



FCC SAR TEST REPORT

Report No.: STS1906134H01

Issued for

Shenzhen AEE Aviation Technology Co.,Ltd.

AEE Hi-Tech

Park,TangtouCrossroads,SongbaiRoad,ShiyanTown,Bao'an
District Shenzhen,P.R.C.

Product Name:	MACH4 Y12
Brand Name:	AEE
Model Name:	Y12
Series Model:	N/A
FCC ID:	2AGZGY12001
Test Standard:	ANSI/IEEE Std. C95.1
	FCC 47 CFR Part 2 (2.1093)
	IEEE 1528: 2013
Max. Report SAR (1g):	Body:0.337W/kg

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Test Report Certification

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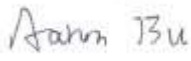
Product description


Product name : MACH4 Y12
Brand name : AEE
Model name : Y12
Series Model : N/A

Standards : ANSI/IEEE Std. C95.1-1992
FCC 47 CFR Part 2 (2.1093)
IEEE 1528: 2013

The device was tested by Shenzhen STS Test Services Co., Ltd. in accordance with the measurement methods and procedures specified in KDB 865664. The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of Test :
Date (s) of performance of tests : 29 Aug. 2019~30 Aug. 2019
Date of Issue : 02 Sep. 2019
Test Result : **Pass**

Testing Engineer : 
(Aaron Bu)

Technical Manager : 
(Jason Lu)

Authorized Signatory : 
(Vita Li)





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**Revision History**

Rev.	Issue Date	Report No.	Effect Page	Contents
00	02 Sep. 2019	STS1906134H01	ALL	Initial Issue
Note: Format version of the report-V01				





1. General Information

Environmental evaluation measurements of specific absorption rate (SAR) distributions in emulated human head and body tissues exposed to radio frequency (RF) radiation from wireless portable devices for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC).

1.1 EUT Description

Product Name	MACH4 Y12		
Brand Name	AEE		
Model Name	Y12		
Series Model	N/A		
FCC ID	2AGZGY12001		
Model Difference	N/A		
Battery	Rated Voltage: 11.1V; Charge Limit: 12.6V; Capacity:5600mAh		
Device Category	Portable		
Product stage	Production unit		
RF Exposure Environment	General Population / Uncontrolled		
Hardware Version	V1.7		
Software Version	1.0		
Frequency Range	2.4GHz:802.11b(DSSS):CCK,DQPSK,DBPSK 802.11g(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11a(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11ac(OFDM):BPSK,QPSK,16-QAM,64-QAM,256-QAM		
Max. Reported SAR(1g): (Limit:1.6W/kg)	Band	Mode	Body SAR (W/kg)
	DTS	2.4G WLAN	0.116
	DSS	2.4G SRDFrequency	0.306
	NII	5.8G WLAN	0.337
	DXX	5.8G SRD ^{Note} Frequency	0.041
FCCEquipment Class	Part 15 Spread Spectrum Transmitter (DSS) Digital Transmission System (DTS) Unlicensed National Information Infrastructure TX(NII)		
Operating Mode:	2.4G WLAN: 802.11 b/g/n(HT20); 5G WLAN: 802.11a(OFDM):BPSK,QPSK,16-QAM,64-QAM 5G WLAN: 802.11n(OFDM):BPSK,QPSK,16-QAM,64-QAM 5G WLAN: 802.11ac(OFDM):BPSK,QPSK,16-QAM,64-QAM,256-QAM		
Antenna Specification:	WIFI: PIFA Antenna WIFI Frequency: Stick Antenna		
Hotspot Mode:	Not Support		
DTM Mode:	Not Support		
Note: 1.5.8G SRDFrequency body SAR was estimated 2. The EUT battery must be fully charged and checked periodically during the test to ascertain uniformpower			



1.2 Test Environment

Ambient conditions in the SAR laboratory:

Items	Required
Temperature (°C)	18-25
Humidity (%RH)	30-70

1.3 Test Factory

ShenZhen STS Test Services Co.,Ltd.

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FCC test Firm Registration No.: 625569

IC Registration No.: 12108A

A2LA Certificate No.: 4338.01





2. Test Standards And Limits

No.	Identity	Document Title
1	47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
2	ANSI/IEEE Std. C95.1-1992	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 D01v06	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
5	FCC KDB 865664 D01v01r04	SAR Measurement 100 MHz to 6 GHz
6	FCC KDB 865664 D02 v01r02	RF Exposure Reporting
7	FCC KDB 248227 D01 Wi-Fi SAR v02r02	SAR Considerations for 802.11 Devices
8	FCC KDB 616217 D04 v01r02	SAR Evaluation Considerations for Laptop, Notebook, Netbook and MACH4 Y12 Computers

(A). Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

(B). Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

NOTE: Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments:

are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational/Controlled Environments:

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

NOTE
GENERAL POPULATION/UNCONTROLLED EXPOSURE
PARTIAL BODY LIMIT
1.6 W/kg

3. SAR Measurement System

3.1 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:

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

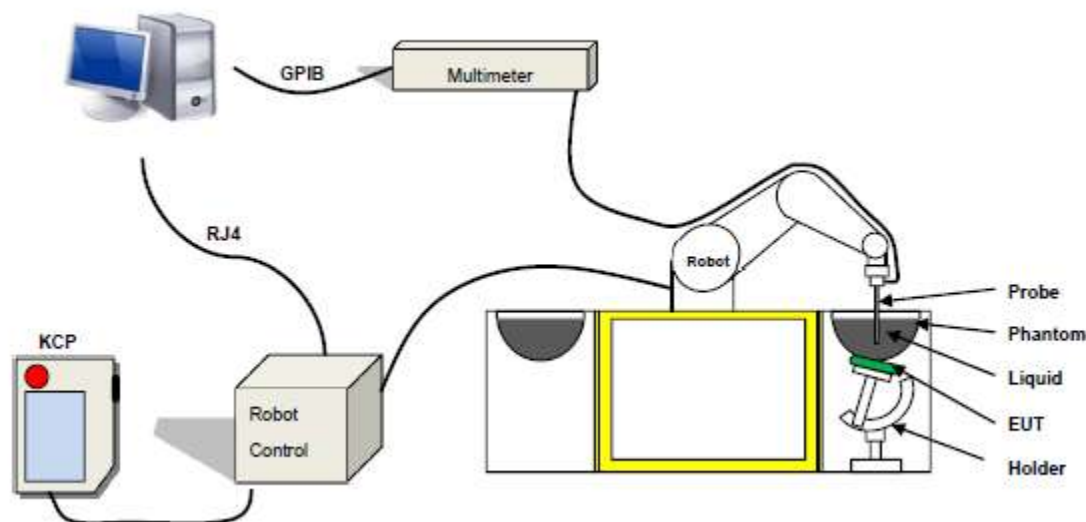
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue,
 ρ is the mass density of the tissue and E is the RMS electrical field strength.

3.2 SAR System

MVG SAR System Diagram:



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

- Main computer to control all the system
- 6 axis robot
- Data acquisition system
- Miniature E-field probe
- Phone holder
- Head simulating tissue

The following figure shows the system.



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

3.2.1 Probe

For the measurements the Specific Dosimetric E-Field Probe SN 45/15 EPGO281 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter: 2.5 mm
- Length of Individual Dipoles: 2 mm
- Maximum external diameter: 8 mm
- Distance between dipole/probe extremity: 8 mm (repeatability better than +/- 1mm)
- Probe linearity: $0 \pm 2.60\%$ (0.11dB)
- Axial Isotropy: < 0.25 dB
- Spherical Isotropy: < 0.25 dB
- Calibration range: 450 MHz to 6 GHz for head & body simulating liquid.
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°



Figure-MVG COMOSAR Dosimetric E field Dipole

3.2.2 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm \pm 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.



Figure-SN 32/14 SAM115



Figure-SN 32/14 SAM116

3.2.3 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 \pm 0.5 mm would produce a SAR uncertainty of \pm 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.



4. Tissue Simulating Liquids

4.1 Simulating Liquids Parameter Check

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Head Tissue

Frequency (MHz)	cellulose %	DGBE %	HEC %	NaCl %	Preventol %	Sugar %	X100 %	Water %	Conductivity σ	Permittivity ϵ_r
750	0.2	/	/	1.4	0.2	57.0	/	41.1	0.89	41.9
835	0.2	/	/	1.4	0.2	57.9	/	40.3	0.90	41.5
900	0.2	/	/	1.4	0.2	57.9	/	40.3	0.97	41.5
1800	/	44.5	/	0.3	/	/	30.45	55.2	1.4	40.0
1900	/	44.5	/	0.3	/	/	30.45	55.2	1.4	40.0
2000	/	44.5	/	0.3	/	/	/	55.2	1.4	40.0
2450	/	44.9	/	0.1	/	/	/	55.0	1.80	39.2
2600	/	45.0	/	0.1	/	/	/	54.9	1.96	39.0

Body Tissue

Frequency (MHz)	cellulose %	DGBE %	HEC %	NaCl %	Preventol %	Sugar %	X100 %	Water %	Conductivity σ	Permittivity ϵ_r
750	0.2	/	/	0.9	0.1	47.2	/	51.7	0.96	55.5
835	0.2	/	/	0.9	0.1	48.2	/	50.8	0.97	55.2
900	0.2	/	/	0.9	0.1	48.2	/	50.8	1.05	55.0
1800	/	29.4	/	0.4	/	/	30.45	70.2	1.52	53.3
1900	/	29.4	/	0.4	/	/	30.45	70.2	1.52	53.3
2000	/	29.4	/	0.4	/	/	/	70.2	1.52	53.3
2450	/	31.3	/	0.1	/	/	/	68.6	1.95	52.7
2600	/	31.7	/	0.1	/	/	/	68.2	2.16	52.3

Tissue dielectric parameters for head and body phantoms				
Frequency	ϵ_r		σ S/m	
	Head	Body	Head	Body
300	45.3	58.2	0.87	0.92
450	43.5	56.7	0.87	0.94
900	41.5	55.0	0.97	1.05
1450	40.5	54.0	1.20	1.30
1800	40.0	53.3	1.40	1.52
2450	39.2	52.7	1.80	1.95
3000	38.5	52.0	2.40	2.73
5800	35.3	48.2	5.27	6.00

**LIQUID MEASUREMENT RESULTS**

Date	Ambient condition		Body Simulating Liquid		Parameters	Target	Measured	Deviation [%]	Limited [%]
	Temp. [°C]	Humidity [%]	Frequency	Temp. [°C]					
2019-08-29	23.1	49	2450 MHz	22.8	Permittivity:	52.70	52.11	-1.12	± 5
					Conductivity	1.95	1.93	-1.03	± 5
2019-08-30	23.4	50	5800 MHz	23.1	Permittivity:	48.2	48.86	1.37	± 5
					Conductivity:	6.00	5.97	-0.50	± 5

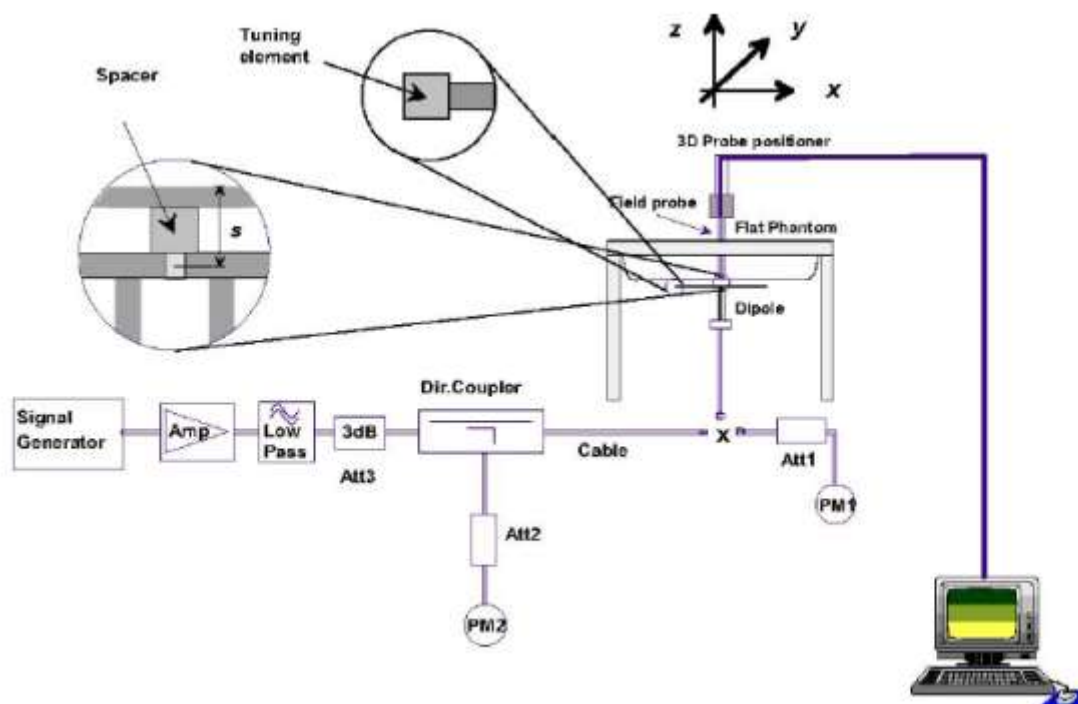


5. SAR System Validation

5.1 Validation System

Each MVG system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the MVG software, enable the user to conduct the system performance check and system validation. System kit includes a dipole, and dipole device holder.

The system check verifies that the system operates within its specifications. It's performed daily or before every SAR measurement. The system check uses normal SAR measurement in the flat section of the phantom with a matched dipole at a specified distance. The system validation setup is shown as below.



5.2 Validation Result

Comparing to the original SAR value provided by MVG, the validation data should be within its specification of 10 %.

Freq.(MHz)	Power(mW)	Tested Value(W/Kg)	Normalized SAR (W/kg)	Target(W/Kg)	Tolerance(%)	Date
2450Body	100	5.264	52.64	52.4	0.46	2019-08-29
5800 Body	100	17.459	174.59	181.2	-3.65	2019-08-30

Note: The tolerance limit of System validation $\pm 10\%$.



6. SAR Evaluation Procedures

The procedure for assessing the average SAR value consists of the following steps:

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 16 mm * 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.

Area Scan & Zoom Scan:

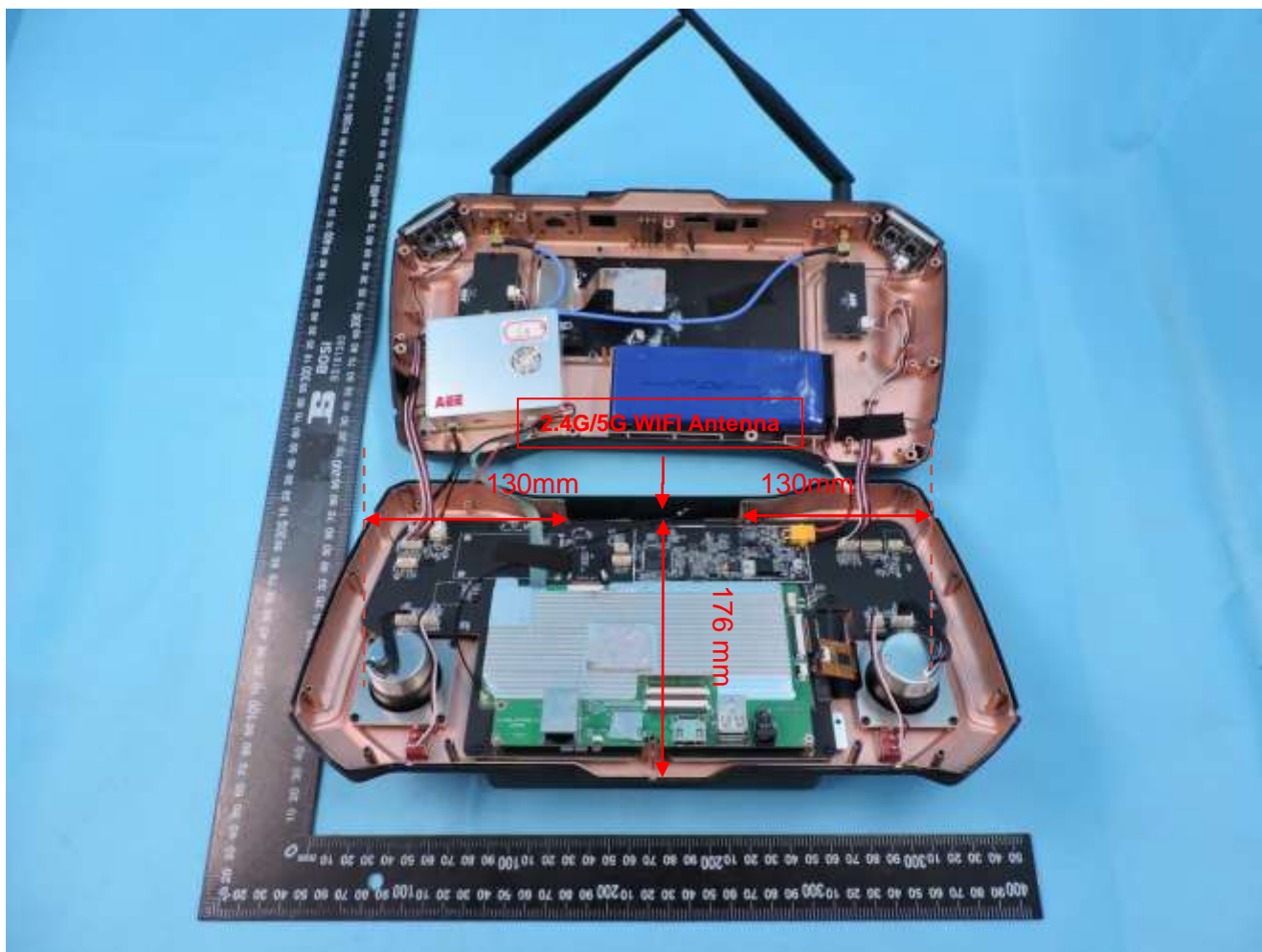
First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan 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 D01v01r01 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. EUT Antenna Location Sketch

It is a MACH4 Y12, Support 2.4G/5G WLAN, 2.4G/5G SRD





Note 1: The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report.

Band	Test position configurations			
	Back	Right edge	Left edge	Bottom edge
2.4G/5G SRD	0mm	60mm	270mm	180mm

Band	Test position configurations			
	Back	Right edge	Left edge	Bottom edge
2.4G/5G WLAN	0mm	130mm	130mm	176mm



7.1 SAR test exclusion consider table

The SAR evaluation of Maximum power (dBm) summing tolerance

Exposure Position	Wireless Interface	2.4G SRD Frequency	5.8G SRD Frequency
	Calculated Frequency	2473	5783
	Maximum power (dBm)	15	-2
	Maximum rated power(mW)	31.623	0.631
Back	Separation distance (mm)	0	0
	exclusion threshold	10	6
	Testing required?	YES	YES
Right edge	Separation distance (mm)	60	60
	exclusion threshold	196	162
	Testing required?	NO	NO
Left edge	Separation distance (mm)	270	270
	exclusion threshold	/	/
	Testing required?	NO	NO
Bottom edge	Separation distance (mm)	180	180
	exclusion threshold	1396	1362
	Testing required?	NO	NO

Exposure Position	Wireless Interface	2.4G WIFI	5.8G WIFI
	Calculated Frequency	2462	5825
	Maximum power (dBm)	13	14
	Maximum rated power(mW)	19.953	25.119
Back	Separation distance (mm)	0	0
	exclusion threshold	10	6
	Testing required?	YES	YES
Right edge	Separation distance (mm)	162	162
	exclusion threshold	1216	1182
	Testing required?	NO	NO
Left edge	Separation distance (mm)	130	130
	exclusion threshold	896	862
	Testing required?	NO	NO
Bottom edge	Separation distance (mm)	178	178
	exclusion threshold	1376	1342
	Testing required?	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 <25mm, 25mm 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 distance $\leq 50\text{mm}$ are determined by:
$$[(\text{max. power of channel, including tune-up tolerance, Mw}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR}$$
$$f(\text{GHz}) \text{ is the RF channel transmit frequency in GHz. Power and distance are rounded to the nearest mW and mm before calculation. The result is rounded to one decimal place for comparison}$$

For <50mm distance, we just calculate mW of the exclusion threshold value (3.0) to do compare
5. per KDB 447498 D01, at 100 MHz to 6GHz and for test separation distances >50mm, the SAR test exclusion threshold is determined according to the following
 - a) [threshold at 50mm in step 1] + (test separation distance - 50mm) * (f (MHz)/150)] mW, at 100 MHz to 1500 MHz
 - b) [threshold at 50mm in step 1] + (test separation distance - 50mm) * 10] mW at > 1500MHz and $\leq 6\text{GHz}$
6. Per KDB 248227 D01, choose the highest output power channel to test SAR and determine further SAR exclusion. 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 lower data rate than 11b mode, thus the SAR can be excluded.
7. Per KDB 616217 D04, SAR evaluations for the front surface of tablet display screens are generally not necessary.

8. EUT Test Position

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 Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. When the same wireless transmission configuration is used for testing body-worn accessory and hotspot mode SAR, respectively, in voice and data mode, SAR results for the most conservative *test separation distance* configuration may be used to support both SAR conditions. 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 the body-worn accessory with a headset attached to the handset.





9. Uncertainty

9.1 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in IEEE 1528: 2013. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Uncertainty Component	Tol (+/- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+/-%)	10g Ui (+/-%)	vi
Measurement System								
Probe calibration	5.831	N	1	1	1	5.83	5.83	∞
Axial Isotropy	0.695	R	$\sqrt{3}$	$\sqrt{0.5}$	$\sqrt{0.5}$	0.28	0.28	∞
Hemispherical Isotropy	1.045	R	$\sqrt{3}$	$\sqrt{0.5}$	$\sqrt{0.5}$	0.43	0.43	∞
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	0.685	R	$\sqrt{3}$	1	1	0.40	0.40	∞
System detection limits	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Readout Electronics	0.021	N	1	1	1	0.021	0.021	∞
Response Time	0	R	$\sqrt{3}$	1	1	0	0	∞
Integration Time	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF ambient conditions-Noise	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient conditions-reflections	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner mechanical tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Post-processing	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Test sample Related								
Test sample positioning	2.6	N	1	1	1	2.6	2.6	∞
Device holder uncertainty	3	N	1	1	1	3	3	∞
SAR drift measurement	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
SAR scaling	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Phantom and tissue parameters								
Phantom uncertainty (shape and thickness uncertainty)	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity (temperature uncertainty)	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid conductivity (measured)	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity (temperature uncertainty)	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Liquid permittivity (measured)	5	N	1	0.23	0.26	1.15	1.30	M
Combined Standard Uncertainty		RSS				9.79	9.59	
Expanded Uncertainty (95% Confidence interval)		K=2				19.58	19.18	



9.2 System validation Uncertainty

Uncertainty Component	Tol (+-%)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	vi
Measurement System								
Probe calibration	5.831	N	1	1	1	5.83	5.83	∞
Axial Isotropy	0.695	R	$\sqrt{3}$	1	1	0.40	0.40	∞
Hemispherical Isotropy	1.045	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	0.685	R	$\sqrt{3}$	1	1	0.40	0.40	∞
System detection limits	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Readout Electronics	0.021	N	1	1	1	0.021	0.021	∞
Response Time	0.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Integration Time	1.4	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient conditions-Noise	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient conditions-reflections	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner mechanical tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Post-Processing	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
System validation source								
Deviation of experimental dipole from numerical dipole	5.0	N	1	1	1	5.00	5.00	∞
Input power and SAR drift measurement	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Other source contribution Uncertainty	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and set-up								
Phantom uncertainty (shape and thickness uncertainty)	4.0	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity (temperature uncertainty)	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid conductivity (measured)	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity (temperature uncertainty)	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Liquid permittivity (measured)	5	N	1	0.23	0.26	1.15	1.30	M
Combined Standard Uncertainty		RSS				9.718	9.517	
Expanded Uncertainty (95% Confidence interval)		K=2				19.44	19.04	



10. Conducted Power Measurement

10.1 Test Result

2.4G WLAN

Mode	Channel Number	Frequency (MHz)	Average Power (dBm)
802.11b	1	2412	12.92
	6	2437	12.91
	11	2462	12.91
802.11g	1	2412	12.17
	6	2437	12.05
	11	2462	12.24
802.11n(HT 20)	1	2412	11.82
	6	2437	11.69
	11	2462	11.52

2.4G SRD Frequency

Mode	Frequency (MHz)	Average Power (dBm)
GFSK(1M)	2405	14.54
	2441	13.94
	2473	14.01

**5.8G WLAN**

Mode	Channel Number	Frequency (MHz)	Average Power (dBm)
802.11a	149	5745	13.82
	157	5785	13.67
	165	5825	13.57
802.11 n-HT20	149	5745	13.36
	157	5785	13.38
	165	5825	13.08
802.11 n-HT40	151	5755	13.21
	159	5795	12.94
802.11ac-HT20	149	5745	13.38
	157	5785	13.24
	165	5825	13.05
802.11ac-HT40-	151	5755	13.14
	159	5795	12.88
802.11ac-HT80-	155	5775	10.20

5.8G SRDFrequency

Mode	Antenna Direction	Channel Number	Frequency (MHz)	Average Power (dBm)
GFSK	Horizontal	01	5731	-2.58
	Vertical			-2.33
	Horizontal	10	5751	-3.94
	Vertical			-3.46
	Horizontal	18	5783	-2.52
	Vertical			-2.79



10.2 Tune-up Power

Mode	2.4G WLAN Frequency(AVG)
IEEE 802.11b	12±1dBm
IEEE 802.11g	12±1dBm
IEEE 802.11n(HT 20)	11±1dBm

Mode	2.4G SRD Frequency(AVG)
GFSK(1M)	14±1dBm

Mode	5.8G WLAN(AVG)
IEEE 802.11a	13±1dBm
IEEE 802.11n(HT 20)	13±1dBm
IEEE 802.11n(HT 40)	13±1dBm
IEEE 802.11ac(HT 20)	13±1dBm
IEEE 802.11ac(HT 40)	13±1dBm
IEEE 802.11ac(HT 80)	10±1dBm

Mode	Antenna Direction	5.8G SRD Frequency (AVG)
GFSK	Horizontal	-3±1dBm
	Vertical	-3±1dBm



10.3 SAR Test Exclusions Applied

Per FCC KDB 447498D01, the 1-g SAR 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, where:

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

$$\frac{\text{Max Power of Channel (mW)}}{\text{Test Separation Dist (mm)}} * \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

Based on the maximum conducted power of **2.4 GHz WLAN Body** (rounded to the nearest mW) and the antenna to user separation distance,

2.4 GHz WLAN SAR was required; $[(19.953/5) * \sqrt{2.462}] = 6.26 > 3.0$.

Based on the maximum conducted power of **2.4 GHz WLAN Frequency Body** (rounded to the nearest mW) and the antenna to user separation distance,

2.4 GHz SRD SAR was required; $[(31.623/5) * \sqrt{2.462}] = 9.92 > 3.0$.

Based on the maximum conducted power of **5.8 GHz WLAN Body** (rounded to the nearest mW) and the antenna to user separation distance,

5.8 GHz WLAN SAR was required; $[(25.119/5) * \sqrt{5.800}] = 12.10 > 3.0$.

Based on the maximum conducted power of **5.8 GHz WLAN Frequency Body** (rounded to the nearest mW) and the antenna to user separation distance,

5.8 GHz SRD SAR was not required; $[(0.631/5) * \sqrt{5.800}] = 0.30 < 3.0$.

11. EUT And Test Setup Photo

11.1 EUT Photo

Front side



Back side



Top side



Bottom side



Left side



Right side



11.2 Setup Photo

Body Back side(separation distance is 0mm)



Body Back side(separation distance is 0mm)_the antennas at 90 degrees

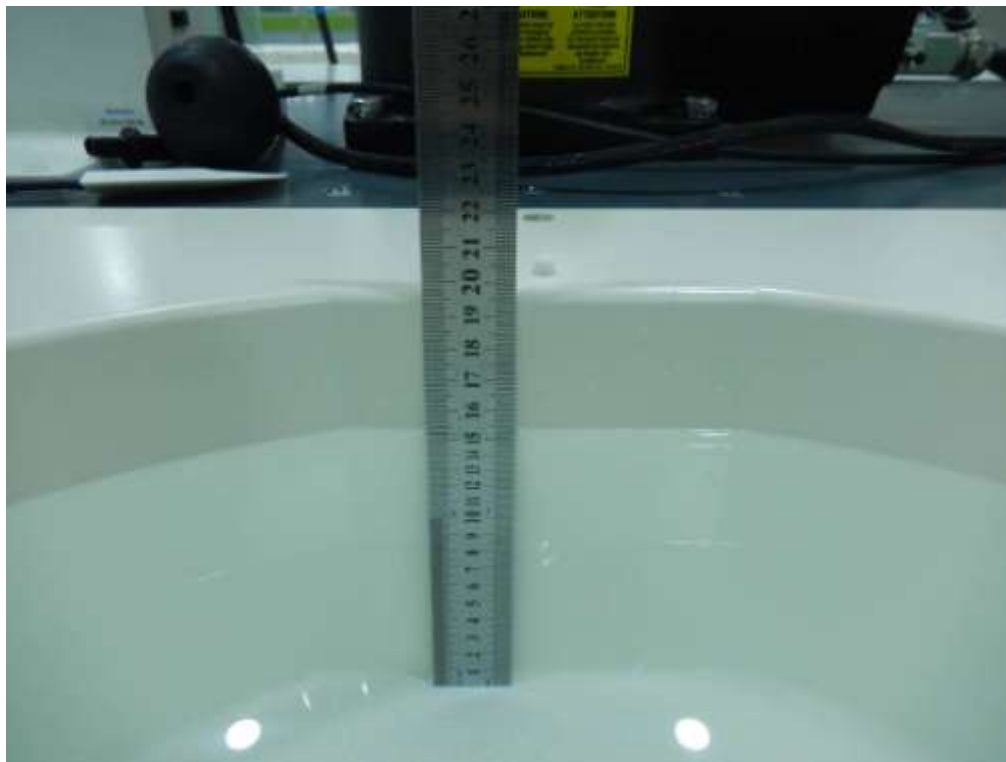




Body Back side(separation distance is 0mm)_the antennas at straight



Liquid depth (15 cm)





12. SAR Result Summary

12.1 Body SAR

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11b	Body Back	11	0.114	-3.13	13	12.92	100	0.116	1
		Back side 90 degrees	11	0.013	-1.79	13	12.92	100	0.013	/
		Back side straight	11	0.079	0.97	13	12.92	100	0.080	/
WLAN 5.8G	802.11a	Body Back	165	0.323	-2.90	14	13.82	100	0.337	3
		Back side 90 degrees	165	0.101	3.62	14	13.82	100	0.105	/
		Back side straight	165	0.248	-1.70	14	13.82	100	0.258	/

2.4G WLAN Frequency

Band	Mode	Test Position	Fre	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
2.4G SRD	GFSK	Body Back	2405	0.275	2.90	15	14.54	100	0.306	2
		Back side 90 degrees	2405	0.049	-1.72	15	14.54	100	0.054	/
		Back side straight	2405	0.142	2.93	15	14.54	100	0.158	/

Note:

- The test separation of all above table is 0mm.
- Per KDB 447498 D01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
 - Scaled SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor

Estimated SAR		Maximum Power		Antenna to user(mm)	Frequency(GHz)	Stand alone SAR(1g) [W/kg]
		dBm	mW			
5.8G SRD Frequency	Body	-2	0.631	5	2.480	0.041



13. Equipment List

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
2450MHz Dipole	MVG	SID2450	SN 30/14 DIP2G450-335	2017.08.15	2020.08.14
Waveguide	SATIMO	SWG5500	SN 13/14 WGA32	2017.08.15	2020.08.14
E-Field Probe	MVG	SSE2	SN 45/15 EPGO281	2019.03.25	2020.03.24
Dielectric Probe Kit	MVG	SCLMP	SN 32/14 OCPG67	2018.12.02	2019.12.01
Antenna	MVG	ANTA3	SN 07/13 ZNTA52	N/A	N/A
Phantom1	MVG	SAM	SN 32/14 SAM115	N/A	N/A
Phantom2	MVG	SAM	SN 32/14 SAM116	N/A	N/A
Phone holder	MVG	N/A	SN 32/14 MSH97	N/A	N/A
Laptop holder	MVG	N/A	SN 32/14 LSH29	N/A	N/A
Attenuator	Agilent	99899	DC-18GHz	N/A	N/A
Directional coupler	Narda	4226-20	3305	N/A	N/A
Network Analyzer	Agilent	8753ES	US38432810	2019.03.02	2020.03.01
Multi Meter	Keithley	Multi Meter 2000	4050073	2018.10.13	2019.10.12
Signal Generator	Agilent	N5182A	MY50140530	2018.10.16	2019.10.15
Wireless Communication Test Set	Agilent	8960-E5515C	MY48360751	2018.10.16	2019.10.15
Wireless Communication Test Set	R&S	CMW500	117239	2018.10.13	2019.10.12
Power Amplifier	DESAY	ZHL-42W	9638	2018.10.13	2019.10.12
Power Meter	R&S	NRP	100510	2018.10.26	2019.10.25
Power Meter	Agilent	E4418B	GB43312526	2018.10.26	2019.10.25
Power Sensor	R&S	NRP-Z11	101919	2018.10.13	2019.10.12
Power Sensor	Agilent	E9301A	MY41497725	2018.10.13	2019.10.12
hygrothermograph	MiEO	HH660	N/A	2018.10.11	2019.10.10
Thermograph	Elitech	RC-4	S/N EF7176501537	2018.10.15	2019.10.14

Note:

Per KDB 865664 D01, Dipole SAR Validation Verification, STS 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

Return-loss in within 20% of calibrated measurement



Appendix A. System Validation Plots

System Performance Check Data (2450MHz Body)

Type: Phone measurement (Complete)

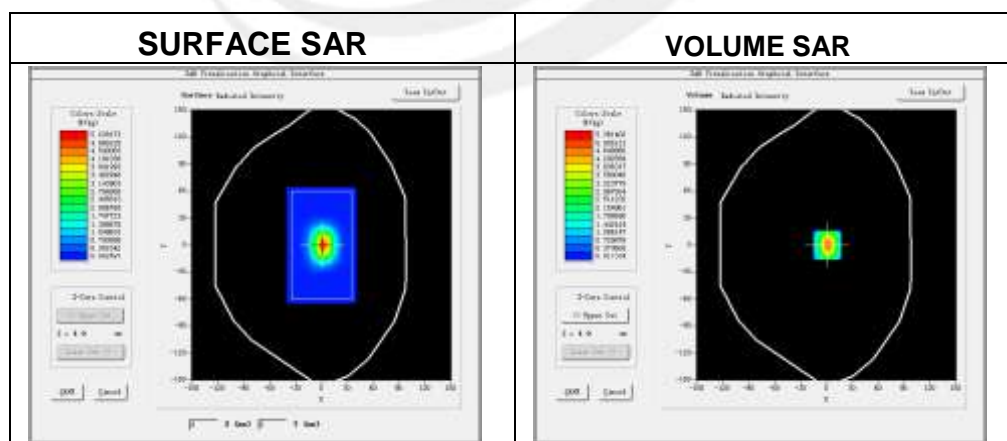
Area scan resolution: dx=8mm, dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2019-08-29

Experimental conditions.

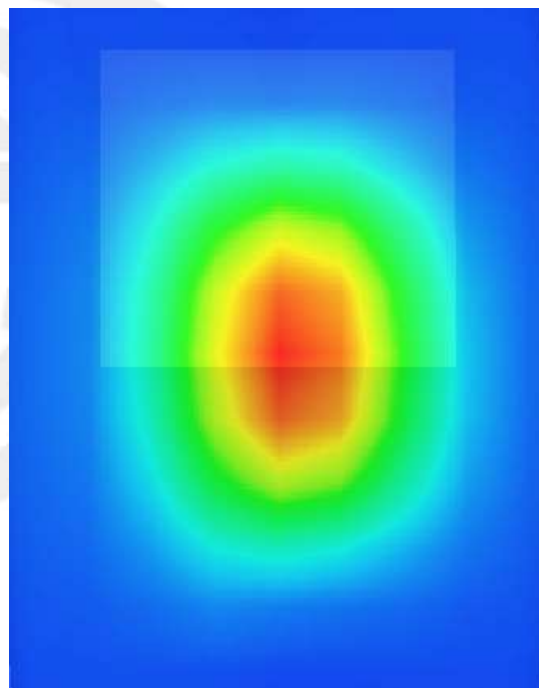
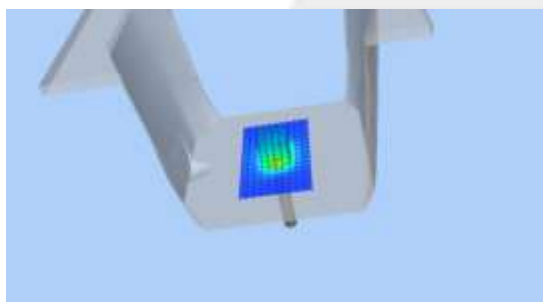
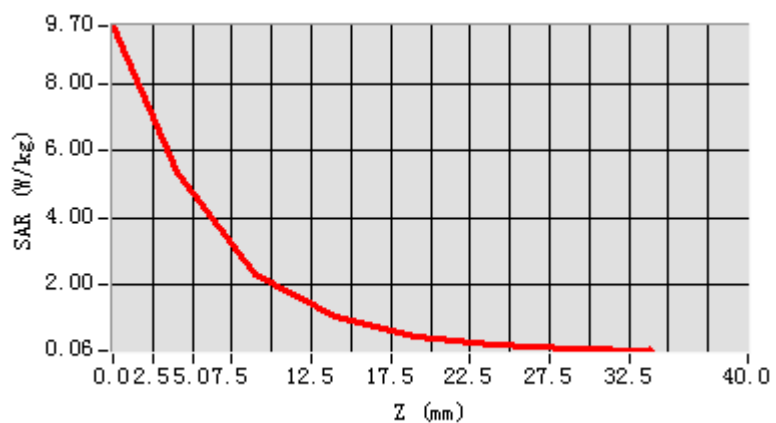
Device Position	Validation plane
Band	2450MHz
Channels	-
Signal	CW
Frequency (MHz)	2450
Relative permittivity	52.11
Conductivity (S/m)	1.93
Power drift (%)	-0.30
Probe	SN 45/15 EPGO281
ConvF	2.28
Crest factor:	1:1



Maximum location: X=1.00, Y=0.00

SAR 10g (W/Kg)	2.441262
SAR 1g (W/Kg)	5.264129

Z Axis Scan



**System Performance Check Data(5800MHz Body)**

Type: Dipole measurement (Complete)

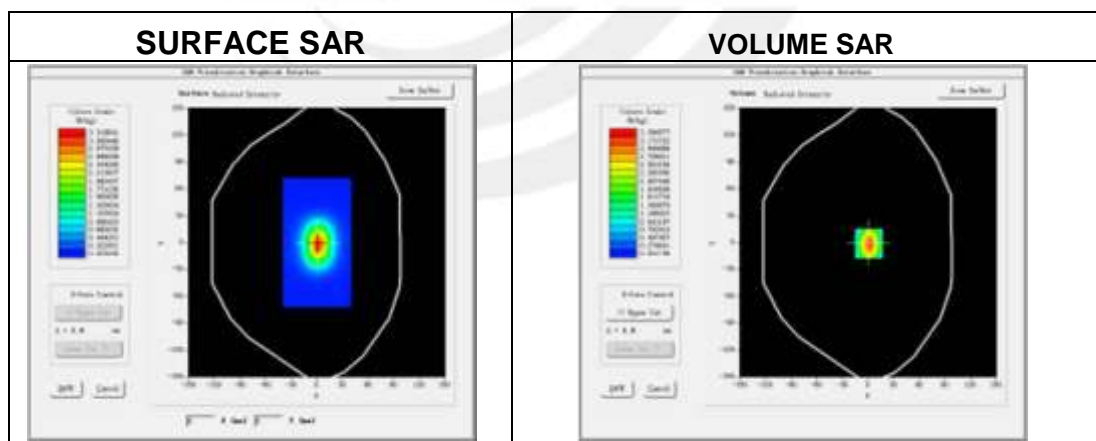
Area scan resolution: dx=8mm,dy=8mm

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

Date of measurement: 2019-08-30

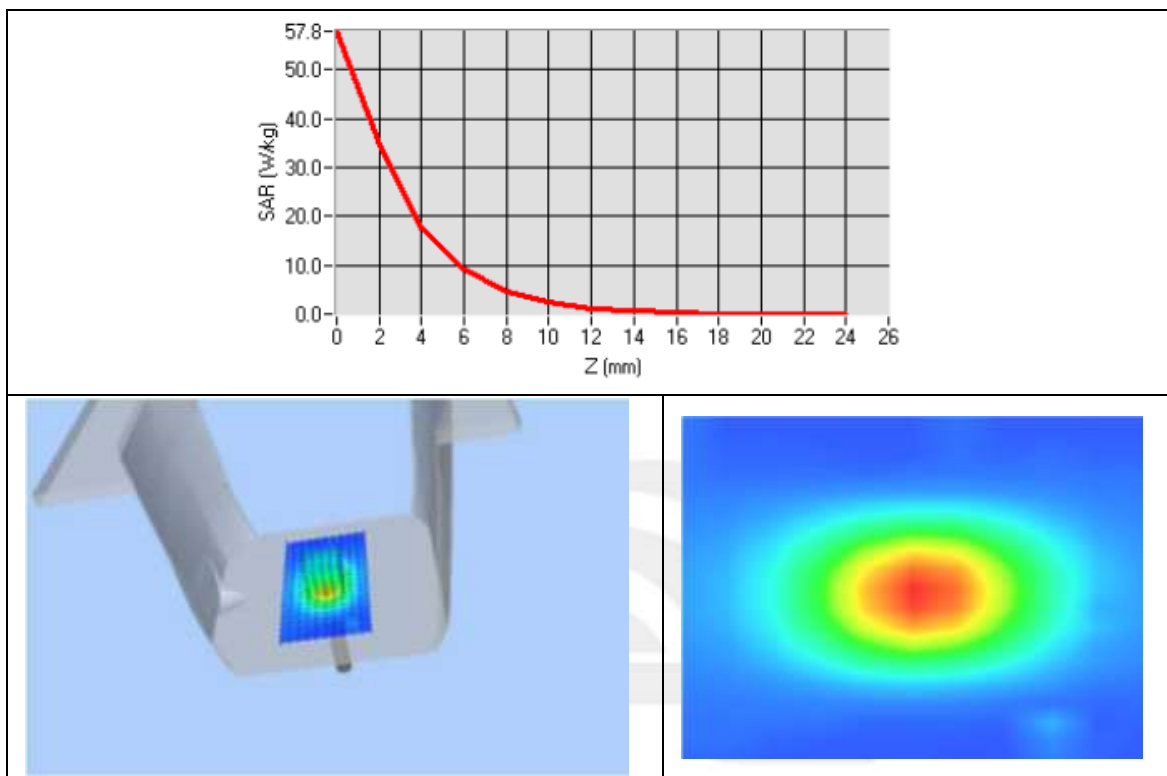
Experimental conditions.

Device Position	Validation plane
Band	5800 MHz
Channels	-
Signal	CW
Frequency (MHz)	5800
Relative permittivity	48.86
Conductivity (S/m)	5.97
Power drift (%)	-1.00
Probe	SN 45/15EPGO281
ConvF	2.60
Crest factor:	1:1

**Maximum location: X=7.00, Y=2.00**

SAR 10g (W/Kg)	6.103257
SAR 1g (W/Kg)	17.458964

Z Axis Scan





Appendix B. SAR Test Plots

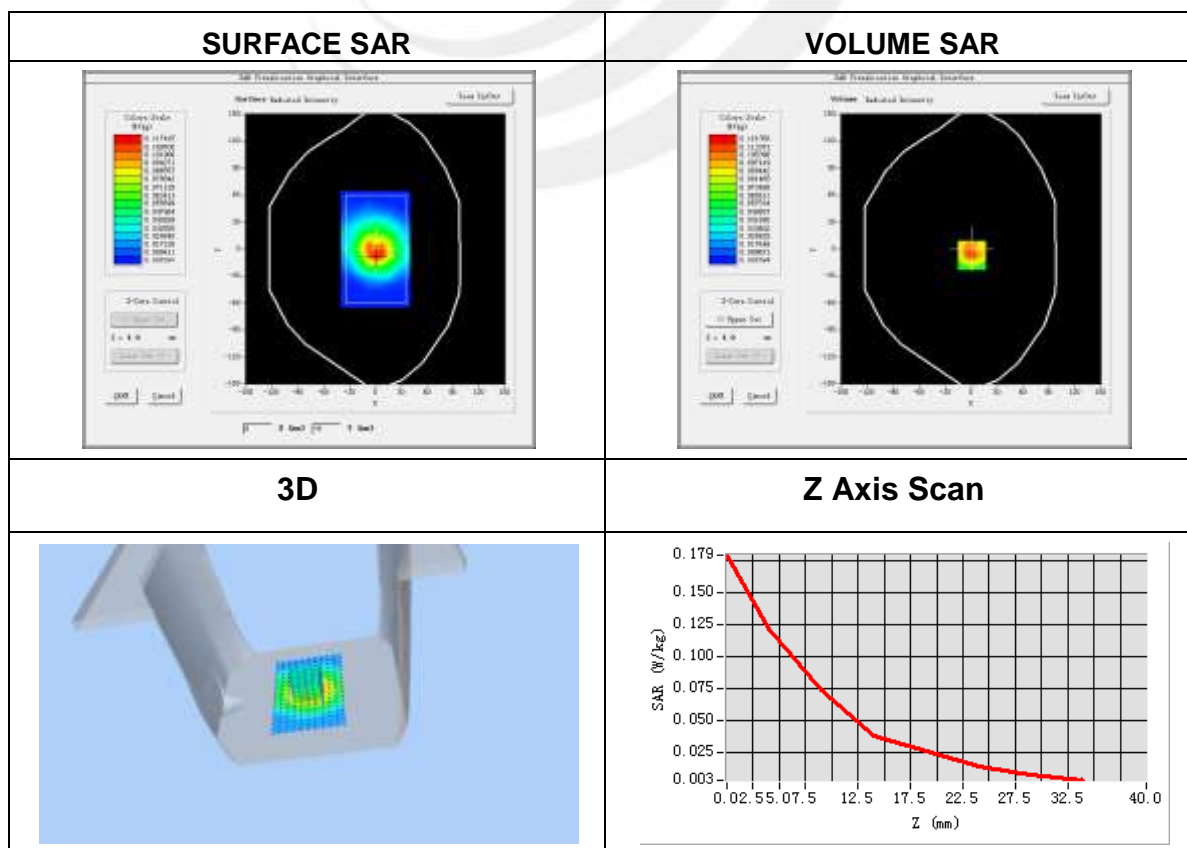
Plot 1: DUT: MACH4 Y12; EUT Model: Y12

Test Date	2019-08-29
Probe	SN 45/15EPGO281
ConvF	2.28
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7, dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	BodyBack side
Band	IEEE 802.11b
Channels	High
Signal	IEEE802.b (Crest factor: 1.0)
Frequency (MHz)	2462
Relative permittivity (real part)	52.70
Conductivity (S/m)	1.95
Variation (%)	-3.13

Maximum location: X=1.00, Y=-7.00

SAR Peak: 0.19 W/kg

SAR 10g (W/Kg)	0.062734
SAR 1g (W/Kg)	0.113709



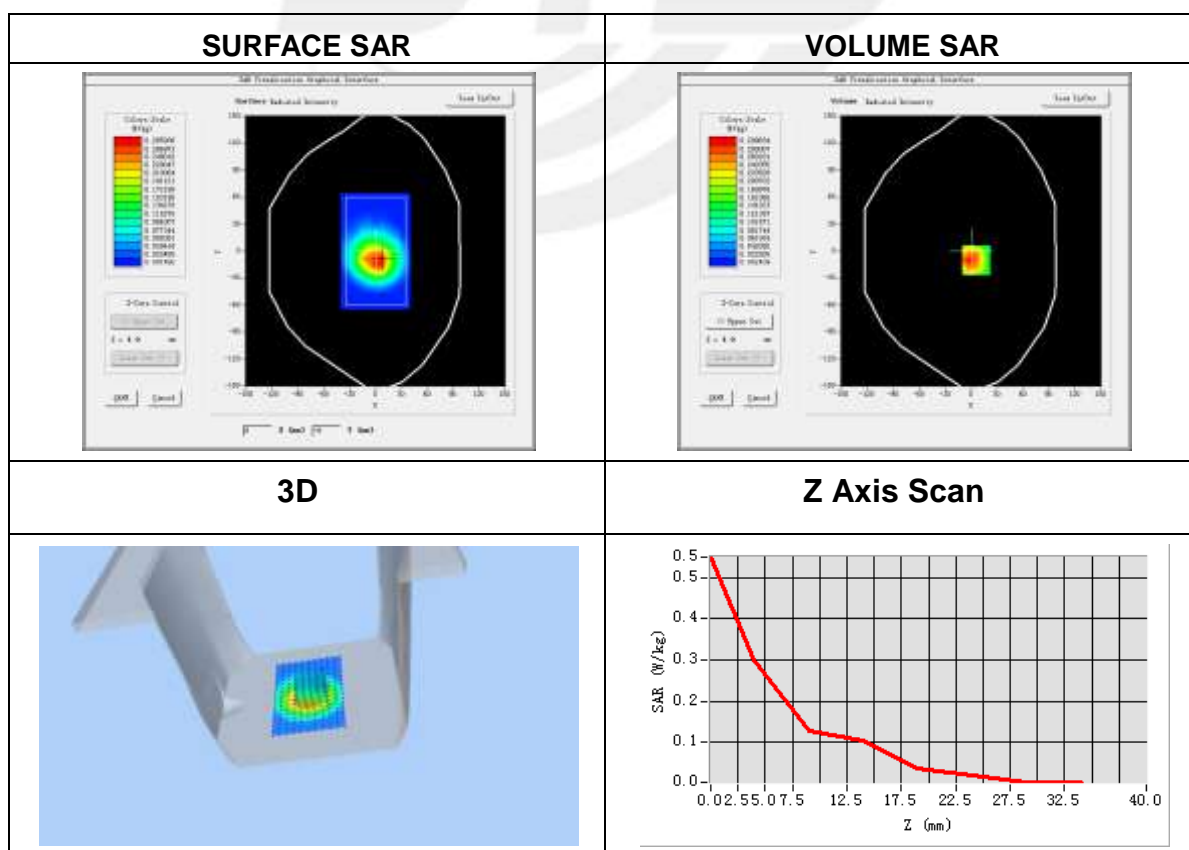
Plot 2: DUT: MACH4 Y12; EUT Model: Y12

Test Date	2019-08-29
Probe	SN 45/15EPGO281
ConvF	2.28
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	BodyBack side
Band	2.4G WLAN Frequency
Channels	Low
Signal	GFSK
Frequency (MHz)	2405
Relative permittivity (real part)	52.70
Conductivity (S/m)	1.95
Variation (%)	2.93

Maximum location: X=6.00, Y=-10.00

SAR Peak: 0.44 W/kg

SAR 10g (W/Kg)	0.152931
SAR 1g (W/Kg)	0.275119



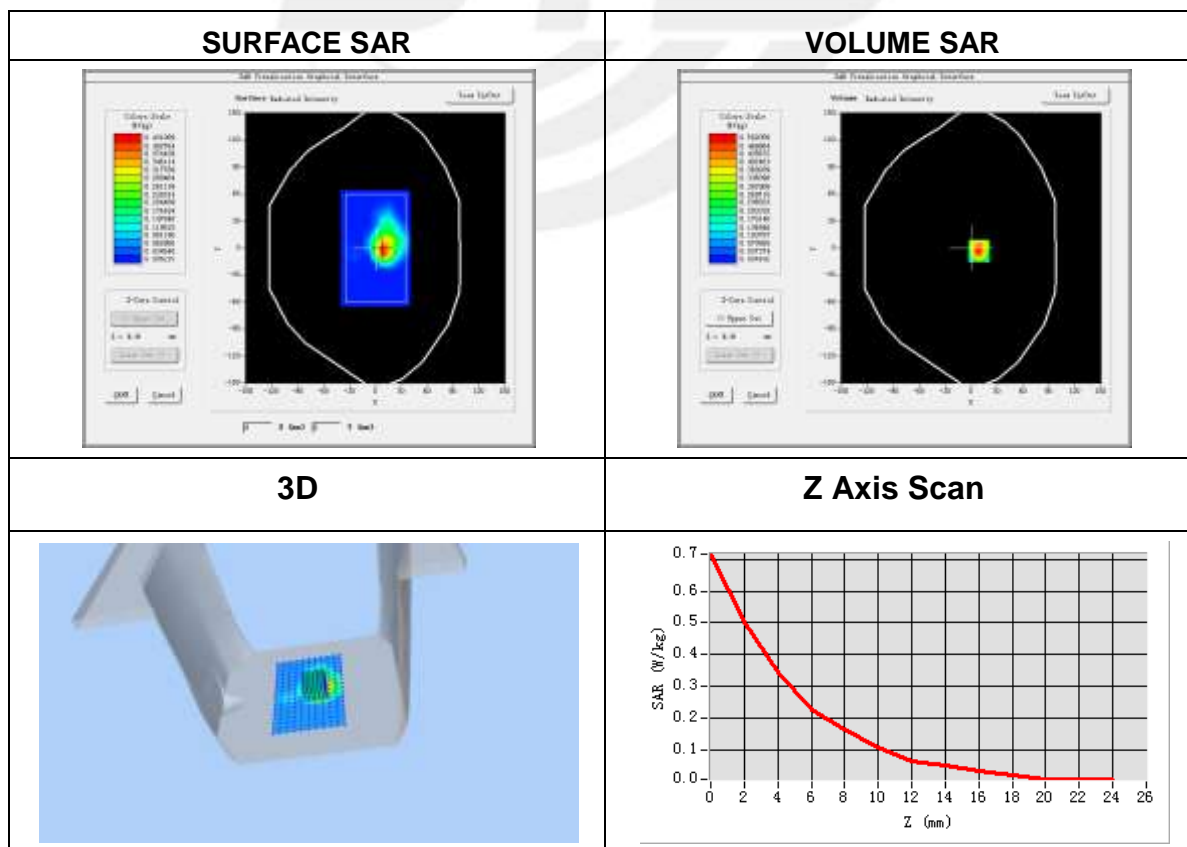

Plot 3: DUT: MACH4 Y12; EUT Model: Y12

Test Date	2019-08-30
Probe	SN 45/15 EPGO281
ConvF	2.60
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	BodyBack side
Band	IEEE 802.11a ISM
Channels	165
Signal	IEEE802.a (Crest factor: 1.0)
Frequency (MHz)	5825
Relative permittivity (real part)	48.2
Conductivity (S/m)	6.00
Variation (%)	-2.90

Maximum location: X=9.00, Y=-3.00

SAR Peak: 0.74 W/kg

SAR 10g (W/Kg)	0.141124
SAR 1g (W/Kg)	0.322919





Appendix C. Probe Calibration And Dipole Calibration Report

Refer the appendix Calibration Report.

※※※※END OF THE REPORT※※※※※