



# TEST REPORT

No. I18D00198-SAR01

*For*

**Client: Hisense International Co., Ltd.**

**Production: Mobile Phone**

**Model Name: Hisense F23 PLUS**

**FCC ID: 2AD0BF23PLUS**

**Hardware Version: YK736-MB-V0.2**

**Software Version: Hisense\_F17\_4G\_10\_S01\_2018**

**Issued date: 2018-10-12**

**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 ECIT Shanghai.

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## Revision Version

Report Number	Revision	Date	Memo
I18D00198-SAR01	00	2018-10-12	Initial creation of test report

## CONTENTS

1.	TEST LABORATORY .....	6
1.1.	TESTING LOCATION .....	6
1.2.	TESTING ENVIRONMENT .....	6
1.3.	PROJECT DATA.....	6
1.4.	SIGNATURE .....	6
2.	STATEMENT OF COMPLIANCE .....	7
3.	CLIENT INFORMATION .....	9
3.1.	APPLICANT INFORMATION .....	9
3.2.	MANUFACTURER INFORMATION .....	9
4.	EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) .....	10
4.1.	ABOUT EUT .....	10
4.2.	INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST .....	11
4.3.	INTERNAL IDENTIFICATION OF AE USED DURING THE TEST .....	11
5.	TEST METHODOLOGY .....	12
5.1.	APPLICABLE LIMIT REGULATIONS.....	12
5.2.	APPLICABLE MEASUREMENT STANDARDS .....	12
6.	SPECIFIC ABSORPTION RATE (SAR).....	13
6.1.	INTRODUCTION.....	13
6.2.	SAR DEFINITION .....	13
7.	TISSUE SIMULATING LIQUIDS .....	14
7.1.	TARGETS FOR TISSUE SIMULATING LIQUID.....	14
7.2.	DIELECTRIC PERFORMANCE .....	15
8.	SYSTEM VERIFICATION .....	16
8.1.	SYSTEM SETUP.....	16
8.2.	SYSTEM VERIFICATION .....	17
9.	MEASUREMENT PROCEDURES .....	18

9.1.	TESTS TO BE PERFORMED.....	18
9.2.	GENERAL MEASUREMENT PROCEDURE.....	19
9.3.	WCDMA MEASUREMENT PROCEDURES FOR SAR.....	21
9.4.	BLUETOOTH & WIFI MEASUREMENT PROCEDURES FOR SAR.....	22
9.5.	POWER DRIFT.....	22
10.	AREA SCAN BASED 1-G SAR.....	23
11.	CONDUCTED OUTPUT POWER.....	24
	MANUFACTURING TOLERANCE.....	24
11.1.	GSM MEASUREMENT RESULT.....	24
11.2.	WCDMA MEASUREMENT RESULT.....	24
11.3.	LTE MEASUREMENT RESULT.....	24
11.4.	WIFI AND BT MEASUREMENT RESULT.....	24
12.	SIMULTANEOUS TX SAR CONSIDERATIONS.....	25
12.1.	INTRODUCTION.....	25
12.2.	TRANSMIT ANTENNA SEPARATION DISTANCES.....	25
12.3.	STANDALONE SAR TEST EXCLUSION CONSIDERATIONS.....	26
12.4.	SAR MEASUREMENT POSITIONS.....	26
13.	SAR TEST RESULT.....	27
14.	EVALUATION OF SIMULTANEOUS.....	51
15.	SAR MEASUREMENT VARIABILITY.....	54
16.	MEASUREMENT UNCERTAINTY.....	55
17.	MAIN TEST INSTRUMENT.....	57
	ANNEX A. GRAPH RESULTS.....	58
	ANNEX B. SYSTEM VALIDATION RESULTS.....	59
	ANNEX C. SAR MEASUREMENT SETUP.....	60
	ANNEX D. POSITION OF THE WIRELESS DEVICE IN RELATION TO THE PHANTOM.....	69
	ANNEX E. EQUIVALENT MEDIA RECIPES.....	73

**ANNEX F. SYSTEM VALIDATION .....74**

**ANNEX G. PROBE AND DAE CALIBRATION CERTIFICATE.....75**

**ANNEX H. ACCREDITATION CERTIFICATE.....103**

## 1. Test Laboratory

### 1.1. Testing Location

Company Name:	ECIT Shanghai, East China Institute of Telecommunications
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Postal Code:	200001
Telephone:	(+86)-021-63843300
Fax:	(+86)-021-63843301

### 1.2. Testing Environment

Normal Temperature:	18-25°C
Relative Humidity:	25-75%
Ambient noise & Reflection:	< 0.012 W/kg

### 1.3. Project Data

Project Leader:	Xu Yuting
Testing Start Date:	2018-9-29
Testing End Date:	2018-9-29

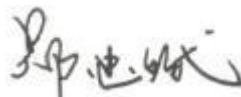
### 1.4. Signature



\_\_\_\_\_  
**Yan Hang**  
(Prepared this test report)



\_\_\_\_\_  
**Fu Erliang**  
(Reviewed this test report)



\_\_\_\_\_  
**Zheng Zhongbin**  
(Approved this test report)

## 2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Hisense F23 PLUS** are as follows .

**Table 2.1: Max. Reported SAR Main Supply (1g)**

Band	SAR 1g (W/Kg)		
	Head	Body worn(10mm)	Hotspot(10mm)
GSM 850	0.191(Original)	0.592(Original)	0.592(Original)
GSM 1900	0.075(Original)	0.531(Original)	0.531(Original)
WCDMA Band2	0.112(Original)	0.645(Original)	0.645(Original)
WCDMA Band4	0.121(Original)	0.520(Original)	0.520(Original)
WCDMA Band5	0.242(Original)	0.408(Original)	0.408(Original)
LTE Band2	0.132(Original)	0.574(Original)	0.574(Original)
LTE Band4	0.114(Original)	0.488(Original)	0.488(Original)
LTE Band5	0.224(Original)	0.374(Original)	0.374(Original)
LTE Band7	0.061(Original)	0.644(Original)	1.085(Original)
LTE Band12	0.113(Original)	0.149(Original)	0.149(Original)
2.4G WiFi	0.705(Original)	0.227(Original)	0.227(Original)
5G WiFi	1.069(Original)	0.181(Original)	0.297(Original)

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 C95.1-1999.

For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

Note: The **Hisense F23 PLUS**, supporting UMTS/GSM/LTE/WLAN, manufactured by **Hisense Communications Co., Ltd.** is a variant product for testing. The content of these change are LCD Module /camera(back and front)/fingerprint module .According to the Product Change Description, SAR test is only required in worse case. Test data are reflected from test report **I18D00020-SAR01**, which is the test report for the initial product.

**Table 2.2: Simultaneous SAR (1g)**

Transmission SAR(W/Kg)									
Test Position			2G	3G	4G	2.4G WiFi	5GWiFi	BT	SUM
Head	Left	Cheek	0.191	0.242	0.224	0.705	0.615	0.167	0.947
		Tilt 15°	0.107	0.152	0.131	0.626	1.069	0.167	1.221
	Right	Cheek	0.139	0.206	0.174	0.257	0.438	0.167	0.644
		Tilt 15°	0.106	0.145	0.122	0.269	0.666	0.167	0.811
Body worn/ Hotspot10mm	Phantom Side		0.388	0.293	0.427	0.166	0.164	0.084	0.593
	Ground Side		0.592	0.645	0.644	0.227	0.181	0.084	0.872
Hotspot 10mm	Left Side		0.495	0.273	0.248	0.020	<0.01	0.084	0.579
	Right Side		0.402	0.192	0.278	0.150	0.014	0.084	0.552
	Bottom Side		0.490	0.483	1.085	--	--	0.084	1.169
	Top Side		--	--	--	0.103	0.297	0.084	0.297

According to the above table, the maximum sum of reported SAR values for GSM/WCDMA/LTE and WiFi is **1.221 W/kg** (1g).



### 3. Client Information

#### 3.1. Applicant Information

Company Name: Hisense International Co., Ltd.  
Address: Floor 22, Hisense Tower, 17 Donghai Xi Road, Qingdao, 266071, China  
Telephone: /  
Postcode: 266010

#### 3.2. Manufacturer Information

Company Name: Hisense Communications Co., Ltd.  
Address: 218 Qianwangang Road, Economic & Technological Development Zone, Qingdao, Shandong Province, P.R. China  
Telephone: /  
Postcode: 266510

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

### 4.1. About EUT

Description:	Mobile Phone
Model name:	Hisense F23 PLUS
Operation Model(s):	GSM850/900/1800/1900,WCDMA Band II/IV/V LTE Band 2/3/4/5/7/12,WiFi2.4G/5G,BT
Tx Frequency:	824.2-848.8MHz(GSM850) 1850.2-1909.8MHz ( GSM1900 ) 1852.4-1907.6 MHz (WCDMA Band II) 1712.4-1752.6 MHz (WCDMA Band IV) 826.4-846.6MHz (WCDMA Band V) 1850.7 -1909.3 MHz (LTE Band 2) 1710.7 -1754.3 MHz (LTE Band 4) 824.7 -848.3 MHz (LTE Band 5) 2502.5 – 2567.5 MHz (LTE Band 7) 699.7 -715.3 MHz (LTE Band 12) 2412- 2462 MHz (WiFi) 5260- 5320 MHz (WiFi) 5745- 5825 MHz (WiFi) 2402-2480 MHz (BT)
Test device Production information:	Production unit
GPRS/EGPRS Class Mode:	B
GPRS/ EGPRS Multislot Class:	12
Device type:	Portable device
UE category:	3
Antenna type:	Inner antenna
Accessories/Body-worn configurations:	Headset Battery
Dimensions:	14.8cmx7.2 cmx1.0cm
Hotspot Mode:	Support simultaneous transmission of hotspot and voice ( or data)
FCC ID:	2ADOBF23PLUS

**4.2. Internal Identification of EUT used during the test**

EUT ID*	SN or IMEI	HW Version	SW Version	Receive Date
N07	636439734605753	YK736-MB-V0.2	Hisense_F17_4G_10_S01_20 180118	2018-9-13

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

**4.3. Internal Identification of AE used during the test**

AE ID*	Description	Model	SN	Manufacturer
BA02	Battery	N/A	N/A	N/A

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

## 5. TEST METHODOLOGY

### 5.1. Applicable Limit Regulations

**ANSI C95.1–1999:**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 Body Due to Wireless Communications Devices:

Experimental Techniques.

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

**KDB248227 D01 802 11 WiFi SAR v02r02:** SAR measurement procedures for 802.112abg transmitters.

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

**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:**provides general reporting requirements as well as certain specific information required to support MPE and SAR compliance.

**KDB941225 D01 3G SAR Procedures v03r01:** 3G SAR Measurement Procedures.

**KDB941225 D06 hotspot SAR v02r01:**SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities.

NOTE: KDB is not in A2LA Scope List.

## 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 ( $\rho$ ). 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,  $\delta T$  is the temperature rise and  $\delta t$  is the exposure duration, or related to the electrical field in the tissue by

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

Where:  $\sigma$  is the conductivity of the tissue,  $\rho$  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( $\sigma$ )	$\pm 5\%$ Range	Permittivity( $\epsilon$ )	$\pm 5\%$ 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
1800	Head	1.40	1.33~1.47	40.0	38.0~42.0
1800	Body	1.52	1.44~1.60	53.3	50.6~56.0
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	39.0	37.1~40.9
2600	Body	2.16	2.05~2.27	52.5	50.9~55.1
5200	Head	4.66	4.43~4.89	36.0	34.2~37.8
5200	Body	5.30	5.04~5.57	49.0	46.6~51.5
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

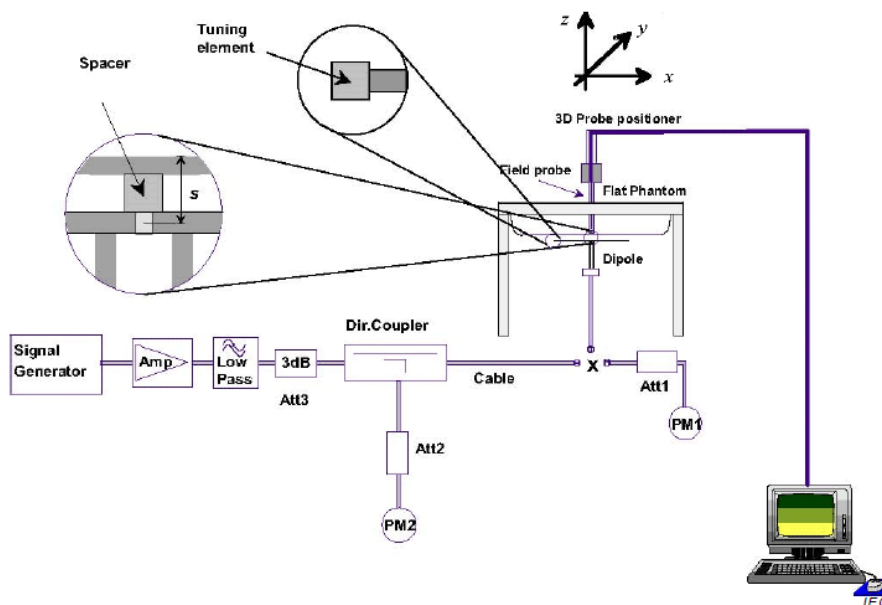
**7.2. Dielectric Performance****Table 7.2: Dielectric Performance of Tissue Simulating Liquid**

Measurement Value						
Liquid Temperature: 22.5 °C						
Type	Frequency	Permittivity $\epsilon$	Drift (%)	Conductivity $\sigma$	Drift (%)	Test Date
Body	2600 MHz	54.37	3.56%	2.11	-2.31%	2018-9-29

## 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 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.

**Table 8.1: System Verification of Body**

<b>Verification Results</b>							
Input power level: 1W							
Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation		Test date
	10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average	
2600 MHz	25.4	57.1	23.88	54.8	-5.98%	-4.03%	2018-9-29

## 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 11.1.

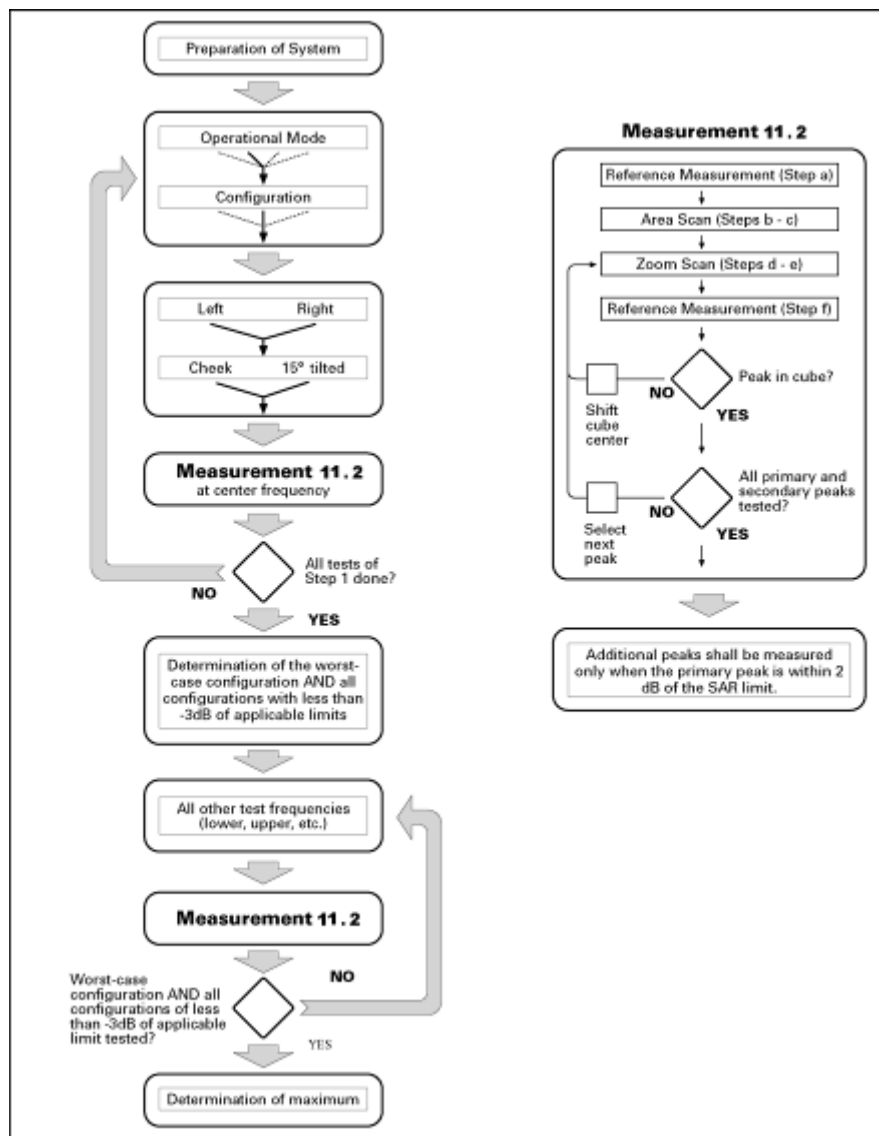
**Step 1:** The tests described in 11.2 shall be performed at the channel that is closest to the centre of the transmit frequency band ( $f_c$ ) for:

- a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom, as described in Chapter 8),
- 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 11.2 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 following procedure shall be performed for each of the test conditions (see Picture 11.1) described in 11.1:

- a) Measure the local SAR at a test point within 8 mm or less in the normal direction from the inner surface of the phantom.
- b) Measure the two-dimensional SAR distribution within the phantom (area scan procedure). The boundary of the measurement area shall not be closer than 20 mm from the phantom side walls. The distance between the measurement points should enable the detection of the location of local maximum with an accuracy of better than half the linear dimension of the tissue cube after interpolation. A maximum grip spacing of 20 mm

for frequencies below 3 GHz and  $(60/f \text{ [GHz]})$  mm for frequencies of 3GHz and greater is recommended. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz and  $\delta \ln(2)/2$  mm for frequencies of 3 GHz and greater, where  $\delta$  is the plane wave skin depth and  $\ln(x)$  is the natural logarithm. The maximum variation of the sensor-phantom surface shall be  $\pm 1$  mm for frequencies below 3 GHz and  $\pm 0.5$  mm for frequencies of 3 GHz and greater. At all measurement points the angle of the probe with respect to the line normal to the surface should be less than  $5^\circ$ . If this cannot be achieved for a measurement distance to the phantom inner surface shorter than the probe diameter, additional uncertainty evaluation is needed.

c) From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that are not within the zoom-scan volume; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR limit. This is consistent with the 2 dB threshold already stated;

d) Measure the three-dimensional SAR distribution at the local maxima locations identified in step c). The horizontal grid step shall be  $(24/f[\text{GHz}])$  mm or less but not more than 8 mm. The minimum zoom size of 30 mm by 30 mm and 30 mm for frequencies below 3 GHz. For higher frequencies, the minimum zoom size of 22 mm by 22 mm and 22 mm. The grid step in the vertical direction shall be  $(8-f[\text{GHz}])$  mm or less but not more than 5 mm, if uniform spacing is used. If variable spacing is used in the vertical direction, the maximum spacing between the two closest measured points to the phantom shell shall be  $(12 / f[\text{GHz}])$  mm or less but not more than 4 mm, and the spacing between further points shall increase by an incremental factor not exceeding 1.5. When variable spacing is used, extrapolation routines shall be tested with the same spacing as used in measurements. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz and  $\delta \ln(2)/2$  mm for frequencies of 3 GHz and greater, where  $\delta$  is the plane wave skin depth and  $\ln(x)$  is the natural logarithm. Separate grids shall be centered on each of the local SAR maxima found in step c). Uncertainties due to field distortion between the media boundary and the dielectric enclosure of the probe should also be minimized, which is achieved is the distance between the phantom surface and physical tip of the probe is larger than probe tip diameter. Other methods may utilize correction procedures for these boundary effects that enable high precision measurements closer than half the probe diameter. For all measurement points, the angle of the probe with respect to the

flat phantom surface shall be less than  $5^\circ$  . If this cannot be achieved an additional uncertainty evaluation is needed.

e) Use post processing( e.g. interpolation and extrapolation ) procedures to determine the local SAR values at the spatial resolution needed for mass averaging.

**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<sub>n</sub>), 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	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c / \beta_d$	$\beta_{hs}$	CM/dB	MPR (dB)
1	2/15	15/15	64	2/15	4/15	1.5	0.5
2	12/15	15/15	64	12/15	24/25	2.0	1
3	15/15	8/15	64	15/8	30/15	2.0	1
4	15/15	4/15	64	15/4	30/15	2.0	1

**For Release 6 HSUPA Data Devices**

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c / \beta_d$	$\beta_{hs}$	$\beta_{ec}$	$\beta_{ed}$	$\beta_{ed}$ (SF)	$\beta_{ed}$ (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	2.0	1.0	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	$\beta_{ed1}:47/15$ $\beta_{ed2}:47/15$	4	2	3.0	2.0	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	2.0	1.0	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	2.0	1.0	21	81

**9.4. Bluetooth & WiFi 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. 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 13 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 v06, 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  $\leq 1.2$  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**

### **Manufacturing tolerance**

Please refer to I18D00020-SAR01

#### **11.1. GSM Measurement result**

Please refer to I18D00020-SAR01

#### **11.2. WCDMA Measurement result**

Please refer to I18D00020-SAR01

#### **11.3. LTE Measurement result**

Please refer to I18D00020-SAR01

#### **11.4. WiFi and BT Measurement result**

Please refer to I18D00020-SAR01



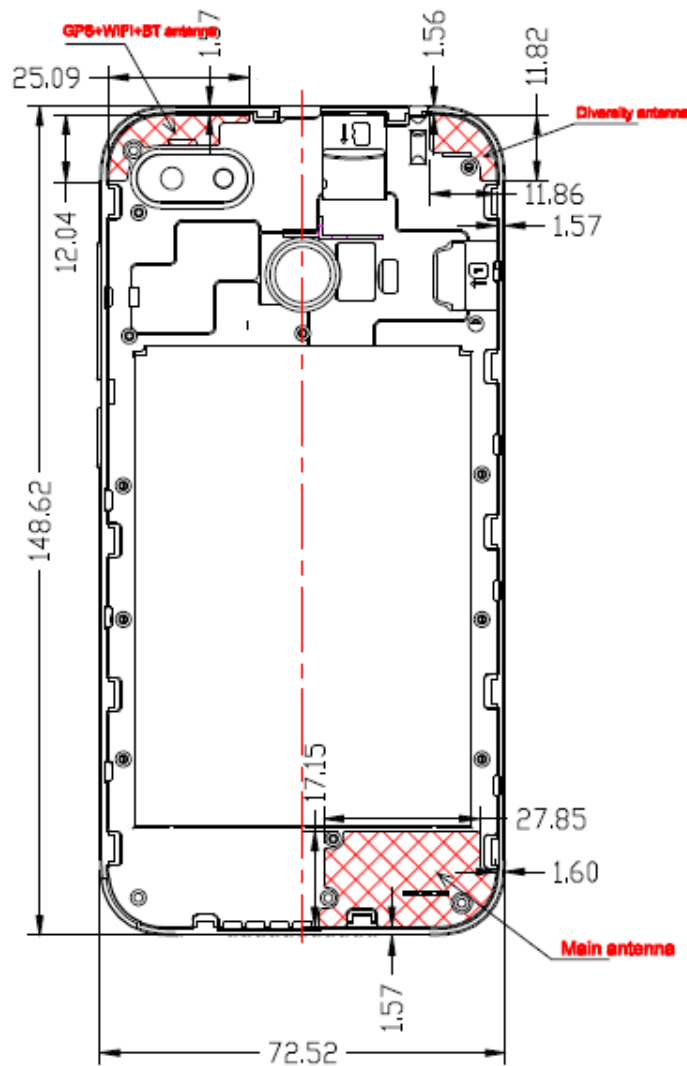
## 12. Simultaneous TX SAR Considerations

### 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 WiFi can transmit simultaneous with other transmitters.

### 12.2. Transmit Antenna Separation Distances



**Picture 12.1 Antenna Locations**

### 12.3. 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:

$$\left[ \frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} \right] \cdot$$

$$\sqrt{f(\text{GHz})} \leq 3.0$$
 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

According to the KDB447498 appendix A, the SAR test exclusion threshold for 2450MHz at 5mm test separation distances is 10mW.

$$\frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} * \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

Based on the above equation, Bluetooth SAR was not required:

Evaluation=1.246 < 3.0

Based on the above equation, WiFi SAR was required:

Evaluation=15.69 > 3.0

### 12.4. 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						
Antenna Mode	Phantom	Ground	Left	Right	Top	Bottom
WWAN	Yes	Yes	Yes	Yes	No	Yes
WLAN	Yes	Yes	No	Yes	Yes	No

### 13. SAR Test Result

#### 13.1. SAR results for Fast SAR for I18D00020-SAR01

**Table 13.1: Duty Cycle**

Duty Cycle	
Speech for GSM900/1800	1:8.3
GPRS for GSM900/1800	1:4
WCDMA Band I/ IV/V and WiFi	1:1
LTE Band 2/4/5/7/12	1:1

**Table 13.2: SAR Values (GSM 850 MHz Band - Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	190	Left	Touch	/	32.65	33.0	1.084	0.156	0.169	-0.06
836.6	190	Left	Tilt	/	32.65	33.0	1.084	0.0983	0.107	0.05
836.6	190	Right	Touch	/	32.65	33.0	1.084	0.128	0.139	0.07
836.6	190	Right	Tilt	/	32.65	33.0	1.084	0.0982	0.106	0.09
824.2	128	Left	Touch	/	32.67	33.0	1.079	0.177	0.191	0.04
848.8	251	Left	Touch	/	32.64	33.0	1.086	0.146	0.159	-0.02

**Table 13.3: SAR Values (GSM 850 MHz Band - Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
Body worn & Hotspot										
836.6	190	GPRS (4)	Phantom	/	29.19	30.0	1.205	0.322	0.388	-0.05
836.6	190	GPRS (4)	Ground	/	29.19	30.0	1.205	0.458	0.552	0.07
824.2	128	GPRS (4)	Ground	/	29.24	30.0	1.191	0.497	0.592	0.12
848.8	251	GPRS (4)	Ground	/	29.23	30.0	1.194	0.414	0.494	0.10
Hotspot										
836.6	190	GPRS (4)	Left	/	29.19	30.0	1.205	0.411	0.495	0.16
836.6	190	GPRS (4)	Right	/	29.19	30.0	1.205	0.334	0.402	-0.03
836.6	190	GPRS (4)	Bottom	/	29.19	30.0	1.205	0.184	0.222	0.06

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

**Table 13.4: SAR Values (GSM 1900 MHz Band - Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	661	Left	Touch	/	29.95	31.0	1.274	0.056	0.071	-0.16
1880	661	Left	Tilt	/	29.95	31.0	1.274	0.0147	0.019	0.02
1880	661	Right	Touch	/	29.95	31.0	1.274	0.0327	0.042	0.12
1880	661	Right	Tilt	/	29.95	31.0	1.274	0.0176	0.022	0.11
1850.2	512	Left	Touch	/	29.79	31.0	1.321	0.0478	0.063	0.10
1909.8	810	Left	Touch	/	29.87	31.0	1.297	0.058	0.075	0.05

**Table 13.5: SAR Values (GSM 1900 MHz Band- Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
Body worn & Hotspot										
1880	661	GPRS (4)	Phantom	/	26.45	28.0	1.429	0.130	0.186	0.17
1880	661	GPRS (4)	Ground	/	26.45	28.0	1.429	0.351	0.502	0.03
1850.2	512	GPRS (4)	Ground	/	26.39	28.0	1.449	0.361	0.523	0.05
1909.8	810	GPRS (4)	Ground	/	26.43	28.0	1.435	0.37	0.531	0.07
Hotspot										
1880	661	GPRS (4)	Left	/	26.45	28.0	1.429	0.102	0.146	0.14
1880	661	GPRS (4)	Right	/	26.45	28.0	1.429	0.115	0.164	-0.13
1880	661	GPRS (4)	Bottom	/	26.45	28.0	1.429	0.343	0.490	-0.16

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

**Table 13.6: SAR Values (WCDMA Band II- Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1880	9400	Left	Touch	/	22.81	24.0	1.315	0.0799	0.105	0.16
1880	9400	Left	Tilt	/	22.81	24.0	1.315	0.0194	0.026	0.03
1880	9400	Right	Touch	/	22.81	24.0	1.315	0.0416	0.055	0.06
1880	9400	Right	Tilt	/	22.81	24.0	1.315	0.0248	0.033	0.10
1852.4	9262	Left	Touch	/	22.68	24.0	1.355	0.0734	0.099	-0.09
1907.6	9538	Left	Touch	/	22.94	24.0	1.276	0.088	0.112	0.10

**Table 13.7: SAR Values (WCDMA Band II- Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
Body worn & Hotspot										
1880	9400	12.2K RMC	Phantom	/	22.81	24.0	1.315	0.188	0.247	0.13
1880	9400	12.2K RMC	Ground	/	22.81	24.0	1.315	0.456	0.600	-0.10
1852.4	9262	12.2K RMC	Ground	/	22.68	24.0	1.355	0.476	0.645	0.04
1907.6	9538	12.2K RMC	Ground	/	22.94	24.0	1.276	0.439	0.560	0.05
Hotspot										
1880	9400	12.2K RMC	Left	/	22.81	24.0	1.315	0.102	0.134	0.07
1880	9400	12.2K RMC	Right	/	22.81	24.0	1.315	0.146	0.192	-0.14
1880	9400	12.2K RMC	Bottom	/	22.81	24.0	1.315	0.367	0.483	-0.16

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

**Table 13.8: SAR Values (WCDMA Band IV- Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1732.6	1638	Left	Touch	/	22.57	23.5	1.239	0.098	0.121	-0.04
1732.6	1638	Left	Tilt	/	22.57	23.5	1.239	0.0904	0.112	-0.07
1732.6	1638	Right	Touch	/	22.57	23.5	1.239	0.0544	0.067	0.15
1732.6	1638	Right	Tilt	/	22.57	23.5	1.239	0.036	0.045	0.12
1712.4	1537	Left	Touch	/	22.6	23.5	1.23	0.0829	0.102	-0.03
1752.6	1738	Left	Touch	/	22.59	23.5	1.233	0.0671	0.083	0.19

**Table 13.9: SAR Values (WCDMA Band IV- Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
Body worn & Hotspot										
1732.6	1638	12.2K RMC	Phantom	/	22.57	23.5	1.239	0.192	0.238	0.12
1732.6	1638	12.2K RMC	Ground	/	22.57	23.5	1.239	0.411	0.509	0.05
1712.4	1537	12.2K RMC	Ground	/	22.6	23.5	1.23	0.423	0.520	-0.01
1752.6	1738	12.2K RMC	Ground	/	22.59	23.5	1.233	0.412	0.508	-0.06
Hotspot										
1732.6	1638	12.2K RMC	Left	/	22.57	23.5	1.239	0.0895	0.111	0.05
1732.6	1638	12.2K RMC	Right	/	22.57	23.5	1.239	0.0867	0.107	0.06
1732.6	1638	12.2K RMC	Bottom	/	22.57	23.5	1.239	0.279	0.346	0.07

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

**Table 13.10: SAR Values (WCDMA Band V- Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
836.6	4182	Left	Touch	/	23.14	24.0	1.219	0.19	0.232	0.02
836.6	4182	Left	Tilt	/	23.14	24.0	1.219	0.125	0.152	-0.05
836.6	4182	Right	Touch	/	23.14	24.0	1.219	0.169	0.206	0.11
836.6	4182	Right	Tilt	/	23.14	24.0	1.219	0.119	0.145	-0.12
826.4	4132	Left	Touch	/	23.18	24.0	1.208	0.187	0.226	0.01
846.6	4233	Left	Touch	/	23.15	24.0	1.216	0.199	0.242	0.03

**Table 13.11: SAR Values (WCDMA Band V- Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
Body worn & Hotspot										
836.6	4182	12.2K RMC	Phantom	/	23.14	24.0	1.219	0.24	0.293	0.04
836.6	4182	12.2K RMC	Ground	/	23.14	24.0	1.219	0.334	0.407	0.11
826.4	4132	12.2K RMC	Ground	/	23.18	24.0	1.208	0.338	0.408	0.11
846.6	4233	12.2K RMC	Ground	/	23.15	24.0	1.216	0.305	0.371	0.15
Hotspot										
836.6	4182	12.2K RMC	Left	/	23.14	24.0	1.219	0.224	0.273	0.07
836.6	4182	12.2K RMC	Right	/	23.14	24.0	1.219	0.147	0.179	-0.03
836.6	4182	12.2K RMC	Bottom	/	23.14	24.0	1.219	0.14	0.171	0.07

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

**Table 13.12: SAR Values (LTE Band 2-Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.											
1900	19100	Band 2	QPSK_20MHz 1RB_50 offset	Left	Touch	/	22.21	23.5	1.346	0.0693	0.093	0.09
1900	19100		QPSK_20MHz 50RB_25offset	Left	Touch	/	21.22	22.5	1.343	0.0577	0.077	0.07
1900	19100	Band 2	QPSK_20MHz 1RB_50 offset	Left	Tilt	/	22.21	23.5	1.346	0.0149	0.020	0.17
1900	19100		QPSK_20MHz 50RB_25offset	Left	Tilt	/	21.22	22.5	1.343	0.0115	0.015	0.01
1900	19100	Band 2	QPSK_20MHz 1RB_50 offset	Right	Touch	/	22.21	23.5	1.346	0.0481	0.065	0.03
1900	19100		QPSK_20MHz 50RB_25offset	Right	Touch	/	21.22	22.5	1.343	0.0407	0.055	-0.11
1900	19100	Band 2	QPSK_20MHz 1RB_50 offset	Right	Tilt	/	22.21	23.5	1.346	0.0183	0.025	0.18
1900	19100		QPSK_20MHz 50RB_25offset	Right	Tilt	/	21.22	22.5	1.343	0.0121	0.016	0.02
1860	18700	Band 2	QPSK_20MHz 1RB_50 offset	Left	Touch	/	22.03	23.5	1.403	0.094	0.132	0.03
1860	18700		QPSK_20MHz 50RB_25offset	Left	Touch	/	21.05	22.5	1.396	0.0579	0.081	0.03
1880	18900	Band 2	QPSK_20MHz 1RB_50 offset	Left	Touch	/	22.11	23.5	1.377	0.0923	0.127	0.11
1880	18900		QPSK_20MHz 50RB_25offset	Left	Touch	/	21.11	22.5	1.377	0.074	0.102	0.06



**Table 13.13: SAR Values (LTE Band2-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
Body worn & Hotspot											
1900	19100	Band2	QPSK_20MHz 1RB_50 offset	Toward Phantom	/	22.21	23.5	1.346	0.161	0.217	-0.16
1900	19100		QPSK_20MHz 50RB_25offset	Toward Phantom	/	21.22	22.5	1.343	0.134	0.180	-0.10
1900	19100	Band2	QPSK_20MHz 1RB_50 offset	Toward Ground	/	22.21	23.5	1.346	0.361	0.486	0.11
1900	19100		QPSK_20MHz 50RB_25offset	Toward Ground	/	21.22	22.5	1.343	0.29	0.389	-0.08
1860	18700	Band2	QPSK_20MHz 1RB_50 offset	Toward Ground	/	22.03	23.5	1.403	0.409	0.574	0.02
1860	18700		QPSK_20MHz 50RB_25offset	Toward Ground	/	21.05	22.5	1.396	0.277	0.386	0.05
1880	18900	Band2	QPSK_20MHz 1RB_50 offset	Toward Ground	/	22.11	23.5	1.377	0.395	0.544	0.15
1880	18900		QPSK_20MHz 50RB_25offset	Toward Ground	/	21.11	22.5	1.377	0.269	0.370	0.04
Hotspot											
1900	19100	Band2	QPSK_20MHz 1RB_50 offset	Toward Left	/	22.21	23.5	1.346	0.0727	0.098	0.03
1900	19100		QPSK_20MHz 50RB_25offset	Toward Left	/	21.22	22.5	1.343	0.0575	0.077	-0.09
1900	19100	Band2	QPSK_20MHz 1RB_50 offset	Toward Right	/	22.21	23.5	1.346	0.0556	0.075	0.18
1900	19100		QPSK_20MHz 50RB_25offset	Toward Right	/	21.22	22.5	1.343	0.0439	0.059	-0.11
1900	19100	Band2	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	22.21	23.5	1.346	0.354	0.476	-0.14
1900	19100		QPSK_20MHz 50RB_25offset	Toward Bottom	/	21.22	22.5	1.343	0.286	0.384	0.11

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

**Table 13.14: SAR Values (LTE Band 4-Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.											
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Left	Touch	/	22.08	23.0	1.236	0.0845	0.104	0.12
1720	20050		QPSK_20MHz 50RB_25offset	Left	Touch	/	21.05	22.0	1.245	0.0643	0.080	-0.05
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Left	Tilt	/	22.08	23.0	1.236	0.0218	0.027	0.14
1720	20050		QPSK_20MHz 50RB_25offset	Left	Tilt	/	21.05	22.0	1.245	0.0165	0.021	0.12
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Right	Touch	/	22.08	23.0	1.236	0.0699	0.086	-0.06
1720	20050		QPSK_20MHz 50RB_25offset	Right	Touch	/	21.05	22.0	1.245	0.064	0.080	-0.02
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Right	Tilt	/	22.08	23.0	1.236	0.0311	0.038	0.12
1720	20050		QPSK_20MHz 50RB_25offset	Right	Tilt	/	21.05	22.0	1.245	0.039	0.049	0.03
1732.5	20175	Band 4	QPSK_20MHz 1RB_50 offset	Left	Touch	/	21.93	23.0	1.279	0.0838	0.107	-0.10
1732.5	20175		QPSK_20MHz 50RB_25offset	Right	Touch	/	21.01	22.0	1.256	0.0604	0.076	0.04
1745	20300	Band 4	QPSK_20MHz 1RB_50 offset	Left	Touch	/	21.94	23.0	1.276	0.089	0.114	0.05
1745	20300		QPSK_20MHz 50RB_25offset	Right	Touch	/	21.02	22.0	1.253	0.0608	0.076	-0.10

**Table 13.15: SAR Values (LTE Band4-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
Body worn & Hotspot											
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Toward Phantom	/	22.08	23.0	1.236	0.166	0.205	-0.03
1720	20050		QPSK_20MHz 50RB_25offset	Toward Phantom	/	21.05	22.0	1.245	0.134	0.167	0.14
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Toward Ground	/	22.08	23.0	1.236	0.395	0.488	0.13
1720	20050		QPSK_20MHz 50RB_25offset	Toward Ground	/	21.05	22.0	1.245	0.267	0.332	-0.01
1732.5	20175	Band 4	QPSK_20MHz 1RB_50 offset	Toward Ground	/	21.93	23.0	1.279	0.331	0.423	0.06
1732.5	20175		QPSK_20MHz 50RB_25offset	Toward Ground	/	21.01	22.0	1.256	0.27	0.339	-0.07
1745	20300	Band 4	QPSK_20MHz 1RB_50 offset	Toward Ground	/	21.94	23.0	1.276	0.329	0.420	0.11
1745	20300		QPSK_20MHz 50RB_25offset	Toward Ground	/	21.02	22.0	1.253	0.269	0.337	0.05
Hotspot											
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Toward Left	/	22.08	23.0	1.236	0.0766	0.095	0.16
1720	20050		QPSK_20MHz 50RB_25offset	Toward Left	/	21.05	22.0	1.245	0.0614	0.076	0.15
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Toward Right	/	22.08	23.0	1.236	0.0864	0.107	0.01
1720	20050		QPSK_20MHz 50RB_25offset	Toward Right	/	21.05	22.0	1.245	0.0683	0.085	0.16
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	22.08	23.0	1.236	0.262	0.324	0.13
1720	20050		QPSK_20MHz 50RB_25offset	Toward Bottom	/	21.05	22.0	1.245	0.207	0.258	0.02

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

**Table 13.16: SAR Values (LTE Band 5-Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.											
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Left	Touch	/	23.05	23.5	1.109	0.19	0.211	0.18
829	20450		QPSK_10MHz 25RB_0offset	Left	Touch	/	22.06	22.5	1.107	0.158	0.175	0.03
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Left	Tilt	/	23.05	23.5	1.109	0.118	0.131	0.06
829	20450		QPSK_10MHz 25RB_0offset	Left	Tilt	/	22.06	22.5	1.107	0.0907	0.100	0.14
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Right	Touch	/	23.05	23.5	1.109	0.157	0.174	0.18
829	20450		QPSK_10MHz 25RB_0offset	Right	Touch	/	22.06	22.5	1.107	0.0975	0.108	0.03
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Right	Tilt	/	23.05	23.5	1.109	0.110	0.122	0.01
829	20450		QPSK_10MHz 25RB_0offset	Right	Tilt	/	22.06	22.5	1.107	0.0916	0.101	0.04
836.5	20525	Band 5	QPSK_10MHz 1RB_25 offset	Left	Touch	/	23.03	23.5	1.114	0.192	0.214	-0.01
836.5	20525		QPSK_10MHz 25RB_0offset	Left	Touch	/	22.03	22.5	1.114	0.158	0.176	0.04
844	20600	Band 5	QPSK_10MHz 1RB_25 offset	Left	Touch	/	22.97	23.5	1.13	0.198	0.224	0.06
844	20600		QPSK_10MHz 25RB_0offset	Left	Touch	/	22.05	22.5	1.109	0.171	0.190	0.08

**Table 13.17: SAR Values (LTE Band5-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
Body worn & Hotspot											
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Toward Phantom	/	23.05	23.5	1.109	0.243	0.269	0.01
829	20450		QPSK_10MHz 25RB_0offset	Toward Phantom	/	22.06	22.5	1.107	0.131	0.145	-0.13
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Toward Ground	/	23.05	23.5	1.109	0.337	0.374	0.14
829	20450		QPSK_10MHz 25RB_0offset	Toward Ground	/	22.06	22.5	1.107	0.206	0.228	0.02
836.5	20525	Band 5	QPSK_10MHz 1RB_25 offset	Toward Ground	/	23.03	23.5	1.114	0.334	0.372	0.12
836.5	20525		QPSK_10MHz 25RB_0offset	Toward Ground	/	22.03	22.5	1.114	0.204	0.227	0.10
844	20600	Band 5	QPSK_10MHz 1RB_25 offset	Toward Ground	/	22.97	23.5	1.13	0.308	0.348	-0.06
844	20600		QPSK_10MHz 25RB_0offset	Toward Ground	/	22.05	22.5	1.109	0.205	0.227	0.05
Hotspot											
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Toward Left	/	23.05	23.5	1.109	0.224	0.248	-0.15
829	20450		QPSK_10MHz 25RB_0offset	Toward Left	/	22.06	22.5	1.107	0.183	0.203	-0.07
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Toward Right	/	23.05	23.5	1.109	0.251	0.278	0.14
829	20450		QPSK_10MHz 25RB_0offset	Toward Right	/	22.06	22.5	1.107	0.188	0.208	0.05
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Toward Bottom	/	23.05	23.5	1.109	0.122	0.135	-0.06
829	20450		QPSK_10MHz 25RB_0offset	Toward Bottom	/	22.06	22.5	1.107	0.0905	0.100	-0.07

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

**Table 13.18: SAR Values (LTE Band 7- Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Left	Touch	/	20.47	20.5	1.007	0.0545	0.055	0.13
			QPSK_20MHz 50RB_25offset	Left	Touch	/	19.47	20	1.130	0.0427	0.048	-0.09
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Left	Tilt	/	20.47	20.5	1.007	0.0115	0.012	0.15
			QPSK_20MHz 50RB_25offset	Left	Tilt	/	19.47	20	1.130	0.009	0.010	-0.14
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Right	Touch	/	20.47	20.5	1.007	0.0317	0.032	0.14
			QPSK_20MHz 50RB_25offset	Right	Touch	/	19.47	20	1.130	0.0228	0.026	0.11
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Right	Tilt	/	20.47	20.5	1.007	0.0228	0.023	-0.09
			QPSK_20MHz 50RB_25offset	Right	Tilt	/	19.47	20	1.130	0.02	0.023	0.15
2510	20850	Band 7	QPSK_20MHz 1RB_50 offset	Left	Touch	/	20.40	20.5	1.023	0.0505	0.052	0.12
			QPSK_20MHz 50RB_25offset	Left	Touch	/	19.38	20	1.153	0.049	0.057	0.04
2535	21100	Band 7	QPSK_20MHz 1RB_50 offset	Left	Touch	/	20.39	20.5	1.026	0.059	0.061	0.10
			QPSK_20MHz 50RB_25offset	Left	Touch	/	19.39	20	1.151	0.0462	0.053	-0.06

**Table 13.19: SAR Values (LTE Band 7-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
Body worn & Hotspot											
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Toward Phantom	/	20.47	20.5	1.007	0.424	0.427	0.11
			QPSK_20MHz 50RB_25offset	Toward Phantom	/	19.47	20	1.130	0.317	0.358	0.15
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Toward Ground	/	20.47	20.5	1.007	0.64	0.644	-0.07
			QPSK_20MHz 50RB_25offset	Toward Ground	/	19.47	20	1.130	0.406	0.459	0.12
Hotspot											
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Toward Left	/	20.47	20.5	1.007	0.169	0.170	0.08
			QPSK_20MHz 50RB_25offset	Toward Left	/	19.47	20	1.130	0.136	0.154	-0.15
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Toward Right	/	20.47	20.5	1.007	0.0343	0.035	0.03
			QPSK_20MHz 50RB_25offset	Toward Right	/	19.47	20	1.130	0.0539	0.061	0.10
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.47	20.5	1.007	1.02	1.027	0.16
			QPSK_20MHz 50RB_25offset	Toward Bottom	/	19.47	20	1.130	0.87	0.983	0.09
2510	20850	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.40	20.5	1.023	1.06	1.085	0.03
			QPSK_20MHz 50RB_25offset	Toward Bottom	/	19.38	20	1.153	0.785	0.905	-0.14
2535	21100	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.39	20.5	1.026	1.04	1.067	0.13
			QPSK_20MHz 50RB_25offset	Toward Bottom	/	19.39	20	1.151	0.841	0.968	-0.09
2535	21100	Band 7	QPSK_20MHz 100RB_0 offset	Toward Bottom	/	19.35	20	1.161	0.78	0.906	0.01
Repeated											
2510	20850	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.40	20.5	1.023	0.979	1.002	0.12
2560	21350		QPSK_20MHz 50RB_25offset	Toward Bottom	/	19.47	20	1.007	0.865	0.977	0.08
Second Supply											

2510	20850	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.40	20.5	1.023	0.904	0.925	0.06
2535	21100		QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.39	20.5	1.026	0.884	0.907	0.07
2560	21350		QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.47	20.5	1.007	0.921	0.927	0.08
Second Supply Repeated											
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.47	20.5	1.007	0.918	0.924	0.03

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

**Table 13.20: SAR Values (LTE Band 12-Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.											
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Left	Touch	/	23.06	23.5	1.107	0.0784	0.087	0.08
707.5	23095		QPSK_10MHz 25RB_0offset	Left	Touch	/	22.12	22.5	1.091	0.0618	0.067	0.07
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Left	Tilt	/	23.06	23.5	1.107	0.0629	0.070	-0.10
707.5	23095		QPSK_10MHz 25RB_0offset	Left	Tilt	/	22.12	22.5	1.091	0.0507	0.055	-0.15
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Right	Touch	/	23.06	23.5	1.107	0.0618	0.068	0.18
707.5	23095		QPSK_10MHz 25RB_0offset	Right	Touch	/	22.12	22.5	1.091	0.0512	0.056	0.03
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Right	Tilt	/	23.06	23.5	1.107	0.0489	0.054	0.06
707.5	23095		QPSK_10MHz 25RB_0offset	Right	Tilt	/	22.12	22.5	1.091	0.0391	0.043	0.14
704	23060	Band 12	QPSK_10MHz 1RB_25 offset	Left	Touch	/	23.03	23.5	1.114	0.0763	0.085	0.18
704	23060		QPSK_10MHz 25RB_0offset	Left	Touch	/	22.05	22.5	1.109	0.0545	0.060	0.10
711	23130	Band 12	QPSK_10MHz 1RB_25 offset	Left	Touch	/	23.01	23.5	1.119	0.101	0.113	0.05
711	23130		QPSK_10MHz 25RB_0offset	Left	Touch	/	22.01	22.5	1.119	0.063	0.071	-0.04



**Table 13.21: SAR Values (LTE Band12-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
Body worn & Hotspot											
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Toward Phantom	/	23.06	23.5	1.107	0.104	0.115	0.03
707.5	23095		QPSK_10MHz 25RB_0offset	Toward Phantom	/	22.12	22.5	1.091	0.0833	0.091	0.04
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Toward Ground	/	23.06	23.5	1.107	0.128	0.142	0.01
707.5	23095		QPSK_10MHz 25RB_0offset	Toward Ground	/	22.12	22.5	1.091	0.103	0.112	0.04
704	23060	Band 12	QPSK_10MHz 1RB_25 offset	Toward Ground	/	23.03	23.5	1.114	0.122	0.136	0.15
704	23060		QPSK_10MHz 25RB_0offset	Toward Ground	/	22.05	22.5	1.109	0.089	0.099	-0.02
711	23130	Band 12	QPSK_10MHz 1RB_25 offset	Toward Ground	/	23.01	23.5	1.119	0.133	0.149	0.12
711	23130		QPSK_10MHz 25RB_0offset	Toward Ground	/	22.01	22.5	1.119	0.105	0.117	0.14
Hotspot											
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Toward Left	/	23.06	23.5	1.107	0.101	0.112	0.10
707.5	23095		QPSK_10MHz 25RB_0offset	Toward Left	/	22.12	22.5	1.091	0.0798	0.087	0.19
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Toward Right	/	23.06	23.5	1.107	0.0726	0.080	0.04
707.5	23095		QPSK_10MHz 25RB_0offset	Toward Right	/	22.12	22.5	1.091	0.057	0.062	-0.12
707.5	23095	Band 12	QPSK_10MHz 1RB_25 offset	Toward Bottom	/	23.06	23.5	1.107	0.0434	0.048	0.01
707.5	23095		QPSK_10MHz 25RB_0offset	Toward Bottom	/	22.12	22.5	1.091	0.0346	0.038	-0.03

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

**Table 13.22: SAR Values (WiFi 802.11b - Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
2412	1	Left	Touch	/	14.74	17.0	1.683	0.419	0.705	-0.09
2412	1	Left	Tilt	/	14.74	17.0	1.683	0.372	0.626	-0.04
2412	1	Right	Touch	/	14.74	17.0	1.683	0.153	0.257	0.05
2412	1	Right	Tilt	/	14.74	17.0	1.683	0.160	0.269	-0.13
2437	6	Left	Touch	/	14.38	17.0	1.828	0.347	0.634	0.07
2462	11	Left	Touch	/	14.61	17.0	1.734	0.395	0.685	0.14

**Table 13.23: SAR Values (WiFi 802.11b - Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
Body worn & Hotspot										
2412	1	WiFi 2450	Phantom	/	14.74	17.0	1.683	0.0988	0.166	0.15
2412	1	WiFi 2450	Ground	/	14.74	17.0	1.683	0.0999	0.168	0.03
2437	6	WiFi 2450	Ground	/	14.38	17.0	1.828	0.115	0.210	0.10
2462	11	WiFi 2450	Ground	/	14.61	17.0	1.734	0.131	0.227	0.14
Hotspot										
2412	1	WiFi 2450	Left	/	14.74	17.0	1.683	0.0119	0.020	-0.10
2412	1	WiFi 2450	Right	/	14.74	17.0	1.683	0.0893	0.150	0.10
2412	1	WiFi 2450	Top	/	14.74	17.0	1.683	0.0612	0.103	0.03

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

**Table 13.24: SAR Values (WiFi 802.11a - Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
5260	52	Left	Touch	/	12.51	13.0	1.119	0.550	0.615	-0.08
5260	52	Left	Tilt	/	12.51	13.0	1.119	0.836	0.935	1.13
5260	52	Right	Touch	/	12.51	13.0	1.119	0.391	0.438	-0.03
5260	52	Right	Tilt	/	12.51	13.0	1.119	0.595	0.666	-0.13
5300	60	Left	Tilt	/	12.31	13.0	1.172	0.912	1.069	0.05
5320	64	Left	Tilt	/	12.22	13.0	1.197	0.804	0.962	-0.06
5785	157	Left	Touch	/	12.31	12.5	1.045	0.461	0.482	-0.16
5785	157	Left	Tilt	/	12.31	12.5	1.045	0.51	0.533	0.04
5785	157	Right	Touch	/	12.31	12.5	1.045	0.183	0.191	0.18
5785	157	Right	Tilt	/	12.31	12.5	1.045	0.430	0.449	0.12
5745	149	Left	Tilt	/	12.09	12.5	1.099	0.507	0.557	-0.16
5825	165	Left	Tilt	/	12.22	12.5	1.067	0.497	0.530	0.06
Repeated										
5300	60	Left	Tilt	Fig.39	12.31	13.0	1.172	0.878	1.029	0.08

**Table 13.25: SAR Values (WiFi 802.11a - Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
Body worn & Hotspot										
5260	52	WiFi 5G	Phantom	/	12.51	13.0	1.119	0.147	0.164	-0.03
5260	52	WiFi 5G	Ground	/	12.51	13.0	1.119	0.129	0.144	0.19
Hotspot										
5260	52	WiFi 5G	Left	/	12.51	13.0	1.119	<0.01	<0.01	0.08
5260	52	WiFi 5G	Right	/	12.51	13.0	1.119	<0.01	<0.01	0.12
5260	52	WiFi 5G	Top	/	12.51	13.0	1.119	0.18	0.201	0.05
5300	60	WiFi 5G	Top	/	12.31	13.0	1.172	0.189	0.222	0.12
5320	64	WiFi 5G	Top	/	12.22	13.0	1.197	0.189	0.226	0.08
5785	157	WiFi 5G	Phantom	/	12.31	12.5	1.045	0.112	0.117	0.19
5785	157	WiFi 5G	Ground	/	12.31	12.5	1.045	0.173	0.181	-0.17
5785	157	WiFi 5G	Left	/	12.31	12.5	1.045	<0.01	<0.01	0.13
5785	157	WiFi 5G	Right	/	12.31	12.5	1.045	0.0132	0.014	0.14
5785	157	WiFi 5G	Top	/	12.31	12.5	1.045	0.284	0.297	0.12
5745	149	WiFi 5G	Top	/	12.09	12.5	1.099	0.164	0.180	0.11
5825	165	WiFi 5G	Top	/	12.22	12.5	1.067	0.18	0.192	0.12

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

**13.2. SAR results for Standard procedure for I18D00020-SAR01**

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

**Table 13.26: SAR Values (GSM 850 MHz Band - Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
824.2	128	Left	Touch	/	32.67	33.0	1.079	0.177	0.191	0.04

**Table 13.27: SAR Values (GSM 850 MHz Band- Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
824.2	128	GPRS (4)	Ground	/	29.24	30.0	1.191	0.497	0.592	0.12

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

**Table 13.28: SAR Values (GSM 1900 MHz Band - Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1909.8	810	Left	Touch	/	29.87	31.0	1.297	0.058	0.075	0.05

**Table 13.29: SAR Values (GSM 1900 MHz Band- Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1909.8	810	GPRS (4)	Ground	/	26.43	28.0	1.435	0.37	0.531	0.07

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

**Table 13.30: SAR Values (WCDMA Band II- Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1907.6	9538	Left	Touch	/	22.94	24.0	1.276	0.088	0.112	0.10

**Table 13.31: SAR Values (WCDMA Band II)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1852.4	9262	12.2K RMC	Ground	/	22.68	24.0	1.355	0.476	0.645	0.04

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

**Table 13.32: SAR Values (WCDMA Band IV- Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1732.6	1638	Left	Touch	/	22.57	23.5	1.239	0.098	0.121	-0.04

**Table 13.33: SAR Values (WCDMA Band IV)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
1712.4	1537	12.2K RMC	Ground	/	22.6	23.5	1.23	0.423	0.520	-0.01

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

**Table 13.34: SAR Values (WCDMA Band V- Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
846.6	4233	Left	Touch	/	23.15	24.0	1.216	0.199	0.242	0.03

**Table 13.35: SAR Values (WCDMA Band V)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
826.4	4132	12.2K RMC	Ground	/	23.18	24.0	1.208	0.338	0.408	0.11

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

**Table 13.36: SAR Values (LTE Band 2-Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.											
1860	18700	Band 2	QPSK_20MHz 1RB_50 offset	Left	Touch	/	22.03	23.5	1.403	0.094	0.132	0.03
1880	18900		QPSK_20MHz 50RB_25offset	Left	Touch	/	21.11	22.5	1.377	0.074	0.102	0.06

**Table 13.37: SAR Values (LTE Band2-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
1860	18700	Band2	QPSK_20MHz 1RB_50 offset	Toward Ground	Fig.14	/	23.5	1.403	0.409	0.574	0.02
1900	19100		QPSK_20MHz 50RB_25offset	Toward Ground	Fig.13	/	22.5	1.343	0.29	0.389	-0.08

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

**Table 13.38: SAR Values (LTE Band 4-Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.											
1745	20300	Band 4	QPSK_20MHz 1RB_50 offset	Left	Touch	/	21.94	23.0	1.276	0.089	0.114	-0.10
1720	20050		QPSK_20MHz 50RB_25offset	Right	Touch	/	21.05	22.0	1.245	0.064	0.080	-0.02

**Table 13.39: SAR Values (LTE Band4-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
1720	20050	Band 4	QPSK_20MHz 1RB_50 offset	Toward Ground	/	22.08	23.0	1.236	0.395	0.488	0.13
1732.5	20175		QPSK_20MHz 50RB_25offset	Toward Ground	/	21.01	22.0	1.256	0.27	0.339	-0.07

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

**Table 13.40: SAR Values (LTE Band 5-Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.											
844	20600	Band 5	QPSK_10MHz 1RB_25 offset	Left	Touch	/	22.97	23.5	1.13	0.198	0.224	0.06
844	20600		QPSK_10MHz 25RB_0offset	Left	Touch	/	22.05	22.5	1.109	0.171	0.190	0.08

**Table 13.41: SAR Values (LTE Band5-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
829	20450	Band 5	QPSK_10MHz 1RB_25 offset	Toward Ground	/	23.05	23.5	1.109	0.337	0.374	0.14
829	20450		QPSK_10MHz 25RB_0offset	Toward Ground	/	22.06	22.5	1.107	0.206	0.228	0.02

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

**Table 13.42: SAR Values (LTE Band 7- Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
2535	21100	Band 7	QPSK_20MHz 1RB_50 offset	Left	Touch	/	19.38	20	1.153	0.049	0.057	0.10
2510	20850		QPSK_20MHz 50RB_25offset	Left	Touch	/	20.39	20.5	1.026	0.059	0.061	0.04

**Table 13.43: SAR Values (LTE Band 7-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)	
MHz	Ch.											
2510	20850	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.40	20.5	1.023	1.06	1.085	0.03	
2560	21350		QPSK_20MHz 50RB_25offset	Toward Bottom	/	19.47	20	1.130	0.87	0.983	0.09	
Repeated												
2510	20850	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.40	20.5	1.023	0.979	1.002	0.12	
2560	21350		QPSK_20MHz 50RB_25offset	Toward Bottom	/	19.47	19.5	1.007	0.865	0.871	0.08	
Second Supply												
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.47	20.5	1.007	0.921	0.927	0.08	
Second Supply Repeated												
2560	21350	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	/	20.47	20.5	1.007	0.918	0.924	0.03	

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

**Table 13.44: SAR Values (LTE Band 12-Head)**

Frequency		Mode	Configuration	Side	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.											
711	23130	Band 12	QPSK_10MHz 1RB_25 offset	Left	Touch	/	23.01	23.5	1.119	0.101	0.113	0.05
711	23130		QPSK_10MHz 25RB_0offset	Left	Touch	/	22.01	22.5	1.119	0.063	0.071	-0.04



**Table 13.45: SAR Values (LTE Band12-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
711	23130	Band 12	QPSK_10MHz 1RB_25 offset	Toward Ground	/	23.01	23.5	1.119	0.133	0.149	0.12
711	23130		QPSK_10MHz 25RB_0offset	Toward Ground	/	22.01	22.5	1.119	0.105	0.117	0.14

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

**Table 13.46: SAR Values (WiFi 802.11b - Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
2412	1	Left	Touch	/	14.74	17.0	1.683	0.419	0.705	-0.09

**Table 13.47: SAR Values (WiFi 802.11b - Body)**

Frequency		Mode (number of timeslots)	Test Position	/	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
2462	11	WiFi 2450	Ground	Fig.36	14.61	17.0	1.734	0.131	0.227	0.14

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

**Table 13.48: SAR Values (WiFi 802.11a - Head)**

Frequency		Side	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
5300	60	Left	Tilt	/	12.31	13.0	1.172	0.912	1.069	0.05
5785	157	Left	Tilt	/	12.31	12.5	1.045	0.51	0.533	0.04
Repeated										
5300	60	Left	Tilt	/	12.31	13.0	1.172	0.878	1.029	0.08

**Table 13.49: SAR Values (WiFi 802.11a - Body)**

Frequency		Mode (number of timeslots)	Test Position	Figure No.	Measured average power(dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.									
5320	64	WiFi 5G	Top	/	12.22	13.0	1.197	0.189	0.226	0.08
5785	157	WiFi 5G	Top	/	12.31	12.5	1.045	0.284	0.297	0.12

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

**13.3. SAR results for Standard procedure for I18D00198-SAR01**

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

**Table 13.50: SAR Values (LTE Band 7-Body)**

Frequency		Mode	Configuration	Test Position	Figure No.	Measured average power (dBm)	Maximum allowed Power (dBm)	Scaling factor	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift(dB)
MHz	Ch.										
2510	20850	Band 7	QPSK_20MHz 1RB_50 offset	Toward Bottom	Fig.1	20.40	20.5	1.023	1.06	1.085	-0.17

## 14. Evaluation of Simultaneous

**Table 14.1: Summary of Transmitters**

Band/Mode	Frequency (GHz)	SAR test exclusion threshold(mW)	RF output power (mW)
Bluetooth	2.41	10	3.981
2.4GHz WLAN 802.11 b/g/n	2.45	10	50.12
5.2GHz WLAN 802.11 a/n	5.2	10	19.95
5.8GHz WLAN 802.11 a/n	5.8	10	17.78

**Table14.2 Simultaneous transmission SAR**

Standalone SAR for 2G(W/Kg)					
Test Position			GSM 850	GSM 1900	Highest SAR
Head	Left	Cheek	0.191	0.075	0.191
		Tilt 15°	0.107	0.019	0.107
	Right	Cheek	0.139	0.042	0.139
		Tilt 15°	0.106	0.022	0.106
Body worn/ Hotspot10mm	Phantom Side		0.388	0.186	0.388
	Ground Side		0.592	0.531	0.592
Hotspot 10mm	Left Side		0.495	0.146	0.495
	Right Side		0.402	0.164	0.402
	Bottom Side		0.222	0.490	0.490
	Top Side		--	--	--

Standalone SAR for 3G (W/Kg)						
Test Position			WCDMA Band II	WCDMA Band IV	WCDMA Band V	Highest SAR
Head	Left	Cheek	0.112	0.121	0.242	0.242
		Tilt 15°	0.026	0.112	0.152	0.152
	Right	Cheek	0.055	0.067	0.206	0.206
		Tilt 15°	0.033	0.045	0.145	0.145
Body worn/ Hotspot10mm	Phantom Side		0.247	0.238	0.293	0.293
	Ground Side		0.645	0.520	0.408	0.645
Hotspot 10mm	Left Side		0.134	0.111	0.273	0.273
	Right Side		0.192	0.107	0.179	0.192
	Bottom Side		0.483	0.346	0.171	0.483
	Top Side		--		--	--

Standalone SAR for 4G (W/Kg)								
Test Position			LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 12	Highest SAR
Head	Left	Cheek	0.132	0.114	0.224	0.061	0.113	0.224
		Tilt 15°	0.020	0.027	0.131	0.012	0.070	0.131
	Right	Cheek	0.065	0.086	0.174	0.032	0.068	0.174
		Tilt 15°	0.025	0.049	0.122	0.023	0.054	0.122
Body worn/ Hotspot10mm	Phantom Side		0.217	0.205	0.269	0.427	0.115	0.427
	Ground Side		0.574	0.488	0.374	0.644	0.149	0.644
Hotspot 10mm	Left Side		0.098	0.095	0.248	0.170	0.112	0.248
	Right Side		0.075	0.107	0.278	0.061	0.080	0.278
	Bottom Side		0.476	0.324	0.135	1.085	0.048	1.085
	Top Side		--			--		--

Transmission SAR(W/Kg)									
Test Position			2G	3G	4G	2.4G WiFi	5GWiFi	BT	SUM
Head	Left	Cheek	0.191	0.242	0.224	0.705	0.615	0.167	0.947
		Tilt 15°	0.107	0.152	0.131	0.626	1.069	0.167	1.221
	Right	Cheek	0.139	0.206	0.174	0.257	0.438	0.167	0.644
		Tilt 15°	0.106	0.145	0.122	0.269	0.666	0.167	0.811
Body worn/ Hotspot10mm	Phantom Side		0.388	0.293	0.427	0.166	0.164	0.084	0.593
	Ground Side		0.592	0.645	0.644	0.227	0.181	0.084	0.872
Hotspot 10mm	Left Side		0.495	0.273	0.248	0.020	<0.01	0.084	0.579
	Right Side		0.402	0.192	0.278	0.150	0.014	0.084	0.552
	Bottom Side		0.490	0.483	1.085	--	--	0.084	1.169
	Top Side		--	--	--	0.103	0.297	0.084	0.297

According to the conducted power measurement result, we can draw the conclusion that: stand-alone SAR for WiFi should be performed. Then, simultaneous transmission SAR for WiFi/BT is considered with measurement results of GSM/WCDMA/LTE and WiFi/BT. According to the above table, the sum of reported SAR values for GSM/WCDMA/LTE and WiFi<1.6W/kg. So the simultaneous transmission SAR is not required for WiFi/BT transmitter.

## 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  $\geq 0.80$  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  $\geq 1.45$  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  $\geq 1.5$  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 Head Value (1g)**

Frequency		Side	Test Position	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio
MHz	Ch.					
5300	60	Left	Tilt	0.878	0.912	1.04

**Table 15.2: SAR Measurement Variability for Body Value (1g)**

Frequency		Configuration	Test Position	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio
MHz	Ch.					
2510	20850	QPSK_20MHz 1RB_50 offset	Bottom	1.06	0.979	1.08
2560	21350	QPSK_20MHz 50RB_25 offset	Bottom	0.87	0.865	1.01
Second Supply						
2560	21350	QPSK_20MHz 1RB_50 offset	Bottom	0.921	0.918	1.01

**Note:** According to the KDB 865664 D01 repeated measurement is not required when the original highest measured SAR is < 0.8 W/kg.

## 16. Measurement Uncertainty

Measurement uncertainty for 750 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	$C_{i(1g)}$	Std. Unc. (1-g)	$V_i$ or $V_{eff}$
<b>Measurement System</b>						
Probe Calibration ( $k=1$ )	5.4	Normal	2	1	5.40	$\infty$
Probe Isotropy	4.70	Rectangular	$\sqrt{3}$	0.7	1.90	$\infty$
Modulation Response	2.40	Rectangular	$\sqrt{3}$	1	1.39	$\infty$
Hemispherical Isotropy	2.60	Rectangular	$\sqrt{3}$	0.7	1.05	$\infty$
Boundary Effect	1.00	Rectangular	$\sqrt{3}$	1	0.58	$\infty$
Linearity	4.70	Rectangular	$\sqrt{3}$	1	2.71	$\infty$
System Detection Limit	1.00	Rectangular	$\sqrt{3}$	1	0.58	$\infty$
Readout Electronics	0.30	Normal	1	1	0.30	$\infty$
Response Time	0.80	Rectangular	$\sqrt{3}$	1	0.46	$\infty$
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1.50	$\infty$
RF Ambient Noise	0.00	Rectangular	$\sqrt{3}$	1	0.00	$\infty$
RF Ambient Reflections	0.00	Rectangular	$\sqrt{3}$	1	0.00	$\infty$
Probe Positioner	0.40	Rectangular	$\sqrt{3}$	1	0.23	$\infty$
Probe Positioning	2.90	Rectangular	$\sqrt{3}$	1	1.67	$\infty$
Post-processing	1.00	Rectangular	$\sqrt{3}$	1	0.58	$\infty$
<b>Test sample Related</b>						
Test sample Positioning	1.2	Normal	1	1	1.2	5
Device Holder Uncertainty	3.2	Normal	1	1	3.2	71
Power drift	5	Rectangular	$\sqrt{3}$	1	2.89	$\infty$
Power Scaling	0	Rectangular	$\sqrt{3}$	1	0.00	$\infty$
<b>Phantom and Tissue Parameters</b>						
Phantom Uncertainty	4	Rectangular	$\sqrt{3}$	1	2.31	$\infty$
SAR correction	1.9	Rectangular	$\sqrt{3}$	1	1.10	$\infty$
Liquid Conductivity (meas)	4.19	Rectangular	1	0.78	3.27	$\infty$
Liquid Permittivity (meas)	4.4	Rectangular	1	0.26	1.14	$\infty$
Temp. unc. - Conductivity	0.18	Rectangular	$\sqrt{3}$	0.78	0.08	$\infty$
Temp. unc. - Permittivity	0.54	Rectangular	$\sqrt{3}$	0.23	0.07	$\infty$
<b>Combined Std. Uncertainty</b>		RSS			9.39	
<b>Expanded STD Uncertainty</b>		$k=2$			18.77%	

System check uncertainty for 750 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	$C_i(1g)$	Std. Unc. (1-g)	$V_i$ or $V_{eff}$
<b>Measurement System</b>						
Probe Calibration ( $k=1$ )	5.40	Normal	1	1	5.40	$\infty$
Probe Isotropy	4.70	Rectangular	$\sqrt{3}$	0.7	1.90	$\infty$
Modulation Response	2.40	Rectangular	$\sqrt{3}$	1	1.39	$\infty$
Hemispherical Isotropy	2.60	Rectangular	$\sqrt{3}$	0.7	1.05	$\infty$
Boundary Effect	1.00	Rectangular	$\sqrt{3}$	1	0.58	$\infty$
Linearity	4.70	Rectangular	$\sqrt{3}$	1	2.71	$\infty$
System Detection Limit	1.00	Rectangular	$\sqrt{3}$	1	0.58	$\infty$
Readout Electronics	0.30	Normal	1	1	0.30	$\infty$
Response Time	0.80	Rectangular	$\sqrt{3}$	1	0.46	$\infty$
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1.50	$\infty$
RF Ambient Noise	0.00	Rectangular	$\sqrt{3}$	1	0.00	$\infty$
RF Ambient Reflections	0.00	Rectangular	$\sqrt{3}$	1	0.00	$\infty$
Probe Positioner	0.40	Rectangular	$\sqrt{3}$	1	0.23	$\infty$
Probe Positioning	2.90	Rectangular	$\sqrt{3}$	1	1.67	$\infty$
Post-processing	1.00	Rectangular	$\sqrt{3}$	1	0.58	$\infty$
<b>Field source</b>						
Deviation of the experimental source from numerical source	5.5	Normal	1	1	5.5	$\infty$
Source to liquid distance	2	Rectangular	$\sqrt{3}$	1	1.15	$\infty$
Power drift	5	Rectangular	$\sqrt{3}$	1	2.89	$\infty$
<b>Phantom and Tissue Parameters</b>						
Phantom Uncertainty	4	Rectangular	$\sqrt{3}$	1	2.31	$\infty$
SAR correction	1.9	Rectangular	$\sqrt{3}$	1	1.10	$\infty$
Liquid Conductivity (meas)	4.19	Normal	1	0.78	3.27	$\infty$
Liquid Permittivity (meas)	4.4	Normal	1	0.26	1.14	$\infty$
Temp. unc. - Conductivity	0.18	Rectangular	$\sqrt{3}$	0.78	0.08	$\infty$
Temp. unc. - Permittivity	0.54	Rectangular	$\sqrt{3}$	0.23	0.07	$\infty$
<b>Combined Std. Uncertainty</b>		RSS			10.39	
<b>Expanded STD Uncertainty</b>		$k=2$			20.79%	



## 17. Main Test Instrument

**Table 17.1: List of Main Instruments**

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	N5242A	MY51221755	Dec 25, 2017	1 year
02	Power meter	NRVD	102257	May 11, 2018	1 year
03	Power sensor	NRV-Z5	100241		
			100644		
04	Signal Generator	E4438C	MY49072044	May 11, 2018	1 Year
05	Amplifier	NTWPA-0086010F	12023024	No Calibration Requested	
06	Coupler	778D	MY4825551	May 11, 2018	1 year
07	BTS	E5515C	MY50266468	Dec 25, 2017	1 year
08	BTS	MT8820C	6201240338	May 11, 2017	1 year
09	E-field Probe	ES3DV3	3252	Spe 4, 2018	1 year
10	DAE	SPEAG DAE4	1244	Dec 4,2017	1 year
11	Dipole Validation Kit	SPEAG D2600V2	1031	Oct 30,2015	3 year

## ANNEX A. GRAPH RESULTS

### LTE Band 7 20M 1RB 50offset Bottom Mode Low

Date/Time: 2018/9/29

Electronics: DAE4 Sn1244

Medium parameters used:  $f = 2510$  MHz;  $\sigma = 1.998$  S/m;  $\epsilon_r = 54.622$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Communication System: LTE Band 7 Professional 2600MHz;    Frequency: 2510 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(4.19, 4.19, 4.19); Calibrated: 9/4/2018

### LTE Band 7 20M 1RB 50offset Bottom Mode Low/Area Scan (31x61x1):

Measurement grid: dx=10 mm, dy=10 mm

Maximum value of SAR (Measurement) = 0.979 W/kg

### LTE Band 7 20M 1RB 50offset Bottom Mode Low/Zoom Scan (7x7x7)/Cube 0:

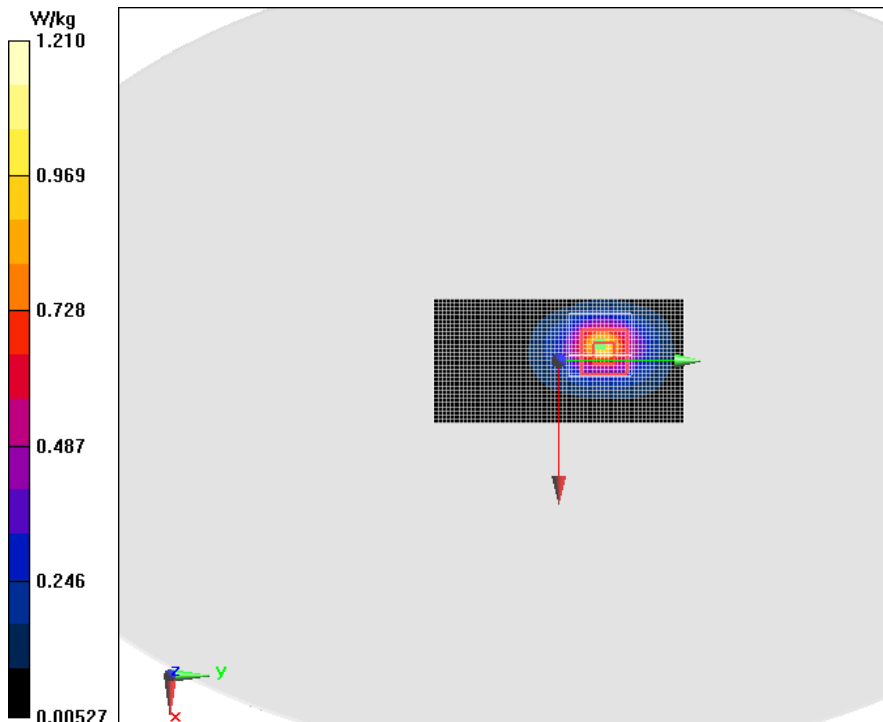
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.67 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 2.18 W/kg

SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.485 W/kg

Maximum value of SAR (measured) = 1.21 W/kg



## ANNEX B. SYSTEM VALIDATION RESULTS

### Body 2600MHz

Date/Time: 2018/9/29

Electronics: DAE4 Sn1244

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.112$  S/m;  $\epsilon_r = 54.37$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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

Communication System: CW 2600MHz;    Frequency: 2600 MHz; Duty Cycle: 1:1

Probe: ES3DV3 - SN3252ConvF(4.19, 4.19, 4.19); Calibrated: 9/4/2018

#### Body 2600MHz/Area Scan (101x101x1):

Measurement grid: dx=10 mm, dy=10 mm

Maximum value of SAR (Measurement) = 16.4 W/kg

#### Body 2600MHz/Zoom Scan (7x7x7)/Cube 0:

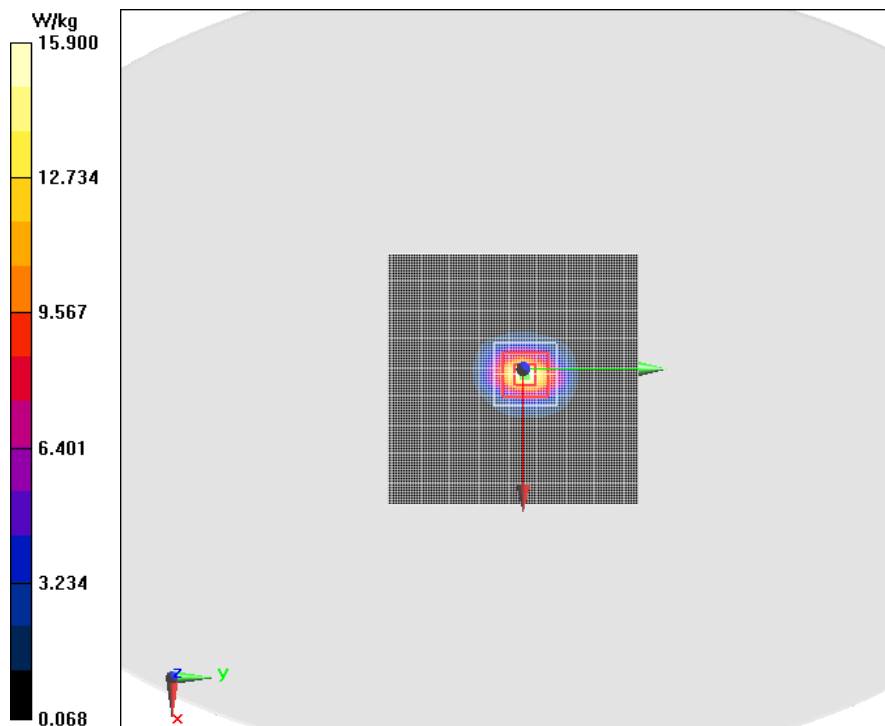
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 85.34 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 30.5 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 5.97 W/kg

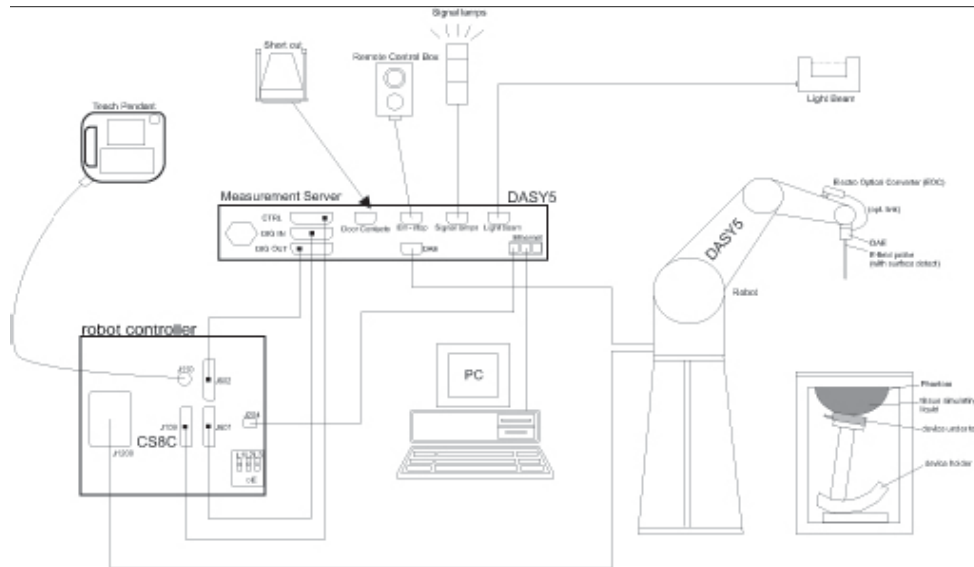
Maximum value of SAR (measured) = 15.9 W/kg



## ANNEX C. SAR Measurement Setup

### C.1. Measurement Set-up

The DASY5 system for performing compliance tests is illustrated above graphically. This system consists of the following items:



**Picture C.1 SAR Lab Test Measurement Set-up**

- A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.

- Remote control and teach pendant as well as additional circuitry for robot safety such as
- warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

## C.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY5 software reads the reflection during a software approach and looks for the maximum using 2<sup>nd</sup> order curve fitting. The approach is stopped at reaching the maximum.

### Probe Specifications:

<b>Model:</b>	<b>ES3DV3,EX3DV4</b>
<b>Frequency</b>	<b>10MHz — 6GHz(EX3DV4)</b>
<b>Range:</b>	<b>10MHz — 4GHz(ES3DV3)</b>
<b>Calibration:</b>	<b>In head and body simulating tissue at Frequencies from 835 up to 5800MHz</b>
<b>Linearity:</b>	<b>± 0.2 dB(30 MHz to 4 GHz) for ES3DV3 ± 0.2 dB(30 MHz to 6 GHz) for EX3DV4</b>
<b>Dynamic Range:</b>	<b>10 mW/kg — 100W/kg</b>
<b>Probe Length:</b>	<b>330 mm</b>
<b>Probe Tip</b>	
<b>Length:</b>	<b>20 mm</b>
<b>Body Diameter:</b>	<b>12 mm</b>
<b>Tip Diameter:</b>	<b>2.5 mm (3.9 mm for ES3DV3)</b>
<b>Tip-Center:</b>	<b>1 mm (2.0mm for ES3DV3)</b>
<b>Application:</b>	<b>SAR Dosimetry Testing Compliance tests of mobile phones Dosimetry in strong gradient fields</b>



Picture7-2 Near-field Probe



Picture 7-3 E-field Probe

## C.3. E-field Probe Calibration

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by

subjecting the probe to a known E-field density (1 mW/cm<sup>2</sup>) using an RF Signal generator, TEM cell, and RF Power Meter.

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

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

$$SAR = C \frac{\Delta T}{\Delta t}$$

Where:

$\Delta t$  = Exposure time (30 seconds),

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

$\Delta T$  = Temperature increase due to RF exposure.

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

Where:

$\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density (kg/m<sup>3</sup>).

## **C.4. Other Test Equipment**

### **C.4.1. Data Acquisition Electronics(DAE)**

The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe

collision detection.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating.

Common mode rejection is above 80 dB.



**PictureC.4: DAE**



### C.4.2. Robot

The SPEAG DASY system uses the high precision robots (DASY5: RX90L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)



**Picture C.5 DASY 5**

### C.4.3. Measurement Server

The Measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128MB), RAM (DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which

is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.



**Picture C.6 Server for DASY 5**

#### **C.4.4. Device Holder for Phantom**

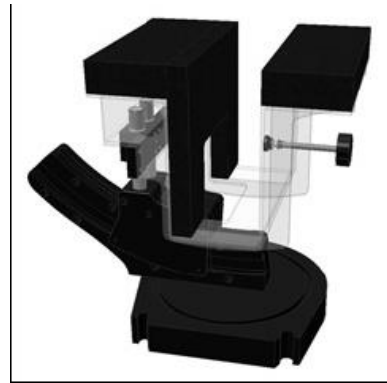
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of  $\pm 0.5\text{mm}$  would produce a SAR uncertainty of  $\pm 20\%$ . Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

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

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon = 3$  and loss tangent  $\delta = 0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

## &lt;Laptop Extension Kit&gt;

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.

**Picture C.7: Device Holder****Picture C.8: Laptop Extension Kit**

### C.4.5. Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to represent the 90<sup>th</sup> percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness:  $2 \pm 0.2$  mm

Filling Volume: Approx. 25 liters

Dimensions: 810 x 1000 x 500 mm (H x L x W)

Available: Special



**Picture C.9: SAM Twin Phantom**