

FCC SAR Test Report

APPLICANT : Motorola Mobility LLC
EQUIPMENT : Mobile Cellular Phone
BRAND NAME : Motorola
MODEL NAME : XT2421-2
FCC ID : IHDT56AR1
STANDARD : FCC 47 CFR Part 2 (2.1093)

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB 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. (Kunshan), the test report shall not be reproduced except in full.



Approved by: Si Zhang

Sporton International Inc. (Kunshan)

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA381717	Rev. 01	Initial issue of report.	Nov. 28, 2023



1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Mobility LLC, Mobile Cellular Phone, XT2421-2**, 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	0.36	1.22	1.22	1.42
		GSM1900	0.25	1.22	1.34	
	WCDMA	Band II	0.48	1.34	1.36	
		Band IV	0.41	1.38	1.24	
		Band V	0.44	1.42	1.42	
	LTE	Band 2	0.60	1.18	1.10	
		Band 7	0.14	1.39	1.27	
		Band 13	0.31	0.92	0.92	
		Band 26/5	0.47	1.13	1.13	
		Band 66/4	0.51	1.30	1.18	
	Band 38	0.14	1.18	1.22		
DTS	WLAN	2.4GHz WLAN	1.34	0.74	1.42	1.42
NII		5GHz WLAN	1.11	0.76	1.12	1.39
DSS	Bluetooth	2.4GHz Bluetooth	0.12	0.11	0.11	1.39

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	2.67	3.91
		GSM1900	1.51	
	WCDMA	Band II	2.08	
		Band IV	1.19	
		Band V	2.13	
	LTE	Band 2	1.85	
		Band 7	0.41	
		Band 66/4	1.07	
		Band 38	0.42	
	DTS	WLAN	2.4GHz WLAN	
NII	5GHz WLAN		1.03	3.91

Date of Testing: 2023/10/30 ~ 2023/11/20

Remark: This device supports LTE B4 / B5 and B66 / B26. Since the supported frequency span for LTE B4 / B5 falls completely within the supports frequency span for LTE B66 / B26, both LTE bands have the same target power, and both LTE bands share the same transmission path; therefore, SAR was only assessed for LTE B66 / B26.

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. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR02-KS	CN1257	314309

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

Product Feature & Specification	
Equipment Name	Mobile Cellular Phone
Brand Name	Motorola
Model Name	XT2421-2
FCC ID	IHDT56AR1
IMEI Code	Sample 1: 351113350007452 Sample 2: 350173910009472 Sample 3: 351113350011058
Wireless Technology and Frequency Range	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 38: 2570 MHz ~ 2620 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 ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA/HSUPA DC-HSDPA HSPA+ (16QAM uplink is not supported) LTE: QPSK, 16QAM WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n/ac HT20/VHT20 Bluetooth BR/EDR/LE
HW Version	DVT2
SW Version	ULA34.53
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype
Remark:	
<ol style="list-style-type: none"> This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation. 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 WiFi Direct (GC/GO), and 5.3GHz / 5.5GHz supports WiFi Direct (GC only). This device does not support DTM operation and supports GPRS/EGPRS mode up to multi-slot class 12. 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). There are two different types of EUT. They are single SIM card mobile and dual SIM card mobile. The difference that is only SIM Slots, all the other are same, so chose single SIM card to perform all the testing. The device implements receiver detect mechanism/hotspot trigger reduced power for the power management for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity). The device will invoke corresponding work scenarios power level base on frequency bands/antennas, which can refer to appendix E. 	



8. There are three samples. The difference between them could be referred to the XT2421-2_Operational Description of Product Equality Declaration which is exhibited separately. According to the difference, sample 1 was chosen to perform full SAR testing and sample 2/3 verified the worst case of sample 1.
9. The device has two headsets. Only suppliers are different, so chose one headset was chosen to perform full SAR testing.

4.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05																																																															
FCC ID	IHDT56AR1																																																														
Equipment Name	Mobile Cellular Phone																																																														
Operating Frequency Range of each LTE transmission band	LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 38: 2570 MHz ~ 2620 MHz																																																														
Channel Bandwidth	LTE Band 2: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 4: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 5: 1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 13: 5MHz, 10MHz LTE Band 26: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 66: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz																																																														
uplink modulations used	QPSK / 16QAM																																																														
LTE Voice / Data requirements	Voice and Data																																																														
LTE Release Version	R12, Cat4																																																														
CA Support	Not Supported																																																														
LTE MPR permanently built-in by design	<p>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3</p> <table border="1"> <thead> <tr> <th rowspan="2">Modulation</th> <th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th> <th rowspan="2">MPR (dB)</th> </tr> <tr> <th>1.4 MHz</th> <th>3.0 MHz</th> <th>5 MHz</th> <th>10 MHz</th> <th>15 MHz</th> <th>20 MHz</th> </tr> </thead> <tbody> <tr> <td>QPSK</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>≤ 5</td> <td>≤ 4</td> <td>≤ 8</td> <td>≤ 12</td> <td>≤ 16</td> <td>≤ 18</td> <td>≤ 1</td> </tr> <tr> <td>64 QAM</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 18</td> <td>≤ 2</td> </tr> <tr> <td>256 QAM</td> <td>≤ 5</td> <td>≤ 4</td> <td>≤ 8</td> <td>≤ 12</td> <td>≤ 16</td> <td>≤ 18</td> <td>≤ 2</td> </tr> <tr> <td>64 QAM</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 18</td> <td>≤ 3</td> </tr> <tr> <td>256 QAM</td> <td colspan="6" style="text-align: center;">≥ 1</td> <td>≤ 5</td> </tr> </tbody> </table>	Modulation	Channel bandwidth / Transmission bandwidth (N _{RB})						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	64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2	256 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2	64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3	256 QAM	≥ 1						≤ 5
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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 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 12.																																																														



Transmission (H, M, L) channel numbers and frequencies in each LTE band																
LTE Band 2																
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)				
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860				
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880				
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900				
LTE Band 4																
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)				
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720				
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5				
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745				
LTE Band 5																
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (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	20450	829	20450	829				
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5	20525	836.5	20525	836.5				
H	20643	848.3	20635	847.5	20625	846.5	20600	844	20600	844	20600	844				
LTE Band 7																
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)				
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510	20850	2510	20850	2510				
M	21100	2535	21100	2535	21100	2535	21100	2535	21100	2535	21100	2535				
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560	21350	2560	21350	2560				
LTE Band 13																
	Bandwidth 5 MHz				Bandwidth 10 MHz				Bandwidth 10 MHz				Bandwidth 10 MHz			
	Channel #		Freq. (MHz)		Channel #		Freq. (MHz)		Channel #		Freq. (MHz)		Channel #		Freq. (MHz)	
L	23205		779.5		23230		782		23230		782		23230		782	
M	23230		782		23230		782		23230		782		23230		782	
H	23255		784.5		23230		782		23230		782		23230		782	
LTE Band 26																
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)				
L	26697	814.7	26705	815.5	26715	816.5	26740	819	26740	819	26765	821.5				
M	26865	831.5	26865	831.5	26865	831.5	26865	831.5	26865	831.5	26865	831.5				
H	27033	848.3	27025	847.5	27015	846.5	26990	844	26990	844	26965	841.5				
LTE Band 38																
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)				
L	37775	2572.5	37800	2575	37825	2577.5	37850	2580	37850	2580	37850	2580				
M	38000	2595	38000	2595	38000	2595	38000	2595	38000	2595	38000	2595				
H	38225	2617.5	38200	2615	38175	2612.5	38150	2610	38150	2610	38150	2610				
LTE Band 66																
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)				
L	131979	1710.7	131987	1711.5	131997	1712.5	132022	1715	132047	1717.5	132072	1720				
M	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745				
H	132665	1779.3	132657	1778.5	132647	1777.5	132622	1775	132597	1772.5	132572	1770				



<For LTE Overlap Bands Description>

1) LTE Bands BW

Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
LTE Band 4	Yes	Yes	Yes	Yes	Yes	Yes
LTE Band 66	Yes	Yes	Yes	Yes	Yes	Yes
LTE Band 5	Yes	Yes	Yes	Yes		
LTE Band 26	Yes	Yes	Yes	Yes	Yes	

2) LTE Bands tune up:

Band	Antenna	Head Tune-up Limit	Body Worn Extremity Tune-up Limit	Hotspot Tune-up Limit	Default Tune-up Limit
LTE Band 4	Ant 1	24.0	18.5	18.0	24.0
LTE Band 66	Ant 1	24.0	18.5	18.0	24.0
LTE Band 5	Ant 1	24.0	24.0	24.0	24.0
LTE Band 26	Ant 1	24.0	24.0	24.0	24.0



5. RF Exposure Limits

5.1 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.

5.2 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.

6. Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

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

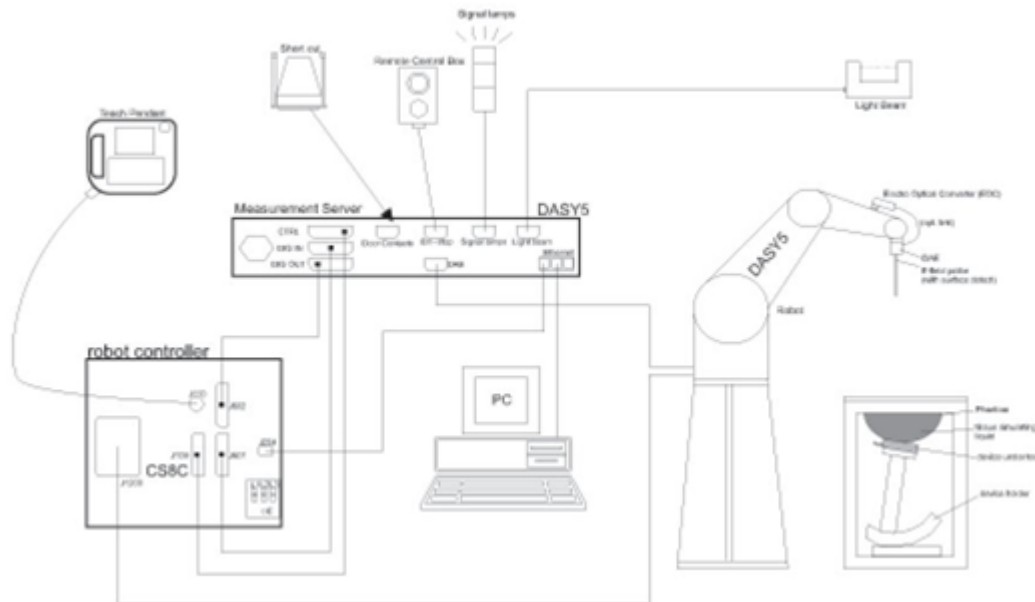
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

7. System Description and Setup

The DASY5 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.

7.1 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>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 6 GHz)	
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)	
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)	
Dimensions	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	

7.2 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

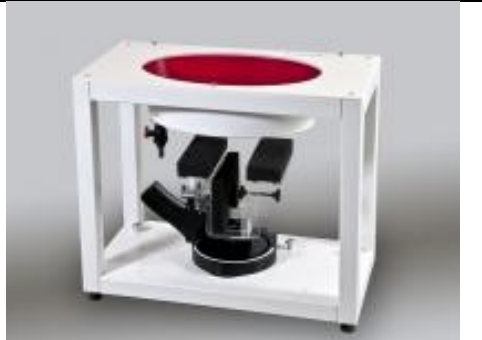
7.3 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	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>

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

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices or for evaluating transmitters operating at low frequencies. ELI is fully compatible with standard and all known tissue simulating liquids.

7.4 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 heads, 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

8. 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

8.1 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

8.2 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.

8.3 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.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{Area}, \Delta y_{Area}$	≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

8.4 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.

		≤ 3 GHz	> 3 GHz	
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm	
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm	
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

8.5 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.

8.6 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.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1087	2022/2/24	2025/2/23
SPEAG	835MHz System Validation Kit	D835V2	4d091	2022/8/19	2025/8/18
SPEAG	1750MHz System Validation Kit	D1750V2	1090	2022/2/24	2025/2/23
SPEAG	1900MHz System Validation Kit	D1900V2	5d118	2022/3/30	2025/3/29
SPEAG	2450MHz System Validation Kit	D2450V2	1040	2023/4/25	2026/4/24
SPEAG	2600MHz System Validation Kit	D2600V2	1061	2020/11/26	2023/11/24
SPEAG	5000MHz System Validation Kit	D5GHzV2	1113	2022/9/23	2025/9/22
SPEAG	Data Acquisition Electronics	DAE4	690	2023/6/20	2024/6/19
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	2022/12/14	2023/12/13
SPEAG	SAM Twin Phantom	SAM Twin	TP-1842	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio Communication Analyzer	MT8821C	6262306175	2023/7/5	2024/7/4
Agilent	ENA Series Network Analyzer	E5071C	MY46111157	2023/7/5	2024/7/4
Anritsu	Vector Signal Generator	MG3710A	6201682672	2023/1/5	2024/1/4
SPEAG	Dielectric Probe Kit	DAK-3.5	1071	2023/2/20	2024/2/19
Rohde & Schwarz	Power Meter	NRVD	102081	2023/7/5	2024/7/4
Rohde & Schwarz	Power Sensor	NRV-Z5	100538	2023/7/5	2024/7/4
Rohde & Schwarz	Power Sensor	NRV-Z5	100539	2023/7/5	2024/7/4
R&S	BLUETOOTH TESTER	CBT	101246	2023/5/15	2024/5/14
Rohde & Schwarz	Spectrum Analyzer	FSV7	101631	2023/10/11	2024/10/10
CHIGO	Thermo-Hygrometer	HTC-1	55011	2023/1/8	2024/1/7
TES	DIGITAC THERMOMETER	1310	220305411	2023/1/8	2024/1/7
ARRA	Power Divider	A3200-2	N/A	Note 1	
MCL	Attenuation1	BW-S10W5+	N/A	Note 1	
MCL	Attenuation2	BW-S10W5+	N/A	Note 1	
MCL	Attenuation3	BW-S10W5+	N/A	Note 1	
BONN	POWER AMPLIFIER	BLMA 0830-3	087193A	Note 1	
BONN	POWER AMPLIFIER	BLMA 2060-2	087193B	Note 1	
Agilent	Dual Directional Coupler	778D	20500	Note 1	
Agilent	Dual Directional Coupler	11691D	MY48151020	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.

10. System Verification

10.1 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.

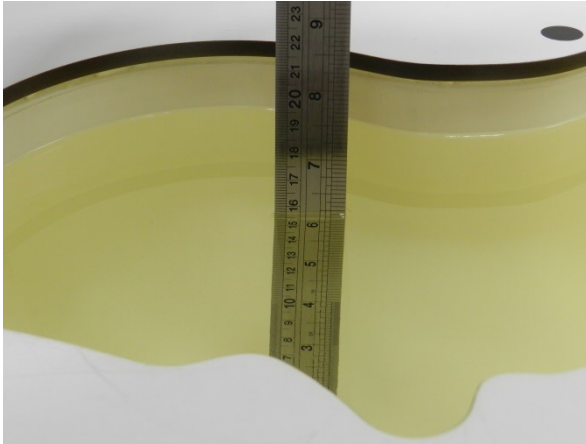


Fig 11.1 Photo of Liquid Height for Head SAR

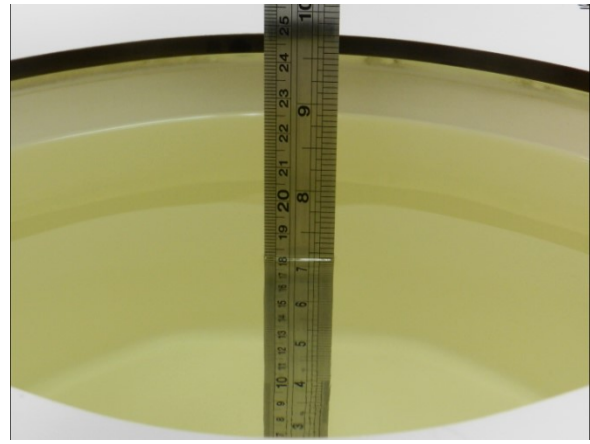


Fig 11.2 Photo of Liquid Height for Body SAR

10.2 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 (σ)	Permittivity (ϵ_r)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
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 (σ)	Permittivity (ε _r)	Conductivity Target (σ)	Permittivity Target (ε _r)	Delta (σ) (%)	Delta (ε _r) (%)	Limit (%)	Date
750	Head	22.7	0.888	42.263	0.89	41.90	-0.22	0.87	±5	2023/10/30
835	Head	22.7	0.912	41.931	0.90	41.50	1.33	1.04	±5	2023/10/31
1750	Head	22.7	1.430	41.500	1.37	40.10	4.38	3.49	±5	2023/11/3
1900	Head	22.8	1.406	40.194	1.40	40.00	0.43	0.49	±5	2023/11/6
2600	Head	22.6	2.031	40.352	1.96	39.00	3.62	3.47	±5	2023/11/8
750	Head	22.9	0.889	42.285	0.89	41.90	-0.11	0.92	±5	2023/11/9
835	Head	22.8	0.930	40.926	0.90	41.50	3.33	-1.38	±5	2023/11/10
1750	Head	22.7	1.317	40.229	1.37	40.10	-3.87	0.32	±5	2023/11/12
1900	Head	22.7	1.407	40.219	1.40	40.00	0.50	0.55	±5	2023/11/14
2600	Head	22.8	1.936	39.106	1.96	39.00	-1.22	0.27	±5	2023/11/16
2450	Head	22.8	1.743	39.248	1.80	39.20	-3.17	0.12	±5	2023/11/17
5250	Head	22.7	4.579	35.734	4.71	35.90	-2.78	-0.46	±5	2023/11/18
5600	Head	22.7	4.954	35.113	5.07	35.50	-2.29	-1.09	±5	2023/11/19
5750	Head	22.7	5.113	34.880	5.22	35.40	-2.05	-1.47	±5	2023/11/20

10.3 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 (%)
2023/10/30	750	Head	50	1087	3857	690	0.431	8.58	8.62	0.47
2023/10/31	835	Head	50	4d091	3857	690	0.509	9.45	10.18	7.72
2023/11/3	1750	Head	50	1090	3857	690	1.950	37.00	39	5.41
2023/11/6	1900	Head	50	5d118	3857	690	2.020	39.30	40.4	2.80
2023/11/8	2600	Head	50	1061	3857	690	2.910	56.60	58.2	2.83
2023/11/9	750	Head	50	1087	3857	690	0.432	8.58	8.64	0.70
2023/11/10	835	Head	50	4d091	3857	690	0.507	9.45	10.14	7.30
2023/11/12	1750	Head	50	1090	3857	690	1.790	37.00	35.8	-3.24
2023/11/14	1900	Head	50	5d118	3857	690	2.010	39.30	40.2	2.29
2023/11/16	2600	Head	50	1061	3857	690	2.760	56.60	55.2	-2.47
2023/11/17	2450	Head	50	1040	3857	690	2.500	52.70	50	-5.12
2023/11/18	5250	Head	50	1113	3857	690	4.140	81.50	82.8	1.60
2023/11/19	5600	Head	50	1113	3857	690	4.380	82.60	87.6	6.05
2023/11/20	5750	Head	50	1113	3857	690	4.140	80.80	82.8	2.48

<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 (%)
2023/10/30	750	Head	50	1087	3857	690	0.284	5.65	5.68	0.53
2023/10/31	835	Head	50	4d091	3857	690	0.334	6.22	6.68	7.40
2023/11/3	1750	Head	50	1090	3857	690	1.020	19.50	20.4	4.62
2023/11/6	1900	Head	50	5d118	3857	690	1.040	20.40	20.8	1.96
2023/11/8	2600	Head	50	1061	3857	690	1.300	25.10	26	3.59
2023/11/9	750	Head	50	1087	3857	690	0.285	5.65	5.7	0.88
2023/11/10	835	Head	50	4d091	3857	690	0.331	6.22	6.62	6.43
2023/11/12	1750	Head	50	1090	3857	690	0.941	19.50	18.82	-3.49
2023/11/14	1900	Head	50	5d118	3857	690	1.040	20.40	20.8	1.96
2023/11/16	2600	Head	50	1061	3857	690	1.230	25.10	24.6	-1.99
2023/11/17	2450	Head	50	1040	3857	690	1.160	24.60	23.2	-5.69
2023/11/18	5250	Head	50	1113	3857	690	1.190	23.30	23.8	2.15
2023/11/19	5600	Head	50	1113	3857	690	1.260	23.70	25.2	6.33
2023/11/20	5750	Head	50	1113	3857	690	1.170	23.00	23.4	1.74

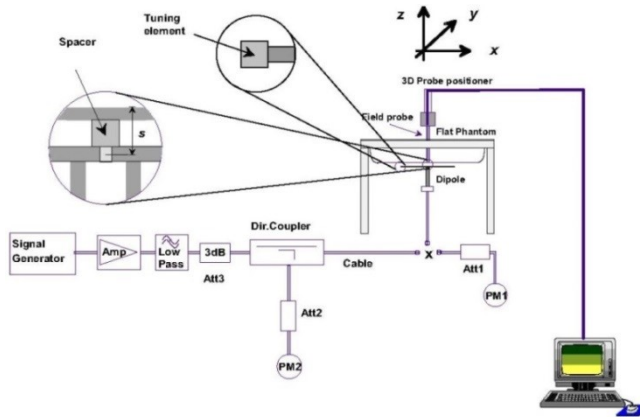


Fig 11.3.1 System Performance Check Setup

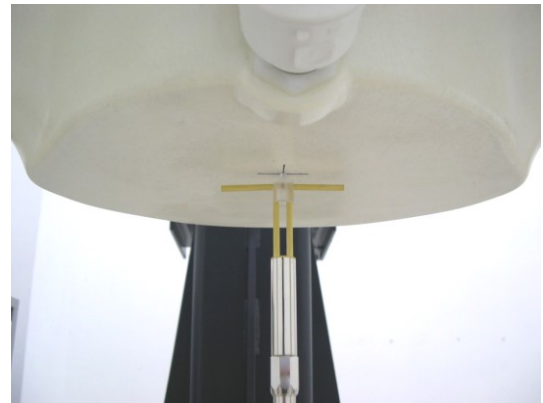


Fig 11.3.2 Setup Photo

11. RF Exposure Positions

11.1 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.

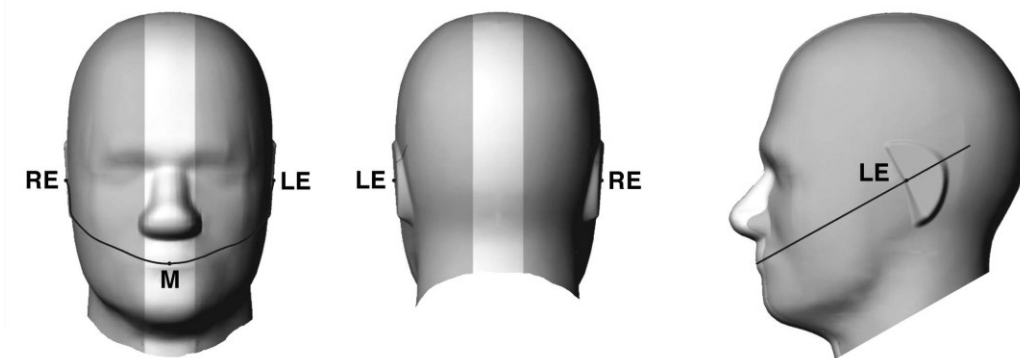


Fig 12.1.1 Front, back, and side views of SAM twin phantom

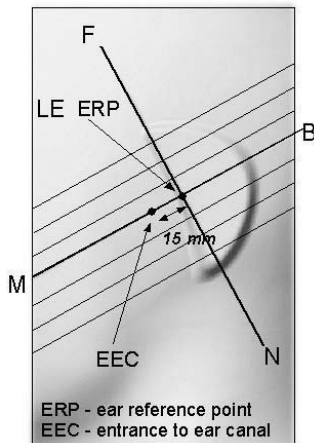


Fig 12.1.2 Close-up side view of phantom showing the ear region.

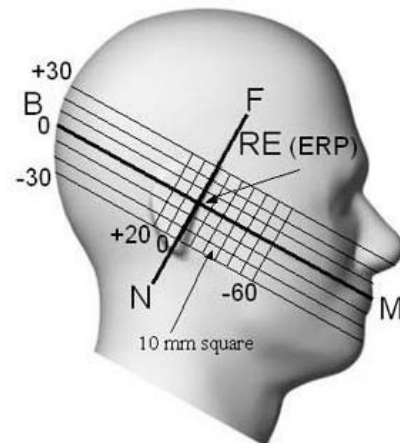


Fig 12.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

11.2 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 horizontal line. 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.

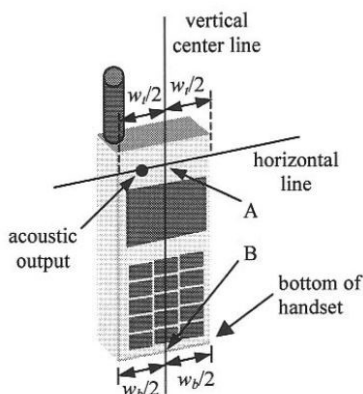


Fig 12.2.1 Handset vertical and horizontal reference lines—“fixed case”

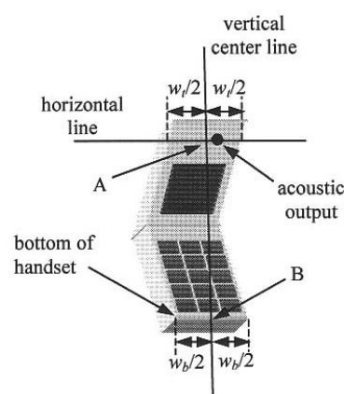


Fig 12.2.2 Handset vertical and horizontal reference lines—“clam-shell case”

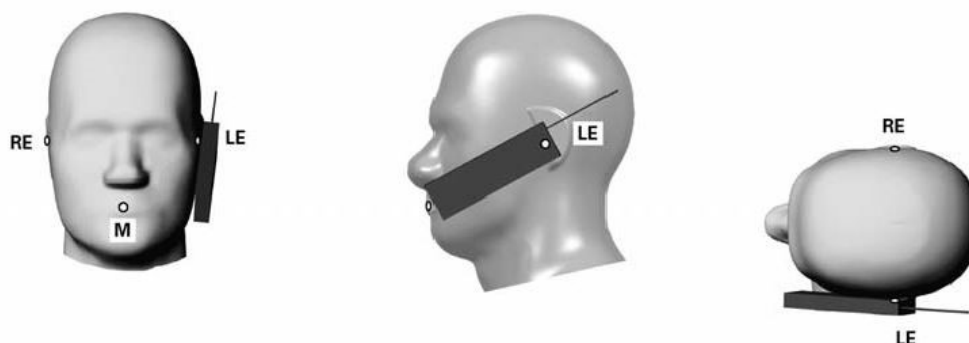


Fig 12.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

11.3 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

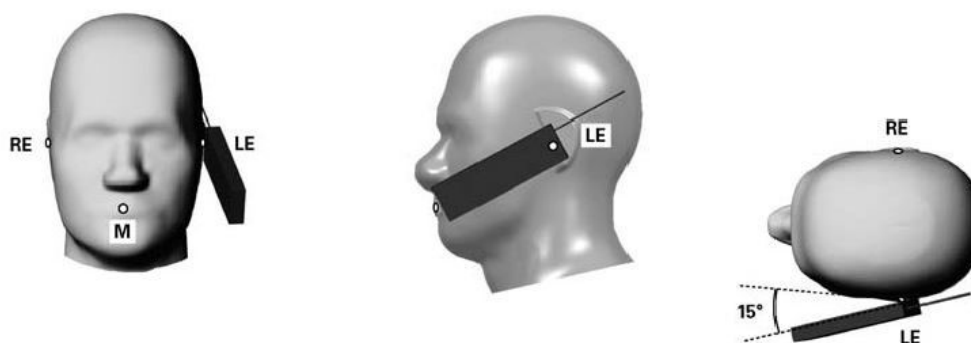


Fig 12.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

11.4 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 headset 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 test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

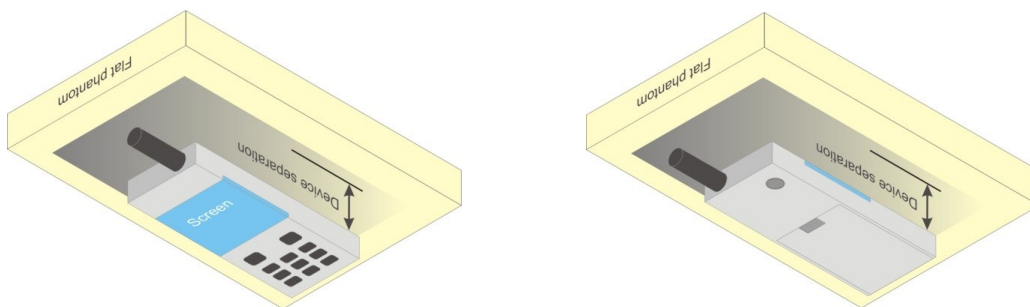


Fig 12.4 Body Worn Position

11.5 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 can provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets and 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 ≤ 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.6 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.

11.6 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.

12. 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.
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 $\leq \frac{1}{4}$ 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 (β_c and β_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: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_o/β_d	β_{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

Note 1: Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$.

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, Δ_{ACK} and $\Delta_{NACK} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$, and $\Delta_{CQI} = 24/15$ with $\beta_{HS} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_o/\beta_d = 12/15$, $\beta_{HS}/\beta_c = 24/15$. 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.

Note 4: For subtest 2 the β_o/β_d 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 $\beta_c = 11/15$ and $\beta_d = 15/15$.

Setup Configuration

HSUPA 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. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
 - ii. Set the Gain Factors (β_c and β_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
 - iii. Set Cell Power = -86 dBm
 - iv. Set Channel Type = 12.2k + HSPA
 - v. Set UE Target Power
 - vi. Power Ctrl Mode= Alternating bits
 - vii. Set and observe the E-TFCI
 - viii. Confirm that E-TFCL is equal to the target E-TFCL of 75 for sub-test 1, and other subtest's E-TFCL
- d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCL
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	β_{ed1} : 47/15 β_{ed2} : 47/15	4 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, Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$. For sub-test 5, Δ_{ACK} , Δ_{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 β_c/β_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, TF0) 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: β_{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 (β_c and β_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.		

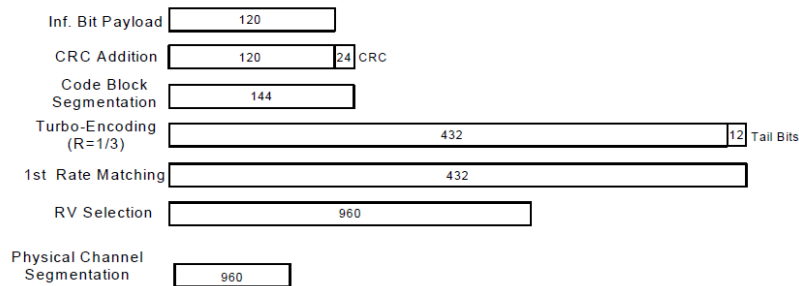


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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 ≤ 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 ≤ 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 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 ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM 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 ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. For LTE B4/B5/B26/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 B5/4 SAR test was covered by B26/66; 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

<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.

- a. 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
- b. "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
- c. 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.

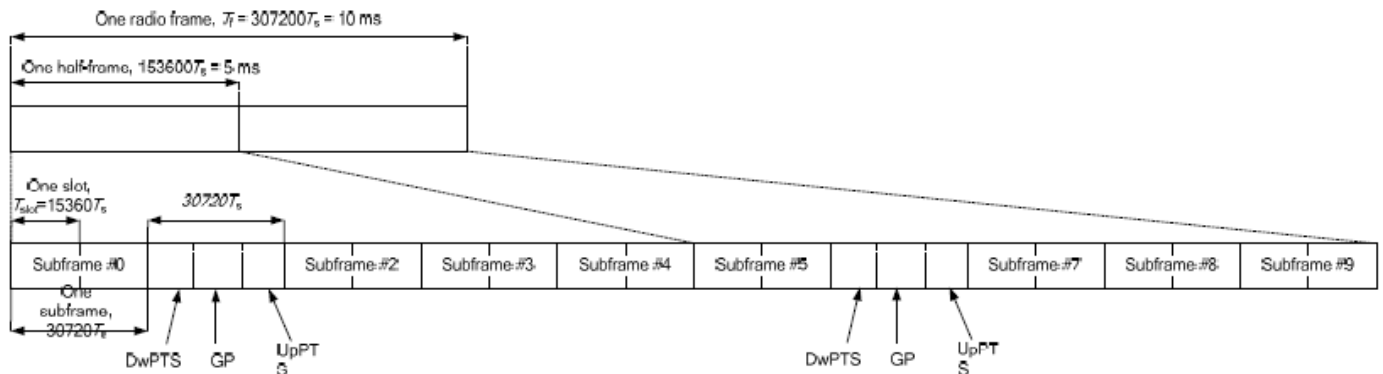


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

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 · Ts	2192 · Ts	2560 · Ts	7680 · Ts	2192 · Ts	2560 · Ts
1	19760 · Ts			20480 · Ts		
2	21952 · Ts			23040 · Ts		
3	24144 · Ts			25600 · Ts		
4	26336 · Ts	4384 · Ts	5120 · Ts	7680 · Ts	4384 · Ts	5120 · Ts
5	6592 · Ts			20480 · Ts		
6	19760 · Ts			23040 · Ts		
7	21952 · Ts			12800 · Ts		
8	24144 · Ts			-		
9	13168 · Ts	-	-	-	-	-

Special subframe (30720·T _s): 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 _s): 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 TDD Power class 3

- i. Uplink-downlink configuration: 0. In a half-frame consisted of 5 subframes, uplink operation is in 3 uplink subframes and 1 special subframe.
- ii. special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink
- iii. for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is: $(3+0.167)/5 = 63.3\%$
- iv. for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is: $(3+0.143)/5 = 62.9\%$
- v. 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:

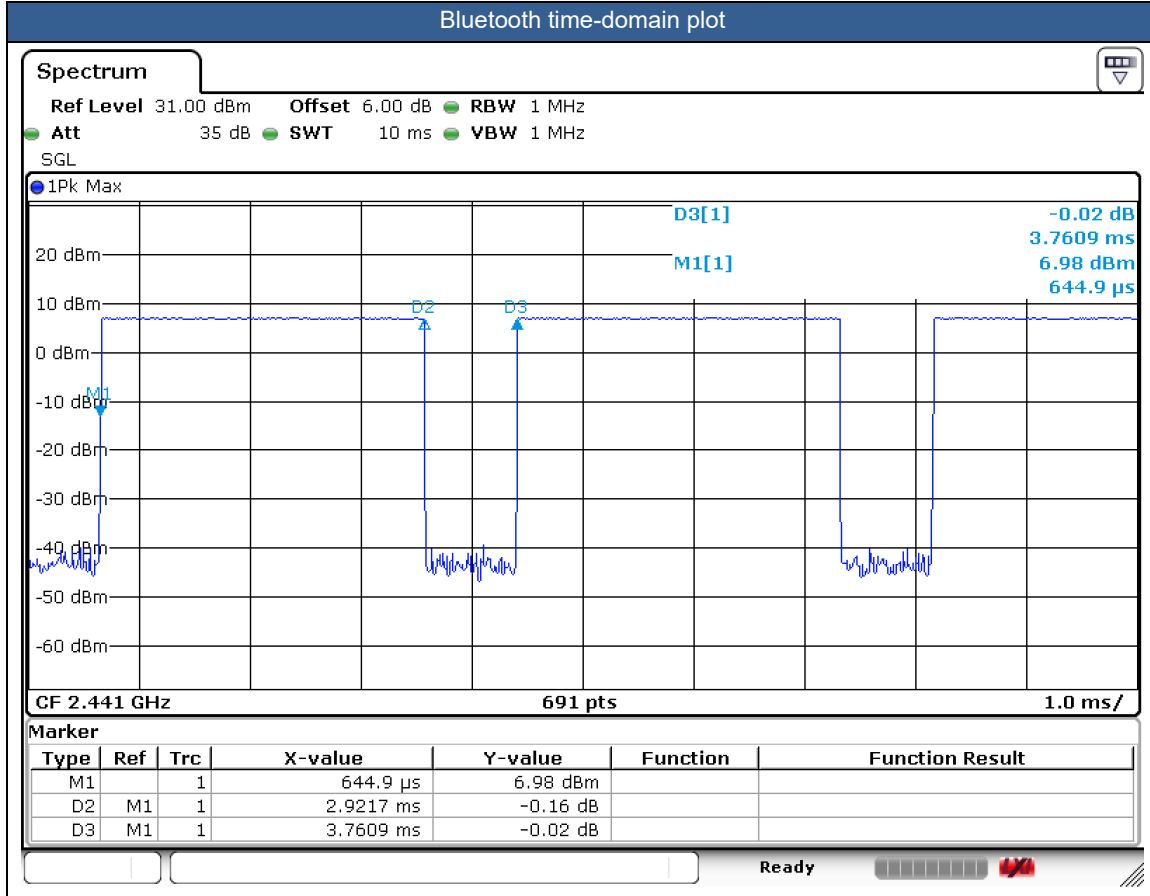
1. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures. For "Not required", SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) 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 in the initial test configuration. Additional output power measurements were not necessary.
2. 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.
3. 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).
4. 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.
5. 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 ≤ 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 ≤ 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 ≤ 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 77.69% as following figure, for Bluetooth SAR scaling need further consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to 100% for Bluetooth reported SAR calculation.





13. Antenna Location

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

14. 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 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 SAR testing of Bluetooth signal with 83.3% theoretical duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle) *83.3%".
 - d. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
 - e. For BT/WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
 - f. 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:
 - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
 - ≤ 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
 - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥ 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 receiver detection/hotspot mode for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity). 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. 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 GSM 850/1900, WCDMA Band II/IV/V, LTE Band 2/4/7/38/66 and WLAN2.4/5.2/5.8GHz, 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.
6. Although the headset SAR is greater than 0.8 W/kg, the headset SAR verified the worst of the non-headset SAR and less than non-headset SAR, so there is no need to be tested other channels.

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.
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 ≤ 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 ≤ 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 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 ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
5. 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 ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
6. For LTE B4 / B5 / B26 / 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 B4/B5 SAR test was covered by B66 / B26; 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 ≤ 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 ≤ 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 ≤ 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 ≤ 1.2 W/kg or all required channels are tested.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

DSI status description:

The device has the following DSI state which used at different exposure condition.

Exposure Condition	DSI	
Head SAR	DSI 2	Receiver on
Hotspot SAR	DSI 6	Hotspot On
Body worn SAR	DSI 4	Receiver off
Extremity (Handheld) SAR	DSI 4	Receiver off



14.1 Head SAR

Table with columns: Plot No., Band, BW (MHz), Modulation, RB Size, RB Offset, Mode, Test Position, Gap (mm), Power State, 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). Rows are grouped by frequency bands: 750MHz, 835MHz, 1750MHz, and 1900MHz.



	LTE Band 2	20M	QPSK	50	0	-	Right Tilted	0mm	DSI 2	18900	1880	1	21.38	23.00	1.452	-	-	0.14	0.247	0.359
	LTE Band 2	20M	QPSK	1	0	-	Left Cheek	0mm	DSI 2	18900	1880	1	22.42	24.00	1.439	-	-	-0.17	0.363	0.522
	LTE Band 2	20M	QPSK	50	0	-	Left Cheek	0mm	DSI 2	18900	1880	1	21.38	23.00	1.452	-	-	0.17	0.285	0.414
	LTE Band 2	20M	QPSK	1	0	-	Left Tilted	0mm	DSI 2	18900	1880	1	22.42	24.00	1.439	-	-	-0.05	0.392	0.564
	LTE Band 2	20M	QPSK	50	0	-	Left Tilted	0mm	DSI 2	18900	1880	1	21.38	23.00	1.452	-	-	0.01	0.300	0.436
2600MHz																				
10	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	DSI 2	21100	2535	1	22.37	24.00	1.455	-	-	0.12	0.094	0.137
	LTE Band 7	20M	QPSK	50	0	-	Right Cheek	0mm	DSI 2	21100	2535	1	21.56	23.00	1.393	-	-	0.1	0.057	0.079
	LTE Band 7	20M	QPSK	1	0	-	Right Tilted	0mm	DSI 2	21100	2535	1	22.37	24.00	1.455	-	-	-0.17	0.071	0.103
	LTE Band 7	20M	QPSK	50	0	-	Right Tilted	0mm	DSI 2	21100	2535	1	21.56	23.00	1.393	-	-	0.04	0.048	0.067
	LTE Band 7	20M	QPSK	1	0	-	Left Cheek	0mm	DSI 2	21100	2535	1	22.37	24.00	1.455	-	-	-0.01	0.082	0.119
	LTE Band 7	20M	QPSK	50	0	-	Left Cheek	0mm	DSI 2	21100	2535	1	21.56	23.00	1.393	-	-	-0.08	0.052	0.072
	LTE Band 7	20M	QPSK	1	0	-	Left Tilted	0mm	DSI 2	21100	2535	1	22.37	24.00	1.455	-	-	0.05	0.081	0.118
	LTE Band 7	20M	QPSK	50	0	-	Left Tilted	0mm	DSI 2	21100	2535	1	21.56	23.00	1.393	-	-	0.06	0.050	0.070
11	LTE Band 38	20M	QPSK	1	0	-	Right Cheek	0mm	DSI 2	38000	2595	1	22.80	24.00	1.318	62.9	1.006	0.01	0.103	0.137
	LTE Band 38	20M	QPSK	50	0	-	Right Cheek	0mm	DSI 2	38000	2595	1	21.83	23.00	1.309	62.9	1.006	-0.09	0.089	0.117
	LTE Band 38	20M	QPSK	1	0	-	Right Tilted	0mm	DSI 2	38000	2595	1	22.80	24.00	1.318	62.9	1.006	-0.08	0.000	0.000
	LTE Band 38	20M	QPSK	50	0	-	Right Tilted	0mm	DSI 2	38000	2595	1	21.83	23.00	1.309	62.9	1.006	0.13	0.000	0.000
	LTE Band 38	20M	QPSK	1	0	-	Left Cheek	0mm	DSI 2	38000	2595	1	22.80	24.00	1.318	62.9	1.006	0.12	0.000	0.000
	LTE Band 38	20M	QPSK	50	0	-	Left Cheek	0mm	DSI 2	38000	2595	1	21.83	23.00	1.309	62.9	1.006	0.03	0.040	0.053
	LTE Band 38	20M	QPSK	1	0	-	Left Tilted	0mm	DSI 2	38000	2595	1	22.80	24.00	1.318	62.9	1.006	0.18	0.000	0.000
	LTE Band 38	20M	QPSK	50	0	-	Left Tilted	0mm	DSI 2	38000	2595	1	21.83	23.00	1.309	62.9	1.006	0.16	0.000	0.000



Plot No.	Band	Mode	Test Position	Gap (mm)	Power State	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)
2450MHz																
	WLAN2.4GHz	802.11b 1Mbps	Right Cheek	0mm	Receiver on	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.08	0.282	0.383
	WLAN2.4GHz	802.11b 1Mbps	Right Tilted	0mm	Receiver on	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.01	0.267	0.362
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Receiver on	1	2412	1	16.76	18.00	1.330	98.01	1.020	-0.09	0.599	0.813
	WLAN2.4GHz	802.11b 1Mbps	Left Tilted	0mm	Receiver on	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.03	0.466	0.632
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Receiver on	6	2437	1	15.64	17.50	1.535	98.01	1.020	-0.08	0.420	0.657
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Receiver on	11	2462	1	15.21	17.00	1.510	98.01	1.020	-0.08	0.348	0.536
12	WLAN2.4GHz	802.11g 6Mbps	Left Cheek	0mm	Receiver on	10	2457	1	19.36	21.00	1.459	88.68	1.128	-0.03	0.817	1.344
	WLAN2.4GHz	802.11g 6Mbps	Left Cheek	0mm	Receiver on	10	2457	2	19.36	21.00	1.459	88.68	1.128	0.03	0.754	1.241
	WLAN2.4GHz	802.11g 6Mbps	Left Cheek	0mm	Receiver on	10	2457	3	19.36	21.00	1.459	88.68	1.128	0.01	0.711	1.170
	WLAN2.4GHz	802.11g 6Mbps	Left Cheek	0mm	Receiver on	1	2412	1	13.41	15.00	1.442	88.68	1.128	0.07	0.232	0.377
	WLAN2.4GHz	802.11g 6Mbps	Left Cheek	0mm	Receiver on	2	2417	1	19.83	21.50	1.469	88.68	1.128	0.01	0.650	1.077
	WLAN2.4GHz	802.11g 6Mbps	Left Cheek	0mm	Receiver on	6	2437	1	19.18	20.50	1.355	88.68	1.128	0.01	0.535	0.818
	WLAN2.4GHz	802.11g 6Mbps	Left Cheek	0mm	Receiver on	11	2462	1	12.72	14.50	1.507	88.68	1.128	0.06	0.201	0.342
	WLAN2.4GHz	802.11g 6Mbps	Left Tilted	0mm	Receiver on	10	2457	1	19.36	21.00	1.459	88.68	1.128	0.06	0.712	1.172
	WLAN2.4GHz	802.11g 6Mbps	Left Tilted	0mm	Receiver on	2	2417	1	19.83	21.50	1.469	88.68	1.128	0.01	0.602	0.997
	Bluetooth	1Mbps	Right Cheek	0mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	0.08	0.000	0.000
	Bluetooth	1Mbps	Right Tilted	0mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	0.01	0.000	0.000
13	Bluetooth	1Mbps	Left Cheek	0mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	0.03	0.086	0.121
	Bluetooth	1Mbps	Left Tilted	0mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	0.03	0.069	0.097
5000MHz																
	WLAN5.3GHz	802.11a 6Mbps	Right Cheek	0mm	Receiver on	60	5300	1	15.83	17.00	1.309	89.10	1.122	-0.06	0.449	0.659
	WLAN5.3GHz	802.11a 6Mbps	Right Tilted	0mm	Receiver on	60	5300	1	15.83	17.00	1.309	89.10	1.122	-0.15	0.562	0.825
	WLAN5.3GHz	802.11a 6Mbps	Right Tilted	0mm	Receiver on	64	5320	1	15.81	17.00	1.315	89.10	1.122	0.03	0.521	0.769
	WLAN5.3GHz	802.11a 6Mbps	Left Cheek	0mm	Receiver on	60	5300	1	15.83	17.00	1.309	89.10	1.122	0.03	0.554	0.814
	WLAN5.3GHz	802.11a 6Mbps	Left Cheek	0mm	Receiver on	64	5320	1	15.81	17.00	1.315	89.10	1.122	0.06	0.521	0.769
	WLAN5.3GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	60	5300	1	15.83	17.00	1.309	89.10	1.122	-0.13	0.693	1.018
	WLAN5.3GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	64	5320	1	15.81	17.00	1.315	89.10	1.122	0.16	0.556	0.820
14	WLAN5.3GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	52	5260	1	15.79	17.00	1.321	89.10	1.122	0.01	0.743	1.101
	WLAN5.3GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	52	5260	2	15.79	17.00	1.321	89.10	1.122	0.01	0.652	0.966
	WLAN5.3GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	52	5260	3	15.79	17.00	1.321	89.10	1.122	0.09	0.568	0.842
	WLAN5.3GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	56	5280	1	15.76	17.00	1.330	89.10	1.122	-0.15	0.573	0.855
	WLAN5.5GHz	802.11a 6Mbps	Right Cheek	0mm	Receiver on	116	5580	1	15.59	16.50	1.233	89.10	1.122	-0.02	0.331	0.458
	WLAN5.5GHz	802.11a 6Mbps	Right Tilted	0mm	Receiver on	116	5580	1	15.59	16.50	1.233	89.10	1.122	-0.09	0.431	0.596
	WLAN5.5GHz	802.11a 6Mbps	Left Cheek	0mm	Receiver on	116	5580	1	15.59	16.50	1.233	89.10	1.122	0.14	0.454	0.628
	WLAN5.5GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	116	5580	1	15.59	16.50	1.233	89.10	1.122	-0.16	0.637	0.881
15	WLAN5.5GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	132	5660	1	15.51	16.50	1.256	89.10	1.122	-0.09	0.790	1.113
	WLAN5.5GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	132	5660	2	15.51	16.50	1.256	89.10	1.122	0.01	0.652	0.919
	WLAN5.5GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	132	5660	3	15.51	16.50	1.256	89.10	1.122	0.06	0.671	0.946
	WLAN5.8GHz	802.11a 6Mbps	Right Cheek	0mm	Receiver on	157	5785	1	14.27	16.00	1.489	89.10	1.122	-0.08	0.362	0.605
	WLAN5.8GHz	802.11a 6Mbps	Right Tilted	0mm	Receiver on	157	5785	1	14.27	16.00	1.489	89.10	1.122	-0.09	0.454	0.758
	WLAN5.8GHz	802.11a 6Mbps	Left Cheek	0mm	Receiver on	157	5785	1	14.27	16.00	1.489	89.10	1.122	-0.01	0.482	0.805
	WLAN5.8GHz	802.11a 6Mbps	Left Cheek	0mm	Receiver on	149	5745	1	14.18	16.00	1.521	89.10	1.122	0.06	0.415	0.708
16	WLAN5.8GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	157	5785	1	14.27	16.00	1.489	89.10	1.122	-0.09	0.666	1.113
	WLAN5.8GHz	802.11a 6Mbps	Left Tilted	0mm	Receiver on	149	5745	1	14.18	16.00	1.521	89.10	1.122	0.03	0.590	1.007



14.2 Hotspot SAR

Table with columns: Plot No., Band, BW (MHz), Modulation, RB Size, RB offset, Mode, Test Position, Gap (mm), Power State, 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). Rows are grouped by frequency bands: 750MHz, 835MHz, 1750MHz.



Table with columns for WCDMA IV, LTE Band, Modulation, Power, etc. Includes rows for WCDMA IV, LTE Band 66, GSM1900, WCDMA II, and LTE Band 2. Some cells are highlighted in yellow (e.g., 1.301, 1.216, 1.344, 1.182).



2600MHz																				
	LTE Band 7	20M	QPSK	1	0	-	Front	5mm	DSI 6	21100	2535	1	10.56	11.50	1.242	-	-	-0.16	0.232	0.288
	LTE Band 7	20M	QPSK	50	0	-	Front	5mm	DSI 6	21100	2535	1	10.53	11.50	1.250	-	-	-0.09	0.185	0.231
	LTE Band 7	20M	QPSK	1	0	-	Back	5mm	DSI 6	21100	2535	1	10.56	11.50	1.242	-	-	0.16	0.578	0.718
	LTE Band 7	20M	QPSK	50	0	-	Back	5mm	DSI 6	21100	2535	1	10.53	11.50	1.250	-	-	-0.03	0.567	0.709
	LTE Band 7	20M	QPSK	1	0	-	Left Side	5mm	DSI 6	21100	2535	1	10.56	11.50	1.242	-	-	0.16	0.040	0.050
	LTE Band 7	20M	QPSK	50	0	-	Left Side	5mm	DSI 6	21100	2535	1	10.53	11.50	1.250	-	-	0.13	0.029	0.036
	LTE Band 7	20M	QPSK	1	0	-	Right Side	5mm	DSI 6	21100	2535	1	10.56	11.50	1.242	-	-	-0.18	0.031	0.038
	LTE Band 7	20M	QPSK	50	0	-	Right Side	5mm	DSI 6	21100	2535	1	10.53	11.50	1.250	-	-	0.02	0.022	0.028
	LTE Band 7	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	21100	2535	1	10.56	11.50	1.242	-	-	0.16	0.985	1.223
	LTE Band 7	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	20850	2510	1	10.30	11.50	1.318	-	-	-0.03	0.965	1.272
26	LTE Band 7	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	21350	2560	1	10.41	11.50	1.285	-	-	0.01	1.080	1.388
	LTE Band 7	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	21350	2560	2	10.41	11.50	1.285	-	-	0.03	0.820	1.054
	LTE Band 7	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	21350	2560	3	10.41	11.50	1.285	-	-	0.06	0.861	1.107
	LTE Band 7	20M	QPSK	50	0	-	Bottom Side	5mm	DSI 6	21100	2535	1	10.53	11.50	1.250	-	-	0.07	0.971	1.214
	LTE Band 7	20M	QPSK	50	0	-	Bottom Side	5mm	DSI 6	20850	2510	1	10.26	11.50	1.330	-	-	0	0.972	1.293
	LTE Band 7	20M	QPSK	50	0	-	Bottom Side	5mm	DSI 6	21350	2560	1	10.48	11.50	1.265	-	-	0.01	0.955	1.208
	LTE Band 7	20M	QPSK	100	0	-	Bottom Side	5mm	DSI 6	21100	2535	1	10.51	11.50	1.256	-	-	-0.01	0.953	1.197
	LTE Band 38	20M	QPSK	1	0	-	Front	5mm	DSI 6	38000	2595	1	13.05	14.00	1.245	62.9	1.006	-0.02	0.282	0.353
	LTE Band 38	20M	QPSK	50	0	-	Front	5mm	DSI 6	38000	2595	1	13.04	14.00	1.247	62.9	1.006	0.13	0.149	0.187
	LTE Band 38	20M	QPSK	1	0	-	Back	5mm	DSI 6	38000	2595	1	13.05	14.00	1.245	62.9	1.006	-0.15	0.773	0.968
	LTE Band 38	20M	QPSK	1	0	-	Back	5mm	DSI 6	37850	2580	1	12.73	14.00	1.340	62.9	1.006	-0.06	0.616	0.830
	LTE Band 38	20M	QPSK	1	0	-	Back	5mm	DSI 6	38150	2610	1	12.73	14.00	1.340	62.9	1.006	-0.14	0.666	0.898
	LTE Band 38	20M	QPSK	50	0	-	Back	5mm	DSI 6	38000	2595	1	13.04	14.00	1.247	62.9	1.006	-0.19	0.685	0.860
	LTE Band 38	20M	QPSK	50	0	-	Back	5mm	DSI 6	37850	2580	1	12.69	14.00	1.352	62.9	1.006	0.01	0.659	0.896
	LTE Band 38	20M	QPSK	50	0	-	Back	5mm	DSI 6	38150	2610	1	12.80	14.00	1.318	62.9	1.006	0.06	0.683	0.906
	LTE Band 38	20M	QPSK	100	0	-	Back	5mm	DSI 6	38000	2595	1	13.03	14.00	1.250	62.9	1.006	0.02	0.694	0.873
	LTE Band 38	20M	QPSK	1	0	-	Left Side	5mm	DSI 6	38000	2595	1	13.05	14.00	1.245	62.9	1.006	0.12	0.021	0.026
	LTE Band 38	20M	QPSK	50	0	-	Left Side	5mm	DSI 6	38000	2595	1	13.04	14.00	1.247	62.9	1.006	-0.16	0.013	0.016
	LTE Band 38	20M	QPSK	1	0	-	Right Side	5mm	DSI 6	38000	2595	1	13.05	14.00	1.245	62.9	1.006	-0.12	0.022	0.028
	LTE Band 38	20M	QPSK	50	0	-	Right Side	5mm	DSI 6	38000	2595	1	13.04	14.00	1.247	62.9	1.006	0.07	0.014	0.018
27	LTE Band 38	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	38000	2595	1	13.05	14.00	1.245	62.9	1.006	0.07	0.939	1.176
	LTE Band 38	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	37850	2580	1	12.73	14.00	1.340	62.9	1.006	-0.02	0.833	1.123
	LTE Band 38	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	38150	2610	1	12.73	14.00	1.340	62.9	1.006	-0.05	0.834	1.124
	LTE Band 38	20M	QPSK	50	0	-	Bottom Side	5mm	DSI 6	38000	2595	1	13.04	14.00	1.247	62.9	1.006	-0.13	0.838	1.052
	LTE Band 38	20M	QPSK	50	0	-	Bottom Side	5mm	DSI 6	37850	2580	1	12.69	14.00	1.352	62.9	1.006	0.08	0.800	1.088
	LTE Band 38	20M	QPSK	50	0	-	Bottom Side	5mm	DSI 6	38150	2610	1	12.80	14.00	1.318	62.9	1.006	0.16	0.833	1.105
	LTE Band 38	20M	QPSK	100	0	-	Bottom Side	5mm	DSI 6	38000	2595	1	13.03	14.00	1.250	62.9	1.006	0.01	0.862	1.084



Plot No.	Band	Mode	Test Position	Gap (mm)	Power State	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)
2450MHz																
	WLAN2.4GHz	802.11b 1Mbps	Front	5mm	Full Power	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.08	0.245	0.332
	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	Full Power	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.06	0.534	0.725
	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	Full Power	6	2437	1	15.64	17.50	1.535	98.01	1.020	-0.08	0.392	0.614
	WLAN2.4GHz	802.11b 1Mbps	Left Side	5mm	Full Power	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.01	0.024	0.033
	WLAN2.4GHz	802.11b 1Mbps	Right Side	5mm	Full Power	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.03	0.117	0.159
	WLAN2.4GHz	802.11b 1Mbps	Top Side	5mm	Full Power	1	2412	1	16.76	18.00	1.330	98.01	1.020	-0.08	0.075	0.102
	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	Reduced	2	2417	1	16.22	18.00	1.507	88.68	1.128	0.08	0.365	0.620
28	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	Reduced	10	2457	1	16.25	18.00	1.496	88.68	1.128	0.12	0.438	0.739
	Bluetooth	1Mbps	Front	5mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	-0.13	0.001	0.001
29	Bluetooth	1Mbps	Back	5mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	0.02	0.076	0.108
	Bluetooth	1Mbps	Left Side	5mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	-0.13	0.001	0.001
	Bluetooth	1Mbps	Right Side	5mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	0.06	0.001	0.001
	Bluetooth	1Mbps	Top Side	5mm	Full Power	0	2402	1	9.31	10.50	1.316	77.69	1.072	-0.03	0.001	0.001
5000MHz																
	WLAN5.2GHz	802.11a 6Mbps	Front	5mm	Reduced	44	5220	1	9.95	11.50	1.429	89.10	1.122	-0.03	0.059	0.095
	WLAN5.2GHz	802.11a 6Mbps	Back	5mm	Reduced	44	5220	1	9.95	11.50	1.429	89.10	1.122	0.14	0.346	0.555
30	WLAN5.2GHz	802.11a 6Mbps	Back	5mm	Reduced	40	5200	1	9.90	11.50	1.445	89.10	1.122	0.01	0.468	0.759
	WLAN5.2GHz	802.11a 6Mbps	Left Side	5mm	Reduced	44	5220	1	9.95	11.50	1.429	89.10	1.122	0.18	0.000	0.000
	WLAN5.2GHz	802.11a 6Mbps	Right Side	5mm	Reduced	44	5220	1	9.95	11.50	1.429	89.10	1.122	0.14	0.063	0.101
	WLAN5.2GHz	802.11a 6Mbps	Top Side	5mm	Reduced	44	5220	1	9.95	11.50	1.429	89.10	1.122	-0.17	0.293	0.470
	WLAN5.8GHz	802.11a 6Mbps	Front	5mm	Reduced	157	5785	1	7.67	9.50	1.524	89.10	1.122	-0.09	0.039	0.067
	WLAN5.8GHz	802.11a 6Mbps	Back	5mm	Reduced	157	5785	1	7.67	9.50	1.524	89.10	1.122	-0.08	0.284	0.486
	WLAN5.8GHz	802.11a 6Mbps	Left Side	5mm	Reduced	157	5785	1	7.67	9.50	1.524	89.10	1.122	0.03	0.000	0.000
	WLAN5.8GHz	802.11a 6Mbps	Right Side	5mm	Reduced	157	5785	1	7.67	9.50	1.524	89.10	1.122	0.18	0.023	0.039
31	WLAN5.8GHz	802.11a 6Mbps	Top Side	5mm	Reduced	157	5785	1	7.67	9.50	1.524	89.10	1.122	0.05	0.365	0.624



FCC SAR Test Report

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	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	5mm	-	DSI 4	9262	1852.4	3	18.34	19.50	1.306	-	-	0.06	0.889	1.161
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	5mm	Headset	DSI 4	9262	1852.4	1	18.34	19.50	1.306	-	-	0.03	0.909	1.187
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	5mm	-	DSI 4	9538	1907.6	1	18.35	19.50	1.303	-	-	0.06	0.931	1.213
	LTE Band 2	20M	QPSK	1	0	-	Front	5mm	-	DSI 4	18900	1880	1	19.13	20.00	1.222	-	-	-0.09	0.470	0.574
	LTE Band 2	20M	QPSK	50	0	-	Front	5mm	-	DSI 4	18900	1880	1	19.07	20.00	1.239	-	-	0.12	0.286	0.354
40	LTE Band 2	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	18900	1880	1	19.13	20.00	1.222	-	-	-0.05	0.901	1.101
	LTE Band 2	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	18700	1860	1	19.00	20.00	1.259	-	-	-0.1	0.695	0.875
	LTE Band 2	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	19100	1900	1	18.89	20.00	1.291	-	-	0.07	0.684	0.883
	LTE Band 2	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	18900	1880	1	19.07	20.00	1.239	-	-	0.18	0.525	0.650
	LTE Band 2	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	18700	1860	1	18.97	20.00	1.268	-	-	-0.1	0.522	0.662
	LTE Band 2	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	19100	1900	1	18.92	20.00	1.282	-	-	0.01	0.492	0.631
	LTE Band 2	20M	QPSK	100	0	-	Back	5mm	-	DSI 4	18900	1880	1	19.05	20.00	1.245	-	-	-0.15	0.522	0.650
2600MHz																					
	LTE Band 7	20M	QPSK	1	0	-	Front	5mm	-	DSI 4	21100	2535	1	10.99	12.00	1.262	-	-	0.19	0.261	0.329
	LTE Band 7	20M	QPSK	50	0	-	Front	5mm	-	DSI 4	21100	2535	1	10.97	12.00	1.268	-	-	0.03	0.209	0.265
	LTE Band 7	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	21100	2535	1	10.99	12.00	1.262	-	-	-0.08	0.697	0.879
	LTE Band 7	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	20850	2510	1	10.73	12.00	1.340	-	-	-0.17	0.722	0.967
41	LTE Band 7	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	21350	2560	1	10.86	12.00	1.300	-	-	0.09	0.973	1.265
	LTE Band 7	20M	QPSK	1	0	-	Back	5mm	Headset	DSI 4	21350	2560	1	10.86	12.00	1.300	-	-	0.03	0.922	1.199
	LTE Band 7	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	21100	2535	1	10.97	12.00	1.268	-	-	-0.04	0.691	0.876
	LTE Band 7	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	20850	2510	1	10.76	12.00	1.330	-	-	-0.08	0.651	0.866
	LTE Band 7	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	21350	2560	1	10.91	12.00	1.285	-	-	0.17	0.652	0.838
	LTE Band 7	20M	QPSK	100	0	-	Back	5mm	-	DSI 4	21100	2535	1	10.91	12.00	1.285	-	-	0.18	0.625	0.803
	LTE Band 38	20M	QPSK	1	0	-	Front	5mm	-	DSI 4	38000	2595	1	13.63	14.50	1.222	62.9	1.006	-0.04	0.362	0.445
	LTE Band 38	20M	QPSK	50	0	-	Front	5mm	-	DSI 4	38000	2595	1	13.61	14.50	1.227	62.9	1.006	-0.13	0.191	0.236
42	LTE Band 38	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	38000	2595	1	13.63	14.50	1.222	62.9	1.006	0.15	0.991	1.218
	LTE Band 38	20M	QPSK	1	0	-	Back	5mm	Headset	DSI 4	38000	2595	1	13.63	14.50	1.222	62.9	1.006	0.03	0.902	1.109
	LTE Band 38	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	37850	2580	1	13.26	14.50	1.330	62.9	1.006	0.08	0.790	1.057
	LTE Band 38	20M	QPSK	1	0	-	Back	5mm	-	DSI 4	38150	2610	1	13.36	14.50	1.300	62.9	1.006	-0.07	0.854	1.117
	LTE Band 38	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	38000	2595	1	13.61	14.50	1.227	62.9	1.006	0.05	0.794	0.980
	LTE Band 38	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	37850	2580	1	13.29	14.50	1.321	62.9	1.006	-0.11	0.715	0.950
	LTE Band 38	20M	QPSK	50	0	-	Back	5mm	-	DSI 4	38150	2610	1	13.30	14.50	1.318	62.9	1.006	-0.12	0.799	1.060
	LTE Band 38	20M	QPSK	100	0	-	Back	5mm	-	DSI 4	38000	2595	1	13.58	14.50	1.236	62.9	1.006	0.03	0.700	0.870



Plot No.	Band	Mode	Test Position	Gap (mm)	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)
2450MHz																	
	WLAN2.4GHz	802.11b 1Mbps	Front	5mm	-	Full power	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.16	0.283	0.384
	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	-	Full power	1	2412	1	16.76	18.00	1.330	98.01	1.020	0.06	0.534	0.725
	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	-	Full power	2	2417	1	19.83	21.50	1.469	88.68	1.128	-0.16	0.656	1.087
	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	-	Reduced	10	2457	1	19.36	21.00	1.459	88.68	1.128	0.02	0.786	1.293
43	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	-	Full power	6	2437	1	19.18	20.50	1.355	88.68	1.128	-0.08	0.928	1.419
	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	Headset	Full power	6	2437	1	19.18	20.50	1.355	88.68	1.128	0.03	0.911	1.393
	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	-	Full power	6	2437	2	19.18	20.50	1.355	88.68	1.128	0.01	0.638	0.975
	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	-	Full power	6	2437	3	19.18	20.50	1.355	88.68	1.128	0.03	0.803	1.228
	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	-	Full power	1	2412	1	13.41	15.00	1.442	88.68	1.128	0.02	0.562	0.914
	WLAN2.4GHz	802.11g 6Mbps	Back	5mm	-	Full power	11	2462	1	12.72	14.50	1.507	88.68	1.128	-0.16	0.556	0.945
	Bluetooth	1Mbps	Front	5mm	-	Full power	0	2402	1	9.31	10.50	1.316	77.69	1.072	-0.13	0.001	0.001
44	Bluetooth	1Mbps	Back	5mm	-	Full power	0	2402	1	9.31	10.50	1.316	77.69	1.072	0.02	0.076	0.108
5000MHz																	
	WLAN5.3GHz	802.11a 6Mbps	Front	5mm	-	Reduced	60	5300	1	13.09	14.50	1.384	89.10	1.122	0.05	0.119	0.185
45	WLAN5.3GHz	802.11a 6Mbps	Back	5mm	-	Reduced	60	5300	1	13.09	14.50	1.384	89.10	1.122	0.01	0.700	1.087
	WLAN5.3GHz	802.11a 6Mbps	Back	5mm	-	Reduced	64	5320	1	13.05	14.50	1.396	89.10	1.122	-0.03	0.652	1.022
	WLAN5.5GHz	802.11a 6Mbps	Front	5mm	-	Reduced	116	5580	1	12.65	14.50	1.531	89.10	1.122	0.05	0.079	0.136
	WLAN5.5GHz	802.11a 6Mbps	Back	5mm	-	Reduced	116	5580	1	12.65	14.50	1.531	89.10	1.122	-0.06	0.528	0.907
46	WLAN5.5GHz	802.11a 6Mbps	Back	5mm	-	Reduced	140	5700	1	12.63	14.50	1.538	89.10	1.122	0.01	0.589	1.017
	WLAN5.8GHz	802.11a 6Mbps	Front	5mm	-	Reduced	157	5785	1	9.52	11.00	1.406	89.10	1.122	-0.14	0.081	0.128
	WLAN5.8GHz	802.11a 6Mbps	Back	5mm	-	Reduced	157	5785	1	9.52	11.00	1.406	89.10	1.122	-0.18	0.581	0.917
47	WLAN5.8GHz	802.11a 6Mbps	Back	5mm	-	Reduced	165	5825	1	9.21	11.00	1.510	89.10	1.122	-0.09	0.661	1.120
	WLAN5.8GHz	802.11a 6Mbps	Back	5mm	-	Reduced	165	5825	2	9.21	11.00	1.510	89.10	1.122	0.01	0.556	0.942
	WLAN5.8GHz	802.11a 6Mbps	Back	5mm	-	Reduced	165	5825	3	9.21	11.00	1.510	89.10	1.122	0.02	0.540	0.915



14.4 Product Specific SAR

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Power State	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)
835MHz																				
48	GSM850	-	-	-	-	GPRS (2 Tx slots)	Back	0mm	DSI 4	189	836.4	1	30.38	31.50	1.294	-	-	0.03	2.060	2.666
	GSM850	-	-	-	-	GPRS (2 Tx slots)	Back	0mm	DSI 4	189	836.4	2	30.38	31.50	1.294	-	-	0.03	1.700	2.200
	GSM850	-	-	-	-	GPRS (2 Tx slots)	Back	0mm	DSI 4	189	836.4	3	30.38	31.50	1.294	-	-	0.01	1.710	2.213
	GSM850	-	-	-	-	GPRS (2 Tx slots)	Back	0mm	DSI 4	128	824.2	1	30.35	31.50	1.303	-	-	0.01	1.840	2.398
	GSM850	-	-	-	-	GPRS (2 Tx slots)	Back	0mm	DSI 4	251	848.8	1	30.31	31.50	1.315	-	-	-0.06	1.930	2.538
49	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	0mm	DSI 4	4182	836.4	1	22.42	24.00	1.439	-	-	0.06	1.480	2.129
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	0mm	DSI 4	4132	826.4	1	22.31	24.00	1.476	-	-	0.03	1.260	1.859
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	0mm	DSI 4	4233	846.6	1	22.40	24.00	1.445	-	-	0.04	1.310	1.894
1750MHz																				
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Back	0mm	DSI 4	1413	1732.6	1	17.76	19.00	1.330	-	-	0.15	0.755	1.004
50	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	DSI 4	1413	1732.6	1	17.76	19.00	1.330	-	-	-0.14	0.895	1.191
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	DSI 4	1413	1732.6	2	17.76	19.00	1.330	-	-	0.04	0.713	0.949
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	DSI 4	1413	1732.6	3	17.76	19.00	1.330	-	-	0.09	0.707	0.941
	LTE Band 66	20M	QPSK	1	0	-	Back	0mm	DSI 4	132322	1745	1	17.49	18.50	1.262	-	-	-0.11	0.740	0.934
	LTE Band 66	20M	QPSK	50	0	-	Back	0mm	DSI 4	132322	1745	1	17.39	18.50	1.291	-	-	0.03	0.628	0.811
51	LTE Band 66	20M	QPSK	1	0	-	Bottom Side	0mm	DSI 4	132322	1745	1	17.49	18.50	1.262	-	-	0.02	0.846	1.068
	LTE Band 66	20M	QPSK	50	0	-	Bottom Side	0mm	DSI 4	132322	1745	1	17.39	18.50	1.291	-	-	0.06	0.716	0.925
1900MHz																				
	GSM1900	-	-	-	-	GPRS (2 Tx slots)	Back	0mm	DSI 4	661	1880	1	25.00	26.00	1.259	-	-	-0.16	0.976	1.229
52	GSM1900	-	-	-	-	GPRS (2 Tx slots)	Bottom Side	0mm	DSI 4	661	1880	1	25.00	26.00	1.259	-	-	0.09	1.200	1.511
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	DSI 4	9400	1880	1	18.47	19.50	1.268	-	-	0.11	1.580	2.003
53	WCDMA II	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	DSI 4	9262	1852.4	1	18.34	19.50	1.306	-	-	0.03	1.590	2.077
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	DSI 4	9262	1852.4	2	18.34	19.50	1.306	-	-	0.06	1.320	1.724
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	DSI 4	9262	1852.4	3	18.34	19.50	1.306	-	-	0.11	1.280	1.672
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Bottom Side	0mm	DSI 4	9538	1907.6	1	18.35	19.50	1.303	-	-	-0.13	1.420	1.850
	LTE Band 2	20M	QPSK	1	0	-	Back	0mm	DSI 4	18900	1880	1	19.13	20.00	1.222	-	-	-0.04	1.290	1.576
	LTE Band 2	20M	QPSK	50	0	-	Back	0mm	DSI 4	18900	1880	1	19.07	20.00	1.239	-	-	0.07	1.130	1.400
54	LTE Band 2	20M	QPSK	1	0	-	Bottom Side	0mm	DSI 4	18900	1880	1	19.13	20.00	1.222	-	-	0.09	1.510	1.845
	LTE Band 2	20M	QPSK	50	0	-	Bottom Side	0mm	DSI 4	18900	1880	1	19.07	20.00	1.239	-	-	-0.12	1.420	1.759
2600MHz																				
55	LTE Band 7	20M	QPSK	1	0	-	Bottom Side	0mm	DSI 4	21100	2535	1	10.99	12.00	1.262	-	-	0.02	0.323	0.408
	LTE Band 7	20M	QPSK	50	0	-	Bottom Side	0mm	DSI 4	21100	2535	1	10.97	12.00	1.268	-	-	0.06	0.251	0.318
56	LTE Band 38	20M	QPSK	1	0	-	Bottom Side	0mm	DSI 4	38000	2595	1	13.63	14.50	1.222	62.9	1.006	-0.04	0.340	0.418
	LTE Band 38	20M	QPSK	1	0	-	Bottom Side	0mm	DSI 4	38000	2595	2	13.63	14.50	1.222	62.9	1.006	0.03	0.215	0.264
	LTE Band 38	20M	QPSK	1	0	-	Bottom Side	0mm	DSI 4	38000	2595	3	13.63	14.50	1.222	62.9	1.006	0.08	0.264	0.324
	LTE Band 38	20M	QPSK	50	0	-	Bottom Side	0mm	DSI 4	38000	2595	1	13.61	14.50	1.227	62.9	1.006	0.03	0.226	0.279



Plot No.	Band	Mode	Test Position	Gap (mm)	Power State	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)
2450MHz																
	WLAN2.4GHz	802.11g 6Mbps	Back	0mm	Full Power	2	2417	1	19.83	21.50	1.469	88.68	1.128	-0.17	0.606	1.004
57	WLAN2.4GHz	802.11g 6Mbps	Back	0mm	Reduced	10	2457	1	19.36	21.00	1.459	88.68	1.128	0.08	0.757	1.246
	WLAN2.4GHz	802.11g 6Mbps	Back	0mm	Reduced	10	2457	2	19.36	21.00	1.459	88.68	1.128	0.09	0.614	1.010
	WLAN2.4GHz	802.11g 6Mbps	Back	0mm	Reduced	10	2457	3	19.36	21.00	1.459	88.68	1.128	0.01	0.535	0.880
5000MHz																
	WLAN5.2GHz	802.11a 6Mbps	Back	0mm	Reduced	44	5220	1	12.88	14.50	1.452	89.10	1.122	0.1	0.516	0.841
58	WLAN5.2GHz	802.11a 6Mbps	Top Side	0mm	Reduced	44	5220	1	12.88	14.50	1.452	89.10	1.122	-0.01	0.549	0.894
	WLAN5.2GHz	802.11a 6Mbps	Top Side	0mm	Reduced	44	5220	2	12.88	14.50	1.452	89.10	1.122	0.01	0.446	0.727
	WLAN5.2GHz	802.11a 6Mbps	Top Side	0mm	Reduced	44	5220	3	12.88	14.50	1.452	89.10	1.122	0.09	0.455	0.741
	WLAN5.3GHz	802.11a 6Mbps	Front	0mm	Reduced	60	5300	1	13.09	14.50	1.384	89.10	1.122	0.19	0.095	0.147
	WLAN5.3GHz	802.11a 6Mbps	Back	0mm	Reduced	60	5300	1	13.09	14.50	1.384	89.10	1.122	0.07	0.467	0.725
	WLAN5.3GHz	802.11a 6Mbps	Left Side	0mm	Reduced	60	5300	1	13.09	14.50	1.384	89.10	1.122	-0.18	0.004	0.006
	WLAN5.3GHz	802.11a 6Mbps	Right Side	0mm	Reduced	60	5300	1	13.09	14.50	1.384	89.10	1.122	0.03	0.064	0.099
59	WLAN5.3GHz	802.11a 6Mbps	Top Side	0mm	Reduced	60	5300	1	13.09	14.50	1.384	89.10	1.122	-0.06	0.570	0.885
	WLAN5.5GHz	802.11a 6Mbps	Front	0mm	Reduced	116	5580	1	12.65	14.50	1.531	89.10	1.122	-0.17	0.110	0.189
	WLAN5.5GHz	802.11a 6Mbps	Back	0mm	Reduced	116	5580	1	12.65	14.50	1.531	89.10	1.122	-0.08	0.418	0.718
	WLAN5.5GHz	802.11a 6Mbps	Left Side	0mm	Reduced	116	5580	1	12.65	14.50	1.531	89.10	1.122	-0.04	0.000	0.000
	WLAN5.5GHz	802.11a 6Mbps	Right Side	0mm	Reduced	116	5580	1	12.65	14.50	1.531	89.10	1.122	-0.08	0.052	0.089
60	WLAN5.5GHz	802.11a 6Mbps	Top Side	0mm	Reduced	116	5580	1	12.65	14.50	1.531	89.10	1.122	-0.05	0.602	1.034
	WLAN5.5GHz	802.11a 6Mbps	Top Side	0mm	Reduced	116	5580	2	12.65	14.50	1.531	89.10	1.122	0.01	0.499	0.857
	WLAN5.5GHz	802.11a 6Mbps	Top Side	0mm	Reduced	116	5580	3	12.65	14.50	1.531	89.10	1.122	0.09	0.452	0.776
	WLAN5.8GHz	802.11a 6Mbps	Back	0mm	Reduced	157	5785	1	9.52	11.00	1.406	89.10	1.122	0.07	0.226	0.357
61	WLAN5.8GHz	802.11a 6Mbps	Top Side	0mm	Reduced	157	5785	1	9.52	11.00	1.406	89.10	1.122	-0.08	0.341	0.538
	WLAN5.8GHz	802.11a 6Mbps	Top Side	0mm	Reduced	157	5785	2	9.52	11.00	1.406	89.10	1.122	0.01	0.335	0.528
	WLAN5.8GHz	802.11a 6Mbps	Top Side	0mm	Reduced	157	5785	3	9.52	11.00	1.406	89.10	1.122	0.09	0.210	0.331

14.5 Repeated SAR Measurement

<1g>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Power State	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	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Bottom Side	5mm	DSI 6	1513	1752.6	1	16.73	18.00	1.340	-	-	0.08	1.030	1	1.380
2nd	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Bottom Side	5mm	DSI 6	1513	1752.6	1	16.73	18.00	1.340	-	-	0.01	0.984	1.047	1.318
1st	LTE Band 7	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	21350	2560	1	10.41	11.50	1.285	-	-	0.01	1.080	1	1.388
2nd	LTE Band 7	20M	QPSK	1	0	-	Bottom Side	5mm	DSI 6	21350	2560	1	10.41	11.50	1.285	-	-	0.06	0.984	1.100	1.265
1st	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	5mm	DSI 4	4233	846.6	1	22.40	24.00	1.445	-	-	0.06	0.983	1	1.421
2nd	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	5mm	DSI 4	4233	846.6	1	22.40	24.00	1.445	-	-	0.01	0.954	1.030	1.379
1st	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	5mm	DSI 4	9262	1852.4	1	18.34	19.50	1.306	-	-	0	1.040	1	1.358
2nd	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	5mm	DSI 4	9262	1852.4	1	18.34	19.50	1.306	-	-	0	0.987	1.054	1.289
1st	WLAN2.4GHz	-	-	-	-	802.11g 6Mbps	Back	5mm	Full power	6	2437	1	19.18	20.50	1.355	88.68	1.128	-0.08	0.928	1	1.419
2nd	WLAN2.4GHz	-	-	-	-	802.11g 6Mbps	Back	5mm	Full power	6	2437	1	19.18	20.50	1.355	88.68	1.128	0.01	0.898	1.033	1.373

<10g>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Ratio	Reported 10g SAR (W/kg)
1st	GSM850	GPRS (2 Tx slots)	Back	0mm	DSI 4	189	836.4	1	30.38	31.50	1.294	0.03	2.060	1	2.666
2nd	GSM850	GPRS (2 Tx slots)	Back	0mm	DSI 4	189	836.4	1	30.38	31.50	1.294	0.06	2.040	1.010	2.640

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is $\geq 0.8W/kg$.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR $< 1.45W/kg$, 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.

15. 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:

1. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
2. EUT will choose each GSM, WCDMA and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
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 WLAN Direct (GC/GO), and 5.3GHz / 5.5GHz supports WLAN Direct (GC only).
5. The worst case 5 GHz WLAN SAR for each configuration was used for SAR summation.
6. WLAN 2.4GHz and Bluetooth share the same antenna so can't transmit simultaneously.
7. According to the EUT characteristic, WLAN 5GHz and Bluetooth can't transmit simultaneously.
8. According to the EUT characteristic, WLAN 5GHz and WLAN 2.4GHz can't transmit simultaneously.
9. NFC can transmit simultaneously with other Radios in extremity exposure condition.
10. For Headset SAR and non-Headset SAR always chose higher SAR to do co-located analysis.
11. The maximum SAR summation is calculated based on the same configuration and test position.
12. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
 - i) 1g Scalar SAR summation < 1.6W/kg and 10g Scalar SAR summation < 4.0W/kg.
 - ii) $SPLSR = (SAR1 + SAR2)^{1.5} / (\min. \text{ separation distance, mm})$, 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.
 - iii) If $SPLSR \leq 0.04$ for 1g SAR and $SPLSR \leq 0.10$ for 10g SAR, simultaneously transmission SAR measurement is not necessary.
 - iv) Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg and 10g SAR < 4.0W/kg.
 - v) The SPLSR calculated results please refer to section 15.5.



15.1 Head Exposure Conditions

WWAN Band	Exposure Position	1	2	1+2	Case No
		WWAN 1g SAR (W/kg)	WLAN2.4GHz/WLAN5G/BT Max 1g SAR (W/kg)	Summed 1g SAR (W/kg)	
All Bands Ant 1	Right Cheek	0.599	0.659	1.26	
	Right Tilted	0.465	0.825	1.29	
	Left Cheek	0.522	1.344	1.87	1
	Left Tilted	0.564	1.172	1.74	2

15.2 Hotspot Exposure Conditions

WWAN Band	Exposure Position	1	2	1+2	Case No
		WWAN 1g SAR (W/kg)	WLAN2.4GHz/WLAN5G/BT Max 1g SAR (W/kg)	Summed 1g SAR (W/kg)	
All Bands Ant1	Front	0.645	0.332	0.98	
	Back	1.421	0.759	2.18	4
	Left side	0.535	0.033	0.57	
	Right side	0.647	0.159	0.81	
	Top side		0.624	0.62	
	Bottom side	1.388		1.39	

15.3 Body-Worn Accessory Exposure Conditions

WWAN Band	Exposure Position	1	2	1+2	SPLSR
		WWAN 1g SAR (W/kg)	WLAN2.4GHz/WLAN5G/BT Max 1g SAR (W/kg)	Summed 1g SAR (W/kg)	
All Bands Ant1	Front	0.667	0.384	1.05	
	Back	1.421	1.419	2.84	3

15.4 Product Specific Exposure Conditions

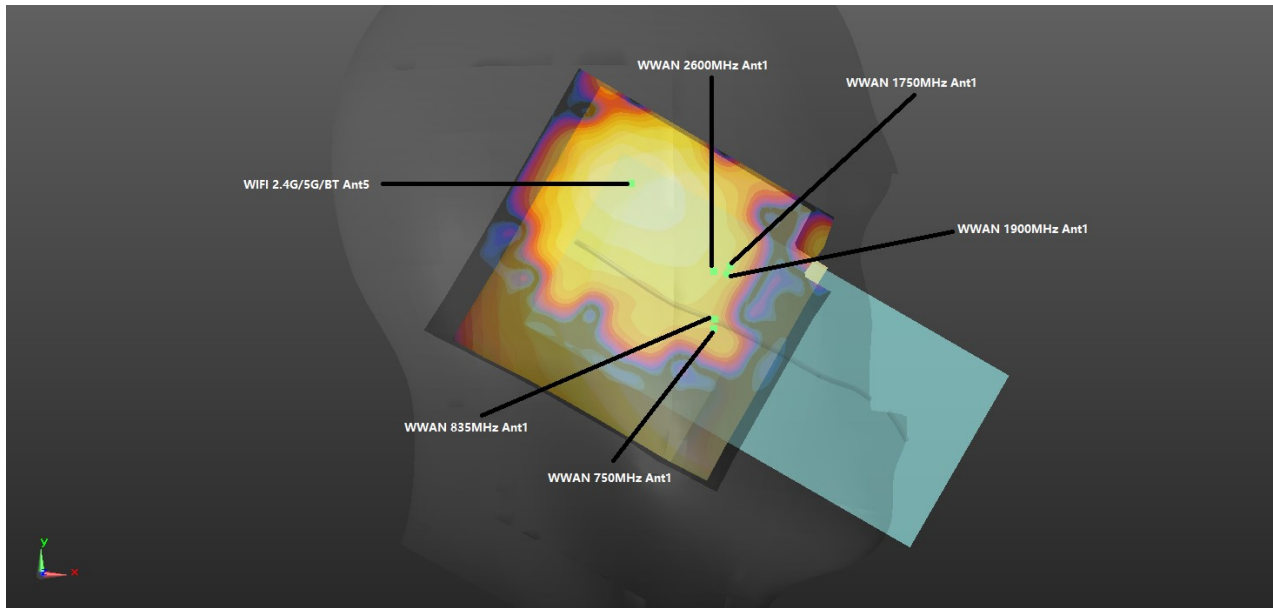
WWAN Band	Exposure Position	1	2	1+2
		WWAN 10g SAR (W/kg)	WLAN2.4GHz/WLAN5G/BT Max SAR 10g SAR (W/kg)	Summed 10g SAR (W/kg)
All Bands Ant1	Front		0.189	0.19
	Back	2.666	1.246	3.91
	Left side		0.006	0.01
	Right side		0.099	0.10
	Top side		1.034	1.03
	Bottom side	2.077		2.08

Note: 1. For Bluetooth Product specific 10g stand-alone SAR is not required for a transmitter or antenna, due to 1g hotspot SAR is <1.2W/kg.

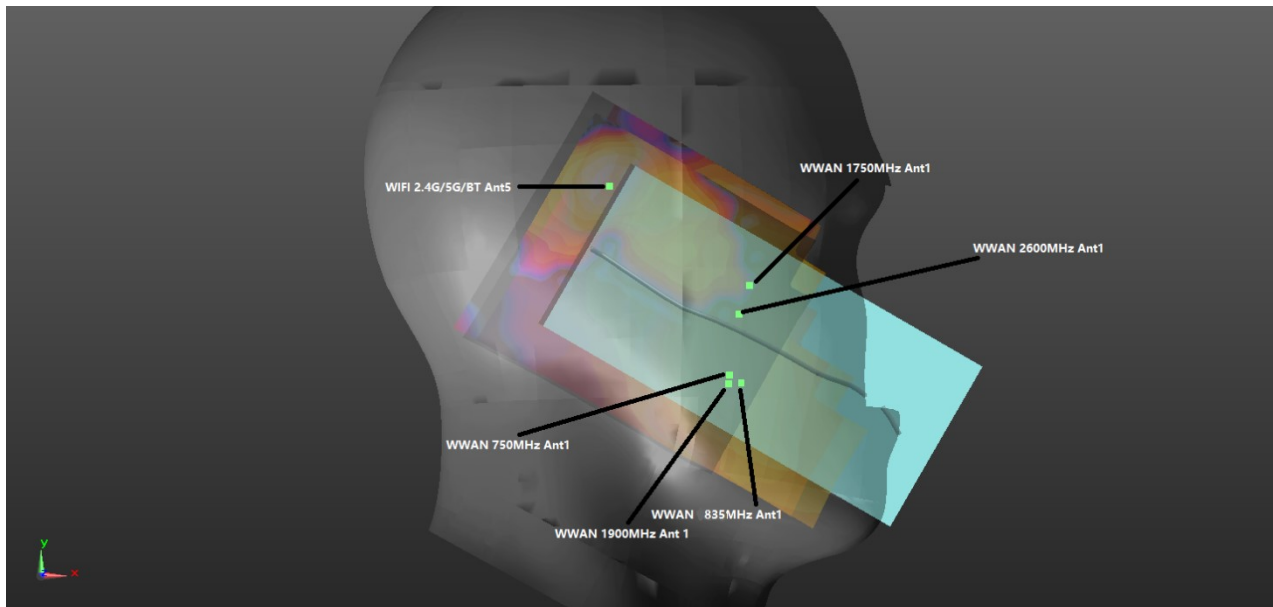
15.5 SPLSR Evaluation and Analysis

General Note:

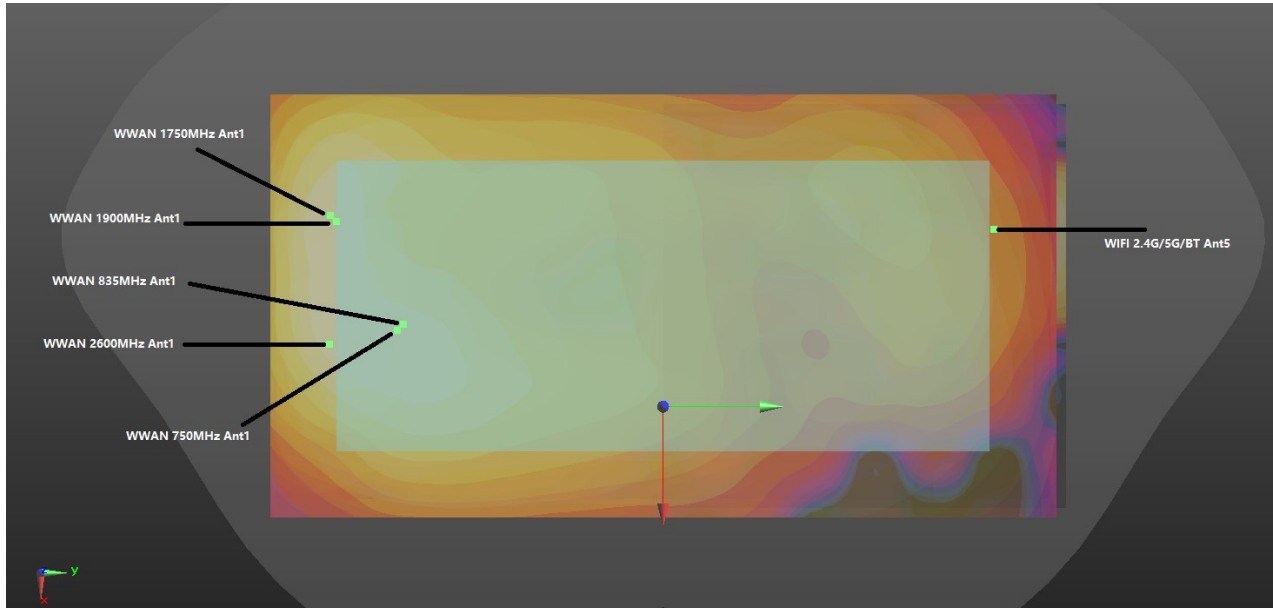
1. When standalone SAR is measured for both antennas in the pair, the peak location separation distance is computed by the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where $(x1, y1, z1)$ and $(x2, y2, z2)$ are the coordinates in the area scans or extrapolated peak SAR locations in the zoom scans, as appropriate.
2. $SPLSR = (SAR1 + SAR2)1.5 / (\text{min. separation distance, mm})$. If $SPLSR \leq 0.04$ for 1g SAR and $SPLSR \leq 0.10$ for 10g SAR, simultaneously transmission SAR measurement is not necessary.
3. The detail hotspot point for each transmitter in each exposure condition are showing as below figure and the minimum 3D distance for each sum combination is used for SPLSR analysis.



WWAN + WLAN 5GHz/2.4GHz Left Cheek_0mm



WWAN + WLAN 5GHz/2.4GHz Left Tilted_0mm



WWAN + WLAN 5GHz/2.4GHz Back_5mm



For Head

No.1 Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
LTE Band 7 Ant1	Left Cheek	0.522	0.522	0mm	47.99	-16.92	-3.9	65.4	1.87	0.04	Not required
WLAN2.4GHz/WLAN5G/BT		1.344	1.344	0mm	11.06	36.99	-2.56				

No.2 Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
LTE Band 66 Ant1	Left Tilted	0.564	0.564	0mm	61.99	-14.9	-0.1	66.1	1.74	0.03	Not required
WLAN2.4GHz/WLAN5G/BT		1.172	1.172	0mm	8.86	24.46	-1.82				

For Hotspot

No.4 Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
WCDMA V Ant1	Back	1.421	1.421	5mm	4.4	-66.2	-1.12	135.4	2.18	0.02	Not required
WLAN2.4GHz/WLAN5G/BT		0.759	0.759	5mm	-27.6	65.4	-1.64				

For Body-worn

No.3 Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
WCDMA V Ant1	Back	1.421	1.421	5mm	4.4	-66.2	-1.12	135.4	2.84	0.04	Not required
WLAN2.4GHz/WLAN5G/BT		1.419	1.419	5mm	-27.6	65.4	-1.64				

Test Engineer : Martin Li, Varus Wang, Light Wang, Ricky Gu



16. 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.

17. 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
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