TEST REPORT

No.I18N00717-SAR

For

Doro AB

LTE Phone

Model Name: DSB-0090

With

Hardware Version: 1XX1

Software Version:

FRANK01A-S10A_DSB0090_600_USERDEBUG_180503

FCC ID: WS5DSB0090

Issued Date: 2018-06-08

Designation Number: CN1210

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

Test Laboratory:

Shenzhen Academy of Information and Communications Technology

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
I18N00717-SAR	Rev.0	2018-06-08	Initial creation of test report

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1 Test Laboratory

1.1 Testing Location

Company Name:	Shenzhen Academy of Information and Communications Technology
Address:	Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China
Postal Code:	518026
Telephone:	+86-755-33322000
Fax:	+86-755-33322001

1.2 Testing Environment

Temperature:	18°C~25 °C
Relative humidity:	30%~ 70%
Ground system resistance:	< 4Ω
Ambient noise & Reflection:	< 0.012 W/kg

1.3 Project Data

Testing Start Date:	April 24, 2017
Testing End Date:	May 20, 2018

1.4 Signature

Li Yongfu
(Prepared this test report)

Zhang Yunzhuan
(Reviewed this test report)

Cao Junfei
Deputy Director of the laboratory
(Approved this test report)

2 Statement of Compliance

This EUT is a variant product and the report of original sample is No.I17N00290-SAR. According to the client request, we quote the test results of original sample. The results of spot check are presented in annex J.

The maximum results of Specific Absorption Rate (SAR) found during testing for Doro AB LTE Phone DSB-0090 are as follows:

Table 2.1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Highest Reported SAR 1g(W/Kg)	Equipment Class
Head (Separation Distance 0mm)	GSM850	0.43	PCE
	PCS1900	0.52	
	UMTS FDD 5	0.30	
	UMTS FDD 2	0.89	
	LTE Band 7	0.37	
	WLAN 2.4GHz	0.46	DTS
	WLAN 5GHz	0.56	UNII
Body-worn (Data) (Separation Distance 10mm)	GSM850	0.97	PCE
	PCS1900	0.87	
	UMTS FDD 5	0.40	
	UMTS FDD 2	1.07	
	LTE Band 7	**1.22**	
	WLAN 2.4GHz	0.11	DTS
	WLAN 5GHz	0.27	UNII

The SAR values found for the Mobile Phone are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1g tissue according to the ANSI C95.1-1992

.

For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and which provides a minimum separation distance of 10 mm between this device and the body of the user. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output.

The measurement together with the test system set-up is described in annex C of this test report. A detailed description of the equipment under test can be found in chapter 4 of this test report.

The highest reported SAR value is obtained at the case of **(Table 2.1),** and the values are**: 1.22W/kg (1g).**

Table 2.2: The sum of reported SAR values for main antenna and Wi-Fi

	Position	Main antenna	Wi-Fi	Sum
Highest reported SAR value for Head	Left Touch	0.89	0.56	**1.45**
	Right Touch	0.43	0.24	**0.67**
Highest reported SAR value for Body	Rear	0.97	0.27	**1.24**
	Bottom	1.22	/	**1.22**

Table2.3: The sum of reported SAR values for main antenna and BT

	Position	Main antenna	BT*	Sum
Highest reported SAR value for Head	Left Touch	0.89	0.23	**1.12**
	Right Touch	0.43	0.23	**0.66**
Highest reported SAR value for Body	Rear	0.97	0.13	**1.10**
	Bottom	1.22	/	**1.22**

BT*-Estimated SAR for Bluetooth (seethetable13.3)

According to the above tables, the highest sum of reported SAR values is **1.45W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 13.

3 Client Information

3.1 Applicant Information

Company Name:	Doro AB
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3.2 Manufacturer Information

Company Name:	CK TELECOM LTD.
Address /Post:	Technology Road. High-Tech Development Zone. Heyuan, Guangdong, P.R.China
Contact:	Xin Li
Email:	xin.li@ck-telecom.com
Telephone:	0755-26739100 ext.8515
Fax:	0755-26739600

4 Equipment Under Test (EUT) and Ancillary Equipment (AE)

4.1 About EUT

Description:	LTE Phone
Model name:	DSB-0090
Operating mode(s):	GSM 850/900, WCDMA 850/1900, LTE_FDD Band 7, BT, Wi-Fi 2.4G/5G
Tested Tx Frequency:	825–848.8 MHz (GSM 850)
	1850.2–1910 MHz (GSM 1900)
	826.4–846.6 MHz (WCDMA850 Band V)
	1852.4–1907.6 MHz (WCDMA1900 Band II)
	2502.5–2567.5 MHz (LTE_FDD Band 7)
	2412 – 2462 MHz (Wi-Fi 2.4G)
	5150 – 5250 MHz (U-NII-1)
	5250 – 5350 MHz (U-NII-2A)
	5725 – 5825 MHz (U-NII-3)
GPRS&EGPRS Multislot Class:	12
GPRS capability Class:	B
Test device Production information:	Production unit
Device type:	Portable device
Antenna type:	Integrated antenna
Accessories/Body-worn configurations:	/
Hotspot mode:	Support

4.2 Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version
EUT1	355115080005942	1011	FRANK01A-S10A_DSB0090_201_USER_170503
EUT2	355115080003384	1011	FRANK01A-S10A_DSB0090_201_USER_170503
EUT3	355115080818484	1021	FRANK01A-S10A_DSB0090_600_USERDEBUG_180503

*EUT ID: is used to identify the test sample in the lab internally.

Note1: It is performed to test SAR with the EUT 1 & 3, and conducted power with the EUT 2.

Note2: Series Hardware Version：1XX1, XX=01~16, XX means different combinations of the components for 2 suppliers. The combinations are as below.

doro8040 HW	G sensor	M sensor	TVS	Memory
1011	1st	1st	1st	1st
1021	2nd	2nd	2nd	2nd
1031	1st	1st	1st	2nd
1041	1st	1st	2nd	1st
1051	1st	1st	2nd	2nd

doro8040 HW	G sensor	M sensor	TVS	Memory
1061	1st	2nd	1st	1st
1071	1st	2nd	1st	2nd
1081	1st	2nd	2nd	1st
1091	1st	2nd	2nd	2nd
1101	2nd	1st	1st	1st
1111	2nd	1st	1st	2nd
1121	2nd	1st	2nd	1st
1131	2nd	1st	2nd	2nd
1141	2nd	2nd	1st	1st
1151	2nd	2nd	2nd	1st
1161	2nd	2nd	1st	2nd

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	DBN-2920A	/	Coslight Technology International Group Co., Ltd.
AE2	Headset	150C-333E-3.5MM-24	/	QUANCHENG ELECTRONIC CO., LTD

*AE ID: is used to identify the test sample in the lab internally.

5 TEST METHODOLOGY

5.1 Applicable Limit Regulations

ANSI C95.1–1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

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.

5.2 Applicable Measurement Standards

IEEE 1528–2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Experimental Techniques.

KDB447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

KDB648474 D04 Handset SAR v01r03: SAR Evaluation Considerations for Wireless Handsets.

KDB941225 D01 SAR test for 3G devices v03r01: SAR Measurement Procedures for 3G Devices

KDB941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices

KDB 941225 D06 Hot Spot SAR v02r01: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

KDB 248227 D01 802.11 Wi-Fi SAR v02r02: SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters.

KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz.

KDB 865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

6 Specific Absorption Rate (SAR)

6.1 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.

6.2 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:

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

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

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

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

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

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

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

7 Tissue Simulating Liquids

7.1 Targets for tissue simulating liquid

Table 7.1: Targets for tissue simulating liquid

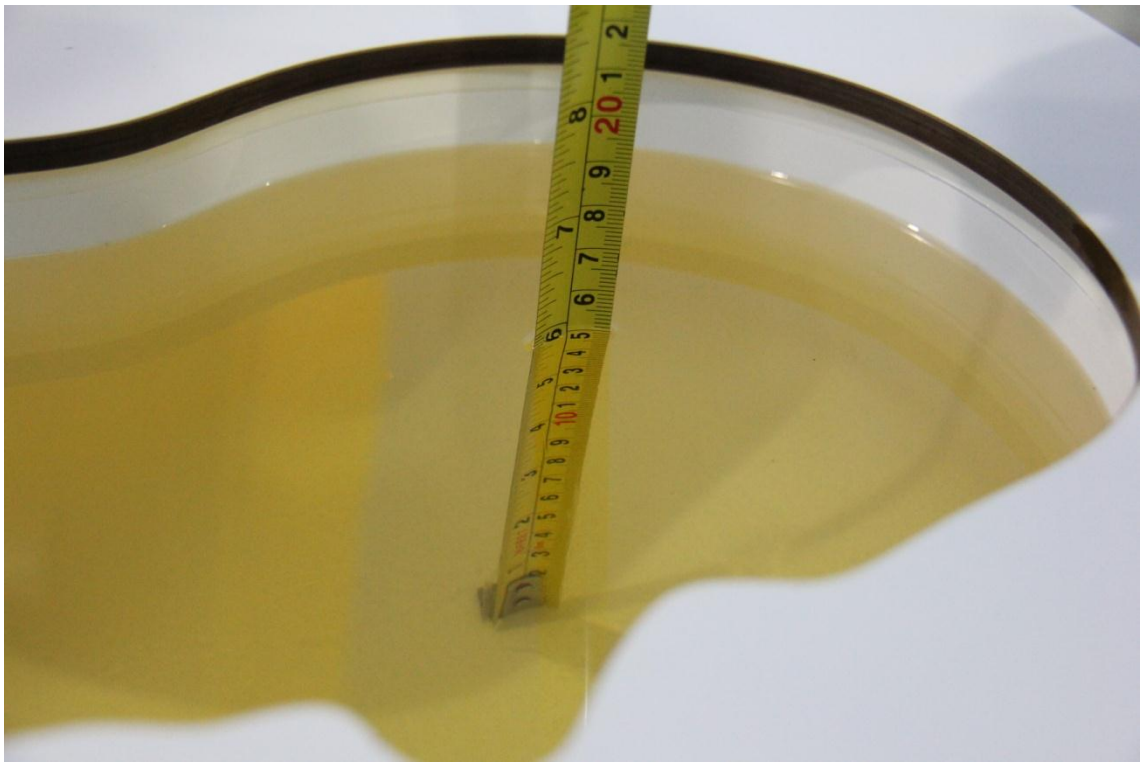
Frequency (MHz)	Liquid Type	Conductivity (σ)	± 5% Range	Permittivity (ε)	± 5% Range
835	Head	0.90	0.86～0.95	41.5	39.4～43.6
835	Body	0.97	0.92～1.02	55.2	52.4～58.0
1900	Head	1.40	1.33～1.47	40.0	38.0～42.0
1900	Body	1.52	1.44～1.60	53.3	50.6～56.0
2450	Head	1.80	1.71～1.89	39.2	37.2～41.2
2450	Body	1.95	1.85～2.05	52.7	50.1～55.3
2550	Head	1.91	1.81～2.01	39.07	37.1～41.0
2550	Body	2.09	1.99～2.19	52.6	50.0～55.2
5200	Head	4.66	4.43～4.89	35.99	34.2～37.7
5200	Body	4.90	4.66～5.14	49.0	46.6～51.4
5800	Head	5.27	5.01～5.53	35.3	33.5～37.1
5800	Body	6.00	5.70～6.30	48.2	45.8～50.6

7.2 Dielectric Performance

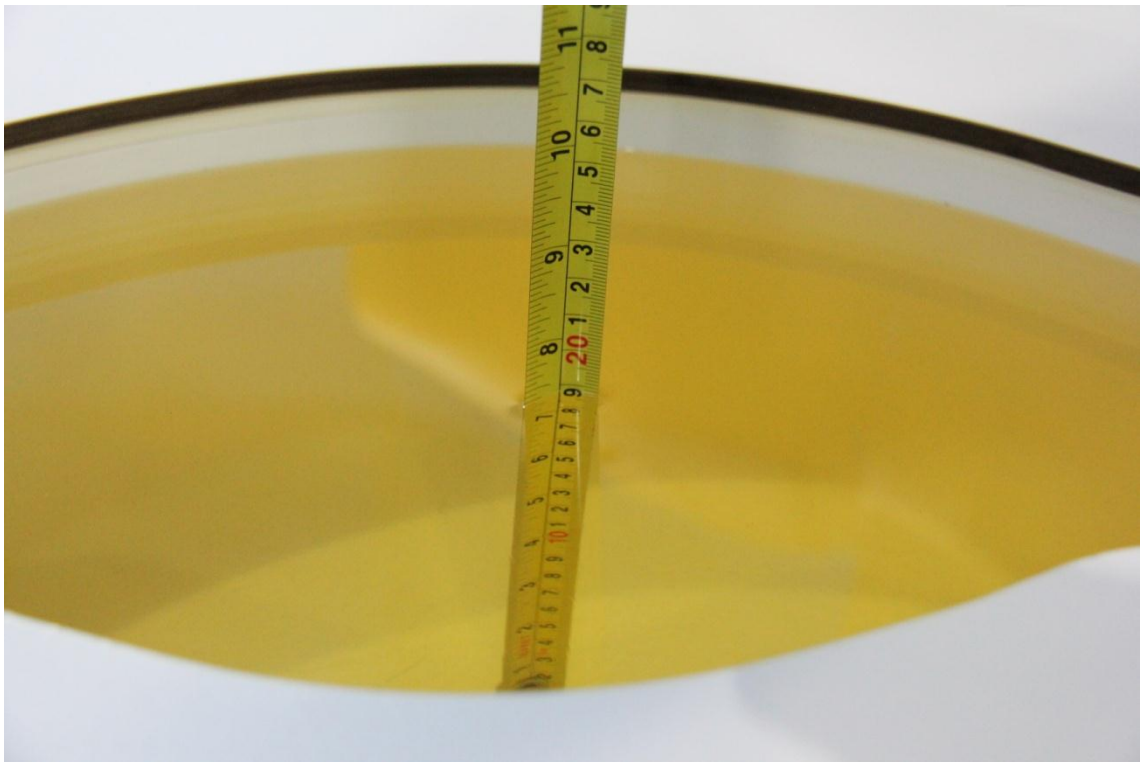
Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2017-4-24	Head	835	40.86	-1.54	0.924	2.67
2017-4-24	Body	835	53.74	-2.64	0.995	2.58
2017-4-26	Head	1900	39.25	-1.88	1.406	-0.43
2017-4-26	Body	1900	52.28	-1.91	1.543	1.51
2017-5-9	Head	2450	38.62	-1.48	1.832	1.78
2017-5-9	Body	2450	51.28	-2.69	1.986	1.85
2016-4-28	Head	2550	38.47	-1.54	1.935	1.31
2016-4-28	Body	2550	53.36	1.44	2.115	1.20
2017-5-9	Head	5200	36.27	0.78	4.586	-1.59
2017-5-9	Body	5200	47.96	-2.12	4.784	-2.37
2017-5-9	Head	5800	34.52	-2.21	5.192	-1.48
2017-5-9	Body	5800	46.84	-2.82	6.233	3.88
2018-5-20	Head	835	41.37	-0.31	0.882	-2.00
2018-5-20	Body	835	53.68	-2.75	0.986	1.65
2018-5-20	Head	1900	39.15	-2.13	1.417	1.21
2018-5-20	Body	1900	52.35	-1.78	1.544	1.58
2018-5-20	Body	2550	53.21	1.16	2.032	-2.78

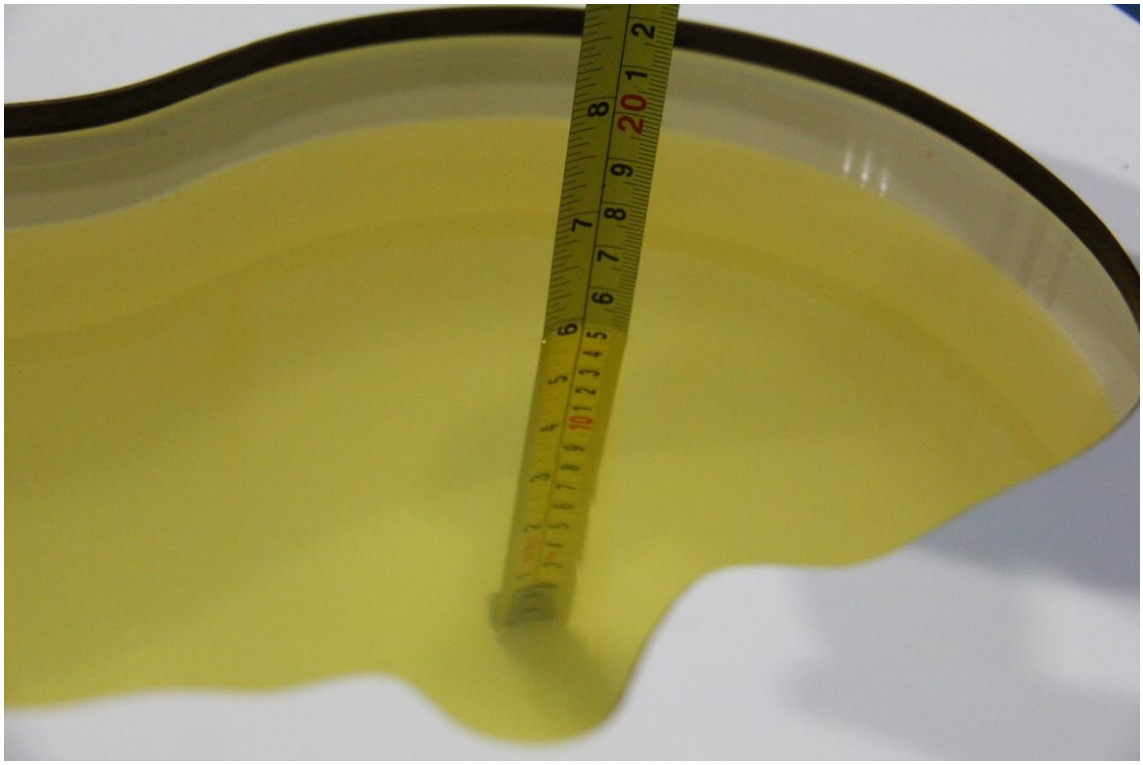
Note: The liquid temperature is 22.0°C



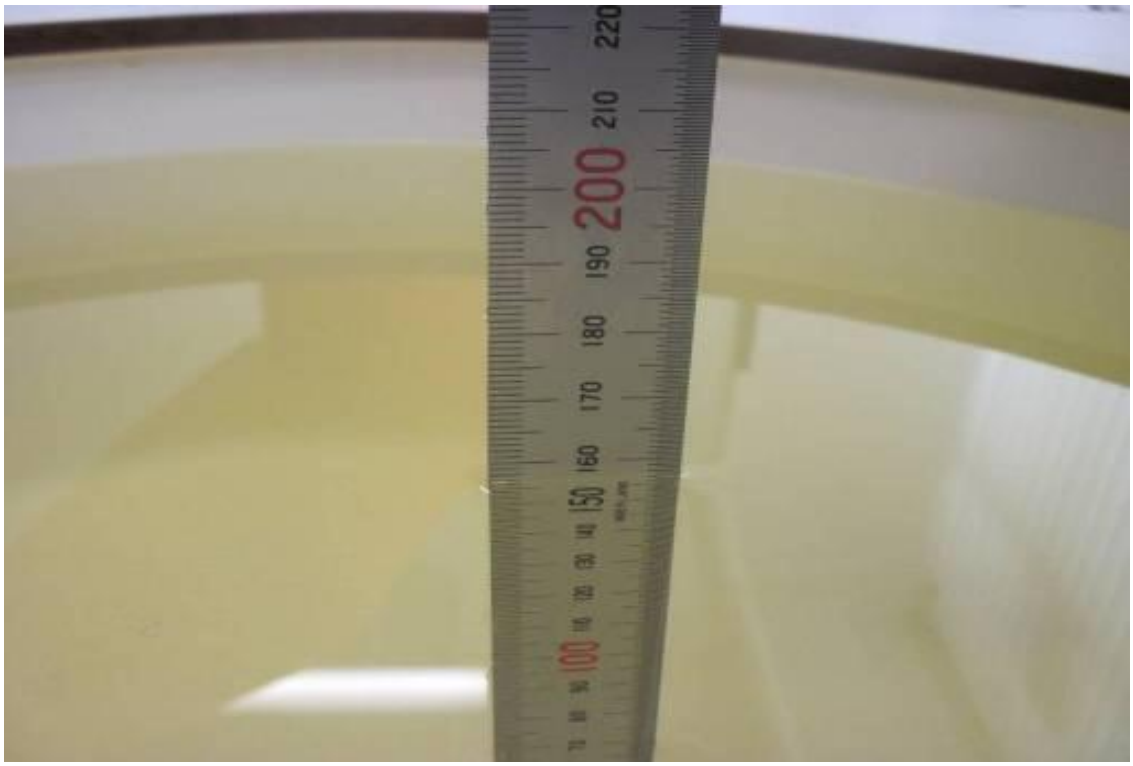
Picture 7-1: Liquid depth in the Head Phantom (835 MHz)



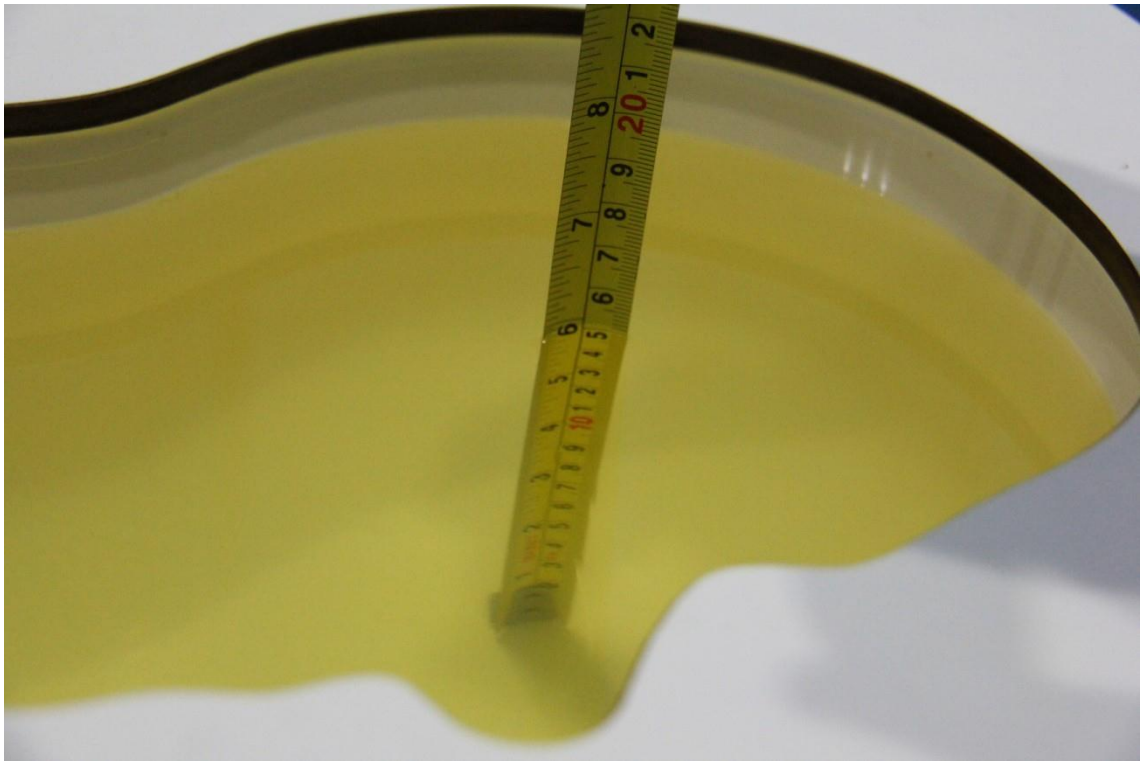
Picture 7-2: Liquid depth in the Flat Phantom (835 MHz)



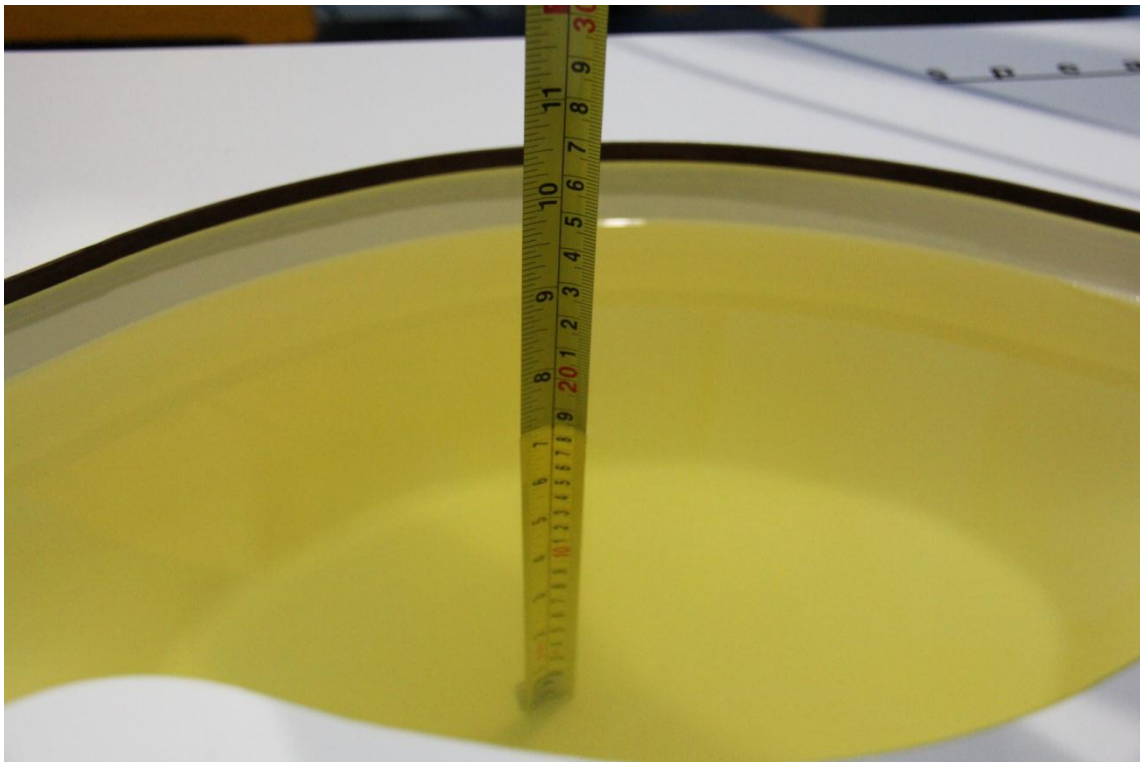
Picture 7-3: Liquid depth in the Head Phantom (1900 MHz)



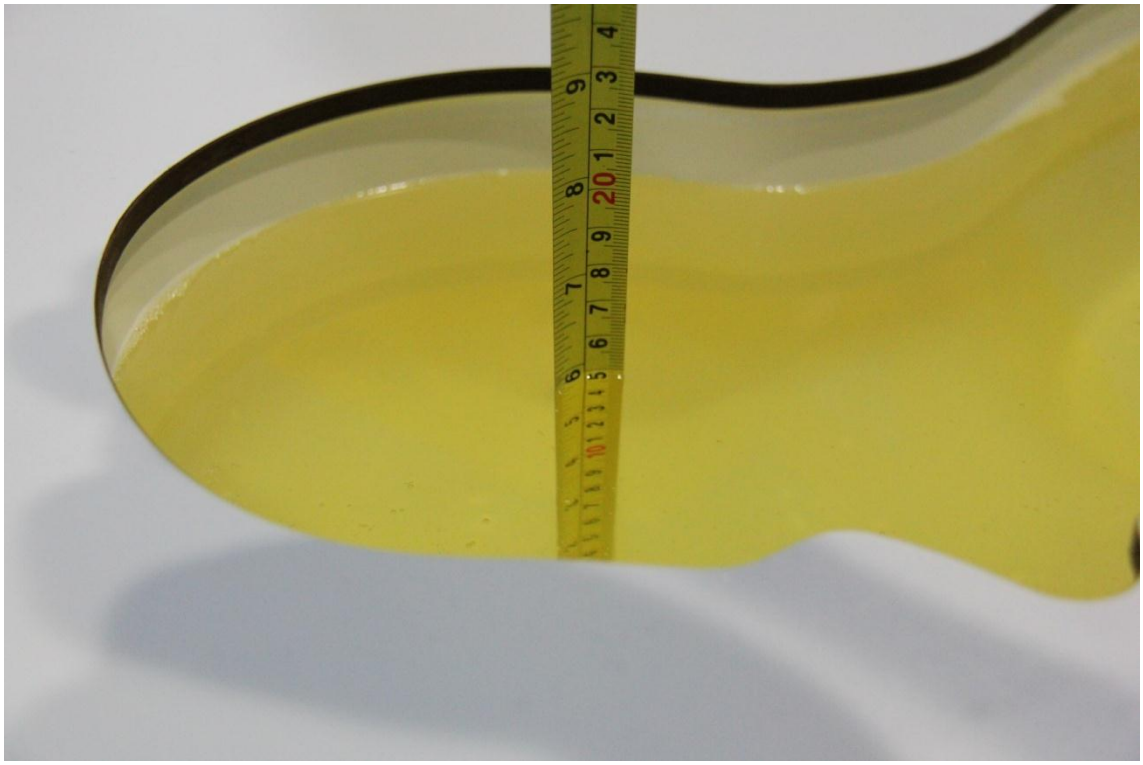
Picture 7-4: Liquid depth in the Flat Phantom (1900MHz)



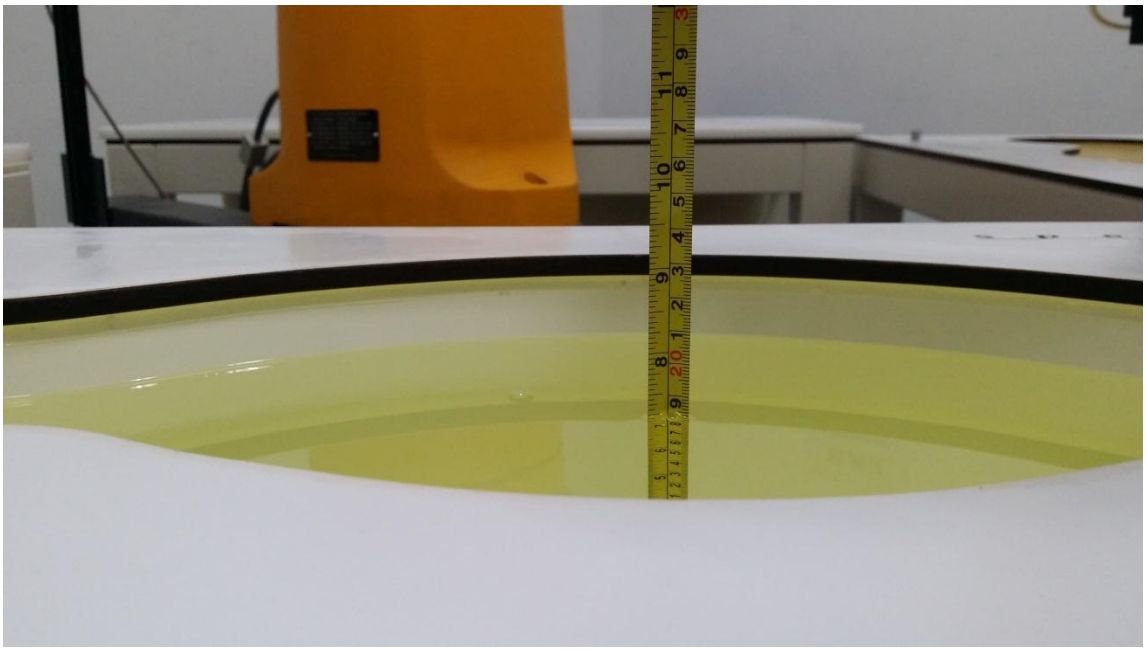
Picture 7-5: Liquid depth in the Head Phantom (2450 MHz)



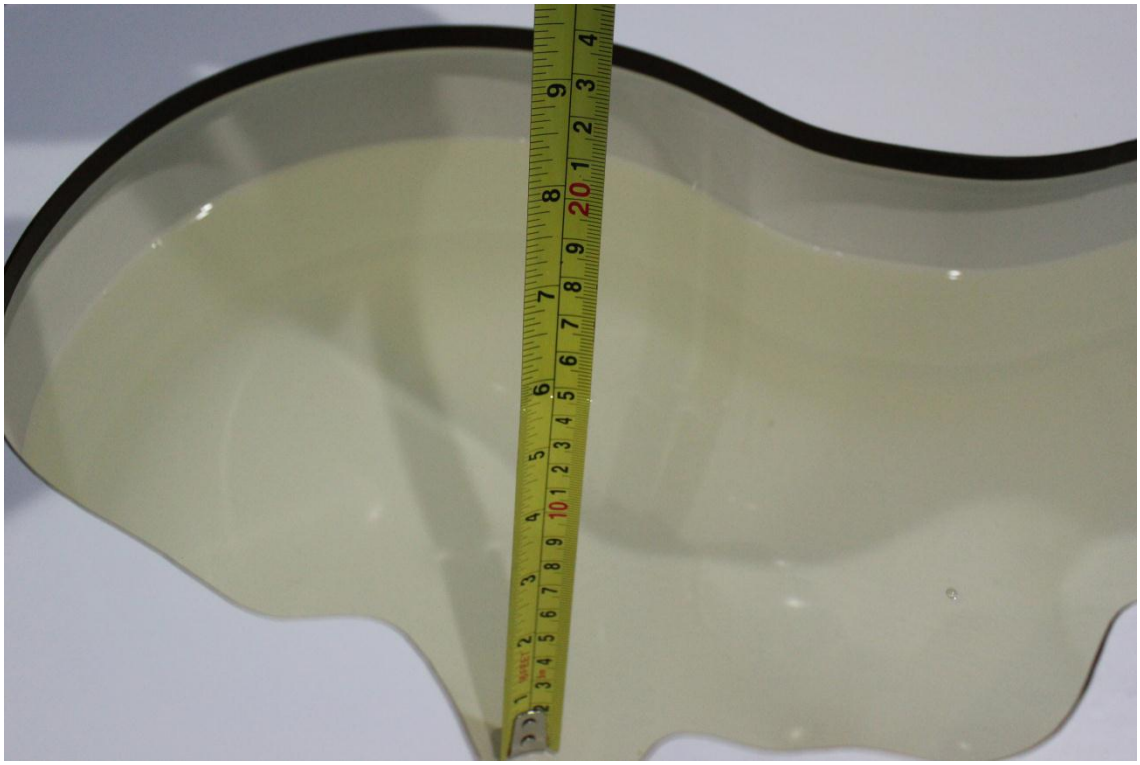
Picture 7-6: Liquid depth in the Flat Phantom (2450MHz)



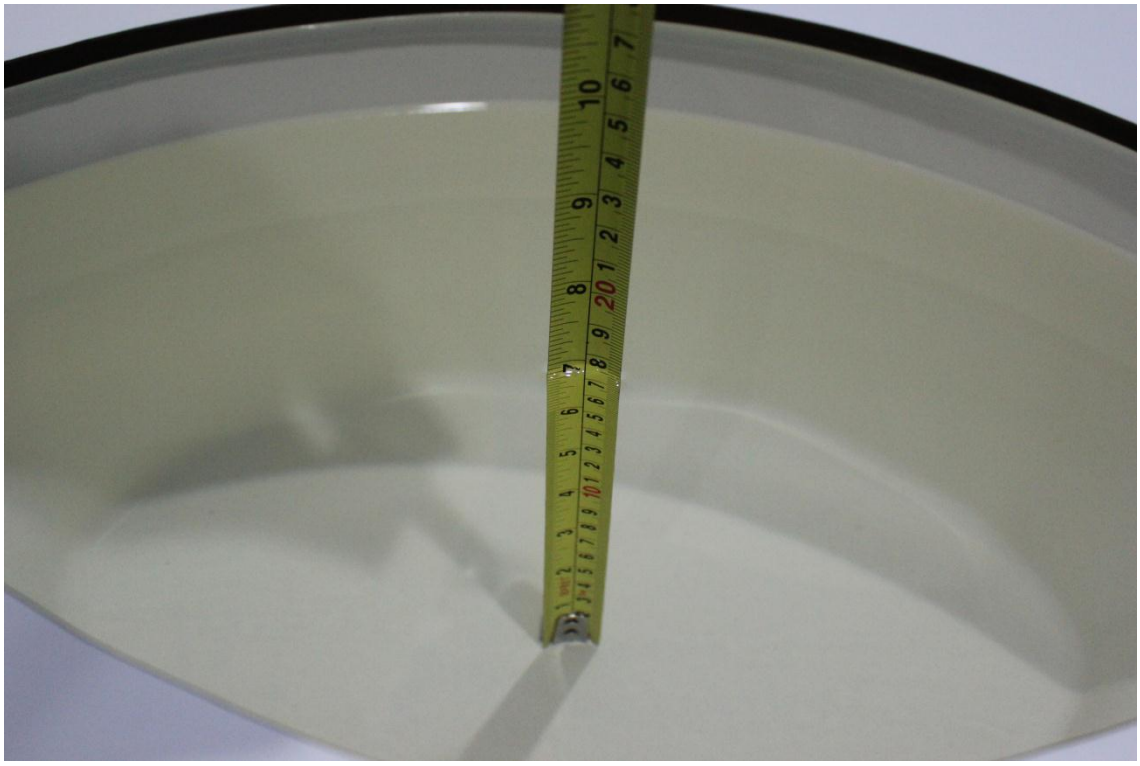
Picture 7-7: Liquid depth in the Head Phantom(2550MHz)



Picture 7-8: Liquid depth in the Flat Phantom(2550MHz)



Picture 7-9: Liquid depth in the Head Phantom(5G)

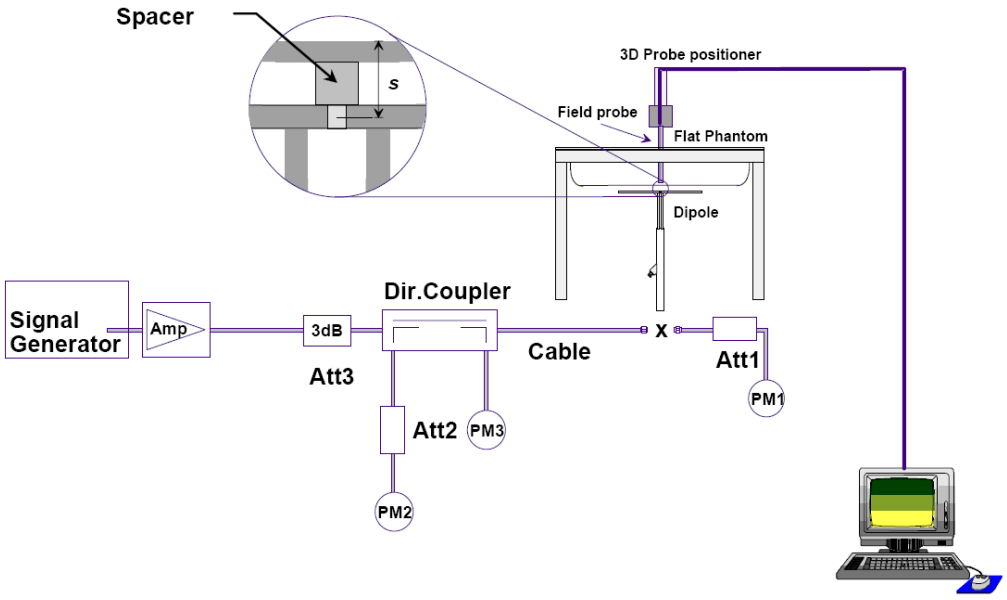


Picture 7-10: Liquid depth in the Flat Phantom (5G)

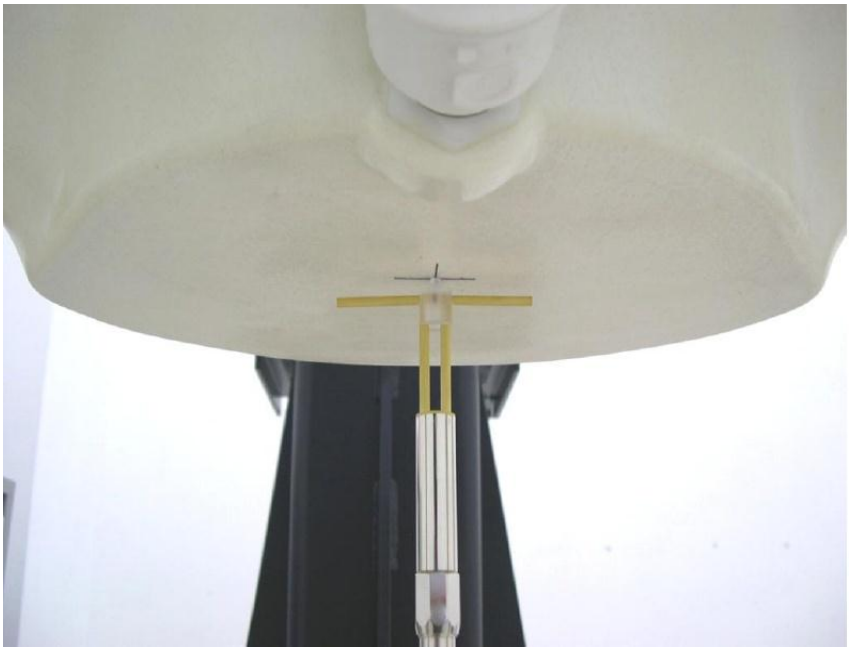
8 System verification

8.1 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 that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



Picture 8.1 System Setup for System Evaluation



Picture 8.2 Photo of Dipole Setup

8.2 System Verification

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device.

The system verification results are required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR. The details are presented in annex B.

Table 8.1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation (%)	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2017-4-24	835 MHz	6.03	9.22	5.96	9.00	-1.16	-2.39
2017-4-26	1900 MHz	21.0	40.8	21.26	41.40	1.24	1.47
2017-5-9	2450 MHz	24.1	52.5	23.44	50.80	-2.74	-3.24
2017-4-28	2550 MHz	26.2	57.2	26.36	58.80	0.61	2.80
2017-5-9	5200 MHz	21.9	76.9	22.30	78.80	1.83	2.47
2017-5-9	5800 MHz	22.3	78.8	22.80	80.90	2.24	2.66
2018-5-20	835 MHz	6.03	9.22	5.92	8.92	-1.82	-3.25
2018-5-20	1900 MHz	21.0	40.8	21.44	42.40	2.10	3.92

Table 8.2: System Verification of Body

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation (%)	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2017-4-24	835 MHz	6.20	9.44	6.08	9.12	-1.94	-3.39
2017-4-26	1900 MHz	21.3	41.1	21.88	42.40	2.72	3.16
2017-5-9	2450 MHz	24.4	52.3	24.68	54.00	1.15	3.25
2017-4-28	2550 MHz	25.1	54.8	24.44	52.80	-2.63	-3.65
2017-5-9	5200 MHz	20.9	74.4	20.60	72.60	-1.44	-2.42
2017-5-9	5800 MHz	21.1	76.2	20.70	74.40	-1.90	-2.36
2018-5-20	835 MHz	6.20	9.44	6.28	9.76	1.29	3.39
2018-5-20	1900 MHz	21.3	41.1	21.80	42.80	2.35	4.14
2018-5-20	2550 MHz	25.1	54.8	24.72	52.80	-1.51	-3.65

9 Measurement Procedures

9.1 Tests to be performed

In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in picture 9.1.

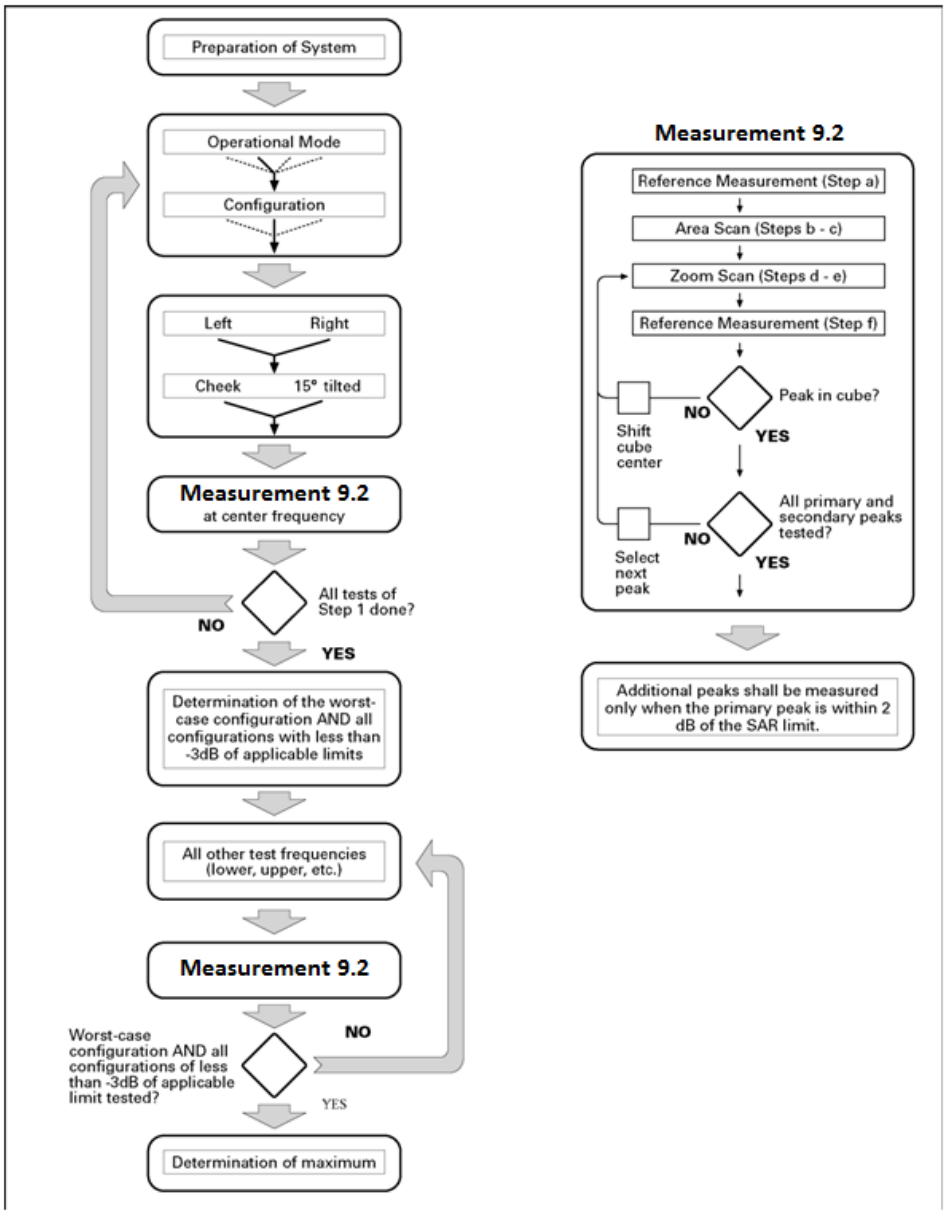
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the center of the transmit frequency band (f_c) for:

a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom, as described in annex D),
b) all configurations for each device position in a), e.g., antenna extended and retracted, and
c) all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

If more than three frequencies need to be tested according to 11.1 (i.e., N_c > 3), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1, perform all tests described in 9.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

Step 3: Examine all data to determine the highest value of the peak spatial-average SAR found in Steps 1 to 2.



Picture 9.1Block diagram of the tests to be performed

9.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2013. The results should be documented as part of the system validation records and may be requested to support test results

when all the measurement parameters in the following table are not satisfied.

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

9.3 WCDMA Measurement Procedures for SAR

The following procedures are applicable to WCDMA handsets operating under 3GPP Release99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & $DPDCH_n$), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.

For Release 5 HSDPA Data Devices:

Sub-test	β_c	β_d	β_d （SF）	β_c / β_d	β_{hs}	CM/dB
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15	15/15	64	12/15	24/25	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

For Release 6 HSPA Data Devices

Sub-test	β_c	β_d	β_d （SF）	β_c / β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} （SF）	β_{ed} （codes）	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	3.0	2.0	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.0	0.0	21	81

9.4 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

9.5 SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator, Anristu MT8820C. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the Anristu MT8820C.It is performed for conducted power and SAR based on the KDB941225 D05.

SAR is evaluated separately according to the following procedures for the different test positions in each exposure condition – head, body, body-worn accessories and other use conditions. The

procedures in the following subsections are applied separately to test each LTE frequency band.

1) QPSK with 1 RB allocation
   Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.
2) QPSK with 50% RB allocation
   The procedures required for 1 RB allocation in 1) are applied to measure the SAR for QPSK with 50% RB allocation.
3) QPSK with 100% RB allocation
   For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 1) and 2) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

9.6 Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Section 14 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10 Area Scan Based 1-g SAR

10.1 Requirement of KDB

According to the KDB447498 D01, when the implementation is based the specific polynomial fit algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-gSAR is ≤ 1.2 W/kg, a zoom scan measurement is not required provided it is also not needed for any other purpose; for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between distinctive peaks and scattered noisy SAR distributions from area scans.

There must not be any warning or alert messages due to various measurement concerns identified by the SAR system; for example, noise in measurements, peaks too close to scan boundary, peaks are too sharp, spatial resolution and uncertainty issues etc. The SAR system verification must also demonstrate that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR (See Annex B). When all the SAR results for each exposure condition in a frequency band and wireless mode are based on estimated 1-g SAR, the 1-g SAR for the highest SAR configuration must be determined by a zoom scan.

10.2 Fast SAR Algorithms

The approach is based on the area scan measurement applying a frequency dependent attenuation parameter. This attenuation parameter was empirically determined by analyzing a large number of phones. The MOTOROLA FAST SAR was developed and validated by the MOTOROLA Research Group in Ft. Lauderdale.

In the initial study, an approximation algorithm based on Linear fit was developed. The accuracy of the algorithm has been demonstrated across a broad frequency range (136-2450 MHz) and for both 1- and 10-g averaged SAR using a sample of 264 SAR measurements from 55 wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithm are 1.2% and 5.8% for 1- and 10-g averaged SAR, respectively. The paper describing the algorithm in detail is expected to be published in August 2004 within the Special Issue of Transactions on MTT.

In the second step, the same research group optimized the fitting algorithm to an Polynomial fit whereby the frequency validity was extended to cover the range 30-6000MHz. Details of this study can be found in the BEMS 2007 Proceedings.

Both algorithms are implemented in DASY software.

11 Conducted Output Power

11.1 Manufacturing tolerance

Table 11.1: GSM Speech

GSM 850			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	32.5	32.5	32.5
Tolerance ±(dB)	1	1	1
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	30	30	30
Tolerance ±(dB)	1	1	1

Table 11.2: GPRS & EGPRS

GSM 850 GPRS/EGPRS				
Channel		**251**	**190**	**128**
1Txslot	Target (dBm)	32	32	32
	Tolerance ±(dB)	1	1	1
2Txslots	Target (dBm)	32	32	32
	Tolerance ±(dB)	1	1	1
3Txslots	Target (dBm)	30	30	30
	Tolerance ±(dB)	1	1	1
4Txslots	Target (dBm)	29	29	29
	Tolerance ±(dB)	1	1	1
GSM 1900 GPRS/EGPRS				
Channel		**810**	**661**	**512**
1Txslot	Target (dBm)	30	30	30
	Tolerance ±(dB)	1	1	1
2Txslots	Target (dBm)	29	29	29
	Tolerance ±(dB)	1	1	1
3Txslots	Target (dBm)	27	27	27
	Tolerance ±(dB)	1	1	1
4Txslots	Target (dBm)	26	26	26
	Tolerance ±(dB)	1	1	1

Table 11.3: WCDMA

UMTS Band V		Conducted Power (dBm)		
		Channel 4233	Channel 4182	Channel 4132
CS	Target (dBm)	22	22	22
	Tolerance ±(dB)	1	1	1
HSUPA sub-test 1-5	Target (dBm)	19.5	19.5	19.5
	Tolerance ±(dB)	1	1	1
HSDPA sub-test 1-4	Target (dBm)	20.5	20.5	20.5
	Tolerance ±(dB)	1	1	1
UMTS Band II		Conducted Power(dBm)		
		Channel 9538	Channel 9400	Channel 9262
CS	Target (dBm)	22	22	22
	Tolerance ±(dB)	1	1	1
HSUPA sub-test 1-5	Target (dBm)	19	19	19
	Tolerance ±(dB)	1	1	1
HSDPA sub-test 1-4	Target (dBm)	20.5	20.5	20.5
	Tolerance ±(dB)	1	1	1

Table 11.4: LTE

LTE Band 7 QPSK			
Channel	Channel 21350	Channel 21100	Channel 20850
Target (dBm)	21	21	21
Tolerance ±(dB)	1	1	1
LTE Band 7 16QAM			
Channel	Channel 21350	Channel 21100	Channel 20850
Target (dBm)	20.3	20.3	20.3
Tolerance ±(dB)	1	1	1

Table 11.5: Bluetooth

Mode		2402MHz（Ch0）	2441MHz（Ch39）	2480MHz（Ch78）
GFSK	Target (dBm)	6.5	6.5	6.5
	Tolerance ±(dB)	1	1	1
EDR2M-4_DQPSK	Target (dBm)	5.5	5.5	5.5
	Tolerance ±(dB)	1	1	1
EDR3M-8DPSK	Target (dBm)	5.5	5.5	5.5
	Tolerance ±(dB)	1	1	1
GFSK(BLE)	Target (dBm)	-1.5	-1.5	-1.5
	Tolerance ±(dB)	1	1	1

Table 11.6: Wi-Fi

Mode	Channel/Data rate	Target (dBm)	Tolerance ±(dB)
802.11 b (2.4GHz)	1Mbps~11Mbps	15	1
802.11 g (2.4GHz)	6Mbps~54Mbps	13.5	1
802.11 n (2.4GHz HT20)	MCS0~MCS7	13	1
802.11 n (2.4GHz HT40)	MCS0~MCS7	14	1
802.11 a (5GHz)	6Mbps~54Mbps	10.5	1
802.11 n (5GHz HT20)	MCS0~MCS7	10.5	1
802.11 n (5GHz HT40)	MCS0~MCS7	10.5	1

11.2 GSM Measurement result

During the process of testing, the EUT was controlled via Agilent Digital Radio Communication tester (E5515C) to ensure the maximum power transmission and proper modulation. This result contains conducted output power for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

Table 11.7: The conducted power measurement results for GSM850/1900

GSM 850MHz	Conducted Power (dBm)		
	Channel 251(848.8MHz)	Channel 190(836.6MHz)	Channel 128(824.2MHz)
	32.78	32.90	32.85
GSM 1900MHz	Conducted Power(dBm)		
	Channel 810(1909.8MHz)	Channel 661(1880MHz)	Channel 512(1850.2MHz)
	29.97	30.05	30.27

Table 11.8: The conducted power measurement results for GPRS and EGPRS

GSM 850		Measured Power (dBm)			calculation	Average Power (dBm)		
		251	190	128		251	190	128
GPRS	1Txslots	32.82	32.95	32.90	-9.03dB	23.79	23.92	23.87
	2Txslots	32.23	32.38	32.32	-6.02dB	26.21	26.36	26.3
	3Txslots	30.55	30.74	30.71	-4.26dB	26.29	26.48	26.45
	4Txslots	29.44	29.66	29.63	-3.01dB	**26.43**	**26.65**	**26.62**
EGPRS (GMSK)	1Txslots	32.77	32.91	32.86	-9.03dB	23.74	23.88	23.83
	2Txslots	32.21	32.35	32.27	-6.02dB	26.19	26.33	26.25
	3Txslots	30.51	30.70	30.66	-4.26dB	26.25	26.44	26.4
	4Txslots	29.42	29.62	29.59	-3.01dB	26.41	26.61	26.58
GSM 1900		Measured Power (dBm)			calculation	Average Power (dBm)		
		810	661	512		810	661	512
GPRS	1Txslots	29.98	30.05	30.26	-9.03dB	20.95	21.02	21.23
	2Txslots	29.22	29.32	29.54	-6.02dB	23.2	23.3	23.52
	3Txslots	27.50	27.54	27.81	-4.26dB	23.24	23.28	23.55
	4Txslots	26.40	26.50	26.74	-3.01dB	**23.39**	**23.49**	**23.73**
EGPRS (GMSK)	1Txslots	29.92	30.01	30.22	-9.03dB	20.89	20.98	21.19
	2Txslots	29.16	29.27	29.51	-6.02dB	23.14	23.25	23.49
	3Txslots	27.44	27.51	27.76	-4.26dB	23.18	23.25	23.5
	4Txslots	26.37	26.46	26.70	-3.01dB	23.36	23.45	23.69

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

According to the conducted power as above, the body measurements are performed with 4Txslots for GSM 850 and GSM 1900.

11.3 WCDMA Measurement result

Table 11.9: The conducted Power for WCDMA850/1700/1900

Item	band	FDD Band 5 result		
	ARFCN	4233 (846.6MHz)	4182(836.4MHz)	4132 (826.4MHz)
WCDMA	\	22.00	22.10	22.10
HSDPA	1	20.80	21.20	21.30
	2	20.80	21.10	21.10
	3	20.40	20.60	20.60
	4	20.30	20.60	20.60
HSUPA	1	19.00	19.20	19.30
	2	18.90	19.10	19.10
	3	18.80	19.10	19.10
	4	18.40	18.60	18.60
	5	19.90	20.10	20.00
Item	band	FDD Band 2 result		
	ARFCN	9538 (1907.6MHz)	9400 (1880MHz)	9262 (1852.4MHz)
WCDMA	\	21.80	21.80	22.10
HSDPA	1	20.80	20.70	21.00
	2	20.70	20.60	20.80
	3	20.10	20.10	20.40
	4	20.00	20.10	20.30
HSUPA	1	18.70	18.90	19.00
	2	18.70	18.70	18.80
	3	18.60	18.60	18.90
	4	18.20	18.20	18.30
	5	19.70	19.60	19.80

11.4 LTE-FDD Measurement result

Table 11.10: The conducted Power for LTE-FDD

LTE-FDD Band 7				Actual output Power (dBm)		
	RB allocation	RB offset	Modulation	High	Middle	Low
				2567.4MHz	2535MHz	2502.5MHz
5 MHz	1RB	High	QPSK	21.71	21.61	21.43
			16QAM	21.00	20.85	20.61
		Middle	QPSK	21.76	21.66	21.48
			16QAM	21.02	20.88	20.65
		Low	QPSK	21.69	21.58	21.43
			16QAM	20.97	20.80	20.59
	50%RB	High	QPSK	20.76	20.65	20.47
			16QAM	19.77	19.61	19.42
		Middle	QPSK	20.79	20.65	20.47
			16QAM	19.80	19.61	19.42
		Low	QPSK	20.79	20.61	20.40
			16QAM	19.78	19.56	19.36
	100%RB	/	QPSK	20.77	20.64	20.45
			16QAM	19.76	19.57	19.39
10 MHz	RB allocation	RB offset	Modulation	High	Middle	Low
				2565MHz	2535MHz	2505MHz
	1RB	High	QPSK	21.80	21.70	21.53
			16QAM	21.09	20.95	20.72
		Middle	QPSK	21.70	21.62	21.43
			16QAM	20.98	20.86	20.64
		Low	QPSK	21.66	21.55	21.42
			16QAM	20.89	20.80	20.61
	50%RB	High	QPSK	20.69	20.66	20.52
			16QAM	19.68	19.61	19.46
		Middle	QPSK	20.75	20.64	20.48
			16QAM	19.74	19.60	19.43
		Low	QPSK	20.80	20.60	20.45
			16QAM	19.77	19.56	19.38
	100%RB	/	QPSK	20.77	20.64	20.49
			16QAM	19.74	19.59	19.43

LTE-FDD Band 7				Actual output Power (dBm)		
15 MHz	RB allocation	RB offset	Modulation	High	Middle	Low
				2562.5MHz	2535MHz	2507.5MHz
	1RB	High	QPSK	21.65	21.59	21.45
			16QAM	20.90	20.83	20.63
		Middle	QPSK	21.66	21.60	21.48
			16QAM	20.91	20.83	20.66
		Low	QPSK	21.72	21.64	21.53
			16QAM	20.96	20.88	20.71
	50%RB	High	QPSK	21.71	21.64	21.51
			16QAM	20.70	20.61	20.45
		Middle	QPSK	21.73	21.64	21.52
			16QAM	20.71	20.61	20.48
		Low	QPSK	21.75	21.65	21.55
			16QAM	20.73	20.62	20.48
	100%RB	/	QPSK	20.75	20.67	20.54
			16QAM	19.73	19.61	19.47
20MHz	RB allocation	RB offset	Modulation	High	Middle	Low
				2560MHz	2535MHz	2510MHz
	1RB	High	QPSK	**21.86**	21.80	21.70
			16QAM	21.16	21.05	20.91
		Middle	QPSK	21.66	21.61	21.48
			16QAM	20.90	20.85	20.68
		Low	QPSK	21.77	21.71	21.61
			16QAM	21.02	20.92	20.80
	50%RB	High	QPSK	20.62	20.70	20.62
			16QAM	19.60	19.66	19.58
		Middle	QPSK	20.71	20.66	20.56
			16QAM	19.70	19.63	19.51
		Low	QPSK	**20.82**	20.70	20.56
			16QAM	19.79	19.66	19.50
	100%RB	/	QPSK	20.72	20.69	20.57
			16QAM	19.69	19.64	19.52

11.5 Wi-Fi and BT Measurement result

The output power of BT antenna is as following:

Mode	Conducted Power (dBm)		
	Channel 0 (2402MHz)	Channel 39 (2441MHz)	Channel 78 (2480MHz)
GFSK	6.46	**6.71**	6.00
EDR2M-4_DQPSK	5.85	6.14	5.26
EDR3M-8DPSK	5.96	6.24	5.35
BLE	-0.41	0.17	-1.58

The average conducted power for Wi-Fi is as following:

802.11b（dBm）

Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1(2412MHz)	15.23	15.21	15.28	**15.32**
6(2437MHz)	14.33	14.39	14.46	14.43
11(2462MHz)	14.41	14.44	14.53	14.49

802.11g（dBm）

Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1(2412MHz)	13.77	/	/	/	/	/	/	/
6(2437MHz)	14.10	14.11	14.18	14.12	14.09	14.03	14.07	14.09
11(2462MHz)	13.81	/	/	/	/	/	/	/

802.11n - HT20 (2.4G)（dBm）

Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1(2412MHz)	13.52	13.47	13.40	13.62	13.51	13.48	13.50	13.51
6(2437MHz)	13.06	/	/	/	/	/	/	/
11(2462MHz)	13.29	/	/	/	/	/	/	/

802.11n - HT40 (2.4G)（dBm）

Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1(2412MHz)	13.48	13.63	13.59	13.60	13.49	13.67	13.64	13.72
6(2437MHz)	12.17	/	/	/	/	/	/	/
11(2462MHz)	12.53	/	/	/	/	/	/	/

The average conducted power for 5GWi-Fi is as following:

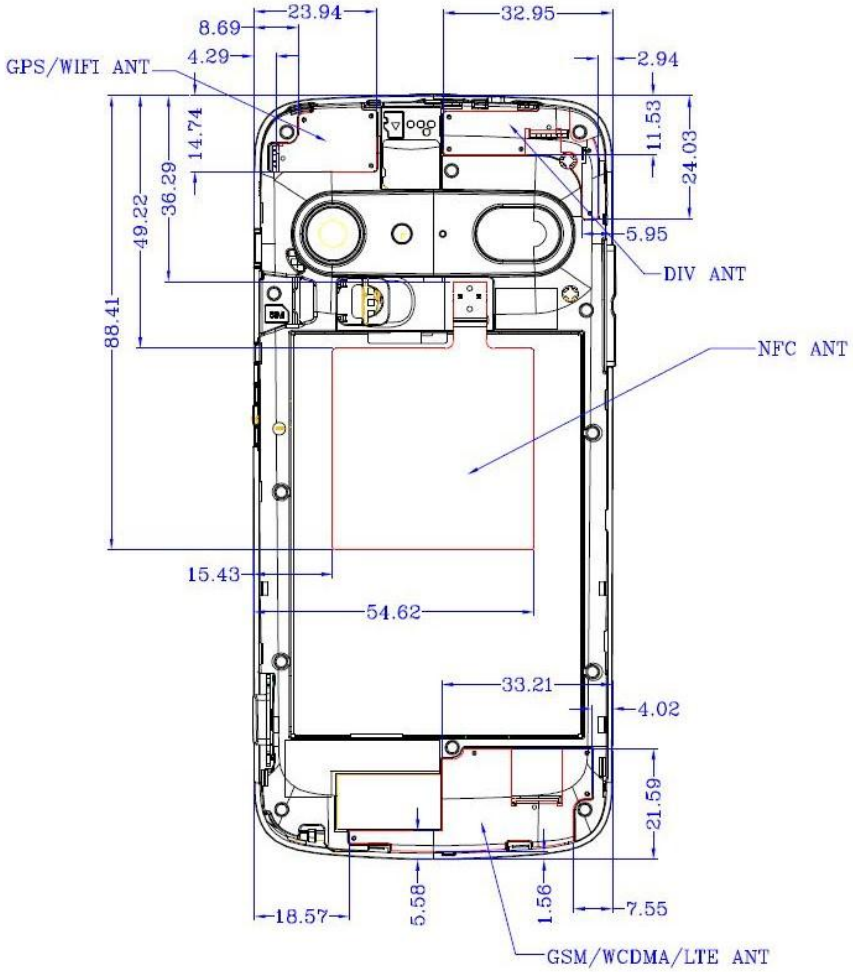
5G Wi-Fi	Averaged Power (dBm)				
	Mode	802.11a	802.11n-20MHz	Mode	802.11n-40MHz
	Ch	6Mbps	MCS0	Ch	MCS0
U-NII-1	36(5180 MHz)	10.63	10.51	38(5190 MHz)	10.45
	40(5200 MHz)	10.88	10.80		
	44(5220 MHz)	10.46	10.97	46(5230 MHz)	10.74
	48(5240 MHz)	10.97	**11.02**		
U-NII-2A	52(5260 MHz)	10.30	10.32	54(5270 MHz)	10.22
	56(5280 MHz)	10.42	10.55		
	60(5300 MHz)	10.31	10.56	62(5310 MHz)	10.42
	64(5320 MHz)	10.55	**10.59**		
U-NII-3	5745MHz(Ch149)	11.23	**11.25**	151(5755 MHz)	10.92
	5765MHz(Ch153)	11.20	11.18		
	5785MHz(Ch157)	11.17	11.15		
	5805MHz(Ch161)	11.14	11.16	159(5795 MHz)	10.63
	5825MHz(Ch165)	11.15	11.12		

12 Simultaneous TX SAR Considerations

12.1 Introduction

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.
For this device, the BT and Wi-Fi can transmit simultaneous with other transmitters.

12.2 Transmit Antenna Separation Distances



Picture 12.1 Antenna Locations

12.3 SAR Measurement Positions

According to the KDB941225 D06 Hot Spot SAR, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

SAR measurement positions						
Mode	Front	Rear	Left edge	Right edge	Top edge	Bottom edge
Main antenna	Yes	Yes	Yes	Yes	No	Yes
WLAN	Yes	Yes	No	Yes	Yes	No

12.4 Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.
The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, where

- f(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

Table 12.1: Standalone SAR test exclusion considerations

Band/Mode	f(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.441	Head	9.60	7.5	5.62	Yes
		Body	19.20	7.5	5.62	Yes
2.4GHz WLAN 802.11 b	2.45	Head	9.58	16	39.81	No
		Body	19.17	16	39.81	No
WLAN 5GHz	5.2	Head	6.58	11.5	14.13	No
		Body	13.16	11.5	14.13	No
	5.3	Head	6.52	11.5	14.13	No
		Body	13.03	11.5	14.13	No
	5.8	Head	6.23	11.5	14.13	No
		Body	12.46	11.5	14.13	No

13 Evaluation of Simultaneous

Table 13.1: The sum of reported SAR values for main antenna and WiFi

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Left Touch	0.89	0.56	**1.45**
	Right Touch	0.43	0.24	**0.67**
Highest reported SAR value for Body	Rear	0.97	0.27	**1.24**
	Bottom	1.22	/	**1.22**

Table 13.2: The sum of reported SAR values for main antenna and Bluetooth

	Position	Main antenna	BT*	Sum
Highest reported SAR value for Head	Left Touch	0.89	0.23	**1.12**
	Right Touch	0.43	0.23	**0.66**
Highest reported SAR value for Body	Rear	0.97	0.13	**1.10**
	Bottom	1.22	/	**1.22**

BT* - Estimated SAR for Bluetooth (see the table 13.3)

Table 13.3: Estimated SAR for Bluetooth

Position	f (GHz)	Distance (mm)	Upper limit of power *		Estimated$_{1g}$ (W/kg)
			dBm	mW	
Head	2.441	5	7.5	5.62	0.23
Body	2.441	10	7.5	5.62	0.13

* - Maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
(Max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
Where x = 7.5 for 1-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Conclusion:
According to the above tables, the sum of reported SAR values is < 1.6W/kg. So the simultaneous transmission SAR with volume scans is not required.

14 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom.
The distance is 10mm and just applied to the condition of body worn accessory.
It is performed for all SAR measurements with area scan based 1-g SAR estimation (Fast SAR). A zoom scan measurement is added when the estimated 1-g SAR is the highest measured SAR in each exposure configuration, wireless mode and frequency band combination or >1.2W/kg.
The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{Target}-P_{Measured})/10}$$

Where P_{Target} is the power of manufacturing upper limit;
$P_{Measured}$ is the measured power in chapter 11.

Table 14.1: Duty Cycle

Mode	Duty Cycle
Speech for GSM850/1900	1:8.3
GPRS&EGPRS for GSM850/1900	1:2
WCDMA850/1900	1:1
FDD_LTE Band 7	1:1

14.1 SAR results for Fast SAR

Table 14.2: SAR Values (GSM 850 MHz - Head)

Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.										
836.6	190	Left	Touch	/	32.90	33.5	0.217	**0.25**	0.318	**0.37**	-0.04
836.6	190	Left	Tilt	/	32.90	33.5	0.123	**0.14**	0.178	**0.20**	0.05
836.6	190	Right	Touch	/	32.90	33.5	0.230	**0.26**	0.336	**0.39**	0.08
836.6	190	Right	Tilt	/	32.90	33.5	0.093	**0.11**	0.133	**0.15**	-0.07
848.8	251	Right	Touch	Fig.1	32.78	33.5	0.282	**0.33**	0.366	**0.43**	0.05
824.2	128	Right	Touch	/	32.85	33.5	0.180	**0.21**	0.261	**0.30**	0.10

Table 14.3: SAR Values (GSM 850 MHz -Body）-AP ON

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	190	Front	/	29.66	30	0.348	**0.38**	0.520	**0.56**	-0.06
836.6	190	Rear	/	29.66	30	0.553	**0.60**	0.790	**0.85**	-0.08
836.6	190	Left	/	29.66	30	0.452	**0.49**	0.691	**0.75**	-0.07
836.6	190	Right	/	29.66	30	0.436	**0.47**	0.652	**0.71**	-0.12
836.6	190	Bottom	/	29.66	30	0.130	**0.14**	0.200	**0.22**	0.08
848.8	251	Rear	Fig.2	29.44	30	0.595	**0.68**	0.852	**0.97**	0.05
824.2	128	Rear	/	29.63	30	0.523	**0.57**	0.756	**0.82**	0.07
848.8	251	Rear EGPRS	/	29.42	30	0.579	**0.66**	0.827	**0.95**	-0.04

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.4: SAR Values (GSM 850 MHz -Body）-AP OFF

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	190	Front	/	29.66	30	0.348	**0.38**	0.520	**0.56**	-0.06
836.6	190	Rear	/	29.66	30	0.553	**0.60**	0.790	**0.85**	-0.08
848.8	251	Rear	/	29.44	30	0.595	**0.68**	0.852	**0.97**	0.05
824.2	128	Rear	/	29.63	30	0.523	**0.57**	0.756	**0.82**	0.07
848.8	251	Rear EGPRS	/	29.42	30	0.579	**0.66**	0.827	**0.95**	-0.04

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.5: SAR Values (GSM 1900 MHz - Head)

Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.										
1880	661	Left	Touch	/	30.05	31	0.225	**0.28**	0.400	**0.50**	-0.03
1880	661	Left	Tilt	/	30.05	31	0.050	**0.06**	0.087	**0.11**	-0.05
1880	661	Right	Touch	/	30.05	31	0.104	**0.13**	0.178	**0.22**	0.05
1880	661	Right	Tilt	/	30.05	31	0.070	**0.09**	0.122	**0.15**	0.01
1909.8	810	Left	Touch	Fig.3	29.97	31	0.252	**0.32**	0.412	**0.52**	0.04
1850.2	512	Left	Touch	/	30.27	31	0.249	**0.29**	0.411	**0.49**	0.11

Table 14.6: SAR Values (GSM 1900 MHz -Body）-AP ON

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
1880	661	Front	/	26.50	27	0.391	**0.44**	0.666	**0.75**	0.01
1880	661	Rear	/	26.50	27	0.460	**0.52**	0.751	**0.84**	0.05
1880	661	Left	/	26.50	27	0.205	**0.23**	0.358	**0.40**	0.07
1880	661	Right	/	26.50	27	0.108	**0.12**	0.184	**0.21**	0.08
1880	661	Bottom	/	26.50	27	0.349	**0.39**	0.654	**0.73**	0.03
1909.8	810	Rear	/	26.40	27	0.441	**0.51**	0.720	**0.83**	0.10
1850.2	512	Rear	Fig.4	26.74	27	0.503	**0.53**	0.815	**0.87**	0.09
1850.2	512	Rear EGPRS	/	26.70	27	0.488	**0.52**	0.796	**0.85**	-0.02

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.7: SAR Values (GSM 1900 MHz -Body）-AP OFF

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
1880	661	Front	/	26.50	27	0.391	**0.44**	0.666	**0.75**	0.01
1880	661	Rear	/	26.50	27	0.460	**0.52**	0.751	**0.84**	0.05
1909.8	810	Rear	/	26.40	27	0.441	**0.51**	0.720	**0.83**	0.10
1850.2	512	Rear	/	26.74	27	0.503	**0.53**	0.815	**0.87**	0.09
1850.2	512	Rear EGPRS	/	26.70	27	0.488	**0.52**	0.796	**0.85**	-0.02

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.8: SAR Values (WCDMA 850 MHz - Head)

Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.										
836.4	4182	Left	Touch	/	22.1	23	0.174	**0.21**	0.235	**0.29**	-0.08
836.4	4182	Left	Tilt	/	22.1	23	0.094	**0.12**	0.136	**0.17**	-0.01
836.4	4182	Right	Touch	Fig.5	22.1	23	0.184	**0.23**	0.241	**0.30**	0.06
836.4	4182	Right	Tilt	/	22.1	23	0.038	**0.05**	0.055	**0.07**	0.04
846.6	4233	Right	Touch	/	22.0	23	0.187	**0.24**	0.228	**0.29**	0.10
826.4	4132	Right	Touch	/	22.1	23	0.141	**0.17**	0.205	**0.25**	-0.09

Table 14.9: SAR Values (WCDMA 850 MHz -Body）-AP ON

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
836.4	4182	Front	/	22.1	23	0.202	**0.25**	0.293	**0.36**	0.05
836.4	4182	Rear	Fig.6	22.1	23	0.238	**0.29**	0.325	**0.40**	-0.02
836.4	4182	Left	/	22.1	23	0.033	**0.04**	0.049	**0.06**	0.04
836.4	4182	Right	/	22.1	23	0.035	**0.04**	0.051	**0.06**	0.16
836.4	4182	Bottom	/	22.1	23	0.051	**0.06**	0.082	**0.10**	-0.08
846.6	4233	Rear	/	22.0	23	0.224	**0.28**	0.320	**0.40**	0.04
826.4	4132	Rear	/	22.1	23	0.214	**0.26**	0.307	**0.38**	0.07

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.10: SAR Values (WCDMA 850 MHz -Body）-AP OFF

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
836.4	4182	Front	/	22.1	23	0.202	**0.25**	0.293	**0.36**	0.05
836.4	4182	Rear	/	22.1	23	0.238	**0.29**	0.325	**0.40**	-0.02
846.6	4233	Rear	/	22.0	23	0.224	**0.28**	0.320	**0.40**	0.04
826.4	4132	Rear	/	22.1	23	0.214	**0.26**	0.307	**0.38**	0.07

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.11: SAR Values (WCDMA1900 MHz - Head)

Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.										
1880	9400	Left	Touch	/	21.8	23	0.409	**0.54**	0.664	**0.88**	0.12
1880	9400	Left	Tilt	/	21.8	23	0.104	**0.14**	0.182	**0.24**	0.07
1880	9400	Right	Touch	/	21.8	23	0.177	**0.23**	0.304	**0.40**	0.02
1880	9400	Right	Tilt	/	21.8	23	0.122	**0.16**	0.205	**0.27**	-0.07
1907.6	9538	Left	Touch	/	21.8	23	0.378	**0.50**	0.644	**0.85**	-0.09
1852.4	9262	Left	Touch	Fig.7	22.1	23	0.433	**0.53**	0.726	**0.89**	0.02

Table 14.12: SAR Values (WCDMA1900 MHz Body)-AP ON

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
1880	9400	Front	/	21.8	23	0.447	**0.59**	0.718	**0.95**	-0.08
1880	9400	Rear	/	21.8	23	0.365	**0.48**	0.596	**0.79**	0.03
1880	9400	Left	/	21.8	23	0.179	**0.24**	0.287	**0.38**	0.04
1880	9400	Right	/	21.8	23	0.086	**0.11**	0.136	**0.18**	0.06
1880	9400	Bottom	/	21.8	23	0.340	**0.45**	0.583	**0.77**	0.08
1907.6	9538	Front	/	21.8	23	0.468	**0.62**	0.795	**1.05**	-0.10
1852.4	9262	Front	Fig.8	22.1	23	0.499	**0.61**	0.866	**1.07**	-0.02

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.13: SAR Values (WCDMA1900 MHz -Body)-AP OFF

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
1880	9400	Front	/	21.8	23	0.447	**0.59**	0.718	**0.95**	-0.08
1880	9400	Rear	/	21.8	23	0.365	**0.48**	0.596	**0.79**	0.03
1907.6	9538	Front	/	21.8	23	0.468	**0.62**	0.795	**1.05**	-0.10
1852.4	9262	Front	/	22.1	23	0.499	**0.61**	0.866	**1.07**	-0.02

Note1: The distance between the EUT and the phantom bottom is 10mm.

Table 14.14: SAR Values (LTE Band 7-Head)

Frequency		Configuration	Test Position	Conduct-ed Power (dBm)	Max. tune-up Power (dBm)	Figure No.	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
2560	21350	1RB_High	Left Touch	21.86	22	Fig.9	0.183	**0.19**	0.354	**0.37**	0.12
2560	21350	50RB_Low	Left Touch	20.82	21	/	0.158	**0.16**	0.292	**0.30**	0.04
2560	21350	1RB_High	Left Tilt	21.86	22	/	0.055	**0.06**	0.109	**0.11**	-0.08
2560	21350	50RB_Low	Left Tilt	20.82	21	/	0.050	**0.05**	0.102	**0.11**	0.06
2560	21350	1RB_High	Right Touch	21.86	22	/	0.127	**0.13**	0.242	**0.25**	-0.06
2560	21350	50RB_Low	Right Touch	20.82	21	/	0.121	**0.13**	0.232	**0.24**	0.08
2560	21350	1RB_High	Right Tilt	21.86	22	/	0.077	**0.08**	0.163	**0.17**	0.11
2560	21350	50RB_Low	Right Tilt	20.82	21	/	0.072	**0.08**	0.160	**0.17**	0.36

Table 14.15: SAR Values (LTE Band 7-Body) -AP ON

Frequency		Configuration	Test Position	Conduct-ed Power (dBm)	Max. tune-up Power (dBm)	Figure No.	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
2560	21350	1RB_High	Front	21.86	22	/	0.314	**0.32**	0.611	**0.63**	0.07
2560	21350	50RB_Low	Front	20.82	21	/	0.245	**0.26**	0.496	**0.52**	-0.11
2560	21350	1RB_High	Rear	21.86	22	Fig.10	0.341	**0.35**	0.632	**0.65**	-0.08
2560	21350	50RB_Low	Rear	20.82	21	/	0.279	**0.29**	0.514	**0.54**	0.02
2560	21350	1RB_High	Left	21.86	22	/	0.041	**0.04**	0.078	**0.08**	0.07
2560	21350	50RB_Low	Left	20.82	21	/	0.036	**0.04**	0.071	**0.07**	0.1
2560	21350	1RB_High	Right	21.86	22	/	0.027	**0.03**	0.047	**0.05**	0.07
2560	21350	50RB_Low	Right	20.82	21	/	0.013	**0.01**	0.038	**0.04**	0.09
2560	21350	1RB_High	Bottom	21.86	22	/	0.574	**0.59**	1.180	**1.22**	0.11
2560	21350	50RB_Low	Bottom	20.82	21	/	0.452	**0.47**	0.895	**0.93**	0.07
2535	21100	1RB_High	Bottom	21.80	22	/	0.553	**0.58**	1.120	**1.17**	0.05
2510	20850	1RB_High	Bottom	21.70	22	/	0.524	**0.56**	1.040	**1.11**	-0.11
2535	21100	50RB_Low	Bottom	20.70	21	/	0.436	**0.47**	0.874	**0.94**	0.12
2510	20850	50RB_Low	Bottom	20.56	21	/	0.414	**0.46**	0.852	**0.94**	-0.04
2560	21350	100RB_Low	Bottom	20．72	21	/	0.458	**0.49**	0.892	**0.95**	0.02
2560	21350	1RB_High	Bottom Headset	21.86	22	/	0.566	**0.58**	1.12	**1.16**	-0.05

Note1: The distance between the EUT and the phantom bottom is 10mm

Table 14.16: SAR Values (LTE Band 7-Body) -AP OFF

Frequency		Configuration	Test Position	Conduct-ed Power (dBm)	Max. tune-up Power (dBm)	Figure No.	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
2560	21350	1RB_High	Front	21.86	22	/	0.314	**0.32**	0.611	**0.63**	0.07
2560	21350	50RB_Low	Front	20.82	21	/	0.245	**0.26**	0.496	**0.52**	-0.11
2560	21350	1RB_High	Rear	21.86	22	/	0.341	**0.35**	0.632	**0.65**	-0.08
2560	21350	50RB_Low	Rear	20.82	21	/	0.279	**0.29**	0.514	**0.54**	0.02

Note1: The distance between the EUT and the phantom bottom is 10mm

14.2 WLAN Evaluation for 2.4G

According to the KDB248227 D01, SAR is measured for 2.4GHz 802.11b DSSS using the initial test position procedure.

Head Evaluation

Table 14.17: SAR Values (WLAN - Head)– 802.11b 11Mbps (Fast SAR)

Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.										
2462	11	Left	Touch	/	15.32	16	0.175	**0.20**	0.372	**0.44**	0.08
2462	11	Left	Tilt	/	15.32	16	0.132	**0.15**	0.289	0.34	0.05
2462	11	Right	Touch	/	15.32	16	0.141	**0.16**	0.183	**0.21**	-0.12
2462	11	Right	Tilt	/	15.32	16	0.144	**0.18**	0.185	**0.23**	0.11

As shown above table, the initial test position for head is “Left Touch”. So the head SAR of WLAN is presented as below:

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. A maximum transmission duty factor of 95.0% is achievable for WLAN in this project and the scaled reported SAR is presented as below.

Table 14.18: SAR Values (WLAN - Head) – 802.11b 11Mbps (Scaled Reported SAR)

Frequency		Side	Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.						
2462	11	Left	Touch	95.0%	100%	0.44	**0.46**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.

Body Evaluation

Table 14.19: SAR Values (WLAN - Body)– 802.11b 11Mbps (Fast SAR)-AP ON

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
2462	11	Front	/	15.32	16	0.032	**0.04**	0.058	**0.07**	0.05
2462	11	Rear	/	15.32	16	0.042	**0.05**	0.082	**0.10**	-0.04
2462	11	Right	/	15.32	16	0.022	**0.03**	0.047	**0.05**	0.11
2462	11	Top	/	15.32	16	0.037	**0.04**	0.073	**0.09**	0.14

Note1: The distance between the EUT and the phantom bottom is 10mm.

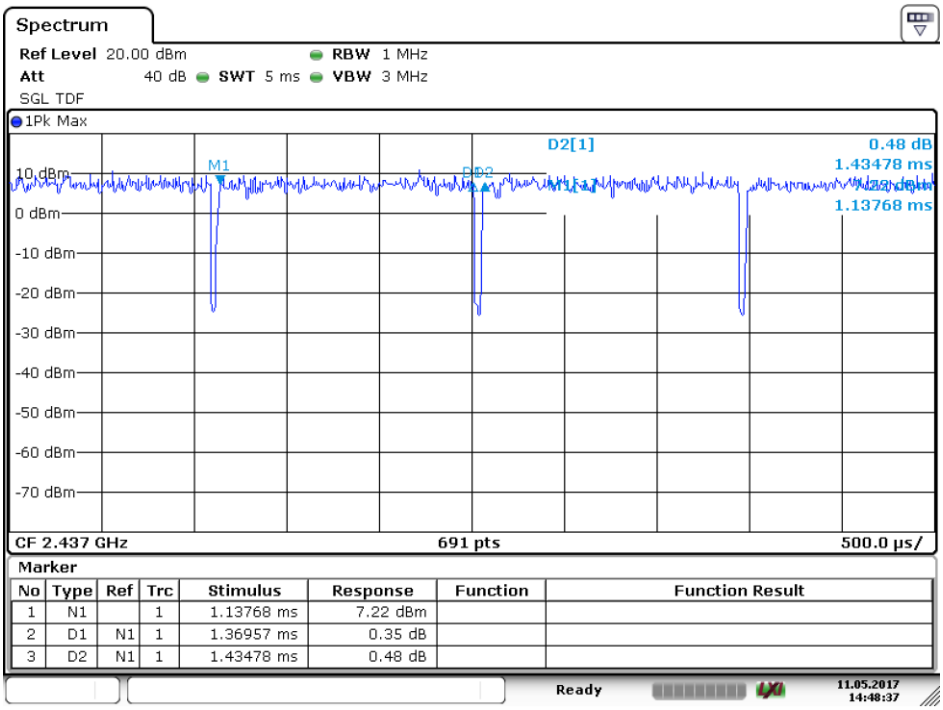
As shown above table, the initial test position for body is “Rear”. So the body SAR of WLAN is presented as below:

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. A maximum transmission duty factor of 95.0% is achievable for WLAN in this project and the scaled reported SAR is presented as below.

Table 14.20: SAR Values (WLAN - Body) – 802.11b 11Mbps (Scaled Reported SAR)

Ambient Temperature: 22.3°C Liquid Temperature: 21.8°C						
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.					
2462	11	Rear	95.0%	100%	0.10	**0.11**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.



Picture 14.1:The plot of duty factor

14.3 WLAN Evaluation for 5G

Table 14.21: OFDM mode specified maximum output power of WLAN antenna

802.11 mode	a	g	n		ac			
Ch. BW(MHz)	20	20	20	40	20	40	80	160
U-NII-1	X		X	X				
U-NII-2A	X		X	X				
U-NII-2C								
U-NII-3	X		X	X				
§15.247(5.8GHz)								
X: maximum(conducted) output power(mW), including tolerance, specified for production units								

Table 14.22: Maximum output power specified of WLAN antenna

802.11 mode	a	g	n		ac			
Ch. BW(MHz)	20	20	20	40	20	40	80	160
U-NII-1	14		14	14				
U-NII-2A	14		14	14				
U-NII-2C								
U-NII-3	14		14	14				
§ 15.247(5.8GHz)								

- The maximum output power specified for production units is the same for all channels, modulations and data rates in each channel bandwidth configuration of the 802.11a/g/n/ac modes.
- The blue highlighted cells represent highest output configurations in each standalone or aggregated frequency band, with tune-up tolerance included
- For SAR test reduction in the 2.4GHz band, the maximum output specified for production units is 16mW for 802.11b and the highest reported SAR for DSSS is 0.46 W/kg for head, 0.11 W/kg for body.

Table 14.23: Maximum output power measured of WLAN antenna, for the applicable OFDM configurations according to the default power measurement procedures for selection initial test configurations

802.11 mode	a	n	
Ch. BW(MHz)	20	20	40
U-NII-1	36/40/44/48 **11.6/12.3/11.1/12.5**	36/40/44/48 **11.3/12.0/12.5/12.7**	38/46 **11.1/11.9**
U-NII-2A	52/56/60/64 **10.7/11.0/10.7/11.4**	52/56/60/64 **10.8/11.4/11.4/11.5**	54/62 **10.5/11.0**
U-NII-3	149/153/157/161/165 **13.3/13.1/13.1/13.0/13.0**	149/153/157/161/165 **13.3/13.1/130/13.1/12.9**	151/159 **12.4/11.6**

- Channels with measured maximum power within 0.25dB are considered to have the same measured output.
- Channels selected for initial test configuration are highlighted in yellow.

Table 14.24: Reported SAR of initial test configuration for head

802.11 mode	a	n	
Ch. BW(MHz)	20	20	40
U-NII-1	36/40/44/48	36/40/44/48 **0.53**	38/46
U-NII-2A	52/56/60/64	52/56/60/64 U-NII-1 exclusion applied	54/62
U-NII-3	149/153/157/161/165	149/153/157/161/165 **0.13**	151/159
U-NII-1 and U-NII-2A bands have the same specified maximum output and tolerance; SAR is measured for U-NII-1 band first. Adjusted SAR of U-NII-1 band is ≤ 1.2W/kg, SAR is not required for U-NII-2A band.			

Table 14.25: SAR Values (WLAN - Head)

Frequency		Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.										
5240	48	Left	Touch	Fig.1	11.02	11.5	0.133	**0.15**	0.478	**0.53**	0.11
5240	48	Left	Tilt	/	11.02	11.5	0.123	**0.14**	0.425	**0.47**	0.14
5240	48	Right	Touch	/	11.02	11.5	0.080	**0.09**	0.210	**0.23**	-0.06
5240	48	Right	Tilt	/	11.02	11.5	0.066	**0.07**	0.226	**0.25**	-0.07
5745	149	Left	Touch	/	11.25	11.5	0.022	**0.02**	0.126	**0.13**	0.08
5745	149	Left	Tilt	/	11.25	11.5	0.018	**0.02**	0.106	**0.11**	0.03
5745	149	Right	Touch	/	11.25	11.5	0.014	**0.01**	0.073	**0.08**	0.05
5745	149	Right	Tilt	/	11.25	11.5	0.009	**0.01**	0.053	**0.06**	-0.12

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below.

Table 14.26: SAR Values (5GWLAN - Head) – 802.11n (Scaled Reported SAR)

Frequency		Side	Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.						
5240	48	Left	Touch	95.0%	100%	0.53	**0.56**
5240	48	Right	Touch	95.0%	100%	0.23	**0.24**

Table 14.27: Reported SAR of initial test configuration for Body

802.11 mode	a	n	
Ch. BW(MHz)	20	20	40
U-NII-1	36/40/44/48	36/40/44/48 **0.26**	38/46
U-NII-2A	52/56/60/64	52/56/60/64 U-NII-1 exclusion applied	54/62
U-NII-3	149/153/157/161/165	149/153/157/161/165 **0.14**	151/159
U-NII-1 and U-NII-2A bands have the same specified maximum output and tolerance; SAR is measured for U-NII-1 band first. Adjusted SAR of U-NII-1 band is ≤ 1.2W/kg, SAR is not required for U-NII-2A band.			

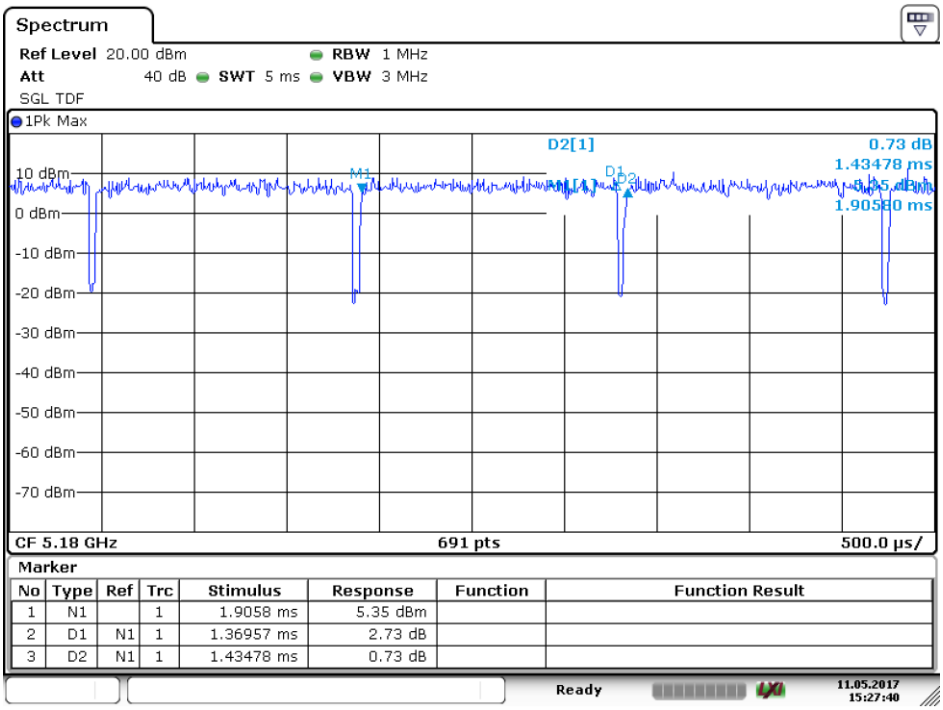
Table 14.28: SAR Values (WLAN - Body)

Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
5240	48	Front	/	11.02	11.5	0.050	**0.06**	0.107	**0.12**	0.02
5240	48	Rear	/	11.02	11.5	0.099	**0.11**	0.234	**0.26**	0.06
5240	48	Right	/	11.02	11.5	0.083	**0.09**	0.142	**0.16**	0.14
5240	48	Top	/	11.02	11.5	0.052	**0.06**	0.128	**0.14**	-0.08
5745	149	Front	/	11.25	11.5	0.025	**0.03**	0.058	**0.06**	-0.05
5745	149	Rear	/	11.25	11.5	0.044	**0.05**	0.136	**0.14**	-0.09
5745	149	Right	/	11.25	11.5	0.044	**0.05**	0.109	**0.12**	0.11
5745	149	Top	/	11.25	11.5	0.047	**0.05**	0.089	**0.09**	0.17

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below.

Table 14.29: SAR Values (5GWLAN - Body) – 802.11n (Scaled Reported SAR)

Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.					
5240	48	Rear	95.0%	100%	0.26	**0.27**



Picture 14.2:The plot of duty factor

15 SAR Measurement Variability

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.

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.

Table 15.1: SAR Measurement Variability for Body GSM 850 (1g) –AP ON

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
848.8	251	Rear	10	0.852	0.844	1.01	/

Table 15.2: SAR Measurement Variability for Body GSM 1900 (1g) - AP ON

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1850.2	512	Rear	10	0.815	0.806	1.01	/

Table 15.3: SAR Measurement Variability for Body WCDMA1900 (1g) - AP ON

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1852.4	9262	Front	10	0.866	0.853	1.02	/

Table 15.4: SAR Measurement Variability for Body LTE Band 7 (1g) –AP ON

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
2560	21350	Bottom	10	1.18	1.14	1.03	/

16 Measurement Uncertainty

16.1 Measurement Uncertainty for Normal SAR Tests (300MHz~3GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	12	N	2	1	1	6.0	6.0	∞
2	Isotropy	B	7.4	R	$\sqrt{3}$	1	1	4.3	4.3	∞
3	Boundary effect	B	1.1	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Readout electronics	B	1.0	N	1	1	1	1.0	1.0	∞
7	Response time	B	0.0	R	$\sqrt{3}$	1	1	0.0	0.0	∞
8	Integration time	B	1.7	R	$\sqrt{3}$	1	1	1.0	1.0	∞
9	RF ambient conditions-noise	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
10	RF ambient conditions-reflection	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
11	Probe positioned mech. restrictions	B	0.35	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	5
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	1.3	N	1	0.64	0.43	0.83	0.56	9
20	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	0.96	0.78	9
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						10.4	10.3	95.5
Expanded uncertainty (Confidence interval of 95 %)		$u_e = 2u_c$						20.8	20.6	

16.2 Measurement Uncertainty for Fast SAR Tests (300MHz~3GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	12	N	2	1	1	6.0	6.0	∞
2	Isotropy	B	7.4	R	$\sqrt{3}$	1	1	4.3	4.3	∞
3	Boundary effect	B	1.1	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Readout electronics	B	1.0	N	1	1	1	1.0	1.0	∞
7	Response time	B	0.0	R	$\sqrt{3}$	1	1	0.0	0.0	∞
8	Integration time	B	1.7	R	$\sqrt{3}$	1	1	1.0	1.0	∞
9	RF ambient conditions-noise	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
10	RF ambient conditions-reflection	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
11	Probe positioned mech. Restrictions	B	0.35	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
14	Fast SAR z-Approximation	B	7.0	R	$\sqrt{3}$	1	1	4.0	4.0	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	5
16	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
17	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
18	Phantom uncertainty	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	1.3	N	1	0.64	0.43	0.83	0.56	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	0.96	0.78	521
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						11.1	11.0	257
Expanded uncertainty (Confidence interval of 95 %)		$u_e = 2u_c$						22.2	22.0	

16.3 Measurement Uncertainty for Normal SAR Tests (3GHz~6GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	13	N	2	1	1	6.5	6.5	∞
2	Isotropy	B	7.4	R	$\sqrt{3}$	1	1	4.3	4.3	∞
3	Boundary effect	B	2.3	R	$\sqrt{3}$	1	1	1.3	1.3	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Readout electronics	B	1.0	N	1	1	1	1.0	1.0	∞
7	Response time	B	0.0	R	$\sqrt{3}$	1	1	0.0	0.0	∞
8	Integration time	B	1.7	R	$\sqrt{3}$	1	1	1.0	1.0	∞
9	RF ambient conditions-noise	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
10	RF ambient conditions-reflection	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
11	Probe positioned mech. restrictions	B	0.71	R	$\sqrt{3}$	1	1	0.4	0.4	∞
12	Probe positioning with respect to phantom shell	B	5.7	R	$\sqrt{3}$	1	1	3.3	3.3	∞
13	Post-processing	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	5
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	1.3	N	1	0.64	0.43	0.83	0.56	9
20	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	0.96	0.78	9
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						11.3	11.2	95.5
Expanded uncertainty (Confidence interval of 95 %)		$u_e = 2u_c$						22.6	22.4	

16.4 Measurement Uncertainty for Fast SAR Tests (3GHz~6GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	13	N	2	1	1	6.5	6.5	∞
2	Isotropy	B	7.4	R	$\sqrt{3}$	1	1	4.3	4.3	∞
3	Boundary effect	B	2.3	R	$\sqrt{3}$	1	1	1.3	1.3	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Readout electronics	B	1.0	N	1	1	1	1.0	1.0	∞
7	Response time	B	0.0	R	$\sqrt{3}$	1	1	0.0	0.0	∞
8	Integration time	B	1.7	R	$\sqrt{3}$	1	1	1.0	1.0	∞
9	RF ambient conditions-noise	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
10	RF ambient conditions-reflection	B	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
11	Probe positioned mech. Restrictions	B	0.71	R	$\sqrt{3}$	1	1	0.4	0.4	∞
12	Probe positioning with respect to phantom shell	B	5.7	R	$\sqrt{3}$	1	1	3.3	3.3	∞
13	Post-processing	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
14	Fast SAR z-Approximation	B	14.0	R	$\sqrt{3}$	1	1	8.1	8.1	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	5
16	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
17	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
18	Phantom uncertainty	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞

20	Liquid conductivity (meas.)	A	1.3	N	1	0.64	0.43	0.83	0.56	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	0.96	0.78	521
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.9	13.9	257
Expanded uncertainty (Confidence interval of 95 %)		$u_e = 2u_c$						27.8	27.7	

17 MAIN TEST INSTRUMENTS

Table 17.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent E5071C	MY46103759	2017-11-17	One year
02	Dielectric probe	85070E	MY44300317	/	/
03	Power meter	NRP	102603	2018-01-04	One year
04	Power sensor	NRP-Z51	102211		
05	Power meter	NRP	101460	2018-02-05	One year
06	Power sensor	NRP-Z91	100553		
07	Signal Generator	E8257D	MY47461211	2017-06-06	One year
08	Amplifier	VTL5400	0404	/	/
09	E-field Probe	SPEAG EX3DV4	3633	2018-02-01	One year
10	DAE	SPEAG DAE4	786	2017-11-22	One year
11	Dipole Validation Kit	SPEAG D835V2	4d057	2015-10-22	Three year
12	Dipole Validation Kit	SPEAG D1900V2	5d088	2015-11-04	Three year
13	Dipole Validation Kit	SPEAG D2450V2	873	2015-10-30	Three year
14	Dipole Validation Kit	SPEAG D2550V2	1010	2015-07-24	Three year
15	Dipole Validation Kit	SPEAG D5GHzV2	1238	2016-09-21	Three year
16	BTS	E5515C	GB46110722	2018-02-19	One year
17	Radio Communication Analyzer	Anristu MT8820C	6201341853	2018-03-08	One year

END OF REPORT BODY

ANNEX A Graph Results

GSM850 Right Cheek High

Date/Time: 2017-4-24
Electronics: DAE4 Sn786
Medium: Head 835 MHz
Medium parameters used (interpolated): f = 848.8 MHz; σ = 0.936 S/m; ε_r = 40.704; ρ = 1000 kg/m^3
Ambient Temperature:22.0^{o}C Liquid Temperature:21.5^{o}C
Communication System: UID 0, GSM (0) Frequency: 848.8 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3633 ConvF (9.04, 9.04, 9.04);

Right Cheek High/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.388 W/kg

Right Cheek High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.439 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.453 W/kg
SAR(1 g) = 0.366 W/kg; SAR(10 g) = 0.282 W/kg
Maximum value of SAR (measured) = 0.382 W/kg

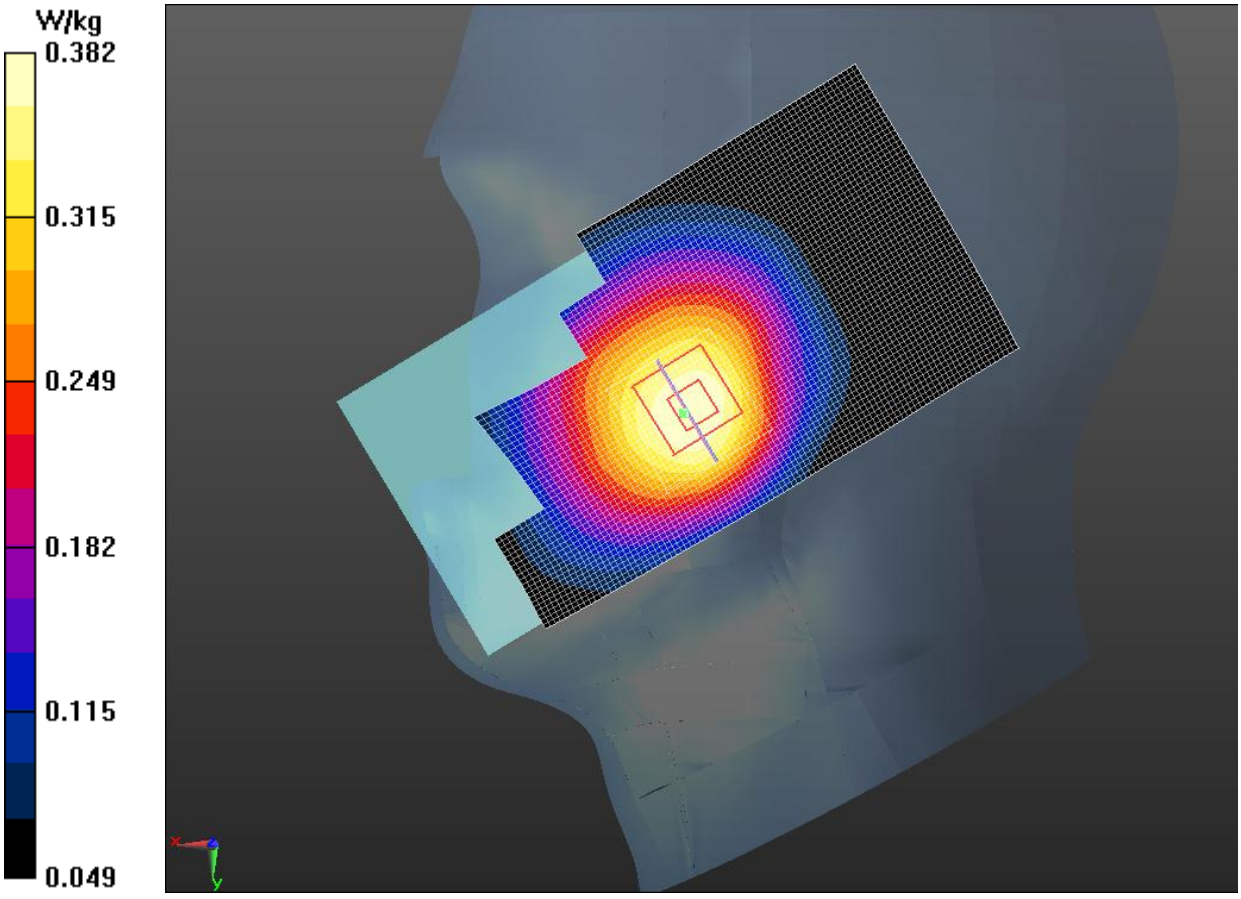


Fig.1 GSM 850MHz

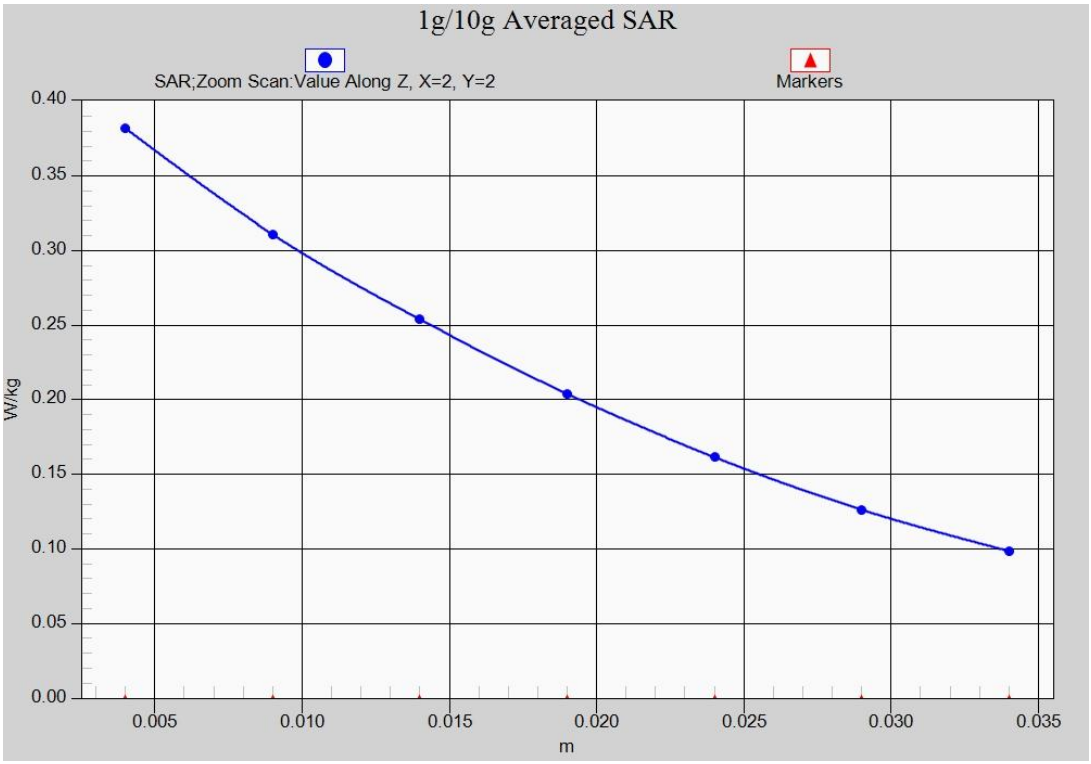


Fig.1-1 Z-Scan at power reference point (GSM 850 MHz)

GSM850 Body Rear High

Date/Time: 2017-4-24
Electronics: DAE4 Sn786
Medium: Body 835 MHz
Medium parameters used (interpolated): f = 848.8 MHz; σ = 1.008 S/m; ε_r = 53.606; ρ = 1000 kg/m^3
Ambient Temperature:22.0^{o}C Liquid Temperature:21.5^{o}C
Communication System: UID 0, 4 slot GPRS (0) Frequency: 848.8 MHz Duty Cycle: 1:2
Probe: EX3DV4 - SN3633 ConvF (9.41, 9.41, 9.41);

Rear side High/Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.890 W/kg

Rear side High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.12 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.45 W/kg
SAR(1 g) = 0.852 W/kg; SAR(10 g) = 0.595 W/kg
Maximum value of SAR (measured) = 0.886 W/kg

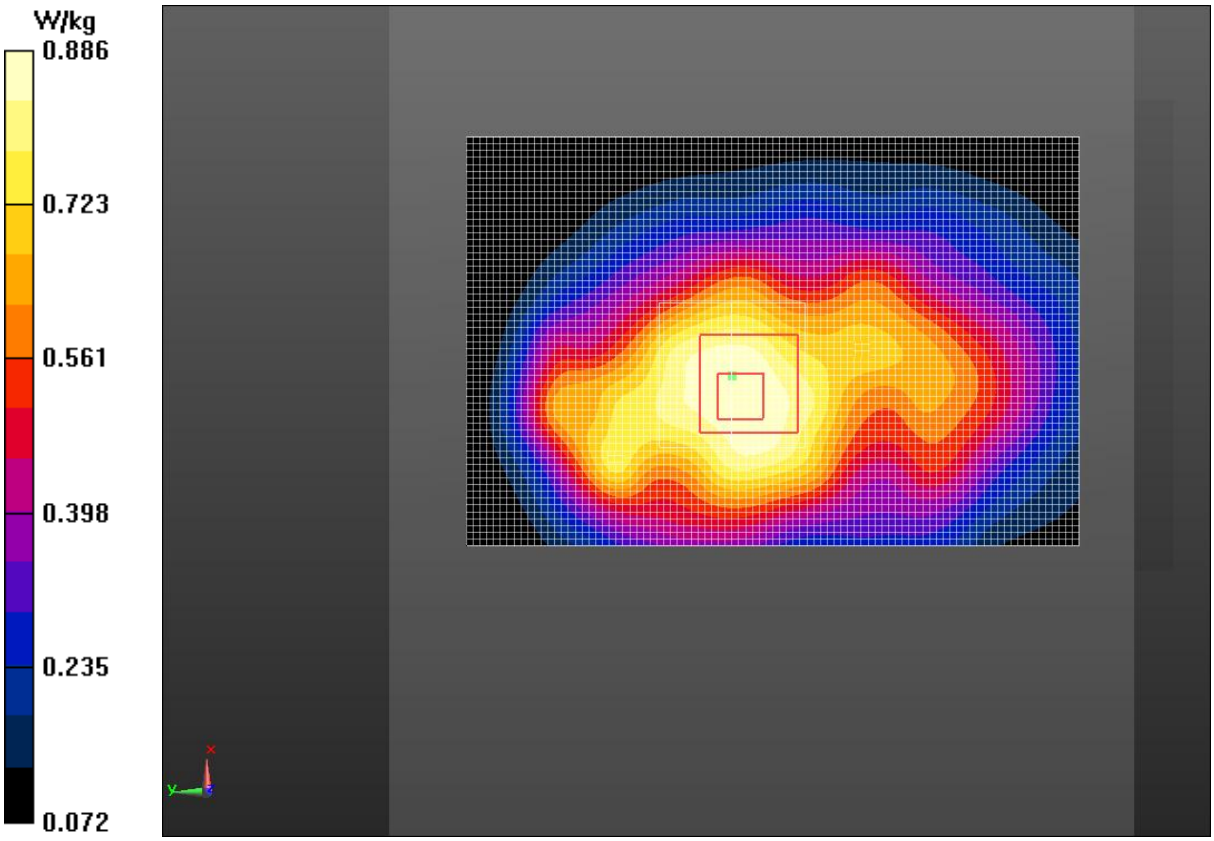


Fig.2 GSM 850 MHz

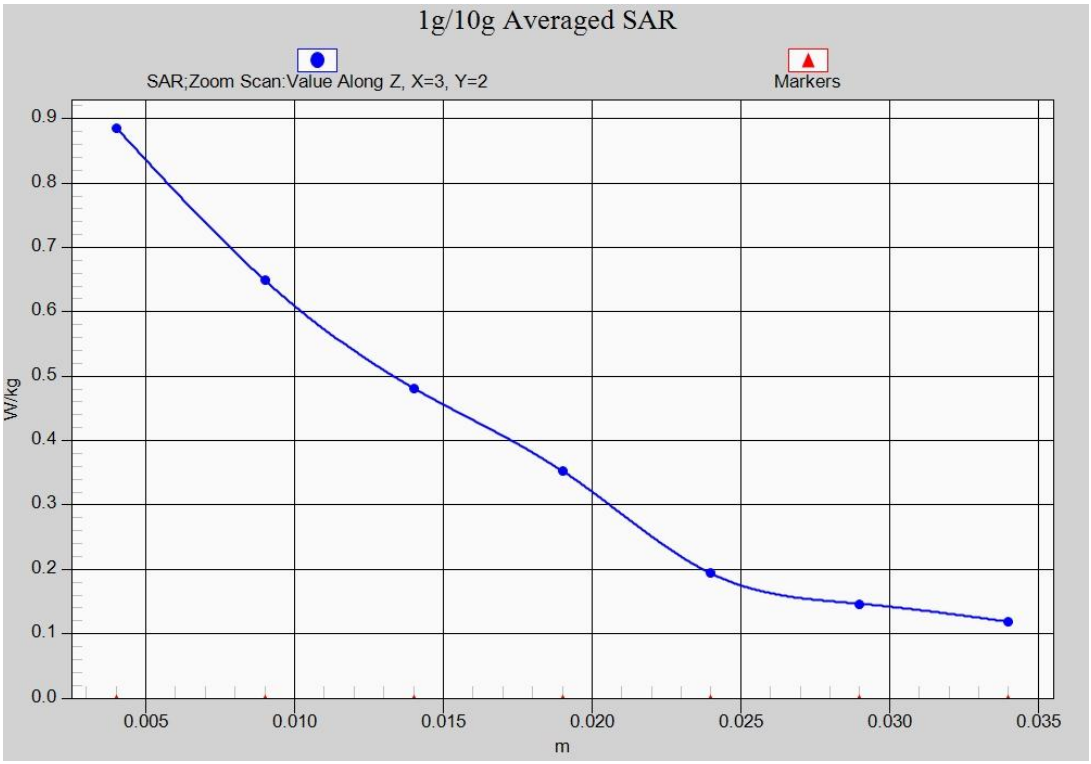


Fig.2-1 Z-Scan at power reference point (GSM 850 MHz)

GSM1900 Left Cheek High

Date/Time: 2017-4-26
Electronics: DAE4 Sn786
Medium: Head 1900 MHz
Medium parameters used (interpolated): f = 1909.8 MHz; σ = 1.414 S/m; ε_r = 39.203; ρ = 1000 kg/m^3
Ambient Temperature:22.0^{o}C Liquid Temperature:21.5^{o}C
Communication System: UID 0, GSM (0) Frequency: 1909.8 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3633 ConvF (8, 8, 8);

Left Cheek High /Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.470 W/kg

Left Cheek High /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.689 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.634 W/kg
SAR(1 g) = 0.412 W/kg; SAR(10 g) = 0.252 W/kg
Maximum value of SAR (measured) = 0.445 W/kg

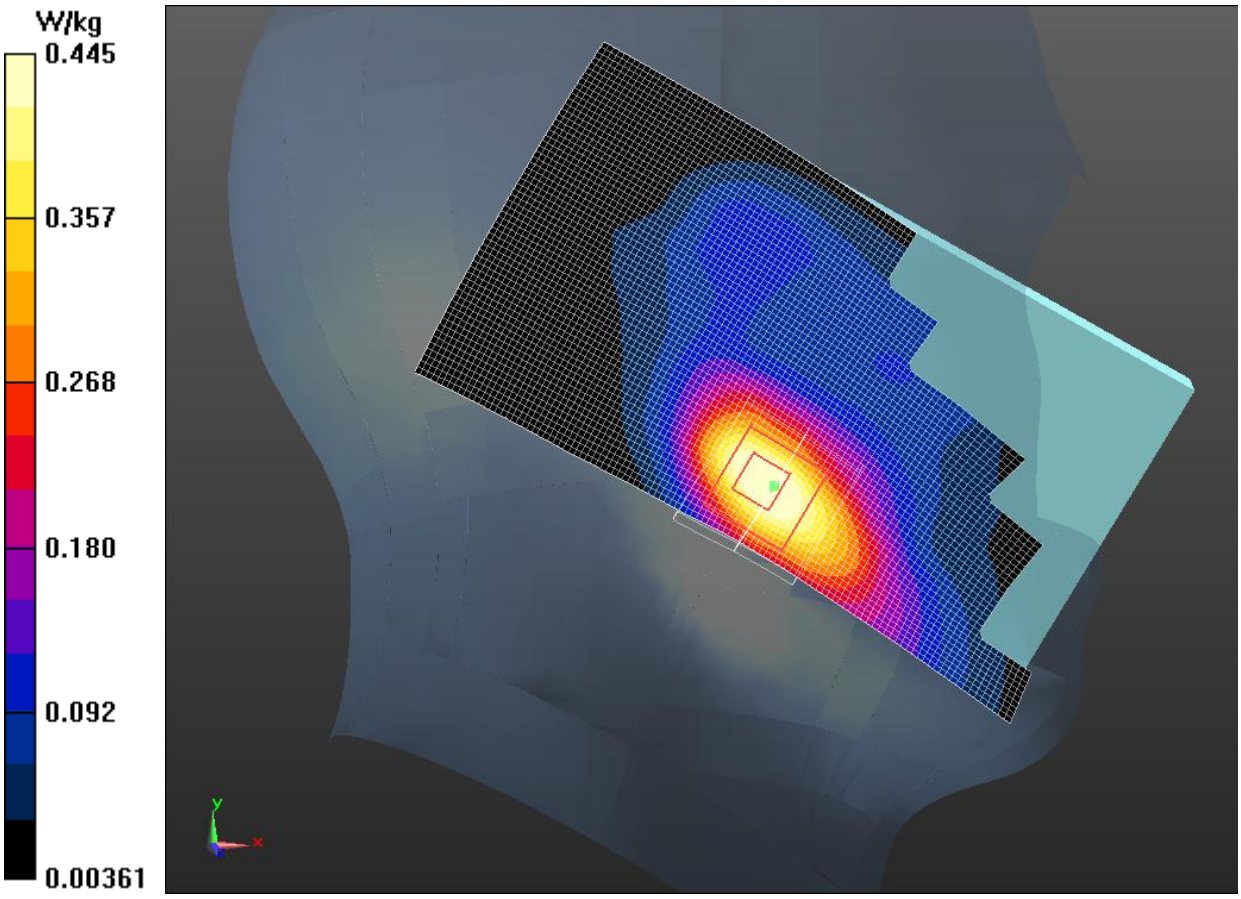


Fig.3 GSM 1900 MHz

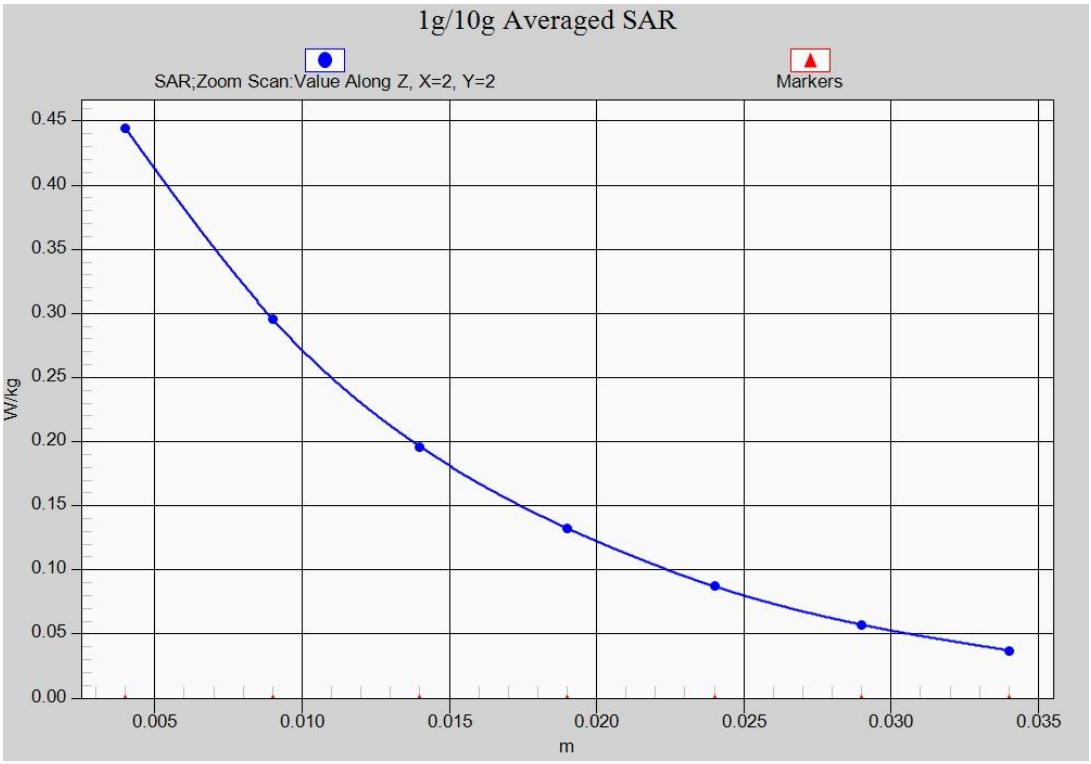


Fig.3-1 Z-Scan at power reference point (GSM 1900 MHz)