FCC SAR TEST REPORT

Report No.:	SET2017-10788
Product:	Smartphone
Brand Name:	Haier
Model No.:	HM-G501-W, U33
FCC ID:	SG7201609G551
Applicant:	Haier Telecom(Qingdao) CO., Ltd.
Address:	No1.Haier Road,Hi-tech Zone Qingdao,China
Issued by:	CCIC-SET
Lab Location:	Building 28/29, East of Shigu, Xili Industrial Zone, Xili Road, Nanshan District, Shenzhen, Guangdong, China
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Test Report

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Applicant Address……:	No1.Haier Road,Hi-tech Zone Qingdao,China
Manufacturer……:	Haier Telecom(Qingdao) CO., Ltd.
Manufacturer Address:	No1.Haier Road,Hi-tech Zone Qingdao,China
Test Standards……:	**47CFR § 2.1093-** Radiofrequency Radiation Exposure Evaluation: Portable Devices; **ANSI C95.1–1992:** Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991) **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
Test Result……:	Pass

Tested by ……: Mei Chun 2017-07-25

Chun Mei, Test Engineer

Reviewed by……: Shuangwen Zhang 2017-07-25

Shuangwen Zhang,Senior Egineer

Approved by……: Wu Lian 2017-07-25

Wu Li'an , Manager

Contents

This Test Report consists of the following Annexes:

1. GENERAL CONDITIONS

1.1 This report only refers to the item that has undergone the test.

1.2 This report standalone does not constitute or imply by its own an approval of the product by the certification Bodies or competent Authorities.

1.3 This document is only valid if complete; no partial reproduction can be made without written approval of CCIC-SET

1.4 This report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of CCIC-SET and the Accreditation Bodies, if it applies.

2. Administrative Date

2.1. Identification of the Responsible Testing Laboratory

Company Name:	CCIC-SET
Department:	EMC & RF Department
Address:	Building 28/29, East of Shigu, Xili Industrial Zone, Xili Road, Nanshan District, Shenzhen, Guangdong, China
Telephone:	+86-755-26629676
Fax:	+86-755-26627238
Responsible Test Lab Managers:	Mr. Wu Li'an

2.2. Identification of the Responsible Testing Location(s)

Company Name:	CCIC-SET
Address:	Building 28/29, East of Shigu, Xili Industrial Zone, Xili Road, Nanshan District, Shenzhen, Guangdong, China

2.3. Organization Item

CCIC-SET Report No.:	SET2017-10788
CCIC-SET Project Leader:	Mr. Li Sixiong
CCIC-SET Responsible for accreditation scope:	Mr. Wu Li'an
Start of Testing:	2016-09-05
End of Testing:	2016-09-11

2.4. Identification of Applicant

Company Name:	Haier Telecom(Qingdao) CO., Ltd.
Address:	No1.Haier Road,Hi-tech Zone Qingdao,China

2.5. Identification of Manufacture

Company Name:	Haier Telecom(Qingdao) CO., Ltd.
Address:	No1.Haier Road,Hi-tech Zone Qingdao,China

Notes: This data is based on the information by the applicant.

3. Equipment Under Test (EUT)

3.1. Identification of the Equipment under Test

Sample Name:	Smartphone	
Model Name:	HM-G501-W, U33	
Brand Name:	Haier	
Hardware Version	V1.2_B	
Software Version	U33-H03-S005-AM	
General description:	Support Band	GSM850MHz/1900MHz/900MHz/1800MHz WCDMA 850MHz/1900MHz,WIFI, BT
	Test Band	GSM 850MHz/ GSM 1900MHz, GPRS 850MHz/ GPRS 1900MHz, WCDMA 850MHz /1900MHz,WIFI 802.11b
	Multislot Class	GPRS: Class 12; EGPRS: Class 12
	GPRS Class	Class B
	Development Stage	Identical Prototype
	Accessories	Power Supply
	Battery type	2000mAh
	Antenna type	Inner Antenna
	Operation mode	GSM / GPRS /WCDMA / LTE /WIFI
	Modulation mode	GSM(GMSK),UMTS(QPSK) WIFI(OFDM/DSSS)
	Max. RF Power	32.82dBm
	Max. SAR Value	Head: 0.467W/kg; Body-Worn: 1.024W/kg; Hotspot: 1.024W/kg (10mm distance)

NOTE:

a. this amend report was refer to original report SET2016-17164, EUT Use software to shut down all the LTE Bands.

4 SAR SUMMARY

Highest Standalone SAR Summary

Exposure Position	Frequency Band	Scaled 1g-SAR(W/kg)	Highest Scaled 1g-SAR(W/kg)
Head	GSM850	0.313	0.467
	GSM1900	0.245	
	WCDMA Band Ⅴ	0.235	
	WCDMA Band II	0.467	
	WIFI	0.406	
Body-worn Accessory (10mm Gap)	GSM850	0.413	1.024
	GSM1900	0.537	
	WCDMA Band Ⅴ	0.357	
	WCDMA Band II	1.024	
	WIFI	0.179	
Hotspot (10mm Gap)	GSM850	0.552	1.024
	GSM1900	0.675	
	WCDMA Band Ⅴ	0.357	
	WCDMA Band II	1.024	
	WIFI	0.179	

Highest Simultaneous SAR Summary

Exposure Position	Frequency Band	Highest Scaled 1g-SAR(W/kg)
Head	WWAN(WCDMA1900)&WIFI	0.729
Body-worn (10mmGap)	WWAN(WCDMA1900)&WIFI	1.203
Hotspot (10mmGap)	WWAN(WCDMA1900)&WIFI	1.203

5 Specific Absorption Rate (SAR)

5.1 Introduction

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

5.2 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 (). The equation description is as below:

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

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

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

$$\mathrm{SAR} = C\frac{\delta T}{\delta t}$$

where C is the specific head capacity, δT is the temperature rise and δt the exposure duration, or related to the electrical field in the tissue by

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

where σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the rms electrical field strength.

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

5.3 Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SATIMO. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).

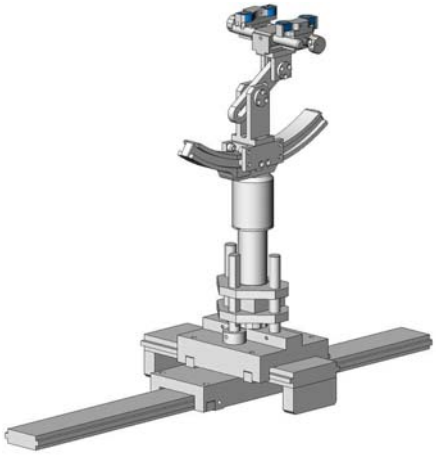
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

5.4 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SATIMO as an integral part of the COMOSAR test system.

The device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.



Device holder

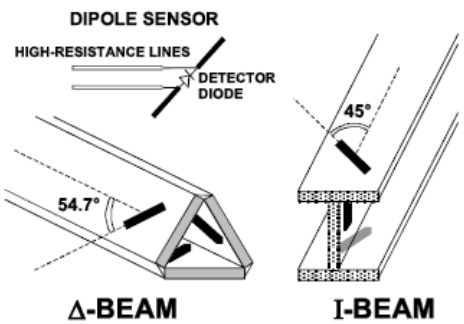
5.5 Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	700 MHz to 3 GHz; Linearity: ± 0.5 dB (700 MHz to 3 GHz)
Directivity	± 0.25 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	1.5 μW/g to 100 mW/g; Linearity: ± 0.5 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 5 mm Distance from probe tip to dipole centers: <2.7 mm
Application	General dosimetry up to 3 GHz Dosimetry in strong gradient fields Compliance tests of Smartphones
Compatibility	COMOSAR

Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



6 OPERATIONAL CONDITIONS DURING TEST

6.1 Schematic Test Configuration

During SAR test, EUT was operating in Traffic Mode (Channel Allocated) at Normal Voltage Condition. A communication link is set up with a System Simulator (SS) by air link, and a call is established. The EUT was commanded to operate at maximum transmitting power.

The EUT should use its internal transmitter. The antenna(s), battery and accessories shall be those specified by the manufacturer. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. If a wireless link was used, the antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the handset.

The signal transmitted by the simulator to the antenna feeding point should be lower than the output power level of the handset by at least 35 dB

6.2 SAR Measurement System

The SAR measurement system being used is the SATIMO system, the system is controlled remotely from a PC, which contains the software to control the robot and data acquisition equipment. The software also displays the data obtained from test scans.

In operation, the system first does an area (2D) scan at a fixed depth within the liquid from the inside wall of the phantom. When the maximum SAR point has been found, the system will then carry out a 3D scan centred at that point to determine volume averaged SAR level.

6.2.1 Tissue Dielectric Parameters for Head and Body Phantoms

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 Power drifts 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.

Table 1: Recommended Dielectric Performance of Tissue

Ingredients (% by weight)	Frequency (MHz)											
	450		835		915		1900		2450		2600	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.46	52.4	41.05	56.0	54.9	40.4	62.7	73.2	55.24	64.49
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04	0.5	0.024
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0	0.0	0.0

Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0	44.45	32.25
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5	39.0	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78	1.96	2.16

Table 2 Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	ε_r	σ(S/m)	ε_r	σ(S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

6.2.2 Simulate liquid

For measurements against the phantom head, the “cheek” and “tilt” position on both the left hand and the right hand sides of the phantom. For body-worn measurements, the EUT was tested against flat phantom representing the user body. The EUT was put on in the belt holder. Stimulate liquid that are used for testing at frequencies of GSM 850MHz/1900MHz, WCDMA850MHz/1700MHz/1900MHz, LTE Band2/4/5/7 and Wi-Fi 2.4GHz, which are made mainly of sugar, salt and water solutions may be left in the phantoms.

Table 3: Dielectric Performance of Head Tissue Simulating Liquid

Temperature: 23.2°C; Humidity: 64%;			
/	Frequency	Permittivity ε	Conductivity σ (S/m)
Target value	850MHz	41.5±5%	0.90±5%
Validation value (Sep. 9th, 2016)	850MHz	41.39	0.89
Target value	1900MHz	40.0±5%	1.40±5%
Validation value (Sep. 10th, 2016)	1900MHz	39.92	1.39
Target value	2450MHz	39.2±5%	1.80±5%
Validation value (Sep. 11th, 2016)	2450MHz	39.63	1.79

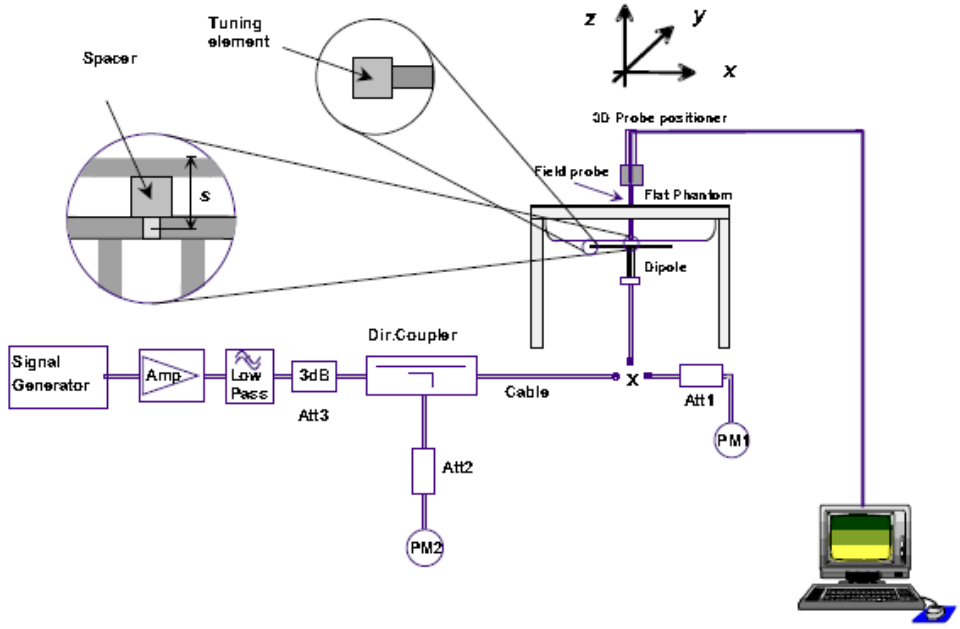
Table 4: Dielectric Performance of Body Tissue Simulating Liquid

Temperature: 23.2°C; Humidity: 64%;			
/	Frequency	Permittivity ε	Conductivity σ (S/m)
Target value	850MHz	55.2±5%	0.97±5%
Validation value (Sep. 5th, 2016)	850MHz	55.08	0.97
Target value	1900MHz	53.3±5%	1.52±5%
Validation value (Sep. 7th, 2016)	1900MHz	53.11	1.52
Target value	2450MHz	52.7±5%	1.95±5%
Validation value (Sep. 8th, 2016)	2450MHz	52.56	1.94

6.3 Results of validation testing

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

The following procedure, recommended for performing validation tests using box phantoms is based on the procedures described in the IEEE standard P1528. Setup according to the setup diagram below:



With the SG and Amp and with directional coupler in place, set up the source signal at the relevant frequency and use a power meter to measure the power at the end of the SMA cable that you intend to connect to the balanced dipole. Adjust the SG to make this, say, 0.25W (24 dBm). If this level is too high to read directly with the power meter sensor, insert a calibrated attenuator (e.g. 10 or 20 dB) and make a suitable correction to the power meter reading.

Note 1: In this method, the directional coupler is used for monitoring rather than setting the exact feed power level. If, however, the directional coupler is used for power measurement, you should check the frequency range and power rating of the coupler and measure the coupling factor (referred to output) at the test frequency using a VNA.

Note 2: Remember that the use of a 3dB attenuator (as shown in Figure 8.1 of P1528) means that you need an RF amplifier of 2 times greater power for the same feed power. The other issue is the cable length. You might get up to 1dB of loss per meter of cable, so the cable length after the coupler needs to be quite short.

Note 3: For the validation testing done using CW signals, most power meters are suitable. However, if you are measuring the output of a modulated signal from either a signal generator or a handset, you must ensure that the power meter correctly reads the modulated signals.

The measured 1-gram averaged SAR values of the device against the phantom are

provided in Tables 5 and Table 6. The humidity and ambient temperature of test facility were 64% and 23.2°C respectively. The body phantom were full of the body tissue simulating liquid. The EUT was supplied with full-charged battery for each measurement.

The distance between the back of the EUT and the bottom of the flat phantom is 10 mm (taking into account of the IEEE 1528 and the place of the antenna).

Table 5: Head SAR system validation (1g)

Frequency	Duty cycle	Target value （W/kg）	Test value (W/kg)	
			250 mW	1W
835MHz(Sep. 9th, 2016)	1:1	9.77±10%	2.38	9.52
1900MHz(Sep. 10th, 2016)	1:1	40.37±10%	9.94	39.76
2450MHz(Sep. 11th, 2016)	1:1	53.60±10%	13.20	52.80

Body SAR system validation (1g)

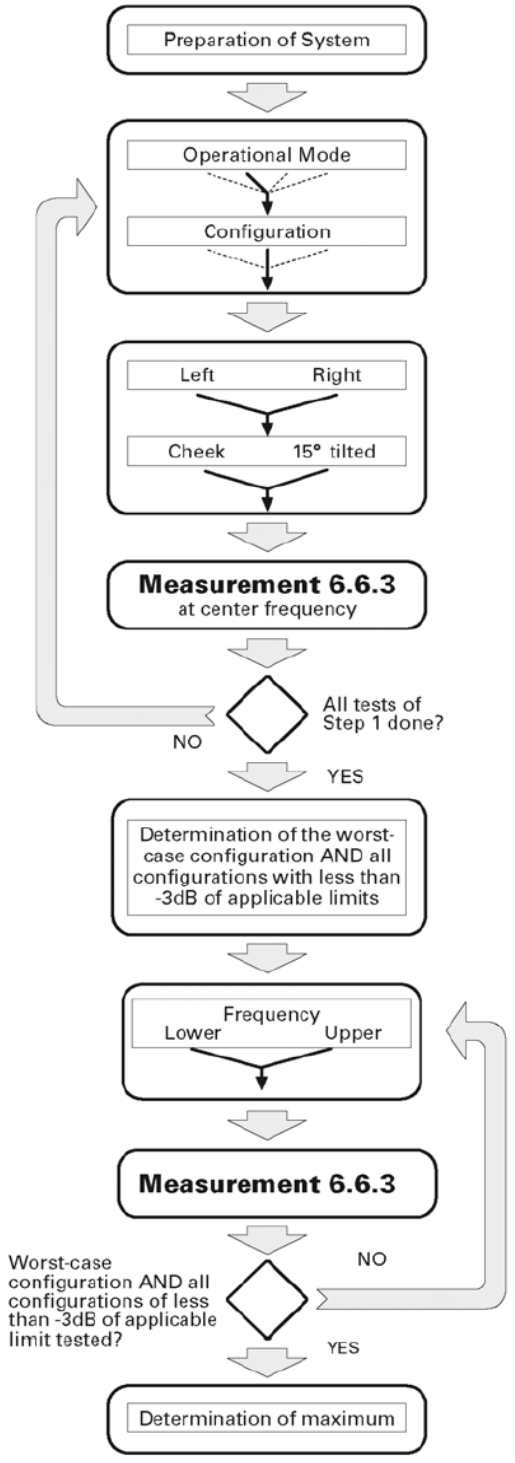
Frequency	Duty cycle	Target value （W/kg）	Test value (W/kg)	
			250 mW	1W
835MHz(Sep. 5th, 2016)	1:1	10.31±10%	2.52	10.08
1900MHz(Sep.7th, 2016)	1:1	40.81±10%	10.15	40.60
2450MHz(Sep. 8th, 2016)	1:1	52.66±10%	13.05	52.20

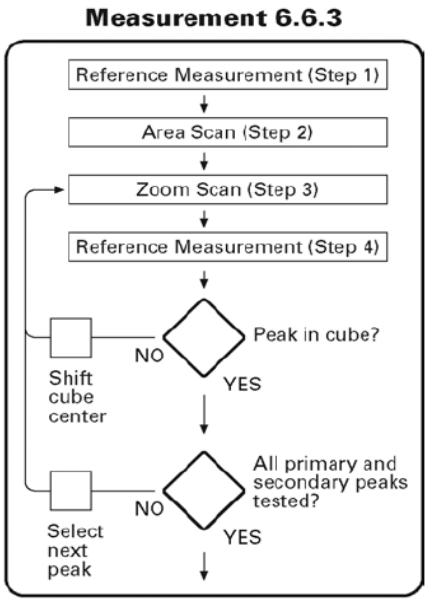
* Note: Target value was referring to the measured value in the calibration certificate of reference dipole.

Note: All SAR values are normalized to 1W forward power.

6.4 SAR measurement procedure

The SAR test against the head phantom was carried out as follow:





Establish a call with the maximum output power with a base station simulator, the connection between the EUT and the base station simulator is established via air interface.

After an area scan has been done at a fixed distance of 2mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, the probe is returned to the same point and a

second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.

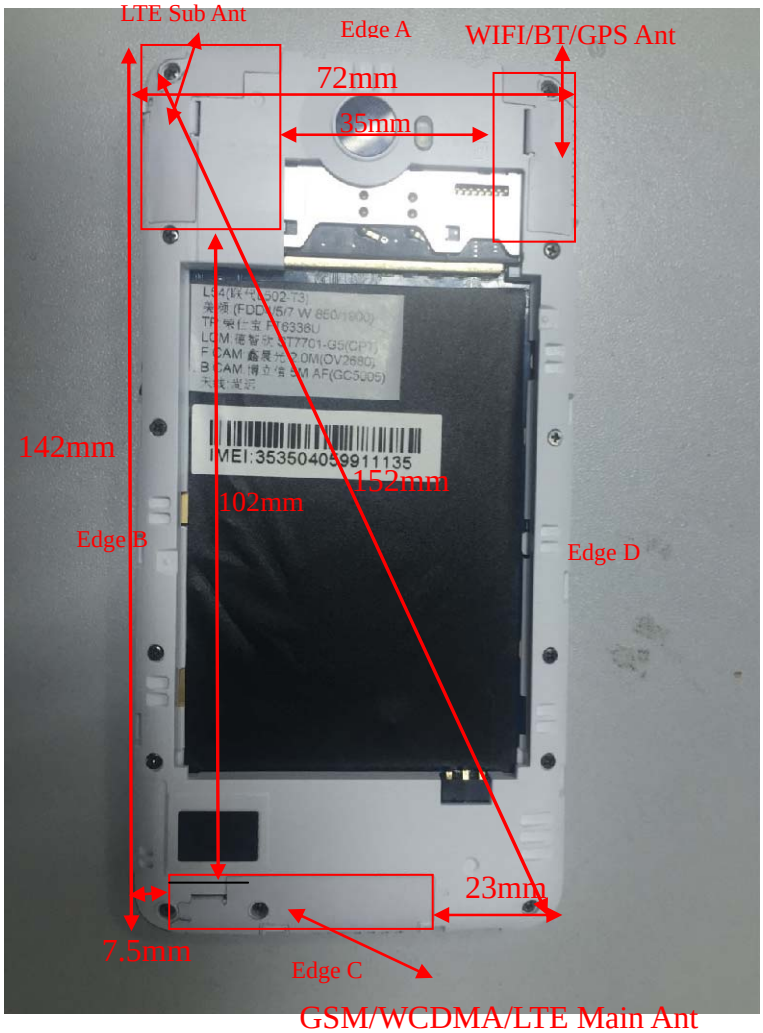
Above is the scanning procedure flow chart and table from the IEEEp1528 standard. This is the procedure for which all compliant testing should be carried out to ensure that all variations of the device position and transmission behavior are tested.

For SAR measurement, the liquid deep max more than 15cm as below photo

Head Liquid	Body Liquid
	

6.5 Transmitting antenna information

The GSM&WCDMA&WIFI&BT antennas inside the EUT.



The Body SAR measurement positions of each band are as below:

Antenna	Front	Back	Edge A	Edge B	Edge C	Edge D
WWAN Antenna Body-worn	Yes	Yes	No	No	No	No
WWAN Antenna hotspot	Yes	Yes	No	Yes	Yes	Yes
WIFI Antenna Body-worn	Yes	Yes	No	No	No	No
WIFI Antenna hotspot	Yes	Yes	Yes	No	No	Yes

Note: According to KDB 941225 D06 v02r01, when antenna-to-edge>2.5cm, SAR is not required.

7 CHARACTERISTICS OF THE TEST

7.1 Applicable Limit Regulations

47CFR § 2.1093- Radiofrequency Radiation Exposure Evaluation: Portable Devices;

ANSI C95.1–1992: Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)

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

It specifies the maximum exposure limit of **1.6 W/kg** as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

7.2 Applicable Measurement Standards

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this is in accordance with the following standards:

FCC 47 CFR Part2 (2.1093)
ANSI/IEEE C95.1-1992
IEEE 1528-2013
FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
FCC KDB 447498 D01 v06 General RF Exposure Guidance
FCC KDB 648474 D04 v01r03 Handset SAR
FCC KDB 865664 D01 v01r04 SAR Measurement 100MHz to 6GHz
FCC KDB 865664 D02 v01r02 SAR Exposure Reporting
FCC KDB 941225 D01 v03r01 3G SAR Procedures
FCC KDB 941225 D05 v02r05 SAR for LTE Devices
FCC KDB 941225 D06 v02r01 Hotspot Mode

8 LABORATORY ENVIRONMENTS

The Ambient Conditions during SAR Test

Temperature	Min. = 22 ℃, Max. = 25 ℃
Atmospheric pressure	Min.=86 kPa, Max.=106 kPa
Relative humidity	Min. = 45%, Max. = 75%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

9. Conducted RF Output Power

9.1 GSM Conducted Power

Band		Burst Average Power (dBm)			Frame-Average Power (dBm)		
GSM850	TX Channel	128	190	251	128	190	251
	Frequency(MHz)	824.2	836.6	848.8	824.2	836.6	848.8
	GSM	32.72	32.78	32.82	23.53	23.59	23.63
	GPRS (Slot 1)	32.59	32.64	32.75	23.40	23.45	23.56
	GPRS (Slot 2)	29.23	29.12	29.33	23.10	22.99	23.20
	GPRS (Slot 3)	27.68	27.88	27.91	23.26	23.46	23.49
	GPRS (Slot 4)	26.83	26.95	26.76	23.65	23.77	23.58
	EDGE (Slot 1)	27.52	27.32	27.08	18.33	18.13	17.89
	EDGE (Slot 2)	25.02	25.13	25.05	18.89	19.00	18.92
	EDGE (Slot 3)	23.45	23.55	23.46	19.03	19.13	19.04
	EDGE (Slot 4)	22.25	22.36	22.31	19.07	19.18	19.13

Band		Burst Average Power (dBm)			Frame-Average Power (dBm)		
GSM1900	TX Channel	512	661	810	512	661	810
	Frequency(MHz)	1850.2	1880	1909.8	1850.2	1880	1909.8
	GSM	29.25	29.36	29.34	20.06	20.17	20.15
	GPRS (Slot 1)	29.15	29.29	29.21	19.96	20.10	20.02
	GPRS (Slot 2)	26.23	26.15	26.23	20.10	20.02	20.10
	GPRS (Slot 3)	24.88	24.84	24.76	20.46	20.42	20.34
	GPRS (Slot 4)	23.76	23.81	23.75	20.58	20.63	20.57
	EDGE (Slot 1)	26.04	26.13	26.32	16.85	16.94	17.13
	EDGE (Slot 2)	23.02	23.12	23.05	16.89	16.99	16.92
	EDGE (Slot 3)	21.55	21.36	21.42	17.13	16.94	17.00
	EDGE (Slot 4)	20.36	20.42	20.38	17.18	17.24	17.20

Note: Per KDB 447498 D01 v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.

For hotspot SAR, EUT was performed at GPRS Class 12 multi-slots(4TX) mode

For Head and Body-worn SAR testing, EUT was set in GSM Voice mode for both GSM850 and GSM1900

Timeslot consignations

No. Of Slots	Slot 1	Slot 2	Slot 3	Slot 4
Slot Consignation	1Up4Down	2UpDown	3UpDown	4Up1Down
Duty Cycle	1:8	1:4	1:2.67	1:2
Crest Factor	-9.03dB	-6.02dB	-4.26dB	-3.01dB

9.2 WCDMA Conducted output Power

WCDMA conducted output power

Item	Band	WCDMA 850			WCDMA 1900		
	Frequency	4132	4183	4233	9262	9400	9538
	Subtest	dBm			dBm		
WCDMA	RMC 12.2Kbps	**22.68**	22.65	22.51	22.09	**22.24**	22.17
HSDPA	1	22.05	22.11	22.02	21.88	21.93	21.86
	2	21.95	21.90	21.91	21.75	21.70	21.67
	3	21.52	21.47	21.41	21.28	21.31	21.35
	4	21.61	21.52	21.55	21.37	21.31	21.38
HSUPA	1	21.82	21.88	21.90	21.75	21.69	21.71
	2	21.71	21.77	21.84	21.58	21.61	21.54
	3	21.51	21.45	21.53	21.35	21.37	21.41
	4	21.86	21.81	21.70	21.62	21.65	21.61
	5	21.47	21.58	21.52	21.41	21.37	21.43

Note:

1. WCDMA SAR was tested under PMC 12.2kbps with HSPA Inactive per KDB Publication 941225 D01v03r01.HSPA SAR was not requires since the average output power of the HSPA subtests was not more than 0.25dB higher than the RMC level and SAR was less than 1.2W/kg.
2. It is expected by the manufacturer that MPR for some HSPA subtests may be up to 2dB more than specified by 3GPP, but also as low as 0dB according to the chipset implementation in this model.

WLAN 2.4GHz Band Conducted Power

Channel/Freq.(MHz)	Maximum Conducted Out Power (dBm)		
	802.11b	802.11g	802.11n(HT20)
1(2412)	13.72	11.62	11.95
6(2437)	14.14	12.55	12.56
11(2462)	13.94	12.02	12.15

Channel/Freq.(MHz)	Maximum Conducted Out Power (dBm)
	802.11n40
3(2422)	11.88
6(2437)	11.73
9(2452)	11.94

Note:

1. Per KDB248227 D01 v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. 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 lowest data rate
3. Per KDB248227 D01 v02r02, 802.11g /11n-HT20/11n-HT40 is not required. . 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 ≤1.2W/Kg. Thus the SAR can be excluded.

Bluetooth Output Power

Channel	Frequency (MHz)	BT3.0 Output Power(dBm)		
		GFSK	π/4-DQPSK	8-DPSK
CH 0	2402	1.17	0.59	0.80
CH 39	2441	0.71	0.56	0.79
CH 78	2480	1.10	0.96	1.05

Channel	Frequency (MHz)	BT4.0 Output Power(dBm)
		GFSK
CH 0	2402	-5.25
CH 20	2442	-5.03
CH 39	2480	-5.92

SAR test Exclusion and estimate SAR calculation:

Note:

1. Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances ≤ 50mm are determined by:[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [$\sqrt{f}$ (GHz)] ≤3.0 for 1-g SAR and ≤7.5 for 10-g extremity SAR
   (1) f(GHz) is the RF channel transmit frequency in GHz
   (2) Power and distance are round to the nearest mW and mm before calculation
   (3) The result is rounded to one decimal place for comparison
   (4) If the test separation distance(antenna-user) is < 5mm, 5mm is used for excluded SAR calculation
   (5)

BT3.0 Max Power (dBm)	mW	Test Distance (mm)	Frequency(GHz)	Exclusion Thresholds
1.5	1.413	5	2.45	0.442

Per KDB 447498 D01v06 exclusion thresholds is 0.442<3, RF exposure evaluation is not required.

BT estimated SAR value=Exclusion Thresholds/7.5=0.442/7.5=**0.059W/Kg**

BT3.0 Max Power (dBm)	mW	Test Distance (mm)	Frequency(GHz)	Exclusion Thresholds
1.5	1.413	10	2.45	0.221

Per KDB 447498 D01v06 exclusion thresholds is 0221<3, RF exposure evaluation is not required.
BT estimated SAR value=Exclusion Thresholds/7.5=0.221/7.5=**0.029W/Kg**

BT4.0 Max Power (dBm)	mW	Test Distance (mm)	Frequency(GHz)	Exclusion Thresholds
-4.5	0.355	5	2.45	0.111

Per KDB 447498 D01v06 exclusion thresholds is 0.198<3, RF exposure evaluation is not required.

BT estimated SAR value=Exclusion Thresholds/7.5=0.111/7.5=0.015W/Kg

BT4.0 Max Power (dBm)	mW	Test Distance (mm)	Frequency(GHz)	Exclusion Thresholds
-4.5	0.355	10	2.45	0.056

Per KDB 447498 D01v06 exclusion thresholds is 0.099<3, RF exposure evaluation is not required.

BT estimated SAR value=Exclusion Thresholds/7.5=0.056/7.5=0.007W/Kg

The estimated SAR value is used for simultaneous transmission analysis.

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
2. Per KDB447498 D01v06, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is≤ 100 MHz. When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
3. Per KDB941225 D06 v02r01, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm, such position does not need to be tested. As the manufacture required, the separation distance use 5mm for Hotspot mode.
4. Per KDB 865664 D01v01r04,for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg, only one repeated measurement is required.
5. Per KDB865664 D02 v01r02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing(Refer to appendix D for details).
6. Per KDB941225 D01 v03r01, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.
7. Per KDB248227 D01 v02r02, 802.11g /11n-HT20/11n-HT40 is not required. 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 ≤1.2W/Kg. Thus the SAR can be excluded.

9.3. Scaling Factor calculation

Operation Mode	Channel	Output Power(dBm)	Tune up Power in tolerance(dBm)	Scaling Factor
GSM 850	128	32.72	32.0 ± 1.0	1.067
	190	32.78	32.0 ± 1.0	1.052
	251	32.82	32.0 ± 1.0	1.042
GPRS 850(4Tx)	128	26.83	26.0 ± 1.0	1.040
	190	26.95	26.0 ± 1.0	1.012
	251	26.76	26.0 ± 1.0	1.057
GSM1900	512	29.25	28.5 ± 1.0	1.059
	661	29.36	28.5 ± 1.0	1.033
	810	29.34	28.5 ± 1.0	1.038
GPRS1900(4Tx)	512	23.76	23.0 ± 1.0	1.057
	661	23.81	23.0 ± 1.0	1.045
	810	23.75	23.0 ± 1.0	1.059
WCDMA850	4132	22.68	22.0 ± 1.0	1.076
	4183	22.65	22.0 ± 1.0	1.084
	4233	22.51	22.0 ± 1.0	1.119
WCDMA1900	9262	22.09	21.5 ± 1.0	1.099
	9400	22.24	21.5 ± 1.0	1.062
	9538	22.17	21.5 ± 1.0	1.079
WIFI 802.11b	1	13.72	13.5 ± 1.0	1.191
	6	14.14	13.5 ± 1.0	1.086
	11	13.94	13.5 ± 1.0	1.138
BT	0	1.17	0.5 ± 1.0	1.079

10 TEST RESULTS

10.1 Summary of SAR Measurement Results

Table 7: SAR Values of GSM 850MHz Band

Temperature: 23.0~23.5°C, humidity: 62~64%.							
Test Positions			Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)			Plot No.
				SAR (W/Kg),1g	Scaled Factor	Scaled SAR(W/Kg) ,1g	
Right Side of Head	Cheek		190/836.6	**0.298**	1.052	**0.313**	**1**
	Tilt 15 degrees		190/836.6	0.240	1.052	0.252	--
Left Side of Head	Cheek		190/836.6	0.225	1.052	0.237	--
	Tilt 15 degrees		190/836.6	0.196	1.052	0.206	--
Body-worn (10mm Separation)	GSM	Face Upward	190/836.6	0.334	1.052	0.351	--
		Back Upward	190/836.6	**0.393**	1.052	**0.413**	**2**
Hotspot (10mm Separation)	GPRS (4Tx)	Face Upward	190/836.6	0.449	1.012	0.454	--
		Back Upward	190/836.6	**0.545**	1.012	**0.552**	**3**
		Edge B	190/836.6	0.138	1.012	0.140	--
		Edge C	190/836.6	0.152	1.012	0.154	--
		Edge D	190/836.6	0.193	1.012	0.195	--

Table 8: SAR Values of GSM1900 MHz Band

Temperature: 23.0~23.5°C, humidity: 62~64%.							
Test Positions			Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)			Plot No.
				SAR (W/Kg),1g	Scaled Factor	Scaled SAR(W/Kg) ,1g	
Right Side of Head	Cheek		661/1880.0	**0.237**	1.033	**0.245**	**4**
	Tilt 15 degrees		661/1880.0	0.122	1.033	0.126	--
Left Side of Head	Cheek		661/1880.0	0.099	1.033	0.102	--
	Tilt 15 degrees		661/1880.0	0.071	1.033	0.073	--
Body-worn (10mm Separation)	GSM	Face Upward	661/1880.0	0.430	1.033	0.444	**--**
		Back Upward	661/1880.0	**0.520**	1.033	**0.537**	**5**
Hotspot (10mm Separation)	GPRS (4Tx)	Face Upward	661/1880.0	0.458	1.045	0.479	--
		Back Upward	661/1880.0	**0.646**	1.045	**0.675**	**6**
		Edge B	661/1880.0	0.200	1.045	0.209	--
		Edge C	661/1880.0	0.441	1.045	0.461	--
		Edge D	661/1880.0	0.075	1.045	0.078	--

Table 9: SAR Values of WCDMA850

Temperature: 23.0~23.5°C, humidity: 62~64%.						
Test Positions		Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)			Plot No.
			SAR (W/Kg), 1g	Scaled Factor	Scaled SAR(W/Kg),1g	
Right Side of Head	Cheek	4183/836.6	**0.217**	1.084	**0.235**	**7**
	Tilt 15 degrees	4183/836.6	0.183	1.084	0.198	--
Left Side of Head	Cheek	4183/836.6	0.210	1.084	0.228	**--**
	Tilt 15 degrees	4183/836.6	0.165	1.084	0.179	--
Body-worn (10mm Separation)	Face Upward	4183/836.6	0.245	1.084	0.266	--
	Back Upward	4183/836.6	**0.329**	1.084	**0.357**	**8**
Hotspot (10mm Separation)	Face Upward	4183/836.6	0.245	1.084	0.266	--
	Back Upward	4183/836.6	**0.329**	1.084	**0.357**	**8**
	Edge B	4183/836.6	0.126	1.084	0.137	--
	Edge C	4183/836.6	0.114	1.084	0.124	--
	Edge D	4183/836.6	0.066	1.084	0.072	--

Table 11: SAR Values of WCDMA1900

Temperature: 23.0~23.5°C, humidity: 62~64%.						
Test Positions		Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)			Plot No.
			SAR (W/Kg),1g	Scaled Factor	Scaled SAR(W/Kg),1g	
Right Side of Head	Cheek	9400/1880	**0.440**	1.062	**0.467**	**9**
	Tilt 15 degrees	9400/1880	0.174	1.062	0.185	--
Left Side of Head	Cheek	9400/1880	0.304	1.062	0.323	**--**
	Tilt 15 degrees	9400/1880	0.206	1.062	0.219	--
Body-worn (10mm Separation)	Face Upward	9400/1880	0.735	1.062	0.781	--
	Back Upward	9262/1852.4	0.931	1.099	1.023	--
	Back Upward	9400/1880	**0.964**	1.062	**1.024**	**10**
	Back Upward	9538/1907.6	0.923	1.079	0.996	**--**
	Back Upward, repeated	9262/1852.4	0.915	1.099	1.006	--
	Back Upward, repeated	9400/1880	0.922	1.062	0.979	--
	Back Upward, repeated	9538/1907.6	0.906	1.079	0.978	--
Hotspot (10mm Separation)	Face Upward	9400/1880	0.735	1.062	0.781	--
	Back Upward	9262/1852.4	0.931	1.099	1.023	--
	Back Upward	9400/1880	**0.964**	1.062	**1.024**	**10**
	Back Upward	9538/1907.6	0.923	1.079	0.996	**--**
	Back Upward, repeated	9262/1852.4	0.915	1.099	1.006	--
	Back Upward, repeated	9400/1880	0.922	1.062	0.979	--
	Back Upward, repeated	9538/1907.6	0.906	1.079	0.978	--
	Edge B	9400/1880	0.311	1.062	0.330	--
	Edge C	9400/1880	0.523	1.062	0.555	
	Edge D	9400/1880	0.343	1.062	0.364	--

Table 12: SAR Values of Wi-Fi 802.11b

Test Positions		Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)			Plot No.
			SAR(W/Kg) 1g	Scaled Factor	Scaled SAR(W/Kg) ,1g	
Right Side of Head	Cheek	6/2437	0.202	1.086	0.219	--
	Tilt 15 degrees	6/2437	0.125	1.086	0.136	--
Left Side of Head	Cheek	6/2437	**0.374**	1.086	**0.406**	**11**
	Tilt 15 degrees	6/2437	0.249	1.086	0.270	**--**
Body-worn (10mm Separation)	Face Upward	6/2437	0.080	1.086	0.087	--
	Back Upward	6/2437	**0.165**	1.086	**0.179**	**12**
Hotspot (10mm Separation)	Face Upward	6/2437	0.080	1.086	0.087	--
	Back Upward	6/2437	**0.165**	1.086	**0.179**	**12**
	Edge A	6/2437	0.055	1.086	0.060	--
	Edge D	6/2437	0.041	1.086	0.045	--

Note:
Per KDB Publication 941225 D01v03r01. RMC 12.2kbps was as primary mode SAR, when the primary mode SAR less than 1.2W/kg, secondary SAR (HSPA) was not requires.

When the 1-g SAR for the mid-band channel or the channel with the highest output power satisfy the following conditions, testing of the other channels in the band is not required. (Per KDB 447498 D01 General RF Exposure Guidance v06)
• ≤ 0.8 W/kg, when the transmission band is ≤ 100 MHz
• ≤ 0.6 W/kg, when the transmission band is between 100 MHz and 200 MHz
• ≤ 0.4 W/kg, when the transmission band is ≥ 200 MHz

10.2 Simultaneous Transmissions Analysis

Localized Specific Absorption Rate (SAR) of this portable wireless device has been measured in all cases requested by the relevant standards cited in Clause 6 of this report. Maximum localized SAR is **below** exposure limits specified in the relevant standards.

Simultaneous SAR

No.	Transmitter Combinations	Scenario Supported or not	Supported for Mobile Hotspot or not
1	GSM+ BT	Yes	No
2	GSM + WIFI	Yes	Yes
3	WCDMA +BT	Yes	No
4	WCDMA +WIFI	Yes	Yes
5	WIFI+BT	No	No

Test Position		Right Cheek	Right Title	Left Cheek	Left Tilt
Head MAX 1-g SAR(W/Kg)	GSM850	0.313	0.252	0.237	0.206
	GSM1900	0.245	0.126	0.102	0.073
	WCDMA850	0.235	0.198	0.228	0.179
	WCDMA1900	0.467	0.185	0.323	0.219
	WIFI 802.11b	0.219	0.136	0.406	0.270
	BT	*0.059	*0.059	*0.059	*0.059
WIFI Simultaneous ∑1-g SAR(W/Kg)		0.686	0.388	0.729	0.489
BT Simultaneous ∑1-g SAR(W/Kg)		0.526	0.311	0.382	0.278

Simultaneous Tx Combination of GSM/WCDMA/LTE and BT/WIFI (Head).

Test Position		Face	Back	Edge A	Edge B	Edge C	Edge D
Body-worn 10mm separation MAX 1-g SAR(W/Kg)	GSM850	0.351	0.413	--	--	--	--
	GSM1900	0.444	0.537	--	--	--	--
	WCDMA850	0.266	0.357	--	--	--	--
	WCDMA1900	0.781	1.024	--	--	--	--
	WIFI 802.11b	0.087	0.179	--	--	--	--
	BT	*0.029	*0.029	--	--	--	--
WIFI Simultaneous ∑1-g SAR(W/Kg)		0.868	1.203	--	--	--	--
BT Simultaneous ∑1-g SAR(W/Kg)		0.810	1.053	--	--	--	--

Simultaneous Tx Combination of GSM/WCDMA and BT/WIFI (Body).

Test Position		Face	Back	Edge A	Edge B	Edge C	Edge D
Hotspot 10mm separation MAX 1-g SAR(W/Kg)	GPRS850	0.454	0.552	--	0.140	0.154	0.195
	GPRS1900	0.479	0.675	--	0.209	0.461	0.078
	WCDMA 850	0.266	0.357	--	0.137	0.124	0.072
	WCDMA 1900	0.781	1.024	--	0.330	0.555	0.364
	WIFI 802.11b	0.087	0.179	0.060	--	--	0.045
	BT	*0.029	*0.029	*0.029	*0.029	*0.029	*0.029
WIFI Simultaneous ∑1-g SAR(W/Kg)		0.868	1.203	--	--	--	0.409
BT Simultaneous ∑1-g SAR(W/Kg)		0.810	1.053	--	--	--	0.393

Simultaneous Tx Combination of GSM/WCDMA and WIFI (Body).

The estimated SAR value with * Signal

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required

11 Measurement Uncertainty

No.	Uncertainty Component	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard Uncertainty (%) ui(%)	Degree of freedom Veff or vi
	Measurement System							
1	– Probe Calibration	B	5.8	N	1	1	5.8	∞
2	– Axial isotropy	B	3.5	R	$\sqrt{3}$	0.5	1.43	∞
3	– Hemispherical Isotropy	B	5.9	R	$\sqrt{3}$	0.5	2.41	∞
4	– Boundary Effect	B	1	R	$\sqrt{3}$	1	0.58	∞
5	– Linearity	B	4.7	R	$\sqrt{3}$	1	2.71	∞
6	– System Detection Limits	B	1.0	R	$\sqrt{3}$	1	0.58	∞
7	Modulation response	B	3	N	1	1	3.00	
8	– Readout Electronics	B	0.5	N	1	1	0.50	∞
9	– Response Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
10	– Integration Time	B	3.0	R	$\sqrt{3}$	1	1.73	∞
11	– RF Ambient Conditions	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	– Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
13	– Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	– Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
15	– Position of the DUT	A	2.6	N	$\sqrt{3}$	1	2.6	5
16	– Holder of the DUT	A	3	N	$\sqrt{3}$	1	3.0	5

17	– Output Power Variation –SAR drift measurement	B	5.0	R	$\sqrt{3}$	1	2.89	∞
Phantom and Tissue Parameters								
18	– Phantom Uncertainty(shape and thickness tolerances)	B	4	R	$\sqrt{3}$	1	2.31	∞
19	Uncertainty in SAR correction for deviation(in permittivity and conductivity)	B	2	N	1	1	2.00	
20	– Liquid Conductivity Target –tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
21	– Liquid Conductivity –measurement Uncertainty)	B	4	N	$\sqrt{3}$	1	0.92	9
22	– Liquid Permittivity Target tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
23	– Liquid Permittivity –measurement uncertainty	B	5	N	$\sqrt{3}$	1	1.15	∞
Combined Standard Uncertainty				RSS			10.63	
Expanded uncertainty (Confidence interval of 95 %)				K=2			21.26	

System Check Uncertainty

No.	Uncertainty Component	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard Uncertainty (%) ui(%)	Degree of freedom Veff or vi
	Measurement System							
1	– Probe Calibration	B	5.8	N	1	1	5.8	∞
2	– Axial isotropy	B	3.5	R	$\sqrt{3}$	0.5	1.43	∞
3	– Hemispherical Isotropy	B	5.9	R	$\sqrt{3}$	0.5	2.41	∞
4	– Boundary Effect	B	1	R	$\sqrt{3}$	1	0.58	∞
5	– Linearity	B	4.7	R	$\sqrt{3}$	1	2.71	∞
6	– System Detection Limits	B	1	R	$\sqrt{3}$	1	0.58	∞
7	Modulation response	B	0	N	1	1	0.00	

8	– Readout Electronics	B	0.5	N	1	1	0.50	∞
9	– Response Time	B	0.00	R	$\sqrt{3}$	1	0.00	∞
10	– Integration Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
11	– RF Ambient Conditions	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	– Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
13	– Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	– Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
15	Deviation of experimental source from numberical source	A	4	N	1	1	4.00	5
16	Input Power and SAR drift measurement	A	5	R	$\sqrt{3}$	1	2.89	5
17	Dipole Axis to Liquid Distance	B	2	R	$\sqrt{3}$	1	1.2	∞
Phantom and Tissue Parameters								
18	– Phantom Uncertainty(shape and thickness tolerances)	B	4	R	$\sqrt{3}$	1	2.31	∞
19	Uncertainty in SAR correction for deviation(in permittivity and conductivity)	B	2	N	1	1	2.00	
20	– Liquid Conductivity Target –tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
21	– Liquid Conductivity –measurement Uncertainty)	B	4	N	$\sqrt{3}$	1	0.92	9
22	– Liquid Permittivity Target tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
23	– Liquid Permittivity –measurement uncertainty	B	5	N	$\sqrt{3}$	1	1.15	∞
Combined Standard Uncertainty				RSS			10.15	
Expanded uncertainty (Confidence interval of 95 %)				K=2			20.29	

12 MAIN TEST INSTRUMENTS

EQUIPMENT	TYPE	Series No.	Calibration Date	calibration period
System Simulator	CMW500	130805	2016/08/10	1 Year
SAR Probe	SATIMO	SN43/15 EP276	2015/12/09	1 Year
Dipole	SID835	SN09/13 DIP0G835-217	2014/08/28	3 Year
Dipole	SID1800	SN09/13 DIP1G800-216	2014/08/28	3 Year
Dipole	SID1900	SN09/13 DIP1G900-218	2014/08/28	3 Year
Dipole	SID2450	SN09/13 DIP2G450-220	2014/08/28	3 Year
Dipole	SID2600	SN32/14 DIP2G600-338	2014/08/12	3 Year
Vector Network Analyzer	ZVB8	A0802530	2016/06/07	1 Year
Signal Generator	SMR27	A0304219	2016/06/07	1 Year
Power Meter	NRP2	A140401673	2016/03/09	1 Year
Power Sensor	NPR-Z11	1138.3004.02-114072-nq	2016/03/09	1 Year
Amplifier	Nucletudes	143060	2016/03/09	1 Year
Directional Coupler	DC6180A	305827	2016/03/09	1 Year
Power Meter	NRVS	A0802531	2016/03/09	1 Year
Power Sensor	NRV-Z4	100069	2016/03/09	1 Year
Multimeter	Keithley-2000	4014020	2016/03/09	1 Year