



SAR EVALUATION REPORT

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

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

**Model: SM-W2015
FCC ID: A3LSMW2015**

**Report Number: 14U18406-S1A
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REVISION HISTORY

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--	08/21/2014	Initial Issue	--
A	9/29/2014	Updated Section 10.1. and added Appendix 14.9. to include: Description of Phantom, wall thickness, liquid depth and tissue composition.	Nathan Sousa

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO. LTD.		
Application Purpose	☒ Original Grant ☐ Class II Permissive Change		
FCC ID	A3LSMW2015		
DUT Description	GSM/WCDMA + Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC		
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)		
The Highest Reported SAR	RF Exposure Conditions	Equipment Class	
		Licensed	DTS
	Head	0.568 W/kg	0.010 W/kg
	Body-worn Accessory	0.791 W/kg	0.242 W/kg
	Wireless Router (Hotspot)	0.791 W/kg	0.242 W/kg
	Wi-Fi Direct	N/A	0.242 W/kg
	Simultaneous Transmission	Head: 0.592 W/kg Body: 1.437 W/kg	Head: 0.578 W/kg Body: 1.033 W/kg
			Head: 0.592 W/kg Body: 1.437 W/kg
Applicable Standards	FCC 47 CFR § 2.1093 KDB publication IEEE Std 1528-2013		
Test Results	Pass		
Date tested	07/30/2014 – 08/21/2014		
UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report. Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.			
Approved & Released By:  Dave Weaver Program Manager UL Verification Services Inc.		Prepared By:  Mark Balauro Laboratory Technician UL Verification Services Inc.	

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2003 & 2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

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

3. Facilities and Accreditation

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

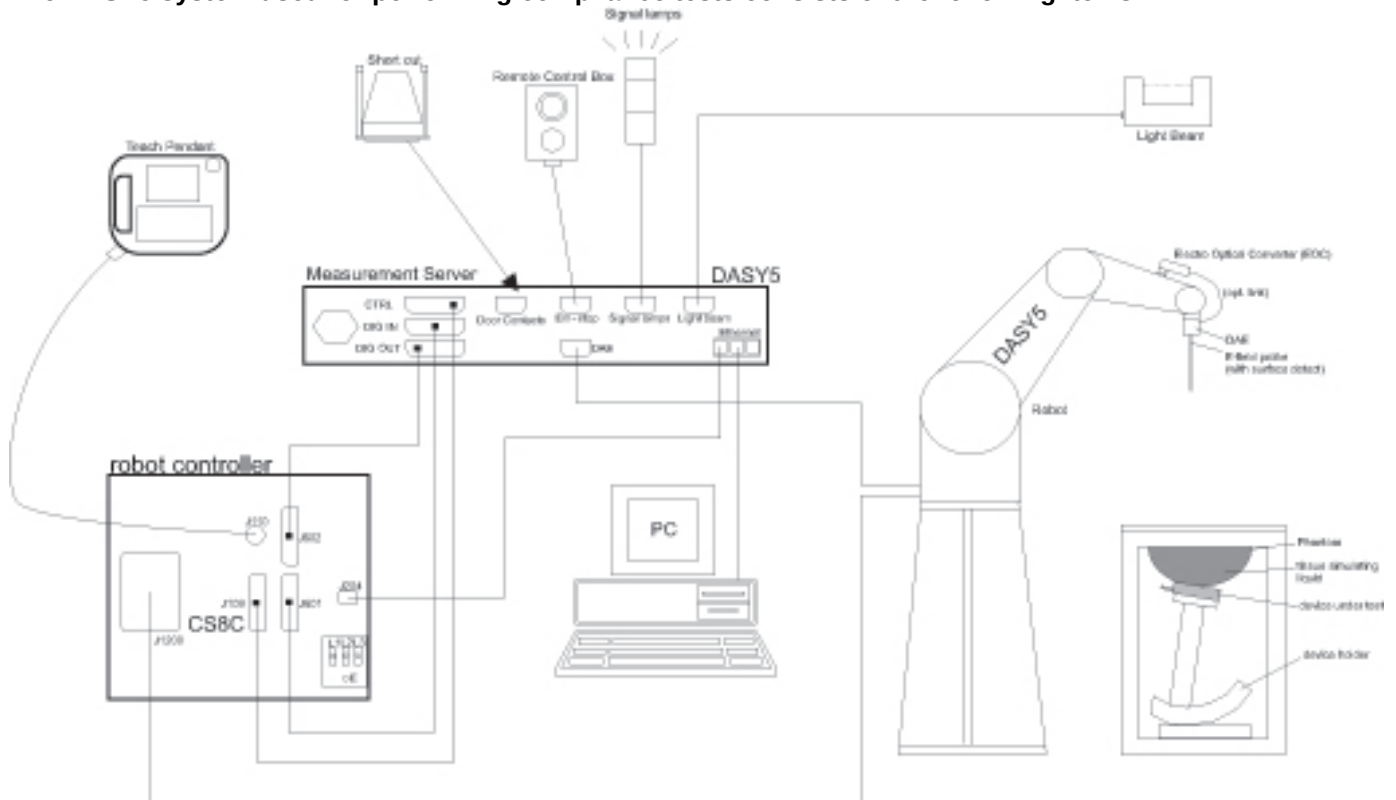
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. Test Equipment

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

Dielectric Property Measurements

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

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
HP Signal Generator	HP	8665B	3546A00784	6/23/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Meter	HP	437B	3125U09516	9/30/2014
Power Sensor	Agilent	8481A	2237A31744	10/2/2014
Power Sensor	Agilent	8481A	2349A36506	9/30/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808939	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2710	N/A
DC Power Supply	Sorensen Ametek	XT15-4	1319A02778	N/A
HP Signal Generator	HP	8665B	3438A00633	7/10/2015
Power Meter	HP	438A	3513U04320	10/2/2014
Power Sensor	Agilent	8481A	2702A66876	9/30/2014
Power Sensor	Agilent	8481A	3318A95392	9/30/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	N/A
DC Power Supply	HP	6296A	2841A-05955	N/A
E-Field Probe (SAR 2)	SPEAG	EX3DV3	3531	11/21/2014
Data Acquisition Electronics (SAR 2)	SPEAG	DAE4	1359	2/17/2015
System Validation Dipole	SPEAG	D835V2	4d002	11/15/2014
System Validation Dipole	SPEAG	D1900V2	5d043	11/12/2014
System Validation Dipole	SPEAG	D2450V2	899	9/10/2014
System Validation Dipole	SPEAG	D5GHzV2	1138	11/19/2014
Thermometer (SAR Lab 2)	EXTECH	445703	CCS-203	3/28/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Sensor	Agilent	N1921A	MY52020011	5/6/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Base Station Simulator	R&S	CMW 500	132909-bd	6/6/2015
Base Station Simulator	R&S	CMW 500	125236-eS	5/29/2015

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 $< 1.5 \text{ W/kg}$, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2003 & 2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-W2015	
Device Dimension	Overall (Length x Width) when closed: 121.3 mm x 62.8 mm Overall (Length x Width) when open: 230 mm x 62.8 mm Overall Diagonal when closed: 129.7 mm Overall Diagonal when open: 235 mm Display Diagonal: 99.9 mm
Battery Back Cover	☒ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC.
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.8Vdc, 7.68Wh ☐ Extended (large capacity)
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☒ Mobile Hotspot (Wi-Fi 2.4 GHz) ☒ Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5 GHz)
SIM Information	☐ Single SIM ☒ Dual SIM

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 supported		
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA (Category 24, Rel. 8) HSUPA (Category 6, Rel. 6) HSPA+ (Rel. 8)	100%
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40)	100%
Bluetooth	2.4 GHz	Version 4.0 LE + HS + EDR	32.25% (DH1), 66.68% (DH3), 77.52% (DH5)

6.3. Nominal and Maximum Output Power

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	33.0	33.5
	GPRS 1 slot	33.0	33.5
	GPRS 2 slots	30.5	31.0
	GPRS 3 slots	29.5	30.0
	GPRS 4 slots	28.0	28.5
	EGPRS 1 slot	27.5	28.0
	EGPRS 2 slot	27.0	27.5
	EGPRS 3 slot	25.0	25.5
	EGPRS 4 slots	24.5	25.0
GSM1900	Voice	31.0	31.5
	GPRS 1 slot	31.0	31.5
	GPRS 2 slots	28.5	29.0
	GPRS 3 slots	26.0	26.5
	GPRS 4 slots	25.0	25.5
	EGPRS 1 slot	26.5	27.0
	EGPRS 2 slot	26.0	26.5
	EGPRS 3 slot	24.0	24.5
	EGPRS 4 slots	23.5	24.0
W-CDMA Band V	R99	23.0	23.5
	HSDPA	22.5	23.0
	HSUPA	22.5	23.0
W-CDMA Band II	R99	22.5	23.0
	HSDPA	22.0	22.5
	HSUPA	22.0	22.5

Upper limit (dB): 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	16.0	16.5
	802.11g	14.0	14.5
	802.11n HT20	13.0	13.5
WiFi 5 GHz	802.11a	12.0	12.5
	802.11n HT20	12.0	12.5
	802.11n HT40	12.0	12.5
	802.11ac VHT20	11.0	11.5
	802.11ac VHT40	11.0	11.5
Bluetooth		10.0	10.5
Bluetooth LE		7.0	7.5

6.4. Simultaneous Transmission Condition

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

Notes:

1. Wi-Fi 2.4GHz supports Hotspot and Wi-Fi Direct.
2. Wi-Fi 5.8GHz supports Wi-Fi Direct.
3. GPRS/EDGE, WCDMA, and supports Hotspot.
4. VoIP is supported in GPRS/EDGE, and WCDMA.
5. Wi-Fi 2.4 and 5GHz and Bluetooth Radio cannot transmit simultaneously.

7. RF Exposure Conditions (Test Configurations)

Refer to Appendix 13.1.Photos and Antenna Locations 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) and Wi-Fi Direct

For WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	76 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)	3 mm	Yes	
Edge 3 (Bottom)	3 mm	Yes	
Edge 4 (Left)	3 mm	Yes	

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

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	15 mm	Yes	
Edge 2 (Right)	4 mm	Yes	
Edge 3 (Bottom)	76 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 4 (Left)	48 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR

8. Conducted Output Power Measurements

The proprietary logic is used to determine when head/body power table is used.

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	33.4	24.4
				190	836.6	33.3	24.3
				251	848.8	33.2	24.2
	GPRS (GMSK)	CS1	1	128	824.2	33.3	24.3
				190	836.6	33.3	24.3
				251	848.8	33.2	24.2
			2	128	824.2	30.7	24.7
				190	836.6	30.7	24.7
				251	848.8	30.8	24.8
			3	128	824.2	29.2	24.9
				190	836.6	29.4	25.1
				251	848.8	29.4	25.1
			4	128	824.2	28.1	25.1
				190	836.6	28.4	25.4
				251	848.8	28.3	25.3
	EGPRS (8PSK)	MCS5	1	128	824.2	27.8	18.8
				190	836.6	27.7	18.7
				251	848.8	27.7	18.7
			2	128	824.2	27.5	21.5
				190	836.6	27.5	21.5
				251	848.8	27.5	21.5
			3	128	824.2	24.9	20.6
				190	836.6	24.9	20.6
				251	848.8	24.9	20.6
			4	128	824.2	24.7	21.7
				190	836.6	24.7	21.7
				251	848.8	24.7	21.7

Notes:

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

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

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	30.6	21.6
				661	1880.0	30.6	21.6
				810	1909.8	30.8	21.8
	GPRS (GMSK)	CS1	1	512	1850.2	30.6	21.6
				661	1880.0	30.6	21.6
				810	1909.8	30.8	21.8
			2	512	1850.2	28.0	22.0
				661	1880.0	28.1	22.1
				810	1909.8	28.4	22.4
			3	512	1850.2	26.0	21.7
				661	1880.0	26.0	21.7
				810	1909.8	26.4	22.1
			4	512	1850.2	24.8	21.8
				661	1880.0	24.9	21.9
				810	1909.8	25.1	22.1
	EGPRS (8PSK)	MCS5	1	512	1850.2	26.4	17.4
				661	1880.0	26.4	17.4
				810	1909.8	26.5	17.5
			2	512	1850.2	26.3	20.3
				661	1880.0	26.2	20.2
				810	1909.8	26.4	20.4
			3	512	1850.2	23.7	19.4
				661	1880.0	23.7	19.4
				810	1909.8	23.8	19.5
			4	512	1850.2	23.6	20.6
				661	1880.0	23.6	20.6
				810	1909.8	23.7	20.7

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 2 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

8.2. W-CDMA Band V and II

Release 99

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

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	22.9
		4183	836.6	22.9
		4233	846.6	22.9
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	22.8
		9400	1880.0	22.9
		9538	1907.6	22.7

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			
	β_c	2/15	12/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15 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} = β_{hs}/β_c	30/15			

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	22.0
		4183	836.6	0	21.9
		4233	846.6	0	21.9
	Subtest 2	4132	826.4	0	21.9
		4183	836.6	0	21.9
		4233	846.6	0	22.0
	Subtest 3	4132	826.4	0.5	21.9
		4183	836.6	0.5	21.9
		4233	846.6	0.5	21.9
	Subtest 4	4132	826.4	0.5	21.9
		4183	836.6	0.5	21.9
		4233	846.6	0.5	21.9
W-CDMA Band II	Subtest 1	9262	1852.4	0	21.3
		9400	1880.0	0	21.3
		9538	1907.6	0	21.4
	Subtest 2	9262	1852.4	0	21.0
		9400	1880.0	0	21.0
		9538	1907.6	0	21.0
	Subtest 3	9262	1852.4	0.5	20.8
		9400	1880.0	0.5	20.8
		9538	1907.6	0.5	20.9
	Subtest 4	9262	1852.4	0.5	20.8
		9400	1880.0	0.5	20.8
		9538	1907.6	0.5	20.9

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

HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

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

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	21.6
		4183	836.6	0	21.7
		4233	846.6	0	21.5
	Subtest 2	4132	826.4	2	20.3
		4183	836.6	2	20.8
		4233	846.6	2	20.3
	Subtest 3	4132	826.4	1	20.8
		4183	836.6	1	20.5
		4233	846.6	1	20.7
	Subtest 4	4132	826.4	2	21.0
		4183	836.6	2	21.0
		4233	846.6	2	20.9
	Subtest 5	4132	826.4	0	21.9
		4183	836.6	0	21.9
		4233	846.6	0	21.8
W-CDMA Band II	Subtest 1	9262	1852.4	0	20.6
		9400	1880.0	0	21.1
		9538	1907.6	0	21.1
	Subtest 2	9262	1852.4	2	20.2
		9400	1880.0	2	19.9
		9538	1907.6	2	20.2
	Subtest 3	9262	1852.4	1	20.3
		9400	1880.0	1	20.0
		9538	1907.6	1	20.4
	Subtest 4	9262	1852.4	2	20.5
		9400	1880.0	2	20.5
		9538	1907.6	2	20.5
	Subtest 5	9262	1852.4	0	21.3
		9400	1880.0	0	21.3
		9538	1907.6	0	21.4

HSPA+

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

8.3. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1 [#]	√	▽
		2.437	6	√	▽
		2.462	11 [#]	√	▽

Notes:

√ = "default test channels"

▽ = possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"

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

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4 (DTS)	802.11b	1 Mbps	1	2412	16.0	Yes
			6	2437	16.2	
			11	2462	15.9	
	802.11g	6 Mbps	1	2412	13.9	No
			6	2437	14.2	
			11	2462	14.0	
	802.11n (HT20)	MCS0	1	2412	12.9	No
			6	2437	13.2	
			11	2462	12.9	

Note(s):

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

Power measurements to determine worst-case data rates

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

8.4. Wi-Fi (5 GHz Bands)

Required Test Channels per KDB 248227 D01

Mode		Band	GHz	Channel	"Default Test Channels"	
					802.11a	
802.11a	UNII (15.407)	5.2 GHz	5.180	36	√	
			5.200	40		*
			2.220	44		*
			5.240	48	√	
		5.3 GHz	5.260	52	√	
			5.280	56		*
			5.300	60		*
			5.320	64	√	
		5.5 GHz	5.500	100		
			5.520	104	√	
			5.540	108		*
			5.560	112		*
			5.580	116	√	
			5.600	120		*
			5.620	124	√	
			5.640	128		*
			5.660	132		*
			5.680	136	√	
			5.700	140		*
	DTS (15.247)	5.8 GHz	5.745	149	√	
			5.765	153		*
			5.785	157	√	
			5.805	161		*
			5.825	165	√	

√ = "default test channels"

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

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

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
5.2 (U-NII-1)	802.11a	6 Mbps	36	5180	12.5	Yes
			40	5200	12.2	
			44	5220	12.2	
			48	5240	12.5	
	802.11n (HT20)	MCS0	36	5180	12.3	No
			40	5200	12.2	
			48	5240	12.0	
	802.11n (HT40)	MCS0	38	5190	12.1	No
			46	5230	12.0	
	802.11ac (VHT20)	MCS0	36	5180	11.2	No
			40	5200	11.2	
	802.11ac (VHT40)	MCS0	38	5190	10.9	No
			46	5230	11.0	
5.3 (U-NII-2A)	802.11a	6 Mbps	52	5260	12.5	Yes
			56	5280	12.5	
			60	5300	12.5	
			64	5320	12.5	
	802.11n (HT20)	MCS0	52	5260	12.5	No
			60	5300	12.5	
			64	5320	12.5	
	802.11n (HT40)	MCS0	54	5270	12.0	No
			62	5310	12.0	
	802.11ac (VHT20)	MCS0	52	5260	11.5	No
			60	5300	11.4	
			64	5320	11.4	
	802.11ac (VHT40)	MCS0	54	5270	11.0	No
			62	5310	10.9	

Wi-Fi (5 GHz Bands) Measured Results (continued)

Band (GHz)	Mode	Mode	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
5.5 (U-NII-2C)	802.11a	6 Mbps	100	5500	12.0	Yes
			104	5520	12.0	
			108	5540	11.9	
			112	5560	11.9	
			116	5580	11.9	
			120	5600	11.7	
			124	5620	11.7	
			128	5640	11.6	
			132	5660	12.5	
			136	5680	12.1	
			140	5700	12.3	
	802.11n (HT20)	MCS0	100	5500	12.0	No
			116	5580	11.8	
			140	5700	12.3	
	802.11n (HT40)	MCS0	102	5510	12.1	No
			110	5550	12.0	
			134	5670	11.6	
	802.11ac (VHT20)	MCS0	100	5500	11.5	No
			116	5580	11.2	
			140	5700	10.8	
	802.11ac (VHT40)	MCS0	102	5510	10.8	No
			110	5550	10.7	
			134	5670	10.9	
5.8 (U-NII-3)	802.11a	6 Mbps	149	5745	11.9	Yes
			153	5765	11.6	
			157	5785	11.6	
			161	5805	12.5	
			165	5825	12.5	
			165	5825	12.5	
	802.11n (HT20)	MCS0	149	5745	11.9	No
			157	5785	11.6	
			161	5805	12.5	
	802.11n (HT40)	MCS0	151	5755	11.7	No
			159	5795	11.5	
			159	5795	11.5	
	802.11ac (VHT20)	MCS0	149	5745	11.5	No
			157	5785	11.5	
			165	5825	11.5	
	802.11ac (VHT40)	MCS0	151	5755	11.5	No
			159	5795	11.5	

Note(s):

Per KDB 248227, SAR is not required for 802.11n HT20/HT40 and 802.11ac VHT40/VHT80 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels.

Power measurements to determine worst-case data rates

Band	Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
5.2 GHz (U-NII-1)	802.11a	36	5180	6 Mbps	12.5	Yes
				9 Mbps	12.4	No
				12 Mbps	12.4	No
				18 Mbps	12.4	No
				24 Mbps	12.4	No
				36 Mbps	12.4	No
				48 Mbps	12.5	No
				54 Mbps	12.5	No
5.3 GHz (U-NII-2A)	802.11a	52	5260	6 Mbps	12.5	Yes
				9 Mbps	12.5	No
				12 Mbps	12.5	No
				18 Mbps	12.5	No
				24 Mbps	12.5	No
				36 Mbps	12.5	No
				48 Mbps	12.5	No
				54 Mbps	12.5	No
5.5 GHz (U-NII-2C)	802.11a	132	5660	6 Mbps	12.5	Yes
				9 Mbps	12.5	No
				12 Mbps	12.5	No
				18 Mbps	12.5	No
				24 Mbps	12.5	No
				36 Mbps	12.5	No
				48 Mbps	12.5	No
				54 Mbps	12.5	No
5.8 GHz (U-NII-3)	802.11a	165	5825	6 Mbps	12.5	Yes
				9 Mbps	12.4	No
				12 Mbps	12.5	No
				18 Mbps	12.5	No
				24 Mbps	12.5	No
				36 Mbps	12.5	No
				48 Mbps	12.5	No
				54 Mbps	12.5	No

8.5. Bluetooth

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

9. Dielectric Property Measurements

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

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

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

9.1. Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

IEEE Std 1528-2013

Refer to Table 3 within IEE Std 1528-2013

9.2. Dielectric Property Measurements Results

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

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

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

SAR Lab 2

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
7/30/2014	Body 1900	e'	50.9800	Relative Permittivity (ε _r):	50.98	53.30	-4.35	5
		e"	14.3400	Conductivity (σ):	1.51	1.52	-0.33	5
	Body 1850	e'	51.1800	Relative Permittivity (ε _r):	51.18	53.30	-3.98	5
		e"	14.1500	Conductivity (σ):	1.46	1.52	-4.24	5
	Body 1910	e'	50.9500	Relative Permittivity (ε _r):	50.95	53.30	-4.41	5
		e"	14.3700	Conductivity (σ):	1.53	1.52	0.40	5
7/30/2014	Head 1900	e'	39.0400	Relative Permittivity (ε _r):	39.04	40.00	-2.40	5
		e"	13.3300	Conductivity (σ):	1.41	1.40	0.59	5
	Head 1850	e'	39.2700	Relative Permittivity (ε _r):	39.27	40.00	-1.82	5
		e"	13.2000	Conductivity (σ):	1.36	1.40	-3.01	5
	Head 1910	e'	38.9900	Relative Permittivity (ε _r):	38.99	40.00	-2.53	5
		e"	13.3600	Conductivity (σ):	1.42	1.40	1.35	5
7/30/2014	Body 835	e'	53.8600	Relative Permittivity (ε _r):	53.86	55.20	-2.43	5
		e"	21.2900	Conductivity (σ):	0.99	0.97	1.90	5
	Body 820	e'	54.0400	Relative Permittivity (ε _r):	54.04	55.28	-2.24	5
		e"	21.4200	Conductivity (σ):	0.98	0.97	0.84	5
	Body 850	e'	53.6800	Relative Permittivity (ε _r):	53.68	55.16	-2.68	5
		e"	21.2300	Conductivity (σ):	1.00	0.99	1.65	5
7/30/2014	Head 835	e'	39.9000	Relative Permittivity (ε _r):	39.90	41.50	-3.86	5
		e"	19.1400	Conductivity (σ):	0.89	0.90	-1.26	5
	Head 820	e'	40.0700	Relative Permittivity (ε _r):	40.07	41.60	-3.68	5
		e"	19.1800	Conductivity (σ):	0.87	0.90	-2.67	5
	Head 850	e'	39.7100	Relative Permittivity (ε _r):	39.71	41.50	-4.31	5
		e"	19.0900	Conductivity (σ):	0.90	0.92	-1.39	5
8/5/2014	Body 835	e'	52.8800	Relative Permittivity (ε _r):	52.88	55.20	-4.20	5
		e"	21.7800	Conductivity (σ):	1.01	0.97	4.25	5
	Body 820	e'	53.1700	Relative Permittivity (ε _r):	53.17	55.28	-3.81	5
		e"	21.8800	Conductivity (σ):	1.00	0.97	3.01	5
	Body 850	e'	53.0200	Relative Permittivity (ε _r):	53.02	55.16	-3.87	5
		e"	21.8400	Conductivity (σ):	1.03	0.99	4.57	5
8/5/2014	Head 835	e'	43.4200	Relative Permittivity (ε _r):	43.42	41.50	4.63	5
		e"	20.1500	Conductivity (σ):	0.94	0.90	3.95	5
	Head 820	e'	43.5500	Relative Permittivity (ε _r):	43.55	41.60	4.68	5
		e"	20.1500	Conductivity (σ):	0.92	0.90	2.26	5
	Head 850	e'	43.2800	Relative Permittivity (ε _r):	43.28	41.50	4.29	5
		e"	20.0800	Conductivity (σ):	0.95	0.92	3.72	5

SAR Lab 2 (continued)

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/4/2014	Body 1900	e'	52.0600	Relative Permittivity (ϵ_r):	52.06	53.30	-2.33	5
		e''	14.4100	Conductivity (σ):	1.52	1.52	0.16	5
	Body 1850	e'	52.2500	Relative Permittivity (ϵ_r):	52.25	53.30	-1.97	5
		e''	14.3100	Conductivity (σ):	1.47	1.52	-3.16	5
	Body 1910	e'	52.0200	Relative Permittivity (ϵ_r):	52.02	53.30	-2.40	5
		e''	14.4300	Conductivity (σ):	1.53	1.52	0.82	5
8/5/2014	Head 1900	e'	39.0300	Relative Permittivity (ϵ_r):	39.03	40.00	-2.43	5
		e''	13.8200	Conductivity (σ):	1.46	1.40	4.29	5
	Head 1850	e'	39.2500	Relative Permittivity (ϵ_r):	39.25	40.00	-1.88	5
		e''	13.7200	Conductivity (σ):	1.41	1.40	0.81	5
	Head 1910	e'	38.9800	Relative Permittivity (ϵ_r):	38.98	40.00	-2.55	5
		e''	13.8200	Conductivity (σ):	1.47	1.40	4.84	5
8/7/2014	Head 5180	e'	36.8400	Relative Permittivity (ϵ_r):	36.84	36.01	2.30	5
		e''	16.3200	Conductivity (σ):	4.70	4.63	1.51	5
	Head 5200	e'	36.8000	Relative Permittivity (ϵ_r):	36.80	35.99	2.25	5
		e''	16.3400	Conductivity (σ):	4.72	4.65	1.58	5
	Head 5600	e'	36.2200	Relative Permittivity (ϵ_r):	36.22	35.53	1.93	5
		e''	16.5000	Conductivity (σ):	5.14	5.06	1.53	5
	Head 5800	e'	35.9600	Relative Permittivity (ϵ_r):	35.96	35.30	1.87	5
		e''	16.5700	Conductivity (σ):	5.34	5.27	1.40	5
	Head 5825	e'	35.9100	Relative Permittivity (ϵ_r):	35.91	35.30	1.73	5
		e''	16.6000	Conductivity (σ):	5.38	5.27	2.02	5
8/7/2014	Body 5180	e'	48.4000	Relative Permittivity (ϵ_r):	48.40	49.05	-1.32	5
		e''	18.5800	Conductivity (σ):	5.35	5.27	1.52	5
	Body 5200	e'	48.3100	Relative Permittivity (ϵ_r):	48.31	49.02	-1.45	5
		e''	18.6000	Conductivity (σ):	5.38	5.29	1.57	5
	Body 5600	e'	47.3800	Relative Permittivity (ϵ_r):	47.38	48.48	-2.26	5
		e''	18.9600	Conductivity (σ):	5.90	5.76	2.48	5
	Body 5800	e'	47.2100	Relative Permittivity (ϵ_r):	47.21	48.20	-2.05	5
		e''	19.2100	Conductivity (σ):	6.20	6.00	3.25	5
	Body 5825	e'	47.1700	Relative Permittivity (ϵ_r):	47.17	48.20	-2.14	5
		e''	19.1900	Conductivity (σ):	6.22	6.00	3.59	5
8/11/2014	Body 5180	e'	47.9900	Relative Permittivity (ϵ_r):	47.99	49.05	-2.15	5
		e''	18.4600	Conductivity (σ):	5.32	5.27	0.86	5
	Body 5200	e'	47.9400	Relative Permittivity (ϵ_r):	47.94	49.02	-2.20	5
		e''	18.4900	Conductivity (σ):	5.35	5.29	0.97	5
	Body 5600	e'	47.2900	Relative Permittivity (ϵ_r):	47.29	48.48	-2.45	5
		e''	18.8500	Conductivity (σ):	5.87	5.76	1.88	5
	Body 5800	e'	46.9700	Relative Permittivity (ϵ_r):	46.97	48.20	-2.55	5
		e''	19.0600	Conductivity (σ):	6.15	6.00	2.45	5
	Body 5825	e'	46.9400	Relative Permittivity (ϵ_r):	46.94	48.20	-2.61	5
		e''	19.0800	Conductivity (σ):	6.18	6.00	3.00	5
8/12/2014	Head 2450	e'	37.7600	Relative Permittivity (ϵ_r):	37.76	39.20	-3.67	5
		e''	13.8100	Conductivity (σ):	1.88	1.80	4.52	5
	Head 2410	e'	37.9300	Relative Permittivity (ϵ_r):	37.93	39.28	-3.43	5
		e''	13.7200	Conductivity (σ):	1.84	1.76	4.44	5
	Head 2475	e'	37.6700	Relative Permittivity (ϵ_r):	37.67	39.17	-3.83	5
		e''	13.8900	Conductivity (σ):	1.91	1.83	4.62	5
8/12/2014	Body 2450	e'	50.4500	Relative Permittivity (ϵ_r):	50.45	52.70	-4.27	5
		e''	14.7300	Conductivity (σ):	2.01	1.95	2.90	5
	Body 2410	e'	50.5700	Relative Permittivity (ϵ_r):	50.57	52.76	-4.15	5
		e''	14.6500	Conductivity (σ):	1.96	1.91	2.92	5
	Body 2475	e'	50.3500	Relative Permittivity (ϵ_r):	50.35	52.67	-4.40	5
		e''	14.7800	Conductivity (σ):	2.03	1.99	2.46	5

SAR Lab 2 (continued)

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/13/2014	Head 5180	e'	36.6300	Relative Permittivity (ϵ_r):	36.63	36.01	1.71	5
		e"	15.7100	Conductivity (σ):	4.52	4.63	-2.28	5
	Head 5200	e'	36.6000	Relative Permittivity (ϵ_r):	36.60	35.99	1.69	5
		e"	15.7200	Conductivity (σ):	4.55	4.65	-2.27	5
	Head 5600	e'	36.0800	Relative Permittivity (ϵ_r):	36.08	35.53	1.54	5
		e"	15.8300	Conductivity (σ):	4.93	5.06	-2.59	5
	Head 5800	e'	35.8300	Relative Permittivity (ϵ_r):	35.83	35.30	1.50	5
		e"	15.9000	Conductivity (σ):	5.13	5.27	-2.70	5
Head 5825	e'	35.7900	Relative Permittivity (ϵ_r):	35.79	35.30	1.39	5	
	e"	15.9100	Conductivity (σ):	5.15	5.27	-2.22	5	
8/20/2014	Body 5180	e'	47.5100	Relative Permittivity (ϵ_r):	47.51	49.05	-3.13	5
		e"	18.3600	Conductivity (σ):	5.29	5.27	0.32	5
	Body 5200	e'	47.4800	Relative Permittivity (ϵ_r):	47.48	49.02	-3.14	5
		e"	18.3900	Conductivity (σ):	5.32	5.29	0.43	5
	Body 5600	e'	46.8100	Relative Permittivity (ϵ_r):	46.81	48.48	-3.44	5
		e"	18.7000	Conductivity (σ):	5.82	5.76	1.07	5
	Body 5800	e'	46.4800	Relative Permittivity (ϵ_r):	46.48	48.20	-3.57	5
		e"	18.8500	Conductivity (σ):	6.08	6.00	1.32	5
Body 5825	e'	46.4600	Relative Permittivity (ϵ_r):	46.46	48.20	-3.61	5	
	e"	18.9100	Conductivity (σ):	6.12	6.00	2.08	5	

10. System Check

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

10.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 $\pm$ 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 $\geq$ 15.0 cm for SAR measurements $\leq$ 3 GHz and $\geq$ 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.

10.2. Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d002	11/15/2013	835	1g	9.49	9.43
				10g	6.18	6.21
D1900V2	5d043	11/12/2013	1900	1g	40.10	39.0
				10g	21.10	20.8
D2450V2	899	9/10/2013	2450	1g	51.30	49.7
				10g	23.90	23.3
D5GHzV2	1138	11/19/2013	5200	1g	78.50	72.9
				10g	22.50	20.4
			5600	1g	82.70	78.3
				10g	23.50	21.7
			5800	1g	78.30	72.8
				10g	22.40	20.1

10.3. 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 2

Date Tested	System Dipole		T.S. Liquid		Measured Results			Target (Ref. Value)	Delta $\pm 10\%$	Est./Zoom Ratio	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
7/30/2014	D1900V2	5d043	Body	1g	3.84	3.85	38.5	39.00	-1.28	-0.26	
				10g	1.97	2.05	20.5	20.80	-1.44		
7/30/2014	D1900V2	5d043	Head	1g	3.89	3.74	37.4	40.10	-6.73	3.86	1,2
				10g	2.03	1.97	19.7	21.10	-6.64		
7/30/2014	D835V2	4d002	Body	1g	0.92	0.91	9.1	9.43	-3.29	1.19	
				10g	0.62	0.62	6.2	6.21	-0.81		
7/30/2014	D835V2	4d002	Head	1g	0.914	0.902	9.0	9.49	-4.95	1.31	3,4
				10g	0.621	0.608	6.1	6.18	-1.62		
8/5/2014	D835V2	4d002	Body	1g	0.96	0.95	9.5	9.43	0.21	1.05	
				10g	0.65	0.64	6.4	6.21	2.74		
8/5/2014	D835V2	4d002	Head	1g	0.94	0.93	9.3	9.49	-2.42	1.91	
				10g	0.64	0.63	6.3	6.18	1.13		
8/5/2014	D1900V2	5d043	Body	1g	3.77	3.80	38.0	39.00	-2.56	-0.80	
				10g	1.93	2.04	20.4	20.80	-1.92		
8/5/2014	D1900V2	5d043	Head	1g	4.09	3.98	39.8	40.10	-0.75	2.69	
				10g	2.15	2.13	21.3	21.10	0.95		
8/7/2014	D5.2GHzV2	1138	Head	1g	6.83	7.49	74.9	78.50	-4.59	-9.66	
				10g	1.96	2.28	22.8	22.50	1.33		
8/7/2014	D5.6GHzV2	1138	Head	1g	6.93	7.80	78.0	82.70	-5.68	-12.55	
				10g	1.99	2.39	23.9	23.50	1.70		
8/7/2014	D5.8GHzV2	1138	Head	1g	6.62	7.57	75.7	78.30	-3.32	-14.35	
				10g	1.89	2.30	23.0	22.40	2.68		
8/7/2014	D5.2GHzV2	1138	Body	1g	6.38	6.86	68.6	72.9	-5.90	-7.52	
				10g	1.79	2.09	20.9	20.4	2.45		
8/7/2014	D5.6GHzV2	1138	Body	1g	6.82	7.34	73.4	78.3	-6.26	-7.62	
				10g	1.92	2.23	22.3	21.7	2.76		
8/7/2014	D5.8GHzV2	1138	Body	1g	6.37	7.13	71.3	72.8	-2.06	-11.93	
				10g	1.81	2.18	21.8	20.1	8.46		
8/11/2014	D5.2GHzV2	1138	Body	1g	6.51	7.18	71.8	72.9	-1.51	-10.29	
				10g	1.82	2.21	22.1	20.4	8.33		
8/11/2014	D5.6GHzV2	1138	Body	1g	6.51	7.30	73.0	78.3	-6.77	-12.14	
				10g	1.81	2.26	22.6	21.7	4.15		
8/11/2014	D5.8GHzV2	1138	Body	1g	5.97	6.86	68.9	72.8	-5.41	-14.91	
				10g	1.69	2.12	21.2	20.1	5.47		
8/12/2014	D2450V2	899	Head	1g	5.21	5.24	52.4	51.30	2.14	-0.58	5,6
				10g	2.27	2.51	25.1	23.90	5.02		
8/12/2014	D2450V2	899	Body	1g	4.85	4.94	49.4	49.7	-0.60	-1.86	
				10g	2.13	2.43	24.3	23.3	4.29		
8/13/2014	D5.2GHzV2	1138	Head	1g	6.54	7.38	73.8	78.50	-5.99	-12.84	
				10g	1.87	2.31	23.1	22.50	2.67		
8/13/2014	D5.6GHzV2	1138	Head	1g	6.50	7.47	74.7	82.70	-9.67	-14.92	7,8
				10g	1.86	2.35	23.5	23.50	0.00		
8/13/2014	D5.8GHzV2	1138	Head	1g	6.10	7.18	71.8	78.30	-8.30	-17.70	
				10g	1.74	2.24	22.4	22.40	0.00		
8/21/2014	D5.2GHzV2	1138	Body	1g	5.87	6.97	69.70	72.9	-4.39	-18.74	
				10g	1.63	2.21	22.10	20.4	8.33		

11. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

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

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

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 941225 D01 SAR test for 3G devices:

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

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

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

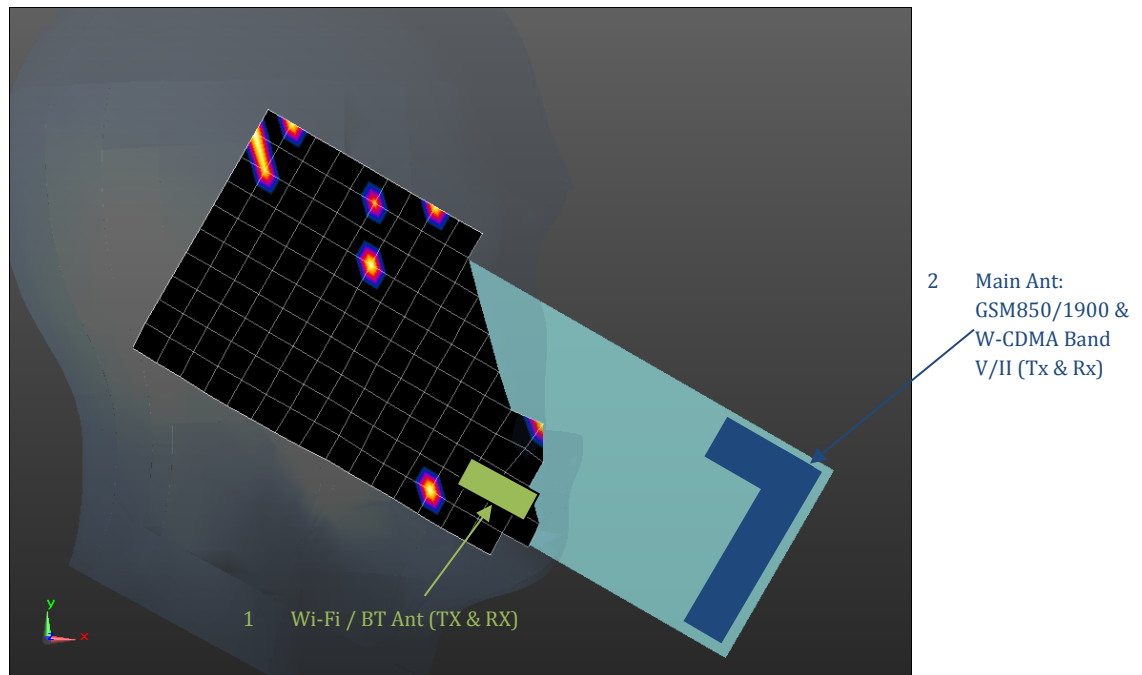
When the extrapolated maximum peak SAR for the maximum output channel is ≤ 1.6 W/kg and the 1-g averaged SAR is ≤ 0.8 W/kg, testing of other channels in the "default test channels" or "required test channels" configuration is optional.

April 2013 TCB Workshop Updates:

Apply usual 802.11 test exclusion considerations, but include 802.11ac SAR for highest 802.11a configuration in each frequency band and each exposure condition.

Justification for using Flat Phantom Measuring Head SAR

Due to the EUT with antenna located near the bottom and lower side edges near the mouth and jaw regions. The following head SAR plot is provided to show the measurements with truncated SAR distributions in the head measured with the SAM Phantom.



The following procedure was applied (KDB 648474 D04 Handset SAR v01r01):

- The phone was positioned with a separation distance of <4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell.
- While maintaining this distance at the ERP location of the phone, the low (bottom) edge of the phone is lowered from the phantom to establish the same separation distance at the peak SAR location identified by the truncated partial SAR distribution measured with the SAM phantom.
- The distance from the peak SAR location to the phone should be determined by the straight line passing perpendicularly through the phantom surface.

11.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.5	33.3	0.020	0.021	
			Left Tilt	190	836.6	33.5	33.3	0.017	0.018	
			Right Touch	190	836.6	33.5	33.3	0.009	0.009	
			Right Tilt	190	836.6	33.5	33.3	0.015	0.016	
		10	Flat Phantom	190	836.6	33.5	33.3	0.189	0.198	1
Head VoIP	GPRS 3 Slots	0	Left Touch	190	836.6	30.0	29.4	0.066	0.076	
			Left Tilt	190	836.6	30.0	29.4	0.035	0.036	
			Right Touch	190	836.6	30.0	29.4	0.014	0.014	
			Right Tilt	190	836.6	30.0	29.4	0.016	0.016	
		10	Flat Phantom	190	836.6	30.0	29.4	0.260	0.299	2
Body-worn	Voice	10	Rear	190	836.6	33.5	33.3	0.224	0.235	3
			Front	190	836.6	33.5	33.3	0.088	0.092	
Body-worn & Hotspot	GPRS 3 Slots	10	Rear	190	836.6	30.0	29.4	0.302	0.347	4
Front			190	836.6	30.0	29.4	0.156	0.179		
Hotspot			Edge 2	190	836.6	30.0	29.4	0.107	0.123	
			Edge 3	190	836.6	30.0	29.4	0.104	0.119	
			Edge 4	190	836.6	30.0	29.4	0.249	0.286	

11.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880	31.5	30.6	0.058	0.071	
			Left Tilt	661	1880	31.5	30.6	0.064	0.079	
			Right Touch	661	1880	31.5	30.6	0.068	0.084	
			Right Tilt	661	1880	31.5	30.6	0.049	0.060	
		10	Flat Phantom	661	1880	31.5	30.6	0.422	0.519	5
Head VoIP	GPRS 2 Slots	0	Left Touch	661	1880	29	28.1	0.070	0.086	
			Left Tilt	661	1880	29	28.1	0.070	0.086	
			Right Touch	661	1880	29	28.1	0.081	0.100	
			Right Tilt	661	1880	29	28.1	0.060	0.074	
		10	Flat Phantom	661	1880	29	28.1	0.447	0.550	6
Body-worn	Voice	10	Rear	661	1880.0	31.5	30.6	0.515	0.634	7
			Front	661	1880.0	31.5	30.6	0.113	0.139	
Body-worn & Hotspot	GPRS 2 Slots	10	Rear	661	1880.0	29.0	28.1	0.584	0.718	8
Front			661	1880.0	29.0	28.1	0.134	0.165		
Hotspot			Edge 2	661	1880.0	29.0	28.1	0.083	0.102	
			Edge 3	661	1880.0	29.0	28.1	0.222	0.273	
			Edge 4	661	1880.0	29.0	28.1	0.259	0.319	

11.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.5	22.9	0.055	0.063	
			Left Tilt	4183	836.6	23.5	22.9	0.027	0.031	
			Right Touch	4183	836.6	23.5	22.9	0.062	0.071	
			Right Tilt	4183	836.6	23.5	22.9	0.029	0.033	
		10	Flat Phantom	4183	836.6	23.5	22.9	0.214	0.245	9
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	23.5	22.9	0.188	0.215	10
			Front	4183	836.6	23.5	22.9	0.090	0.103	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.5	22.9	0.044	0.050	
			Edge 3	4183	836.6	23.5	22.9	0.088	0.101	
			Edge 4	4183	836.6	23.5	22.9	0.166	0.190	

11.4. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	23.0	22.9	0.088	0.090	
			Left Tilt	9400	1880.0	23.0	22.9	0.084	0.086	
			Right Touch	9400	1880.0	23.0	22.9	0.104	0.106	
			Right Tilt	9400	1880.0	23.0	22.9	0.069	0.071	
		10	Flat Phantom	9400	1880.0	23.0	22.9	0.555	0.568	11
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	23.0	22.9	0.773	0.791	12
			Front	9400	1880.0	23.0	22.9	0.187	0.191	
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	23.0	22.9	0.085	0.087	
			Edge 3	9400	1880.0	23.0	22.9	0.159	0.163	
			Edge 4	9400	1880.0	23.0	22.9	0.299	0.306	

11.5. Wi-Fi (DTS Band)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
2.4 GHz	Head	802.11b 1 Mbps	0	Left Touch	6	2437.0	16.5	16.2	0.008	0.008	
				Left Tilt	6	2437.0	16.5	16.2	0.008	0.009	
				Right Touch	6	2437.0	16.5	16.2	0.009	0.009	
				Right Tilt	6	2437.0	16.5	16.2	0.008	0.009	
				Right Tilt	6	2437.0	16.5	16.2	0.009	0.010	
			10	Flat Phantom	6	2437.0	16.5	16.2	0.009	0.010	13
	Body-worn, Hotspot, & Wi-Fi Direct	802.11b 1 Mbps	10	Rear	6	2437.0	16.5	16.2	0.226	0.242	14
				Front	6	2437.0	16.5	16.2	0.012	0.013	
	Hotspot & Wi-Fi Direct	802.11b 1 Mbps	10	Edge 1	6	2437.0	16.5	16.2	0.018	0.019	
				Edge 2	6	2437.0	16.5	16.2	0.073	0.078	

11.6. Wi-Fi (UNII Band)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	
							Tune-up limit	Meas.	Meas.	Scaled		
5.2 GHz (U-NII-1)	Head	802.11a 6 Mbps	0	Left Touch	36	5180.0	12.5	12.5	0.020	0.020		
				Left Tilt	36	5180.0	12.5	12.5	0.026	0.026	15	
				Right Toch	36	5180.0	12.5	12.5	0.013	0.013		
				Right Tilt	36	5180.0	12.5	12.5	0.014	0.014		
	Body-worn	802.11a 6 Mbps	10	Rear	36	5180.0	12.5	12.5	0.810	0.810		
					48	5240.0	12.5	12.2	0.893	0.957	16	
				Front	36	5180.0	12.5	12.5	0.025	0.025		
Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	
							Tune-up limit	Meas.	Meas.	Scaled		
5.3 GHz (U-NII-2A)	Head	802.11a 6 Mbps	0	Lef Touch	52	5260.0	12.5	12.5	0.027	0.027		
				Left Tilt	52	5260.0	12.5	12.5	0.037	0.037	17	
				Right Touch	52	5260.0	12.5	12.5	0.013	0.013		
				Right Tilt	52	5260.0	12.5	12.5	0.024	0.024		
	Body-worn	802.11a 6 Mbps	10	Rear	52	5260.0	12.5	12.5	1.090	1.090	18	
					64	5320.0	12.5	12.5	1.000	1.000		
				Front	52	5260.0	12.5	12.5	0.031	0.031		
Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	
							Tune-up limit	Meas.	Meas.	Scaled		
5.5 GHz (U-NII-2C)	Head	802.11a 6 Mbps	0	Left Touch	132	5660.0	12.5	12.5	0.024	0.024		
				Left Tilt	132	5660.0	12.5	12.5	0.024	0.024	19	
				Right Touch	132	5660.0	12.5	12.5	0.010	0.010		
				Right Tilt	132	5660.0	12.5	12.5	0.018	0.018		
	Body-worn	802.11a 6 Mbps	10	Flat Phantom	132	5660.0	12.5	12.5	0.005	0.005		
				Rear	132	5660.0	12.5	12.5	0.677	0.677	20	
					Front	132	5660.0	12.5	12.5	0.025	0.025	
Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	
							Tune-up limit	Meas.	Meas.	Scaled		
5.8 GHz (U-NII-3)	Head	802.11a 6 Mbps	0	Left Touch	165	5825.0	12.5	12.5	0.024	0.024		
				Left Tilt	165	5825.0	12.5	12.5	0.031	0.031	21	
				Right Touch	165	5825.0	12.5	12.5	0.019	0.019		
				Right Tilt	165	5825.0	12.5	12.5	0.006	0.006		
	Body-worn, Hotspot & Wi-Fi Direct	802.11a 6 Mbps	10	Flat Phantom	165	5825.0	12.5	12.5	0.023	0.023		
				Rear	165	5825.0	12.5	12.5	0.588	0.588	22	
				Front	165	5825.0	12.5	12.5	0.019	0.019		
				Edge 1	165	5825.0	12.5	12.5	0.013	0.013		
					Edge 2	165	5825.0	12.5	12.5	0.217	0.217	

11.7. Bluetooth

11.7.1. Standalone SAR Test Exclusion Considerations

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

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

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

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

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
10.5	11	10	2.480	1.8

Conclusion:

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

11.7.2. Estimated SAR

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

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

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Rear/Front	11	10	2.480	0.231

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) & Wi-Fi Direct (W/kg)	Repeated SAR (Yes/No)
850	GSM 850		0.302		No
	WCDMA Band V				No
1900	GSM 1900				No
	WCDMA Band II		0.773		No
2400	Wi-Fi 802.11b/g/n		0.226		No
5200	Wi-Fi 802.11a/n/ac		0.893		Yes
5300	Wi-Fi 802.11a/n/ac		1.090		Yes
5500	Wi-Fi 802.11a/n/ac		0.677		No
5800	Wi-Fi 802.11a/n/ac		0.588		No

12.2. Repeated Measurement Results

Body-worn Accessory

Frequency band	Test Position	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
					Original	Repeated		
Wi-Fi 5.2GHz	Rear	802.11a 6 Mbps	48	5240.0	0.893	0.889	1.00	
Wi-Fi 5.3GHz	Rear	802.11a 6 Mbps	52	5260.0	1.090	1.090	1.00	

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.

13. Simultaneous Transmission SAR Analysis

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

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		① GSM1900	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.076	0.008		0.084	No
		① + ③	0.076	0.027		0.103	No
	Left Tilt	① + ②	0.036	0.009		0.045	No
		① + ③	0.036	0.037		0.073	No
	Right Touch	① + ②	0.014	0.009		0.023	No
		① + ③	0.014	0.019		0.033	No
	Right Tilt	① + ②	0.016	0.009		0.025	No
		① + ③	0.016	0.024		0.040	No
	Flat Phantom	① + ②	0.299	0.010		0.309	No
		① + ③	0.299	0.024		0.323	No
Body-worn Accessory, Hotspot, & Wi-Fi Direct	Rear	① + ②	0.347	0.242		0.589	No
		① + ③	0.347	1.090		1.437	No
		① + ④	0.347		0.231	0.578	No
	Front	① + ②	0.179	0.013		0.192	No
		① + ③	0.179	0.031		0.210	No
		① + ④	0.179		0.231	0.410	No
Hotspot & Wi-Fi Direct	Edge 1	②		0.019		0.019	No
		③		0.013		0.013	No
	Edge 2	① + ②	0.123	0.078		0.201	No
		① + ③	0.123	0.217		0.340	No
	Edge 3	①	0.119			0.119	No
	Edge 4	①	0.286			0.286	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.086	0.008			0.094	No
		① + ③	0.086		0.027		0.113	No
	Left Tilt	① + ②	0.086	0.009			0.095	No
		① + ③	0.086		0.037		0.123	No
	Right Touch	① + ②	0.100	0.009			0.109	No
		① + ③	0.100		0.019		0.119	No
	Right Tilt	① + ②	0.074	0.009			0.083	No
		① + ③	0.074		0.024		0.098	No
	Flat Phantom	① + ②	0.550	0.010			0.560	No
		① + ③	0.550		0.024		0.574	No
Body-worn Accessory, Hotspot, & Wi-Fi Direct	Rear	① + ②	0.718	0.242			0.961	No
		① + ③	0.718		1.090		1.808	Yes
		① + ④	0.718			0.231	0.949	No
	Front	① + ②	0.165	0.013			0.178	No
		① + ③	0.165		0.031		0.196	No
		① + ④	0.165			0.231	0.396	No
Hotspot & Wi-Fi Direct	Edge 1	②		0.019			0.019	No
		③			0.013		0.013	No
	Edge 2	① + ②	0.102	0.078			0.180	No
		① + ③	0.102		0.217		0.319	No
	Edge 3	①	0.273				0.273	No
	Edge 4	①	0.319				0.319	No

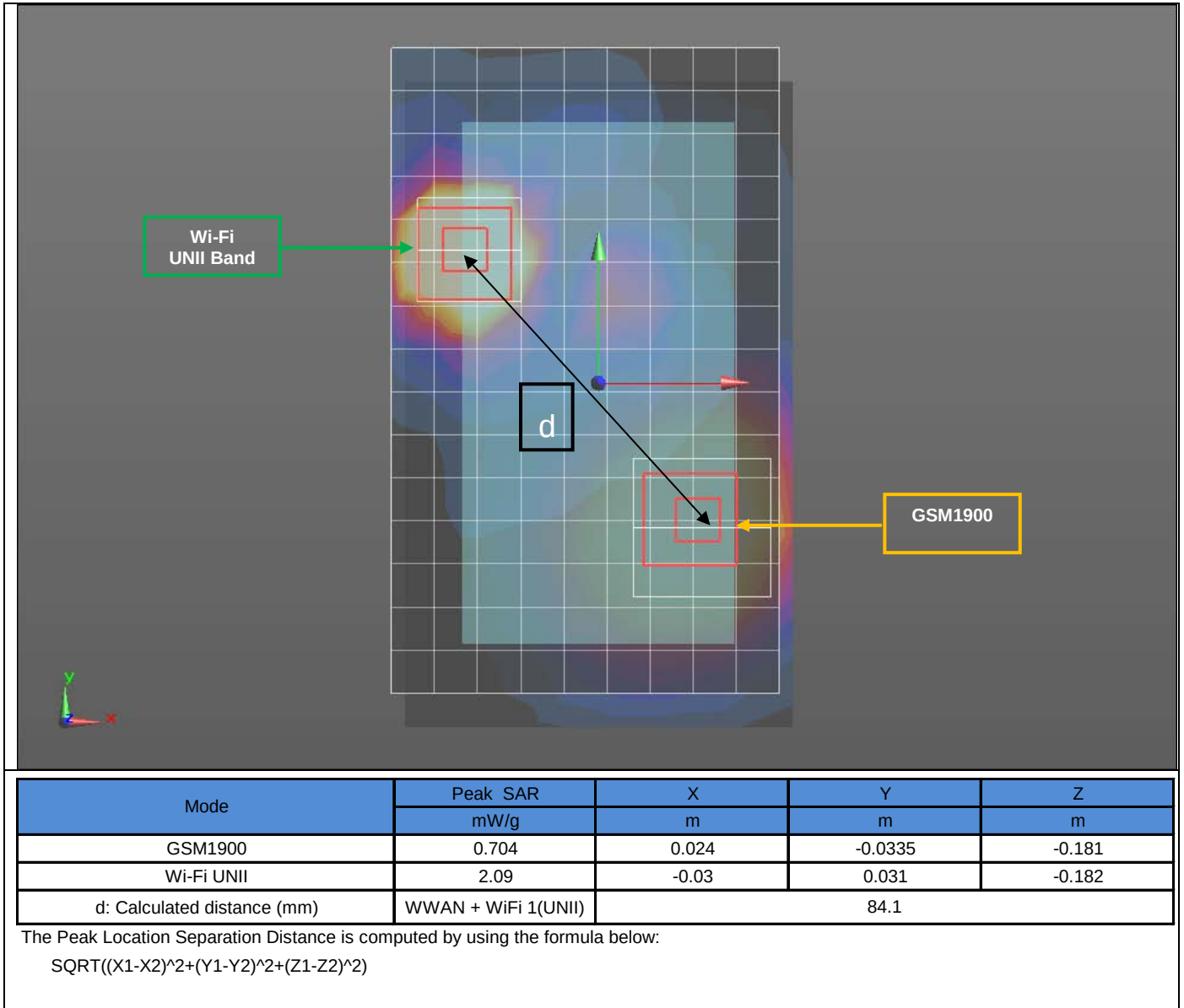
SAR to Peak Location Separation Ratio (SPLSR)

Case #	Test Position		Worst-case combination			Σ 1-g SAR (mW/g)	Calculated distance (mm)	SPLSR (≤ 0.04)
			① GSM1900	② Wi-Fi(DTS)	③ Wi-Fi(UNII)			
1	Rear	① + ③	0.718		1.090	1.808	84.1	0.029

Conclusion:

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

Figure (1)



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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.063	0.008			0.071	No
		① + ③	0.063		0.027		0.090	No
	Left Tilt	① + ②	0.031	0.009			0.040	No
		① + ③	0.031		0.037		0.068	No
	Right Touch	① + ②	0.071	0.009			0.080	No
		① + ③	0.071		0.019		0.090	No
	Right Tilt	① + ②	0.033	0.009			0.042	No
		① + ③	0.033		0.024		0.057	No
	Flat Phantom	① + ②	0.245	0.010			0.255	No
		① + ③	0.245		0.024		0.269	No
Body-worn Accessory, Hotspot, & Wi-Fi Direct	Rear	① + ②	0.215	0.242			0.458	No
		① + ③	0.215		1.090		1.305	No
		① + ④	0.215			0.231	0.446	No
	Front	① + ②	0.103	0.013			0.116	No
		① + ③	0.103		0.031		0.134	No
		① + ④	0.103			0.231	0.334	No
Hotspot & Wi-Fi Direct	Edge 1	②		0.019			0.019	No
		③			0.013		0.013	No
	Edge 2	① + ②	0.050	0.078			0.129	No
		① + ③	0.050		0.217		0.267	No
	Edge 3	①	0.101				0.101	No
	Edge 4	①	0.190				0.190	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.090	0.008			0.098	No
		① + ③	0.090		0.027		0.117	No
	Left Tilt	① + ②	0.086	0.009			0.094	No
		① + ③	0.086		0.037		0.122	No
	Right Touch	① + ②	0.106	0.009			0.116	No
		① + ③	0.106		0.019		0.125	No
	Right Tilt	① + ②	0.071	0.009			0.080	No
		① + ③	0.071		0.024		0.095	No
	Flat Phantom	① + ②	0.568	0.010			0.578	No
		① + ③	0.568		0.024		0.592	No
Body-worn Accessory, Hotspot, & Wi-Fi Direct	Rear	① + ②	0.791	0.242			1.033	No
		① + ③	0.791		1.090		1.881	Yes
		① + ④	0.791			0.231	1.022	No
	Front	① + ②	0.191	0.013			0.204	No
		① + ③	0.191		0.031		0.223	No
		① + ④	0.191			0.231	0.422	No
Hotspot & Wi-Fi Direct	Edge 1	②		0.019			0.019	No
		③			0.013		0.013	No
	Edge 2	① + ②	0.087	0.078			0.165	No
		① + ③	0.087		0.217		0.304	No
	Edge 3	①	0.163				0.163	No
	Edge 4	①	0.306				0.306	No

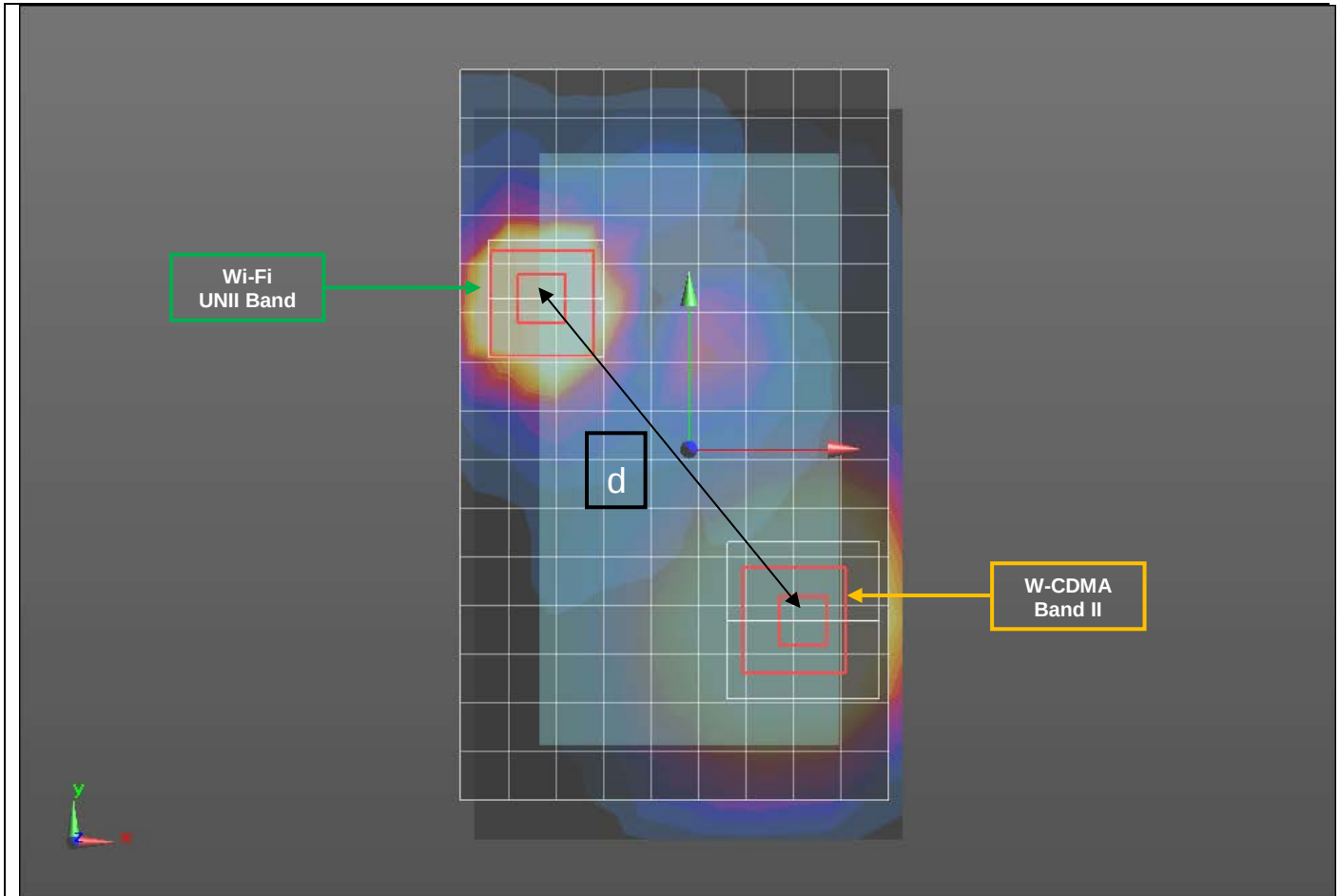
SAR to Peak Location Separation Ratio (SPLSR)

Case #	Test Position		Worst-case combination			Σ 1-g SAR (mW/g)	Calculated distance (mm)	SPLSR (≤ 0.04)
			① W-CDMA II	② Wi-Fi(DTS)	③ Wi-Fi(UNII)			
1	Rear	① + ③	0.791		1.090	1.881	85.3	0.030

Conclusion:

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

Figure (1)



Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
W-CDMA Band II	0.934	0.024	-0.035	-0.181
Wi-Fi UNII	2.09	-0.03	0.031	-0.182
d: Calculated distance (mm)	WWAN + WiFi 1(UNII)	85.3		

The Peak Location Separation Distance is computed by using the formula below:

$$\text{SQRT}((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)$$

14. Appendixes

Refer to separated files for the following appendixes.

- 14.1. Photos and Antenna Locations**
- 14.2. System Performance Check Plots**
- 14.3. Highest SAR Test Plots**
- 14.4. Calibration Certificate for E-Field Probe EX3DV3 - SN 3531**
- 14.5. Calibration Certificate for D835V2 - SN 4d002**
- 14.6. Calibration Certificate for D1900V2- SN 5d043**
- 14.7. Calibration Certificate for D2450V2 - SN 899**
- 14.8. Calibration Certificate for D5GHzV2 - SN 1138**
- 14.9. Tissue Material Ingredients**

END OF REPORT