



**FCC 47 CFR Parts 1 & 2  
Published RF Exposure KDB Procedures  
IEEE Std 1528-2013**

**SAR EVALUATION REPORT**

*For*

**GSM/WCDMA/LTE Phablet + Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC**

**Model: SM-G7508Q  
FCC ID: A3LSMG7508Q**

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### 1. Attestation of Test Results

Applicant	Samsung Electronics			
DUT description	GSM/WCDMA Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ and NFC			
Model	SM-G7508Q			
Test device is	An identical prototype			
Device category	Portable			
Exposure category	General Population/Uncontrolled Exposure			
Date tested	7/1/2014 – 7/22/2014			
The highest reported SAR values	RF exposure condition	Licensed	DTS	UNII
	Head	0.317 W/kg	0.079 W/kg	0.030 W/kg
	Body-worn Accessory	1.089 W/kg	0.088 W/kg	0.210 W/kg
	Wireless Router (Hotspot)			0.081 W/kg
Simultaneous Transmission	Head: 0.396 W/kg Body: 1.126 W/kg		Head: 0.347 W/kg Body: 1.097 W/kg	
Applicable Standards	FCC 47 CFR Parts 1 & 2 Published RF Exposure KDB Procedures, and TCB workshop updates IEEE Std 1528-2013			
Test Results	Pass			

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

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## 2. Test Methodology

The tests documented in this report were performed in accordance with FCC 47 CFR Parts 1 & 2, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 HSPA and 1x Advanced v02r02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 941225 D05 SAR for LTE Devices v02r03
- 941225 D06 Hotspot Mode SAR v01r01
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r03

## 3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. Calibration and Uncertainty

### 4.1. Measuring Instrument Calibration

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

#### Tissue Dielectric Properties

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	ENA Series/E5071B	MY42100131	2/24/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	11/13/2014
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	4242	122529163	9/19/2014
Thermometer	EXTECH	445703	CCS-200	3/24/2015

#### System Performance Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
ESG Vecto Signal Generator	Agilent	E4438C	MY47271507	6/17/2015
Power Meter	HP	438A	2822A05684	10/10/2014
Power Sensor	Agilent	8481A	2237A31744	10/2/2014
Power Sensor	Agilent	8481A	2349A36506	9/30/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808939	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2710	N/A
DC Power Supply	Sorensen Ametek	XT15-4	1319A02778	N/A
ESG Vecto Signal Generator	Agilent	E4438C	MY47271045	6/18/2015
Power Meter	HP	438A	3513U04320	10/2/2014
Power Sensor	Agilent	8481A	2702A66876	9/30/2014
Power Sensor	Agilent	8481A	3318A95392	9/30/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	N/A
DC Power Supply	HP	6296A	2841A-05955	N/A
E-Field Probe (SAR 3)	SPEAG	EX3DV4	3773	4/22/2015
E-Field Probe (SAR 4)	SPEAG	EX3DV4	3929	5/9/2015
E-Field Probe (SAR 5)	SPEAG	EX3DV4	3991	5/6/2015
Data Acquisition Electronics (SAR 3)	SPEAG	DAE4	1343	7/24/2014
Data Acquisition Electronics (SAR 4)	SPEAG	DAE4	1352	9/11/2014
Data Acquisition Electronics (SAR 5)	SPEAG	DAE4	1439	5/14/2015
System Validation Dipole	SPEAG	D835V2	4d002	11/15/2015
System Validation Dipole	SPEAG	D1900V2	5d043	11/12/2015
System Validation Dipole	SPEAG	D2450V2	899	9/10/2014
System Validation Dipole	SPEAG	D2600V2	1006	9/11/2014
System Validation Dipole	SPEAG	D5GHzV2	1138	11/19/2014
Thermometer (SAR Lab 3)	EXTECH	445703	CCS-237	6/3/2015
Thermometer (SAR Lab 4)	EXTECH	445703	CCS-238	6/3/2015
Thermometer (SAR Lab 5)	EXTECH	445703	CCS-239	6/3/2015

#### Others

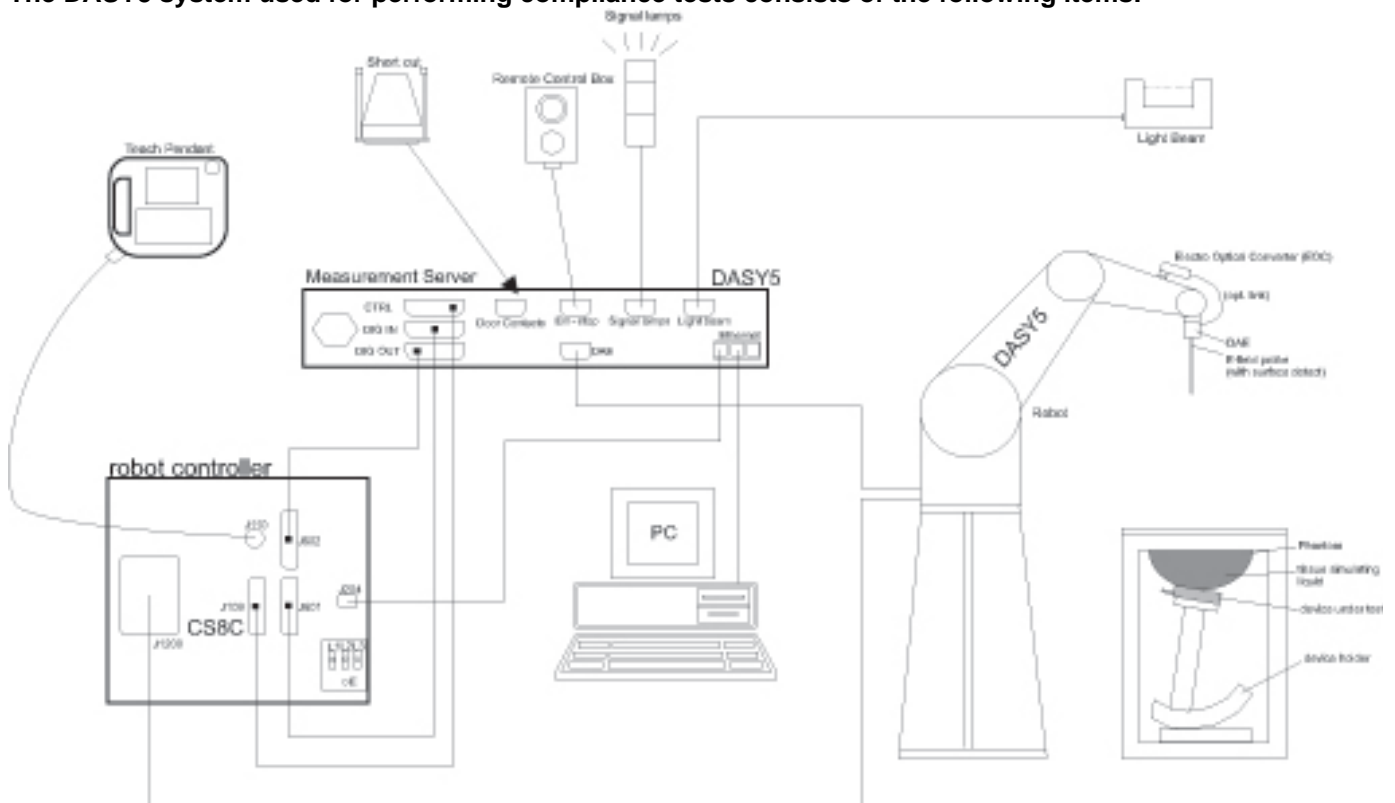
Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1911A	MY53060016	8/3/2014
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
Base Station Simulator	Agilent	8960	GB46160222	11/21/2014
Base Station Simulator	R & S	CMW500	132910-cp	4/25/2015

### 4.2. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

## 5. Measurement 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.

## 6. SAR Measurement Procedure

### 6.1. Normal SAR Measurement Procedure

#### Step 1: 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. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

#### Step 2: 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 locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) 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 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

**Step 3: Zoom Scan**

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g 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 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

**Step 4: Power drift measurement**

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

**Step 5: Z-Scan (FCC only)**

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

## 6.2. Volume Scan Procedures

### Step 1: Repeat Step 1-4 in Section 6.1

### Step 2: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

### Step 3: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

## 7. Device Under Test

### 7.1. General Information

Operating Configuration(s)	Held to head, Body-worn (Voice call)
Mobile Hotspot	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi -enabled devices. <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 2.4 GHz) (Mobile AP, FCC: Ch.1 ~ Ch.11) <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 5 GHz) (Mobile AP, FCC: Ch.149~165)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 2.4 GHz) (FCC: Ch.1 ~ Ch.11) <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 5 GHz) (FCC: Ch.149 ~ Ch.165)
Device dimension	Overall (Length x Width): 163.6 mm x 84.8 mm Overall Diagonal: 177.2 mm Display Diagonal: 152.7 mm
Back Cover	<input checked="" type="checkbox"/> Normal Battery Cover <input type="checkbox"/> Normal Battery Cover with NFC <input type="checkbox"/> Wireless Charger Battery Cover <input type="checkbox"/> Wireless Charger Battery Cover with NFC
Accessory	<input checked="" type="checkbox"/> Headset
Battery Options	<input checked="" type="checkbox"/> Standard – Lithium-ion battery, Rating 3.8Vdc, 10.64Wh <input type="checkbox"/> Extended (large capacity)

### 7.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
GSM	850, 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GSM Voice: 12.5%; GPRS/EGPRS: 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%;
		GPRS Multi-Slot Class: <input type="checkbox"/> Class 8 - One Up <input type="checkbox"/> Class 10 - Two Up <input type="checkbox"/> Class 12 - Four Up <input checked="" type="checkbox"/> Class 33 - Four Up DTM (Dual Transfer Mode): Not support	
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 5) HSUPA (Rel. 6) HSPA+ (Rel. 7)	100%
LTE (TDD)	Band 41	QPSK, 16QAM (Rel. 10) (Rel. 10 is not functional for US LTE Band)	63.3%
		Does this device SV-LTE (1xRTT-LTE)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40)	100%
Bluetooth	2.4 GHz	Version 4.0 LE	32.25% (DH1), 66.68% (DH3), 77.52% (DH5)

### 7.3. RF Output Power Tolerance

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	32.5	<b>33.0</b>
	GPRS 1 slot	32.5	<b>33.0</b>
	GPRS 2 slots	30.5	<b>31.0</b>
	GPRS 3 slots	29.0	<b>29.5</b>
	GPRS 4 slots	26.5	<b>27.0</b>
	EGPRS 1 slot	27.0	<b>27.5</b>
	EGPRS 2 slots	26.0	<b>26.5</b>
	EGPRS 3 slots	25.0	<b>25.5</b>
GSM1900	Voice	29.5	<b>30.0</b>
	GPRS 1 slot	29.5	<b>30.0</b>
	GPRS 2 slots	27.5	<b>28.0</b>
	GPRS 3 slots	26.0	<b>26.5</b>
	GPRS 4 slots	24.0	<b>24.5</b>
	EGPRS 1 slot	26.5	<b>27.0</b>
	EGPRS 2 slots	25.0	<b>25.5</b>
	EGPRS 3 slots	23.0	<b>23.5</b>
W-CDMA Band V	R99	23.0	<b>23.5</b>
	HSDPA	22.0	<b>22.5</b>
	HSUPA	22.5	<b>23.0</b>
	HSPA+	22.0	<b>22.5</b>
W-CDMA Band II	R99	22.0	<b>22.5</b>
	HSDPA	21.0	<b>21.5</b>
	HSUPA	22.0	<b>22.5</b>
	HSPA+	21.0	<b>21.5</b>
LTE Band 41	QPSK	22.5	<b>23.0</b>

Upper limit (dB): 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	16.0	<b>16.5</b>
	802.11g	13.0	<b>13.5</b>
	802.11n HT20	12.0	<b>12.5</b>
WiFi 5 GHz	802.11a	13.0	<b>13.5</b>
	802.11n HT20	12.0	<b>12.5</b>
	802.11n HT40	12.0	<b>12.5</b>
Bluetooth	GFSK	13.0	<b>13.5</b>
	8PSK	10.5	<b>11.0</b>
Bluetooth LE		2.5	<b>3.0</b>

### 7.4. Simultaneous Transmission Condition

Item	Capable Transmit Configurations	RF Exposure Condition			Notes
		Head	Body-worn Accessory	Wireless Router (Hotspot) & Wi-Fi Direct	
1	GSM 850/1900 Voice + Wi-Fi 2.4/5GHz	v	v	v	
2	GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4/5GHz (VoIP)	v	v	v	
3	WCDMA Band V/II + Wi-Fi 2.4/5GHz	v	v	v	
5	LTE B41 + Wi-Fi 2.4/5GHz	v	v	v	
6	GSM 850/1900 Voice + BT		v		
7	GSM 850/1900 (GPRS/EDGE) + BT(VoIP)		v		
8	WCDMA Band V/II + BT		v		
10	LTE B41 + BT		v		

Notes:

1. Wi-Fi 2.4GHz supports Hotspot and Wi-Fi Direct.
2. GPRS/EDGE, WCDMA, and LTE support Hotspot.
3. VoIP is support in GPRS/EDGE, WCDMA and LTE.
4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.
5. Wi-Fi 5 GHz Radio can transmit simultaneously with Bluetooth Radio.

### 7.5. General LTE SAR Test and Reporting Considerations

Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 41	Frequency range: 2496 - 2690 MHz																																											
		Channel Bandwidth																																											
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																						
Low		39750/2506.0	39725/2503.5	39700/2501	39675/2498.5																																								
Low-Mid		40185/2549.5	40173/2548.3	40160/2547.0	40148/2545.8																																								
Mid		40620/2593.0	40620/2593.0	40620/2593.0	40620/2593.0																																								
Mid-High		41055/2636.5	41068/2547.8	41080/2639.0	41093/2640.3																																								
High		41490/2680.0	41515/2682.5	41540/2685.0	41565/2687.5																																								
LTE transmitter and antenna implementation	LTE has one (1) TX/RX antennas and one (1) RX antennas Refer to Appendix 15.1. Photos and Antenna Locations.																																												
Maximum power reduction (MPR)	<p align="center"><b>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Modulation</th> <th colspan="6">Channel bandwidth / Transmission bandwidth (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>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 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>16 QAM</td> <td>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 18</td> <td>≤ 2</td> </tr> </tbody> </table> <p>MPR Built-in by design                      A-MPR (additional MPR) was disabled during SAR testing</p>							Modulation	Channel bandwidth / Transmission bandwidth (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	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
Modulation	Channel bandwidth / Transmission bandwidth (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																																						
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2																																						
Power reduction	No																																												
Spectrum plots for RB configurations	A properly configured base station simulator was used for the SAR and power measurements; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.																																												

## 7.6. LTE (TDD) Considerations

According to KDB 941225 D05 SAR for LTE Devices v02r02, for Time-Division Duplex (TDD) systems, SAR must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP LTE TDD configurations.

SAR was tested with the highest transmission duty factor (63.33%) using Uplink-downlink configuration 0 and Special subframe configuration 7.

LTE TDD Band 41 supports 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations and Table 4.2-1 for Special subframe configurations.

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

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

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

### Calculated Duty Cycle

Uplink-Downlink Configuration	Downlink-to-Uplink Switch-point Periodicity	Subframe Number										Calculated Duty Cycle (%)
		0	1	2	3	4	5	6	7	8	9	
0	5 ms	D	S	U	U	U	D	S	U	U	U	63.33
1	5 ms	D	S	U	U	D	D	S	U	U	D	43.33
2	5 ms	D	S	U	D	D	D	S	U	D	D	23.33
3	10 ms	D	S	U	U	U	D	D	D	D	D	31.67
4	10 ms	D	S	U	U	D	D	D	D	D	D	21.67
5	10 ms	D	S	U	D	D	D	D	D	D	D	11.67
6	5 ms	D	S	U	U	U	D	S	U	U	D	53.33

Calculated Duty Cycle = Extended cyclic prefix in uplink x ( $T_s$ ) x # of S + # of U

Example for Calculated Duty Cycle for Uplink-Downlink Configuration 0:

Calculated Duty Cycle =  $5120 \times [1/(15000 \times 2048)] \times 2 + 6 \text{ ms} = 63.33\%$

where

$T_s = 1/(15000 \times 2048)$  seconds

## 8. RF Exposure Conditions

Refer to Appendix "Antenna Locations and Separation Distances" for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

### 8.1. Head Exposure Conditions

#### For GSM, W-CDMA, LTE and Wi-Fi

Test Configurations	SAR Required	Note
Left Touch	Yes	
Left Tilt (15°)	Yes	
Right Touch	Yes	
Right Tilt (15°)	Yes	

### 8.2. Body-worn Accessory Exposure Conditions

#### For WWAN and LTE

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	

#### For Wi-Fi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	

### 8.3. Hotspot Exposure Conditions and Wi-Fi Direct

#### For WWAN and LTE

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	146 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 2 (Right)	1.3 mm	Yes	
Edge 3 (Bottom)	1.3 mm	Yes	
Edge 4 (Left)	50.2 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR

#### For Wi-Fi (2.4 GHz and 5.8 GHz only)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	16.8 mm	Yes	
Edge 2 (Right)	75 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR
Edge 3 (Bottom)	128.9 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR
Edge 4 (Left)	5 mm	Yes	

## 9. RF Output Power Measurement

### 9.1. GSM

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)	
850	GSM (Voice)	CS1	1	128	824.2	32.2	23.2	
				190	836.6	32.0	22.9	
				251	848.8	32.2	23.2	
	GPRS (GMSK)	CS1	1	1	128	824.2	32.3	23.3
					190	836.6	32.0	23.0
					251	848.8	32.2	23.2
			2	1	128	824.2	29.6	23.6
					190	836.6	29.6	23.6
					251	848.8	29.8	23.8
			3	1	128	824.2	28.2	23.9
					190	836.6	28.1	23.8
					251	848.8	28.3	24.0
			4	1	128	824.2	26.2	23.2
					190	836.6	26.3	23.3
					251	848.8	26.5	23.5
	EGPRS (8PSK)	MCS5	1	1	128	824.2	26.1	17.1
					190	836.6	26.1	17.1
					251	848.8	26.1	17.1
			2	1	128	824.2	26.0	20.0
					190	836.6	26.0	20.0
					251	848.8	26.0	20.0
			3	1	128	824.2	23.5	19.2
					190	836.6	23.5	19.2
					251	848.8	23.6	19.3
4			1	128	824.2	23.0	20.0	
				190	836.6	23.0	20.0	
				251	848.8	23.1	20.1	

#### Notes:

The worst-case configuration and mode for SAR testing is determined to be as follows:

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 3 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)	
1900	GSM (Voice)	CS1	1	512	1850.2	29.8	20.8	
				661	1880.0	29.8	20.8	
				810	1909.8	29.9	20.9	
	GPRS (GMSK)	CS1	1	1	512	1850.2	29.9	20.8
					661	1880.0	29.8	20.8
					810	1909.8	29.9	20.8
			2	1	512	1850.2	27.6	21.6
					661	1880.0	27.6	21.6
					810	1909.8	27.7	21.6
			3	1	512	1850.2	25.5	21.2
					661	1880.0	25.5	21.2
					810	1909.8	25.5	21.2
			4	1	512	1850.2	24.3	21.3
					661	1880.0	24.3	21.3
					810	1909.8	24.4	21.3
	EGPRS (8PSK)	MCS5	1	1	512	1850.2	26.0	17.0
					661	1880.0	26.0	17.0
					810	1909.8	26.0	17.0
			2	1	512	1850.2	25.0	19.0
					661	1880.0	25.0	19.0
					810	1909.8	25.0	19.0
			3	1	512	1850.2	23.0	18.7
					661	1880.0	23.0	18.7
					810	1909.8	23.0	18.7
4			1	512	1850.2	22.8	19.8	
				661	1880.0	22.8	19.8	
				810	1909.8	22.8	19.8	

**Notes:**

The worst-case configuration and mode for SAR testing is determined to be as follows:

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 3 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

## 9.2. W-CDMA

### Release 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	$\beta_c/\beta_d$	8/15

### Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	22.9
		4183	836.6	22.8
		4233	846.6	22.8
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	22.1
		9400	1880.0	21.9
		9538	1907.6	22.3

### HSDPA

The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121-1. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	$\beta_c$	2/15	12/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
	$\beta_{hs}$	4/15	24/15	30/15	30/15
MPR (dB)	0	0	0.5	0.5	
HSDPA Specific Settings	$D_{ACK}$	8			
	$D_{NAK}$	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
Ahs= $\beta_{hs}/\beta_c$	30/15				

**Measured Results**

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	21.9
		4183	836.6	0	21.9
		4233	846.6	0	21.7
	Subtest 2	4132	826.4	0	21.5
		4183	836.6	0	21.4
		4233	846.6	0	21.3
	Subtest 3	4132	826.4	0.5	21.3
		4183	836.6	0.5	21.3
		4233	846.6	0.5	21.2
	Subtest 4	4132	826.4	0.5	21.3
		4183	836.6	0.5	21.3
		4233	846.6	0.5	21.1
W-CDMA Band II	Subtest 1	9262	1852.4	0	20.9
		9400	1880.0	0	20.8
		9538	1907.6	0	21.2
	Subtest 2	9262	1852.4	0	20.6
		9400	1880.0	0	20.6
		9538	1907.6	0	20.8
	Subtest 3	9262	1852.4	0.5	20.6
		9400	1880.0	0.5	20.5
		9538	1907.6	0.5	20.8
	Subtest 4	9262	1852.4	0.5	20.5
		9400	1880.0	0.5	20.5
		9538	1907.6	0.5	20.7

Maximum output power levels that are possible for all subtests reported.

**HSPA (HSDPA & HSUPA)**

The following 5 Sub-tests were completed according to Release 7 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSPA				
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	$\beta_c$	11/15	6/15	15/15	2/15	15/15
	$\beta_d$	15/15	15/15	9/15	15/15	0
	$\beta_{ec}$	209/225	12/15	30/15	2/15	5/15
	$\beta_c/\beta_d$	11/15	11/15	15/9	2/15	15/0
	$\beta_{hs}$	22/15	12/15	30/15	4/15	5/15
	$\beta_{ed}$	1309/225	94/75	47/15 47/15	56/75	47/15
CM (dB)	1	3	2	3	1	
MPR (dB)	0	2	1	2	0	
HSDPA Specific Settings	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	A <sub>hs</sub> = $\beta_{hs}/\beta_c$	30/15				
HSUPA Specific Settings	E-DPDCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
Reference E-TFCI PO	27	27	27	27	27	
Maximum Channelisation Codes	2xSF2				SF4	

**Measured Results**

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	21.5
		4183	836.6	0	21.7
		4233	846.6	0	21.1
	Subtest 2	4132	826.4	2	20.3
		4183	836.6	2	20.8
		4233	846.6	2	20.6
	Subtest 3	4132	826.4	1	20.5
		4183	836.6	1	20.7
		4233	846.6	1	20.5
	Subtest 4	4132	826.4	2	20.3
		4183	836.6	2	20.8
		4233	846.6	2	21.0
	Subtest 5	4132	826.4	0	21.9
		4183	836.6	0	21.9
		4233	846.6	0	21.8
W-CDMA Band II	Subtest 1	9262	1852.4	0	20.6
		9400	1880.0	0	20.7
		9538	1907.6	0	21.0
	Subtest 2	9262	1852.4	2	19.8
		9400	1880.0	2	19.8
		9538	1907.6	2	20.1
	Subtest 3	9262	1852.4	1	20.0
		9400	1880.0	1	19.8
		9538	1907.6	1	20.2
	Subtest 4	9262	1852.4	2	20.4
		9400	1880.0	2	20.4
		9538	1907.6	2	20.5
	Subtest 5	9262	1852.4	0	21.0
		9400	1880.0	0	20.9
		9538	1907.6	0	21.2

**HSPA+**

Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6. Therefore, the RF conducted power is not measured.

## 9.1. LTE Band 41

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

**Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3**

Modulation	Channel bandwidth / Transmission bandwidth (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
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signalling Value of "NS\_01".

**Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)**

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks ( $N_{RB}$ )	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4, 10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10, 15, 20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3	13	10	Table 6.2.4-2	Table 6.2.4-2
	6.6.3.3.2				
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23 <sup>1</sup>	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-

Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

**LTE Band 41 Measured Results**

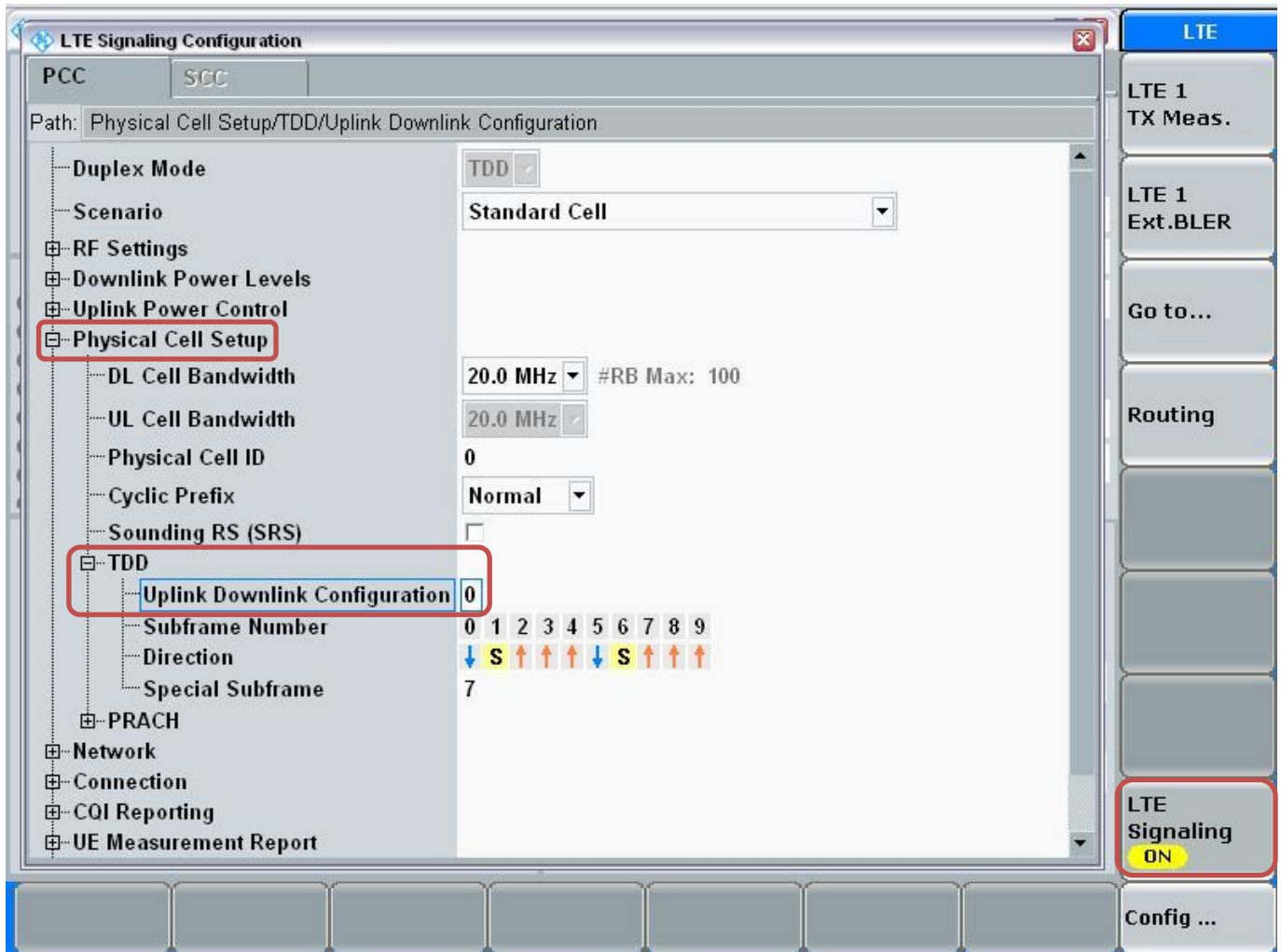
**Procedure used to establish SAR test signal for LTE TDD Band 41**

Set to CMW-500 with following parameters:

- Turn the LTE Signaling off using “ON | OFF” key
- Operating Band: Select Band 41 and TDD
- Go to “Config...”

The screenshot shows the 'LTE Signaling 1 - X3.2.10.6' interface. On the left, there is a 'Connection Status' section with 'Cell' (OFF), 'Packet Switched' (OFF), and 'RRC State' (Idle). Below it is an 'Event Log' with several entries. The 'UE Info' section shows fields for IMEI, IMSI, UE IPv4 Address, and UE IPv6 Prefix, all with dashes. The main configuration area is split into 'PCC' and 'SCC' tabs. Under 'SCC', 'Operating Band' is set to 'Band 41' and 'TDD'. Below this, 'Channel' and 'Frequency' are set to '40620 Ch' and '2593.0 MHz' respectively. 'Cell Bandwidth' is '20.0 MHz' and 'RS EPRE' is '-85.8 dBm/15kHz'. Power settings include 'Full Cell BW Pow.' at '-55.0 dBm', 'PUSCH Open Loop Nom.Power' at '23 dBm', and 'PUSCH Closed Loop Target Power' at '23.0 dBm'. The 'Connection Setup' section shows 'Scheduling' as 'RMC', '# RB' as '100', 'RB Pos./Start RB' as 'low', 'Modulation' as 'QPSK', and 'Throughput' as '3.970 Mbit/s' (Downlink) and '1.834 Mbit/s' (Uplink). On the right side, there is a vertical toolbar with buttons for 'LTE 1 TX Meas.', 'LTE 1 Ext.BLER', 'Go to...', 'Routing', 'LTE Signaling OFF' (highlighted with a red box), and 'Config ...' (also highlighted with a red box).

- Go to "Physical Cell Setup"
- Select "TDD" and Set "Uplink Downlink Configuration" to "0"
- Turn the cell on using "ON | OFF" key



**Connect to EUT**

- Turn the cell on using “ON | OFF” key
- After EUT is Attached
- Select “Connect”

The screenshot displays the 'LTE Signaling 1 - X3.2.10.6' interface. On the left, the 'Connection Status' section shows the cell is 'Attached' and 'Connected'. Below this is an 'Event Log' with several entries, including 'State 'Attached'', 'EPS Default Bearer Established', and 'RRC Connection Established'. The 'UE Info' section lists IMEI (001027009999998), IMSI (001010123456789), UE IPv4 Address (192.168.48.129), and UE IPv6 Prefix (fc01:abab:cdcd:efe0::). The main configuration area is split into 'PCC' and 'SCC' tabs. Under 'SCC', the 'Operating Band' is 'Band 41' and 'TDD'. The 'Channel' is '40620 Ch' for both Downlink and Uplink, with a 'Frequency' of '2593.0 MHz'. 'Cell Bandwidth' is '20.0 MHz'. 'RS EPRE' is '-85.8 dBm/15kHz' and 'Full Cell BW Pow.' is '-55.0 dBm'. 'PUSCH Open Loop Nom.Power' is '23 dBm' and 'PUSCH Closed Loop Target Power' is '23.0 dBm'. The 'Connection Setup' section shows 'Scheduling' as 'RMC'. For both Downlink and Uplink, '# RB' is '100', 'RB Pos./Start RB' is 'low', and 'Modulation' is 'QPSK'. 'TBS Idx / Value' for Downlink is '5 / 8760' and for Uplink is '2 / 4584'. 'Throughput' is '3.970 Mbit/s' for Downlink and '1.834 Mbit/s' for Uplink. On the right side, there is a vertical toolbar with buttons for 'LTE 1 TX Meas.', 'LTE 1 Ext.BLER', 'Go to...', 'Routing', and 'LTE Signaling ON' (which is highlighted with a red box). At the bottom, there is a row of buttons: 'Detach', 'Connect' (highlighted with a red box), 'Send SMS', 'Handover ...', and 'Config ...'.

**Max Power Setting**

- Select "LTE 1 TX Meas."
- Press "RESTART | STOP" Soft key

**LTE Signaling 1 - X3.2.10.6**

**Connection Status**  
 Cell: Connection Established  
 Packet Switched: Connection Established  
 RRC State: Connected

**Event Log**  
 03:33:07 [i] State 'Connection Established'  
 03:33:07 [i] EPS Dedicated Bearer Established  
 03:31:31 [i] State 'Attached'  
 03:31:31 [i] EPS Default Bearer Established  
 03:31:31 [i] RRC Connection Established  
 03:31:02 [i] State 'Cell On'  
 03:31:00 [i] State 'Cell Off'  
 03:30:23 [i] State 'Cell On'

**UE Info**  
 IMEI: 001027009999998  
 IMSI: 001010123456789  
 UE IPv4 Address [0]: 192.168.48.129  
 UE IPv6 Prefix [0]: fc01:abab:cdcd:efe0::

**Connection Setup**  
 Scheduling: RMC

	Downlink	Uplink
Operating Band	Band 41	TDD
Channel	40620 Ch	40620 Ch
Frequency	2593.0 MHz	2593.0 MHz
Cell Bandwidth	20.0 MHz	20.0 MHz
RS EPRE	-85.8 dBm/15kHz	
Full Cell BW Pow.	-55.0 dBm	
PUSCH Open Loop Nom.Power		23 dBm
PUSCH Closed Loop Target Power		23.0 dBm
# RB	100	100
RB Pos./Start RB	low 0	low 0
Modulation	QPSK	QPSK
TBS Idx / Value	5 8760	2 4584
Throughput	3.970 Mbit/s	1.834 Mbit/s

**LTE**  
 LTE 1 TX Meas.  
 LTE 1 Ext.BLER  
 Go to...  
 Routing  
 LTE Signaling ON

Detach Disconnect Send SMS Handover ... Config ...

- Select “Signaling Parameter”
- Select “TX Power Control (TPC)” > Select “Active TPC Setup” to “Max Power” > Set “Closed Loop Target Power” to “23 dBm”

The screenshot displays the 'LTE Measurement - X3.2.10.6 - TX Measurement' software interface. The main window shows various measurement plots: EVM, Inband Emissions, Equalizer Spectrum Flatness, and Spectrum ACLR. A 'Signaling TPC' dialog box is open, showing the 'TX Power Control (TPC)' settings. The 'Active TPC Setup' is set to 'Max Power' and the 'Closed Loop Target Power' is set to '23.0 dBm'. The 'Signaling Parameter' button on the right sidebar is highlighted with a red box. The 'LTE Signaling' status is 'ON'.

TX Power Control (TPC)	
Active TPC Setup	Max Power
Closed Loop Target Power	23.0 dBm

**View TX Power**

- Go to “Display”
- Select “Select View...”
- Select “Spectrum Emission Mask”

The screenshot shows the 'LTE Measurement - X3.2.10.6 - TX Measurement' interface. At the top, it indicates 'Multi Evaluation' is selected, along with 'PRACH' and 'SRS' options. The mode is 'TDD' at a frequency of 2593.0 MHz with a reference level of 45.00 dBm and a bandwidth of 20.0 MHz. The 'Spectrum Emission Mask' graph displays power in dBm (y-axis, -60 to 30) versus frequency in MHz (x-axis, -30 to 30). A blue trace labeled 'Current' shows a signal between -10 and 10 MHz, peaking at approximately -10 dBm. A red dashed line indicates the mask level. Below the graph, a table shows detected allocation parameters: NoRB: 100, OffsetRB: 0. Further down, a table provides OBW and TX Power statistics. A 'Select View' dialog box is open, showing 'SpectrumEmissionMask' selected. The 'Display' button on the right sidebar is highlighted with a red box. At the bottom, the 'Select View ...' button is also highlighted with a red box.

OBW	Current	Average	Extreme	StdDev
	17.790 MHz	17.773 MHz	17.790 MHz	0.013 MHz

TX Power	Current	Average	Min	Max	StdDev
	23.72 dBm	23.33 dBm	22.10 dBm	24.27 dBm	0.23 dBm

Statistic Count	Out of Tolerance	Detected Modulation	Detected Channel Type	View Filter	Throughput
20 / 20	0.00 %	QPSK	PUSCH		100.0 %

**LTE Band 41 Measured Results (continued)**

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)				
							2506 MHz	2549.5 MHz	2593 MHz	2636.5 MHz	2680 MHz
LTE Band 41	20	QPSK	1	0	0	0	<b>22.4</b>	<b>22.0</b>	<b>22.4</b>	<b>22.3</b>	<b>22.2</b>
			1	50	0	0	22.3	22.0	22.2	22.2	22.1
			1	99	0	0	22.3	22.0	22.1	22.2	22.0
			50	0	1	1	21.0	<b>21.0</b>	21.1	21.1	21.1
			50	25	1	1	<b>21.1</b>	21.0	<b>21.1</b>	21.1	<b>21.1</b>
			50	50	1	1	21.0	20.9	21.0	<b>21.1</b>	21.1
			100	0	1	1	21.0	21.0	21.1	<b>21.2</b>	21.1
		16QAM	1	0	1	1	21.3	21.1	21.2	21.4	21.3
			1	50	1	1	21.3	21.1	21.2	21.3	21.3
			1	99	1	1	21.3	21.1	21.2	21.4	21.1
			50	0	2	2	19.9	20.0	20.0	20.2	20.1
			50	25	2	2	20.0	19.9	20.0	20.1	20.1
			50	50	2	2	20.0	19.9	20.0	20.1	20.0
			100	0	2	2	19.9	20.0	20.2	20.2	20.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)				
							2503.5 MHz	2548.3 MHz	2593 MHz	2637.8 MHz	2682.5 MHz
LTE Band 41	15	QPSK	1	0	0	0	22.2	22.2	22.3	22.4	22.3
			1	36	0	0	22.2	22.2	22.3	22.3	22.2
			1	74	0	0	22.1	22.1	22.2	22.3	22.1
			36	0	1	1	21.0	21.0	21.0	21.1	21.2
			36	18	1	1	20.9	21.0	21.1	21.1	21.1
			36	37	1	1	21.0	20.9	21.1	21.1	21.0
			75	0	1	1	20.9	20.9	21.1	21.1	21.1
		16QAM	1	0	1	1	21.3	21.4	21.3	21.4	21.5
			1	36	1	1	21.2	21.4	21.3	21.4	21.5
			1	74	1	1	21.2	21.4	21.3	21.3	21.4
			36	0	2	2	20.0	20.1	20.1	20.2	20.2
			36	18	2	2	20.0	20.1	20.2	20.3	20.2
			36	37	2	2	20.1	20.1	20.2	20.2	20.1
			75	0	2	2	19.9	20.0	20.1	20.2	20.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)				
							2501 MHz	2547 MHz	2593 MHz	2639 MHz	2685 MHz
LTE Band 41	10	QPSK	1	0	0	0	22.1	22.0	22.2	22.2	22.2
			1	25	0	0	22.1	22.1	22.1	22.2	22.1
			1	49	0	0	22.1	22.1	22.2	22.2	22.0
			25	0	1	1	21.1	21.0	21.2	21.1	21.1
			25	12	1	1	21.0	21.1	21.1	21.3	21.1
			25	25	1	1	21.0	21.0	21.2	21.2	21.1
			50	0	1	1	21.0	21.0	21.1	21.1	21.1
		16QAM	1	0	1	1	21.1	20.9	20.7	21.3	21.2
			1	25	1	1	21.0	21.0	20.7	21.4	21.1
			1	49	1	1	21.1	21.0	20.7	21.3	21.1
			25	0	2	2	20.0	19.9	20.3	20.1	20.1
			25	12	2	2	19.9	20.0	20.2	20.2	20.1
			25	25	2	2	20.0	20.1	20.2	20.2	20.1
			50	0	2	2	19.9	20.1	20.2	20.2	20.1

**LTE Band 41 Measured Results (continued)**

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)				
							2498.5 MHz	2545.8 MHz	2593 MHz	2640.3 MHz	2687.5 MHz
LTE Band 41	5	QPSK	1	0	0	0	22.2	22.2	22.2	22.3	22.0
			1	12	0	0	22.1	22.1	22.2	22.2	22.0
			1	24	0	0	22.2	22.2	22.2	22.2	22.0
			12	0	1	1	21.2	21.1	21.2	21.3	21.2
			12	6	1	1	21.1	21.1	21.2	21.3	21.2
			12	13	1	1	21.1	21.1	21.2	21.2	21.1
			25	0	1	1	21.0	21.0	21.1	21.1	21.1
		16QAM	1	0	1	1	20.9	21.5	21.4	21.0	21.5
			1	12	1	1	20.8	21.5	21.3	20.9	21.5
			1	24	1	1	20.9	21.5	21.4	20.9	21.5
			12	0	2	2	20.0	20.0	20.3	20.3	20.2
			12	6	2	2	20.0	20.0	20.3	20.2	20.2
			12	13	2	2	20.0	20.0	20.2	20.2	20.1
			25	0	2	2	20.0	20.0	20.1	20.3	20.1

## 9.2. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1 <sup>#</sup>	√	∇
		2.437	6	√	∇
		2.462	11 <sup>#</sup>	√	∇

**Notes:**

√ = "default test channels"

∇ = possible 802.11g channels with maximum average output  $\frac{1}{4}$  dB  $\geq$  the "default test channels"

<sup>#</sup> = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

### Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4 (DTS)	802.11b	1 Mbps	1	2412	16.2	Yes
			6	2437	15.8	
			11	2462	15.8	
	802.11g	6 Mbps	1	2412	12.5	No
			6	2437	12.6	
			11	2462	12.3	
	802.11n (HT20)	MCS0	1	2412	11.6	No
			6	2437	12.2	
			11	2462	11.4	

**Note(s):**

Per KDB 248227 D01, SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

### Power measurements to determine worst-case data rates

Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
802.11b	6	2437	1 Mbps	16.1	Yes
			2 Mbps	16.1	No
			5.5 Mbps	16.2	No
			11 Mbps	16.2	No

### 9.3. Wi-Fi (5 GHz Bands)

#### Required Test Channels per KDB 248227 D01

Mode		Band	GHz	Channel	"Default Test Channels"	
					802.11a	
802.11a	UNII (15.407)	5.2 GHz	5.180	36	√	
			5.200	40		*
			2.220	44		*
			5.240	48	√	
		5.3 GHz	5.260	52	√	
			5.280	56		*
			5.300	60		*
			5.320	64	√	
		5.5 GHz	5.500	100		
			5.520	104	√	
			5.540	108		*
			5.560	112		*
			5.580	116	√	
			5.600	120		*
	5.620		124	√		
	5.640		128		*	
	DTS (15.247)	5.8 GHz	5.745	149	√	
			5.765	153		*
			5.785	157	√	
			5.805	161		*
5.825			165	√		

√ = "default test channels"

\* = possible 802.11a channels with maximum average output > the "default test channels"

# = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

**Measured Results**

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
5.2 (U-NII-1)	802.11a	6 Mbps	36	5180	13.2	Yes
			40	5200	13.2	
			44	5220	12.8	
			48	5240	12.9	
	802.11n (HT20)	MCS0	36	5180	12.2	No
			40	5200	12.3	
			48	5240	12.0	
	802.11n (HT40)	MCS0	38	5190	11.8	No
46			5230	11.9		
5.3 (U-NII-2A)	802.11a	6 Mbps	52	5260	13.3	Yes
			56	5280	13.4	
			60	5300	12.9	
			64	5320	12.5	
	802.11n (HT20)	MCS0	52	5260	11.6	No
			60	5300	12.0	
			64	5320	11.6	
	802.11n (HT40)	MCS0	54	5270	12.4	No
62			5310	12.5		
Band (GHz)	Mode	Mode	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
5.5 (U-NII-2C)	802.11a	6 Mbps	100	5500	13.2	Yes
			104	5520	12.9	
			108	5540	13.3	
			112	5560	12.9	
			116	5580	12.7	
			120	5600	12.7	
			124	5620	12.7	
			128	5640	12.6	
			132	5660	13.0	
			136	5680	13.2	
	140	5700	13.1			
	802.11n (HT20)	MCS0	100	5500	12.2	No
			116	5580	11.9	
			140	5700	12.3	
	802.11n (HT40)	MCS0	102	5510	12.3	No
			110	5550	12.0	
134			5670	11.6		
5.8 (U-NII-3)	802.11a	6 Mbps	149	5745	12.6	Yes
			153	5765	13.1	
			157	5785	13.2	
			161	5805	13.1	
			165	5825	13.1	
	802.11n (HT20)	MCS0	149	5745	12.5	No
			157	5785	11.8	
			161	5805	11.8	
	802.11n (HT40)	MCS0	151	5755	11.2	No
159			5795	11.9		

**Note(s):**

Per KDB 248227, SAR is not required for 802.11n HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels.

**Power measurements to determine worst-case data rates**

Band	Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
5.2 GHz (U-NII-1)	802.11a	44	5220	6 Mbps	13.2	Yes
				9 Mbps	13.2	No
				12 Mbps	13.1	No
				18 Mbps	13.3	No
				24 Mbps	13.3	No
				36 Mbps	13.2	No
				48 Mbps	13.3	No
54 Mbps	13.3	No				
5.3 GHz (U-NII-2A)	802.11a	64	5320	6 Mbps	13.4	Yes
				9 Mbps	13.4	No
				12 Mbps	13.4	No
				18 Mbps	13.4	No
				24 Mbps	13.5	No
				36 Mbps	13.5	No
				48 Mbps	13.5	No
54 Mbps	13.5	No				
5.5 GHz (U-NII-2C)	802.11a	116	5580	6 Mbps	13.3	Yes
				9 Mbps	13.3	No
				12 Mbps	13.3	No
				18 Mbps	13.3	No
				24 Mbps	13.4	No
				36 Mbps	13.4	No
				48 Mbps	13.4	No
54 Mbps	13.4	No				
5.8 GHz (U-NII-3)	802.11a	149	5745	6 Mbps	13.2	Yes
				9 Mbps	13.2	No
				12 Mbps	13.2	No
				18 Mbps	13.2	No
				24 Mbps	13.2	No
				36 Mbps	13.1	No
				48 Mbps	13.1	No
54 Mbps	13.1	No				

**9.4. Bluetooth**

Band (MHz)	Mode	Ch #	Freq. (MHz)	Freq. (MHz)	Conducted Avg Power	
					(dBm)	(mW)
2.4	V3.0 + EDR, GFSK	0	2402	2412	12.3	16.98
		39	2441	2437	13.1	20.42
		78	2480	2462	11.9	15.49
	V3.0 + EDR, 8-DPSK	0	2402	2412	10.0	10.00
		39	2441	2437	10.9	12.30
		78	2480	2462	9.6	9.12
	V4.0 LE, GFSK	0	2402	2422	2.2	1.66
		19	2440	2437	2.7	1.86
		39	2480	2452	2.0	1.58

## 10. Tissue Dielectric Properties

### IEEE Std 1528-2013

Target Frequency (MHz)	Head	
	$\epsilon_r$	$\sigma$ (S/m)
300	45.3	0.87
450	43.5	0.87
750	41.9	0.89
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1500	40.4	1.23
1640	40.2	1.31
1750	40.1	1.37
1800	40.0	1.40
1900	40.0	1.40
2000	40.0	1.40
2100	39.8	1.49
2300	39.5	1.67
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40
3500	37.9	2.91
4000	37.4	3.43
4500	36.8	3.94
5000	36.2	4.45
5200	36.0	4.66
5400	35.8	4.86
5600	35.5	5.07
5800	35.3	5.27
6000	35.1	5.48

NOTE—For convenience, permittivity and conductivity values at some frequencies that are not part of the original data from Drossos et al. [B60] or the extension to 5800 MHz are provided (i.e., the values shown in italics). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6000 MHz that were linearly extrapolated from the values at 3000 MHz and 5800 MHz.

### FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

## 10.1. Composition of Ingredients for the Tissue Material Used in the SAR Tests

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.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16 MΩ+ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

### MSL/HSL750 (Body and Head liquids for 700 – 800 MHz)

Item	Head Tissue Simulation Liquids HSL750 Muscle (body) Tissue Simulation Liquids MSL750
Type No	SL AAH 075
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H <sup>2</sup> O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40-60%
NaCl	Sodium Chloride, 0-6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone, 0.1-0.7%

### MSL/HSL1750 (Body and Head liquids for 1700 – 1800 MHz)

Item	Head Tissue Simulation Liquids HSL1750 Muscle (body) Tissue Simulation Liquids MSL1750
Type No	SL AAM 175
Manufacturer	SPEAG
-The item is composed of the following ingredients:	
H <sup>2</sup> O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25-48%
NaCl	Sodium Chloride, <1.0%

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

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

## 10.2. Tissue Dielectric Parameter Check Results

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within  $\pm 2^\circ\text{C}$  of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

### SAR Lab 3

	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit $\pm$ (%)	
7/8/2014	Head 835	e'	41.6700	Relative Permittivity ( $\epsilon_r$ ):	41.67	41.50	0.41	5
		e"	19.2100	Conductivity ( $\sigma$ ):	0.89	0.90	-0.90	5
	Head 820	e'	41.8500	Relative Permittivity ( $\epsilon_r$ ):	41.85	41.60	0.59	5
		e"	19.2600	Conductivity ( $\sigma$ ):	0.88	0.90	-2.26	5
	Head 850	e'	41.5000	Relative Permittivity ( $\epsilon_r$ ):	41.50	41.50	0.00	5
		e"	19.1700	Conductivity ( $\sigma$ ):	0.91	0.92	-0.98	5
7/8/2014	Body 835	e'	54.5600	Relative Permittivity ( $\epsilon_r$ ):	54.56	55.20	-1.16	5
		e"	21.2600	Conductivity ( $\sigma$ ):	0.99	0.97	1.76	5
	Body 820	e'	54.6300	Relative Permittivity ( $\epsilon_r$ ):	54.63	55.28	-1.17	5
		e"	21.3400	Conductivity ( $\sigma$ ):	0.97	0.97	0.47	5
	Body 850	e'	54.4800	Relative Permittivity ( $\epsilon_r$ ):	54.48	55.16	-1.23	5
		e"	21.1900	Conductivity ( $\sigma$ ):	1.00	0.99	1.45	5
7/8/2014	Head 1900	e'	38.4600	Relative Permittivity ( $\epsilon_r$ ):	38.46	40.00	-3.85	5
		e"	13.6600	Conductivity ( $\sigma$ ):	1.44	1.40	3.08	5
	Head 1850	e'	38.6500	Relative Permittivity ( $\epsilon_r$ ):	38.65	40.00	-3.38	5
		e"	13.5400	Conductivity ( $\sigma$ ):	1.39	1.40	-0.51	5
	Head 1910	e'	38.4000	Relative Permittivity ( $\epsilon_r$ ):	38.40	40.00	-4.00	5
		e"	13.6600	Conductivity ( $\sigma$ ):	1.45	1.40	3.62	5
7/8/2014	Body 1900	e'	51.0800	Relative Permittivity ( $\epsilon_r$ ):	51.08	53.30	-4.17	5
		e"	14.4400	Conductivity ( $\sigma$ ):	1.53	1.52	0.36	5
	Body 1850	e'	51.2000	Relative Permittivity ( $\epsilon_r$ ):	51.20	53.30	-3.94	5
		e"	14.3200	Conductivity ( $\sigma$ ):	1.47	1.52	-3.09	5
	Body 1910	e'	51.0600	Relative Permittivity ( $\epsilon_r$ ):	51.06	53.30	-4.20	5
		e"	14.4300	Conductivity ( $\sigma$ ):	1.53	1.52	0.82	5
7/12/2014	Head 1900	e'	38.5700	Relative Permittivity ( $\epsilon_r$ ):	38.57	40.00	-3.58	5
		e"	13.3500	Conductivity ( $\sigma$ ):	1.41	1.40	0.74	5
	Head 1850	e'	38.7700	Relative Permittivity ( $\epsilon_r$ ):	38.77	40.00	-3.07	5
		e"	13.1900	Conductivity ( $\sigma$ ):	1.36	1.40	-3.09	5
	Head 1910	e'	38.5200	Relative Permittivity ( $\epsilon_r$ ):	38.52	40.00	-3.70	5
		e"	13.3700	Conductivity ( $\sigma$ ):	1.42	1.40	1.42	5
7/12/2014	Body 1900	e'	51.5700	Relative Permittivity ( $\epsilon_r$ ):	51.57	53.30	-3.25	5
		e"	14.5100	Conductivity ( $\sigma$ ):	1.53	1.52	0.85	5
	Body 1850	e'	51.7400	Relative Permittivity ( $\epsilon_r$ ):	51.74	53.30	-2.93	5
		e"	14.3100	Conductivity ( $\sigma$ ):	1.47	1.52	-3.16	5
	Body 1910	e'	51.5400	Relative Permittivity ( $\epsilon_r$ ):	51.54	53.30	-3.30	5
		e"	14.5400	Conductivity ( $\sigma$ ):	1.54	1.52	1.59	5
7/22/2014	Body 2450	e'	50.2100	Relative Permittivity ( $\epsilon_r$ ):	50.21	52.70	-4.72	5
		e"	14.5300	Conductivity ( $\sigma$ ):	1.98	1.95	1.51	5
	Body 2410	e'	50.3800	Relative Permittivity ( $\epsilon_r$ ):	50.38	52.76	-4.51	5
		e"	14.3500	Conductivity ( $\sigma$ ):	1.92	1.91	0.81	5
	Body 2475	e'	50.1000	Relative Permittivity ( $\epsilon_r$ ):	50.10	52.67	-4.88	5
		e"	14.6200	Conductivity ( $\sigma$ ):	2.01	1.99	1.35	5

**SAR Lab 4**

	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
		e'						
7/7/2014	Body 2450	e'	51.2900	Relative Permittivity ( $\epsilon_r$ ):	51.29	52.70	-2.68	5
		e"	14.6000	Conductivity ( $\sigma$ ):	1.99	1.95	2.00	5
	Body 2410	e'	51.4000	Relative Permittivity ( $\epsilon_r$ ):	51.40	52.76	-2.58	5
		e"	14.5000	Conductivity ( $\sigma$ ):	1.94	1.91	1.87	5
	Body 2475	e'	51.2100	Relative Permittivity ( $\epsilon_r$ ):	51.21	52.67	-2.77	5
		e"	14.6600	Conductivity ( $\sigma$ ):	2.02	1.99	1.63	5
7/7/2014	Body 2600	e'	51.8700	Relative Permittivity ( $\epsilon_r$ ):	51.87	52.51	-1.22	5
		e"	14.3800	Conductivity ( $\sigma$ ):	2.08	2.16	-3.79	5
	Body 2500	e'	52.1500	Relative Permittivity ( $\epsilon_r$ ):	52.15	52.64	-0.93	5
		e"	14.1400	Conductivity ( $\sigma$ ):	1.97	2.02	-2.71	5
	Body 2700	e'	51.5600	Relative Permittivity ( $\epsilon_r$ ):	51.56	52.38	-1.57	5
		e"	14.6700	Conductivity ( $\sigma$ ):	2.20	2.30	-4.30	5
7/8/2014	Head 2600	e'	38.4300	Relative Permittivity ( $\epsilon_r$ ):	38.43	39.01	-1.49	5
		e"	13.9200	Conductivity ( $\sigma$ ):	2.01	1.96	2.56	5
	Head 2500	e'	38.8400	Relative Permittivity ( $\epsilon_r$ ):	38.84	39.14	-0.76	5
		e"	13.7000	Conductivity ( $\sigma$ ):	1.90	1.85	2.72	5
	Head 2700	e'	38.0400	Relative Permittivity ( $\epsilon_r$ ):	38.04	38.88	-2.17	5
		e"	14.1100	Conductivity ( $\sigma$ ):	2.12	2.07	2.32	5

**SAR Lab 5**

Freq. (MHz)		Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
7/3/2014	Head 2450	e'	38.0700	Relative Permittivity ( $\epsilon_r$ ):	38.07	39.20	-2.88	5	
		e"	13.3500	Conductivity ( $\sigma$ ):	1.82	1.80	1.04	5	
	Head 2410	e'	38.2400	Relative Permittivity ( $\epsilon_r$ ):	38.24	39.28	-2.65	5	
		e"	13.2500	Conductivity ( $\sigma$ ):	1.78	1.76	0.86	5	
	Head 2475	e'	37.9700	Relative Permittivity ( $\epsilon_r$ ):	37.97	39.17	-3.06	5	
		e"	13.4000	Conductivity ( $\sigma$ ):	1.84	1.83	0.93	5	
7/3/2014	Body 2450	e'	50.1500	Relative Permittivity ( $\epsilon_r$ ):	50.15	52.70	-4.84	5	
		e"	14.2100	Conductivity ( $\sigma$ ):	1.94	1.95	-0.73	5	
	Body 2410	e'	50.3000	Relative Permittivity ( $\epsilon_r$ ):	50.30	52.76	-4.66	5	
		e"	14.0800	Conductivity ( $\sigma$ ):	1.89	1.91	-1.09	5	
	Body 2475	e'	50.0500	Relative Permittivity ( $\epsilon_r$ ):	50.05	52.67	-4.97	5	
		e"	14.2900	Conductivity ( $\sigma$ ):	1.97	1.99	-0.94	5	
7/3/2014	Head 5180	e'	36.3700	Relative Permittivity ( $\epsilon_r$ ):	36.37	36.01	0.99	5	
		e"	15.4100	Conductivity ( $\sigma$ ):	4.44	4.63	-4.15	5	
	Head 5200	e'	36.3400	Relative Permittivity ( $\epsilon_r$ ):	36.34	35.99	0.97	5	
		e"	15.4200	Conductivity ( $\sigma$ ):	4.46	4.65	-4.14	5	
	Head 5600	e'	35.8600	Relative Permittivity ( $\epsilon_r$ ):	35.86	35.53	0.92	5	
		e"	15.4900	Conductivity ( $\sigma$ ):	4.82	5.06	-4.68	5	
	Head 5800	e'	35.6000	Relative Permittivity ( $\epsilon_r$ ):	35.60	35.30	0.85	5	
		e"	15.5700	Conductivity ( $\sigma$ ):	5.02	5.27	-4.72	5	
	Head 5825	e'	35.5600	Relative Permittivity ( $\epsilon_r$ ):	35.56	35.30	0.74	5	
		e"	15.5800	Conductivity ( $\sigma$ ):	5.05	5.27	-4.25	5	
	7/6/2014	Head 5180	e'	37.4400	Relative Permittivity ( $\epsilon_r$ ):	37.44	36.01	3.96	5
			e"	16.4400	Conductivity ( $\sigma$ ):	4.74	4.63	2.26	5
Head 5200		e'	37.4100	Relative Permittivity ( $\epsilon_r$ ):	37.41	35.99	3.94	5	
		e"	16.4600	Conductivity ( $\sigma$ ):	4.76	4.65	2.33	5	
Head 5600		e'	36.8300	Relative Permittivity ( $\epsilon_r$ ):	36.83	35.53	3.65	5	
		e"	16.6100	Conductivity ( $\sigma$ ):	5.17	5.06	2.21	5	
Head 5800		e'	36.5400	Relative Permittivity ( $\epsilon_r$ ):	36.54	35.30	3.51	5	
		e"	16.7200	Conductivity ( $\sigma$ ):	5.39	5.27	2.32	5	
Head 5825		e'	36.5000	Relative Permittivity ( $\epsilon_r$ ):	36.50	35.30	3.40	5	
		e"	16.7300	Conductivity ( $\sigma$ ):	5.42	5.27	2.82	5	
7/7/2014		Body 5180	e'	48.3600	Relative Permittivity ( $\epsilon_r$ ):	48.36	49.05	-1.40	5
			e"	18.3200	Conductivity ( $\sigma$ ):	5.28	5.27	0.10	5
	Body 5200	e'	48.3200	Relative Permittivity ( $\epsilon_r$ ):	48.32	49.02	-1.43	5	
		e"	18.3400	Conductivity ( $\sigma$ ):	5.30	5.29	0.15	5	
	Body 5600	e'	47.7000	Relative Permittivity ( $\epsilon_r$ ):	47.70	48.48	-1.60	5	
		e"	18.6000	Conductivity ( $\sigma$ ):	5.79	5.76	0.53	5	
	Body 5800	e'	47.4500	Relative Permittivity ( $\epsilon_r$ ):	47.45	48.20	-1.56	5	
		e"	18.8800	Conductivity ( $\sigma$ ):	6.09	6.00	1.48	5	
	Body 5825	e'	47.4000	Relative Permittivity ( $\epsilon_r$ ):	47.40	48.20	-1.66	5	
		e"	18.9100	Conductivity ( $\sigma$ ):	6.12	6.00	2.08	5	
	7/9/2014	Head 2600	e'	37.8600	Relative Permittivity ( $\epsilon_r$ ):	37.86	39.01	-2.95	5
			e"	13.9000	Conductivity ( $\sigma$ ):	2.01	1.96	2.41	5
Head 2500		e'	38.3500	Relative Permittivity ( $\epsilon_r$ ):	38.35	39.14	-2.01	5	
		e"	13.6200	Conductivity ( $\sigma$ ):	1.89	1.85	2.12	5	
Head 2700		e'	37.3400	Relative Permittivity ( $\epsilon_r$ ):	37.34	38.88	-3.97	5	
		e"	14.1900	Conductivity ( $\sigma$ ):	2.13	2.07	2.90	5	
7/9/2014	Body 2600	e'	51.4100	Relative Permittivity ( $\epsilon_r$ ):	51.41	52.51	-2.10	5	
		e"	15.2600	Conductivity ( $\sigma$ ):	2.21	2.16	2.10	5	
	Body 2500	e'	51.8300	Relative Permittivity ( $\epsilon_r$ ):	51.83	52.64	-1.53	5	
		e"	14.8500	Conductivity ( $\sigma$ ):	2.06	2.02	2.18	5	
	Body 2700	e'	50.9800	Relative Permittivity ( $\epsilon_r$ ):	50.98	52.38	-2.68	5	
		e"	15.6200	Conductivity ( $\sigma$ ):	2.35	2.30	1.90	5	

## 11. System Performance Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

### 11.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.  
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.  
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

### 11.2. Reference SAR Values for System Performance Check

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d002	11/15/2013	835	1g	9.49	9.43
				10g	6.18	6.21
D1900V2	5d043	11/12/2013	1900	1g	40.1	39.0
				10g	21.1	20.8
D2450V2	899	9/10/2013	2450	1g	51.3	49.7
				10g	23.9	23.3
D2600V2	1006	9/11/2013	2450	1g	56.5	55.7
				10g	25.2	24.8
D5GHzV2	1138	11/19/2013	5200	1g	78.5	72.9
				10g	22.5	20.4
			5600	1g	82.7	78.3
				10g	23.5	21.7
			5800	1g	78.3	72.8
				10g	22.4	20.1

### 11.3. System Performance Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

#### SAR Room 3

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta $\pm 10\%$	Est./Zoom Ratio	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W					
7/8/2014	D835V2	4d002	Head	1g	0.965	0.942	9.4	9.49	-0.74	2.38	
				10g	0.649	0.62	6.2	6.18	0.32		
7/8/2014	D835V2	4d002	Body	1g	0.962	0.953	9.5	9.43	1.06	0.94	1, 2
				10g	0.65	0.632	6.3	6.21	1.77		
7/8/2014	D1900V2	5d043	Head	1g	4.27	4.11	41.1	40.10	2.49	3.75	
				10g	2.19	2.12	21.2	21.10	0.47		
7/8/2014	D1900V2	5d043	Body	1g	4.04	4.01	40.1	39.00	2.82	0.74	3, 4
				10g	2.03	2.10	21.0	20.80	0.96		
7/12/2014	D1900V2	5d163	Head	1g	4.16	4.04	40.4	40.10	0.75	2.88	
				10g	2.15	2.09	20.9	21.10	-0.95		
7/12/2014	D1900V2	5d163	Body	1g	4.11	4.07	40.7	39.00	4.36	0.97	5, 6
				10g	2.07	2.13	21.3	20.80	2.40		
7/22/2014	D2450V2	899	Body	1g	5.18	5.29	52.9	49.70	6.44	-2.12	19,20
				10g	2.23	2.47	24.7	23.30	6.01		

#### SAR Room 4

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta $\pm 10\%$	Est./Zoom Ratio	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W					
7/8/2014	D2600V2	1006	Body	1g	5.90	5.67	56.7	55.70	1.80	3.90	
				10g	2.55	2.50	25.0	24.80	0.81		
7/8/2014	D2600V2	1006	Head	1g	6.35	6.09	60.9	56.50	7.79	4.09	7, 8
				10g	2.82	2.70	27.0	25.20	7.14		
7/7/2014	D2450V2	899	Body	1g	5.29	5.31	53.1	49.70	6.84	-0.38	
				10g	2.28	2.45	24.5	23.30	5.15		

**SAR Room 5**

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W					
7/3/2014	D2450V2	899	Head	1g	5.33	5.30	53.0	51.30	3.31	0.56	
				10g	2.33	2.43	24.3	23.90	1.67		
7/3/2014	D2450V2	899	Body	1g	5.46	5.38	53.8	49.70	8.25	1.47	9, 10
				10g	2.36	2.53	25.3	23.30	8.58		
7/3/2014	D5.2GHzV2	1138	Head	1g	8.61	7.35	73.5	78.50	-6.37	14.63	
				10g	2.46	2.11	21.1	22.50	-6.22		
7/3/2014	D5.6GHzV2	1138	Head	1g	7.22	7.65	76.5	82.70	-7.50	-5.96	11, 12
				10g	2.02	2.17	21.7	23.50	-7.66		
7/3/2014	D5.8GHzV2	1138	Head	1g	6.99	7.52	75.2	78.30	-3.96	-7.58	
				10g	1.96	2.14	21.4	22.40	-4.46		
7/6/2014	D5.2GHzV2	1138	Head	1g	7.26	7.61	76.1	78.50	-3.06	-4.82	
				10g	2.07	2.16	21.6	22.50	-4.00		
7/6/2014	D5.6GHzV2	1138	Head	1g	7.20	7.72	77.2	82.70	-6.65	-7.22	
				10g	2.02	2.17	21.7	23.50	-7.66		
7/6/2014	D5.8GHzV2	1138	Head	1g	6.94	7.42	74.2	78.30	-5.24	-6.92	13, 14
				10g	1.95	2.09	20.9	22.40	-6.70		
7/7/2014	D5.2GHzV2	1138	Body	1g	7.45	7.68	76.8	72.90	5.35	-3.09	15, 16
				10g	2.08	2.20	22.0	20.40	7.84		
7/7/2014	D5.6GHzV2	1138	Body	1g	8.09	8.25	82.5	78.30	5.36	-1.98	
				10g	2.20	2.30	23.0	21.70	5.99		
7/7/2014	D5.8GHzV2	1138	Body	1g	6.54	6.93	69.3	72.80	-4.81	-5.96	
				10g	1.78	1.93	19.3	20.10	-3.98		
7/9/2014	D2600V2	1006	Head	1g	5.96	5.69	56.9	56.5	0.71	4.53	
				10g	2.63	2.49	24.9	25.2	-1.19		
7/9/2014	D2600V2	1006	Body	1g	5.99	5.87	58.7	55.70	5.39	2.00	17,18
				10g	2.61	2.63	26.3	24.8	6.05		

## 12. Measured and Reported (Scaled) SAR Results

**SAR Test Reduction criteria are as follows:**

### **KDB 447498 D01 General RF Exposure Guidance:**

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
- $\leq 0.6$  W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz

### **KDB 648474 D04 Handset SAR:**

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is  $> 1.2$  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.

Additional 1-g SAR testing at 5 mm is not required. For hotspot mode, 10-g extremity SAR is not required for the surfaces and edges since all 1-g reported SAR  $< 1.2$  W/kg.

### **KDB 941225 D01 SAR test for 3G devices:**

Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least  $\frac{1}{4}$  dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2.

### **KDB 941225 D05 SAR for LTE Devices:**

SAR test reduction is applied using the following criteria:

- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
- When the reported SAR is  $> 0.8$  W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are  $> 0.8$  W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation  $< 1.45$  W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is  $< 1.45$  W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is  $< 1.45$  W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

### **KDB 248227 D01 SAR Measurements Procedures for 802.11 a/b/g Transmitters v01r02 (pg.6):**

Each channel should be tested at the lowest data rate in each a-b/g mode or 4.9 GHz channel BW configuration.

When the extrapolated maximum peak SAR for the maximum output channel is  $\leq 1.6$  W/kg and the 1-g averaged SAR is  $\leq 0.8$  W/kg, testing of other channels in the "default test channels" or "required test channels" configuration is optional.

**12.1. GSM850**

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.0	32.0	0.100	0.127	
			Left Tilt	190	836.6	33.0	32.0	0.063	0.080	
			Right Touch	190	836.6	33.0	32.0	0.161	0.204	
			Right Tilt	190	836.6	33.0	32.0	0.081	0.103	
Head VoIP	GPRS 3 Slots	0	Left Touch	190	836.6	29.5	28.1	0.149	0.206	
			Left Tilt	190	836.6	29.5	28.1	0.094	0.130	
			Right Touch	190	836.6	29.5	28.1	0.230	0.317	1
			Right Tilt	190	836.6	29.5	28.1	0.123	0.170	
Body-worn	Voice	10	Rear	190	836.6	33.0	32.0	0.447	0.567	
			Front	190	836.6	33.0	32.0	0.289	0.366	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	190	836.6	29.5	28.1	0.570	0.787	2
Hotspot			Front	190	836.6	29.5	28.1	0.404	0.558	
			Edge 2	190	836.6	29.5	28.1	0.220	0.304	
			Edge 3	190	836.6	29.5	28.1	0.263	0.363	

**12.2. GSM1900**

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.0	29.8	0.057	0.059	
			Left Tilt	661	1880.0	30.0	29.8	0.030	0.031	
			Right Touch	661	1880.0	30.0	29.8	0.071	0.074	
			Right Tilt	661	1880.0	30.0	29.8	0.022	0.023	
Head VoIP	GPRS 3 Slots	0	Left Touch	661	1880.0	26.5	25.5	0.066	0.084	
			Left Tilt	661	1880.0	26.5	25.5	0.045	0.057	
			Right Touch	661	1880.0	26.5	25.5	0.089	0.113	3
			Right Tilt	661	1880.0	26.5	25.5	0.033	0.042	
Body-worn	Voice	10	Rear	661	1880.0	30.0	29.8	0.307	0.319	
			Front	661	1880.0	30.0	29.8	0.452	0.469	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	661	1880.0	26.5	25.5	0.360	0.456	
Hotspot			Front	661	1880.0	26.5	25.5	0.435	0.551	4
			Edge 2	661	1880.0	26.5	25.5	0.059	0.075	
			Edge 3	661	1880.0	26.5	25.5	0.351	0.445	

**12.3. W-CDMA Band V**

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.5	22.8	0.103	0.121	
			Left Tilt	4183	836.6	23.5	22.8	0.066	0.077	
			Right Touch	4183	836.6	23.5	22.8	0.155	0.182	5
			Right Tilt	4183	836.6	23.5	22.8	0.083	0.097	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	23.5	22.8	0.377	0.443	6
			Front	4183	836.6	23.5	22.8	0.254	0.298	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.5	22.8	0.160	0.188	
			Edge 3	4183	836.6	23.5	22.8	0.180	0.211	

### 12.4. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	22.5	21.9	0.124	0.142	7
			Left Tilt	9400	1880.0	22.5	21.9	0.071	0.082	
			Right Touch	9400	1880.0	22.5	21.9	0.127	0.146	
			Right Tilt	9400	1880.0	22.5	21.9	0.044	0.051	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	22.5	21.9	0.613	0.704	8
			Front	9262	1852.4	22.5	22.1	0.886	0.971	
				9400	1880.0	22.5	21.9	0.902	1.036	
				9538	1907.6	22.5	22.3	1.040	1.089	
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	22.5	21.9	0.131	0.150	8
			Edge 3	9262	1852.4	22.5	22.1	0.731	0.802	
				9400	1880.0	22.5	21.9	0.767	0.881	
				9538	1907.6	22.5	22.3	0.915	0.958	

### 12.5. LTE Band 41 (20MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	40620	2593.0	1	0	23.0	22.4	0.042	0.049	9
						50	24	22.0	21.1	0.032	0.040	
			Left Tilt	40620	2593.0	1	0	23.0	22.4	0.034	0.039	9
						50	24	22.0	21.1	0.027	0.033	
			Right Touch	40620	2593.0	1	0	23.0	22.4	0.032	0.037	9
						50	24	22.0	21.1	0.019	0.024	
			Right Tilt	40620	2593.0	1	0	23.0	22.4	0.021	0.024	9
						50	24	22.0	21.1	0.016	0.020	
Body-worn & Hotspot	QPSK	10	Rear	40620	2593.0	1	0	23.0	22.4	0.344	0.400	10
						50	24	22.0	21.1	0.262	0.325	
			Front	40620	2593.0	1	0	23.0	22.4	0.332	0.386	10
						50	24	22.0	21.1	0.257	0.318	
Hotspot	QPSK	10	Edge 2	40620	2593.0	1	0	23.0	22.4	0.148	0.172	11
						50	24	22.0	21.1	0.114	0.141	
			Edge 3	40620	2593.0	1	0	23.0	22.4	0.360	0.418	11
						50	24	22.0	21.1	0.270	0.334	

### 12.6. Wi-Fi (DTS Band)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
2.4 GHz	Head	802.11b 1 Mbps	0	Left Touch	6	2437.0	16.5	15.8	0.029	0.035	12
				Left Tilt	6	2437.0	16.5	15.8	0.025	0.030	
				Right Touch	6	2437.0	16.5	15.8	0.067	0.079	
				Right Tilt	6	2437.0	16.5	15.8	0.045	0.053	
	Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	16.5	15.8	0.075	0.088	13
				Front	6	2437.0	16.5	15.8	0.032	0.037	
				Edge 1	6	2437.0	16.5	15.8	0.013	0.015	
				Edge 4	6	2437.0	16.5	15.8	0.043	0.050	

### 12.7. Wi-Fi (UNII Bands)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
5.2 GHz (U-NII-1)	Head	802.11a 6 Mbps	0	Left Touch	36	5180.0	13.5	13.2	0.005	0.005	
				Left Tilt	36	5180.0	13.5	13.2	0.003	0.003	
				Right Touch	36	5180.0	13.5	13.2	0.028	0.030	14
				Right Tilt	36	5180.0	13.5	13.2	0.012	0.013	
	Body-worn	802.11a 6 Mbps	10	Rear	36	5180.0	13.5	13.2	0.196	0.210	15
				Front	36	5180.0	13.5	13.2	0.006	0.006	
5.3 GHz (U-NII-2A)	Head	802.11a 6 Mbps	0	Left Touch	56	5280.0	13.5	13.4	0.006	0.007	
				Left Tilt	56	5280.0	13.5	13.4	0.006	0.006	
				Right Touch	56	5280.0	13.5	13.4	0.024	0.025	16
				Right Tilt	56	5280.0	13.5	13.4	0.008	0.009	
	Body-worn	802.11a 6 Mbps	10	Rear	56	5280.0	13.5	13.4	0.173	0.177	17
				Front	56	5280.0	13.5	13.4	0.008	0.008	
5.5 GHz (U-NII-2C)	Head	802.11a 6 Mbps	0	Left Touch	108	5540.0	13.5	13.3	0.006	0.007	
				Left Tilt	108	5540.0	13.5	13.3	0.005	0.005	
				Right Touch	108	5540.0	13.5	13.3	0.014	0.014	18
				Right Tilt	108	5540.0	13.5	13.3	0.009	0.010	
	Body-worn	802.11a 6 Mbps	10	Rear	108	5540.0	13.5	13.3	0.129	0.135	19
				Front	108	5540.0	13.5	13.3	0.001	0.001	
5.8 GHz (U-NII-3)	Head	802.11a 6 Mbps	0	Left Touch	157	5785.0	13.5	13.2	0.011	0.012	
				Left Tilt	157	5785.0	13.5	13.2	0.012	0.013	
				Right Touch	157	5785.0	13.5	13.2	0.023	0.025	20
				Right Tilt	157	5785.0	13.5	13.2	0.020	0.021	
	Body-worn & Hotspot	802.11a 6 Mbps	10	Rear	157	5785.0	13.5	13.2	0.076	0.081	21
				Front	157	5785.0	13.5	13.2	0.005	0.006	
Edge 1				157	5785.0	13.5	13.2	0.009	0.010		
Edge 4				157	5785.0	13.5	13.2	0.031	0.033		

### 12.8. Bluetooth

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
BT	Body-worn	GFSK	10	Rear	39	2441.0	13.5	13.1	0.026	0.029	22
				Front	39	2441.0	13.5	13.1	0.004	0.004	

### 13. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the **ratio of largest to smallest SAR** for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

#### 13.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Hotspot/Wi-Fi Direct (W/kg)	Repeated SAR (Yes/No)
850	GSM 850		0.570		No
	WCDMA Band V		0.377		No
1900	GSM 1900		0.452		No
	WCDMA Band II		1.040		Yes
2400	Wi-Fi 802.11b/g/n		0.075		No
	Bluetooth		0.026		No
2600	LTE Band 41			0.360	No
5200	Wi-Fi 802.11a/n		0.196		No
5300	Wi-Fi 802.11a/n		0.173		No
5500	Wi-Fi 802.11a/n		0.129		No
5800	Wi-Fi 802.11a/n			0.031	No

#### 13.2. Repeated Measurement Results

##### Body-worn Accessory & Hotspot Mode Exposure Conditions

Frequency band	Test Position	Antenna	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
						Original	Repeated		
WCDMA Band II	Front	Main	Rel 99 RMC 12.2 kbps	9538	1907.6	1.040	0.969	1.07	1

**Note(s):**

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.

### 14. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

**SAR<sub>1</sub>** is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

**SAR<sub>2</sub>** is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

**Ri** is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured for both antennas in the pair, it is determined by the actual x, y, and z coordinates in the 1-g SAR for each SAR Peak Location; based on the extrapolated and interpolated result in the zoom scan measurement using the formula:

$$[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$$

A new threshold of 0.04 is also introduced in the KDB 447498. Thus, in order for a pair of simultaneously transmitting antennas, with the sum of 1-g SAR > 1.6 W/kg, to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri < 0.04$$

#### 14.1. Sum of the SAR for GSM850 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM850	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.206	0.035			0.241	No
		① + ③	0.206		0.012		0.218	No
	Left Tilt	① + ②	0.130	0.030			0.160	No
		① + ③	0.130		0.013		0.143	No
	Right Touch	① + ②	0.317	0.079			0.396	No
		① + ③	0.317		0.030		0.347	No
	Right Tilt	① + ②	0.170	0.053			0.223	No
		① + ③	0.170		0.021		0.191	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.787	0.088			0.875	No
		① + ③	0.787		0.210		0.997	No
		① + ④	0.787			0.029	0.816	No
	Front	① + ②	0.558	0.037			0.595	No
		① + ③	0.558		0.008		0.566	No
		① + ④	0.558			0.004	0.562	No
Hotspot	Edge 1	① + ②		0.015			0.015	No
		① + ③			0.010		0.010	No
	Edge 2	① + ②	0.304				0.304	No
	Edge 3	① + ②	0.363				0.363	No
	Edge 4	① + ②		0.050			0.050	No
		① + ③			0.033		0.033	No

#### SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**14.2. Sum of the SAR for GSM1900 & Wi-Fi & BT**

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.084	0.035			0.119	No
		① + ③	0.084		0.012		0.096	No
	Left Tilt	① + ②	0.057	0.030			0.087	No
		① + ③	0.057		0.013		0.070	No
	Right Touch	① + ②	0.113	0.079			0.192	No
		① + ③	0.113		0.030		0.143	No
Right Tilt	① + ②	0.042	0.053			0.095	No	
	① + ③	0.042		0.021		0.063	No	
Body-worn Accessory & Hotspot	Rear	① + ②	0.456	0.088			0.544	No
		① + ③	0.456		0.210		0.666	No
		① + ④	0.456			0.029	0.485	No
	Front	① + ②	0.551	0.037			0.588	No
		① + ③	0.551		0.008		0.559	No
		① + ④	0.551			0.004	0.555	No
Hotspot	Edge 1	① + ②		0.015			0.015	No
		① + ③			0.010		0.010	No
	Edge 2	① + ②	0.075				0.075	No
	Edge 3	① + ②	0.445				0.445	No
	Edge 4	① + ②		0.050			0.050	No
		① + ③			0.033		0.033	No

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**14.3. Sum of the SAR for WCDMA Band V & Wi-Fi & BT**

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① WCDMA Band V	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.121	0.035			0.156	No
		① + ③	0.121		0.012		0.133	No
	Left Tilt	① + ②	0.077	0.030			0.107	No
		① + ③	0.077		0.013		0.090	No
	Right Touch	① + ②	0.182	0.079			0.261	No
		① + ③	0.182		0.030		0.212	No
Right Tilt	① + ②	0.097	0.053			0.150	No	
	① + ③	0.097		0.021		0.118	No	
Body-worn Accessory & Hotspot	Rear	① + ②	0.443	0.088			0.531	No
		① + ③	0.443		0.210		0.653	No
		① + ④	0.443			0.029	0.472	No
	Front	① + ②	0.298	0.037			0.335	No
		① + ③	0.298		0.008		0.306	No
		① + ④	0.298			0.004	0.302	No
Hotspot	Edge 1	① + ②		0.015			0.015	No
		① + ③			0.010		0.010	No
	Edge 2	① + ②	0.188				0.188	No
	Edge 3	① + ②	0.211				0.211	No
	Edge 4	① + ②		0.050			0.050	No
		① + ③			0.033		0.033	No

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**14.4. Sum of the SAR for WCDMA Band II & Wi-Fi & BT**

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① WCDMA Band II	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.142	0.035			0.177	No
		① + ③	0.142		0.012		0.154	No
	Left Tilt	① + ②	0.082	0.030			0.112	No
		① + ③	0.082		0.013		0.095	No
	Right Touch	① + ②	0.146	0.079			0.225	No
		① + ③	0.146		0.030		0.176	No
Right Tilt	① + ②	0.051	0.053			0.104	No	
	① + ③	0.051		0.021		0.072	No	
Body-worn Accessory & Hotspot	Rear	① + ②	0.704	0.088			0.792	No
		① + ③	0.704		0.210		0.914	No
		① + ④	0.704			0.029	0.733	No
	Front	① + ②	1.089	0.037			1.126	No
		① + ③	1.089		0.008		1.097	No
		① + ④	1.089			0.004	1.093	No
Hotspot	Edge 1	① + ②		0.015			0.015	No
		① + ③			0.010		0.010	No
	Edge 2	① + ②	0.150				0.150	No
	Edge 3	① + ②	0.958				0.958	No
	Edge 4	① + ②		0.050			0.050	No
		① + ③			0.033		0.033	No

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**14.5. Sum of the SAR for LTE Band 41 & Wi-Fi & BT**

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① LTE Band 41	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.049	0.035			0.084	No
		① + ③	0.049		0.012		0.061	No
	Left Tilt	① + ②	0.039	0.030			0.069	No
		① + ③	0.039		0.013		0.052	No
	Right Touch	① + ②	0.037	0.079			0.116	No
		① + ③	0.037		0.030		0.067	No
Right Tilt	① + ②	0.024	0.053			0.077	No	
	① + ③	0.024		0.021		0.045	No	
Body-worn Accessory & Hotspot	Rear	① + ②	0.400	0.088			0.488	No
		① + ③	0.400		0.210		0.610	No
		① + ④	0.400			0.029	0.429	No
	Front	① + ②	0.386	0.037			0.423	No
		① + ③	0.386		0.008		0.394	No
		① + ④	0.386			0.004	0.390	No
Hotspot	Edge 1	① + ②		0.015			0.015	No
		① + ③			0.010		0.010	No
	Edge 2	① + ②	0.172				0.172	No
	Edge 3	① + ②	0.418				0.418	No
	Edge 4	① + ②		0.050			0.050	No
		① + ③			0.033		0.033	No

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

## 15. Appendixes

Refer to separated files for the following appendixes.

- 15.1. Photos and Antenna Locations
- 15.2. System Performance Check Plots
- 15.3. Highest SAR Test Plots
- 15.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3773
- 15.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3929
- 15.6. Calibration Certificate for E-Field Probe EX3DV4 - SN 3991
- 15.7. Calibration Certificate for D835V2 - SN 4d002
- 15.8. Calibration Certificate for D1900V2- SN 5d043
- 15.9. Calibration Certificate for D2450V2 - SN 899
- 15.10. Calibration Certificate for D2600V2 - SN 1006
- 15.11. Calibration Certificate for D5GHzV2 - SN 1138

END OF REPORT