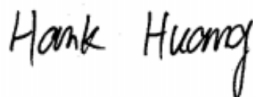


# FCC SAR Test Report

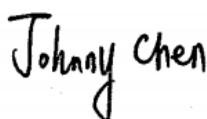
APPLICANT : Motorola Mobility LLC  
EQUIPMENT : Mobile Cellular Phone  
BRAND NAME : Motorola  
MODEL NAME : XT2231-2  
FCC ID : IHDT56AC3  
STANDARD : FCC 47 CFR Part 2 (2.1093)

We, Sporton International Inc. (Shenzhen), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Shenzhen), the test report shall not be reproduced except in full.



Reviewed by: Hank Huang / Supervisor



Approved by: Johnny Chen / Manager



**Sporton International Inc. (Shenzhen)**

**1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055  
People's Republic of China**



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## Revision History

**Sporton International Inc. (Shenzhen)**

Form version. : 200414

## 1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Mobility LLC, Mobile Cellular Phone, XT2231-2**, are as follows.

Highest 1g SAR Summary						
Equipment Class	Frequency Band		Head (Separation 0mm)	Hotspot (Separation 5mm)	Body-worn (Separation 5mm)	Highest Simultaneous Transmission 1g SAR (W/kg)
			1g SAR (W/kg)			
Licensed	GSM	GSM850	0.46	1.30	1.30	1.59
		GSM1900	0.37	1.44	1.37	
	WCDMA	Band V	0.45	1.27	1.27	
		Band II	0.52	1.44	1.32	
	LTE	Band 5	0.45	1.27	1.27	
		Band 7	0.12	1.42	1.34	
		Band 41/Band 38	0.06	1.43	1.43	
DTS	WLAN	2.4GHz WLAN	1.20	0.87	0.87	1.59
NII		5GHz WLAN	0.64	0.67	0.37	1.44
DSS	Bluetooth	2.4GHz Bluetooth	<0.10	0.12	0.12	1.55
Highest 10g SAR Summary						
Equipment Class	Frequency Band		Product Specific 10g SAR (W/kg) (Separation 0mm)		Highest Simultaneous Transmission 10g SAR (W/kg)	
License	GSM	GSM850	2.51		3.94	
		GSM1900	3.54			
	WCDMA	Band V	1.92			
		Band II	3.40			
	LTE	Band 5	1.89			
		Band 7	2.93			
		Band 41/Band 38	3.14			
DTS	WLAN	2.4GHz WLAN	1.52		3.54	
NII		5GHz WLAN	2.02		3.94	
Date of Testing:			2021/12/19 ~ 2022/1/13			
<b>Remark:</b> This device supports both LTE B38 and B41. Since the supported frequency span for LTE B38 falls completely within the supports frequency span for LTE B41, both LTE bands have the same target power, and both LTE bands share the same transmission path; therefore, SAR was only assessed for LTE B41.						

### Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

### Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR, 4.0 W/kg for Product Specific 10g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

## **2. Administration Data**

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Testing Laboratory			
Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR02-SZ	CN1256	421272

Applicant	
Company Name	Motorola Mobility LLC
Address	222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

Manufacturer	
Company Name	Motorola Mobility LLC
Address	222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

## **3. Guidance Applied**

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 616217 D04 SAR for laptop and tablets v01r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05
- FCC KDB 941225 D06 Hotspot Mode SAR v02r01

## **4. Equipment Under Test (EUT) Information**

### **4.1 General Information**

<b>Product Feature &amp; Specification</b>	
<b>Equipment Name</b>	Mobile Cellular Phone
<b>Brand Name</b>	Motorola
<b>Model Name</b>	XT2231-2
<b>FCC ID</b>	IHDT56AC3
<b>IMEI Code</b>	Sample 1: IMEI 1: 356965730022989 IMEI 2: 356965730023821 Sample 2: IMEI 1: 356965730030107 IMEI 2: 356965730030263
<b>Wireless Technology and Frequency Range</b>	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2535 MHz ~ 2655 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC: 13.56 MHz
<b>Mode</b>	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA/HSUPA DC-HSDPA HSPA+ (16QAM uplink is not supported) LTE: QPSK, 16QAM, 64QAM WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE NFC: ASK
<b>HW Version</b>	PVT2
<b>SW Version</b>	STA32.48
<b>GSM / (E)GPRS Transfer mode</b>	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
<b>EUT Stage</b>	Identical Prototype
<b>Remark:</b> 1. 802.11n-HT40 is not supported in 2.4GHz WLAN. 2. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation. 3. This device 2.4GHz WLAN support hotspot operation and Bluetooth support tethering applications. 4. This device 5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.3GHz / 5.5GHz supports WiFi Direct (GC only). 5. This device does not support DTM operation and supports GPRS/EGPRS mode up to multi-slot class 12. 6. The device implements the power management and proximity sensor /receiver detection/hotspot mode for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity) and the details about the power management decision and sensor detection are provided in the operational description. And the device will invoke corresponding work scenarios power level base on frequency bands/antennas, which can refer to power table at appendix E.	

7. There are two different types of EUT. They are single SIM card mobile and dual SIM card mobile. The others are the same including circuit design, PCB board, structure and all components. It is special to declare. After pre-scan two types of EUT, we found test result of the sample that dual SIM was the worst, so we chose dual SIM card mobile to perform all tests.
8. For dual SIM card mobile has two SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (single active). After pre-scan two SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 slot to perform all tests.
9. For some WWAN bands, sensor on reduced power level is higher than hotspot reduced power level, so front/back sensor on SAR can represent hotspot conservatively.
10. There are two samples. The difference between them could be referred to the XT2231-2 \_Operational Description of Product Equality Declaration which is exhibited separately. According to the difference, we choose sample 1 for full testing and sample 2 for worst case verification.
11. The device has three headsets. For three headsets only suppliers are different. So we chose headset 1 to perform full SAR testing only.
12. This device has two batteries. For battery 1 was in sample 1, and battery 2 was in sample 2. They were all evaluated for SAR testing conservatively.

## 4.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05								
FCC ID	IHDT56AC3							
Equipment Name	Mobile Cellular Phone							
Operating Frequency Range of each LTE transmission band	LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2535 MHz ~ 2655 MHz							
Channel Bandwidth	LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz							
uplink modulations used	QPSK / 16QAM / 64QAM							
LTE Voice / Data requirements	Voice and Data							
LTE Release Version	R11, Cat4							
CA Support	Not Supported							
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3							
	Modulation	Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> )						MPR (dB)
		1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
	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
	64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
	64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
	256 QAM	≥ 1						≤ 5
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)							
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.							
Power reduction applied to satisfy SAR compliance	Yes, when operating in Proximity sensors/receiver/hotspot detect mechanism, head/body-worn/hotspot/extremity will trigger reduced power for some WWAN bands applied to satisfy SAR compliance,the detail please referred to section 13.							



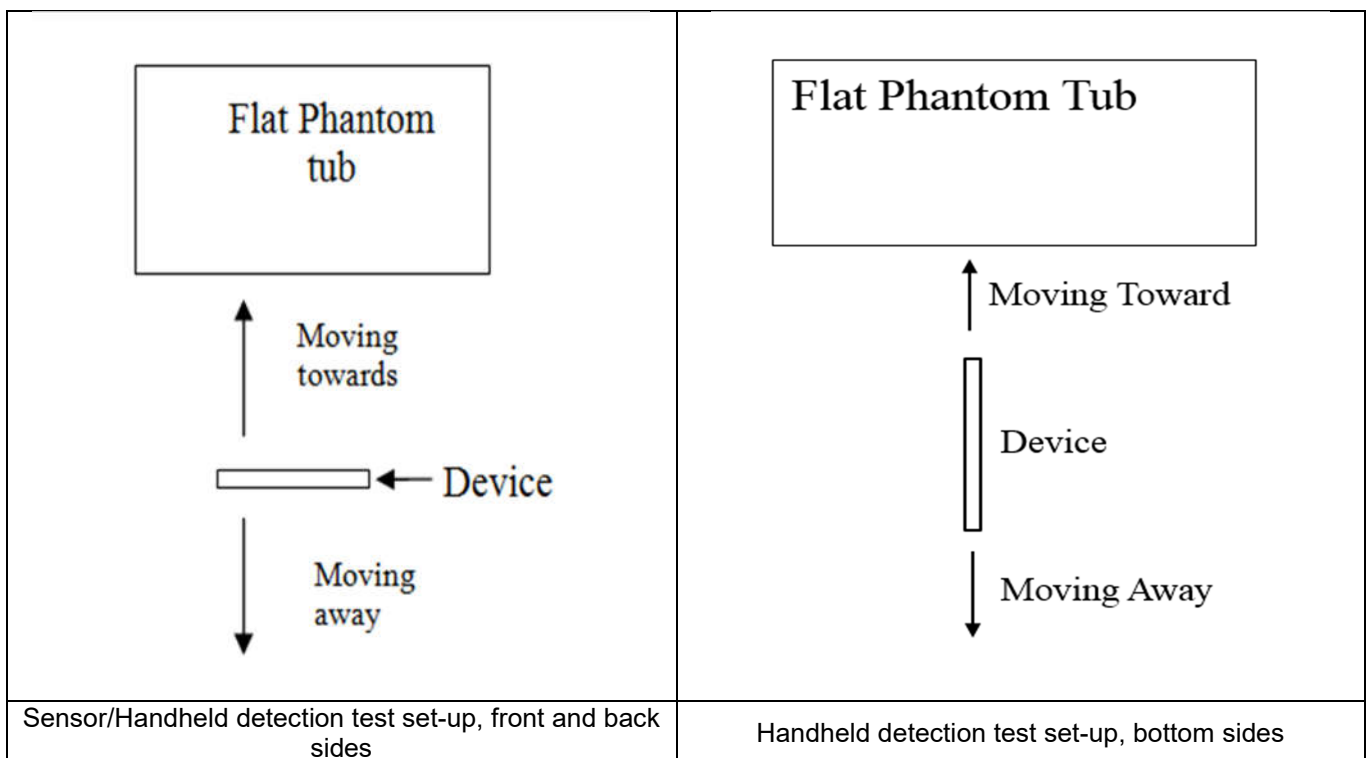
Transmission (H, M, L) channel numbers and frequencies in each LTE band								
LTE Band 5								
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844
LTE Band 7								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

LTE Band 38								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	37775	2572.5	37800	2575	37825	2577.5	37850	2580
M	38000	2595	38000	2595	38000	2595	38000	2595
H	38225	2617.5	38200	2615	38175	2612.5	38150	2610
LTE Band 41								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	40065	2537.5	40090	2540	40115	2542.5	40140	2545
LM	40385	2569.5	40390	2570	40395	2570.5	40400	2571
HM	40705	2601.5	40690	2600	40685	2599.5	40670	2598
H	41215	2652.5	41190	2650	41165	2647.5	41140	2645

## 5. Proximity Sensor Triggering Test

### <Proximity Sensor Triggering Distance>:

1. Proximity sensor triggering distance testing was performed according to the procedures outlined in KDB 616217 D04 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed and the tissue-equivalent medium for highest frequency (5850MHz) and lowest (835MHz) frequency was used for proximity sensor triggering testing.
2. Capacitive proximity sensors placed coincident with antenna elements at the top and bottom ends of the phone are utilized to determine when the device comes in proximity of the user's body at the front or back of the device. The output power will reduce to body worn power level when top and bottom sensor pad be detected.
3. The sensors used to detect the proximity of the user's body at the front or back surface of the device use a detection threshold distance. The data shown in the sections below shows the distance(s). When front or back body worn condition is detected reduced power will be active.
4. The device employs proximity sensors also can detect the presence of the user's a finger or hand when handheld state at the front/back /bottom side of the device. When front/back /bottom side of handheld condition is detected reduced power will be active.
5. For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance -1mm was performed:



**<P-Sensor>**

Proximity Sensor Triggering Distance (mm)				
Position	Front		Back	
	Moving towards	Moving away	Moving towards	Moving away
Minimum	15	15	19	19

**<Handheld for ANT1>**

Proximity Sensor Triggering Distance (mm)						
Position	Front		Back		Bottom Side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	5	5	8	8	14	14

## 6. RF Exposure Limits

### 6.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

### 6.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

**Limits for Occupational/Controlled Exposure (W/kg)**

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

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

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

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

## **7. Specific Absorption Rate (SAR)**

### **7.1 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.

### **7.2 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:

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

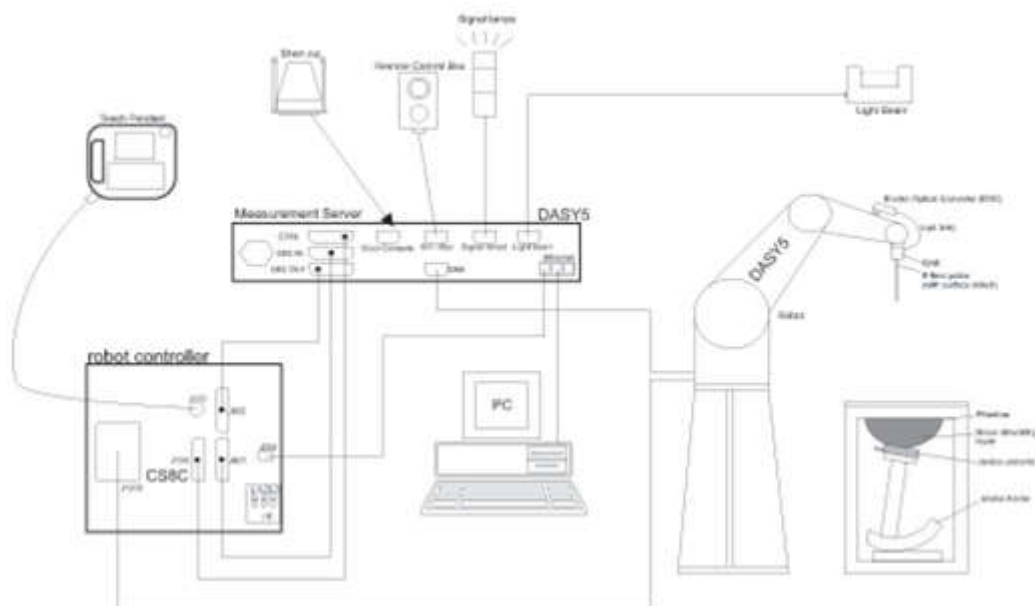
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

## 8. System Description and Setup

The DASY system used for performing compliance tests consists of the following items:




- A standard high precision 6-axis robot 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 or Win7 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.

## 8.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

### <EX3DV4 Probe>

<b>Construction</b>	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
<b>Frequency</b>	10 MHz – >6 GHz Linearity: $\pm 0.2$ dB (30 MHz – 6 GHz)	
<b>Directivity</b>	$\pm 0.3$ dB in TSL (rotation around probe axis) $\pm 0.5$ dB in TSL (rotation normal to probe axis)	
<b>Dynamic Range</b>	10 $\mu$ W/g – >100 mW/g Linearity: $\pm 0.2$ dB (noise: typically <1 $\mu$ W/g)	
<b>Dimensions</b>	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

## 8.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists 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 and 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 input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



**Photo of DAE**


### 8.3 Phantom

#### <SAM Twin Phantom>

<b>Shell Thickness</b>	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
<b>Filling Volume</b>	Approx. 25 liters	
<b>Dimensions</b>	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
<b>Measurement Areas</b>	Left Hand, Right Hand, Flat Phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

#### <ELI Phantom>

<b>Shell Thickness</b>	2 ± 0.2 mm (sagging: <1%)	
<b>Filling Volume</b>	Approx. 30 liters	
<b>Dimensions</b>	Major ellipse axis: 600 mm Minor axis: 400 mm	

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.



## 8.4 Device Holder

### <Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the head, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

### <Mounting Device for Laptops and other Body-Worn Transmitters>

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 positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.



Mounting Device for Laptops

## 9. Measurement Procedures

The measurement procedures are as follows:

### <Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

### <SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix D demonstrates.
- (c) Set scan area, grid size and other setting on the DASY software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

### 9.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

## 9.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

## 9.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	$\leq 3$ GHz	$> 3$ GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	$5 \pm 1$ 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: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$	$\leq 2$ GHz: $\leq 15$ mm $2 - 3$ GHz: $\leq 12$ mm	$3 - 4$ GHz: $\leq 12$ mm $4 - 6$ GHz: $\leq 10$ 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.	

## 9.4 Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

			$\leq 3\text{ GHz}$	$> 3\text{ GHz}$
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			$\leq 2\text{ GHz}: \leq 8\text{ mm}$ $2 - 3\text{ GHz}: \leq 5\text{ mm}^*$	$3 - 4\text{ GHz}: \leq 5\text{ mm}^*$ $4 - 6\text{ GHz}: \leq 4\text{ mm}^*$
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		$\leq 5\text{ mm}$	$3 - 4\text{ GHz}: \leq 4\text{ mm}$ $4 - 5\text{ GHz}: \leq 3\text{ mm}$ $5 - 6\text{ GHz}: \leq 2\text{ mm}$
	graded grid	$\Delta z_{\text{Zoom}}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4\text{ mm}$	$3 - 4\text{ GHz}: \leq 3\text{ mm}$ $4 - 5\text{ GHz}: \leq 2.5\text{ mm}$ $5 - 6\text{ GHz}: \leq 2\text{ mm}$
		$\Delta z_{\text{Zoom}}(n>1)$ : between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq 30\text{ mm}$	$3 - 4\text{ GHz}: \geq 28\text{ mm}$ $4 - 5\text{ GHz}: \geq 25\text{ mm}$ $5 - 6\text{ GHz}: \geq 22\text{ mm}$
Note: $\delta$ 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 <u>area scan based 1-g SAR estimation</u> procedures of KDB 447498 is $\leq 1.4\text{ W/kg}$ , $\leq 8\text{ mm}$ , $\leq 7\text{ mm}$ and $\leq 5\text{ mm}$ zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

## 9.5 Volume Scan Procedures

The volume scan is used to assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

## 9.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

## 10. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d258	2020/5/7	2023/5/6
SPEAG	1900MHz System Validation Kit	D1900V2	5d170	2019/3/26	2022/3/24
SPEAG	2450MHz System Validation Kit	D2450V2	924	2020/9/2	2023/9/1
SPEAG	2600MHz System Validation Kit	D2600V2	1061	2020/11/26	2023/11/25
SPEAG	5000MHz System Validation Kit	D5GHzV2	1113	2019/9/24	2022/9/22
SPEAG	Data Acquisition Electronics	DAE4	1664	2021/3/1	2022/2/28
SPEAG	Dosimetric E-Field Probe	EX3DV4	7641	2021/3/15	2022/3/14
SPEAG	SAM Twin Phantom	QD 000 P40 CD	1670	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio communication analyzer	MT8820C	6201300653	2021/7/14	2022/7/13
Anritsu	Radio communication analyzer	MT8821C	6262314715	2021/6/29	2022/6/28
Anritsu	Radio communication analyzer	MT8821C	6272278319	2021/6/29	2022/6/28
Anritsu	Radio communication analyzer	MT8821C	6201588577	2021/4/8	2022/4/7
Agilent	Wireless Communication Test Set	E5515C	MY50267224	2021/7/14	2022/7/13
Agilent	Network Analyzer	E5071C	MY46523671	2021/10/25	2022/10/24
Speag	Dielectric Assessment KIT	DAK-3.5	1138	2021/6/9	2022/6/8
Agilent	Vector Signal Generator	MG3710A	6201682672	2021/1/7	2022/1/6
Agilent	Signal Generator	N5181A	MY50145381	2021/12/28	2022/12/27
Anritsu	Power Sensor	MA2411B	1306099	2021/9/29	2022/9/28
Anritsu	Power Meter	ML2495A	1349001	2021/9/29	2022/9/28
R&S	Power Sensor	NRP50S	101254	2021/4/9	2022/4/8
R&S	Power Sensor	NRP8S	109228	2021/4/9	2022/4/8
R&S	CBT BLUETOOTH TESTER	CBT	101246	2021/4/12	2022/4/11
R&S	Spectrum Analyzer	FSP7	100818	2021/7/14	2022/7/13
TES	Hygrometer	1310	200505600	2021/7/17	2022/7/16
Anymetre	Thermo-Hygrometer	JR593	2018100801	2021/4/12	2022/4/11
SPEAG	Device Holder	N/A	N/A	N/A	N/A
AR	Amplifier	5S1G4	0333096	Note 1	
mini-circuits	Amplifier	ZVE-3W-83+	599201528	Note 1	
ARRA	Power Divider	A3200-2	N/A	Note 1	
ET Industries	Dual Directional Coupler	C-058-10	N/A	Note 1	
Weinschel	Attenuator 1	3M-10	N/A	Note 1	
Weinschel	Attenuator 2	3M-20	N/A	Note 1	

**Note:**

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check.
2. Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

## 11. System Verification

### 11.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 11.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 11.2.

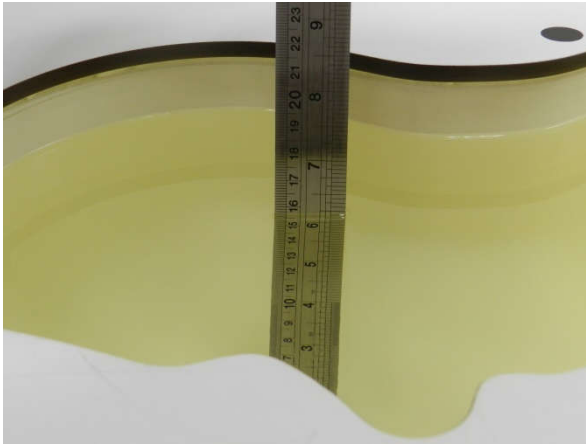


Fig 11.1 Photo of Liquid Height for Head SAR



Fig 11.2 Photo of Liquid Height for Body SAR



## 11.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0

### Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

### <Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Conductivity Target ( $\sigma$ )	Permittivity Target ( $\epsilon_r$ )	Delta ( $\sigma$ ) (%)	Delta ( $\epsilon_r$ ) (%)	Limit (%)	Date
835	Head	22.3	0.904	41.212	0.90	41.50	0.44	-0.69	±5	2021/12/19
835	Head	22.8	0.910	42.653	0.90	41.50	1.11	2.78	±5	2021/12/28
1900	Head	22.6	1.450	40.004	1.40	40.00	3.57	0.01	±5	2021/12/24
1900	Head	22.6	1.453	39.136	1.40	40.00	3.79	-2.16	±5	2021/12/29
2450	Head	22.5	1.822	37.986	1.80	39.20	1.22	-3.10	±5	2021/12/31
2450	Head	22.7	1.823	37.953	1.80	39.20	1.28	-3.18	±5	2022/1/10
2600	Head	22.4	1.974	38.204	1.96	39.00	0.71	-2.04	±5	2021/12/25
2600	Head	22.4	2.053	38.007	1.96	39.00	4.74	-2.55	±5	2021/12/30
5250	Head	22.3	4.588	36.661	4.71	35.95	-2.59	1.98	±5	2022/1/1
5250	Head	22.1	4.748	36.885	4.71	35.95	0.81	2.60	±5	2022/1/13
5600	Head	22.7	5.024	37.007	5.07	35.50	-0.91	4.25	±5	2022/1/1
5600	Head	22.5	5.211	36.230	5.07	35.50	2.78	2.06	±5	2022/1/13
5750	Head	22.5	5.165	36.678	5.22	35.35	-1.05	3.76	±5	2022/1/1
5750	Head	22.1	5.383	35.944	5.22	35.35	3.12	1.68	±5	2022/1/13

### 11.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

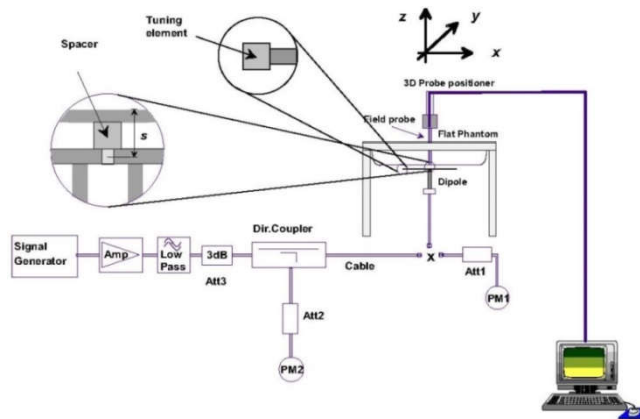
#### <1g SAR>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2021/12/19	835	Head	250	4d258	7641	1664	2.32	9.44	9.28	-1.69
2021/12/28	835	Head	250	4d258	7641	1664	2.19	9.44	8.76	-7.20
2021/12/24	1900	Head	250	5d170	7641	1664	10.00	39.00	40	2.56
2021/12/29	1900	Head	250	5d170	7641	1664	8.99	39.00	35.96	-7.79
2021/12/31	2450	Head	250	924	7641	1664	12.50	51.40	50	-2.72
2022/1/10	2450	Head	250	924	7641	1664	13.00	51.40	52	1.17
2021/12/25	2600	Head	250	1061	7641	1664	14.10	56.60	56.4	-0.35
2021/12/30	2600	Head	250	1061	7641	1664	13.70	56.60	54.8	-3.18
2022/1/1	5250	Head	100	1113	7641	1664	7.69	80.50	76.9	-4.47
2022/1/13	5250	Head	100	1113	7641	1664	8.63	80.50	86.3	7.20
2022/1/1	5600	Head	100	1113	7641	1664	8.03	83.40	80.3	-3.72
2022/1/13	5600	Head	100	1113	7641	1664	9.03	83.40	90.3	8.27
2022/1/1	5750	Head	100	1113	7641	1664	8.11	80.00	81.1	1.37
2022/1/13	5750	Head	100	1113	7641	1664	8.76	80.00	87.6	9.50

#### <10g SAR>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2021/12/19	835	Head	250	4d258	7641	1664	1.51	6.13	6.04	-1.47
2021/12/28	835	Head	250	4d258	7641	1664	1.43	6.13	5.72	-6.69
2021/12/24	1900	Head	250	5d170	7641	1664	5.14	20.30	20.56	1.28
2021/12/29	1900	Head	250	5d170	7641	1664	4.87	20.30	19.48	-4.04
2021/12/31	2450	Head	250	924	7641	1664	5.68	24.00	22.72	-5.33
2022/1/10	2450	Head	250	924	7641	1664	6.04	24.00	24.16	0.67
2021/12/25	2600	Head	250	1061	7641	1664	6.31	25.10	25.24	0.56
2021/12/30	2600	Head	250	1061	7641	1664	6.46	25.10	25.84	2.95
2022/1/1	5250	Head	100	1113	7641	1664	2.33	23.10	23.3	0.87
2022/1/13	5250	Head	100	1113	7641	1664	2.11	23.10	21.1	-8.66
2022/1/1	5600	Head	100	1113	7641	1664	2.59	23.80	25.9	8.82
2022/1/13	5600	Head	100	1113	7641	1664	2.61	23.80	26.1	9.66
2022/1/1	5750	Head	100	1113	7641	1664	2.43	22.80	24.3	6.58
2022/1/13	5750	Head	100	1113	7641	1664	2.42	22.80	24.2	6.14





**Fig 11.3.1 System Performance Check Setup**



**Fig 11.3.2 Setup Photo**

## 12. RF Exposure Positions

### 12.1 Ear and handset reference point

Figure 12.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 12.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 12.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 12.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

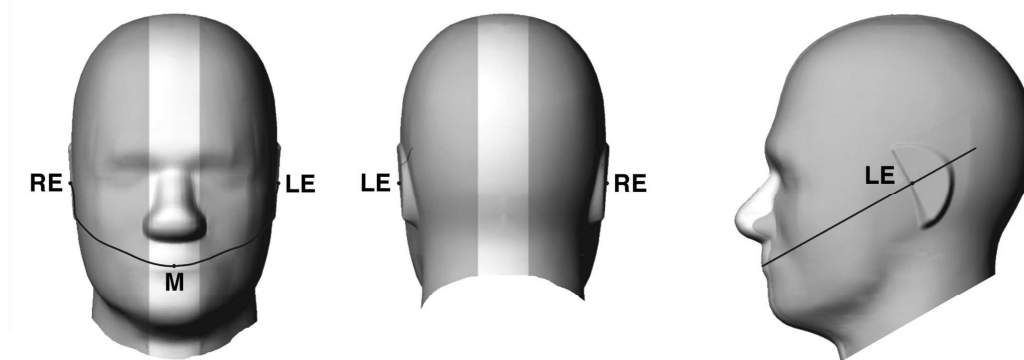


Fig 12.1.1 Front, back, and side views of SAM twin phantom

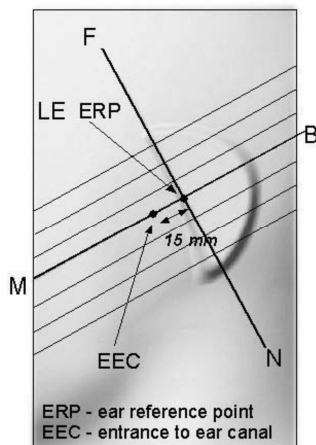


Fig 12.1.2 Close-up side view of phantom showing the ear region.

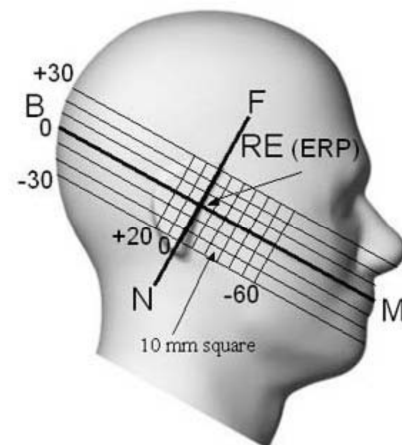


Fig 12.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

## 12.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width  $w_t$  of the handset at the level of the acoustic output (point A in Figure 12.2.1 and Figure 12.2.2), and the midpoint of the width  $w_b$  of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 12.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the handset. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 12.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 12.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 12.2.3. The actual rotation angles should be documented in the test report.

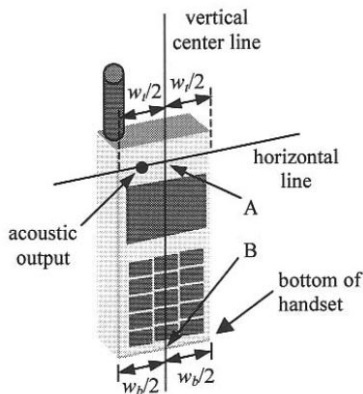


Fig 12.2.1 Handset vertical and horizontal reference lines—"fixed case"

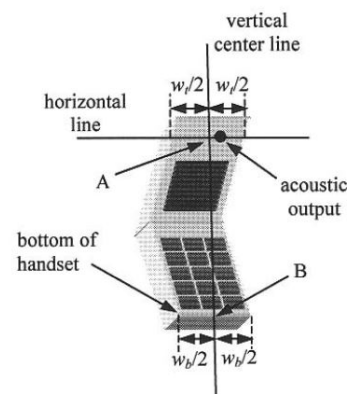


Fig 12.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

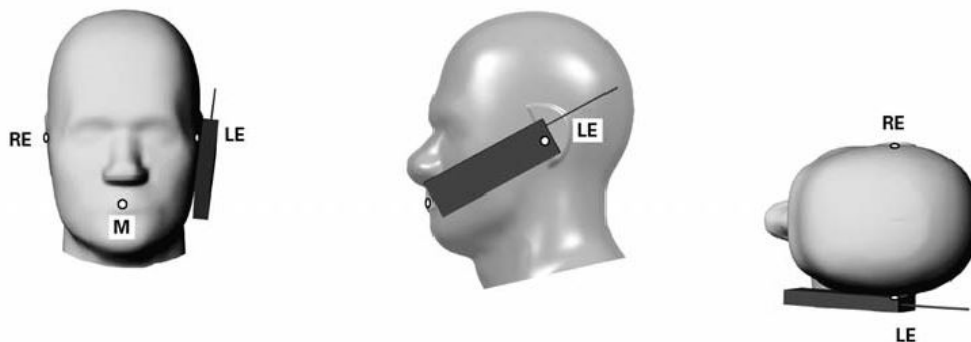


Fig 12.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

### 12.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 12.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

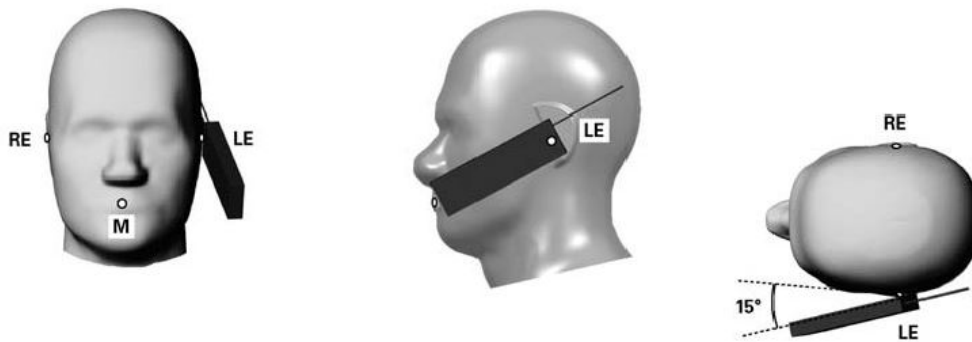


Fig 12.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

## 12.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 12.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is  $> 1.2 \text{ W/kg}$ , the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

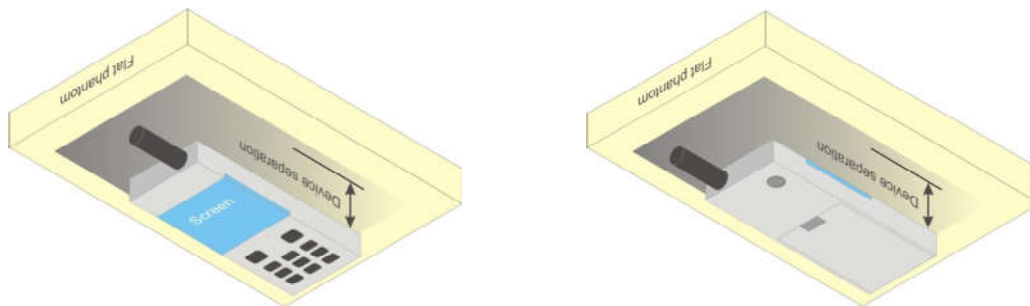


Fig 12.4 Body Worn Position

## 12.5 Product Specific 10g SAR Exposure

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, According to KDB648474 D04v01r03, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance

1. The normally required head and body-worn accessory SAR test procedures for handsets, including hotspot mode, must be applied.
2. The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at  $\leq 25$  mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions.<sup>6</sup> The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

## 12.6 Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets ( $L \times W \geq 9$  cm x 5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

### **13. Conducted RF Output Power (Unit: dBm)**

The detailed conducted power table can refer to Appendix E.

#### **<GSM Conducted Power>**

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01v03r01, for SAR test reduction for GSM / GPRS / EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the GPRS 2Tx slots for GSM850 and GSM1900 are considered as the primary mode.
3. Other configurations of GSM / GPRS / EDGE are considered as secondary modes. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is  $\leq 1/4$  dB higher than the primary mode, SAR measurement is not required for the secondary mode.

#### **<WCDMA Conducted Power>**

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

A summary of these settings are illustrated below:

#### **HSDPA Setup Configuration:**

- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
  - i. Set Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters were set according to each
  - ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
  - iii. Set RMC 12.2Kbps + HSDPA mode.
  - iv. Set Cell Power = -86 dBm
  - v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
  - vi. Select HSDPA Uplink Parameters
  - vii. Set Delta ACK, Delta NACK and Delta CQI = 8
  - viii. Set Ack-Nack Repetition Factor to 3
  - ix. Set CQI Feedback Cycle (k) to 4 ms
  - x. Set CQI Repetition Factor to 2
  - xi. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.



**Table C.10.1.4:  $\beta$  values for transmitter characteristics tests with HS-DPCCH**

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_o/\beta_d$	$\beta_{HS}$ (Note 1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5
<p>Note 1: <math>\Delta_{ACK}</math>, <math>\Delta_{NACK}</math> and <math>\Delta_{CQI} = 30/15</math> with <math>\beta_{HS} = 30/15 * \beta_c</math>.</p> <p>Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, <math>\Delta_{ACK}</math> and <math>\Delta_{NACK} = 30/15</math> with <math>\beta_{HS} = 30/15 * \beta_c</math>, and <math>\Delta_{CQI} = 24/15</math> with <math>\beta_{HS} = 24/15 * \beta_c</math>.</p> <p>Note 3: CM = 1 for <math>\beta_o/\beta_d = 12/15</math>, <math>\beta_{HS}/\beta_c = 24/15</math>. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.</p> <p>Note 4: For subtest 2 the <math>\beta_o/\beta_d</math> ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to <math>\beta_c = 11/15</math> and <math>\beta_d = 15/15</math>.</p>							

**Setup Configuration**



**HSUPA Setup Configuration:**

- The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- The RF path losses were compensated into the measurements.
- A call was established between EUT and Base Station with following setting \* :
  - Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
  - Set the Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
  - Set Cell Power = -86 dBm
  - Set Channel Type = 12.2k + HSPA
  - Set UE Target Power
  - Power Ctrl Mode= Alternating bits
  - Set and observe the E-TFCI
  - Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
- The transmitted maximum output power was recorded.

**Table C.11.1.3:  $\beta$  values for transmitter characteristics tests with HS-DPCCH and E-DCH**

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{HS}$ (Note 1)	$\beta_{EC}$	$\beta_{ed}$ (Note 4) (Note 5)	$\beta_{ed}$ (SF)	$\beta_{ed}$ (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/25	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	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	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4,  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 30/15$  with  $\beta_{hs} = 30/15 * \beta_c$ . For sub-test 5,  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 5/15$  with  $\beta_{hs} = 5/15 * \beta_c$ .

Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the  $\beta_c/\beta_d$  ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 10/15$  and  $\beta_d = 15/15$ .

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5:  $\beta_{ed}$  can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

**Setup Configuration**

**DC-HSDPA 3GPP release 8 Setup Configuration:**

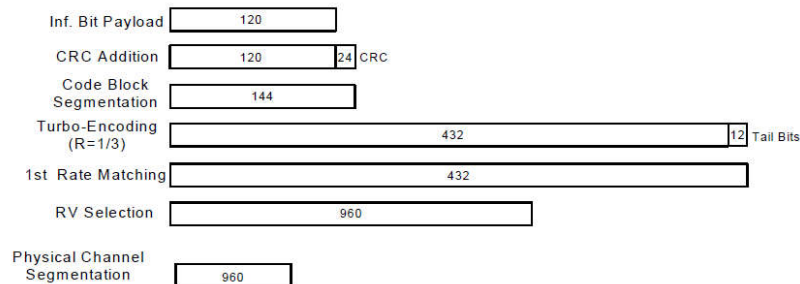
- a. The EUT was connected to Base Station referred to the Setup Configuration below
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
  - i. Set RMC 12.2Kbps + HSDPA mode.
  - ii. Set Cell Power = -25 dBm
  - iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
  - iv. Select HSDPA Uplink Parameters
  - v. Set Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
    - a). Subtest 1:  $\beta_c/\beta_d=2/15$
    - b). Subtest 2:  $\beta_c/\beta_d=12/15$
    - c). Subtest 3:  $\beta_c/\beta_d=15/8$
    - d). Subtest 4:  $\beta_c/\beta_d=15/4$
  - vi. Set Delta ACK, Delta NACK and Delta CQI = 8
  - vii. Set Ack-Nack Repetition Factor to 3
  - viii. Set CQI Feedback Cycle (k) to 4 ms
  - ix. Set CQI Repetition Factor to 2
  - x. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

**C.8.1.12 Fixed Reference Channel Definition H-Set 12**

**Table C.8.1.12: Fixed Reference Channel H-Set 12**

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload ( $N_{INF}$ )	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table.		
Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		



**Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)**

**Setup Configuration**

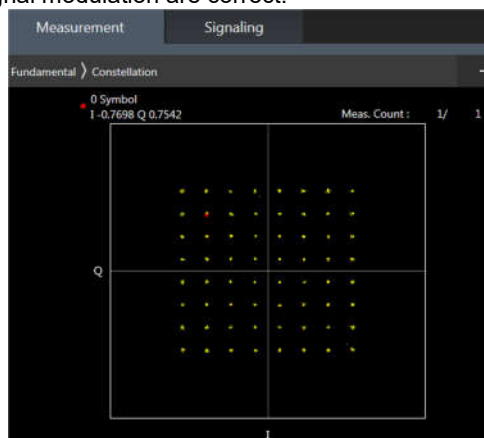
**<WCDMA Conducted Power>****General Note:**

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is  $\leq \frac{1}{4}$  dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA / DC-HSDPA) are less than  $\frac{1}{4}$  dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA

# **<LTE Conducted Power>**

## **General Note:**

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, 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 for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, 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 are  $\leq 0.8$  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.
6. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, 16QAM/64QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. For LTE B5 / B38 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
9. LTE B38 SAR test was covered by B41; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
  - a. the maximum output power, including tolerance, for the smaller band is  $\leq$  the larger band to qualify for the SAR test exclusion
  - b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band
10. According to 2017 TCB workshop, for 64 QAM and 16 QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >> constellation" mode of the device connect to the MT8821C base station, therefore, the device 64QAM and 16QAM signal modulation are correct.



**64QAM**



**16QAM**

### <TDD LTE SAR Measurement>

TDD LTE configuration setup for SAR measurement

SAR was tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

- 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
- “special subframe S” contains both uplink and downlink transmissions, it has been taken into consideration to determine the transmission duty factor according to the worst case uplink and downlink cyclic prefix requirements for UpPTS
- Establishing connections with base station simulators ensure a consistent means for testing SAR and recommended for evaluating SAR. The Anritsu MT8820C (firmware: #22.52#004) was used for LTE output power measurements and SAR testing.

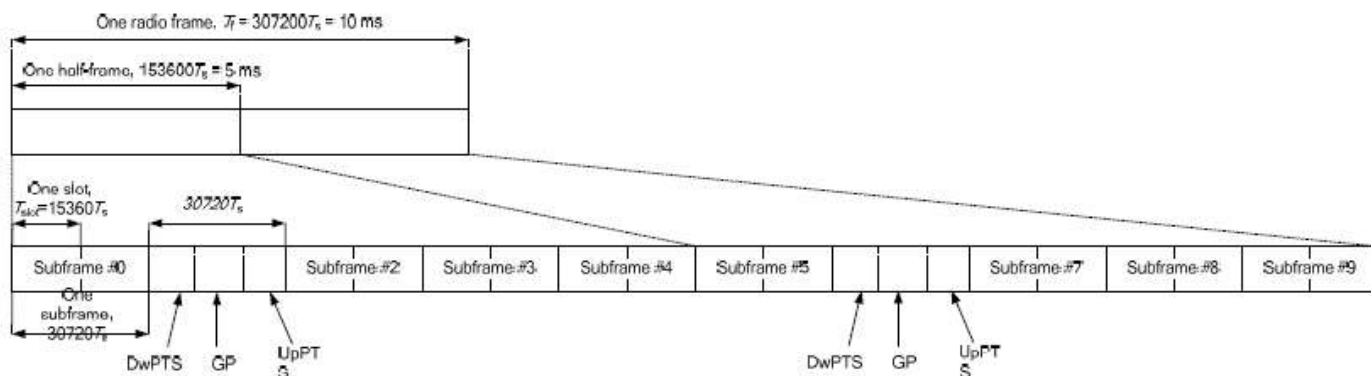


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

Table 4.2-2: Uplink-downlink configurations.

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$			$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$	-	-
8	$24144 \cdot T_s$			-		
9	$13168 \cdot T_s$			-	-	-

Special subframe (30720·T <sub>s</sub> ): Normal cyclic prefix in downlink (UpPTS)			
	Special subframe configuration	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
Uplink duty factor in one special subframe	0~4	7.13%	8.33%
	5~9	14.3%	16.7%

Special subframe(30720·T <sub>s</sub> ): Extended cyclic prefix in downlink (UpPTS)			
	Special subframe configuration	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
Uplink duty factor in one special subframe	0~3	7.13%	8.33%
	4~7	14.3%	16.7%

The highest duty factor is resulted from:

For LTE Band 41 Power class 3

- Uplink-downlink configuration: 0. In a half-frame consisted of 5 subframes, uplink operation is in 3 uplink subframes and 1 special subframe.
- special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink
- for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is:  
 $(3+0.167)/5 = 63.3\%$
- for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is:  
 $(3+0.143)/5 = 62.9\%$
- For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix  $63.3\%/62.9\% = 1.006$  is applied to scale-up the measured SAR result. The scaled TDD LTE SAR = measured SAR (W/kg)\* Tune-up Scaling Factor\* scaling factor for extended cyclic prefix.



**<WLAN Conducted Power>**

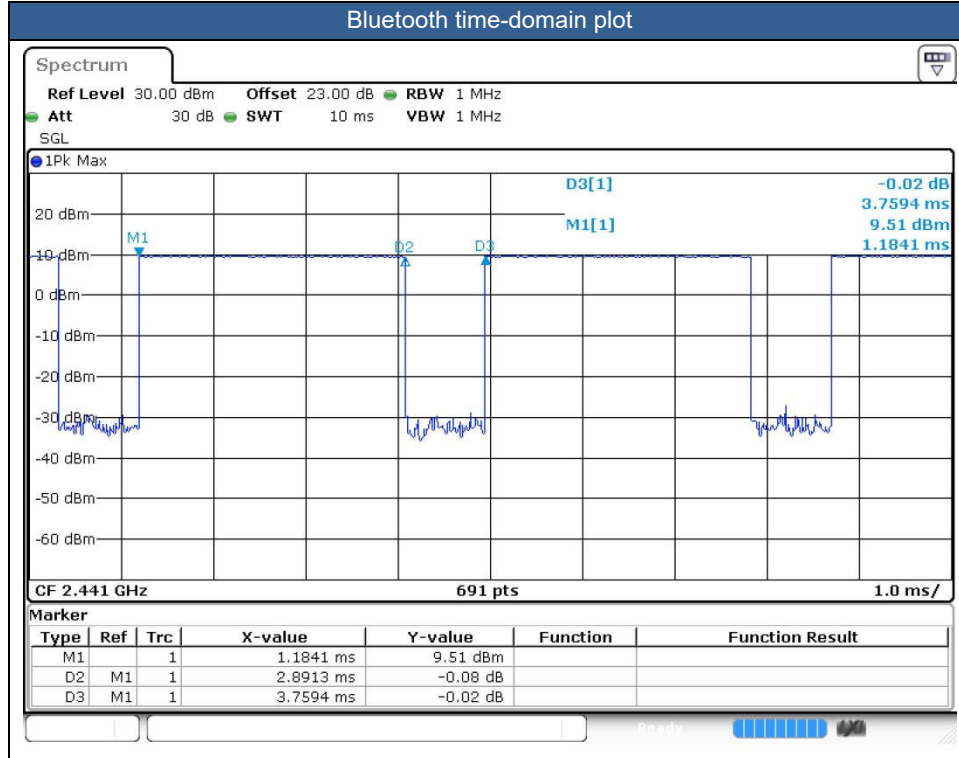
**General Note:**

1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
4. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
  - a. When the reported SAR of the initial test position is  $\leq 0.4$  W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
  - b. When the reported SAR of the test position is  $> 0.4$  W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is  $\leq 0.8$  W/kg or all required test position are tested.
  - c. For all positions/configurations, 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(s) until the reported SAR is  $\leq 1.2$  W/kg or all required channels are tested.

**<2.4GHz Bluetooth>**

**General Note:**

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle is 76.91 % as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the maximum duty cycle is 100%, therefore the actual duty cycle will be scaled up to 100% for Bluetooth reported SAR calculation







## **14. Antenna Location**

The detailed antenna location information can refer to SAR Test Setup Photos.

## 15. SAR Test Results

### General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
  - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
  - b. For SAR testing of BT/WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
  - c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)\*Tune-up Scaling Factor
  - d. For BT/WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)\* Duty Cycle scaling factor \* Tune-up scaling factor
  - e. For TDD LTE SAR measurement of power class 3, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The Reported TDD LTE SAR = measured SAR (W/kg)\* Tune-up Scaling Factor\* scaling factor for extended cyclic prefix.
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
  - $\leq 0.8$  W/kg or  $2.0$  W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
  - $\leq 0.6$  W/kg or  $1.5$  W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
  - $\leq 0.4$  W/kg or  $1.0$  W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is  $\geq 0.8$ W/kg. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
4. The device implements the power management and proximity sensor /receiver detection/hotspot mode for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity) and the details about the power management decision and sensor detection are provided in the operational description. And the device will invoke corresponding work scenarios power level base on frequency bands/antennas, which can refer to power table at appendix E.
5. For some WWAN bands, sensor on reduced power level is higher than hotspot reduced power level, so front/back sensor on SAR can represent hotspot conservatively.
6. For dual SIM card mobile has two SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (single active). After pre-scan two SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 slot to perform all tests.
7. There are two samples. The difference between them could be referred to the XT2231-2 \_Operational Description of Product Equality Declaration which is exhibited separately. According to the difference, we choose sample 1 for full testing and sample 2 for worst case verification.
8. The device has three headsets. For three headsets only suppliers are different. So we chose headset 1 to perform full SAR testing only.
9. This device has two batteries. For battery 1 was in sample 1, and battery 2 was in sample 2. They were all evaluated for SAR testing conservatively.
10. Per KDB648474 D04v01r03, for smart phones with a display diagonal dimension  $> 15.0$  cm or an overall diagonal dimension  $> 16.0$  cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR  $> 1.2$  W/kg, however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.
  - a. For this device SAR for WWAN/WLAN transmitter scaled to maximum output power mode for product specific 10g SAR is higher than 1.2W/kg of GSM850/1900, WCDMA Band II/V, LTE Band5/7/38/41, WLAN 2.4GHz/5.2GHz/5.8GHz, therefore product specific 10g SAR is necessary.
  - b. WLAN 5.3/5.5GHz tested the product specific 10g SAR since it has no hotspot mode.
  - c. When 10-g product specific 10g SAR is considered, SAR thresholds is specified in the procedures for SAR test reduction and exclusion should be multiplied by 2.5.
11. For distance SAR and non-distance SAR in body-worn, always chose higher SAR to do co-located analysis.

**GSM Note:**

1. Per KDB 941225 D01v03r01, for SAR test reduction for GSM / GPRS / EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the GPRS 2Tx slots for GSM850 and GSM1900 are considered as the primary mode.
2. Other configurations of GSM / GPRS / EDGE are considered as secondary modes. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is  $\leq \frac{1}{4}$  dB higher than the primary mode, SAR measurement is not required for the secondary mode.

**WCDMA Note:**

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is  $\leq \frac{1}{4}$  dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA / DC-HSDPA) are less than  $\frac{1}{4}$  dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

**LTE Note:**

1. Per KDB 941225 D05v02r05, 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 for RB offsets at the upper edge, middle and lower edge of each required test channel.
2. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
3. Per KDB 941225 D05v02r05, 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 are  $\leq 0.8$  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.
4. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration is  $> \text{not } \frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, 16QAM/64QAM SAR testing is not required.
5. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is  $> \text{not } \frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
6. For LTE B5 / B38 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
7. LTE B38 SAR test was covered by B41; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
  - a. the maximum output power, including tolerance, for the smaller band is  $\leq$  the larger band to qualify for the SAR test exclusion
  - b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band

**WLAN Note:**

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg.
2. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is  $\leq 1.2$  W/kg, SAR is not required for U-NII-1 band.
3. When the reported SAR of the test position is  $> 0.4$  W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is  $\leq 0.8$  W/kg or all required test position are tested.
4. For all positions / configurations, 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(s) until the reported SAR is  $\leq 1.2$  W/kg or all required channels are tested.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.



## 15.1 Head SAR

### <GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
01	GSM850	GPRS 2 Tx slots	Right Cheek	0mm	Ant 1	Full	251	848.8	1	30.96	32.00	1.271	0.12	0.363	<b>0.461</b>
	GSM850	GPRS 2 Tx slots	Right Cheek	0mm	Ant 1	Full	251	848.8	2	30.96	32.00	1.271	-0.01	0.321	0.408
	GSM850	GPRS 2 Tx slots	Right Tilted	0mm	Ant 1	Full	251	848.8	1	30.96	32.00	1.271	0.04	0.178	0.226
	GSM850	GPRS 2 Tx slots	Left Cheek	0mm	Ant 1	Full	251	848.8	1	30.96	32.00	1.271	0.03	0.309	0.393
	GSM850	GPRS 2 Tx slots	Left Tilted	0mm	Ant 1	Full	251	848.8	1	30.96	32.00	1.271	-0.01	0.187	0.238
02	GSM1900	GPRS 2 Tx slots	Right Cheek	0mm	Ant 1	Full	661	1880	1	27.94	29.50	1.432	-0.07	0.256	<b>0.367</b>
	GSM1900	GPRS 2 Tx slots	Right Tilted	0mm	Ant 1	Full	661	1880	1	27.94	29.50	1.432	0.06	0.120	0.172
	GSM1900	GPRS 2 Tx slots	Left Cheek	0mm	Ant 1	Full	661	1880	1	27.94	29.50	1.432	0.04	0.182	0.261
	GSM1900	GPRS 2 Tx slots	Left Tilted	0mm	Ant 1	Full	661	1880	1	27.94	29.50	1.432	-0.02	0.181	0.259

### <WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
03	WCDMA V	RMC 12.2Kbps	Right Cheek	0mm	Ant 1	Full	4182	836.4	1	22.82	24.00	1.312	0.07	0.344	<b>0.451</b>
	WCDMA V	RMC 12.2Kbps	Right Tilted	0mm	Ant 1	Full	4182	836.4	1	22.82	24.00	1.312	0.09	0.161	0.211
	WCDMA V	RMC 12.2Kbps	Left Cheek	0mm	Ant 1	Full	4182	836.4	1	22.82	24.00	1.312	0.01	0.286	0.375
	WCDMA V	RMC 12.2Kbps	Left Tilted	0mm	Ant 1	Full	4182	836.4	1	22.82	24.00	1.312	-0.03	0.182	0.239
04	WCDMA II	RMC 12.2Kbps	Right Cheek	0mm	Ant 1	Full	9400	1880	1	22.80	24.00	1.318	0.17	0.397	<b>0.523</b>
	WCDMA II	RMC 12.2Kbps	Right Cheek	0mm	Ant 1	Full	9400	1880	2	22.80	24.00	1.318	0.05	0.301	0.397
	WCDMA II	RMC 12.2Kbps	Right Tilted	0mm	Ant 1	Full	9400	1880	1	22.80	24.00	1.318	0.01	0.193	0.254
	WCDMA II	RMC 12.2Kbps	Left Cheek	0mm	Ant 1	Full	9400	1880	1	22.80	24.00	1.318	-0.06	0.288	0.380
	WCDMA II	RMC 12.2Kbps	Left Tilted	0mm	Ant 1	Full	9400	1880	1	22.80	24.00	1.318	0.03	0.290	0.382

### <FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
05	LTE Band 5	10M	QPSK	1	25	Right Cheek	0mm	Ant 1	Full	20525	836.5	1	22.96	24.00	1.271	0.13	0.352	<b>0.447</b>
	LTE Band 5	10M	QPSK	1	25	Right Tilted	0mm	Ant 1	Full	20525	836.5	1	22.96	24.00	1.271	0.15	0.159	0.202
	LTE Band 5	10M	QPSK	1	25	Left Cheek	0mm	Ant 1	Full	20525	836.5	1	22.96	24.00	1.271	-0.16	0.294	0.374
	LTE Band 5	10M	QPSK	1	25	Left Tilted	0mm	Ant 1	Full	20525	836.5	1	22.96	24.00	1.271	0.04	0.174	0.221
	LTE Band 5	10M	QPSK	25	0	Right Cheek	0mm	Ant 1	Full	20525	836.5	1	21.92	23.00	1.282	-0.04	0.248	0.318
	LTE Band 5	10M	QPSK	25	0	Right Tilted	0mm	Ant 1	Full	20525	836.5	1	21.92	23.00	1.282	0.06	0.128	0.164
	LTE Band 5	10M	QPSK	25	0	Left Cheek	0mm	Ant 1	Full	20525	836.5	1	21.92	23.00	1.282	-0.09	0.236	0.303
	LTE Band 5	10M	QPSK	25	0	Left Tilted	0mm	Ant 1	Full	20525	836.5	1	21.92	23.00	1.282	0.07	0.141	0.181
06	LTE Band 7	20M	QPSK	1	49	Right Cheek	0mm	Ant 1	Full	21100	2535	1	22.69	24.00	1.352	0.01	0.086	<b>0.117</b>
	LTE Band 7	20M	QPSK	1	49	Right Tilted	0mm	Ant 1	Full	21100	2535	1	22.69	24.00	1.352	0.03	0.029	0.039
	LTE Band 7	20M	QPSK	1	49	Left Cheek	0mm	Ant 1	Full	21100	2535	1	22.69	24.00	1.352	0.02	0.063	0.085
	LTE Band 7	20M	QPSK	1	49	Left Tilted	0mm	Ant 1	Full	21100	2535	1	22.69	24.00	1.352	0.14	0.043	0.058
	LTE Band 7	20M	QPSK	50	0	Right Cheek	0mm	Ant 1	Full	21100	2535	1	21.46	23.00	1.426	0.11	0.081	0.115
	LTE Band 7	20M	QPSK	50	0	Right Tilted	0mm	Ant 1	Full	21100	2535	1	21.46	23.00	1.426	0.13	0.023	0.033
	LTE Band 7	20M	QPSK	50	0	Left Cheek	0mm	Ant 1	Full	21100	2535	1	21.46	23.00	1.426	-0.12	0.046	0.066
	LTE Band 7	20M	QPSK	50	0	Left Tilted	0mm	Ant 1	Full	21100	2535	1	21.46	23.00	1.426	0.05	0.035	0.050



## &lt;TDD LTE SAR&gt;

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
07	LTE Band 41	20M	QPSK	1	49	Right Cheek	0mm	Ant 1	Full	40400	2571	1	23.33	24.00	1.167	62.9	1.006	0.11	0.053	0.062
	LTE Band 41	20M	QPSK	1	49	Right Tilted	0mm	Ant 1	Full	40400	2571	1	23.33	24.00	1.167	62.9	1.006	0.06	0.017	0.020
	LTE Band 41	20M	QPSK	1	49	Left Cheek	0mm	Ant 1	Full	40400	2571	1	23.33	24.00	1.167	62.9	1.006	0.09	0.047	0.055
	LTE Band 41	20M	QPSK	1	49	Left Tilted	0mm	Ant 1	Full	40400	2571	1	23.33	24.00	1.167	62.9	1.006	-0.08	0.035	0.041
	LTE Band 41	20M	QPSK	50	0	Right Cheek	0mm	Ant 1	Full	40400	2571	1	22.12	23.00	1.225	62.9	1.006	0.04	0.047	0.058
	LTE Band 41	20M	QPSK	50	0	Right Tilted	0mm	Ant 1	Full	40400	2571	1	22.12	23.00	1.225	62.9	1.006	0.01	0.013	0.016
	LTE Band 41	20M	QPSK	50	0	Left Cheek	0mm	Ant 1	Full	40400	2571	1	22.12	23.00	1.225	62.9	1.006	-0.05	0.035	0.043
	LTE Band 41	20M	QPSK	50	0	Left Tilted	0mm	Ant 1	Full	40400	2571	1	22.12	23.00	1.225	62.9	1.006	0.01	0.027	0.033

## &lt;WLAN2.4G SAR&gt;

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Right Cheek	0mm	Ant 3	Full	6	2437	1	19.10	20.00	1.230	99.27	1.007	0.03	0.415	0.514
	WLAN2.4GHz	802.11b 1Mbps	Right Tilted	0mm	Ant 3	Full	6	2437	1	19.10	20.00	1.230	99.27	1.007	-0.06	0.515	0.638
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Ant 3	Full	6	2437	1	19.10	20.00	1.230	99.27	1.007	0.08	0.914	1.132
	WLAN2.4GHz	802.11b 1Mbps	Left Tilted	0mm	Ant 3	Full	6	2437	1	19.10	20.00	1.230	99.27	1.007	0.14	0.902	1.117
08	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Ant 3	Full	11	2462	1	18.90	20.00	1.288	99.27	1.007	0.13	0.924	1.199
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Ant 3	Full	11	2462	2	18.90	20.00	1.288	99.27	1.007	0.12	0.923	1.197

## &lt;WLAN5G SAR&gt;

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN5.3GHz	802.11ac-VHT80 MCS0	Right Cheek	0mm	Ant 3	Reduced	58	5290	1	11.00	12.00	1.259	87.77	1.139	-0.03	0.168	0.241
	WLAN5.3GHz	802.11ac-VHT80 MCS0	Right Tilted	0mm	Ant 3	Reduced	58	5290	1	11.00	12.00	1.259	87.77	1.139	-0.18	0.185	0.265
	WLAN5.3GHz	802.11ac-VHT80 MCS0	Left Cheek	0mm	Ant 3	Reduced	58	5290	1	11.00	12.00	1.259	87.77	1.139	0.07	0.232	0.333
09	WLAN5.3GHz	802.11ac-VHT80 MCS0	Left Tilted	0mm	Ant 3	Reduced	58	5290	1	11.00	12.00	1.259	87.77	1.139	-0.07	0.306	0.439
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Right Cheek	0mm	Ant 3	Reduced	122	5610	1	11.41	12.00	1.146	87.77	1.139	-0.19	0.215	0.281
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Right Tilted	0mm	Ant 3	Reduced	122	5610	1	11.41	12.00	1.146	87.77	1.139	0.14	0.243	0.317
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Left Cheek	0mm	Ant 3	Reduced	122	5610	1	11.41	12.00	1.146	87.77	1.139	0.05	0.270	0.352
10	WLAN5.5GHz	802.11ac-VHT80 MCS0	Left Tilted	0mm	Ant 3	Reduced	122	5610	1	11.41	12.00	1.146	87.77	1.139	0.19	0.295	0.385
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Right Cheek	0mm	Ant 3	Reduced	155	5775	1	10.70	11.50	1.202	87.77	1.139	-0.16	0.278	0.381
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Right Tilted	0mm	Ant 3	Reduced	155	5775	1	10.70	11.50	1.202	87.77	1.139	0.05	0.327	0.448
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Left Cheek	0mm	Ant 3	Reduced	155	5775	1	10.70	11.50	1.202	87.77	1.139	0.07	0.341	0.467
11	WLAN5.8GHz	802.11ac-VHT80 MCS0	Left Tilted	0mm	Ant 3	Reduced	155	5775	1	10.70	11.50	1.202	87.77	1.139	-0.15	0.468	0.641
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Left Tilted	0mm	Ant 3	Reduced	155	5775	2	10.70	11.50	1.202	87.77	1.139	-0.15	0.321	0.440

## &lt;Bluetooth SAR&gt;

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	DH5 1Mbps	Right Cheek	0mm	Ant 3	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	-0.18	0.006	0.011
	Bluetooth	DH5 1Mbps	Right Tilted	0mm	Ant 3	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	0.19	0.001	0.002
12	Bluetooth	DH5 1Mbps	Left Cheek	0mm	Ant 3	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	-0.14	0.033	0.061
	Bluetooth	DH5 1Mbps	Left Tilted	0mm	Ant 3	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	0.04	0.013	0.024





## 15.2 Hotspot SAR

### <GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS 2 Tx slots	Front	5mm	Ant 1	Reduced	251	848.8	1	29.26	30.50	1.330	0.01	0.575	0.765
13	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	Reduced	251	848.8	1	29.26	30.50	1.330	-0.08	0.979	1.303
	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	Reduced	251	848.8	2	29.26	30.50	1.330	0.03	0.869	1.156
	GSM850	GPRS 2 Tx slots	Left Side	5mm	Ant 1	Reduced	251	848.8	1	29.26	30.50	1.330	-0.06	0.296	0.394
	GSM850	GPRS 2 Tx slots	Right Side	5mm	Ant 1	Reduced	251	848.8	1	29.26	30.50	1.330	0.11	0.408	0.543
	GSM850	GPRS 2 Tx slots	Bottom Side	5mm	Ant 1	Reduced	251	848.8	1	29.26	30.50	1.330	0.16	0.491	0.653
	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	Reduced	128	824.2	1	29.21	30.50	1.346	0.08	0.855	1.151
	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	Reduced	189	836.4	1	29.22	30.50	1.343	0.09	0.940	1.262
	GSM1900	GPRS 2 Tx slots	Front	5mm	Ant 1	Reduced	661	1880	1	24.44	26.00	1.432	0.09	0.604	0.865
	GSM1900	GPRS 2 Tx slots	Back	5mm	Ant 1	Reduced	661	1880	1	24.44	26.00	1.432	0.02	0.782	1.120
	GSM1900	GPRS 2 Tx slots	Left Side	5mm	Ant 1	Reduced	661	1880	1	22.99	24.50	1.416	0.08	0.123	0.174
	GSM1900	GPRS 2 Tx slots	Right Side	5mm	Ant 1	Reduced	661	1880	1	22.99	24.50	1.416	-0.03	0.057	0.081
	GSM1900	GPRS 2 Tx slots	Bottom Side	5mm	Ant 1	Reduced	661	1880	1	22.99	24.50	1.416	0.07	0.797	1.128
14	GSM1900	GPRS 2 Tx slots	Bottom Side	5mm	Ant 1	Reduced	512	1850.2	1	22.81	24.50	1.476	0.03	0.977	1.442
	GSM1900	GPRS 2 Tx slots	Bottom Side	5mm	Ant 1	Reduced	512	1850.2	2	22.81	24.50	1.476	0.01	0.647	0.955
	GSM1900	GPRS 2 Tx slots	Bottom Side	5mm	Ant 1	Reduced	810	1909.8	1	22.95	24.50	1.429	-0.04	0.628	0.897
	GSM1900	GPRS 2 Tx slots	Front	5mm	Ant 1	Reduced	512	1850.2	1	24.28	26.00	1.486	0.16	0.782	1.162
	GSM1900	GPRS 2 Tx slots	Front	5mm	Ant 1	Reduced	810	1909.8	1	24.41	26.00	1.442	-0.05	0.487	0.702
	GSM1900	GPRS 2 Tx slots	Back	5mm	Ant 1	Reduced	512	1850.2	1	24.28	26.00	1.486	0.14	0.923	1.372
	GSM1900	GPRS 2 Tx slots	Back	5mm	Ant 1	Reduced	810	1909.8	1	24.41	26.00	1.442	0.11	0.550	0.793

### <WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	5mm	Ant 1	Reduced	4182	836.4	1	22.32	23.50	1.312	0.04	0.484	0.635
15	WCDMA V	RMC 12.2Kbps	Back	5mm	Ant 1	Reduced	4182	836.4	1	22.32	23.50	1.312	-0.11	0.964	1.265
	WCDMA V	RMC 12.2Kbps	Left Side	5mm	Ant 1	Reduced	4182	836.4	1	22.32	23.50	1.312	-0.01	0.279	0.366
	WCDMA V	RMC 12.2Kbps	Right Side	5mm	Ant 1	Reduced	4182	836.4	1	22.32	23.50	1.312	0.06	0.519	0.681
	WCDMA V	RMC 12.2Kbps	Bottom Side	5mm	Ant 1	Reduced	4182	836.4	1	22.32	23.50	1.312	0.03	0.438	0.575
	WCDMA V	RMC 12.2Kbps	Back	5mm	Ant 1	Reduced	4132	826.4	1	22.22	23.50	1.343	0.09	0.937	1.258
	WCDMA V	RMC 12.2Kbps	Back	5mm	Ant 1	Reduced	4233	846.6	1	22.17	23.50	1.358	0.17	0.896	1.217
	WCDMA II	RMC 12.2Kbps	Front	5mm	Ant 1	Reduced	9400	1880	1	18.38	19.50	1.294	0.11	0.666	0.862
	WCDMA II	RMC 12.2Kbps	Back	5mm	Ant 1	Reduced	9400	1880	1	18.38	19.50	1.294	0.05	0.852	1.103
	WCDMA II	RMC 12.2Kbps	Left Side	5mm	Ant 1	Reduced	9400	1880	1	15.49	17.00	1.416	0.01	0.179	0.253
	WCDMA II	RMC 12.2Kbps	Right Side	5mm	Ant 1	Reduced	9400	1880	1	15.49	17.00	1.416	0.09	0.084	0.119
	WCDMA II	RMC 12.2Kbps	Bottom Side	5mm	Ant 1	Reduced	9400	1880	1	15.49	17.00	1.416	0.15	0.758	1.073
16	WCDMA II	RMC 12.2Kbps	Bottom Side	5mm	Ant 1	Reduced	9262	1852.4	1	15.40	17.00	1.445	0.13	0.996	1.440
	WCDMA II	RMC 12.2Kbps	Bottom Side	5mm	Ant 1	Reduced	9538	1907.6	1	15.21	17.00	1.510	-0.04	0.721	1.089
	WCDMA II	RMC 12.2Kbps	Front	5mm	Ant 1	Reduced	9262	1852.4	1	18.37	19.50	1.297	0.06	0.763	0.990
	WCDMA II	RMC 12.2Kbps	Front	5mm	Ant 1	Reduced	9538	1907.6	1	18.33	19.50	1.309	-0.03	0.792	1.037
	WCDMA II	RMC 12.2Kbps	Back	5mm	Ant 1	Reduced	9262	1852.4	1	18.37	19.50	1.297	0.13	0.894	1.160
	WCDMA II	RMC 12.2Kbps	Back	5mm	Ant 1	Reduced	9538	1907.6	1	18.33	19.50	1.309	-0.02	1.010	1.322



<FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1	25	Front	5mm	Ant 1	Reduced	20525	836.5	1	22.46	23.50	1.271	0.07	0.552	0.701
17	LTE Band 5	10M	QPSK	1	25	Back	5mm	Ant 1	Reduced	20525	836.5	1	22.46	23.50	1.271	-0.05	1.000	1.271
	LTE Band 5	10M	QPSK	1	25	Left Side	5mm	Ant 1	Reduced	20525	836.5	1	22.46	23.50	1.271	0.12	0.421	0.535
	LTE Band 5	10M	QPSK	1	25	Right Side	5mm	Ant 1	Reduced	20525	836.5	1	22.46	23.50	1.271	0.09	0.470	0.597
	LTE Band 5	10M	QPSK	1	25	Bottom Side	5mm	Ant 1	Reduced	20525	836.5	1	22.46	23.50	1.271	0.14	0.380	0.483
	LTE Band 5	10M	QPSK	25	0	Front	5mm	Ant 1	Reduced	20525	836.5	1	21.42	22.50	1.282	0.03	0.443	0.568
	LTE Band 5	10M	QPSK	25	0	Back	5mm	Ant 1	Reduced	20525	836.5	1	21.42	22.50	1.282	0.02	0.793	1.017
	LTE Band 5	10M	QPSK	25	0	Left Side	5mm	Ant 1	Reduced	20525	836.5	1	21.42	22.50	1.282	-0.01	0.348	0.446
	LTE Band 5	10M	QPSK	25	0	Right Side	5mm	Ant 1	Reduced	20525	836.5	1	21.42	22.50	1.282	0.11	0.383	0.491
	LTE Band 5	10M	QPSK	25	0	Bottom Side	5mm	Ant 1	Reduced	20525	836.5	1	21.42	22.50	1.282	0.19	0.296	0.380
	LTE Band 5	10M	QPSK	50	0	Back	5mm	Ant 1	Reduced	20525	836.5	1	21.38	22.50	1.294	0.16	0.810	1.048
	LTE Band 7	20M	QPSK	1	49	Front	5mm	Ant 1	Reduced	21100	2535	1	13.31	14.50	1.315	0.08	0.416	0.547
	LTE Band 7	20M	QPSK	1	49	Back	5mm	Ant 1	Reduced	21100	2535	1	13.31	14.50	1.315	-0.12	0.659	0.867
	LTE Band 7	20M	QPSK	1	49	Left Side	5mm	Ant 1	Reduced	21100	2535	1	12.69	14.00	1.352	0.13	0.042	0.057
	LTE Band 7	20M	QPSK	1	49	Right Side	5mm	Ant 1	Reduced	21100	2535	1	12.69	14.00	1.352	-0.15	0.039	0.053
	LTE Band 7	20M	QPSK	1	49	Bottom Side	5mm	Ant 1	Reduced	21100	2535	1	12.69	14.00	1.352	0.01	0.941	1.272
	LTE Band 7	20M	QPSK	1	49	Bottom Side	5mm	Ant 1	Reduced	20850	2510	1	12.33	14.00	1.469	-0.09	0.806	1.184
18	LTE Band 7	20M	QPSK	1	49	Bottom Side	5mm	Ant 1	Reduced	21350	2560	1	12.68	14.00	1.355	0.04	1.050	1.423
	LTE Band 7	20M	QPSK	1	49	Back	5mm	Ant 1	Reduced	20850	2510	1	13.13	14.50	1.371	0.07	0.971	1.331
	LTE Band 7	20M	QPSK	1	49	Back	5mm	Ant 1	Reduced	21350	2560	1	13.29	14.50	1.321	-0.04	1.010	1.335
	LTE Band 7	20M	QPSK	50	0	Front	5mm	Ant 1	Reduced	21100	2535	1	12.34	13.50	1.306	0.03	0.323	0.422
	LTE Band 7	20M	QPSK	50	0	Back	5mm	Ant 1	Reduced	21100	2535	1	12.34	13.50	1.306	0.01	0.525	0.686
	LTE Band 7	20M	QPSK	50	0	Left Side	5mm	Ant 1	Reduced	21100	2535	1	11.78	13.00	1.324	-0.06	0.033	0.044
	LTE Band 7	20M	QPSK	50	0	Right Side	5mm	Ant 1	Reduced	21100	2535	1	11.78	13.00	1.324	0.14	0.029	0.038
	LTE Band 7	20M	QPSK	50	0	Bottom Side	5mm	Ant 1	Reduced	21100	2535	1	11.78	13.00	1.324	-0.03	0.753	0.997
	LTE Band 7	20M	QPSK	50	0	Bottom Side	5mm	Ant 1	Reduced	20850	2510	1	11.58	13.00	1.387	-0.15	0.623	0.864
	LTE Band 7	20M	QPSK	50	0	Bottom Side	5mm	Ant 1	Reduced	21350	2560	1	11.76	13.00	1.330	-0.14	0.808	1.075
	LTE Band 7	20M	QPSK	100	0	Back	5mm	Ant 1	Reduced	21100	2535	1	12.33	13.50	1.309	-0.03	0.524	0.686
	LTE Band 7	20M	QPSK	100	0	Bottom Side	5mm	Ant 1	Reduced	21100	2535	1	11.69	13.00	1.352	-0.14	0.725	0.980



**<TDD LTE SAR>**

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 41	20M	QPSK	1	49	Front	5mm	Ant 1	Reduced	40400	2571	1	15.82	17.00	1.312	62.9	1.006	0.1	0.448	0.591
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	Reduced	40400	2571	1	15.82	17.00	1.312	62.9	1.006	0.18	0.838	1.106
	LTE Band 41	20M	QPSK	1	49	Left Side	5mm	Ant 1	Reduced	40400	2571	1	15.25	16.50	1.334	62.9	1.006	0.15	0.051	0.068
	LTE Band 41	20M	QPSK	1	49	Right Side	5mm	Ant 1	Reduced	40400	2571	1	15.25	16.50	1.334	62.9	1.006	0.01	0.040	0.054
	LTE Band 41	20M	QPSK	1	49	Bottom Side	5mm	Ant 1	Reduced	40400	2571	1	15.25	16.50	1.334	62.9	1.006	-0.09	1.040	1.395
	LTE Band 41	20M	QPSK	1	49	Bottom Side	5mm	Ant 1	Reduced	40140	2545	1	15.20	16.50	1.349	62.9	1.006	0.12	0.996	1.352
19	LTE Band 41	20M	QPSK	1	49	Bottom Side	5mm	Ant 1	Reduced	40670	2598	1	15.05	16.50	1.396	62.9	1.006	0.02	1.020	<b>1.433</b>
	LTE Band 41	20M	QPSK	1	49	Bottom Side	5mm	Ant 1	Reduced	40670	2598	2	15.05	16.50	1.396	62.9	1.006	0.03	0.815	1.145
	LTE Band 41	20M	QPSK	1	49	Bottom Side	5mm	Ant 1	Reduced	41140	2645	1	14.99	16.50	1.416	62.9	1.006	0.05	0.630	0.897
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	Reduced	40140	2545	1	15.78	17.00	1.324	62.9	1.006	-0.07	0.761	1.014
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	Reduced	40670	2598	1	15.77	17.00	1.327	62.9	1.006	-0.07	1.070	1.429
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	Reduced	41140	2645	1	15.62	17.00	1.374	62.9	1.006	-0.15	0.776	1.073
	LTE Band 41	20M	QPSK	50	0	Front	5mm	Ant 1	Reduced	40400	2571	1	14.84	16.00	1.306	62.9	1.006	-0.02	0.366	0.481
	LTE Band 41	20M	QPSK	50	0	Back	5mm	Ant 1	Reduced	40400	2571	1	14.84	16.00	1.306	62.9	1.006	-0.1	0.653	0.858
	LTE Band 41	20M	QPSK	50	0	Left Side	5mm	Ant 1	Reduced	40400	2571	1	14.36	15.50	1.300	62.9	1.006	0.19	0.038	0.050
	LTE Band 41	20M	QPSK	50	0	Right Side	5mm	Ant 1	Reduced	40400	2571	1	14.36	15.50	1.300	62.9	1.006	-0.15	0.027	0.035
	LTE Band 41	20M	QPSK	50	0	Bottom Side	5mm	Ant 1	Reduced	40400	2571	1	14.36	15.50	1.300	62.9	1.006	-0.04	0.815	1.066
	LTE Band 41	20M	QPSK	50	0	Bottom Side	5mm	Ant 1	Reduced	40140	2545	1	14.30	15.50	1.318	62.9	1.006	-0.04	0.769	1.020
	LTE Band 41	20M	QPSK	50	0	Bottom Side	5mm	Ant 1	Reduced	40670	2598	1	14.03	15.50	1.403	62.9	1.006	-0.12	0.758	1.070
	LTE Band 41	20M	QPSK	50	0	Bottom Side	5mm	Ant 1	Reduced	41140	2645	1	14.09	15.50	1.384	62.9	1.006	-0.08	0.525	0.731
	LTE Band 41	20M	QPSK	50	0	Back	5mm	Ant 1	Reduced	40140	2545	1	14.79	16.00	1.321	62.9	1.006	0.02	0.601	0.799
	LTE Band 41	20M	QPSK	50	0	Back	5mm	Ant 1	Reduced	40670	2598	1	14.59	16.00	1.384	62.9	1.006	0.19	0.624	0.869
	LTE Band 41	20M	QPSK	50	0	Back	5mm	Ant 1	Reduced	41140	2645	1	14.63	16.00	1.371	62.9	1.006	-0.02	0.415	0.572
	LTE Band 41	20M	QPSK	100	0	Back	5mm	Ant 1	Reduced	40400	2571	1	14.85	16.00	1.303	62.9	1.006	0.02	0.690	0.905
	LTE Band 41	20M	QPSK	100	0	Bottom Side	5mm	Ant 1	Reduced	40400	2571	1	14.28	15.50	1.324	62.9	1.006	-0.06	0.810	1.079

**<WLAN2.4 SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Front	5mm	Ant 3	Reduced	6	2437	1	17.00	18.00	1.259	99.27	1.007	0.02	0.226	0.287
	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	Ant 3	Reduced	6	2437	1	17.00	18.00	1.259	99.27	1.007	-0.07	0.635	0.805
	WLAN2.4GHz	802.11b 1Mbps	Right Side	5mm	Ant 3	Reduced	6	2437	1	17.00	18.00	1.259	99.27	1.007	-0.13	0.551	0.699
	WLAN2.4GHz	802.11b 1Mbps	Top Side	5mm	Ant 3	Reduced	6	2437	1	17.00	18.00	1.259	99.27	1.007	-0.1	0.311	0.394
20	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	Ant 3	Reduced	11	2462	1	16.80	18.00	1.318	99.27	1.007	0.01	0.654	<b>0.868</b>





**<WLAN5G SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN5.2GHz	802.11ac-VHT80 MCS0	Front	5mm	Ant 3	Reduced	42	5210	1	11.00	12.00	1.259	87.77	1.139	-0.01	0.112	0.161
	WLAN5.2GHz	802.11ac-VHT80 MCS0	Back	5mm	Ant 3	Reduced	42	5210	1	11.00	12.00	1.259	87.77	1.139	0.01	0.162	0.232
	WLAN5.2GHz	802.11ac-VHT80 MCS0	Right Side	5mm	Ant 3	Reduced	42	5210	1	9.70	11.00	1.349	87.77	1.139	0.06	0.062	0.095
21	WLAN5.2GHz	802.11ac-VHT80 MCS0	Top Side	5mm	Ant 3	Reduced	42	5210	1	9.70	11.00	1.349	87.77	1.139	0.16	0.229	<b>0.352</b>
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Front	5mm	Ant 3	Reduced	155	5775	1	11.50	12.50	1.259	87.77	1.139	-0.07	0.151	0.217
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Back	5mm	Ant 3	Reduced	155	5775	1	11.50	12.50	1.259	87.77	1.139	0.04	0.258	0.370
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Right Side	5mm	Ant 3	Reduced	155	5775	1	9.90	11.00	1.288	87.77	1.139	-0.15	0.068	0.100
22	WLAN5.8GHz	802.11ac-VHT80 MCS0	Top Side	5mm	Ant 3	Reduced	155	5775	1	9.90	11.00	1.288	87.77	1.139	0.11	0.458	<b>0.672</b>
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Top Side	5mm	Ant 3	Reduced	155	5775	2	9.90	11.00	1.288	87.77	1.139	0.06	0.421	0.618

**<Bluetooth SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	DH5 1Mbps	Front	5mm	Ant 3	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	0.01	0.012	0.022
23	Bluetooth	DH5 1Mbps	Back	5mm	Ant 3	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	-0.03	0.064	<b>0.118</b>
	Bluetooth	DH5 1Mbps	Right Side	5mm	Ant 3	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	-0.05	0.060	0.110
	Bluetooth	DH5 1Mbps	Top Side	5mm	Ant 3	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	0.09	0.045	0.083



## 15.3 Body Worn Accessory SAR

## &lt;GSM SAR&gt;

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Headset	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS 2 Tx slots	Front	5mm	Ant 1	-	Reduced	251	848.8	1	29.26	30.50	1.330	0.01	0.575	0.765
24	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	-	Reduced	251	848.8	1	29.26	30.50	1.330	-0.08	0.979	1.303
	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	-	Reduced	251	848.8	2	29.26	30.50	1.330	0.03	0.869	1.156
	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	-	Reduced	128	824.2	1	29.21	30.50	1.346	0.08	0.855	1.151
	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	-	Reduced	189	836.4	1	29.22	30.50	1.343	0.09	0.940	1.262
	GSM850	GPRS 2 Tx slots	Back	5mm	Ant 1	Headset	Reduced	251	848.8	1	29.26	30.50	1.330	0.03	0.967	1.287
	GSM850	GPRS 2 Tx slots	Front	14mm	Ant 1	-	Full	251	848.8	1	30.96	32.00	1.271	-0.18	0.314	0.399
	GSM850	GPRS 2 Tx slots	Back	18mm	Ant 1	-	Full	251	848.8	1	30.96	32.00	1.271	0.14	0.344	0.437
	GSM1900	GPRS 2 Tx slots	Front	5mm	Ant 1	-	Reduced	661	1880	1	24.44	26.00	1.432	0.09	0.604	0.865
	GSM1900	GPRS 2 Tx slots	Back	5mm	Ant 1	-	Reduced	661	1880	1	24.44	26.00	1.432	0.02	0.782	1.120
	GSM1900	GPRS 2 Tx slots	Front	5mm	Ant 1	-	Reduced	512	1850.2	1	24.28	26.00	1.486	0.16	0.782	1.162
	GSM1900	GPRS 2 Tx slots	Front	5mm	Ant 1	-	Reduced	810	1909.8	1	24.41	26.00	1.442	-0.05	0.487	0.702
25	GSM1900	GPRS 2 Tx slots	Back	5mm	Ant 1	-	Reduced	512	1850.2	1	24.28	26.00	1.486	0.14	0.923	1.372
	GSM1900	GPRS 2 Tx slots	Back	5mm	Ant 1	-	Reduced	512	1850.2	2	24.28	26.00	1.486	0.01	0.721	1.071
	GSM1900	GPRS 2 Tx slots	Back	5mm	Ant 1	-	Reduced	810	1909.8	1	24.41	26.00	1.442	0.11	0.550	0.793
	GSM1900	GPRS 2 Tx slots	Back	5mm	Ant 1	Headset	Reduced	512	1850.2	1	24.28	26.00	1.486	0.12	0.803	1.193
	GSM1900	GPRS 2 Tx slots	Front	14mm	Ant 1	-	Full	512	1850.2	1	27.83	29.50	1.469	0.06	0.341	0.501
	GSM1900	GPRS 2 Tx slots	Back	18mm	Ant 1	-	Full	512	1850.2	1	27.83	29.50	1.469	-0.06	0.280	0.411

## &lt;WCDMA SAR&gt;

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Headset	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	5mm	Ant 1	-	Reduced	4182	836.4	1	22.32	23.50	1.312	0.04	0.484	0.635
26	WCDMA V	RMC 12.2Kbps	Back	5mm	Ant 1	-	Reduced	4182	836.4	1	22.32	23.50	1.312	-0.11	0.964	1.265
	WCDMA V	RMC 12.2Kbps	Back	5mm	Ant 1	-	Reduced	4132	826.4	1	22.22	23.50	1.343	0.09	0.937	1.258
	WCDMA V	RMC 12.2Kbps	Back	5mm	Ant 1	-	Reduced	4233	846.6	1	22.17	23.50	1.358	0.17	0.896	1.217
	WCDMA V	RMC 12.2Kbps	Back	5mm	Ant 1	Headset	Reduced	4182	836.4	1	22.32	23.50	1.312	0.12	0.942	1.236
	WCDMA V	RMC 12.2Kbps	Front	14mm	Ant 1	-	Full	4182	836.4	1	22.82	24.00	1.312	0.09	0.284	0.373
	WCDMA V	RMC 12.2Kbps	Back	18mm	Ant 1	-	Full	4182	836.4	1	22.82	24.00	1.312	0.04	0.364	0.478
	WCDMA II	RMC 12.2Kbps	Front	5mm	Ant 1	-	Reduced	9400	1880	1	18.38	19.50	1.294	0.11	0.666	0.862
	WCDMA II	RMC 12.2Kbps	Back	5mm	Ant 1	-	Reduced	9400	1880	1	18.38	19.50	1.294	0.05	0.852	1.103
	WCDMA II	RMC 12.2Kbps	Front	5mm	Ant 1	-	Reduced	9262	1852.4	1	18.37	19.50	1.297	0.06	0.763	0.990
	WCDMA II	RMC 12.2Kbps	Front	5mm	Ant 1	-	Reduced	9538	1907.6	1	18.33	19.50	1.309	-0.03	0.792	1.037
	WCDMA II	RMC 12.2Kbps	Back	5mm	Ant 1	-	Reduced	9262	1852.4	1	18.37	19.50	1.297	0.13	0.894	1.160
27	WCDMA II	RMC 12.2Kbps	Back	5mm	Ant 1	-	Reduced	9538	1907.6	1	18.33	19.50	1.309	-0.02	1.010	1.322
	WCDMA II	RMC 12.2Kbps	Back	5mm	Ant 1	Headset	Reduced	9538	1907.6	1	18.33	19.50	1.309	0.09	0.893	1.169
	WCDMA II	RMC 12.2Kbps	Front	14mm	Ant 1	-	Full	9538	1907.6	1	22.63	24.00	1.371	0.06	0.538	0.738
	WCDMA II	RMC 12.2Kbps	Back	18mm	Ant 1	-	Full	9538	1907.6	1	22.63	24.00	1.371	0.04	0.387	0.531



## &lt;FDD LTE SAR&gt;

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Antenna	Headset	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1	25	Front	5mm	Ant 1	-	Reduced	20525	836.5	1	22.46	23.50	1.271	0.07	0.552	0.701
28	LTE Band 5	10M	QPSK	1	25	Back	5mm	Ant 1	-	Reduced	20525	836.5	1	22.46	23.50	1.271	-0.05	1.000	1.271
	LTE Band 5	10M	QPSK	1	25	Back	5mm	Ant 1	Headset	Reduced	20525	836.5	1	22.46	23.50	1.271	0.03	0.992	1.260
	LTE Band 5	10M	QPSK	1	25	Front	14mm	Ant 1	-	Full	20525	836.5	1	22.96	24.00	1.271	0.06	0.302	0.384
	LTE Band 5	10M	QPSK	1	25	Back	18mm	Ant 1	-	Full	20525	836.5	1	22.96	24.00	1.271	-0.04	0.355	0.451
	LTE Band 5	10M	QPSK	25	0	Front	5mm	Ant 1	-	Reduced	20525	836.5	1	21.42	22.50	1.282	0.03	0.443	0.568
	LTE Band 5	10M	QPSK	25	0	Back	5mm	Ant 1	-	Reduced	20525	836.5	1	21.42	22.50	1.282	0.02	0.793	1.017
	LTE Band 5	10M	QPSK	50	0	Back	5mm	Ant 1	-	Reduced	20525	836.5	1	21.38	22.50	1.294	0.16	0.810	1.048
	LTE Band 7	20M	QPSK	1	49	Front	5mm	Ant 1	-	Reduced	21100	2535	1	13.31	14.50	1.315	0.08	0.416	0.547
	LTE Band 7	20M	QPSK	1	49	Back	5mm	Ant 1	-	Reduced	21100	2535	1	13.31	14.50	1.315	-0.12	0.659	0.867
	LTE Band 7	20M	QPSK	1	49	Back	5mm	Ant 1	-	Reduced	20850	2510	1	13.13	14.50	1.371	0.07	0.971	1.331
29	LTE Band 7	20M	QPSK	1	49	Back	5mm	Ant 1	-	Reduced	21350	2560	1	13.29	14.50	1.321	-0.04	1.010	1.335
	LTE Band 7	20M	QPSK	1	49	Back	5mm	Ant 1	Headset	Reduced	21350	2560	1	13.29	14.50	1.321	0.05	0.817	1.079
	LTE Band 7	20M	QPSK	1	49	Front	14mm	Ant 1	-	Full	21100	2535	1	22.69	24.00	1.352	0.04	0.674	0.911
	LTE Band 7	20M	QPSK	1	49	Front	14mm	Ant 1	-	Full	20850	2510	1	22.50	24.00	1.413	0.03	0.589	0.832
	LTE Band 7	20M	QPSK	1	49	Front	14mm	Ant 1	-	Full	21350	2560	1	22.65	24.00	1.365	0.02	0.638	0.871
	LTE Band 7	20M	QPSK	1	49	Back	18mm	Ant 1	-	Full	21350	2560	1	22.65	24.00	1.365	0.02	0.901	1.229
	LTE Band 7	20M	QPSK	50	0	Front	5mm	Ant 1	-	Reduced	21100	2535	1	12.34	13.50	1.306	0.03	0.323	0.422
	LTE Band 7	20M	QPSK	50	0	Back	5mm	Ant 1	-	Reduced	21100	2535	1	12.34	13.50	1.306	0.01	0.525	0.686
	LTE Band 7	20M	QPSK	100	0	Back	5mm	Ant 1	-	Reduced	21100	2535	1	12.33	13.50	1.309	-0.03	0.524	0.686

## &lt;TDD LTE SAR&gt;

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Antenna	Headset	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 41	20M	QPSK	1	49	Front	5mm	Ant 1	-	Reduced	40400	2571	1	15.82	17.00	1.312	62.9	1.006	0.1	0.448	0.591
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	-	Reduced	40400	2571	1	15.82	17.00	1.312	62.9	1.006	0.18	0.838	1.106
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	-	Reduced	40140	2545	1	15.78	17.00	1.324	62.9	1.006	-0.07	0.761	1.014
30	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	-	Reduced	40670	2598	1	15.77	17.00	1.327	62.9	1.006	-0.07	1.070	1.429
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	-	Reduced	40670	2598	2	15.77	17.00	1.327	62.9	1.006	0.03	0.522	0.697
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	-	Reduced	41140	2645	1	15.62	17.00	1.374	62.9	1.006	-0.15	0.776	1.073
	LTE Band 41	20M	QPSK	1	49	Back	5mm	Ant 1	Headset	Reduced	40670	2598	1	15.77	17.00	1.327	62.9	1.006	0.05	0.797	1.064
	LTE Band 41	20M	QPSK	1	49	Front	14mm	Ant 1	-	Full	40400	2571	1	23.33	24.00	1.167	62.9	1.006	-0.01	0.435	0.511
	LTE Band 41	20M	QPSK	1	49	Back	18mm	Ant 1	-	Full	40670	2598	1	22.92	24.00	1.282	62.9	1.006	-0.08	0.431	0.556
	LTE Band 41	20M	QPSK	50	0	Front	5mm	Ant 1	-	Reduced	40400	2571	1	14.84	16.00	1.306	62.9	1.006	-0.02	0.366	0.481
	LTE Band 41	20M	QPSK	50	0	Back	5mm	Ant 1	-	Reduced	40400	2571	1	14.84	16.00	1.306	62.9	1.006	-0.1	0.653	0.858
	LTE Band 41	20M	QPSK	50	0	Back	5mm	Ant 1	-	Reduced	40140	2545	1	14.79	16.00	1.321	62.9	1.006	0.02	0.601	0.799
	LTE Band 41	20M	QPSK	50	0	Back	5mm	Ant 1	-	Reduced	40670	2598	1	14.59	16.00	1.384	62.9	1.006	0.19	0.624	0.869
	LTE Band 41	20M	QPSK	50	0	Back	5mm	Ant 1	-	Reduced	41140	2645	1	14.63	16.00	1.371	62.9	1.006	-0.02	0.415	0.572
	LTE Band 41	20M	QPSK	100	0	Back	5mm	Ant 1	-	Reduced	40400	2571	1	14.85	16.00	1.303	62.9	1.006	0.02	0.690	0.905



**<WLAN2.4G SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Headset	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Front	5mm	Ant 3	-	Reduced	6	2437	1	17.00	18.00	1.259	99.27	1.007	0.02	0.226	0.287
	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	Ant 3	-	Reduced	6	2437	1	17.00	18.00	1.259	99.27	1.007	-0.07	0.635	0.805
31	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	Ant 3	-	Reduced	11	2462	1	16.80	18.00	1.318	99.27	1.007	0.01	0.654	<b>0.868</b>
	WLAN2.4GHz	802.11b 1Mbps	Front	14mm	Ant 3	-	Full	6	2437	1	19.10	20.00	1.230	99.27	1.007	0.01	0.174	0.216
	WLAN2.4GHz	802.11b 1Mbps	Back	18mm	Ant 3	-	Full	6	2437	1	19.10	20.00	1.230	99.27	1.007	-0.12	0.459	0.569

**<WLAN5G SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Headset	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN5.3GHz	802.11ac-VHT80 MCS0	Front	5mm	Ant 3	-	Reduced	58	5290	1	11.00	12.00	1.259	87.77	1.139	0.05	0.145	0.208
32	WLAN5.3GHz	802.11ac-VHT80 MCS0	Back	5mm	Ant 3	-	Reduced	58	5290	1	11.00	12.00	1.259	87.77	1.139	0.01	0.256	<b>0.367</b>
	WLAN5.3GHz	802.11a 6Mbps	Front	14mm	Ant 3	-	Full	56	5280	1	17.48	18.00	1.127	96.97	1.031	0.09	0.134	0.156
	WLAN5.3GHz	802.11a 6Mbps	Back	18mm	Ant 3	-	Full	56	5280	1	17.48	18.00	1.127	96.97	1.031	0.12	0.167	0.194
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Front	5mm	Ant 3	-	Reduced	122	5610	1	11.41	12.00	1.146	87.77	1.139	0.09	0.131	0.171
33	WLAN5.5GHz	802.11ac-VHT80 MCS0	Back	5mm	Ant 3	-	Reduced	122	5610	1	11.41	12.00	1.146	87.77	1.139	0.05	0.218	<b>0.284</b>
	WLAN5.5GHz	802.11a 6Mbps	Front	14mm	Ant 3	-	Full	100	5500	1	16.98	17.50	1.126	96.97	1.031	-0.18	0.125	0.145
	WLAN5.5GHz	802.11a 6Mbps	Back	18mm	Ant 3	-	Full	100	5500	1	16.98	17.50	1.126	96.97	1.031	0.04	0.184	0.214
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Front	5mm	Ant 3	-	Reduced	155	5775	1	11.50	12.50	1.259	87.77	1.139	-0.07	0.151	0.217
34	WLAN5.8GHz	802.11ac-VHT80 MCS0	Back	5mm	Ant 3	-	Reduced	155	5775	1	11.50	12.50	1.259	87.77	1.139	0.04	0.258	<b>0.370</b>
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Back	5mm	Ant 3	-	Reduced	155	5775	2	11.50	12.50	1.259	87.77	1.139	0.01	0.197	0.282
	WLAN5.8GHz	802.11a 6Mbps	Front	14mm	Ant 3	-	Full	149	5745	1	16.81	17.50	1.171	96.97	1.031	0.01	0.074	0.089
	WLAN5.8GHz	802.11a 6Mbps	Back	18mm	Ant 3	-	Full	149	5745	1	16.57	17.50	1.238	96.97	1.031	-0.13	0.178	0.227

**<Bluetooth SAR>**

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Headset	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	DH5 1Mbps	Front	5mm	Ant 3	-	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	0.01	0.012	0.022
35	Bluetooth	DH5 1Mbps	Back	5mm	Ant 3	-	Full	78	2480	1	10.50	12.00	1.413	76.91	1.300	-0.03	0.064	<b>0.118</b>



## 15.4 Product Specific SAR

### <GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	GSM850	GPRS 2 Tx slots	Back	0mm	Ant 1	Reduced	251	848.8	1	30.46	31.50	1.271	0.06	1.770	2.249
36	GSM850	GPRS 2 Tx slots	Back	0mm	Ant 1	Reduced	128	824.2	1	30.43	31.50	1.279	-0.05	1.960	2.508
	GSM850	GPRS 2 Tx slots	Back	0mm	Ant 1	Reduced	128	824.2	2	30.43	31.50	1.279	0.12	1.870	2.392
	GSM850	GPRS 2 Tx slots	Back	0mm	Ant 1	Reduced	189	836.4	1	30.42	31.50	1.282	0.03	1.930	2.475
	GSM850	GPRS 2 Tx slots	Back	7mm	Ant 1	Full	128	824.2	1	30.93	32.00	1.279	0.08	0.560	0.716
	GSM1900	GPRS 2 Tx slots	Front	0mm	Ant 1	Reduced	661	1880	1	27.46	29.00	1.426	0.08	1.120	1.597
	GSM1900	GPRS 2 Tx slots	Back	0mm	Ant 1	Reduced	661	1880	1	27.46	29.00	1.426	0.01	1.850	2.637
	GSM1900	GPRS 2 Tx slots	Bottom Side	0mm	Ant 1	Reduced	661	1880	1	27.46	29.00	1.426	0.06	2.160	3.079
	GSM1900	GPRS 2 Tx slots	Back	0mm	Ant 1	Reduced	512	1850.2	1	27.22	29.00	1.507	-0.05	1.950	2.938
	GSM1900	GPRS 2 Tx slots	Back	0mm	Ant 1	Reduced	810	1909.8	1	27.41	29.00	1.442	-0.17	1.710	2.466
37	GSM1900	GPRS 2 Tx slots	Bottom Side	0mm	Ant 1	Reduced	512	1850.2	1	27.22	29.00	1.507	0.02	2.350	3.541
	GSM1900	GPRS 2 Tx slots	Bottom Side	0mm	Ant 1	Reduced	512	1850.2	2	27.22	29.00	1.507	0.03	1.850	2.787
	GSM1900	GPRS 2 Tx slots	Bottom Side	0mm	Ant 1	Reduced	810	1909.8	1	27.41	29.00	1.442	-0.02	1.930	2.783
	GSM1900	GPRS 2 Tx slots	Front	4mm	Ant 1	Full	661	1880	1	27.94	29.50	1.432	0.01	0.736	1.054
	GSM1900	GPRS 2 Tx slots	Back	7mm	Ant 1	Full	512	1850.2	1	27.83	29.50	1.469	0.04	0.672	0.987
	GSM1900	GPRS 2 Tx slots	Bottom Side	13mm	Ant 1	Full	512	1850.2	1	27.83	29.50	1.469	0.12	0.532	0.781

### <WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
38	WCDMA V	RMC 12.2Kbps	Back	0mm	Ant 1	Full	4182	836.4	1	22.82	24.00	1.312	0.03	1.460	1.916
	WCDMA II	RMC 12.2Kbps	Front	0mm	Ant 1	Reduced	9400	1880	1	20.25	21.50	1.334	0.04	1.490	1.987
	WCDMA II	RMC 12.2Kbps	Back	0mm	Ant 1	Reduced	9400	1880	1	20.25	21.50	1.334	0.07	1.990	2.654
	WCDMA II	RMC 12.2Kbps	Left Side	0mm	Ant 1	Reduced	9400	1880	1	20.25	21.50	1.334	-0.05	0.423	0.564
	WCDMA II	RMC 12.2Kbps	Bottom Side	0mm	Ant 1	Reduced	9400	1880	1	20.25	21.50	1.334	0.09	2.330	3.107
	WCDMA II	RMC 12.2Kbps	Back	0mm	Ant 1	Reduced	9262	1852.4	1	20.20	21.50	1.349	0.01	2.050	2.765
	WCDMA II	RMC 12.2Kbps	Back	0mm	Ant 1	Reduced	9538	1907.6	1	20.18	21.50	1.355	-0.03	1.932	2.618
39	WCDMA II	RMC 12.2Kbps	Bottom Side	0mm	Ant 1	Reduced	9262	1852.4	1	20.20	21.50	1.349	0.11	2.520	3.399
	WCDMA II	RMC 12.2Kbps	Bottom Side	0mm	Ant 1	Reduced	9538	1907.6	1	20.18	21.50	1.355	0.19	2.410	3.266
	WCDMA II	RMC 12.2Kbps	Front	4mm	Ant 1	Full	9400	1880	1	22.80	24.00	1.318	-0.02	1.020	1.345
	WCDMA II	RMC 12.2Kbps	Back	7mm	Ant 1	Full	9262	1852.4	1	22.74	24.00	1.337	-0.13	0.920	1.230
	WCDMA II	RMC 12.2Kbps	Bottom Side	13mm	Ant 1	Full	9262	1852.4	1	22.74	24.00	1.337	0.06	0.555	0.742



<FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
40	LTE Band 5	10M	QPSK	1	25	Back	0mm	Ant 1	Full	20525	836.5	1	22.96	24.00	1.271	0.13	1.490	1.893
	LTE Band 5	10M	QPSK	25	0	Back	0mm	Ant 1	Full	20525	836.5	1	21.92	23.00	1.282	-0.1	1.090	1.398
	LTE Band 7	20M	QPSK	1	49	Front	0mm	Ant 1	Reduced	21100	2535	1	16.84	18.00	1.306	-0.03	1.160	1.515
	LTE Band 7	20M	QPSK	1	49	Back	0mm	Ant 1	Reduced	21100	2535	1	16.84	18.00	1.306	-0.07	1.910	2.495
	LTE Band 7	20M	QPSK	1	49	Bottom Side	0mm	Ant 1	Reduced	21100	2535	1	16.84	18.00	1.306	0.13	1.310	1.711
	LTE Band 7	20M	QPSK	1	49	Back	0mm	Ant 1	Reduced	20850	2510	1	16.51	18.00	1.409	0.1	1.740	2.452
41	LTE Band 7	20M	QPSK	1	49	Back	0mm	Ant 1	Reduced	21350	2560	1	16.74	18.00	1.337	0.01	2.190	2.927
	LTE Band 7	20M	QPSK	1	49	Front	4mm	Ant 1	Full	21100	2535	1	22.69	24.00	1.352	0.16	1.550	2.096
	LTE Band 7	20M	QPSK	1	49	Front	4mm	Ant 1	Full	20850	2510	1	22.50	24.00	1.413	0.12	1.480	2.091
	LTE Band 7	20M	QPSK	1	49	Front	4mm	Ant 1	Full	21350	2560	1	22.65	24.00	1.365	0.03	1.410	1.924
	LTE Band 7	20M	QPSK	1	49	Back	7mm	Ant 1	Full	21350	2560	1	22.65	24.00	1.365	-0.06	1.850	2.524
	LTE Band 7	20M	QPSK	1	49	Bottom Side	13mm	Ant 1	Full	21100	2535	1	22.69	24.00	1.352	-0.15	1.110	1.501
	LTE Band 7	20M	QPSK	50	0	Front	0mm	Ant 1	Reduced	21100	2535	1	15.76	17.00	1.330	0.02	0.954	1.269
	LTE Band 7	20M	QPSK	50	0	Back	0mm	Ant 1	Reduced	21100	2535	1	15.76	17.00	1.330	-0.19	1.510	2.009
	LTE Band 7	20M	QPSK	50	0	Bottom Side	0mm	Ant 1	Reduced	21100	2535	1	15.76	17.00	1.330	-0.01	1.040	1.384
	LTE Band 7	20M	QPSK	50	0	Back	0mm	Ant 1	Reduced	20850	2510	1	15.59	17.00	1.384	-0.01	1.370	1.895
	LTE Band 7	20M	QPSK	50	0	Back	0mm	Ant 1	Reduced	21350	2560	1	15.74	17.00	1.337	-0.09	1.530	2.045
	LTE Band 7	20M	QPSK	100	0	Back	0mm	Ant 1	Reduced	21100	2535	1	15.75	17.00	1.334	-0.19	1.520	2.027

<TDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	LTE Band 41	20M	QPSK	1	49	Front	0mm	Ant 1	Reduced	40400	2571	1	19.96	21.00	1.271	62.9	1.006	0.03	1.126	1.439
42	LTE Band 41	20M	QPSK	1	49	Back	0mm	Ant 1	Reduced	40400	2571	1	19.96	21.00	1.271	62.9	1.006	0.05	2.460	3.144
	LTE Band 41	20M	QPSK	1	49	Back	0mm	Ant 1	Reduced	40400	2571	2	19.96	21.00	1.271	62.9	1.006	0.03	2.100	2.684
	LTE Band 41	20M	QPSK	1	49	Bottom Side	0mm	Ant 1	Reduced	40400	2571	1	19.96	21.00	1.271	62.9	1.006	-0.02	1.135	1.451
	LTE Band 41	20M	QPSK	1	49	Back	0mm	Ant 1	Reduced	40140	2545	1	19.67	21.00	1.358	62.9	1.006	0.17	2.258	3.085
	LTE Band 41	20M	QPSK	1	49	Back	0mm	Ant 1	Reduced	40670	2598	1	19.37	21.00	1.455	62.9	1.006	0.09	1.920	2.811
	LTE Band 41	20M	QPSK	1	49	Back	0mm	Ant 1	Reduced	41140	2645	1	19.42	21.00	1.439	62.9	1.006	0.07	1.400	2.026
	LTE Band 41	20M	QPSK	1	49	Front	4mm	Ant 1	Full	40400	2571	1	23.33	24.00	1.167	62.9	1.006	0.18	0.999	1.173
	LTE Band 41	20M	QPSK	1	49	Back	7mm	Ant 1	Full	40400	2571	1	23.33	24.00	1.167	62.9	1.006	-0.09	1.200	1.409
	LTE Band 41	20M	QPSK	1	49	Bottom Side	13mm	Ant 1	Full	40400	2571	1	23.33	24.00	1.167	62.9	1.006	0.09	0.670	0.786
	LTE Band 41	20M	QPSK	50	0	Front	0mm	Ant 1	Reduced	40400	2571	1	18.81	20.00	1.315	62.9	1.006	-0.16	1.080	1.429
	LTE Band 41	20M	QPSK	50	0	Back	0mm	Ant 1	Reduced	40400	2571	1	18.81	20.00	1.315	62.9	1.006	-0.14	1.780	2.355
	LTE Band 41	20M	QPSK	50	0	Bottom Side	0mm	Ant 1	Reduced	40400	2571	1	18.81	20.00	1.315	62.9	1.006	0.04	1.100	1.455
	LTE Band 41	20M	QPSK	50	0	Back	0mm	Ant 1	Reduced	40140	2545	1	18.79	20.00	1.321	62.9	1.006	0.16	1.820	2.419
	LTE Band 41	20M	QPSK	50	0	Back	0mm	Ant 1	Reduced	40670	2598	1	18.50	20.00	1.413	62.9	1.006	-0.02	1.530	2.174
	LTE Band 41	20M	QPSK	50	0	Back	0mm	Ant 1	Reduced	41140	2645	1	18.54	20.00	1.400	62.9	1.006	-0.11	1.150	1.619
	LTE Band 41	20M	QPSK	100	0	Back	0mm	Ant 1	Reduced	40400	2571	1	18.75	20.00	1.334	62.9	1.006	0.03	1.730	2.321





## &lt;WLAN2.4G SAR&gt;

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
43	WLAN2.4GHz	802.11b 1Mbps	Back	0mm	Ant 3	Full	6	2437	1	19.10	20.00	1.230	99.27	1.007	-0.12	1.230	1.524

## &lt;WLAN5G SAR&gt;

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
44	WLAN5.2GHz	802.11a 6Mbps	Top Side	0mm	Ant 3	Full	40	5200	1	15.89	17.50	1.449	96.97	1.031	-0.09	1.350	2.016
	WLAN5.2GHz	802.11a 6Mbps	Top Side	0mm	Ant 3	Full	40	5200	1	15.89	17.50	1.449	96.97	1.031	-0.07	1.070	1.598
	WLAN5.3GHz	802.11a 6Mbps	Front	0mm	Ant 3	Full	56	5280	1	17.48	18.00	1.127	96.97	1.031	-0.05	0.468	0.544
	WLAN5.3GHz	802.11a 6Mbps	Back	0mm	Ant 3	Full	56	5280	1	17.48	18.00	1.127	96.97	1.031	0.06	0.686	0.797
	WLAN5.3GHz	802.11a 6Mbps	Right Side	0mm	Ant 3	Full	56	5280	1	17.48	18.00	1.127	96.97	1.031	-0.1	0.311	0.361
45	WLAN5.3GHz	802.11a 6Mbps	Top Side	0mm	Ant 3	Full	56	5280	1	17.48	18.00	1.127	96.97	1.031	0.07	1.160	1.348
	WLAN5.5GHz	802.11a 6Mbps	Front	0mm	Ant 3	Full	100	5500	1	16.98	17.50	1.126	96.97	1.031	0.13	0.324	0.376
	WLAN5.5GHz	802.11a 6Mbps	Back	0mm	Ant 3	Full	100	5500	1	16.98	17.50	1.126	96.97	1.031	-0.09	0.564	0.655
	WLAN5.5GHz	802.11a 6Mbps	Right Side	0mm	Ant 3	Full	100	5500	1	16.98	17.50	1.126	96.97	1.031	-0.02	0.253	0.294
46	WLAN5.5GHz	802.11a 6Mbps	Top Side	0mm	Ant 3	Full	100	5500	1	16.98	17.50	1.126	96.97	1.031	0.15	0.941	1.093
47	WLAN5.8GHz	802.11a 6Mbps	Top Side	0mm	Ant 3	Full	149	5745	1	16.81	17.50	1.171	96.97	1.031	-0.16	1.360	1.642





## 15.5 Repeated SAR Measurement

&lt;1g&gt;

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	WLAN2.4GHz	-	-	-	-	802.11b 1Mbps	Left Cheek	0mm	Ant 3	Full	11	2462	1	18.90	20.00	1.288	99.27	1.007	0.13	0.924	1	1.199
2nd	WLAN2.4GHz	-	-	-	-	802.11b 1Mbps	Left Cheek	0mm	Ant 3	Full	11	2462	1	18.90	20.00	1.288	99.27	1.007	0.03	0.912	1.013	1.183
1st	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	5mm	Ant 1	Reduced	9538	1907.6	1	18.33	19.50	1.309	-	-	-0.02	1.010	1	1.322
2nd	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	5mm	Ant 1	Reduced	9538	1907.6	1	18.33	19.50	1.309	-	-	0.06	0.918	1.100	1.202
1st	LTE Band 5	10M	QPSK	1	25	-	Back	5mm	Ant 1	Reduced	20525	836.5	1	22.46	23.50	1.271	-	-	-0.05	1.000	1	1.271
2nd	LTE Band 5	10M	QPSK	1	25	-	Back	5mm	Ant 1	Reduced	20525	836.5	1	22.46	23.50	1.271	-	-	0.19	0.983	1.017	1.249
1st	LTE Band 41	20M	QPSK	1	49	-	Back	5mm	Ant 1	Reduced	40670	2598	1	15.77	17.00	1.327	62.9	1.006	-0.07	1.070	1	1.429
2nd	LTE Band 41	20M	QPSK	1	49	-	Back	5mm	Ant 1	Reduced	40670	2598	1	15.77	17.00	1.327	62.9	1.006	0.05	1.020	1.049	1.362

&lt;10g&gt;

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power Reduction	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Ratio	Reported 10g SAR (W/kg)
1st	WCDMA II	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	Ant 1	Reduced	9262	1852.4	1	20.20	21.50	1.349	-	-	0.11	2.520	1	3.399
2nd	WCDMA II	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	Ant 1	Reduced	9262	1852.4	1	20.20	21.50	1.349	-	-	0.07	2.460	1.024	3.318
1st	LTE Band 41	20M	QPSK	1	49	-	Back	0mm	Ant 1	Reduced	40400	2571	1	19.96	21.00	1.271	62.9	1.006	0.05	2.460	1	3.144
2nd	LTE Band 41	20M	QPSK	1	49	-	Back	0mm	Ant 1	Reduced	40400	2571	1	19.96	21.00	1.271	62.9	1.006	-0.02	2.430	1.012	3.106

## General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8\text{W/kg}$ .
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is  $\leq 1.2$  and the measured SAR  $< 1.45\text{W/kg}$ , only one repeated measurement is required.
3. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
4. The ratio is the difference in percentage between original and repeated *measured SAR*.
5. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

## 16. Simultaneous Transmission Analysis

No.	Simultaneous Transmission Configurations	Portable Handset			
		Head	Body-worn	Hotspot	Product specific 10g SAR
1.	WWAN + WLAN2.4GHz	Yes	Yes	Yes	Yes
2.	WWAN + WLAN5GHz	Yes	Yes	Yes	Yes
3.	WWAN + Bluetooth	Yes	Yes	Yes	Yes

### General Note:

- This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
- EUT will choose each GSM, WCDMA and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
- This device 2.4GHz WLAN support hotspot operation and Bluetooth support tethering applications.
- This device 5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WLAN Direct (GC/GO), and 5.3GHz / 5.5GHz supports WLAN Direct (GC only).
- WIFI 5.3/5.5GHz has no hotspot function.
- The worst case 5 GHz WLAN SAR for each configuration was used for SAR summation.
- WLAN 2.4GHz and Bluetooth share the same antenna so can't transmit simultaneously.
- According to the EUT characteristic, WLAN 5GHz and Bluetooth can't transmit simultaneously.
- The maximum SAR summation is calculated based on the same configuration and test position.
- Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
  - 1g Scalar SAR summation < 1.6W/kg and 10g Scalar SAR summation < 4.0W/kg.
  - $SPLSR = (SAR1 + SAR2)^{1.5} / (\min. \text{ separation distance, mm})$ , and the peak separation distance is determined from the square root of  $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$ , where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
  - If  $SPLSR \leq 0.04$  for 1g SAR and  $SPLSR \leq 0.10$  for 10g SAR, simultaneously transmission SAR measurement is not necessary.
  - Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg and 10g SAR < 4.0W/kg.
  - The SPLSR calculated results please refer to section 16.5.



**16.1 Head Exposure Conditions**

WWAN Band	Exposure Position	1	3	6	9	1+3	1+6	1+9
		WWAN	2.4GHz WLAN Ant 3	5GHz WLAN Ant 3	Bluetooth Ant 3	Summed	Summed	Summed
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
GSM850Ant 1	Right Cheek	0.461	0.514	0.381	0.011	0.98	0.84	0.47
	Right Tilted	0.226	0.638	0.448	0.002	0.86	0.67	0.23
	Left Cheek	0.393	1.199	0.467	0.061	1.59	0.86	0.45
	Left Tilted	0.238	1.117	0.641	0.024	1.36	0.88	0.26
GSM1900Ant 1	Right Cheek	0.367	0.514	0.381	0.011	0.88	0.75	0.38
	Right Tilted	0.172	0.638	0.448	0.002	0.81	0.62	0.17
	Left Cheek	0.261	1.199	0.467	0.061	1.46	0.73	0.32
	Left Tilted	0.259	1.117	0.641	0.024	1.38	0.90	0.28
WCDMA VAnt 1	Right Cheek	0.451	0.514	0.381	0.011	0.97	0.83	0.46
	Right Tilted	0.211	0.638	0.448	0.002	0.85	0.66	0.21
	Left Cheek	0.375	1.199	0.467	0.061	1.57	0.84	0.44
	Left Tilted	0.239	1.117	0.641	0.024	1.36	0.88	0.26
WCDMA IIAnt 1	Right Cheek	0.523	0.514	0.381	0.011	1.04	0.90	0.53
	Right Tilted	0.254	0.638	0.448	0.002	0.89	0.70	0.26
	Left Cheek	0.380	1.199	0.467	0.061	1.58	0.85	0.44
	Left Tilted	0.382	1.117	0.641	0.024	1.50	1.02	0.41
LTE Band 5Ant 1	Right Cheek	0.447	0.514	0.381	0.011	0.96	0.83	0.46
	Right Tilted	0.202	0.638	0.448	0.002	0.84	0.65	0.20
	Left Cheek	0.374	1.199	0.467	0.061	1.57	0.84	0.44
	Left Tilted	0.221	1.117	0.641	0.024	1.34	0.86	0.25
LTE Band 7Ant 1	Right Cheek	0.117	0.514	0.381	0.011	0.63	0.50	0.13
	Right Tilted	0.039	0.638	0.448	0.002	0.68	0.49	0.04
	Left Cheek	0.085	1.199	0.467	0.061	1.28	0.55	0.15
	Left Tilted	0.058	1.117	0.641	0.024	1.18	0.70	0.08
LTE Band 41Ant 1	Right Cheek	0.062	0.514	0.381	0.011	0.58	0.44	0.07
	Right Tilted	0.020	0.638	0.448	0.002	0.66	0.47	0.02
	Left Cheek	0.055	1.199	0.467	0.061	1.25	0.52	0.12
	Left Tilted	0.041	1.117	0.641	0.024	1.16	0.68	0.07



## 16.2 Hotspot Exposure Conditions

WWAN Band	Exposure Position	1	3	6	9	1+3	1+6	1+9	Case No
		WWAN	2.4GHz WLAN Ant 3	5GHz WLAN Ant 3	Bluetooth Ant 3	Summed	Summed	Summed	
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
GSM850Ant 1	Front	0.765	0.287	0.217	0.022	1.05	0.98	0.79	
	Back	1.303	0.868	0.370	0.118	2.17	1.67	1.42	Case 1/8
	Left side	0.394				0.39	0.39	0.39	
	Right side	0.543	0.699	0.100	0.110	1.24	0.64	0.65	
	Top side		0.394	0.672	0.083	0.39	0.67	0.08	
	Bottom side	0.653				0.65	0.65	0.65	
GSM1900Ant 1	Front	1.162	0.287	0.217	0.022	1.45	1.38	1.18	
	Back	1.372	0.868	0.370	0.118	2.24	1.74	1.49	Case 2/9
	Left side	0.174				0.17	0.17	0.17	
	Right side	0.081	0.699	0.100	0.110	0.78	0.18	0.19	
	Top side		0.394	0.672	0.083	0.39	0.67	0.08	
	Bottom side	1.442				1.44	1.44	1.44	
WCDMA VAnt 1	Front	0.635	0.287	0.217	0.022	0.92	0.85	0.66	
	Back	1.265	0.868	0.370	0.118	2.13	1.64	1.38	Case 3/10
	Left side	0.366				0.37	0.37	0.37	
	Right side	0.681	0.699	0.100	0.110	1.38	0.78	0.79	
	Top side		0.394	0.672	0.083	0.39	0.67	0.08	
	Bottom side	0.575				0.58	0.58	0.58	
WCDMA IIAnt 1	Front	1.037	0.287	0.217	0.022	1.32	1.25	1.06	
	Back	1.322	0.868	0.370	0.118	2.19	1.69	1.44	Case 4/11
	Left side	0.253				0.25	0.25	0.25	
	Right side	0.119	0.699	0.100	0.110	0.82	0.22	0.23	
	Top side		0.394	0.672	0.083	0.39	0.67	0.08	
	Bottom side	1.440				1.44	1.44	1.44	
LTE Band 5Ant 1	Front	0.701	0.287	0.217	0.022	0.99	0.92	0.72	
	Back	1.271	0.868	0.370	0.118	2.14	1.64	1.39	Case 5/12
	Left side	0.535				0.54	0.54	0.54	
	Right side	0.597	0.699	0.100	0.110	1.30	0.70	0.71	
	Top side		0.394	0.672	0.083	0.39	0.67	0.08	
	Bottom side	0.483				0.48	0.48	0.48	
LTE Band 7Ant 1	Front	0.547	0.287	0.217	0.022	0.83	0.76	0.57	
	Back	1.335	0.868	0.370	0.118	2.20	1.71	1.45	Case 6/13
	Left side	0.057				0.06	0.06	0.06	
	Right side	0.053	0.699	0.100	0.110	0.75	0.15	0.16	
	Top side		0.394	0.672	0.083	0.39	0.67	0.08	
	Bottom side	1.423				1.42	1.42	1.42	
LTE Band 41Ant 1	Front	0.591	0.287	0.217	0.022	0.88	0.81	0.61	
	Back	1.429	0.868	0.370	0.118	2.30	1.80	1.55	Case 7/14
	Left side	0.068				0.07	0.07	0.07	
	Right side	0.054	0.699	0.100	0.110	0.75	0.15	0.16	
	Top side		0.394	0.672	0.083	0.39	0.67	0.08	
	Bottom side	1.433				1.43	1.43	1.43	



### 16.3 Body-Worn Accessory Exposure Conditions

WWAN Band	Exposure Position	1	3	6	9	1+3	1+6	1+9	Case No
		WWAN	2.4GHz WLAN Ant 3	5GHz WLAN Ant 3	Bluetooth Ant 3	Summed	Summed	Summed	
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
GSM850Ant 1	Front	0.765	0.287	0.217	0.022	1.05	0.98	0.79	
	Back	1.303	0.868	0.370	0.118	<b>2.17</b>	<b>1.67</b>	1.42	<b>Case 1/8</b>
	Front with Headset					0.00	0.00	0.00	
	Back with Headset	1.287				1.29	1.29	1.29	
GSM1900Ant 1	Front	1.162	0.287	0.217	0.022	1.45	1.38	1.18	
	Back	1.372	0.868	0.370	0.118	<b>2.24</b>	<b>1.74</b>	1.49	<b>Case 2/9</b>
	Front with Headset					0.00	0.00	0.00	
	Back with Headset	1.193				1.19	1.19	1.19	
WCDMA VAnt 1	Front	0.635	0.287	0.217	0.022	0.92	0.85	0.66	
	Back	1.265	0.868	0.370	0.118	<b>2.13</b>	<b>1.64</b>	1.38	<b>Case 3/10</b>
	Front with Headset					0.00	0.00	0.00	
	Back with Headset	1.236				1.24	1.24	1.24	
WCDMA II Ant 1	Front	1.037	0.287	0.217	0.022	1.32	1.25	1.06	
	Back	1.322	0.868	0.370	0.118	<b>2.19</b>	<b>1.69</b>	1.44	<b>Case 4/11</b>
	Front with Headset					0.00	0.00	0.00	
	Back with Headset	1.169				1.17	1.17	1.17	
LTE Band 5Ant 1	Front	0.701	0.287	0.217	0.022	0.99	0.92	0.72	
	Back	1.271	0.868	0.370	0.118	<b>2.14</b>	<b>1.64</b>	1.39	<b>Case 5/12</b>
	Front with Headset					0.00	0.00	0.00	
	Back with Headset	1.260				1.26	1.26	1.26	
LTE Band 7Ant 1	Front	0.911	0.287	0.217	0.022	1.20	1.13	0.93	
	Back	1.335	0.868	0.370	0.118	<b>2.20</b>	<b>1.71</b>	1.45	<b>Case 6/13</b>
	Front with Headset					0.00	0.00	0.00	
	Back with Headset	1.079				1.08	1.08	1.08	
LTE Band 41Ant 1	Front	0.591	0.287	0.217	0.022	0.88	0.81	0.61	
	Back	1.429	0.868	0.370	0.118	<b>2.30</b>	<b>1.80</b>	<b>1.55</b>	<b>Case 7/14</b>
	Front with Headset					0.00	0.00	0.00	
	Back with Headset	1.064				1.06	1.06	1.06	

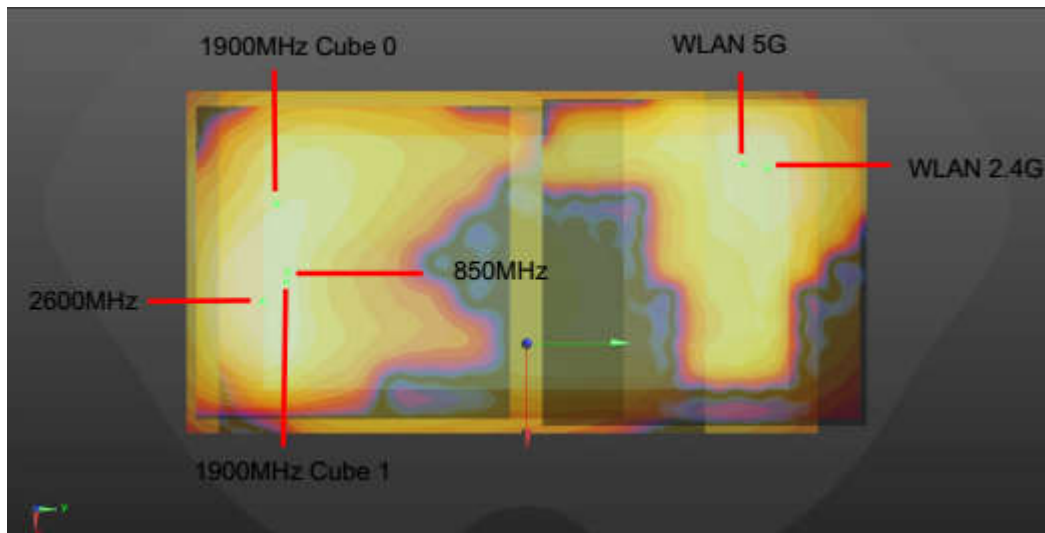
**16.4 Product Specific Exposure Conditions**

WWAN Band		Exposure Position	1	2	5	1+2	1+5	Case No
			WWAN	2.4GHz WLAN Ant 3	5GHz WLAN Ant 3	Summed	Summed	
			10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	
GSM	GSM850Ant 1	Front			0.544	0.00	0.54	
		Back	2.508	1.524	0.797	<b>4.03</b>	3.31	<b>Case 15</b>
		Left side				0.00	0.00	
		Right side			0.361	0.00	0.36	
		Top side			2.016	0.00	2.02	
		Bottom side				0.00	0.00	
	GSM1900Ant 1	Front	1.597		0.544	1.60	2.14	
		Back	2.938	1.524	0.797	<b>4.46</b>	3.74	<b>Case 16</b>
		Left side				0.00	0.00	
		Right side			0.361	0.00	0.36	
		Top side			2.016	0.00	2.02	
		Bottom side	3.541			3.54	3.54	
WCDMA	WCDMA VAnt 1	Front			0.544	0.00	0.54	
		Back	1.916	1.524	0.797	3.44	2.71	
		Left side				0.00	0.00	
		Right side			0.361	0.00	0.36	
		Top side			2.016	0.00	2.02	
		Bottom side				0.00	0.00	
	WCDMA IIAnt 1	Front	1.987		0.544	1.99	2.53	
		Back	2.765	1.524	0.797	<b>4.29</b>	3.56	<b>Case 17</b>
		Left side	0.564			0.56	0.56	
		Right side			0.361	0.00	0.36	
		Top side			2.016	0.00	2.02	
		Bottom side	3.399			3.40	3.40	
LTE	LTE Band 5Ant 1	Front			0.544	0.00	0.54	
		Back	1.893	1.524	0.797	3.42	2.69	
		Left side				0.00	0.00	
		Right side			0.361	0.00	0.36	
		Top side			2.016	0.00	2.02	
		Bottom side				0.00	0.00	
	LTE Band 7Ant 1	Front	2.091		0.544	2.09	2.64	
		Back	2.927	1.524	0.797	<b>4.45</b>	3.72	<b>Case 18</b>
		Left side				0.00	0.00	
		Right side			0.361	0.00	0.36	
		Top side			2.016	0.00	2.02	
		Bottom side	1.711			1.71	1.71	
	LTE Band 41Ant 1	Front	1.439		0.544	1.44	1.98	
		Back	3.144	1.524	0.797	<b>4.67</b>	3.94	<b>Case 19</b>
		Left side				0.00	0.00	
		Right side			0.361	0.00	0.36	
		Top side			2.016	0.00	2.02	
		Bottom side	1.455			1.46	1.46	

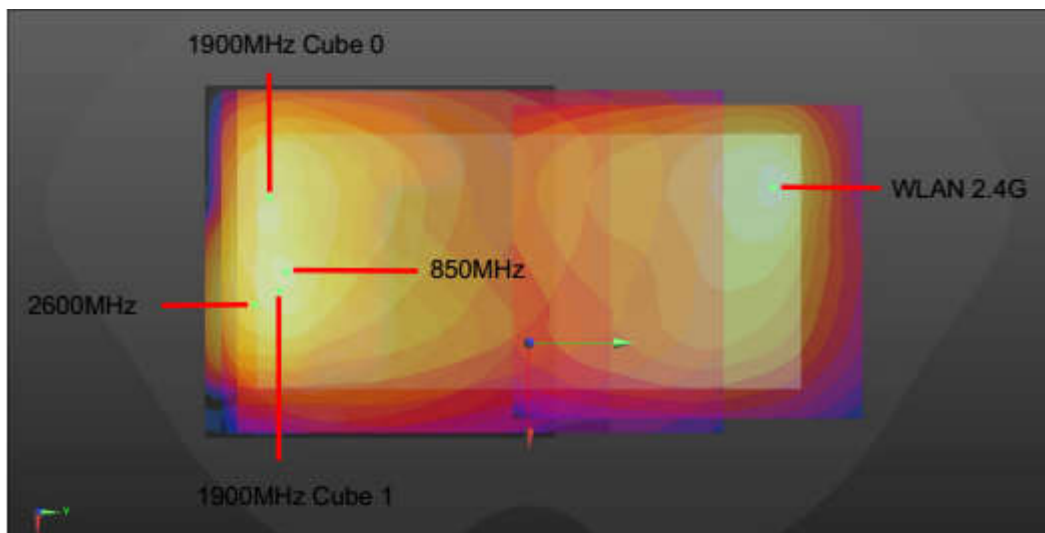
## 16.5 SPLSR Evaluation and Analysis

### General Note:

1. When standalone SAR is measured for both antennas in the pair, the peak location separation distance is computed by the square root of  $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$ , where  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  are the coordinates in the area scans or extrapolated peak SAR locations in the zoom scans, as appropriate.
2.  $SPLSR = (SAR_1 + SAR_2)1.5 / (\text{min. separation distance, mm})$ . If  $SPLSR \leq 0.04$  for 1g SAR and  $SPLSR \leq 0.10$  for 10g SAR, simultaneously transmission SAR measurement is not necessary.



WWAN+WLAN2.4GHz /WLAN5GHz \_Back 5mm



WWAN+ WLAN2.4GHz \_Back 0mm





Case 1	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	GSM850	Back	1.303	5	-0.022	-0.0735	-0.209	151.1	2.17	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
Case 2	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	GSM1900 Cube 0	Back	1.372	5	-0.035	-0.077	-0.209	152.4	2.24	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
	GSM1900 Cube 1	Back	1.372	5	-0.035	-0.074	-0.209	149.4	2.24	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
Case 3	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	WCDMA V	Back	1.265	5	-0.022	-0.072	-0.209	149.6	2.13	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
Case 4	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	WCDMA II Cube 0	Back	1.322	5	-0.01	-0.07	-0.209	150.7	2.19	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
	WCDMA II Cube 1	Back	1.322	5	-0.0445	-0.077	-0.209	151.5	2.19	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
Case 5	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	LTE B5	Back	1.271	5	-0.026	-0.072	-0.209	148.8	2.14	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
Case 6	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	LTE B7	Back	1.335	5	-0.013	-0.0816	-0.209	161.1	2.20	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
Case 7	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	LTE B41	Back	1.429	5	-0.0154	-0.0756	-0.209	154.6	2.30	0.02	Not required
	WLAN 2.4G		0.868	5	-0.0538	0.0742	-0.209				
Case 8	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	GSM850	Back	1.303	5	-0.022	-0.0735	-0.209	145.5	1.67	0.01	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				
Case 9	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	GSM1900 Cube 0	Back	1.372	5	-0.035	-0.077	-0.209	146.5	1.74	0.02	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				
	GSM1900 Cube 1	Back	1.372	5	-0.035	-0.074	-0.209	143.5	1.74	0.02	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				
Case 10	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	WCDMA V	Back	1.265	5	-0.022	-0.072	-0.209	144.1	1.64	0.01	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				
Case 11	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
	WCDMA II Cube 0	Back	1.322	5	-0.01	-0.07	-0.209	145.5	1.69	0.02	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				
	WCDMA II Cube 1	Back	1.322	5	-0.0445	-0.077	-0.209	145.5	1.69	0.02	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				



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Case	Band	Position	SAR (W/kg)	Gap (mm)	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Case 12	LTE B5	Back	1.271	5	-0.026	-0.072	-0.209	143.2	1.64	0.01	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				
Case 13	LTE B7	Back	1.335	5	-0.013	-0.0816	-0.209	155.7	1.71	0.01	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				
Case 14	LTE B41	Back	1.429	5	-0.0154	-0.0756	-0.209	149.2	1.80	0.02	Not required
	WLAN 5G		0.37	5	-0.056	0.068	-0.209				
Case 15	GSM850	Back	2.508	0	-0.03	-0.083	-0.209	158.9	4.03	0.05	Not required
	WLAN 2.4G		1.524	0	-0.0428	0.0754	-0.209				
Case 16	GSM1900 Cube 0	Back	2.938	0	-0.016	-0.077	-0.209	154.7	4.46	0.06	Not required
	WLAN 2.4G		1.524	0	-0.0428	0.0754	-0.209				
	GSM1900 Cube 1	Back	2.938	0	-0.0365	-0.08	-0.209	155.5	4.46	0.06	Not required
	WLAN 2.4G		1.524	0	-0.0428	0.0754	-0.209				
Case 17	WCDMA II Cube 0	Back	2.765	0	-0.0205	-0.076	-0.209	153.0	4.29	0.06	Not required
	WLAN 2.4G		1.524	0	-0.0428	0.0754	-0.209				
	WCDMA II Cube 1	Back	2.765	0	-0.0255	-0.0805	-0.209	156.9	4.29	0.06	Not required
	WLAN 2.4G		1.524	0	-0.0428	0.0754	-0.209				
Case 18	LTE B7	Back	2.927	0	-0.0168	-0.0844	-0.209	161.9	4.45	0.06	Not required
	WLAN 2.4G		1.524	0	-0.0428	0.0754	-0.209				
Case 19	LTE B41	Back	3.144	0	-0.0192	-0.0808	-0.209	158.0	4.67	0.06	Not required
	WLAN 2.4G		1.524	0	-0.0428	0.0754	-0.209				

Test Engineer : Kevin Xu, David Dai, Bin He

## **17. Uncertainty Assessment**

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is  $< 1.5$  W/kg and the measured 10-g SAR within a frequency band is  $< 3.75$  W/kg. The expanded SAR measurement uncertainty must be  $\leq 30\%$ , for a confidence interval of  $k = 2$ . If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

## **18. References**

- [1] FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
- [2] ANSI/IEEE Std. C95.1-1992, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", September 1992
- [3] IEEE Std. 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", Sep 2013
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [6] FCC KDB 865664 D02 v01r02, "RF Exposure Compliance Reporting and Documentation Considerations" Oct 2015.
- [7] FCC KDB 447498 D01 v06, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Oct 2015
- [8] FCC KDB 648474 D04 v01r03, "SAR Evaluation Considerations for Wireless Handsets", Oct 2015.
- [9] FCC KDB 248227 D01 v02r02, "SAR Guidance for IEEE 802.11 (WiFi) Transmitters", Oct 2015.
- [10] FCC KDB 616217 D04 v01r02, "SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers", Oct 2015
- [11] FCC KDB 941225 D01 v03r01, "3G SAR MEAUREMENT PROCEDURES", Oct 2015
- [12] FCC KDB 941225 D05 v02r05, "SAR Evaluation Considerations for LTE Devices", Dec 2015
- [13] FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2015.

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## ***Appendix A. Plots of System Performance Check***

The plots are shown as follows.

## System Check\_835MHz

### DUT: D835V2-SN:4d258

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL\_835\_211219 Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.904$  S/m;  $\epsilon_r = 41.212$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.2 °C; Liquid Temperature : 22.3 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN7641; ConvF(10.9, 10.9, 10.9); Calibrated: 2021/3/15
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2021/3/1
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 3.07 W/kg

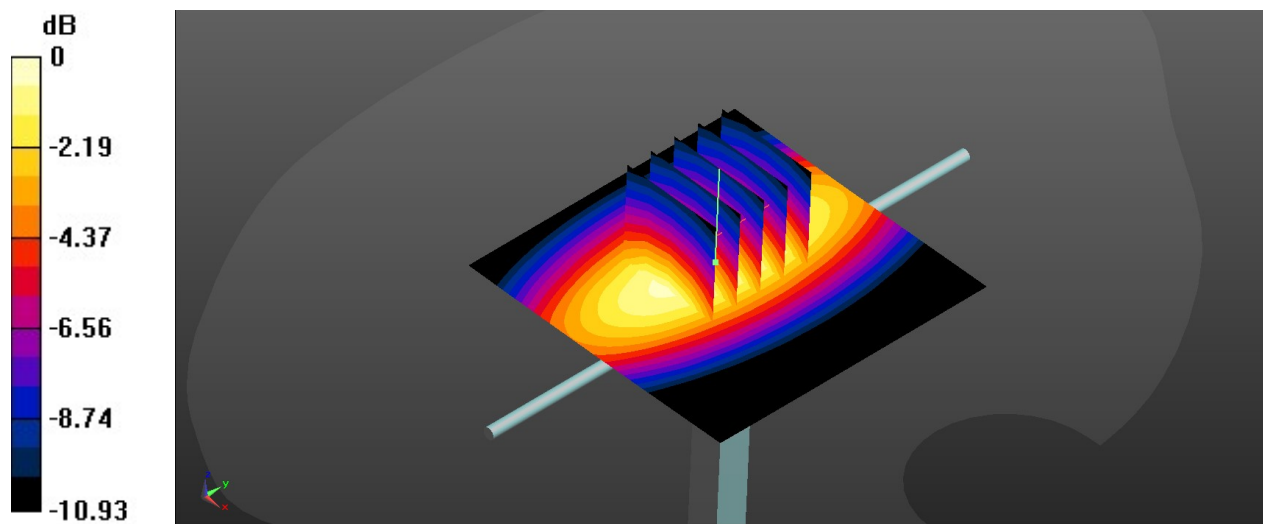
**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 57.67 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 3.51 W/kg

**SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.51 W/kg**

Maximum value of SAR (measured) = 3.12 W/kg



0 dB = 3.12 W/kg