



SAR TEST REPORT

No. I16Z40428-SEM03

For

TCL Communication Ltd.

LTE/UMTS/GSM handheld station

Model name: VFD 700

With

Hardware Version: PIO

Software Version: v2DS1

FCC ID: 2ACCJH051

Issued Date: 2016-4-20



中国认可
国际互认
检测
TESTING
CNAS L0570

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 CTTL.

Test Laboratory:

CTTL, Telecommunication Technology Labs, Academy of Telecommunication Research, MIIT
No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China100191
Tel:+86(0)10-62304633-2512,Fax:+86(0)10-62304633-2504
Email:cttl_terminals@catr.cn, website:www.chinattl.com



REPORT HISTORY

Report Number	Revision	Issue Date	Description
I16Z40428-SEM03	Rev.0	2016-4-20	Initial creation of test report

TABLE OF CONTENT

1 TEST LABORATORY	5
1.1 TESTING LOCATION	5
1.2 TESTING ENVIRONMENT.....	5
1.3 PROJECT DATA	5
1.4 SIGNATURE.....	5
2 STATEMENT OF COMPLIANCE	6
3 CLIENT INFORMATION	8
3.1 APPLICANT INFORMATION	8
3.2 MANUFACTURER INFORMATION	8
4 EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE)	9
4.1 ABOUT EUT	9
4.2 INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST	9
4.3 INTERNAL IDENTIFICATION OF AE USED DURING THE TEST	9
5 TEST METHODOLOGY	10
5.1 APPLICABLE LIMIT REGULATIONS	10
5.2 APPLICABLE MEASUREMENT STANDARDS.....	10
6 SPECIFIC ABSORPTION RATE (SAR).....	11
6.1 INTRODUCTION.....	11
6.2 SAR DEFINITION	11
7 TISSUE SIMULATING LIQUIDS	12
7.1 TARGETS FOR TISSUE SIMULATING LIQUID	12
7.2 DIELECTRIC PERFORMANCE	12
8 SYSTEM VERIFICATION	18
8.1 SYSTEM SETUP.....	18
8.2 SYSTEM VERIFICATION.....	19
9 MEASUREMENT PROCEDURES	20
9.1 TESTS TO BE PERFORMED	20
9.2 GENERAL MEASUREMENT PROCEDURE.....	21
9.3 WCDMA MEASUREMENT PROCEDURES FOR SAR	23
9.4 SAR MEASUREMENT FOR LTE.....	24
9.5 BLUETOOTH & WI-FI MEASUREMENT PROCEDURES FOR SAR	24
9.6 POWER DRIFT.....	25
10 AREA SCAN BASED 1-G SAR.....	25
10.1 REQUIREMENT OF KDB.....	25
10.2 FAST SAR ALGORITHMS	25
11 CONDUCTED OUTPUT POWER.....	26

11.1 MANUFACTURING TOLERANCE	26
11.2 GSM MEASUREMENT RESULT	31
11.3 WCDMA MEASUREMENT RESULT	32
11.4 LTE MEASUREMENT RESULT	33
11.5 WI-FI AND BT MEASUREMENT RESULT	35
12 SIMULTANEOUS TX SAR CONSIDERATIONS	37
12.1 INTRODUCTION	37
12.2 TRANSMIT ANTENNA SEPARATION DISTANCES	37
12.3 SAR MEASUREMENT POSITIONS	38
12.4 STANDALONE SAR TEST EXCLUSION CONSIDERATIONS	38
13 EVALUATION OF SIMULTANEOUS	39
14 SAR TEST RESULT	40
14.1 THE EVALUATION OF MULTI-BATTERIES	40
14.2 SAR RESULTS FOR FAST SAR	40
14.3 SAR RESULTS FOR STANDARD PROCEDURE	44
14.4 WLAN EVALUATION	47
15 SAR MEASUREMENT VARIABILITY	52
16 MEASUREMENT UNCERTAINTY	53
16.1 MEASUREMENT UNCERTAINTY FOR NORMAL SAR TESTS (300MHz~3GHz)	53
16.2 MEASUREMENT UNCERTAINTY FOR NORMAL SAR TESTS (3~6GHz)	54
16.3 MEASUREMENT UNCERTAINTY FOR FAST SAR TESTS (300MHz~3GHz)	55
16.4 MEASUREMENT UNCERTAINTY FOR FAST SAR TESTS (3~6GHz)	56
17 MAIN TEST INSTRUMENTS	57
ANNEX A GRAPH RESULTS	58
ANNEX B SYSTEM VERIFICATION RESULTS	86
ANNEX C SAR MEASUREMENT SETUP	97
ANNEX D POSITION OF THE WIRELESS DEVICE IN RELATION TO THE PHANTOM	103
ANNEX E EQUIVALENT MEDIA RECIPES	106
ANNEX F SYSTEM VALIDATION	107
ANNEX G PROBE CALIBRATION CERTIFICATE	108
ANNEX H DIPOLE CALIBRATION CERTIFICATE	119
ANNEX I ACCREDITATION CERTIFICATE	167

1 Test Laboratory

1.1 Testing Location

Company Name:	CTTL(Shouxiang)
Address:	No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China100191

1.2 Testing Environment

Temperature:	18°C~25 °C,
Relative humidity:	30%~ 70%
Ground system resistance:	< 0.5 Ω
Ambient noise & Reflection:	< 0.012 W/kg

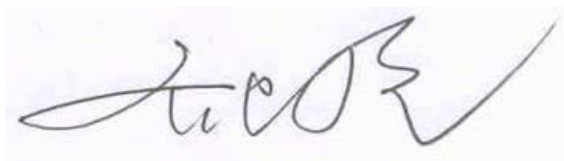
1.3 Project Data

Project Leader:	Qi Dianyuan
Test Engineer:	Lin Xiaojun
Testing Start Date:	March 11, 2016
Testing End Date:	March 17, 2016

1.4 Signature



Lin Xiaojun
(Prepared this test report)



Qi Dianyuan
(Reviewed this test report)



Xiao Li
Deputy Director of the laboratory
(Approved this test report)

2 Statement of Compliance

The maximum results of SAR found during testing for TCL Communication Ltd. LTE/UMTS/GSM handheld station VFD 700 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)	GSM 850	0.31	PCE
	PCS 1900	0.32	
	UMTS FDD 5	0.46	
	UMTS FDD 2	0.56	
	LTE Band 7	0.35	
	WLAN 2.4 GHz	0.69	DTS
	WLAN 5 GHz	0.04	UNII
Hotspot (Separation Distance 10mm)	GSM 850	0.34	PCE
	PCS 1900	1.04	
	UMTS FDD 5	0.80	
	UMTS FDD 2	0.99	
	LTE Band 7	1.01	
	WLAN 2.4 GHz	0.12	DTS
	WLAN 5 GHz	0.04	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: **1.04W/kg (1g)**.

Table 2.2: The sum of reported SAR values for main antenna and WiFi

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Right hand, Touch cheek	0.56	0.69	1.25
Highest reported SAR value for Body	Rear	1.04	0.12	1.16

Table 2.3: The sum of reported SAR values for main antenna and BT

	Position	Main antenna	BT	Sum
Maximum reported SAR value for Head	Right hand, Touch cheek	0.56	0.21 ^[1]	0.77
Maximum reported SAR value for Body	Rear	1.04	0.10 ^[1]	1.14

[1] - Estimated SAR for Bluetooth (see the table 13.3)

According to the above tables, the highest sum of reported SAR values is **1.25 W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 13.

3 Client Information

3.1 Applicant Information

Company Name:	TCL Communication Ltd.
Address /Post:	5F, C building, No. 232, Liang Jing Road ZhangJiang High-Tech Park, Pudong Area Shanghai, P.R. China. 201203
City:	Shanghai
Postal Code:	201203
Country:	China
Contact Person:	Gong Zhizhou
E-mail:	zhizhou.gong@tcl.com
Telephone:	0086-21-31363544
Fax:	0086-21-61460602

3.2 Manufacturer Information

Company Name:	TCL Communication Ltd.
Address /Post:	5F, C building, No. 232, Liang Jing Road ZhangJiang High-Tech Park, Pudong Area Shanghai, P.R. China. 201203
City:	Shanghai
Postal Code:	201203
Country:	China
Contact Person:	Gong Zhizhou
E-mail:	zhizhou.gong@tcl.com
Telephone:	0086-21-31363544
Fax:	0086-21-61460602

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

4.1 About EUT

Description:	LTE/UMTS/GSM handheld station
Model name:	VFD 700
Operating mode(s):	GSM 850/900/1800/1900, WCDMA 850/900/1900/2100 BT, Wi-Fi2.4G,WiFi5G(U-NII-1), LTE Band 1/2/3/7/8/20/28
Tested Tx Frequency:	825 – 848.8 MHz (GSM 850)
	1850.2 – 1910 MHz (GSM 1900)
	826.4–846.6 MHz (WCDMA 850 Band V)
	1852.4–1907.6 MHz (WCDMA1900 Band II)
	2502.5 – 2567.5 MHz (LTE Band 7)
	2412 – 2462 MHz (Wi-Fi 2.4G)
	5150-5250 MHz (Wi-Fi 5G)
GPRS/EGPRS Multislot Class:	12
GPRS capability Class:	B
Accessories/Body-worn configurations:	Headset
Hotspot mode:	Support

4.2 Internal Identification of EUT used during the test

EUT ID*	IMEI	HW	SW Version
EUT1	357042070007167	PIO	v2DS1
EUT2	357042070003182	PIO	v2DS1
EUT3	357042070003331	PIO	v2DS1
EUT4	357042070006771	PIO	v2DS1

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

Note: It is performed to test SAR with the EUT1&2 and conducted power with the EUT3&4.

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	CAC2960003C2	/	SCUD
AE2	Headset	CCB0009A16C1	/	JUWEI
AE3	Headset	CCB0009A16C4	/	MEIHAO

*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: Measurement 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

KDB941225 D06 Hotspot Mode SAR v02r01: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

KDB248227 D01 802.11 Wi-Fi SAR v02r02: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS

KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz.

KDB865664 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 heat 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

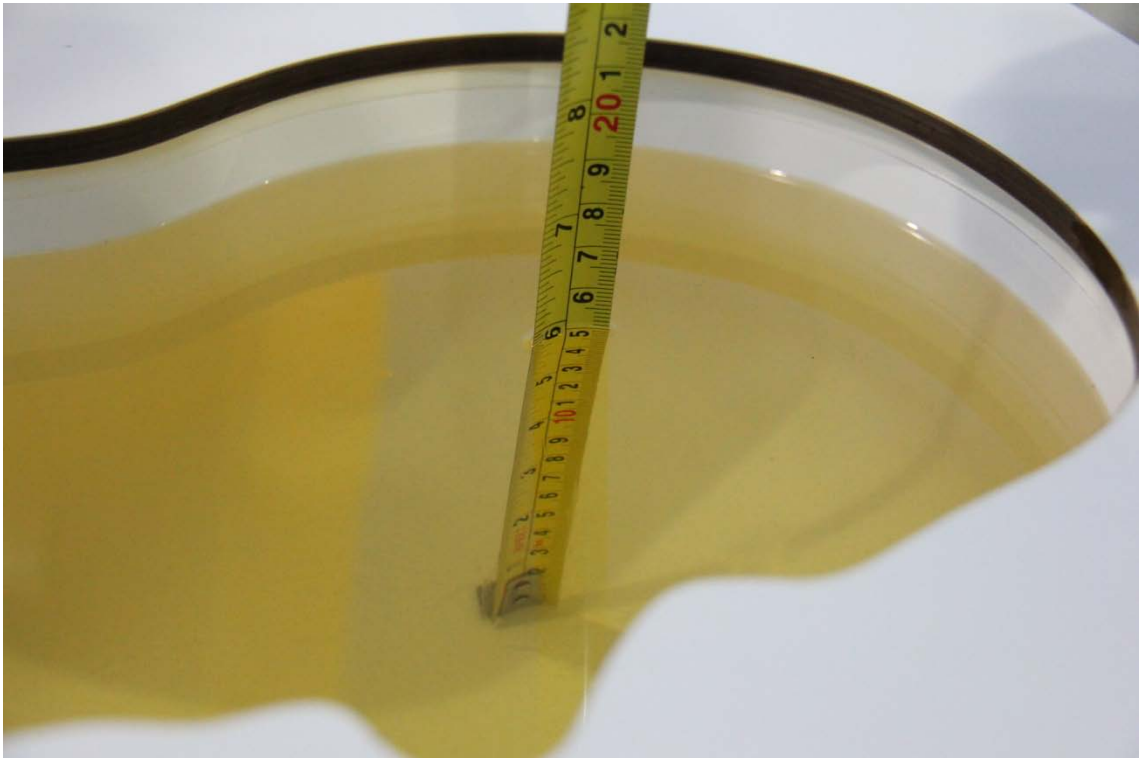
Frequency(MHz)	Liquid Type	Conductivity(σ)	$\pm 5\%$ Range	Permittivity(ϵ)	$\pm 5\%$ Range
835	Head	0.90	0.86~0.95	41.5	39.4~43.6
835	Body	0.97	0.92~1.02	55.2	52.4~58.0
1900	Head	1.40	1.33~1.47	40.0	38.0~42.0
1900	Body	1.52	1.44~1.60	53.3	50.6~56.0
2450	Head	1.80	1.71~1.89	39.2	37.2~41.2
2450	Body	1.95	1.85~2.05	52.7	50.1~55.3
2600	Head	1.96	1.86~2.06	39.01	37.06~40.96
2600	Body	2.16	2.05~2.27	52.5	49.9~55.1
5200	Head	4.66	4.43~4.89	35.99	34.19~37.79
5200	Body	5.30	5.04~5.56	49.0	46.6~51.4

7.2 Dielectric Performance

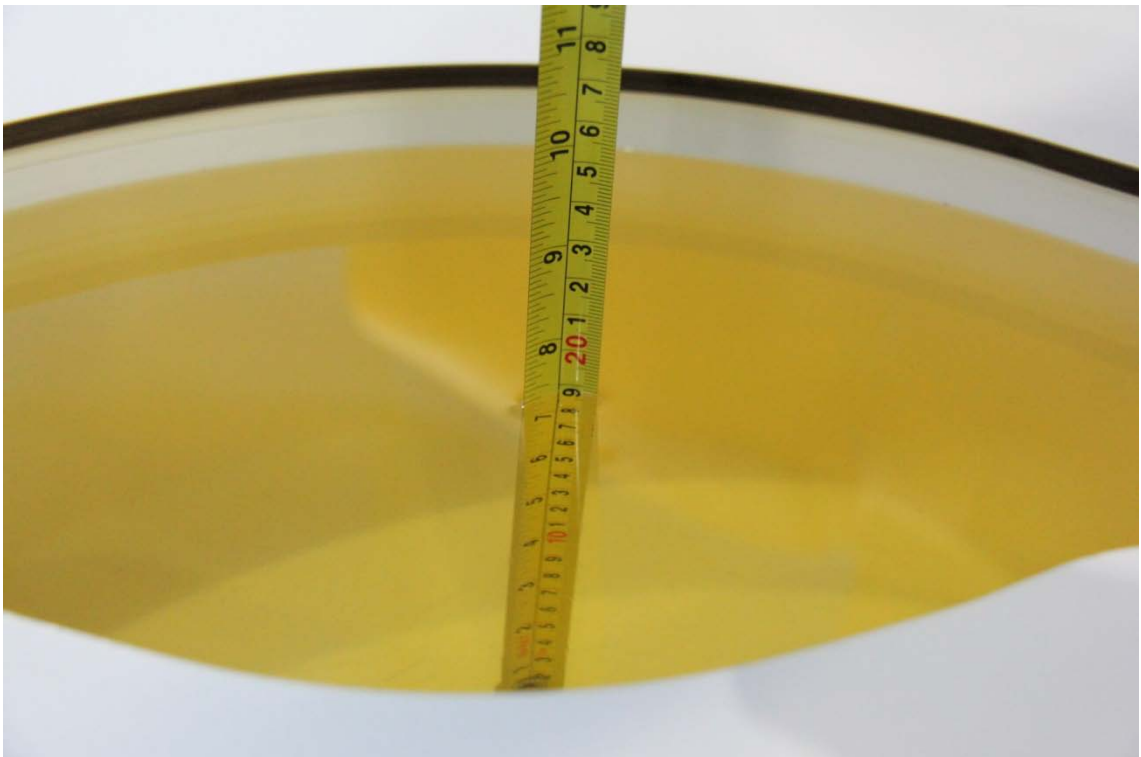
Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ϵ	Drift (%)	Conductivity σ (S/m)	Drift (%)
2016-3-14	Head	835 MHz	41.26	-0.58	0.889	-1.22
	Body	835 MHz	56.11	1.65	0.968	-0.21
2016-3-15	Head	1900 MHz	39.98	-0.05	1.396	-0.29
	Body	1900 MHz	53.94	1.20	1.518	-0.13
2016-3-11	Head	2450 MHz	38.55	-1.66	1.834	1.89
	Body	2450 MHz	51.68	-1.94	1.982	1.64
2016-3-17	Head	2600 MHz	38.93	-0.21	1.938	-1.12
	Body	2600 MHz	51.24	-2.40	2.152	-0.37
2016-3-13	Head	5200 MHz	36.70	1.97	4.640	-0.43
	Body	5200 MHz	50.47	3.00	5.107	-3.64

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 (2450MHz)



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



Picture 7-7 Liquid depth in the Head Phantom (2600 MHz Head)



Picture 7-8 Liquid depth in the Flat Phantom (2600MHz)



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

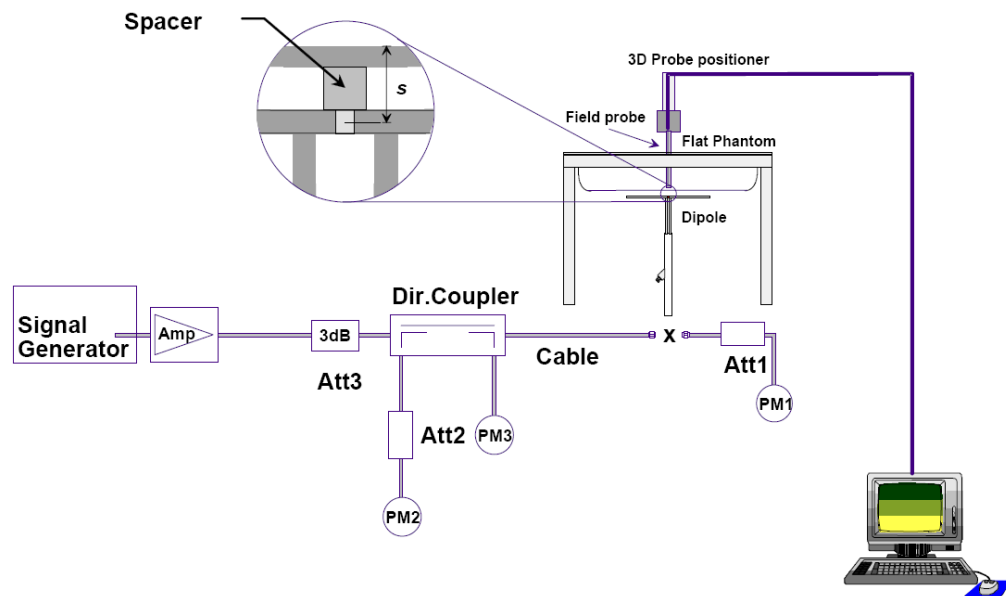


Picture 7-10 Liquid depth in the Flat Phantom (5GHz)

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
2016-3-14	835 MHz	5.92	9.12	5.98	9.08	1.01%	-0.44%
2016-3-15	1900 MHz	21.36	40.4	21.32	39.96	-0.19%	-1.09%
2016-3-11	2450 MHz	24.5	52.5	24.16	52.80	-1.39%	0.57%
2016-3-17	2600 MHz	26.0	57.1	26.76	57.60	2.92%	0.88%
2016-3-13	5200 MHz	22.3	77.8	23.2	81.8	4.04%	4.11%

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
2016-3-14	835 MHz	6.24	9.52	6.36	9.48	1.92%	-0.42%
2016-3-15	1900 MHz	21.88	40.8	21.92	40.88	0.18%	0.20%
2016-3-11	2450 MHz	24.4	52.1	23.76	50.80	-2.62%	-2.50%
2016-3-17	2600 MHz	25.4	56.4	26.12	58.04	2.83%	2.91%
2016-3-13	5200 MHz	21.2	75.9	21.2	74.8	0.00%	-1.45%

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.

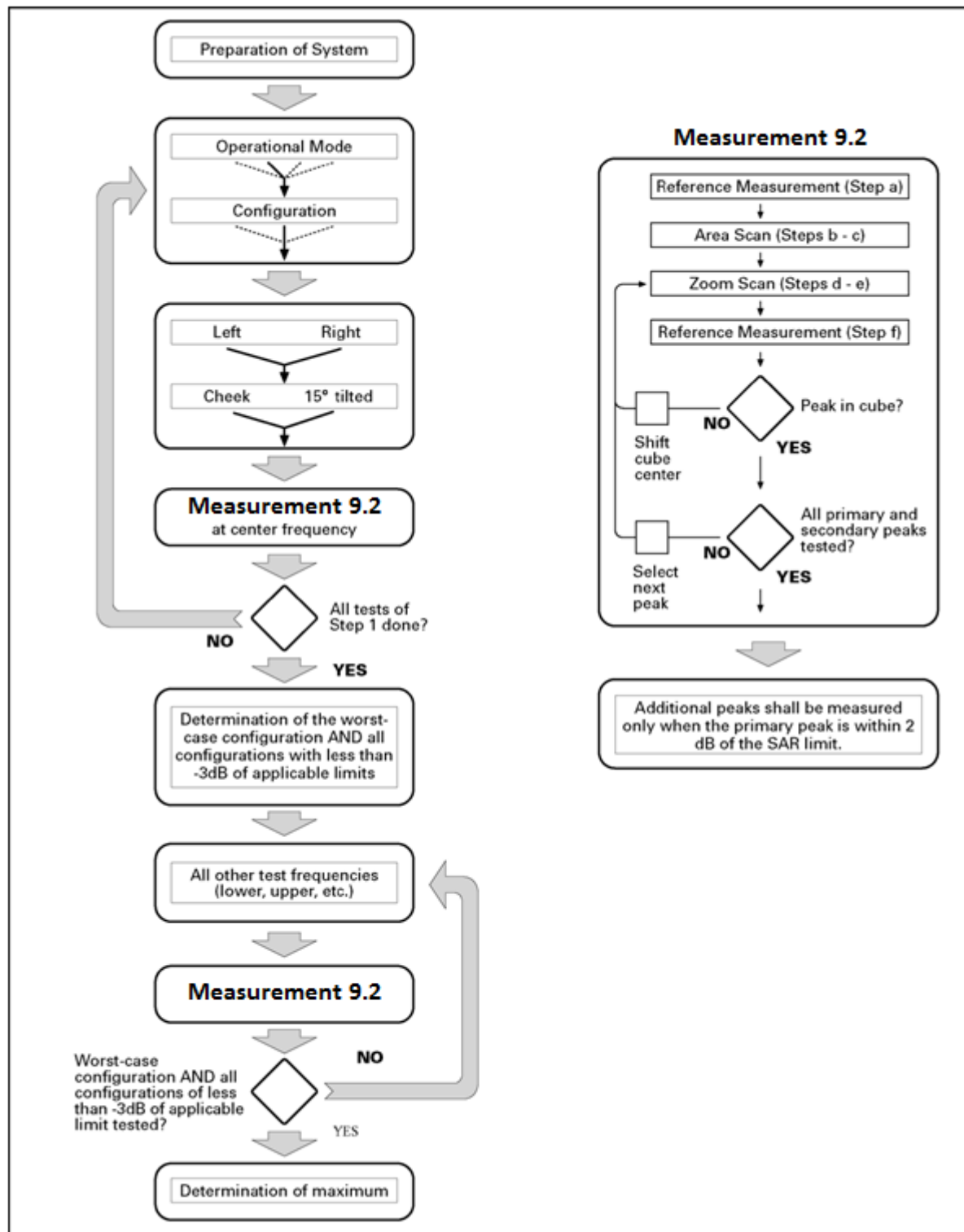
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the centre of the transmit frequency band (f_c) for:

- 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 9.1 Block 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 1528-2003. 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	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
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 $\leq$ 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 1 st 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	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
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 <u>reported</u> 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	1.5	1.5	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	1.5	1.5	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}:47/15$ $\beta_{ed2}:47/15$	4	2	1.5	1.5	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	1.5	1.5	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.5	1.5	21	81

Rel.8 DC-HSDPA (Cat 24)

SAR test exclusion for Rel.8 DC-HSDPA must satisfy the SAR test exclusion requirements of Rel.5 HSDPA. SAR test exclusion for DC-HSDPA devices is determined by power measurements according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to qualify for SAR test exclusion.

9.4 SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator, Rohde & Schwarz CMW500. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the CMW 500.

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.

9.5 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.

9.6 Power Drift

To control the output power stability during the SAR test, DASY4 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 v05, when the implementation is based the specific polynomial fit algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-g SAR 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 11.1-1: GSM Speech

GSM 850			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	32.5	32.5	32.5
Tune-up (dBm)	33.5	33.5	33.5
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	30.0	30.0	30.0
Tune-up (dBm)	31.0	31.0	31.0

Table 11.1-2: GPRS and EGPRS

GSM 850 GPRS (GMSK)				
Channel		251	190	128
1 Txslot	Target (dBm)	32.5	32.5	32.5
	Tune-up (dBm)	33.5	33.5	33.5
2 Txslots	Target (dBm)	29.0	29.0	29.0
	Tune-up (dBm)	30.0	30.0	30.0
3 Txslots	Target (dBm)	27.0	27.0	27.0
	Tune-up (dBm)	28.0	28.0	28.0
4 Txslots	Target (dBm)	26.0	26.0	26.0
	Tune-up (dBm)	27.0	27.0	27.0
GSM 850 EGPRS (GMSK)				
Channel		251	190	128
1 Txslot	Target (dBm)	32.5	32.5	32.5
	Tune-up (dBm)	33.5	33.5	33.5
2 Txslots	Target (dBm)	29.0	29.0	29.0
	Tune-up (dBm)	30.0	30.0	30.0
3 Txslots	Target (dBm)	27.0	27.0	27.0
	Tune-up (dBm)	28.0	28.0	28.0
4 Txslots	Target (dBm)	26.0	26.0	26.0
	Tune-up (dBm)	27.0	27.0	27.0
GSM 850 EGPRS (8PSK)				
Channel		810	661	512
1 Txslot	Target (dBm)	26.5	26.5	26.5
	Tune-up (dBm)	27.5	27.5	27.5
2 Txslots	Target (dBm)	22.5	22.5	22.5
	Tune-up (dBm)	23.5	23.5	23.5
3 Txslots	Target (dBm)	20.5	20.5	20.5
	Tune-up (dBm)	21.5	21.5	21.5

4 Txslots	Target (dBm)	19.5	19.5	19.5
	Tune-up (dBm)	20.5	20.5	20.5
GSM 1900 GPRS (GMSK)				
	Channel	810	661	512
1 Txslot	Target (dBm)	30.0	30.0	30.0
	Tune-up (dBm)	31.0	31.0	31.0
2 Txslots	Target (dBm)	28.0	28.0	28.0
	Tune-up (dBm)	29.0	29.0	29.0
3 Txslots	Target (dBm)	26.5	26.5	26.5
	Tune-up (dBm)	27.5	27.5	27.5
4 Txslots	Target (dBm)	25.5	25.5	25.5
	Tune-up (dBm)	26.5	26.5	26.5
GSM 1900 EGPRS (GMSK)				
	Channel	810	661	512
1 Txslot	Target (dBm)	30.0	30.0	30.0
	Tune-up (dBm)	31.0	31.0	31.0
2 Txslots	Target (dBm)	28.0	28.0	28.0
	Tune-up (dBm)	29.0	29.0	29.0
3 Txslots	Target (dBm)	26.5	26.5	26.5
	Tune-up (dBm)	27.5	27.5	27.5
4 Txslots	Target (dBm)	25.5	25.5	25.5
	Tune-up (dBm)	26.5	26.5	26.5
GSM 1900 EGPRS (8PSK)				
	Channel	810	661	512
1 Txslot	Target (dBm)	26.0	26.0	26.0
	Tune-up (dBm)	27.0	27.0	27.0
2 Txslots	Target (dBm)	23.0	23.0	23.0
	Tune-up (dBm)	24.0	24.0	24.0
3 Txslots	Target (dBm)	21.0	21.0	21.0
	Tune-up (dBm)	22.0	22.0	22.0
4 Txslots	Target (dBm)	20.5	20.5	20.5
	Tune-up (dBm)	21.5	21.5	21.5

Table 11.1-3: WCDMA

WCDMA 850 CS			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	23.0	23.0	23.0
Tune-up (dBm)	24.0	24.0	24.0
HSUPA (sub-test 1/2)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	20.5	20.5	20.5
Tune-up (dBm)	21.5	21.5	21.5

HSUPA (sub-test 3/5)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	21.5	21.5	21.5
Tune-up (dBm)	22.5	22.5	22.5
HSUPA (sub-test 4)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	20.0	20.0	20.0
Tune-up (dBm)	21.0	21.0	21.0
HSPA+			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	20.5	20.5	20.5
Tune-up (dBm)	21.5	21.5	21.5
DC-HSDPA (sub-test 1~4)			
Channel	Channel 4233	Channel 4182	Channel 4132
Target (dBm)	22.5	22.5	22.5
Tune-up (dBm)	23.5	23.5	23.5
WCDMA 1900 CS			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	23.5	23.5	23.5
Tune-up (dBm)	24.5	24.5	24.5
HSUPA (sub-test 1/2)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	20.5	20.5	20.5
Tune-up (dBm)	21.5	21.5	21.5
HSUPA (sub-test 3/5)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	21.5	21.5	21.5
Tune-up (dBm)	22.5	22.5	22.5
HSUPA (sub-test 4)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	20.0	20.0	20.0
Tune-up (dBm)	21.0	21.0	21.0
HSPA+			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	21.0	21.0	21.0
Tune-up (dBm)	22.0	22.0	22.0
DC-HSDPA (sub-test 1~4)			
Channel	Channel 9538	Channel 9400	Channel 9262
Target (dBm)	22.5	22.5	22.5
Tune-up (dBm)	23.5	23.5	23.5

Table 11.1-4: LTE

Mode	Target (dBm)	Tune-up (dBm)
LTE Band 7	23	24

LTE MPR will follow up 3GPP setting as below:

Modulation	Channel bandwidth / Transmission bandwidth (NRB)						MPR (dB)
	1.4MHz	3.0MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2

Table 11.1-5: Bluetooth

GFSK	Channel	Channel 0	Channel 39	Channel 78
	Target (dBm)	3.5	5	4.5
	Tune-up (dBm)	4.5	6	5.5
EDR2M-4_DQPSK	Channel	Channel 0	Channel 39	Channel 78
	Target (dBm)	2	4.5	3
	Tune-up (dBm)	3	5.5	4
EDR3M-8DPSK	Channel	Channel 0	Channel 39	Channel 78
	Target (dBm)	2	4	3
	Tune-up (dBm)	3	5	4

Table 11.6: WiFi

WiFi 802.11b (2.4GHz)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15	17	15
Tune-up (dBm)	16	18	16
WiFi 802.11g (2.4GHz)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	11	14	11
Tune-up (dBm)	12	15	12
WiFi 802.11n HT20 (2.4GHz)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	10.5	12.5	10.5
Tune-up (dBm)	11.5	13.5	11.5
WiFi 802.11n HT40 (2.4GHz)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	9	11.5	9
Tune-up (dBm)	10	12.5	10

WiFi 802.11a (5.0GHz)				
Channel	Channel 36	Channel 40	Channel 44	Channel 48
Target (dBm)	14	14	14	14
Tune-up(dB)	15	15	15	15
WiFi 802.11n-20 (5.0GHz)				
Data Rate	Channel 36	Channel 40	Channel 44	Channel 48
Target (dBm)	12	12	12	12
Tune-up(dB)	13	13	13	13
WiFi 802.11n-40 (5.0GHz) MCS0~3				
Data Rate	Channel 38	Channel 46	Channel 151	Channel 159
Target (dBm)	12	12	12	12
Tune-up(dB)	13	13	13	13
WiFi 802.11n-40 (2.4GHz) MCS4~7				
Data Rate	Channel 38	Channel 46	Channel 151	Channel 159
Target (dBm)	11	11	11	11
Tune-up(dB)	12	12	12	12

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 11.2-1: 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)
	32.70	32.73	32.72
GSM 1900MHz	Conducted Power (dBm)		
	Channel 810(1909.8MHz)	Channel 661(1880MHz)	Channel 512(1850.2MHz)
	29.48	29.75	29.95

Table 2-2: The conducted power measurement results for GPRS and EGPRS

GSM 850 GPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	190	128		251	190	128
1 Txslot	32.55	32.59	32.64	-9.03	23.52	23.56	23.61
2 Txslots	29.19	29.22	29.26	-6.02	23.17	23.20	23.24
3Txslots	27.12	27.21	27.27	-4.26	22.86	22.95	23.01
4 Txslots	26.42	26.50	26.57	-3.01	23.41	23.49	23.56
GSM 850 EGPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	190	128		251	190	128
1 Txslot	32.56	32.61	32.65	-9.03	23.53	23.58	23.62
2 Txslots	29.18	29.21	29.27	-6.02	23.16	23.19	23.25
3Txslots	27.11	27.21	27.27	-4.26	22.85	22.95	23.01
4 Txslots	26.43	26.51	26.54	-3.01	23.42	23.50	23.53
GSM 850 EGPRS (8PSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	251	190	128		251	190	128
1 Txslot	26.63	26.66	26.56	-9.03	17.60	17.63	17.53
2 Txslots	22.74	22.75	22.69	-6.02	16.72	16.73	16.67
3Txslots	20.63	20.66	20.64	-4.26	16.37	16.40	16.38
4 Txslots	19.72	19.87	19.82	-3.01	16.71	16.86	16.81
PCS1900 GPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	661	512		810	661	512
1 Txslot	29.65	29.58	29.37	-9.03	20.62	20.55	20.34
2 Txslots	28.01	27.69	27.41	-6.02	21.99	21.67	21.39
3Txslots	26.05	25.64	25.56	-4.26	21.79	21.38	21.30
4 Txslots	25.05	24.80	24.63	-3.01	22.04	21.79	21.62

PCS1900 EGPRS (GMSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	661	512		810	661	512
1 Txslot	29.63	29.56	29.37	-9.03	20.60	20.53	20.34
2 Txslots	28.03	27.68	27.39	-6.02	22.01	21.66	21.37
3Txslots	26.04	25.63	25.54	-4.26	21.78	21.37	21.28
4 Txslots	25.03	24.80	24.62	-3.01	22.02	21.79	21.61
PCS1900 EGPRS (8PSK)	Measured Power (dBm)			calculation	Averaged Power (dBm)		
	810	661	512		810	661	512
1 Txslot	26.26	25.91	25.75	-9.03	17.23	16.88	16.72
2 Txslots	23.58	23.21	22.98	-6.02	17.56	17.19	16.96
3Txslots	21.40	20.89	20.68	-4.26	17.14	16.63	16.42
4 Txslots	20.24	19.91	19.71	-3.01	17.23	16.90	16.70

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 1Txslots for 850 GPRS and EGPRS and 4Txslots for 1900 GPRS and EGPRS.

11.3 WCDMA Measurement result

Table 3-1: The conducted Power for WCDMA

Item	band	FDDV result		
	ARFCN	4233 (846.6MHz)	4182 (836.4MHz)	4132 (826.4MHz)
WCDMA	\	23.49	23.47	23.47
HSUPA	1	21.04	20.55	20.61
	2	20.55	20.54	20.60
	3	21.55	21.50	21.56
	4	20.06	20.07	20.07
	5	21.52	21.50	21.54
HSPA+	\	20.70	20.69	20.65
DC-HSDPA	1	21.86	21.75	21.74
	2	21.85	21.75	21.75
	3	21.85	21.73	21.70
	4	21.83	21.72	21.70

Item	band	FDDII result		
	ARFCN	9538 (1907.6MHz)	9400 (1880MHz)	9262 (1852.4MHz)
WCDMA	1	24.06	24.14	24.23
HSUPA	1	21.30	21.01	20.95
	2	20.83	21.00	20.93
	3	21.82	21.96	21.89
	4	20.35	20.57	20.47
	5	21.79	21.94	21.86
HSPA+	1	21.26	21.22	21.18
DC-HSDPA	1	22.27	22.30	22.28
	2	22.25	22.31	22.33
	3	22.27	22.31	22.29
	4	22.26	22.32	22.31

11.4 LTE Measurement result

Table 4-1: The conducted Power for LTE

Band 7							
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Max. Target Power (dBm)	QPSK		16QAM	
	RB offset (Start RB)			Actual output power (dBm)	MPR	Actual output power (dBm)	MPR
5 MHz	1RB High (24)	2567.5	23	23.18	0	22.08	1
		2535	23	23.18	0	22.08	1
		2502.5	23	23.19	0	22.10	1
	1RB Middle (12)	2567.5	23	23.25	0	22.14	1
		2535	23	23.26	0	22.14	1
		2502.5	23	23.26	0	22.15	1
	1RB Low (0)	2567.5	23	23.18	0	22.08	1
		2535	23	23.20	0	22.08	1
		2502.5	23	23.21	0	22.09	1
	12RB High (13)	2567.5	23	22.31	1	21.38	2
		2535	23	22.35	1	21.44	2
		2502.5	23	22.36	1	21.45	2
	12RB Middle (6)	2567.5	23	22.36	1	21.43	2
		2535	23	22.36	1	21.45	2
		2502.5	23	22.38	1	21.47	2
	12RB Low (0)	2567.5	23	22.37	1	21.44	2
		2535	23	22.32	1	21.40	2
		2502.5	23	22.36	1	21.44	2
	25RB (0)	2567.5	23	22.32	1	21.34	2
		2535	23	22.31	1	21.32	2
		2502.5	23	22.33	1	21.36	2

10 MHz	1RB High (49)	2565	23	23.12	0	22.80	1
		2535	23	23.34	0	22.83	1
		2505	23	23.38	0	22.87	1
	1RB Middle (24)	2565	23	23.38	0	22.86	1
		2535	23	23.40	0	22.88	1
		2505	23	23.40	0	22.89	1
	1RB Low (0)	2565	23	23.24	0	22.79	1
		2535	23	23.31	0	22.80	1
		2505	23	23.30	0	22.78	1
	25RB High (25)	2565	23	22.21	1	21.24	2
		2535	23	22.34	1	21.37	2
		2505	23	22.33	1	21.37	2
	25RB Middle (12)	2565	23	22.29	1	21.46	2
		2535	23	22.34	1	21.38	2
		2505	23	22.35	1	21.39	2
	25RB Low (0)	2565	23	22.39	1	21.20	2
		2535	23	22.27	1	21.31	2
		2505	23	22.34	1	21.39	2
	50RB (0)	2565	23	22.47	1	21.43	2
		2535	23	22.31	1	21.31	2
		2505	23	22.33	1	21.35	2
15 MHz	1RB High (74)	2562.5	23	23.34	0	22.70	1
		2535	23	23.50	0	22.50	1
		2507.5	23	23.32	0	22.84	1
	1RB Middle (37)	2562.5	23	23.33	0	22.79	1
		2535	23	23.53	0	22.86	1
		2507.5	23	23.41	0	22.89	1
	1RB Low (0)	2562.5	23	23.22	0	22.71	1
		2535	23	23.17	0	22.77	1
		2507.5	23	23.34	0	22.93	1
	36RB High (38)	2562.5	23	22.41	1	21.30	2
		2535	23	22.38	1	21.37	2
		2507.5	23	22.33	1	21.34	2
	36RB Middle (19)	2562.5	23	22.33	1	21.33	2
		2535	23	22.42	1	21.41	2
		2507.5	23	22.50	1	21.44	2
	36RB Low (0)	2562.5	23	22.31	1	21.28	2
		2535	23	22.39	1	21.36	2
		2507.5	23	22.44	1	21.42	2
	75RB (0)	2562.5	23	22.30	1	21.29	2
		2535	23	22.37	1	21.36	2
		2507.5	23	22.42	1	21.41	2
20 MHz	1RB High (99)	2560	23	23.27	0	22.51	1
		2535	23	23.25	0	22.50	1
		2510	23	23.35	0	22.55	1

	1RB Middle (50)	2560	23	23.38	0	22.62	1
		2535	23	23.40	0	22.64	1
		2510	23	23.36	0	22.67	1
	1RB Low (0)	2560	23	23.25	0	22.50	1
		2535	23	23.29	0	22.52	1
		2510	23	23.25	0	22.49	1
	50RB High (50)	2560	23	22.24	1	21.28	2
		2535	23	22.19	1	21.27	2
		2510	23	22.35	1	21.37	2
	50RB Middle (25)	2560	23	22.29	1	21.33	2
		2535	23	22.35	1	21.66	2
		2510	23	22.36	1	21.40	2
	50RB Low (0)	2560	23	22.34	1	21.36	2
		2535	23	22.39	1	21.28	2
		2510	23	22.40	1	21.43	2
	100RB (0)	2560	23	22.30	1	21.34	2
		2535	23	22.42	1	21.33	2
		2510	23	22.38	1	21.42	2

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	3.55	5.81	4.65
EDR2M-4_DQPSK	2.12	4.46	3.29
EDR3M-8DPSK	2.19	4.47	3.33

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

802.11b (dBm)

Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps
1	15.04	/	/	/
6	17.34	16.95	16.97	16.88
11	14.92	/	/	/

802.11g (dBm)

Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1	11.05	/	/	/	/	/	/	/
6	14.01	13.78	13.89	13.81	13.56	13.38	13.40	13.36
11	10.96	/	/	/	/	/	/	/

802.11n (dBm) - HT20 (2.4G)

Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1	10.92	/	/	/	/	/	/	/
6	12.91	12.79	12.72	12.64	12.50	12.43	12.38	12.32
11	10.57	/	/	/	/	/	/	/

802.11n (dBm) – HT40 (2.4G)

Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
3	9.18	/	/	/	/	/	/	/
6	12.16	11.99	11.83	11.43	11.23	10.93	10.77	10.46
9	9.11	/	/	/	/	/	/	/

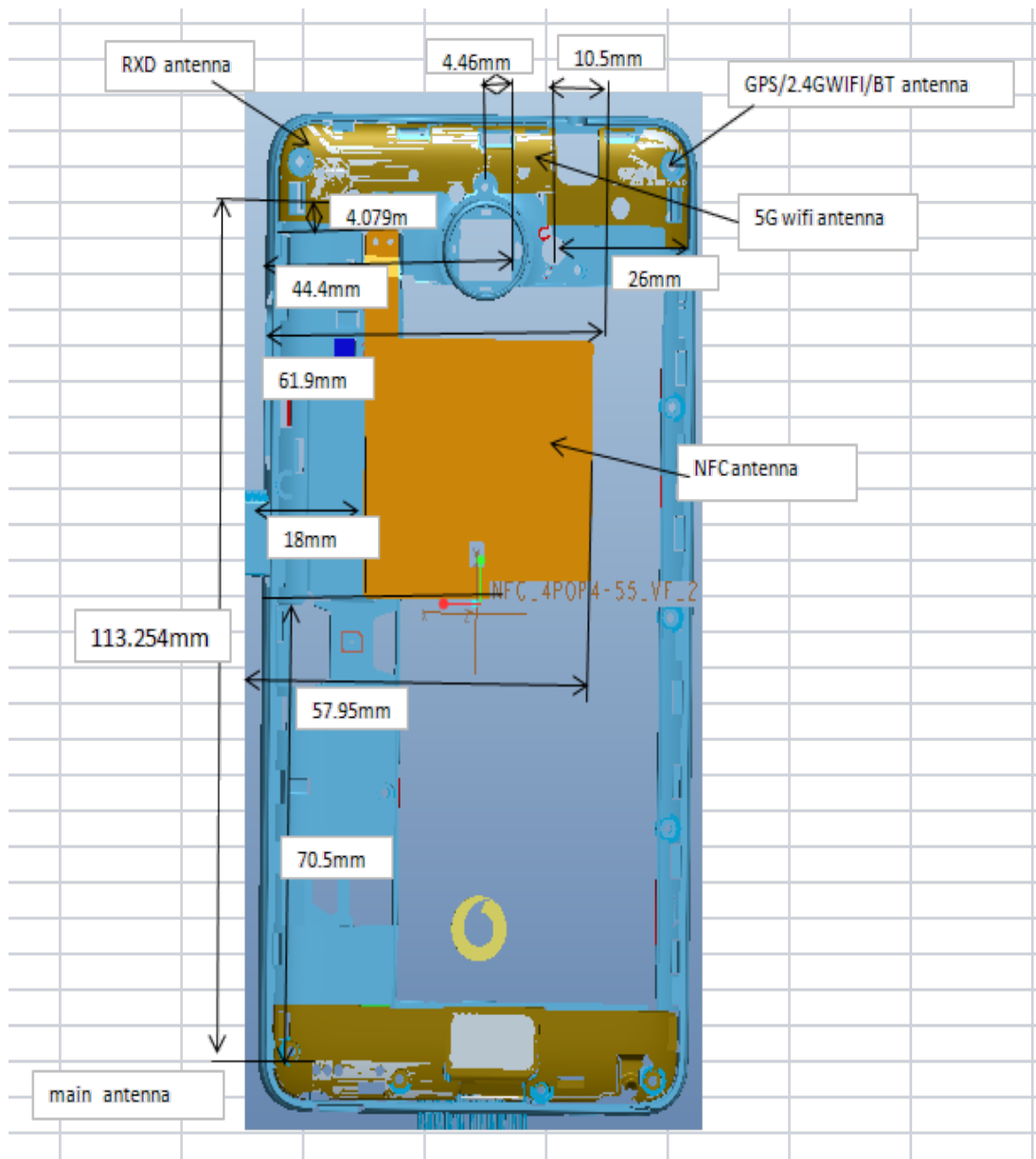
802.11a(dBm)								
Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
36(5180 MHz)	14.15	/	/	/	/	/	/	/
40(5200 MHz)	14.03	/	/	/	/	/	/	/
44(5220 MHz)	14.21	/	/	/	/	/	/	/
48(5240 MHz)	14.53	14.45	14.48	14.47	14.31	14.03	13.99	13.96
802.11n(dBm)-20MHz								
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
36(5180 MHz)	12.49	12.40	12.37	12.28	11.96	11.49	11.44	11.39
40(5200 MHz)	12.07	/	/	/	/	/	/	/
44(5220 MHz)	12.13	/	/	/	/	/	/	/
48(5240 MHz)	12.37	/	/	/	/	/	/	/
802.11n(dBm)-40MHz								
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
38(5190 MHz)	12.22	/	/	/	/	/	/	/
46(5230 MHz)	12.38	12.16	12.04	11.92	11.54	11.48	10.96	10.81

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 v01, 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 2.4G	Yes	Yes	Yes	No	Yes	No
WLAN 5G	Yes	Yes	No	No	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:

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

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

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	5.01	Yes
		Body	19.20	7	5.01	Yes
2.4GHz WLAN	2.45	Head	9.58	18	63.10	No
		Body	19.17	18	63.10	No
WLAN 5GHz	5.2	Head	6.58	15	31.62	No
		Body	13.16	15	31.62	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	Right hand, Touch cheek	0.56	0.69	1.25
Highest reported SAR value for Body	Rear	1.04	0.12	1.16

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

	Position	Main antenna	BT	Sum
Maximum reported SAR value for Head	Right hand, Touch cheek	0.56	0.21 ^[1]	0.77
Maximum reported SAR value for Body	Rear	1.04	0.10 ^[1]	1.14

[1] - Estimated SAR for Bluetooth (see the table 13.3)

Table 13.3: Estimated SAR for Bluetooth

Mode/Band	F (GHz)	Position	Distance (mm)	Upper limit of power *		Estimated _{1g} (W/kg)
				dBm	mW	
Bluetooth	2.441	Head	5	7	5.01	0.21
Bluetooth	2.441	Body	10	7	5.01	0.10

* - 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) · [$\sqrt{f(\text{GHz})/x}$] 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 < 1.6 W/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 more than 1.2W/kg.

The calculated SAR is obtained by the following formula:

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

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 850	1:8.3
GPRS&EGPRS for 1900	1:2
WCDMA<E	1:1

14.1 The evaluation of multi-batteries

14.2 SAR results for Fast SAR

Table 14.2-1: SAR Values (GSM 850 MHz Band - Head)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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.										
848.8	251	Left	Touch	Fig.1	32.51	33.5	0.191	0.24	0.249	0.31	0.11
836.6	190	Left	Touch	/	32.57	33.5	0.149	0.18	0.193	0.24	-0.04
824.2	128	Left	Touch	/	32.60	33.5	0.111	0.14	0.168	0.21	-0.02
836.6	190	Left	Tilt	/	32.57	33.5	0.088	0.11	0.126	0.16	0.05
836.6	190	Right	Touch	/	32.57	33.5	0.102	0.13	0.150	0.19	0.01
836.6	190	Right	Tilt	/	32.57	33.5	0.076	0.09	0.112	0.14	-0.01

Table 14.2-2: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
Frequency		Mode (number of timeslots)	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	GPRS (1)	Front	/	32.59	33	0.089	0.10	0.132	0.15	0.19
848.8	251	GPRS (1)	Rear	Fig.2	32.55	33	0.176	0.20	0.306	0.34	0.06
836.6	190	GPRS (1)	Rear	/	32.59	33	0.156	0.17	0.246	0.27	-0.05
824.2	128	GPRS (1)	Rear	/	32.64	33	0.127	0.14	0.180	0.20	0.17
836.6	190	GPRS (1)	Left	/	32.59	33	0.079	0.09	0.120	0.13	-0.19
836.6	190	GPRS (1)	Right	/	32.59	33	0.036	0.04	0.054	0.06	0.11
836.6	190	GPRS (1)	Bottom	/	32.59	33	0.027	0.03	0.053	0.06	-0.15
848.8	251	EGPRS (1)	Rear	/	32.56	33.5	0.153	0.19	0.244	0.30	-0.01

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

Table 14.2-3: SAR Values (GSM 1900 MHz Band - Head)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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	/	29.56	31	0.062	0.09	0.100	0.14	0.07
1880	661	Left	Tilt	/	29.56	31	0.048	0.07	0.095	0.13	0.03
1909.8	810	Right	Touch	Fig.3	29.70	31	0.151	0.20	0.239	0.32	-0.08
1880	661	Right	Touch	/	29.56	31	0.149	0.21	0.233	0.32	0.05
1850.2	512	Right	Touch	/	29.35	31	0.141	0.21	0.222	0.32	0.05
1880	661	Right	Tilt	/	29.56	31	0.041	0.06	0.072	0.10	0.03

Table 14.2-4: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
Frequency		Mode (number of timeslots)	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.										
1909.8	810	GPRS (4)	Front	/	25.05	26.5	0.352	0.49	0.614	0.86	-0.09
1880	661	GPRS (4)	Front		24.80	26.5	0.322	0.48	0.581	0.86	-0.07
1850.2	512	GPRS (4)	Front	/	24.63	26.5	0.269	0.41	0.471	0.72	-0.08
1909.8	810	GPRS (4)	Rear	Fig.4	25.05	26.5	0.379	0.53	0.744	1.04	-0.06
1880	661	GPRS (4)	Rear	/	24.80	26.5	0.304	0.45	0.600	0.89	-0.09
1850.2	512	GPRS (4)	Rear	/	24.63	26.5	0.278	0.43	0.553	0.85	-0.06
1880	661	GPRS (4)	Left	/	24.80	26.5	0.171	0.25	0.288	0.43	0.12
1880	661	GPRS (4)	Right	/	24.80	26.5	0.050	0.07	0.080	0.12	-0.05
1880	661	GPRS (4)	Bottom	/	24.80	26.5	0.224	0.33	0.403	0.60	0.15
1909.8	810	EGPRS (4)	Rear	/	25.03	26.5	0.363	0.51	0.708	0.99	0.02

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

Table 14.2-5: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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.										
846.6	4233	Left	Touch	/	23.49	24	0.309	0.35	0.390	0.44	-0.03
836.4	4182	Left	Touch	Fig.5	23.47	24	0.316	0.36	0.404	0.46	-0.12
826.4	4132	Left	Touch	/	23.47	24	0.272	0.31	0.341	0.39	0.01
836.4	4182	Left	Tilt	/	23.47	24	0.218	0.25	0.309	0.35	-0.01
836.4	4182	Right	Touch	/	23.47	24	0.225	0.25	0.326	0.37	-0.05
836.4	4182	Right	Tilt	/	23.47	24	0.173	0.20	0.252	0.28	0.03

Table 14.2-6: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C				
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	/	23.47	24	0.378	0.43	0.560	0.63	-0.1
846.6	4233	Rear	/	23.49	24	0.436	0.49	0.658	0.74	-0.04
836.4	4182	Rear	Fig.6	23.47	24	0.408	0.46	0.704	0.80	-0.15
826.4	4132	Rear	/	23.47	24	0.416	0.47	0.598	0.68	0.04
836.4	4182	Left	/	23.47	24	0.293	0.33	0.432	0.49	-0.02
836.4	4182	Right	/	23.47	24	0.148	0.17	0.219	0.25	-0.03
836.4	4182	Bottom	/	23.47	24	0.103	0.12	0.185	0.21	-0.19

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

Table 14.2-7: SAR Values (WCDMA 1900 MHz Band - Head)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5 °C											
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	/	24.14	24.5	0.136	0.15	0.189	0.21	0.07
1880	9400	Left	Tilt	/	24.14	24.5	0.116	0.13	0.196	0.21	-0.11
1907.6	9538	Right	Touch	/	24.06	24.5	0.241	0.27	0.417	0.46	0.12
1880	9400	Right	Touch	/	24.14	24.5	0.253	0.27	0.427	0.46	0.01
1852.4	9262	Right	Touch	Fig.7	24.23	24.5	0.333	0.35	0.522	0.56	0.14
1880	9400	Right	Tilt	/	24.14	24.5	0.118	0.13	0.218	0.24	0.08

Table 14.2-8: SAR Values (WCDMA 1900 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C				
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.									
1907.6	9538	Front	/	24.06	24.5	0.411	0.45	0.720	0.80	-0.06
1880	9400	Front	/	24.14	24.5	0.426	0.46	0.764	0.83	-0.04
1852.4	9262	Front	/	24.23	24.5	0.460	0.49	0.814	0.87	0.07
1907.6	9538	Rear	/	24.06	24.5	0.432	0.48	0.835	0.92	-0.09
1880	9400	Rear	Fig.8	24.14	24.5	0.475	0.52	0.911	0.99	-0.01
1852.4	9262	Rear	/	24.23	24.5	0.407	0.43	0.723	0.77	-0.13
1880	9400	Left	/	24.14	24.5	0.068	0.07	0.110	0.12	-0.02
1880	9400	Right	/	24.14	24.5	0.224	0.24	0.385	0.42	-0.07
1880	9400	Bottom	/	24.14	24.5	0.302	0.33	0.549	0.60	-0.15

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

Table 14.2-9: SAR Values (LTE Band7 - Head)

Ambient Temperature: 22.9 °C							Liquid Temperature: 22.5 °C					
Frequency		Mode	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.											
2535	21100	1RB_Mid	Left	Touch	/	23.40	24	0.124	0.14	0.233	0.27	0.08
2535	21100	1RB_Mid	Left	Tilt	/	23.40	24	0.100	0.11	0.193	0.22	0.07
2535	21100	1RB_Mid	Right	Touch	Fig.9	23.40	24	0.173	0.20	0.309	0.35	-0.05
2535	21100	1RB_Mid	Right	Tilt	/	23.40	24	0.094	0.11	0.186	0.21	-0.01
2510	20850	50RB_Low	Left	Touch	/	22.40	23	0.110	0.13	0.205	0.24	0.03
2510	20850	50RB_Low	Left	Tilt	/	22.40	23	0.088	0.10	0.174	0.20	0.05
2510	20850	50RB_Low	Right	Touch	/	22.40	23	0.135	0.16	0.256	0.29	0.11
2510	20850	50RB_Low	Right	Tilt	/	22.40	23	0.066	0.08	0.123	0.14	0.05

Note1: The LTE mode is QPSK_20MHz.

Table 14.2-10: SAR Values (LTE Band7 - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
Frequency		Mode	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.										
2535	21100	1RB_Mid	Front	/	23.40	24	0.263	0.30	0.512	0.59	0.12
2535	21100	1RB_Mid	Rear		23.40	24	0.309	0.35	0.677	0.78	0.15
2535	21100	1RB_Mid	Left	/	23.40	24	0.026	0.03	0.047	0.05	0.11
2535	21100	1RB_Mid	Right	/	23.40	24	0.214	0.25	0.420	0.48	0.15
2560	21350	1RB_Mid	Bottom	Fig.10	23.38	24	0.380	0.44	0.874	1.01	0.09
2535	21100	1RB_Mid	Bottom	/	23.40	24	0.315	0.36	0.724	0.83	0.01
2510	20850	1RB_Mid	Bottom	/	23.36	24	0.276	0.32	0.641	0.74	-0.16
2510	20850	50RB_Low	Front	/	22.40	23	0.207	0.24	0.407	0.47	-0.13
2510	20850	50RB_Low	Rear	/	22.40	23	0.254	0.29	0.537	0.62	0.18
2510	20850	50RB_Low	Left	/	22.40	23	0.022	0.03	0.040	0.05	0.19
2510	20850	50RB_Low	Right	/	22.40	23	0.170	0.20	0.319	0.37	0.01
2510	20850	50RB_Low	Bottom	/	22.40	23	0.250	0.29	0.541	0.62	0.13
2535	21100	100RB	Bottom	/	22.42	23	0.258	0.29	0.602	0.69	-0.13

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

Note2: The LTE mode is QPSK_20MHz.

14.3 SAR results for Standard procedure

There is zoom scan measurement to be added for the highest measured SAR in each exposure configuration/band.

Table 14.3-1: SAR Values (GSM 850 MHz Band - Head)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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.										
848.8	251	Left	Touch	Fig.1	32.51	33.5	0.191	0.24	0.249	0.31	0.11

Table 14.3-2: SAR Values (GSM 850 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
Frequency		Mode (number of timeslots)	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.										
848.8	251	GPRS (1)	Rear	Fig.2	32.55	33	0.176	0.20	0.306	0.34	0.06

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

Table 14.3-3: SAR Values (GSM 1900 MHz Band - Head)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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.										
1909.8	810	Right	Touch	Fig.3	29.70	31	0.151	0.20	0.239	0.32	-0.08

Table 14.3-4: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
Frequency		Mode (number of timeslots)	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.										
1909.8	810	GPRS (4)	Rear	Fig.4	25.05	26.5	0.379	0.53	0.744	1.04	-0.06

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

Table 14.3-5: SAR Values (WCDMA 850 MHz Band - Head)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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	Fig.5	23.47	24	0.316	0.36	0.404	0.46	-0.12

Table 14.3-6: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C				
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	Rear	Fig.6	23.47	24	0.408	0.46	0.704	0.80	-0.15

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

Table 14.3-7: SAR Values (WCDMA 1900 MHz Band - Head)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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.										
1852.4	9262	Right	Touch	Fig.7	24.23	24.5	0.333	0.35	0.522	0.56	0.14

Table 14.3-8: SAR Values (WCDMA 1900 MHz Band - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C				
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	Rear	Fig.8	24.14	24.5	0.475	0.52	0.911	0.99	-0.01

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

Table 14.3-9: SAR Values (LTE Band7 - Head)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C						
Frequency		Mode	Side	Test Position	Figure No.	Conducte d 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.											
2535	21100	1RB_Mid	Right	Touch	Fig.9	23.40	24	0.173	0.20	0.309	0.35	-0.05

Note1: The LTE mode is QPSK_20MHz.

Table 14.3-10: SAR Values (LTE Band7 - Body)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
Frequency		Mode	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.										
2560	21350	1RB_Mid	Bottom	Fig.10	23.38	24	0.380	0.44	0.874	1.01	0.09

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

Note2: The LTE mode is QPSK_20MHz.

14.4 WLAN Evaluation

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

Head Evaluation

Table 14.4-1: SAR Values (WLAN - Head) – 802.11b 1Mbps (Fast SAR)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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.										
2437	6	Left	Touch	/	17.34	18	0.114	0.13	0.217	0.25	-0.05
2437	6	Left	Tilt	/	17.34	18	0.111	0.13	0.218	0.25	0.03
2437	6	Right	Touch	/	17.34	18	0.267	0.31	0.595	0.69	0.01
2437	6	Right	Tilt	/	17.34	18	0.231	0.27	0.520	0.61	0.13

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

Table 14.4-2: SAR Values (WLAN - Head) – 802.11b 1Mbps (Full SAR)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C					
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.										
2437	6	Right	Touch	Fig.11	17.34	18	0.268	0.31	0.593	0.69	0.01
2437	6	Right	Tilt	/	17.34	18	0.230	0.27	0.517	0.60	0.13

Note1: When the reported SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest estimated 1-g SAR conditions determined by area scans, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg.

Note2: For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

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 14.4-3: SAR Values (WLAN - Head) – 802.11b 1Mbps (Scaled Reported SAR)

Ambient Temperature: 22.9 °C					Liquid Temperature: 22.5 °C		
Frequency		Side	Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g) (W/kg)	Scaled reported SAR (1g) (W/kg)
MHz	Ch.						
2437	6	Right	Touch	99.52%	100%	0.69	0.69

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

Body Evaluation

Table 14.4-4: SAR Values (WLAN - Body) – 802.11b 1Mbps (Fast SAR)

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5 °C				
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.									
2437	6	Front	/	17.34	18	0.000	0.00	0.001	0.00	-0.12
2437	6	Rear	/	17.34	18	0.046	0.05	0.097	0.11	-0.17
2437	6	Left	/	17.34	18	0.002	0.00	0.007	0.01	0.19
2437	6	Top	/	17.34	18	0.004	0.01	0.007	0.01	0.01

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

Table 14.4-5: SAR Values (WLAN - Body) – 802.11b 1Mbps (Full SAR)

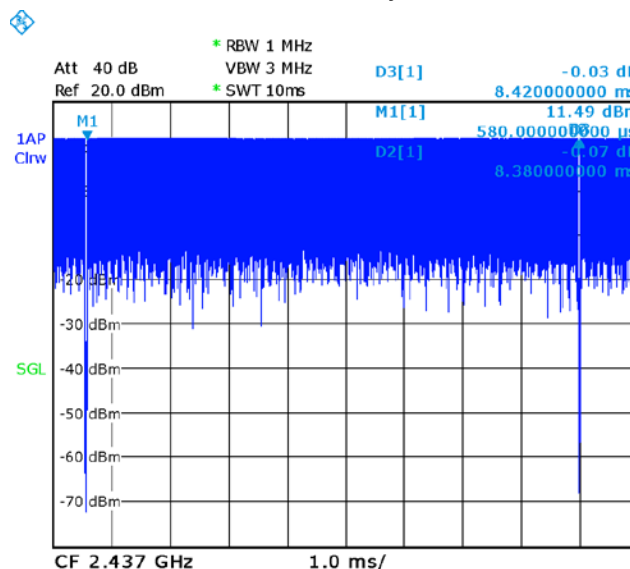
Ambient Temperature: 22.9 °C					Liquid Temperature: 22.5 °C					
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
2437	6	Rear	Fig.12	17.34	18	0.049	0.06	0.101	0.12	-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 14.4-6: SAR Values (WLAN - Body) – 802.11b 1Mbps (Scaled Reported SAR)

Ambient Temperature: 22.9 °C					Liquid Temperature: 22.5 °C	
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g) (W/kg)	Scaled reported SAR (1g) (W/kg)
MHz	Ch.					
2437	6	Rear	99.52%	100%	0.12	0.12

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



Picture 14.1 Duty factor plot

OFDM – 5G

Table 14.4-7: 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				

X: maximum(conducted) output power(mW), including tolerance, specified for production units

Table 14.4-8: 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	32		20	20				

- 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 50mW for 802.11b and the highest reported SAR for DSSS is 0.98 W/kg for head, 0.23 W/kg for body.

Table 14.4-9: 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	g	n	
BW(MHz)	20	20	20	40
U-NII-1	36/40/44/48 26/25/26/28		36/40/44/48 Lower power	38/46 Lower power

- 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.

Base on the above table, the initial test position procedure is performed according to the following:

Table 14.4-10: Initial test position evaluation for OFDM – Head

Ambient Temperature: 22.5 °C						Liquid Temperature: 22.0 °C					
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	/	14.53	15	0.006	0.01	0.022	0.02	-0.12
5240	48	Left	Tilt	Fig.13	14.53	15	0.010	0.01	0.032	0.04	0.13
5240	48	Right	Touch	/	14.53	15	0.001	0.00	0.008	0.01	0.18
5240	48	Right	Tilt	/	14.53	15	0.008	0.01	0.031	0.04	0.15

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 14.3-11: SAR Values for Head (Scaled Reported SAR)

Ambient Temperature: 22.5 °C					Liquid Temperature: 22.0 °C		
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	Tilt	97.47%	100%	0.04	0.04

Table 14.3-13: Reported SAR of initial test configuration for head

802.11 mode	a	g	n	
BW(MHz)	20	20	20	40
U-NII-1	36/40/44/48 0.04		36/40/44/48	38/46

Table 14.3-14: Initial test position evaluation for OFDM - Body

Ambient Temperature: 22.5 °C						Liquid Temperature: 22.0 °C				
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	/	14.53	15	0.002	0.00	0.010	0.01	0.00
5240	48	Rear		14.53	15	0.001	0.00	0.007	0.01	0.05
5240	48	Top	Fig.14	14.53	15	0.010	0.01	0.033	0.04	0.11

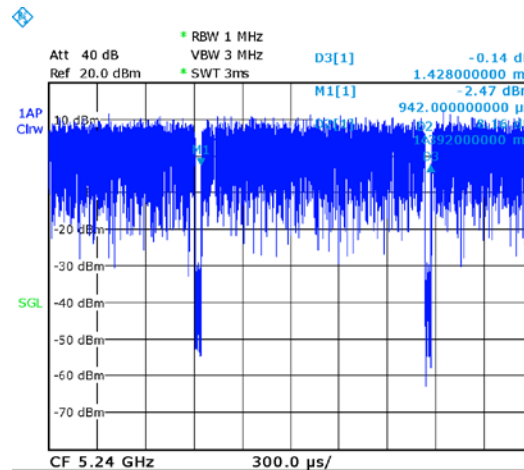
According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below:

Table 14.3-16: SAR Values for Body (Scaled Reported SAR)

Ambient Temperature: 22.5 °C						Liquid Temperature: 22.0 °C	
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g) (W/kg)	Scaled reported SAR (1g) (W/kg)	
MHz	Ch.						
5240	48	Top	97.47%	100%	0.04	0.04	

Table 14.3-17: Reported SAR of initial test configuration for body

802.11 mode	a	g	n	
BW(MHz)	20	20	20	40
U-NII-1	36/40/44/48 0.04		36/40/44/48	38/46



Picture 14.2 The plot of duty factor for WLAN-5G channel 48

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 ($\sim 10\%$ 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 WCDMA1900 (1g)

Frequency		Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
MHz	Ch.						
1880	9400	Rear	10	0.911	0.901	1.01	/

Table 15.2: SAR Measurement Variability for Body Band 7 (1g)

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	0.874	0.866	1.01	/

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	5.5	N	1	1	1	5.5	5.5	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	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	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. restrictions	B	0.4	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	71
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	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
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	1.0	0.8	521

Combined standard uncertainty	$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					9.25	9.12	257
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$					18.5	18.2	

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

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	6.5	N	1	1	1	6.5	6.5	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	2.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
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	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. restrictions	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
12	Probe positioning with respect to phantom shell	B	6.7	R	$\sqrt{3}$	1	1	3.9	3.9	∞
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	71
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	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43

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	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						10.8	10.7	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						21.6	21.4	

16.3 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	5.5	N	1	1	1	5.5	5.5	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	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	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. Restrictions	B	0.4	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	71
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	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	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	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						10.1	9.95	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						20.2	19.9	

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

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	6.5	N	1	1	1	6.5	6.5	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	2.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
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	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. Restrictions	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
12	Probe positioning with respect to phantom shell	B	6.7	R	$\sqrt{3}$	1	1	3.9	3.9	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
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	71
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	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	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	1.0	0.8	521
Combined standard uncertainty		$u_c' = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.3	13.2	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						26.6	26.4	

17 MAIN TEST INSTRUMENTS

Table 17.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 26, 2016	One year
02	Power meter	NRVD	102196	March 03, 2016	One year
03	Power sensor	NRV-Z5	100596		
04	Signal Generator	E4438C	MY49071430	February 01, 2016	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	E5515C	MY50263375	January 30, 2016	One year
07	BTS	CMW500	129942	March 03, 2016	One year
08	E-field Probe	SPEAG EX3DV4	3617	August 26, 2015	One year
09	DAE	SPEAG DAE4	777	August 26, 2015	One year
10	Dipole Validation Kit	SPEAG D835V2	4d069	July 23, 2015	One year
11	Dipole Validation Kit	SPEAG D1900V2	5d101	July 23, 2015	One year
12	Dipole Validation Kit	SPEAG D2450V2	853	July 24, 2015	One year
13	Dipole Validation Kit	SPEAG D2600V2	1012	July 24, 2015	One year
14	Dipole Validation Kit	SPEAG D5GHZV2	1060	July 27, 2015	One year

END OF REPORT BODY

ANNEX A Graph Results

850 Left Cheek High

Date: 2016-3-14

Electronics: DAE4 Sn777

Medium: Head 850 MHz

Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.941$ mho/m; $\epsilon_r = 40.11$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.9°C Liquid Temperature: 22.5°C

Communication System: GSM 850 Frequency: 848.8 MHz Duty Cycle: 1:8.3

Probe: EX3DV4 - SN3617 ConvF(9.56, 9.56, 9.56)

Area Scan (71x121x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.269 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 5.198 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.314 W/kg

SAR(1 g) = 0.249 W/kg; SAR(10 g) = 0.191 W/kg

Maximum value of SAR (measured) = 0.272 W/kg

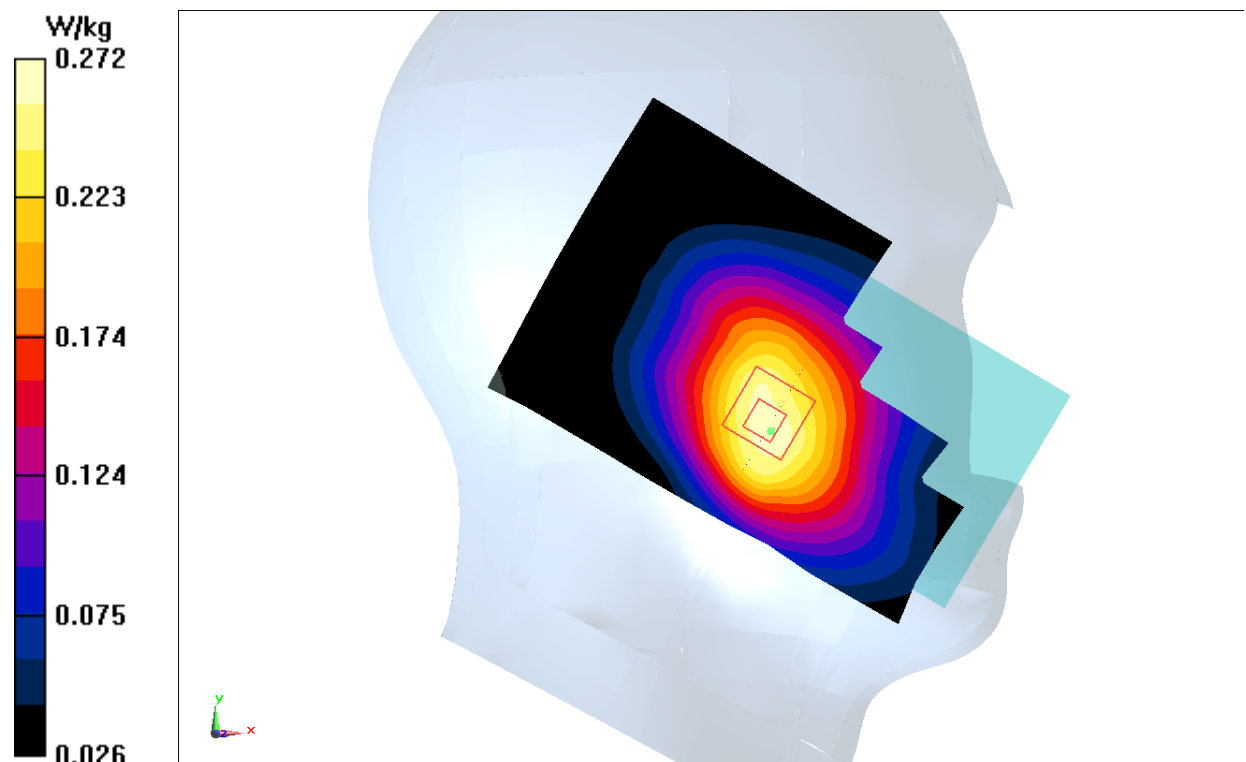


Fig.1 850MHz