SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
GSM/WCDMA Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC

Model: SM-A5000, SM-A5009
FCC ID: A3LSMA5000

Report Number: 14I18594-S1
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Prepared for
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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO. LTD.			
Application Purpose	☒ Original Grant ☐ Class II Permissive Change			
FCC ID	A3LSMA5000			
DUT Description	GSM/WCDMA Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC			
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)			
The highest reported SAR	RF Exposure Conditions	Equipment Class		
		Licensed	DTS	UNII
	Head	0.164 W/kg	0.615 W/kg	0.212 W/kg
	Body-worn Accessory	0.465 W/kg	0.88 W/kg	0.121 W/kg
	Wireless Router (Hotspot)	0.608 W/kg		
	Wi-Fi Direct	N/A		
	Simultaneous Transmission	Head: 0.779 W/kg Body: 0.549 W/kg	Head: 0.779 W/kg Body: 0.549 W/kg	Head: 0.376 W/kg Body: 0.545 W/kg
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
Test Results	Pass			
Date tested	08/18/2014 – 08/26/2014 and 9/2/2014 – 9/9/2014			

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.

Approved & Released By:	Prepared By:
Dave Weaver Program Manager UL Verification Services Inc.	AJ Newcomer Laboratory Technician UL Verification Services Inc.

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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

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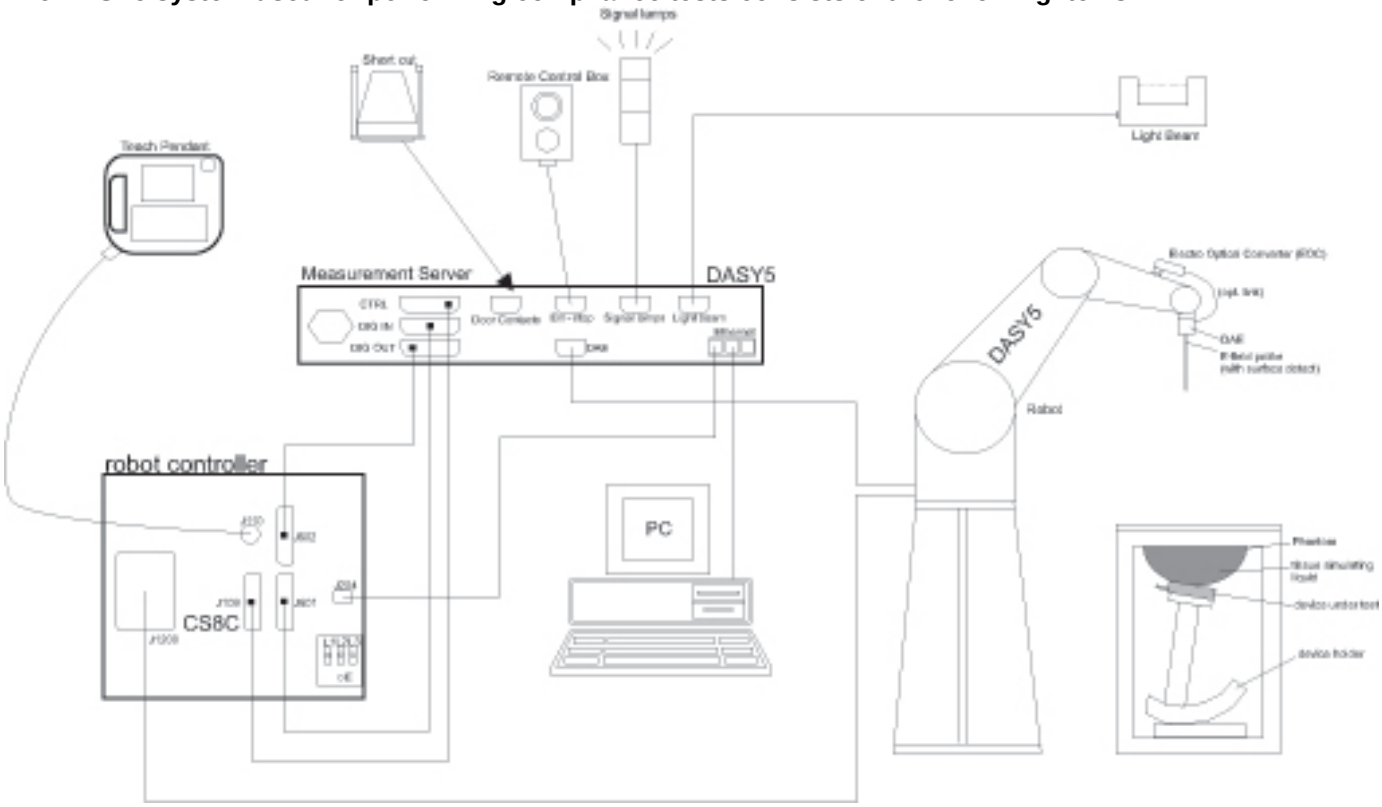
4. SAR Measurement System & Test Equipment

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.

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4.2. 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
Synthesized Signal Generator	HP	8665B	3744A01155	5/12/2015
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	EX3DV3	3531	11/21/2014
E-Field Probe (SAR 4)	SPEAG	EX3DV4	3929	5/9/2015
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 4)	SPEAG	DAE4	1352	9/11/2014
Data Acquisition Electronics (SAR 5)	SPEAG	DAE4	1439	5/14/2015
System Validation Dipole	SPEAG	D835V2	4d142	9/17/2014
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
System Validation Dipole	SPEAG	D5GHzV2	1003	2/26/2015
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 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	N1912A	MY53040015	7/10/2015
Power Sensor	Agilent	N1921A	MY52020011	5/6/2015
Base Station Simulator	R&S	CMW 500	132909-bd	6/6/2015
Base Station Simulator	R&S	CMW 500	125236-eS	5/29/2015
Base Station Simulator	R&S	CMW 500	135393-VQ	7/3/2015

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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.

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6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-A5000 and SM-A5009	
Device Dimension	Overall (Length x Width): 139 mm x 70 mm Overall Diagonal: 151 mm Display Diagonal: 127 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. ☒ Mobile Hotspot (Wi-Fi 2.4 GHz) ☒ Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5 GHz)
SIM Information	☐ Single SIM ☒ Dual SIM

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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: ☐ Class 8 - One Up ☐ Class 10 - Two Up ☐ Class 12 - Four Up ☒ Class 33 - Four Up Is DTM (Dual Transfer Mode) supported? ☐Yes ☒ No		
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7, CAT 24) HSUPA (Rel. 6, CAT 6) DC-HSDPA (Rel. 8, CAT 21) HSPA+ (Rel. 6, CAT 6)	100%
LTE (TDD)	Band 41	QPSK, 16QAM	63.3%
	Does this device SV-LTE (1xRTT-LTE)? ☐Yes ☒ 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)

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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	30.0	**30.5**
	GPRS 3 slots	29.0	**29.5**
	GPRS 4 slots	27.0	**27.5**
	EGPRS 1 slot	27.0	**27.5**
	EGPRS 2 slots	26.0	**26.5**
	EGPRS 3 slots	24.0	**24.5**
	EGPRS 4 slots	23.5	**24.0**
GSM1900	Voice	31.0	**31.5**
	GPRS 1 slot	31.0	**31.5**
	GPRS 2 slots	28.0	**28.5**
	GPRS 3 slots	26.0	**26.5**
	GPRS 4 slots	24.5	**25.0**
	EGPRS 1 slot	26.0	**26.5**
	EGPRS 2 slots	25.0	**25.5**
	EGPRS 3 slots	23.0	**23.5**
	EGPRS 4 slots	22.5	**23.0**
W-CDMA Band V	R99	23.0	**23.5**
	HSDPA	22.0	**22.5**
	HSUPA	23.0	**23.5**
	DC-DSPA	22.0	**22.5**
W-CDMA Band II	R99	23.0	**23.5**
	HSDPA	22.0	**22.5**
	HSUPA	23.0	**23.5**
	DC-DSPA	22.0	**22.5**
LTE Band 41	QPSK	23.5	**24.0**

Upper limit (dB): 0.5		RF Output Pow er (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	17.0	**17.5**
	802.11g	14.0	**14.5**
	802.11n HT20	13.0	**13.5**
WiFi 5 GHz	802.11a	12.0	**12.5**
	802.11n HT20	12.0	**12.5**
	802.11n HT40	11.5	**12.0**
Bluetooth		10.0	**10.5**
Bluetooth LE		0.0	**0.5**

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6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM 850/1900 Voice + Wi-Fi 2.4/5GHz 2. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4/5GHz 3. WCDMA Band 2/5 + Wi-Fi 2.4/5GHz 4. LTE B41 + Wi-Fi 2.4/5GHz
Body-worn Accessory	1. GSM 850/1900 Voice + Wi-Fi 2.4/5GHz 2. GSM 850/1900 Voice + BT 3. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4/5GHz 4. GSM 850/1900 (GPRS/EDGE) + BT 5. WCDMA Band 2/5 + Wi-Fi 2.4/5GHz 6. WCDMA Band 2/5 + BT 7. LTE B41 + Wi-Fi 2.4/5GHz 8. LTE B41 + BT
Wireless Router (Hotspot)	1. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4/5.8GHz 2. WCDMA Band 2/5 + Wi-Fi 2.4/5.8GHz 3. LTE B41 + Wi-Fi 2.4/5.8GHz

Notes:
1. Wi-Fi 2.4/5.8GHz supports Hotspot and Wi-Fi Direct.
2. GPRS/EDGE, LTE, and WCDMA support Hotspot.
3. VoIP is supported in WCDMA, LTE, and GPRS.
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.

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6.5. General LTE SAR Test and Reporting Considerations

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Frequency range, Channel Bandwidth, Numbers and Frequencies</td><td>
<table>
<tr><th rowspan="3">Band 41</th><th colspan="6">Frequency range: 2555 - 2655 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>
<tr><td>Low</td><td>40340/
2565.0</td><td>40315/
2562.5</td><td>40290/
2560.0</td><td>40265/
2557.5</td><td></td><td></td></tr>
<tr><td>Mid</td><td>40740/
2605.0</td><td>40740/
2605.0</td><td>40740/
2605.0</td><td>40740/
2605.0</td><td></td><td></td></tr>
<tr><td>High</td><td>41140/
2645.0</td><td>41165/
2647.5</td><td>41190/
2650.0</td><td>41215/
2652.5</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>LTE has one (1) TX/RX antennas and one (1) RX antennas
Refer to Appendix 14.1. Photos and Antenna Locations.</td></tr>
<tr><td>Maximum power reduction (MPR)</td><td>
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3
<table>
<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>
<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>
</table>
MPR Built-in by design
A-MPR (additional MPR) was disabled during SAR testing
</td></tr>
<tr><td>Power reduction</td><td>No</td></tr>
<tr><td>Spectrum plots for RB configurations</td><td>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.</td></tr>
</table>

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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	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
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

<u>Example for Calculated Duty Cycle for Uplink-Downlink Configuration 0:</u>
Calculated Duty Cycle = 5120 x [1/(15000 x 2048)] x 2 + 6 ms = 63.33%
where
T_s = 1/(15000 x 2048) seconds

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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) and Wi-Fi Direct

For WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	120 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)	15 mm	Yes	
Edge 3 (Bottom)	0mm	Yes	
Edge 4 (Left)	0mm	Yes	

For LTE

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	114 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)	0mm	Yes	
Edge 3 (Bottom)	0mm	Yes	
Edge 4 (Left)	56 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

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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)	128 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

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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	33.5	24.5
				190	836.6	33.4	24.4
				251	848.8	33.5	24.5
	GPRS (GMSK)	CS1	1	128	824.2	33.5	24.5
				190	836.6	33.4	24.4
				251	848.8	33.5	24.5
			2	128	824.2	30.5	24.5
				190	836.6	30.5	24.5
				251	848.8	30.5	24.5
			3	**128**	**824.2**	**29.4**	**25.1**
				190	**836.6**	**29.5**	**25.2**
				251	**848.8**	**29.3**	**25.0**
			4	128	824.2	27.4	24.4
				190	836.6	27.5	24.5
				251	848.8	27.5	24.5
	EGPRS (8PSK)	MCS5	1	128	824.2	27.1	18.1
				190	836.6	27.1	18.1
				251	848.8	27.0	18.0
			2	128	824.2	26.5	20.5
				190	836.6	26.5	20.5
				251	848.8	26.5	20.5
			3	128	824.2	24.3	20.0
				190	836.6	24.3	20.0
				251	848.8	24.3	20.0
			4	128	824.2	23.9	20.9
				190	836.6	23.9	20.9
				251	848.8	24.0	21.0

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 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

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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	30.6	21.6
				661	1880.0	30.3	21.3
				810	1909.8	30.7	21.7
	GPRS (GMSK)	CS1	1	512	1850.2	30.6	21.6
				661	1880.0	30.3	21.3
				810	1909.8	30.7	21.7
			2	**512**	**1850.2**	**28.5**	**22.5**
				661	**1880.0**	**28.1**	**22.1**
				810	**1909.8**	**28.5**	**22.5**
			3	512	1850.2	26.2	21.9
				661	1880.0	25.9	21.6
				810	1909.8	26.5	22.2
			4	512	1850.2	24.9	21.9
				661	1880.0	24.6	21.6
				810	1909.8	25.0	22.0
	EGPRS (8PSK)	MCS5	1	512	1850.2	25.8	16.8
				661	1880.0	25.7	16.7
				810	1909.8	26.1	17.1
			2	512	1850.2	25.5	19.5
				661	1880.0	25.4	19.4
				810	1909.8	25.5	19.5
			3	512	1850.2	23.3	19.0
				661	1880.0	23.1	18.8
				810	1909.8	23.5	19.2
			4	512	1850.2	23.0	20.0
				661	1880.0	22.9	19.9
				810	1909.8	23.0	20.0

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

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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
	βc/βd	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	23.2
		4183	836.6	23.2
		4233	846.6	23.2
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	23.3
		9400	1880.0	23.2
		9538	1907.6	23.3

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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			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	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=βhs/βc	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	22.2
		4183	836.6	0	22.3
		4233	846.6	0	22.3
	Subtest 2	4132	826.4	0	22.2
		4183	836.6	0	22.3
		4233	846.6	0	22.3
	Subtest 3	4132	826.4	0.5	21.7
		4183	836.6	0.5	21.8
		4233	846.6	0.5	21.8
	Subtest 4	4132	826.4	0.5	21.7
		4183	836.6	0.5	21.8
		4233	846.6	0.5	21.8
W-CDMA Band II	Subtest 1	9262	1852.4	0	22.2
		9400	1880.0	0	22.1
		9538	1907.6	0	22.3
	Subtest 2	9262	1852.4	0	22.3
		9400	1880.0	0	22.2
		9538	1907.6	0	22.4
	Subtest 3	9262	1852.4	0.5	21.7
		9400	1880.0	0.5	21.6
		9538	1907.6	0.5	21.7
	Subtest 4	9262	1852.4	0.5	21.7
		9400	1880.0	0.5	21.6
		9538	1907.6	0.5	21.7

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

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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
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	11/15	15/9	2/15	15/0
	βhs	22/15	12/15	30/15	4/15	5/15
	βed	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				
	Ahs = βhs/βc	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

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Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	22.2
		4183	836.6	0	21.7
		4233	846.6	0	22.0
	Subtest 2	4132	826.4	2	21.1
		4183	836.6	2	21.1
		4233	846.6	2	21.3
	Subtest 3	4132	826.4	1	21.3
		4183	836.6	1	21.3
		4233	846.6	1	21.3
	Subtest 4	4132	826.4	2	21.2
		4183	836.6	2	21.4
		4233	846.6	2	21.5
	Subtest 5	4132	826.4	0	22.2
		4183	836.6	0	22.4
		4233	846.6	0	22.4
W-CDMA Band II	Subtest 1	9262	1852.4	0	22.2
		9400	1880.0	0	21.9
		9538	1907.6	0	22.1
	Subtest 2	9262	1852.4	2	20.9
		9400	1880.0	2	20.9
		9538	1907.6	2	20.7
	Subtest 3	9262	1852.4	1	21.1
		9400	1880.0	1	21.0
		9538	1907.6	1	21.0
	Subtest 4	9262	1852.4	2	21.2
		9400	1880.0	2	21.4
		9538	1907.6	2	21.5
	Subtest 5	9262	1852.4	0	22.4
		9400	1880.0	0	22.3
		9538	1907.6	0	22.2

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DC-HSDPA

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

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

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

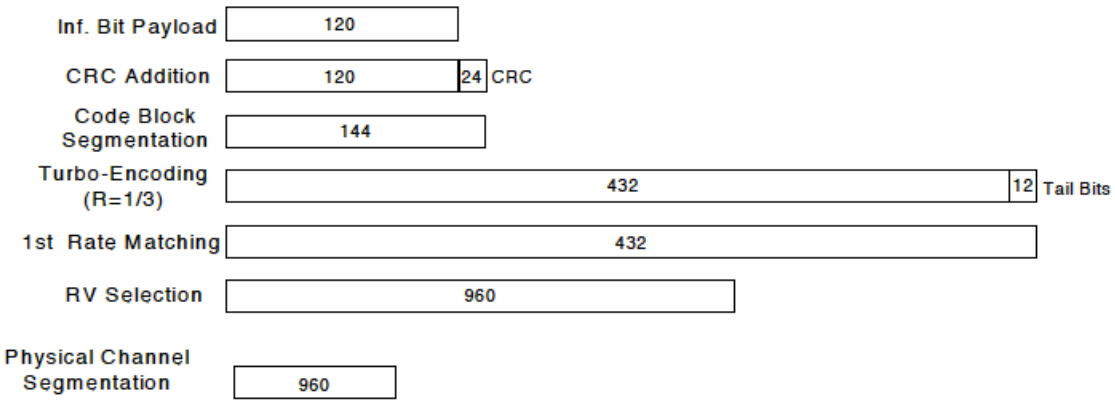

Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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The following 4 Sub-tests for HSDPA were completed according to Release 8 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest 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			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	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=βhs/βc	30/15			

Up commands are set continuously to set the UE to Max power.

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	22.2
		4183	836.6	0	22.3
		4233	846.6	0	22.3
	Subtest 2	4132	826.4	0	22.2
		4183	836.6	0	22.3
		4233	846.6	0	22.3
	Subtest 3	4132	826.4	0.5	21.7
		4183	836.6	0.5	21.8
		4233	846.6	0.5	21.8
	Subtest 4	4132	826.4	0.5	21.7
		4183	836.6	0.5	21.8
		4233	846.6	0.5	21.8
W-CDMA Band II	Subtest 1	9262	1852.4	0	22.2
		9400	1880.0	0	22.1
		9538	1907.6	0	22.3
	Subtest 2	9262	1852.4	0	22.3
		9400	1880.0	0	22.2
		9538	1907.6	0	22.4
	Subtest 3	9262	1852.4	0.5	21.7
		9400	1880.0	0.5	21.6
		9538	1907.6	0.5	21.7
	Subtest 4	9262	1852.4	0.5	21.7
		9400	1880.0	0.5	21.6
		9538	1907.6	0.5	21.7

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.

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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 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
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.					

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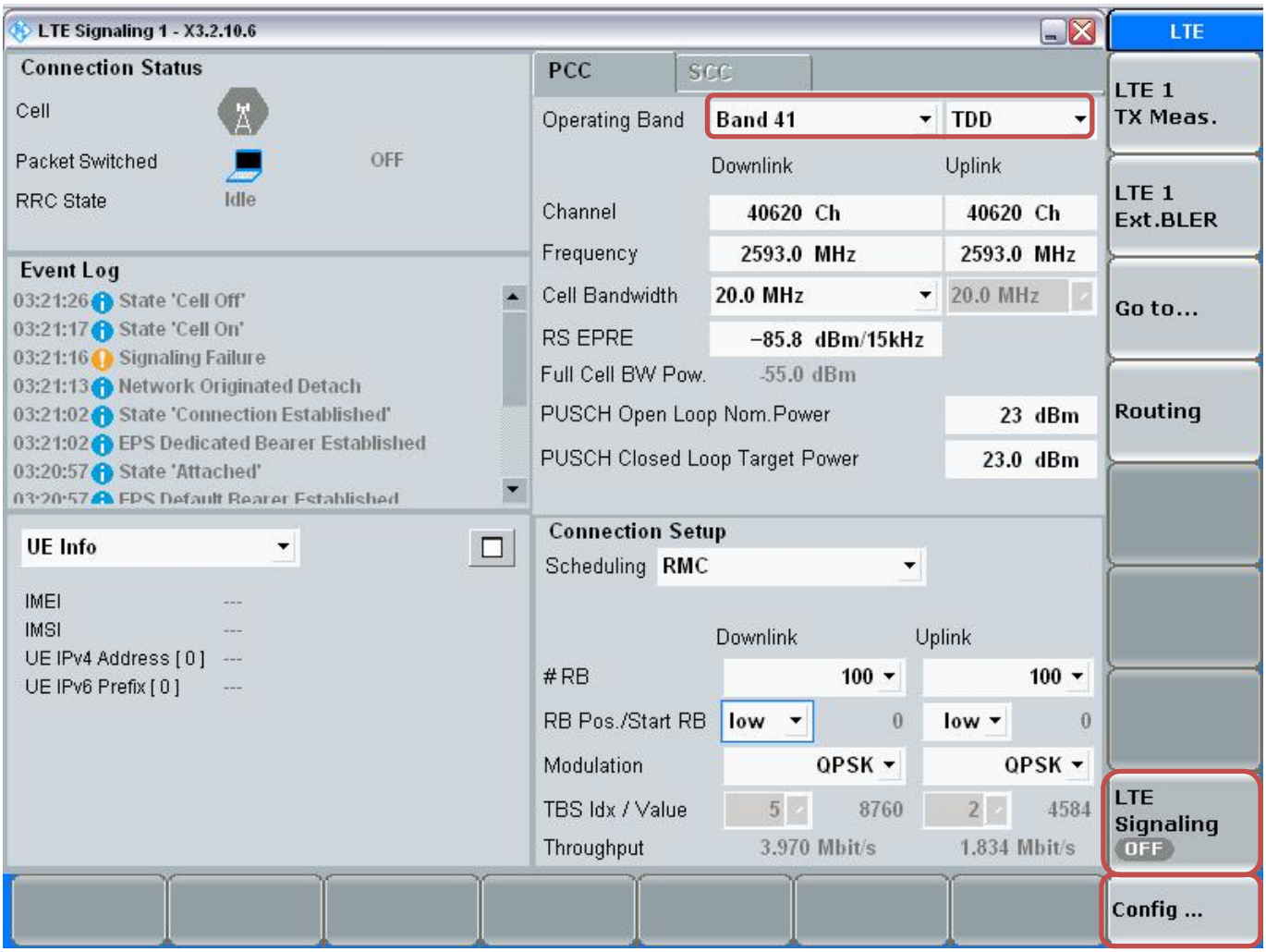
LTE Band 41 Measured Results

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….”



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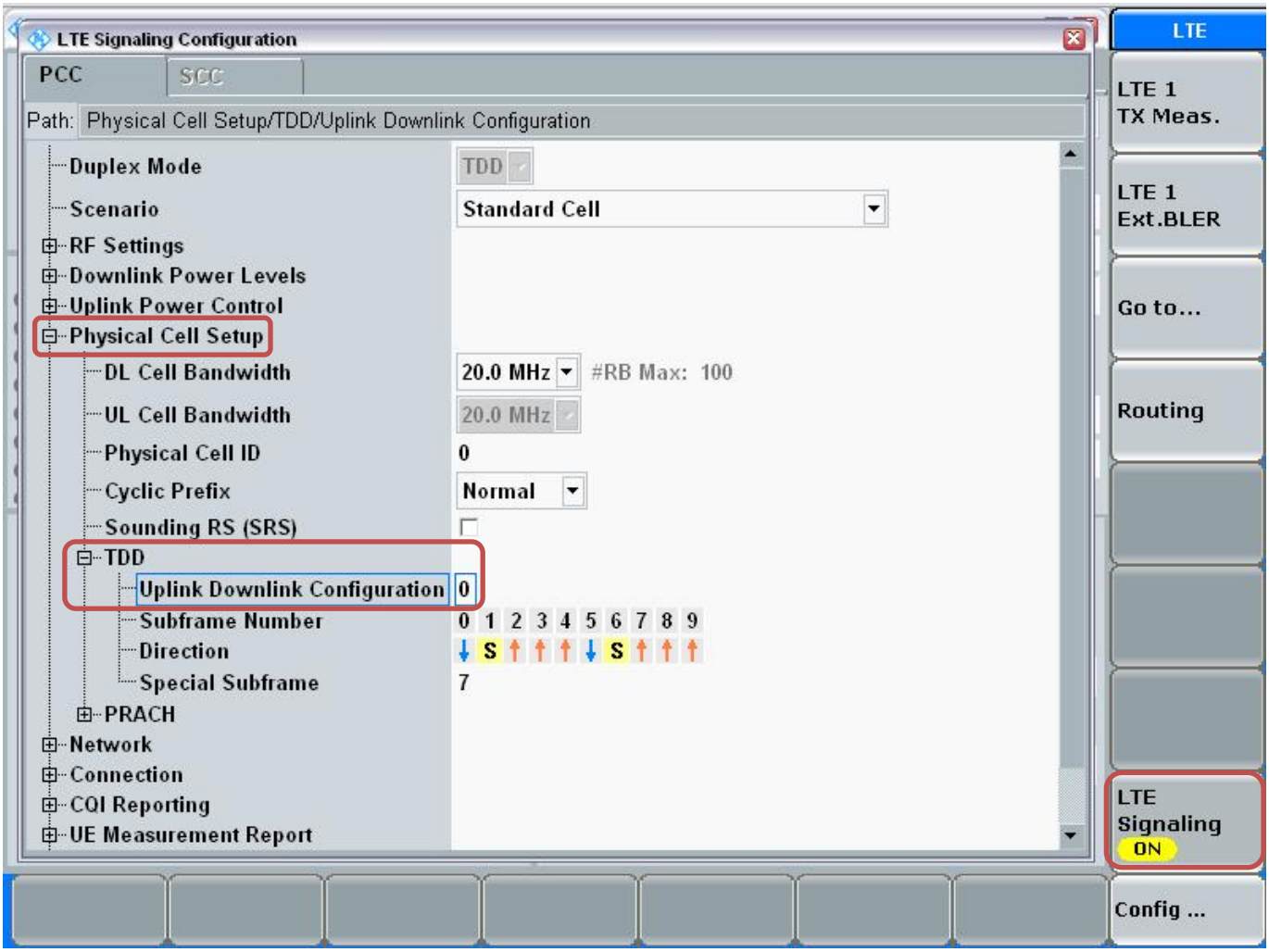
- Go to “Physical Cell Setup”
- Select “TDD” and Set “Uplink Downlink Configuration” to “0”
- Turn the cell on using “ON | OFF” key



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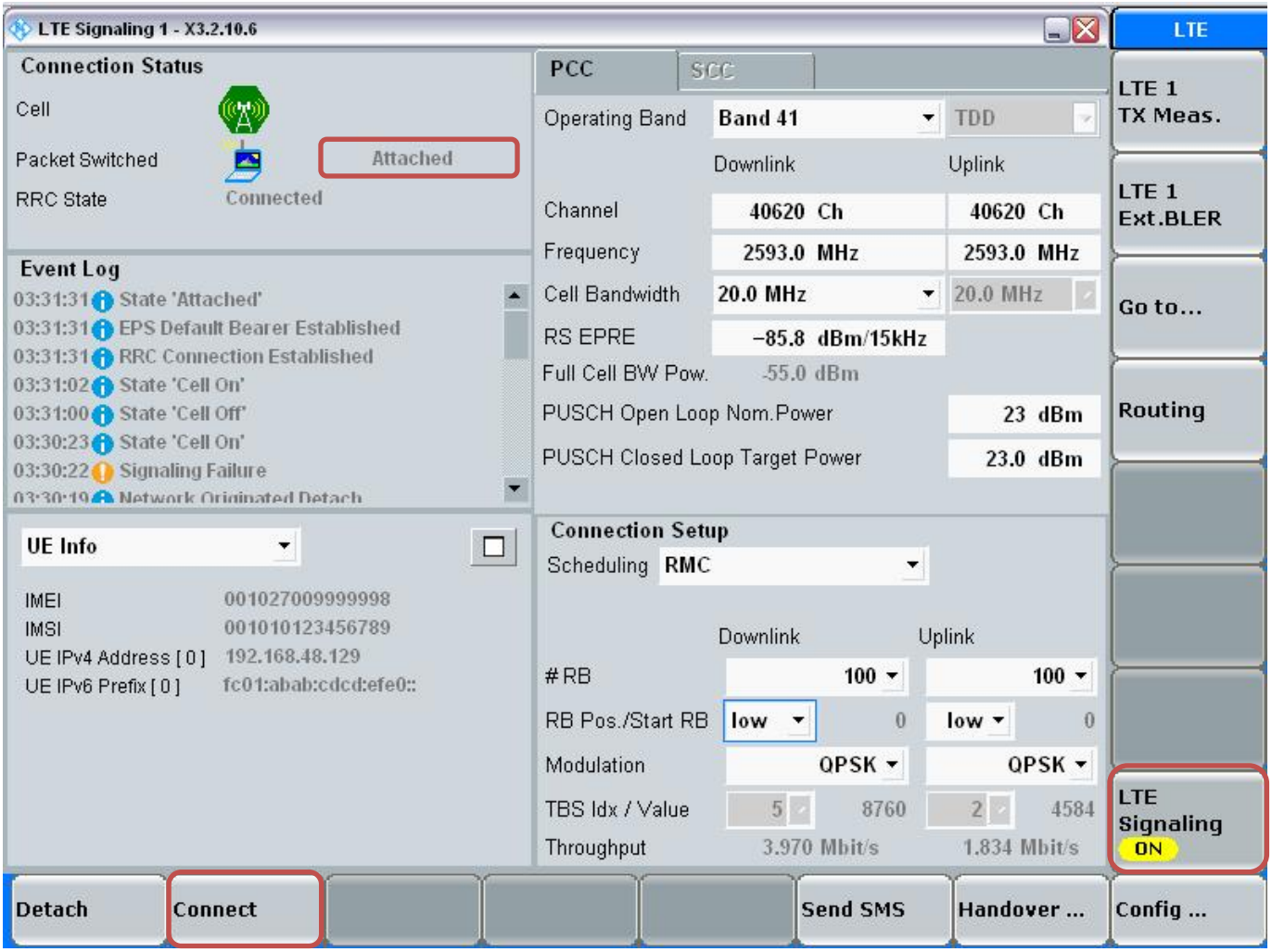
Connect to EUT

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



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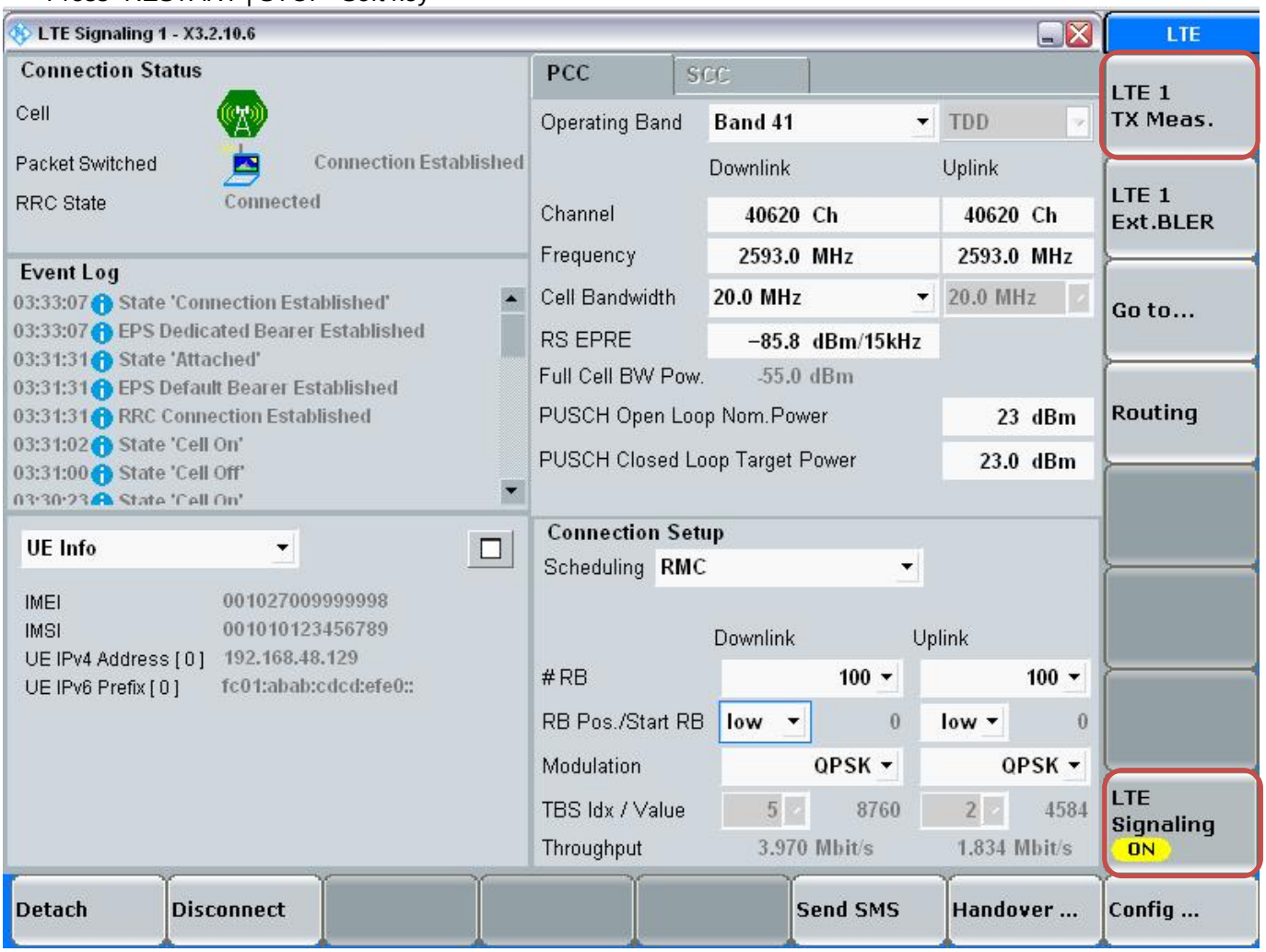
Max Power Setting

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



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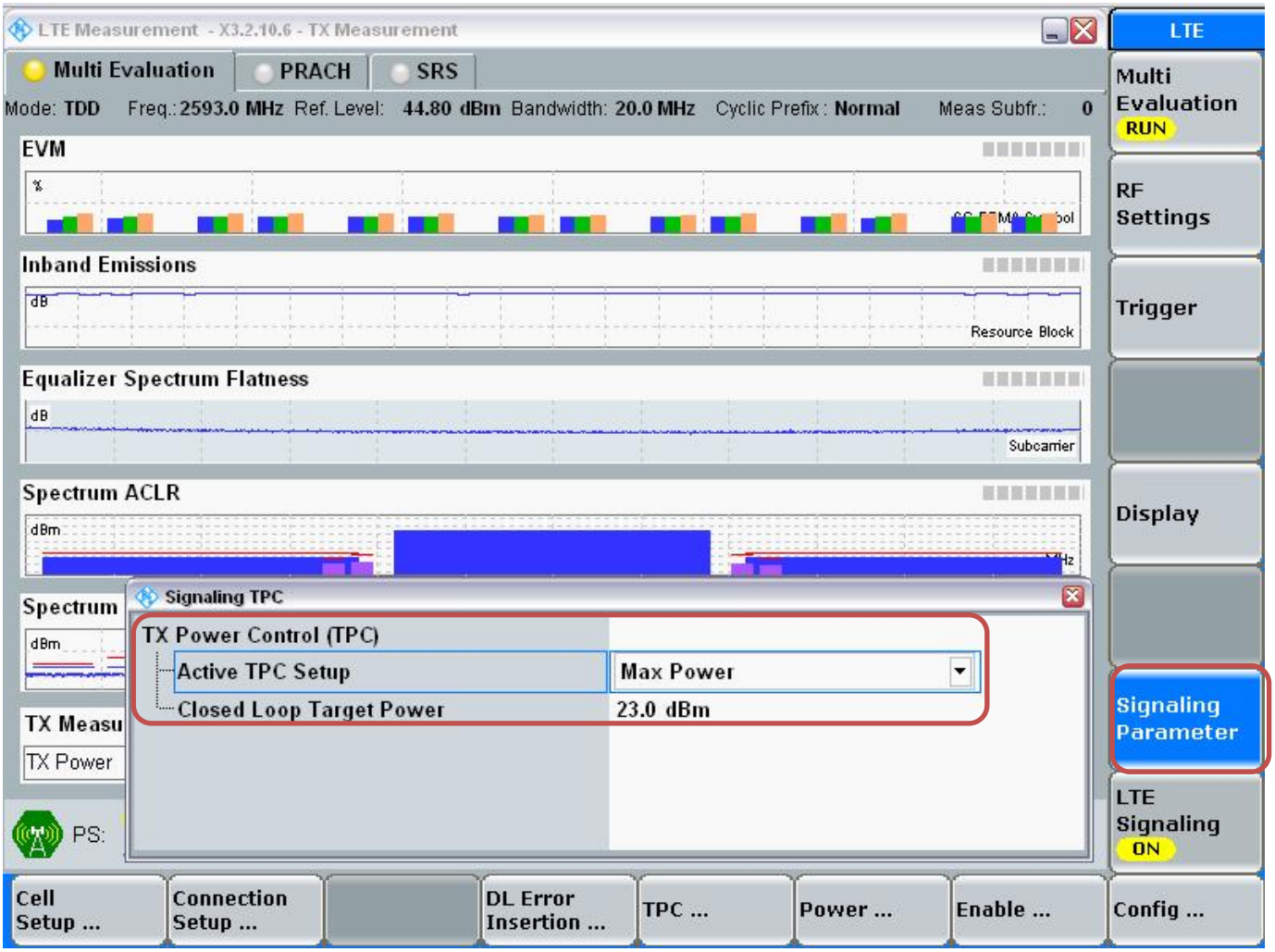
- Select “Signaling Parameter”
- Select “TX Power Control (TPC)” > Select “Active TPC Setup” to “Max Power” > Set “Closed Loop Target Power” to “23 dBm”



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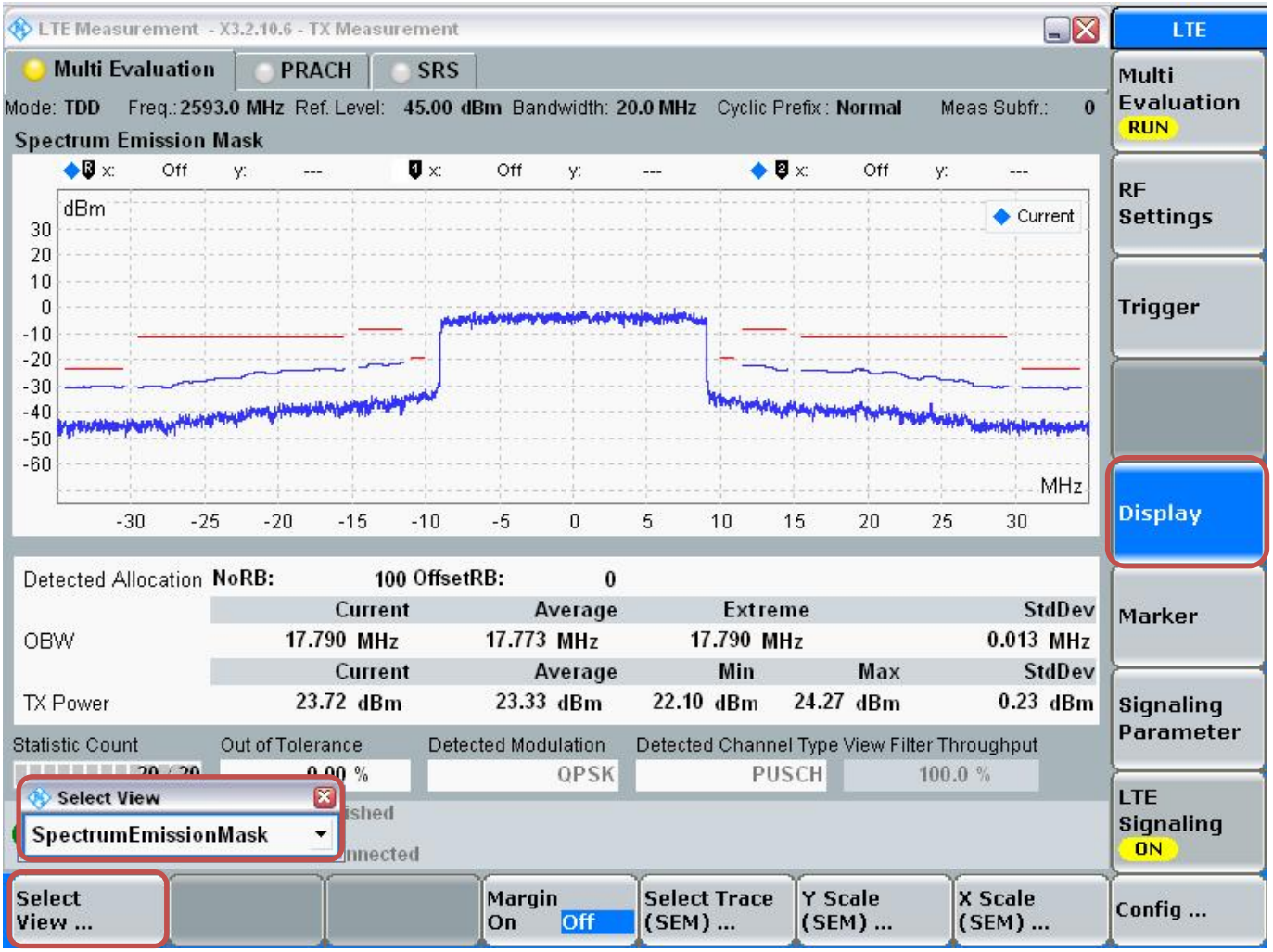
View TX Power

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



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LTE Band 41 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							2565 MHz	2605 MHz	2645 MHz
LTE Band 41	20	QPSK	1	0	0	0	23.5	24.0	24.0
			1	50	0	0	23.6	24.0	24.0
			1	99	0	0	23.6	23.9	23.7
			50	0	1	1	22.3	22.8	23.0
			50	25	1	1	22.3	22.7	23.0
			50	50	1	1	22.3	22.7	23.0
			100	0	1	1	22.3	22.8	23.0
		16QAM	1	0	1	1	22.5	23.0	23.0
			1	50	1	1	22.4	22.9	23.0
			1	99	1	1	22.6	22.9	23.0
			50	0	2	2	21.3	21.5	22.0
			50	25	2	2	21.4	21.5	22.0
			50	50	2	2	21.3	21.5	22.0
			100	0	2	2	21.3	21.7	22.0
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							2562.5 MHz	2605 MHz	2647.5 MHz
LTE Band 41	15	QPSK	1	0	0	0	23.5	23.7	24.0
			1	36	0	0	23.4	23.6	24.0
			1	74	0	0	23.5	23.7	23.8
			36	0	1	1	22.2	22.6	23.0
			36	18	1	1	22.2	22.5	23.0
			36	37	1	1	22.1	22.6	23.0
			75	0	1	1	22.1	22.6	23.0
		16QAM	1	0	1	1	22.5	22.8	23.0
			1	36	1	1	22.5	22.8	23.0
			1	74	1	1	22.4	22.8	23.0
			36	0	2	2	21.3	21.6	22.0
			36	18	2	2	21.3	21.6	22.0
			36	37	2	2	21.3	21.7	22.0
			75	0	2	2	21.2	21.7	22.0
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							2560 MHz	2605 MHz	2650 MHz
LTE Band 41	10	QPSK	1	0	0	0	23.3	23.9	24.0
			1	25	0	0	23.4	23.8	24.0
			1	49	0	0	23.4	23.8	23.9
			25	0	1	1	22.2	22.7	23.0
			25	12	1	1	22.2	22.6	23.0
			25	25	1	1	22.2	22.7	23.0
			50	0	1	1	22.1	22.5	23.0
		16QAM	1	0	1	1	22.4	23.0	23.0
			1	25	1	1	22.4	23.0	23.0
			1	49	1	1	22.4	23.0	23.0
			25	0	2	2	21.2	21.6	22.0
			25	12	2	2	21.3	21.6	22.0
			25	25	2	2	21.3	21.6	22.0
			50	0	2	2	21.2	21.6	22.0

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LTE Band 41 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							2557.5 MHz	2605 MHz	2652.5 MHz
LTE Band 41	5	QPSK	1	0	0	0	23.5	23.7	24.0
			1	12	0	0	23.4	23.7	24.0
			1	24	0	0	23.5	23.7	23.8
			12	0	1	1	22.3	22.7	23.0
			12	6	1	1	22.3	22.7	23.0
			12	13	1	1	22.4	22.7	23.0
			25	0	1	1	22.2	22.6	23.0
		16QAM	1	0	1	1	22.9	22.5	23.0
			1	12	1	1	22.9	22.4	23.0
			1	24	1	1	22.9	22.4	23.0
			12	0	2	2	21.4	21.7	22.0
			12	6	2	2	21.4	21.7	22.0
			12	13	2	2	21.5	21.7	22.0
			25	0	2	2	21.2	21.7	22.0

8.4. Wi-Fi (2.4 GHz Band) (reference to additional KDB in footnote)

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	15.9	Yes
			6	2437	15.5	
			11	2462	15.8	
	802.11g	6 Mbps	1	2412	12.9	No
			6	2437	13.0	
			11	2462	12.8	
	802.11n (HT20)	MCS0	1	2412	12.0	No
			6	2437	12.1	
			11	2462	11.8	

Note(s):

1. 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	15.6	Yes
			2 Mbps	15.7	No
			5.5 Mbps	15.4	No
			11 Mbps	15.7	No

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8.5. Wi-Fi (5 GHz Bands)

Required Test Channels per KDB 248227 D01

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
5.2 (UNII-1)	802.11a	6 Mbps	36	5180	12.0	Yes
			40	5200	12.0	
			44	5220	12.1	
			48	5240	12.1	
	802.11n (HT20)	MCS0	36	5180	12.0	No
			40	5200	12.1	
			48	5240	12.2	
	802.11n (HT40)	MCS0	38	5190	11.7	No
			46	5230	11.8	
5.3 (UNII-2A)	802.11a	6 Mbps	52	5260	12.2	Yes
			56	5280	12.2	
			60	5300	12.3	
			64	5320	12.4	
	802.11n (HT20)	MCS0	52	5260	12.1	No
			60	5300	12.3	
			64	5320	12.4	
	802.11n (HT40)	MCS0	54	5270	11.9	No
			62	5310	12.0	
5.5 (UNII-2C)	802.11a	6 Mbps	100	5500	12.0	Yes
			104	5520	11.4	
			108	5540	11.0	
			112	5560	11.5	
			116	5580	11.5	
			120	5600	11.5	
			124	5620	11.5	
			128	5640	11.6	
			132	5660	11.6	
			136	5680	11.6	
			140	5700	11.6	
	802.11n (HT20)	MCS0	100	5500	12.1	No
			116	5580	11.6	
			140	5700	11.7	
	802.11n (HT40)	MCS0	102	5510	11.2	No
			110	5550	11.7	
			134	5670	11.3	
5.8 (UNII-3)	802.11a	6 Mbps	149	5745	11.3	Yes
			153	5765	11.0	
			157	5785	10.7	
			161	5805	11.2	
			165	5825	10.7	
	802.11n (HT20)	MCS0	149	5745	11.3	No
			157	5785	10.8	
			161	5805	10.7	
	802.11n (HT40)	MCS0	151	5755	10.4	No
			159	5795	10.9	

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.

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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 (UNII-1)	802.11a	44	5220	6 Mbps	12.2	Yes
				9 Mbps	12.0	No
				12 Mbps	11.9	No
				18 Mbps	11.5	No
				24 Mbps	11.3	No
				36 Mbps	11.0	No
				48 Mbps	10.6	No
				54 Mbps	10.5	No
5.3 GHz (UNII-2A)	802.11a	52	5260	6 Mbps	12.2	Yes
				9 Mbps	12.0	No
				12 Mbps	11.9	No
				18 Mbps	11.7	No
				24 Mbps	11.4	No
				36 Mbps	11.0	No
				48 Mbps	10.6	No
				54 Mbps	10.5	No
5.5 GHz (UNII-2C)	802.11a	132	5660	6 Mbps	11.7	Yes
				9 Mbps	11.5	No
				12 Mbps	11.3	No
				18 Mbps	11.2	No
				24 Mbps	10.9	No
				36 Mbps	10.6	No
				48 Mbps	10.2	No
				54 Mbps	10.1	No
5.8 GHz (UNII-3)	802.11a	149	5745	6 Mbps	11.2	Yes
				9 Mbps	11.1	No
				12 Mbps	11.0	No
				18 Mbps	10.8	No
				24 Mbps	10.7	No
				36 Mbps	10.2	No
				48 Mbps	9.9	No
				54 Mbps	9.9	No

8.6. Bluetooth

Maximum tune-up tolerance limit is 10.5 dBm. This power level qualifies for exclusion of SAR testing.
Refer to Standalone SAR Test Exclusion Considerations Section.

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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 ± 2°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 IEEE Standard 1528-2013.

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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 ± 2°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 ±(%)
8/18/2014	Head 1900	e'	38.2900	Relative Permittivity (ε_r):	38.29	40.00	-4.28	5
		e''	13.1000	Conductivity (σ):	1.38	1.40	-1.15	5
	Head 1850	e'	38.6800	Relative Permittivity (ε_r):	38.68	40.00	-3.30	5
		e''	12.9500	Conductivity (σ):	1.33	1.40	-4.85	5
	Head 1910	e'	38.2500	Relative Permittivity (ε_r):	38.25	40.00	-4.38	5
		e''	13.1300	Conductivity (σ):	1.39	1.40	-0.40	5
8/18/2014	Body 1900	e'	50.9700	Relative Permittivity (ε_r):	50.97	53.30	-4.37	5
		e''	14.9800	Conductivity (σ):	1.58	1.52	4.12	5
	Body 1850	e'	51.3100	Relative Permittivity (ε_r):	51.31	53.30	-3.73	5
		e''	14.7900	Conductivity (σ):	1.52	1.52	0.09	5
	Body 1910	e'	50.9400	Relative Permittivity (ε_r):	50.94	53.30	-4.43	5
		e''	15.0200	Conductivity (σ):	1.60	1.52	4.94	5
9/8/2014	Head 5180	e'	35.8900	Relative Permittivity (ε_r):	35.89	36.01	-0.34	5
		e''	15.3700	Conductivity (σ):	4.43	4.63	-4.40	5
	Head 5200	e'	35.8600	Relative Permittivity (ε_r):	35.86	35.99	-0.36	5
		e''	15.3800	Conductivity (σ):	4.45	4.65	-4.39	5
	Head 5600	e'	35.3300	Relative Permittivity (ε_r):	35.33	35.53	-0.57	5
		e''	15.5300	Conductivity (σ):	4.84	5.06	-4.44	5
	Head 5800	e'	35.0800	Relative Permittivity (ε_r):	35.08	35.30	-0.62	5
		e''	15.6500	Conductivity (σ):	5.05	5.27	-4.23	5
	Head 5825	e'	35.0600	Relative Permittivity (ε_r):	35.06	35.30	-0.68	5
		e''	15.6500	Conductivity (σ):	5.07	5.27	-3.82	5

SAR Lab 2

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
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
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
			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

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SAR Lab 4

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/8/2014	Body 5180	e'	47.2500	Relative Permittivity (ε_r):	47.25	49.05	-3.66	5
		e''	18.4900	Conductivity (σ):	5.33	5.27	1.03	5
	Body 5200	e'	47.2100	Relative Permittivity (ε_r):	47.21	49.02	-3.69	5
		e''	18.5000	Conductivity (σ):	5.35	5.29	1.03	5
	Body 5600	e'	46.5500	Relative Permittivity (ε_r):	46.55	48.48	-3.98	5
		e''	18.8200	Conductivity (σ):	5.86	5.76	1.72	5
	Body 5800	e'	46.2200	Relative Permittivity (ε_r):	46.22	48.20	-4.11	5
		e''	19.0100	Conductivity (σ):	6.13	6.00	2.18	5
	Body 5825	e'	46.1600	Relative Permittivity (ε_r):	46.16	48.20	-4.23	5
		e''	19.0400	Conductivity (σ):	6.17	6.00	2.78	5

SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/18/2014	Head 835	e'	40.8100	Relative Permittivity (ε_r):	40.81	41.50	-1.66	5
		e''	20.0200	Conductivity (σ):	0.93	0.90	3.28	5
	Head 820	e'	40.9700	Relative Permittivity (ε_r):	40.97	41.60	-1.52	5
		e''	19.9800	Conductivity (σ):	0.91	0.90	1.39	5
	Head 850	e'	40.6100	Relative Permittivity (ε_r):	40.61	41.50	-2.14	5
		e''	20.0200	Conductivity (σ):	0.95	0.92	3.41	5
8/19/2014	Body 835	e'	54.5800	Relative Permittivity (ε_r):	54.58	55.20	-1.12	5
		e''	21.8900	Conductivity (σ):	1.02	0.97	4.78	5
	Body 820	e'	54.7400	Relative Permittivity (ε_r):	54.74	55.28	-0.97	5
		e''	21.9900	Conductivity (σ):	1.00	0.97	3.53	5
	Body 850	e'	54.4400	Relative Permittivity (ε_r):	54.44	55.16	-1.30	5
		e''	21.8300	Conductivity (σ):	1.03	0.99	4.52	5
8/20/2014	Head 2450	e'	37.4700	Relative Permittivity (ε_r):	37.47	39.20	-4.41	5
		e''	13.8500	Conductivity (σ):	1.89	1.80	4.82	5
	Head 2410	e'	37.6400	Relative Permittivity (ε_r):	37.64	39.28	-4.17	5
		e''	13.7300	Conductivity (σ):	1.84	1.76	4.51	5
	Head 2475	e'	37.3700	Relative Permittivity (ε_r):	37.37	39.17	-4.59	5
		e''	13.9200	Conductivity (σ):	1.92	1.83	4.85	5
8/20/2014	Body 2450	e'	50.7000	Relative Permittivity (ε_r):	50.70	52.70	-3.80	5
		e''	14.7000	Conductivity (σ):	2.00	1.95	2.69	5
	Body 2410	e'	50.8200	Relative Permittivity (ε_r):	50.82	52.76	-3.68	5
		e''	14.6200	Conductivity (σ):	1.96	1.91	2.71	5
	Body 2475	e'	50.6300	Relative Permittivity (ε_r):	50.63	52.67	-3.87	5
		e''	14.7600	Conductivity (σ):	2.03	1.99	2.32	5
8/25/2014	Head 2450	e'	37.4400	Relative Permittivity (ε_r):	37.44	39.20	-4.49	5
		e''	13.8600	Conductivity (σ):	1.89	1.80	4.90	5
	Head 2410	e'	37.6200	Relative Permittivity (ε_r):	37.62	39.28	-4.22	5
		e''	13.7700	Conductivity (σ):	1.85	1.76	4.82	5
	Head 2475	e'	37.3400	Relative Permittivity (ε_r):	37.34	39.17	-4.67	5
		e''	13.9300	Conductivity (σ):	1.92	1.83	4.93	5
8/25/2014	Body 2450	e'	52.2700	Relative Permittivity (ε_r):	52.27	52.70	-0.82	5
		e''	14.4900	Conductivity (σ):	1.97	1.95	1.23	5
	Body 2410	e'	52.3800	Relative Permittivity (ε_r):	52.38	52.76	-0.72	5
		e''	14.3900	Conductivity (σ):	1.93	1.91	1.09	5
	Body 2475	e'	52.2300	Relative Permittivity (ε_r):	52.23	52.67	-0.83	5
		e''	14.5400	Conductivity (σ):	2.00	1.99	0.80	5

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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	4d142	9/17/2013	835	1g	9.44	9.36
				10g	6.12	6.20
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
D5GHzV2	1003	2/26/2014	5200	1g	77.7	73.5
				10g	22.2	20.5
			5600	1g	81.8	79.6
				10g	23.2	22.1
			5800	1g	78.3	73.8
				10g	22.1	20.4

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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 ±10 %	Est./Zoom Ratio	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
8/18/2014	D1900V2	5d163	Head	1g	4.09	4.03	40.3	40.9	-1.47	1.47	
				10g	2.11	2.09	20.9	21.2	-1.42		
8/18/2014	D1900V2	5d163	Body	1g	3.86	3.80	38.0	40.1	-5.24	1.55	1,2
				10g	1.96	1.99	19.9	21.2	-6.13		
9/8/2014	D5GHz 5200	1003	Head	1g	6.91	7.57	75.7	77.7	-2.57	-9.55	
				10g	1.99	2.17	21.7	22.2	-2.25		
9/8/2014	D5GHz 5600	1003	Head	1g	7.34	7.83	78.3	81.8	-4.28	-6.68	3,4
				10g	2.08	2.22	22.2	23.2	-4.31		
9/8/2014	D5GHz 5800	1003	Head	1g	6.96	7.54	75.4	78.3	-3.70	-8.33	
				10g	1.97	2.14	21.4	22.1	-3.17		

SAR Lab 2

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				
9/2/2014	D2600V2	1006	Head	1g	5.97	5.74	57.4	56.50	1.59	3.85	
				10g	2.640	2.700	27.0	25.20	7.14		
9/2/2014	D2600V2	1006	Body	1g	5.61	5.32	53.2	55.70	-4.49	5.17	5,6
				10g	2.430	2.500	25.0	24.80	0.81		

SAR Lab 4

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				
9/8/2014	D5GHzV2 5200	1003	Body	1g	7.32	7.61	76.1	73.50	3.54	-3.96	
				10g	2.00	2.19	21.9	20.50	6.83		
9/8/2014	D5GHzV2 5600	1003	Body	1g	7.76	8.29	82.9	79.60	4.15	-6.83	7,8
				10g	2.11	2.37	23.7	22.10	7.24		
9/8/2014	D5GHzV2 5800	1003	Body	1g	6.87	7.33	73.3	73.80	-0.68	-6.70	
				10g	1.86	2.08	20.8	20.40	1.96		

SAR Lab 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				
8/18/2014	D835V2	4d142	Head	1g	1.04	1.02	10.2	9.44	8.05	1.92	9,10
				10g	0.70	0.67	6.7	6.12	9.80		
8/19/2014	D835V2	4d142	Body	1g	1.05	0.99	9.9	9.36	5.24	6.19	
				10g	0.70	0.65	6.5	6.2	4.52		
8/20/2014	D2450V2	899	Head	1g	5.57	5.47	54.7	51.30	6.63	1.80	
				10g	2.41	2.49	24.9	23.90	4.18		
8/20/2014	D2450V2	899	Body	1g	5.15	5.16	51.6	49.70	3.82	-0.19	
				10g	2.23	2.38	23.8	23.30	2.15		
8/25/2014	D2450V2	899	Head	1g	5.63	5.50	55.0	51.30	7.21	2.31	11,12
				10g	2.45	2.49	24.9	23.90	4.18		
8/25/2014	D2450V2	899	Body	1g	5.29	5.28	52.8	49.70	6.24	0.19	
				10g	2.28	2.42	24.2	23.30	3.86		

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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 ¼ 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.

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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	33.4	0.053	**0.054**	1
			Left Tilt	190	836.6	33.5	33.4	0.023	0.023	
			Right Touch	190	836.6	33.5	33.4	0.050	0.051	
			Right Tilt	190	836.6	33.5	33.4	0.020	0.021	
Head VoIP	GPRS 3 Slots	0	Left Touch	190	836.6	29.5	29.5	0.066	0.066	
			Left Tilt	190	836.6	29.5	29.5	0.031	0.031	
			Right Touch	190	836.6	29.5	29.5	0.074	**0.074**	2
			Right Tilt	190	836.6	29.5	29.5	0.030	0.030	
Body-worn	Voice	10	Rear	190	836.6	33.5	33.4	0.165	**0.169**	3
			Front	190	836.6	33.5	33.4	0.158	0.162	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	190	836.6	29.5	29.5	0.281	**0.281**	4
			Front	190	836.6	29.5	29.5	0.240	0.240	
Hotspot			Edge 2	190	836.6	29.5	29.5	0.137	0.137	
			Edge 3	190	836.6	29.5	29.5	0.214	0.214	
			Edge 4	190	836.6	29.5	29.5	0.045	0.045	

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	31.5	30.3	0.016	0.021	
			Left Tilt	661	1880.0	31.5	30.3	0.011	0.015	
			Right Touch	661	1880.0	31.5	30.3	0.027	**0.036**	5
			Right Tilt	661	1880.0	31.5	30.3	0.009	0.012	
Head VoIP	GPRS 2 Slots	0	Left Touch	661	1880.0	28.5	28.1	0.017	0.019	
			Left Tilt	661	1880.0	28.5	28.1	0.014	0.015	
			Right Touch	661	1880.0	28.5	28.1	0.030	**0.033**	6
			Right Tilt	661	1880.0	28.5	28.1	0.011	0.012	
Body-worn	Voice	10	Rear	661	1880.0	31.5	30.3	0.083	0.109	
			Front	661	1880.0	31.5	30.3	0.091	**0.120**	7
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	661	1880.0	28.5	28.1	0.095	0.104	
			Front	661	1880.0	28.5	28.1	0.109	**0.120**	8
Hotspot			Edge 2	661	1880.0	28.5	28.1	0.014	0.016	
			Edge 3	661	1880.0	28.5	28.1	0.126	**0.138**	9
			Edge 4	661	1880.0	28.5	28.1	0.033	0.037	

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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	4183	836.6	23.5	23.2	0.028	0.030	
			Left Tilt	4183	836.6	23.5	23.2	0.014	0.014	
			Right Touch	4183	836.6	23.5	23.2	0.032	**0.034**	10
			Right Tilt	4183	836.6	23.5	23.2	0.013	0.014	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	23.5	23.2	0.133	**0.143**	11
			Front	4183	836.6	23.5	23.2	0.117	0.125	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.5	23.2	0.075	0.080	
			Edge 3	4183	836.6	23.5	23.2	0.108	0.116	
			Edge 4	4183	836.6	23.5	23.2	0.020	0.022	

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	23.5	23.2	0.025	0.027	
			Left Tilt	9400	1880.0	23.5	23.2	0.021	0.023	
			Right Touch	9400	1880.0	23.5	23.2	0.041	**0.044**	12
			Right Tilt	9400	1880.0	23.5	23.2	0.013	0.014	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	23.5	23.2	0.143	0.153	
			Front	9400	1880.0	23.5	23.2	0.150	**0.161**	13
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	23.5	23.2	0.018	0.019	
			Edge 3	9400	1880.0	23.5	23.2	0.181	**0.194**	14
			Edge 4	9400	1880.0	23.5	23.2	0.046	0.049	

11.5. LTE Band 41 (20MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	40740	2605.0	1	0	24.0	24.0	0.164	**0.164**	15
						50	0	23.0	22.8	0.121	0.127	
			Left Tilt	40740	2605.0	1	0	24.0	24.0	0.069	0.069	
						50	0	23.0	22.8	0.047	0.049	
			Right Touch	40740	2605.0	1	0	24.0	24.0	0.141	0.141	
						50	0	23.0	22.8	0.112	0.117	
			Right Tilt	40740	2605.0	1	0	24.0	24.0	0.067	0.067	
						50	0	23.0	22.8	0.057	0.060	
Body-worn & Hotspot	QPSK	10	Rear	40740	2605.0	1	0	24.0	24.0	0.406	0.406	
						50	0	23.0	22.8	0.317	0.332	
			Front	40740	2605.0	1	0	24.0	24.0	0.465	**0.465**	16
						50	0	23.0	22.8	0.351	0.368	
Hotspot	QPSK	10	Edge 2	40740	2605.0	1	0	24.0	24.0	0.111	0.111	
						50	0	23.0	22.8	0.084	0.088	
			Edge 3	40740	2605.0	1	0	24.0	24.0	0.608	**0.608**	17
						50	0	23.0	22.8	0.483	0.506	

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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	6	2437.0	17.5	15.5	0.388	**0.615**	18
				Left Tilt	6	2437.0	17.5	15.5	0.343	0.544	
				Right Touch	6	2437.0	17.5	15.5	0.148	0.235	
				Right Tilt	6	2437.0	17.5	15.5	0.134	0.212	
	Body-worn, Hotspot & Wi-Fi Direct	802.11b 1 Mbps	10	Rear	6	2437.0	17.5	15.5	0.055	**0.088**	19
				Front	6	2437.0	17.5	15.5	0.053	0.084	
	Hotspot & Wi-Fi Direct	802.11b 1 Mbps	10	Edge 1	6	2437.0	17.5	15.5	0.051	0.081	
				Edge 2	6	2437.0	17.5	15.5	0.019	0.031	

11.7. Wi-Fi (UNII 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	
5.2 GHz (UNII-1)	Head	802.11b 6 Mbps	0	Left Touch	48	5240.0	12.5	12.1	0.171	**0.187**	20
				Left Tilt	48	5240.0	12.5	12.1	0.157	0.172	
				Right Touch	48	5240.0	12.5	12.1	0.077	0.084	
				Right Tilt	48	5240.0	12.5	12.1	0.065	0.071	
	Body-worn	802.11b 6 Mbps	10	Rear	48	5240.0	12.5	12.1	0.110	**0.121**	21
				Front	48	5240.0	12.5	12.1	0.066	0.072	
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	
5.3 GHz (UNII-2A)	Head	802.11b 6 Mbps	0	Left Touch	52	5260.0	12.5	12.2	0.198	**0.212**	22
				Left Tilt	52	5260.0	12.5	12.2	0.159	0.170	
				Right Touch	52	5260.0	12.5	12.2	0.088	0.094	
				Right Tilt	52	5260.0	12.5	12.2	0.073	0.078	
	Body-worn	802.11b 6 Mbps	10	Rear	52	5260.0	12.5	12.2	0.093	**0.100**	23
				Front	52	5260.0	12.5	12.2	0.059	0.063	
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	
5.5 GHz (UNII-2C)	Head	802.11b 6 Mbps	0	Left Touch	132	5660.0	12.5	11.6	0.072	**0.089**	24
				Left Tilt	132	5660.0	12.5	11.6	0.040	0.049	
				Right Touch	132	5660.0	12.5	11.6	0.031	0.038	
				Right Tilt	132	5660.0	12.5	11.6	0.000	0.000	
	Body-worn	802.11b 6 Mbps	10	Rear	132	5660.0	12.5	11.6	0.083	**0.102**	25
				Front	132	5660.0	12.5	11.6	0.065	0.080	
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	
5.8 GHz (UNII-3)	Head	802.11b 6 Mbps	0	Left Touch	149	5745.0	12.5	11.3	0.084	**0.111**	26
				Left Tilt	149	5745.0	12.5	11.3	0.053	0.070	
				Right Touch	149	5745.0	12.5	11.3	0.037	0.049	
				Right Tilt	149	5745.0	12.5	11.3	0.021	0.028	
	Body-worn, Hotspot & Wi-Fi Direct	802.11b 6 Mbps	10	Rear	149	5745.0	12.5	11.3	0.066	**0.087**	27
				Front	149	5745.0	12.5	11.3	0.057	0.075	
	Hotspot & Wi-Fi Direct	802.11b 6 Mbps	10	Edge 1	149	5745.0	12.5	11.3	0.048	0.063	
				Edge 2	149	5745.0	12.5	11.3	0.052	0.069	

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11.8. Bluetooth

11.8.1. 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:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

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

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)			
10.5	11	10	2.480	1.7

Conclusion:

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

11.8.2. 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:

- *(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√$f_{(GHz)}$/x]* 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	11	10	2.480	0.231

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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		0.281		No
	WCDMA Band V				No
1900	GSM 1900				No
	WCDMA Band II			0.181	No
2400	Wi-Fi 802.11b/g/n	0.388			No
2600	LTE Band 41			0.608	No
5200	Wi-Fi 802.11a/n	0.171			No
5300	Wi-Fi 802.11a/n	0.198			No
5500	Wi-Fi 802.11a/n		0.083		No
5800	Wi-Fi 802.11a/n	0.084			No

Note(s):

1. Repeated measurements not required because no measured values exceeded 0.8W/kg.

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13. Simultaneous Transmission SAR Analysis

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				∑ 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	0.066	0.615			0.681	No
		① + ③	0.066		0.212		0.278	No
	Left Tilt	① + ②	0.031	0.544			0.575	No
		① + ③	0.031		0.172		0.203	No
	Right Touch	① + ②	0.074	0.235			0.309	No
		① + ③	0.074		0.094		0.168	No
	Right Tilt	① + ②	0.030	0.212			0.242	No
		① + ③	0.030		0.078		0.108	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.281	0.088			0.369	No
		① + ③	0.281		0.121		0.402	No
		① + ④	0.281			0.231	0.512	No
		① + ③ + ④	0.281		0.121	0.231	0.633	No
	Front	① + ②	0.240	0.084			0.324	No
		① + ③	0.240		0.080		0.320	No
		① + ④	0.240			0.231	0.471	No
		① + ③ + ④	0.240		0.080	0.231	0.551	No
Hotspot	Edge 1	① + ②		0.081	0.063		0.144	No
	Edge 2	① + ②	0.137	0.031	0.069		0.237	No
	Edge 3	① + ②	0.214				0.214	No
	Edge 4	① + ②	0.045				0.045	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				∑ 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	0.021	0.615			0.636	No
		① + ③	0.021		0.212		0.233	No
	Left Tilt	① + ②	0.015	0.544			0.559	No
		① + ③	0.015		0.172		0.187	No
	Right Touch	① + ②	0.036	0.235			0.271	No
		① + ③	0.036		0.094		0.130	No
	Right Tilt	① + ②	0.012	0.212			0.224	No
		① + ③	0.012		0.078		0.090	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.109	0.088			0.197	No
		① + ③	0.109		0.121		0.230	No
		① + ④	0.109			0.231	0.340	No
		① + ③ + ④	0.109		0.121	0.231	0.461	No
	Front	① + ②	0.120	0.084			0.204	No
		① + ③	0.120		0.080		0.200	No
		① + ④	0.120			0.231	0.351	No
		① + ③ + ④	0.120		0.080	0.231	0.431	No
Hotspot	Edge 1	① + ②		0.081	0.063		0.144	No
	Edge 2	① + ②	0.016	0.031	0.069		0.116	No
	Edge 3	① + ②	0.138				0.138	No
	Edge 4	① + ②	0.037				0.037	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band V	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.030	0.615			0.645	No
		① + ③	0.030		0.212		0.242	No
	Left Tilt	① + ②	0.014	0.544			0.558	No
		① + ③	0.014		0.172		0.186	No
	Right Touch	① + ②	0.034	0.235			0.269	No
		① + ③	0.034		0.094		0.128	No
	Right Tilt	① + ②	0.014	0.212			0.226	No
		① + ③	0.014		0.078		0.092	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.143	0.088			0.231	No
		① + ③	0.143		0.121		0.264	No
		① + ④	0.143			0.231	0.374	No
		① + ③ + ④	0.143		0.121	0.231	0.495	No
	Front	① + ②	0.125	0.084			0.209	No
		① + ③	0.125		0.080		0.205	No
		① + ④	0.125			0.231	0.356	No
		① + ③ + ④	0.125		0.080	0.231	0.436	No
Hotspot	Edge 1	① + ②		0.081	0.063		0.144	No
	Edge 2	① + ②	0.080	0.031	0.069		0.180	No
	Edge 3	① + ②	0.116				0.116	No
	Edge 4	① + ②	0.022				0.022	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band II	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.027	0.615			0.642	No
		① + ③	0.027		0.212		0.239	No
	Left Tilt	① + ②	0.023	0.544			0.567	No
		① + ③	0.023		0.172		0.195	No
	Right Touch	① + ②	0.044	0.235			0.279	No
		① + ③	0.044		0.094		0.138	No
	Right Tilt	① + ②	0.014	0.212			0.226	No
		① + ③	0.014		0.078		0.092	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.153	0.088			0.241	No
		① + ③	0.153		0.121		0.274	No
		① + ④	0.153			0.231	0.384	No
		① + ③ + ④	0.153		0.121	0.231	0.505	No
	Front	① + ②	0.161	0.084			0.245	No
		① + ③	0.161		0.080		0.241	No
		① + ④	0.161			0.231	0.392	No
		① + ③ + ④	0.161		0.080	0.231	0.472	No
Hotspot	Edge 1	① + ②		0.081	0.063		0.144	No
	Edge 2	① + ②	0.019	0.031	0.069		0.119	No
	Edge 3	① + ②	0.194				0.194	No
	Edge 4	① + ②	0.049				0.049	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				∑ 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	0.164	0.615			**0.779**	No
		① + ③	0.164		0.212		**0.376**	No
	Left Tilt	① + ②	0.069	0.544			0.613	No
		① + ③	0.069		0.172		0.241	No
	Right Touch	① + ②	0.141	0.235			0.376	No
		① + ③	0.141		0.094		0.235	No
	Right Tilt	① + ②	0.067	0.212			0.279	No
		① + ③	0.067		0.078		0.145	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.406	0.088			0.494	No
		① + ③	0.406		0.121		0.527	No
		① + ④	0.406			0.231	0.637	No
		① + ③ + ④	0.406		0.121	0.231	0.758	No
	Front	① + ②	0.465	0.084			**0.549**	No
		① + ③	0.465		0.080		**0.545**	No
		① + ④	0.465			0.231	0.696	No
		① + ③ + ④	0.465		0.080	0.231	0.776	No
Hotspot	Edge 1	① + ②		0.081	0.063		0.144	No
	Edge 2	① + ②	0.111	0.031	0.069		0.211	No
	Edge 3	① + ②	0.608				0.608	No
	Edge 4	① + ②					0.000	No

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

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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 EX3DV3 - SN 3531

14.6. Calibration Certificate for E-Field Probe EX3DV4 - SN 3929

14.7. Calibration Certificate for E-Field Probe EX3DV4 - SN 3991

14.8. Calibration Certificate for D835V2 - SN 4d142

14.9. Calibration Certificate for D1900V2- SN 5d163

14.10. Calibration Certificate for D2450V2 - SN 899

14.11. Calibration Certificate for D2600V2 - SN 1006

14.12. Calibration Certificate for D5GHzV2 - SN 1003

END OF REPORT

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