

FCC

SAR

TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.



FOR
Mobile Computer

ISSUED TO
Honeywell International Inc
Honeywell Safety and Productivity Solutions

9680 OLD BAILES RD FORT MILL SC 29707-7539



Report No.:	BL-EC1850176-701
EUT Name:	Mobile Computer
Model Name:	EDA51-0
Brand Name:	Honeywell
FCC ID:	HD5-EDA510
Test Standard:	FCC 47 CFR Part 2.1093 ANSI C95.1: 2005, IEEE 1528: 2013
Maximum SAR:	Head (1 g): 0.455 W/kg Body-worn (1 g): 0.190 W/kg Hand-held (10 g): 0.632 W/kg
Test Conclusion:	Pass
Test Date:	May 15, 2018 ~ May 25, 2018
Date of Issue:	Jun. 01, 2018

NOTE: This test report of test results only related to testing samples, which can be duplicated completely for the legal use with the approval of the applicant; it shall not be reproduced except in full, without the written approval of Shenzhen BALUN Technology Co., Ltd. BALUN Laboratory. Any objections should be raised within thirty days from the date of issue. To validate the report, please contact us.

Revision History

Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>May 29, 2018</u>	<u>Initial Issue</u>
<u>Rev. 02</u>	<u>Jun. 01, 2018</u>	<u>Updated the Applicant Information and Manufacturer Information.</u> <u>Updated WLAN 802.11a and 802.11b mode duty cycle and recalculated report SAR values.</u>

TABLE OF CONTENTS

1	ADMINISTRATIVE DATA (GENERAL INFORMATION)	4
1.1	Identification of the Testing Laboratory	4
1.2	Identification of the Responsible Testing Location	4
1.3	Test Environment Condition	4
1.4	Announce	4
2	PRODUCT INFORMATION	5
2.1	Applicant Information	5
2.2	Manufacturer Information	5
2.3	Factory Information	5
2.4	General Description for Equipment under Test (EUT)	5
2.5	Ancillary Equipment	6
2.6	Technical Information	7
3	SUMMARY OF TEST RESULTS	8
3.1	Test Standards	8
3.2	Device Category and SAR Limit	8
3.3	Test Result Summary	10
3.4	Test Uncertainty	11
3.5	Definition of Specific Absorption Rate (SAR)	12
3.6	SATIMO SAR System	12
4	SYSTEM VERIFICATION	22
4.1	Antenna Port Test Requirement	22
4.2	Purpose of System Check	22
4.3	System Check Setup	22
5	EUT TEST POSITION CONFIGURATIONS	23

5.1	Head Exposure Conditions.....	23
5.2	Body-worn Position Conditions	24
5.3	Hotspot Mode Exposure Position Conditions	25
6	SAR MEASUREMENT PROCEDURES	26
6.1	SAR Measurement Process Diagram	26
6.2	SAR Scan General Requirements.....	27
6.3	SAR Measurement Procedure	28
6.4	Area & Zoom Scan Procedures.....	28
7	CONDUCTED RF OUPUT POWER.....	29
7.1	WIFI.....	29
7.2	Bluetooth	31
8	TEST EXCLUSION CONSIDERATION.....	32
8.1	SAR Test Exclusion Consider Table	33
9	TEST RESULTS	35
9.1	WIFI 2.4GHz (1g SAR).....	35
9.2	WIFI 2.4GHz (10g SAR).....	35
9.3	WIFI 5GHz (1g SAR).....	36
9.4	WIFI 5GHz (10g SAR).....	37
9.5	Bluetooth (1g SAR)	38
9.6	Bluetooth (10g SAR)	38
10	SAR Measurement Variability	39
11	SIMULTANEOUS TRANSMISSION	40
11.1	Simultaneous Transmission Mode Consider	40
11.2	Sum SAR of Simultaneous Transmission	40
12	TEST EQUIPMENTS LIST	41
ANNEX A	SIMULATING LIQUID VERIFICATION RESULT	42
ANNEX B	SYSTEM CHECK RESULT	43
ANNEX C	TEST DATA.....	64
ANNEX D	EUT EXTERNAL PHOTOS	79
ANNEX E	SAR TEST SETUP PHOTOS.....	79
ANNEX F	CALIBRATION REPORT	79

1 ADMINISTRATIVE 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°C to 23°C
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	Honeywell International Inc Honeywell Safety and Productivity Solutions
Address	9680 OLD BAILES RD FORT MILL SC 29707-7539

2.2 Manufacturer Information

Manufacturer	Honeywell International Inc Honeywell Safety and Productivity Solutions
Address	9680 OLD BAILES RD FORT MILL SC 29707-7539

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	Mobile Computer
Model Name Under Test	EDA51-0
Series Model Name	N/A
Description of Model Name Differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	BAT-EDA50US
	Serial No.	N/A
	Capacitance	4000 mAh
	Rated Voltage	3.8 V
	Extreme Voltage	N/A
Ancillary Equipment 2	Charger 1	
	Brand Name	N/A
	Model No.	ADS-12B-06 05010E
	Rated Input	100-240 V~, 0.3 A, 50/60 Hz
	Rated Output	5 V $\overline{\text{=}}$, 2.0 A

2.6 Technical Information

Network and Wireless connectivity	WLAN; Bluetooth V4.2; NFC
-----------------------------------	---------------------------

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

Operating Mode	2.4G WLAN, 5G WLAN, Bluetooth	
Frequency Range	802.11b/g/n(HT20)	2400 ~ 2483.5 MHz
	802.11a/	5150 ~ 5250 MHz
	/n(HT20/HT40)	5250 ~ 5350 MHz
	/ac(VHT20/VHT40/	5470 ~ 5725 MHz
	VHT80)	5725 ~ 5850 MHz
	Bluetooth	2400 ~ 2483.5 MHz
Antenna Type	WLAN: FPC Antenna Bluetooth: FPC Antenna	
Hotspot Function	N/A	
Power Reduction	Not Support	
Exposure Category	General Population/Uncontrolled exposure	
EUT Stage	Portable Device	
Product	Type	
	☒ Production unit	☐ Identical prototype

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. C95.1-2005	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 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
6	FCC KDB 865664 D02 v01r02	RF Exposure Reporting
7	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, and it is 4.0 W/kg as averaged over any 10 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	Head	Body-worn	
2.4G WLAN	0.293	0.190	0.455	0.190	1.6
5.2G&5.3G WLAN	0.300	0.176			
5.6G WLAN	0.322	0.106			
5.8G WLAN	0.455	0.091			
Bluetooth	0.047	0.039			
Verdict	Pass				

3.3.2 Highest SAR (10 g Value)

Band	Maximum Scaled SAR (W/kg)	Maximum Report SAR (W/kg)	Limit (W/kg)
	Hand-held	Hand-held	
2.4G WLAN	0.632	0.632	4.0
5.2G&5.3G WLAN	0.454		
5.6G WLAN	0.277		
5.8G WLAN	0.245		
Bluetooth	0.084		
Verdict	Pass		

3.3.3 Highest Simultaneous SAR

Position	Simultaneous Configuration	Simultaneous SAR (W/kg)	Limit (W/kg)	Verdict
Head	Bluetooth + 5G WLAN	0.502	1.6	Pass
Body-worn	Bluetooth + 5G WLAN	0.223	1.6	Pass
Hand-held	Bluetooth + 5G WLAN	0.536	4.0	Pass

3.4 Test Uncertainty

According to KDB 865664 D01, when the highest measured 1 g SAR within a frequency band is $< 1.5 \text{ W/kg}$, the extensive SAR measurement uncertainty analysis is not required in SAR reports submitted for equipment approval. The equivalent ratio ($1.5/1.6 \text{ 10 g SAR} < 3.75 \text{ W/kg}$) should be applied to extremity exposure condition. The maximum 1 g SAR for the EUT in this report is 0.455 W/kg , which is lower than 1.5 W/kg , and the maximum 10 g SAR for the EUT in this report is 0.632 W/kg , which is lower than 3.75 W/kg , so the extensive SAR measurement uncertainty analysis is not required in this report.

3.4.1 SAR MEASUREMENT SYSTEM

3.5 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:

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

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

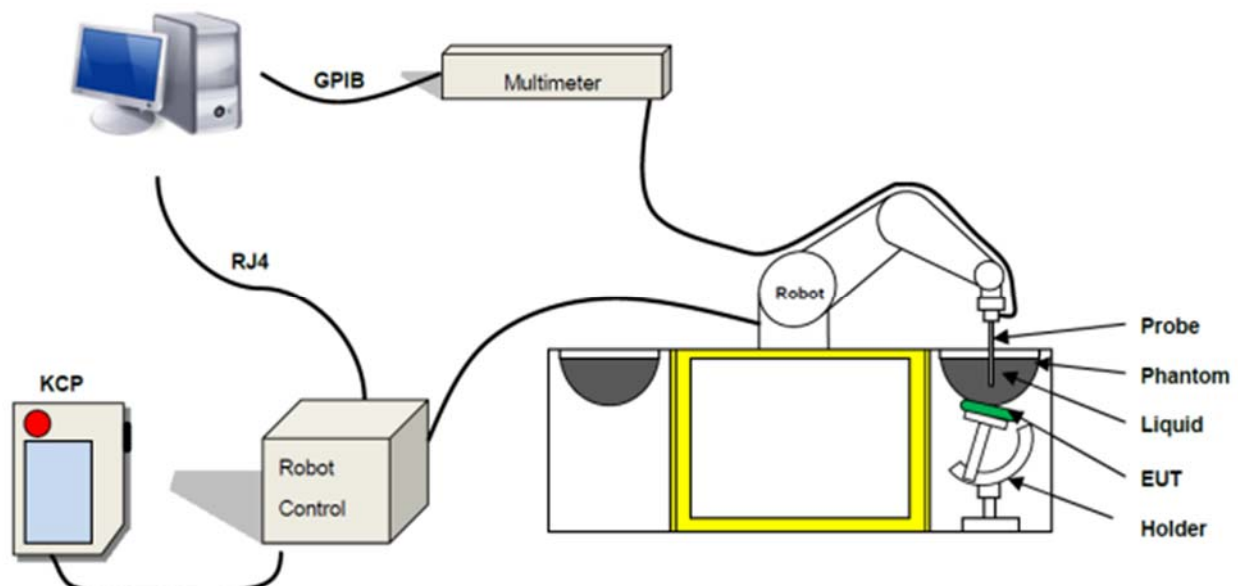
$$\text{SAR} = \frac{\sigma E^2}{\rho}$$

Where: σ is the conductivity of the tissue,

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

3.6 SATIMO SAR System

3.6.1 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 $\pm 10\%$. 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.

3.6.2 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)

3.6.3 E-Field Probe

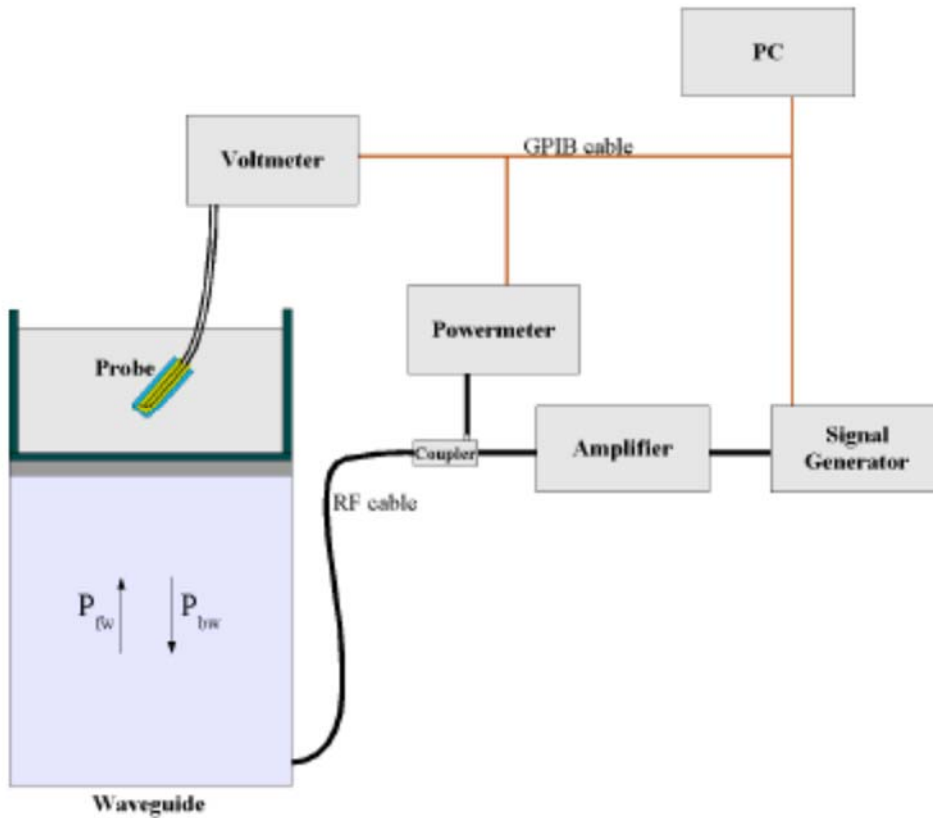
For the measurements the Specific Dosimetric E-Field Probe SN 08 /16 EPGO 295 with following specifications is used

- 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
l = Skin Depth

Keithley configuration

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

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

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

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

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

Where the DCP is the diode compression point in mV.

3.6.4 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.

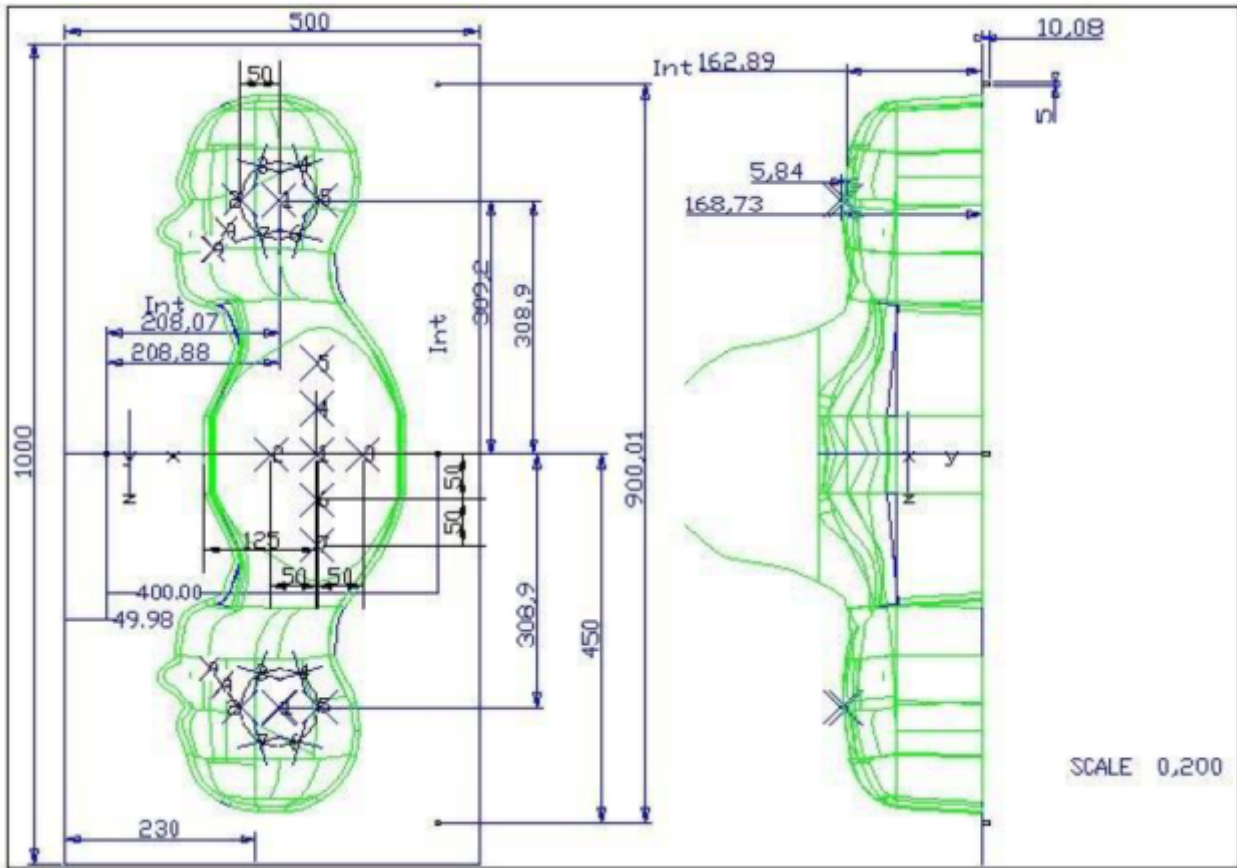
Photo of Phantom SN 30/13 SAM103



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	-	-

3.6.5 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.

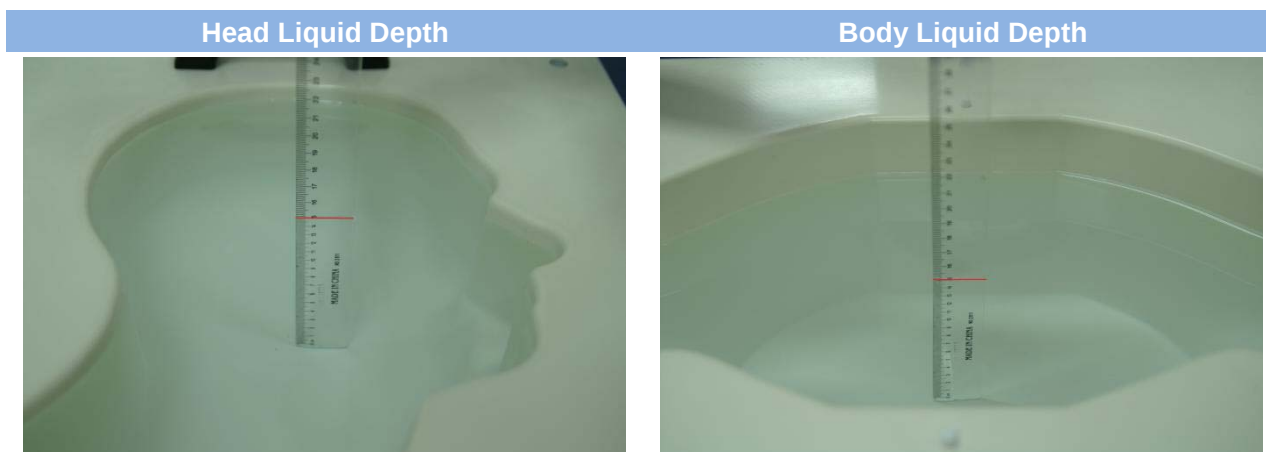


Serial Number	Holder Material	Permittivity	Loss Tangent
SN 25/13 MSH87	Deirin	3.7	0.005
SN 25/13 MSH88	Deirin	3.7	0.005

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° .

3.6.6 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%.



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

4 SYSTEM VERIFICATION

4.1 Antenna Port Test Requirement

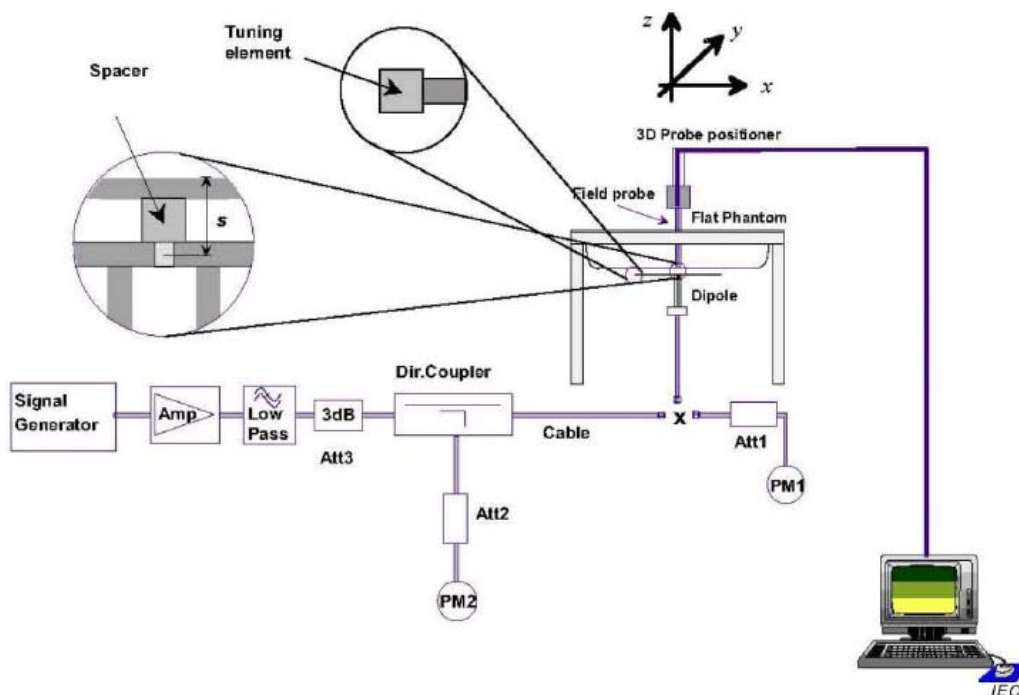
The SATIMO SAR system is equipped with one or more system validation kits. These units together with the predefined measurement procedures within the SATIMO software enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to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

4.2 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.

4.3 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:



5 EUT TEST POSITION CONFIGURATIONS

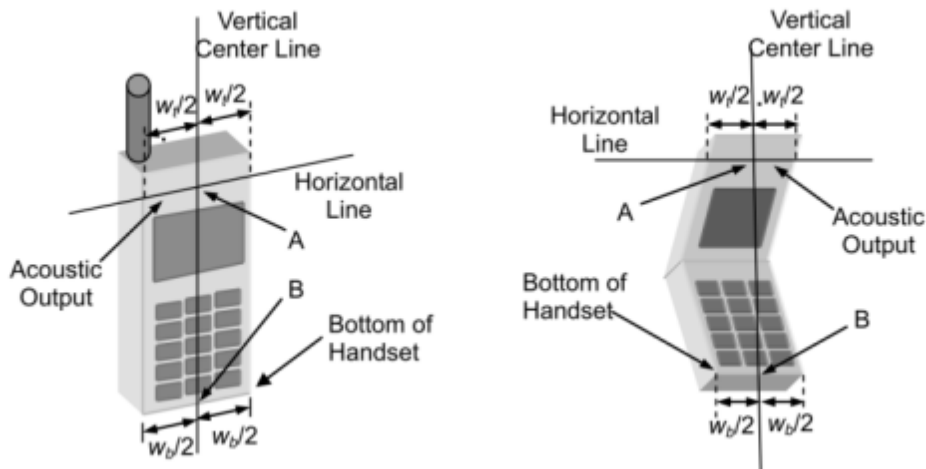
According to KDB 648474 D04 Handset, handsets are tested for SAR compliance in head, body-worn accessory and other use configurations described in the following subsections.

5.1 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.

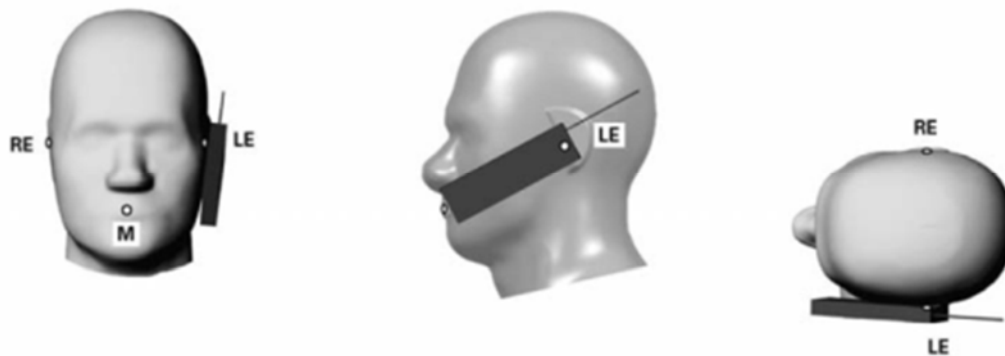
5.1.1 Define two imaginary lines on the handset

- 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.
- 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.
- 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.



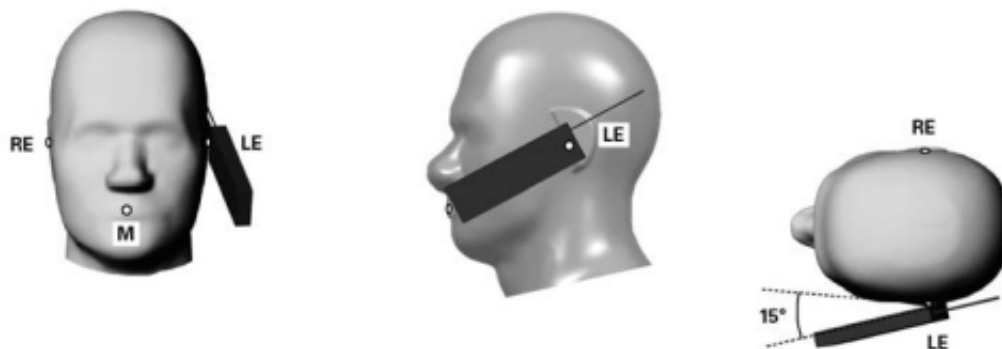
5.1.2 Cheek Position

- 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.
- 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.



5.1.3 Tilted Position

- To position the device in the “cheek” position described above.
- 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.



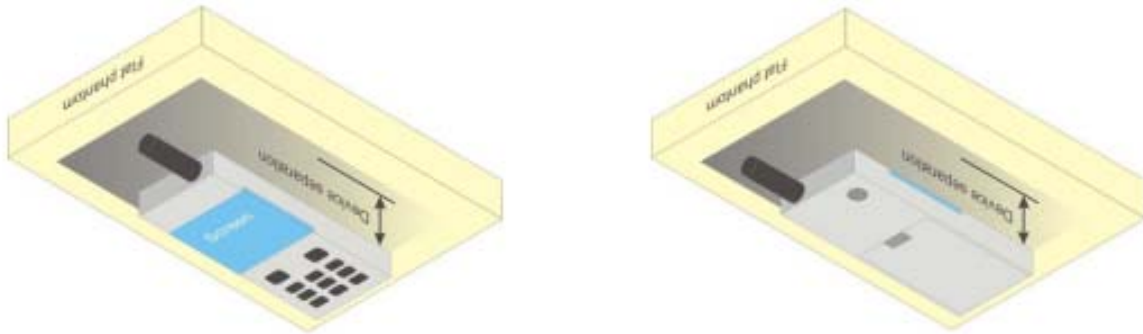
5.2 Body-worn Position Conditions

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 $> 1.2 \text{ W/kg}$, 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.

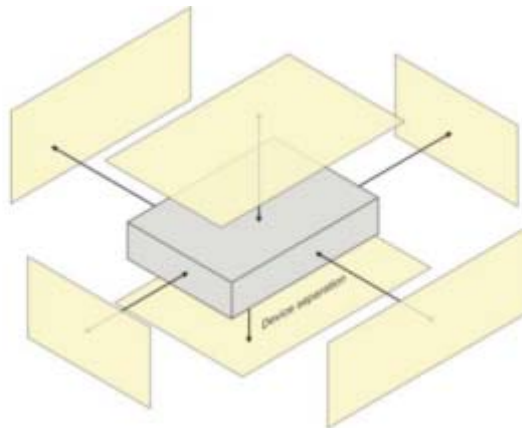
Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice 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.



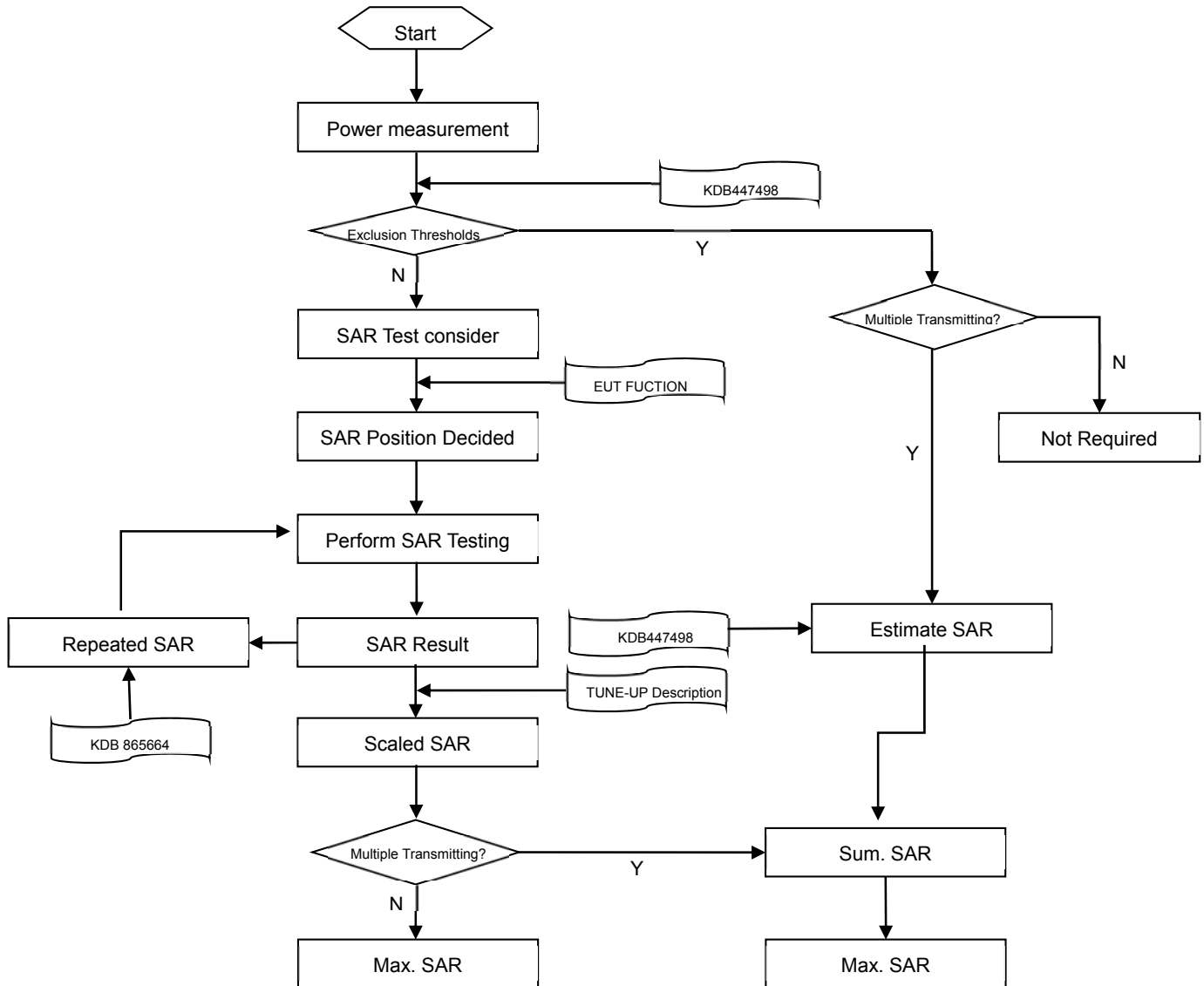
5.3 Hotspot Mode Exposure Position Conditions

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).



6 SAR MEASUREMENT PROCEDURES

6.1 SAR Measurement Process Diagram



6.2 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.

			≤3GHz	>3GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5±1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30°±1°	20°±1°
Maximum area scan spatial resolution: Δx Area , Δy Area			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3–4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx Zoom , Δy Zoom			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3–4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: Δz Zoom (n)		≤ 5 mm	3–4 GHz: ≤ 4 mm
				4–5 GHz: ≤ 3 mm
				5–6 GHz: ≤ 2 mm
	graded grid	Δ z Zoom (1): between 1st two points closest to phantom surface	≤ 4 mm	3–4 GHz: ≤ 3 mm
				4–5 GHz: ≤ 2.5 mm
				5–6 GHz: ≤ 2 mm
			Δ z Zoom (n>1): between subsequent points	≤ 1.5·Δz Zoom (n-1)
Minimum zoom scan volume	x, y, z		≥30 mm	3–4 GHz: ≥ 28 mm
				4–5 GHz: ≥ 25 mm
				5–6 GHz: ≥ 22 mm
Note: 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.				

6.3 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 to 16 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.

6.4 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.

7 CONDUCTED RF OUTPUT POWER

7.1 WIFI

7.1.1 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	16.22	17.00	Yes
		6	2437	16.12	17.00	Yes
		11	2462	15.86	17.00	Yes
	802.11g	1	2412	13.02	14.00	No
		6	2437	12.97	14.00	No
		11	2462	13.10	14.00	No
	802.11n(HT20)	1	2412	12.14	13.00	No
		6	2437	12.14	13.00	No
		11	2462	12.29	13.00	No

7.1.2 5GWIFI

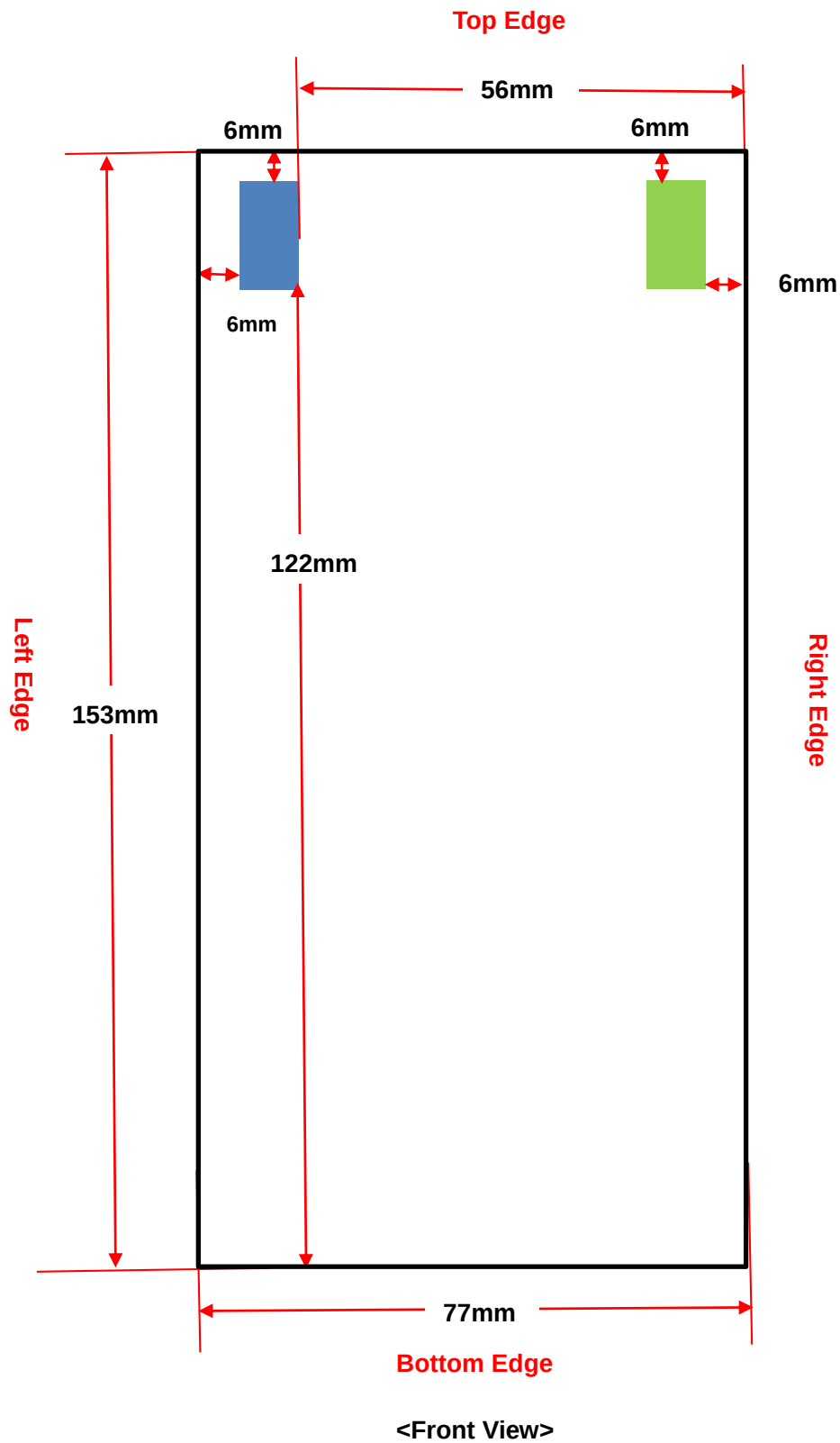
Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	13.96	15.00	No
		44	5220	14.04	15.00	No
		48	5240	14.15	15.00	No
	802.11n(HT20)	36	5180	12.78	14.00	No
		44	5220	13.07	14.00	No
		48	5240	13.05	14.00	No
	802.11n(HT40)	38	5190	10.86	12.00	No
		46	5230	10.96	12.00	No
	802.11ac(VHT20)	36	5180	12.87	14.00	No
		44	5220	12.89	14.00	No
		48	5240	13.01	14.00	No
	802.11ac(VHT40)	38	5190	10.98	12.00	No
		46	5230	10.84	12.00	No
	802.11ac(VHT80)	42	5210	10.74	11.50	No
5.3 (5.25~5.35)	802.11a	52	5260	14.10	15.00	Yes
		56	5280	13.84	15.00	Yes
		64	5320	13.90	15.00	Yes
	802.11n(HT20)	52	5260	13.25	14.00	No
		56	5280	12.85	14.00	No
		64	5320	12.85	14.00	No
	802.11n(HT40)	54	5270	11.00	12.00	No
		62	5310	11.19	12.00	No
	802.11ac(VHT20)	52	5260	13.04	12.00	No

		56	5280	13.18	14.00	No
		64	5320	13.24	14.00	No
	802.11ac(VHT40)	54	5270	10.85	12.00	No
		62	5310	11.00	12.00	No
	802.11ac(VHT80)	58	5290	10.46	11.50	No
5.6 (5.47~5.725)	802.11a	100	5500	14.09	15.00	Yes
		116	5580	13.84	15.00	Yes
		140	5700	13.79	15.00	Yes
		144	5720	13.89	15.00	Yes
	802.11n(HT20)	100	5500	12.84	14.00	No
		116	5580	12.95	14.00	No
		140	5700	12.99	14.00	No
		144	5720	12.76	14.00	No
	802.11n(HT40)	102	5510	11.02	12.00	No
		118	5590	11.17	12.00	No
		134	5670	10.77	12.00	No
		142	5710	10.85	12.00	No
	802.11ac(VHT20)	100	5500	12.85	14.00	No
		116	5580	12.76	14.00	No
		140	5700	12.86	14.00	No
		144	5720	13.24	14.00	No
	802.11ac(VHT40)	102	5510	10.95	12.00	No
		118	5590	11.15	12.00	No
		134	5670	11.19	12.00	No
		142	5710	10.83	12.00	No
	802.11ac(VHT80)	106	5530	10.38	11.50	No
		122	5610	10.51	11.50	No
5.8 (5.725~5.850)	802.11a	149	5745	14.27	15.00	Yes
		157	5785	14.02	15.00	Yes
		165	5825	13.92	15.00	Yes
	802.11n(HT20)	149	5745	13.05	14.00	No
		157	5785	12.95	14.00	No
		165	5825	12.86	14.00	No
	802.11n(HT40)	151	5755	11.19	12.00	No
		159	5790	10.85	12.00	No
	802.11ac(VHT20)	149	5745	12.90	14.00	No
		157	5785	12.75	14.00	No
		165	5825	13.29	14.00	No
	802.11ac(VHT40)	151	5755	11.13	11.50	No
		159	5790	10.83	11.50	No
	802.11ac(VHT80)	155	5775	10.31	11.50	No

7.2 Bluetooth

Mode	GFSK			$\pi/4$ -DQPSK		
Channel	0	39	78	0	39	78
Frequency (MHz)	2402	2441	2480	2402	2441	2480
Conducted Power (dBm)	5.51	7.17	5.37	5.67	7.26	5.47
Tune-up Limit (dBm)	7.50			7.50		
Mode	8-DPSK			BLE		
Channel	0	39	78	0	19	39
Frequency (MHz)	2402	2441	2480	2402	2440	2480
Conducted Power (dBm)	5.97	7.57	5.82	3.26	3.79	2.53
Tune-up Limit (dBm)	6.50	8.00	6.50	4.50		

8 TEST EXCLUSION CONSIDERATION



WLAN/Bluetooth Antenna



DRX Antenna

8.1 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. Conducted Power		Test Position Configurations					
		dBm	mW	Head	Front/Back	Left Edge	Right Edge	Top Edge	Bottom Edge
WLAN 2.4 G	Distance to User			<5mm	<5mm	6mm	56mm	6mm	122mm
	802.11b	17.00	50.12	Yes	Yes	Yes	No	Yes	No
	802.11g	14.00	25.12	No	No	No	No	No	No
	802.11n(HT20)	13.00	19.95	No	No	No	No	No	No
WLAN 5.2G&5.3 G	Distance to User			<5mm	<5mm	6mm	56mm	6mm	122mm
	802.11a	15.00	31.62	Yes	Yes	Yes	No	Yes	No
	802.11n(HT20)	14.00	25.12	No	No	No	No	No	No
	802.11n(HT40)	12.00	15.85	No	No	No	No	No	No
	802.11ac(VHT20)	14.00	25.12	No	No	No	No	No	No
	802.11ac(VHT40)	12.00	15.85	No	No	No	No	No	No
	802.11ac(VHT80)	11.50	14.13	No	No	No	No	No	No
WLAN 5.6 G	Distance to User			<5mm	<5mm	6mm	56mm	6mm	122mm
	802.11a	15.00	31.62	Yes	Yes	Yes	No	Yes	No
	802.11n(HT20)	14.00	25.12	No	No	No	No	No	No
	802.11n(HT40)	12.00	15.85	No	No	No	No	No	No
	802.11ac(VHT20)	14.00	25.12	No	No	No	No	No	No
	802.11ac(VHT40)	12.00	15.85	No	No	No	No	No	No
	802.11ac(VHT80)	11.50	14.13	No	No	No	No	No	No
WLAN 5.8 G	Distance to User			<5mm	<5mm	6mm	56mm	6mm	122mm
	802.11a	15.00	31.62	Yes	Yes	Yes	No	Yes	No
	802.11n(HT20)	14.00	25.12	No	No	No	No	No	No
	802.11n(HT40)	12.00	15.85	No	No	No	No	No	No
	802.11ac(VHT20)	14.00	25.12	No	No	No	No	No	No
	802.11ac(VHT40)	11.50	14.13	No	No	No	No	No	No
	802.11ac(VHT80)	11.50	14.13	No	No	No	No	No	No
Bluetooth	Distance to User			<5mm	<5mm	6mm	56mm	6mm	122mm
	BR/EDR	8.00	6.31	Yes	Yes	Yes	No	Yes	No
	BLE	4.00	2.51	No	No	No	No	No	No

Note:

- Maximum power is the source-based time-average power and represents the maximum RF output power including tune-up tolerance among production units
- 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.
- 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
- 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:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

- a. $f(\text{GHz})$ 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 $[3.0] / [\sqrt{f(\text{GHz})}] \cdot [(\text{min. test separation distance, mm})] = \text{exclusion threshold of mW}$.

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) $\cdot$ (f(MHz)/150)] mW, at 100 MHz to 1500 MHz
 - b. [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) $\cdot$ 10] mW at > 1500 MHz and ≤ 6 GHz
6. Per KDB 248227 D01, choose the highest output power channel to test SAR and determine further SAR exclusion.8. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate
7. 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.
8. Per KDB 248227 D01 SAR is not required for the following U-NII-1 and U-NII-2A bands conditions.
 - a. When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
 - b. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

9 TEST RESULTS

9.1 WIFI 2.4GHz (1g SAR)

Mode	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 Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head													
802.11 b	Left Cheek	0	1	2412.0	0.03	0.155	16.22	17.00	1.197	97.14	1.029	0.191	/
	Left Tilt	0	1	2412.0	-2.11	0.133	16.22	17.00	1.197	97.14	1.029	0.164	/
	Right Cheek	0	1	2412.0	0.63	0.238	16.22	17.00	1.197	97.14	1.029	0.293	#1
		0	6	2437.0	-4.09	0.219	16.12	17.00	1.225	97.14	1.029	0.276	/
		0	11	2462.0	1.71	0.206	15.86	17.00	1.300	97.14	1.029	0.276	/
	Right Tilt	0	1	2412.0	-2.84	0.167	16.22	17.00	1.197	97.14	1.029	0.206	/
Body-worn													
802.11 b	Front Side	10	1	2412.0	2.39	0.057	16.22	17.00	1.197	97.14	1.029	0.070	/
	Back Side	10	1	2412.0	-0.15	0.151	16.22	17.00	1.197	97.14	1.029	0.186	/
		10	6	2437.0	0.06	0.101	16.12	17.00	1.225	97.14	1.029	0.127	/
		10	11	2462.0	0.19	0.142	15.86	17.00	1.300	97.14	1.029	0.190	#2

9.2 WIFI 2.4GHz (10g SAR)

Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	10 g Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	Duty Cycle (%)	Duty Cycle Scaling Factor	10 g Scaled SAR (W/Kg)	Meas. No.
Hand-held													
802.11 b	Front Side	0	1	2412.0	-4.22	0.193	16.22	17.00	1.197	97.14	1.029	0.238	/
	Back Side	0	1	2412.0	-3.36	0.312	16.22	17.00	1.197	97.14	1.029	0.384	/
	Left Edge	0	1	2412.0	3.08	0.488	16.22	17.00	1.197	97.14	1.029	0.601	/
		0	6	2437.0	-0.83	0.342	16.12	17.00	1.225	97.14	1.029	0.431	/
		0	11	2462.0	-0.92	0.472	15.86	17.00	1.300	97.14	1.029	0.632	#3
	Top Edge	0	1	2412.0	-3.39	0.105	16.22	17.00	1.197	97.14	1.029	0.129	/

9.3 WIFI 5GHz (1g SAR)

Fre. Band	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1 g Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	Duty Cycle (%)	Duty Cycle Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head														
5.3G	802.11 a	Left Cheek	0	52	5260.0	-2.91	0.188	14.10	15.00	1.230	86.84	1.152	0.231	/
		Left Tilt	0	52	5260.0	-3.67	0.160	14.10	15.00	1.230	86.84	1.152	0.197	/
		Right Cheek	0	52	5260.0	1.26	0.159	14.10	15.00	1.230	86.84	1.152	0.196	/
			0	56	5280.0	1.74	0.165	13.84	15.00	1.306	86.84	1.152	0.216	/
			0	64	5320.0	-0.05	0.233	13.90	15.00	1.288	86.84	1.152	0.300	#4
		Right Tilt	0	52	5260.0	-4.90	0.216	14.15	15.00	1.230	86.84	1.152	0.266	/
5.6G	802.11 a	Left Cheek	0	100	5500.0	0.07	0.197	14.09	15.00	1.233	86.84	1.152	0.243	/
		Left Tilt	0	100	5500.0	1.29	0.162	14.09	15.00	1.233	86.84	1.152	0.200	/
		Right Cheek	0	100	5500.0	4.06	0.261	14.09	15.00	1.233	86.84	1.152	0.322	#5
			0	144	5720.0	2.53	0.238	13.89	15.00	1.291	86.84	1.152	0.307	/
			0	116	5580.0	-4.67	0.223	13.84	15.00	1.306	86.84	1.152	0.291	/
			0	140	5700.0	-1.63	0.212	13.79	15.00	1.321	86.84	1.152	0.280	/
		Right Tilt	0	100	5500.0	1.87	0.219	14.09	15.00	1.233	86.84	1.152	0.270	/
5.8G	802.11 a	Left Cheek	0	149	5745.0	3.01	0.341	14.27	15.00	1.183	86.84	1.152	0.403	/
		Left Tilt	0	149	5745.0	-1.66	0.302	14.27	15.00	1.183	86.84	1.152	0.357	/
		Right Cheek	0	149	5745.0	-2.57	0.385	14.27	15.00	1.183	86.84	1.152	0.455	#6
			0	157	5785.0	0.55	0.349	14.02	15.00	1.253	86.84	1.152	0.437	/
			0	165	5825.0	-4.01	0.331	13.92	15.00	1.282	86.84	1.152	0.424	/
		Right Tilt	0	149	5745.0	-2.77	0.356	14.27	15.00	1.183	86.84	1.152	0.421	/
Body-worn														
5.3G	802.11 a	Front Side	10	52	5260.0	0.00	0.044	14.10	15.00	1.230	86.84	1.152	0.054	/
		Back Side	10	52	5260.0	-1.36	0.109	14.10	15.00	1.230	86.84	1.152	0.134	/
			10	56	5280.0	-3.73	0.082	13.84	15.00	1.306	86.84	1.152	0.107	/
			10	64	5320.0	0.09	0.137	13.90	15.00	1.288	86.84	1.152	0.176	#7
5.6G	802.11 a	Front Side	10	100	5580.0	2.78	0.055	14.09	15.00	1.233	86.84	1.152	0.068	/
		Back Side	10	100	5500.0	-1.92	0.086	14.09	15.00	1.233	86.84	1.152	0.106	#8
			10	144	5720.0	-4.36	0.079	13.89	15.00	1.291	86.84	1.152	0.102	/
			10	116	5580.0	0.06	0.076	13.84	15.00	1.306	86.84	1.152	0.099	/
			10	140	5700.0	-1.26	0.071	13.79	15.00	1.321	86.84	1.152	0.094	/
5.8G	802.11 a	Front Side	10	149	5745.0	-1.39	0.062	14.27	15.00	1.183	86.84	1.152	0.073	/
		Back Side	10	149	5745.0	1.84	0.077	14.27	15.00	1.183	86.84	1.152	0.091	#9
			10	157	5785.0	2.69	0.069	14.02	15.00	1.253	86.84	1.152	0.086	/
			10	165	5825.0	1.64	0.070	13.92	15.00	1.282	86.84	1.152	0.090	/

9.4 WIFI 5GHz (10g SAR)

Fre. Band	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	10 g Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	Duty Cycle (%)	Duty Cycle Scaling Factor	10 g Scaled SAR (W/Kg)	Meas. No.
Hand-held														
5.3G	802.11 a	Front Side	0	52	5260.0	-1.05	0.081	14.10	15.00	1.230	86.84	1.152	0.115	/
		Back Side	0	52	5260.0	0.99	0.301	14.10	15.00	1.230	86.84	1.152	0.426	/
			0	56	5280.0	4.16	0.286	13.84	15.00	1.306	86.84	1.152	0.430	/
			0	64	5320.0	-1.49	0.305	13.90	15.00	1.288	86.84	1.152	0.452	#10
		Left Edge	0	52	5260.0	0.06	0.153	14.10	15.00	1.230	86.84	1.152	0.217	/
		Top Edge	0	52	5260.0	-2.93	0.004	14.10	15.00	1.230	86.84	1.152	0.251	/
5.6G	802.11 a	Front Side	0	100	5580.0	-1.21	0.123	14.09	15.00	1.233	86.84	1.152	0.175	/
		Back Side	0	100	5500.0	-2.66	0.195	14.09	15.00	1.233	86.84	1.152	0.277	#11
			0	144	5720.0	-0.98	0.133	13.89	15.00	1.291	86.84	1.152	0.198	/
			0	116	5580.0	0.06	0.124	13.84	15.00	1.306	86.84	1.152	0.187	/
			0	140	5700.0	-1.82	0.118	13.79	15.00	1.321	86.84	1.152	0.180	/
		Left Edge	0	100	5580.0	-4.11	0.187	14.09	15.00	1.233	86.84	1.152	0.266	/
		Top Edge	0	100	5580.0	-2.68	0.192	14.09	15.00	1.233	86.84	1.152	0.273	/
5.8G	802.11 a	Front Side	0	149	5745.0	-1.37	0.143	14.27	15.00	1.183	86.84	1.152	0.195	/
		Back Side	0	149	5745.0	-2.53	0.167	14.27	15.00	1.183	86.84	1.152	0.228	/
			0	157	5785.0	-1.42	0.158	14.02	15.00	1.253	86.84	1.152	0.228	/
			0	165	5825.0	-1.60	0.166	13.92	15.00	1.282	86.84	1.152	0.245	#12
		Left Edge	0	149	5745.0	-1.16	0.146	14.27	15.00	1.183	86.84	1.152	0.199	/
		Top Edge	0	149	5745.0	-2.38	0.151	14.27	15.00	1.183	86.84	1.152	0.206	/

9.5 Bluetooth (1g SAR)

Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	1 g Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Head											
3DH5	Left Cheek	0	39	2441	1.23	0.039	7.57	8.00	1.104	0.043	/
	Left Tilt	0	39	2441	0.06	0.026	7.57	8.00	1.104	0.029	/
	Right Cheek	0	39	2441	-3.90	0.043	7.57	8.00	1.104	0.047	#13
		0	0	2402	-2.18	0.038	5.97	6.50	1.130	0.043	/
		0	78	2480	1.96	0.035	5.82	6.50	1.169	0.041	/
	Right Tilt	0	39	2441	0.72	0.029	7.57	8.00	1.104	0.032	/
Body-worn											
3DH5	Front Side	10	39	2441	-2.61	0.021	7.57	8.00	1.104	0.023	/
	Back Side	10	39	2441	1.67	0.035	7.57	8.00	1.104	0.039	#14
		10	0	2402	-3.28	0.031	5.97	6.50	1.130	0.035	/
		10	78	2480	0.09	0.029	5.82	6.50	1.169	0.034	/

9.6 Bluetooth (10g SAR)

Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	10 g Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power (dBm)	Scaling Factor	10 g Scaled SAR (W/Kg)	Meas. No.
Hand-held											
3DH5	Front Side	0	39	2441	1.97	0.038	7.57	8.00	1.104	0.042	/
	Back Side	0	39	2441	3.57	0.055	7.57	8.00	1.104	0.061	/
	Left Edge	0	39	2441	-1.60	0.076	7.57	8.00	1.104	0.084	#15
		0	0	2402	-1.06	0.068	5.97	6.50	1.130	0.077	/
		0	78	2480	-4.53	0.071	5.82	6.50	1.169	0.083	/
	Top Edge	0	39	2441	0.07	0.026	7.57	8.00	1.104	0.029	/

10 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.

The same procedures should be adapted for measurements according to extremity exposure limits by applying a factor of 2.5 (10g 2.0 W/kg) for extremity exposure SAR threshold.

The highest measured 1g SAR is 0.455 W/kg less than 0.80 W/kg, so the repeated measurement is not required.

The highest measured 10 g SAR is 0.632 W/kg less than 2.0 W/kg, so the repeated measurement is not required.

11 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).

11.1 Simultaneous Transmission Mode Consider

NO.	Mode	5G WLAN & Bluetooth		
		Head	Body-worn	Hand-held
1	Bluetooth	+ 5G WLAN	+ 5G WLAN	+ 5G WLAN
Note: 1. The Bluetooth and 2.4G WLAN share the same antenna, can't transmitting together. 2. The Bluetooth and 5G WLAN can transmitting together				

11.2 Sum SAR of Simultaneous Transmission

11.2.1 Sum Head SAR of Simultaneous Transmission

Simultaneous Mode	Mode	Max. 1g SAR (W/kg)	1g Sum SAR (W/kg)	SPLSR (Yes/No)
Bluetooth + 5G WLAN	Bluetooth	0.047	0.502	No
	5G WLAN	0.455		

11.2.2 Sum Body-worn SAR of Simultaneous Transmission

Simultaneous Mode	Mode	Max. 1g SAR (W/kg)	1g Sum SAR (W/kg)	SPLSR (Yes/No)
Bluetooth + 5G WLAN	Bluetooth	0.047	0.223	No
	5G WLAN	0.176		

11.2.3 Sum Hand-held mode SAR of Simultaneous Transmission

Simultaneous Mode	Mode	Max. 10g SAR (W/kg)	10g Sum SAR (W/kg)	SPLSR (Yes/No)
Bluetooth + 5G WLAN	Bluetooth	0.084	0.536	No
	5G WLAN	0.452		

12 TEST EQUIPMENTS LIST

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
2450MHz Dipole	SATIMO	SID 2450	S/N 11/17 DIP 2G450-452	2017/03/22	2020/03/21
Waveguide	SATIMO	SWG5500	S/N 49/16 DIP WGA42	2017/03/22	2020/03/21
E-Field Probe	MVG	SSE2	S/N 3117 EPGO 321	2018/03/16	2019/03/15
MultiMeter	Keithley	MultiMeter 2000	4024022	2017/06/12	2018/06/11
Signal Generator	R&S	SMBV100A	260592	2017/06/12	2018/06/11
Power Meter	Agilent	E4419B	GB40201833	2017/11/02	2018/11/01
Power Sensor	Agilent	E9300A	MY41498012	2017/11/02	2018/11/01
Power Sensor	Agilent	E9300A	MY41499891	2017/11/02	2018/11/01
Power Amplifier	SATIMO	6552B	22374	2017/06/12	2018/06/11
Network Analyzer	Agilent	5071B	MY42404001	2017/06/12	2018/06/11
Thermometer	Elitech	RC-4HC	N/A	2017/11/13	2018/11/12
Dielectric Probe Kit	SATIMO	SCLMP	SN 25/13 OCPG56	N/A	N/A
Antenna	SATIMO	ANTA3	SN 17/13 ZNTA45	N/A	N/A
Phantom1	SATIMO	SAM	SN 30/13 SAM103	N/A	N/A
Phantom2	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: Per KDB 865664 Dipole SAR Validation Verification, BALUN LAB has adopted 3 years calibration intervals. 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.

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. (°C)	Meas. Conductivity (σ) (S/m)	Meas. Permittivity (ϵ)	Target Conductivity (σ) (S/m)	Target Permittivity (ϵ)	Conductivity Tolerance (%)	Permittivity Tolerance (%)
2018.05.15	Head	2450	21.1	1.82	38.40	1.80	39.20	0.88	-2.04
2018.05.17	Body	2450	21.0	1.98	51.14	1.95	52.70	1.54	-2.96
2018.05.25	Head	5200	21.0	4.73	36.75	4.66	35.99	1.70	2.11
2018.05.25	Body	5200	21.0	5.29	49.12	5.30	49.01	-0.17	0.22
2018.05.25	Head	5400	21.0	4.95	36.49	4.86	35.76	1.85	2.04
2018.05.25	Body	5400	21.0	5.38	48.82	5.53	48.74	-2.77	0.16
2018.05.16	Head	5600	20.8	5.07	35.50	5.07	35.53	0.10	-0.08
2018.05.18	Body	5600	20.9	5.81	47.48	5.77	48.47	0.76	-2.04
2018.05.16	Head	5750	20.8	5.38	34.85	5.27	35.30	2.09	-1.27
2018.05.18	Body	5750	20.9	6.01	46.28	6.00	48.20	0.17	-3.98
Note: The tolerance limit of Conductivity and Permittivity is $\pm 5\%$.									

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 (%)
2018.05.15	Head	2450	100	5.652	56.52	54.31	4.07	52.40	7.86
2018.05.17	Body	2450	100	5.558	55.58	53.67	3.56	52.40	6.07
2018.05.25	Head	5200	100	15.475	154.75	161.03	-3.90	159.00	-2.67
2018.05.25	Body	5200	100	16.151	161.51	158.91	1.64	159.00	1.58
2018.05.25	Head	5400	100	16.462	164.62	168.17	-2.11	166.40	-1.07
2018.05.25	Body	5400	100	15.371	153.71	164.39	-6.50	166.40	-7.63
2018.05.16	Head	5600	100	18.155	181.55	175.43	3.49	173.80	4.46
2018.05.15	Body	5600	100	17.240	172.40	170.90	0.88	173.80	-0.81
2018.05.16	Head	5800	100	18.447	184.47	182.30	1.19	181.20	1.80
2018.05.18	Body	5800	100	17.580	175.80	177.09	-0.73	181.20	-2.98
Note ¹ : The tolerance limit of System validation is $\pm 10\%$.									
Note ² : Using waveguide to system check for 5200 MHz to 5800 MHz.									

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10%(for 10 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 (%)
2018.05.15	Head	2450	100	2.574	25.74	24.20	6.36	24.00	7.25
2018.05.17	Body	2450	100	2.592	25.92	24.37	6.36	24.00	8.00
2018.05.25	Head	5200	100	5.312	53.12	56.23	-5.53	56.90	-6.64
2018.05.25	Body	5200	100	5.512	55.12	56.35	-2.18	56.90	-3.13
2018.05.25	Head	5400	100	5.579	55.79	57.98	-3.78	58.43	-4.52
2018.05.25	Body	5400	100	5.361	53.61	57.72	-7.12	58.43	-8.25
2018.05.16	Head	5600	100	6.093	60.93	59.94	1.65	59.97	1.60
2018.05.15	Body	5600	100	5.844	58.44	59.37	-1.57	59.97	-2.55
2018.05.16	Head	5800	100	6.093	60.93	61.84	-1.47	61.50	-0.93
2018.05.18	Body	5800	100	5.883	58.83	61.19	-3.86	61.50	-4.34
Note ¹ : The tolerance limit of System validation is $\pm 10\%$.									
Note ² : Using waveguide to system check for 5200 MHz to 5800 MHz.									

System Performance Check Data(2450MHz Head)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8mm,dy=8mm

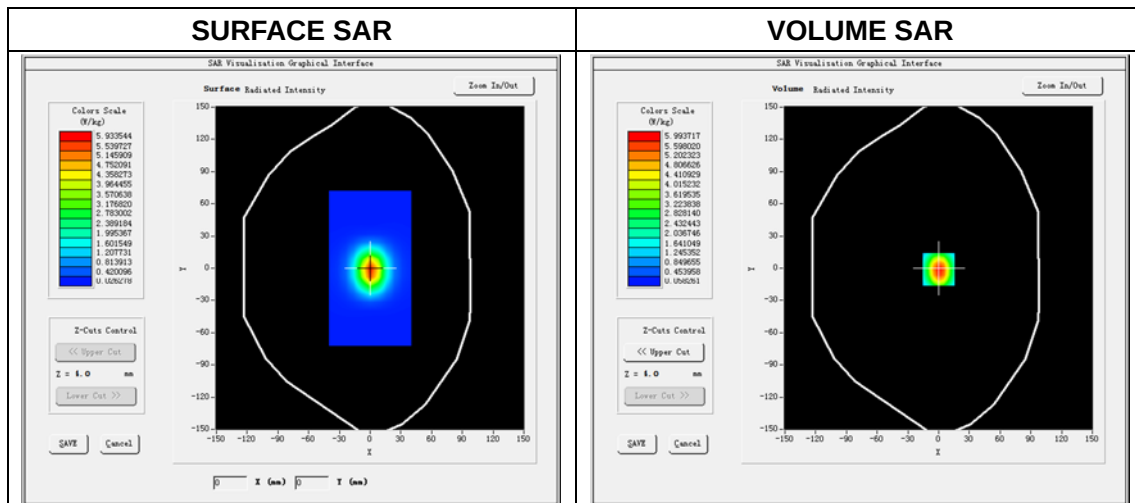
Zoom scan resolution: dx=5mm, dy=5mm, dz=5mm

Date of measurement: 2018.05.15

Measurement duration: 18 minutes 18 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2450MHz
Signal	CW
Frequency (MHz)	2450.000000
Relative permittivity (real part)	38.398700
Conductivity (S/m)	1.815790
Power drift (%)	-0.250000
Ambient Temperature:	22.3°C
Liquid Temperature:	21.1°C
ConvF:	2.33
Crest factor:	1:1

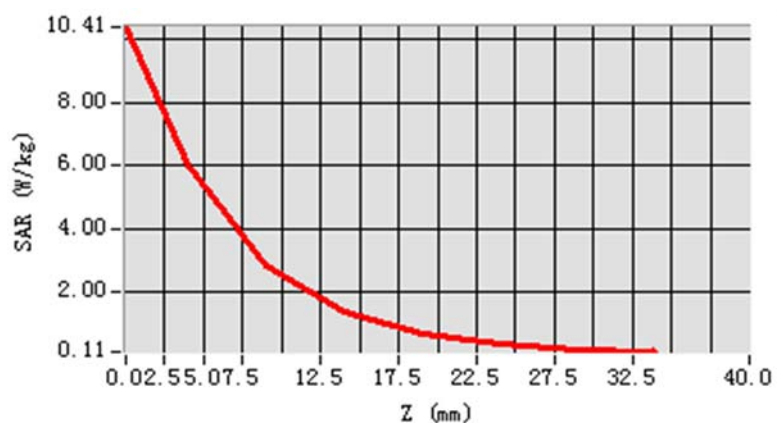


Maximum location: X=0.00, Y=-1.00

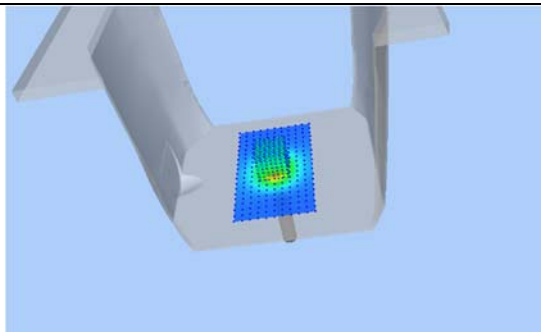
SAR Peak: 10.32 W/kg

SAR 10g (W/Kg)	2.573720
SAR 1g (W/Kg)	5.651914

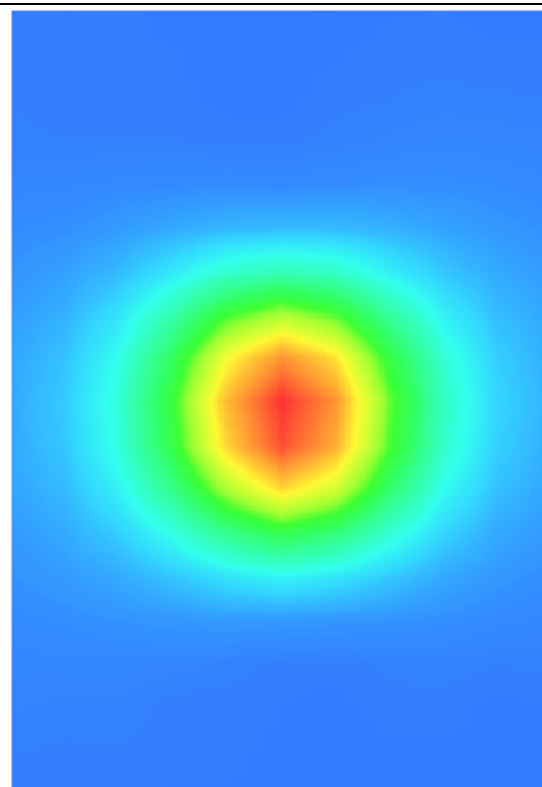
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(5200 MHz Head)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8 mm,dy=8 mm

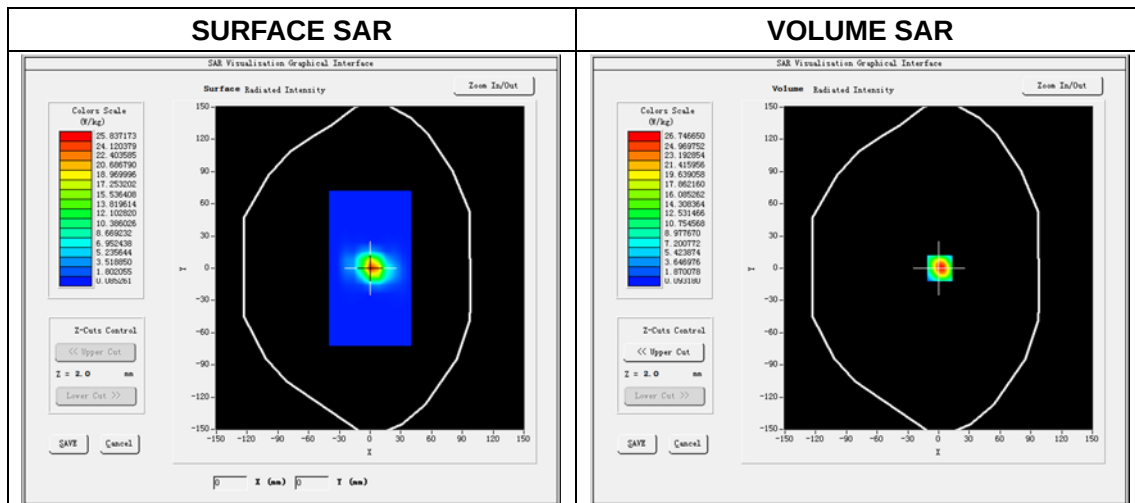
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm

Date of measurement: 2018.05.25

Measurement duration: 29 minutes 17 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5200 MHz
Signal	CW
Frequency (MHz)	5200.000000
Relative permittivity (real part)	36.752607
Conductivity (S/m)	4.733941
Power drift (%)	-0.260000
Ambient Temperature:	22.3°C
Liquid Temperature:	21.0°C
ConvF:	2.21
Crest factor:	1:1

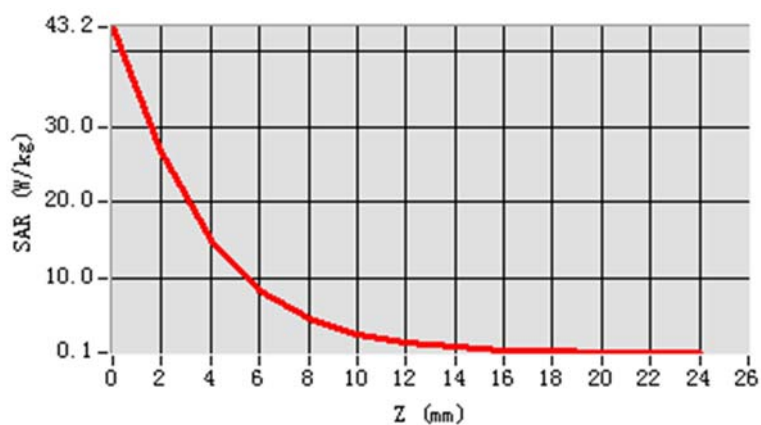


Maximum location: X=1.00, Y=0.00

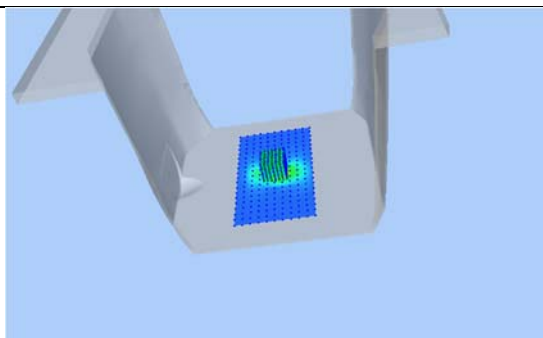
SAR Peak: 45.46 W/kg

SAR 10 g (W/Kg)	5.312352
SAR 1 g (W/Kg)	15.475469

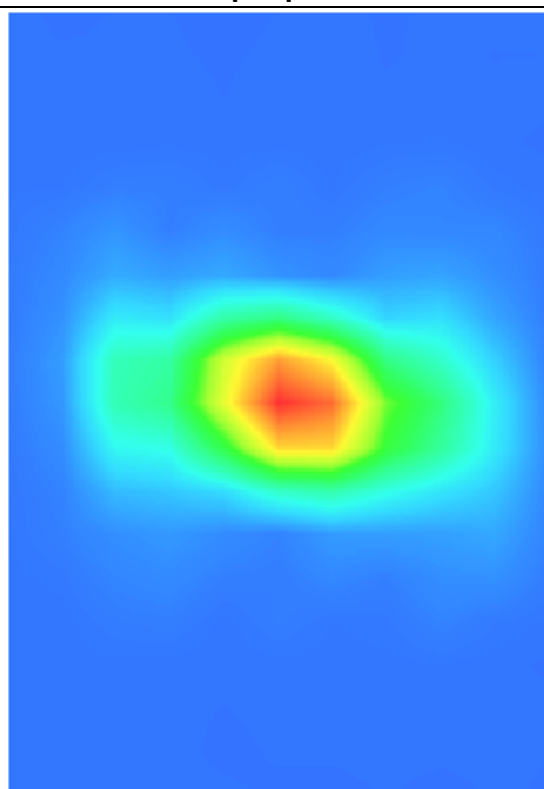
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(5400 MHz)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8 mm,dy=8 mm

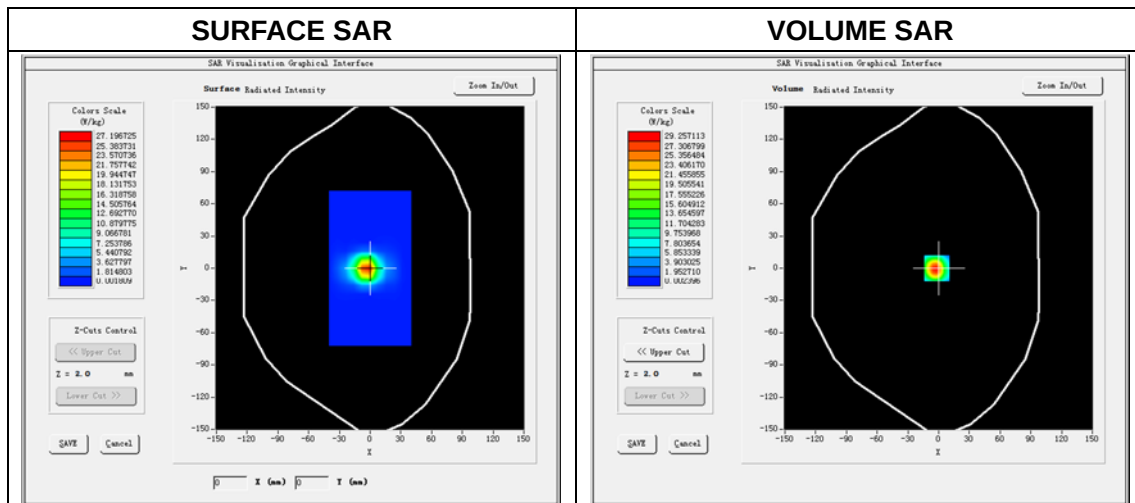
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm

Date of measurement: 2018.05.25

Measurement duration: 28 minutes 37 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5400 MHz
Signal	CW
Frequency (MHz)	5400.000000
Relative permittivity (real part)	36.488152
Conductivity (S/m)	4.949778
Power drift (%)	-0.950000
Ambient Temperature:	22.3°C
Liquid Temperature:	21.0°C
ConvF:	2.17
Crest factor:	1:1

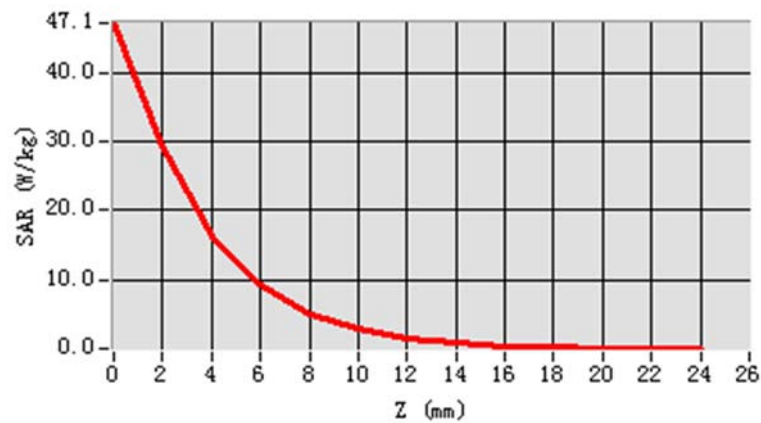


Maximum location: X=-2.00, Y=0.00

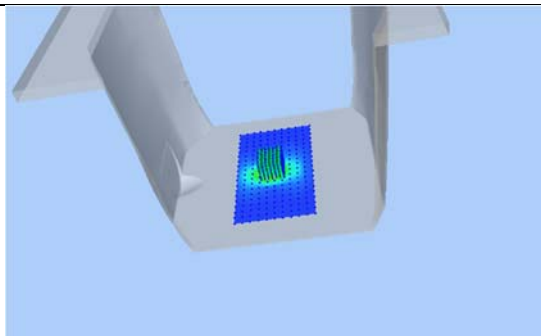
SAR Peak: 46.27 W/kg

SAR 10 g (W/Kg)	5.579495
SAR 1 g (W/Kg)	16.462172

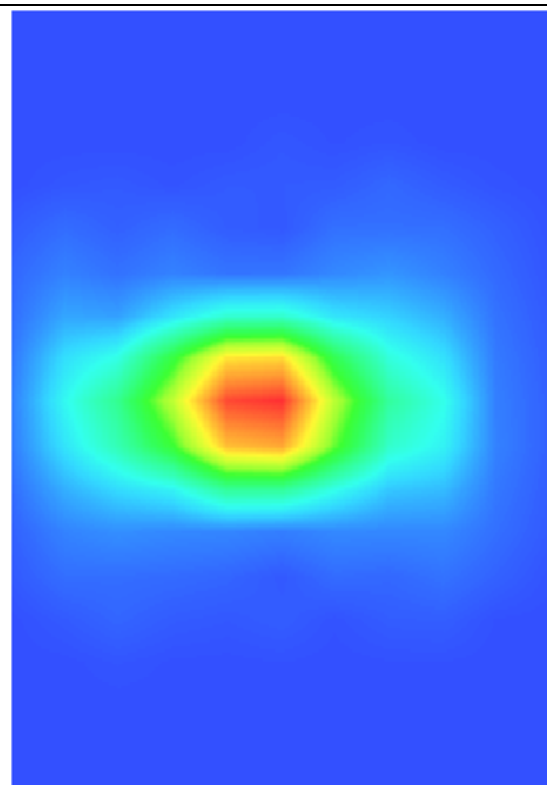
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(5600 MHz Head)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8 mm,dy=8 mm

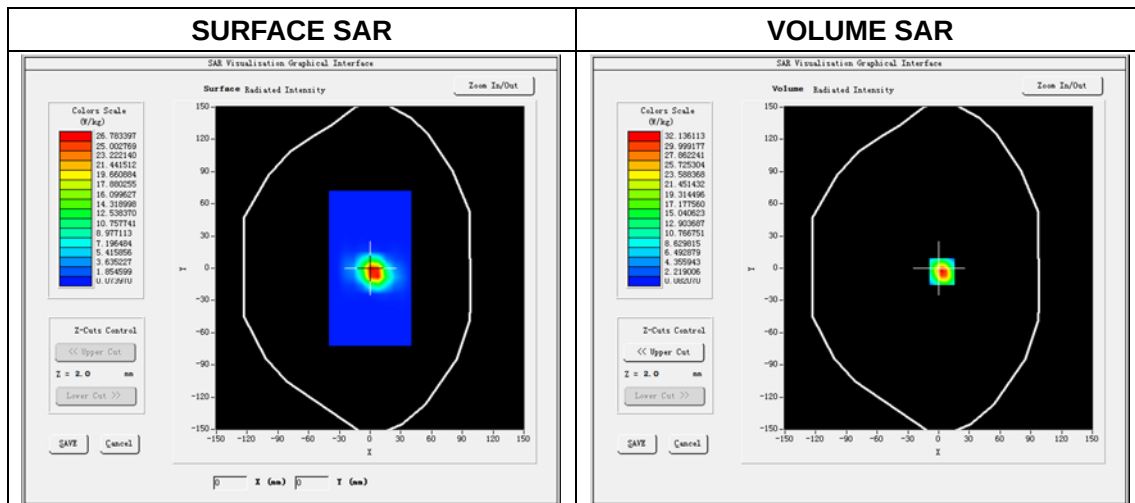
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm

Date of measurement: 2018.05.16

Measurement duration: 29 minutes 58 seconds

Experimental conditions.

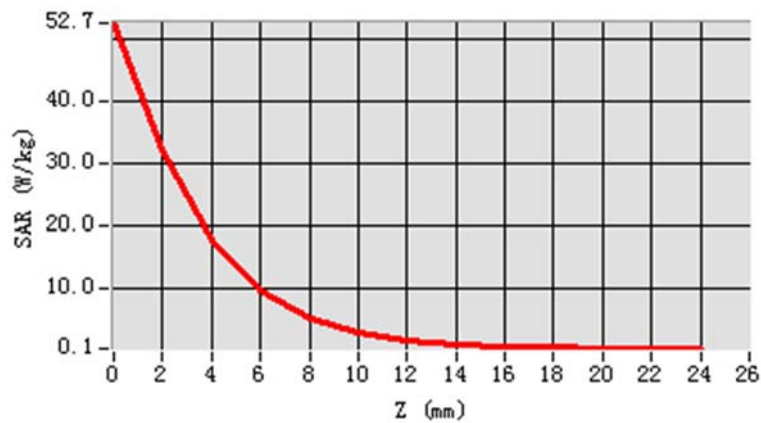
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5600 MHz
Signal	CW
Frequency (MHz)	5600.000000
Relative permittivity (real part)	35.502574
Conductivity (S/m)	5.071111
Power drift (%)	-0.370000
Ambient Temperature:	22.0°C
Liquid Temperature:	20.8°C
ConvF:	2.27
Crest factor:	1:1



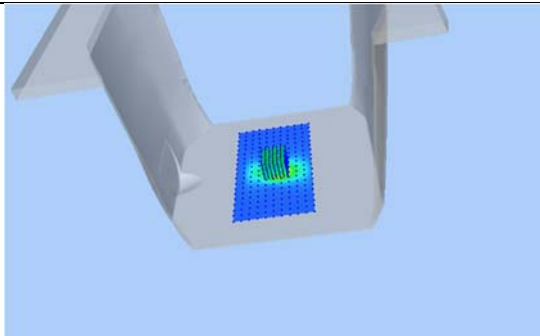
Maximum location: X=3.00, Y=-3.00
SAR Peak: 55.07 W/kg

SAR 10 g (W/Kg)	6.092752
SAR 1 g (W/Kg)	18.155321

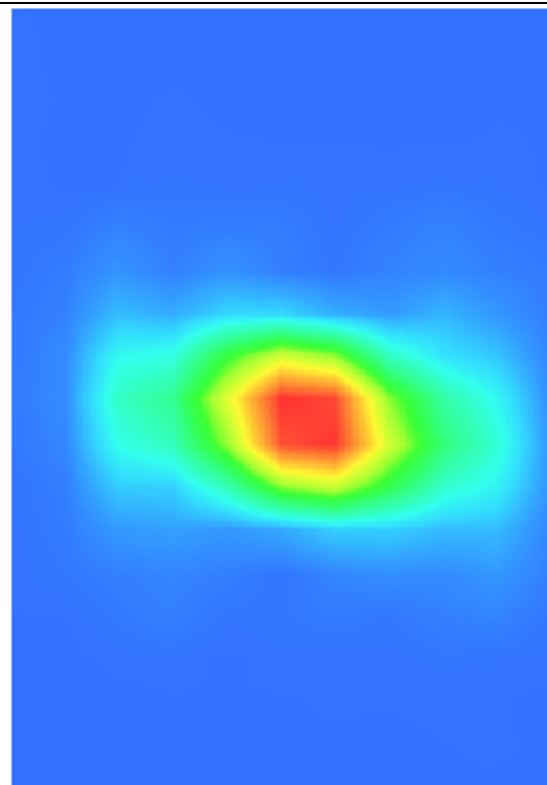
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(5800 MHz Head)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8 mm,dy=8 mm

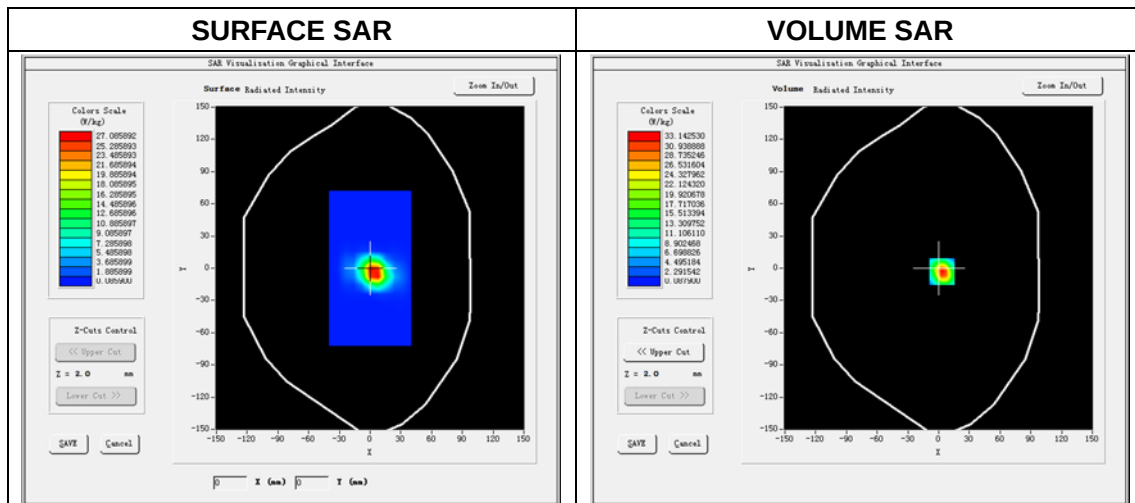
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm

Date of measurement: 2018.05.16

Measurement duration: 29 minutes 53 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5800 MHz
Signal	CW
Frequency (MHz)	5800.000000
Relative permittivity (real part)	34.852315
Conductivity (S/m)	5.381556
Power drift (%)	-0.250000
Ambient Temperature:	22.0°C
Liquid Temperature:	20.8°C
ConvF:	2.33
Crest factor:	1:1

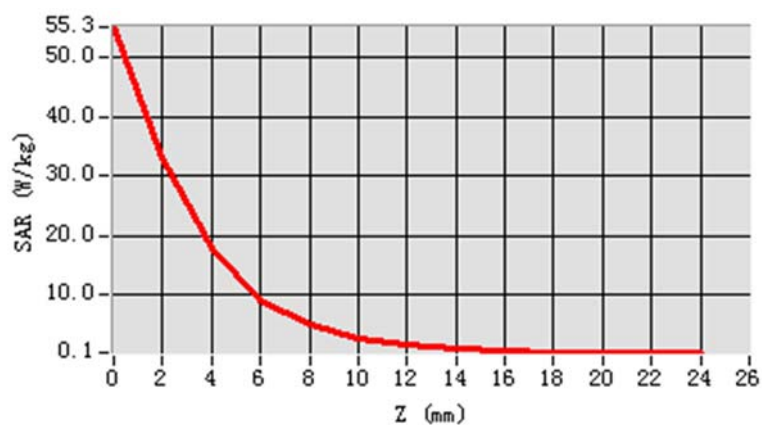


Maximum location: X=3.00, Y=-3.00

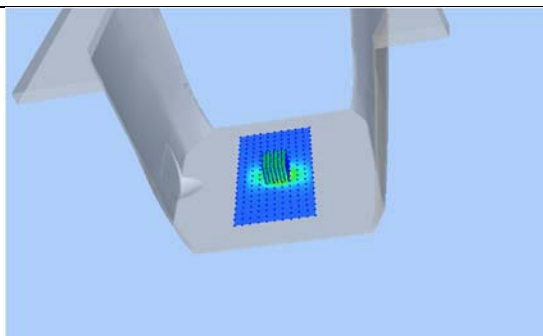
SAR Peak: 57.96 W/kg

SAR 10 g (W/Kg)	6.092835
SAR 1 g (W/Kg)	18.446642

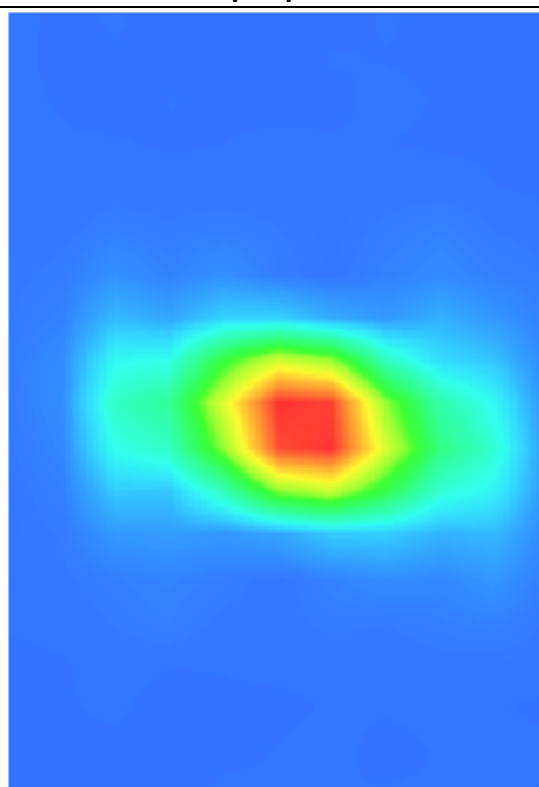
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(2450MHz Body)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8mm,dy=8mm

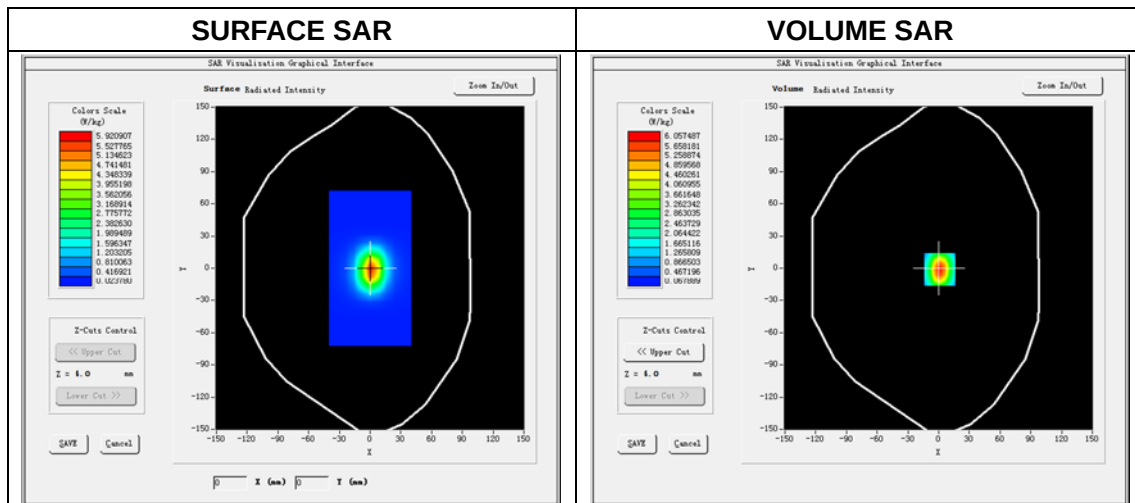
Zoom scan resolution: dx=5mm, dy=5mm, dz=5mm

Date of measurement: 2018.05.17

Measurement duration: 18 minutes 47 seconds

Experimental conditions.

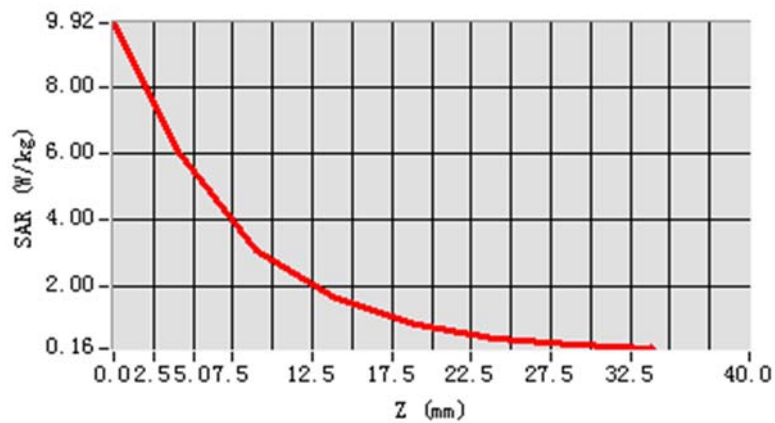
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2450MHz
Signal	CW
Frequency (MHz)	2450.000000
Relative permittivity (real part)	51.138900
Conductivity (S/m)	1.979105
Power drift (%)	-0.150000
Ambient Temperature:	22.2°C
Liquid Temperature:	21.0°C
ConvF:	2.41
Crest factor:	1:1



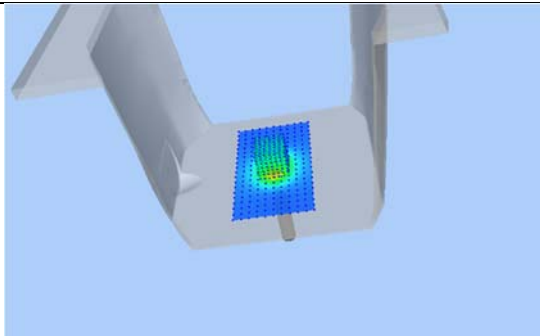
Maximum location: X=1.00, Y=-1.00
SAR Peak: 9.82W/kg

SAR 10g (W/Kg)	2.591581
SAR 1g (W/Kg)	5.557807

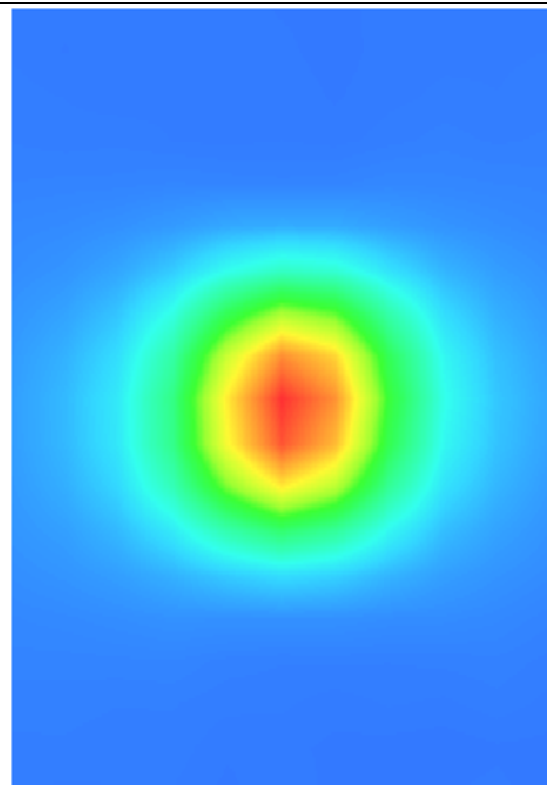
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(5200 MHz Body)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8 mm,dy=8 mm

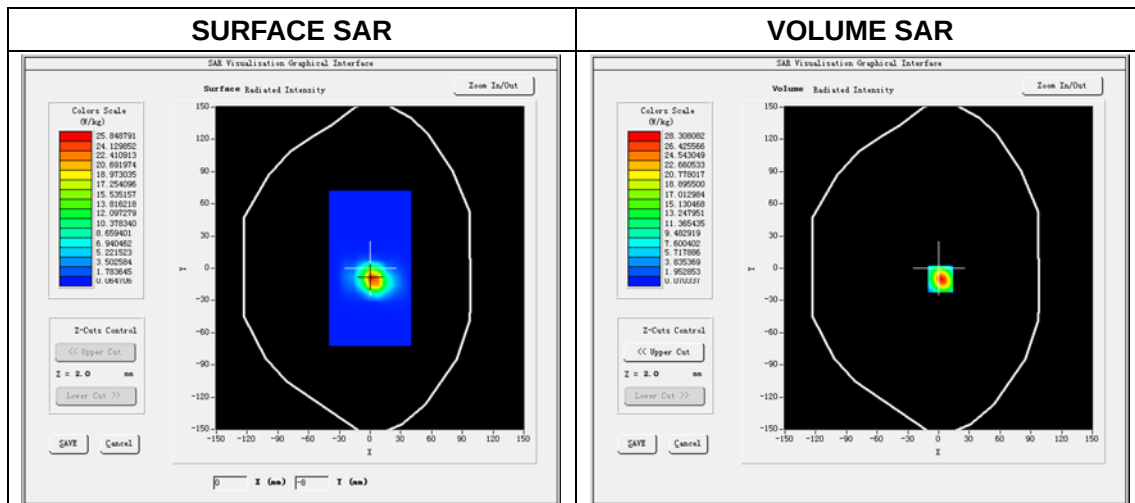
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm

Date of measurement: 2018.05.25

Measurement duration: 29 minutes 18 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5200 MHz
Signal	CW
Frequency (MHz)	5200.000000
Relative permittivity (real part)	49.121843
Conductivity (S/m)	5.288484
Power drift (%)	-0.410000
Ambient Temperature:	22.3°C
Liquid Temperature:	21.0°C
ConvF:	2.26
Crest factor:	1:1

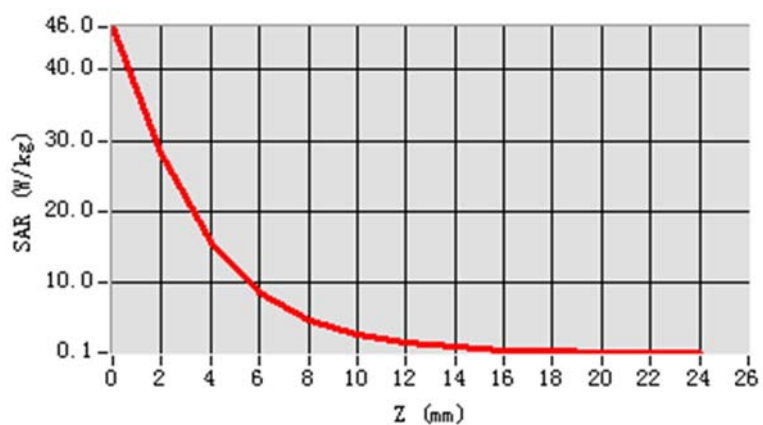


Maximum location: X=0.00, Y=-8.00

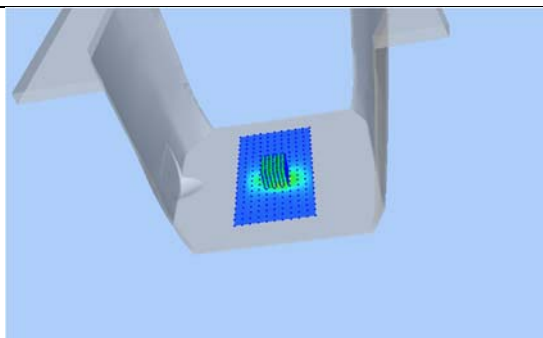
SAR Peak: 45.83 W/kg

SAR 10 g (W/Kg)	5.512234
SAR 1 g (W/Kg)	16.150859

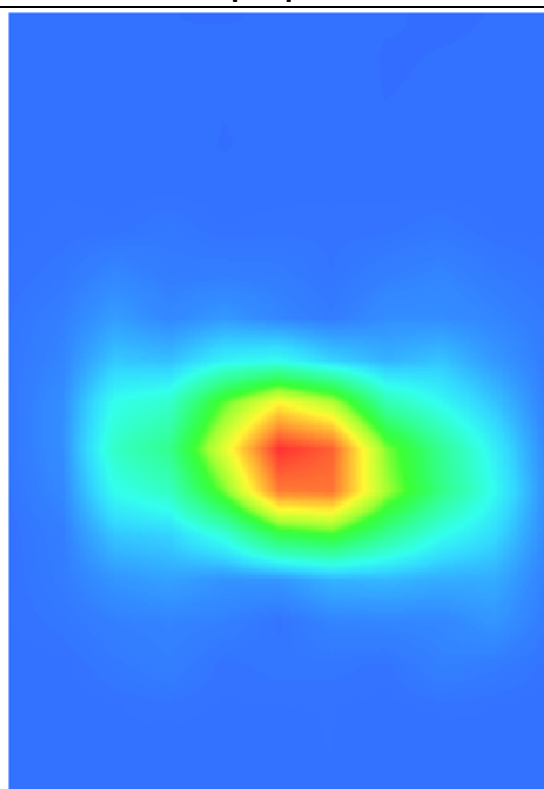
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(5400 MHz Body)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8 mm,dy=8 mm

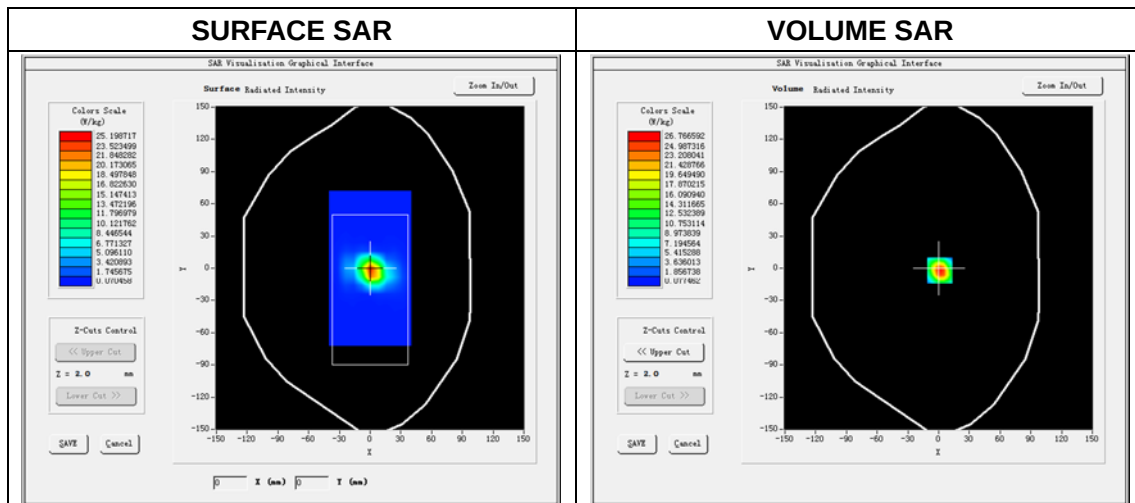
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm

Date of measurement: 2018.05.25

Measurement duration: 28 minutes 39 seconds

Experimental conditions.

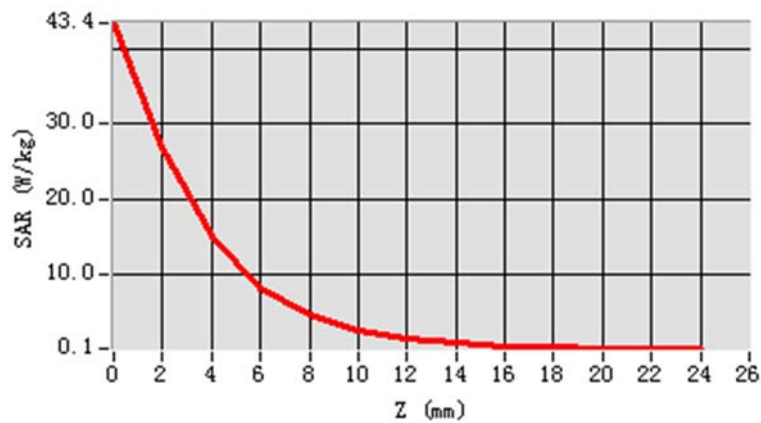
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5400 MHz
Signal	CW
Frequency (MHz)	5400.000000
Relative permittivity (real part)	48.819399
Conductivity (S/m)	5.376099
Power drift (%)	0.040000
Ambient Temperature:	22.3°C
Liquid Temperature:	21.0°C
ConvF:	2.24
Crest factor:	1:1



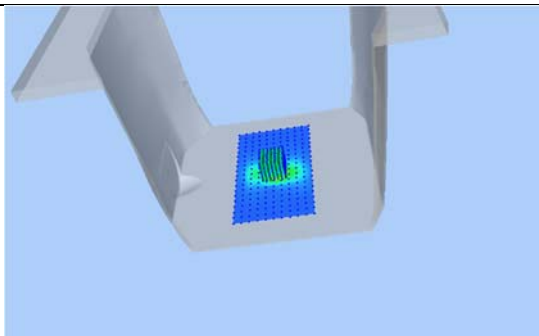
Maximum location: X=0.00, Y=0.00
SAR Peak: 45.24 W/kg

SAR 10 g (W/Kg)	5.360837
SAR 1 g (W/Kg)	15.371213

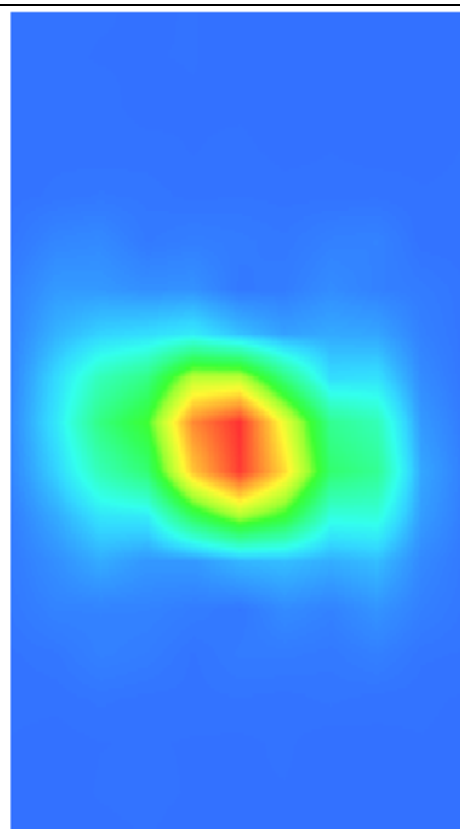
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(5600 MHz Body)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8 mm,dy=8 mm

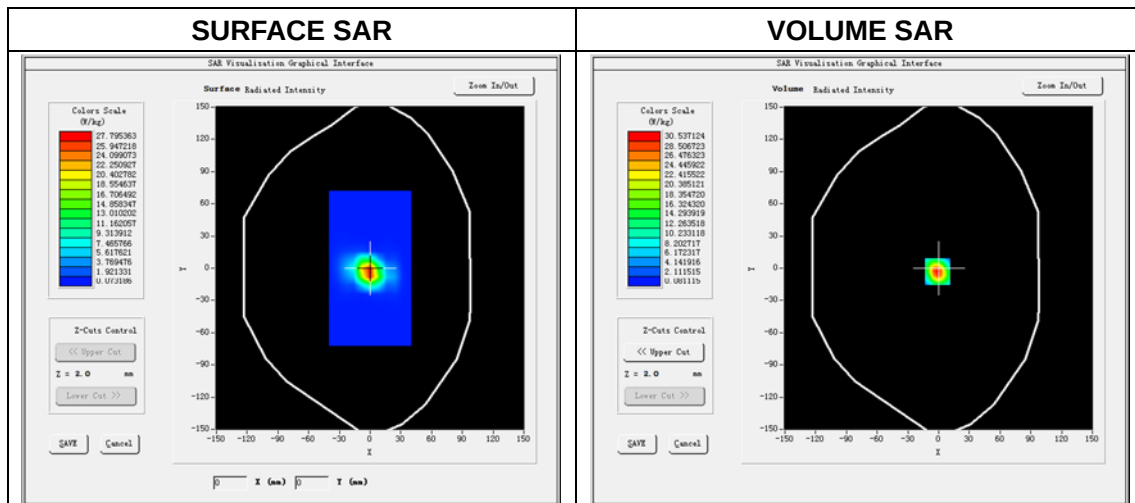
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm

Date of measurement: 2018.05.18

Measurement duration: 27 minutes 28 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5600 MHz
Signal	CW
Frequency (MHz)	5600.000000
Relative permittivity (real part)	47.484594
Conductivity (S/m)	5.805103
Power drift (%)	0.390000
Ambient Temperature:	22.1°C
Liquid Temperature:	20.9°C
ConvF:	2.35
Crest factor:	1:1

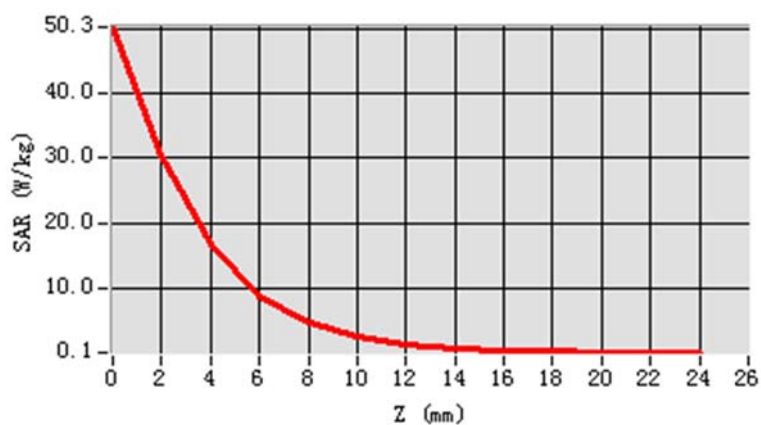


Maximum location: X=0.00, Y=0.00

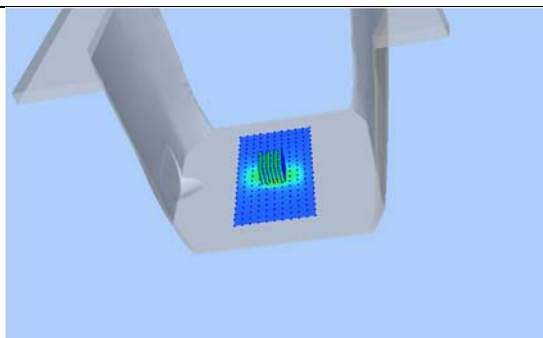
SAR Peak: 52.24 W/kg

SAR 10 g (W/Kg)	5.844205
SAR 1 g (W/Kg)	17.239801

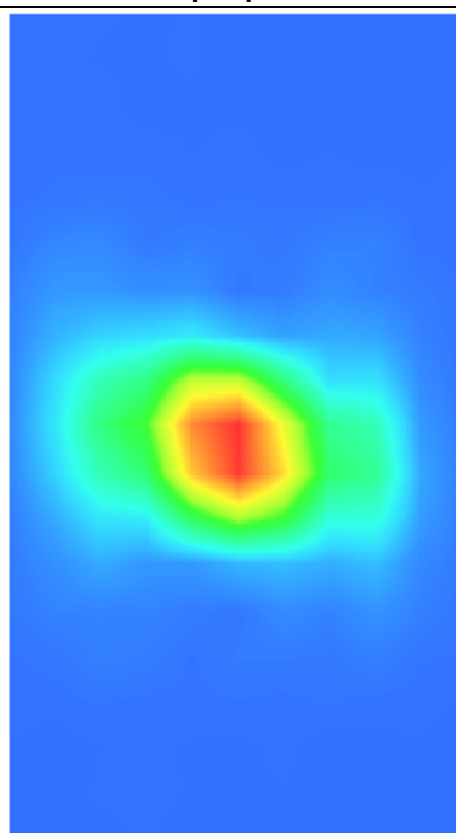
Z Axis Scan



3D screen shot



Hot spot position



System Performance Check Data(5800 MHz Body)

Type: Phone measurement (Complete)

E-Field Probe: SN 3117 EPG0321

Area scan resolution: dx=8 mm,dy=8 mm

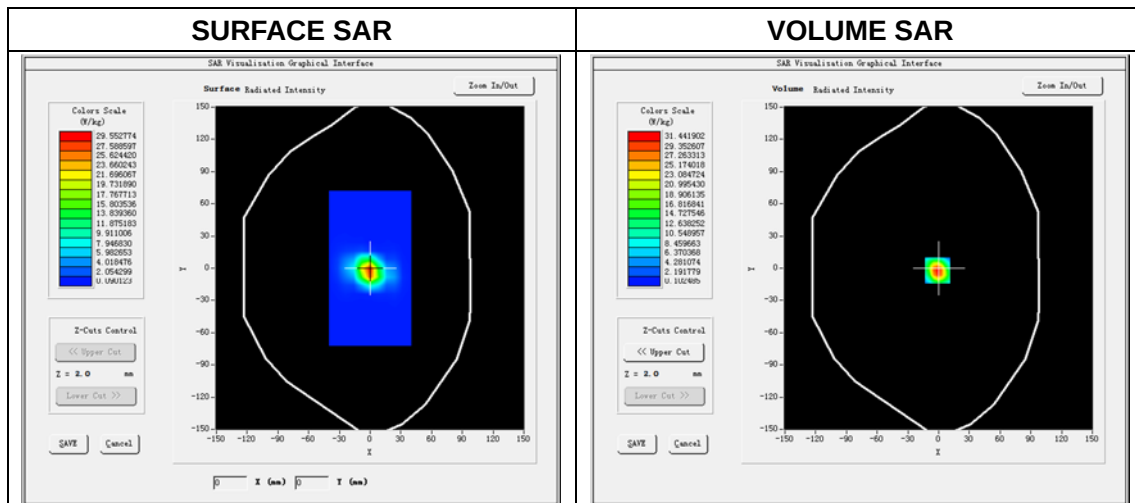
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm

Date of measurement: 2018.05.18

Measurement duration: 27 minutes 33 seconds

Experimental conditions.

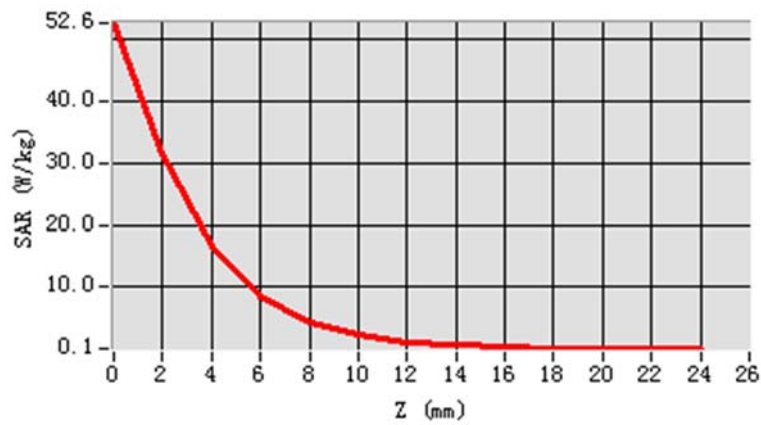
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5800 MHz
Signal	CW
Frequency (MHz)	5800.000000
Relative permittivity (real part)	46.279083
Conductivity (S/m)	6.012611
Power drift (%)	0.110000
Ambient Temperature:	22.1°C
Liquid Temperature:	20.9°C
ConvF:	2.39
Crest factor:	1:1



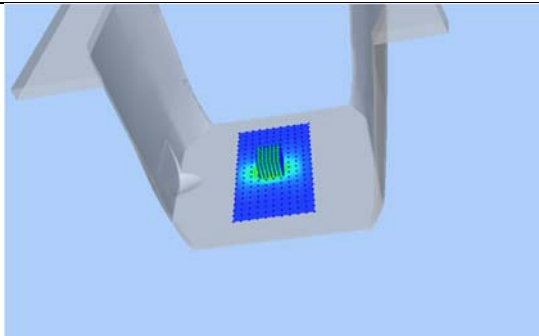
Maximum location: X=0.00, Y=0.00
SAR Peak: 55.01 W/kg

SAR 10 g (W/Kg)	5.882889
SAR 1 g (W/Kg)	17.580306

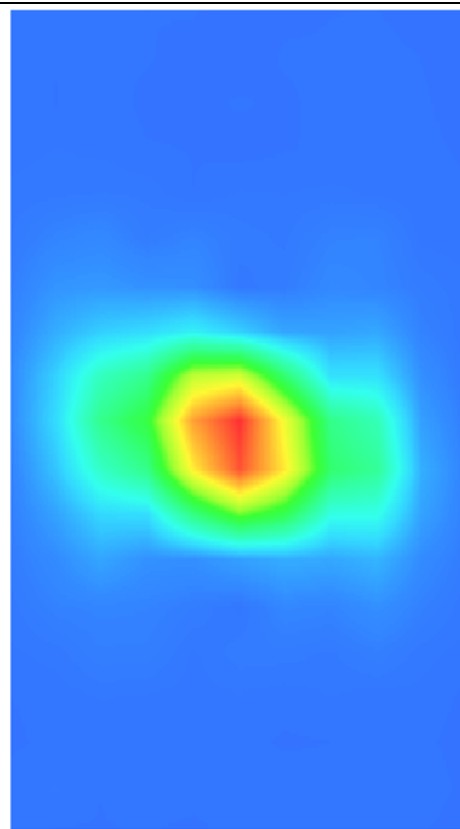
Z Axis Scan



3D screen shot



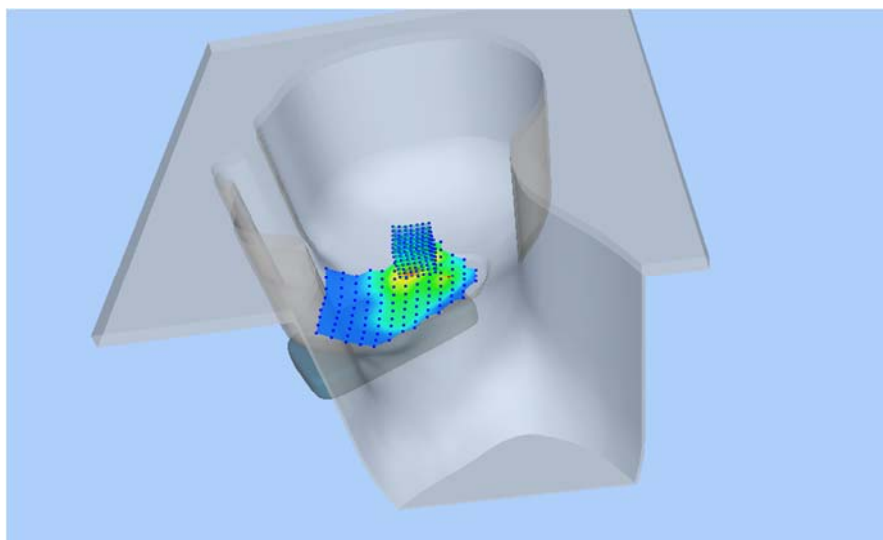
Hot spot position



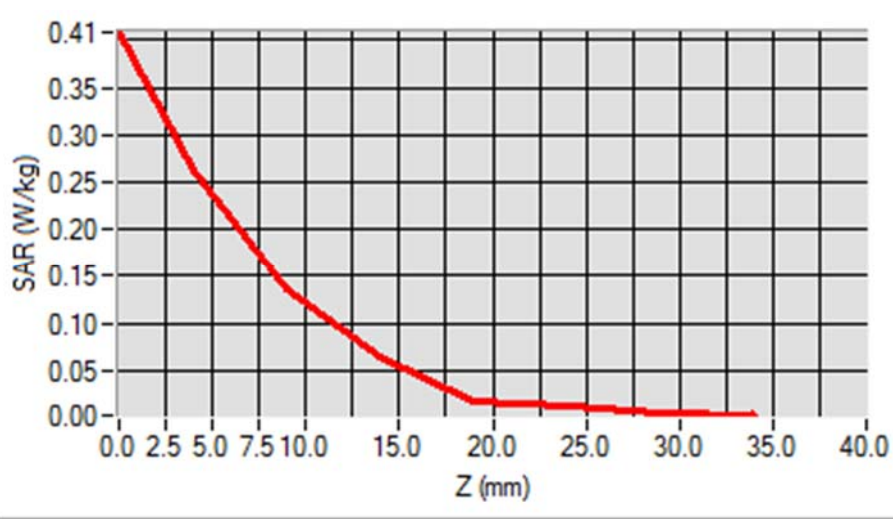
ANNEX C TEST DATA

MEAS. 1 Right Head with Cheek on Low Channel in IEEE 802.b mode

Test Date: 15/5/2018
Measurement duration: 14 minutes 54 seconds
Signal: WLAN(b), f=2412.0 MHz, Duty Cycle: 1:1.03
Liquid Parameters: Permittivity: 38.89; Conductivity: 1.72 S/m
Test condition: Ambient Temperature: 22.3°C, Liquid Temperature: 21.1°C
Probe: SN 3117 EPGO321, ConvF: 2.33
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): 0.108645
SAR 1g (W/Kg): 0.237971
Power drift (%): 0.63
3D screen shot



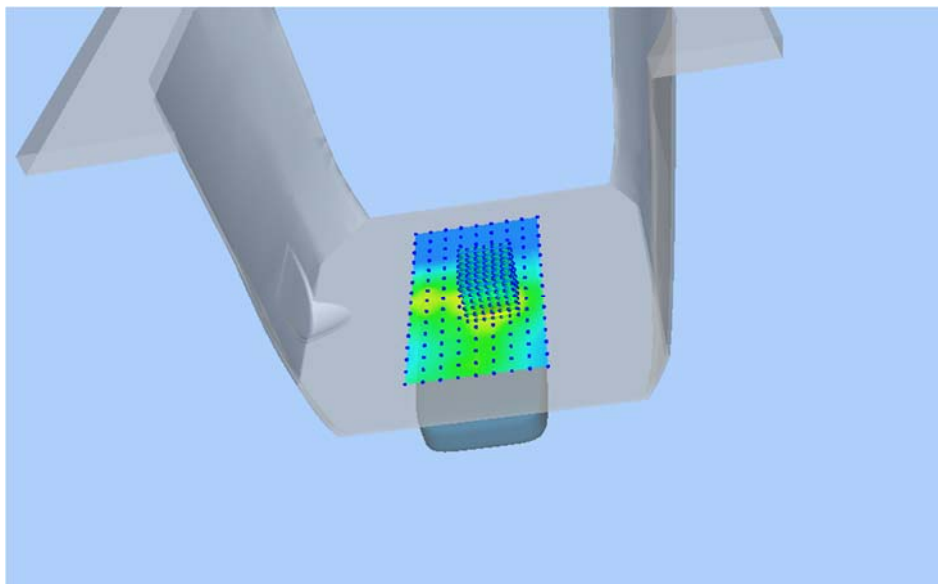
Z Axis Scan



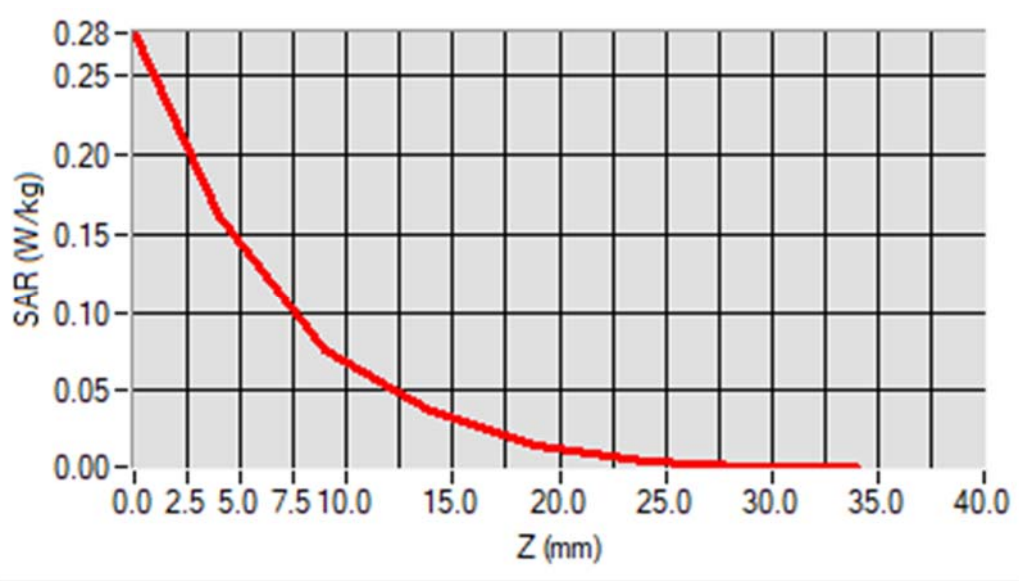
MEAS. 2 Body Plane with Body Back Side 10mm on High Channel in IEEE

802.b mode

Test Date: 17/5/2018
Measurement duration: 19 minutes 50 seconds
Signal: WLAN(b), f=2462.0 MHz, Duty Cycle: 1:1.03
Liquid Parameters: Permittivity: 51.01; Conductivity: 2.01 S/m
Test condition: Ambient Temperature: 22.2°C, Liquid Temperature: 21.0°C
Probe: SN 3117 EPGO321, ConvF: 2.41
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=-12.000000
SAR 10g (W/Kg): 0.060912
SAR 1g (W/Kg): 0.141859
Power drift (%): 0.19
3D screen shot



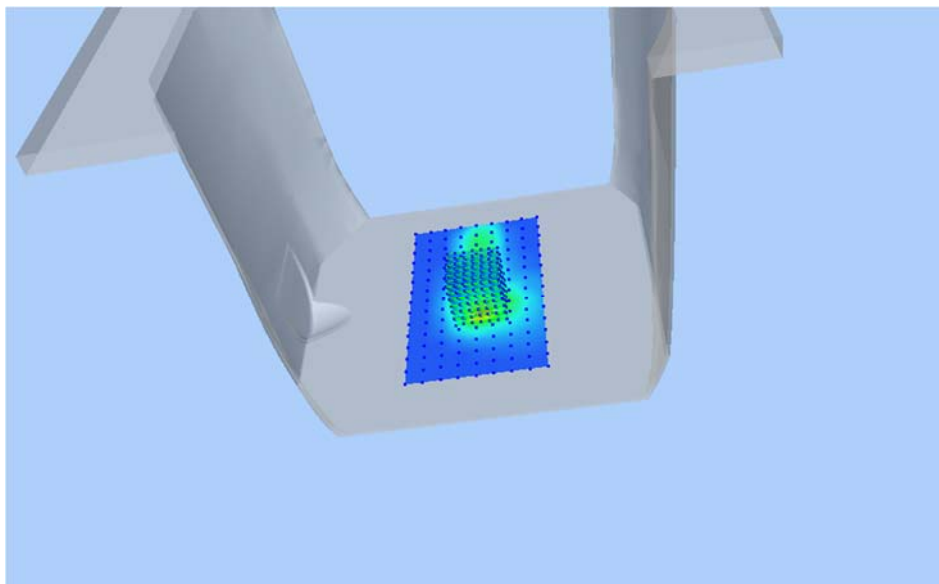
Z Axis Scan



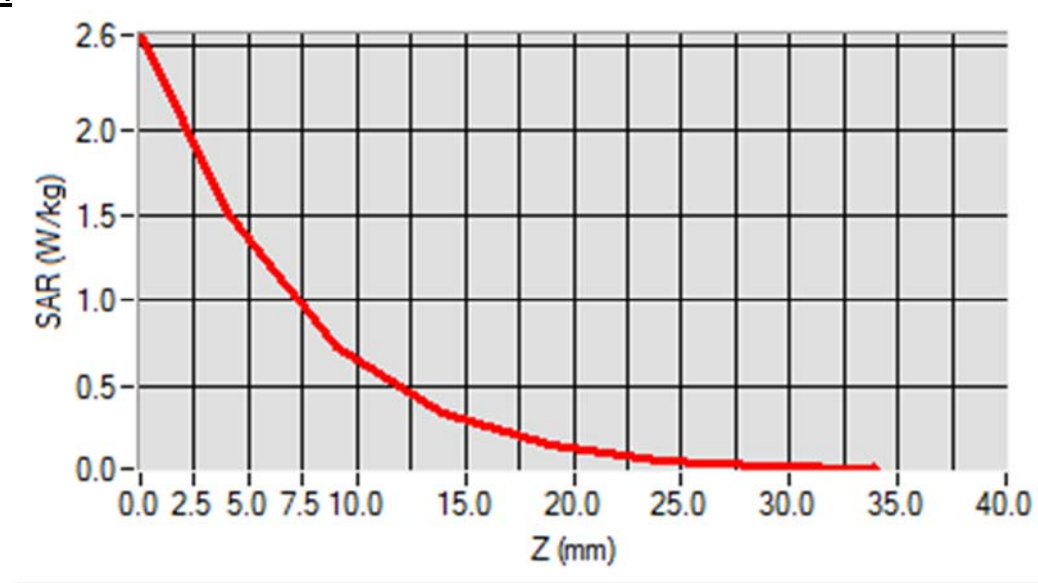
MEAS. 3 Body Plane with Left Edge 0mm on High Channel in IEEE 802.b

mode

Test Date: 17/5/2018
Measurement duration: 18 minutes 16 seconds
Signal: WLAN(b), f=2462.0 MHz, Duty Cycle: 1:1.03
Liquid Parameters: Permittivity: 51.01; Conductivity: 2.01 S/m
Test condition: Ambient Temperature: 22.2°C, Liquid Temperature: 21.0°C
Probe: SN 3117 EPGO321, ConvF: 2.41
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=-12.000000
SAR 10g (W/Kg): 0.472212
SAR 1g (W/Kg): 1.290820
Power drift (%): -0.92
3D screen shot

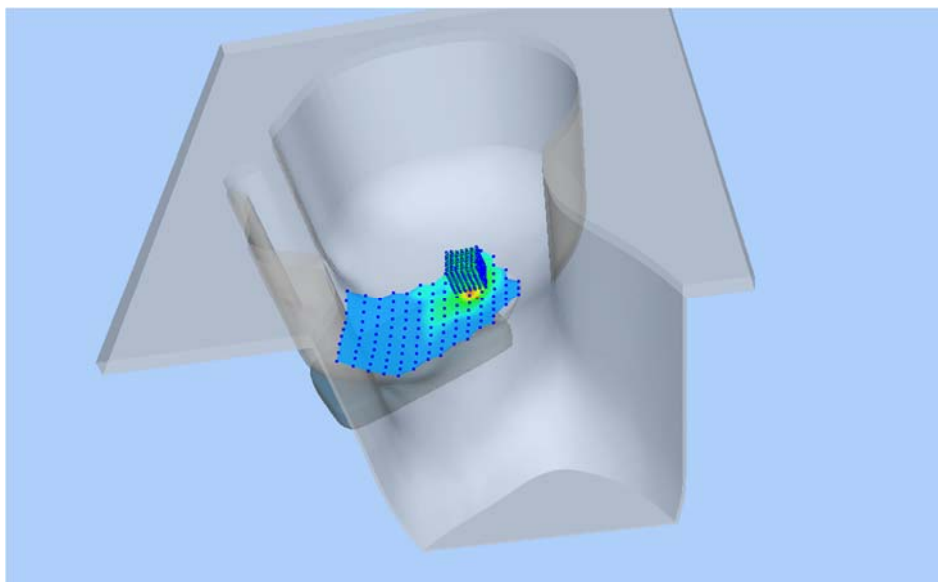


Z Axis Scan

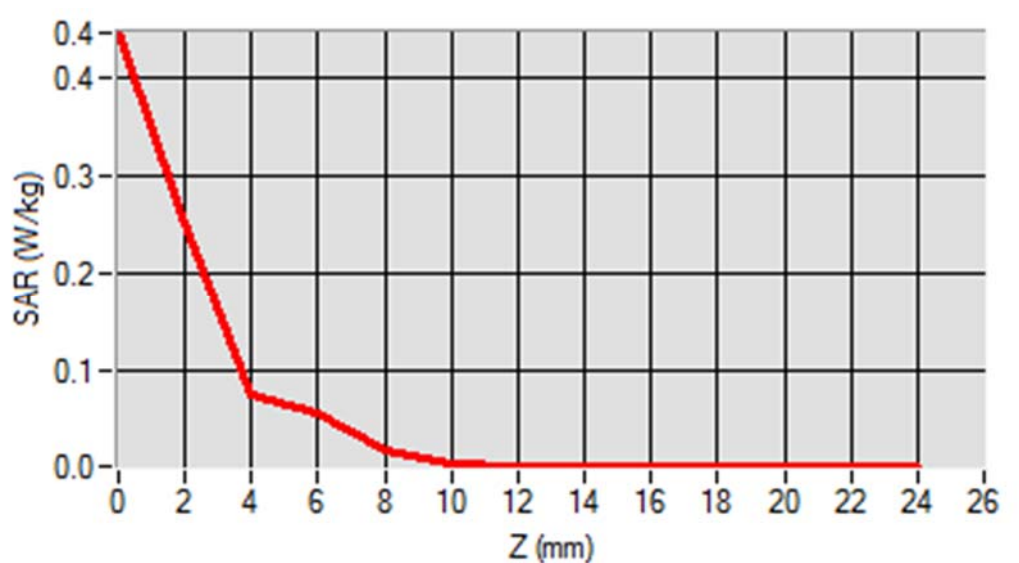


MEAS. 4 Right Head with Cheek on Channel 64 in IEEE 802.a mode

Test Date: 25/5/2018
Measurement duration: 21 minutes 8 seconds
Signal: WLAN(a), f=5320.0 MHz, Duty Cycle: 1:1.16
Liquid Parameters: Permittivity: 36.55; Conductivity: 4.94 S/m
Test condition: Ambient Temperature: 22.3°C, Liquid Temperature: 21.0°C
Probe: SN 3117 EPGO321, ConvF: 2.17
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=-6.000000, Y=24.000000
SAR 10g (W/Kg): 0.082392
SAR 1g (W/Kg): 0.233384
Power drift (%): -0.05
3D screen shot

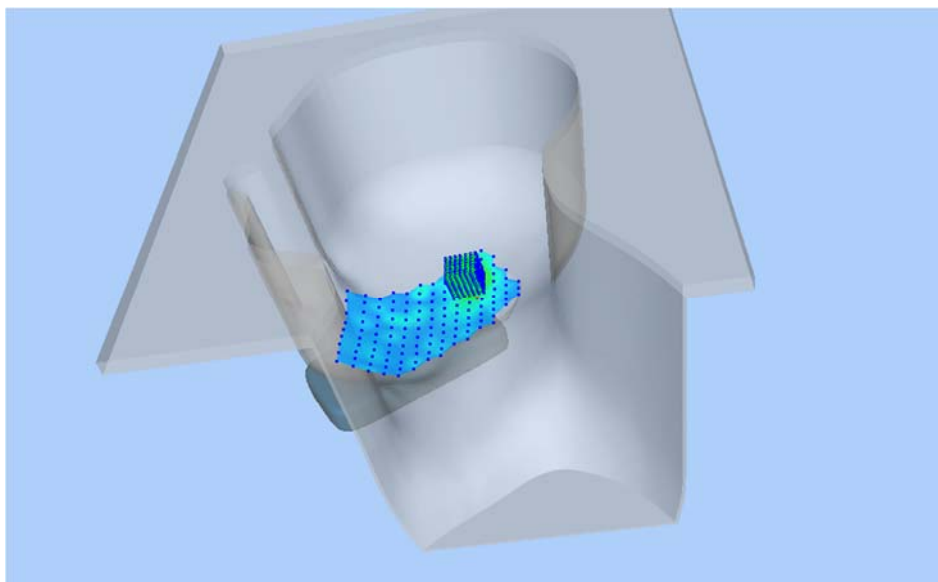


Z Axis Scan

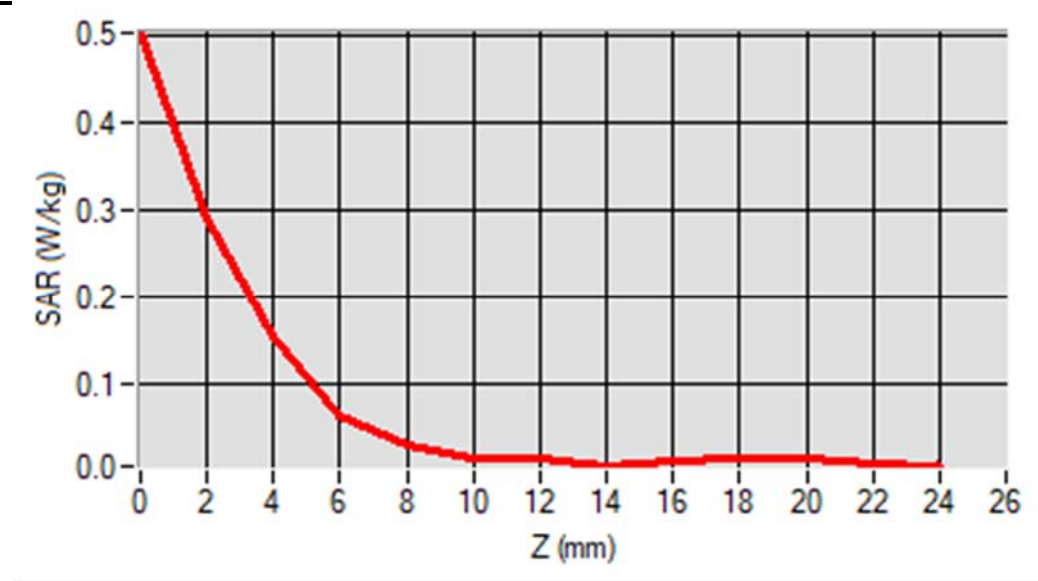


MEAS. 5 Right Head with on Channel 100 in IEEE 802.a mode

Test Date: 16/5/2018
Measurement duration: 20 minutes 53 seconds
Signal: WLAN(a), f=5500.0 MHz, Duty Cycle: 1:1.16
Liquid Parameters: Permittivity: 36.01; Conductivity: 4.96 S/m
Test condition: Ambient Temperature: 22.0°C, Liquid Temperature: 20.8°C
Probe: SN 3117 EPGO321, ConvF: 2.27
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=-6.000000, Y=14.000000
SAR 10g (W/Kg): 0.080591
SAR 1g (W/Kg): 0.261199
Power drift (%): 4.06
3D screen shot

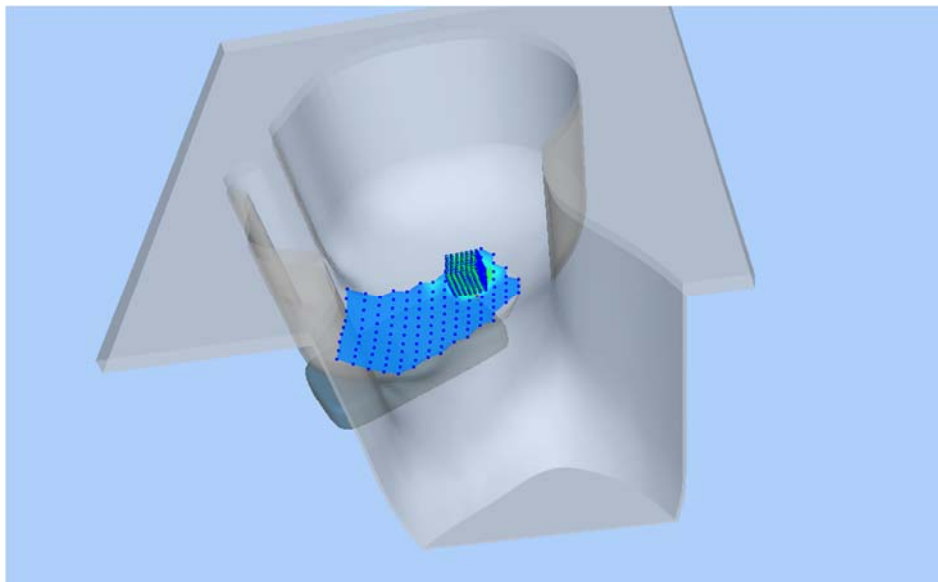


Z Axis Scan

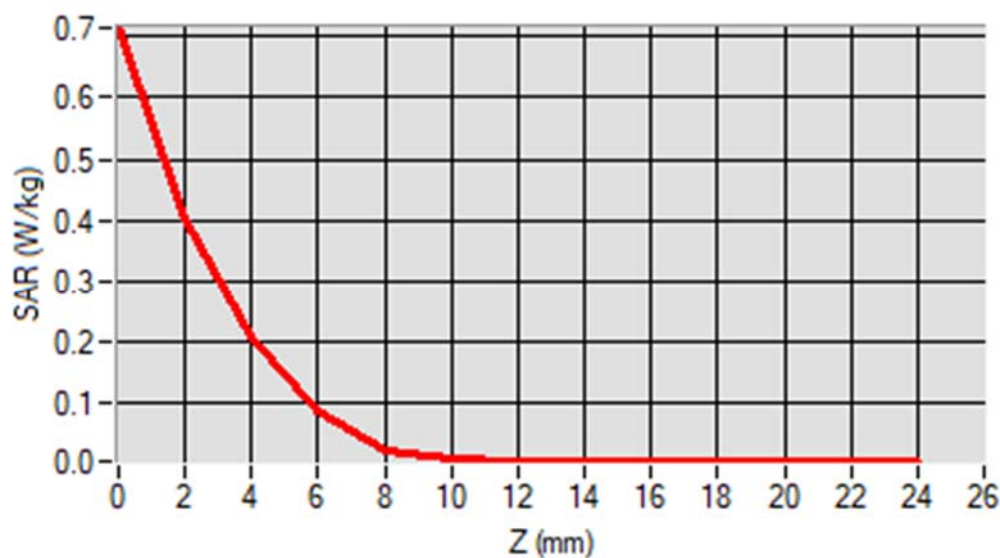


MEAS. 6 Right Head with Cheek on Channel 149 in IEEE 802.a mode

Test Date: 16/5/2018
Measurement duration: 21 minutes 2 seconds
Signal: WLAN(a), f=5745.0 MHz, Duty Cycle: 1:1.16
Liquid Parameters: Permittivity: 35.07; Conductivity: 5.33 S/m
Test condition: Ambient Temperature: 22.0°C, Liquid Temperature: 20.8°C
Probe: SN 3117 EPGO321, ConvF: 2.33
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=-6.000000, Y=14.000000
SAR 10g (W/Kg): 0.110931
SAR 1g (W/Kg): 0.385305
Power drift (%): -2.57
3D screen shot

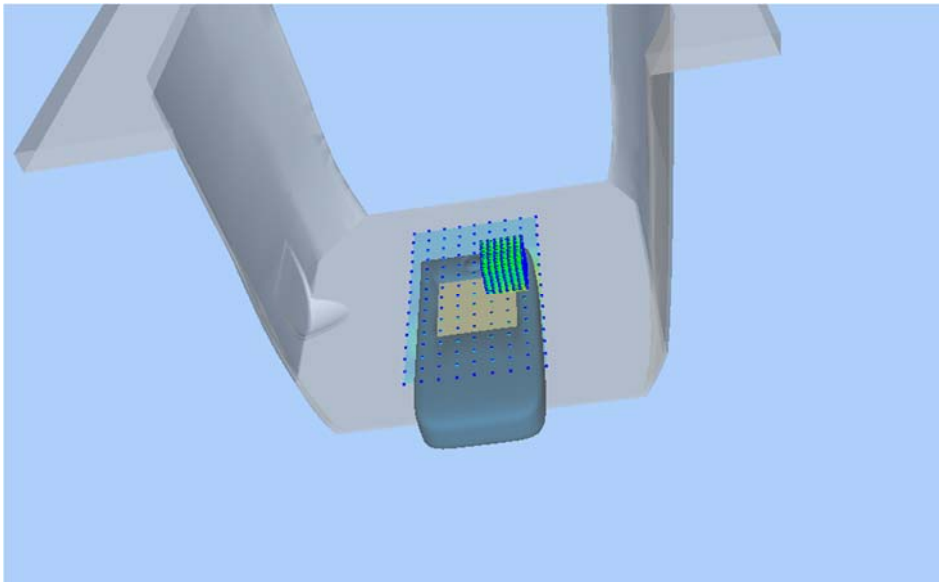


Z Axis Scan

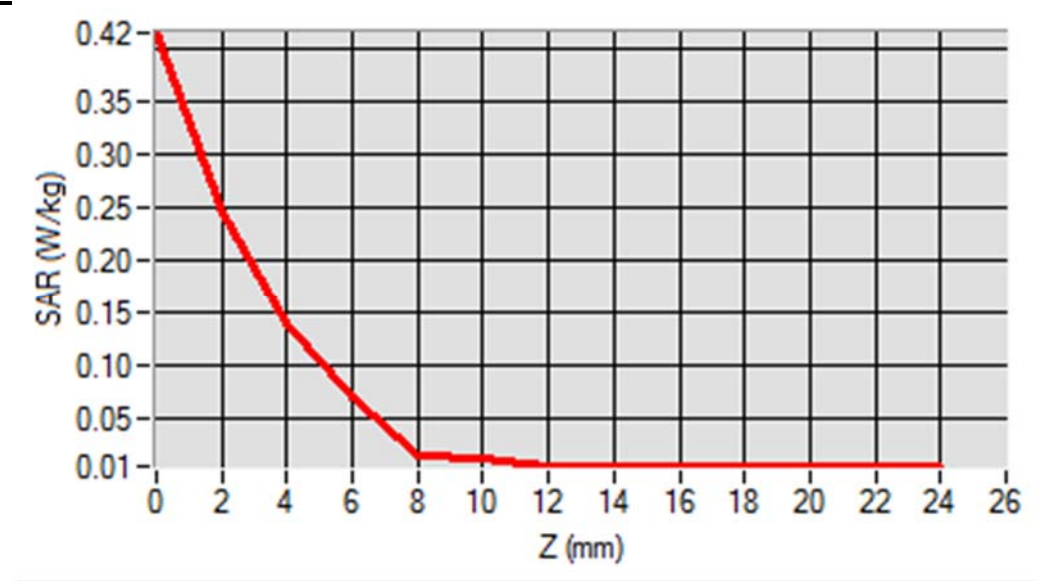


MEAS. 7 Body Plane with Back Side 10mm on Channel 64 in IEEE 802.a mode

Test Date: 25/5/2018
Measurement duration: 26 minutes 5 seconds
Signal: WLAN(a), f=5320.0 MHz, Duty Cycle: 1:1.16
Liquid Parameters: Permittivity: 48.86; Conductivity: 5.36 S/m
Test condition: Ambient Temperature: 22.3°C, Liquid Temperature: 21.0°C
Probe: SN 3117 EPGO321, ConvF: 2.24
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=20.000000, Y=8.000000
SAR 10g (W/Kg): 0.050995
SAR 1g (W/Kg): 0.137475
Power drift (%): 0.09
3D screen shot



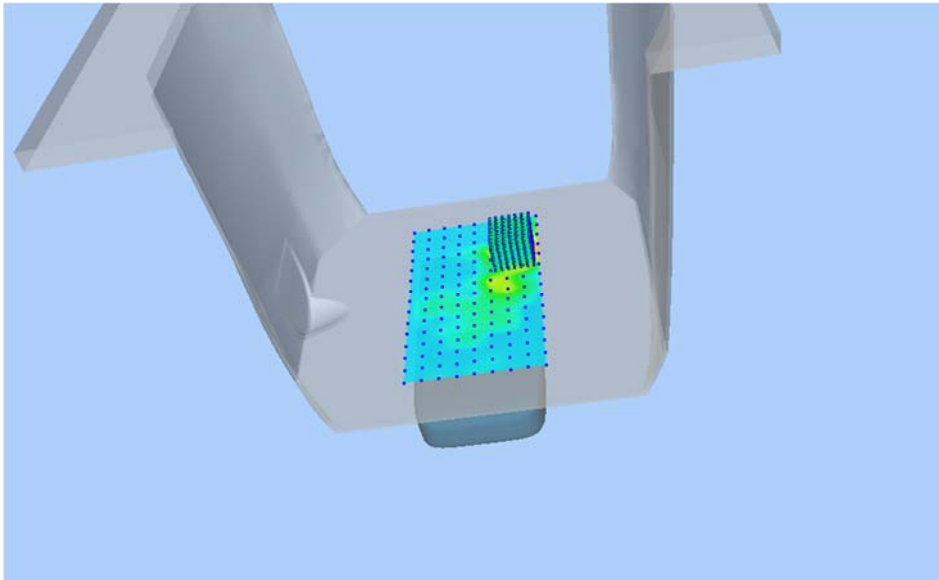
Z Axis Scan



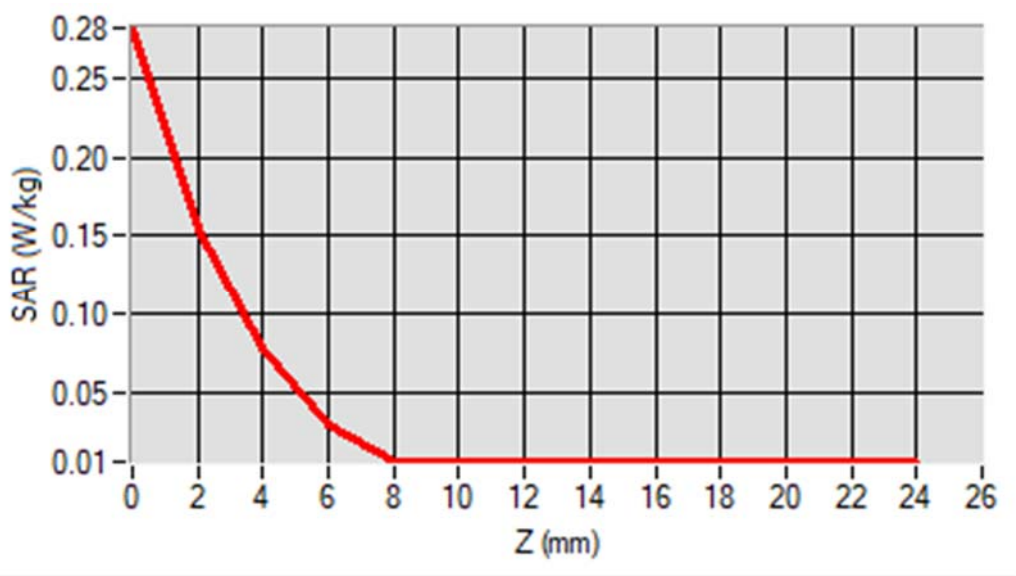
MEAS. 8 Body Plane with Back Side 10mm on Channel 100 in IEEE 802.a

mode

Test Date: 18/5/2018
Measurement duration: 23 minutes 15 seconds
Signal: WLAN(a), f=5500.0 MHz, Duty Cycle: 1:1.16
Liquid Parameters: Permittivity: 47.68; Conductivity: 5.73 S/m
Test condition: Ambient Temperature: 22.1°C, Liquid Temperature: 20.9°C
Probe: SN 3117 EPGO321, ConvF: 2.35
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=30.000000, Y=28.000000
SAR 10g (W/Kg): 0.034233
SAR 1g (W/Kg): 0.086203
Power drift (%): -1.92
3D screen shot



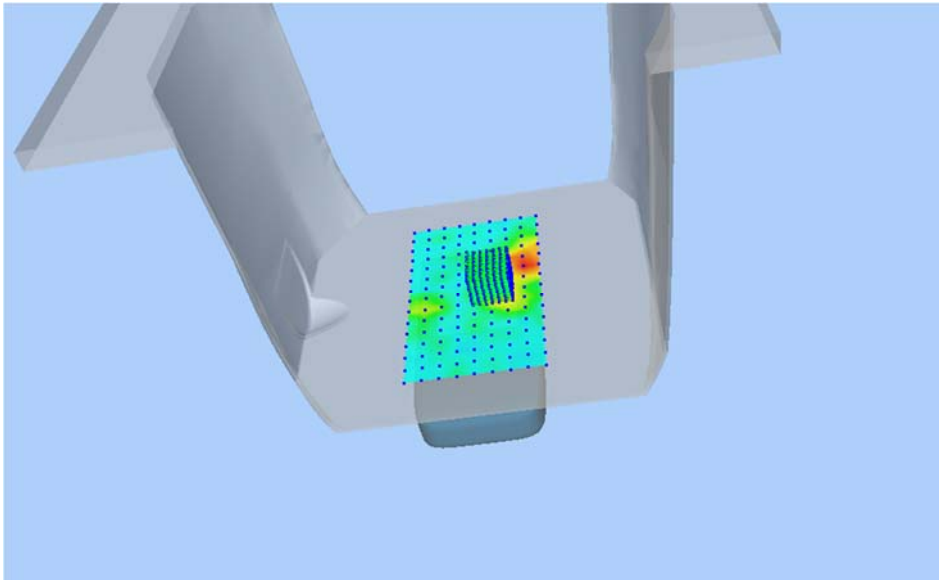
Z Axis Scan



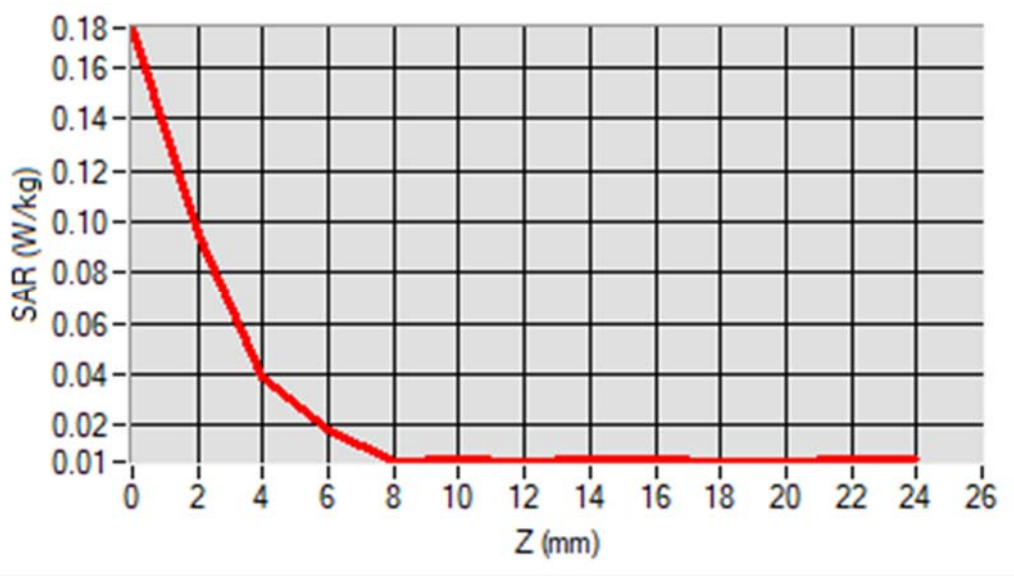
MEAS. 9 Body Plane with Back Side 10mm on Channel 149 in IEEE 802.a

mode

Test Date: 18/5/2018
Measurement duration: 30 minutes 29 seconds
Signal: WLAN(a), f=5745.0 MHz, Duty Cycle: 1:1.15
Liquid Parameters: Permittivity: 46.42; Conductivity: 5.94 S/m
Test condition: Ambient Temperature: 22.1°C, Liquid Temperature: 20.9°C
Probe: SN 3117 EPGO321, ConvF: 2.39
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=10.000000, Y=-2.000000
SAR 10g (W/Kg): 0.032215
SAR 1g (W/Kg): 0.076649
Power drift (%): 1.84
3D screen shot

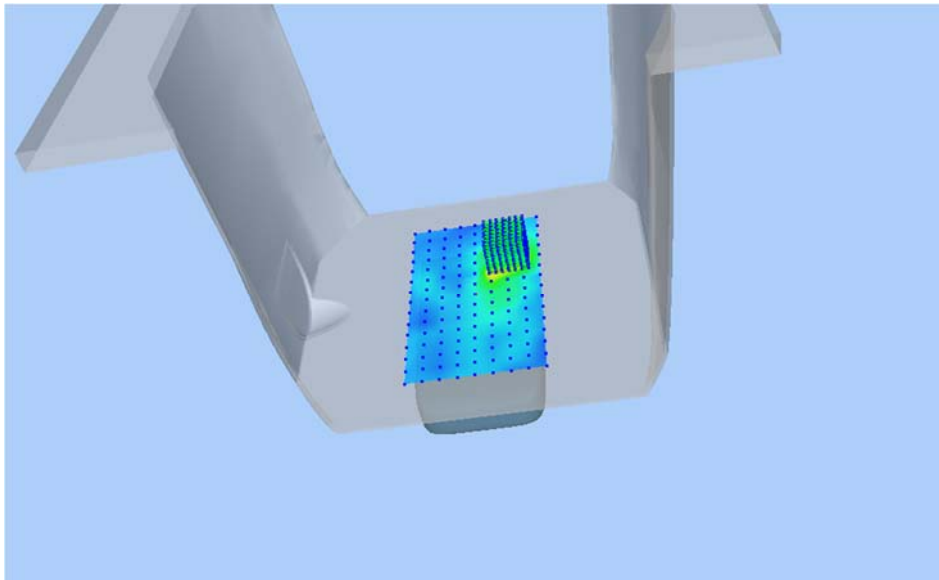


Z Axis Scan

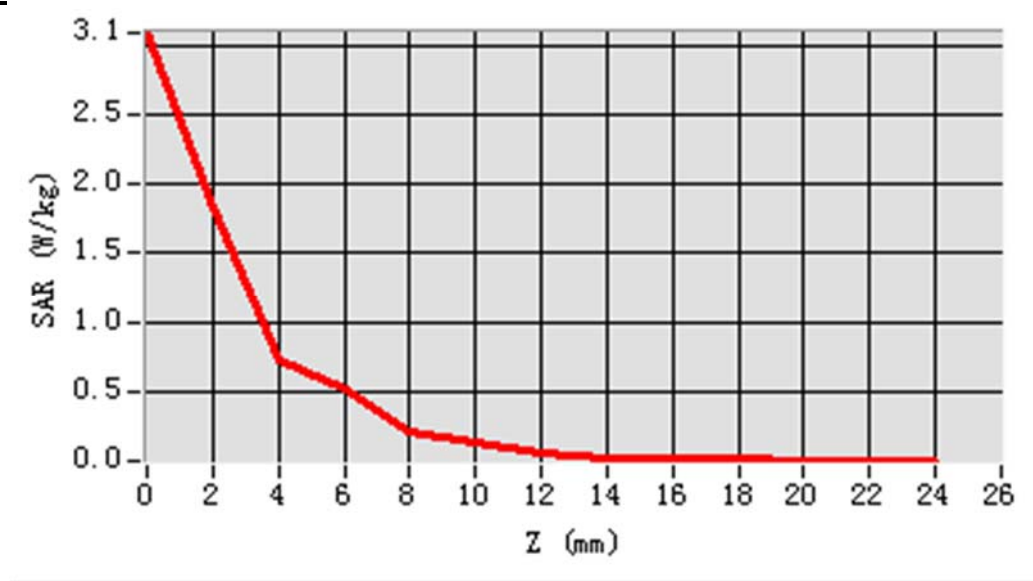


MEAS. 10 Body Plane with Back Side 0mm on Channel 64 in IEEE 802.a mode

Test Date: 25/5/2018
Measurement duration: 25 minutes 11 seconds
Signal: WLAN(a), f=5320.0 MHz, Duty Cycle: 1:1.16
Liquid Parameters: Permittivity: 48.86; Conductivity: 5.36 S/m
Test condition: Ambient Temperature: 22.3°C, Liquid Temperature: 21.0°C
Probe: SN 3117 EPGO321, ConvF: 2.24
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=20.000000, Y=28.000000
SAR 10g (W/Kg): 0.305017
SAR 1g (W/Kg): 0.869057
Power drift (%): -1.49
3D screen shot



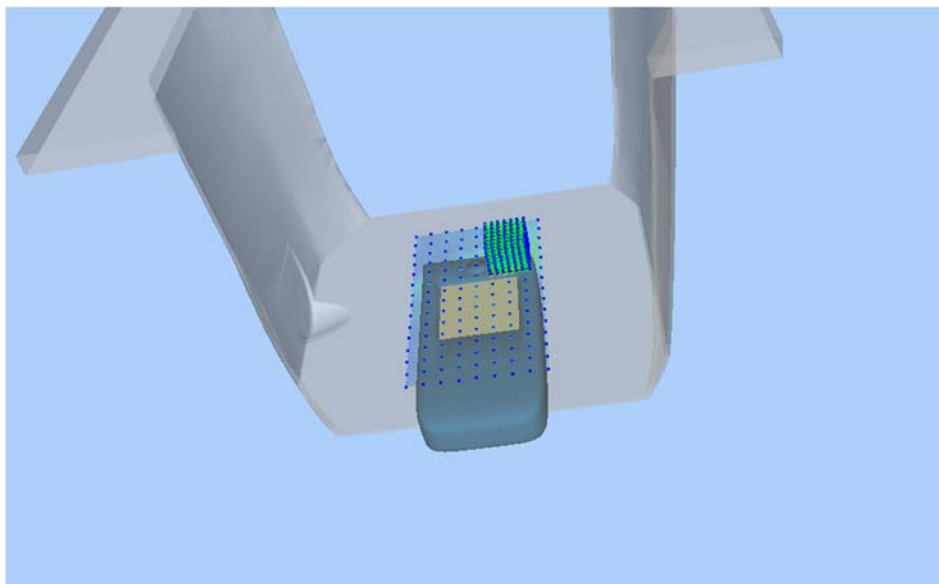
Z Axis Scan



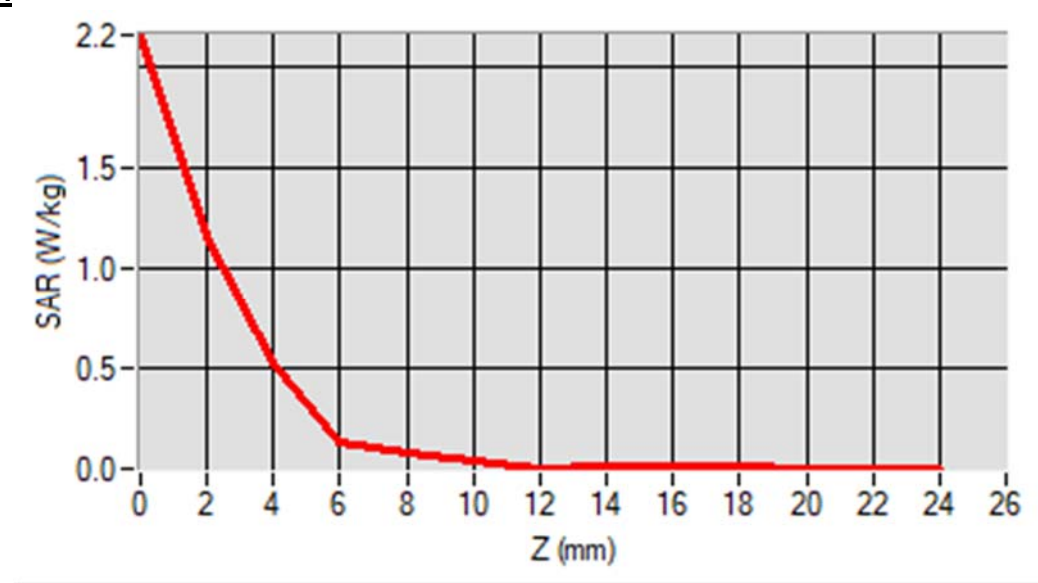
MEAS. 11 Body Plane with Back Side 0mm on Channel 100 in IEEE 802.a

mode

Test Date: 18/5/2018
Measurement duration: 25 minutes 52 seconds
Signal: WLAN(a), f=5500.0 MHz, Duty Cycle: 1:1.16
Liquid Parameters: Permittivity: 47.68; Conductivity: 5.73 S/m
Test condition: Ambient Temperature: 22.1°C, Liquid Temperature: 20.9°C
Probe: SN 3117 EPGO321, ConvF: 2.35
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=20.000000, Y=28.000000
SAR 10g (W/Kg): 0.195030
SAR 1g (W/Kg): 0.598934
Power drift (%): -2.66
3D screen shot



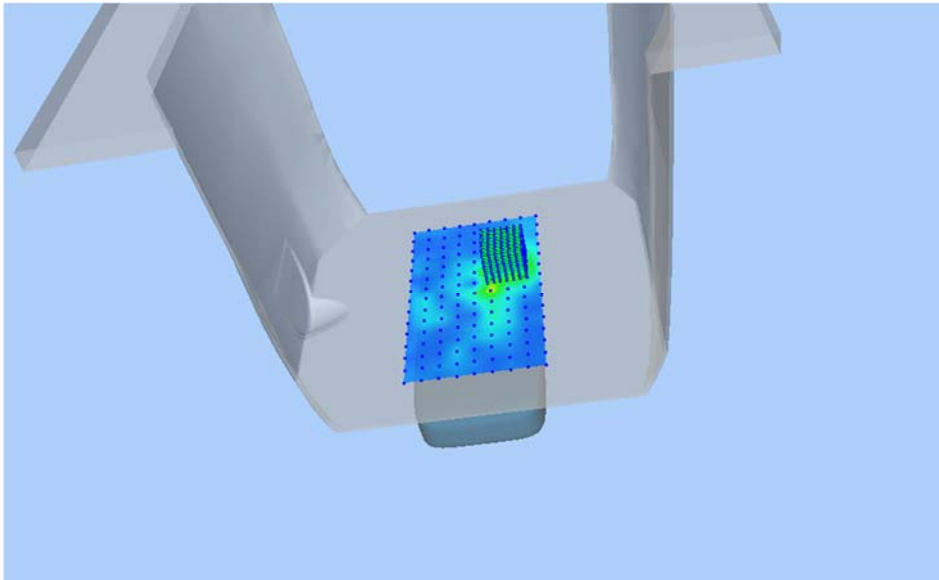
Z Axis Scan



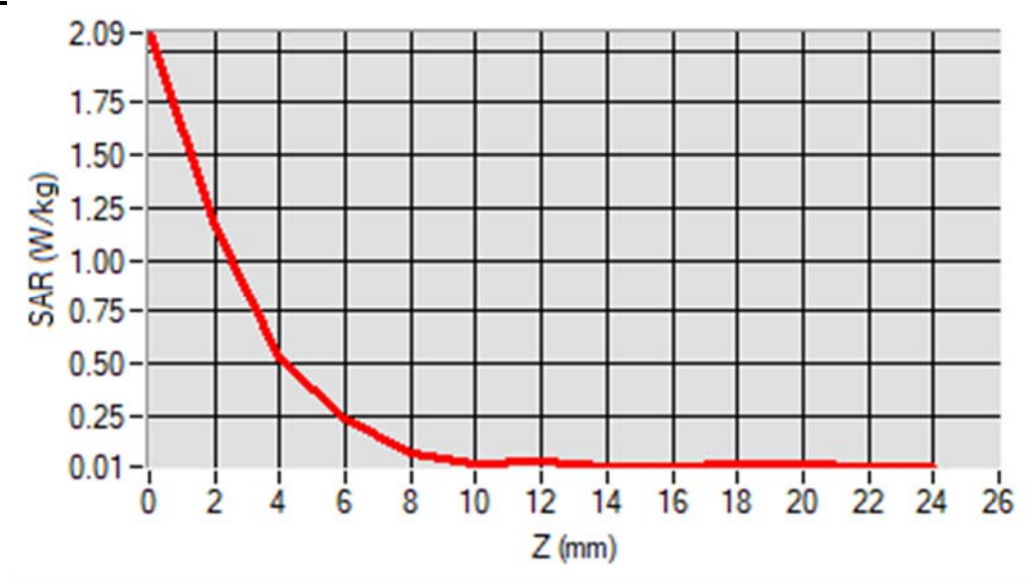
MEAS. 12 Body Plane with Back Side 0mm on Channel 165 in IEEE 802.a

mode

Test Date: 18/5/2018
Measurement duration: 26 minutes 0 seconds
Signal: WLAN(a), f=5825.0 MHz, Duty Cycle: 1:1.15
Liquid Parameters: Permittivity: 46.19; Conductivity: 6.03 S/m
Test condition: Ambient Temperature: 22.1°C, Liquid Temperature: 20.9°C
Probe: SN 3117 EPGO321, ConvF: 2.39
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan: 7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location: X=20.000000, Y=18.000000
SAR 10g (W/Kg): 0.165711
SAR 1g (W/Kg): 0.572292
Power drift (%): -1.60
3D screen shot

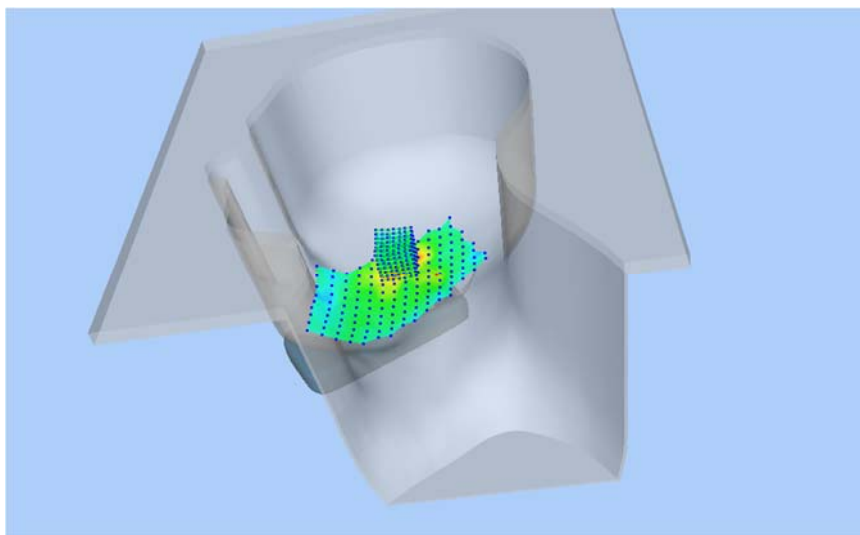


Z Axis Scan

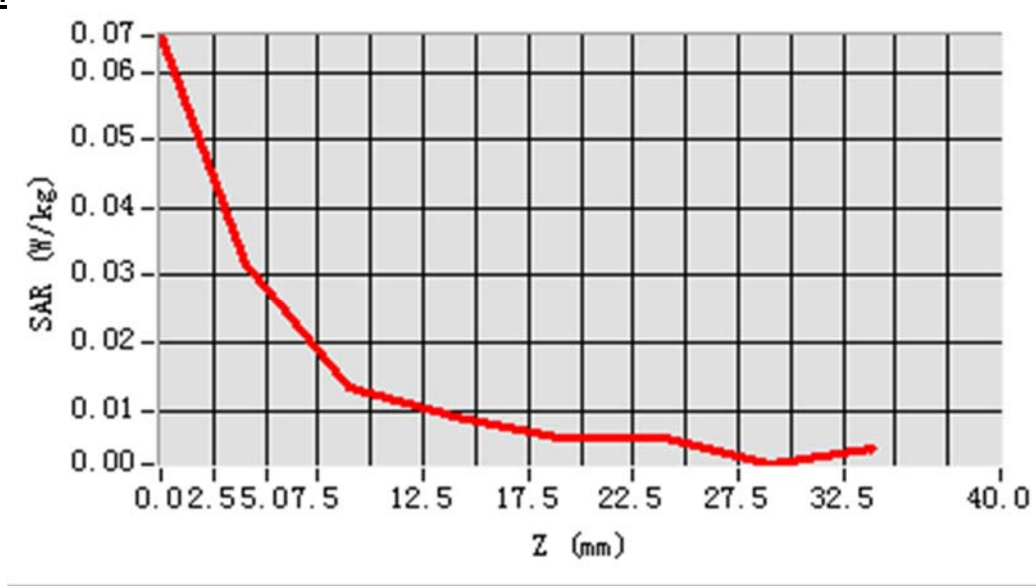


MEAS. 13 Right Head with Cheek on Middle Channel in Bluetooth 3DH5 mode

Test Date: 15/5/2018
Measurement duration: 14 minutes 8 seconds
Signal: BT, f=2441.0 MHz, Duty Cycle: 1:1.3
LiquidParameters: Permittivity: 38.58; Conductivity: 1.80 S/m
Test condition: Ambient Temperature: 22.3°C, Liquid Temperature: 21.1°C
Probe: SN 3117 EPGO321, ConvF: 2.33
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
ZoomScan: 7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location: X=-6.000000, Y=-16.000000
SAR 10g (W/Kg): 0.021949
SAR 1g(W/Kg): 0.043016
Power drift (%): -3.90
3D screen shot



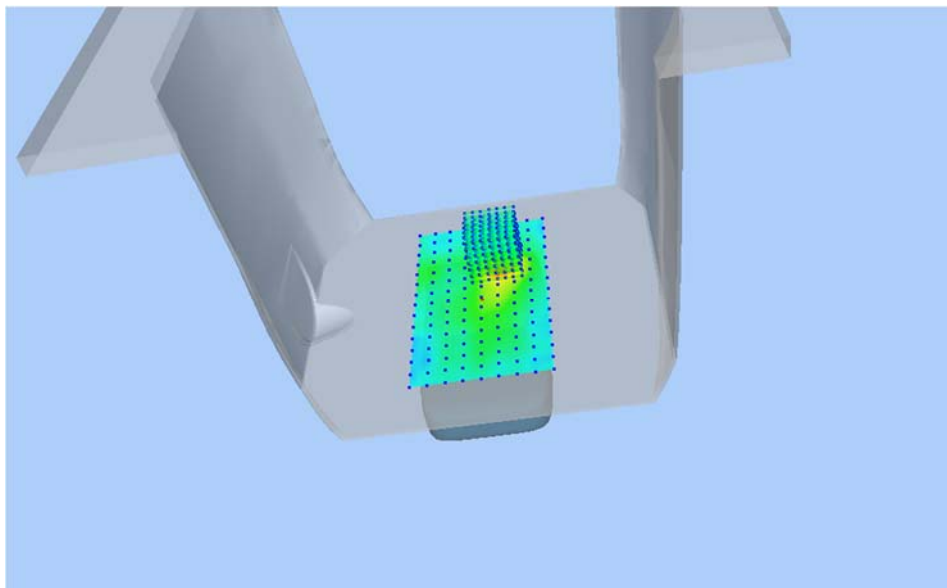
Z Axis Scan



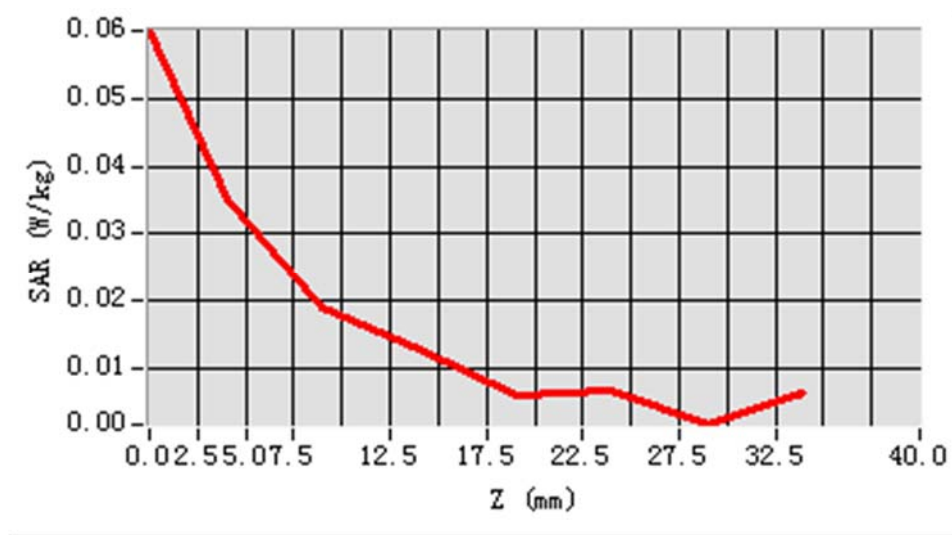
MEAS. 14 Body Plane with Back Side 10mm on Middle Channel in Bluetooth

3DH5 mode

Test Date: 17/5/2018
Measurement duration: 14 minutes 34 seconds
Signal: BT, f=2441.0 MHz, Duty Cycle: 1:1.3
LiquidParameters: Permittivity: 51.16; Conductivity: 1.97 S/m
Test condition: Ambient Temperature: 22.2°C, Liquid Temperature: 21.0°C
Probe: SN 3117 EPGO321, ConvF: 2.41
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
ZoomScan: 7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location: X=20.000000, Y=8.000000
SAR 10g (W/Kg): 0.018564
SAR 1g(W/Kg): 0.035245
Power drift (%): 1.67
3D screen shot



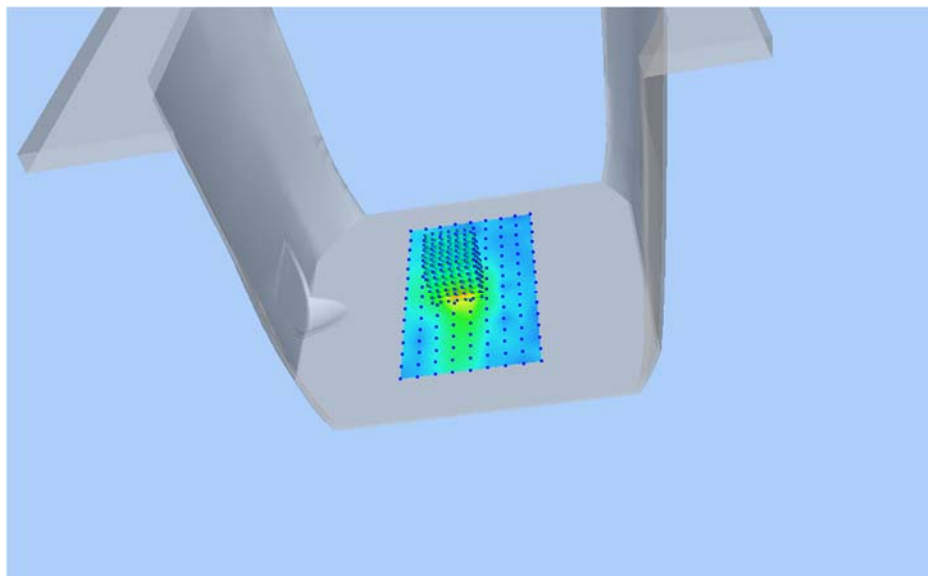
Z Axis Scan



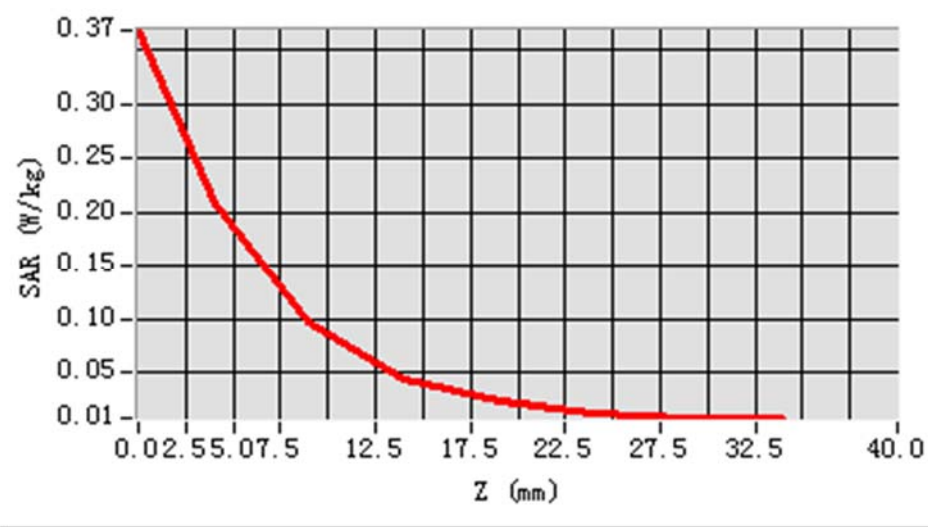
MEAS. 15 Body Plane with Left Edge 0mm on Middle Channel in Bluetooth

3DH5 mode

Test Date: 17/5/2018
Measurement duration: 14 minutes 18 seconds
Signal: BT, f=2441.0 MHz, Duty Cycle: 1:1.3
LiquidParameters: Permittivity: 51.16; Conductivity: 1.97 S/m
Test condition: Ambient Temperature: 22.2°C, Liquid Temperature: 21.0°C
Probe: SN 3117 EPGO321, ConvF: 2.41
Area Scan: sam_direct_droit2_surf10mm.txt, h= 5.00 mm
ZoomScan: 7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location: X=-10.000000, Y=8.000000
SAR 10g (W/Kg): 0.075828
SAR 1g(W/Kg): 0.188922
Power drift (%): -1.60
3D screen shot



Z Axis Scan



ANNEX D EUT EXTERNAL PHOTOS

Please refer the document "BL-EC1850176-AW.pdf".

ANNEX E SAR TEST SETUP PHOTOS

Please refer the document "BL-EC1850176-AS.pdf".

ANNEX F CALIBRATION REPORT

Please refer the document "CALIBRATION REPORT.pdf".

--END OF REPORT--