



SAR EVALUATION REPORT

**FCC 47 CFR § 2.1093
IEEE Std 1528-2013**

For
GSM/WCDMA/LTE Phone + Bluetooth, WLAN 2.4GHz b/g/n & ANT+

**Model: SM-A3000
FCC ID: A3LSMA3000**

**Report Number: 14118652-S1A
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Prepared for
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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS		
Application Purpose	<input checked="" type="checkbox"/> Original Grant <input type="checkbox"/> Class II Permissive Change		
FCC ID	A3LSMA3000		
DUT Description	GSM/WCDMA/LTE Phone + Bluetooth, WLAN 2.4GHz b/g/n & ANT+		
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)		
The Highest Reported SAR	RF Exposure Conditions	Equipment Class	
		Licensed	DTS
	Head	0.131 W/kg	0.626 W/kg
	Body-worn Accessory	0.347 W/kg	0.031 W/kg
	Wireless Router (Hotspot)		
	Wi-Fi Direct	N/A	
Simultaneous Transmission	Head: 0.695 W/kg	Body: 0.376 W/kg	
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013		
Test Results	Pass		
Date tested	08/26/2014 – 09/05/2014		
<p>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.</p> <p>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.</p>			
Approved & Released By:	Prepared By:		
			
Dave Weaver Program Manager UL Verification Services Inc.	Coltyce Sanders Laboratory Engineer UL Verification Services Inc.		

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2003 & 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

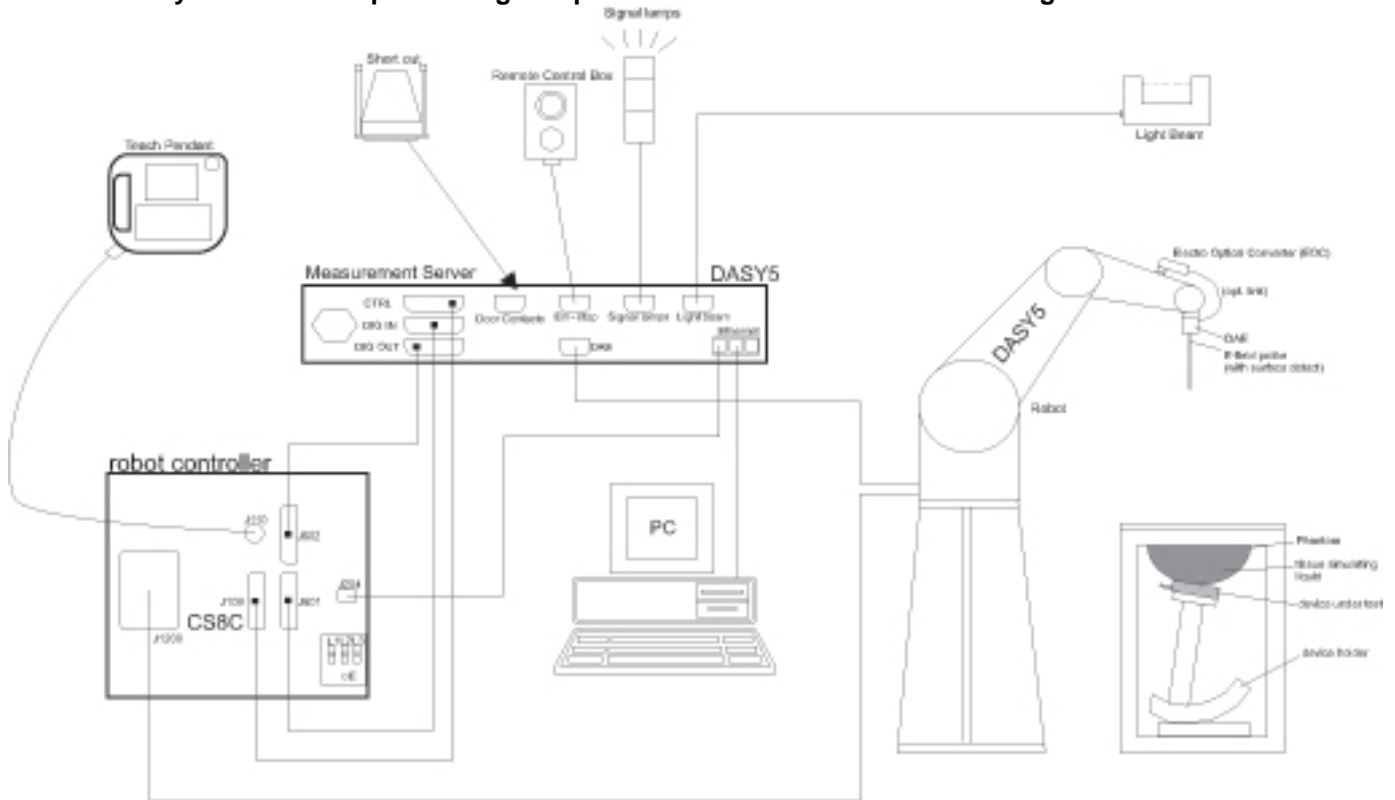
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

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.

4.2. SAR Scan 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

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

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

		≤ 3 GHz	> 3 GHz	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		≤ 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 area scan based <i>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.				

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.

4.3. Test Equipment

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.

Dielectric Property Measurements

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 Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
HP Signal Generator	HP	8665B	3546A00784	6/23/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Meter	HP	437B	3125U09516	9/30/2014
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
HP Signal Generator	HP	8665B	3438A00633	7/10/2015
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 1)	SPEAG	EX3DV4	3902	5/19/2015
E-Field Probe (SAR 2)	SPEAG	EX3DV4	3531	11/21/2014
E-Field Probe (SAR 5)	SPEAG	EX3DV4	3991	5/16/2015
Data Acquisition Electronics (SAR 1)	SPEAG	DAE3	427	1/21/2015
Data Acquisition Electronics (SAR 2)	SPEAG	DAE4	1359	2/17/2015
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	5d163	9/17/2014
System Validation Dipole	SPEAG	D2450V2	899	9/10/2014
System Validation Dipole	SPEAG	D2600V2	1006	9/11/2014
Thermometer (SAR Lab 1)	EXTECH	445703	CCS-205	3/24/2015
Thermometer (SAR Lab 2)	EXTECH	445703	CCS-203	3/28/2015
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	N1912A	MY53040015	7/10/2015
Power Sensor	Agilent	N1921A	MY52020011	5/6/2015
Base Station Simulator	R & S	CMW500	135393-VQ	7/3/2015
Base Station Simulator	R & S	CMW500	125236-eS	5/29/2015
Base Station Simulator	R & S	CMW500	127733-cy	6/2/2015

5. 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 1528-2003 & 2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-A3000	
Device Dimension	Overall (Length x Width): 130 mm x 65 mm Overall Diagonal: 140 mm Display Diagonal: 115 mm
Battery Back Cover	The rechargeable battery is not user accessible.
Battery Options	The rechargeable battery is not user accessible.
Accessory	Headset
Wireless Router (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) <input type="checkbox"/> Mobile Hotspot (Wi-Fi 5 GHz)
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) <input type="checkbox"/> Wi-Fi Direct (Wi-Fi 5 GHz)
SIM Information	<input type="checkbox"/> Single SIM <input checked="" type="checkbox"/> Dual SIM

6.2. 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 Is DTM (Dual Transfer Mode) supported: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA HSUPA HSPA+	100%
LTE (TDD)	Band 41	QPSK, 16QAM	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%
Bluetooth	2.4 GHz	Version 4.0 LE	32.25% (DH1), 66.68% (DH3), 77.52% (DH5)

6.3. Nominal and Maximum Output Power

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	33.0	33.5
	GPRS 1 slot	33.0	33.5
	GPRS 2 slots	31.0	31.5
	GPRS 3 slots	29.5	30.0
	GPRS 4 slots	27.0	27.5
	EGPRS 1 slot	27.0	27.5
	EGPRS 2 slots	27.0	27.5
	EGPRS 3 slots	25.5	26.0
	EGPRS 4 slots	24.5	25.0
GSM1900	Voice	29.5	30.0
	GPRS 1 slot	29.5	30.0
	GPRS 2 slots	27.5	28.0
	GPRS 3 slots	25.5	26.0
	GPRS 4 slots	24.0	24.5
	EGPRS 1 slot	26.0	26.5
	EGPRS 2 slots	25.0	25.5
	EGPRS 3 slots	24.0	24.5
	EGPRS 4 slots	23.0	23.5
W-CDMA Band V	R99	22.0	22.5
	HSDPA	22.0	22.5
	HSUPA	22.0	22.5
W-CDMA Band II	R99	22.5	23.0
	HSDPA	21.5	22.0
	HSUPA	22.0	22.5
LTE Band 41	QPSK	21.5	22.0

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	17.0	17.5
	802.11g	13.0	13.5
	802.11n HT20	12.0	12.5
Bluetooth		9.0	9.5
Bluetooth LE		1.0	1.5

6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	<ol style="list-style-type: none"> GSM 850/1900 Voice + Wi-Fi 2.4GHz GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz WCDMA Band 2/5 + Wi-Fi 2.4GHz LTE B41 + Wi-Fi 2.4GHz
Body-worn Accessory	<ol style="list-style-type: none"> GSM 850/1900 Voice + Wi-Fi 2.4GHz GSM 850/1900 Voice + BT GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz GSM 850/1900 (GPRS/EDGE) + BT WCDMA Band 2/5 + Wi-Fi 2.4GHz WCDMA Band 2/5 + BT LTE B41 + Wi-Fi 2.4GHz LTE B41 + BT
Wireless Router (Hotspot) and Wi-Fi Direct	<ol style="list-style-type: none"> GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz WCDMA Band 2/5 + Wi-Fi 2.4GHz LTE B41 + Wi-Fi 2.4GHz
<p>Notes:</p> <ol style="list-style-type: none"> Wi-Fi 2.4GHz supports Hotspot and Wi-Fi Direct. GPRS/EDGE, WCDMA and LTE support Hotspot. VoIP is supported in LTE, WCDMA and GPRS. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio. 	

6.5. General LTE SAR Test and Reporting Considerations

Item	Description																																																						
Frequency range, Channel Bandwidth, Numbers and Frequencies	<table border="1"> <thead> <tr> <th rowspan="3">Band 41</th> <th colspan="6">Frequency range: 2496 - 2690 MHz</th> </tr> <tr> <th colspan="6">Channel Bandwidth</th> </tr> <tr> <th>20 MHz</th> <th>15 MHz</th> <th>10 MHz</th> <th>5 MHz</th> <th>3 MHz</th> <th>1.4 MHz</th> </tr> </thead> <tbody> <tr> <td>Low</td> <td>39750/2506.0</td> <td>39725/2503.5</td> <td>39700/2501</td> <td>39675/2498.5</td> <td></td> <td></td> </tr> <tr> <td>Low-Mid</td> <td>40185/2549.5</td> <td>40173/2548.3</td> <td>40160/2547.0</td> <td>40148/2545.8</td> <td></td> <td></td> </tr> <tr> <td>Mid</td> <td>40620/2593.0</td> <td>40620/2593.0</td> <td>40620/2593.0</td> <td>40620/2593.0</td> <td></td> <td></td> </tr> <tr> <td>Mid-High</td> <td>41055/2636.5</td> <td>41068/2547.8</td> <td>41080/2639.0</td> <td>41093/2640.3</td> <td></td> <td></td> </tr> <tr> <td>High</td> <td>41490/2680.0</td> <td>41515/2682.5</td> <td>41540/2685.0</td> <td>41565/2687.5</td> <td></td> <td></td> </tr> </tbody> </table>	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		
	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 "Photos and Antenna Locations" Appendix.																																																						
Maximum power reduction (MPR)	<p>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</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>> 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>16 QAM</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 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.																																																						

6.6. 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	$26336 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$			$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-		
9	$13168 \cdot T_s$	-	-	-	-	-

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 x 2048) seconds

7. RF Exposure Conditions (Test Configurations)

Refer to “Photos and Antenna Locations” Appendix for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

7.1. Head

For WWAN, LTE and Wi-Fi

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

7.2. Body-worn Accessory

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	

7.3. Wireless Router (Hotspot)

For WWAN and LTE

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	115 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)	10 mm	Yes	
Edge 3 (Bottom)	0 mm	Yes	
Edge 4 (Left)	10 mm	Yes	

For Wi-Fi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	0 mm	Yes	
Edge 2 (Right)	0 mm	Yes	
Edge 3 (Bottom)	105 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 4 (Left)	55 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

8. Conducted Output Power Measurements

8.1. GSM850 and GSM1900

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)		
850	GSM (Voice)	CS1	1	128	824.2	33.1	24.1		
				190	836.6	33.2	24.1		
				251	848.8	33.0	24.0		
	GPRS (GMSK)	CS1	1	1	128	824.2	33.2	24.1	
					190	836.6	33.2	24.2	
					251	848.8	33.1	24.0	
				2	128	824.2	30.9	24.9	
					190	836.6	31.4	25.3	
					251	848.8	31.1	25.1	
			3	128	824.2	29.5	25.2		
				190	836.6	29.9	25.6		
				251	848.8	29.6	25.4		
			4	4	128	824.2	27.4	24.4	
						190	836.6	27.5	24.5
						251	848.8	27.5	24.5
	128	824.2			26.4	17.4			
		190			836.6	26.4	17.4		
		251			848.8	26.9	17.9		
	EGPRS (8PSK)	MCS5	2	128	824.2	26.1	20.1		
					190	836.6	26.1	20.1	
					251	848.8	26.1	20.1	
			3	128	824.2	24.0	19.7		
					190	836.6	24.0	19.8	
					251	848.8	24.0	19.7	
4	128	824.2	23.5	20.5					
		190	836.6	23.6	20.6				
		251	848.8	23.7	20.7				

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

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)	
1900	GSM (Voice)	CS1	1	512	1850.2	30.0	21.0	
				661	1880.0	30.0	21.0	
				810	1909.8	29.8	20.8	
	GPRS (GMSK)	CS1	1	1	512	1850.2	30.0	20.9
					661	1880.0	30.0	21.0
					810	1909.8	29.8	20.8
				2	512	1850.2	28.0	22.0
					661	1880.0	28.0	22.0
					810	1909.8	28.0	22.0
			3	1	512	1850.2	25.6	21.3
					661	1880.0	26.0	21.7
					810	1909.8	26.0	21.7
			4	1	512	1850.2	24.3	21.3
					661	1880.0	24.5	21.5
					810	1909.8	24.5	21.5
	EGPRS (8PSK)	MCS5	1	1	512	1850.2	24.5	15.5
					661	1880.0	24.7	15.7
					810	1909.8	24.5	15.5
			2	1	512	1850.2	23.9	17.8
					661	1880.0	24.3	18.3
					810	1909.8	24.2	18.2
			3	1	512	1850.2	22.5	18.2
					661	1880.0	22.5	18.2
					810	1909.8	22.5	18.2
4			1	512	1850.2	21.7	18.6	
				661	1880.0	22.0	19.0	
				810	1909.8	22.0	19.0	

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 2 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

8.2. W-CDMA Band V and II

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 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_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	22.2
		4183	836.6	22.3
		4233	846.6	22.5
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	21.9
		9400	1880.0	22.2
		9538	1907.6	21.9

HSDPA

The following 4 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	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-Set 1			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{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			
	$A_{hs}=\beta_{hs}/\beta_c$	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	21.2
		4183	836.6	0	21.1
		4233	846.6	0	21.3
	Subtest 2	4132	826.4	0	21.2
		4183	836.6	0	21.1
		4233	846.6	0	21.2
	Subtest 3	4132	826.4	0.5	20.8
		4183	836.6	0.5	20.7
		4233	846.6	0.5	20.5
	Subtest 4	4132	826.4	0.5	20.8
		4183	836.6	0.5	20.7
		4233	846.6	0.5	20.8
W-CDMA Band II	Subtest 1	9262	1852.4	0	20.9
		9400	1880.0	0	21.3
		9538	1907.6	0	21.0
	Subtest 2	9262	1852.4	0	21.0
		9400	1880.0	0	21.2
		9538	1907.6	0	21.0
	Subtest 3	9262	1852.4	0.5	20.5
		9400	1880.0	0.5	20.6
		9538	1907.6	0.5	20.5
	Subtest 4	9262	1852.4	0.5	20.5
		9400	1880.0	0.5	20.6
		9538	1907.6	0.5	20.5

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

HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 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	12.2 kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	11/15	15/9	2/15	15/0
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{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				
	$A_{hs} = \beta_{hs}/\beta_c$	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	21.0
		4183	836.6	0	21.1
		4233	846.6	0	21.2
	Subtest 2	4132	826.4	2	19.7
		4183	836.6	2	19.7
		4233	846.6	2	20.4
	Subtest 3	4132	826.4	1	20.4
		4183	836.6	1	20.3
		4233	846.6	1	20.4
	Subtest 4	4132	826.4	2	20.4
		4183	836.6	2	20.2
		4233	846.6	2	20.4
	Subtest 5	4132	826.4	0	21.3
		4183	836.6	0	21.2
		4233	846.6	0	21.4
W-CDMA Band II	Subtest 1	9262	1852.4	0	21.1
		9400	1880.0	0	20.9
		9538	1907.6	0	20.9
	Subtest 2	9262	1852.4	2	18.9
		9400	1880.0	2	19.6
		9538	1907.6	2	19.0
	Subtest 3	9262	1852.4	1	19.5
		9400	1880.0	1	19.9
		9538	1907.6	1	19.6
	Subtest 4	9262	1852.4	2	19.2
		9400	1880.0	2	20.1
		9538	1907.6	2	19.4
	Subtest 5	9262	1852.4	0	21.2
		9400	1880.0	0	21.4
		9538	1907.6	0	21.1

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.

8.3. 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
			20	>10	≤ 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 ¹	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

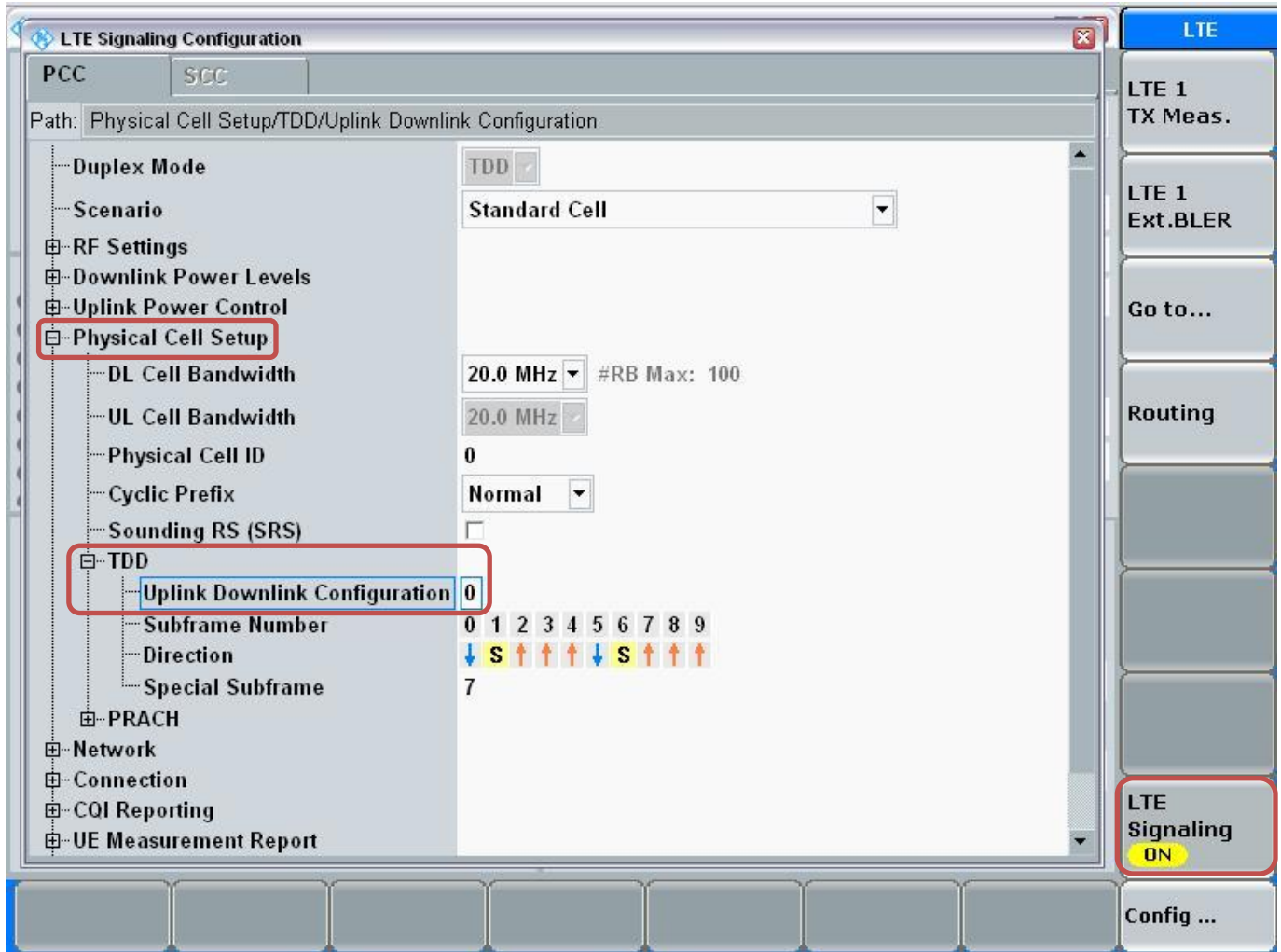
Set to CMW-500 with following parameters:

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

The screenshot displays the 'LTE Signaling 1 - X3.2.10.6' software interface. The main window is divided into several sections:

- Connection Status:** Shows 'Cell' as 'Idle', 'Packet Switched' as 'OFF', and 'RRC State' as 'Idle'.
- Event Log:** Lists system events such as 'State 'Cell Off'', 'State 'Cell On'', 'Signaling Failure', 'Network Originated Detach', 'State 'Connection Established'', 'EPS Dedicated Bearer Established', 'State 'Attached'', and 'EPS Default Bearer Established'.
- UE Info:** Fields for IMEI, IMSI, UE IPv4 Address [0], and UE IPv6 Prefix [0] are shown as empty.
- Connection Setup:**
 - Operating Band:** Set to 'Band 41' and 'TDD'.
 - Channel:** 40620 Ch for both Downlink and Uplink.
 - Frequency:** 2593.0 MHz for both.
 - Cell Bandwidth:** 20.0 MHz for both.
 - 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.
 - Scheduling:** RMC.
 - # RB:** 100 for both Downlink and Uplink.
 - RB Pos./Start RB:** low for both.
 - Modulation:** QPSK for both.
 - TBS Idx / Value:** 5 / 8760 for Downlink, 2 / 4584 for Uplink.
 - Throughput:** 3.970 Mbit/s for Downlink, 1.834 Mbit/s for Uplink.
- Right Panel:** Contains buttons for 'LTE 1 TX Meas.', 'LTE 1 Ext.BLER', 'Go to...', 'Routing', 'LTE Signaling OFF' (highlighted with a red box), and 'Config ...' (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. The 'SCC' tab shows 'Operating Band' as 'Band 41' and 'TDD'. It details 'Downlink' and 'Uplink' parameters: Channel (40620 Ch), Frequency (2593.0 MHz), Cell Bandwidth (20.0 MHz), RS EPRE (-85.8 dBm/15kHz), Full Cell BW Pow. (-55.0 dBm), PUSCH Open Loop Nom. Power (23 dBm), and PUSCH Closed Loop Target Power (23.0 dBm). The 'Connection Setup' section shows 'Scheduling' as 'RMC', '# RB' as 100, 'RB Pos./Start RB' as 'low', 'Modulation' as 'QPSK', 'TBS Idx / Value' as 5/8760 and 2/4584, 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', 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

The screenshot displays the LTE Signaling 1 - X3.2.10.6 interface. It is divided into several sections:

- Connection Status:** Shows 'Connection Established' and 'RRC State Connected'.
- Event Log:** Lists system events such as 'State Connection Established', 'EPS Dedicated Bearer Established', and 'RRC Connection Established'.
- UE Info:** Displays identifiers like IMEI (001027009999998), IMSI (001010123456789), and IP addresses.
- Connection Setup:** Shows parameters for PCC and SCC, including Operating Band (Band 41), Channel (40620 Ch), Frequency (2593.0 MHz), Cell Bandwidth (20.0 MHz), and various power settings like Full Cell BW Pow. (-55.0 dBm) and PUSCH Open Loop Nom. Power (23 dBm).
- Buttons:** A vertical stack of buttons on the right includes 'LTE 1 TX Meas.' (highlighted in red), 'LTE 1 Ext. BLER', 'Go to...', 'Routing', and 'LTE Signaling ON' (highlighted in red).
- Bottom Bar:** Contains 'Detach', 'Disconnect', 'Send SMS', 'Handover ...', and 'Config ...' buttons.

- 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 software interface. The main window is titled "LTE Measurement - X3.2.10.6 - TX Measurement". It features several 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 "Multi Evaluation" button is also highlighted with a yellow "RUN" label. The "LTE Signaling" button is highlighted with a yellow "ON" label. The bottom of the interface has a toolbar with buttons for "Cell Setup ...", "Connection Setup ...", "DL Error Insertion ...", "TPC ...", "Power ...", "Enable ...", and "Config ...".

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 displays 'Multi Evaluation' mode with 'PRACH' and 'SRS' options. The main display area shows a 'Spectrum Emission Mask' graph with a blue trace labeled 'Current' plotted against frequency (MHz) on the x-axis and power (dBm) on the y-axis. The graph shows a signal centered around 0 MHz with a bandwidth of approximately 20 MHz. Below the graph, there are several data tables and status indicators.

Detected Allocation	NoRB:	100	OffsetRB:	0	
	Current	Average	Extreme	StdDev	
OBW	17.790 MHz	17.773 MHz	17.790 MHz	0.013 MHz	
	Current	Average	Min	Max	StdDev
TX Power	23.72 dBm	23.33 dBm	22.10 dBm	24.27 dBm	0.23 dBm

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

A 'Select View' dialog box is open, showing 'SpectrumEmissionMask' selected. The 'Display' button on the right sidebar is highlighted with a red box. Other buttons like 'Select View ...', 'Margin On Off', 'Select Trace (SEM) ...', 'Y Scale (SEM) ...', and 'X Scale (SEM) ...' are also visible at the bottom.

LTE Band 41 Measured Results

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	21.8	21.4	21.5	21.5	21.0
			1	49	0	0	21.6	21.2	21.5	21.7	21.5
			1	99	0	0	21.4	21.0	21.3	21.3	21.5
			50	0	1	1	20.3	20.2	20.3	20.4	20.8
			50	24	1	1	20.3	20.2	20.4	20.5	20.7
			50	50	1	1	20.2	20.1	20.5	20.5	20.6
			100	0	1	1	20.4	20.3	20.4	20.5	20.7
		16QAM	1	0	1	1	20.4	20.5	20.6	20.7	20.0
			1	49	1	1	20.4	20.4	20.8	20.9	20.6
			1	99	1	1	20.3	20.2	20.7	20.5	20.1
			50	0	2	2	19.3	19.1	19.3	19.3	19.8
			50	24	2	2	19.4	19.2	19.4	19.4	19.6
			50	50	2	2	19.2	19.0	19.4	19.5	19.6
			100	0	2	2	19.4	19.2	19.5	19.4	19.7
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	21.5	21.6	21.5	21.4	21.0
			1	37	0	0	21.4	21.5	21.5	21.4	21.1
			1	74	0	0	21.2	21.3	21.3	21.2	21.0
			36	0	1	1	20.4	20.3	20.2	20.4	20.7
			36	20	1	1	20.3	20.2	20.2	20.4	20.7
			36	39	1	1	20.3	20.2	20.2	20.4	20.6
			75	0	1	1	20.4	20.3	20.2	20.3	20.6
		16QAM	1	0	1	1	20.9	20.4	20.3	20.3	20.4
			1	37	1	1	20.9	20.3	20.2	20.4	20.6
			1	74	1	1	20.7	20.1	20.1	20.5	20.0
			36	0	2	2	19.5	19.3	19.3	19.5	19.7
			36	20	2	2	19.4	19.3	19.3	19.5	19.7
			36	39	2	2	19.3	19.2	19.3	19.5	19.7
			75	0	2	2	19.4	19.2	19.2	19.4	19.6
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	21.6	21.6	21.5	21.7	21.0
			1	25	0	0	21.7	21.4	21.5	21.8	21.0
			1	49	0	0	21.6	21.4	21.6	21.5	21.0
			25	0	1	1	20.6	20.4	20.5	20.6	20.8
			25	12	1	1	20.7	20.3	20.5	20.5	20.7
			25	25	1	1	20.6	20.4	20.6	20.6	20.7
			50	0	1	1	20.6	20.3	20.4	20.5	20.6
		16QAM	1	0	1	1	20.5	20.7	20.5	20.9	20.0
			1	25	1	1	20.6	20.7	20.5	20.9	20.2
			1	49	1	1	20.5	20.7	20.5	20.9	20.0
			25	0	2	2	19.5	19.3	19.4	19.6	19.8
			25	12	2	2	19.6	19.3	19.5	19.6	19.9
			25	25	2	2	19.5	19.4	19.6	19.6	19.8
			50	0	2	2	19.5	19.5	19.4	19.5	19.8

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	21.6	21.5	21.7	21.9	21.0
			1	12	0	0	21.6	21.4	21.8	21.9	21.0
			1	24	0	0	21.6	21.5	21.7	21.8	21.0
			12	0	1	0	20.6	20.5	20.6	20.7	20.8
			12	7	1	0	20.6	20.5	20.7	20.7	20.9
			12	13	1	0	20.6	20.5	20.6	20.7	20.8
			25	0	1	0	20.6	20.5	20.6	20.7	20.7
		16QAM	1	0	1	1	21.0	20.2	21.0	20.9	20.0
			1	12	1	1	21.0	20.1	21.0	21.0	20.0
			1	24	1	1	21.0	20.2	21.0	21.0	20.0
			12	0	2	1	19.6	19.5	19.6	19.7	20.0
			12	7	2	1	19.6	19.5	19.7	19.7	20.0
			12	13	2	1	19.6	19.5	19.7	19.7	20.0
			25	0	2	1	19.6	19.4	19.7	19.6	20.0

8.4. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

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	16.8	Yes
			6	2437	16.8	
			11	2462	17.1	
	802.11g	6 Mbps	1	2412	13.2	No
			6	2437	12.9	
			11	2462	13.4	
	802.11n (HT20)	MCS0	1	2412	12.2	No
			6	2437	11.9	
			11	2462	12.3	

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	11	2462	1 Mbps	17.1	Yes
			2 Mbps	16.8	No
			5.5 Mbps	16.8	No
			11 Mbps	16.6	No

8.5. Bluetooth

Maximum tune-up tolerance limit is 9.5 dBm (9mW). This power level qualifies for exclusion of SAR testing. Refer to Standalone SAR Exclusion Section

9. Dielectric Property Measurements

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.

9.1. Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

9.2. Dielectric Property Measurements 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 1

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit \pm (%)	
9/2/2014	Head 2450	e'	39.1100	Relative Permittivity (ϵ_r):	39.11	39.20	-0.23	5
		e"	13.5700	Conductivity (σ):	1.85	1.80	2.70	5
	Head 2410	e'	39.2500	Relative Permittivity (ϵ_r):	39.25	39.28	-0.07	5
		e"	13.4200	Conductivity (σ):	1.80	1.76	2.15	5
	Head 2475	e'	39.0100	Relative Permittivity (ϵ_r):	39.01	39.17	-0.40	5
		e"	13.6200	Conductivity (σ):	1.87	1.83	2.59	5
9/2/2014	Body 2450	e'	52.4400	Relative Permittivity (ϵ_r):	52.44	52.70	-0.49	5
		e"	14.9900	Conductivity (σ):	2.04	1.95	4.72	5
	Body 2410	e'	52.6400	Relative Permittivity (ϵ_r):	52.64	52.76	-0.23	5
		e"	14.8100	Conductivity (σ):	1.98	1.91	4.04	5
	Body 2475	e'	52.3500	Relative Permittivity (ϵ_r):	52.35	52.67	-0.60	5
		e"	15.0900	Conductivity (σ):	2.08	1.99	4.61	5

SAR Lab 2

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit \pm (%)	
8/26/2014	Head 2600	e'	37.4200	Relative Permittivity (ϵ_r):	37.42	39.01	-4.08	5
		e"	13.8100	Conductivity (σ):	2.00	1.96	1.75	5
	Head 2500	e'	37.8300	Relative Permittivity (ϵ_r):	37.83	39.14	-3.34	5
		e"	13.5500	Conductivity (σ):	1.88	1.85	1.59	5
	Head 2700	e'	37.0400	Relative Permittivity (ϵ_r):	37.04	38.88	-4.74	5
		e"	14.0600	Conductivity (σ):	2.11	2.07	1.96	5
9/2/2014	Head 2600	e'	37.9100	Relative Permittivity (ϵ_r):	37.91	39.01	-2.82	5
		e"	14.0600	Conductivity (σ):	2.03	1.96	3.59	5
	Head 2500	e'	38.3200	Relative Permittivity (ϵ_r):	38.32	39.14	-2.09	5
		e"	13.7600	Conductivity (σ):	1.91	1.85	3.17	5
	Head 2700	e'	37.4900	Relative Permittivity (ϵ_r):	37.49	38.88	-3.59	5
		e"	14.3300	Conductivity (σ):	2.15	2.07	3.92	5
9/2/2014	Body 2600	e'	50.2300	Relative Permittivity (ϵ_r):	50.23	52.51	-4.34	5
		e"	15.2100	Conductivity (σ):	2.20	2.16	1.76	5
	Body 2500	e'	50.5100	Relative Permittivity (ϵ_r):	50.51	52.64	-4.04	5
		e"	14.9800	Conductivity (σ):	2.08	2.02	3.07	5
	Body 2700	e'	49.9600	Relative Permittivity (ϵ_r):	49.96	52.38	-4.63	5
		e"	15.4200	Conductivity (σ):	2.31	2.30	0.59	5

SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
9/2/2014	Head 835	e'	41.9900	Relative Permittivity (ϵ_r):	41.99	41.50	1.18	5
		e"	20.0900	Conductivity (σ):	0.93	0.90	3.64	5
	Head 820	e'	42.2700	Relative Permittivity (ϵ_r):	42.27	41.60	1.60	5
		e"	20.1100	Conductivity (σ):	0.92	0.90	2.05	5
	Head 850	e'	41.7900	Relative Permittivity (ϵ_r):	41.79	41.50	0.70	5
		e"	20.0900	Conductivity (σ):	0.95	0.92	3.77	5
9/2/2014	Body 835	e'	52.7800	Relative Permittivity (ϵ_r):	52.78	55.20	-4.38	5
		e"	21.9200	Conductivity (σ):	1.02	0.97	4.92	5
	Body 820	e'	52.9000	Relative Permittivity (ϵ_r):	52.90	55.28	-4.30	5
		e"	22.0000	Conductivity (σ):	1.00	0.97	3.57	5
	Body 850	e'	52.6400	Relative Permittivity (ϵ_r):	52.64	55.16	-4.56	5
		e"	21.8200	Conductivity (σ):	1.03	0.99	4.47	5
9/3/2014	Head 1900	e'	39.2800	Relative Permittivity (ϵ_r):	39.28	40.00	-1.80	5
		e"	13.3300	Conductivity (σ):	1.41	1.40	0.59	5
	Head 1850	e'	39.4900	Relative Permittivity (ϵ_r):	39.49	40.00	-1.28	5
		e"	13.1900	Conductivity (σ):	1.36	1.40	-3.09	5
	Head 1910	e'	39.2400	Relative Permittivity (ϵ_r):	39.24	40.00	-1.90	5
		e"	13.3600	Conductivity (σ):	1.42	1.40	1.35	5
9/3/2014	Body 1900	e'	51.3100	Relative Permittivity (ϵ_r):	51.31	53.30	-3.73	5
		e"	14.2800	Conductivity (σ):	1.51	1.52	-0.75	5
	Body 1850	e'	51.4900	Relative Permittivity (ϵ_r):	51.49	53.30	-3.40	5
		e"	14.1200	Conductivity (σ):	1.45	1.52	-4.44	5
	Body 1910	e'	51.2700	Relative Permittivity (ϵ_r):	51.27	53.30	-3.81	5
		e"	14.3200	Conductivity (σ):	1.52	1.52	0.05	5

10. System 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.

10.1. Reference Target SAR Values

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	5d163	9/17/2013	1900	1g	40.9	40.1
				10g	21.2	21.2
D2450V2	899	9/10/2013	2450	1g	51.3	49.7
				10g	23.9	23.3
D2600V2	1006	9/11/2013	2600	1g	56.5	55.7
				10g	25.2	24.8

10.2. System 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 Lab 1

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					
9/3/2014	D2450V2	899	Head	1g	5.68	5.54	55.4	51.30	7.99	2.46	
				10g	2.46	2.50	25.0	23.90	4.60		
9/3/2014	D2450V2	899	Body	1g	5.39	5.45	54.5	49.70	9.66	-1.11	1,2
				10g	2.35	2.52	25.2	23.30	8.15		

SAR Lab 2

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					
8/26/2014	D2600V2	1006	Head	1g	5.66	5.48	54.8	56.5	-3.01	3.18	
				10g	2.52	2.57	25.7	25.2	1.98		
9/2/2014	D2600V2	1006	Head	1g	5.97	5.74	57.4	56.5	1.59	3.85	
				10g	2.64	2.70	27.0	25.2	7.14		
9/2/2014	D2600V2	1006	Body	1g	5.61	5.32	53.2	55.7	-4.49	5.17	3,4
				10g	2.43	2.50	25.0	24.8	0.81		

SAR Lab 5

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					
9/2/2014	D835V2	4d002	Head	1g	1.05	1.03	10.3	9.49	8.54	1.90	5, 6
				10g	0.712	0.679	6.8	6.18	9.87		
9/2/2014	D835V2	4d002	Body	1g	1.04	1.03	10.2	9.43	8.17	0.96	
				10g	0.70	0.68	6.8	6.21	9.66		
9/3/2014	D1900V2	5d163	Head	1g	3.84	3.83	38.3	40.90	-6.36	0.26	7, 8
				10g	2.03	1.98	19.8	21.20	-6.60		
9/3/2014	D1900V2	5d163	Body	1g	4.05	4.01	40.1	40.10	0.00	0.99	
				10g	2.04	2.09	20.9	21.20	-1.42		

11. 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:

- ≤ 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

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.

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 ≤ 1.6 W/kg and the 1-g averaged SAR is ≤ 0.8 W/kg, testing of other channels in the "default test channels" or "required test channels" configuration is optional.

11.1. 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	33.5	33.2	0.014	0.015	1
			Left Tilt	190	836.6	33.5	33.2	0.003	0.003	
			Right Touch	190	836.6	33.5	33.2	0.035	0.038	
			Right Tilt	190	836.6	33.5	33.2	0.004	0.005	
Head VoIP	GPRS 3 Slots	0	Left Touch	190	836.6	30.0	29.9	0.019	0.019	2
			Left Tilt	190	836.6	30.0	29.9	0.005	0.005	
			Right Touch	190	836.6	30.0	29.9	0.046	0.047	
			Right Tilt	190	836.6	30.0	29.9	0.005	0.005	
Body-worn	Voice	10	Rear	190	836.6	33.5	33.2	0.094	0.101	3
			Front	190	836.6	33.5	33.2	0.075	0.080	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	190	836.6	30.0	29.9	0.115	0.118	4
Hotspot			Front	190	836.6	30.0	29.9	0.100	0.102	
			Edge 2	190	836.6	30.0	29.9	0.096	0.098	
			Edge 3	190	836.6	30.0	29.9	0.034	0.034	
			Edge 4	190	836.6	30.0	29.9	0.013	0.013	

11.2. 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	30.0	0.026	0.026	5
			Left Tilt	661	1880.0	30.0	30.0	0.009	0.009	
			Right Touch	661	1880.0	30.0	30.0	0.053	0.053	
			Right Tilt	661	1880.0	30.0	30.0	0.013	0.013	
Head VoIP	GPRS 2 Slots	0	Left Touch	661	1880.0	28.0	28.0	0.036	0.036	6
			Left Tilt	661	1880.0	28.0	28.0	0.010	0.010	
			Right Touch	661	1880.0	28.0	28.0	0.067	0.067	
			Right Tilt	661	1880.0	28.0	28.0	0.013	0.013	
Body-worn	Voice	10	Rear	661	1880.0	30.0	30.0	0.169	0.169	7
			Front	661	1880.0	30.0	30.0	0.126	0.126	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	661	1880.0	28.0	28.0	0.206	0.206	8
Hotspot			Front	661	1880.0	28.0	28.0	0.167	0.167	
			Edge 2	661	1880.0	28.0	28.0	0.040	0.040	
			Edge 3	661	1880.0	28.0	28.0	0.068	0.068	
			Edge 4	661	1880.0	28.0	28.0	0.003	0.003	

11.3. 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	4233	846.6	22.5	22.5	0.011	0.011	9
			Left Tilt	4233	846.6	22.5	22.5	0.001	0.001	
			Right Touch	4233	846.6	22.5	22.5	0.025	0.025	
			Right Tilt	4233	846.6	22.5	22.5	0.002	0.002	
Body-worn & Hptspot	Rel 99 RMC	10	Rear	4233	846.6	22.5	22.5	0.068	0.068	10
			Front	4233	846.6	22.5	22.5	0.058	0.058	
Hotspot	Rel 99 RMC	10	Edge 2	4233	846.6	22.5	22.5	0.056	0.056	
			Edge 3	4233	846.6	22.5	22.5	0.024	0.024	
			Edge 4	4233	846.6	22.5	22.5	0.008	0.008	

11.4. 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	23.0	22.2	0.057	0.069	
			Left Tilt	9400	1880.0	23.0	22.2	0.015	0.018	
			Right Touch	9400	1880.0	23.0	22.2	0.109	0.131	11
			Right Tilt	9400	1880.0	23.0	22.2	0.024	0.029	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	23.0	22.2	0.289	0.347	12
			Front	9400	1880.0	23.0	22.2	0.287	0.345	
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	23.0	22.2	0.048	0.058	
			Edge 3	9400	1880.0	23.0	22.2	0.074	0.089	
			Edge 4	9400	1880.0	23.0	22.2	0.011	0.013	

11.5. 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	22.0	21.5	0.021	0.024	
						50	50	21.0	20.5	0.019	0.021	
			Left Tilt	40620	2593.0	1	0	22.0	21.5	0.015	0.017	
						50	50	21.0	20.5	0.015	0.017	
			Right Touch	40620	2593.0	1	0	22.0	21.5	0.022	0.025	13
						50	50	21.0	20.5	0.021	0.024	
Right Tilt	40620	2593.0	1	0	22.0	21.5	0.017	0.019				
			50	50	21.0	20.5	0.017	0.019				
Body-worn & Hotspot	QPSK	10	Rear	40620	2593.0	1	0	22.0	21.5	0.046	0.052	
						50	50	21.0	20.5	0.039	0.044	
			Front	40620	2593.0	1	0	22.0	21.5	0.064	0.072	14
						50	50	21.0	20.5	0.053	0.059	
Hotspot	QPSK	10	Edge 2	40620	2593.0	1	0	22.0	21.5	0.024	0.027	
						50	50	21.0	20.5	0.022	0.025	
			Edge 3	40620	2593.0	1	0	22.0	21.5	0.063	0.071	
						50	50	21.0	20.5	0.050	0.056	
			Edge 4	40620	2593.0	1	0	22.0	21.5	0.018	0.020	
						50	50	21.0	20.5	0.016	0.018	

11.6. 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	11	2462.0	17.5	17.1	0.571	0.626	15
				Left Tilt	11	2462.0	17.5	17.1	0.175	0.192	
				Right Touch	11	2462.0	17.5	17.1	0.190	0.208	
				Right Tilt	11	2462.0	17.5	17.1	0.079	0.087	
	Body-worn, Hotspot & Wi-Fi Direct	802.11b 1 Mbps	10	Rear	11	2462.0	17.5	17.1	0.026	0.029	
				Front	11	2462.0	17.5	17.1	0.028	0.031	16
	Hotspot & Wi-Fi Direct	802.11b 1 Mbps	10	Edge 1	11	2462.0	17.5	17.1	0.006	0.007	
				Edge 2	11	2462.0	17.5	17.1	0.004	0.004	

11.7. Bluetooth

11.7.1. Standalone SAR Test Exclusion Considerations

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

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

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
9.5	9	10	2.480	1.4

Conclusion:

The computed value is < 3 ; therefore, Bluetooth qualifies for Standalone SAR test exclusion.

11.7.2. Estimated SAR

When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{(\text{GHz})}/x}] \text{ W/kg}$ for test separation distances ≤ 50 mm; where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.
- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Rear/Front	9	10	2.480	0.189

12. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. 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.

12.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Wireless Router (Hotspot) and Wi-Fi Direct (W/kg)	Repeated SAR (Yes/No)
850	GSM 850		0.118		No
	WCDMA Band V				
1900	GSM 1900				
	WCDMA Band II		0.289		No
2400	Wi-Fi 802.11b/g/n	0.571			No
2600	LTE Band 41		0.064		No

12.2. Repeated Measurement Results

No repeated measurements were performed since no measured SAR values were > 0.800 W/kg.

13. Simultaneous Transmission SAR Analysis

13.1. 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 Bluetooth		
Head	Left Touch	① + ②	0.019	0.626		0.645	No
	Left Tilt	① + ②	0.005	0.192		0.197	No
	Right Touch	① + ②	0.047	0.208		0.255	No
	Right Tilt	① + ②	0.005	0.087		0.092	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.118	0.029		0.147	No
		① + ③	0.118		0.189	0.307	No
	Front	① + ②	0.102	0.031		0.133	No
		① + ③	0.102		0.189	0.291	No
Hotspot	Edge 1	① + ②		0.007		0.007	No
	Edge 2	① + ②	0.098	0.004		0.102	No
	Edge 3	① + ②	0.034			0.034	No
	Edge 4	① + ②	0.013			0.013	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.

13.2. 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 Bluetooth		
Head	Left Touch	① + ②	0.036	0.626		0.662	No
	Left Tilt	① + ②	0.010	0.192		0.202	No
	Right Touch	① + ②	0.067	0.208		0.275	No
	Right Tilt	① + ②	0.013	0.087		0.100	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.206	0.029		0.235	No
		① + ③	0.206		0.189	0.395	No
	Front	① + ②	0.167	0.031		0.198	No
		① + ③	0.167		0.189	0.356	No
Hotspot	Edge 1	① + ②		0.007		0.007	No
	Edge 2	① + ②	0.040	0.004		0.044	No
	Edge 3	① + ②	0.068			0.068	No
	Edge 4	① + ②	0.003			0.003	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.

13.3. 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 Bluetooth		
Head	Left Touch	① + ②	0.011	0.626		0.637	No
	Left Tilt	① + ②	0.001	0.192		0.193	No
	Right Touch	① + ②	0.025	0.208		0.233	No
	Right Tilt	① + ②	0.002	0.087		0.089	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.068	0.029		0.097	No
		① + ③	0.068		0.189	0.257	No
	Front	① + ②	0.058	0.031		0.089	No
		① + ③	0.058		0.189	0.247	No
Hotspot	Edge 1	① + ②		0.007		0.007	No
	Edge 2	① + ②	0.056	0.004		0.060	No
	Edge 3	① + ②	0.024			0.024	No
	Edge 4	① + ②	0.008			0.008	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.

13.4. 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 Bluetooth		
Head	Left Touch	① + ②	0.069	0.626		0.695	No
	Left Tilt	① + ②	0.018	0.192		0.210	No
	Right Touch	① + ②	0.131	0.208		0.339	No
	Right Tilt	① + ②	0.029	0.087		0.116	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.347	0.029		0.376	No
		① + ③	0.347		0.189	0.536	No
	Front	① + ②	0.345	0.031		0.376	No
		① + ③	0.345		0.189	0.534	No
Hotspot	Edge 1	① + ②		0.007		0.007	No
	Edge 2	① + ②	0.058	0.004		0.062	No
	Edge 3	① + ②	0.089			0.089	No
	Edge 4	① + ②	0.013			0.013	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.

13.5. 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 Bluetooth		
Head	Left Touch	① + ②	0.024	0.626		0.650	No
	Left Tilt	① + ②	0.017	0.192		0.209	No
	Right Touch	① + ②	0.025	0.208		0.233	No
	Right Tilt	① + ②	0.019	0.087		0.106	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.052	0.029		0.081	No
		① + ③	0.052		0.189	0.241	No
	Front	① + ②	0.072	0.031		0.103	No
		① + ③	0.072		0.189	0.261	No
Hotspot	Edge 1	① + ②		0.007		0.007	No
	Edge 2	① + ②	0.027	0.004		0.031	No
	Edge 3	① + ②	0.071			0.071	No
	Edge 4	① + ②	0.020			0.020	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. Appendixes

Refer to separated files for the following appendixes.

- 14.1. Photos and Antenna Locations**
- 14.2. System Performance Check Plots**
- 14.3. Highest SAR Test Plots**
- 14.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3902**
- 14.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3531**
- 14.6. Calibration Certificate for E-Field Probe EX3DV3 - SN 3991**
- 14.7. Calibration Certificate for D835V2 - SN 4d002**
- 14.8. Calibration Certificate for D1900V2- SN 5d163**
- 14.9. Calibration Certificate for D2450V2 - SN 899**
- 14.10. Calibration Certificate for D2600V2 - SN 1006**

END OF REPORT