FCC

SAR

TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

Mobile Phone

ISSUED TO
vivo Mobile Communication Co., Ltd.

#283, BBK Road, Wusha, Chang'An, DongGuan City, China

Report No.:	BL-SZ1980332-701
EUT Name:	Mobile Phone
Model Name:	vivo 1908
Brand Name:	vivo
FCC ID:	2AUCY-Y90
Test Standard:	FCC 47 CFR Part 2.1093
	ANSI C95.1: 1999
	IEEE 1528: 2013
Maximum SAR:	Head (1 g): 0.549 W/kg
	Body (1 g): 1.185 W/kg
Test Conclusion:	Pass
Test Date:	Aug. 21, 2019 ~ Aug. 25, 2019
Date of Issue:	Sep. 03, 2019

Tested by: Zong Liyao
Zong Liyao
(Engineer)
Date Sep. 03, 2019

Approved by:
Wei Yanquan
(Chief Engineer)
Date Sep. 03, 2019

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Revision History

Version	Issue Date	Revisions Content
Rev. 01	Sep. 03, 2019	Initial Issue

TABLE OF CONTENTS

1 ADMINSTRATIVE DATA (GENERAL INFORMATION) 5
1.1 Identification of the Testing Laboratory 5
1.2 Identification of the Responsible Testing Location 5
1.3 Test Environment Condition 5
1.4 Announce 5
2 PRODUCT INFORMATION 6
2.1 Applicant Information 6
2.2 Manufacturer Information 6
2.3 Factory Information 6
2.4 General Description for Equipment under Test (EUT) 6
2.5 Ancillary Equipment 7
2.6 Technical Information 8
2.7 Audio Receiver and Proximity Sensor Detection Mechanism 9
3 SUMMARY OF TEST RESULTS 10
3.1 Test Standards 10
3.2 Device Category and SAR Limit 11
3.3 Test Result Summary 12
3.4 Test Uncertainty 13
4 SAR MEASUREMENT SYSTEM 14
4.1 Definition of Specific Absorption Rate (SAR) 14
4.2 SATIMO SAR System 14
5 SYSTEM VERIFICATION 23
5.1 Antenna Port Test Requirement 23
5.2 Purpose of System Check 23
5.3 System Check Setup 23
6 EUT TEST POSITION CONFIGURATUONS 24

6.1 Head Exposure Conditions 24
6.2 Body-worn Position Conditions 25
6.3 Hotspot Mode Exposure Position Conditions 26
7 SAR MEASUREMENT PROCEDURES 27
7.1 SAR Measurement Process Diagram 27
7.2 SAR Scan General Requirements 28
7.3 SAR Measurement Procedure 29
7.4 Area & Zoom Scan Procedures 29
8 CONDUCTED RF OUPUT POWER 30
8.1 GSM 30
8.2 WCDMA 31
8.3 LTE 32
8.4 WIFI 34
8.5 Bluetooth 34
8.6 Power Reduction List 35
9 EUT ANTENNA LOCATION SKETCH 37
9.1 SAR Test Exclusion Consider Table 38
9.2 10g Extremity Exposure Consider 40
10 TEST RESULTS 41
10.1 GSM 850 41
10.2 GSM 1900 42
10.3 WCDMA Band 5 43
10.4 LTE Band 5 (10MHz Bandwidth) 44
10.5 LTE Band 41 (20MHz Bandwidth) 45
10.6 WIFI 2.4GHz 46
11 SAR Measurement Variability 47
12 SIMULTANEOUS TRANSMISSION 48
12.1 Simultaneous Transmission Mode Consider 48
12.2 Estimated SAR Calculation 49
12.3 Sum SAR of Simultaneous Transmission 50
13 TEST EQUIPMENTS LIST 52

ANNEX A SIMULATING LIQUID VERIFICATION RESULT 53
ANNEX B SYSTEM CHECK RESULT 54
ANNEX C TEST DATA 63
ANNEX D EUT EXTERNAL PHOTOS 75
ANNEX E SAR TEST SETUP PHOTOS 75
ANNEX F CALIBRATION REPORT 75

1 ADMINSTRATIVE DATA (GENERAL INFORMATION)

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196. The laboratory is a testing organization accredited by American Association for Laboratory Accreditation (A2LA) according to ISO/IEC 17025.The accreditation certificate is 4344.01. The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Test Environment Condition

Ambient Temperature	21℃ to 23℃
Ambient Relative Humidity	37% to 48%
Ambient Pressure	100 to 102KPa

1.4 Announce

(1) The test report reference to the report template version v2.3.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.

(5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.

(6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	vivo Mobile Communication Co., Ltd.
Address	#283, BBK Road, Wusha, Chang'An, DongGuan City, China

2.2 Manufacturer Information

Manufacturer	vivo Mobile Communication Co., Ltd.
Address	#283, BBK Road, Wusha, Chang'An, DongGuan City, China

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	Mobile Phone
Model Name Under Test	vivo 1908
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	PD1917FEXM
Software Version	PD1917F_EX_A_1.0.0
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	vivo
	Model No.	B-F3
	Serial No.	N/A
	Capacity	3935 mAh
	Rated Voltage	3.85 V
	Limit Charge Voltage	4.4 V
Ancillary Equipment 2	Adapter	
	Brand Name	vivo
	Model No.	V0510A-US
	Serial No.	N/A
	Rated Input	100-240 V~, 0.15 A, 50/60 Hz
	Rated Output	5 V⎓ 1 A
Ancillary Equipment 3	USB Cable	
	Model No.	N/A
	Length (Approx.)	0.8 m

2.6 Technical Information

Network and Wireless connectivity	2G Network GSM/GPRS/EDGE 850/1900 MHz 3G Network WCDMA/HSDPA/HSUPA Band 5 4G Network FDD LTE Band 5 TDD LTE Band 41 Bluetooth 5.0 (BR+EDR+BLE) WIFI 802.11b, 802.11g, 802.11n(HT20/40) FM, GPS, GLONASS, BDS, SBAS
Note : The EUT is a mobile phone, which supports dual SIM card under the same transceiver. Each SIM supports GSM, WCDMA and LTE, and both SIM share the same transmitting electro circuit, NV parameters, so only SIM1 was tested in this report.	

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	GSM, WCDMA, FDD-LTE, TDD-LTE, 2.4G WLAN, Bluetooth		
Frequency Range	GSM 850	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	GSM 1900	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE Band 41	TX: 2496 ~ 2690 MHz	RX: 2496 ~ 2690 MHz
	802.11b/g /n(HT20/HT40)	2400 ~ 2483.5 MHz	
Antenna Type	WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna		
DTM	Not Support		
Hotspot Function	Support		
Power Reduction	Support		
Exposure Category	General Population/Uncontrolled exposure		
EUT Stage	Portable Device		
Product	Type		
	☒ Production unit	☐ Identical prototype	

2.7 Audio Receiver and Proximity Sensor Detection Mechanism

This mobile phone device supports the receiver and proximity sensor detection mechanism.
This device uses the receiver and proximity sensor to indicate whether the user is making a call in head.
When there is a voice call (including VOIP) and the audio is actively routed through the earpiece receiver, which indicating the head exposure condition and the proximity sensor will trigger the reduced the power for GSM 1900 and LTE Band 41.
When this mobile phone is uses body-worn ors hotspot mode, this product is not support power reduction function.
Reduced power please refer to section 8.6.

Summary of Reduction Tune-up Limit Power for WWAN Antenna

Frequency Band	Full Power(dBm)	Head Reduce power （dBm） (Receiver On)	Body-worn & Hotspot （dBm）
GSM850	33.00	33.00	33.00
PCS	29.50	19.50	29.50
WCDMA5	22.00	22.00	22.00
FDD-LTE B5	23.00	23.00	23.00
TDD-LTE B41	23.50	17.00	23.50

Note:
For some frequency bands, the power reduction level amount value 0 means there is no power reduction in this frequency band and exposure conditions. The power level is the same as full power

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
2	ANSI/IEEE Std. C95.1-1999	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
3	IEEE Std. 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
4	FCC KDB 447498 D01 v06	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
5	FCC KDB 941225 D01 v03r01	3G SAR MEAUREMENT PROCEDURES
6	FCC KDB 941225 D05 v02r05	SAR Evaluation Considerations for LTE Devices
7	FCC KDB 941225 D06 v02r01	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
8	FCC KDB 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
9	FCC KDB 865664 D02 v01r02	RF Exposure Reporting
10	FCC KDB 648474 D04 v01r03	SAR Evaluation Considerations for Wireless Handsets
11	KDB 248227 D01 v02r02	SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters

3.2 Device Category and SAR Limit

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

Table of Exposure Limits:

Body Position	SAR Value (W/Kg)	
	General Population/ Uncontrolled Exposure	Occupational/ Controlled Exposure
Whole-Body SAR (averaged over the entire body)	0.08	0.4
Partial-Body SAR (averaged over any 1 gram of tissue)	1.60	8.0
SAR for hands, wrists, feet and ankles (averaged over any 10 grams of tissue)	4.0	20.0

NOTE:

General Population/Uncontrolled: Locations where there is the exposure of individuals who have no knowledge or control of their exposure. General population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Occupational/Controlled: Locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

3.3 Test Result Summary

3.3.1 Highest SAR (1 g Value)

Band	Maximum Scaled SAR (W/kg)			Maximum Report SAR (W/kg)			Limit (W/kg)
	Head	Body-worn	Hotspot	Head	Body-worn	Hotspot	
GSM 850	0.483	0.207	0.207	0.549	0.291	1.185	1.6
GSM 1900	0.502	**0.774**	0.774				
WCDMA Band 5	0.314	0.152	0.152				
LTE Band 5	0.402	0.184	0.184				
LTE Band 41	**0.549**	0.389	**1.185**				
2.4G WLAN	0.390	0.110	0.150				
Verdict	Pass						

3.3.2 Highest Simultaneous SAR

Position	Simultaneous Configuration	Simultaneous SAR (W/kg)	Limit (W/kg)	Verdict
Head	LTE QPSK + 2.4G WLAN	0.939	1.6	Pass
Body-worn	GSM + 2.4G WLAN	0.884	1.6	Pass
Hotspot Mode	LTE QPSK + 2.4G WLAN	1.335	1.6	Pass

3.4 Test Uncertainty

According to KDB 865664 D01, when the highest measured 1 g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis is not required in SAR reports submitted for equipment approval.

The maximum 1 g SAR for the EUT in this report is 1.185 W/kg, which is lower than 1.5 W/kg, so the extensive SAR measurement uncertainty analysis is not required in this report.

4 SAR MEASUREMENT SYSTEM

4.1 Definition of Specific Absorption Rate (SAR)

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.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

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

SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

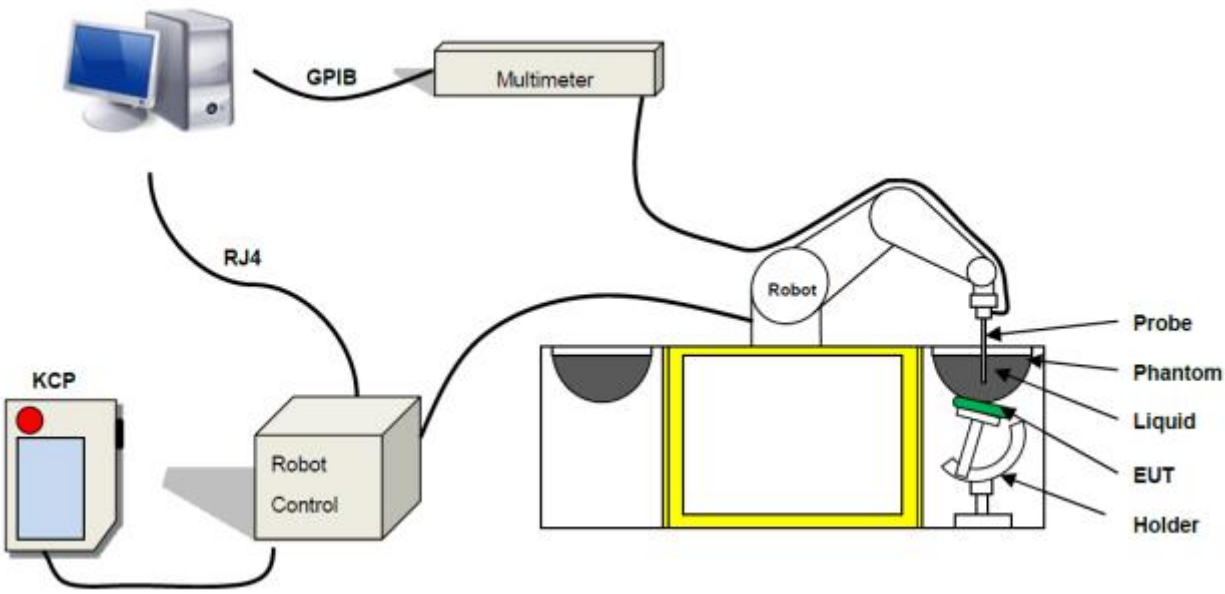
$$\mathbf{SAR} = \frac{\sigma E^2}{\rho}$$

Where: σ is the conductivity of the tissue,

ρ is the mass density of the tissue and E is the RMS electrical field strength.

4.2 SATIMO SAR System

4.2.1 SATIMO SAR System Diagram



These measurements were performed with the automated near-field scanning system OPENSAR from SATIMO. The system is based on a high precision robot (working range: 850 mm), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

The SAR measurements were conducted with dosimetric probe (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in SAR standard with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in SAR standard and found to be better than ±0.25 dB. The phantom used was the SAM Phantom as described in FCC supplement C, IEEE P1528.

4.2.2 Robot

The SATIMO SAR system uses the high precision robots from KUKA. For the 6-axis controller system, the robot controller version (KUKA) from KUKA is used. The KUKA robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

4.2.3 E-Field Probe

For the measurements the Specific Dosimetric E-Field Probe SN 34/15 EPGO 265 with following specifications is used

-- Dynamic range: 0.01-100 W/kg

- Tip Diameter : 2.5 mm
- Lower detection limit : 10 mW/kg

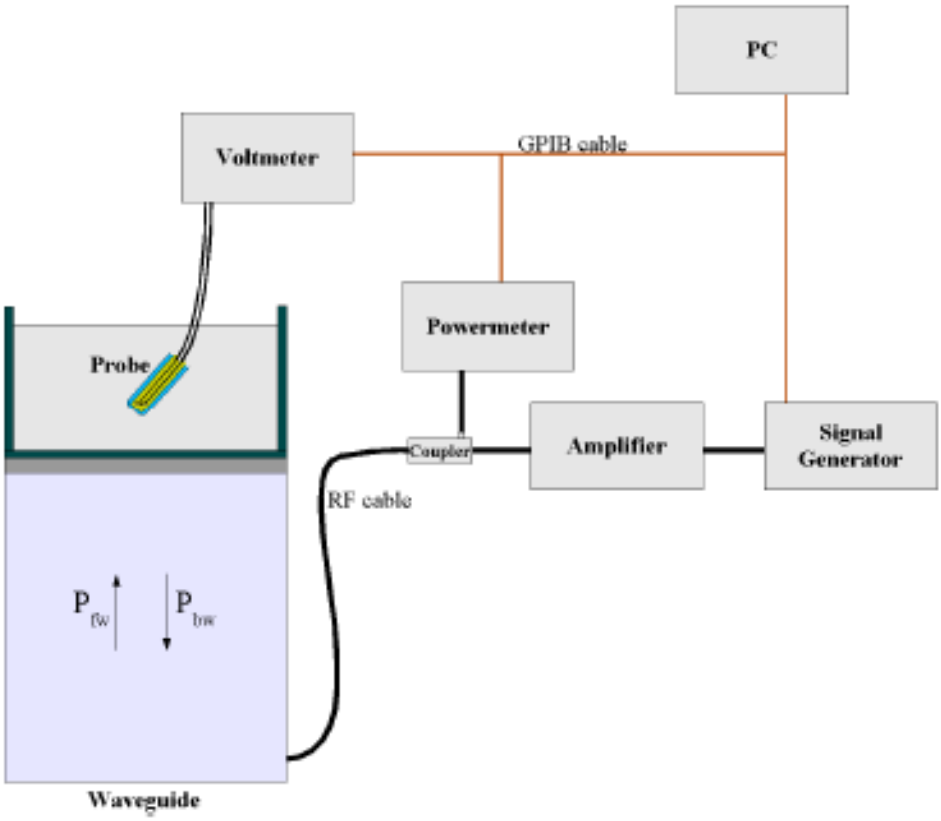
(repeatability better than +/- 1mm)

- Probe linearity: +/- 0.07 dB
- Calibration range: 300 MHz to 6000 MHz for head & body simulating liquid.

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

E-Field Probe Calibration Process

Probe calibration is realized, in compliance with CENELEC EN 62209-1/-2 and IEEE 1528 std, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the IEC62209-1/2 annexe technique using reference guide at the five frequencies.



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

Where :

Pfw	=	Forward Power
Pbw	=	Backward Power
a and b	=	Waveguide Dimensions
ı	=	Skin Depth

Keithley configuration

Rate = Medium; Filter =ON; RDGS=10; FILTER TYPE =MOVING AVERAGE; RANGE AUTO After each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

The calibration factors, CF(N), for the 3 sensors corresponding to dipole 1, dipole 2 and dipole 3 are:

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

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

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

Where the DCP is the diode compression point in mV.

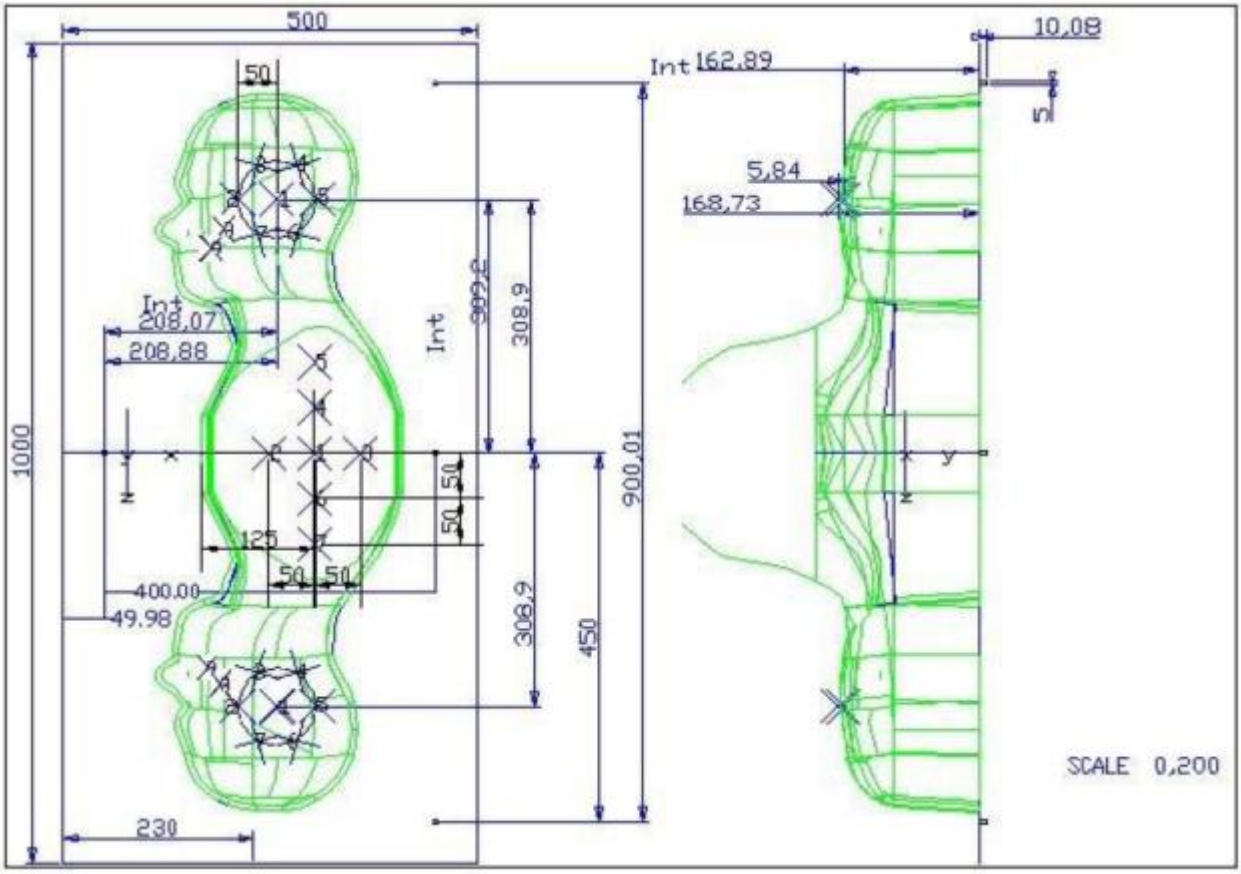
4.2.4 Phantoms

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.

Photo of Phantom SN 30/13 SAM103

Photo of Phantom SN 30/13 SAM104

Serial Number	Positionner Material	Permittivity	Loss Tangent
SN 30/13 SAM103	Gelcoat with fiberglass	3.4	0.02
SN 30/13 SAM104	Gelcoat with fiberglass	3.4	0.02



Serial Number	Left Head		Right Head		Flat Part	
SN 30/13 SAM103	2	2.00	2	2.03	1	2.09
	3	2.02	3	2.05	2	2.10
	4	2.04	4	2.04	3	2.09
	5	2.04	5	2.07	4	2.11
	6	2.02	6	2.07	5	2.11
	7	2.01	7	2.09	6	2.09
	8	2.04	8	2.10	7	2.11
	9	2.02	9	2.09	-	-
SN 30/13 SAM104	2	2.05	2	2.06	1	2.03
	3	2.08	3	2.03	2	2.03
	4	2.05	4	2.03	3	2.01
	5	2.06	5	2.02	4	2.03
	6	2.08	6	2.02	5	2.03
	7	2.06	7	2.04	6	2.00
	8	2.07	8	2.04	7	1.98
	9	2.07	9	2.05	-	-

4.2.5 Device Holder

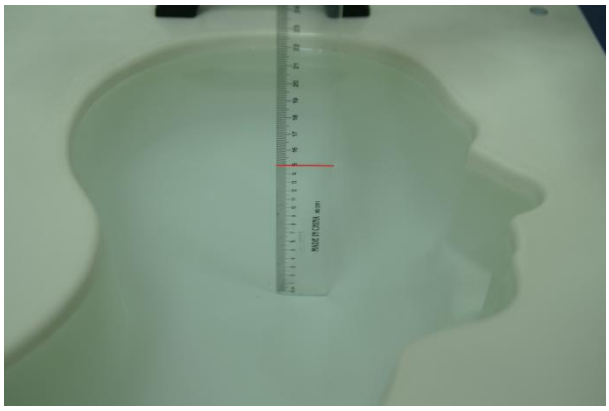
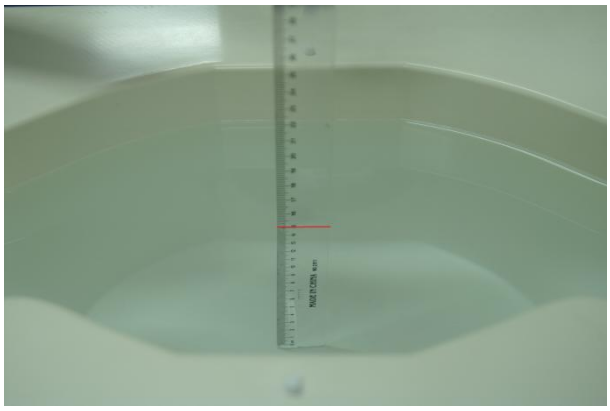
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

Serial Number	Holder Material	Permittivity	Loss Tangent
SN 25/13 MSH87	Deirin	3.7	0.005
SN 25/13 MSH88	Deirin	3.7	0.005

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°.

4.2.6 Simulating Liquid

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. 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. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5%.

Head Liquid Depth	Body Liquid Depth
	

The following table gives the recipes for tissue simulating liquid and the theoretical Conductivity/Permittivity.

Head (Reference IEEE1528)								
Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity σ (S/m)	Permittivity ε
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.4	40.0
2450	55.0	0	0	0.1	0	44.9	1.80	39.2
2600	54.9	0	0	0.1	0	45.0	1.96	39.0
Frequency(MHz)	Water (%)	Hexyl Carbitol (%)			Triton X-100 (%)		Conductivity σ (S/m)	Permittivity ε
5200	62.52	17.24			17.24		4.66	36.0
5800	62.52	17.24			17.24		5.27	35.3
Body (From instrument manufacturer)								
Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity σ (S/m)	Permittivity ε
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0.1	0	31.3	1.95	52.7
2600	68.2	0	0	0.1	0	31.7	2.16	52.5

Frequency(MHz)	Water	DGBE (%)	Salt (%)	Conductivity σ (S/m)	Permittivity ε
5200	78.60	21.40	/	5.54	47.86
5800	78.50	21.40	0.1	6.0	48.20

5 SYSTEM VERIFICATION

5.1 Antenna Port Test Requirement

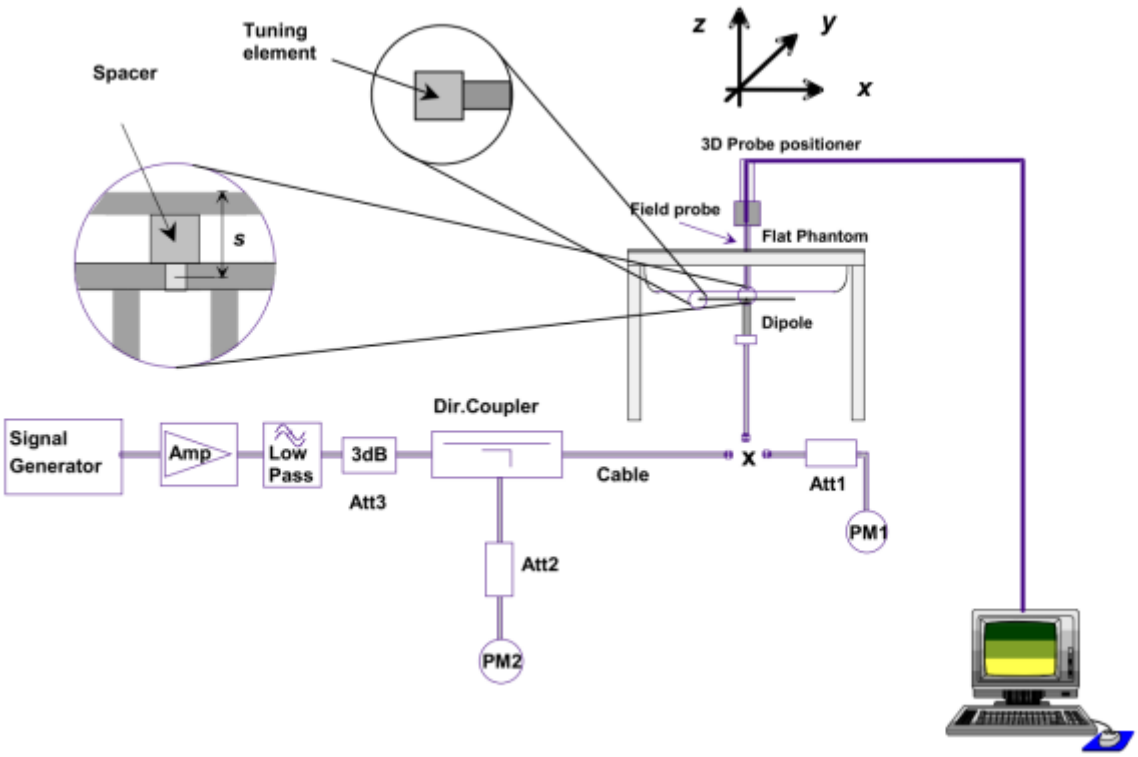
The SATIMO SAR system is equipped with one or more system validation kits. These units together with the predefined measurement procedures within the SATIMO software enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

5.2 Purpose of System Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

5.3 System Check Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



6 EUT TEST POSITION CONFIGURATUONS

According to KDB 648474 D04 Handset, handsets are tested for SAR compliance in head, body-worn accessory and other use configurations described in the following subsections.

6.1 Head Exposure Conditions

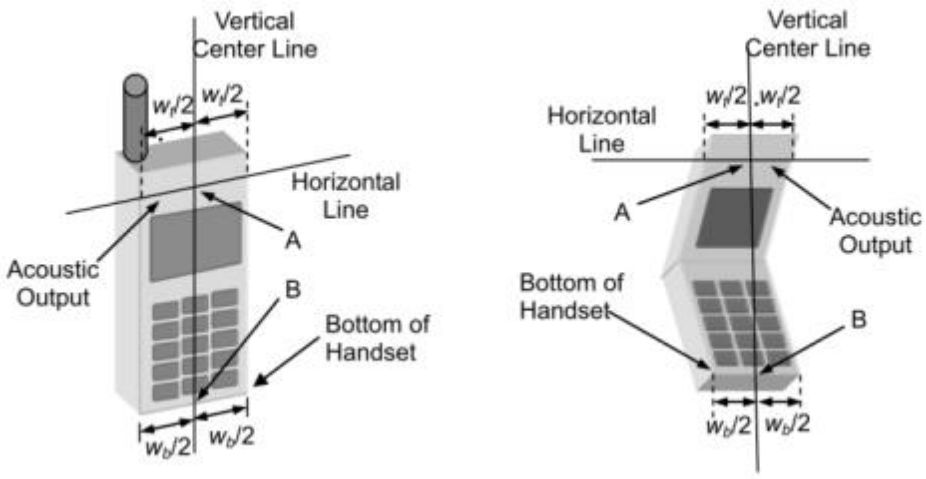
Head exposure is limited to next to the ear voice mode operations. Head SAR compliance is tested according to the test positions defined in IEEE Std 1528-2013 using the SAM phantom illustrated as below.

6.1.1 Define two imaginary lines on the handset

(a) The vertical center line 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.

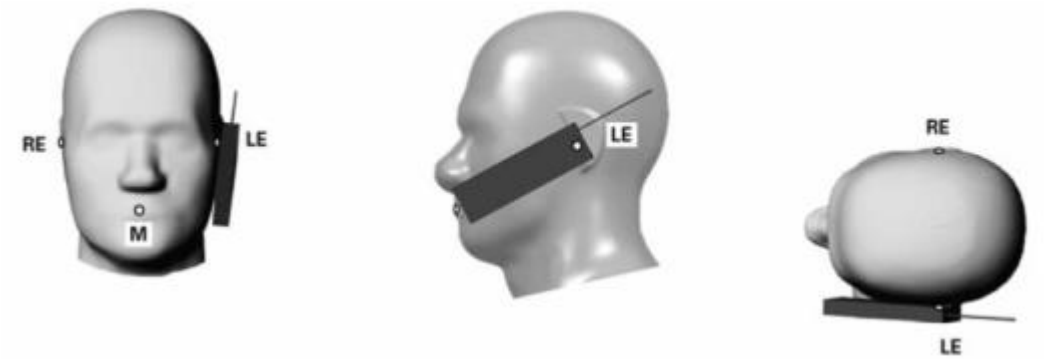
(c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset,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



6.1.2 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.



6.1.3 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.

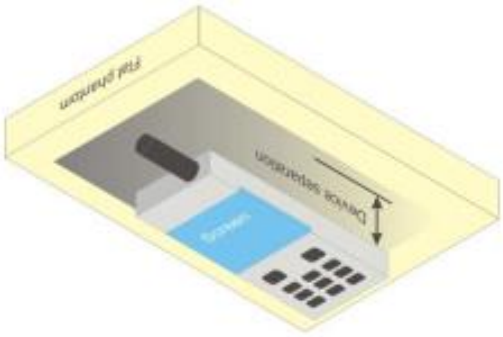
6.2 Body-worn Position Conditions

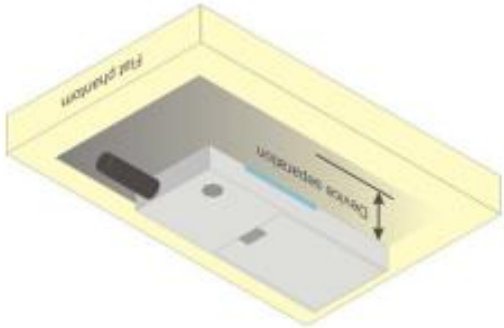
Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB 447498 are used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode. 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 that body-worn accessory with a headset attached to the handset.

Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components are tested in conjunction with the host device.

Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice only operations in its normal and expected use conditions, testing of data mode for body-worn compliance is not required. A conservative minimum test separation distance for supporting off-the-shelf body-worn accessories that may be acquired by

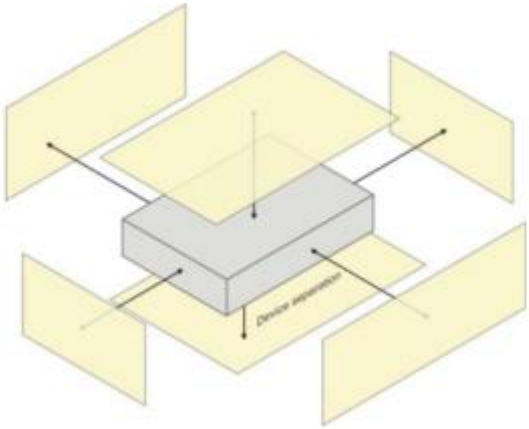
users of consumer handsets is used to test for body-worn accessory SAR compliance. This distance is determined by the handset manufacturer, according to the requirements of Supplement C 01-01. Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, will be tested using a conservative minimum test separation distance <= 5 mm to support compliance.





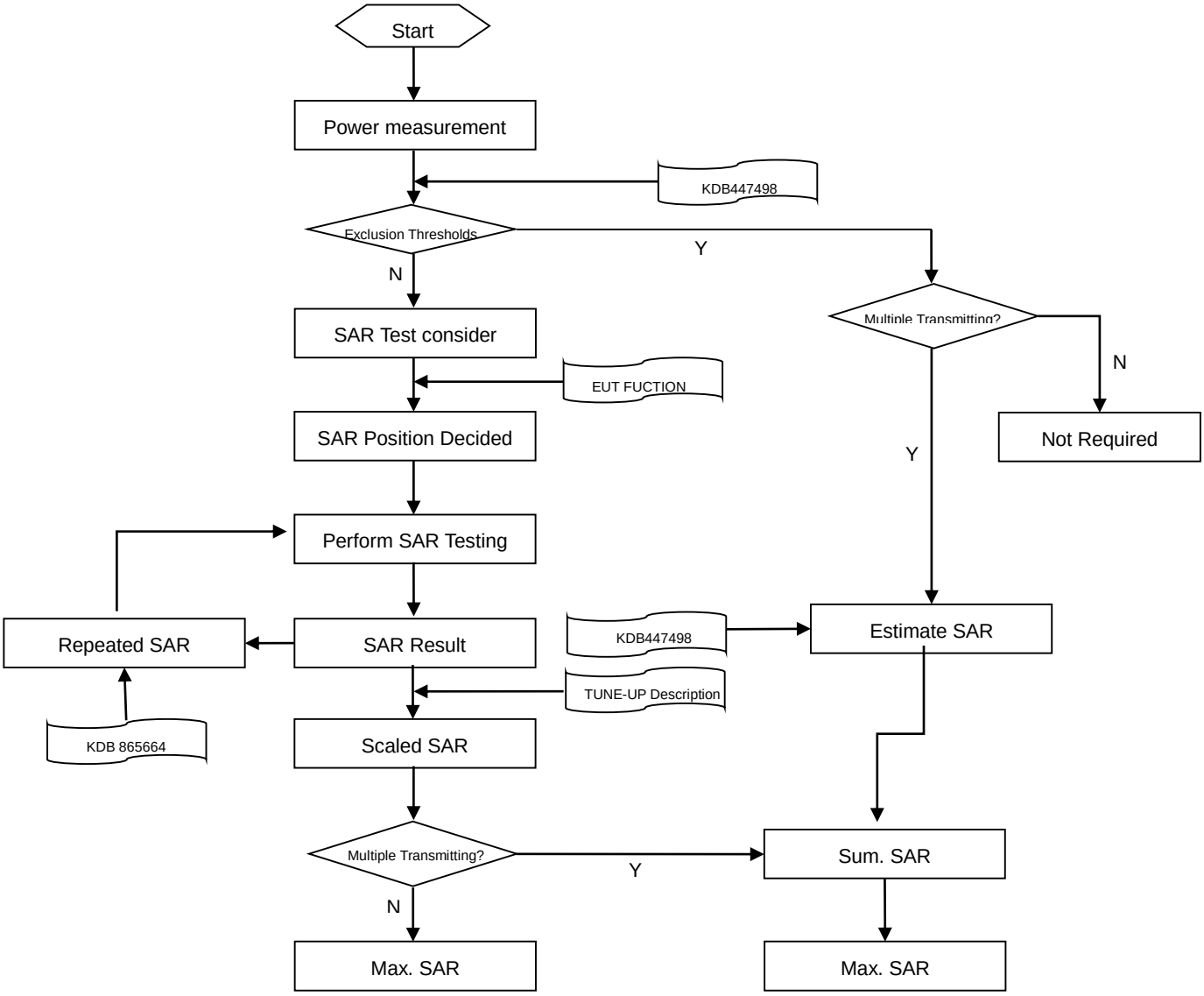
6.3 Hotspot Mode Exposure Position Conditions

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode 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).



7 SAR MEASUREMENT PROCEDURES

7.1 SAR Measurement Process Diagram



7.2 SAR Scan General Requirements

Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2013.

<table>
<tr><th colspan="3"></th><th>≤3GHz</th><th>>3GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5±1 mm</td><td>½·δ·ln(2)±0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30°±1°</td><td>20°±1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx Area , Δy Area</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3–4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ⩽ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx Zoom , Δy Zoom</td><td>≤ 2 GHz: ≤ 8 mm
2 –3 GHz: ≤ 5 mm*</td><td>3–4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="6">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2" rowspan="3">uniform grid: Δz Zoom (n)</td><td rowspan="3">≤ 5 mm</td><td>3–4 GHz: ≤ 4 mm</td></tr>
<tr><td>4–5 GHz: ≤ 3 mm</td></tr>
<tr><td>5–6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="3">graded grid</td><td rowspan="2">Δz Zoom (1): between 1st two points closest to phantom surface</td><td rowspan="2">≤ 4 mm</td><td>3–4 GHz: ≤ 3 mm</td></tr>
<tr><td>4–5 GHz: ≤ 2.5 mm
5–6 GHz: ≤ 2 mm</td></tr>
<tr><td>Δz Zoom (n>1): between subsequent points</td><td colspan="2">≤ 1.5·Δz Zoom (n-1)</td></tr>
<tr><td rowspan="3">Minimum zoom scan volume</td><td colspan="2" rowspan="3">x, y, z</td><td rowspan="3">≥30 mm</td><td>3–4 GHz: ≥ 28 mm</td></tr>
<tr><td>4–5 GHz: ≥ 25 mm</td></tr>
<tr><td>5–6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note:
1. δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
2. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ⩽ 1.4 W/kg, ⩽ 8 mm, ⩽ 7 mm and ⩽ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

7.3 SAR Measurement Procedure

The following steps are used for each test position

- Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface
- Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
- Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
- Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

7.4 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01 quoted below.

When the 1-g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

8 CONDUCTED RF OUPUT POWER

8.1 GSM

GSM 850								
GSM850 Band	Burst Average Power(dBm)			Tune-up Limit (dBm)	Frame-Averaged power (dBm)			Tune-up Limit (dBm)
Channel	128	190	251		128	190	251	
GSM (GMSK, 1-Slot)	32.51	32.59	32.55	33.00	23.32	**23.40**	23.36	23.81
GPRS (GMSK, 1-Slot)	32.46	32.58	32.53	33.00	23.27	23.39	23.34	23.81
GPRS (GMSK, 2-Slots)	31.71	31.85	31.77	32.00	25.58	**25.72**	25.64	25.87
GPRS (GMSK, 3-Slots)	29.86	29.93	29.91	30.00	25.44	25.51	25.49	25.58
GPRS (GMSK, 4-Slots)	28.73	28.89	28.75	29.00	25.55	25.71	25.57	25.82
EGPRS (8PSK, 1-Slot)	30.10	30.27	30.15	30.50	20.91	21.08	20.96	21.31
EGPRS (8PSK, 2-Slots)	28.99	29.13	29.08	29.50	22.86	**23.00**	22.95	23.37
EGPRS (8PSK, 3-Slots)	27.02	27.15	27.07	27.50	22.60	22.73	22.65	23.08
EGPRS (8PSK, 4-Slots)	25.88	25.97	26.07	26.50	22.70	22.79	22.89	23.32
GSM 1900								
GSM1900 Band	Burst Average Power(dBm)			Tune-up Limit (dBm)	Frame-Averaged power(dBm)			Tune-up Limit (dBm)
Channel	512	661	810		512	661	810	
GSM (GMSK, 1-Slot)	28.78	28.81	28.65	29.50	19.59	**19.62**	19.46	20.31
GPRS (GMSK, 1-Slot)	29.40	29.39	29.22	29.50	20.21	20.20	20.03	20.31
GPRS (GMSK, 2-Slots)	28.69	28.70	28.53	28.50	22.56	22.57	22.40	22.37
GPRS (GMSK, 3-Slots)	26.90	26.93	26.78	27.00	22.48	22.51	22.36	22.58
GPRS (GMSK, 4-Slots)	25.82	25.86	25.69	26.00	22.64	**22.68**	22.51	22.82
EGPRS (8PSK, 1-Slot)	25.44	25.49	25.40	28.50	16.25	16.30	16.21	19.31
EGPRS (8PSK, 2-Slots)	25.17	25.25	25.11	28.00	19.04	**19.12**	18.98	21.87
EGPRS (8PSK, 3-Slots)	23.05	23.12	22.95	26.00	18.63	18.70	18.53	21.58
EGPRS (8PSK, 4-Slots)	21.91	22.01	21.86	25.00	18.73	18.83	18.68	21.82

Note [1]: SAR testing was performed on the maximum frame-averaged power mode.

Note [2]: The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum burst-averaged power based on time slots. The calculated method is shown as below:

Frame-averaged power = Burst averaged power (1 Tx Slot) – 9.19 dB

Frame-averaged power = Burst averaged power (2 Tx Slots) – 6.13 dB

Frame-averaged power = Burst averaged power (3 Tx Slots) - 4.42dB

Frame-averaged power = Burst averaged power (4 Tx Slots) – 3.18 dB

8.2 WCDMA

WCDMA	Band 5			
Channel	4132	4182	4233	Tune-up Limit (dBm)
RMC 12.2Kbps	**21.74**	21.72	21.71	22.00
HSDPA Subtest-1	20.76	20.73	20.68	21.00
HSDPA Subtest-2	20.72	20.71	20.67	21.00
HSDPA Subtest-3	20.25	20.23	20.17	21.00
HSDPA Subtest-4	20.24	20.18	20.19	21.00
HSUPA Subtest-1	18.79	18.74	18.69	19.00
HSUPA Subtest-2	18.78	18.76	18.70	19.00
HSUPA Subtest-3	19.72	19.69	19.69	20.00
HSUPA Subtest-4	18.30	18.28	18.24	19.00
HSUPA Subtest-5	19.72	19.70	19.66	20.00

8.3 LTE

FDD LTE Band 5									
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	20450	20525	20600		20450	20525	20600	
10 MHz	1 (RB_Pos:0)	22.51	22.50	22.42	23.00	21.48	21.93	21.53	22.50
	1 (RB_Pos:25)	**22.69**	22.64	22.52	23.00	21.64	22.13	21.58	22.50
	1 (RB_Pos:49)	22.47	22.46	22.39	23.00	21.52	21.87	21.47	22.50
	25 (RB_Pos:0)	21.62	21.58	21.52	22.00	20.66	20.68	20.65	21.50
	25 (RB_Pos:12)	21.61	21.60	21.50	22.00	20.65	20.69	20.58	21.50
	25 (RB_Pos:25)	21.58	21.60	21.39	22.00	20.62	20.70	20.53	21.50
	50 (RB_Pos:0)	21.62	21.60	21.48	22.00	20.62	20.64	20.54	21.50
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	20425	20525	20625		20425	20525	20625	
5MHz	1 (RB_Pos:0)	22.47	22.44	22.33	23.00	21.66	22.02	21.49	22.50
	1 (RB_Pos:13)	22.58	22.52	22.39	23.00	21.78	22.07	21.54	22.50
	1 (RB_Pos:24)	22.49	22.41	22.29	23.00	21.67	21.92	21.50	22.50
	12 (RB_Pos:0)	21.52	21.53	21.46	22.00	20.59	20.71	20.50	21.50
	12 (RB_Pos:6)	21.61	21.55	21.46	22.00	20.69	20.74	20.55	21.50
	12 (RB_Pos:13)	21.56	21.52	21.43	22.00	20.66	20.66	20.49	21.50
	25 (RB_Pos:0)	21.54	21.55	21.41	22.00	20.59	20.64	20.44	21.50
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	20415	20525	20635		20415	20525	20635	
3.0 MHz	1 (RB_Pos:0)	22.51	22.46	22.39	23.00	21.54	21.97	21.50	22.50
	1 (RB_Pos:8)	22.50	22.47	22.40	23.00	21.52	21.96	21.44	22.50
	1 (RB_Pos:14)	22.47	22.45	22.37	23.00	21.50	21.94	21.43	22.50
	8 (RB_Pos:0)	21.54	21.49	21.41	22.00	20.67	20.65	20.48	21.50
	8 (RB_Pos:3)	21.59	21.51	21.44	22.00	20.73	20.69	20.53	21.50
	8 (RB_Pos:7)	21.54	21.46	21.38	22.00	20.66	20.60	20.50	21.50
	15 (RB_Pos:0)	21.53	21.47	21.45	22.00	20.59	20.56	20.43	21.50
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	20407	20525	20643		20407	20525	20643	
1.4MHz	1 (RB_Pos:0)	22.50	22.46	22.27	23.00	21.63	21.93	21.44	22.50
	1 (RB_Pos:3)	22.68	22.65	22.57	23.00	21.80	22.10	21.64	22.50
	1 (RB_Pos:5)	22.48	22.40	22.38	23.00	21.67	21.88	21.47	22.50
	3 (RB_Pos:0)	22.61	22.59	22.54	23.00	21.65	21.81	21.66	22.00
	3 (RB_Pos:1)	22.66	22.64	22.56	23.00	21.68	21.83	21.69	22.00

	3 (RB_Pos:3)	22.61	22.64	22.52	23.00	21.50	21.80	21.69	22.00
	6 (RB_Pos:0)	21.56	21.52	21.44	22.00	20.75	20.50	20.63	21.00

FDD LTE Band 41									
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	40140	40640	41140		40140	40640	41140	
20MHz	1 (RB_Pos:0)	22.43	22.55	22.72	23.50	21.79	21.83	22.08	23.00
	1 (RB_Pos:50)	22.99	23.06	**23.26**	23.50	22.27	22.31	22.62	23.00
	1 (RB_Pos:99)	22.38	22.58	22.87	23.50	21.79	21.88	22.24	23.00
	50 (RB_Pos:0)	21.62	21.91	21.99	22.50	20.64	20.92	21.06	22.00
	50 (RB_Pos:25)	21.71	21.89	21.99	22.50	20.76	20.93	21.06	22.00
	50 (RB_Pos:50)	21.72	21.90	21.89	22.50	20.75	20.99	20.96	22.00
	100 (RB_Pos:0)	21.71	21.91	21.97	22.50	20.73	20.98	20.98	22.00
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	40115	40640	41165		40115	40640	41165	
15MHz	1 (RB_Pos:0)	22.64	22.78	22.82	23.50	21.92	22.27	22.19	23.00
	1 (RB_Pos:38)	22.73	22.86	22.98	23.50	21.99	22.34	22.31	23.00
	1 (RB_Pos:74)	22.63	22.78	22.93	23.50	21.99	22.24	22.26	23.00
	36 (RB_Pos:0)	21.63	21.87	22.00	22.50	20.63	20.82	21.00	22.00
	36 (RB_Pos:20)	21.73	21.89	21.99	22.50	20.69	20.82	21.00	22.00
	36 (RB_Pos:39)	21.70	21.86	21.96	22.50	20.69	20.80	20.98	22.00
	75 (RB_Pos:0)	21.67	21.85	21.98	22.50	20.68	20.83	20.97	22.00
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	40090	40640	41190		40090	40640	41190	
10MHz	1 (RB_Pos:0)	22.66	22.87	22.96	23.50	22.01	22.31	22.37	23.00
	1 (RB_Pos:25)	22.96	23.16	23.29	23.50	22.25	22.60	22.71	23.00
	1 (RB_Pos:49)	22.67	22.85	23.04	23.50	21.98	22.31	22.44	23.00
	25 (RB_Pos:0)	21.64	21.87	22.11	22.50	20.69	20.88	21.12	22.00
	25 (RB_Pos:12)	21.76	21.89	22.06	22.50	20.78	20.88	21.11	22.00
	25 (RB_Pos:25)	21.77	21.85	22.06	22.50	20.79	21.02	21.10	22.00
	50 (RB_Pos:0)	21.70	21.81	22.08	22.50	20.74	21.02	21.10	22.00
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	40065	40640	41215		40065	40640	41215	
5MHz	1 (RB_Pos:0)	22.57	22.70	22.90	23.50	21.90	22.14	22.11	23.00
	1 (RB_Pos:13)	22.69	22.86	23.02	23.50	22.03	22.27	22.29	23.00
	1 (RB_Pos:24)	22.56	22.72	22.94	23.50	21.90	22.14	22.22	23.00

	12 (RB_Pos:0)	21.66	21.82	22.02	22.50	20.66	20.94	21.06	22.00
	12 (RB_Pos:6)	21.72	21.85	22.06	22.50	20.71	20.98	21.12	22.00
	12 (RB_Pos:13)	21.67	21.79	22.00	22.50	20.69	20.90	21.06	22.00
	25 (RB_Pos:0)	21.68	21.80	22.02	22.50	20.75	20.86	21.04	22.00

8.4 WIFI

8.4.1 2.4GWIFI

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
2.4 (2.4~2.4835)	802.11b	1	2412	14.00	15.00	Yes
		6	2437	**14.31**	15.00	Yes
		11	2462	13.80	15.00	Yes
	802.11g	1	2412	11.41	13.00	No
		6	2437	11.94	13.00	No
		11	2462	11.91	13.00	No
	802.11n(HT20)	1	2412	9.56	11.00	No
		6	2437	10.12	11.00	No
		11	2462	9.70	11.00	No
	802.11n(HT40)	3	2422	10.08	11.00	No
		6	2437	10.16	11.00	No
		9	2452	9.98	11.00	No

8.5 Bluetooth

Mode	GFSK			π/4-DQPSK		
Channel	0	39	78	0	39	78
Frequency (MHz)	2402	2441	2480	2402	2441	2480
Conducted Power (dBm)	2.64	**3.71**	3.56	1.81	2.93	2.74
Tune-Up Limit (dBm)	4.00			3.50		
Mode	8-DPSK			BLE		
Channel	0	39	78	0	19	39
Frequency (MHz)	2402	2441	2480	2402	2440	2480
Conducted Power (dBm)	1.89	3.01	2.79	-4.14	-3.06	-3.27
Tune-Up Limit (dBm)	3.50			-2.50		

8.6 Power Reduction List

When device operating under hotspot mode, the GSM1900, LTE Band 41 power reduction will applied for SAR compliance.

8.6.1 Power Reduced Level 1 of GSM 1900

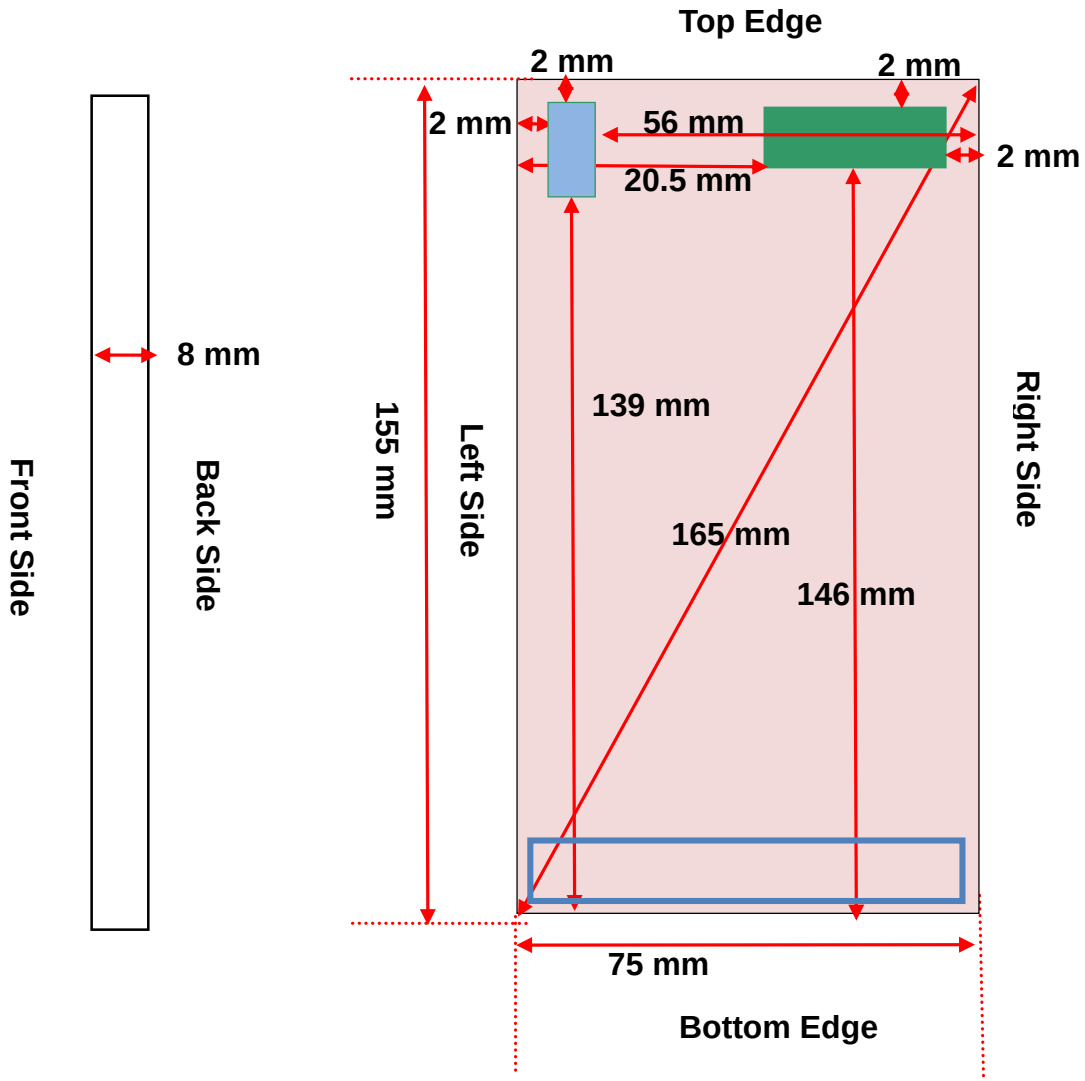
GSM 1900								
GSM1900 Band	Burst Average Power(dBm)			Tune-up	Frame-Averaged power(dBm)			Tune-up
Channel	512	661	810	Limit (dBm)	512	661	810	Limit (dBm)
GSM (GMSK, 1-Slot)	18.92	19.03	18.88	19.50	9.73	**9.84**	9.69	10.31
GPRS (GMSK, 1-Slot)	18.88	18.97	18.83	19.50	9.69	9.78	9.64	10.31
GPRS (GMSK, 2-Slots)	17.80	17.90	17.77	18.00	11.67	11.77	11.64	11.87
GPRS (GMSK, 3-Slots)	15.82	15.93	15.79	16.50	11.40	11.51	11.37	12.08
GPRS (GMSK, 4-Slots)	14.86	14.97	14.83	15.50	11.68	**11.79**	11.65	12.32
EGPRS (8PSK, 1-Slot)	15.69	15.71	15.56	16.00	6.50	6.52	6.37	6.81
EGPRS (8PSK, 2-Slots)	14.39	14.41	14.29	15.00	8.26	8.28	8.16	8.87
EGPRS (8PSK, 3-Slots)	12.21	12.14	12.08	13.00	7.79	7.72	7.66	8.58
EGPRS (8PSK, 4-Slots)	11.00	10.98	10.99	11.50	7.82	7.80	7.81	8.32

8.6.2 Power Reduced Level 1 of LTE Band 41

FDD LTE Band 41									
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	40140	40640	41140		40140	40640	41140	
20MHz	1 (RB_Pos:0)	15.40	15.52	15.68	17.00	15.70	15.78	16.09	17.00
	1 (RB_Pos:50)	15.87	16.02	**16.19**	17.00	16.21	16.24	16.53	17.00
	1 (RB_Pos:99)	15.41	15.56	15.77	17.00	15.72	15.79	16.16	17.00
	50 (RB_Pos:0)	15.53	15.83	15.93	17.00	15.57	15.86	16.00	17.00
	50 (RB_Pos:25)	15.64	15.80	15.90	17.00	15.65	15.85	15.96	17.00
	50 (RB_Pos:50)	15.67	15.78	15.78	17.00	15.69	15.83	15.90	17.00
	100 (RB_Pos:0)	15.63	15.82	15.89	17.00	15.63	15.86	15.94	17.00
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	40115	40640	41165		40115	40640	41165	
15MHz	1 (RB_Pos:0)	15.59	15.80	15.82	17.00	15.90	16.23	16.14	17.00
	1 (RB_Pos:38)	15.67	15.82	15.91	17.00	15.96	16.21	16.27	17.00
	1 (RB_Pos:74)	15.56	15.76	15.83	17.00	15.85	16.19	16.19	17.00
	36 (RB_Pos:0)	15.54	15.79	15.87	17.00	15.54	15.74	15.88	17.00
	36 (RB_Pos:20)	15.63	15.77	15.86	17.00	15.60	15.79	15.89	17.00
	36 (RB_Pos:39)	15.61	15.76	15.83	17.00	15.60	15.76	15.86	17.00
	75 (RB_Pos:0)	15.57	15.76	15.85	17.00	15.62	15.78	15.86	17.00

Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	40090	40640	41190		40090	40640	41190	
10MHz	1 (RB_Pos:0)	15.60	15.84	15.95	17.00	15.92	16.26	16.20	17.00
	1 (RB_Pos:25)	15.93	16.14	16.24	17.00	16.22	16.56	16.64	17.00
	1 (RB_Pos:49)	15.65	15.86	15.92	17.00	15.94	16.26	16.28	17.00
	25 (RB_Pos:0)	15.55	15.81	15.96	17.00	15.65	15.81	16.04	17.00
	25 (RB_Pos:12)	15.67	15.85	15.96	17.00	15.74	15.85	16.03	17.00
	25 (RB_Pos:25)	15.70	15.82	15.90	17.00	15.73	15.81	16.03	17.00
	50 (RB_Pos:0)	15.62	15.81	15.93	17.00	15.68	15.84	16.00	17.00
Bandwidth (MHz)	RB Set	Power (dBm)							
		QPSK			Tune up limit (dBm)	16QAM			Tune up limit (dBm)
	Channel	40065	40640	41215		40065	40640	41215	
5MHz	1 (RB_Pos:0)	15.51	15.69	15.84	17.00	15.86	16.07	16.05	17.00
	1 (RB_Pos:13)	15.65	15.83	15.96	17.00	16.00	16.20	16.22	17.00
	1 (RB_Pos:24)	15.53	15.73	15.85	17.00	15.86	16.07	16.14	17.00
	12 (RB_Pos:0)	15.61	15.77	15.96	17.00	15.61	15.86	16.04	17.00
	12 (RB_Pos:6)	15.67	15.82	15.97	17.00	15.69	15.92	16.01	17.00
	12 (RB_Pos:13)	15.61	15.73	15.86	17.00	15.64	15.82	16.03	17.00
	25 (RB_Pos:0)	15.62	15.77	15.92	17.00	15.70	15.80	15.84	17.00

9 EUT ANTENNA LOCATION SKETCH



WWAN Main Antenna TX/RX

WWAN Diversity Antenna RX (Receiving only)

WLAN/BT Antenna

EUT Back View

9.1 SAR Test Exclusion Consider Table

According with FCC KDB 447498 D01, Appendix A, <SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm> Table, this Device SAR test configurations consider as following :

Band	Mode	Max. Peak Power		Test Position Configurations					
		dBm	mW	Head	Front/ Back	Left Edge	Right Edge	Top Edge	Bottom Edge
GSM 850	Distance to User			<5mm	<5mm	20.5mm	<5mm	<5mm	146mm
	Voice	33.00	1995.26	Yes	Yes	Yes	Yes	Yes	No
	Data	32.00	1584.89	Yes	Yes	Yes	Yes	Yes	No
GSM 1900	Distance to User			<5mm	<5mm	20.5mm	<5mm	<5mm	146mm
	Voice	29.50	891.25	Yes	Yes	Yes	Yes	Yes	No
	Data	26.00	398.11	Yes	Yes	Yes	Yes	Yes	No
WCDMA Band 5	Distance to User			<5mm	<5mm	20.5mm	<5mm	<5mm	146mm
	RMC	22.00	158.49	Yes	Yes	Yes	Yes	Yes	No
LTE Band 5	Distance to User			<5mm	<5mm	20.5mm	<5mm	<5mm	146mm
	QPSK	23.00	199.53	Yes	Yes	Yes	Yes	Yes	No
LTE Band 41	Distance to User			<5mm	<5mm	20.5mm	<5mm	<5mm	146mm
	QPSK	23.50	223.87	Yes	Yes	Yes	Yes	Yes	No
WLAN 2.4 G	Distance to User			<5mm	<5mm	<5mm	56mm	<5mm	139mm
	802.11b	15.00	31.62	Yes	Yes	Yes	No	Yes	No
	802.11g	13.00	19.95	No	No	No	No	No	No
	802.11n(HT20)	11.00	12.59	No	No	No	No	No	No
	802.11n(HT40)	11.00	12.59	No	No	No	No	No	No
Bluetooth	Distance to User			<5mm	<5mm	<5mm	56mm	<5mm	139mm
	Bluetooth BR/EDR	4.00	2.51	No	No	No	No	No	No
	Bluetooth BLE	-2.50	0.56	No	No	No	No	No	No

Note:

1. Maximum power is the source-based time-average power and represents the maximum RF output power among production units.
2. Per KDB 447498 D01, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D01, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D01, 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:

   [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

   a. f(GHz) is the RF channel transmit frequency in GHz
   b. Power and distance are rounded to the nearest mW and mm before calculation
   c. The result is rounded to one decimal place for comparison
   d. For < 50 mm distance, we just calculate mW of the exclusion threshold value (3.0) to do compare.

   This formula is [3.0] / [√f(GHz)] ·[(min. test separation distance, mm)] = exclusion threshold of mW.
5. Per KDB 447498 D01, at 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold

is determined according to the following:

a. [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz

b. [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

6. Per KDB 941225 D01, When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ 1/4 dB higher than the primary mode 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.

7. Per KDB 941225 D05, SAR test reduction is applied using the following criteria:

a. 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.

b. 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.

c. 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.

d. Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.

e. 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.

8. Per KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions.

a. 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.

b. 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.

9. Per KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions.

a. When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.

b. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

10. According to 2019 TCB workshop, FCC accept SAR testing with IEC tissue parameters for head and body, so this product only used IEC tissue parameters to perform SAR testing.

9.2 10g Extremity Exposure Consider

According with FCC KDB 648474 D04, for smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, unless it is confirmed otherwise through KDB inquiries, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance;

The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions. The UMPC mini-tablet 1-g SAR at 5 mm is not required. 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.

Conclusion:

The EUT hotspot mode 1-g reported SAR is 1.185 W/Kg, which is less than 1.2W/Kg, 10-g extremity SAR is not required.

10 TEST RESULTS

10.1 GSM 850

Power Reduction	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	Meas. SAR1 g (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head												
Off	GPRS (2slots)	Left Cheek	0	190	836.6	-3.21	0.377	31.85	32.00	1.035	0.390	/
Off		Left Tilt	0	190	836.6	-0.39	0.251	31.85	32.00	1.035	0.260	/
Off		Right Cheek	0	190	836.6	-3.40	0.467	31.85	32.00	1.035	**0.483**	1#
Off		Right Tilt	0	190	836.6	0.52	0.258	31.85	32.00	1.035	0.267	/
Body-worn&Hotspot (10mm)												
Off	Voice	Front Side	10	190	836.6	0.82	0.079	32.59	33.00	1.099	0.087	/
Off		Back Side	10	190	836.6	-4.28	0.112	32.59	33.00	1.099	0.123	/
Off	GPRS (2slots)	Front Side	10	190	836.6	0.40	0.120	31.85	32.00	1.035	0.124	/
Off		Back Side	10	190	836.6	1.01	0.200	31.85	32.00	1.035	**0.207**	2#
Off		Top Edge	10	190	836.6	-0.55	0.075	31.85	32.00	1.035	0.078	/
Off		Left Edge	10	190	836.6	-1.77	0.134	31.85	32.00	1.035	0.139	/
Off		Right Edge	10	190	836.6	3.53	0.088	31.85	32.00	1.035	0.091	/
Note: Refer to ANNEX C for the detailed test data for each test configuration.												

10.2GSM 1900

Power Reduction	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	Meas. SAR1 g (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head												
level1	GPRS (4slots)	Left Cheek	0	661	1880.0	-0.53	0.283	14.97	15.50	1.130	0.320	/
level1		Left Tilt	0	661	1880.0	-1.30	0.370	14.97	15.50	1.130	0.418	/
level1		Right Cheek	0	661	1880.0	0.45	0.444	14.97	15.50	1.130	**0.502**	3#
level1		Right Tilt	0	661	1880.0	-0.02	0.358	14.97	15.50	1.130	0.404	/
Body-Worn&Hotspot (10mm)												
Off	Voice	Front Side	10	661	1880.0	-4.69	0.194	28.81	29.50	1.172	0.227	/
Off		Back Side	10	661	1880.0	-0.29	0.395	28.81	29.50	1.172	0.463	/
Off	GPRS (4slots)	Front Side	10	661	1880.0	0.62	0.316	25.86	26.00	1.033	0.326	/
Off		Back Side	10	661	1880.0	-3.15	0.749	25.86	26.00	1.033	**0.774**	4#
Off		Top Edge	10	661	1880.0	-4.25	0.551	25.86	26.00	1.033	0.569	/
Off		Left Edge	10	661	1880.0	-2.94	0.110	25.86	26.00	1.033	0.114	/
Off		Right Edge	10	661	1880.0	-2.08	0.338	25.86	26.00	1.033	0.349	/
Note: Refer to ANNEX C for the detailed test data for each test configuration.												

10.3WCDMA Band 5

Power Reduction	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	Meas. SAR1 g (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head												
Off	RMC	Left Cheek	0	4132	826.4	-0.42	0.273	21.74	22.00	1.062	0.290	/
Off		Left Tilt	0	4132	826.4	-0.01	0.199	21.74	22.00	1.062	0.211	/
Off		Right Cheek	0	4132	826.4	0.12	0.296	21.74	22.00	1.062	**0.314**	5#
Off		Right Tilt	0	4132	826.4	-0.24	0.174	21.74	22.00	1.062	0.185	/
Body-worn&Hotspot (10mm)												
Off	RMC	Front Side	10	4132	826.4	-0.53	0.095	21.74	22.00	1.062	0.101	/
Off		Back Side	10	4132	826.4	-0.48	0.143	21.74	22.00	1.062	**0.152**	6#
Off		Top Edge	10	4132	826.4	-0.53	0.062	21.74	22.00	1.062	0.066	/
Off		Left Edge	10	4132	826.4	-0.52	0.110	21.74	22.00	1.062	0.117	/
Off		Right Edge	10	4132	826.4	0.33	0.077	21.74	22.00	1.062	0.082	/
Note: Refer to ANNEX C for the detailed test data for each test configuration.												

10.4LTE Band 5 (10MHz Bandwidth)

Power Reduction	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	RB Numb.	RB Start	Power Drift (%)	Meas. SAR1 g (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head														
Off	QPSK	Left Cheek	0	20450	829	1	MID	-0.29	0.314	22.69	23.00	1.074	0.337	/
Off			0	20450	829	50	LOW	-0.48	0.262	21.62	22.00	1.091	0.286	/
Off		Left Tilt	0	20450	829	1	MID	0.23	0.225	22.69	23.00	1.074	0.242	/
Off			0	20450	829	50	LOW	-0.07	0.190	21.62	22.00	1.091	0.207	/
Off		Right Cheek	0	20450	829	1	MID	-0.20	0.374	22.69	23.00	1.074	**0.402**	7#
Off			0	20450	829	50	LOW	-0.24	0.318	21.62	22.00	1.091	0.347	/
Off		Right Tilt	0	20450	829	1	MID	-0.48	0.231	22.69	23.00	1.074	0.248	/
Off			0	20450	829	50	LOW	-0.13	0.196	21.62	22.00	1.091	0.214	/
Body-worn&Hotspot (10mm)														
Off	QPSK	Front Side	10	20450	829	1	MID	-0.90	0.112	22.69	23.00	1.074	0.120	/
Off			10	20450	829	50	LOW	-0.80	0.085	21.62	22.00	1.091	0.093	/
Off		Back Side	10	20450	829	1	MID	-0.77	0.171	22.69	23.00	1.074	**0.184**	8#
Off			10	20450	829	50	LOW	-0.27	0.144	21.62	22.00	1.091	0.157	/
Off		Top Edge	10	20450	829	1	MID	-0.32	0.059	22.69	23.00	1.074	0.063	/
Off			10	20450	829	50	LOW	-0.15	0.045	21.62	22.00	1.091	0.049	/
Off		Left Edge	10	20450	829	1	MID	-0.64	0.117	22.69	23.00	1.074	0.126	/
Off			10	20450	829	50	LOW	-0.12	0.088	21.62	22.00	1.091	0.096	/
Off		Right Edge	10	20450	829	1	MID	-0.45	0.085	22.69	23.00	1.074	0.091	/
Off			10	20450	829	50	LOW	-0.79	0.056	21.62	22.00	1.091	0.061	/
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

10.5LTE Band 41 (20MHz Bandwidth)

Power Reduction	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	RB Numb.	RB Start	Power Drift (%)	Meas. SAR1 g (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head														
level1	QPSK	Left Cheek	0	41140	2645	1	MID	-2.31	0.174	16.19	17.00	1.205	0.210	/
level1			0	41140	2645	50	LOW	-4.94	0.177	15.93	17.00	1.279	0.226	/
level1		Left Tilt	0	41140	2645	1	MID	-1.00	0.230	16.19	17.00	1.205	0.277	/
level1			0	41140	2645	50	LOW	0.02	0.228	15.93	17.00	1.279	0.292	/
level1		Right Cheek	0	41140	2645	1	MID	0.24	0.355	16.19	17.00	1.205	0.428	/
level1			0	41140	2645	50	LOW	0.35	0.352	15.93	17.00	1.279	0.450	/
level1		Right Tilt	0	41140	2645	1	MID	-1.90	0.402	16.19	17.00	1.205	0.484	/
level1			0	41140	2645	50	LOW	-1.87	0.429	15.93	17.00	1.279	**0.549**	9#
level1			10	41140	2645	50	LOW	-2.28	0.139	15.93	17.00	1.279	0.178	/
Body-worn&Hotspot (10mm)														
Off	QPSK	Front Side	10	41140	2645	1	MID	-2.71	0.368	23.26	23.50	1.057	0.389	/
Off			10	41140	2645	50	LOW	-3.90	0.283	21.99	22.50	1.125	0.318	/
Off		Back Side	10	41140	2645	1	MID	0.51	0.365	23.26	23.50	1.057	0.386	/
Off			10	41140	2645	50	LOW	-0.38	0.285	21.99	22.50	1.125	0.321	/
Off		Top Edge	10	41140	2645	1	MID	-0.13	0.809	23.26	23.50	1.057	0.855	/
Off			10	40140	2545	1	MID	-1.34	1.054	22.99	23.50	1.125	**1.185**	10#
Off			10	40640	2595	1	MID	-1.21	0.982	23.06	23.50	1.107	1.087	/
Off			10	41140	2645	50	LOW	-2.27	0.631	21.99	22.50	1.125	0.710	/
Off			10	41140	2645	100	LOW	-1.81	0.582	21.97	22.50	1.130	0.658	/
Off		Left Edge	10	41140	2645	1	MID	-0.85	0.034	23.26	23.50	1.057	0.036	/
Off			10	41140	2645	50	LOW	1.23	0.028	21.99	22.50	1.125	0.031	/
Off		Right Edge	10	41140	2645	1	MID	-2.00	0.349	23.26	23.50	1.057	0.369	/
Off			10	41140	2645	50	LOW	-0.88	0.302	21.99	22.50	1.125	0.340	/
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

10.6WIFI 2.4GHz

Mode	Power Reduction	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	1 g Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	Duty Cycle (%)	Duty Cycle Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head														
802.11 b	Off	Left Cheek	0	6	2437.0	1.44	0.333	14.31	15.00	1.172	100.00	1.000	**0.390**	11#
	Off	Left Tilt	0	6	2437.0	-0.20	0.262	14.31	15.00	1.172	100.00	1.000	0.307	/
	Off	Right Cheek	0	6	2437.0	1.77	0.145	14.31	15.00	1.172	100.00	1.000	0.170	/
	Off	Right Tilt	0	6	2437.0	-1.56	0.176	14.31	15.00	1.172	100.00	1.000	0.206	/
Body-worn&Hotspot (10mm)														
802.11 b	Off	Front Side	10	6	2437.0	-2.90	0.071	14.31	15.00	1.172	100.00	1.000	0.083	/
	Off	Back Side	10	6	2437.0	-2.37	0.094	14.31	15.00	1.172	100.00	1.000	0.110	/
	Off	Top Edge	10	6	2437.0	-4.95	0.128	14.31	15.00	1.172	100.00	1.000	**0.150**	12#
	Off	Left Edge	10	6	2437.0	-2.91	0.083	14.31	15.00	1.172	100.00	1.000	0.097	/
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

11 SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10, the highest SAR configuration for either head or body tissue-equivalent medium may be used to perform the repeated measurement. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR repeated measurement procedure:

1. When the highest measured SAR is < 0.80 W/kg, repeated measurement is not required.
2. When the highest measured SAR is >= 0.80 W/kg, repeat that measurement once.
3. 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, perform a second repeated measurement.
4. If the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20, and the original, first or second repeated measurement is >= 1.5 W/kg, perform a third repeated measurement.

Frequency Band (MHz)	Wireless Band	RF Exposure Conditions	Test Position	Highest Measured SAR (W/kg)	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Largest to Smallest SAR Radio
2600	LTE Band 41	Body	Top Edge	1.054	Yes	0.985	1.07
Note: The ratio of largest to smallest SAR for the original and first repeated measurements is < 1.20, the second repeated measurement is not required.							

12 SIMULTANEOUS TRANSMISSION

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. When the sum of SAR 1g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (SAR 1g 1.6 W/kg), the simultaneous transmission SAR is not required. When the sum of SAR 1g is greater than the SAR limit (SAR 1g 1.6 W/kg), SAR test exclusion is determined by the SAR to Peak Location Ratio (SPLSR).

12.1 Simultaneous Transmission Mode Consider

NO.	Mode	2.4G WLAN & Bluetooth		
		Head	Body-worn	Hotspot
1	GSM	+ Bluetooth	+ Bluetooth	+ Bluetooth
		+ 2.4G WLAN	+ 2.4G WLAN	+ 2.4G WLAN
2	WCDMA RMC	+ Bluetooth	+ Bluetooth	+ Bluetooth
		+ 2.4G WLAN	+ 2.4G WLAN	+ 2.4G WLAN
3	LTE	+ Bluetooth	+ Bluetooth	+ Bluetooth
		+ 2.4G WLAN	+ 2.4G WLAN	+ 2.4G WLAN

Note:

1. 2G&3G&4G share the same antenna and can't transmit simultaneously.
2. The Bluetooth and 2.4G WLAN share the same antenna, can't transmitting together.
3. Both the 2.4G WLAN or Bluetooth can transmit simultaneously with each WWAN.

12.2 Estimated SAR Calculation

According to KDB 447498 D01 when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR was estimated according to following formula to result in substantially conservative SAR values of <= 0.4 W/kg to determine simultaneous transmission SAR test exclusion.

$$\text{Estimated SAR} = \frac{Max.Tune\ Up\ Power(mw)}{Min\ Test\ Separation\ Distance} * \frac{\sqrt{f_{GHz}}}{x}$$ (where x = 7.5 for 1-g SAR)

If the minimum test separation distance is < 5 mm, a distance of 5 mm is used for estimated SAR calculation. When the test separation distance is > 50 mm, the 0.4 W/kg is used for SAR-1g.

Band	Mode	Position	Antenna To user (mm)	SAR Testing	Max. Tune-up Power (dBm)	Max. Tune-up Power (mW)	Frequency (GHz)	Calculation Distance/Gap (mm)	Estimated SAR (W/kg)
Bluetooth	GFSK	Right Cheek	5	NO	4.00	2.51	2.441	5	0.105
		Left Cheek	5	NO	4.00	2.51	2.441	5	0.105
		Front side	10	NO	4.00	2.51	2.441	10	0.052
		Back Side	10	NO	4.00	2.51	2.441	10	0.052
		Left Edge	10	NO	4.00	2.51	2.441	10	0.052
		Top Edge	10	NO	4.00	2.51	2.441	10	0.052

12.3 Sum SAR of Simultaneous Transmission

12.3.1 Sum Head SAR of Simultaneous Transmission

Simultaneous Mode	Mode	Max. 1g SAR (W/kg)	1g Sum SAR (W/kg)	SPLSR (Yes/No)
GSM +Bluetooth	GSM	0.502	0.607	No
	Bluetooth	0.105		
GSM + 2.4G WLAN	GSM	0.502	0.892	No
	2.4G WLAN	0.390		
WCDMA RMC +Bluetooth	WCDMA RMC	0.314	0.419	No
	Bluetooth	0.105		
WCDMA RMC +2.4G WLAN	WCDMA RMC	0.314	0.704	No
	2.4G WLAN	0.390		
LTE QPSK + Bluetooth	LTE QPSK	0.549	0.654	No
	Bluetooth	0.105		
LTE QPSK + 2.4G WLAN	LTE QPSK	0.549	**0.939**	No
	2.4G WLAN	0.390		

12.3.2 Sum Body-worn SAR of Simultaneous Transmission

Simultaneous Mode	Mode	Max. 1g SAR (W/kg)	1g Sum SAR (W/kg)	SPLSR (Yes/No)
GSM +Bluetooth	GSM	0.774	0.826	No
	Bluetooth	0.052		
GSM + 2.4G WLAN	GSM	0.774	**0.884**	No
	2.4G WLAN	0.110		
WCDMA RMC +Bluetooth	WCDMA RMC	0.152	0.204	No
	Bluetooth	0.052		
WCDMA RMC +2.4G WLAN	WCDMA RMC	0.152	0.262	No
	2.4G WLAN	0.110		
LTE QPSK + Bluetooth	LTE QPSK	0.389	0.441	No
	Bluetooth	0.052		
LTE QPSK + 2.4G WLAN	LTE QPSK	0.389	0.499	No
	2.4G WLAN	0.110		

12.3.3 Sum Hotspot mode SAR of Simultaneous Transmission

Simultaneous Mode	Mode	Max. 1g SAR (W/kg)	1g Sum SAR (W/kg)	SPLSR (Yes/No)
GSM +Bluetooth	GSM	0.774	0.826	No
	Bluetooth	0.052		
GSM + 2.4G WLAN	GSM	0.774	0.924	No
	2.4G WLAN	0.150		
WCDMA RMC +Bluetooth	WCDMA RMC	0.152	0.204	No
	Bluetooth	0.052		
WCDMA RMC +2.4G WLAN	WCDMA RMC	0.152	0.302	No
	2.4G WLAN	0.150		
LTE QPSK + Bluetooth	LTE QPSK	1.185	1.237	No
	Bluetooth	0.052		
LTE QPSK + 2.4G WLAN	LTE QPSK	1.185	**1.335**	No
	2.4G WLAN	0.150		

13 TEST EQUIPMENTS LIST

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
835MHz Dipole	SATIMO	SID 835	S/N 11/17 DIP 0G750-447	2017/03/22	2020/03/21
1900MHz Dipole	SATIMO	SID 1900	S/N 11/17 DIP 1G900-450	2017/03/22	2020/03/21
2450MHz Dipole	SATIMO	SID 2450	S/N 11/17 DIP 2G450-452	2017/03/22	2020/03/21
2600MHz Dipole	SATIMO	SID 2600	S/N 11/17 DIP 2G600-453	2017/03/22	2020/03/21
E-Field Probe	MVG	SSE2	S/N 34/15 EPGO 265	2019/03/19	2020/03/18
MultiMeter	Keithley	MultiMeter 2000	4024022	2019/06/17	2020/06/16
Signal Generator	R&S	SMBV100A	260592	2019/06/13	2020/06/12
Power Meter	Agilent	E4419B	GB40201833	2018/11/01	2019/10/31
Power Sensor	Agilent	E9300A	MY41498012	2018/11/01	2019/10/31
Power Sensor	Agilent	E9300A	MY41499891	2018/11/01	2019/10/31
Wireless Communication Test Set	Agilent	8960-E5515C	MY50260493	2019/06/13	2020/06/13
Wireless Communication Test Set	R&S	CMW 500	151885	2019/06/13	2020/06/13
Network Analyzer	R&S	ZVL-6	101380	2019/06/20	2020/06/19
Thermometer	Elitech	RC-4HC	N/A	2018/11/05	2019/11/04
Power Amplifier	SATIMO	6552B	22374	N/A	N/A
Dielectric Probe Kit	SATIMO	SCLMP	SN 25/13 OCPG56	N/A	N/A
Antenna	SATIMO	ANTA3	SN 17/13 ZNTA45	N/A	N/A
Phantom 1	SATIMO	SAM	SN 30/13 SAM103	N/A	N/A
Phantom 2	SATIMO	SAM	SN 30/13 SAM104	N/A	N/A
Attenuator	COM-MW	ZA-S1-31	1305003187	N/A	N/A
Directional coupler	AA-MCS	AAMCS-UDC	000272	N/A	N/A

Note: For dipole antennas, BALUN has adopted 3 years as calibration intervals, and on annual basis, every measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole;
2. System validation with specific dipole is within 10% of calibrated value;
3. Return-loss in within 20% of calibrated measurement.
4. Impedance (real or imaginary parts) in within 5 Ohms of calibrated measurement.

ANNEX A SIMULATING LIQUID VERIFICATION RESULT

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an SCLMP Dielectric Probe Kit.

Date	Liquid Type	Fre. (MHz)	Temp. (℃)	Meas. Conductivity(σ) (S/m)	Meas. Permittivity(ε)	Target Conductivity(σ) (S/m)	Target Permittivity(ε)	Conductivity Tolerance (%)	Permittivity Tolerance (%)
2019.08.21	Head	835	21.4	0.90	42.02	0.90	41.50	0.00	1.25
2019.08.24	Head	1900	21.3	1.44	39.74	1.40	40.00	2.86	-0.65
2019.08.22	Head	2450	21.5	1.77	40.13	1.80	39.20	-1.67	2.37
2019.08.25	Head	2600	21.4	1.99	38.69	1.96	39.01	1.53	-0.82
Note: The tolerances limit of Conductivity and Permittivity is ± 5%.									

ANNEX B SYSTEM CHECK RESULT

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10% (for 1 g).

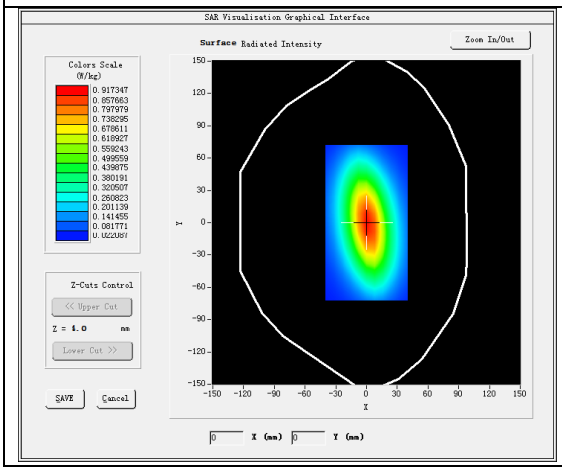
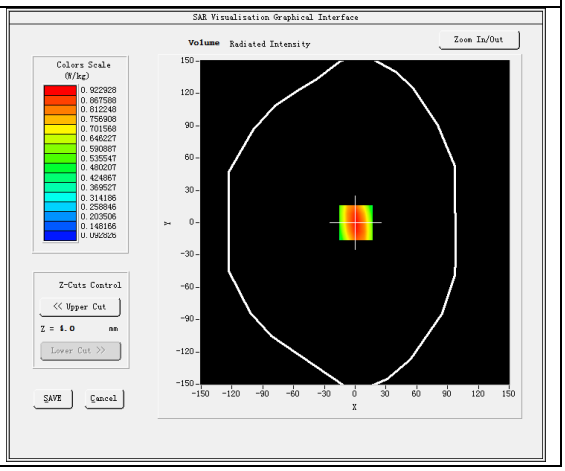
Date	Liquid Type	Freq. (MHz)	Power (mW)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Dipole SAR (W/kg)	Tolerance (%)	Targeted SAR(W/kg)	Tolerance (%)
2019.08.21	Head	835	100	0.913	9.13	9.58	-4.70	9.56	-4.50
2019.08.24	Head	1900	100	3.701	37.01	39.49	-6.28	39.70	-6.78
2019.08.22	Head	2450	100	5.313	53.13	54.31	-2.17	52.40	1.39
2019.08.25	Head	2600	100	5.579	55.79	56.32	-0.94	55.30	0.89
Note[1]: The tolerance limit of System validation is ±10%.									

System Performance Check Data(835 MHz)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2019.08.21
Measurement duration: 13 minutes 27 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	835MHz
Signal	CW
Frequency (MHz)	835.000000
Relative permittivity (real part)	42.023043
Conductivity (S/m)	0.904305
Power drift (%)	0.850000
Ambient Temperature:	22.8°C
Liquid Temperature:	21.4°C
ConvF:	1.93
Crest factor:	1:1

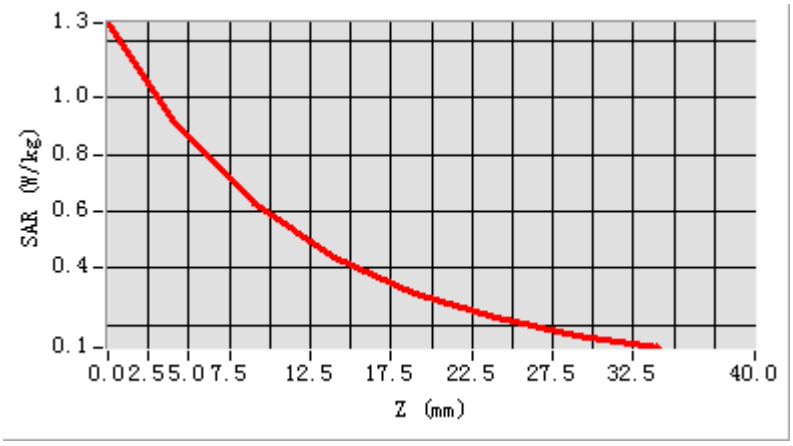
SURFACE SAR	VOLUME SAR
	

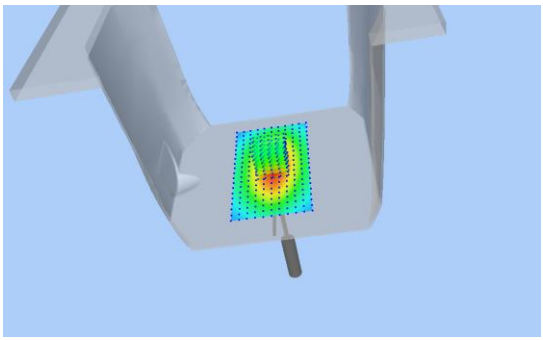
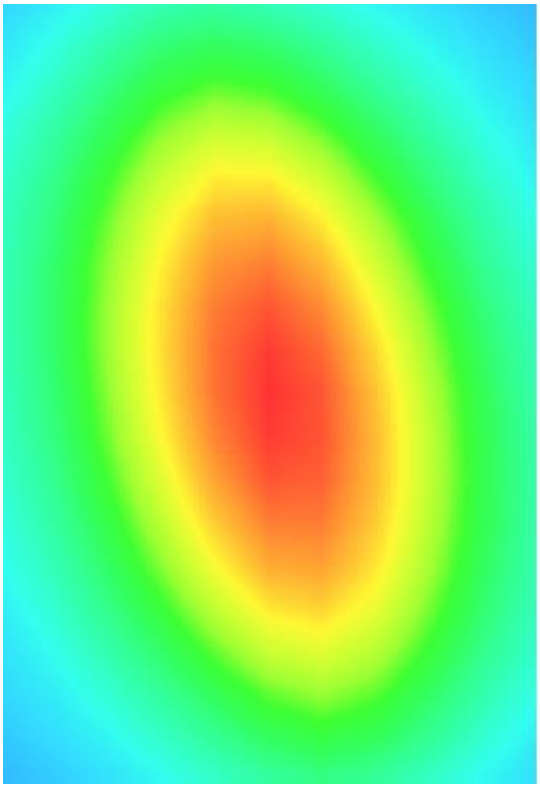
Maximum location: X=1.00, Y=0.00

SAR Peak: 1.26 W/kg

SAR 10 g (W/Kg)	0.605918
SAR 1g (W/Kg)	0.912506

Z Axis Scan



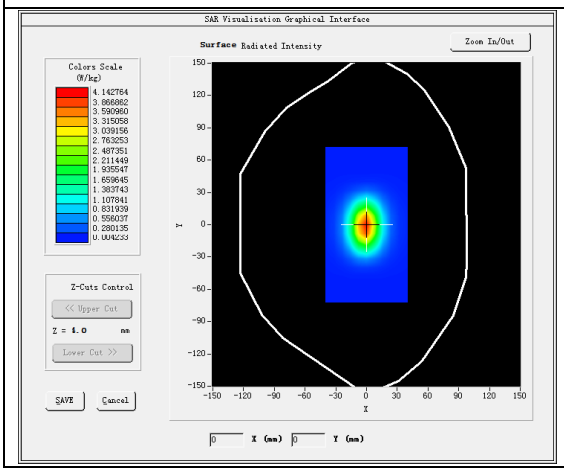
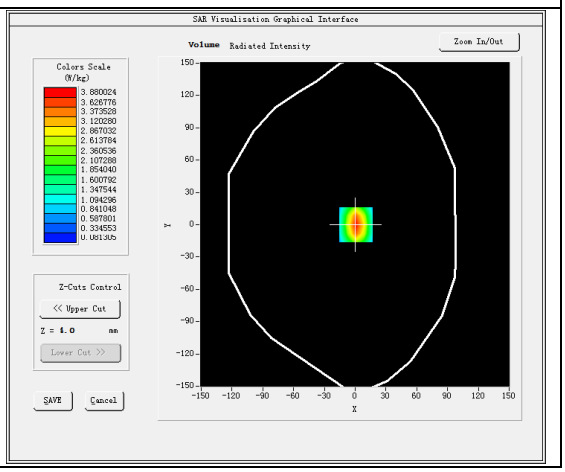
3D screen shot	Hot spot position
	

System Performance Check Data(1900MHz)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2019.08.24
Measurement duration: 14 minutes 5 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	1900MHz
Signal	CW
Frequency (MHz)	1900.000000
Relative permittivity (real part)	39.740300
Conductivity (S/m)	1.441015
Power drift (%)	-0.520000
Ambient Temperature:	22.5°C
Liquid Temperature:	21.3°C
ConvF:	2.46
Crest factor:	1:1

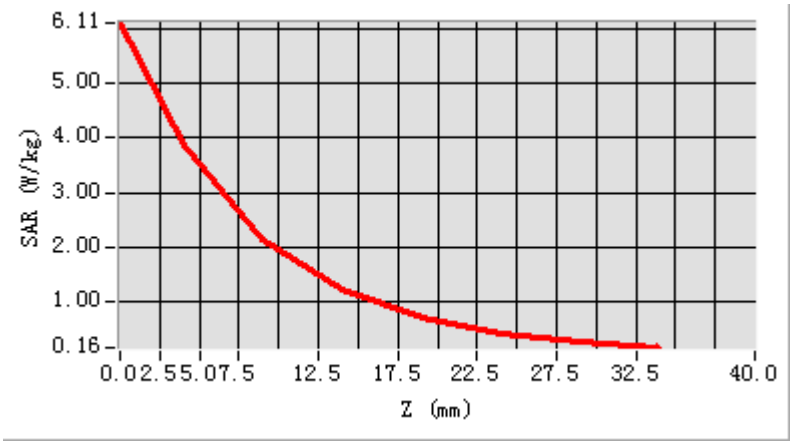
SURFACE SAR	VOLUME SAR
	

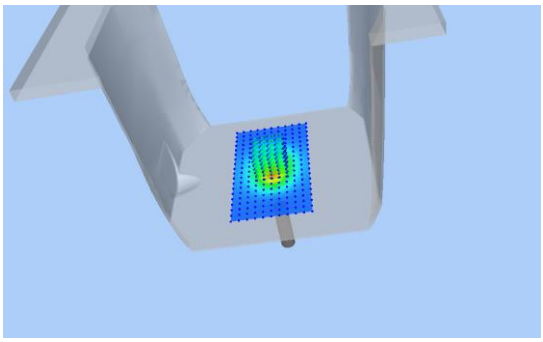
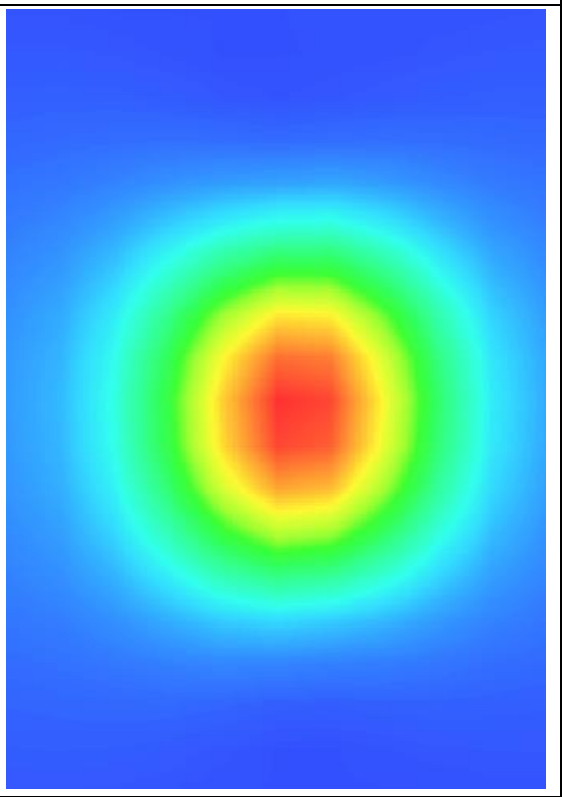
Maximum location: X=1.00, Y=0.00

SAR Peak: 6.05 W/kg

SAR 10g (W/Kg)	1.922159
SAR 1g (W/Kg)	3.70056

Z Axis Scan



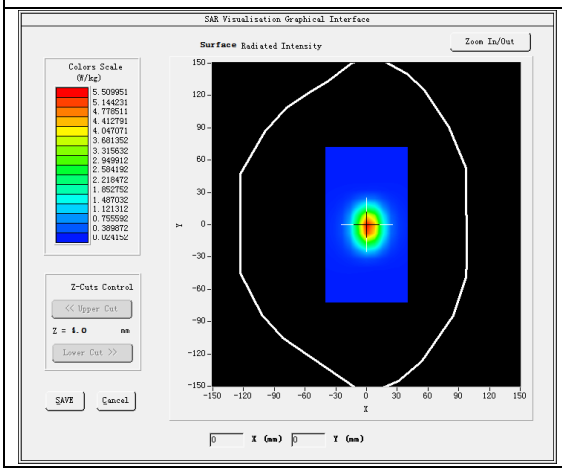
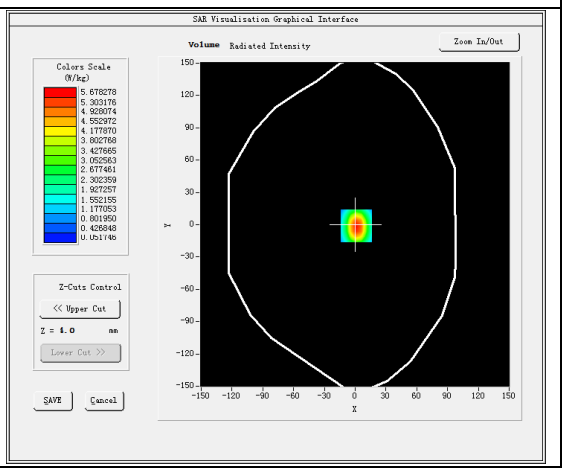
3D screen shot	Hot spot position
	

System Performance Check Data(2450MHz)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=5mm, dy=5mm, dz=5mm
Date of measurement: 2019.08.22
Measurement duration: 18 minutes 38 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2450MHz
Signal	CW
Frequency (MHz)	2450.000000
Relative permittivity (real part)	40.128132
Conductivity (S/m)	1.767156
Power drift (%)	-0.770000
Ambient Temperature:	22.6°C
Liquid Temperature:	21.5°C
ConvF:	2.55
Crest factor:	1:1

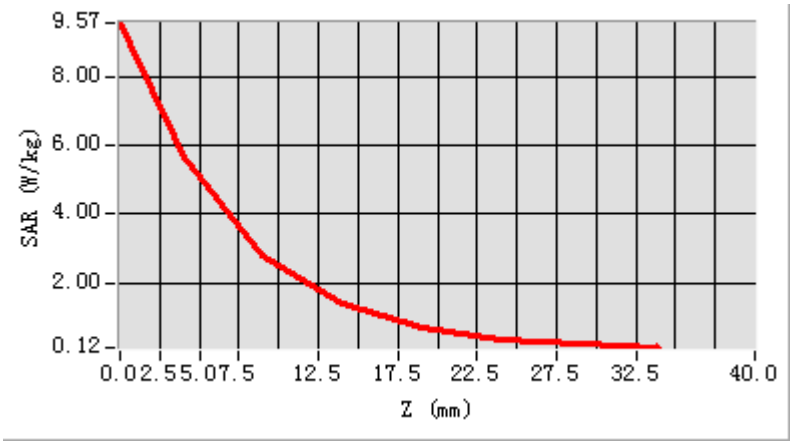
SURFACE SAR	VOLUME SAR
	

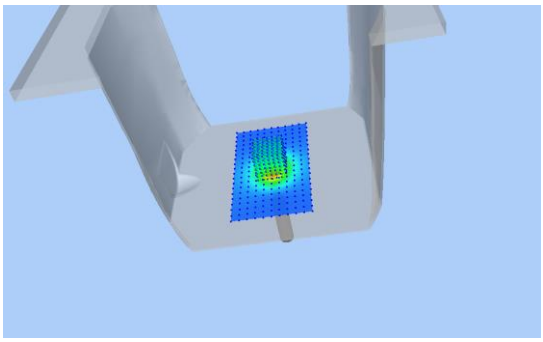
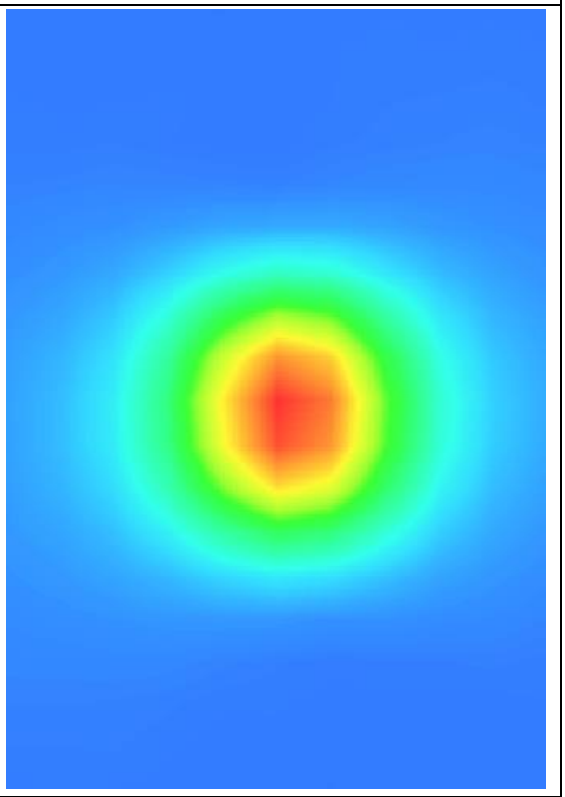
Maximum location: X=1.00, Y=-1.00

SAR Peak: 9.55 W/kg

SAR 10g (W/Kg)	2.424226
SAR 1g (W/Kg)	5.313262

Z Axis Scan



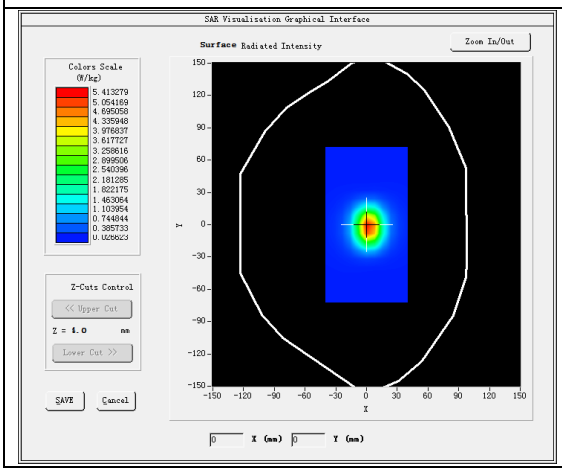
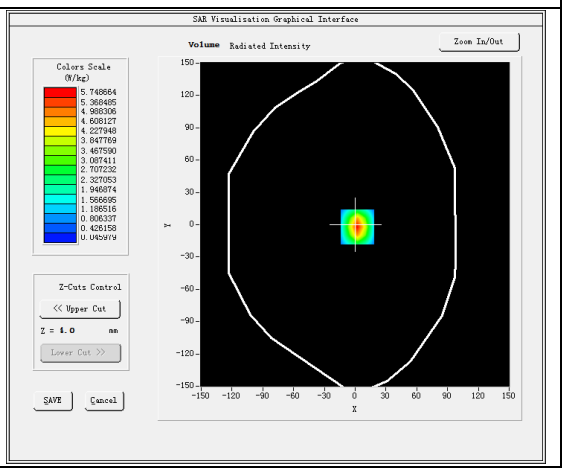
3D screen shot	Hot spot position
	

System Performance Check Data(2600MHz)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=5mm, dy=5mm, dz=5mm
Date of measurement: 2019.08.25
Measurement duration: 18 minutes 7 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2600MHz
Signal	CW
Frequency (MHz)	2600.000000
Relative permittivity (real part)	38.693484
Conductivity (S/m)	1.992813
Power drift (%)	0.740000
Ambient Temperature:	22.7°C
Liquid Temperature:	21.4°C
ConvF:	2.38
Crest factor:	1:1

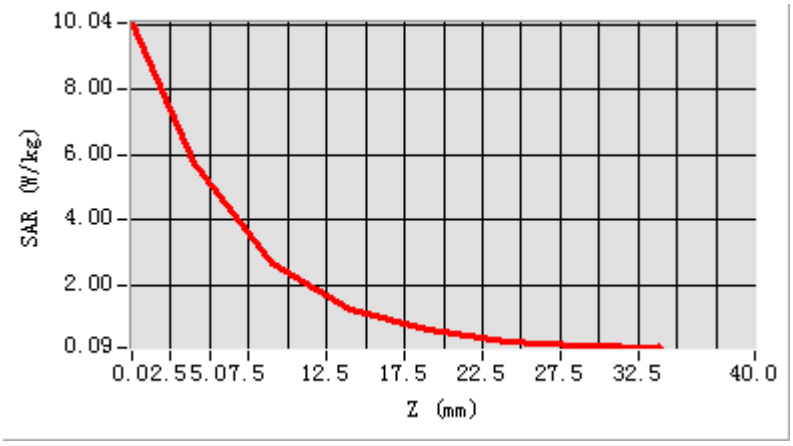
SURFACE SAR	VOLUME SAR
	

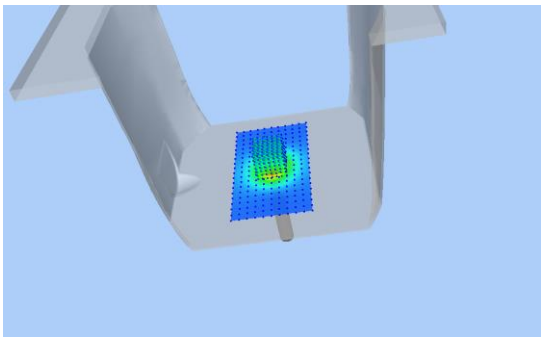
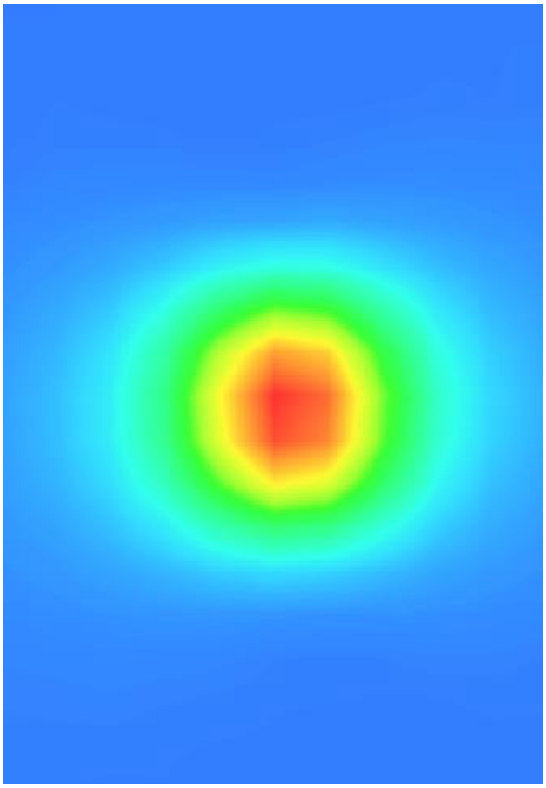
Maximum location: X=2.00, Y=-2.00

SAR Peak:9.91 W/kg

SAR 10g (W/Kg)	2.492108
SAR 1g (W/Kg)	5.579191

Z Axis Scan



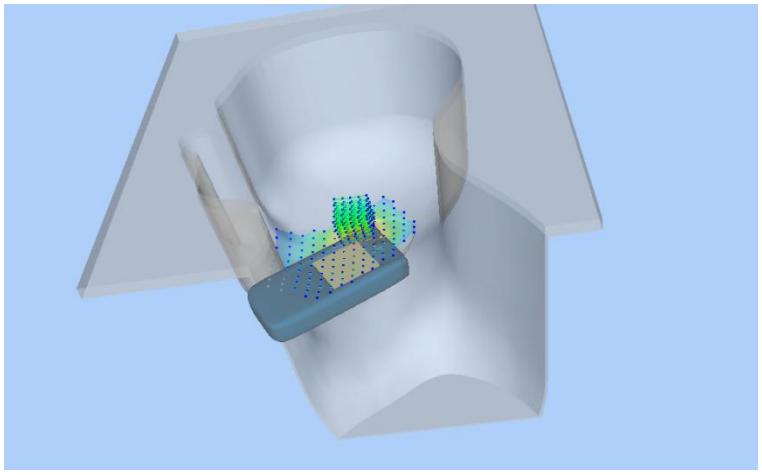
3D screen shot	Hot spot position
	

ANNEX C TEST DATA

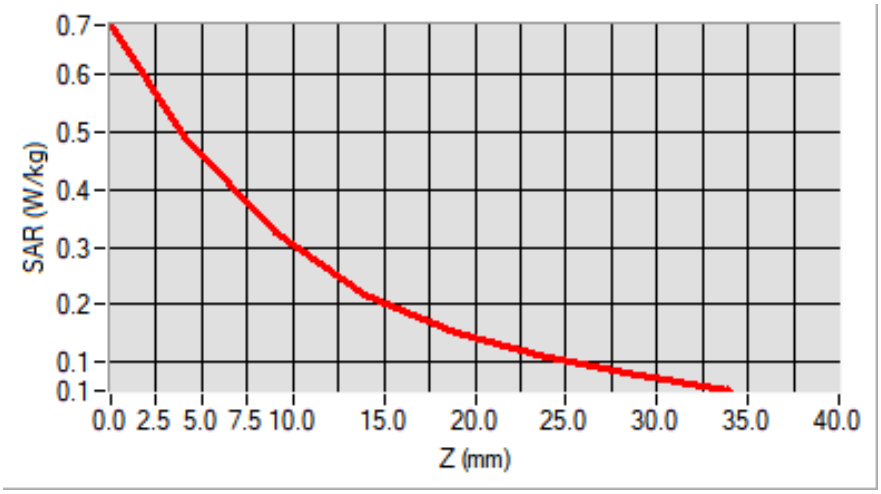
MEAS. 1 Right Head with Cheek on Middle Channel in GPRS850 2Slots mode

Test Date:	21/8/2019
Measurement duration:	10 minutes 37 seconds
Signal:	GPRS, f=836.6 MHz, Duty Cycle: 1:4.0
Liquid Parameters:	Permittivity: 42.02; Conductivity: 0.90 S/m
Test condition:	Ambient Temperature: 22.8°C, Liquid Temperature: 21.4°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 1.93
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-26.000000, Y=14.000000
SAR 10g (W/Kg):	0.297061
SAR 1g (W/Kg):	0.467356
Power drift (%):	-3.40

3D screen shot



Z Axis Scan

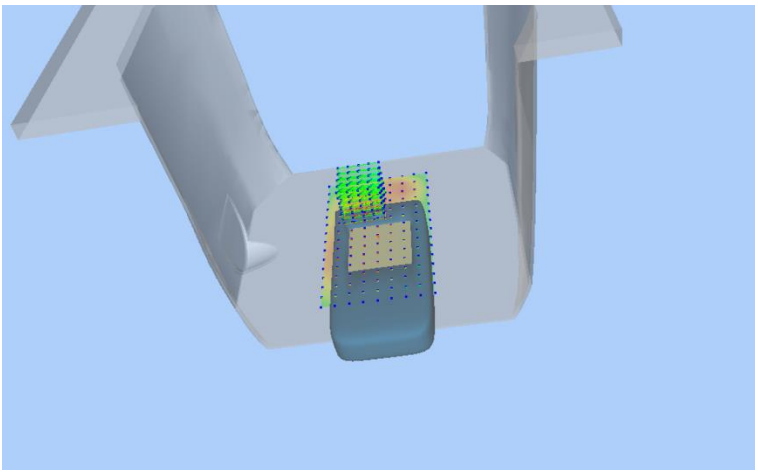


MEAS. 2 Body Plane with Back Side 10mm on Middle Channel in GPRS850

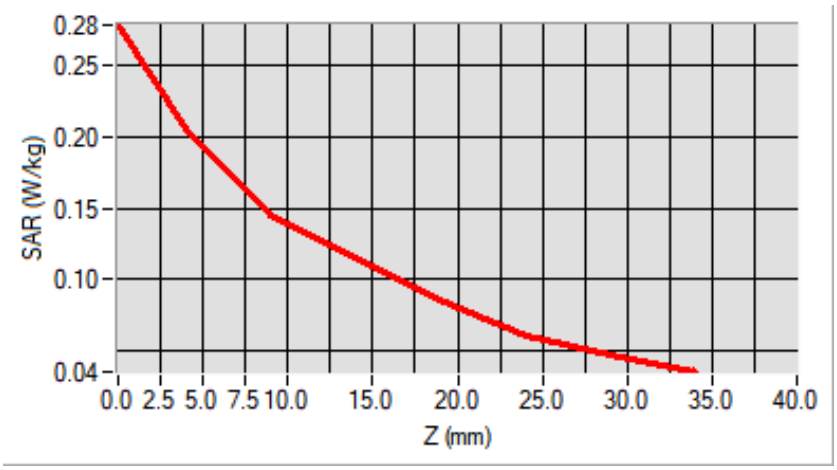
2Slots mode

Test Date:	21/8/2019
Measurement duration:	10 minutes 17 seconds
Signal:	GPRS, f=836.6 MHz, Duty Cycle: 1:4.0
Liquid Parameters:	Permittivity: 42.02; Conductivity: 0.90 S/m
Test condition:	Ambient Temperature: 22.8°C, Liquid Temperature: 21.4°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 1.93
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-10.000000, Y=28.000000
SAR 10g (W/Kg):	0.139536
SAR 1g (W/Kg):	0.199859
Power drift (%):	1.01

3D screen shot



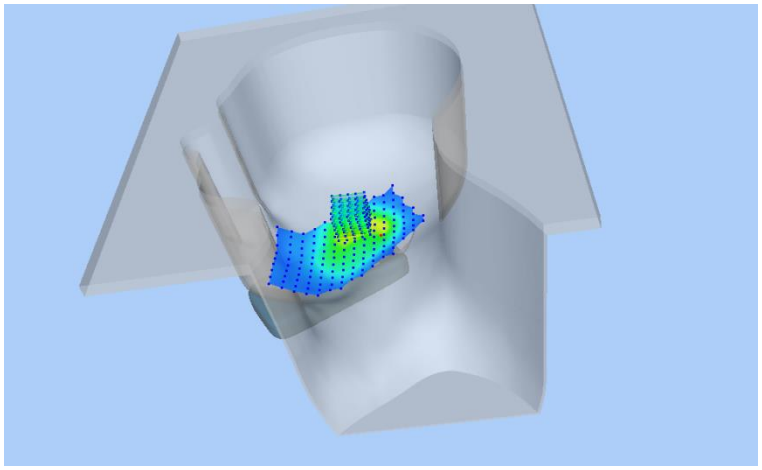
Z Axis Scan



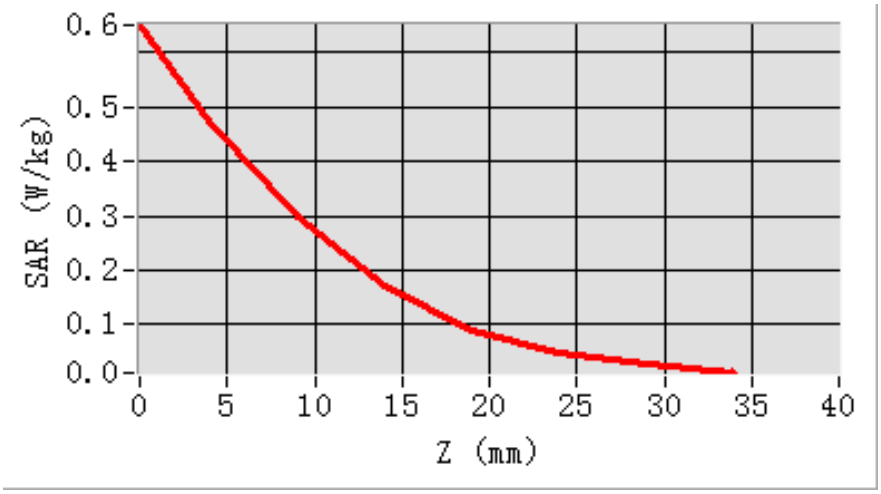
MEAS. 3 Right Head with Cheek on Middle Channel in GPRS1900 4slots mode

Test Date:	24/8/2019
Measurement duration:	10 minutes 13 seconds
Signal:	GPRS, f=1880.0 MHz, Duty Cycle: 1:2.0
Liquid Parameters:	Permittivity: 40.12; Conductivity: 1.43 S/m
Test condition:	Ambient Temperature: 22.5°C, Liquid Temperature: 21.3°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 2.46
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-26.000000, Y=14.000000
SAR 10g (W/Kg):	0.229057
SAR 1g (W/Kg):	0.444318
Power drift (%):	0.45

3D screen shot



Z Axis Scan

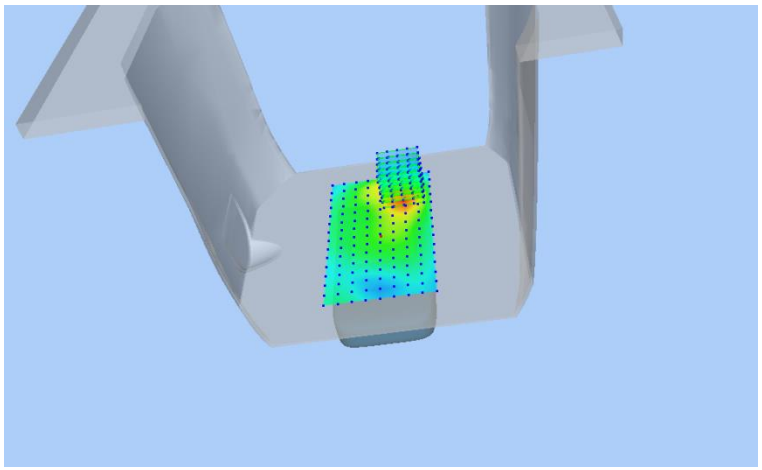


MEAS. 4 Body Plane with Back Side 10mm on Middle Channel in GPRS1900

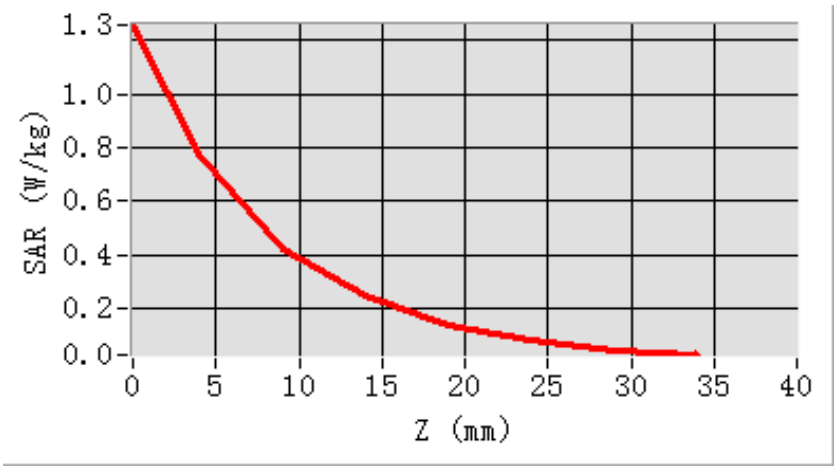
4slots mode

Test Date:	24/8/2019
Measurement duration:	13 minutes 15 seconds
Signal:	GPRS, f=1880.0 MHz, Duty Cycle: 1:2.0
Liquid Parameters:	Permittivity: 40.12; Conductivity: 1.43 S/m
Test condition:	Ambient Temperature: 22.5°C, Liquid Temperature: 21.3°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 2.46
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=20.000000, Y=48.000000
SAR 10g (W/Kg):	0.397430
SAR 1g (W/Kg):	0.748594
Power drift (%):	-3.15

3D screen shot



Z Axis Scan

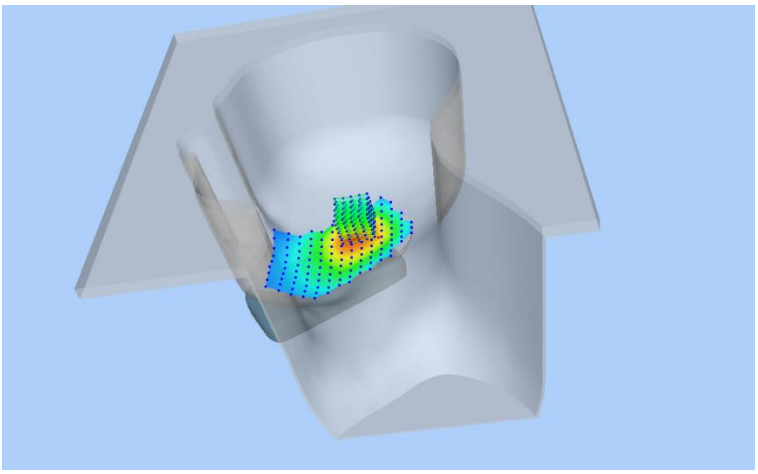


MEAS. 5 Right Head with Cheek device position on Low Channel in WCDMA

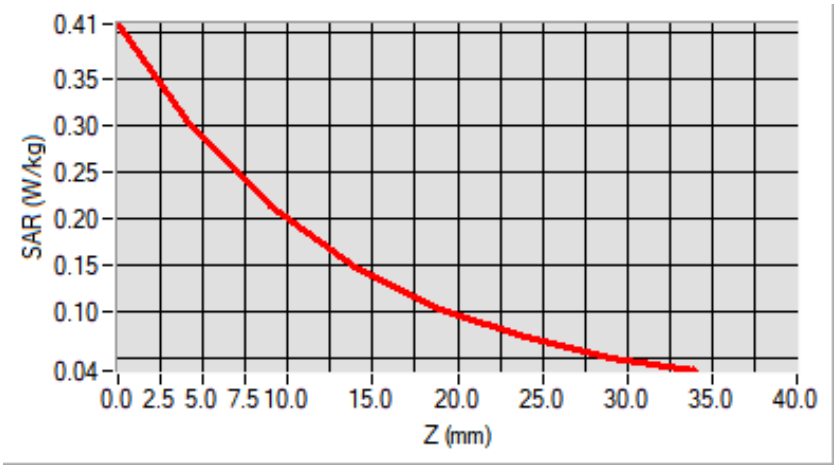
Band 5 mode

Test Date:	21/8/2019
Measurement duration:	10 minutes 25 seconds
Signal:	WCDMA, f=826.4 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 42.18; Conductivity: 0.89 S/m
Test condition:	Ambient Temperature: 22.8°C, Liquid Temperature: 21.4°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 1.93
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-16.000000, Y=14.000000
SAR 10g (W/Kg):	0.197761
SAR 1g (W/Kg):	0.295671
Power drift (%):	0.12

3D screen shot



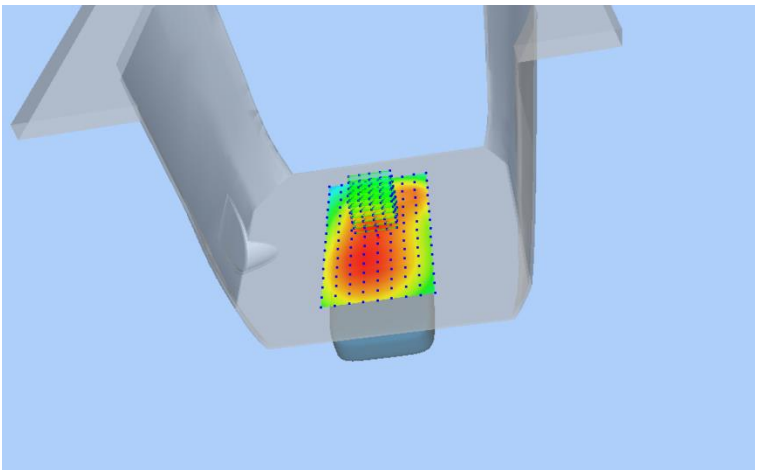
Z Axis Scan



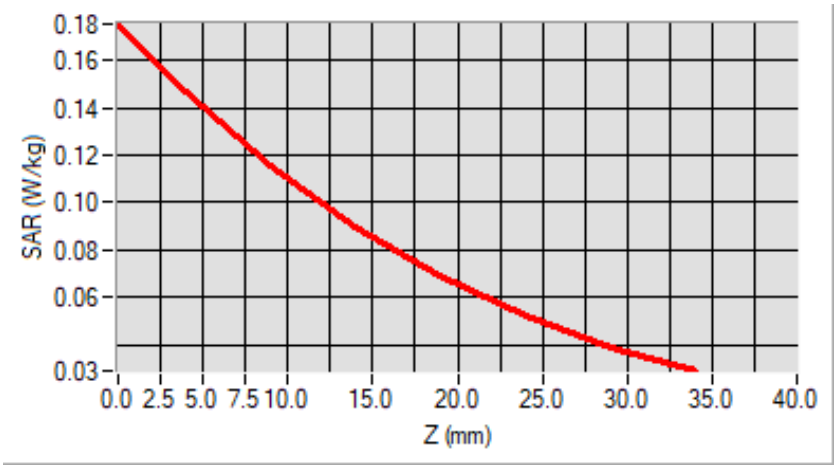
MEAS. 6 Body Plane with Back Side 10mm on Low Channel in WCDMA Band 5 mode

Test Date:	21/8/2019
Measurement duration:	12 minutes 0 seconds
Signal:	WCDMA, f=826.4 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 42.18; Conductivity: 0.89 S/m
Test condition:	Ambient Temperature: 22.8°C, Liquid Temperature: 21.4°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 1.93
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=0.000000, Y=18.000000
SAR 10g (W/Kg):	0.106288
SAR 1g (W/Kg):	0.142963
Power drift (%):	-0.48

3D screen shot



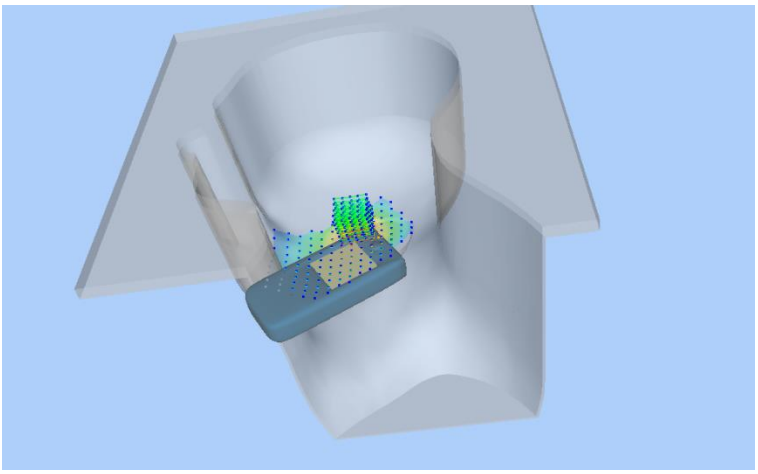
Z Axis Scan



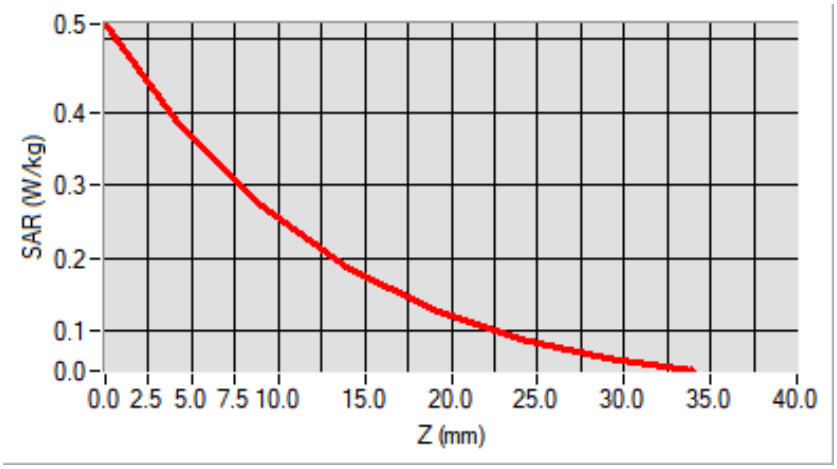
MEAS. 7 Right Head with Cheek on Low Channel in LTE Band 5 mode with 1RB

Test Date:	21/8/2019
Measurement duration:	10 minutes 33 seconds
Signal:	LTE, f=829 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 42.10; Conductivity: 0.89 S/m
Test condition:	Ambient Temperature: 22.8°C, Liquid Temperature: 21.4°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 1.93
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-16.000000, Y=14.000000
SAR 10g (W/Kg):	0.249605
SAR 1g (W/Kg):	0.374405
Power drift (%):	-0.20

3D screen shot



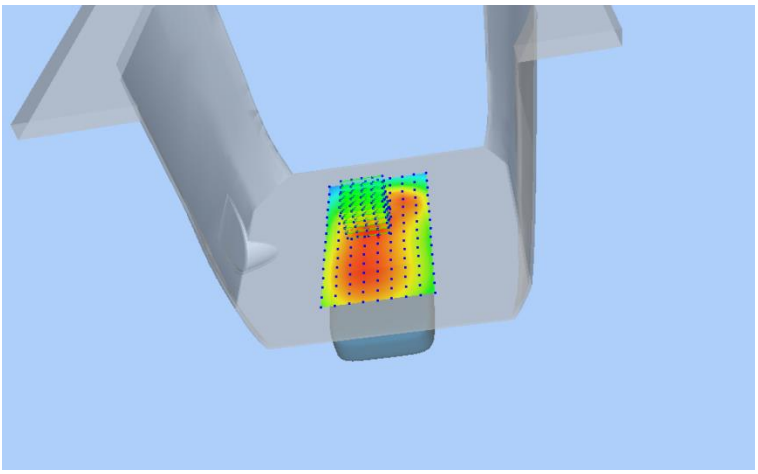
Z Axis Scan



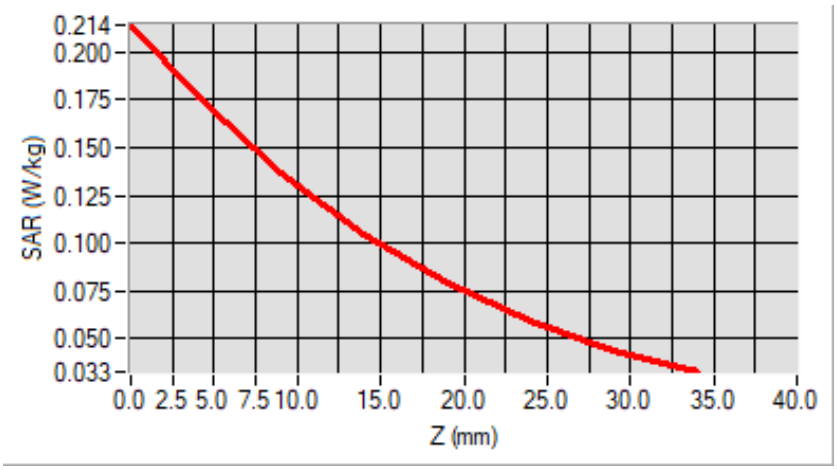
MEAS. 8 Body Plane with Back Side 10mm on Low Channel in LTE Band 5 mode with 1RB

Test Date:	21/8/2019
Measurement duration:	10 minutes 58 seconds
Signal:	LTE, f=829 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 42.10; Conductivity: 0.89 S/m
Test condition:	Ambient Temperature: 22.8°C, Liquid Temperature: 21.4°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 1.93
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-10.000000, Y=18.000000
SAR 10g (W/Kg):	0.125232
SAR 1g (W/Kg):	0.170592
Power drift (%):	-0.77

3D screen shot



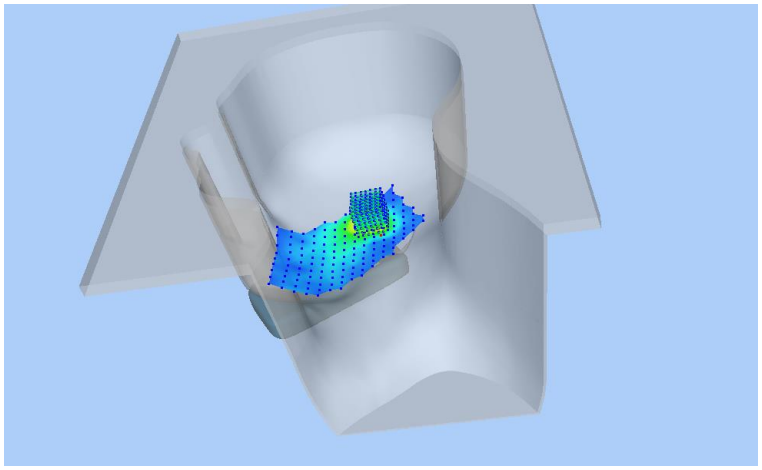
Z Axis Scan



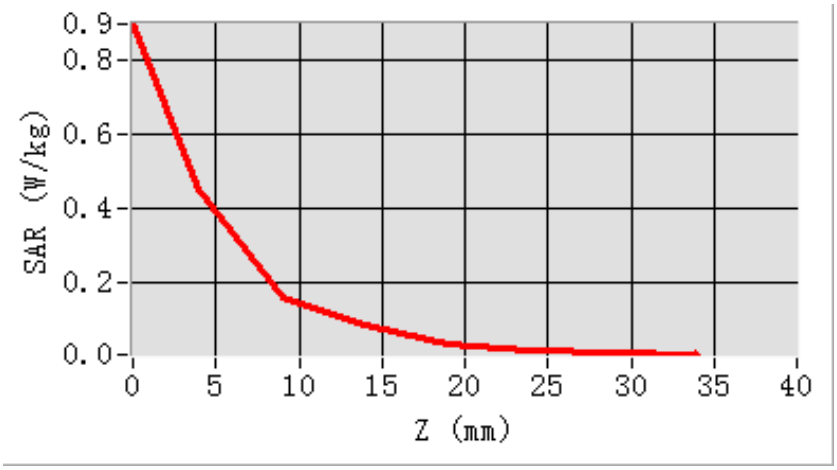
MEAS. 9 Right Head with Tilt on High Channel in LTE Band 41 mode with 50RB

Test Date:	25/8/2019
Measurement duration:	13 minutes 57 seconds
Signal:	LTE, f=2645.0 MHz, Duty Cycle: 1:1.58
Liquid Parameters:	Permittivity: 38.19; Conductivity: 2.06 S/m
Test condition:	Ambient Temperature: 22.7°C, Liquid Temperature: 21.4°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 2.38
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location:	X=-6.000000, Y=14.000000
SAR 10g (W/Kg):	0.185831
SAR 1g (W/Kg):	0.429324
Power drift (%):	-1.87

3D screen shot



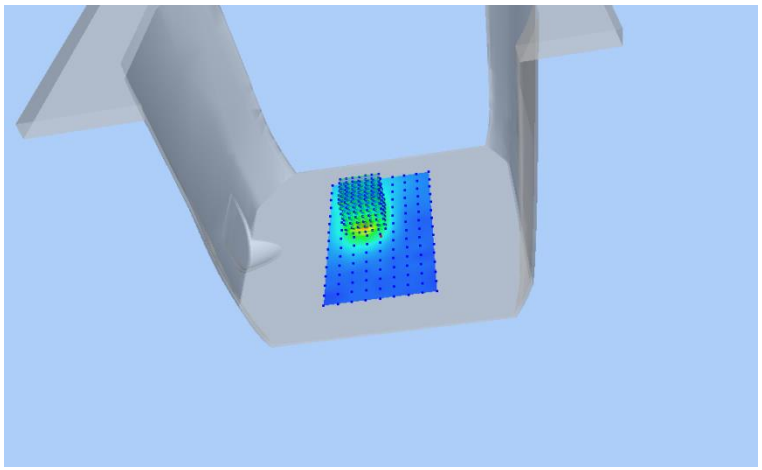
Z Axis Scan



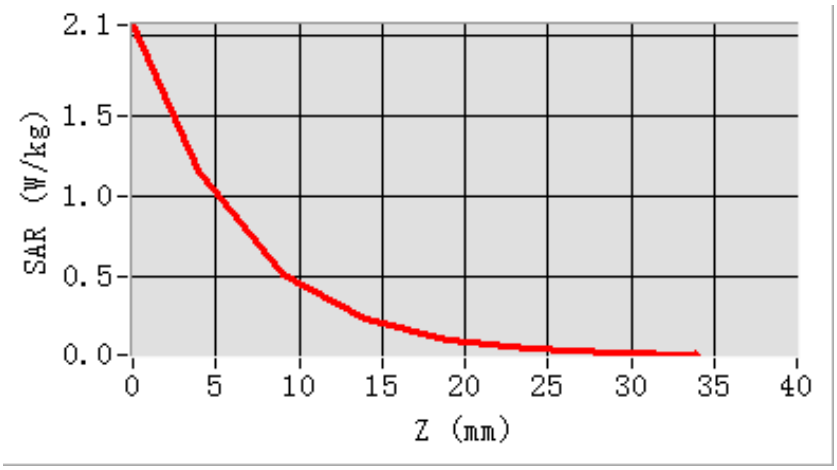
MEAS. 10 Body Plane with Top Edge 10mm on Low Channel in LTE Band 41 mode with 1RB

Test Date:	25/8/2019
Measurement duration:	13 minutes 45 seconds
Signal:	LTE, f=2545.0 MHz, Duty Cycle: 1:1.58
Liquid Parameters:	Permittivity: 39.12; Conductivity: 1.92 S/m
Test condition:	Ambient Temperature: 22.7°C, Liquid Temperature: 21.4°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 2.38
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location:	X=-10.000000, Y=18.000000
SAR 10g (W/Kg):	0.448038
SAR 1g (W/Kg):	1.053559
Power drift (%):	-1.34

3D screen shot



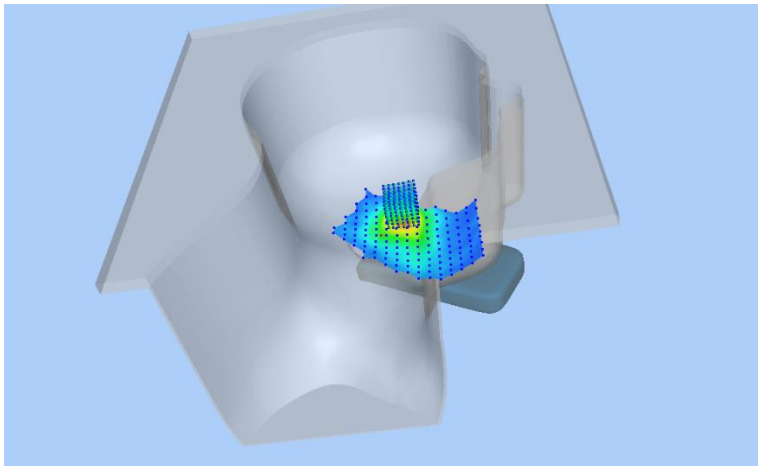
Z Axis Scan



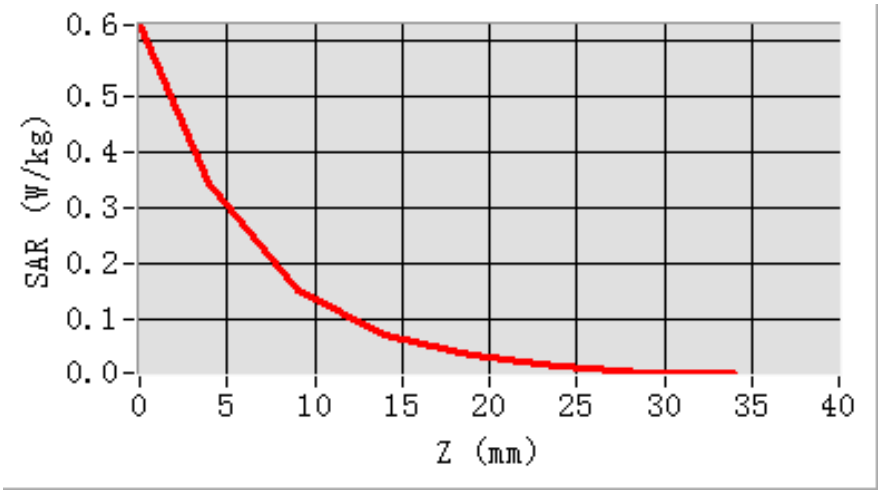
MEAS. 11 Left Head with Cheek on Middle Channel in IEEE 802 b mode

Test Date:	22/8/2019
Measurement duration:	14 minutes 21 seconds
Signal:	WLAN, f=2437.0 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 40.28; Conductivity: 1.75 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 21.5°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 2.55
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location:	X=-26.000000, Y=24.000000
SAR 10g (W/Kg):	0.155395
SAR 1g (W/Kg):	0.332772
Power drift (%):	1.44

3D screen shot



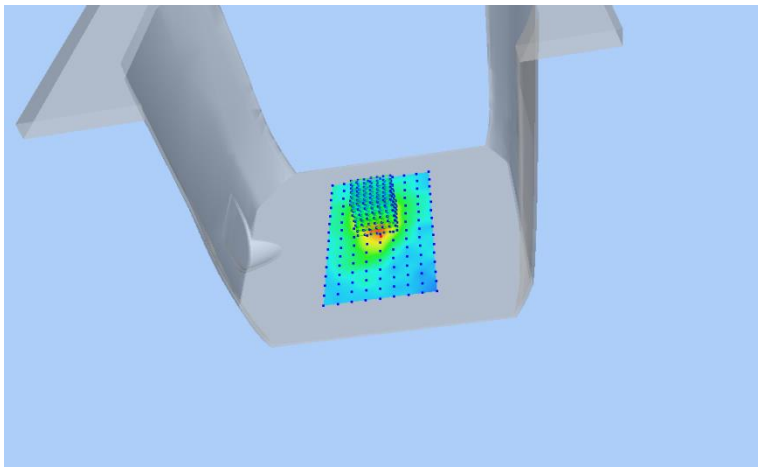
Z Axis Scan



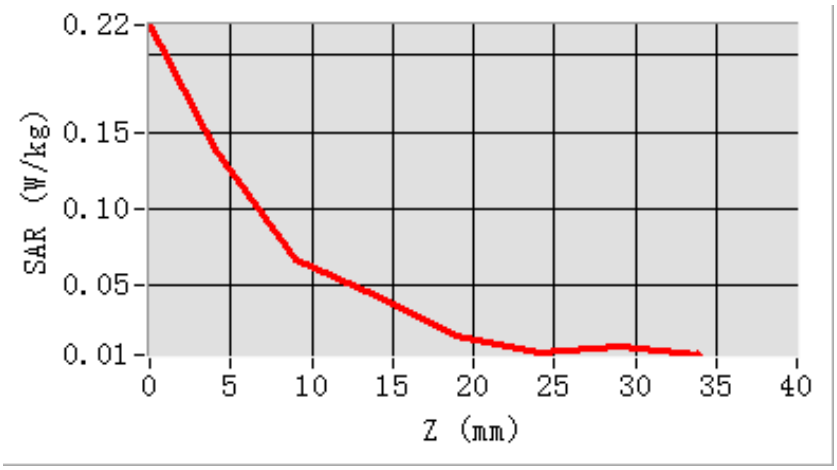
MEAS. 12 Body Plane with Top Edge 10mm on Middle Channel in IEEE 802 b mode

Test Date:	22/8/2019
Measurement duration:	16 minutes 3 seconds
Signal:	WLAN, f=2437.0 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 40.28; Conductivity: 1.75 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 21.5°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 2.55
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location:	X=0.000000, Y=18.000000
SAR 10g (W/Kg):	0.065086
SAR 1g (W/Kg):	0.128356
Power drift (%):	-4.95

3D screen shot



Z Axis Scan



ANNEX D EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ1980332-AW.pdf”.

ANNEX E SAR TEST SETUP PHOTOS

Please refer the document “BL-SZ1980332-AS.pdf”.

ANNEX F CALIBRATION REPORT

Please refer the document “CALIBRATION REPORT.pdf”.

--END OF REPORT--