SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

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

Model: SM-A300G/DS and SM-A300G
FCC ID: A3LSMA300G

Report Number: 14I18889-S1
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Prepared for
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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	8753ES	MY40001647	7/17/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2/18/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Cole-Palmer	91100-50	1007	7/31/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/20/2015
Power Meter	Agilent	N1912A	MY53040016	5/5/2015
Power Sensor	Agilent	E9323A	MY53070005	5/1/2015
Power Sensor	Agilent	E9323A	MY53070009	5/28/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/12/2015
Power Meter	Agilent	N1912A	MY52310061	12/12/2014
Power Sensor	Agilent	E9323A	US40411681	10/4/2014
Power Sensor	Agilent	N1921A	MY52270022	12/12/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
E-Field Probe	SPEAG	EX3DV4	3686	3/18/2015
E-Field Probe	SPEAG	EX3DV4	3749	1/29/2015
E-Field Probe	SPEAG	EX3DV4	3751	11/21/2014
E-Field Probe	SPEAG	EX3DV4	3936	7/24/2015
Data Acquisition Electronics	SPEAG	DAE3	500	5/15/2015
Data Acquisition Electronics	SPEAG	DAE4	1239	4/15/2015
Data Acquisition Electronics	SPEAG	DAE4	1258	5/15/2015
Data Acquisition Electronics	SPEAG	DAE4	1360	3/17/2015
System Validation Dipole	SPEAG	D835V2	4d002	11/15/2014
System Validation Dipole	SPEAG	D1900V2	5d140	4/23/2015
System Validation Dipole	SPEAG	D2450V2	748	2/18/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1911A	MY53060009	5/5/2015
Power Sensor	Agilent	N1921A	MY52260009	12/12/2014
Base Station Simulator	R & S	CMW500	134853-ud	7/17/2015
Base Station Simulator	R & S	CMW500	137874-nu	7/24/2015
Base Station Simulator	R & S	CMW500	135390-ws	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-A300G/DS and SM-A300G	
Device Dimension	Overall (Length x Width): 130 mm x 65 mm Overall Diagonal: 140mm Display Diagonal: 115mm
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)

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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 DTM (Dual Transfer Mode): Not support		
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7, CAT 14) HSUPA (Rel. 6, CAT 6)	100%
LTE (FDD)	Band 5	QPSK, 16QAM	100%
	Does this device SV-LTE (1xRTT-LTE)? ☐Yes ☒ No		
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
Bluetooth	2.4 GHz	Version 4.0 LE	N/A

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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	30.5	**31.0**
	GPRS 3 slots	28.5	**29.0**
	GPRS 4 slots	27.5	**28.0**
	EGPRS 1 slot	27.0	**27.5**
	EGPRS 2 slots	27.0	**27.5**
	EGPRS 3 slots	25.5	**26.0**
	EGPRS 4 slots	24.5	**25.0**
GSM1900	Voice	30.5	**31.0**
	GPRS 1 slot	30.5	**31.0**
	GPRS 2 slots	28.0	**28.5**
	GPRS 3 slots	26.5	**27.0**
	GPRS 4 slots	26.0	**26.5**
	EGPRS 1 slot	26.0	**26.5**
	EGPRS 2 slots	25.0	**25.5**
	EGPRS 3 slots	24.0	**24.5**
	EGPRS 4 slots	23.0	**23.5**
W-CDMA Band V	R99	23.0	**23.5**
	HSDPA	22.5	**23.0**
	HSUPA	22.5	**23.0**
W-CDMA Band II	R99	23.0	**23.5**
	HSDPA	22.0	**22.5**
	HSUPA	22.0	**22.5**
LTE Band 5	QPSK	22.5	**23.0**

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	17.0	**17.5**
	802.11g	13.0	**13.5**
	802.11n HT20	12.0	**12.5**
Bluetooth		10.0	**10.5**
Bluetooth LE		3.0	**3.5**

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6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM 850/1900 Voice + Wi-Fi 2.4MHz 2. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 3. WCDMA Band V / II + Wi-Fi 2.4GHz 4. LTE B5 + Wi-Fi 2.4MHz
Body-worn Accessory	1. GSM 850/1900 Voice + Wi-Fi 2.4GHz 2. GSM 850/1900 Voice + BT 3. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 4. GSM 850/1900 (GPRS/EDGE) + BT 5. WCDMA Band V / II + Wi-Fi 2.4GHz 6. WCDMA Band V / II + BT 7. LTE B5 + Wi-Fi 2.4GHz 8. LTE B5 + BT
Wireless Router (Hotspot)	1. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 2. WCDMA Band V / II + Wi-Fi 2.4GHz 3. LTE B5 + Wi-Fi 2.4GHz
Notes: 1. Wi-Fi only 2.4GHz supports Hotspot. 2. GPRS/EDGE, WCDMA and LTE support Hotspot. 3. VoIP is supported in LTE, WCDMA and GPRS. 4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.	

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6.5. General LTE SAR Test and Reporting Considerations

<table>
<tr><td>Item</td><td>Description</td></tr>
<tr><td>Frequency range, Channel Bandwidth, Numbers and Frequencies</td><td>
<table>
<tr><td rowspan="3">Band 5</td><td colspan="6">Frequency range: 824 - 849 MHz</td></tr>
<tr><td colspan="6">Channel Bandwidth</td></tr>
<tr><td>20 MHz</td><td>15 MHz</td><td>10 MHz</td><td>5 MHz</td><td>3 MHz</td><td>1.4 MHz</td></tr>
<tr><td>Low</td><td></td><td></td><td>20450/ 829</td><td>20425/ 826.5</td><td>20415/ 825.5</td><td>20407/ 824.7</td></tr>
<tr><td>Mid</td><td></td><td></td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td></tr>
<tr><td>High</td><td></td><td></td><td>20600/ 844</td><td>20625/ 846.5</td><td>20635/ 847.5</td><td>20643/ 848.3</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 for 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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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 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

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) & Wi-Fi Direct (2.4GHz only)

For WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	115 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 2 (Right)	10 mm	Yes	
Edge 3 (Bottom)	0 mm	Yes	
Edge 4 (Left)	10 mm	Yes	

For Wi-Fi (2.4GHz only)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	0 mm	Yes	
Edge 2 (Right)	0 mm	Yes	
Edge 3 (Bottom)	105 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset 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 648474 D04 Handset 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	33.5	24.5
				251	848.8	33.5	24.5
	GPRS (GMSK)	CS1	1	128	824.2	33.5	24.5
				190	836.6	33.5	24.5
				251	848.8	33.5	24.5
			2	128	824.2	30.3	24.3
				190	836.6	30.6	24.6
				251	848.8	30.6	24.6
			3	128	824.2	29.0	24.7
				190	836.6	29.0	24.7
				251	848.8	29.0	24.7
			4	128	824.2	27.7	24.7
				190	836.6	27.8	24.8
				251	848.8	28.0	25.0
	EGPRS (8PSK)	MCS5	1	128	824.2	27.5	18.5
				190	836.6	27.5	18.5
				251	848.8	27.5	18.5
			2	128	824.2	26.0	20.0
				190	836.6	26.0	20.0
				251	848.8	26.1	20.1
			3	128	824.2	24.2	19.9
				190	836.6	24.2	19.9
				251	848.8	24.2	19.9
			4	128	824.2	24.0	21.0
				190	836.6	24.0	21.0
				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 4 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	30.9	21.9
				810	1909.8	30.9	21.9
	GPRS (GMSK)	CS1	1	512	1850.2	30.6	21.6
				661	1880.0	30.9	21.9
				810	1909.8	30.9	21.9
			2	512	1850.2	28.2	22.2
				661	1880.0	28.5	22.5
				810	1909.8	28.3	22.3
			3	512	1850.2	26.4	22.1
				661	1880.0	26.7	22.4
				810	1909.8	26.5	22.2
			4	512	1850.2	26.1	23.1
				661	1880.0	26.4	23.4
				810	1909.8	26.2	23.2
	EGPRS (8PSK)	MCS5	1	512	1850.2	26.5	17.5
				661	1880.0	26.5	17.5
				810	1909.8	26.5	17.5
			2	512	1850.2	24.9	18.9
				661	1880.0	25.0	19.0
				810	1909.8	25.0	19.0
			3	512	1850.2	22.5	18.2
				661	1880.0	22.5	18.2
				810	1909.8	22.5	18.2
			4	512	1850.2	22.3	19.3
				661	1880.0	22.6	19.6
				810	1909.8	22.4	19.4

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 4 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 1
	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	23.5
		4183	836.6	23.5
		4233	846.6	23.2
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	23.5
		9400	1880.0	23.5
		9538	1907.6	23.5

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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-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	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	1	1.5	1.5
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			

For the E-MPR setting, the table below was used referencing from 3GPP TS34.121-1 version 11.1.1 Release 11 specification.

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-6.7	+21	+2.7/-5.7
2	+22	+3.7/-5.2	+19	+4.7/-4.2
3	+23	+2.7/-5.2	+20	+3.7/-4.2
4	+22	+3.7/-5.2	+19	+4.7/-4.2
5	+24	+1.7/-3.7	+21	+2.7/-2.7

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Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	22.5
		4183	836.6	22.3
		4233	846.6	22.3
	Subtest 2	4132	826.4	22.3
		4183	836.6	22.3
		4233	846.6	22.3
	Subtest 3	4132	826.4	22.0
		4183	836.6	21.8
		4233	846.6	21.8
	Subtest 4	4132	826.4	21.8
		4183	836.6	21.8
		4233	846.6	21.8
W-CDMA Band II	Subtest 1	9262	1852.4	22.5
		9400	1880.0	22.5
		9538	1907.6	22.5
	Subtest 2	9262	1852.4	22.3
		9400	1880.0	22.3
		9538	1907.6	22.3
	Subtest 3	9262	1852.4	21.6
		9400	1880.0	21.6
		9538	1907.6	21.6
	Subtest 4	9262	1852.4	21.5
		9400	1880.0	21.5
		9538	1907.6	21.5

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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	HSPA	HSPA	HSPA	HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	15/15
	βec	209/225	12/15	30/15	2/15	24/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	βhs	22/15	12/15	30/15	4/15	30/15
	βed	1309/225	94/75	47/15 47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	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				
HSUPA Specific Settings	D E-DPCCH	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	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

For the E-MPR setting, the table below was used referencing from 3GPP TS34.121-1 version 11.1.1 Release 11 specification.

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-6.7	+21	+2.7/-5.7
2	+22	+3.7/-5.2	+19	+4.7/-4.2
3	+23	+2.7/-5.2	+20	+3.7/-4.2
4	+22	+3.7/-5.2	+19	+4.7/-4.2
5	+24	+1.7/-3.7	+21	+2.7/-2.7

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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	22.3
		4183	836.6	0	22.3
		4233	846.6	0	22.3
	Subtest 2	4132	826.4	2	21.4
		4183	836.6	2	21.3
		4233	846.6	2	21.2
	Subtest 3	4132	826.4	1	21.0
		4183	836.6	1	21.0
		4233	846.6	1	21.0
	Subtest 4	4132	826.4	2	21.9
		4183	836.6	2	21.6
		4233	846.6	2	21.1
	Subtest 5	4132	826.4	0	22.3
		4183	836.6	0	22.3
		4233	846.6	0	22.3
W-CDMA Band II	Subtest 1	9262	1852.4	0	22.3
		9400	1880.0	0	22.4
		9538	1907.6	0	22.4
	Subtest 2	9262	1852.4	2	21.1
		9400	1880.0	2	21.1
		9538	1907.6	2	20.8
	Subtest 3	9262	1852.4	1	21.1
		9400	1880.0	1	21.1
		9538	1907.6	1	20.6
	Subtest 4	9262	1852.4	2	21.1
		9400	1880.0	2	21.1
		9538	1907.6	2	21.7
	Subtest 5	9262	1852.4	0	22.3
		9400	1880.0	0	22.4
		9538	1907.6	0	22.4

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8.3. LTE Band 5

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 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	23.00	23.00	23.00
			1	25	0	0	22.80	22.70	22.20
			1	49	0	0	22.50	22.60	23.00
			25	0	1	1	22.00	22.00	22.00
			25	12	1	1	22.00	22.00	21.90
			25	25	1	1	22.00	22.00	22.00
			50	0	1	1	21.90	21.90	22.00
		16QAM	1	0	1	1	21.60	22.00	21.80
			1	25	1	1	21.50	22.00	21.80
			1	49	1	1	21.50	22.00	21.70
			25	0	2	2	21.00	21.00	20.90
			25	12	2	2	21.00	20.90	21.00
			25	25	2	2	21.00	20.90	20.90
			50	0	2	2	20.90	21.00	21.00
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	23.00	22.90	22.80
			1	12	0	0	22.90	22.80	22.90
			1	24	0	0	22.90	22.80	22.90
			12	0	1	1	22.00	22.00	22.00
			12	6	1	1	21.90	21.80	21.80
			12	11	1	1	22.00	21.90	21.80
			25	0	1	1	22.00	21.10	22.00
		16QAM	1	0	1	1	22.00	21.90	22.00
			1	12	1	1	21.90	21.80	21.80
			1	24	1	1	21.90	21.70	21.70
			12	0	2	2	20.80	20.90	20.90
			12	6	2	2	20.90	20.90	20.80
			12	11	2	2	20.90	20.80	20.80
			25	0	2	2	20.90	20.90	21.00
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	23.00	23.00	23.00
			1	7	0	0	23.00	22.90	23.00
			1	14	0	0	22.80	22.90	22.90
			8	0	1	1	22.00	22.00	22.00
			8	4	1	1	21.90	21.90	22.00
			8	7	1	1	21.90	21.80	21.80
			15	0	1	1	21.90	22.00	22.00
		16QAM	1	0	1	1	21.80	21.80	21.40
			1	7	1	1	21.80	21.70	21.30
			1	14	1	1	21.80	21.80	21.30
			8	0	2	2	21.00	20.80	21.00
			8	4	2	2	21.00	20.90	21.00
			8	7	2	2	20.90	20.90	21.00
			15	0	2	2	21.00	20.90	21.00

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LTE Band 5 Measured Results (continued)

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	23.00	22.90	23.00
			1	2	0	0	23.00	22.90	23.00
			1	5	0	0	22.90	22.90	22.80
			3	0	0	1	23.00	23.00	22.90
			3	1	0	1	23.00	22.90	22.80
			3	2	0	1	22.90	23.00	22.80
			6	0	1	1	22.00	21.90	21.90
		16QAM	1	0	1	1	21.40	21.40	21.60
			1	2	1	1	21.80	21.40	21.50
			1	5	1	1	21.90	21.40	21.50
			3	0	1	2	21.90	21.80	21.70
			3	1	1	2	21.90	21.80	21.70
			3	2	1	2	21.80	21.80	21.70
			6	0	2	2	20.90	20.90	20.90

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8.4. Wi-Fi (2.4 GHz Band)

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	17.5	Yes
			6	2437	17.5	
			11	2462	17.5	
	802.11g	6 Mbps	1	2412	13.5	No
			6	2437	13.5	
			11	2462	13.5	
	802.11n (HT20)	MCS0	1	2412	12.5	No
			6	2437	12.5	
			11	2462	12.4	

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	17.5	Yes
			2 Mbps	17.5	No
			5.5 Mbps	17.2	No
			11 Mbps	17.5	No

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8.5. Bluetooth

Maximum tune-up tolerance limit is 10.5 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

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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 the IEEE Std 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 B

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/22/2014	Head 2450	e'	39.3100	Relative Permittivity (ϵ_r):	39.31	39.20	0.28	5
		e''	13.2500	Conductivity (σ):	1.81	1.80	0.28	5
	Head 2410	e'	39.4800	Relative Permittivity (ϵ_r):	39.48	39.28	0.51	5
		e''	13.0800	Conductivity (σ):	1.75	1.76	-0.44	5
	Head 2475	e'	39.2900	Relative Permittivity (ϵ_r):	39.29	39.17	0.31	5
		e''	13.2900	Conductivity (σ):	1.83	1.83	0.10	5
9/22/2014	Body 2450	e'	50.9500	Relative Permittivity (ϵ_r):	50.95	52.70	-3.32	5
		e''	14.0500	Conductivity (σ):	1.91	1.95	-1.85	5
	Body 2410	e'	51.0600	Relative Permittivity (ϵ_r):	51.06	52.76	-3.22	5
		e''	13.8900	Conductivity (σ):	1.86	1.91	-2.42	5
	Body 2475	e'	50.9300	Relative Permittivity (ϵ_r):	50.93	52.67	-3.30	5
		e''	14.0700	Conductivity (σ):	1.94	1.99	-2.46	5

SAR Lab C

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/22/2014	Head 835	e'	40.3100	Relative Permittivity (ϵ_r):	40.31	41.50	-2.87	5
		e''	19.4500	Conductivity (σ):	0.90	0.90	0.34	5
	Head 820	e'	40.4900	Relative Permittivity (ϵ_r):	40.49	41.60	-2.67	5
		e''	19.4800	Conductivity (σ):	0.89	0.90	-1.14	5
	Head 850	e'	40.1600	Relative Permittivity (ϵ_r):	40.16	41.50	-3.23	5
		e''	19.4300	Conductivity (σ):	0.92	0.92	0.36	5
9/22/2014	Body 835	e'	53.0300	Relative Permittivity (ϵ_r):	53.03	55.20	-3.93	5
		e''	21.9300	Conductivity (σ):	1.02	0.97	4.97	5
	Body 820	e'	53.0800	Relative Permittivity (ϵ_r):	53.08	55.28	-3.97	5
		e''	21.9800	Conductivity (σ):	1.00	0.97	3.48	5
	Body 850	e'	52.9000	Relative Permittivity (ϵ_r):	52.90	55.16	-4.09	5
		e''	21.8300	Conductivity (σ):	1.03	0.99	4.52	5
9/25/2014	Head 835	e'	41.2000	Relative Permittivity (ϵ_r):	41.20	41.50	-0.72	5
		e''	19.7100	Conductivity (σ):	0.92	0.90	1.68	5
	Head 820	e'	41.4100	Relative Permittivity (ϵ_r):	41.41	41.60	-0.46	5
		e''	19.7600	Conductivity (σ):	0.90	0.90	0.28	5
	Head 850	e'	41.0200	Relative Permittivity (ϵ_r):	41.02	41.50	-1.16	5
		e''	19.6600	Conductivity (σ):	0.93	0.92	1.55	5
9/25/2014	Body 835	e'	53.1700	Relative Permittivity (ϵ_r):	53.17	55.20	-3.68	5
		e''	21.8000	Conductivity (σ):	1.01	0.97	4.34	5
	Body 820	e'	53.3200	Relative Permittivity (ϵ_r):	53.32	55.28	-3.54	5
		e''	21.8700	Conductivity (σ):	1.00	0.97	2.96	5
	Body 850	e'	53.0200	Relative Permittivity (ϵ_r):	53.02	55.16	-3.87	5
		e''	21.7400	Conductivity (σ):	1.03	0.99	4.09	5

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SAR Lab F

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
10/6/2014	Head 2450	e'	38.2000	Relative Permittivity (ϵ_r):	38.20	39.20	-2.55	5
		e''	13.4300	Conductivity (σ):	1.83	1.80	1.64	5
	Head 2410	e'	38.3600	Relative Permittivity (ϵ_r):	38.36	39.28	-2.34	5
		e''	13.1500	Conductivity (σ):	1.76	1.76	0.10	5
	Head 2475	e'	38.1700	Relative Permittivity (ϵ_r):	38.17	39.17	-2.55	5
		e''	13.4700	Conductivity (σ):	1.85	1.83	1.46	5
10/6/2014	Body 1750	e'	51.3400	Relative Permittivity (ϵ_r):	51.34	53.44	-3.93	5
		e''	15.5200	Conductivity (σ):	1.51	1.49	1.62	5
	Body 1710	e'	51.4100	Relative Permittivity (ϵ_r):	51.41	53.54	-3.98	5
		e''	15.3900	Conductivity (σ):	1.46	1.46	0.12	5
	Body 1755	e'	51.3200	Relative Permittivity (ϵ_r):	51.32	53.43	-3.95	5
		e''	15.5200	Conductivity (σ):	1.51	1.49	1.70	5

SAR Lab H

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/22/2014	Head 1900	e'	40.1800	Relative Permittivity (ϵ_r):	40.18	40.00	0.45	5
		e''	13.3000	Conductivity (σ):	1.41	1.40	0.36	5
	Head 1850	e'	40.3100	Relative Permittivity (ϵ_r):	40.31	40.00	0.78	5
		e''	13.2700	Conductivity (σ):	1.37	1.40	-2.50	5
	Head 1910	e'	40.1500	Relative Permittivity (ϵ_r):	40.15	40.00	0.37	5
		e''	13.2700	Conductivity (σ):	1.41	1.40	0.66	5
9/22/2014	Body 1900	e'	52.5900	Relative Permittivity (ϵ_r):	52.59	53.30	-1.33	5
		e''	14.9600	Conductivity (σ):	1.58	1.52	3.98	5
	Body 1850	e'	52.5600	Relative Permittivity (ϵ_r):	52.56	53.30	-1.39	5
		e''	15.0400	Conductivity (σ):	1.55	1.52	1.78	5
	Body 1910	e'	52.5800	Relative Permittivity (ϵ_r):	52.58	53.30	-1.35	5
		e''	14.8600	Conductivity (σ):	1.58	1.52	3.83	5
9/25/2014	Head 1900	e'	39.7300	Relative Permittivity (ϵ_r):	39.73	40.00	-0.68	5
		e''	13.3900	Conductivity (σ):	1.41	1.40	1.04	5
	Head 1850	e'	39.9000	Relative Permittivity (ϵ_r):	39.90	40.00	-0.25	5
		e''	13.2800	Conductivity (σ):	1.37	1.40	-2.42	5
	Head 1910	e'	39.6800	Relative Permittivity (ϵ_r):	39.68	40.00	-0.80	5
		e''	13.4000	Conductivity (σ):	1.42	1.40	1.65	5
9/25/2014	Body 1900	e'	51.0400	Relative Permittivity (ϵ_r):	51.04	53.30	-4.24	5
		e''	14.9000	Conductivity (σ):	1.57	1.52	3.56	5
	Body 1850	e'	51.1500	Relative Permittivity (ϵ_r):	51.15	53.30	-4.03	5
		e''	14.9700	Conductivity (σ):	1.54	1.52	1.31	5
	Body 1910	e'	51.0100	Relative Permittivity (ϵ_r):	51.01	53.30	-4.30	5
		e''	14.9100	Conductivity (σ):	1.58	1.52	4.18	5
9/29/214	Body 1900	e'	51.0700	Relative Permittivity (ϵ_r):	51.07	53.30	-4.18	5
		e''	14.9000	Conductivity (σ):	1.57	1.52	3.56	5
	Body 1850	e'	51.2000	Relative Permittivity (ϵ_r):	51.20	53.30	-3.94	5
		e''	14.9100	Conductivity (σ):	1.53	1.52	0.90	5
	Body 1910	e'	51.0500	Relative Permittivity (ϵ_r):	51.05	53.30	-4.22	5
		e''	14.9000	Conductivity (σ):	1.58	1.52	4.11	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	4d002	11/15/2013	850	1g	9.49	9.43
				10g	6.18	6.21
D1900V2	5d140	4/23/2014	1900	1g	40.1	40.2
				10g	21.0	21.3
D2450V2	748	2/18/2014	2450	1g	51.6	50.7
				10g	24.0	23.7

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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 B

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			
9/22/2014	D2450V2	748	Head	1g	4.96	49.6	51.6	-3.88	
				10g	2.28	22.8	24.0	-5.00	
9/22/2014	D2450V2	748	Body	1g	5.29	52.9	50.7	4.34	1,2
				10g	2.44	24.4	23.7	3.08	

SAR Lab C

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			
9/22/2014	D835V2	4d002	Head	1g	0.938	9.4	9.49	-1.16	
				10g	0.615	6.2	6.18	-0.49	
9/22/2014	D835V2	4d002	Body	1g	0.971	9.7	9.43	2.97	3,4
				10g	0.638	6.4	6.21	2.74	
9/25/2014	D835V2	4d002	Head	1g	0.952	9.5	9.49	0.32	
				10g	0.626	6.3	6.18	1.29	
9/25/2014	D835V2	4d002	Body	1g	0.935	9.4	9.43	-0.85	
				10g	0.617	6.2	6.21	-0.64	

SAR Lab F

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			
10/6/2014	D2450V2	748	Head	1g	5.02	50.2	51.6	-2.71	
				10g	2.27	22.7	24.0	-5.42	
10/6/2014	D2450V2	748	Body	1g	5.35	53.5	50.7	5.52	5,6
				10g	2.48	24.8	23.7	4.64	

SAR Lab H

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			
9/22/2014	D1900V2	5d140	Head	1g	4.06	40.6	40.1	1.25	
				10g	2.09	20.9	21.0	-0.48	
9/22/2014	D1900V2	5d140	Body	1g	4.35	43.5	40.2	8.21	7,8
				10g	2.26	22.6	21.3	6.10	
9/25/2014	D1900V2	5d140	Head	1g	4.09	40.9	40.1	2.00	
				10g	2.10	21.0	21.0	0.00	
9/25/2014	D1900V2	5d140	Body	1g	4.23	42.3	40.2	5.22	
				10g	2.19	21.9	21.3	2.82	
9/29/2014	D1900V2	5d140	Body	1g	3.92	39.20	40.2	-2.49	
				10g	2.03	20.30	21.3	-4.69	

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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.

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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)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.5	33.5	0.227	0.227	0.151	0.151	1
			Left Tilt	190	836.6	33.5	33.5	0.059	0.059	0.046	0.046	
			Right Touch	190	836.6	33.5	33.5	0.210	0.210	0.153	0.153	
			Right Tilt	190	836.6	33.5	33.5	0.066	0.066	0.051	0.051	
Head VoIP	GPRS 4 Slots	0	Left Touch	190	836.6	28.0	27.8	0.264	0.276	0.176	0.184	2
			Left Tilt	190	836.6	28.0	27.8	0.064	0.067	0.051	0.053	
			Right Touch	190	836.6	28.0	27.8	0.209	0.219	0.158	0.165	
			Right Tilt	190	836.6	28.0	27.8	0.062	0.065	0.048	0.050	
Body-worn	Voice	10	Rear	190	836.6	33.5	33.5	0.572	0.572	0.330	0.330	3
			Front	190	836.6	33.5	33.5	0.492	0.492	0.312	0.312	
Body-worn(VoIP) & Hotspot	GPRS 4 Slots	10	Rear	190	836.6	28.0	27.8	0.586	0.614	0.332	0.348	4
			Front	190	836.6	28.0	27.8	0.469	0.491	0.270	0.283	
Hotspot			Edge 2	190	836.6	28.0	27.8	0.201	0.210	0.130	0.136	
			Edge 3	190	836.6	28.0	27.8	0.343	0.359	0.184	0.193	
			Edge 4	190	836.6	28.0	27.8	0.142	0.149	0.088	0.092	

11.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	31.0	30.9	0.079	0.081	0.049	0.050	5
			Left Tilt	661	1880.0	31.0	30.9	0.016	0.016	0.008	0.008	
			Right Touch	661	1880.0	31.0	30.9	0.039	0.040	0.022	0.023	
			Right Tilt	661	1880.0	31.0	30.9	0.013	0.013	0.009	0.009	
Head VoIP	GPRS 4 Slots	0	Left Touch	661	1880.0	26.5	26.4	0.105	0.107	0.062	0.063	6
			Left Tilt	661	1880.0	26.5	26.4	0.014	0.014	0.007	0.007	
			Right Touch	661	1880.0	26.5	26.4	0.062	0.063	0.031	0.032	
			Right Tilt	661	1880.0	26.5	26.4	0.016	0.016	0.011	0.011	
Body-worn	Voice	10	Rear	661	1880.0	31.0	30.9	0.267	0.273	0.147	0.150	7
			Front	661	1880.0	31.0	30.9	0.164	0.168	0.088	0.090	
Body-worn(VoIP) & Hotspot	GPRS 4 Slots	10	Rear	661	1880.0	26.5	26.4	0.340	0.348	0.183	0.187	
			Front	661	1880.0	26.5	26.4	0.243	0.249	0.126	0.129	
Hotspot			Edge 2	661	1880.0	26.5	26.4	0.011	0.011	0.007	0.007	
			Edge 3	661	1880.0	26.5	26.4	0.536	0.548	0.286	0.293	8
			Edge 4	661	1880.0	26.5	26.4	0.098	0.100	0.054	0.055	

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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)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.5	23.5	0.327	0.327	0.217	0.217	9
			Left Tilt	4183	836.6	23.5	23.5	0.076	0.076	0.060	0.060	
			Right Touch	4183	836.6	23.5	23.5	0.256	0.256	0.187	0.187	
			Right Tilt	4183	836.6	23.5	23.5	0.084	0.084	0.064	0.064	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	23.5	23.5	0.780	0.780	0.442	0.442	10
			Front	4183	836.6	23.5	23.5	0.559	0.559	0.324	0.324	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.5	23.5	0.216	0.216	0.140	0.140	
			Edge 3	4183	836.6	23.5	23.5	0.339	0.339	0.184	0.184	
			Edge 4	4183	836.6	23.5	23.5	0.174	0.174	0.106	0.106	

11.4. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	23.5	23.5	0.120	0.120	0.074	0.074	11
			Left Tilt	9400	1880.0	23.5	23.5	0.030	0.030	0.017	0.017	
			Right Touch	9400	1880.0	23.5	23.5	0.060	0.060	0.039	0.039	
			Right Tilt	9400	1880.0	23.5	23.5	0.028	0.028	0.018	0.018	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	23.5	23.5	0.273	0.273	0.161	0.161	12
			Front	9400	1880.0	23.5	23.5	0.249	0.249	0.141	0.141	
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	23.5	23.5	0.012	0.012	0.008	0.008	
			Edge 3	9400	1880.0	23.5	23.5	0.441	0.441	0.245	0.245	13
			Edge 4	9400	1880.0	23.5	23.5	0.115	0.115	0.062	0.062	

11.5. LTE Band 5 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	QPSK	0	Left Touch	20525	836.5	1	0	23.0	23.0	0.187	0.187	0.125	0.125	14
						25	0	22.0	22.0	0.165	0.165	0.109	0.109	
			Left Tilt	20525	836.5	1	0	23.0	23.0	0.050	0.050	0.039	0.039	
						25	0	22.0	22.0	0.043	0.043	0.034	0.034	
			Right Touch	20525	836.5	1	0	23.0	23.0	0.165	0.165	0.120	0.120	
						25	0	22.0	22.0	0.143	0.143	0.104	0.104	
			Right Tilt	20525	836.5	1	0	23.0	23.0	0.051	0.051	0.040	0.040	
						25	0	22.0	22.0	0.044	0.044	0.034	0.034	
Body-worn & Hotspot	QPSK	10	Rear	20525	836.5	1	0	23.0	23.0	0.443	0.443	0.255	0.255	15
						25	0	22.0	22.0	0.377	0.377	0.216	0.216	
			Front	20525	836.5	1	0	23.0	23.0	0.347	0.347	0.223	0.223	
						25	0	22.0	22.0	0.301	0.301	0.193	0.193	
Hotspot	QPSK	10	Edge 2	20525	836.5	1	0	23.0	23.0	0.172	0.172	0.112	0.112	
						25	0	22.0	22.0	0.145	0.145	0.095	0.095	
			Edge 3	20525	836.5	1	0	23.0	23.0	0.259	0.259	0.140	0.140	
						25	0	22.0	22.0	0.216	0.216	0.116	0.116	
			Edge 4	20525	836.5	1	0	23.0	23.0	0.100	0.100	0.062	0.062	
						25	0	22.0	22.0	0.086	0.086	0.054	0.054	

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11.6. Wi-Fi (DTS Band)

Freq. Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
2.4 GHz	Head	802.11b 1 Mbps	0	Left Touch	1	2412.0	17.5	17.5	0.671	0.671	0.268	0.268	
					6	2437.0	17.5	17.5	0.877	0.877	0.352	0.352	16
					11	2462.0	17.5	17.5	0.724	0.724	0.289	0.289	
				Left Tilt	6	2437.0	17.5	17.5	0.572	0.572	0.222	0.222	
				Right Touch	6	2437.0	17.5	17.5	0.390	0.390	0.185	0.185	
				Right Tilt	6	2437.0	17.5	17.5	0.232	0.232	0.111	0.111	
	Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	17.5	17.5	0.109	0.109	0.056	0.056	17
				Front	6	2437.0	17.5	17.5	0.104	0.104	0.055	0.055	
	Hotspot	802.11b 1 Mbps	10	Edge 1	6	2437.0	17.5	17.5	0.060	0.060	0.035	0.035	
				Edge 2	6	2437.0	17.5	17.5	0.053	0.053	0.026	0.026	

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11.7. Bluetooth

11.7.1. Standalone SAR Test Exclusion Considerations

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

[(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.

11.7.2. Estimated SAR

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

- *(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	0.220

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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) (W/kg)	Repeated SAR (Yes/No)
850	GSM 850	N/A	N/A	N/A	No
	WCDMA Band V	N/A	N/A	N/A	No
	LTE Band 5	N/A	N/A	N/A	No
1900	GSM 1900	N/A	N/A	N/A	No
	WCDMA Band II	N/A	N/A	N/A	No
2400	Wi-Fi 802.11b/g/n	0.877	N/A	N/A	No

12.2. Repeated Measurement Results

Head

Frequency band	Test Position	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
					Original	Repeated		
Wi-Fi 2.4 GHz	Left Touch	802.11b	6	2437.0	0.877	0.857	1.02	1

Note(s):

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

Body-worn Accessory

N/A

Wireless Router (Hotspot)

N/A

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13. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance v05, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

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

Where:

SAR_1 is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR_2 is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

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

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

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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 Bluetooth		
Head	Left Touch	① + ②	0.276	0.877		1.153	No
	Left Tilt	① + ②	0.067	0.572		0.639	No
	Right Touch	① + ②	0.219	0.390		0.609	No
	Right Tilt	① + ②	0.066	0.232		0.298	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.614	0.109		0.723	No
		① + ③	0.614		0.220	0.834	No
	Front	① + ②	0.492	0.104		0.596	No
		① + ③	0.492		0.220	0.712	No
Hotspot	Edge 1	① + ②		0.060		0.060	No
	Edge 2	① + ②	0.210	0.053		0.263	No
	Edge 3	① + ②	0.359			0.359	No
	Edge 4	① + ②	0.149			0.149	No

SAR to Peak Location Separation Ratio (SPLSR)
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.107	0.877		0.984	No
	Left Tilt	① + ②	0.016	0.572		0.588	No
	Right Touch	① + ②	0.063	0.390		0.453	No
	Right Tilt	① + ②	0.016	0.232		0.248	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.348	0.109		0.457	No
		① + ③	0.348		0.220	0.568	No
	Front	① + ②	0.249	0.104		0.353	No
		① + ③	0.249		0.220	0.469	No
Hotspot	Edge 1	① + ②		0.060		0.060	No
	Edge 2	① + ②	0.011	0.053		0.064	No
	Edge 3	① + ②	0.548			0.548	No
	Edge 4	① + ②	0.100			0.100	No

SAR to Peak Location Separation Ratio (SPLSR)
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

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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 WCDMA V	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.327	0.877		1.204	No
	Left Tilt	① + ②	0.076	0.572		0.648	No
	Right Touch	① + ②	0.256	0.390		0.646	No
	Right Tilt	① + ②	0.084	0.232		0.316	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.780	0.109		0.889	No
		① + ③	0.780		0.220	1.000	No
	Front	① + ②	0.559	0.104		0.663	No
		① + ③	0.559		0.220	0.779	No
Hotspot	Edge 1	① + ②		0.060		0.060	No
	Edge 2	① + ②	0.216	0.053		0.269	No
	Edge 3	① + ②	0.339			0.339	No
	Edge 4	① + ②	0.174			0.174	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① WCDMA II	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.120	0.877		0.997	No
	Left Tilt	① + ②	0.030	0.572		0.602	No
	Right Touch	① + ②	0.060	0.390		0.450	No
	Right Tilt	① + ②	0.028	0.232		0.260	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.273	0.109		0.382	No
		① + ③	0.273		0.220	0.493	No
	Front	① + ②	0.249	0.104		0.353	No
		① + ③	0.249		0.220	0.469	No
Hotspot	Edge 1	① + ②		0.060		0.060	No
	Edge 2	① + ②	0.012	0.053		0.065	No
	Edge 3	① + ②	0.441			0.441	No
	Edge 4	① + ②	0.115			0.115	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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13.5. Sum of the SAR for LTE Band 5 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① LTE Band 5	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.187	0.877		1.064	No
	Left Tilt	① + ②	0.050	0.572		0.622	No
	Right Touch	① + ②	0.165	0.390		0.555	No
	Right Tilt	① + ②	0.051	0.232		0.283	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.443	0.109		0.552	No
		① + ③	0.443		0.220	0.663	No
	Front	① + ②	0.347	0.104		0.451	No
		① + ③	0.347		0.220	0.567	No
Hotspot	Edge 1	① + ②		0.060		0.060	No
	Edge 2	① + ②	0.172	0.053		0.225	No
	Edge 3	① + ②	0.259			0.259	No
	Edge 4	① + ②	0.100			0.100	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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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. Tissue Material Ingredients

14.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3686

14.6. Calibration Certificate for E-Field Probe EX3DV4 - SN 3749

14.7. Calibration Certificate for E-Field Probe EX3DV4 - SN 3751

14.8. Calibration Certificate for E-Field Probe EX3DV4 - SN 3936

14.9. Calibration Certificate for D835V2 - SN 4d002

14.10. Calibration Certificate for D1900V2 - SN 5d140

14.11. Calibration Certificate for D2450V2 - SN 748

END OF REPORT

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