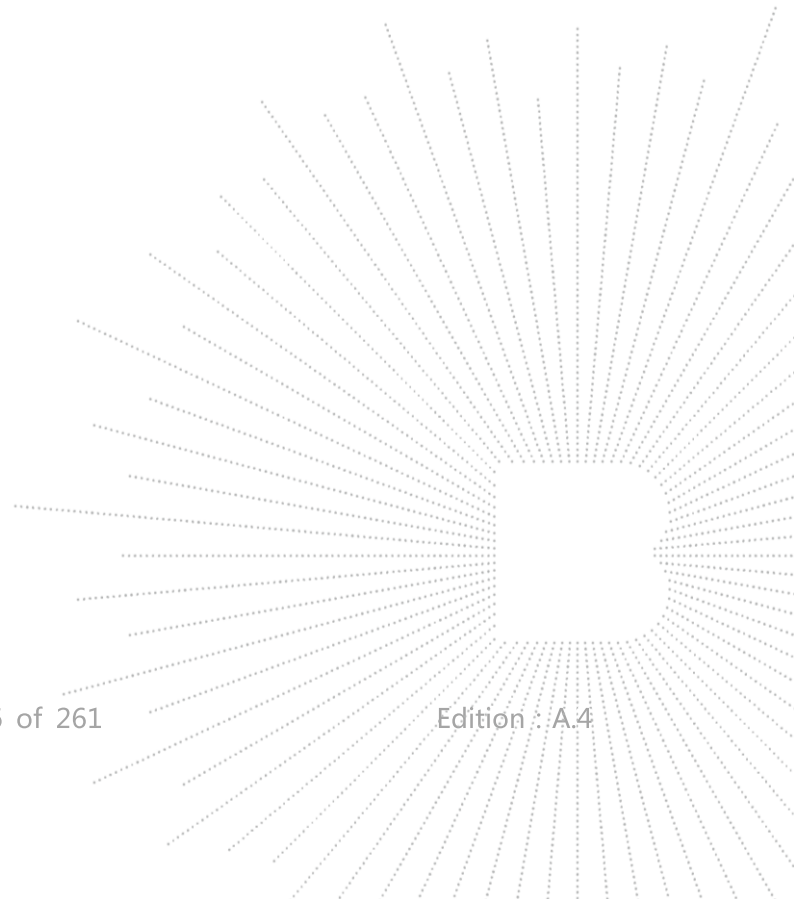
KDB 248227 D01 802.11 Wi-Fi SAR v02r02: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS

KDB 941225 D01 3G SAR Procedures: 3G SAR MEAUREMENT PROCEDURES

KDB 941225 D05 SAR for LTE Devices: SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES

KDB 941225 D06 Hotspot Mode v02r01: SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES

KDB 648474 D04 Handset SAR v01r03: SAR EVALUATION CONSIDERATIONS FOR WIRELESS HANDSETS

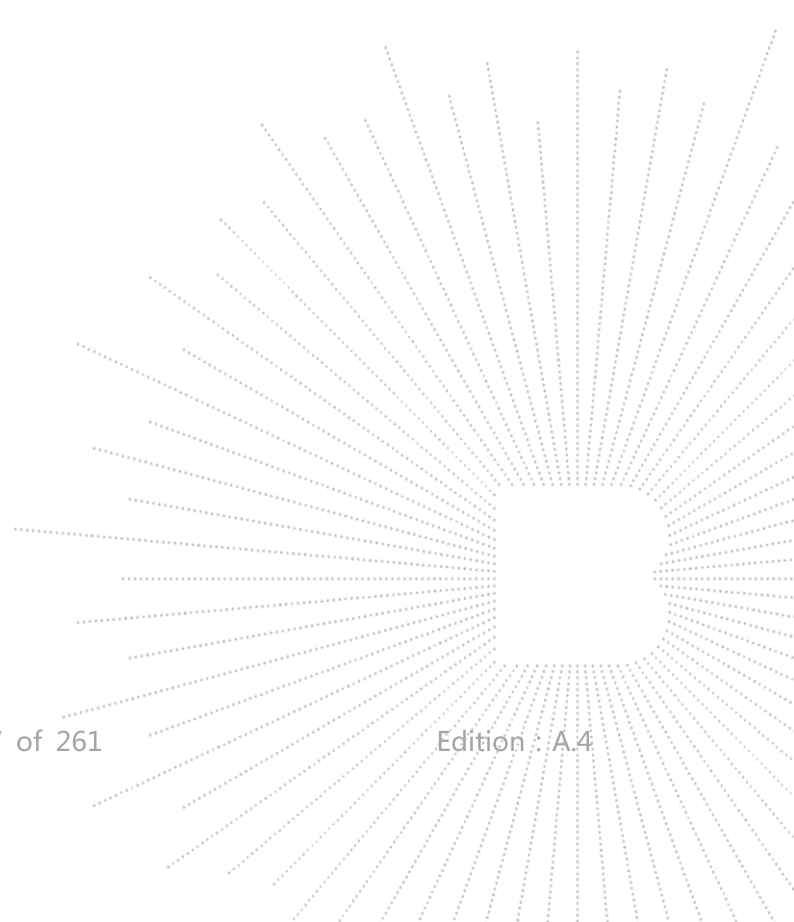


3. Test Summary

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

Frequency Band	Report SAR1g (W/kg)			SAR1g Limit (W/kg)
	Head	Body (10mm Gap)	Hotspot (10mm Gap)	
GSM	0.059	0.229	0.229	1.6
WCDMA	0.118	0.322	0.366	1.6
LTE	0.114	0.548	0.548	1.6
WLAN 2.4G	0.135	0.043	0.043	1.6
WLAN 5G	0.541	0.415	0.543	1.6
Simultaneous Transmission	0.653	0.723	0.723	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.

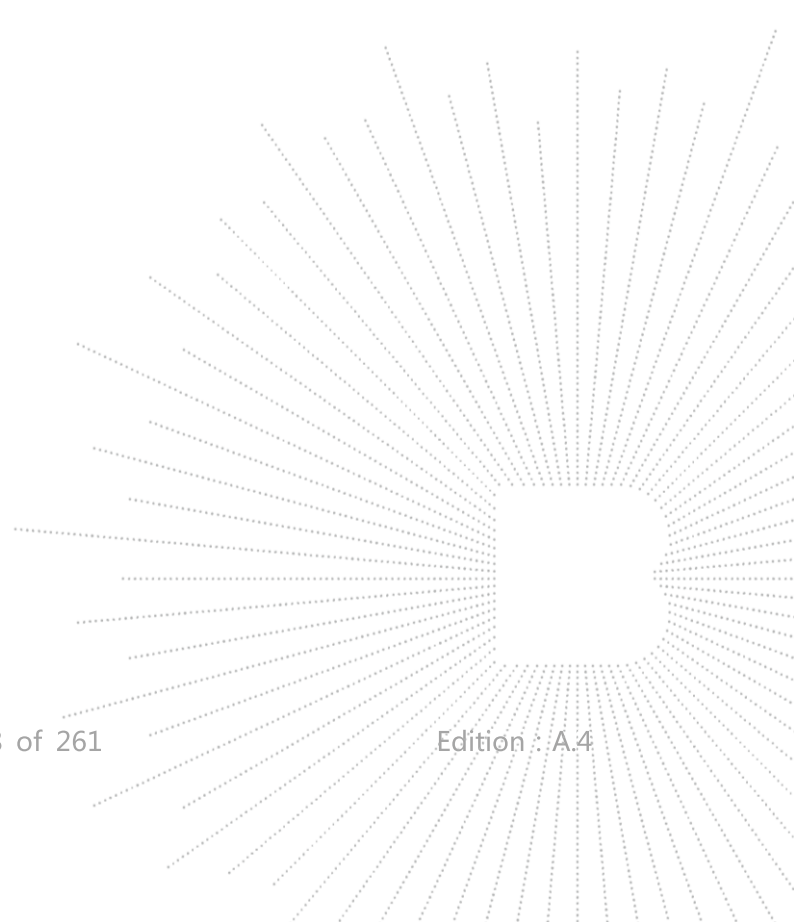


4. SAR Limits

EXPOSURE LIMITS	FCC Limit (1g Tissue)	
	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.

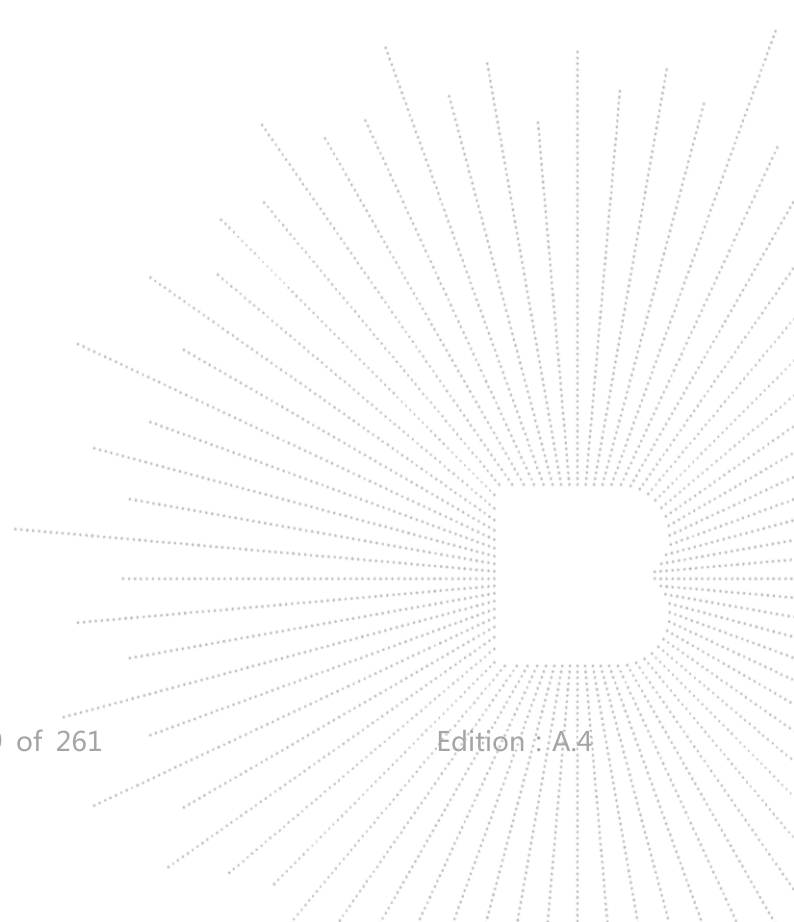
Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).



5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be $\leq 30\%$, for a confidence interval of $k=2$. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

Therefore, the measurement uncertainty is not required.



6. Product Information and Test Setup

6.1 Product Information

Model/Type Ref.:	F102 F102+, F102PLUS, F102PRO, F102S
Model differences:	All the model are the same circuit and RF module, except model names.
Hardware Version:	CA-F122B
Software Version:	R03-20230418
Ratings:	DC 5V from adapter/DC 3.87V from battery
Adapter:	Model: HJ-PD33W-JP Input: 100-240V~50/60Hz 0.8A Output: DC 5.0V 3.0A OR: DC 9.0V 3.0A OR: DC 12.0V 2.75A 33.0W MAX

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 IV: TX: 1712.40~1752.60MHz; RX: 2112.60 – 2452.40MHz 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: 33.47 dBm, GSM/GPRS/EGPRS 1900: 30.35 dBm WCDMA Band II: 23.00 dBm WCDMA Band IV: 22.32 dBm WCDMA Band V: 22.81 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
Antenna installation:	Internal antenna
Antenna Gain:	GSM850: -1.5 dBi GSM1900: -1 dBi WCDMA Band II: -1 dBi WCDMA Band IV: -1 dBi WCDMA Band V: -1.5 dBi

4G

Tx Frequency:	LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500MHz-2570MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 17: 704MHz-716MHz
Rx Frequency:	LTE Band 2: 1930 MHz ~ 1990 MHz LTE Band 4: 2110 MHz ~ 2155 MHz LTE Band 5: 869 MHz ~ 894 MHz LTE Band 7: 2620MHz-2690MHz LTE Band 12: 729 MHz ~ 746 MHz LTE Band 17: 734MHz-746MHz

Bandwidth:	LTE Band 2: 1.4MHz /3MHz /5MHz /10MHz /15MHz /20MHz LTE Band 4: 1.4MHz /3MHz /5MHz /10MHz /15MHz /20MHz LTE Band 5: 1.4MHz /3MHz /5MHz /10MHz LTE Band 7: 5MHz /10MHz /15MHz /20MHz LTE Band 12: 1.4MHz /3MHz /5MHz /10MHz LTE Band 17: 5MHz /10MHz
Maximum Output Power to Antenna:	LTE Band 2: 23.56 dBm LTE Band 4: 22.72 dBm LTE Band 5: 23.00 dBm LTE Band 7: 22.49 dBm LTE Band 12: 23.52 dBm LTE Band 17: 23.58 dBm
Type of Modulation:	QPSK/16QAM
Antenna Type:	Internal Antenna
Antenna Gain:	LTE Band 2: -1 dBi LTE Band 4: -1 dBi LTE Band 5: -1.5 dBi LTE Band 7: 0.5 dBi LTE Band 12: -2 dBi LTE Band 17: -2 dBi

BT

BT	
Operation Frequency:	2402-2480MHz
Bluetooth Version:	5.2
Type of Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Number Of Channel	79CH
Antenna installation:	Internal antenna
Antenna Gain:	-0.5 dBi
BLE	
Operation Frequency:	2402-2480MHz
Bluetooth Version:	5.2
Type of Modulation:	GFSK
Data Rate:	LE 1M PHY, LE 2M PHY
Number Of Channel	40CH
Antenna installation:	Internal antenna
Antenna Gain:	-0.5 dBi

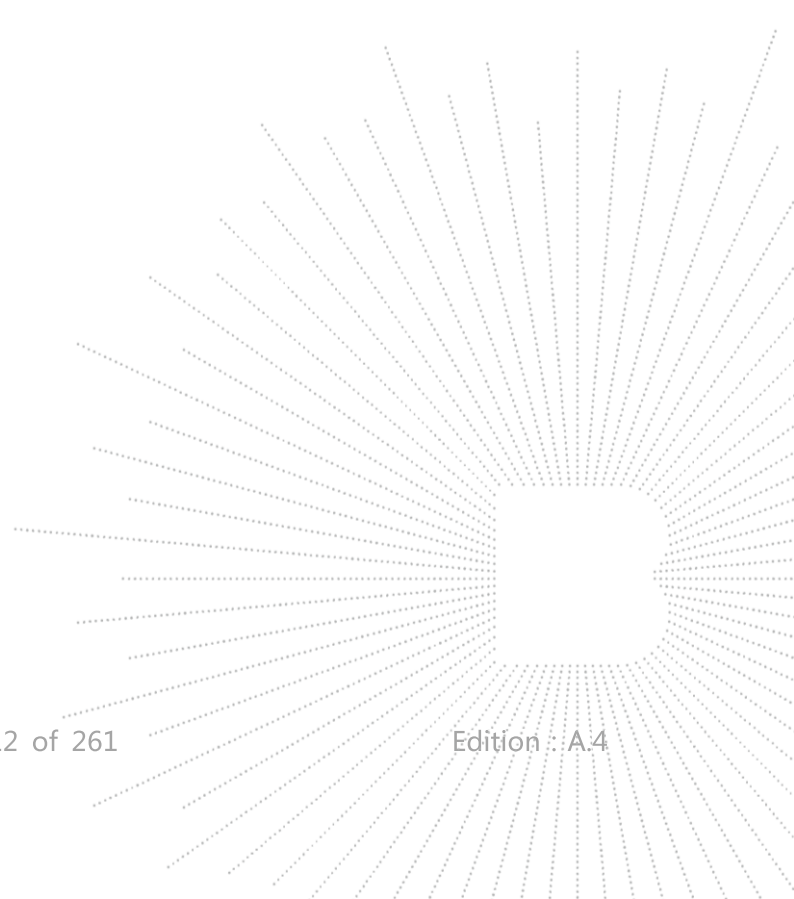
WLAN

WIFI2.4G	
Operation Frequency:	802.11b/g/n20MHz:2412~2462MHz 802.11n40MHz:2422~2452 MHz
Bit Rate of Transmitter	802.11b:11/5.5/2/1Mbps 802.11g:54/48/36/24/18/12/9/6Mbps 802.11n Up to 150Mbps
Type of Modulation:	OFDM/DSSS
Number Of Channel	802.11b/g/n20MHz:11CH 802.11n40MHz: 7 CH
Antenna Gain:	-0.5 dBi
WIFI5G	

IEEE 802.11 WLAN Mode Supported	802.11a/n/ac(20MHz channel bandwidth) 802.11n/ac(40MHz channel bandwidth) 802.11ac(80MHz channel bandwidth)
Operation Frequency:	5180-5240MHz for 802.11a/n(HT20); 5190-5230MHz for 802.11n(HT40); 5210MHz for 802.11 ac80; 5745-5825 MHz for 802.11a/n(HT20); 5755-5795 MHz for 802.11n(HT40); 5775MHz for 802.11 ac80;
Data Rate	802.11a: 6,9,12,18,24,36,48,54Mbps; 802.11n(HT20/HT40): MCS0-MCS15; 802.11ac(VHT20): NSS1, MCS0-MCS8 802.11ac(VHT40/VHT80):NSS1, MCS0-MCS
Type of Modulation:	OFDM with BPSK/QPSK/16QAM/64QAM/256QAM for 802.11a/n/ac;
Number Of Channel	4 channels for 802.11a/n20 in the 5180-5240MHz band ; 2 channels for 802.11 n40 in the 5190-5230MHz band ; 1 channels for 802.11 ac80 in the 5210MHz band ; 5 channels for 802.11a/n20 in the 5745-5825MHz band ; 2 channels for 802.11 n40 in the 5755-5795MHz band ; 1 channels for 802.11 ac80 in the 5775MHz band
Antenna installation:	Internal antenna
Antenna Gain:	1 dBi

NFC

Operation Frequency:	13.56 MHz
Modulation Type:	ASK
Number Of Channel	1 CH
Antenna installation:	Coil Antenna
Antenna Gain:	0 dBi



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(%):	35-75
Atmospheric Pressure(kPa):	95-105
Temperature(°C):	18-25

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.

FCC Test Firm Registration Number: 712850
A2LA certificate registration number is: CN1212
ISED Registered No.: 23583
ISED CAB identifier: CN0017

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	Keysight	83711B	US37100131	Aug. 29, 2022	Aug. 28, 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 750	SATIMO	SID 750	SN 47/21 DIP 0G835-620	Nov. 25, 2021	Nov. 24, 2024
DIPOLE 835	SATIMO	SID 835	SN 47/21 DIP 0G835-621	Nov. 25, 2021	Nov. 24, 2024
DIPOLE 1800	SATIMO	SID 1800	SN 47/21 DIP 1G800-623	Nov. 25, 2021	Nov. 24, 2024
DIPOLE 1900	SATIMO	SID 1900	SN 47/21 DIP 2G100-624	Nov. 25, 2021	Nov. 24, 2024
DIPOLE 2450	SATIMO	SID 2450	SN 47/21 DIP 2G450-627	Nov. 25, 2021	Nov. 24, 2024
DIPOLE 2600	SATIMO	SID 2600	SN 47/21 DIP 2G600-628	Nov. 25, 2021	Nov. 24, 2024
DIPOLE 5000	SATIMO	SID5000	SN 47/21 DIP 5G000-629	Nov. 25, 2021	Nov. 24, 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	N/A	N/A

Power meter	Agilent	E4419	\	May 15, 2023	May 14, 2024
Power meter	Agilent	E4419	\	May 15, 2023	May 14, 2024
Power sensor	Agilent	E9300A	\	May 15, 2023	May 14, 2024
Power sensor	Agilent	E9300A	\	May 15, 2023	May 14, 2024
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 evaluate with following criteria at least on annual interval.

1. There is no physical damage on the dipole;
2. System check with specific dipole is within 10% of calibrated values;
3. The most recent return-loss results, measured at least annually, deviates by no more than 20% from the previous measurement;
4. The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous 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 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.

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:

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

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

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

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

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the

electrical field in the tissue by

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

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.

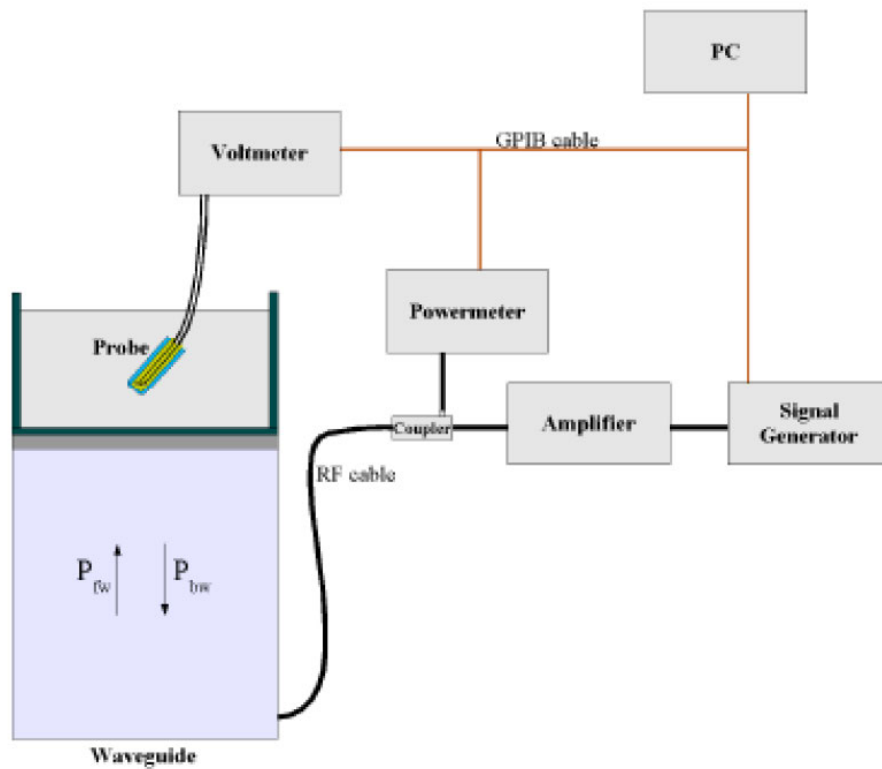
9.2 Probe

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: less 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 :

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:

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

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

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

where DCP is the diode compression point in mV.

9.3 Probe Calibration Process

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.

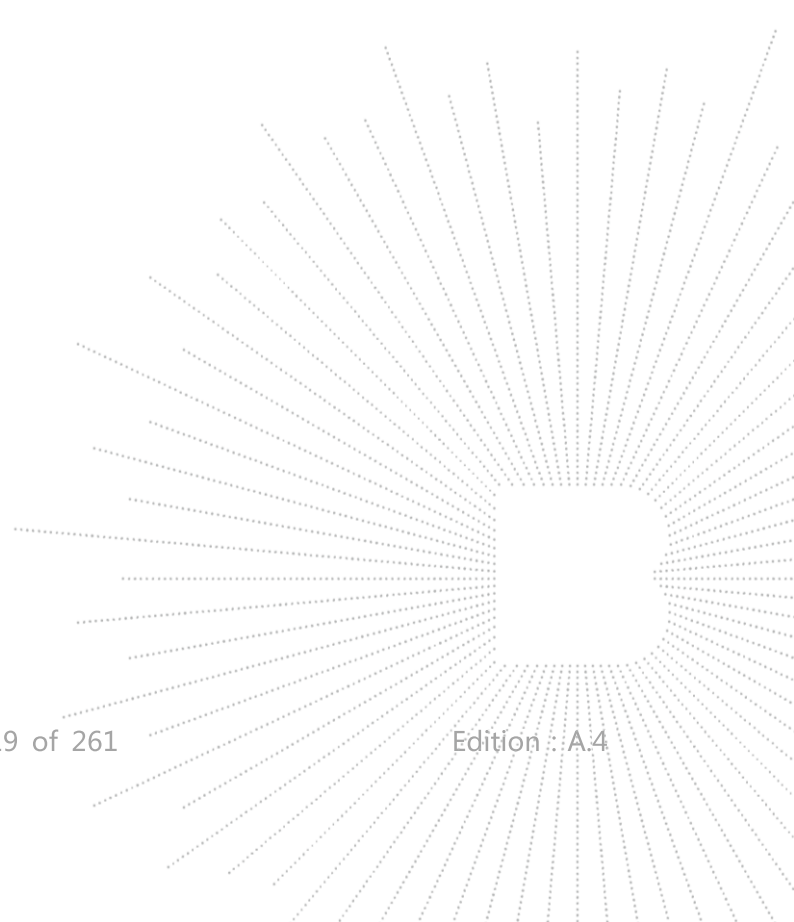
SAR is proportional to $\Delta T/\Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

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

Where:

σ = simulated tissue conductivity,

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

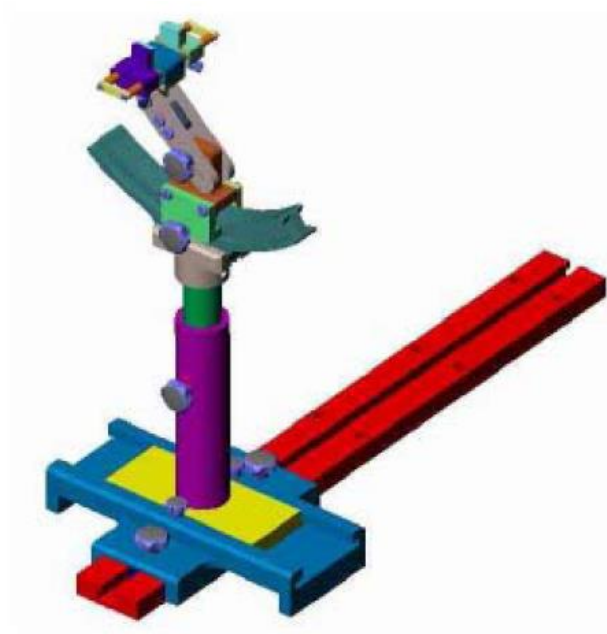


9.4 Phantom

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 Device Holder

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	
	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 Conductivity (σ)	Target Permittivity (ϵ_r)	Measured Conductivity (σ)	Measured Permittivity (ϵ_r)	Delta (σ)%	Delta (ϵ_r)%	Limit (%)	Temp . TSL (°C)	Date
750	Head	0.89	41.9	0.872	42.428	-2.02	1.26	±5	23.1	06/12/2023
835	Head	0.90	41.5	0.892	41.794	-0.89	0.71	±5	23.1	06/12/2023
1800	Head	1.40	40.0	1.381	40.636	-1.36	1.59	±5	23.5	06/14/2023
1900	Head	1.40	40.0	1.427	40.503	1.93	1.26	±5	23.5	06/14/2023
2450	Head	1.80	39.2	1.832	39.903	1.78	1.79	±5	23.7	06/16/2023
2600	Head	1.96	39.0	1.982	39.553	1.12	1.42	±5	23.7	06/16/2023
5200	Head	4.66	36.0	4.593	35.129	-1.44	-2.42	±5	23.4	06/21/2023
5800	Head	5.27	35.3	5.213	34.682	-1.08	-1.75	±5	23.4	06/21/2023

Remark:

1. The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within $\pm 2^\circ\text{C}$ of the temperature when the tissue parameters are characterized.
2. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

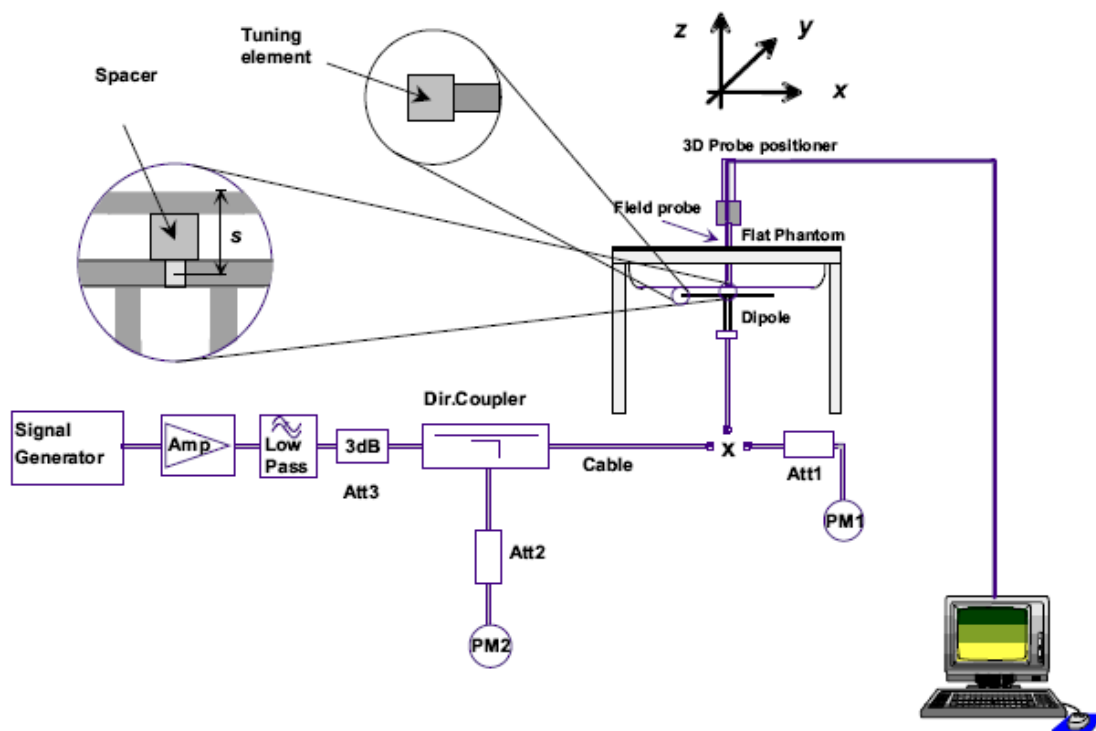
11. System Check

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 600MHz-6000MHz. 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 20 dBm (100 mW) before dipole is connected.



System Verification Setup Block Diagram



Setup Photo of Dipole Antenna

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.

Frequency (MHz)	Power	Measured SAR _{1g} (W/Kg)	Normalize to 1 Watt	Drift (%)	1W Target	Difference Percentage (%)	Limit (%)	Liquid Temp	Date
					SAR _{1g} (W/Kg)				
750	250 mW	2.178	8.712	1.01	8.58	1.54	±10	23.1	06/12/2023
835	250 mW	2.581	10.324	2.14	10.01	3.14	±10	23.1	06/12/2023
1800	250 mW	9.785	39.14	-1.83	39.74	-1.51	±10	23.5	06/14/2023
1900	250 mW	10.064	40.256	-2.34	41.26	-2.43	±10	23.5	06/14/2023
2450	250 mW	13.112	52.448	-1.85	55.16	-4.92	±10	23.7	06/16/2023
2600	250 mW	13.875	55.50	-1.01	56.50	-1.77	±10	23.7	06/16/2023
5200	100 mW	7.385	73.85	1.46	76.41	-3.35	±10	23.4	06/21/2023
5800	100 mW	7.412	74.12	1.05	76.49	-3.10	±10	23.4	06/21/2023

12. EUT Testing Position

12.1 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.

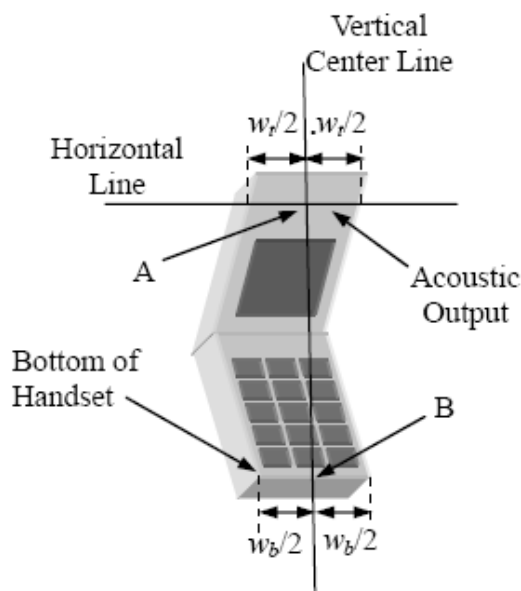
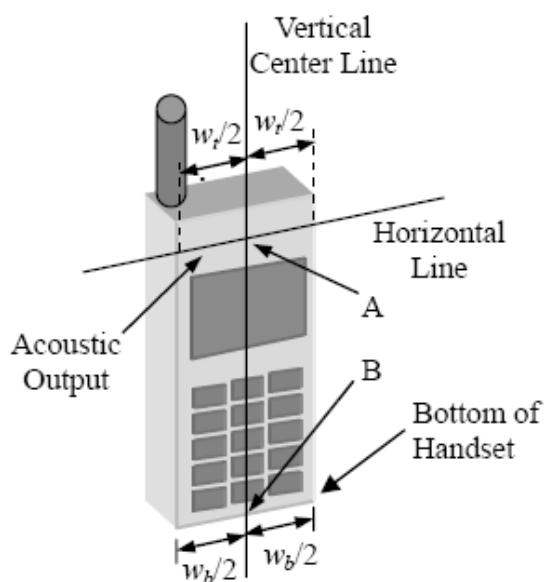


Illustration for Handset Vertical and Horizontal Reference Lines

12.2 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).

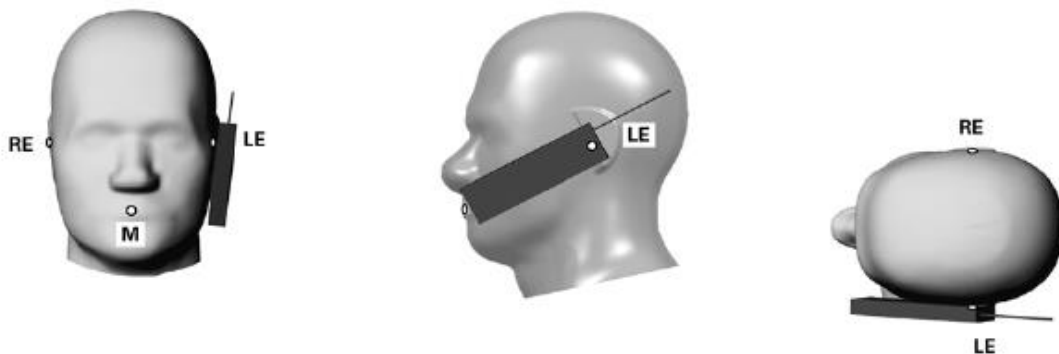


Illustration for Cheek Position

12.3 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).

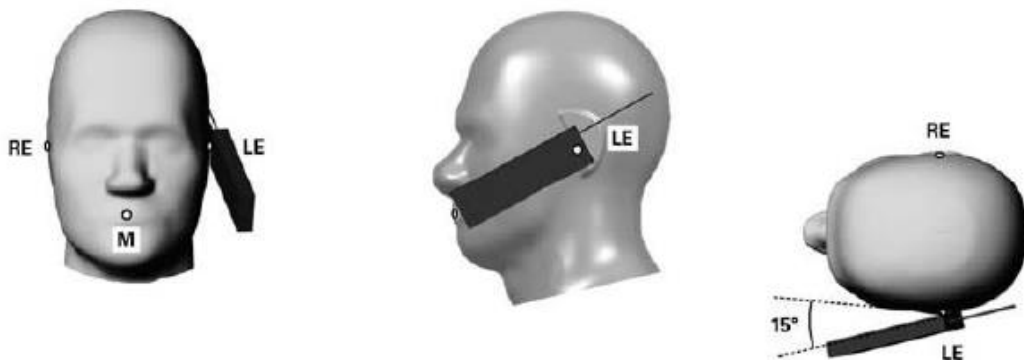
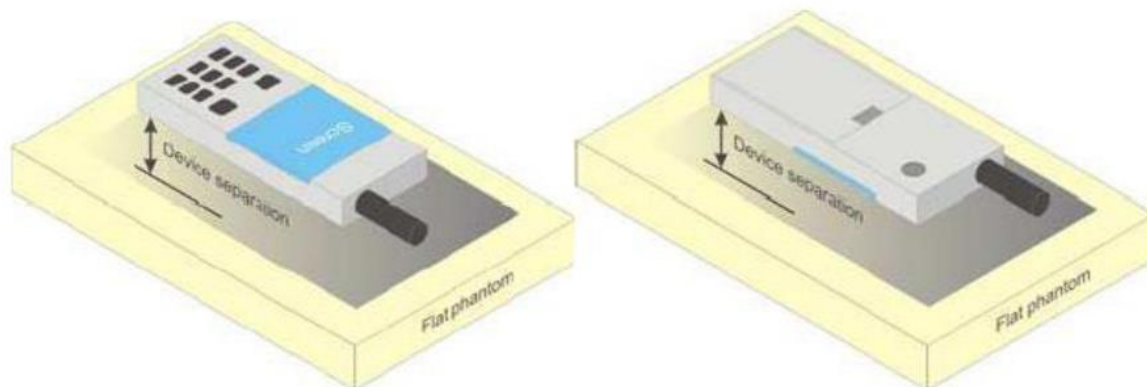


Illustration for Tilted Position

12.4 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

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 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

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.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 mm $\pm$ 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm $\pm$ 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° $\pm$ 1°	20° $\pm$ 1°
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.				
* When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

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

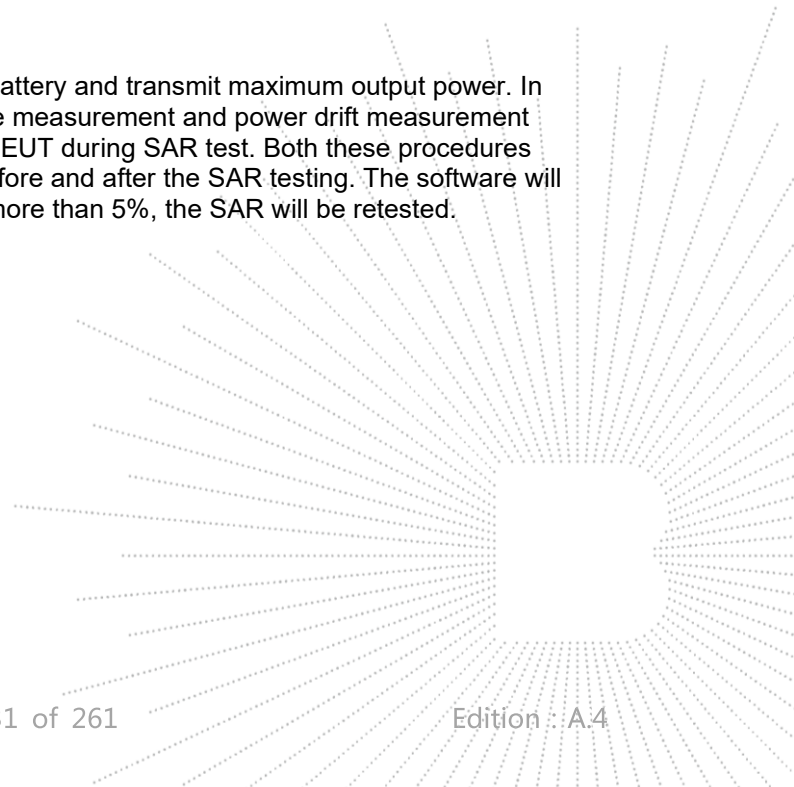
The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimize measurements errors, but the highest local SAR will occur at the surface of the phantom.

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.”

The Tune-up limit already includes component tolerance. KDB 447498 sec.4.1.(d) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

<GSM>

General Note:

1. Per KDB 447498 D01, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions.
3. Per October 2013 TCB Workshop: When the maximum frame-averaged powers levels are within 0.25 dB of each other, test the configuration with the most number of time slots.

Conducted power measurement results

GSM - Burst Average Power (dBm)								
Band	GSM850			Tune-up	GSM1900			Tune-up
Channel	128	190	251		512	661	810	
Frequency (MHz)	824.2	836.6	848.8		1850.2	1880	1909.8	
GSM	33.47	33.38	33.21	34.0	30.30	29.76	29.07	31.0
GPRS (1 slot)	33.47	33.37	33.23	34.0	30.35	29.85	29.09	31.0
GPRS (2 slots)	32.60	32.44	32.29	33.0	29.31	28.77	28.01	30.0
GPRS (3 slots)	30.64	30.47	30.36	31.0	27.28	26.68	25.99	28.0
GPRS (4 slots)	29.41	29.20	29.05	30.0	25.97	25.44	24.65	26.0
EGPRS (1 slot)	33.36	33.29	33.15	34.0	26.70	26.83	26.61	27.0
EGPRS (2 slots)	32.50	32.33	32.21	33.0	25.84	25.33	25.03	26.0
EGPRS (3 slots)	30.59	30.41	30.32	31.0	23.58	23.21	23.07	24.0
EGPRS (4 slots)	29.29	29.19	28.99	30.0	22.17	21.87	21.35	22.5

GSM - Source-Based Time-Average Power (dBm)						
Band	GSM850			GSM1900		
Channel	128	190	251	512	661	810
Frequency (MHz)	824.2	836.6	848.8	1850.2	1880	1909.8
GSM	24.47	24.38	24.21	21.30	20.76	20.07
GPRS (1 slot)	24.47	24.37	24.23	21.35	20.85	20.09
GPRS (2 slots)	26.60	26.44	26.29	23.31	22.77	22.01
GPRS (3 slots)	26.39	26.22	26.11	23.03	22.43	21.74
GPRS (4 slots)	26.41	26.20	26.05	22.97	22.44	21.65
EGPRS (1 slot)	24.36	24.29	24.15	17.70	17.83	17.61
EGPRS (2 slots)	26.50	26.33	26.21	19.84	19.33	19.03
EGPRS (3 slots)	26.34	26.16	26.07	19.33	18.96	18.82
EGPRS (4 slots)	26.29	26.19	25.99	19.17	18.87	18.35

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 2Txslot GPRS1900.

3. Per KDB 941225 D01, SAR is not required for EDGE (8PSK) mode because the maximum output power and tune-up limit is $\leq 1/4$ dB higher than GPRS/EDGE (GMSK) or the adjusted SAR of the highest reported SAR of GPRS/EDGE (GMSK) is ≤ 1.2 W/kg.

<W-CDMA>

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

Table 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} (Note 1, 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 $\Delta_{CQI} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$.

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 $\Delta_{NACK} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$, and $\Delta_{CQI} = 24/15$ with $\beta_{HS} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{HS}/\beta_c = 24/15$. 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 $\beta_c = 11/15$ and $\beta_d = 15/15$.

Setup Configuration

HSUPA Setup Configuration:

- a. The EUT was connected to Base Station R&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 (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
 - iii. Set Cell Power = -86 dBm
 - iv. Set Channel Type = 12.2k + HSPA
 - v. Set UE Target Power
 - vi. Power Ctrl Mode= Alternating bits
 - vii. Set and observe the E-TFCI
 - viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
- d. The transmitted maximum output power was recorded.

Table 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} (Note 1)	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	209/25	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	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (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: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d=12/15$, $\beta_{hs}/\beta_c=24/15$. 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 $\beta_c = 10/15$ and $\beta_d = 15/15$.

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 $\beta_c = 14/15$ and $\beta_d = 15/15$.

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

Band	WCDMA Band II				WCDMA Band IV			
Channel	9262	9400	9538	Tune-up	1312	1450	1513	Tune-up
Frequency (MHz)	1852.4	1880.0	1907.6		1712.4	1740	1752.6	
RMC 12.2K	23.00	22.68	22.06	23.5	22.32	22.22	22.03	23.0
HSDPA Subtest-1	22.13	21.77	21.15	22.5	21.33	21.27	21.08	22.0
HSDPA Subtest-2	21.79	21.40	20.36		20.96	20.53	20.40	
HSDPA Subtest-3	20.60	20.11	19.68		19.45	19.80	19.18	
HSDPA Subtest-4	20.67	20.34	19.34		19.77	19.81	19.64	
HSUPA Subtest-1	20.69	21.59	20.95	22.5	19.78	20.97	20.85	22.0
HSUPA Subtest-2	22.05	21.68	21.01		21.29	21.05	20.97	
HSUPA Subtest-3	20.17	20.51	19.75		19.76	19.97	19.44	
HSUPA Subtest-4	22.09	21.77	21.15		21.30	21.22	21.02	
HSUPA Subtest-5	20.86	21.11	20.07		20.08	20.45	20.43	

Band	WCDMA Band V				/			
Channel	4132	4182	4233	Tune-up	/	/	/	Tune-up
Frequency (MHz)	826.4	836.4	846.6		/	/	/	
RMC 12.2K	22.66	22.81	22.71	23.5	/	/	/	/
HSDPA Subtest-1	21.70	21.87	21.73	22.5	/	/	/	/
HSDPA Subtest-2	21.34	21.61	21.38		/	/	/	
HSDPA Subtest-3	19.79	20.34	20.25		/	/	/	
HSDPA Subtest-4	20.40	20.29	20.00		/	/	/	
HSUPA Subtest-1	20.56	21.69	21.51	22.5	/	/	/	/
HSUPA Subtest-2	21.58	21.67	21.73		/	/	/	
HSUPA Subtest-3	20.07	20.49	20.30		/	/	/	
HSUPA Subtest-4	21.70	21.85	21.75		/	/	/	
HSUPA Subtest-5	20.08	20.99	21.06		/	/	/	

Note:

1. Per KDB 941225 D01 v03, the 12.2kbps RMC mode was selected for SAR testing (the primary mode).
2. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq 1/4$ dB 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.

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

LTE QPSK configuration has the highest maximum average output power per 3GPP standard.

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					18607	18900	19193
Band2	1.4	1	#0	QPSK	23.25	22.93	22.45
		1	#Mid		23.35	23.04	22.53
		1	#Max		23.23	22.94	22.49
		3	#0		23.39	23.03	22.42
		3	#Mid		23.40	23.06	22.43
		3	#Max		23.39	22.99	22.46
		6	#0		22.43	22.07	21.51
	1.4	1	#0	QAM16	22.45	21.75	21.46
		1	#Mid		22.50	21.85	21.52
		1	#Max		22.42	21.78	21.47
		3	#0		22.58	22.14	21.58
		3	#Mid		22.63	22.17	21.63
		3	#Max		22.62	22.18	21.58
		6	#0		21.60	21.28	20.70

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					18615	18900	19185
Band2	3	1	#0	QPSK	23.19	22.79	22.25
		1	#Mid		23.24	22.88	22.38
		1	#Max		23.15	22.82	22.37
		8	#0		22.36	22.01	21.41
		8	#Mid		22.45	22.12	21.50
		8	#Max		22.44	22.04	21.43
		15	#0		22.38	22.03	21.47
	3	1	#0	QAM16	22.57	21.96	21.05
		1	#Mid		22.64	22.07	21.17
		1	#Max		22.55	22.03	21.09
		8	#0		21.41	21.03	20.39
		8	#Mid		21.47	21.09	20.45
		8	#Max		21.44	21.00	20.44
		15	#0		21.44	21.04	20.50

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					18625	18900	19175
Band2	5	1	#0	QPSK	23.32	23.06	22.46
		1	#Mid		23.47	23.12	22.58
		1	#Max		23.34	23.10	22.54
		12	#0		22.44	22.04	21.50
		12	#Mid		22.51	22.15	21.55
		12	#Max		22.46	22.07	21.52
		25	#0		22.46	22.11	21.48
	5	1	#0	QAM16	22.68	22.50	21.76
		1	#Mid		22.80	22.62	21.83
		1	#Max		22.67	22.61	21.83
		12	#0		21.45	21.09	20.46
		12	#Mid		21.54	21.16	20.50
		12	#Max		21.52	21.13	20.48
		25	#0		21.44	21.11	20.54

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					18650	18900	19150
Band2	10	1	#0	QPSK	23.56	23.08	22.56
		1	#Mid		23.56	23.16	22.54
		1	#Max		23.43	23.14	22.59
		25	#0		22.37	22.06	21.45
		25	#Mid		22.46	22.17	21.54
		25	#Max		22.38	22.12	21.46
		50	#0		22.46	22.11	21.50
	10	1	#0	QAM16	22.33	22.41	21.73
		1	#Mid		22.33	22.56	21.68
		1	#Max		22.14	22.57	21.72
		25	#0		21.39	21.12	20.47
		25	#Mid		21.50	21.24	20.60
		25	#Max		21.42	21.16	20.49
		50	#0		21.44	21.14	20.54

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					18675	18900	19125
Band2	15	1	#0	QPSK	23.44	23.00	22.69
		1	#Mid		23.39	23.14	22.63
		1	#Max		23.09	22.99	22.61
		36	#0		22.40	22.11	21.61
		36	#Mid		22.43	22.17	21.56
		36	#Max		22.37	22.16	21.51
		75	#0		22.43	22.17	21.62
	15	1	#0	QAM16	22.81	22.12	21.67
		1	#Mid		22.75	22.32	21.67
		1	#Max		22.47	22.23	21.62
		36	#0		21.38	21.16	20.55
		36	#Mid		21.43	21.22	20.54
		36	#Max		21.37	21.21	20.49
		75	#0		21.36	21.15	20.61

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					18700	18900	19100
Band2	20	1	#0	QPSK	23.38	22.94	22.76
		1	#Mid		23.47	23.25	22.65
		1	#Max		23.12	22.95	22.50
		50	#0		22.32	22.07	21.68
		50	#Mid		22.34	22.19	21.65
		50	#Max		22.19	22.12	21.53
		100	#0		22.24	22.11	21.56
	20	1	#0	QAM16	22.59	22.10	22.02
		1	#Mid		22.52	22.44	21.93
		1	#Max		22.20	22.23	21.77
		50	#0		21.29	21.12	20.74
		50	#Mid		21.30	21.25	20.71
		50	#Max		21.21	21.18	20.56
		100	#0		21.26	21.13	20.62

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					19957	20175	20393
Band4	1.4	1	#0	QPSK	22.45	22.20	22.19
		1	#Mid		22.54	22.30	22.28
		1	#Max		22.43	22.24	22.17
		3	#0		22.58	22.28	22.18
		3	#Mid		22.63	22.33	22.19
		3	#Max		22.54	22.26	22.16
		6	#0		21.57	21.36	21.27
	1.4	1	#0	QAM16	21.61	21.01	21.28
		1	#Mid		21.68	21.11	21.31
		1	#Max		21.65	21.02	21.23
		3	#0		21.76	21.39	21.36
		3	#Mid		21.81	21.40	21.44
		3	#Max		21.77	21.43	21.32
		6	#0		20.77	20.51	20.42

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					19965	20175	20385
Band4	3	1	#0	QPSK	22.32	21.96	22.03
		1	#Mid		22.42	22.08	22.06
		1	#Max		22.34	22.03	21.96
		8	#0		21.47	21.20	21.21
		8	#Mid		21.52	21.28	21.27
		8	#Max		21.49	21.27	21.18
		15	#0		21.48	21.23	21.23
	3	1	#0	QAM16	21.20	21.42	21.19
		1	#Mid		21.26	21.49	21.27
		1	#Max		21.10	21.47	21.17
		8	#0		20.48	20.22	20.23
		8	#Mid		20.53	20.32	20.26
		8	#Max		20.49	20.26	20.14
		15	#0		20.57	20.29	20.16

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					19975	20175	20375
Band4	5	1	#0	QPSK	22.49	22.21	22.35
		1	#Mid		22.53	22.32	22.32
		1	#Max		22.39	22.33	22.20
		12	#0		21.50	21.23	21.32
		12	#Mid		21.57	21.37	21.33
		12	#Max		21.52	21.35	21.24
		25	#0		21.55	21.29	21.33
	5	1	#0	QAM16	21.82	21.67	21.69
		1	#Mid		21.84	21.85	21.64
		1	#Max		21.67	21.81	21.48
		12	#0		20.51	20.21	20.28
		12	#Mid		20.58	20.35	20.32
		12	#Max		20.57	20.31	20.24
		25	#0		20.53	20.27	20.36

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20000	20175	20350
Band4	10	1	#0	QPSK	22.64	22.21	22.60
		1	#Mid		22.51	22.37	22.52
		1	#Max		22.30	22.46	22.34
		25	#0		21.46	21.18	21.40
		25	#Mid		21.46	21.34	21.42
		25	#Max		21.46	21.34	21.33
		50	#0		21.42	21.29	21.39
	10	1	#0	QAM16	22.00	21.37	21.36
		1	#Mid		21.89	21.52	21.31
		1	#Max		21.74	21.62	21.11
		25	#0		20.44	20.17	20.41
		25	#Mid		20.52	20.34	20.47
		25	#Max		20.44	20.38	20.38
		50	#0		20.43	20.33	20.39

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20025	20175	20325
Band4	15	1	#0	QPSK	22.57	22.21	22.47
		1	#Mid		22.42	22.44	22.50
		1	#Max		22.16	22.57	22.20
		36	#0		21.45	21.22	21.52
		36	#Mid		21.45	21.36	21.58
		36	#Max		21.33	21.47	21.42
		75	#0		21.41	21.40	21.54
	15	1	#0	QAM16	21.70	21.24	21.83
		1	#Mid		21.55	21.47	21.90
		1	#Max		21.30	21.54	21.59
		36	#0		20.46	20.14	20.53
		36	#Mid		20.46	20.34	20.56
		36	#Max		20.40	20.43	20.39
		75	#0		20.39	20.36	20.50

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20050	20175	20300
Band4	20	1	#0	QPSK	22.47	22.07	22.37
		1	#Mid		22.37	22.40	22.72
		1	#Max		22.20	22.50	22.31
		50	#0		21.28	21.16	21.48
		50	#Mid		21.37	21.36	21.59
		50	#Max		21.26	21.44	21.52
		100	#0		21.25	21.28	21.50
	20	1	#0	QAM16	21.68	21.39	21.47
		1	#Mid		21.59	21.70	21.83
		1	#Max		21.40	21.80	21.45
		50	#0		20.30	20.18	20.47
		50	#Mid		20.36	20.42	20.57
		50	#Max		20.26	20.48	20.48
		100	#0		20.25	20.30	20.49

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20407	20525	20643
Band5	1.4	1	#0	QPSK	22.49	22.81	22.69
		1	#Mid		22.69	22.88	22.81
		1	#Max		22.58	22.76	22.65
		3	#0		22.68	22.89	22.68
		3	#Mid		22.73	22.93	22.72
		3	#Max		22.71	22.85	22.70
		6	#0		21.72	21.96	21.77
	1.4	1	#0	QAM16	21.77	21.69	21.72
		1	#Mid		21.82	21.72	21.84
		1	#Max		21.83	21.70	21.78
		3	#0		21.86	22.02	21.89
		3	#Mid		21.93	22.04	21.96
		3	#Max		21.93	22.02	21.91
		6	#0		20.88	21.14	20.95

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20415	20525	20635
Band5	3	1	#0	QPSK	22.33	22.63	22.55
		1	#Mid		22.54	22.72	22.70
		1	#Max		22.48	22.65	22.55
		8	#0		21.62	21.85	21.64
		8	#Mid		21.69	21.90	21.76
		8	#Max		21.74	21.91	21.64
		15	#0		21.64	21.93	21.72
	3	1	#0	QAM16	21.77	21.88	21.35
		1	#Mid		21.95	21.95	21.43
		1	#Max		21.82	21.86	21.35
		8	#0		20.65	20.83	20.62
		8	#Mid		20.74	20.94	20.74
		8	#Max		20.75	20.89	20.69
		15	#0		20.66	20.85	20.79

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20425	20525	20625
Band5	5	1	#0	QPSK	22.57	22.89	22.74
		1	#Mid		22.77	22.95	22.84
		1	#Max		22.78	22.89	22.71
		12	#0		21.72	21.88	21.80
		12	#Mid		21.83	22.06	21.82
		12	#Max		21.83	21.99	21.74
		25	#0		21.78	22.00	21.76
	5	1	#0	QAM16	21.89	22.44	22.02
		1	#Mid		22.06	22.53	22.15
		1	#Max		22.09	22.42	22.03
		12	#0		20.71	20.88	20.77
		12	#Mid		20.89	21.04	20.79
		12	#Max		20.86	20.97	20.75
		25	#0		20.76	20.97	20.82

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20450	20525	20600
Band5	10	1	#0	QPSK	22.68	22.92	22.96
		1	#Mid		22.93	23.00	22.96
		1	#Max		22.97	22.98	22.84
		25	#0		21.68	21.90	21.78
		25	#Mid		21.93	22.01	21.88
		25	#Max		21.95	21.99	21.73
		50	#0		21.86	21.97	21.83
	10	1	#0	QAM16	22.04	22.08	21.76
		1	#Mid		22.30	22.19	21.71
		1	#Max		22.39	22.17	21.68
		25	#0		20.82	20.95	20.85
		25	#Mid		20.98	21.06	20.90
		25	#Max		20.99	21.01	20.75
		50	#0		20.81	21.01	20.75

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20775	21100	21425
Band7	5	1	#0	QPSK	21.69	22.00	22.26
		1	#Mid		21.81	22.18	22.32
		1	#Max		21.79	22.21	22.34
		12	#0		20.76	21.05	21.24
		12	#Mid		20.86	21.16	21.30
		12	#Max		20.88	21.20	21.29
		25	#0		20.82	21.12	21.29
	5	1	#0	QAM16	21.00	21.44	21.54
		1	#Mid		21.07	21.59	21.59
		1	#Max		21.04	21.63	21.57
		12	#0		19.80	20.03	20.15
		12	#Mid		19.90	20.17	20.25
		12	#Max		19.88	20.19	20.25
		25	#0		19.79	20.08	20.32

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20800	21100	21400
Band7	10	1	#0	QPSK	21.95	22.02	22.33
		1	#Mid		22.03	22.20	22.37
		1	#Max		22.15	22.38	22.38
		25	#0		20.81	21.06	21.28
		25	#Mid		20.97	21.19	21.33
		25	#Max		20.95	21.27	21.29
		50	#0		20.88	21.21	21.34
	10	1	#0	QAM16	20.63	21.35	21.43
		1	#Mid		20.76	21.56	21.49
		1	#Max		20.84	21.71	21.48
		25	#0		19.77	20.10	20.32
		25	#Mid		19.97	20.25	20.35
		25	#Max		19.96	20.27	20.29
		50	#0		19.82	20.17	20.37

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20825	21100	21375
Band7	15	1	#0	QPSK	21.89	21.91	22.37
		1	#Mid		22.15	22.21	22.30
		1	#Max		22.08	22.43	22.24
		36	#0		20.89	21.04	21.41
		36	#Mid		21.05	21.26	21.39
		36	#Max		21.08	21.38	21.32
		75	#0		21.00	21.28	21.38
	15	1	#0	QAM16	20.85	21.29	21.51
		1	#Mid		21.07	21.53	21.45
		1	#Max		21.05	21.73	21.42
		36	#0		19.82	20.06	20.43
		36	#Mid		19.98	20.27	20.43
		36	#Max		19.96	20.34	20.35
		75	#0		19.95	20.22	20.34

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					20850	21100	21350
Band7	20	1	#0	QPSK	21.80	21.82	22.43
		1	#Mid		22.20	22.26	22.49
		1	#Max		22.05	22.49	22.29
		50	#0		20.82	20.96	21.44
		50	#Mid		21.03	21.25	21.38
		50	#Max		20.94	21.42	21.27
		100	#0		20.86	21.15	21.29
	20	1	#0	QAM16	20.86	21.00	21.63
		1	#Mid		21.23	21.46	21.68
		1	#Max		21.12	21.66	21.51
		50	#0		19.78	19.99	20.45
		50	#Mid		20.02	20.29	20.42
		50	#Max		19.95	20.33	20.28
		100	#0		19.84	20.17	20.31

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					23017	23095	23173
Band12	1.4	1	#0	QPSK	23.27	23.24	23.31
		1	#Mid		23.39	23.33	23.45
		1	#Max		23.23	23.26	23.37
		3	#0		23.42	23.28	23.31
		3	#Mid		23.41	23.31	23.34
		3	#Max		23.37	23.28	23.35
		6	#0		22.41	22.36	22.46
	1.4	1	#0	QAM16	22.46	22.05	22.30
		1	#Mid		22.49	22.10	22.39
		1	#Max		22.42	22.06	22.30
		3	#0		22.63	22.37	22.43
		3	#Mid		22.66	22.39	22.45
		3	#Max		22.58	22.37	22.44
		6	#0		21.60	21.52	21.56

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					23025	23095	23165
Band12	3	1	#0	QPSK	23.09	23.07	23.04
		1	#Mid		23.18	23.16	23.13
		1	#Max		23.12	23.18	23.07
		8	#0		22.30	22.24	22.28
		8	#Mid		22.34	22.26	22.32
		8	#Max		22.35	22.29	22.30
		15	#0		22.33	22.24	22.33
	3	1	#0	QAM16	22.32	21.86	22.44
		1	#Mid		22.37	21.95	22.51
		1	#Max		22.30	21.85	22.41
		8	#0		21.32	21.16	21.33
		8	#Mid		21.39	21.25	21.35
		8	#Max		21.34	21.19	21.27
		15	#0		21.34	21.34	21.31

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					23035	23095	23155
Band12	5	1	#0	QPSK	23.39	23.26	23.24
		1	#Mid		23.45	23.29	23.37
		1	#Max		23.35	23.21	23.36
		12	#0		22.25	22.26	22.40
		12	#Mid		22.48	22.36	22.38
		12	#Max		22.28	22.27	22.27
		25	#0		22.33	22.27	22.32
	5	1	#0	QAM16	22.66	22.56	22.72
		1	#Mid		22.72	22.59	22.85
		1	#Max		22.61	22.50	22.76
		12	#0		21.31	21.33	21.32
		12	#Mid		21.38	21.38	21.39
		12	#Max		21.25	21.37	21.27
		25	#0		21.37	21.28	21.32

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					23060	23095	23130
Band12	10	1	#0	QPSK	23.52	23.34	23.33
		1	#Mid		23.50	23.37	23.41
		1	#Max		23.49	23.37	23.43
		25	#0		22.47	22.41	22.23
		25	#Mid		22.36	22.30	22.39
		25	#Max		22.37	22.38	22.18
		50	#0		22.37	22.35	22.25
	10	1	#0	QAM16	22.28	22.74	22.53
		1	#Mid		22.26	22.75	22.52
		1	#Max		22.16	22.71	22.49
		25	#0		21.36	21.34	21.22
		25	#Mid		21.38	21.38	21.33
		25	#Max		21.40	21.41	21.23
		50	#0		21.37	21.39	21.25

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					23755	23790	23825
Band17	5	1	#0	QPSK	23.35	23.23	23.32
		1	#Mid		23.43	23.34	23.44
		1	#Max		23.36	23.26	23.40
		12	#0		22.46	22.34	22.41
		12	#Mid		22.44	22.38	22.52
		12	#Max		22.42	22.36	22.32
		25	#0		22.40	22.32	22.35
	5	1	#0	QAM16	22.63	22.53	22.75
		1	#Mid		22.73	22.61	22.91
		1	#Max		22.59	22.54	22.78
		12	#0		21.35	21.29	21.40
		12	#Mid		21.39	21.43	21.45
		12	#Max		21.35	21.38	21.31
		25	#0		21.45	21.31	21.33

Band	Bandwidth (MHz)	RB Size	RB Position	Modulation	Channel		
					23780	23790	23800
Band17	10	1	#0	QPSK	23.41	23.49	23.40
		1	#Mid		23.46	23.56	23.45
		1	#Max		23.41	23.58	23.47
		25	#0		22.25	22.27	22.29
		25	#Mid		22.39	22.36	22.45
		25	#Max		22.35	22.26	22.31
		50	#0		22.32	22.32	22.31
	10	1	#0	QAM16	22.55	22.24	22.74
		1	#Mid		22.54	22.26	22.79
		1	#Max		22.57	22.31	22.80
		25	#0		21.36	21.23	21.28
		25	#Mid		21.42	21.41	21.43
		25	#Max		21.36	21.27	21.30
		50	#0		21.37	21.30	21.28

WLAN 2.4G			
Mode	Frequency	Maximum Conducted Output Power	Tune-up power
	(MHz)	(dBm)	(dBm)
802.11b	2412	14.36	15.0
	2437	14.45	
	2462	14.53	
802.11g	2412	13.36	14.0
	2437	13.46	
	2462	13.38	
802.11n20	2412	12.16	13.0
	2437	12.41	
	2462	12.42	
802.11n40	2422	11.68	12.0
	2437	11.87	
	2452	11.74	

Note:

1. When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 b/g/n modes, the channel in the lower order/sequence 802.11 mode (i.e. g, n) is selected. Therefore the SAR measurements performed for the 802.11b modes, as the lowest order modulation, cover 802.11g/n modes.
2. SAR is not required for the following 2.4 GHz OFDM conditions as 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.
3. Per KDB 248227 D01 v02r02, For 802.11b DSSS SAR measurements ,when the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration. When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

WLAN 5.1G			
Mode	Frequency	Maximum Conducted Output Power	Tune-up power
	(MHz)	(dBm)	(dBm)
802.11a	5180	8.62	9.0
	5200	8.16	
	5240	8.48	
802.11n20	5180	7.61	8.0
	5200	7.38	
	5240	7.66	
802.11n40	5190	8.11	8.5
	5230	7.77	
802.11nac20	5180	7.64	8.0
	5200	7.51	
	5240	7.44	
802.11nac40	5190	7.63	8.0
	5230	7.78	
802.11nac80	5210	7.19	7.5

WLAN 5.8G			
Mode	Frequency	Maximum Conducted Output Power	Tune-up power
	(MHz)	(dBm)	(dBm)
802.11a	5745	8.77	11.0
	5785	8.98	
	5825	10.49	
802.11n20	5745	8.14	10.0
	5785	7.94	
	5825	9.39	
802.11n40	5755	7.89	8.5
	5795	8.19	
802.11nac20	5745	8.03	10.0
	5785	8.00	
	5825	9.41	
802.11nac40	5755	8.13	9.0
	5795	8.45	
802.11nac80	5775	7.04	7.5

Bluetooth			
Modulation	Frequency (MHz)	Output Power (dBm)	Tune-up power (dBm)
1-DH1	2402	1.21	2.0
	2441	1.45	
	2480	1.34	
2-DH1	2402	0.58	1.5
	2441	0.87	
	2480	0.76	
3-DH1	2402	0.34	1.0
	2441	0.56	
	2480	0.42	

BLE			
Modulation	Frequency (MHz)	Output Power (dBm)	Tune-up power (dBm)
GFSK 1Mbps	2402	-1.78	-1.0
	2440	-1.51	
	2480	-1.66	
GFSK 2Mbps	2402	-1.81	-1.0
	2440	-1.49	
	2480	-1.71	

Note:

Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \right] \cdot \sqrt{f(\text{GHz})}$$

≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

f(GHz) is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

Bluetooth Turn up Power (dBm)	Bluetooth Turn up Power (mW)	Separation Distance (mm)	Frequency (GHz)	Result	Exclusion Thresholds
2.0	1.58	5	2.48	0.50	3.0

Per KDB 447498 D01v06, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

According to the calculation results in the table above, BT SAR does not need to be tested.

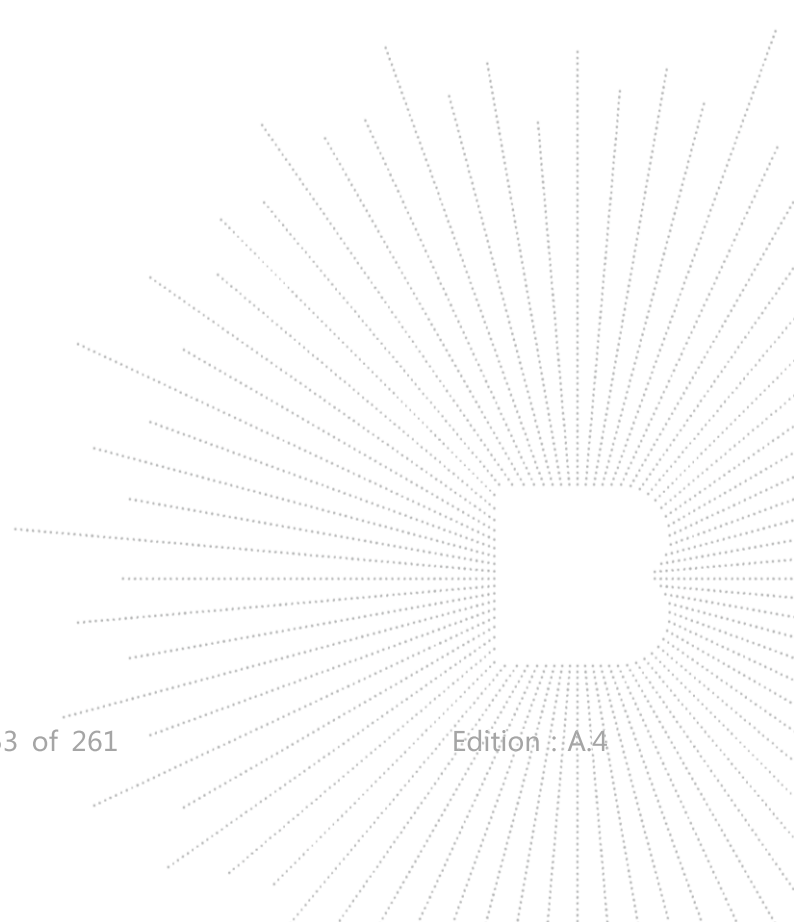
NFC			
Modulation	Frequency (MHz)	Output Power (dBm)	Tune-up power (dBm)
ASK	13.56	-12.73	-12.0

Note:

Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

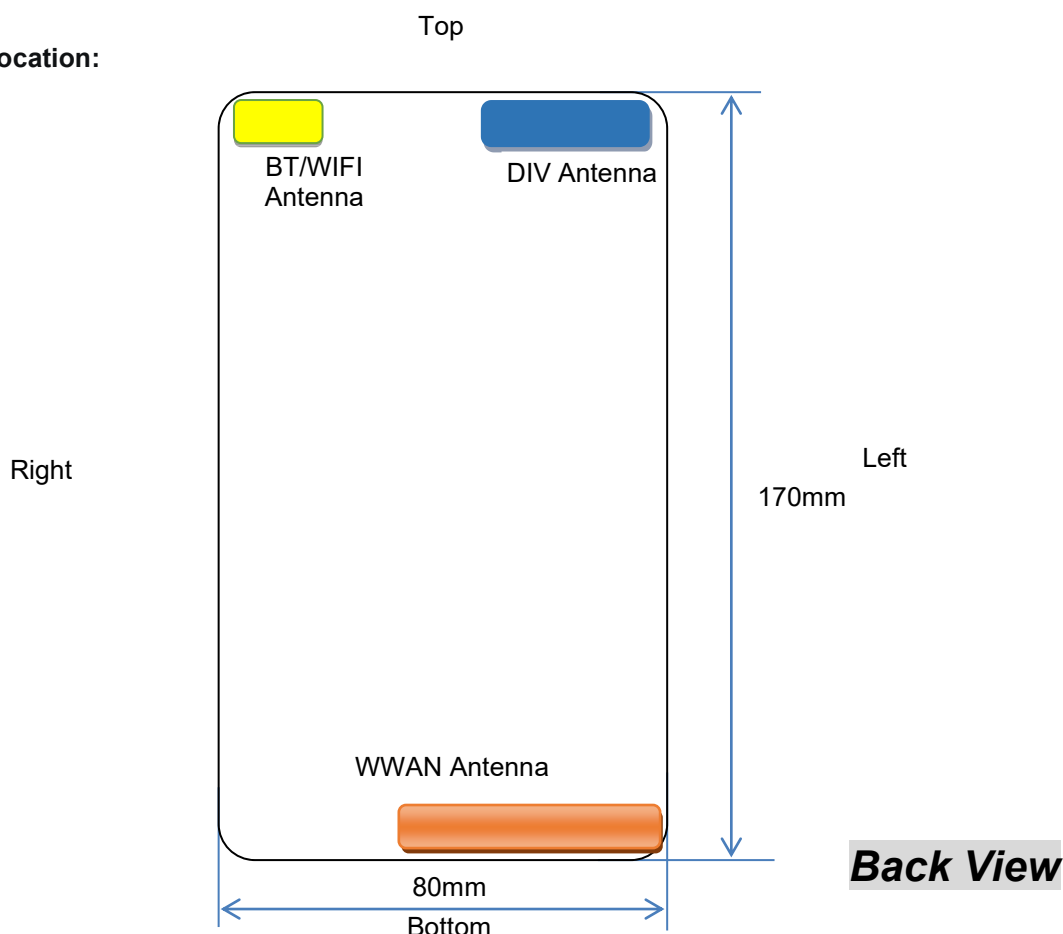
Frequency (MHz)	NFC Turn up Power (dBm)	NFC Turn up Power (mW)	Exclusion Limits (mW)	Result
13.56	-12.0	0.06	1	No

According to the calculation results in the table above, NFC SAR does not need to be tested.



14.2 Transmit Antennas and SAR Measurement Position

EUT Antenna Location:



Distance of The Antenna to the EUT surface and edge (mm)						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
WWAN	<25	<25	154	<25	<25	31
BT/WIFI	<25	<25	<25	151	61	<25

EUT Testing Location Evaluation:

Positions for SAR tests; Hotspot mode						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
WWAN	Yes	Yes	No	Yes	Yes	No
BT/WIFI	Yes	Yes	Yes	No	No	Yes

Note:

- According to the KDB 941225 D06 Hot Spot SAR v02, the edges with less than 25 mm distance to the antennas need to be tested for SAR.
- According to the KDB 941225 D06 Hot Spot SAR v02, When the overall length and width of a device is > 9 cm x 5 cm (~3.5" x 2"), a test separation distance of 10 mm is required for hotspot mode SAR measurements.

14.3 Measured and Reported (Scaled) SAR Results

The calculated SAR is obtained by the following formula:

1. Reported SAR for WWAN=Measured SAR * Tune-up Scaling factor
2. Reported SAR for WLAN and Bluetooth=Measured SAR * Tune-up Scaling factor * Duty Cycle Scaling factor
3. Duty Cycle Scaling factor=1/ Duty Cycle (%)

KDB 447498 D01 General RF Exposure Guidance:

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

KDB 648474 D04 Handset SAR v01r03:

1. When the *reported* SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest *reported* SAR configuration for that wireless mode and frequency band should be repeated for the body-worn accessory with a headset attached to the handset.
2. 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)
3. 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.

KDB 941225 D01 3G SAR Procedures:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq 1/4$ dB 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.

KDB 941225 D05 SAR for LTE Devices:

1. Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
2. When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
3. Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
4. SAR measurement is not required for the 16QAM and 64QAM. When the highest maximum output power for 16QAM and 64QAM is $\leq 1/2$ dB higher than the QPSK or when the reported SAR for the QPSK configuration is ≤ 1.45 W/kg.
5. Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

KDB 248227 D01 802.11 Wi-Fi SAR

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements.

For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions.

DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.16 The initial test position procedure is described in the following:

- a) When the *reported* SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other (remaining) test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band. SAR is also not required for that exposure configuration in the subsequent test configuration(s).
- b) When the *reported* SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest extrapolated or estimated 1-g SAR conditions determined by area scans or next closest/smallest test separation distance and maximum RF coupling test positions based on manufacturer justification, on the highest maximum output power channel, until the *reported* SAR is ≤ 0.8 W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.
- c) For all positions/configurations tested using the initial test position and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

Additional power measurements may be required for this step, which should be limited to those necessary for identifying the subsequent highest output power channels.

When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.

When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR

TCB workshop April 2015:

SAR test exclusion can be applied for testing overlapping LTE bands as follows:

- a) The maximum output power, including tolerance, for the smaller band must be s the larger band to qualify for the SAR test exclusion.
- b) The channel bandwidth and other operating parameters for the smaller band must be fully supported by the larger band.

LTE Band 17 (704-716 MHz) is covered by LTE Band 12 (699-716 MHz)

GSM 850											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	Voice	Right Cheek	128	824.2	33.47	34.0	1.130	0.052	0.059	1
		Voice	Right Tilt	128	824.2	33.47	34.0	1.130	0.045	0.051	
		Voice	Left Cheek	128	824.2	33.47	34.0	1.130	0.044	0.050	
		Voice	Left Tilt	128	824.2	33.47	34.0	1.130	0.045	0.051	
Body & Hotspot	10	GPRS-2Tx	Back	128	824.2	32.60	33.0	1.096	0.209	0.229	2
		GPRS-2Tx	Front	128	824.2	32.60	33.0	1.096	0.091	0.100	
Hotspot	10	GPRS-2Tx	Left Side	128	824.2	32.60	33.0	1.096	0.082	0.090	
		GPRS-2Tx	Bottom Side	128	824.2	32.60	33.0	1.096	0.184	0.202	

GSM 1900											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	Voice	Right Cheek	512	1850.2	30.30	31.0	1.175	0.018	0.021	3
		Voice	Right Tilt	512	1850.2	30.30	31.0	1.175	0.012	0.014	
		Voice	Left Cheek	512	1850.2	30.30	31.0	1.175	0.010	0.012	
		Voice	Left Tilt	512	1850.2	30.30	31.0	1.175	0.008	0.009	
Body & Hotspot	10	GPRS-2Tx	Back	512	1850.2	29.31	30.0	1.172	0.118	0.138	4
		GPRS-2Tx	Front	512	1850.2	29.31	30.0	1.172	0.063	0.074	
Hotspot	10	GPRS-2Tx	Left Side	512	1850.2	29.31	30.0	1.172	0.047	0.055	
		GPRS-2Tx	Bottom Side	512	1850.2	29.31	30.0	1.172	0.142	0.166	5

WCDMA Band II											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	RMC*	Right Cheek	9262	1852.4	23.00	23.5	1.122	0.041	0.046	6
		RMC*	Right Tilt	9262	1852.4	23.00	23.5	1.122	0.011	0.012	
		RMC*	Left Cheek	9262	1852.4	23.00	23.5	1.122	0.022	0.025	
		RMC*	Left Tilt	9262	1852.4	23.00	23.5	1.122	0.018	0.020	
Body & Hotspot	10	RMC*	Back	9262	1852.4	23.00	23.5	1.122	0.189	0.212	7
		RMC*	Front	9262	1852.4	23.00	23.5	1.122	0.085	0.095	
Hotspot	10	RMC*	Left Side	9262	1852.4	23.00	23.5	1.122	0.031	0.035	
		RMC*	Bottom Side	9262	1852.4	23.00	23.5	1.122	0.226	0.254	8

WCDMA Band IV											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	RMC*	Right Cheek	1312	1712.4	22.32	23.0	1.169	0.065	0.076	9
		RMC*	Right Tilt	1312	1712.4	22.32	23.0	1.169	0.053	0.062	
		RMC*	Left Cheek	1312	1712.4	22.32	23.0	1.169	0.061	0.071	
		RMC*	Left Tilt	1312	1712.4	22.32	23.0	1.169	0.036	0.042	
Body & Hotspot	10	RMC*	Back	1312	1712.4	22.32	23.0	1.169	0.275	0.322	10
		RMC*	Front	1312	1712.4	22.32	23.0	1.169	0.162	0.189	
Hotspot	10	RMC*	Left Side	1312	1712.4	22.32	23.0	1.169	0.145	0.170	
		RMC*	Bottom Side	1312	1712.4	22.32	23.0	1.169	0.313	0.366	11

WCDMA Band V											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	RMC*	Right Cheek	4182	836.4	22.81	23.5	1.172	0.075	0.088	
		RMC*	Right Tilt	4182	836.4	22.81	23.5	1.172	0.068	0.080	
		RMC*	Left Cheek	4182	836.4	22.81	23.5	1.172	0.095	0.111	
		RMC*	Left Tilt	4182	836.4	22.81	23.5	1.172	0.101	0.118	12
Body & Hotspot	10	RMC*	Back	4182	836.4	22.81	23.5	1.172	0.193	0.226	13
		RMC*	Front	4182	836.4	22.81	23.5	1.172	0.109	0.128	
Hotspot	10	RMC*	Left Side	4182	836.4	22.81	23.5	1.172	0.142	0.166	
		RMC*	Bottom Side	4182	836.4	22.81	23.5	1.172	0.227	0.266	14

FDD-LTE Band 2 (20MHz Bandwidth)											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	QPSK,1RB	Right Cheek	18700	1860.0	23.47	24.0	1.130	0.034	0.038	15
		QPSK,1RB	Right Tilt	18700	1860.0	23.47	24.0	1.130	0.020	0.023	
		QPSK,1RB	Left Cheek	18700	1860.0	23.47	24.0	1.130	0.019	0.021	
		QPSK,1RB	Left Tilt	18700	1860.0	23.47	24.0	1.130	0.015	0.017	
		QPSK,50%RB	Right Cheek	18700	1860.0	22.34	23.0	1.164	0.029	0.034	
		QPSK,50%RB	Right Tilt	18700	1860.0	22.34	23.0	1.164	0.017	0.020	
		QPSK,50%RB	Left Cheek	18700	1860.0	22.34	23.0	1.164	0.014	0.016	
		QPSK,50%RB	Left Tilt	18700	1860.0	22.34	23.0	1.164	0.010	0.012	
Body & Hotspot	10	QPSK,1RB	Back	18700	1860.0	23.47	24.0	1.130	0.183	0.207	16
		QPSK,1RB	Front	18700	1860.0	23.47	24.0	1.130	0.088	0.099	
		QPSK,50%RB	Back	18700	1860.0	22.34	23.0	1.164	0.160	0.186	
		QPSK,50%RB	Front	18700	1860.0	22.34	23.0	1.164	0.070	0.081	
Hotspot	10	QPSK,1RB	Left Side	18700	1860.0	23.47	24.0	1.130	0.051	0.058	
		QPSK,1RB	Bottom Side	18700	1860.0	23.47	24.0	1.130	0.204	0.230	17
		QPSK,50%RB	Left Side	18700	1860.0	22.34	23.0	1.164	0.039	0.045	
		QPSK,50%RB	Bottom Side	18700	1860.0	22.34	23.0	1.164	0.188	0.219	

FDD-LTE Band 4 (20MHz Bandwidth)											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	QPSK,1RB	Right Cheek	20300	1745.0	22.72	23.0	1.067	0.035	0.037	18
		QPSK,1RB	Right Tilt	20300	1745.0	22.72	23.0	1.067	0.041	0.044	
		QPSK,1RB	Left Cheek	20300	1745.0	22.72	23.0	1.067	0.043	0.046	
		QPSK,1RB	Left Tilt	20300	1745.0	22.72	23.0	1.067	0.026	0.028	
		QPSK,50%RB	Right Cheek	20300	1745.0	21.59	22.0	1.099	0.030	0.033	
		QPSK,50%RB	Right Tilt	20300	1745.0	21.59	22.0	1.099	0.033	0.036	
		QPSK,50%RB	Left Cheek	20300	1745.0	21.59	22.0	1.099	0.030	0.033	
		QPSK,50%RB	Left Tilt	20300	1745.0	21.59	22.0	1.099	0.018	0.020	
Body & Hotspot	10	QPSK,1RB	Back	20300	1745.0	22.72	23.0	1.067	0.215	0.229	19
		QPSK,1RB	Front	20300	1745.0	22.72	23.0	1.067	0.131	0.140	
		QPSK,50%RB	Back	20300	1745.0	21.59	22.0	1.099	0.163	0.179	
		QPSK,50%RB	Front	20300	1745.0	21.59	22.0	1.099	0.101	0.111	
Hotspot	10	QPSK,1RB	Left Side	20300	1745.0	22.72	23.0	1.067	0.133	0.142	20
		QPSK,1RB	Bottom Side	20300	1745.0	22.72	23.0	1.067	0.245	0.261	
		QPSK,50%RB	Left Side	20300	1745.0	21.59	22.0	1.099	0.105	0.115	
		QPSK,50%RB	Bottom Side	20300	1745.0	21.59	22.0	1.099	0.192	0.211	

FDD-LTE Band 5 (10MHz Bandwidth)											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	QPSK,1RB	Right Cheek	20525	836.5	23.00	23.5	1.122	0.058	0.065	21
		QPSK,1RB	Right Tilt	20525	836.5	23.00	23.5	1.122	0.071	0.080	
		QPSK,1RB	Left Cheek	20525	836.5	23.00	23.5	1.122	0.094	0.105	
		QPSK,1RB	Left Tilt	20525	836.5	23.00	23.5	1.122	0.102	0.114	
		QPSK,50%RB	Right Cheek	20525	836.5	22.01	22.5	1.119	0.044	0.049	
		QPSK,50%RB	Right Tilt	20525	836.5	22.01	22.5	1.119	0.058	0.065	
		QPSK,50%RB	Left Cheek	20525	836.5	22.01	22.5	1.119	0.077	0.086	
		QPSK,50%RB	Left Tilt	20525	836.5	22.01	22.5	1.119	0.086	0.096	
Body & Hotspot	10	QPSK,1RB	Back	20525	836.5	23.00	23.5	1.122	0.189	0.212	22
		QPSK,1RB	Front	20525	836.5	23.00	23.5	1.122	0.144	0.162	
		QPSK,50%RB	Back	20525	836.5	22.01	22.5	1.119	0.153	0.171	
		QPSK,50%RB	Front	20525	836.5	22.01	22.5	1.119	0.119	0.133	
Hotspot	10	QPSK,1RB	Left Side	20525	836.5	23.00	23.5	1.122	0.093	0.104	23
		QPSK,1RB	Bottom Side	20525	836.5	23.00	23.5	1.122	0.214	0.240	
		QPSK,50%RB	Left Side	20525	836.5	22.01	22.5	1.119	0.077	0.086	
		QPSK,50%RB	Bottom Side	20525	836.5	22.01	22.5	1.119	0.173	0.194	

FDD-LTE Band 7 (20MHz Bandwidth)											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	QPSK,1RB	Right Cheek	21100	2535	22.49	23.0	1.125	0.018	0.020	24
		QPSK,1RB	Right Tilt	21100	2535	22.49	23.0	1.125	0.010	0.011	
		QPSK,1RB	Left Cheek	21100	2535	22.49	23.0	1.125	0.039	0.044	
		QPSK,1RB	Left Tilt	21100	2535	22.49	23.0	1.125	0.013	0.015	
		QPSK,50%RB	Right Cheek	21100	2535	21.42	22.0	1.143	0.012	0.014	
		QPSK,50%RB	Right Tilt	21100	2535	21.42	22.0	1.143	0.009	0.010	
		QPSK,50%RB	Left Cheek	21100	2535	21.42	22.0	1.143	0.033	0.038	
		QPSK,50%RB	Left Tilt	21100	2535	21.42	22.0	1.143	0.011	0.013	
Body & Hotspot	10	QPSK,1RB	Back	21100	2535	22.49	23.0	1.125	0.487	0.548	25
		QPSK,1RB	Front	21100	2535	22.49	23.0	1.125	0.122	0.137	
		QPSK,50%RB	Back	21100	2535	21.42	22.0	1.143	0.393	0.449	
		QPSK,50%RB	Front	21100	2535	21.42	22.0	1.143	0.101	0.115	
Hotspot	10	QPSK,1RB	Left Side	21100	2535	22.49	23.0	1.125	0.073	0.082	
		QPSK,1RB	Bottom Side	21100	2535	22.49	23.0	1.125	0.480	0.540	
		QPSK,50%RB	Left Side	21100	2535	21.42	22.0	1.143	0.059	0.067	
		QPSK,50%RB	Bottom Side	21100	2535	21.42	22.0	1.143	0.410	0.469	

FDD-LTE Band 12 (10MHz Bandwidth)											
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
						Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	QPSK,1RB	Right Cheek	23060	704	23.52	24.0	1.117	0.036	0.040	26
		QPSK,1RB	Right Tilt	23060	704	23.52	24.0	1.117	0.031	0.035	
		QPSK,1RB	Left Cheek	23060	704	23.52	24.0	1.117	0.047	0.052	
		QPSK,1RB	Left Tilt	23060	704	23.52	24.0	1.117	0.046	0.051	
		QPSK,50%RB	Right Cheek	23060	704	22.47	23.0	1.130	0.028	0.032	
		QPSK,50%RB	Right Tilt	23060	704	22.47	23.0	1.130	0.026	0.029	
		QPSK,50%RB	Left Cheek	23060	704	22.47	23.0	1.130	0.036	0.041	
		QPSK,50%RB	Left Tilt	23060	704	22.47	23.0	1.130	0.034	0.038	
Body & Hotspot	10	QPSK,1RB	Back	23060	704	23.52	24.0	1.117	0.064	0.071	27
		QPSK,1RB	Front	23060	704	23.52	24.0	1.117	0.039	0.044	
		QPSK,50%RB	Back	23060	704	22.47	23.0	1.130	0.049	0.055	
		QPSK,50%RB	Front	23060	704	22.47	23.0	1.130	0.029	0.033	
Hotspot	10	QPSK,1RB	Left Side	23060	704	23.52	24.0	1.117	0.047	0.052	
		QPSK,1RB	Bottom Side	23060	704	23.52	24.0	1.117	0.048	0.054	
		QPSK,50%RB	Left Side	23060	704	22.47	23.0	1.130	0.039	0.044	
		QPSK,50%RB	Bottom Side	23060	704	22.47	23.0	1.130	0.037	0.042	

WLAN 2.4G												
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Duty Cycle (%)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
							Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	802.11b	Right Cheek	11	2462	100	14.53	15.0	1.114	0.062	0.069	
		802.11b	Right Tilt	11	2462	100	14.53	15.0	1.114	0.068	0.076	
		802.11b	Left Cheek	11	2462	100	14.53	15.0	1.114	0.106	0.118	
		802.11b	Left Tilt	11	2462	100	14.53	15.0	1.114	0.121	0.135	28
Body & Hotspot	10	802.11b	Back	11	2462	100	14.53	15.0	1.114	0.037	0.041	
		802.11b	Front	11	2462	100	14.53	15.0	1.114	0.039	0.043	29
Hotspot	10	802.11b	Right Side	11	2462	100	14.53	15.0	1.114	0.025	0.028	
		802.11b	Top Side	11	2462	100	14.53	15.0	1.114	0.033	0.037	

WLAN 5.1G												
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Duty Cycle (%)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
							Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	802.11a	Right Cheek	36	5180	100	8.62	9.0	1.091	0.411	0.449	
		802.11a	Right Tilt	36	5180	100	8.62	9.0	1.091	0.365	0.398	
		802.11a	Left Cheek	36	5180	100	8.62	9.0	1.091	0.467	0.510	30
		802.11a	Left Tilt	36	5180	100	8.62	9.0	1.091	0.426	0.465	
Body & Hotspot	10	802.11a	Back	36	5180	100	8.62	9.0	1.091	0.160	0.175	
		802.11a	Front	36	5180	100	8.62	9.0	1.091	0.380	0.415	31
Hotspot	10	802.11a	Right Side	36	5180	100	8.62	9.0	1.091	0.369	0.403	
		802.11a	Top Side	36	5180	100	8.62	9.0	1.091	0.485	0.529	32

WLAN 5.8G												
RF Exposure Conditions	Dist. (mm)	Mode	Test Position	CH.	Freq. (MHz)	Duty Cycle (%)	Output Power (dBm)			SAR1g (W/kg)		Plot No.
							Meas.	Turn-up	Scaling Factor	Meas.	Scaled	
Head	0	802.11a	Right Cheek	165	5825	100	10.49	11.0	1.125	0.390	0.439	
		802.11a	Right Tilt	165	5825	100	10.49	11.0	1.125	0.313	0.352	
		802.11a	Left Cheek	165	5825	100	10.49	11.0	1.125	0.481	0.541	33
		802.11a	Left Tilt	165	5825	100	10.49	11.0	1.125	0.476	0.535	
Body & Hotspot	10	802.11a	Back	165	5825	100	10.49	11.0	1.125	0.154	0.173	
		802.11a	Front	165	5825	100	10.49	11.0	1.125	0.367	0.413	34
Hotspot	10	802.11a	Right Side	165	5825	100	10.49	11.0	1.125	0.161	0.181	
		802.11a	Top Side	165	5825	100	10.49	11.0	1.125	0.483	0.543	35

Remark:

1. The value with the bold 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 SAR tests are not necessary.

14.4 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 $\leq 20\%$ 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 ($\sim 10\%$ 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)	Test Mode	RF Exposure Configuration	Test Position	Repeated SAR (yes/no)	Highest Measured SAR1-g (W/Kg)	First Repeated	
						Measured SAR1-g (W/Kg)	Largest to Smallest SAR Ratio
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

14.5 Simultaneous Transmission Evaluation

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.

Application Simultaneous Transmission information:

No.	Configurations	Head SAR	Body SAR	Hotspot SAR
1	WWAN+WLAN 2.4G (Data)	Yes	Yes	Yes
2	WWAN+WLAN 5G(Data)	Yes	Yes	Yes
3	WWAN+ Bluetooth (Data)	Yes	Yes	Yes

Remark:

1. WWAN cannot transmit simultaneously.
2. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
3. WLAN 2.4G and WLAN 5G cannot transmit simultaneously.
3. According to the KDB 447498 D01 v06, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
 - $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg}$ for test separation distances $\leq 50 \text{ mm}$;
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 $> 50 \text{ mm}$

Estimated stand alone SAR						
Communication system	Frequency (MHz)	Maximum Power (dBm)	Maximum Power (mW)	Separation Distance (mm)	X	Estimated SAR1-g (W/kg)
Bluetooth*	2480	2.0	1.58	5	7.5	0.067
Bluetooth*	2480	2.0	1.58	10	7.5	0.034

Note:

1. Bluetooth*- Including Lower power Bluetooth
2. Maximum average power including tune-up tolerance;
3. When the minimum test separation distance is $< 5 \text{ mm}$, a distance of 5 mm is applied to determine SAR test exclusion

4. 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 $\leq 1.6 \text{ W/Kg}$. When the sum is greater than the SAR limit, SAR test exclusion is determined by the SAR to peak location separation ratio.

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

5. Simultaneous transmission of maximum SAR sum calculation.

RF Exposure Conditions	Test Position	WWAN	WLAN 2.4G	Summed SAR (W/kg)	SAR1-g Limit (W/kg)
		Scaled SAR (W/kg)	Scaled SAR (W/kg)		
Head	Right Cheek	0.088	0.069	0.157	1.6
	Right Tilt	0.080	0.076	0.156	1.6
	Left Cheek	0.111	0.118	0.229	1.6
	Left Tilt	0.118	0.135	0.253	1.6
Body-worn & Hotspot	Back	0.548	0.041	0.589	1.6
	Front	0.189	0.043	0.232	1.6
Hotspot	Right side	/	0.028	0.028	1.6
	Left side	0.170	/	0.170	1.6
	Top side	/	0.037	0.037	1.6
	Bottom side	0.540	/	0.540	1.6

RF Exposure Conditions	Test Position	WWAN	WLAN 5G	Summed SAR (W/kg)	SAR1-g Limit (W/kg)
		Scaled SAR (W/kg)	Scaled SAR (W/kg)		
Head	Left Cheek	0.088	0.449	0.537	1.6
	Left Tilt	0.080	0.398	0.478	1.6
	Right Cheek	0.111	0.541	0.652	1.6
	Right Tilt	0.118	0.535	0.653	1.6
Body-worn & Hotspot	Back	0.548	0.175	0.723	1.6
	Front	0.189	0.415	0.604	1.6
Hotspot	Right side	/	0.403	0.403	1.6
	Left side	0.170	/	0.170	1.6
	Top side	/	0.543	0.543	1.6
	Bottom side	0.540	/	0.540	1.6

RF Exposure Conditions	Test Position	WWAN	Bluetooth	Summed SAR (W/kg)	SAR1-g Limit (W/kg)
		Scaled SAR (W/kg)	Scaled SAR (W/kg)		
Head	Left Cheek	0.088	0.067	0.155	1.6
	Left Tilt	0.080	0.067	0.147	1.6
	Right Cheek	0.111	0.067	0.178	1.6
	Right Tilt	0.118	0.067	0.185	1.6
Body-worn & Hotspot	Back	0.548	0.034	0.582	1.6
	Front	0.189	0.034	0.223	1.6
Hotspot	Right side	/	0.034	0.034	1.6
	Left side	0.170	/	0.170	1.6
	Top side	/	0.034	0.034	1.6
	Bottom side	0.540	/	0.540	1.6

15. Test Plots

15.1 System Performance Check

System check at 750 MHz

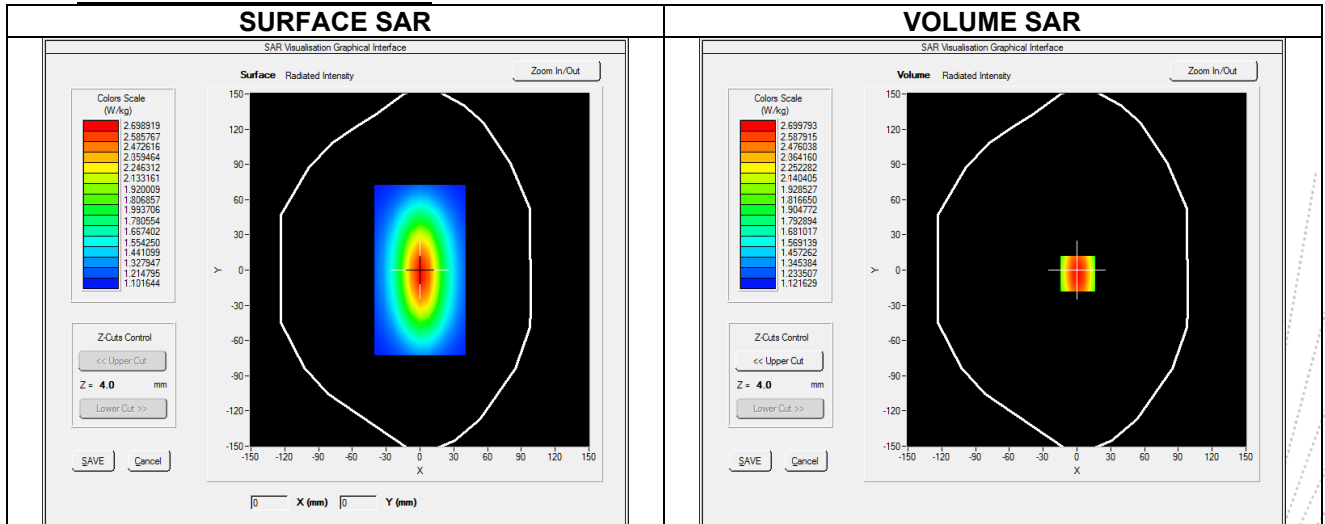
A. Experimental conditions.

Probe	SN EPGO373
ConvF	2.96
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW750
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	750.000
Relative permittivity (real part)	42.428
Relative permittivity (imaginary part)	21.363
Conductivity (S/m)	0.872

C. SAR Surface and Volume



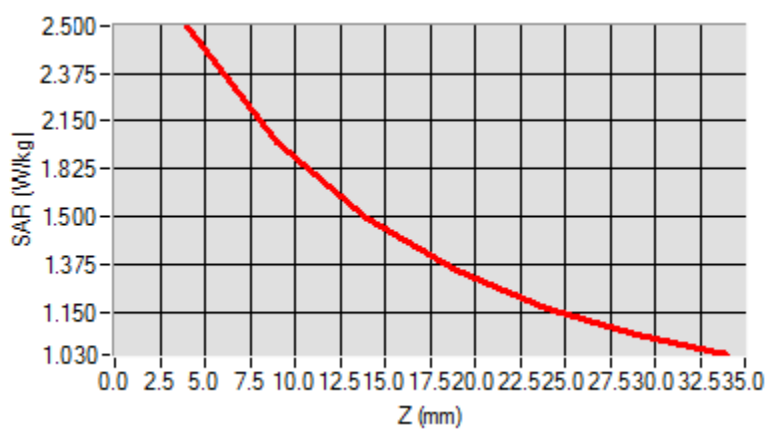
Maximum location: X=0.00, Y=-1.00 ; SAR Peak: 5.04 W/kg

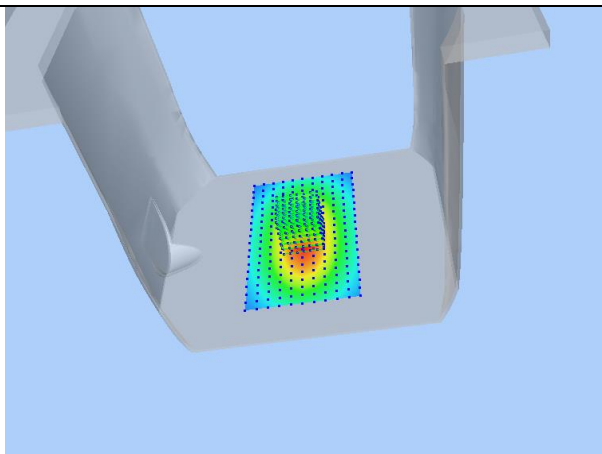
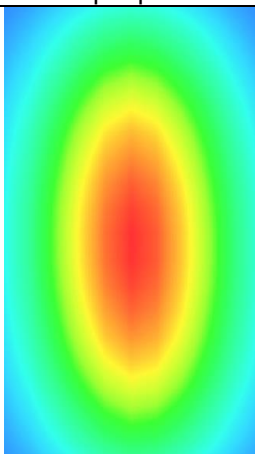
D. SAR 1g & 10g

SAR 10g (W/Kg)	1.362
SAR 1g (W/Kg)	2.178
Variation (%)	1.010
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	4.00	9.00	14.00	19.00	24.00
SAR (W/Kg)	2.3825	1.8741	1.4618	1.2805	1.2012


F. 3D Image

3D screen shot	Hot spot position
	

System check at 835 MHz

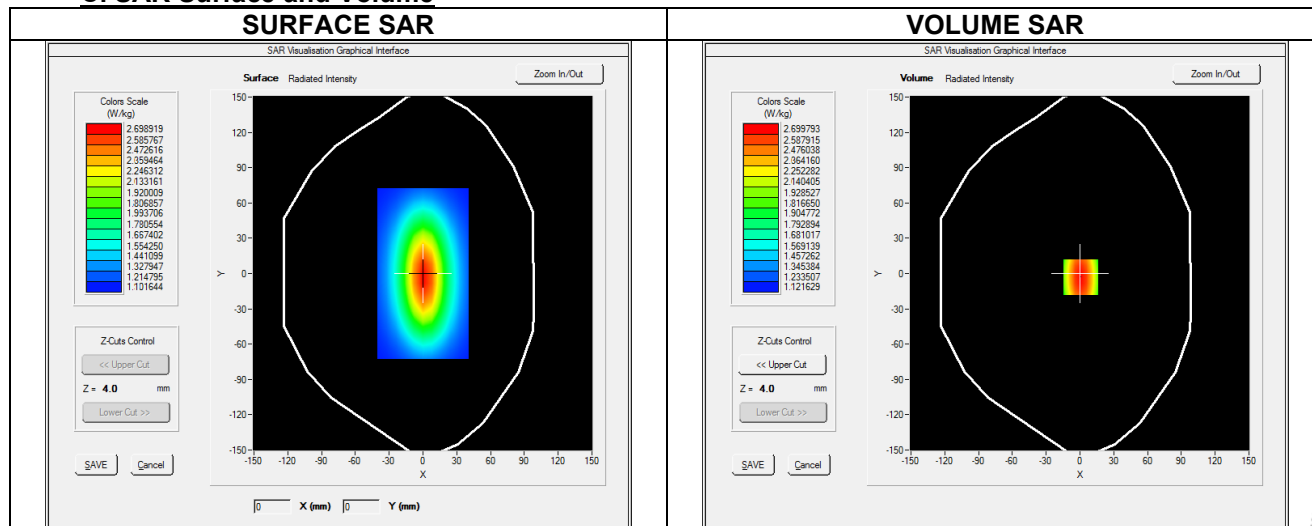
A. Experimental conditions.

Probe	SN EPGO373
ConvF	3.01
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW835
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	835.000
Relative permittivity (real part)	41.794
Relative permittivity (imaginary part)	20.910
Conductivity (S/m)	0.892

C. SAR Surface and Volume



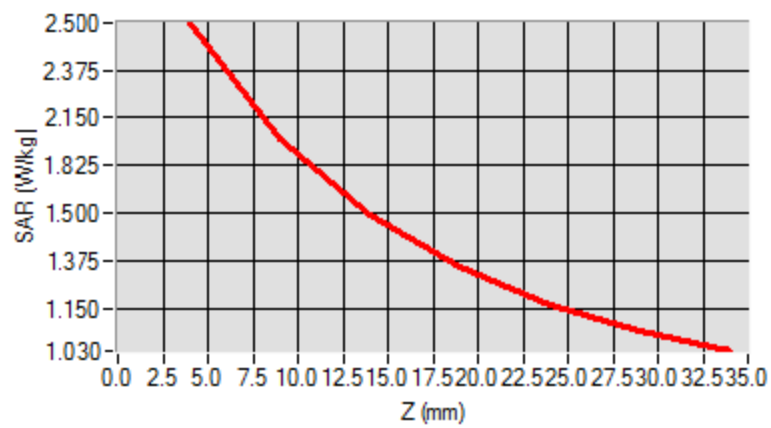
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 5.92 W/kg

D. SAR 1g & 10g

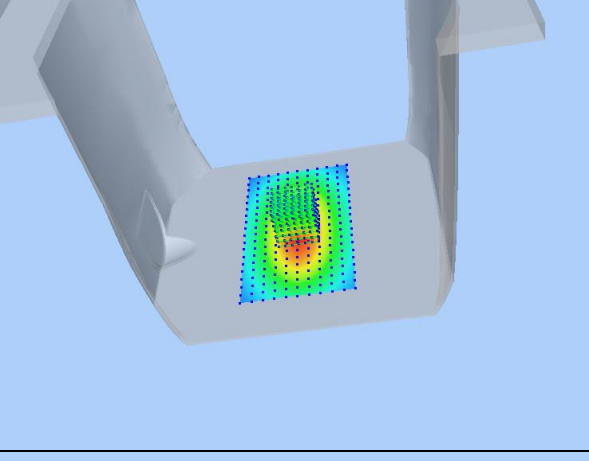
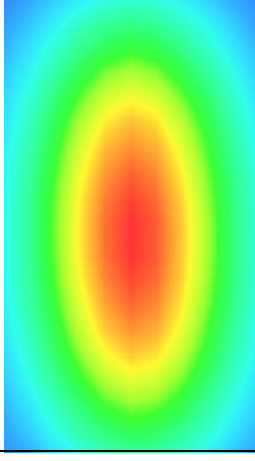
SAR 10g (W/Kg)	1.596
SAR 1g (W/Kg)	2.581
Variation (%)	2.140
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	4.00	9.00	14.00	19.00	24.00
SAR (W/Kg)	2.5004	1.9526	1.5361	1.4042	1.2835



F. 3D Image

3D screen shot	Hot spot position
	

System check at 1800 MHz

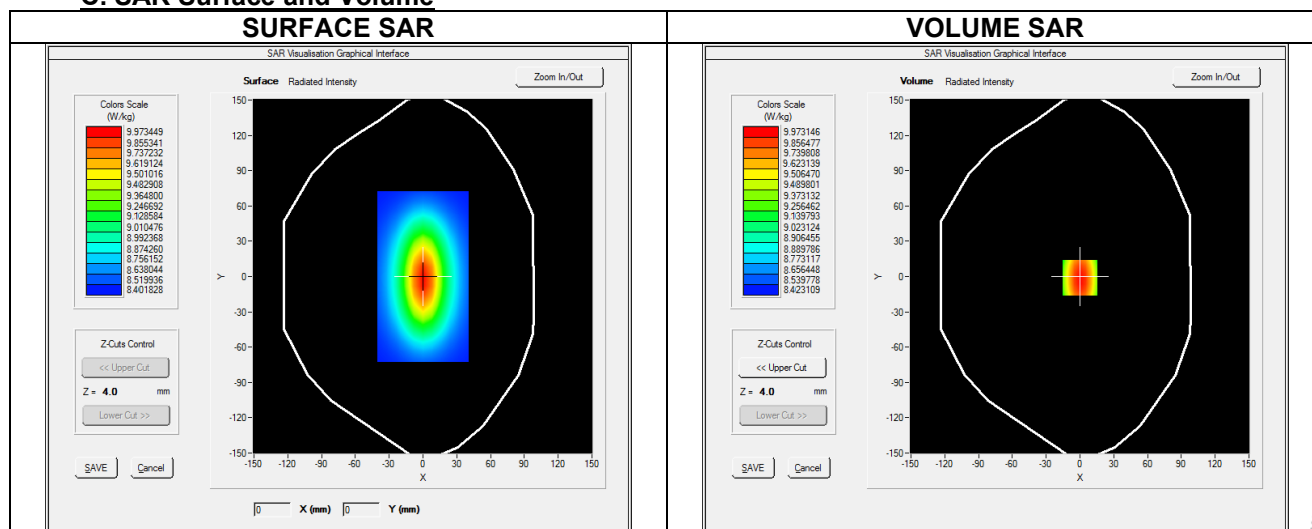
A. Experimental conditions.

Probe	SN EPGO373
ConvF	3.35
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=5mm
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)	40.636
Relative permittivity (imaginary part)	15.200
Conductivity (S/m)	1.381

C. SAR Surface and Volume



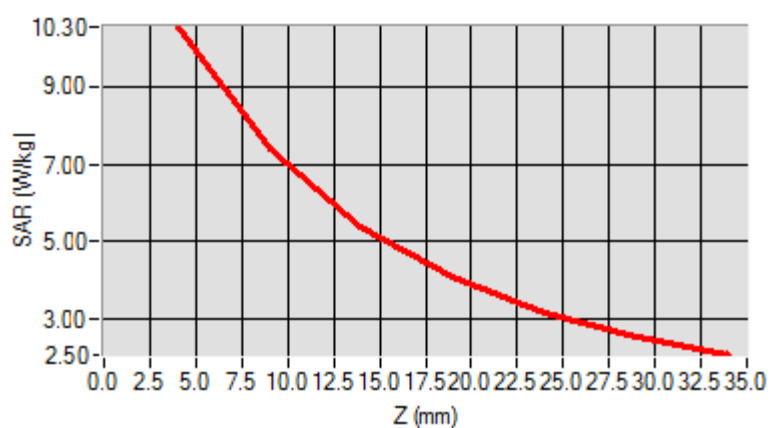
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 21.64 W/kg

D. SAR 1g & 10g

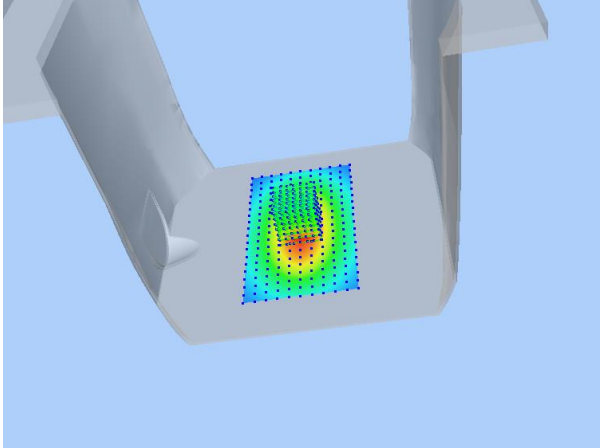
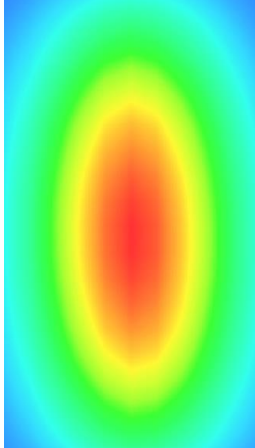
SAR 10g (W/Kg)	5.241
SAR 1g (W/Kg)	9.785
Variation (%)	-1.830
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	4.00	9.00	14.00	19.00	24.00
SAR (W/Kg)	10.4615	7.2138	5.2033	3.6014	3.1602



F. 3D Image

3D screen shot	Hot spot position
	

System check at 1900 MHz

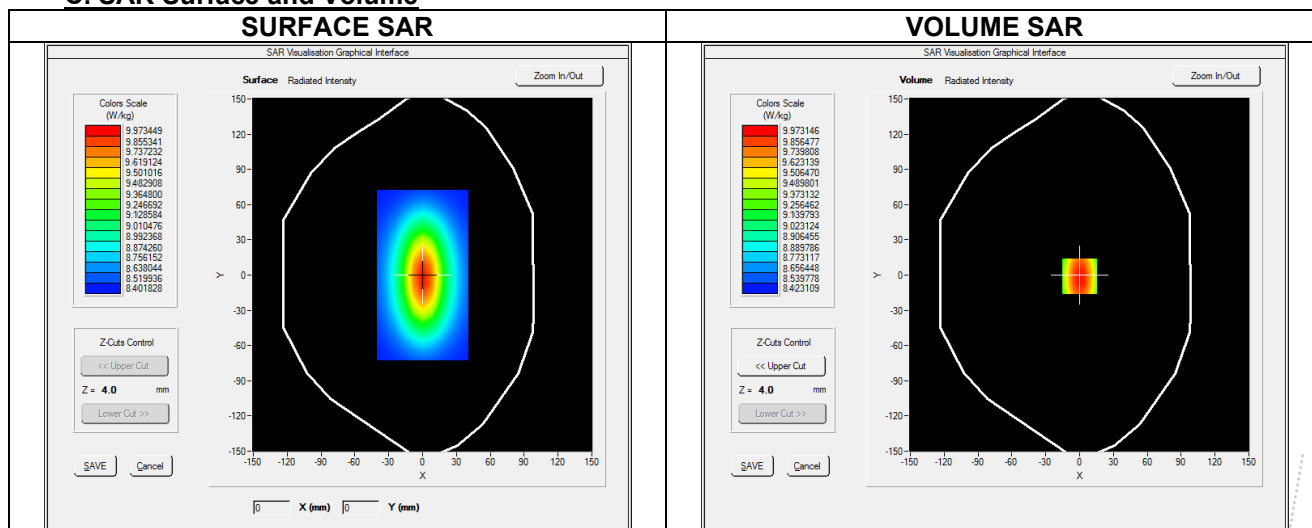
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.27
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1900
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	1900.000
Relative permittivity (real part)	40.503
Relative permittivity (imaginary part)	12.824
Conductivity (S/m)	1.427

C. SAR Surface and Volume



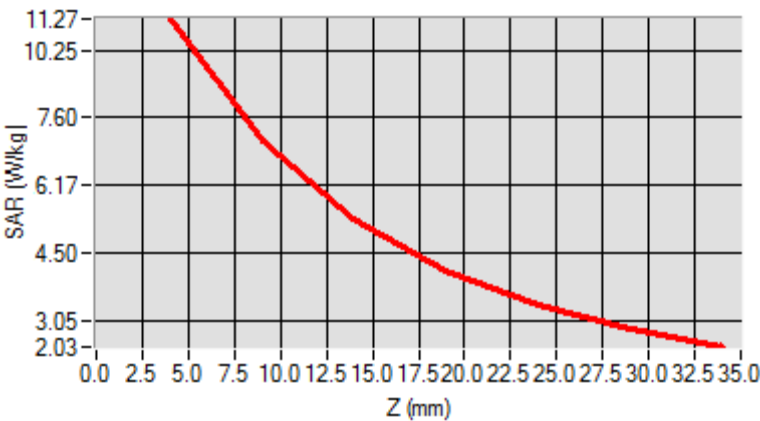
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 22.24 W/kg

D. SAR 1g & 10g

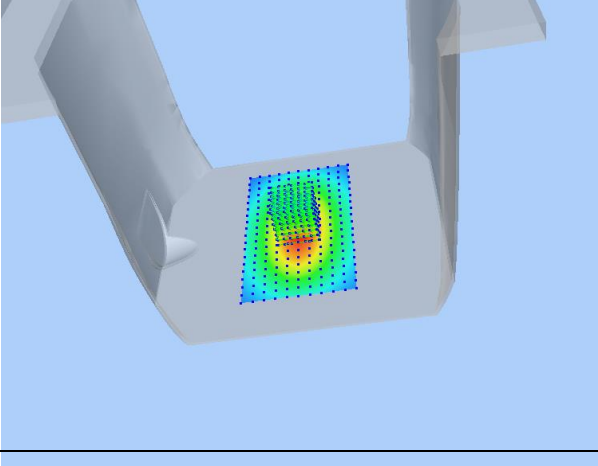
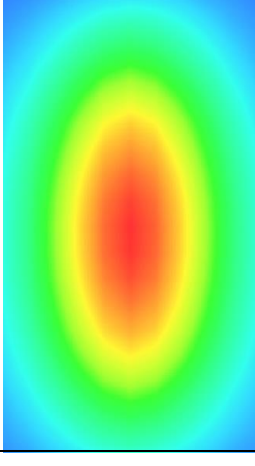
SAR 10g (W/Kg)	5.283
SAR 1g (W/Kg)	10.064
Variation (%)	-2.340
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

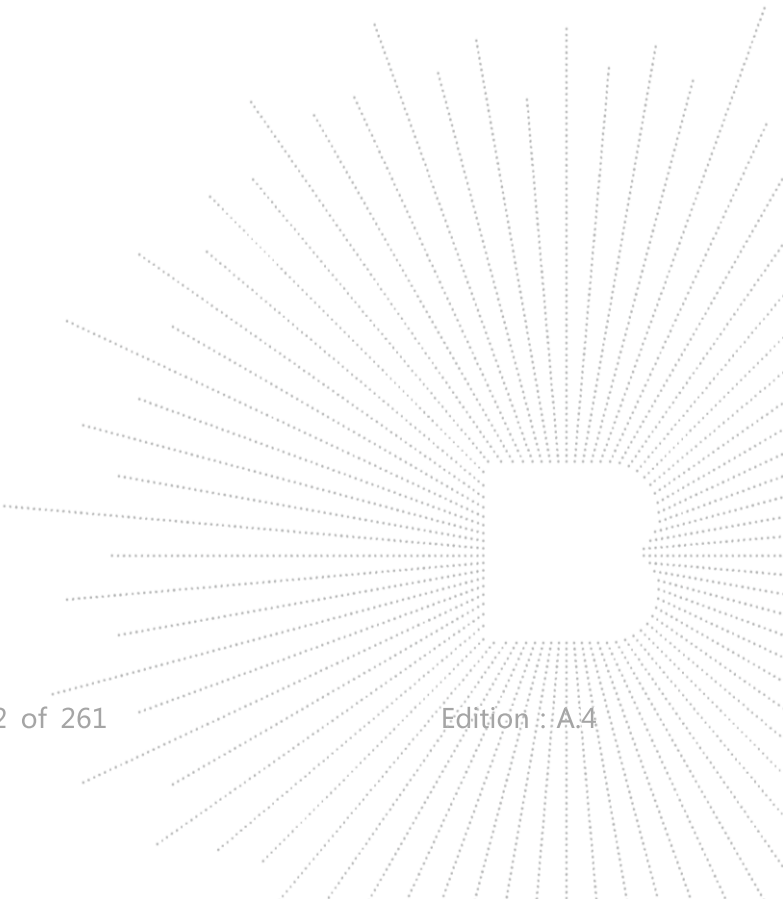
E. Z Axis Scan

Z (mm)	4.00	9.00	14.00	19.00	24.00
SAR (W/Kg)	11.2804	7.0425	5.4128	4.3019	3.2614



F. 3D Image

3D screen shot	Hot spot position
	



System check at 2450 MHz

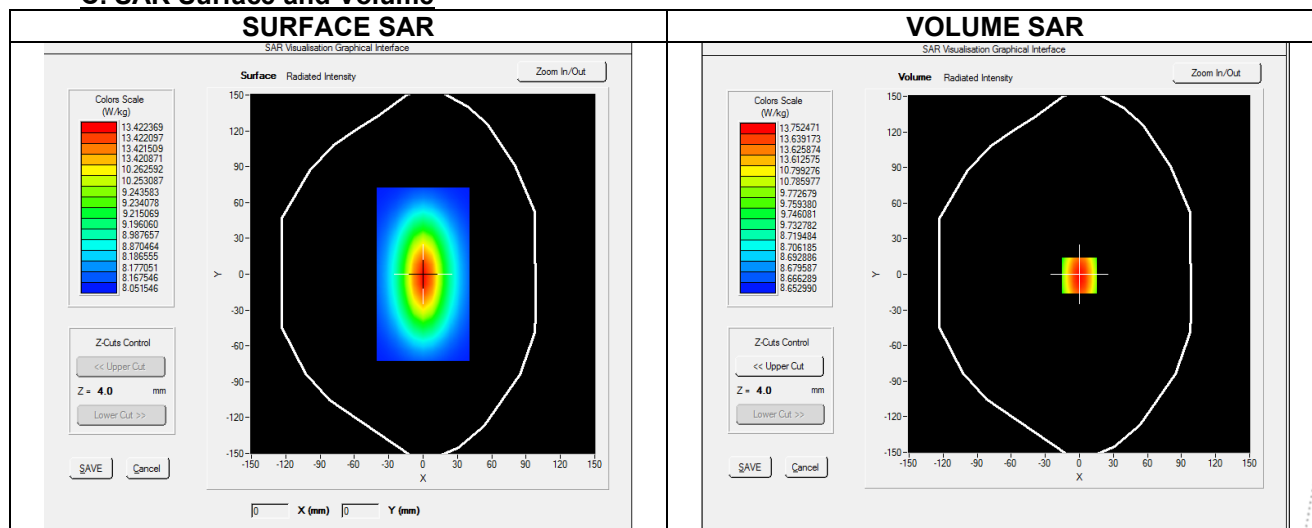
A. Experimental conditions.

Probe	SN EPG0373
ConvF	3.96
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=5mm
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)	39.903
Relative permittivity (imaginary part)	13.207
Conductivity (S/m)	1.832

C. SAR Surface and Volume



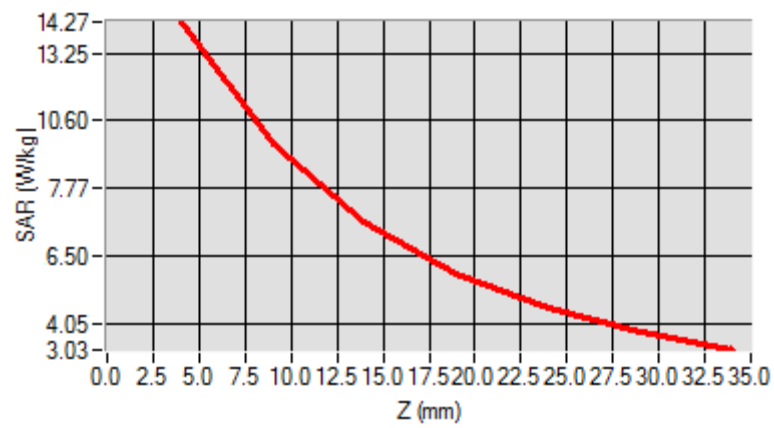
Maximum location: X=2.00, Y=0.00 ; SAR Peak: 27.06 W/kg

D. SAR 1g & 10g

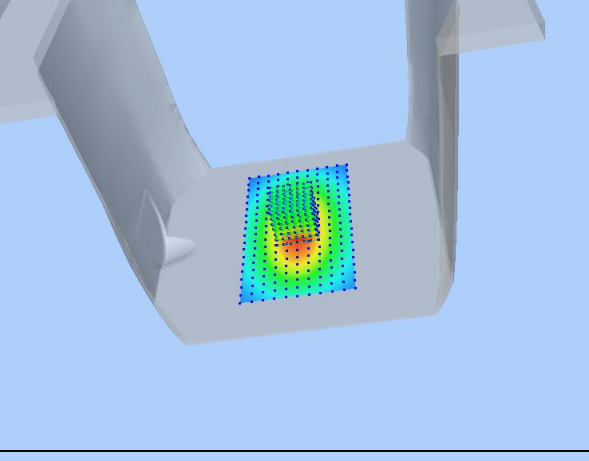
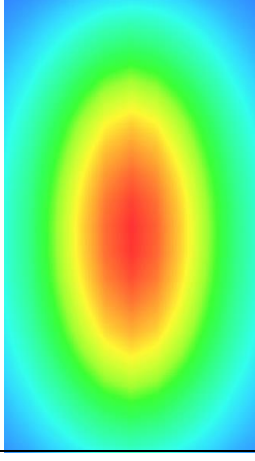
SAR 10g (W/Kg)	5.894
SAR 1g (W/Kg)	13.112
Variation (%)	-1.850
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	4.00	9.00	14.00	19.00	24.00
SAR (W/Kg)	14.2104	12.0006	10.0815	7.2624	5.6008



F. 3D Image

3D screen shot	Hot spot position
	

System check at 2600 MHz

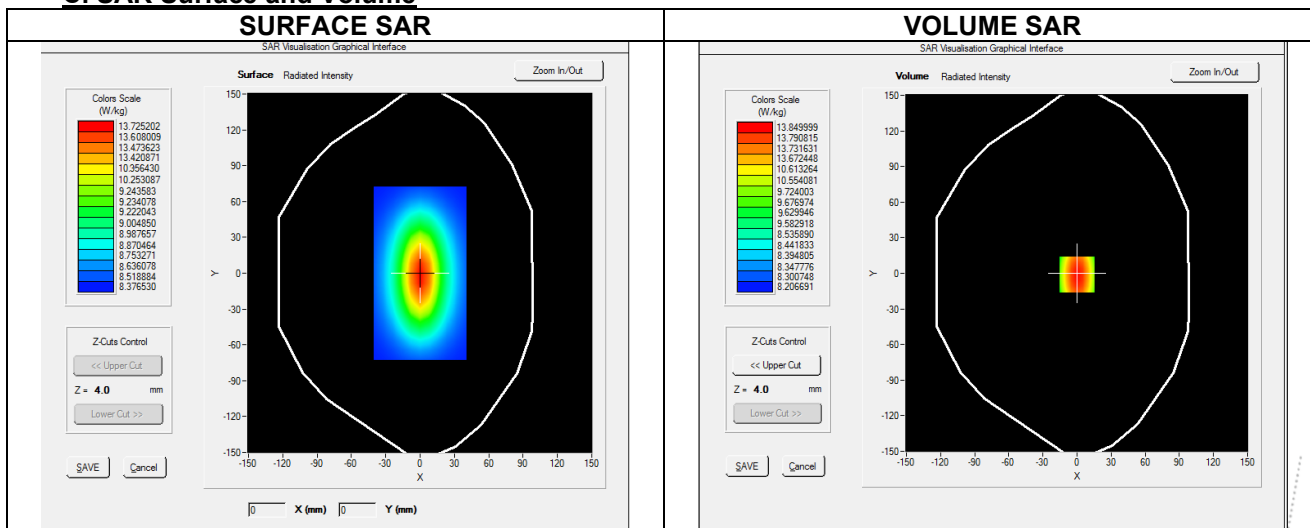
A. Experimental conditions.

Probe	SN 25/22 EPG0373
ConvF	3.63
Area Scan	surf_sam_plan.txt
Zoom Scan	7x7x8,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2600
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. Permittivity

Frequency (MHz)	2600.000
Relative permittivity (real part)	39.553
Relative permittivity (imaginary part)	13.889
Conductivity (S/m)	1.982

C. SAR Surface and Volume



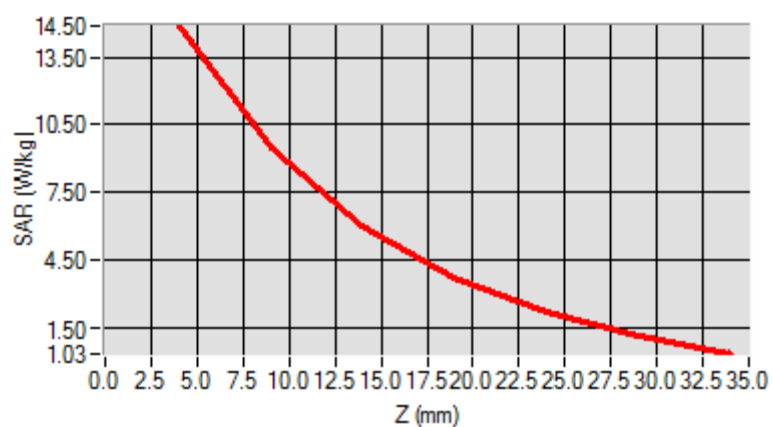
Maximum location: X=1.00, Y=0.00 ; SAR Peak: 27.82 W/kg

D. SAR 1g & 10g

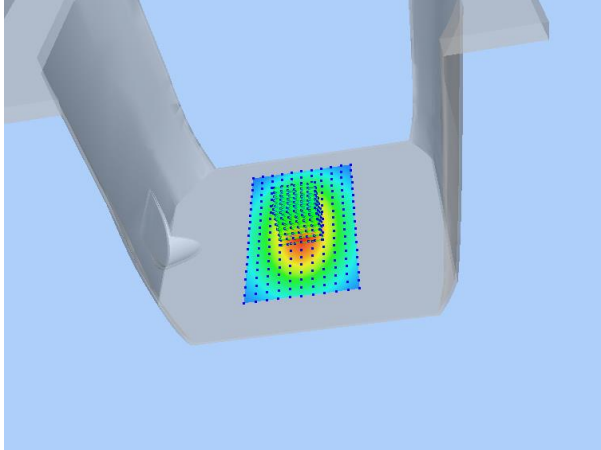
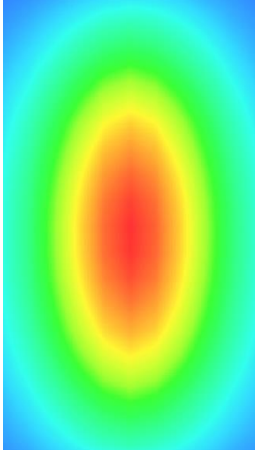
SAR 10g (W/Kg)	6.004
SAR 1g (W/Kg)	13.875
Variation (%)	-1.010
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	4.00	9.00	14.00	19.00	24.00
SAR (W/Kg)	14.4018	12.2465	10.5018	7.7016	5.9825



F. 3D Image

3D screen shot	Hot spot position
	

System check at 5200 MHz

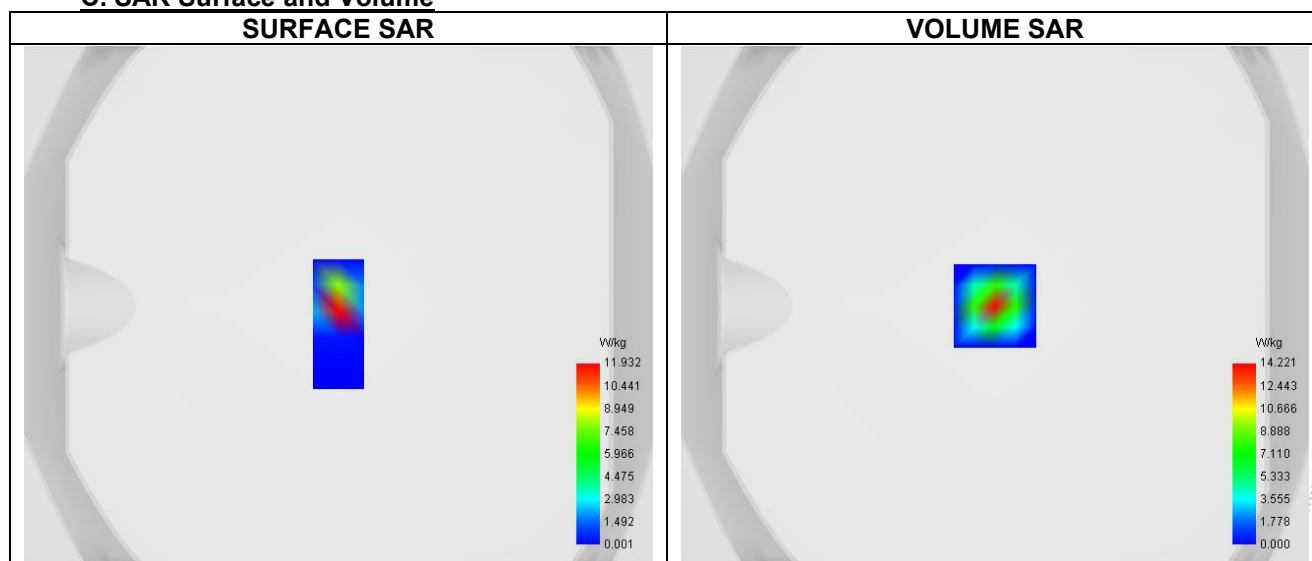
A. Experimental conditions.

Probe	SN EPG0373
ConvF	2.72
Area Scan	dx=10mm dy=10mm, Adaptative 2 max
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm
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)	35.129
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	4.593

C. SAR Surface and Volume



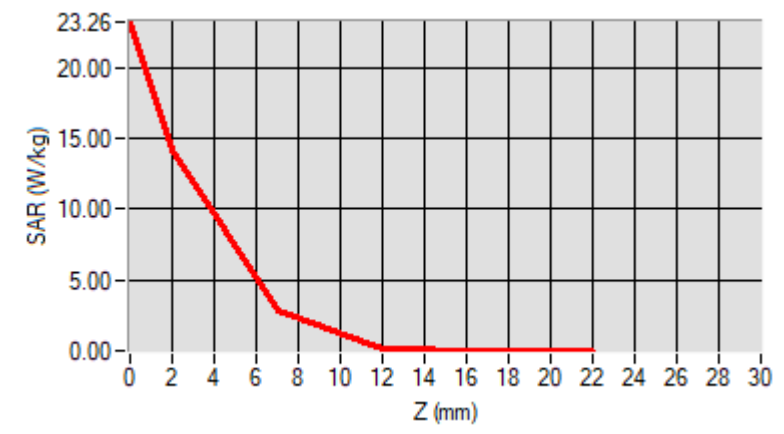
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 24.22 W/kg

D. SAR 1g & 10g

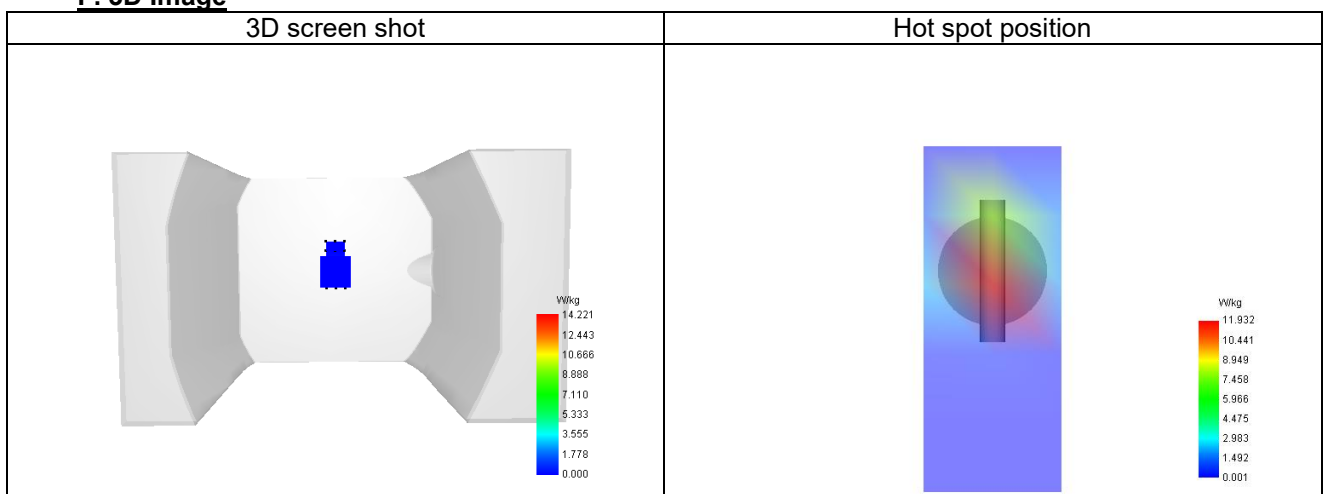
SAR 10g (W/Kg)	2.196
SAR 1g (W/Kg)	7.385
Variation (%)	1.460
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	23.262	14.221	9.984	5.012	2.418	1.384	0.155	0.006	0.001



F. 3D Image



System check at 5800 MHz

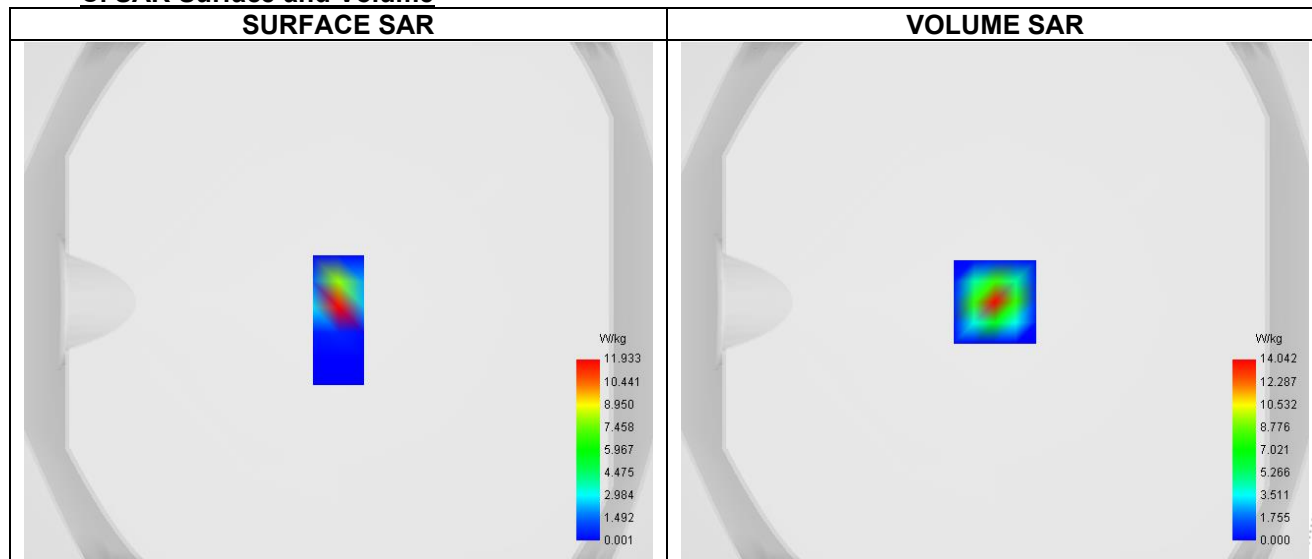
A. Experimental conditions.

Probe	SN EPGO373
ConvF	2.86
Area Scan	dx=10mm dy=10mm, Adaptive 2 max
Zoom Scan	7x7x12, dx=4mm dy=4mm dz=2mm
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)	34.682
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	5.213

C. SAR Surface and Volume



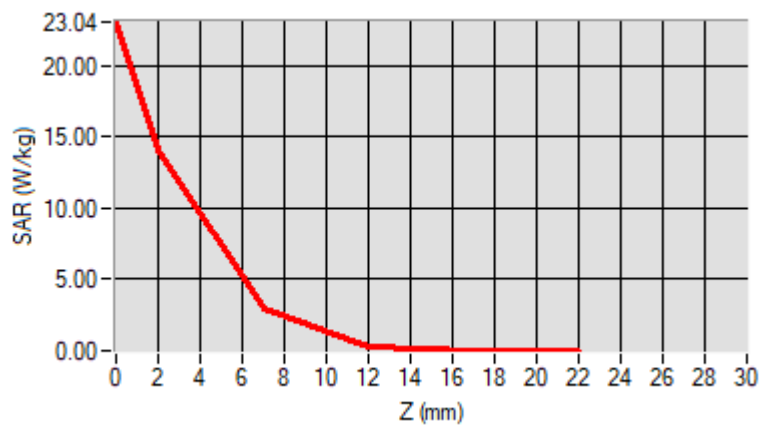
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 23.81 W/kg

D. SAR 1g & 10g

SAR 10g (W/Kg)	2.228
SAR 1g (W/Kg)	7.412
Variation (%)	1.050
Horizontal validation criteria: minimum distance (mm)	-
Vertical validation criteria: SAR ratio M2/M1 (%)	-

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	23.084	14.042	9.984	5.105	3.402	2.018	0.275	0.012	0.008



F. 3D Image

