MORLAB

REPORT No. : SZ16050136S01

FCC SAR TEST REPORT

APPLICANT	:	Suzhou Hyco Information Technology Ltd
PRODUCT NAME	:	Smart Logistics watches
MODEL NAME	:	W561
TRADE NAME	:	HYCO
BRAND NAME	:	HYCO
FCC ID	:	2AIHX-561V21
STANDARD(S)	:	47CFR 2.1093 IEEE 1528-2013
ISSUE DATE	:	2016-09-05

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Change History		
Issue	Date	Reason for change
1.0	2016-09-05	First edition

TEST REPORT DECLARATION

Applicant	Suzhou Hyco Information Technology Ltd		
Applicant Address	Room 105, Tower B, North Zone, No.999, Huaxu Road, Qingpu District, Shanghai		
Manufacturer	Suzhou Hyco Information Technology Ltd		
Manufacturer Address	Room 105, Tower B, North Zone, No.999, Huaxu Road, Qingpu District, Shanghai		
Product Name	Smart Logistics watches		
Model Name	W561		
Brand Name	HYCO		
HW Version	V2.1		
SW Version	w561a_4.3-20160604_1436		
Test Standards	47CFR 2.1093; IEEE 1528-2013		
Test Date	2016-06-28		
The Highest Reported 10g-SAR(W/kg)	Body	0.692W/kg	Limit(W/kg): 4.0W/kg

Tested by : Chen Shengkui

Chen Shengkui

Reviewed by : Liu Jun

Liu Jun

Approved by : Zeng Dexin

Zeng Dexin

1.TECHNICAL INFORMATION

Note: the Following data is based on the information by the applicant.

1.1 Identification of Applicant

Company Name:	Suzhou Hyco Information Technology Ltd
Address:	Room 105, Tower B, North Zone, No.999, Huaxu Road, Qingpu District, Shanghai

1.2 Identification of Manufacturer

Company Name:	Suzhou Hyco Information Technology Ltd
Address:	Room 105, Tower B, North Zone, No.999, Huaxu Road, Qingpu District, Shanghai

1.3 Equipment Under Test (EUT)

Model Name:	W561
Trade Name:	HYCO
Brand Name:	HYCO
Hardware Version:	V2.1
Software Version:	w561a_4.3-20160604_1436
Tx Frequency Bands:	WIFI 802.11 b/g/n20 (2.4GHz); Bluetooth2.1+EDR; Bluetooth4.1
Uplink Modulations:	WIFI802.11b: DSSS (2.4GHz);WIFI802.11g: OFDM(2.4GHz); WIFI802.11n20: OFDM(2.4GHz); Bluetooth2.1+EDR: GFSK/π/4-DQPSK/8-DPSK; Bluetooth4.1:GFSK;
Antenna type:	Fixed Internal Antenna
Development Stage:	Identical prototype

1.3.1 Photographs of the EUT

Please refer to the External Photos for the Photos of the EUT

1.3.2 Identification of all used EUT

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the Following two numerical characters indicate the software version of the test sample.

EUT Identity	Hardware Version	Software Version
1#	V2.1	w561a_4.3-20160604_1436

1.4 Applied Reference Documents

Leading reference documents for testing:

No.	Identity	Document Title
1	**47 CFR§2.1093**	Radiofrequency Radiation Exposure Evaluation: Portable Devices
2	**IEEE 1528-2013**	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
3	**KDB 447498 D01v06**	General RF Exposure Guidance
4	**KDB 248227 D01v02r02**	SAR Measurement Guidance for IEEE 802.11 Transmitters
5	**KDB 865664 D01v01r04**	SAR Measurement 100 MHz to 6 GHz
6	**KDB 865664 D02v01r02**	SAR Reporting

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1.5 Device Category and SAR Limits

Uncontrolled Environment

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

Controlled Environment

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

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

Note: 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 4.0 W/kg as averaged over any 10 gram of tissue.

2. SPECIFIC ABSORPTION RATE (SAR)

2.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are Middle than the limits for general population/uncontrolled.

2.2 SAR Definition

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

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

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

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

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

Where C is the specific head capacity, $\delta\mathrm{T}$ is the temperature rise and $\delta\mathrm{t}$ the exposure duration, or related to the electrical field in the tissue by

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

Where σ is the conductivity of the tissue, ρ is the mass density of the tissue and $|\mathrm{E}|$ is the rms electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

3. SAR MEASUREMENT SETUP

3.1 The Measurement System

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

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

The Following figure shows the system.

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

3.2 Probe

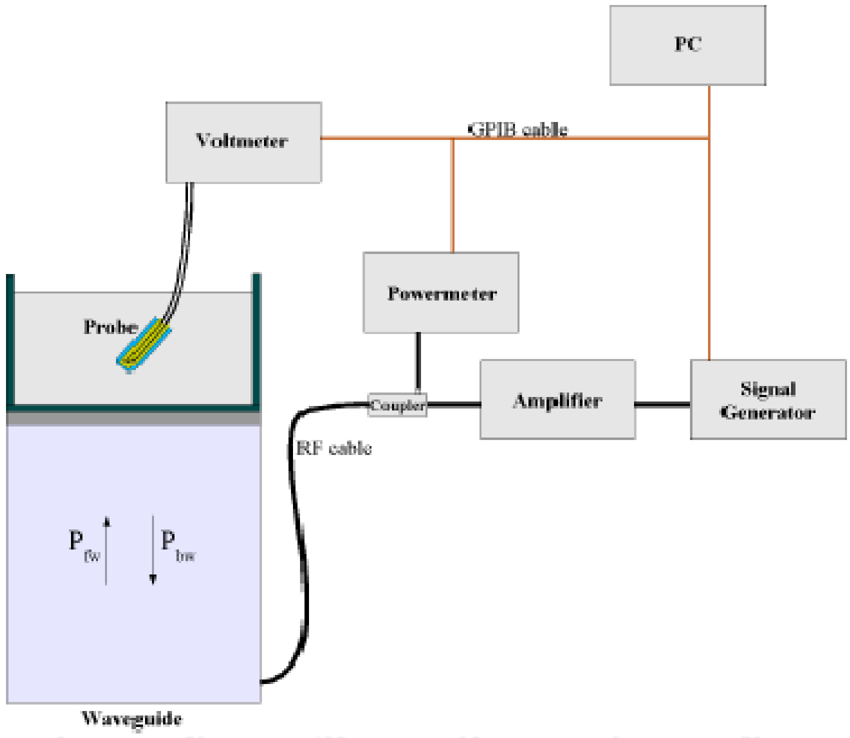
For the measurements the Specific Dosimetric E-Field Probe SN 37/08 EP80 with Following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter: 6.5 mm

- Distance between probe tip and sensor center: 2.5mm
- Distance between sensor center and the inner phantom surface: 4 mm
  (repeatability better than +/- 1mm)
- Probe linearity: <0.25 dB
- Axial Isotropy: <0.25 dB
- Spherical Isotropy: <0.25 dB
- Calibration range: 835to 2500MHz for head & body simulating liquid.

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

Probe calibration is realized, in compliance with CENELEC EN 62209 and IEEE 1528 std, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the EN 622091 annex technique using reference guide at the five frequencies.



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

Where :

Pfw = Forward Power

Pbw = Backward Power

a and b = Waveguide dimensions

ı = Skin depth

Keithley configuration:

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

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

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

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

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

Where DCP is the diode compression point in mV.

3.3 Probe Calibration Process

3.3.1 Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. SATIMO Probe calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an with CALISAR, Antenna proprietary calibration system.

3.3.2 Free Space Assessment Procedure

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

3.3.3 Temperature Assessment Procedure

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulating head tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Where:

δt = exposure time (30 seconds),

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

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

δT = temperature increase due to RF exposure.

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

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

Where:

σ = simulated tissue conductivity,

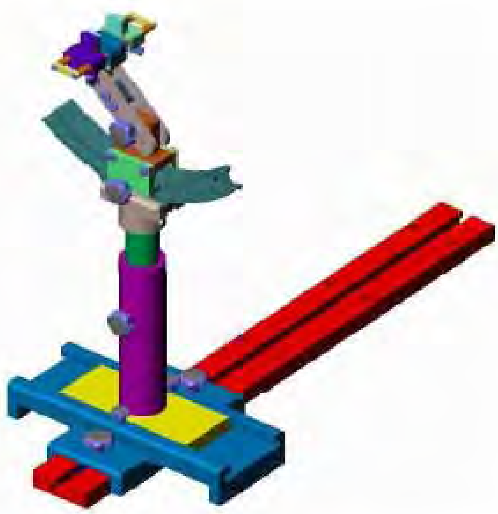
ρ = Tissue density (1.25 g/cm³ for brain tissue)

3.4 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

3.5 Device Holder

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is Middle than 1°.



Device holder

System Material	Permittivity	Loss Tangent
Delrin	3.7	0.005

4. TISSUE SIMULATING LIQUIDS

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% are listed in below table.

The following table gives the recipes for tissue simulating liquids

Frequency Band (MHz)	2450
Tissue Type	Body
Ingredients (% by weight)	
Deionised Water	73.20
Salt(NaCl)	0.10
Sugar	0.00
Tween 20	0.00
HEC	0.00
Bactericide	0.00
Triton X-100	0.00
DGBE	26.70
Diethylenglycol monohexylether	0.00
Measured dielectric parameters	
Dielectric Constant	52.70
Conductivity (S/m)	1.95

Note: Please refer to the validation results for dielectric parameters of each frequency band.

The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using an Agilent 85033E Dielectric Probe Kit and an Agilent Network Analyzer.

Table 1: Dielectric Performance of Tissue Simulating Liquid

Temperature: 22.0~23.8°C, humidity: 54~60%.						
Date	**Freq.(MHz)**	**Liquid Parameters**	**Meas.**	**Target**	**Delta(%)**	**Limit±(%)**
2016/06/28	Body 2450	Relative Permittivity(ϵr):	52.48	52.70	-0.42	5
		Conductivity(σ):	1.96	1.95	0.51	5

5. UNCERTAINTY ASSESSMENT

The Following table includes the uncertainty table of the IEEE 1528. The values are determined by Antennessa.

5.1 UNCERTAINTY EVALUATION FOR EUT SAR TEST

a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	E.2.1	4.76	N	1	1	1	4.76	4.7	∞
Axial Isotropy	E.2.2	2.5	R	$\sqrt{3}$	0.7	0.7	1.01	1.0	∞
Hemispherical Isotropy	E.2.2	4.0	R	$\sqrt{3}$	0.7	0.7	1.62	1.6	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.5	∞
Linearity	E.2.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.8	∞
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.5	∞
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.0	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.7	∞
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.1	∞
RF ambient Conditions	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.7	∞
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	E.5.2	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Test sample Related									
Test sample positioning	E.4.2.1	0.03	N	1	1	1	0.03	0.03	N-1
Device Holder Uncertainty	E.4.1.	5.00	N	1	1	1	5.00	5.0	N-

	1							0	1
Output power Power drift - SAR drift measurement	6.6.2	4.04	R	$\sqrt{3}$	1	1	2.33	2.33	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Liquid conductivity - deviation from target value	E.3.2	4.57	R	$\sqrt{3}$	0.64	0.43	1.69	1.13	∞
Liquid conductivity - measurement uncertainty	E.3.3	5.00	N	1	0.64	0.43	3.20	2.15	M
Liquid permittivity - deviation from target value	E.3.2	3.69	R	$\sqrt{3}$	0.6	0.49	1.28	1.04	∞
Liquid permittivity - measurement uncertainty	E.3.3	10.00	N	1	0.6	0.49	6.00	4.90	M
Combined Standard Uncertainty			RSS				11.55	10.67	
Expanded Uncertainty (95% Confidence interval)			K=2				23.11	21.33	

5.2 UNCERTAINTY FOR SYSTEM PERFORMANCE CHECK

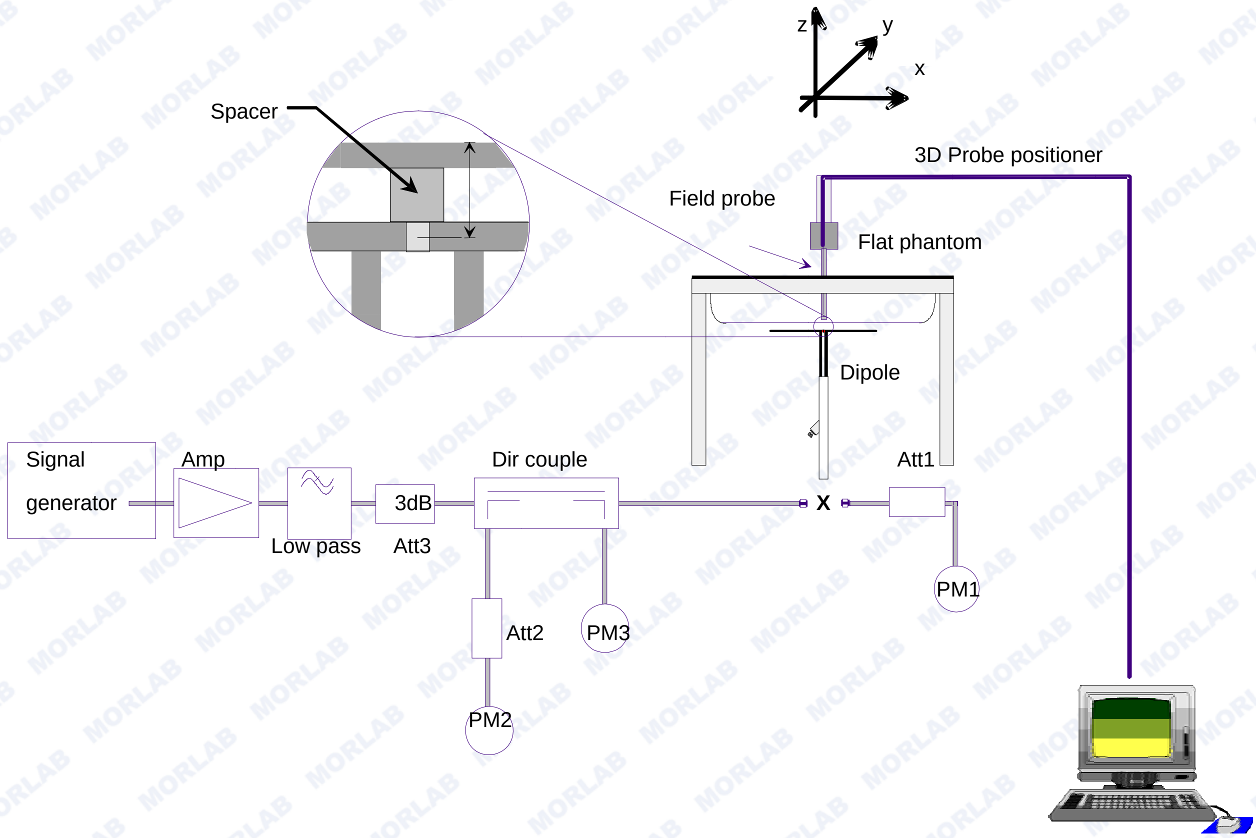
a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	E.2.1	4.76	N	1	1	1	4.76	4.7	∞
Axial Isotropy	E.2.2	2.5	R	$\sqrt{3}$	0.7	0.7	1.01	1.0	∞
Hemispherical Isotropy	E.2.2	4.0	R	$\sqrt{3}$	0.7	0.7	1.62	1.6	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.5	∞
Linearity	E.2.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.8	∞
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.5	∞
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.0	∞

Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.7	∞
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.1	∞
RF ambient Conditions	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.7	∞
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.1 5	∞
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.0 3	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	E.5.2	5.0	R	$\sqrt{3}$	1	1	2.89	2.8 9	∞
Dipole									
Dipole axis to liquid Distance	8,E.4. 2	1.00	N	$\sqrt{3}$	1	1	0.58	0.5 8	∞
Input power and SAR drift measurement	8,6.6. 2	4.04	R	$\sqrt{3}$	1	1	2.33	2.3 3	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.0 3	∞
Liquid conductivity - deviation from target value	E.3.2	4.57	R	$\sqrt{3}$	0.64	0.43	1.69	1.1 3	∞
Liquid conductivity - measurement uncertainty	E.3.3	5.00	N	$\sqrt{3}$	0.64	0.43	1.85	1.2 4	M
Liquid permittivity - deviation from target value	E.3.2	3.69	R	$\sqrt{3}$	0.6	0.49	1.28	1.0 4	∞
Liquid permittivity - measurement uncertainty	E.3.3	10.0 0	N	$\sqrt{3}$	0.6	0.49	3.46	2.8 3	M
Combined Standard Uncertainty			RSS				8.83	8.3 7	
Expanded Uncertainty (95% Confidence interval)			K=2				17.66	16. 73	

6. SAR MEASUREMENT EVALUATION

6.1 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which 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 system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below



The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The power meter PM1 measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz,100 mW is used for 3.5 GHz to

6 GHz) at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

6.2 Validation Results

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

Frequency	2450MHz(B)
Target value 1W (1g)	56.13 W/Kg
Test value 1g (250 mW input power)	13.287W/Kg (07.12)
Normalized to 1W value(1g)	53.148 W/Kg

Note: System checks the specific test data please see 40~41.

7. OPERATIONAL CONDITIONS DURING TEST

7.1 Body-worn Configurations

The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration.

For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

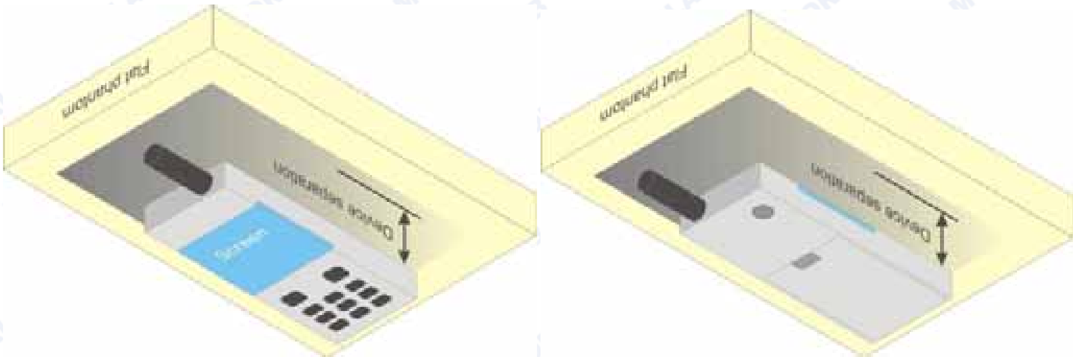


Illustration for Body Worn Position

7.2 Measurement procedure

The Following steps are used for each test position

1. 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.
2. Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
3. Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
4. Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

7.3 Description of interpolation/extrapolation scheme

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

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

8. MEASUREMENT OF CONDUCTED OUTPUT POWER

1. WiFi Average output power

Band	Channel	Frequency (MHz)	Output Power(dBm)		
			802.11b (DSSS)	802.11g (OFDM)	802.11n20 (OFDM)
WiFi	1	2412	15.12	9.85	9.04
	6	2437	15.23	9.92	9.36
	11	2462	15.63	9.85	9.22

2. BT+EDR 2.1 peak output power

Band	Channel	Frequency (MHz)	Output Power(dBm)		
			GFSK	π/4-DQPSK	8-DPSK
BT	0	2402	10.52	8.94	9.04
	39	2441	10.18	7.83	7.95
	78	2480	9.64	6.31	6.50

Band	Channel	Frequency (MHz)	Output Power(dBm)
			GFSK
BT	0	2402	10.23
	19	2441	9.71
	39	2480	8.32

9. TEST RESULTS LIST

Summary of Measurement Results (WLAN 802.11b Band)

Temperature: 21.0~23.8°C, humidity: 54~60%.							
Phantom Configurations	Device Test Positions	Device Test channel	SAR(W/Kg), 10g Peak	Duty Cycle	Scaling Factor (Duty Cycle)	Scaling Factor (Power)	Scaled SAR (W/Kg), 10g
Body (0mm Separation)	Back upward 802.11b	1	0.537	99.2%	1.008	1.225	0.663
		6	0.575			1.194	0.692
		11	0.601			1.089	0.660

Summary of Measurement Results (Bluetooth Band)

Temperature: 21.0~23.8°C, humidity: 54~60%.					
Phantom Configurations	Device Test Positions	Device Test channel	SAR(W/Kg), 10g Peak	Scaling Factor	Scaled SAR (W/Kg), 10g
Body (0mm Separation)	Back upward GFSK	0	0.020	1.117	0.022
		39	0.039	1.208	0.047
		78	0.018	1.368	0.024

Notes:

1. Adjust SAR for OFDM is 0.053*11.91/11.63=0.054W/Kg<1.2, so SAR is not required for OFDM modes.

2. SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

   1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

   2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

3. 2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed.

4. For held-to-ear and hotspot operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.

5. Justification for test configurations for WLAN per KDB Publication 248227 D01DR02-41929 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR.

6. Scaling Factor calculation

Band	Tune-up power tolerance(dBm)	SAR test channel Power (dBm)	Scaling Factor
802.11b	Max output power =15.5+-0.5	15.12	1.225
		15.23	1.194
		15.63	1.089
Bluetooth (GFSK-1M)	Max output power =10.5+0.5/-1	10.52	1.117
		10.18	1.208
		9.64	1.368

10. REPEATED SAR MEASUREMENT

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz. 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.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

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Tel: 86-755-36698555 Http://www.morlab.com
Fax: 86-755-36698525 E-mail: service@morlab.cn

11. MULTIPLE TRANSMITTERS EVALUATION

Stand-alone SAR

Test distance: 5mm			
Band	Highest power(mW) per tune up	1-g SAR test threshold	Test required?
WiFi	39.81	[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)] ≤ 3.0 for 1-g SAR	Yes
BT2.1+EDR	12.59	[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)] ≤ 3.0 for 1-g SAR	Yes

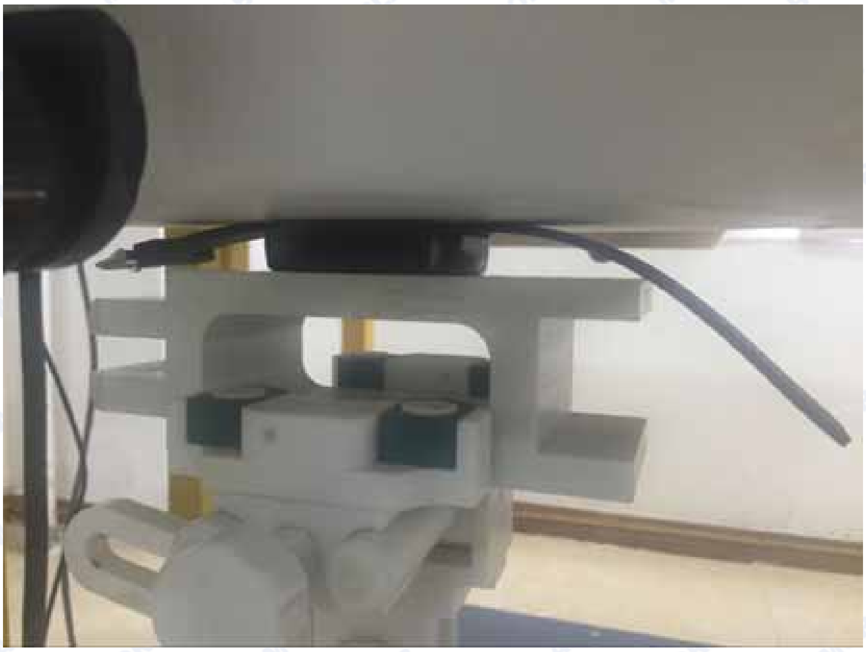
Note:

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

2. Simultaneous Transmission SAR evaluation is not required for BT and WiFi, because the software mechanism have been incorporated to guarantee that the WLAN and Bluetooth transmitters would not simultaneously operate.

ANNEX A PHOTOGRAPS OF THE EUT

1. Back Side Position



2. Liquid Level Photo

ANNEX B GRAPH TEST RESULTS

BAND	PARAMETERS
802.11b	Measurement 1: Flat Plane with Body device position on Low Channel in DSSS mode Measurement 2: Flat Plane with Body device position on Middle Channel in DSSS mode Measurement 3: Flat Plane with Body device position on High Channel in DSSS mode
Bluetooth	Measurement 4: Flat Plane with Body device position on High Channel in GFSK mode. Measurement 5: Flat Plane with Body device position on High Channel in GFSK mode. Measurement 6: Flat Plane with Body device position on High Channel in GFSK mode.

MEASUREMENT 1

Type: Phone measurement (Complete)

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

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

Date of measurement: 2016.04.28

Measurement duration: 9 minutes 1 second

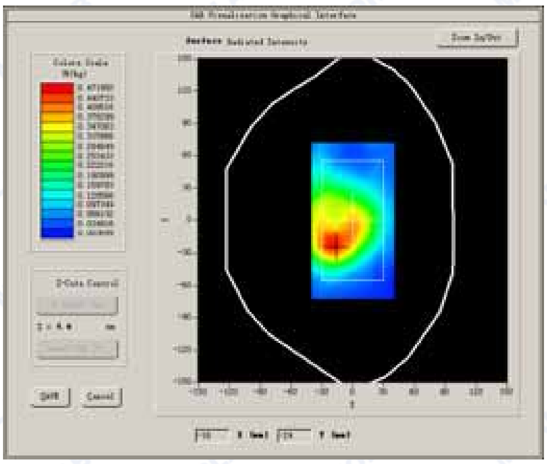
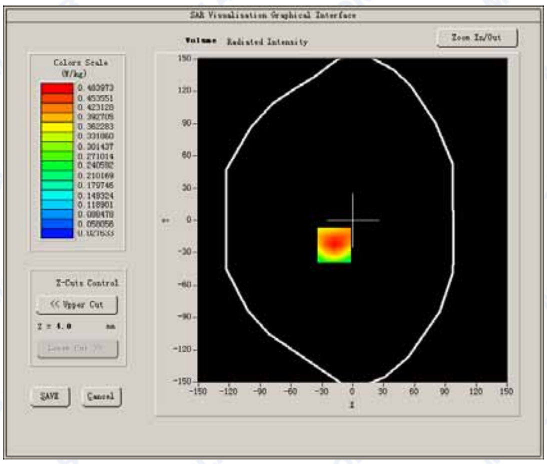
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat
Device Position	Body
Band	802.11b
Channels	Low
Signal	GSM

B. SAR Measurement Results

Low Band SAR (Channel 128):

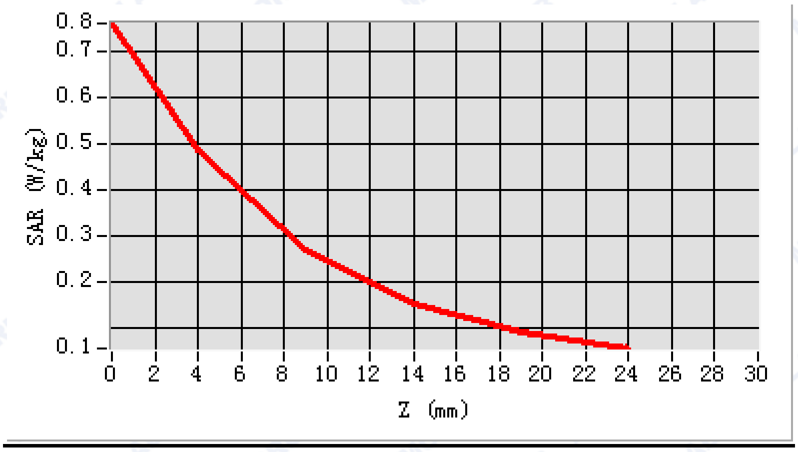
Frequency (MHz)	824.200000
Relative permittivity (real part)	52.483045
Conductivity (S/m)	1.964408
Power drift (%)	1.270000
Ambient Temperature:	22.9°C
Liquid Temperature:	22.1°C
ConvF:	4.81
Crest factor:	1:1

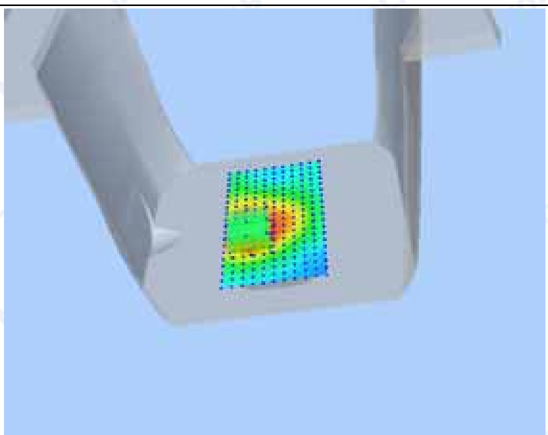
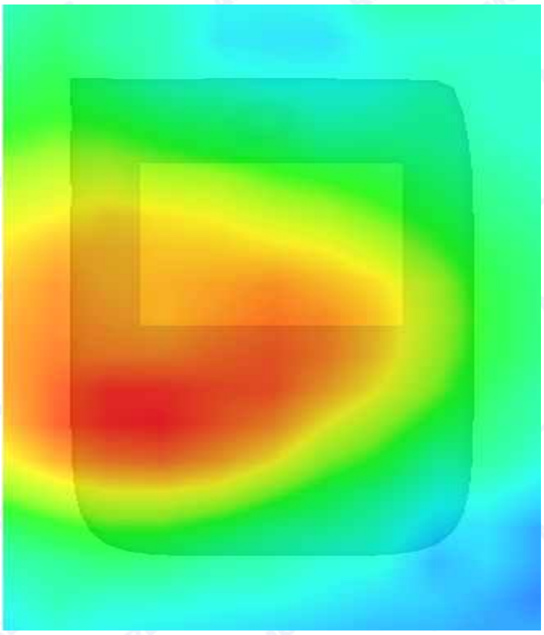
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-18.00, Y=-23.00
SAR Peak: 0.76 W/kg

SAR 10g (W/Kg)	0.536949
SAR 1g (W/Kg)	1.025384

Z axis scan



3D screen shot	Hot spot position
	

MEASUREMENT 2

Type: Phone measurement (Complete)

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

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

Date of measurement: 2016.04.28

Measurement duration: 8 minutes 24 seconds

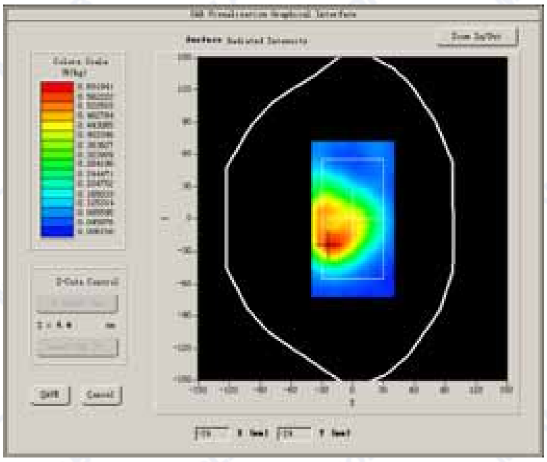
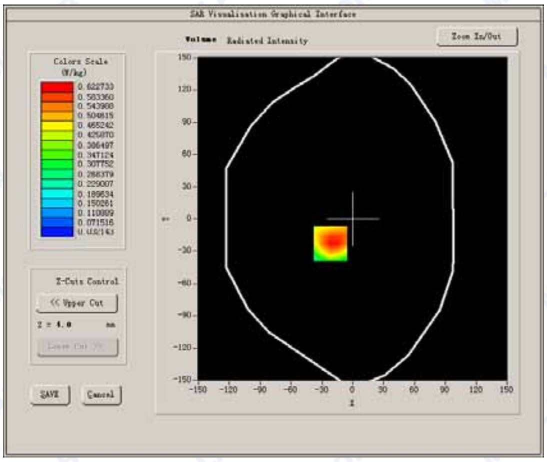
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat
Device Position	Body
Band	802.11b
Channels	Middle
Signal	GSM

B. SAR Measurement Results

Low Band SAR (Channel 128):

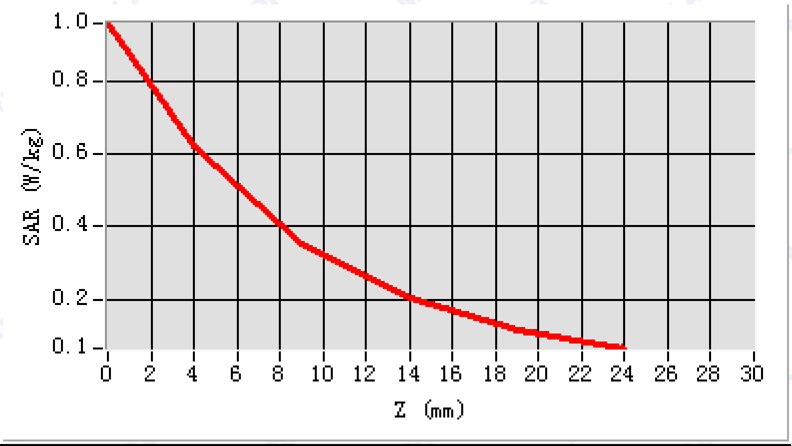
Frequency (MHz)	824.200000
Relative permittivity (real part)	52.483045
Conductivity (S/m)	1.964408
Power drift(%)	2.070000
Ambient Temperature:	22.9°C
Liquid Temperature:	22.1°C
ConvF:	4.81
Crest factor:	1:1

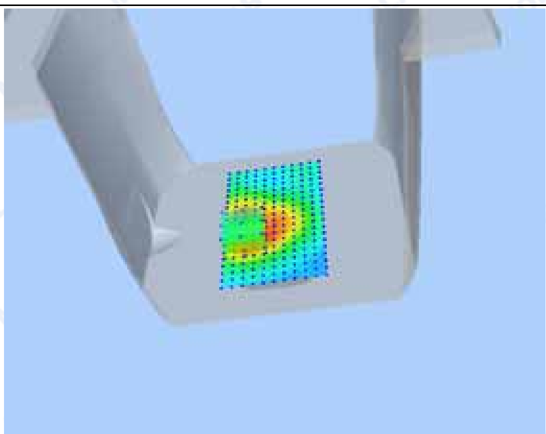
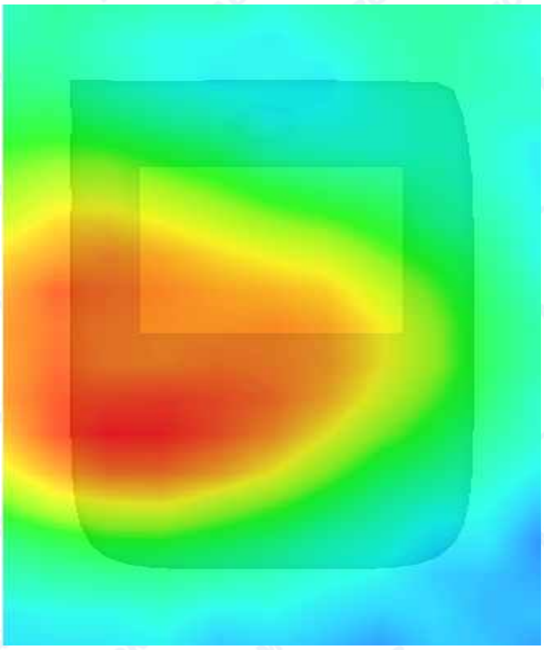
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-22.00, Y=-23.00
SAR Peak: 0.97 W/kg

SAR 10g (W/Kg)	0.575114
SAR 1g (W/Kg)	1.034982

Z axis scan



3D screen shot	**Hot spot position**
	

MEASUREMENT 3

Type: Phone measurement (Complete)

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

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

Date of measurement: 2016.04.28

Measurement duration: 8 minutes 56 seconds

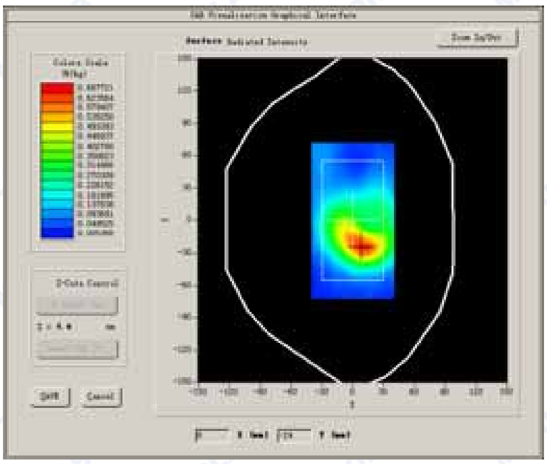
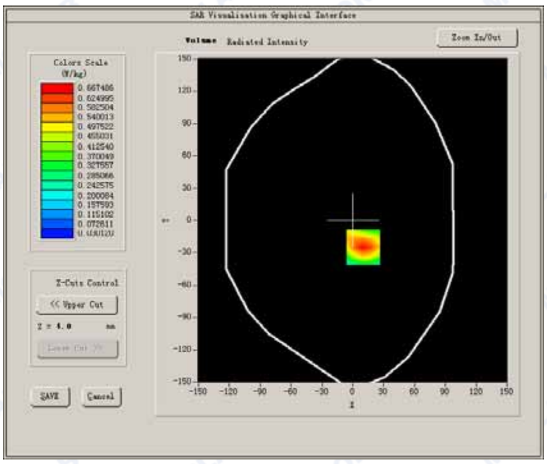
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat
Device Position	Body
Band	802.11b
Channels	High
Signal	GSM

B. SAR Measurement Results

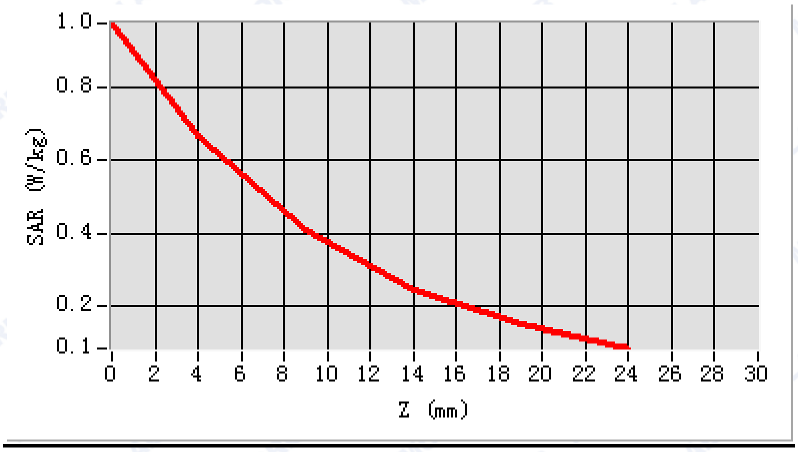
Low Band SAR (Channel 128):

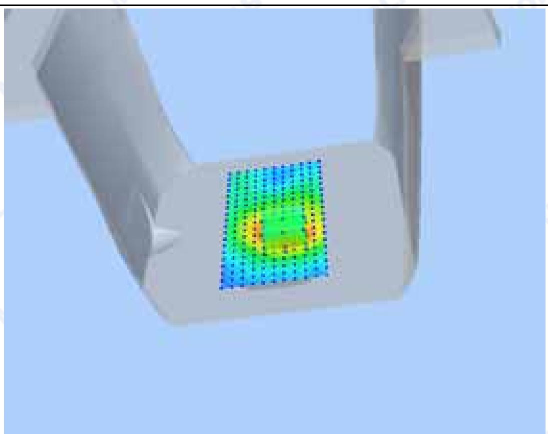
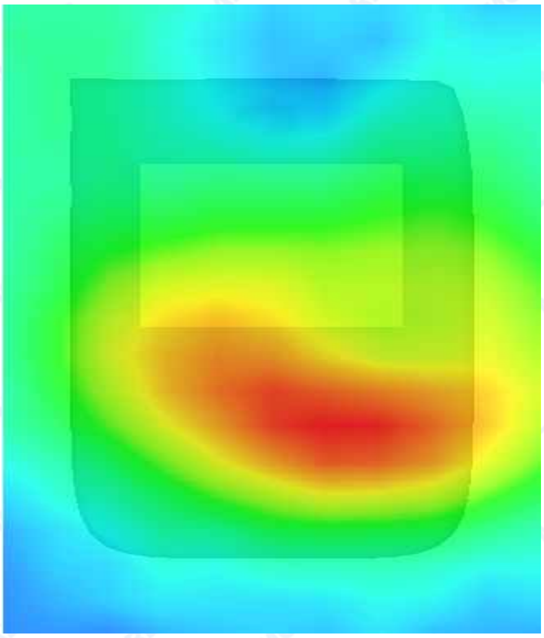
Frequency (MHz)	824.200000
Relative permittivity (real part)	52.483045
Conductivity (S/m)	1.964408
Power drift (%)	2.550000
Ambient Temperature:	22.9°C
Liquid Temperature:	22.1°C
ConvF:	4.81
Crest factor:	1:1

SURFACE SAR	VOLUME SAR
	

Maximum location: X=10.00, Y=-25.00
SAR Peak: 0.98 W/kg

SAR 10g (W/Kg)	0.600942
SAR 1g (W/Kg)	1.350136

Z axis scan


3D screen shot	Hot spot position
	

MEASUREMENT 4

Type: Phone measurement (Complete)

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

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

Date of measurement: 2016.04.28

Measurement duration: 8 minutes 18 seconds

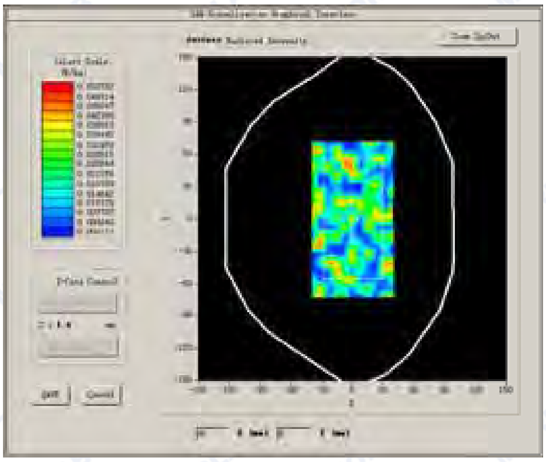
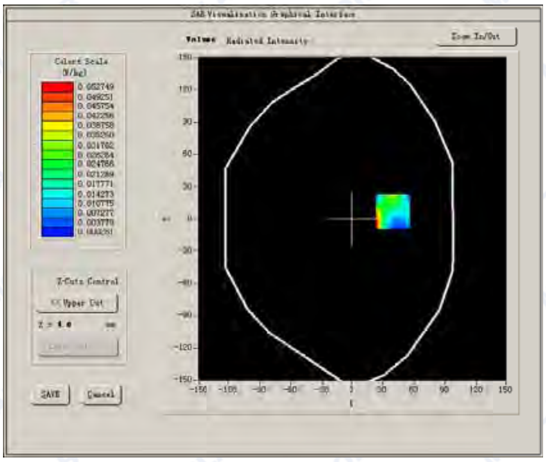
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat
Device Position	Body
Band	Bluetooth
Channels	Low
Signal	Bluetooth

B. SAR Measurement Results

Low Band SAR (Channel 128):

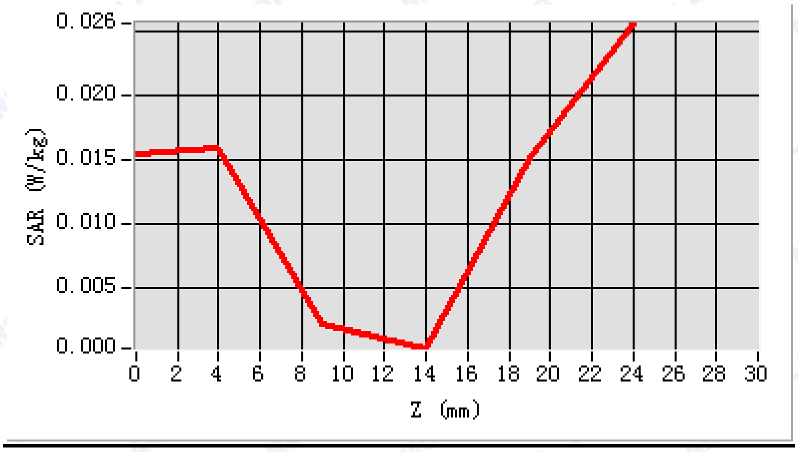
Frequency (MHz)	824.200000
Relative permittivity (real part)	52.483045
Conductivity (S/m)	1.964408
Power drift(%)	0.850000
Ambient Temperature:	22.9°C
Liquid Temperature:	22.1°C
ConvF:	4.81
Crest factor:	1:1

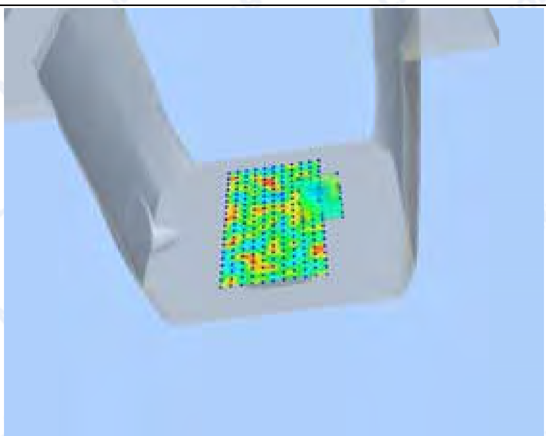
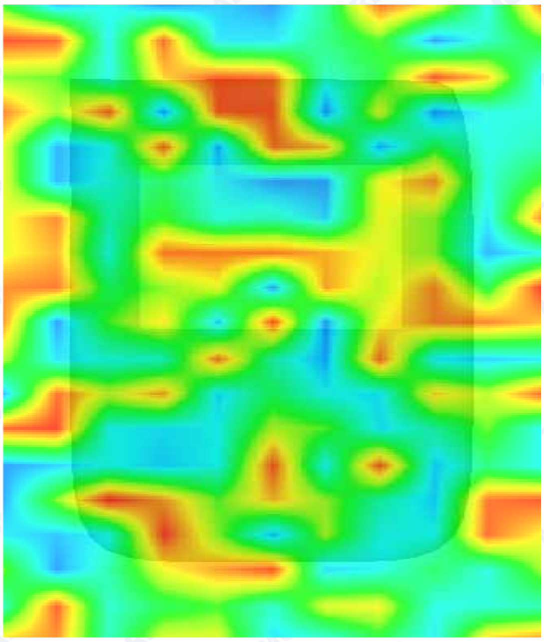
SURFACE SAR	VOLUME SAR
	

Maximum location: X=40.00, Y=7.00
SAR Peak: 0.17 W/kg

SAR 10g (W/Kg)	0.019588
SAR 1g (W/Kg)	0.052078

Z axis scan



3D screen shot	Hot spot position
	

MEASUREMENT 5

Type: Phone measurement (Complete)

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

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

Date of measurement: 2016.04.28

Measurement duration: 9 minutes 37 seconds

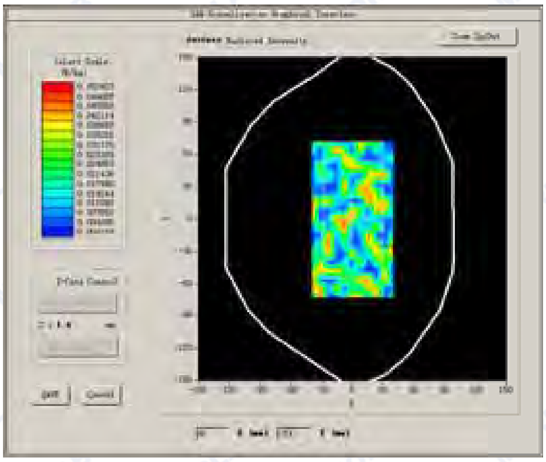
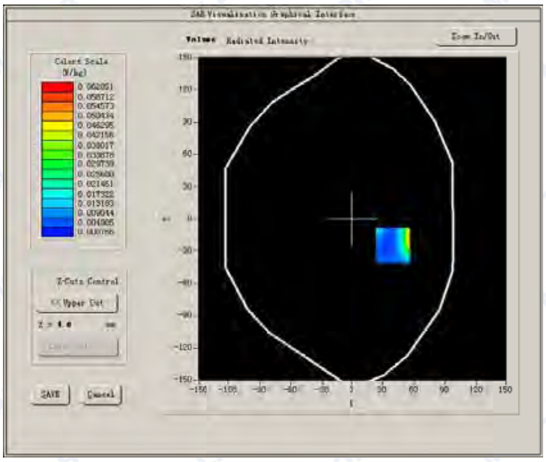
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat
Device Position	Body
Band	Bluetooth
Channels	Middle
Signal	Bluetooth

B. SAR Measurement Results

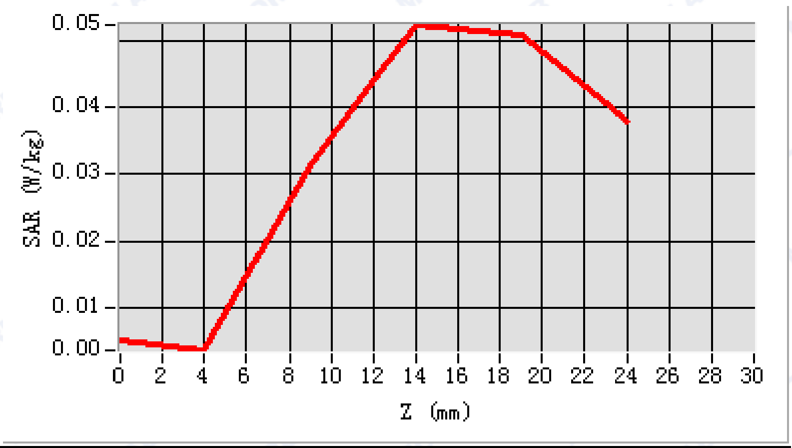
Low Band SAR (Channel 128):

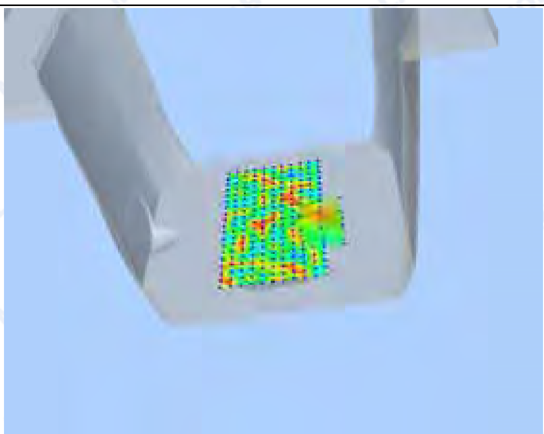
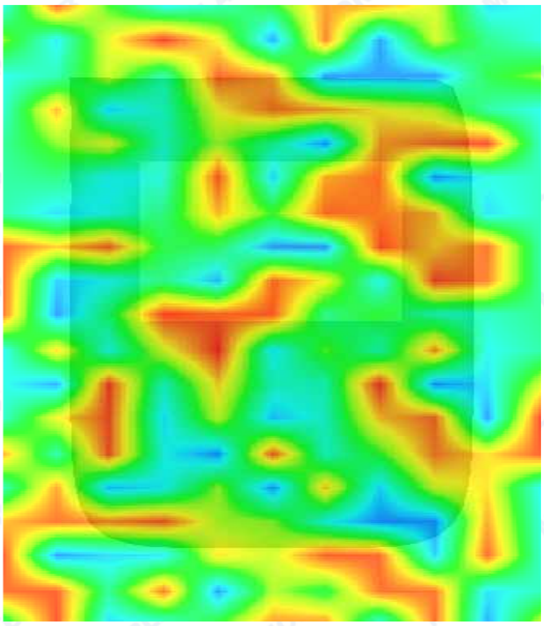
Frequency (MHz)	824.200000
Relative permittivity (real part)	52.483045
Conductivity (S/m)	1.964408
Power drift (%)	2.210000
Ambient Temperature:	22.9°C
Liquid Temperature:	22.1°C
ConvF:	4.81
Crest factor:	1:1

SURFACE SAR	VOLUME SAR
	

Maximum location: X=40.00, Y=-25.00
SAR Peak: 0.08 W/kg

SAR 10g (W/Kg)	0.039240
SAR 1g (W/Kg)	0.042928

Z axis scan


3D screen shot	Hot spot position
	

MEASUREMENT 6

Type: Phone measurement (Complete)

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

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

Date of measurement: 2016.04.28

Measurement duration: 9 minutes 37 seconds

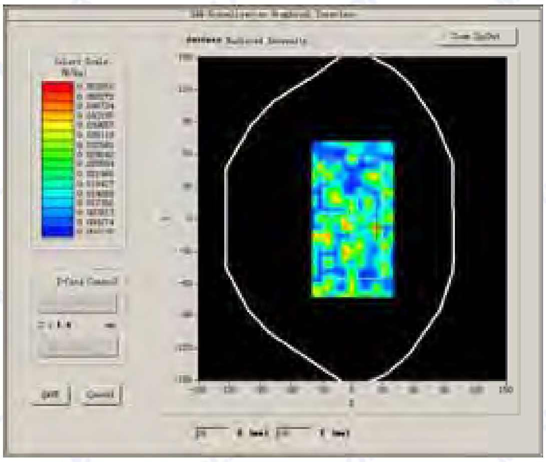
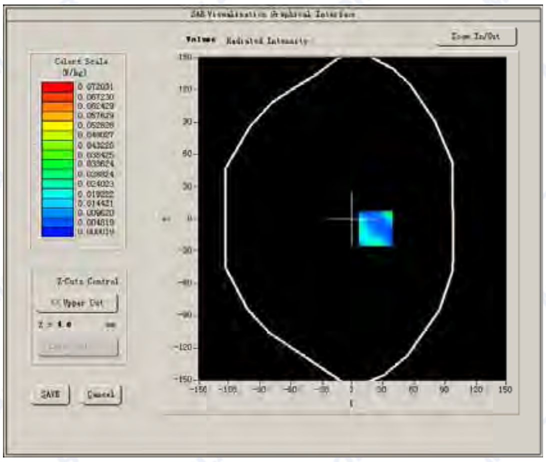
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat
Device Position	Body
Band	Bluetooth
Channels	High
Signal	Bluetooth

B. SAR Measurement Results

Low Band SAR (Channel 128):

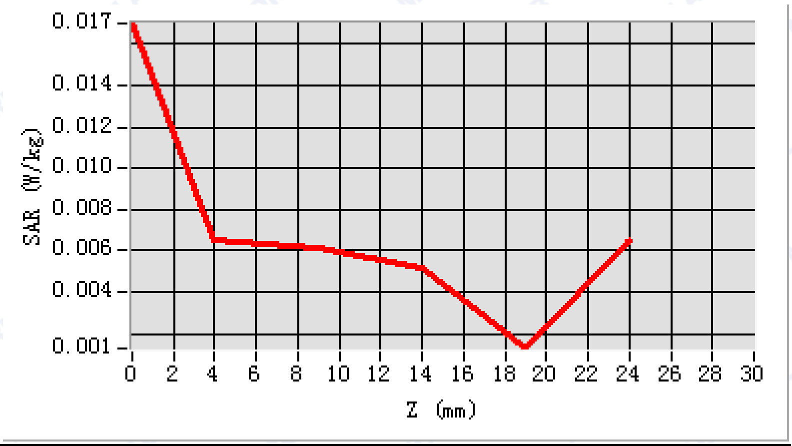
Frequency (MHz)	824.200000
Relative permittivity (real part)	52.483045
Conductivity (S/m)	1.964408
Power drift (%)	-0.210000
Ambient Temperature:	22.9°C
Liquid Temperature:	22.1°C
ConvF:	4.81
Crest factor:	1:1

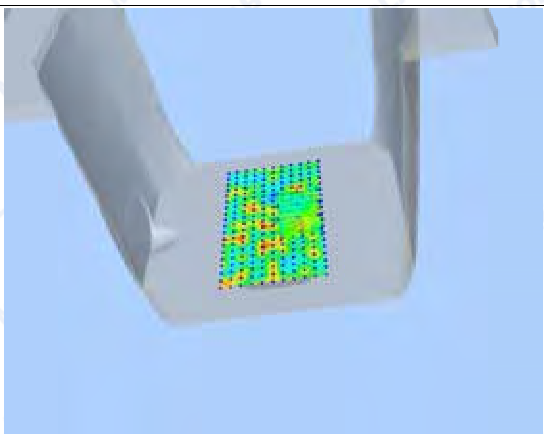
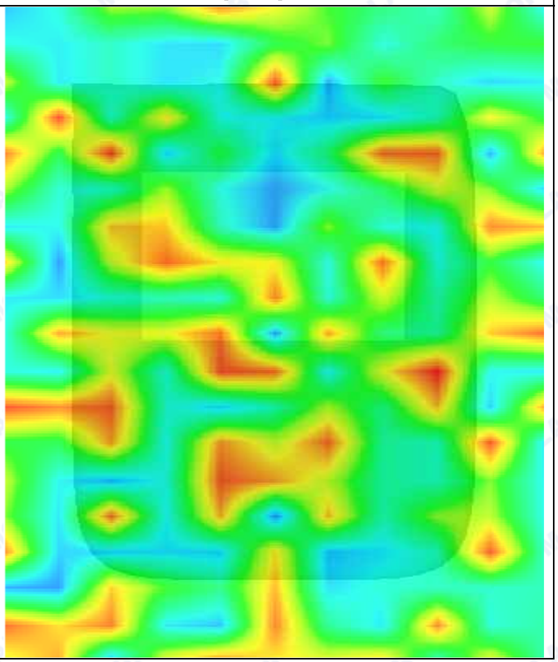
SURFACE SAR	VOLUME SAR
	

Maximum location: X=23.00, Y=-9.00
SAR Peak: 0.17 W/kg

SAR 10g (W/Kg)	0.018492
SAR 1g (W/Kg)	0.033293

Z axis scan



3D screen shot	**Hot spot position**
	

ANNEX C GENERAL INFORMATION

1. Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. List of Test Equipments

No.	Instrument	Type	Cal. Date	Cal. Due
1	PC	Dell (Pentium IV 2.4GHz, SN:X10-23533)	(n.a)	(n.a)
2	Network Emulator	Aglient (8960, SN:10752)	2015-6-18	1year
3	Network Analyzer	Agilent(E5071B ,SN:MY42404762)	2015-9-24	1year
4	Voltmeter	Keithley (2000, SN:1000572)	2015-9-20	1year
5	Signal Generator	Rohde&Schwarz (SMP_02)	2015-9-20	1year
6	Power Amplifier	PRANA (Ap32 SV125AZ)	2015-9-20	1year
7	Power Meter	Agilent (E4416A, SN:MY45102093)	2015-9-20	1year
8	Power Sensor	Agilent (N8482A, SN:MY41091706)	2015-9-20	1year
9	Directional coupler	Giga-tronics(SN:1829112)	2014-9-20	1year
10	Probe	Satimo (SN:SN 37/08 EP80)	2015-8-17	1year
11	Dielectric Probe Kit	Agilent (85033E)	2015-9-20	1year
12	Phantom	Satimo (SN:SN_36_08_SAM62)	2015-9-20	1year
13	Liquid	Satimo(Last Calibration: 2016-04-28)	N/A	N/A
14	Dipole 2450MHz	Satimo (SN 30/13 DIP2G450-263)	2015-6-20	1year

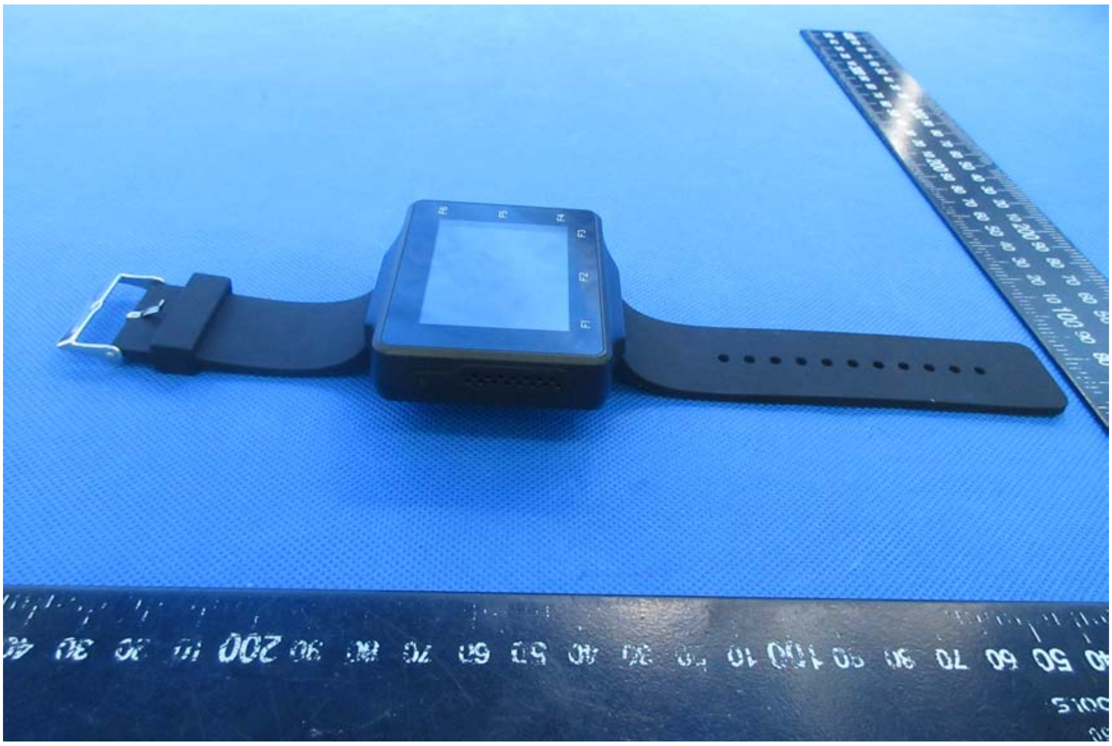
***** END OF REPORT *****

External Photos

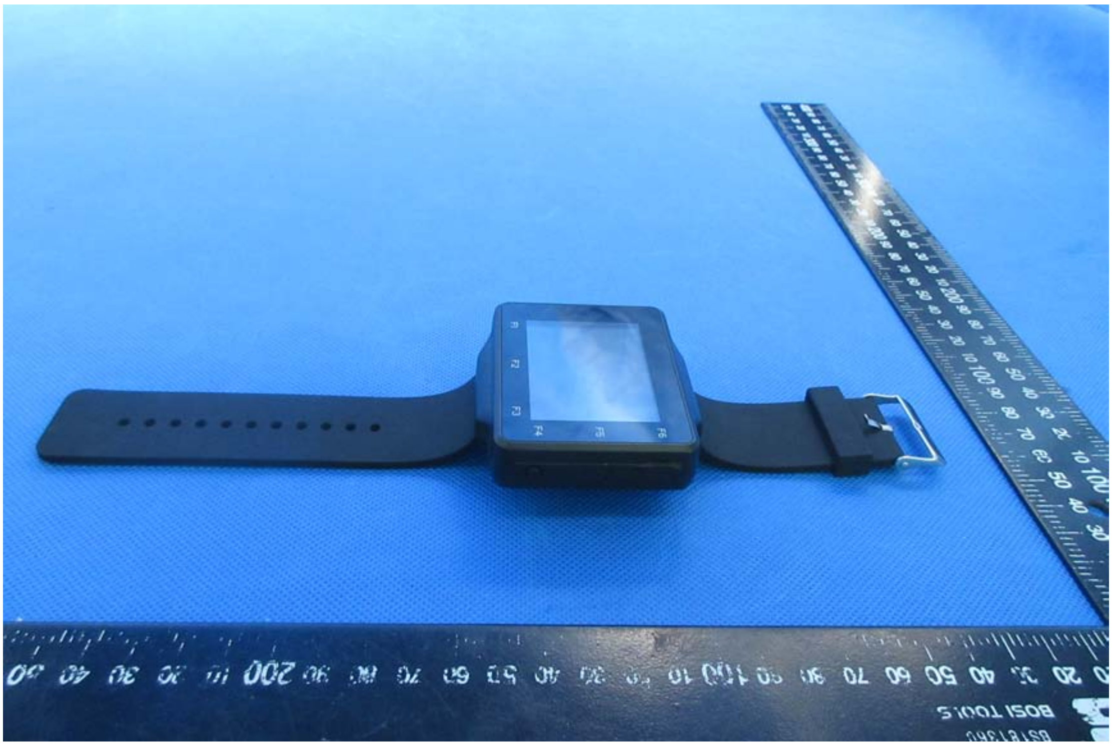
1. EUT front view

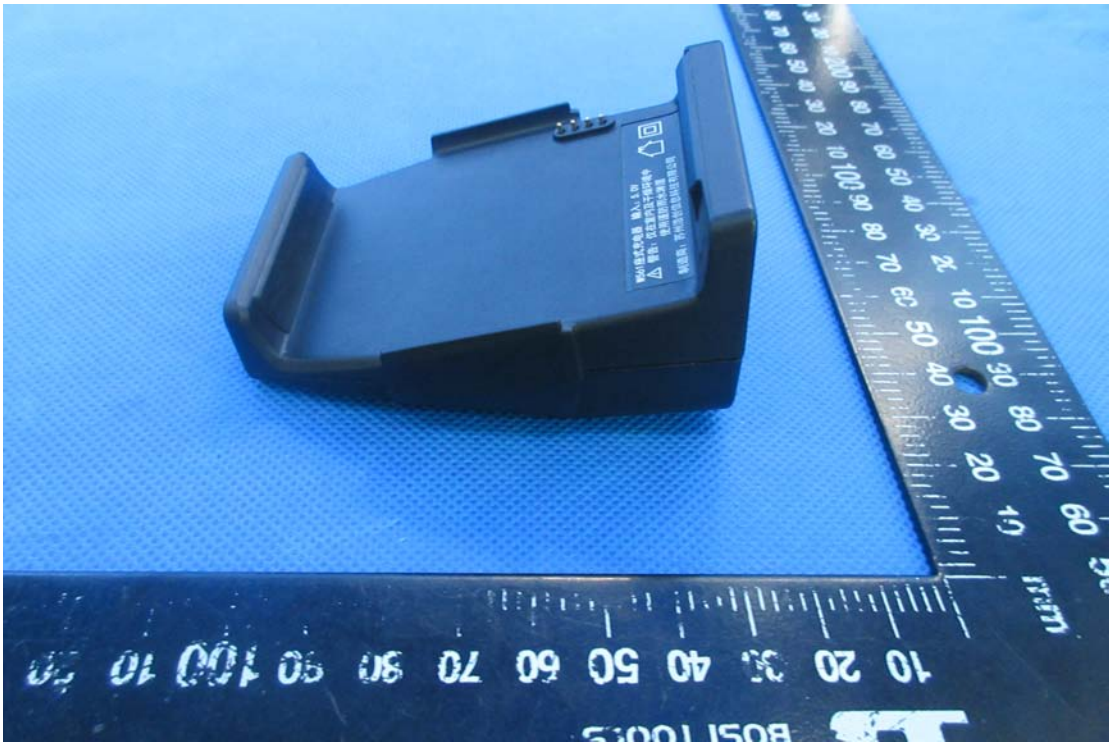
2. EUT rear view

3. EUT left side view

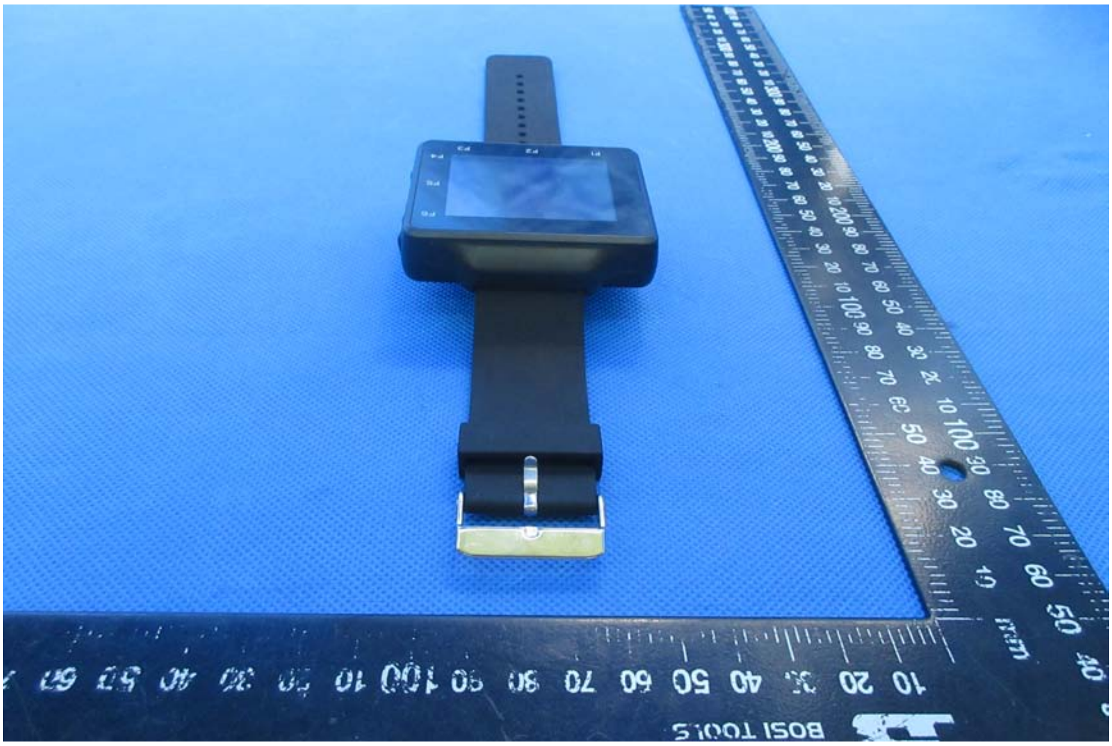


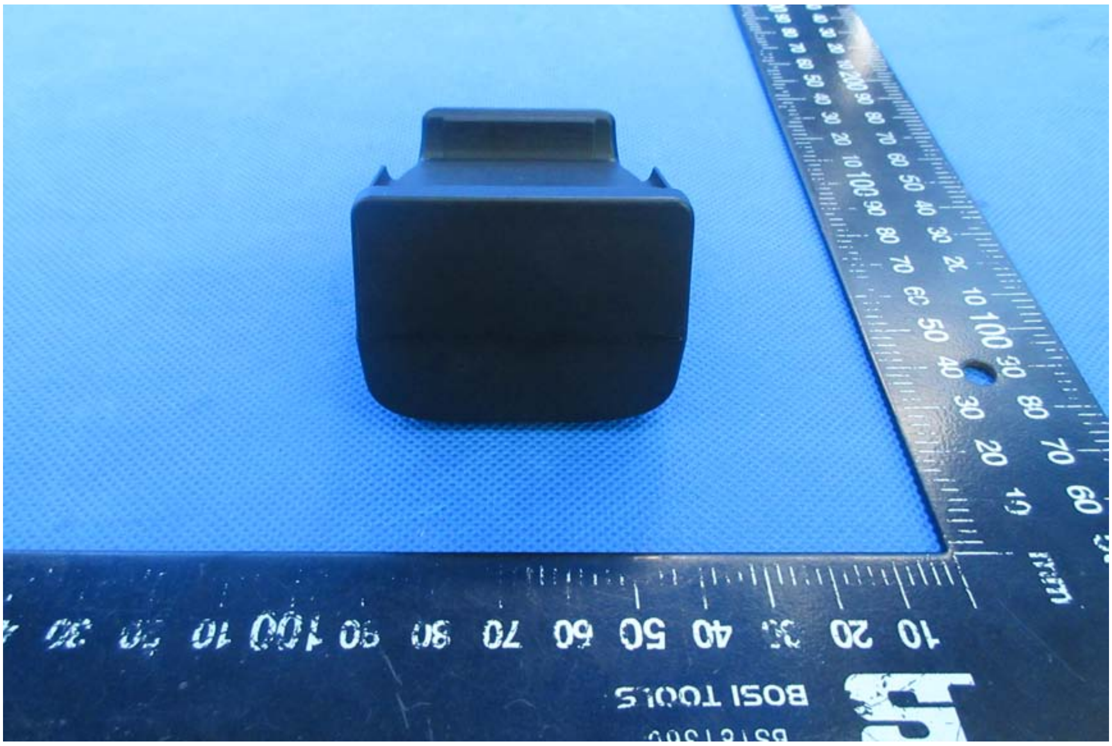
4. EUT right side view





5. EUT top view



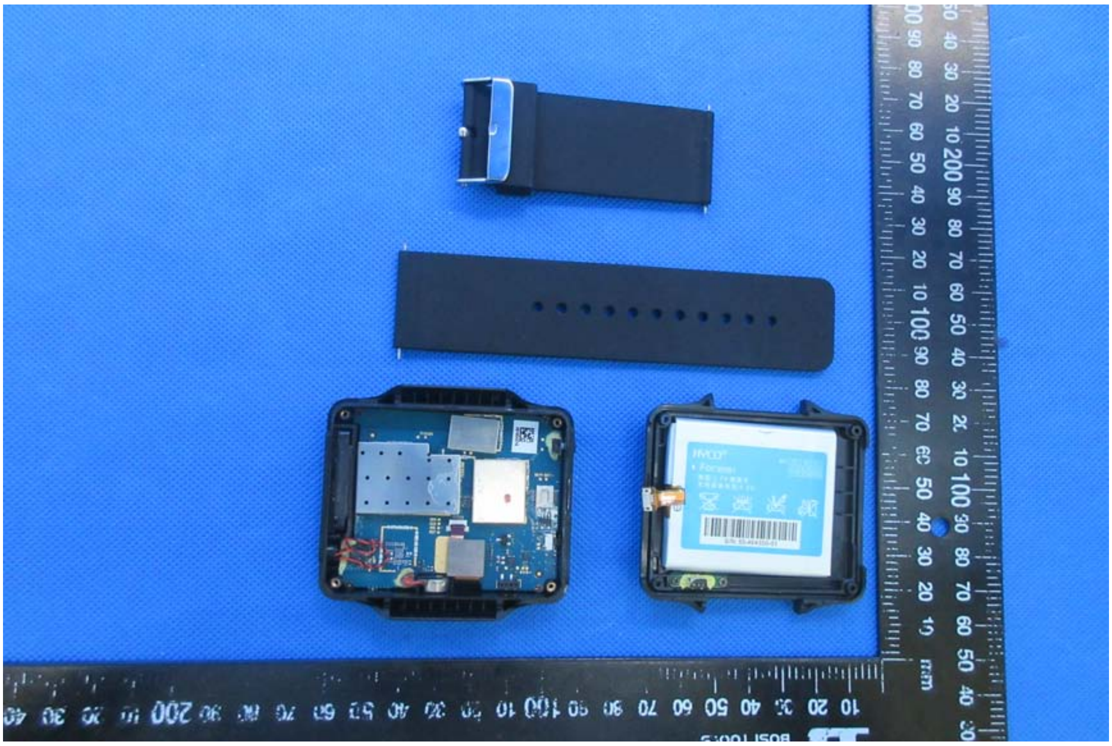


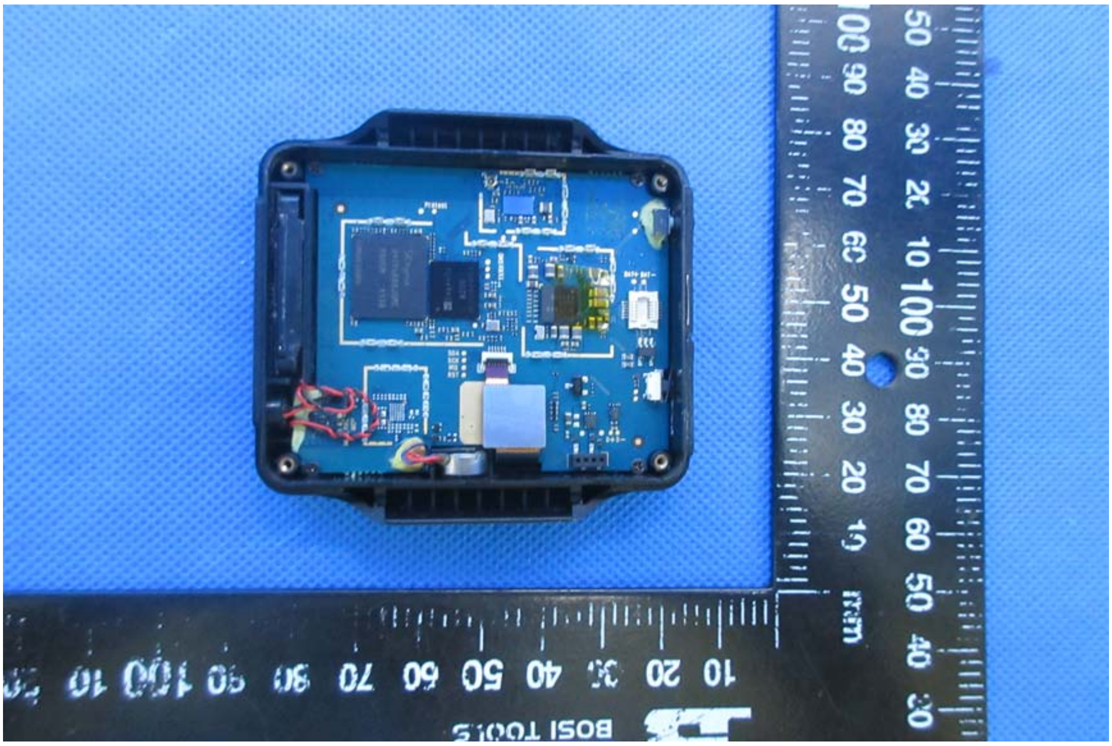
6. EUT bottom view

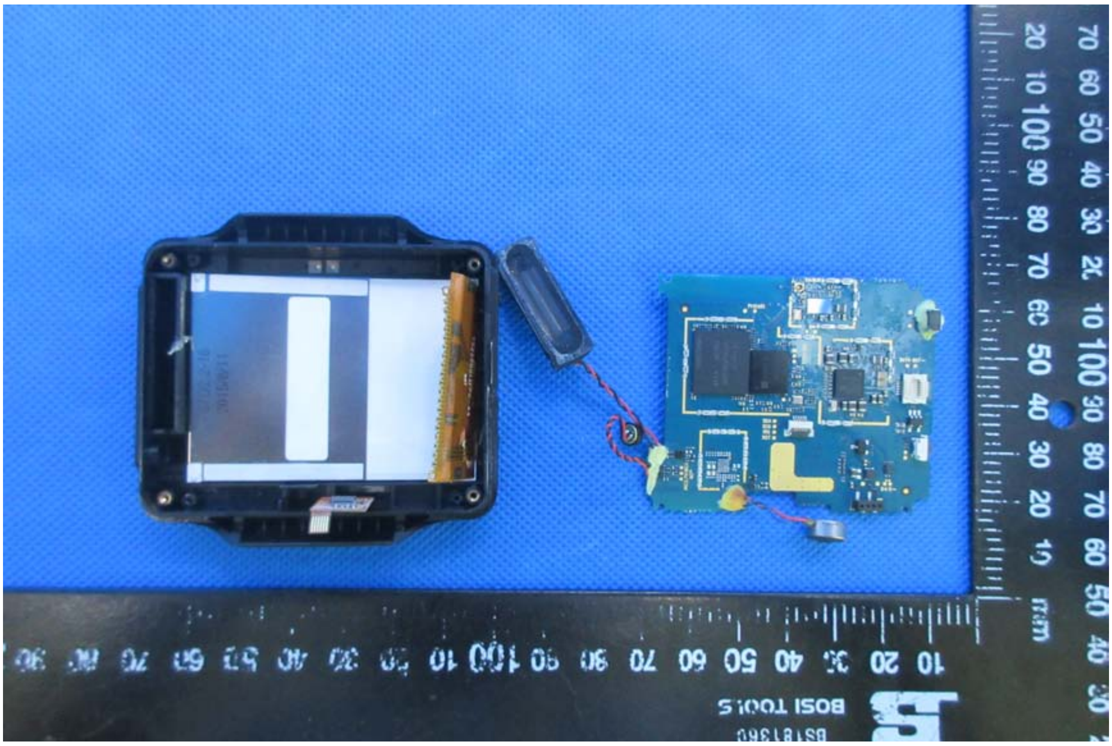
7. Accessories

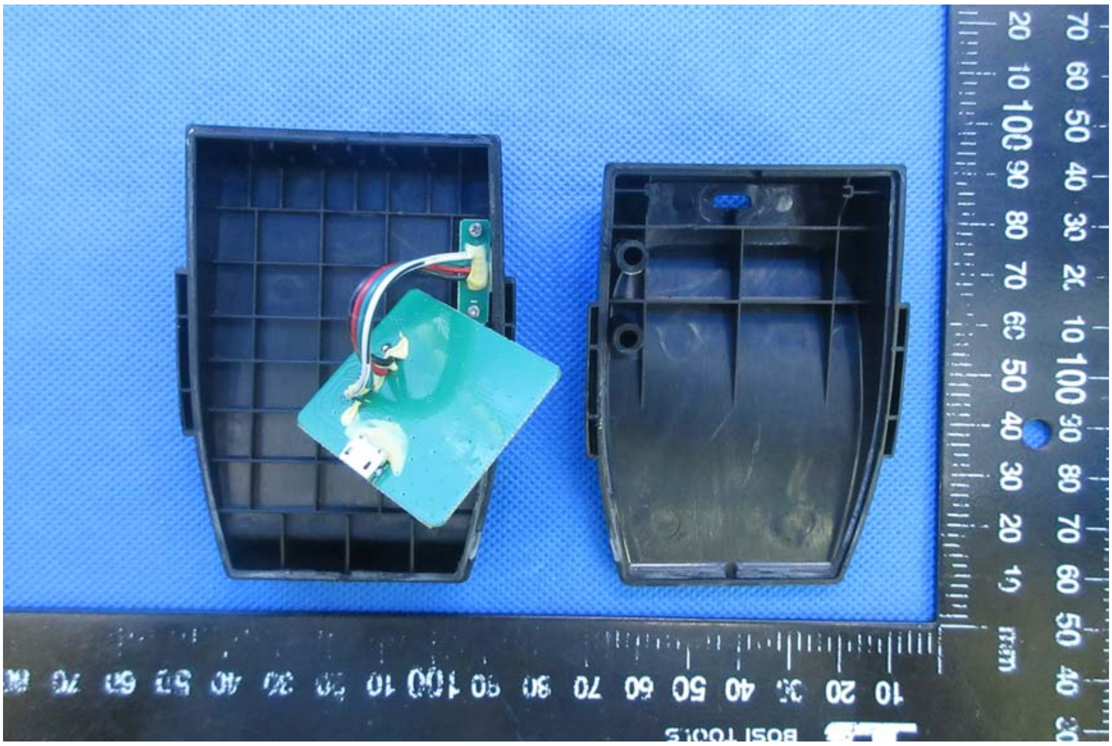
Internal Photos

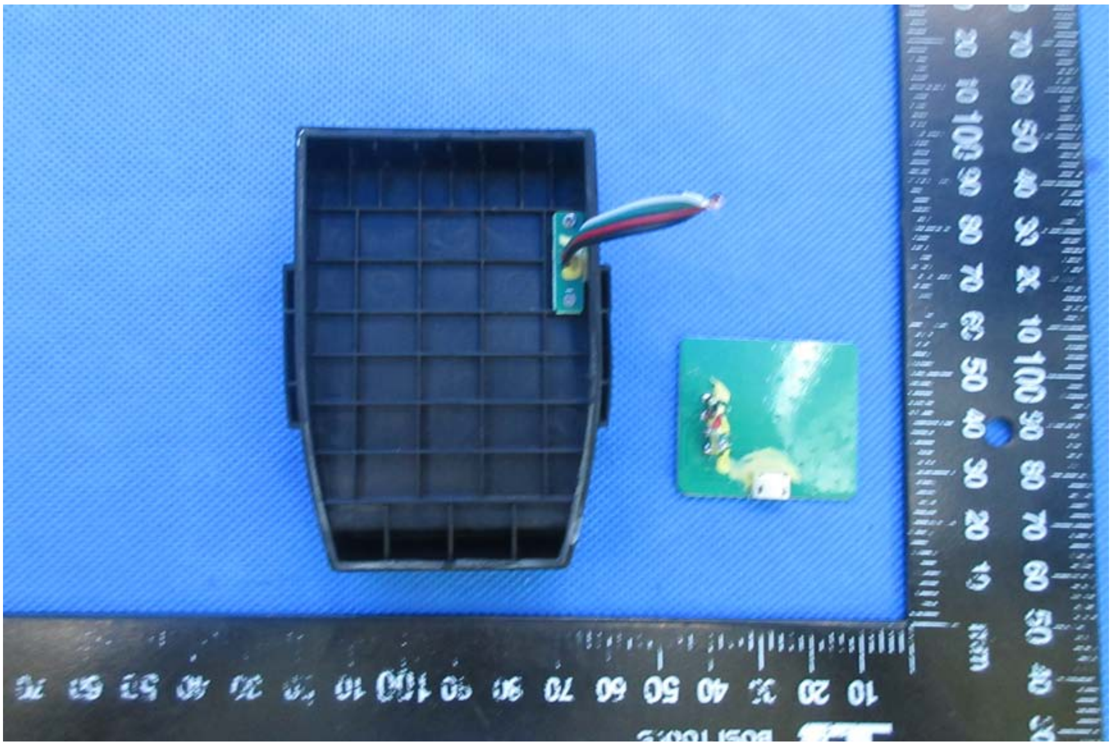
1. EUT uncover view



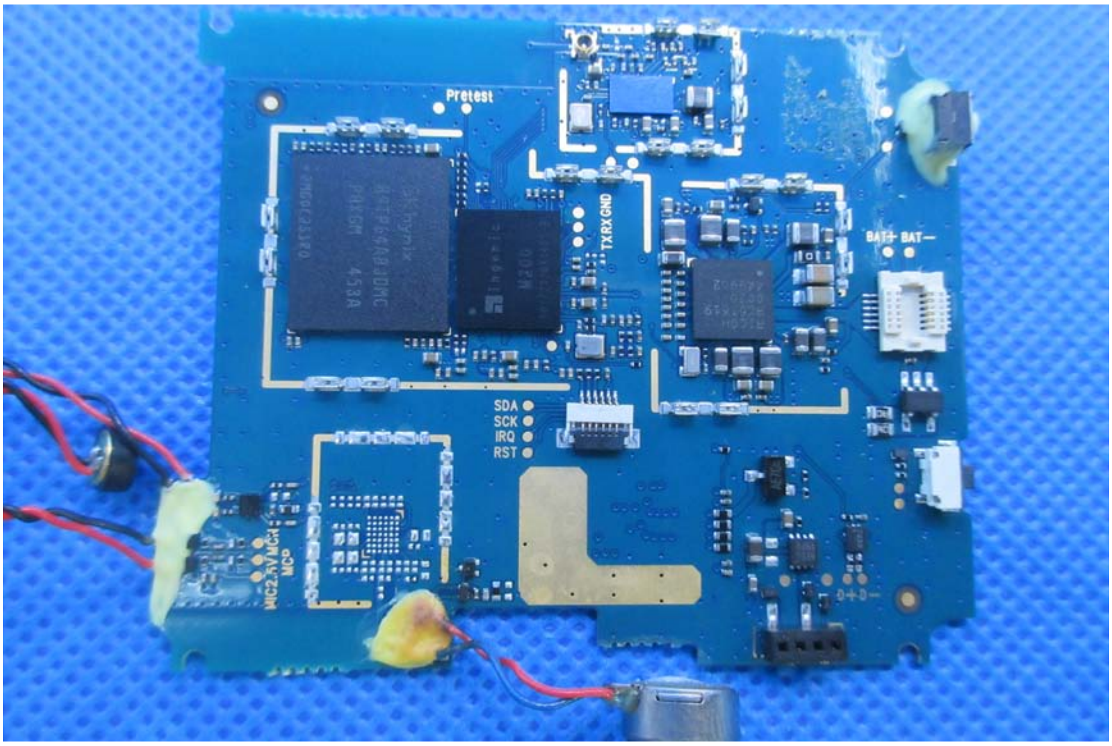


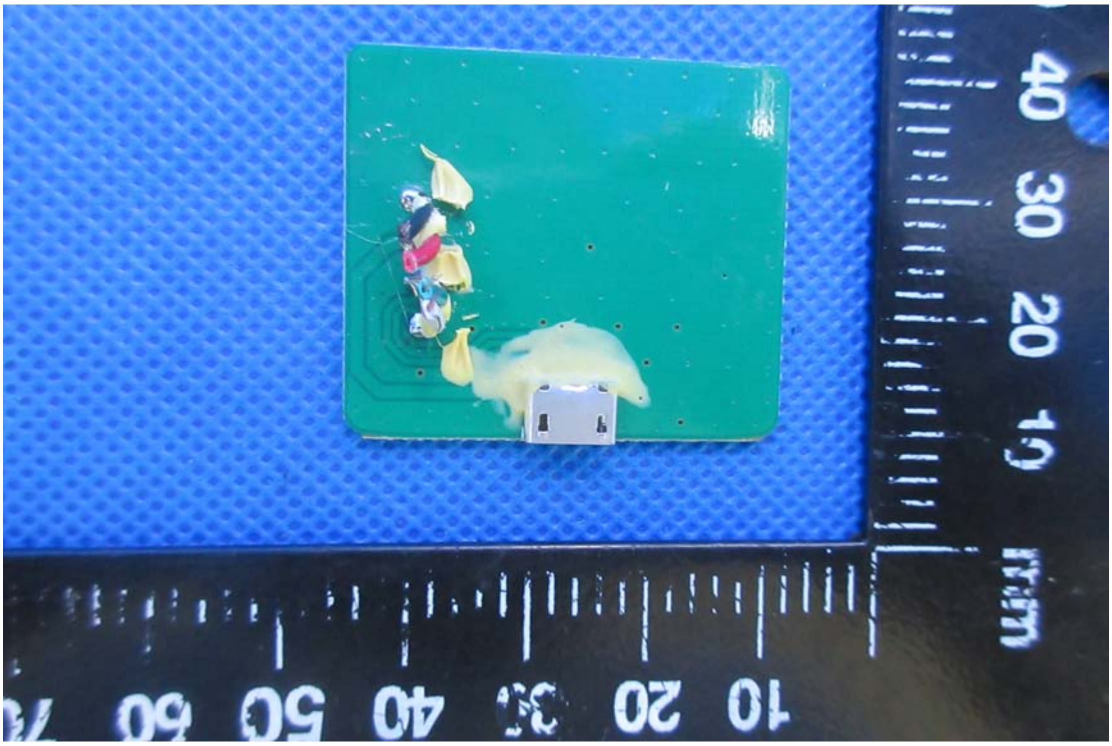




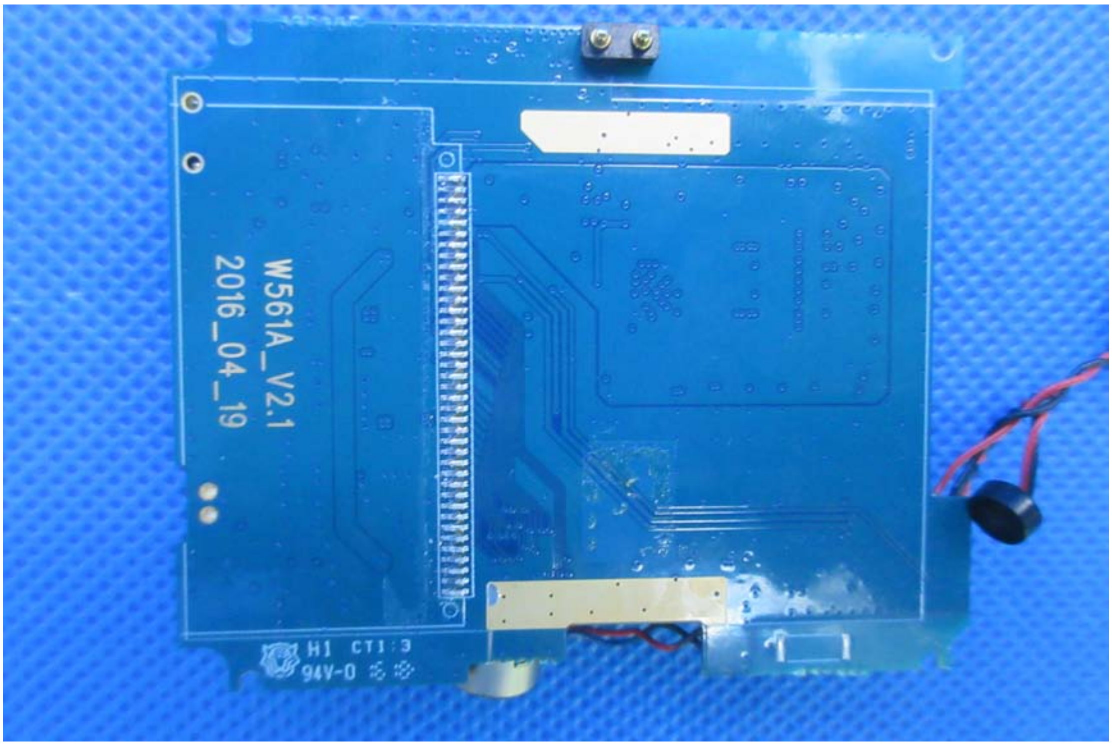


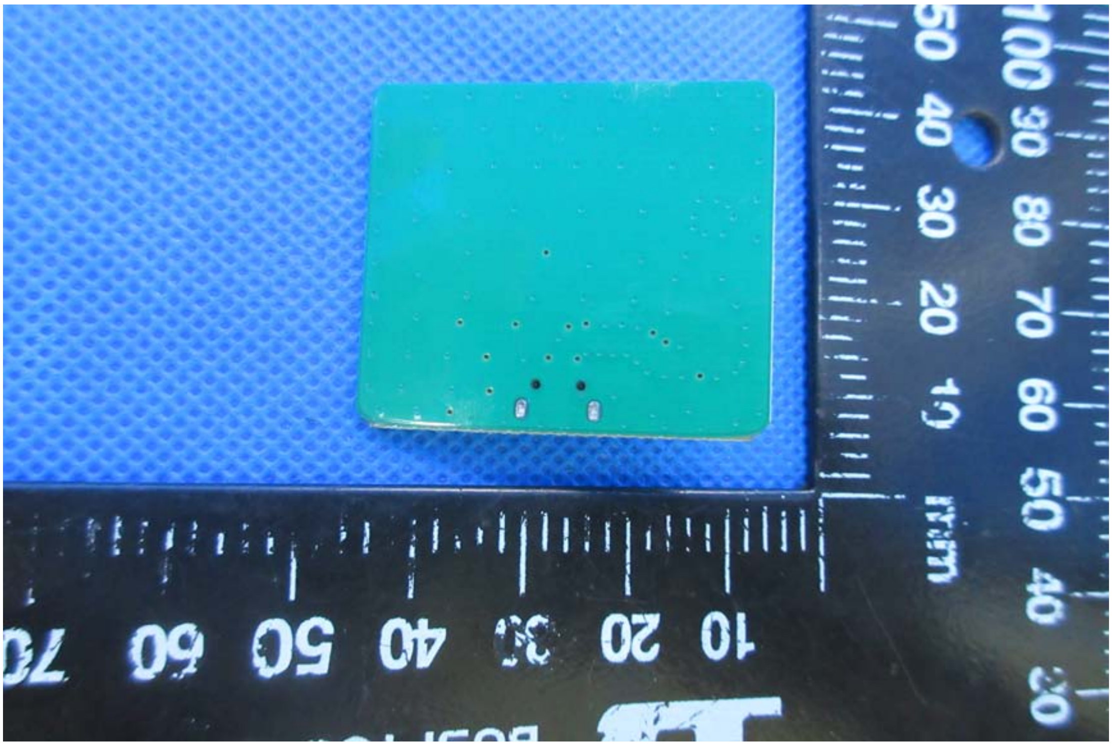
2. Mainboard front view





3. Mainboard rear view





4. BT/WIFI antenna view