



SAR EVALUATION REPORT
CLASS II PERMISSIVE CHANGE

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
GSM/WCDMA/LTE PHONE + BLUETOOTH, DTS/UNII a/b/g/n & NFC

FCC ID: ZNFH443
Model Name: LG-H443, H443, LGH443, LG-H445, LGH445, H445

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Rev.	Date	Revisions	Revised By
--	3/12/2015	Initial Issue	--

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1. Attestation of Test Results

Applicant Name	LG ELECTRONICS MOBILECOMM U.S.A., INC.								
FCC ID	ZNFH443								
Model Name	LG-H443, H443, LGH443, LG-H445, LGH445, H445								
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013								
SAR Limits (W/Kg)									
Exposure Category	Peak spatial-average (1g of tissue)								
General population / Uncontrolled exposure	1.6								
The Highest Reported SAR (W/kg)									
RF Exposure Conditions	Equipment Class								
	Licensed	DTS	U-NII	DSS (BT)					
Head	0.824	0.370	0.048	N/A					
Body-worn	1.229	0.088	0.111						
Hotspot/Wi-Fi Direct	1.229	0.088	0.108						
Simultaneous Tx	1.340	1.317	1.340						
Date Tested	2/2/2015 to 2/24/2015								
Test Results	Pass								
<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:								
									
Devin Chang Senior Engineer 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 1528-2013, the following FCC Published RF exposure [KDB](#) procedures:

- 248227 D01 SAR meas for 802.11 v02
- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- 865664 D02 RF Exposure Reporting v01r01
- 941225 D01 3G SAR Procedures v03
- 941225 D05 SAR for LTE Devices v02r03
- 941225 D06 Hotspot Mode v02

3. Facilities and Accreditation

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

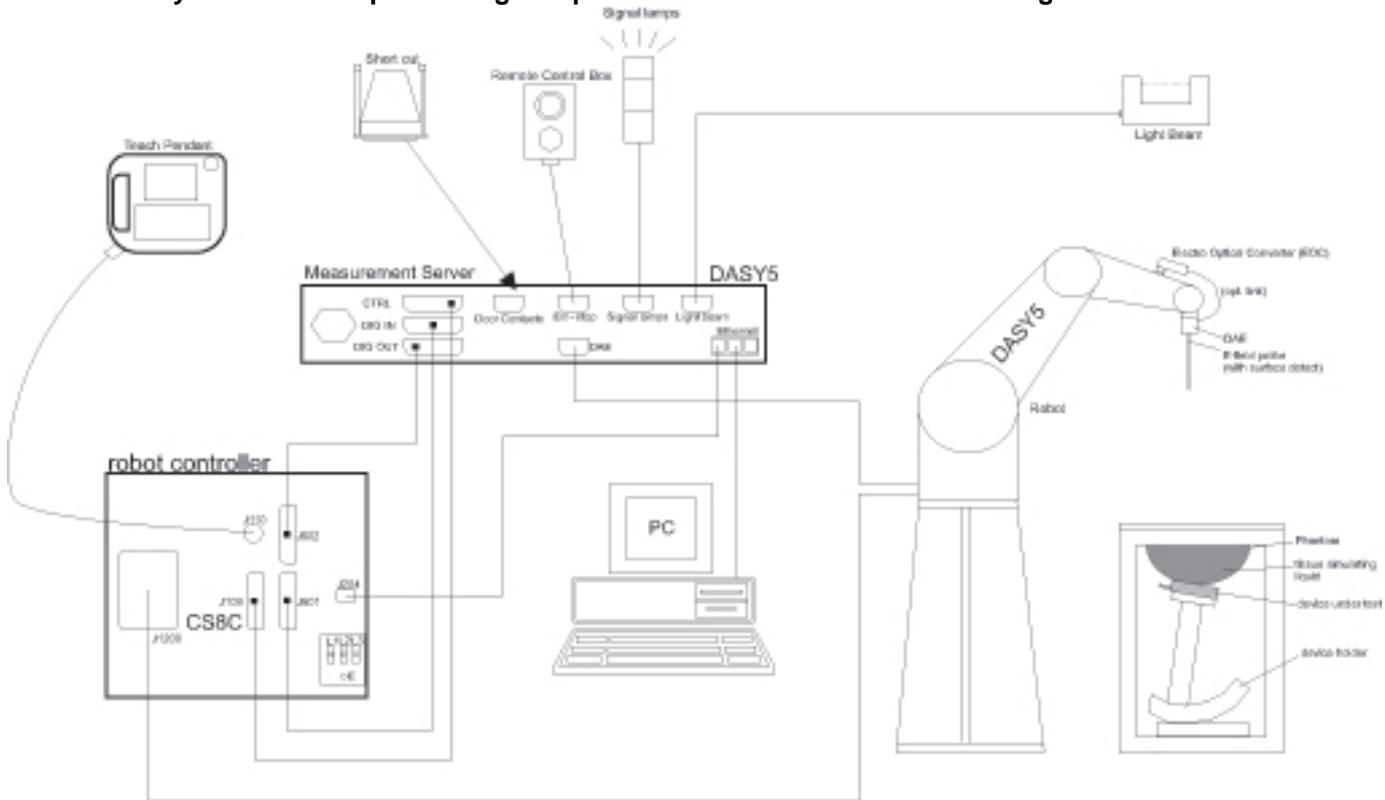
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

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 Procedures

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	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
	≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}	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: Δx_{Zoom} , Δy_{Zoom}		≤ 2 GHz: ≤ 8 mm $2 - 3$ GHz: ≤ 5 mm*	$3 - 4$ GHz: ≤ 5 mm* $4 - 6$ GHz: ≤ 4 mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$3 - 4$ 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	$3 - 4$ GHz: ≤ 3 mm $4 - 5$ GHz: ≤ 2.5 mm $5 - 6$ GHz: ≤ 2 mm	
Minimum zoom scan volume		$\Delta z_{Zoom}(n > 1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
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 *reported* SAR from the area scan based *1-g SAR estimation* 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	E753ES	MY40000980	4/7/2015
Dielectric Probe kit	SPEAG	DAK-3.5	1082	9/16/2015
Dielectric Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	4242	122529163	10/8/2015
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	3125U09516	10/6/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
Power Sensor	Agilent	8481A	3318A95392	10/6/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	N/A
DC Power Supply	Sorensen Ametek	XT20-3	1318A00530	N/A
Synthesized Signal Generator	Agilent	8665B	3438A00633	7/10/2015
Power Meter	HP	437B	3125U11347	8/27/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Sensor	HP	8481A	2702A60780	6/16/2015
Power Sensor	HP	8481A	1926A16917	10/10/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808938	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2710	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 3)	SPEAG	EX3DV4	3773	4/22/2015
E-Field Probe (SAR 4)	SPEAG	EX3DV4	3929	5/9/2015
E-Field Probe (SAR 5)	SPEAG	EX3DV4	3749	1/26/2016
Data Acquisition Electronics (SAR 1)	SPEAG	DAE4	1352	11/7/2015
Data Acquisition Electronics (SAR 3)	SPEAG	DAE4	1380	7/23/2015
Data Acquisition Electronics (SAR 4)	SPEAG	DAE4	1377	8/27/2015
Data Acquisition Electronics (SAR 5)	SPEAG	DAE4	1439	5/14/2015
System Validation Dipole	SPEAG	D750V3	1019	3/17/2015
System Validation Dipole	SPEAG	D835V2	4d142	9/9/2015
System Validation Dipole	SPEAG	D1750V2	1050	4/22/2015
System Validation Dipole	SPEAG	D1900V2	5d163	9/11/2015
System Validation Dipole	SPEAG	D2450V2	748	2/18/2015
System Validation Dipole	SPEAG	D5GHzV2	1138	9/18/2015
Thermometer (SAR Lab 1)	EXTECH	445703	CCS-205	3/24/2015
Thermometer (SAR Lab 3)	EXTECH	445703	CCS-237	6/3/2015
Thermometer (SAR Lab 4)	EXTECH	445703	CCS-238	6/3/2015
Thermometer (SAR Lab 5)	EXTECH	445703	CCS-239	6/3/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1912A	MY53040015	7/10/2015
Power Sensor	Agilent	N1921A	MY52020011	5/6/2015
Base Station Simulator	R & S	CMW500	135393-VQ	7/3/2015

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

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Overall (Length x Width): 133.25 mm x 66.12 mm Overall Diagonal: 143 mm Display Diagonal: 120 mm
Battery Back Cover	<input type="checkbox"/> Normal Battery Cover <input checked="" type="checkbox"/> Normal Battery Cover with NFC <input type="checkbox"/> Wireless Charger Battery Cover <input type="checkbox"/> Wireless Charger Battery Cover with NFC <input type="checkbox"/> The rechargeable battery is not user accessible.
Battery Options	<input checked="" type="checkbox"/> Standard – Lithium-ion battery, Rating 3.8Vdc, 8.0Wh <input type="checkbox"/> Extended (large capacity) <input type="checkbox"/> 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 checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 5 GHz) (U-NII 3 only)
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 checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 5 GHz) (U-NII 3 only)

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%; (E)GPRS: 1 Slot: 12.5%; 2 Slots: 25%,
		GPRS Multi-Slot Class: <input type="checkbox"/> Class 8 - One Up <input checked="" type="checkbox"/> Class 10 - Two Up <input type="checkbox"/> Class 12 - Four Up <input type="checkbox"/> Class 33 - Four Up	
		DTM (Dual Transfer Mode): Not supported	
W-CDMA (UMTS)	Band II Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7) HSUPA (Rel. 6) DC-HSDPA (Rel. 8) HSPA+ (Rel. 6)	100%
LTE (FDD)	Band 2 Band 4 Band 5 Band 17	QPSK 16QAM	100%
	Does this device SV-LTE (1xRTT-LTE)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40)	100%
	TDWR (Terminal Doppler Weather Radar): Not supported.		
Bluetooth	2.4 GHz	Version 4.0 LE	77.5% (DH5)

6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1.(3) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

Upper limit (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	32.7	33.2
	GPRS 1 slot	32.7	33.2
	GPRS 2 slots	31.2	31.7
	EGPRS 1 slots	27.2	27.7
	EGPRS 2 slots	27.2	27.7
GSM1900	Voice	29.7	30.2
	GPRS 1 slot	29.7	30.2
	GPRS 2 slots	29.2	29.7
	EGPRS 1 slots	26.2	26.7
	EGPRS 2 slots	26.2	26.7
W-CDMA Band V	R99	23.7	24.2
	HSDPA	23.7	24.2
	HSUPA	23.7	24.2
	DC-HSDPA	23.7	24.2
W-CDMA Band II	R99	23.2	23.7
	HSDPA	23.2	23.7
	HSUPA	23.2	23.7
	DC-HSDPA	23.2	23.7
LTE Band 2	QPSK	23.2	23.7
LTE Band 4	QPSK	23.2	23.7
LTE Band 5	QPSK	23.2	23.7
LTE Band 17	QPSK	23.2	23.7

Upper limit (dB): ~ 1.0		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	14.5	15.5
	802.11g	11.0	12.0
	802.11n HT20	9.5	10.5
WiFi 5 GHz	802.11a	10.6	11.6
	802.11n HT20	10.3	11.3
	802.11n HT40	9.0	10.0
Bluetooth		7.0	8.0
Bluetooth LE		0.0	1.0

6.4. General LTE SAR Test and Reporting Considerations

Item	Description							
Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 2	Frequency range: 1850 - 1910 MHz						
		Channel Bandwidth						
	20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz		
	Low	18700 / 1860	18675 / 1857.5	18650 / 1855	18625 / 1852.5	18615 / 1851.5	18607 / 1850.7	
	Mid	18900 / 1880	18900 / 1880	18900 / 1880	18900 / 1880	18900 / 1880	18900 / 1880	
	High	19100 / 1900	19125 / 1902.5	19150 / 1905	19175 / 1907.5	19185 / 1908.5	19193 / 1909.3	
	Band 4	Frequency range: 1710 - 1755 MHz						
		Channel Bandwidth						
	20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz		
	Low	20050 / 1720	20025 / 1717.5	20000 / 1715	19975 / 1712.5	19965 / 1711.5	19957 / 1710.7	
	Mid	20175 / 1732.5	20175 / 1732.5	20175 / 1732.5	20175 / 1732.5	20175 / 1732.5	20175 / 1732.5	
	High	20300 / 1745	20325 / 1747.5	20350 / 1750	20375 / 1752.5	20385 / 1753.5	20393 / 1754.3	
LTE transmitter and antenna implementation	Band 5	Frequency range: 824 - 849 MHz						
		Channel Bandwidth						
	20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz		
	Low			20450 / 829	20425 / 826.5	20415 / 825.5	20407 / 824.7	
	Mid			20525 / 836.5	20525 / 836.5	20525 / 836.5	20525 / 836.5	
	High			20600 / 844	20625 / 846.5	20635 / 847.5	20643 / 848.3	
	Band 17	Frequency range: 704 - 716 MHz						
		Channel Bandwidth						
	20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz		
	Low				23755 / 706.5			
	Mid			23790 / 710	23790 / 710			
	High				23825 / 713.5			
Maximum power reduction (MPR)	LTE Band 2 has one (1) TX/RX antenna. LTE Bands 4 / 5 / 17 have one (1) TX/RX antenna and one (1) RX antenna Refer to Appendix A.							
	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3							
	Modulation	Channel bandwidth / Transmission bandwidth (RB)						
		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
	MPR Built-in by design A-MPR (additional MPR) was disabled during SAR testing							
	Power reduction							
	No							
	Spectrum plots for RB configurations							
	A properly configured base station simulator was used for the SAR and power measurements; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.							

7. RF Exposure Conditions (Test Configurations)

Refer to "SAR Photos and Ant locations" Appendix for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WWAN (Antenna 1)	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	10 mm	Rear	N/A	Yes	
			Front	N/A	Yes	
	Hotspot	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	> 25 mm	No	1
			Edge 2 (Right)	< 25 mm	Yes	
			Edge 3 (Bottom)	< 25 mm	Yes	
			Edge 4 (Left)	< 25 mm	Yes	
WWAN (Antenna 2)	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	10 mm	Rear	N/A	Yes	
			Front	N/A	Yes	
	Hotspot	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	> 25 mm	No	1
			Edge 2 (Right)	> 25 mm	No	1
			Edge 3 (Bottom)	< 25 mm	Yes	
			Edge 4 (Left)	< 25 mm	Yes	
WLAN	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	10 mm	Rear	N/A	Yes	
			Front	N/A	Yes	
	Hotspot / Wi-Fi Direct	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	< 25 mm	Yes	
			Edge 2 (Right)	> 25 mm	No	1
			Edge 3 (Bottom)	> 25 mm	No	1
			Edge 4 (Left)	< 25 mm	Yes	

Notes:

1. 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. Dielectric Property Measurements & System Check

8.1. 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.

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 Standard 1528-2013

Dielectric Property Measurements Results:

SAR Lab 1

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2/6/2015	Head 2450	e'	39.4800	Relative Permittivity (ϵ_r):	39.48	39.20	0.71	5
		e"	13.8000	Conductivity (σ):	1.88	1.80	4.44	5
	Head 2410	e'	39.6300	Relative Permittivity (ϵ_r):	39.63	39.28	0.89	5
		e"	13.6700	Conductivity (σ):	1.83	1.76	4.06	5
	Head 2475	e'	39.3400	Relative Permittivity (ϵ_r):	39.34	39.17	0.44	5
		e"	13.8500	Conductivity (σ):	1.91	1.83	4.32	5
2/6/2015	Body 2450	e'	51.2100	Relative Permittivity (ϵ_r):	51.21	52.70	-2.83	5
		e"	14.8200	Conductivity (σ):	2.02	1.95	3.53	5
	Body 2410	e'	51.3400	Relative Permittivity (ϵ_r):	51.34	52.76	-2.69	5
		e"	14.7000	Conductivity (σ):	1.97	1.91	3.27	5
	Body 2475	e'	51.0900	Relative Permittivity (ϵ_r):	51.09	52.67	-3.00	5
		e"	14.9500	Conductivity (σ):	2.06	1.99	3.64	5
2/16/2015	Head 5180	e'	36.4400	Relative Permittivity (ϵ_r):	36.44	36.01	1.19	5
		e"	15.8300	Conductivity (σ):	4.56	4.63	-1.54	5
	Head 5200	e'	36.4000	Relative Permittivity (ϵ_r):	36.40	35.99	1.14	5
		e"	15.8700	Conductivity (σ):	4.59	4.65	-1.34	5
	Head 5600	e'	36.0700	Relative Permittivity (ϵ_r):	36.07	35.53	1.51	5
		e"	15.8600	Conductivity (σ):	4.94	5.06	-2.41	5
	Head 5800	e'	35.5400	Relative Permittivity (ϵ_r):	35.54	35.30	0.68	5
		e"	16.0000	Conductivity (σ):	5.16	5.27	-2.09	5
	Head 5825	e'	35.5100	Relative Permittivity (ϵ_r):	35.51	35.30	0.59	5
		e"	16.0900	Conductivity (σ):	5.21	5.27	-1.11	5
2/16/2015	Body 5180	e'	48.9400	Relative Permittivity (ϵ_r):	48.94	49.05	-0.22	5
		e"	18.5200	Conductivity (σ):	5.33	5.27	1.19	5
	Body 5200	e'	49.1300	Relative Permittivity (ϵ_r):	49.13	49.02	0.23	5
		e"	18.5700	Conductivity (σ):	5.37	5.29	1.41	5
	Body 5600	e'	48.7100	Relative Permittivity (ϵ_r):	48.71	48.48	0.48	5
		e"	18.5000	Conductivity (σ):	5.76	5.76	-0.01	5
	Body 5800	e'	48.0300	Relative Permittivity (ϵ_r):	48.03	48.20	-0.35	5
		e"	18.8600	Conductivity (σ):	6.08	6.00	1.37	5
	Body 5825	e'	48.1600	Relative Permittivity (ϵ_r):	48.16	48.20	-0.08	5
		e"	19.0700	Conductivity (σ):	6.18	6.00	2.94	5
2/23/2015	Body 5180	e'	47.1000	Relative Permittivity (ϵ_r):	47.10	49.05	-3.97	5
		e"	18.8600	Conductivity (σ):	5.43	5.27	3.05	5
	Body 5200	e'	47.1100	Relative Permittivity (ϵ_r):	47.11	49.02	-3.90	5
		e"	18.6400	Conductivity (σ):	5.39	5.29	1.79	5
	Body 5600	e'	46.3700	Relative Permittivity (ϵ_r):	46.37	48.48	-4.35	5
		e"	19.1500	Conductivity (σ):	5.96	5.76	3.50	5
	Body 5800	e'	46.2100	Relative Permittivity (ϵ_r):	46.21	48.20	-4.13	5
		e"	19.2500	Conductivity (σ):	6.21	6.00	3.47	5
	Body 5825	e'	46.0800	Relative Permittivity (ϵ_r):	46.08	48.20	-4.40	5
		e"	19.4200	Conductivity (σ):	6.29	6.00	4.83	5

SAR Lab 3

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2/22/2015	Body 1750	e'	51.2100	Relative Permittivity (ϵ_r):	51.21	53.44	-4.17	5
		e"	15.3200	Conductivity (σ):	1.49	1.49	0.31	5
	Body 1710	e'	51.2100	Relative Permittivity (ϵ_r):	51.21	53.54	-4.36	5
		e"	15.3300	Conductivity (σ):	1.46	1.46	-0.27	5
	Body 1755	e'	51.1700	Relative Permittivity (ϵ_r):	51.17	53.43	-4.23	5
		e"	15.3700	Conductivity (σ):	1.50	1.49	0.71	5
2/3/2015	Head 1750	e'	38.6000	Relative Permittivity (ϵ_r):	38.60	40.08	-3.70	5
		e"	13.7500	Conductivity (σ):	1.34	1.37	-2.27	5
	Head 1710	e'	38.7600	Relative Permittivity (ϵ_r):	38.76	40.15	-3.45	5
		e"	13.6700	Conductivity (σ):	1.30	1.35	-3.46	5
	Head 1755	e'	38.6100	Relative Permittivity (ϵ_r):	38.61	40.08	-3.66	5
		e"	13.7700	Conductivity (σ):	1.34	1.37	-2.05	5
2/9/2015	Head 750	e'	40.5400	Relative Permittivity (ϵ_r):	40.54	41.96	-3.39	5
		e"	21.9900	Conductivity (σ):	0.92	0.89	2.68	5
	Head 700	e'	41.5500	Relative Permittivity (ϵ_r):	41.55	42.22	-1.58	5
		e"	22.4700	Conductivity (σ):	0.87	0.89	-1.65	5
	Head 725	e'	41.0600	Relative Permittivity (ϵ_r):	41.06	42.09	-2.45	5
		e"	22.1900	Conductivity (σ):	0.89	0.89	0.38	5
2/9/2015	Body 750	e'	54.3600	Relative Permittivity (ϵ_r):	54.36	55.55	-2.14	5
		e"	23.6300	Conductivity (σ):	0.99	0.96	2.32	5
	Body 700	e'	55.4200	Relative Permittivity (ϵ_r):	55.42	55.74	-0.57	5
		e"	24.2400	Conductivity (σ):	0.94	0.96	-1.64	5
	Body 725	e'	54.9500	Relative Permittivity (ϵ_r):	54.95	55.64	-1.24	5
		e"	23.9800	Conductivity (σ):	0.97	0.96	0.58	5

Dielectric Property Measurements Results: (continued)**SAR Lab 4**

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
2/2/2015	Head 1900	e'	38.4900	Relative Permittivity (ϵ_r):	38.49	40.00	-3.78	5
		e"	13.6000	Conductivity (σ):	1.44	1.40	2.63	5
	Head 1850	e'	38.7100	Relative Permittivity (ϵ_r):	38.71	40.00	-3.23	5
		e"	13.4300	Conductivity (σ):	1.38	1.40	-1.32	5
	Head 1910	e'	38.4400	Relative Permittivity (ϵ_r):	38.44	40.00	-3.90	5
		e"	13.6100	Conductivity (σ):	1.45	1.40	3.24	5
2/2/2015	Body 1900	e'	51.9000	Relative Permittivity (ϵ_r):	51.90	53.30	-2.63	5
		e"	14.5100	Conductivity (σ):	1.53	1.52	0.85	5
	Body 1850	e'	52.0400	Relative Permittivity (ϵ_r):	52.04	53.30	-2.36	5
		e"	14.3900	Conductivity (σ):	1.48	1.52	-2.62	5
	Body 1910	e'	51.8500	Relative Permittivity (ϵ_r):	51.85	53.30	-2.72	5
		e"	14.5700	Conductivity (σ):	1.55	1.52	1.80	5
2/9/2015	Head 1900	e'	38.4600	Relative Permittivity (ϵ_r):	38.46	40.00	-3.85	5
		e"	13.1000	Conductivity (σ):	1.38	1.40	-1.15	5
	Head 1850	e'	38.7500	Relative Permittivity (ϵ_r):	38.75	40.00	-3.13	5
		e"	12.9500	Conductivity (σ):	1.33	1.40	-4.85	5
	Head 1910	e'	38.4400	Relative Permittivity (ϵ_r):	38.44	40.00	-3.90	5
		e"	13.1600	Conductivity (σ):	1.40	1.40	-0.17	5
2/9/2015	Body 1900	e'	51.3400	Relative Permittivity (ϵ_r):	51.34	53.30	-3.68	5
		e"	14.3800	Conductivity (σ):	1.52	1.52	-0.05	5
	Body 1850	e'	51.5600	Relative Permittivity (ϵ_r):	51.56	53.30	-3.26	5
		e"	14.2700	Conductivity (σ):	1.47	1.52	-3.43	5
	Body 1910	e'	51.3400	Relative Permittivity (ϵ_r):	51.34	53.30	-3.68	5
		e"	14.4500	Conductivity (σ):	1.53	1.52	0.96	5

SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
2/4/2015	Head 835	e'	42.1100	Relative Permittivity (ϵ_r):	42.11	41.50	1.47	5
		e"	19.8300	Conductivity (σ):	0.92	0.90	2.30	5
	Head 820	e'	42.3600	Relative Permittivity (ϵ_r):	42.36	41.60	1.82	5
		e"	19.9000	Conductivity (σ):	0.91	0.90	0.99	5
	Head 850	e'	41.9300	Relative Permittivity (ϵ_r):	41.93	41.50	1.04	5
		e"	19.8000	Conductivity (σ):	0.94	0.92	2.27	5
2/4/2015	Body 835	e'	53.3900	Relative Permittivity (ϵ_r):	53.39	55.20	-3.28	5
		e"	21.1300	Conductivity (σ):	0.98	0.97	1.14	5
	Body 820	e'	53.5700	Relative Permittivity (ϵ_r):	53.57	55.28	-3.09	5
		e"	21.2800	Conductivity (σ):	0.97	0.97	0.18	5
	Body 850	e'	53.2000	Relative Permittivity (ϵ_r):	53.20	55.16	-3.55	5
		e"	21.0500	Conductivity (σ):	0.99	0.99	0.78	5
2/9/2015	Head 835	e'	40.7000	Relative Permittivity (ϵ_r):	40.70	41.50	-1.93	5
		e"	19.4800	Conductivity (σ):	0.90	0.90	0.49	5
	Head 820	e'	40.8900	Relative Permittivity (ϵ_r):	40.89	41.60	-1.71	5
		e"	19.5900	Conductivity (σ):	0.89	0.90	-0.59	5
	Head 850	e'	40.5600	Relative Permittivity (ϵ_r):	40.56	41.50	-2.27	5
		e"	19.5200	Conductivity (σ):	0.92	0.92	0.83	5
2/9/2015	Body 835	e'	53.4300	Relative Permittivity (ϵ_r):	53.43	55.20	-3.21	5
		e"	21.5300	Conductivity (σ):	1.00	0.97	3.05	5
	Body 820	e'	53.6200	Relative Permittivity (ϵ_r):	53.62	55.28	-3.00	5
		e"	21.6400	Conductivity (σ):	0.99	0.97	1.88	5
	Body 850	e'	53.2900	Relative Permittivity (ϵ_r):	53.29	55.16	-3.39	5
		e"	21.5500	Conductivity (σ):	1.02	0.99	3.18	5

8.2. 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 re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

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

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
D750V3	1019	3/17/2014	750	1g	8.21	8.64
				10g	5.38	5.69
D835V2	4d142	9/9/2014	835	1g	8.91	9.22
				10g	5.77	6.05
D1750V2	1050	4/22/2014	1750	1g	36.6	37.2
				10g	19.4	20.0
D1900V2	5d163	9/11/2014	1900	1g	40.8	40.6
				10g	21.2	21.4
D2450V2	748	2/18/2014	2450	1g	51.6	50.7
				10g	24.0	23.7
D5GHzV2	1138	9/18/2014	5200	1g	81.4	75.4
				10g	23.3	21
			5600	1g	85.1	81.9
				10g	24.2	22.6
			5800	1g	80.6	75.2
				10g	23	20.8

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 %	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
2/6/2015	D2450V2	748	Head	1g	5.26	52.6	51.6	1.94	
				10g	2.38	23.8	24	-0.83	
2/6/2015	D2450V2	748	Body	1g	5.51	55.1	50.70	8.68	1,2
				10g	2.53	25.3	23.7	6.75	
2/16/2015	D5GHzV2 (5.2 GHz)	1138	Head	1g	7.50	75.0	81.40	-7.86	
				10g	2.15	21.5	23.30	-7.73	
2/16/2015	D5GHzV2 (5.6 GHz)	1138	Head	1g	7.82	78.2	85.10	-8.11	3,4
				10g	2.20	22.0	24.20	-9.09	
2/16/2015	D5GHzV2 (5.8 GHz)	1138	Head	1g	7.42	74.2	80.60	-7.94	
				10g	2.10	21.0	23.00	-8.70	
2/16/2015	D5GHzV2 (5.2 GHz)	1138	Body	1g	7.78	77.8	75.40	3.18	
				10g	2.23	22.3	21.00	6.19	
2/16/2015	D5GHzV2 (5.6 GHz)	1138	Body	1g	7.85	78.5	81.90	-4.15	
				10g	2.21	22.1	22.60	-2.21	
2/16/2015	D5GHzV2 (5.8 GHz)	1138	Body	1g	6.91	69.1	75.20	-8.11	
				10g	1.95	19.5	20.80	-6.25	
2/23/2015	D5GHzV2 (5.2 GHz)	1138	Body	1g	7.72	77.2	75.4	2.39	
				10g	2.20	22.0	21.0	4.76	
2/23/2015	D5GHzV2 (5.6 GHz)	1138	Body	1g	8.75	87.5	81.9	6.84	
				10g	2.46	24.6	22.6	8.85	
2/23/2015	D5GHzV2 (5.8 GHz)	1138	Body	1g	7.06	70.6	75.2	-6.12	
				10g	1.98	19.8	20.8	-4.81	

SAR Lab 3

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
2/2/2015	D1750V2	1050	Body	1g	3.76	37.6	37.2	1.08	
				10g	2.01	20.1	20	0.50	
2/3/2015	D1750V2	1050	Head	1g	3.49	34.9	36.6	-4.64	5,6
				10g	1.84	18.4	19.4	-5.15	
2/9/2015	D750V3	1019	Head	1g	0.759	7.6	8.2	-7.55	7,8
				10g	0.497	5.0	5.4	-7.62	
2/9/2015	D750V3	1019	Body	1g	0.836	8.4	8.6	-3.24	
				10g	0.556	5.6	5.7	-2.28	

SAR Lab 4

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
2/2/2015	1900	5d163	Head	1g	4.01	40.1	40.80	-1.72	
				10g	2.07	20.7	21.20	-2.36	
2/2/2015	1900	5d163	Body	1g	3.85	38.5	40.60	-5.17	9,10
				10g	1.99	19.9	21.40	-7.01	
2/9/2015	1900	5d163	Head	1g	4.20	42.0	40.80	2.94	
				10g	2.17	21.7	21.20	2.36	
2/9/2015	1900	5d163	Body	1g	3.98	39.8	40.60	-1.97	
				10g	2.06	20.6	21.40	-3.74	

SAR Lab 5

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
2/4/2015	D835V2	4d142	Head	1g	0.93	9.3	8.91	4.71	
				10g	0.61	6.1	5.77	6.41	
2/4/2015	D835V2	4d142	Body	1g	0.92	9.2	9.22	0.11	
				10g	0.61	6.1	6.05	0.83	
2/9/2015	D835V2	4d142	Head	1g	0.93	9.3	8.91	3.82	
				10g	0.61	6.1	5.77	5.37	
2/9/2015	D835V2	4d142	Body	1g	0.97	9.7	9.22	5.64	11,12
				10g	0.64	6.4	6.05	6.28	

9. Conducted Output Power Measurements

9.1. GSM

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	24.0
				190	836.6	33.1	24.1
				251	848.8	33.1	24.1
	GPRS (GMSK)	CS1	1	128	824.2	33.1	24.0
				190	836.6	33.1	24.1
				251	848.8	33.1	24.1
			2	128	824.2	31.7	25.7
				190	836.6	31.7	25.7
				251	848.8	31.7	25.7
	EGPRS (8PSK)	MCS5	1	128	824.2	27.7	18.7
				190	836.6	27.7	18.7
				251	848.8	27.7	18.7
			2	128	824.2	27.7	21.7
				190	836.6	27.7	21.7
				251	848.8	27.5	21.5

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

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	30.1	21.1
				810	1909.8	30.2	21.2
	GPRS (GMSK)	CS1	1	512	1850.2	30.0	21.0
				661	1880.0	30.1	21.1
				810	1909.8	30.2	21.2
			2	512	1850.2	29.7	23.7
				661	1880.0	29.7	23.7
				810	1909.8	29.7	23.6
	EGPRS (8PSK)	MCS5	1	512	1850.2	26.7	17.7
				661	1880.0	26.7	17.7
				810	1909.8	26.7	17.7
			2	512	1850.2	26.7	20.7
				661	1880.0	26.7	20.7
				810	1909.8	26.7	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 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

9.2. W-CDMA

Release 99 Setup Procedures used to establish the test signals

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

HSDPA Setup Procedures used to establish the test signals

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
	B_d (SF)	64			
	β_c/β_d	2/15	11/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
HSDPA Specific Settings	MPR (dB)	0	0	0.5	0.5
	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			

HSPA (HSDPA & HSUPA) Setup Procedures used to establish the test signals

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				
		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	6/15	15/9	2/15	15/1
	β_{hs}	22/15	12/15	30/15	4/15	5/15
HSDPA Specific Settings	β_{ed}	1309/225	94/75	47/15	56/75	47/15
	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
	DACK	8				0
	DNAK	8				0
	DCQI	8				0
HSUPA Specific Settings	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = β_{hs}/β_c	30/15				
	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 Channelization Codes	2xSF2				SF4

DC-HSDPA Setup Procedures used to establish the test signals

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.		

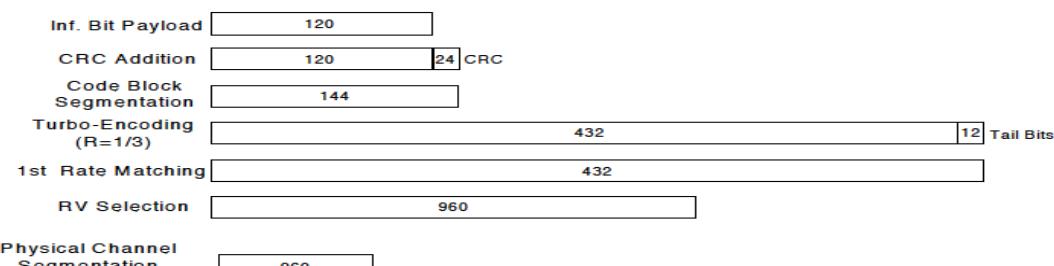


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm2			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	β_d (SF)	64			
	β_c/β_d	2/15	11/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
HSDPA Specific Settings	MPR (dB)	0	0	0.5	0.5
	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs = β_{hs}/β_c	30/15			

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.

Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Avg Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	23.2
			9400	1880.0	N/A	23.4
			9538	1907.6	N/A	23.5
	HSDPA	Subtest 1	9262	1852.4	0	23.3
			9400	1880.0	0	23.5
			9538	1907.6	0	23.5
		Subtest 2	9262	1852.4	0	23.3
			9400	1880.0	0	23.5
			9538	1907.6	0	23.5
		Subtest 3	9262	1852.4	0.5	22.9
			9400	1880.0	0.5	23.1
			9538	1907.6	0.5	23.0
		Subtest 4	9262	1852.4	0.5	22.9
			9400	1880.0	0.5	23.1
			9538	1907.6	0.5	23.0
	HSUPA	Subtest 1	9262	1852.4	0	22.4
			9400	1880.0	0	22.5
			9538	1907.6	0	22.9
		Subtest 2	9262	1852.4	2	21.4
			9400	1880.0	2	21.5
			9538	1907.6	2	21.6
		Subtest 3	9262	1852.4	1	21.8
			9400	1880.0	1	21.9
			9538	1907.6	1	22.0
		Subtest 4	9262	1852.4	2	21.4
			9400	1880.0	2	21.5
			9538	1907.6	2	21.6
		Subtest 5	9262	1852.4	0	22.4
			9400	1880.0	0	22.5
			9538	1907.6	0	22.9
	DC-HSPA	Subtest 1	9262	1852.4	0	22.9
			9400	1880.0	0	23.1
			9538	1907.6	0	23.0
		Subtest 2	9262	1852.4	0	22.9
			9400	1880.0	0	23.1
			9538	1907.6	0	23.0
		Subtest 3	9262	1852.4	0.5	22.9
			9400	1880.0	0.5	23.1
			9538	1907.6	0.5	23.0
		Subtest 4	9262	1852.4	0.5	22.9
			9400	1880.0	0.5	23.1
			9538	1907.6	0.5	23.0

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	23.7
			4183	836.6	N/A	23.7
			4233	846.6	N/A	23.7
	HSDPA	Subtest 1	4132	826.4	0	23.7
			4183	836.6	0	23.7
			4233	846.6	0	23.7
		Subtest 2	4132	826.4	0	23.7
			4183	836.6	0	23.7
			4233	846.6	0	23.7
		Subtest 3	4132	826.4	0.5	23.2
			4183	836.6	0.5	23.1
			4233	846.6	0.5	23.1
		Subtest 4	4132	826.4	0.5	23.2
			4183	836.6	0.5	23.1
			4233	846.6	0.5	23.1
DC-HSPA	Subtest 1	Subtest 1	4132	826.4	0	22.5
			4183	836.6	0	22.9
			4233	846.6	0	22.5
	Subtest 2	Subtest 2	4132	826.4	2	21.5
			4183	836.6	2	21.7
			4233	846.6	2	21.7
	Subtest 3	Subtest 3	4132	826.4	1	22.4
			4183	836.6	1	22.4
			4233	846.6	1	22.5
	Subtest 4	Subtest 4	4132	826.4	2	21.5
			4183	836.6	2	21.7
			4233	846.6	2	21.7
	Subtest 5	Subtest 5	4132	826.4	0	22.5
			4183	836.6	0	22.9
			4233	846.6	0	22.5

9.3. LTE

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
64 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 Signaling 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.

LTE Band 2 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1860 MHz	1880 MHz	1900 MHz
LTE Band 2	20	QPSK	1	0	0	0	23.6	23.2	23.6
			1	49	0	0	23.5	22.9	23.6
			1	99	0	0	23.3	23.5	23.5
			50	0	1	1	22.3	22.2	22.3
			50	25	1	1	22.3	22.1	22.3
			50	49	1	1	22.2	22.2	22.1
			100	0	1	1	22.2	22.1	22.2
		16QAM	1	0	1	1	22.7	22.7	22.7
			1	49	1	1	22.7	22.3	22.7
			1	99	1	1	22.0	22.2	22.7
			50	0	2	2	21.3	21.2	21.2
			50	25	2	2	21.0	21.1	21.2
			50	49	2	2	21.0	21.2	21.1
			100	0	2	2	21.1	21.1	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1857.5 MHz	1880 MHz	1902.5 MHz
LTE Band 2	15	QPSK	1	0	0	0	23.1	23.3	23.3
			1	37	0	0	23.2	23.2	23.2
			1	74	0	0	23.3	23.3	23.2
			36	0	1	1	22.2	22.3	22.3
			36	18	1	1	22.3	22.3	22.3
			36	35	1	1	22.2	22.3	22.1
			75	0	1	1	22.2	22.2	22.2
		16QAM	1	0	1	1	22.5	22.7	22.4
			1	37	1	1	22.7	22.4	22.5
			1	74	1	1	22.7	22.5	22.5
			36	0	2	2	21.2	21.4	21.2
			36	18	2	2	21.1	21.4	21.2
			36	35	2	2	21.1	21.3	21.1
			75	0	2	2	21.2	21.1	21.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1855 MHz	1880 MHz	1905 MHz
LTE Band 2	10	QPSK	1	0	0	0	23.4	23.7	23.4
			1	25	0	0	23.3	23.5	23.3
			1	49	0	0	23.3	23.4	23.3
			25	0	1	1	22.2	22.4	22.3
			25	12	1	1	22.2	22.3	22.2
			25	25	1	1	22.2	22.3	22.2
			50	0	1	1	22.2	22.4	22.2
		16QAM	1	0	1	1	22.7	22.6	22.3
			1	25	1	1	22.4	22.7	22.2
			1	49	1	1	22.7	22.7	22.3
			25	0	2	2	21.2	21.3	21.2
			25	12	2	2	21.2	21.3	21.3
			25	25	2	2	21.4	21.3	21.3
			50	0	2	2	21.3	21.3	21.2

LTE Band 2 Measured Results Cont.

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1852.5 MHz	1880 MHz	1907.5 MHz
LTE Band 2	5	QPSK	1	0	0	0	23.1	23.3	23.2
			1	12	0	0	23.2	23.6	23.3
			1	24	0	0	23.2	23.3	23.3
			12	0	1	1	22.1	22.2	22.2
			12	7	1	1	22.2	22.3	22.2
			12	13	1	1	22.2	22.3	22.2
			25	0	1	1	22.2	22.3	22.2
		16QAM	1	0	1	1	22.2	22.3	22.6
			1	12	1	1	22.2	22.3	22.2
			1	24	1	1	22.1	22.2	22.1
			12	0	2	2	21.1	21.1	21.2
			12	7	2	2	21.0	21.1	21.4
			12	13	2	2	21.2	21.2	21.3
			25	0	2	2	21.3	21.5	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1851.5 MHz	1880 MHz	1908.5 MHz
LTE Band 2	3	QPSK	1	0	0	1	23.0	23.2	23.1
			1	7	0	0	23.4	23.7	23.4
			1	14	0	0	23.0	23.1	23.2
			6	0	1	1	22.0	22.1	22.2
			6	3	1	1	22.0	22.1	22.2
			6	5	1	1	22.0	22.2	22.2
			15	0	1	1	22.0	22.2	22.3
		16QAM	1	0	1	1	22.1	22.7	22.6
			1	7	1	1	22.4	22.7	22.7
			1	14	1	1	22.3	22.5	22.5
			6	0	2	2	21.0	21.0	21.4
			6	3	2	2	21.2	21.1	21.4
			6	5	2	2	21.1	21.0	21.4
			15	0	2	2	21.0	21.3	21.3
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1850.7 MHz	1880 MHz	1909.3 MHz
LTE Band 2	1.4	QPSK	1	0	0	0	23.0	23.2	23.3
			1	2	0	0	23.0	23.0	23.3
			1	5	0	0	23.1	23.0	23.3
			3	0	0	0	23.0	23.0	23.3
			3	1	0	0	23.0	23.1	23.3
			3	2	0	0	23.0	23.2	23.3
			6	0	1	1	22.0	22.1	22.2
		16QAM	1	0	1	1	22.1	22.2	22.7
			1	2	1	1	22.7	22.2	22.7
			1	5	1	1	22.7	22.2	22.7
			3	0	1	1	22.3	22.0	22.6
			3	1	1	1	22.3	22.0	22.6
			3	2	1	1	22.0	22.2	22.6
			6	0	2	2	21.6	21.0	21.5

LTE Band 4 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1720 MHz	1732.5 MHz	1745 MHz
LTE Band 4	20	QPSK	1	0	0	0	23.5	23.1	23.2
			1	49	0	0	23.5	23.1	23.5
			1	99	0	0	23.2	23.1	23.4
			50	0	1	1	22.2	22.3	22.2
			50	25	1	1	22.2	22.3	22.2
			50	49	1	1	22.1	22.1	22.2
			100	0	1	1	22.2	22.2	22.2
		16QAM	1	0	1	1	22.2	22.4	22.7
			1	49	1	1	22.1	22.1	22.7
			1	99	1	1	22.0	22.0	22.7
			50	0	2	2	21.2	21.3	21.1
			50	25	2	2	21.2	21.1	20.9
			50	49	2	2	21.2	21.0	21.0
			100	0	2	2	21.1	21.2	21.3
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1717.5 MHz	1732.5 MHz	1747.5 MHz
LTE Band 4	15	QPSK	1	0	0	0	23.0	23.2	23.2
			1	37	0	0	23.7	23.1	23.6
			1	74	0	1	23.0	23.1	23.1
			36	0	1	1	22.2	22.3	22.2
			36	18	1	1	22.1	22.2	22.2
			36	35	1	1	22.2	22.2	22.2
			75	0	1	1	22.1	22.2	22.1
		16QAM	1	0	1	1	22.4	22.6	22.7
			1	37	1	1	22.2	22.4	22.7
			1	74	1	1	22.1	22.4	22.7
			36	0	2	2	21.1	21.2	21.3
			36	18	2	2	21.0	21.3	21.1
			36	35	2	2	21.0	21.3	21.1
			75	0	2	2	21.0	21.3	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1715 MHz	1732.5 MHz	1750 MHz
LTE Band 4	10	QPSK	1	0	0	1	23.1	23.1	23.1
			1	24	0	1	23.1	23.1	23.1
			1	49	0	1	23.0	23.0	23.1
			25	0	1	1	22.3	22.2	22.2
			25	12	1	1	22.2	22.2	22.2
			25	24	1	1	22.1	22.2	22.2
			50	0	1	1	22.1	22.2	22.2
		16QAM	1	0	1	1	22.7	22.7	22.5
			1	24	1	1	22.7	22.7	22.3
			1	49	1	1	22.7	22.3	22.0
			25	0	2	2	21.2	21.2	21.3
			25	12	2	2	21.0	21.2	21.3
			25	24	2	2	21.1	21.2	21.3
			50	0	2	2	21.0	21.1	21.2

LTE Band 4 Measured Results Cont.

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1712.5 MHz	1732.5 MHz	1752.5 MHz
LTE Band 4	5	QPSK	1	0	0	1	22.9	23.1	22.9
			1	12	0	0	23.1	23.7	23.5
			1	24	0	1	22.9	23.2	22.9
			12	0	1	2	22.1	22.1	22.1
			12	6	1	2	22.2	22.2	22.2
			12	11	1	2	22.2	22.2	22.1
			25	0	1	1	22.1	22.1	22.2
		16QAM	1	0	1	1	22.1	22.2	21.8
			1	12	1	1	22.3	22.3	22.6
			1	24	1	1	22.0	22.0	22.7
			12	0	2	2	21.1	21.2	21.2
			12	6	2	2	21.2	21.2	21.2
			12	11	2	2	21.1	21.2	21.3
			25	0	2	2	21.2	21.2	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1711.5 MHz	1732.5 MHz	1753.5 MHz
LTE Band 4	3	QPSK	1	0	0	0	23.1	23.0	22.9
			1	37	0	0	23.3	23.5	23.3
			1	74	0	0	23.0	23.1	23.0
			36	0	1	1	22.1	22.2	22.1
			36	18	1	1	22.3	22.1	22.1
			36	35	1	1	22.2	22.1	22.2
			75	0	1	1	22.2	22.2	22.2
		16QAM	1	0	1	1	22.5	22.7	22.7
			1	37	1	1	22.7	22.7	21.8
			1	74	1	1	22.5	22.3	22.5
			36	0	2	2	21.2	21.0	21.3
			36	18	2	2	21.3	21.0	21.3
			36	35	2	2	21.4	20.9	21.3
			75	0	2	2	21.2	21.2	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1710.7 MHz	1732.5 MHz	1754.3 MHz
LTE Band 4	1.4	QPSK	1	0	0	0	23.1	23.0	23.1
			1	2	0	0	23.2	23.1	23.2
			1	5	0	0	23.2	23.1	23.1
			3	0	0	0	23.2	23.1	23.2
			3	1	0	0	23.2	23.1	23.2
			3	2	0	0	23.1	23.2	23.2
			6	0	1	1	22.2	22.2	22.1
		16QAM	1	0	1	1	22.7	22.7	22.3
			1	2	1	1	22.7	22.7	22.6
			1	5	1	1	22.7	22.4	22.4
			3	0	1	1	22.4	22.5	22.1
			3	1	1	1	22.5	22.0	22.3
			3	2	1	1	22.4	22.2	22.2
			6	0	2	2	21.2	21.3	21.4

LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	0	23.1	23.4	23.1
			1	25	0	0	23.1	23.2	23.0
			1	49	0	0	23.2	23.0	23.0
			25	0	1	1	22.3	22.3	22.2
			25	12	1	1	22.4	22.3	22.3
			25	25	1	1	22.3	22.4	22.2
			50	0	1	1	22.4	22.3	22.2
		16QAM	1	0	1	1	22.5	22.7	22.2
			1	25	1	1	22.6	22.0	22.1
			1	49	1	1	22.6	22.4	22.4
			25	0	2	2	21.3	21.3	21.4
			25	12	2	2	21.4	21.3	21.3
			25	25	2	2	21.3	21.4	21.4
			50	0	2	2	21.4	21.3	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	0	23.0	23.4	23.1
			1	12	0	0	23.1	23.7	23.3
			1	24	0	0	23.0	23.3	23.0
			12	0	1	1	22.2	22.3	22.2
			12	6	1	1	22.3	22.3	22.2
			12	11	1	1	22.3	22.3	22.2
			25	0	1	1	22.3	22.3	22.2
		16QAM	1	0	1	1	22.5	22.3	22.5
			1	12	1	1	22.7	22.4	22.7
			1	24	1	1	22.1	22.5	22.7
			12	0	2	2	21.2	21.4	21.3
			12	6	2	2	21.4	21.4	21.2
			12	11	2	2	21.3	21.4	21.3
			25	0	2	2	21.3	21.3	21.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							825.5 MHz	836.5 MHz	847.5 MHz
LTE Band 5	3	QPSK	1	0	0	0	23.1	23.3	23.0
			1	7	0	0	23.2	23.5	23.4
			1	14	0	1	23.0	23.1	23.1
			6	0	1	1	22.3	22.3	22.2
			6	3	1	1	22.3	22.4	22.1
			6	5	1	1	22.2	22.3	22.3
			15	0	1	1	22.3	22.4	22.2
		16QAM	1	0	1	1	22.7	22.7	22.7
			1	7	1	1	22.7	22.6	22.4
			1	14	1	1	22.7	22.7	22.0
			6	0	2	2	21.5	21.1	21.3
			6	3	2	2	21.1	21.1	21.4
			6	5	2	2	21.5	21.1	21.3
			15	0	2	2	21.3	21.3	21.2

LTE Band 5 Measured Results Cont.

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							824.7 MHz	836.5 MHz	848.3 MHz
LTE Band 5	1.4	QPSK	1	0	0	0	23.1	23.1	23.0
			1	2	0	0	23.2	23.3	23.0
			1	5	0	0	23.1	23.2	23.0
			3	0	0	0	23.2	23.2	23.0
			3	1	0	0	23.2	23.3	23.2
			3	2	0	0	23.2	23.3	23.1
			6	0	1	1	22.3	22.3	22.1
		16QAM	1	0	1	1	22.7	22.7	22.5
			1	2	1	1	22.0	22.0	22.7
			1	5	1	1	22.5	22.2	22.2
			3	0	1	1	22.6	22.0	22.2
			3	1	1	1	22.6	22.0	22.5
			3	2	1	1	22.6	22.5	22.6
			6	0	2	2	21.2	21.1	21.3

LTE Band 17 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)	
							710 MHz	
LTE Band 17	10	QPSK	1	0	0	0		23.7
			1	25	0	0		23.3
			1	49	0	0		23.4
			25	0	1	1		22.5
			25	12	1	1		22.4
			25	25	1	1		22.4
			50	0	1	1		22.5
		16QAM	1	0	1	1		22.7
			1	25	1	1		22.7
			1	49	1	1		22.5
			25	0	2	2		21.5
			25	12	2	2		21.5
			25	25	2	2		21.5
			50	0	2	2		21.4
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)	
							710 MHz	
LTE Band 17	5	QPSK	1	0	0	0		23.2
			1	12	0	0		23.4
			1	24	0	0		23.1
			12	0	1	1		22.3
			12	6	1	1		22.3
			12	11	1	1		22.3
			25	0	1	1		22.2
		16QAM	1	0	1	1		22.4
			1	12	1	1		22.6
			1	24	1	1		22.1
			12	0	2	2		21.3
			12	6	2	2		21.2
			12	11	2	2		21.2
			25	0	2	2		21.3

Note(s):

10/5 MHz Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing per KDB 941225 D05 SAR for LTE Devices

9.4. Wi-Fi 2.4GHz

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	15.2	15.5	Yes	
			6	2437	15.0			
			11	2462	14.9			
	802.11g	6 Mbps	1	2412		12.0	No	1
			6	2437				
			11	2462				
	802.11n (HT20)	MCS0	1	2412		10.5	No	1
			6	2437				
			11	2462				

Note(s):

1. Output Power and SAR measurement is not required for 802.11g/n HT20 channels when the specified tune-up tolerances for 802.11g/n HT20 are lower than 802.11b by more than 1/4 dB and the measured SAR is ≤ 1.2 W/Kg.

9.5. Wi-Fi 5GHz

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)	
5.2 (U-NII 1)	802.11a	6 Mbps	36	5180	10.8	11.6	No	2	
			40	5200	10.8				
			44	5220	10.8				
			48	5240	10.8				
	802.11n (HT20)	6.5 Mbps	36-48	5180 - 5240	Not Required	11.3	No	1	
	802.11n (HT40)	13.5 Mbps	38-46	5190 - 5230		10	No	1	
	802.11a	6 Mbps	52	5260	10.9	11.6	Yes		
			56	5280	10.9				
			60	5300	11.0				
			64	5320	11.0				
			802.11n (HT20)	6.5 Mbps	5260 - 5320	Not Required	11.3	No	1
			802.11n (HT40)	13.5 Mbps	5270 - 5310		10	No	1
5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500	10.5	11.6	Yes		
			112	5560	10.5				
			116	5580	10.4				
			128	5640	TDWR				
	802.11n (HT20)	6.5 Mbps	100-140	5500-5700	Not Required	11.3	No	1	
	802.11n (HT40)	13.5 Mbps	102-134	5510-5670		10	No	1	
5.8 (U-NII 3)	802.11a	6 Mbps	132	5660	10.4	11.6	Yes		
			149	5745	10.5				
			165	5825	10.7				
	802.11n (HT20)	6.5 Mbps	149-161	5745-5805	Not Required	11.3	No	1	
	802.11n (HT40)	13.5 Mbps	151-159	5755-5795		10	No	1	

Note(s):

1. Output Power and SAR measurement is not required for 802.11n HT20/HT40 channels when the specified tune-up tolerances for 802.11n HT20/HT40 are lower than 802.11a by more than 1/4 dB and the measured SAR is ≤ 1.2 W/Kg.
2. When the specified maximum output power is the same for both UNII band 1 and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
 - o ≤ 1.2 W/kg, SAR is not required for UNII band 1
 - o > 1.2 W/kg, both bands should be tested independently for SAR.

9.6. Bluetooth

Maximum tune-up tolerance limit is 8.00 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

10. 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:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

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 meas for 802.11 v02:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the reported SAR for the initial test position is:

- $\leq 0.4 \text{ W/kg}$, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- $> 0.4 \text{ W/kg}$, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closest/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is $\leq 0.8 \text{ W/kg}$ or all required test positions are tested.
 - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
 - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is $> 0.8 \text{ W/kg}$, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is $\leq 1.2 \text{ W/kg}$ or all required test channels are considered.
 - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is $\leq 1.2 \text{ W/kg}$, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is $\leq 1.2 \text{ W/kg}$, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the initial test position, Area Scans were performed to determine the position with the *Maximum Value of SAR (measured)*. The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the initial test position.

10.1. 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	33.2	33.1	0.382	0.391			
			Left Tilt	190	836.6	33.2	33.1	0.258	0.264			
			Right Touch	190	836.6	33.2	33.1	0.458	0.469	1		
			Right Tilt	190	836.6	33.2	33.1	0.270	0.276			
Head VoIP	GPRS 2 Slots	0	Left Touch	190	836.6	31.7	31.7	0.569	0.569			
			Left Tilt	190	836.6	31.7	31.7	0.396	0.396			
			Right Touch	190	836.6	31.7	31.7	0.681	0.681	2		
			Right Tilt	190	836.6	31.7	31.7	0.412	0.412			
Body-worn	Voice	10	Rear	190	836.6	33.2	33.1	0.524	0.536	3		
			Front	190	836.6	33.2	33.1	0.473	0.484			
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	190	836.6	31.7	31.7	0.736	0.736	4		
Hotspot			Front	190	836.6	31.7	31.7	0.665	0.665			
			Edge 2	190	836.6	31.7	31.7	0.414	0.414			
			Edge 3	190	836.6	31.7	31.7	0.173	0.173			
			Edge 4	190	836.6	31.7	31.7	0.443	0.443			

10.2. 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	30.2	30.1	0.439	0.449	5		
			Left Tilt	661	1880.0	30.2	30.1	0.067	0.069			
			Right Touch	661	1880.0	30.2	30.1	0.313	0.320			
			Right Tilt	661	1880.0	30.2	30.1	0.164	0.168			
Head VoIP	GPRS 2 Slots	0	Left Touch	661	1880.0	29.7	29.7	0.697	0.697	6		
			Left Tilt	661	1880.0	29.7	29.7	0.320	0.320			
			Right Touch	661	1880.0	29.7	29.7	0.533	0.533			
			Right Tilt	661	1880.0	29.7	29.7	0.266	0.266			
Body-worn	Voice	10	Rear	661	1880.0	30.2	30.1	0.473	0.484	7		
			Front	661	1880.0	30.2	30.1	0.439	0.449			
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	661	1880.0	29.7	29.7	0.768	0.768	8		
Hotspot			Front	661	1880.0	29.7	29.7	0.739	0.739			
			Edge 3	661	1880.0	29.7	29.7	0.308	0.308			
			Edge 4	661	1880.0	29.7	29.7	0.504	0.504			

10.3. 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	24.2	23.7	0.430	0.482	
			Left Tilt	4183	836.6	24.2	23.7	0.252	0.283	
			Right Touch	4183	836.6	24.2	23.7	0.501	0.562	9
			Right Tilt	4183	836.6	24.2	23.7	0.272	0.305	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	24.2	23.7	0.555	0.623	10
			Front	4183	836.6	24.2	23.7	0.492	0.552	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	24.2	23.7	0.305	0.342	
			Edge 3	4183	836.6	24.2	23.7	0.118	0.132	
			Edge 4	4183	836.6	24.2	23.7	0.284	0.319	

10.4. 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	9262	1852.4	23.7	23.2	0.721	0.809	
				9400	1880.0	23.7	23.4	0.769	0.824	11
				9538	1907.6	23.7	23.5	0.758	0.794	
				9400	1880.0	23.7	23.4	0.355	0.380	
				9400	1880.0	23.7	23.4	0.528	0.566	
			Right Tilt	9400	1880.0	23.7	23.4	0.288	0.309	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9262	1852.4	23.7	23.2	0.876	0.983	
				9400	1880.0	23.7	23.4	0.879	0.942	
				9538	1907.6	23.7	23.5	0.739	0.774	
			Front	9262	1852.4	23.7	23.2	0.953	1.069	12
				9400	1880.0	23.7	23.4	0.886	0.949	
				9538	1907.6	23.7	23.5	0.804	0.842	
Hotspot	Rel 99 RMC	10	Edge 3	9400	1880.0	23.7	23.4	0.345	0.370	
			Edge 4	9400	1880.0	23.7	23.4	0.574	0.615	

10.5. LTE Band 2 (10MHz 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	19150	1905.0	1	0	23.7	23.6	0.648	0.663	
						50	0	22.7	22.3	0.639	0.701	13
			Left Tilt	19150	1905.0	1	0	23.7	23.6	0.332	0.340	
						50	0	22.7	22.3	0.259	0.284	
			Right Touch	19150	1905.0	1	0	23.7	23.6	0.676	0.692	
						50	0	22.7	22.3	0.429	0.470	
			Right Tilt	19150	1905.0	1	0	23.7	23.6	0.299	0.306	
						50	0	22.7	22.3	0.222	0.243	
Body-worn & Hotspot	QPSK	10	Rear	18650	1855.0	1	0	23.7	23.6	0.986	1.009	
						50	0	22.7	22.3	0.769	0.843	
				18900	1880.0	1	49	23.7	22.9	0.932	1.121	
						50	0	22.7	22.2	0.765	0.858	
				19150	1905.0	1	0	23.7	23.6	1.020	1.044	
						50	0	22.7	22.3	0.774	0.849	
			Front	18650	1855.0	1	0	23.7	23.6	0.708	0.724	
						18900	1880.0	1	49	23.7	22.9	0.945
				19150	1905.0	1	0	23.7	23.6	0.958	0.980	
						50	0	22.7	22.3	0.703	0.771	
Hotspot	QPSK	10	Edge 3	19150	1905.0	1	0	23.7	23.6	0.454	0.465	
						50	0	22.7	22.3	0.365	0.400	
			Edge 4	19150	1905.0	1	0	23.7	23.6	0.600	0.614	
						50	0	22.7	22.3	0.463	0.508	

10.6. LTE Band 4 (10MHz 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	20300	1745.0	1	49	23.7	23.5	0.642	0.672	15
						50	0	22.7	22.2	0.508	0.570	
			Left Tilt	20300	1745.0	1	49	23.7	23.5	0.293	0.307	
						50	0	22.7	22.2	0.216	0.242	
			Right Touch	20300	1745.0	1	49	23.7	23.5	0.582	0.609	
						50	0	22.7	22.2	0.449	0.504	
			Right Tilt	20300	1745.0	1	49	23.7	23.5	0.285	0.298	
						50	0	22.7	22.2	0.193	0.217	
Body-worn & Hotspot	QPSK	10	Rear	20050	1720.0	1	0	23.7	23.5	1.020	1.068	
						50	0	22.7	22.2	0.834	0.936	
				20175	1732.5	1	0	23.7	23.1	1.070	1.229	16
						50	0	22.7	22.3	0.846	0.928	
				20300	1745.0	1	49	23.7	23.5	1.150	1.204	
						50	0	22.7	22.2	0.830	0.931	
			Front	100	0	22.7	22.2	0.824	0.925			
				20050	1720.0	1	0	23.7	23.5	0.886	0.928	
				20175	1732.5	1	0	23.7	23.1	0.882	1.013	
				20300	1745.0	1	49	23.7	23.5	0.861	0.902	
						50	0	22.7	22.2	0.699	0.784	
Hotspot	QPSK	10	Edge 3	20300	1745.0	1	49	23.7	23.5	0.491	0.514	
						50	0	22.7	22.2	0.322	0.361	
			Edge 4	20300	1745.0	1	49	23.7	23.5	0.558	0.584	
						50	0	22.7	22.2	0.428	0.480	

10.7. LTE Band 5 (10MHz 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	20525	836.5	1	0	23.7	23.4	0.397	0.425	
						25	24	22.7	22.4	0.301	0.323	
			Left Tilt	20525	836.5	1	0	23.7	23.4	0.249	0.267	
						25	24	22.7	22.4	0.195	0.209	
			Right Touch	20525	836.5	1	0	23.7	23.4	0.454	0.486	17
						25	24	22.7	22.4	0.358	0.384	
			Right Tilt	20525	836.5	1	0	23.7	23.4	0.283	0.303	
						25	24	22.7	22.4	0.221	0.237	
Body-worn & Hotspot	QPSK	10	Rear	20525	836.5	1	0	23.7	23.4	0.511	0.548	18
						25	24	22.7	22.4	0.384	0.411	
			Front	20525	836.5	1	0	23.7	23.4	0.448	0.480	
						25	24	22.7	22.4	0.332	0.356	
Hotspot	QPSK	10	Edge 2	20525	836.5	1	0	23.7	23.4	0.279	0.299	
						25	24	22.7	22.4	0.210	0.225	
			Edge 3	20525	836.5	1	0	23.7	23.4	0.113	0.121	
						25	24	22.7	22.4	0.090	0.096	
			Edge 4	20525	836.5	1	0	23.7	23.4	0.300	0.321	
						25	24	22.7	22.4	0.230	0.246	

10.8. LTE Band 17 (10MHz 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	23790	710.0	1	0	23.7	23.7	0.253	0.255	
						25	0	22.7	22.5	0.176	0.185	
			Left Tilt	23790	710.0	1	0	23.7	23.7	0.165	0.166	
						25	0	22.7	22.5	0.109	0.114	
			Right Touch	23790	710.0	1	0	23.7	23.7	0.283	0.285	19
						25	0	22.7	22.5	0.195	0.205	
			Right Tilt	23790	710.0	1	0	23.7	23.7	0.161	0.162	
						25	0	22.7	22.5	0.110	0.115	
Body-worn & Hotspot	QPSK	10	Rear	23790	710.0	1	0	23.7	23.7	0.435	0.438	20
						25	0	22.7	22.5	0.308	0.323	
			Front	23790	710.0	1	0	23.7	23.7	0.362	0.364	
						25	0	22.7	22.5	0.251	0.263	
Hotspot	QPSK	10	Edge 2	23790	710.0	1	0	23.7	23.7	0.300	0.302	
						25	0	22.7	22.5	0.216	0.227	
			Edge 3	23790	710.0	1	0	23.7	23.7	0.085	0.086	
						25	0	22.7	22.5	0.059	0.062	
			Edge 4	23790	710.0	1	0	23.7	23.7	0.194	0.195	
						25	0	22.7	22.5	0.144	0.151	

10.9. Wi-Fi 2.4 GHz SAR

Frequency Band	Mode	RF Exposure Conditions	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.	
								Tune-up limit	Meas.	Meas.	Scaled			
2.4GHz	802.11b 1 Mbps	Head	0	Left Touch	1	2412.0	0.158	15.5	15.2					
				Left Tilt	1	2412.0	0.126	15.5	15.2					
				Right Touch	1	2412.0	0.342	15.5	15.2	0.345	0.370	1	21	
				Right Tilt	1	2412.0	0.227	15.5	15.2					
	Body-worn & Hotspot & Wi-Fi Direct		10	Rear	1	2412.0	0.084	15.5	15.2	0.082	0.088	1	22	
				Front	1	2412.0	0.061	15.5	15.2					
				Edge 1	1	2412.0	0.075	15.5	15.2					
				Edge 4	1	2412.0	0.054	15.5	15.2					

Note(s):

- Highest reported SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.

10.10. Wi-Fi 5 GHz SAR

Frequency Band	Mode	RF Exposure Conditions	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.	
								Tune-up limit	Meas.	Meas.	Scaled			
5.3 GHz U-NII 2A	802.11a 6 Mbps	Head	0	Left Touch	60	5300.0	0.021	11.6	11.0					
				Left Tilt	60	5300.0	0.014	11.6	11.0					
				Right Touch	60	5300.0	0.076	11.6	11.0	0.042	0.048	1	23	
				Right Tilt	60	5300.0	0.071	11.6	11.0					
	Body-worn		10	Rear	60	5300.0	0.164	11.6	11.0	0.097	0.111	1	24	
				Front	60	5300.0	0.014	11.6	11.0					
5.6 GHz U-NII 2C	802.11a 6 Mbps	Head	0	Left Touch	112	5560.0	0.278	11.6	10.5	<0.001	<0.001	1	25	
				Left Tilt	112	5560.0	0.038	11.6	10.5					
				Right Touch	112	5560.0	0.036	11.6	10.5					
				Right Tilt	112	5560.0	0.034	11.6	10.5					
	Body-worn		10	Rear	112	5560.0	0.017	11.6	10.5	<0.001	<0.001	1	26	
				Front	112	5560.0	0.025	11.6	10.5					
5.8 GHz U-NII 3	802.11a 6 Mbps	Head	0	Left Touch	165	5825.0	0.024	11.6	10.7					
				Left Tilt	165	5825.0	0.026	11.6	10.7					
				Right Touch	165	5825.0	0.040	11.6	10.7	0.034	0.042	1	27	
				Right Tilt	165	5825.0	0.030	11.6	10.7					
	Body-worn & Hotspot & Wi-Fi Direct		10	Rear	165	5825.0	0.200	11.6	10.7	0.088	0.108	1	28	
				Front	165	5825.0	0.041	11.6	10.7					
				Edge 1	165	5825.0	0.06	11.6	10.7					
				Edge 4	165	5825.0	0.078	11.6	10.7					

Note(s):

- Highest reported SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.

10.11. Bluetooth

Standalone SAR Test Exclusion Considerations & Estimated SAR

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.

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.

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	SAR test exclusion Result*	Test Configuration	Estimated 1-g SAR (W/kg)
(dBm)	(mW)					
8.0	6	10	2.480	0.9	Rear/Front	0.132

Conclusion:

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

11. SAR Measurement Variability

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

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

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
750	LTE Band 17	Body & Hotspot	Rear	No	0.435	N/A	N/A
850	GSM 850	Body & Hotspot	Rear	No	0.736	N/A	N/A
	WCDMA Band V	Body & Hotspot	Rear	No	0.555	N/A	N/A
	LTE Band 5	Body & Hotspot	Rear	No	0.511	N/A	N/A
1700	LTE Band 4	Body & Hotspot	Rear	Yes	1.15	1.03	1.12
1900	GSM 1900	Body & Hotspot	Rear	No	0.768	N/A	N/A
	WCDMA Band II	Body & Hotspot	Front	No	0.953	0.903	1.06
	LTE Band 2	Body & Hotspot	Rear	Yes	1.02	0.945	1.08
2400	Wi-Fi 802.11b/g/n	Head	Right Touch	No	0.345	N/A	N/A
5300	Wi-Fi 802.11a/n/ac	Body-worn	Rear	No	0.097	N/A	N/A
5500	Wi-Fi 802.11a/n/ac	Body-worn	Rear	No	<0.001	N/A	N/A
5800	Wi-Fi 802.11a/n/ac	Body & Hotspot	Rear	No	0.088	N/A	N/A

Note(s):

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

12. Simultaneous Transmission SAR Analysis

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations	
Head	1	GSM(Voice)	+
	2	GSM(Voice)	+
	3	GSM(GPRS/EDGE)	+
	4	GSM(GPRS/EDGE)	+
	5	W-CDMA	+
	6	W-CDMA	+
	9	LTE	+
	10	LTE	+
	1	GSM(Voice)	+
	2	GSM(Voice)	+
Body-w orn	3	GSM(Voice)	+
	4	GSM(GPRS/EDGE)	+
	5	GSM(GPRS/EDGE)	+
	6	GSM(GPRS/EDGE)	+
	7	W-CDMA	+
	8	W-CDMA	+
	9	W-CDMA	+
	10	LTE	+
	11	LTE	+
	12	LTE	+
	1	GSM(GPRS/EDGE)	+
	2	GSM(GPRS/EDGE)	+
Hotspot & Wi-Fi Direct	3	W-CDMA	+
	4	W-CDMA	+
	7	LTE	+
	8	LTE	+
	1	GSM(GPRS/EDGE)	+
	2	GSM(GPRS/EDGE)	+

Notes:

1. DTS and U-NII 3 support Hotspot.
2. GPRS/EDGE, W-CDMA, and LTE support Hotspot.
3. VoIP is supported in GPRS/EDGE, W-CDMA, and LTE.
4. DTS Radio cannot transmit simultaneously with Bluetooth Radio.
5. U-NII Radio cannot transmit simultaneously with Bluetooth Radio.

12.1. Sum of the SAR for WWAN & Wi-Fi & BT

RF Exposure conditions	① WWAN	② DTS	③ U-NII	④ BT	① + ② WWAN + DTS		① + ③ WWAN + U-NII		① + ④ WWAN + BT	
					Σ 1g SAR (mW/g)	SPLSR (Yes/ No)	Σ 1g SAR (mW/g)	SPLSR (Yes/ No)	Σ 1g SAR (mW/g)	SPLSR (Yes/ No)
Head	0.824	0.370	0.048		1.194	No	0.872	No		
Body-worn	1.229	0.088	0.111	0.132	1.317	No	1.340	No	1.361	No
Hotspot	1.229	0.088	0.108		1.317	No	1.337	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.

Appendices

Refer to separated files for the following appendixes.

A_15I19922v0 SAR Photos & Ant. Locations

B_15I19922v0 SAR Highest Test Plots

C_15I19922v0 SAR System Check Plots

D_15I19922v0 SAR Tissue Ingredients

E_15I19922v0 SAR Probe Cal. Certificates

F_15I19922v0 SAR Dipole Cal. Certificates

END OF REPORT