



SAR EVALUATION REPORT

Applicant Name:

LG Electronics U.S.A., Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

Date of Testing:

02/11/19 – 03/06/19

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

1M1902110024-01-R1.ZNF

FCC ID:

ZNFX220TB

APPLICANT:

LG ELECTRONICS U.S.A., INC.

DUT Type:

Portable Handset

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093

Model:

LM-X220TB

Additional Model(s):

LMX220TB, X220TB, LM-X220MB, LMX220MB, X220MB

Equipment Class	Band & Mode	Tx Frequency	SAR		
			1g Head (W/kg)	1g Body-Worn (W/kg)	1g Hotspot (W/kg)
PCE	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	0.42	0.69	0.78
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.42	0.40	0.40
PCE	UMTS 850	826.40 - 846.60 MHz	0.47	0.76	0.76
PCE	UMTS 1750	1712.4 - 1752.6 MHz	0.58	0.79	0.93
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.60	0.72	0.72
PCE	LTE Band 71	665.5 - 695.5 MHz	0.30	0.42	0.42
PCE	LTE Band 12	699.7 - 715.3 MHz	0.51	0.74	0.74
PCE	LTE Band 26 (Cell)	814.7 - 848.3 MHz	0.57	0.77	0.77
PCE	LTE Band 5 (Cell)	824.7 - 848.3 MHz	N/A	N/A	N/A
PCE	LTE Band 66 (AWS)	1710.7 - 1779.3 MHz	0.58	0.93	1.09
PCE	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	N/A	N/A	N/A
PCE	LTE Band 25 (PCS)	1850.7 - 1914.3 MHz	0.57	0.58	0.67
PCE	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	N/A	N/A	N/A
DTS	2.4 GHz WLAN	2412 - 2462 MHz	1.20	0.47	0.47
NII	U-NII-1	5180 - 5240 MHz	1.26	N/A	0.85
NII	U-NII-2A	5260 - 5320 MHz	1.28	0.70	N/A
NII	U-NII-2C	5500 - 5700 MHz	1.15	0.72	N/A
NII	U-NII-3	5745 - 5825 MHz	1.13	0.69	0.70
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A	< 0.1	N/A
Simultaneous SAR per KDB 690783 D01v01r03:			1.58	1.58	1.59

Note: This revised Test Report (S/N: 1M1902110024-01-R1.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.7 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.


Randy Ortañez
President



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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.6 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 71	Voice/Data	665.5 - 695.5 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 26 (Cell)	Voice/Data	814.7 - 848.3 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 66 (AWS)	Voice/Data	1710.7 - 1779.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 25 (PCS)	Voice/Data	1850.7 - 1914.3 MHz
LTE Band 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2462 MHz
U-NII-1	Voice/Data	5180 - 5240 MHz
U-NII-2A	Voice/Data	5260 - 5320 MHz
U-NII-2C	Voice/Data	5500 - 5700 MHz
U-NII-3	Voice/Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz

1.2 Power Reduction for SAR

This device uses an independent fixed level power reduction mechanism for WLAN operations during voice or VoIP held to ear scenarios. Per FCC Guidance, the held-to-ear exposure conditions were evaluated at reduced power according to the head SAR positions described in IEEE 1528-2013. Detailed descriptions of the power reduction mechanism are included in the operational description.

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1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

1.3.1 Maximum Output Power

Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		1 TX Slot	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots
GSM/GPRS/EDGE 850	Maximum	33.7	33.7	31.7	29.7	27.7	26.7	25.7	24.7	23.7
	Nominal	33.2	33.2	31.2	29.2	27.2	26.2	25.2	24.2	23.2
GSM/GPRS/EDGE 1900	Maximum	30.7	30.7	28.7	26.7	25.7	26.7	25.7	24.7	23.7
	Nominal	30.2	30.2	28.2	26.2	25.2	26.2	25.2	24.2	23.2

Mode / Band		Modulated Average (dBm)		
		3GPP WCDMA	3GPP HSDPA	3GPP HSUPA
UMTS Band 5 (850 MHz)	Maximum	24.7	24.7	24.7
	Nominal	24.2	24.2	24.2
UMTS Band 4 (1750 MHz)	Maximum	24.7	24.7	24.7
	Nominal	24.2	24.2	24.2
UMTS Band 2 (1900 MHz)	Maximum	24.7	24.7	24.7
	Nominal	24.2	24.2	24.2

Mode / Band		Modulated Average (dBm)
LTE Band 71	Maximum	24.7
	Nominal	24.2
LTE Band 12	Maximum	24.7
	Nominal	24.2
LTE Band 26 (Cell)	Maximum	24.7
	Nominal	24.2
LTE Band 5 (Cell)	Maximum	24.7
	Nominal	24.2
LTE Band 66 (AWS)	Maximum	24.7
	Nominal	24.2
LTE Band 4 (AWS)	Maximum	24.7
	Nominal	24.2
LTE Band 25 (PCS)	Maximum	24.7
	Nominal	24.2
LTE Band 2 (PCS)	Maximum	24.7
	Nominal	24.2

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Mode / Band		Modulated Average (dBm)		
		Ch 1	Ch 2-10	Ch 11
IEEE 802.11b (2.4 GHz)	Maximum	19.0		
	Nominal	18.0		
IEEE 802.11g (2.4 GHz)	Maximum	16.0	17.0	15.0
	Nominal	15.0	16.0	14.0
IEEE 802.11n (2.4 GHz)	Maximum	15.5	16.5	14.5
	Nominal	14.5	15.5	13.5

Mode / Band		Modulated Average (dBm)
Bluetooth	Maximum	10.0
	Nominal	9.0
Bluetooth LE	Maximum	2.0
	Nominal	1.0

Mode / Band		Modulated Average (dBm)		
		20 MHz Bandwidth		40 MHz Bandwidth
		Ch 36, 64, 100, 161-165	Ch 40-60, 104-157	Ch. 38-159
IEEE 802.11a (5 GHz)	Maximum	14.5	16.0	
	Nominal	13.5	15.0	
IEEE 802.11n (5 GHz)	Maximum	14.5	16.0	12.0
	Nominal	13.5	15.0	11.0

1.3.2 Reduced Power

Mode / Band		Modulated Average (dBm)		
		Ch 1	Ch 2-10	Ch 11
IEEE 802.11b (2.4 GHz)	Maximum	16.0		
	Nominal	15.0		
IEEE 802.11g (2.4 GHz)	Maximum	15.0	16.0	14.0
	Nominal	14.0	15.0	13.0
IEEE 802.11n (2.4 GHz)	Maximum	15.0	16.0	14.0
	Nominal	14.0	15.0	13.0

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Mode / Band		Modulated Average (dBm)		
		20 MHz Bandwidth		40 MHz Bandwidth
		Ch 36, 64, 100, 161-165	Ch 40-60, 104-157	Ch. 38-159
IEEE 802.11a (5 GHz)	Maximum	11.0	12.5	
	Nominal	10.0	11.5	
IEEE 802.11n (5 GHz)	Maximum	11.0	12.5	12.0
	Nominal	10.0	11.5	11.0

1.4 DUT Antenna Locations

The overall dimensions of this device are > 9 x 5 cm. The overall diagonal dimension of the device is ≤160 mm and the diagonal display is ≤150 mm. A diagram showing the location of the device antennas can be found in Appendix F.

Table 1-1
Device Edges/Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	Yes	Yes
GPRS 1900	Yes	Yes	No	Yes	No	Yes
UMTS 850	Yes	Yes	No	Yes	Yes	Yes
UMTS 1750	Yes	Yes	No	Yes	No	Yes
UMTS 1900	Yes	Yes	No	Yes	No	Yes
LTE Band 71	Yes	Yes	No	Yes	Yes	Yes
LTE Band 12	Yes	Yes	No	Yes	Yes	Yes
LTE Band 26 (Cell)	Yes	Yes	No	Yes	Yes	Yes
LTE Band 66 (AWS)	Yes	Yes	No	Yes	No	Yes
LTE Band 25 (PCS)	Yes	Yes	No	Yes	No	Yes
2.4 GHz WLAN	Yes	Yes	Yes	No	Yes	No
5 GHz WLAN	Yes	Yes	Yes	No	Yes	No

Note: Particular DUT edges were not required to be evaluated for wireless router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v02r01 Section III. The distances between the transmit antennas and the edges of the device are included in the filing. When wireless router mode is enabled, U-NII-2A and U-NII-2C operations are disabled.

1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.

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Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Notes
1	GSM voice + 2.4 GHz Wi-Fi	Yes	Yes	N/A	
2	GSM voice + 5 GHz Wi-Fi	Yes	Yes	N/A	
3	GSM voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	
4	GSM voice + 2.4 GHz Bluetooth + 5 GHz Wi-Fi	N/A	Yes	N/A	
5	UMTS + 2.4 GHz Wi-Fi	Yes	Yes	Yes	
6	UMTS + 5 GHz Wi-Fi	Yes	Yes	Yes	
7	UMTS + 2.4 GHz Bluetooth	N/A	Yes	N/A	
8	UMTS + 2.4 GHz Bluetooth + 5 GHz Wi-Fi	N/A	Yes	N/A	
9	LTE + 2.4 GHz Wi-Fi	Yes	Yes	Yes	
10	LTE + 5 GHz Wi-Fi	Yes	Yes	Yes	
11	LTE + 2.4 GHz Bluetooth	N/A	Yes	N/A	
12	LTE + 2.4 GHz Bluetooth + 5 GHz Wi-Fi	N/A	Yes	N/A	
13	GPRS/EDGE + 2.4 GHz Wi-Fi	Yes*	Yes*	Yes	* Pre-installed VOIP applications are considered
14	GPRS/EDGE + 5 GHz Wi-Fi	Yes*	Yes*	Yes	* Pre-installed VOIP applications are considered
15	GPRS/EDGE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	* Pre-installed VOIP applications are considered
16	GPRS/EDGE + 2.4 GHz Bluetooth + 5 GHz Wi-Fi	N/A	Yes*	N/A	* Pre-installed VOIP applications are considered

- 2.4 GHz WLAN and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
- All licensed modes share the same antenna path and cannot transmit simultaneously.
- When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.
- Per the manufacturer, WIFI Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. There are no simultaneous transmission scenarios involving WIFI direct beyond that listed in the above table.
- 5 GHz Wireless Router is only supported for U-NII 1 & U-NII-3 by S/W, therefore U-NII2A and U-NII2C were not evaluated for wireless router conditions.
- This device supports VOLTE.
- This device supports VOWIFI.

1.6 Miscellaneous SAR Test Considerations

(A) WIFI/BT

Since U-NII-1 and U-NII-2A bands have the same maximum output power and the highest reported SAR for U-NII-2A is greater than 1.2 W/kg, SAR is required for U-NII-1 band according to FCC KDB Publication 248227 D01v02r02.

Since Wireless Router operations are not allowed by the chipset firmware using U-NII-2A and U-NII-2C WIFI, only 2.4 GHz, U-NII-1, and U-NII-3 WIFI Hotspot SAR tests and combinations are considered for SAR with respect to Wireless Router configurations according to FCC KDB 941225 D06v02r01.

(B) Licensed Transmitter(s)

GSM/GPRS/EDGE DTM is not supported for US bands. Therefore, the GSM Voice modes in this report do not transmit simultaneously with GPRS/EDGE Data.

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v03r01.

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LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth; and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02r04.

This device supports LTE capabilities with overlapping transmission frequency ranges. When the supported frequency range of an LTE Band falls completely within an LTE band with a larger transmission frequency range, both LTE bands have the same target power (or the band with the larger transmission frequency range has a higher target power), and both LTE bands share the same transmission path and signal characteristics, SAR was only assessed for the band with the larger transmission frequency range.

1.7 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01, D05v02r04, D05Av01r02, D06v02r01 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

1.8 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 11.

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2 LTE INFORMATION

LTE Information			
Form Factor	Portable Handset		
Frequency Range of each LTE transmission band	LTE Band 71 (665.5 - 695.5 MHz)		
	LTE Band 12 (699.7 - 715.3 MHz)		
	LTE Band 26 (Cell) (814.7 - 848.3 MHz)		
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)		
	LTE Band 66 (AWS) (1710.7 - 1779.3 MHz)		
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)		
	LTE Band 25 (PCS) (1850.7 - 1914.3 MHz)		
	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)		
Channel Bandwidths	LTE Band 71: 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 26 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz		
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 66 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20		
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20		
	LTE Band 25 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20		
	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 71: 5 MHz	665.5 (133147)	680.5 (133297)	695.5 (133447)
LTE Band 71: 10 MHz	668 (133172)	680.5 (133297)	693 (133422)
LTE Band 71: 15 MHz	670.5 (133197)	680.5 (133297)	690.5 (133397)
LTE Band 71: 20 MHz	673 (133222)	680.5 (133297)	688 (133372)
LTE Band 12: 1.4 MHz	699.7 (23017)	707.5 (23095)	715.3 (23173)
LTE Band 12: 3 MHz	700.5 (23025)	707.5 (23095)	714.5 (23165)
LTE Band 12: 5 MHz	701.5 (23035)	707.5 (23095)	713.5 (23155)
LTE Band 12: 10 MHz	704 (23060)	707.5 (23095)	711 (23130)
LTE Band 26 (Cell): 1.4 MHz	814.7 (26697)	831.5 (26865)	848.3 (27033)
LTE Band 26 (Cell): 3 MHz	815.5 (26705)	831.5 (26865)	847.5 (27025)
LTE Band 26 (Cell): 5 MHz	816.5 (26715)	831.5 (26865)	846.5 (27015)
LTE Band 26 (Cell): 10 MHz	819 (26740)	831.5 (26865)	844 (26990)
LTE Band 26 (Cell): 15 MHz	821.5 (26765)	831.5 (26865)	841.5 (26965)
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)	836.5 (20525)	848.3 (20643)
LTE Band 5 (Cell): 3 MHz	825.5 (20415)	836.5 (20525)	847.5 (20635)
LTE Band 5 (Cell): 5 MHz	826.5 (20425)	836.5 (20525)	846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829 (20450)	836.5 (20525)	844 (20600)
LTE Band 66 (AWS): 1.4 MHz	1710.7 (131979)	1745 (132322)	1779.3 (132665)
LTE Band 66 (AWS): 3 MHz	1711.5 (131987)	1745 (132322)	1778.5 (132657)
LTE Band 66 (AWS): 5 MHz	1712.5 (131997)	1745 (132322)	1777.5 (132647)
LTE Band 66 (AWS): 10 MHz	1715 (132022)	1745 (132322)	1775 (132622)
LTE Band 66 (AWS): 15 MHz	1717.5 (132047)	1745 (132322)	1772.5 (132597)
LTE Band 66 (AWS): 20 MHz	1720 (132072)	1745 (132322)	1770 (132572)
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)	1732.5 (20175)	1754.3 (20393)
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)	1732.5 (20175)	1753.5 (20385)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)	1732.5 (20175)	1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715 (20000)	1732.5 (20175)	1750 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)	1732.5 (20175)	1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720 (20050)	1732.5 (20175)	1745 (20300)
LTE Band 25 (PCS): 1.4 MHz	1850.7 (26047)	1882.5 (26365)	1914.3 (26683)
LTE Band 25 (PCS): 3 MHz	1851.5 (26055)	1882.5 (26365)	1913.5 (26675)
LTE Band 25 (PCS): 5 MHz	1852.5 (26065)	1882.5 (26365)	1912.5 (26665)
LTE Band 25 (PCS): 10 MHz	1855 (26090)	1882.5 (26365)	1910 (26640)
LTE Band 25 (PCS): 15 MHz	1857.5 (26115)	1882.5 (26365)	1907.5 (26615)
LTE Band 25 (PCS): 20 MHz	1860 (26140)	1882.5 (26365)	1905 (26590)
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)	1880 (18900)	1909.3 (19193)
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)	1880 (18900)	1908.5 (19185)
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)	1880 (18900)	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)	1880 (18900)	1905 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)	1880 (18900)	1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860 (18700)	1880 (18900)	1900 (19100)
UE Category	4		
Modulations Supported in UL	QPSK, 16QAM		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3-6.2.5? (manufacturer attestation to be provided)	YES		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		
LTE Carrier Aggregation Possible Combinations	The technical description includes all the possible carrier aggregation combinations		
LTE Additional Information	This device does not support full CA features on 3GPP Release 10. All uplink communications are identical to the Release 8 Specifications. The following LTE Release 10 features are not supported: Carrier Aggregation, Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.		

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3 INTRODUCTION

The FCC and Innovation, Science, and Economic Development Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

3.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 3-1).

Equation 3-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt} \left(\frac{dU}{dm} \right) = \frac{d}{dt} \left(\frac{dU}{\rho dv} \right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

- σ = conductivity of the tissue-simulating material (S/m)
- ρ = mass density of the tissue-simulating material (kg/m³)
- E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

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4.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 4-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 4-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
 - a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
 - b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
 - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

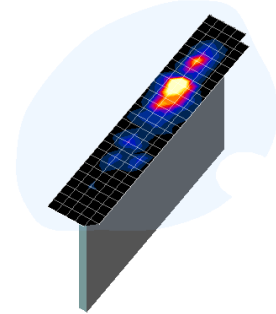


Figure 4-1
Sample SAR Area
Scan

Table 4-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area} , Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom} , Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x, y, z)
			Uniform Grid	Graded Grid		
				$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)^*$	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5* $\Delta z_{zoom}(n-1)$	≥ 22

*Also compliant to IEEE 1528-2013 Table 6

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5.1 EAR REFERENCE POINT

Figure 5-2 shows the front, back and side views of the SAM Twin Phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 5-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (see Figure 5-1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

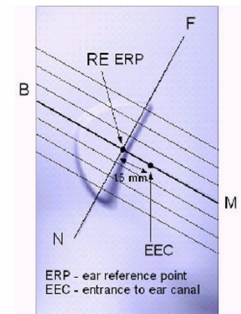


Figure 5-1
Close-Up Side view
of ERP

5.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the acoustic output located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Figure 5-3). The acoustic output was then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at its top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.

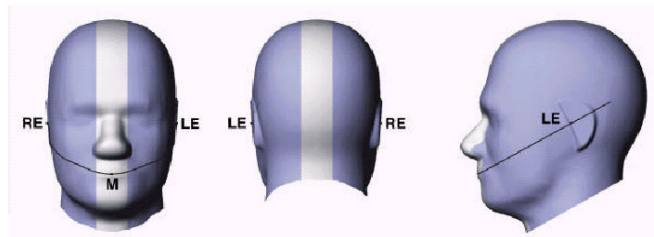


Figure 5-2
Front, back and side view of SAM Twin Phantom

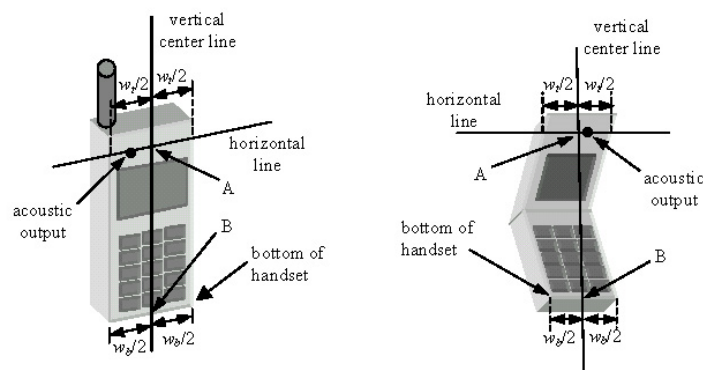


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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6 TEST CONFIGURATION POSITIONS

6.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$.

6.2 Positioning for Cheek

1. The test device was positioned with the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 6-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

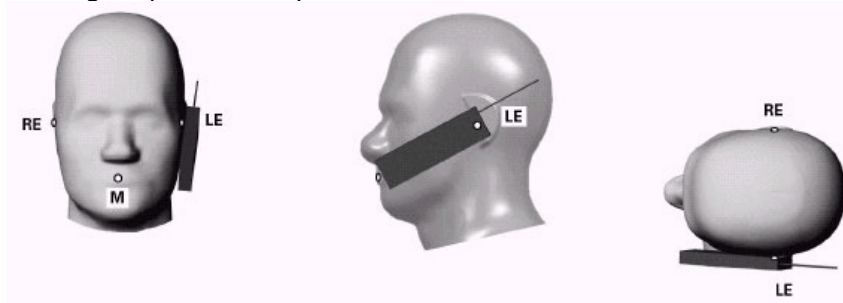


Figure 6-1 Front, Side and Top View of Cheek Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the reference plane.
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical with respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 6-2).

6.3 Positioning for Ear / 15° Tilt

With the test device aligned in the “Cheek Position”:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 6-2).

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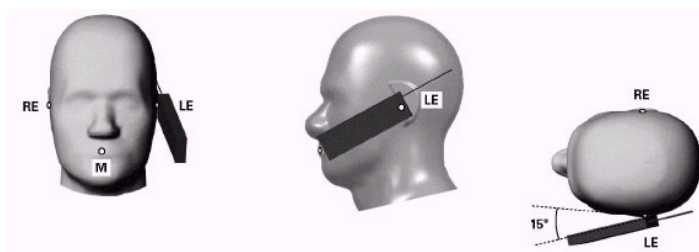


Figure 6-2 Front, Side and Top View of Ear/15° Tilt Position

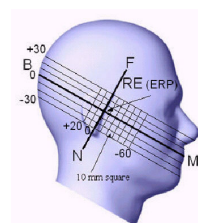


Figure 6-3 Side view w/ relevant markings

6.4 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. Per IEEE 1528-2013, a rotated SAM phantom is necessary to allow probe access to such regions. Both SAM heads of the TwinSAM-Chin20 are rotated 20 degrees around the NF line. Each head can be removed from the table for emptying and cleaning.

Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04v01r03. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be 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, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between 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 is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

6.5 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6-4). Per FCC KDB Publication 648474 D04v01r03, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a 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.

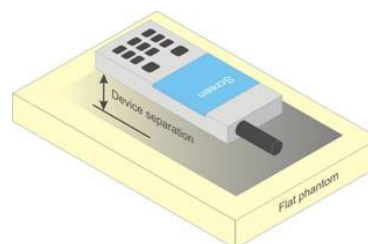


Figure 6-4 Sample Body-Worn Diagram

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not

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contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

6.6 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1g body and 10g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D01v06 should be applied to determine SAR test requirements.

Per KDB Publication 447498 D01v06, Cell phones (handsets) are not normally designed to be used on extremities or operated in extremity only exposure conditions. The maximum output power levels of handsets generally do not require extremity SAR testing to show compliance. Therefore, extremity SAR was not evaluated for this device.

6.7 Wireless Router Configurations

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06v02r01 where SAR test considerations for handsets ($L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

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7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

7.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 7-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT <i>General Population</i> (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT <i>Occupational</i> (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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8 FCC MEASUREMENT PROCEDURES

Power measurements for licensed transmitters are performed using a base station simulator under digital average power.

8.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

8.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01v03r01, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is ≤ 0.25 dB higher than the primary mode or when the highest reported SAR of the primary mode, scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode, is ≤ 1.2 W/kg, SAR measurements are not required for the secondary mode. These criteria are referred to as the 3G SAR test reduction procedure. When the 3G SAR test reduction procedure is not satisfied, SAR measurements are additionally required for the secondary mode.

8.3 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03r01 “3G SAR Measurement Procedures.”

The device is placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test are evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device is tested throughout the SAR test at maximum output power, the SAR measurement system measures a “point SAR” at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviates by more than 5%, the SAR test and drift measurements are repeated.

8.4 SAR Measurement Conditions for UMTS

8.4.1 Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC with TPC (transmit power control) set to all “1s” or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

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8.4.2 Head SAR Measurements

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

8.4.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all “1s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCH_n configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or DPDCH_n, for the highest reported SAR configuration in 12.2 kbps RMC.

8.4.4 SAR Measurements with Rel 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

8.4.5 SAR Measurements with Rel 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, 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 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA.

When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing.

8.5 SAR Measurement Conditions for LTE

LTE modes are tested according to FCC KDB 941225 D05v02r04 publication. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 or Anritsu MT8820C simulators are used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

8.5.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

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8.5.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

8.5.3 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

8.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r04:

- a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
 - i. The required channel and offset combination with the highest maximum output power is required for SAR.
 - ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
 - iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
- b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
- c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
- d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to $\frac{1}{2}$ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is < 1.45 W/kg.

8.5.5 Downlink Only Carrier Aggregation

Conducted power measurements with LTE Carrier Aggregation (CA) (downlink only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to specifications when downlink carrier aggregation is inactive on the PCC. Additional conducted output powers are measured with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band. Per FCC KDB Publication 941225 D05Av01r02, no SAR measurements are required for downlink only carrier aggregation configurations when the average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink only carrier aggregation inactive.

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8.6 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v02r02 for more details.

8.6.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

8.6.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg.

8.6.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification. Unless band gap channels are permanently disabled, SAR must be considered for these channels. Each band is tested independently according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

8.6.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.

8.6.5 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

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- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed.

8.6.6 OFDM Transmission Mode and SAR Test Channel Selection

When the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a, 802.11n and 802.11ac or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11n and 802.11ac or 802.11g then 802.11n, is used for SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

8.6.7 Initial Test Configuration Procedure

For OFDM, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order IEEE 802.11 mode. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements (See Section 8.6.6).

8.6.8 Subsequent Test Configuration Procedures

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is ≤ 1.2 W/kg, no additional SAR tests for the subsequent test configurations are required.

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9 RF CONDUCTED POWERS

9.1 GSM Conducted Powers

Table 9-1
Maximum Conducted Power

Maximum Burst-Averaged Output Power										
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 850	128	33.53	33.52	31.70	29.61	27.70	26.65	25.70	24.48	23.59
	190	33.70	33.38	31.68	29.58	27.62	26.49	25.70	24.46	23.53
	251	33.42	33.69	31.63	29.59	27.64	26.43	25.60	24.49	23.54
GSM 1900	512	30.58	30.67	28.63	26.52	25.57	26.70	25.58	24.70	23.70
	661	30.70	30.68	28.59	26.48	25.54	26.69	25.60	24.70	23.61
	810	30.44	30.65	28.58	26.41	25.53	26.67	25.65	24.56	23.61
Calculated Maximum Frame-Averaged Output Power										
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 850	128	24.50	24.49	25.68	25.35	24.69	17.62	19.68	20.22	20.58
	190	24.67	24.35	25.66	25.32	24.61	17.46	19.68	20.20	20.52
	251	24.39	24.66	25.61	25.33	24.63	17.40	19.58	20.23	20.53
GSM 1900	512	21.55	21.64	22.61	22.26	22.56	17.67	19.56	20.44	20.69
	661	21.67	21.65	22.57	22.22	22.53	17.66	19.58	20.44	20.60
	810	21.41	21.62	22.56	22.15	22.52	17.64	19.63	20.30	20.60
GSM 850	Frame	24.17	24.17	25.18	24.94	24.19	17.17	19.18	19.94	20.19
GSM 1900	Avg.Targets:	21.17	21.17	22.18	21.94	22.19	17.17	19.18	19.94	20.19

Note:

- Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
- GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
- EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

GSM Class: B
GPRS Multislot class: 12 (Max 4 Tx uplink slots)
EDGE Multislot class: 12 (Max 4 Tx uplink slots)
DTM Multislot Class: N/A

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Figure 9-1
Power Measurement Setup

9.2 UMTS Conducted Powers

Table 9-2
Maximum Conducted Power

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	1312	1412	1513	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	24.53	24.51	24.48	24.60	24.52	24.61	24.55	24.65	24.46	-
99		12.2 kbps AMR	24.46	24.38	24.55	24.63	24.56	24.58	24.53	24.61	24.45	-
6	HSDPA	Subtest 1	24.56	24.52	24.47	24.63	24.54	24.62	24.55	24.63	24.58	0
6		Subtest 2	24.52	24.46	24.48	24.51	24.52	24.56	24.49	24.58	24.45	0
6		Subtest 3	23.64	23.50	23.54	24.17	24.05	24.00	23.56	23.57	23.48	0.5
6		Subtest 4	23.59	23.52	23.58	24.14	24.01	24.05	23.52	23.63	23.51	0.5
6	HSUPA	Subtest 1	24.31	24.34	24.35	24.58	24.52	24.61	24.42	24.40	24.45	0
6		Subtest 2	22.69	22.64	22.53	22.64	22.61	22.51	22.61	22.51	22.61	2
6		Subtest 3	23.58	23.34	23.42	23.56	23.65	23.66	23.31	23.42	23.52	1
6		Subtest 4	22.64	22.61	22.33	22.60	22.57	22.61	22.56	22.47	22.61	2
6		Subtest 5	24.42	24.39	24.38	24.59	24.51	24.63	24.35	24.51	24.41	0

This device does not support DC-HSDPA.



Figure 9-2
Power Measurement Setup

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9.3 LTE Conducted Powers

9.3.1 LTE Band 71

Table 9-3
LTE Band 71 Conducted Powers - 20 MHz Bandwidth

LTE Band 71 20 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			133297 (680.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	24.61	0	0
	1	50	24.32		0
	1	99	24.31		0
	50	0	23.65	0-1	1
	50	25	23.68		1
	50	50	23.65		1
	100	0	23.57		1
16QAM	1	0	23.66	0-1	1
	1	50	23.51		1
	1	99	23.41		1
	50	0	22.52	0-2	2
	50	25	22.53		2
	50	50	22.54		2
	100	0	22.58		2

Note: LTE Band 71 at 20 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 9-4
LTE Band 71 Conducted Powers - 15 MHz Bandwidth

LTE Band 71 15 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			133297 (680.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	24.45	0	0
	1	36	24.44		0
	1	74	24.43		0
	36	0	23.69	0-1	1
	36	18	23.70		1
	36	37	23.70		1
	75	0	23.67		1
16QAM	1	0	23.37	0-1	1
	1	36	23.35		1
	1	74	23.58		1
	36	0	22.67	0-2	2
	36	18	22.58		2
	36	37	22.59		2
	75	0	22.69		2

Note: LTE Band 71 at 15 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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Table 9-5
LTE Band 71 Conducted Powers - 10 MHz Bandwidth

LTE Band 71 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			133172 (668.0 MHz)	133297 (680.5 MHz)	133422 (693.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.45	24.54	24.38	0	0
	1	25	24.65	24.53	24.35		0
	1	49	24.60	24.54	24.33		0
	25	0	23.70	23.66	23.65	0-1	1
	25	12	23.67	23.66	23.61		1
	25	25	23.69	23.66	23.45		1
	50	0	23.70	23.66	23.66		1
16QAM	1	0	23.69	23.52	23.52	0-1	1
	1	25	23.69	23.53	23.68		1
	1	49	23.69	23.54	23.68		1
	25	0	22.62	22.50	22.55	0-2	2
	25	12	22.60	22.60	22.51		2
	25	25	22.69	22.51	22.62		2
	50	0	22.40	22.60	22.59		2

Table 9-6
LTE Band 71 Conducted Powers - 5 MHz Bandwidth

LTE Band 71 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			133147 (665.5 MHz)	133297 (680.5 MHz)	133447 (695.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.69	24.53	24.49	0	0
	1	12	24.66	24.57	24.42		0
	1	24	24.54	24.58	24.42		0
	12	0	23.67	23.46	23.61	0-1	1
	12	6	23.67	23.60	23.53		1
	12	13	23.67	23.55	23.50		1
16QAM	25	0	23.65	23.63	23.56	0-1	1
	1	0	23.24	23.36	23.45		1
	1	12	23.24	23.63	23.60		1
	1	24	23.20	23.62	23.59	0-2	1
	12	0	22.62	22.51	22.44		2
	12	6	22.42	22.62	22.62		2
	12	13	22.54	22.59	22.64		2
	25	0	22.56	22.61	22.60	2	

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9.3.2

LTE Band 12

Table 9-7
LTE Band 12 Conducted Powers - 10 MHz Bandwidth

LTE Band 12 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23095 (707.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	24.44	0	0
	1	25	24.63		0
	1	49	24.53		0
	25	0	23.60	0-1	1
	25	12	23.62		1
	25	25	23.60		1
	50	0	23.58		1
16QAM	1	0	23.45	0-1	1
	1	25	23.41		1
	1	49	23.32		1
	25	0	22.56	0-2	2
	25	12	22.57		2
	25	25	22.58		2
	50	0	22.39		2

Note: LTE Band 12 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 9-8
LTE Band 12 Conducted Powers - 5 MHz Bandwidth

LTE Band 12 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23035 (701.5 MHz)	23095 (707.5 MHz)	23155 (713.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.55	24.57	24.41	0	0
	1	12	24.53	24.56	24.43		0
	1	24	24.50	24.55	24.51		0
	12	0	23.50	23.53	23.53	0-1	1
	12	6	23.50	23.53	23.54		1
	12	13	23.50	23.54	23.55		1
	25	0	23.38	23.49	23.54		1
16QAM	1	0	23.62	23.32	23.21	0-1	1
	1	12	23.60	23.32	23.32		1
	1	24	23.51	23.32	23.25		1
	12	0	22.27	22.39	22.24	0-2	2
	12	6	22.28	22.39	22.24		2
	12	13	22.28	22.50	22.25		2
	25	0	22.41	22.41	22.42		2

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Table 9-9
LTE Band 12 Conducted Powers - 3 MHz Bandwidth

LTE Band 12 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23025 (700.5 MHz)	23095 (707.5 MHz)	23165 (714.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.55	24.45	24.53	0	0
	1	7	24.51	24.57	24.51		0
	1	14	24.50	24.57	24.50		0
	8	0	23.63	23.59	23.63	0-1	1
	8	4	23.63	23.59	23.64		1
	8	7	23.64	23.58	23.63		1
	15	0	23.58	23.64	23.69		1
16QAM	1	0	23.45	23.53	23.50	0-1	1
	1	7	23.54	23.52	23.51		1
	1	14	23.61	23.56	23.45		1
	8	0	22.62	22.62	22.60	0-2	2
	8	4	22.67	22.61	22.53		2
	8	7	22.63	22.51	22.61		2
	15	0	22.42	22.57	22.57		2

Table 9-10
LTE Band 12 Conducted Powers -1.4 MHz Bandwidth

LTE Band 12 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23017 (699.7 MHz)	23095 (707.5 MHz)	23173 (715.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.46	24.41	24.64	0	0
	1	2	24.43	24.48	24.60		0
	1	5	24.39	24.55	24.66		0
	3	0	24.50	24.65	24.51		0
	3	2	24.57	24.64	24.54		0
	3	3	24.65	24.63	24.47		0
	6	0	23.54	23.61	23.57	0-1	1
16QAM	1	0	23.66	23.43	23.60	0-1	1
	1	2	23.65	23.43	23.64		1
	1	5	23.45	23.39	23.51		1
	3	0	23.45	23.62	23.33		1
	3	2	23.45	23.49	23.33		1
	3	3	23.36	23.43	23.33	1	
	6	0	22.29	22.35	22.50	0-2	2

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9.3.3

LTE Band 26 (Cell)

Table 9-11
LTE Band 26 (Cell) Conducted Powers - 15 MHz Bandwidth

LTE Band 26 (Cell) 15 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26865 (831.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	24.49	0	0
	1	36	24.48		0
	1	74	24.47		0
	36	0	23.57	0-1	1
	36	18	23.60		1
	36	37	23.57		1
	75	0	23.53		1
16QAM	1	0	23.41	0-1	1
	1	36	23.41		1
	1	74	23.69		1
	36	0	22.54	0-2	2
	36	18	22.55		2
	36	37	22.53		2
	75	0	22.54		2

Note: LTE Band 26 (Cell) at 15 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 9-12
LTE Band 26 (Cell) Conducted Powers - 10 MHz Bandwidth

LTE Band 26 (Cell) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26740 (819.0 MHz)	26865 (831.5 MHz)	26990 (844.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.42	24.47	24.44	0	0
	1	25	24.41	24.46	24.42		0
	1	49	24.40	24.45	24.41		0
	25	0	23.62	23.55	23.60	0-1	1
	25	12	23.61	23.55	23.60		1
	25	25	23.53	23.56	23.59		1
	50	0	23.52	23.58	23.60		1
16QAM	1	0	23.60	23.46	23.65	0-1	1
	1	25	23.58	23.53	23.51		1
	1	49	23.64	23.51	23.54		1
	25	0	22.61	22.57	22.59	0-2	2
	25	12	22.62	22.53	22.70		2
	25	25	22.60	22.51	22.70		2
	50	0	22.46	22.51	22.43		2

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Table 9-13
LTE Band 26 (Cell) Conducted Powers - 5 MHz Bandwidth

LTE Band 26 (Cell) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26715 (816.5 MHz)	26865 (831.5 MHz)	27015 (846.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.60	24.64	24.41	0	0
	1	12	24.63	24.51	24.49		0
	1	24	24.62	24.38	24.47		0
	12	0	23.54	23.52	23.50	0-1	1
	12	6	23.55	23.52	23.49		1
	12	13	23.55	23.44	23.48		1
	25	0	23.62	23.49	23.56		1
16QAM	1	0	23.50	23.38	23.44	0-1	1
	1	12	23.60	23.31	23.49		1
	1	24	23.63	23.39	23.49		1
	12	0	22.46	22.23	22.32	0-2	2
	12	6	22.30	22.46	22.32		2
	12	13	22.31	22.44	22.42		2
	25	0	22.51	22.54	22.60		2

Table 9-14
LTE Band 26 (Cell) Conducted Powers - 3 MHz Bandwidth

LTE Band 26 (Cell) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26705 (815.5 MHz)	26865 (831.5 MHz)	27025 (847.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.58	24.46	24.52	0	0
	1	7	24.49	24.44	24.48		0
	1	14	24.49	24.38	24.46		0
	8	0	23.55	23.46	23.60	0-1	1
	8	4	23.56	23.47	23.59		1
	8	7	23.56	23.47	23.58		1
	15	0	23.51	23.45	23.58		1
16QAM	1	0	23.61	23.49	23.60	0-1	1
	1	7	23.64	23.54	23.61		1
	1	14	23.68	23.48	23.51		1
	8	0	22.59	22.45	22.59	0-2	2
	8	4	22.70	22.51	22.45		2
	8	7	22.65	22.46	22.46		2
	15	0	22.51	22.70	22.69		2

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Table 9-15
LTE Band 26 (Cell) Conducted Powers -1.4 MHz Bandwidth

LTE Band 26 (Cell) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26697 (814.7 MHz)	26865 (831.5 MHz)	27033 (848.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.45	24.47	24.65	0	0
	1	2	24.45	24.47	24.62		0
	1	5	24.62	24.48	24.67		0
	3	0	24.47	24.50	24.54		0
	3	2	24.47	24.55	24.61		0
	3	3	24.46	24.55	24.51		0
	6	0	23.53	23.54	23.52	0-1	1
16QAM	1	0	23.53	23.60	23.65	0-1	1
	1	2	23.54	23.50	23.65		1
	1	5	23.40	23.68	23.65		1
	3	0	23.50	23.61	23.47		1
	3	2	23.49	23.51	23.30		1
	3	3	23.50	23.42	23.40		1
	6	0	22.64	22.59	22.47	0-2	2

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LTE Band 66 (AWS)

Table 9-16
LTE Band 66 (AWS) Conducted Powers - 20 MHz Bandwidth

LTE Band 66 (AWS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132072 (1720.0 MHz)	132322 (1745.0 MHz)	132572 (1770.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.60	24.50	24.48	0	0
	1	50	24.68	24.49	24.55		0
	1	99	24.65	24.41	24.54		0
	50	0	23.65	23.64	23.52	0-1	1
	50	25	23.64	23.56	23.52		1
	50	50	23.64	23.52	23.52		1
	100	0	23.60	23.61	23.53		1
16QAM	1	0	23.51	23.65	23.62	0-1	1
	1	50	23.50	23.58	23.62		1
	1	99	23.59	23.62	23.51		1
	50	0	22.59	22.55	22.50	0-2	2
	50	25	22.60	22.55	22.50		2
	50	50	22.61	22.56	22.51		2
	100	0	22.59	22.44	22.47		2

Table 9-17
LTE Band 66 (AWS) Conducted Powers - 15 MHz Bandwidth

LTE Band 66 (AWS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132047 (1717.5 MHz)	132322 (1745.0 MHz)	132597 (1772.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.50	24.41	24.55	0	0
	1	36	24.57	24.40	24.45		0
	1	74	24.57	24.42	24.59		0
	36	0	23.48	23.54	23.70	0-1	1
	36	18	23.48	23.54	23.69		1
	36	37	23.47	23.54	23.68		1
	75	0	23.52	23.34	23.60		1
16QAM	1	0	23.52	23.51	23.63	0-1	1
	1	36	23.50	23.68	23.62		1
	1	74	23.59	23.55	23.61		1
	36	0	22.43	22.69	22.60	0-2	2
	36	18	22.45	22.63	22.65		2
	36	37	22.45	22.57	22.45		2
	75	0	22.46	22.60	22.58		2

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Table 9-18
LTE Band 66 (AWS) Conducted Powers - 10 MHz Bandwidth

LTE Band 66 (AWS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132022 (1715.0 MHz)	132322 (1745.0 MHz)	132622 (1775.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.47	24.47	24.46	0	0
	1	25	24.44	24.47	24.44		0
	1	49	24.29	24.47	24.53		0
	25	0	23.40	23.43	23.37	0-1	1
	25	12	23.40	23.44	23.37		1
	25	25	23.40	23.45	23.37		1
	50	0	23.44	23.44	23.42		1
16QAM	1	0	23.60	23.50	23.56	0-1	1
	1	25	23.59	23.62	23.57		1
	1	49	23.52	23.31	23.56		1
	25	0	22.40	22.42	22.41	0-2	2
	25	12	22.41	22.63	22.41		2
	25	25	22.51	22.55	22.42		2
	50	0	22.54	22.48	22.41		2

Table 9-19
LTE Band 66 (AWS) Conducted Powers - 5 MHz Bandwidth

LTE Band 66 (AWS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131997 (1712.5 MHz)	132322 (1745.0 MHz)	132647 (1777.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.63	24.53	24.41	0	0
	1	12	24.60	24.53	24.42		0
	1	24	24.59	24.46	24.62		0
	12	0	23.35	23.43	23.42	0-1	1
	12	6	23.35	23.44	23.41		1
	12	13	23.35	23.44	23.41		1
	25	0	23.36	23.44	23.46		1
16QAM	1	0	23.70	23.40	23.37	0-1	1
	1	12	23.69	23.40	23.47		1
	1	24	23.69	23.42	23.47		1
	12	0	22.35	22.33	22.41	0-2	2
	12	6	22.24	22.34	22.43		2
	12	13	22.37	22.35	22.32		2
	25	0	22.24	22.39	22.38		2

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Table 9-20
LTE Band 66 (AWS) Conducted Powers - 3 MHz Bandwidth

LTE Band 66 (AWS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131987 (1711.5 MHz)	132322 (1745.0 MHz)	132657 (1778.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.53	24.53	24.63	0	0
	1	7	24.52	24.59	24.60		0
	1	14	24.41	24.54	24.58		0
	8	0	23.47	23.53	23.58	0-1	1
	8	4	23.58	23.34	23.58		1
	8	7	23.58	23.35	23.58		1
	15	0	23.47	23.45	23.43		1
16QAM	1	0	23.64	23.62	23.47	0-1	1
	1	7	23.54	23.60	23.46		1
	1	14	23.64	23.51	23.46		1
	8	0	22.65	22.63	22.32	0-2	2
	8	4	22.66	22.64	22.33		2
	8	7	22.65	22.68	22.34		2
	15	0	22.44	22.53	22.48		2

Table 9-21
LTE Band 66 (AWS) Conducted Powers -1.4 MHz Bandwidth

LTE Band 66 (AWS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131979 (1710.7 MHz)	132322 (1745.0 MHz)	132665 (1779.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.70	24.52	24.60	0	0
	1	2	24.67	24.52	24.51		0
	1	5	24.65	24.53	24.49		0
	3	0	24.66	24.43	24.54		0
	3	2	24.64	24.50	24.52		0
	3	3	24.63	24.50	24.50		0
	6	0	23.43	23.38	23.49	0-1	1
16QAM	1	0	23.57	23.51	23.50	0-1	1
	1	2	23.57	23.56	23.64		1
	1	5	23.57	23.60	23.52		1
	3	0	23.51	23.33	23.56		1
	3	2	23.36	23.33	23.60		1
	3	3	23.36	23.43	23.51		1
	6	0	22.54	22.33	22.42	0-2	2

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LTE Band 25 (PCS)

Table 9-22
LTE Band 25 (PCS) Conducted Powers - 20 MHz Bandwidth

LTE Band 25 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26140 (1860.0 MHz)	26365 (1882.5 MHz)	26590 (1905.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.52	24.58	24.48	0	0
	1	50	24.48	24.57	24.56		0
	1	99	24.59	24.57	24.55		0
	50	0	23.28	23.22	23.53	0-1	1
	50	25	23.28	23.23	23.43		1
	50	50	23.37	23.45	23.43		1
	100	0	23.33	23.22	23.20		1
16QAM	1	0	23.21	23.29	23.46	0-1	1
	1	50	23.20	23.30	23.45		1
	1	99	23.20	23.50	23.45		1
	50	0	22.35	22.34	22.50	0-2	2
	50	25	22.35	22.46	22.60		2
	50	50	22.45	22.46	22.50		2
	100	0	22.44	22.27	22.42		2

Table 9-23
LTE Band 25 (PCS) Conducted Powers - 15 MHz Bandwidth

LTE Band 25 (PCS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26115 (1857.5 MHz)	26365 (1882.5 MHz)	26615 (1907.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.40	24.49	24.44	0	0
	1	36	24.47	24.49	24.52		0
	1	74	24.54	24.49	24.40		0
	36	0	23.35	23.33	23.36	0-1	1
	36	18	23.34	23.44	23.36		1
	36	37	23.34	23.34	23.36		1
	75	0	23.22	23.49	23.35		1
16QAM	1	0	23.45	23.42	23.47	0-1	1
	1	36	23.43	23.53	23.49		1
	1	74	23.42	23.53	23.38		1
	36	0	22.49	22.34	22.46	0-2	2
	36	18	22.39	22.35	22.37		2
	36	37	22.41	22.36	22.48		2
	75	0	22.32	22.30	22.43		2

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Table 9-24
LTE Band 25 (PCS) Conducted Powers - 10 MHz Bandwidth

LTE Band 25 (PCS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26090 (1855.0 MHz)	26365 (1882.5 MHz)	26640 (1910.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.40	24.40	24.46	0	0
	1	25	24.47	24.40	24.44		0
	1	49	24.36	24.44	24.43		0
	25	0	23.28	23.34	23.39	0-1	1
	25	12	23.28	23.35	23.49		1
	25	25	23.28	23.35	23.39		1
	50	0	23.29	23.40	23.38		1
16QAM	1	0	23.50	23.50	23.38	0-1	1
	1	25	23.60	23.32	23.36		1
	1	49	23.61	23.30	23.37		1
	25	0	22.28	22.33	22.34	0-2	2
	25	12	22.39	22.34	22.45		2
	25	25	22.39	22.35	22.36		2
	50	0	22.35	22.33	22.41		2

Table 9-25
LTE Band 25 (PCS) Conducted Powers - 5 MHz Bandwidth

LTE Band 25 (PCS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26065 (1852.5 MHz)	26365 (1882.5 MHz)	26665 (1912.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.49	24.49	24.54	0	0
	1	12	24.47	24.59	24.52		0
	1	24	24.55	24.59	24.49		0
	12	0	23.31	23.50	23.49	0-1	1
	12	6	23.31	23.30	23.47		1
	12	13	23.30	23.31	23.46		1
	25	0	23.23	23.44	23.22		1
16QAM	1	0	23.60	23.25	23.43	0-1	1
	1	12	23.69	23.36	23.44		1
	1	24	23.69	23.37	23.44		1
	12	0	22.41	22.39	22.35	0-2	2
	12	6	22.42	22.39	22.35		2
	12	13	22.39	22.32	22.46		2
	25	0	22.32	22.40	22.47		2

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Table 9-26
LTE Band 25 (PCS) Conducted Powers - 3 MHz Bandwidth

LTE Band 25 (PCS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26055 (1851.5 MHz)	26365 (1882.5 MHz)	26675 (1913.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.57	24.46	24.40	0	0
	1	7	24.46	24.56	24.46		0
	1	14	24.45	24.56	24.43		0
	8	0	23.56	23.45	23.39	0-1	1
	8	4	23.46	23.58	23.38		1
	8	7	23.56	23.49	23.37		1
	15	0	23.48	23.41	23.30		1
16QAM	1	0	23.65	23.32	23.69	0-1	1
	1	7	23.64	23.32	23.58		1
	1	14	23.64	23.35	23.47		1
	8	0	22.31	22.26	22.39	0-2	2
	8	4	22.32	22.39	22.31		2
	8	7	22.40	22.48	22.35		2
	15	0	22.23	22.46	22.48		2

Table 9-27
LTE Band 25 (PCS) Conducted Powers -1.4 MHz Bandwidth

LTE Band 25 (PCS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26047 (1850.7 MHz)	26365 (1882.5 MHz)	26683 (1914.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.48	24.53	24.43	0	0
	1	2	24.44	24.52	24.37		0
	1	5	24.53	24.51	24.24		0
	3	0	24.61	24.50	24.59		0
	3	2	24.60	24.22	24.47		0
	3	3	24.58	24.40	24.23		0
	6	0	23.54	23.41	23.38	0-1	1
16QAM	1	0	23.62	23.11	23.30	0-1	1
	1	2	23.40	23.05	23.40		1
	1	5	23.35	23.06	23.39		1
	3	0	23.38	23.36	23.38		1
	3	2	23.28	23.20	23.48		1
	3	3	23.37	23.36	23.58		1
	6	0	22.51	22.20	22.29	0-2	2

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9.4 WLAN Conducted Powers

Table 9-28
2.4 GHz WLAN Maximum Average RF Power

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
2412	1	18.55	15.60	15.25
2437	6	18.54	16.69	16.15
2462	11	18.25	14.40	14.17

Table 9-29
5 GHz WLAN Maximum Average RF Power

5GHz (20MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11a	802.11n
5180	36	14.03	13.83
5200	40	15.70	15.69
5220	44	15.72	15.70
5240	48	15.76	15.67
5260	52	15.58	15.61
5280	56	15.60	15.61
5300	60	15.64	15.55
5320	64	13.94	13.52
5500	100	13.59	13.51
5520	104	15.40	15.38
5580	116	15.54	15.49
5660	132	15.54	15.54
5700	140	15.50	15.50
5745	149	15.38	15.36
5785	157	15.56	15.44
5825	165	13.94	13.52

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Table 9-30
2.4 GHz WLAN Reduced Average RF Power

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
2412	1	15.46	14.35	14.35
2417	2	N/A	15.42	15.38
2437	6	15.60	15.62	15.63
2457	10	N/A	15.51	15.51
2462	11	15.59	13.26	13.27

Table 9-31
5 GHz WLAN Reduced Average RF Power

5GHz (20MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11a	802.11n
5180	36	10.61	10.35
5200	40	11.81	11.84
5220	44	11.69	11.73
5240	48	11.74	11.69
5260	52	11.90	11.87
5280	56	11.86	11.78
5300	60	11.82	11.86
5320	64	10.33	10.45
5500	100	10.02	10.04
5520	104	11.73	11.79
5580	116	11.94	11.82
5660	132	11.86	11.99
5700	140	11.94	11.88
5745	149	11.91	11.79
5785	157	12.05	11.98
5805	161	10.35	10.15
5825	165	10.33	10.45

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.

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- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.
- The bolded data rate and channel above were tested for SAR.

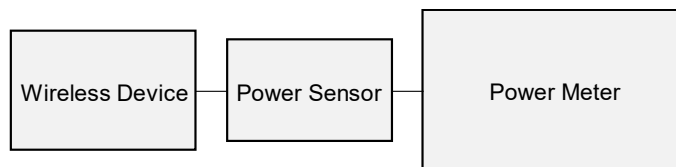


Figure 9-3
Power Measurement Setup

9.5 Bluetooth Conducted Powers

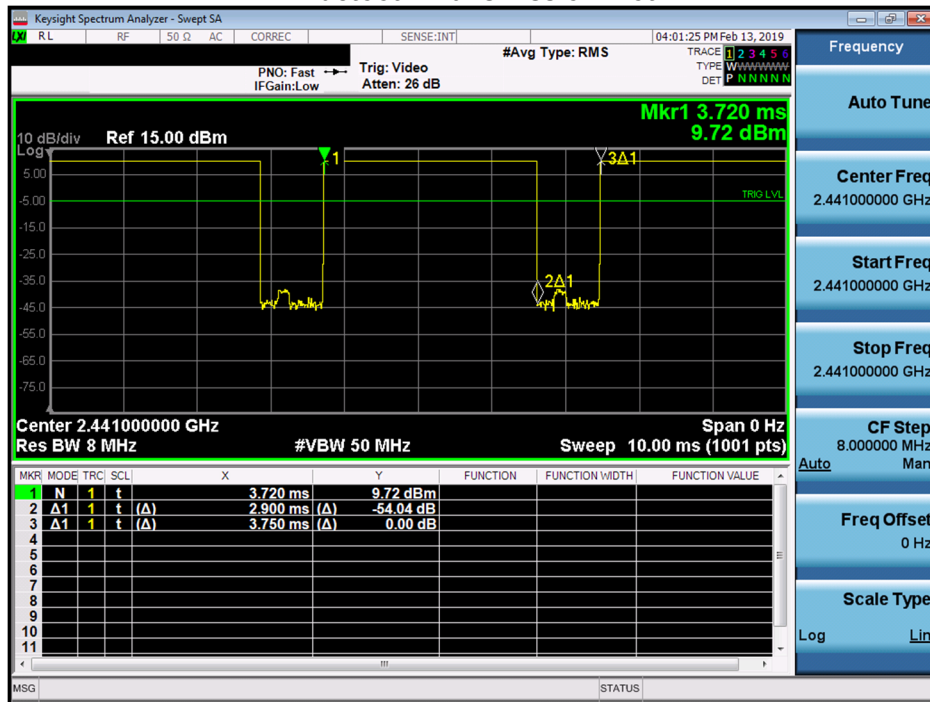
Table 9-32
Bluetooth Average RF Power

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
			[dBm]	[mW]
2402	1.0	0	8.77	7.540
2441	1.0	39	9.49	8.900
2480	1.0	78	7.91	6.186
2402	2.0	0	8.14	6.515
2441	2.0	39	8.87	7.703
2480	2.0	78	7.29	5.359
2402	3.0	0	8.31	6.770
2441	3.0	39	8.95	7.846
2480	3.0	78	7.36	5.440

Note: The bolded data rates and channel above were tested for SAR.

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Figure 9-4
Bluetooth Transmission Plot



Equation 9-1
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.90ms}{3.75ms} * 100\% = 77.3\%$$

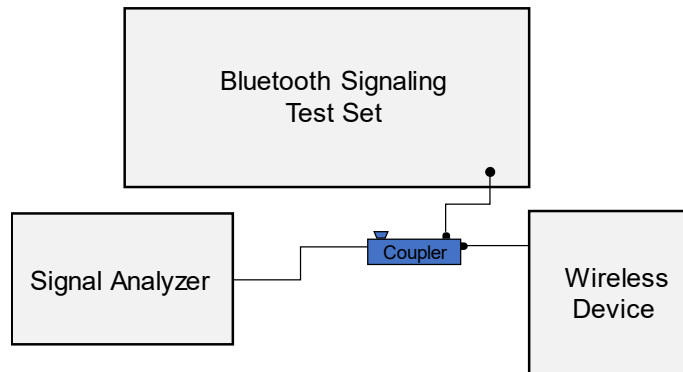


Figure 9-5
Power Measurement Setup

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10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (°C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ϵ	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ϵ	% dev σ	% dev ϵ
2/14/2019	750H	20.7	680	0.871	42.164	0.888	42.305	-1.91%	-0.33%
			695	0.876	42.098	0.889	42.227	-1.46%	-0.31%
			700	0.881	42.165	0.889	42.201	-0.90%	-0.09%
			710	0.883	42.129	0.890	42.149	-0.79%	-0.05%
			740	0.897	41.952	0.893	41.994	0.45%	-0.10%
			755	0.899	41.906	0.894	41.916	0.56%	-0.02%
2/11/2019	835H	20.3	820	0.875	39.560	0.899	41.578	-2.67%	-4.85%
			835	0.881	39.523	0.900	41.500	-2.11%	-4.76%
			850	0.887	39.481	0.916	41.500	-3.17%	-4.87%
2/26/2019	1750H	21.8	1710	1.314	39.241	1.348	40.142	-2.52%	-2.24%
			1750	1.337	39.206	1.371	40.079	-2.48%	-2.18%
			1790	1.355	39.135	1.394	40.016	-2.80%	-2.20%
2/26/2019	1900H	21.8	1850	1.394	39.048	1.400	40.000	-0.43%	-2.38%
			1880	1.411	39.006	1.400	40.000	0.79%	-2.49%
			1910	1.426	38.925	1.400	40.000	1.86%	-2.69%
2/13/2019	2450H	20.3	2400	1.795	38.630	1.756	39.289	2.22%	-1.68%
			2450	1.836	38.552	1.800	39.200	2.00%	-1.65%
			2500	1.873	38.461	1.855	39.136	0.97%	-1.72%
3/2/2019	2450H	21.9	2400	1.833	41.198	1.756	39.289	4.38%	4.86%
			2450	1.876	41.135	1.800	39.200	4.22%	4.94%
			2500	1.915	41.031	1.855	39.136	3.23%	4.84%
02/25/2019	5200H-5800H	21.7	5180	4.510	35.649	4.635	36.009	-2.70%	-1.00%
			5200	4.546	35.621	4.655	35.986	-2.34%	-1.01%
			5220	4.563	35.646	4.676	35.963	-2.42%	-0.88%
			5240	4.582	35.642	4.696	35.940	-2.43%	-0.83%
			5260	4.595	35.550	4.717	35.917	-2.59%	-1.02%
			5280	4.611	35.461	4.737	35.894	-2.66%	-1.21%
			5300	4.645	35.406	4.758	35.871	-2.37%	-1.30%
			5320	4.677	35.409	4.778	35.849	-2.11%	-1.23%
			5500	4.867	35.123	4.963	35.643	-1.93%	-1.46%
			5520	4.893	35.088	4.983	35.620	-1.81%	-1.49%
			5540	4.922	35.032	5.004	35.597	-1.64%	-1.59%
			5560	4.948	34.974	5.024	35.574	-1.51%	-1.69%
			5580	4.974	34.977	5.045	35.551	-1.41%	-1.61%
			5600	4.996	34.982	5.065	35.529	-1.36%	-1.54%
			5620	5.022	34.945	5.086	35.506	-1.26%	-1.58%
			5640	5.038	34.889	5.106	35.483	-1.33%	-1.67%
			5660	5.066	34.840	5.127	35.460	-1.19%	-1.75%
			5680	5.092	34.809	5.147	35.437	-1.07%	-1.77%
			5700	5.128	34.793	5.168	35.414	-0.77%	-1.75%
			5745	5.165	34.727	5.214	35.363	-0.94%	-1.80%
			5765	5.182	34.704	5.234	35.340	-0.99%	-1.80%
			5785	5.218	34.672	5.255	35.317	-0.70%	-1.83%
			5800	5.252	34.619	5.270	35.300	-0.34%	-1.93%
			5805	5.259	34.610	5.275	35.294	-0.30%	-1.94%
			5825	5.276	34.602	5.296	35.271	-0.38%	-1.90%

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Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (°C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ϵ	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ϵ	% dev σ	% dev ϵ
2/25/2019	750B	19.8	680	0.916	54.005	0.958	55.804	-4.38%	-3.22%
			695	0.924	53.972	0.959	55.745	-3.65%	-3.18%
			700	0.927	53.962	0.959	55.726	-3.34%	-3.17%
			710	0.932	53.942	0.960	55.687	-2.92%	-3.13%
			740	0.943	53.874	0.963	55.570	-2.08%	-3.05%
			755	0.947	53.838	0.964	55.512	-1.76%	-3.02%
2/20/2019	835B	21.2	820	0.943	53.083	0.969	55.258	-2.68%	-3.94%
			835	0.957	52.932	0.970	55.200	-1.34%	-4.11%
			850	0.971	52.769	0.988	55.154	-1.72%	-4.32%
3/6/2019	835B	21.4	820	0.948	53.490	0.969	55.258	-2.17%	-3.20%
			835	0.963	53.334	0.970	55.200	-0.72%	-3.38%
			850	0.979	53.174	0.988	55.154	-0.91%	-3.59%
2/20/2019	1750B	21.7	1710	1.410	52.659	1.463	53.537	-3.62%	-1.64%
			1750	1.457	52.518	1.488	53.432	-2.08%	-1.71%
			1790	1.495	52.430	1.514	53.326	-1.25%	-1.68%
3/3/2019	1750B	22.0	1710	1.485	51.614	1.463	53.537	1.50%	-3.59%
			1750	1.530	51.428	1.488	53.432	2.82%	-3.75%
			1790	1.573	51.254	1.514	53.326	3.90%	-3.89%
2/14/2019	1900B	23.4	1850	1.506	52.497	1.520	53.300	-0.92%	-1.51%
			1880	1.536	52.388	1.520	53.300	1.05%	-1.71%
			1910	1.571	52.335	1.520	53.300	3.36%	-1.81%
2/20/2019	1900B	22.0	1850	1.508	52.765	1.520	53.300	-0.79%	-1.00%
			1880	1.540	52.674	1.520	53.300	1.32%	-1.17%
			1910	1.573	52.536	1.520	53.300	3.49%	-1.43%
2/25/2019	2450B	21.5	2400	1.967	51.870	1.902	52.767	3.42%	-1.70%
			2450	2.028	51.750	1.950	52.700	4.00%	-1.80%
			2500	2.085	51.592	2.021	52.636	3.17%	-1.98%
2/27/2019	2450B	20.9	2400	1.992	53.444	1.902	52.767	4.73%	1.28%
			2450	2.037	53.357	1.950	52.700	4.46%	1.25%
			2500	2.082	53.325	2.021	52.636	3.02%	1.31%
02/22/2019	5200B-5800B	21.5	5180	5.356	48.136	5.276	49.041	1.52%	-1.85%
			5200	5.386	48.077	5.299	49.014	1.64%	-1.91%
			5220	5.416	48.031	5.323	48.987	1.75%	-1.95%
			5240	5.451	47.979	5.346	48.960	1.96%	-2.00%
			5260	5.468	47.943	5.369	48.933	1.84%	-2.02%
			5280	5.483	47.937	5.393	48.906	1.67%	-1.98%
			5300	5.521	47.884	5.416	48.879	1.94%	-2.04%
			5320	5.543	47.859	5.439	48.851	1.91%	-2.03%
			5500	5.798	47.478	5.650	48.607	2.62%	-2.32%
			5520	5.833	47.466	5.673	48.580	2.82%	-2.29%
			5540	5.889	47.400	5.696	48.553	3.39%	-2.37%
			5560	5.914	47.344	5.720	48.526	3.39%	-2.44%
			5580	5.931	47.343	5.743	48.499	3.27%	-2.38%
			5600	5.942	47.297	5.766	48.471	3.05%	-2.42%
			5620	5.980	47.260	5.790	48.444	3.28%	-2.44%
			5640	6.031	47.188	5.813	48.417	3.75%	-2.54%
			5660	6.056	47.109	5.837	48.390	3.75%	-2.65%
			5680	6.092	47.111	5.860	48.363	3.96%	-2.59%
			5700	6.110	47.098	5.883	48.336	3.86%	-2.56%
			5745	6.181	46.995	5.936	48.275	4.13%	-2.65%
			5765	6.219	46.923	5.959	48.248	4.36%	-2.75%
			5785	6.241	46.918	5.982	48.220	4.33%	-2.70%
			5800	6.268	46.896	6.000	48.200	4.47%	-2.71%
			5805	6.280	46.885	6.006	48.193	4.56%	-2.71%
			5825	6.314	46.875	6.029	48.166	4.73%	-2.68%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

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10.2 Test System Verification

Prior to SAR assessment, the system is verified to $\pm 10\%$ of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix E.

Table 10-2
System Verification Results

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation _{1g} (%)
G	750	HEAD	02/14/2019	22.9	20.7	0.200	1054	7410	1.710	8.370	8.550	2.15%
G	835	HEAD	02/11/2019	21.1	20.3	0.200	4d133	7410	1.910	9.430	9.550	1.27%
D	1750	HEAD	02/26/2019	23.4	21.8	0.100	1148	7357	3.520	36.400	35.200	-3.30%
D	1900	HEAD	02/26/2019	23.4	21.8	0.100	5d080	7357	4.280	39.800	42.800	7.54%
H	2450	HEAD	02/13/2019	20.9	20.3	0.100	797	7409	5.510	52.700	55.100	4.55%
E	2450	HEAD	03/02/2019	20.5	20.3	0.100	981	3589	5.320	52.300	53.200	1.72%
H	5250	HEAD	02/25/2019	21.6	21.1	0.050	1191	7409	3.790	78.900	75.800	-3.93%
H	5600	HEAD	02/25/2019	21.6	21.1	0.050	1191	7409	4.050	83.600	81.000	-3.11%
H	5750	HEAD	02/25/2019	21.6	21.0	0.050	1191	7409	3.850	79.100	77.000	-2.65%
E	750	BODY	02/25/2019	21.8	19.8	0.200	1003	3589	1.730	8.580	8.650	0.82%
D	835	BODY	02/20/2019	21.7	21.2	0.200	4d047	7357	1.960	9.710	9.800	0.93%
D	835	BODY	03/06/2019	22.3	21.4	0.200	4d132	7357	2.080	9.670	10.400	7.55%
G	1750	BODY	02/20/2019	22.6	21.8	0.100	1148	7410	3.780	37.000	37.800	2.16%
G	1750	BODY	03/03/2019	20.7	21.5	0.100	1148	7410	3.760	37.000	37.600	1.62%
J	1900	BODY	02/14/2019	21.1	21.9	0.100	5d080	7488	4.040	39.200	40.400	3.06%
J	1900	BODY	02/20/2019	20.3	21.0	0.100	5d149	7488	4.200	39.400	42.000	6.60%
K	2450	BODY	02/25/2019	22.6	21.0	0.100	981	3319	5.160	50.900	51.600	1.38%
L	2450	BODY	02/27/2019	23.0	20.0	0.100	797	7308	5.030	51.100	50.300	-1.57%
L	5250	BODY	02/22/2019	22.6	20.8	0.050	1191	7308	3.640	77.000	72.800	-5.45%
L	5600	BODY	02/22/2019	22.6	20.8	0.050	1191	7308	3.850	79.200	77.000	-2.78%
L	5750	BODY	02/22/2019	22.6	20.8	0.050	1191	7308	3.600	76.100	72.000	-5.39%

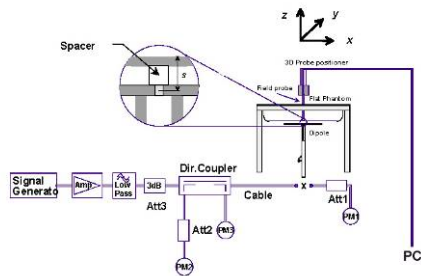


Figure 10-1
System Verification Setup Diagram



Figure 10-2
System Verification Setup Photo

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11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

**Table 11-1
GSM 850 Head SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.7	33.70	0.00	Right	Cheek	00831	1	1:8.3	0.416	1.000	0.416	A1
836.60	190	GSM 850	GSM	33.7	33.70	0.05	Right	Tilt	00831	1	1:8.3	0.283	1.000	0.283	
836.60	190	GSM 850	GSM	33.7	33.70	-0.19	Left	Cheek	00831	1	1:8.3	0.333	1.000	0.333	
836.60	190	GSM 850	GSM	33.7	33.70	-0.19	Left	Tilt	00831	1	1:8.3	0.241	1.000	0.241	
836.60	190	GSM 850	GPRS	29.7	29.58	0.07	Right	Cheek	00831	3	1:2.76	0.388	1.028	0.399	
836.60	190	GSM 850	GPRS	29.7	29.58	0.06	Right	Tilt	00831	3	1:2.76	0.254	1.028	0.261	
836.60	190	GSM 850	GPRS	29.7	29.58	0.09	Left	Cheek	00831	3	1:2.76	0.294	1.028	0.302	
836.60	190	GSM 850	GPRS	29.7	29.58	0.09	Left	Tilt	00831	3	1:2.76	0.211	1.028	0.217	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

**Table 11-2
GSM 1900 Head SAR**

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	30.7	30.70	-0.02	Right	Cheek	00823	1	1:8.3	0.233	1.000	0.233	
1880.00	661	GSM 1900	GSM	30.7	30.70	0.06	Right	Tilt	00823	1	1:8.3	0.091	1.000	0.091	
1880.00	661	GSM 1900	GSM	30.7	30.70	0.07	Left	Cheek	00823	1	1:8.3	0.335	1.000	0.335	
1880.00	661	GSM 1900	GSM	30.7	30.70	0.07	Left	Tilt	00823	1	1:8.3	0.134	1.000	0.134	
1880.00	661	GSM 1900	GPRS	25.7	25.54	0.04	Right	Cheek	00823	4	1:2.076	0.304	1.038	0.316	
1880.00	661	GSM 1900	GPRS	25.7	25.54	0.12	Right	Tilt	00823	4	1:2.076	0.112	1.038	0.116	
1880.00	661	GSM 1900	GPRS	25.7	25.54	0.06	Left	Cheek	00823	4	1:2.076	0.400	1.038	0.415	A2
1880.00	661	GSM 1900	GPRS	25.7	25.54	0.01	Left	Tilt	00823	4	1:2.076	0.155	1.038	0.161	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

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Table 11-3
UMTS 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	24.7	24.51	-0.02	Right	Cheek	00815	1:1	0.453	1.045	0.473	A3
836.60	4183	UMTS 850	RMC	24.7	24.51	-0.06	Right	Tilt	00815	1:1	0.283	1.045	0.296	
836.60	4183	UMTS 850	RMC	24.7	24.51	0.13	Left	Cheek	00815	1:1	0.344	1.045	0.359	
836.60	4183	UMTS 850	RMC	24.7	24.51	-0.13	Left	Tilt	00815	1:1	0.257	1.045	0.269	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-4
UMTS 1750 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1732.40	1412	UMTS 1750	RMC	24.7	24.52	-0.08	Right	Cheek	00823	1:1	0.474	1.042	0.494	
1732.40	1412	UMTS 1750	RMC	24.7	24.52	0.13	Right	Tilt	00823	1:1	0.334	1.042	0.348	
1732.40	1412	UMTS 1750	RMC	24.7	24.52	0.06	Left	Cheek	00823	1:1	0.552	1.042	0.575	A4
1732.40	1412	UMTS 1750	RMC	24.7	24.52	-0.02	Left	Tilt	00823	1:1	0.379	1.042	0.395	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-5
UMTS 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	24.7	24.65	0.08	Right	Cheek	00823	1:1	0.442	1.012	0.447	
1880.00	9400	UMTS 1900	RMC	24.7	24.65	0.14	Right	Tilt	00823	1:1	0.164	1.012	0.166	
1880.00	9400	UMTS 1900	RMC	24.7	24.65	0.06	Left	Cheek	00823	1:1	0.588	1.012	0.595	A5
1880.00	9400	UMTS 1900	RMC	24.7	24.65	0.01	Left	Tilt	00823	1:1	0.241	1.012	0.244	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

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Table 11-6
LTE Band 71 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	-0.06	0	Right	Cheek	QPSK	1	0	00831	1:1	0.294	1.021	0.300	A6
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	-0.09	1	Right	Cheek	QPSK	50	25	00831	1:1	0.240	1.005	0.241	
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	-0.01	0	Right	Tilt	QPSK	1	0	00831	1:1	0.130	1.021	0.133	
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	0.07	1	Right	Tilt	QPSK	50	25	00831	1:1	0.116	1.005	0.117	
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	-0.12	0	Left	Cheek	QPSK	1	0	00831	1:1	0.234	1.021	0.239	
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	-0.11	1	Left	Cheek	QPSK	50	25	00831	1:1	0.191	1.005	0.192	
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	-0.13	0	Left	Tilt	QPSK	1	0	00831	1:1	0.119	1.021	0.121	
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	0.06	1	Left	Tilt	QPSK	50	25	00831	1:1	0.102	1.005	0.103	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-7
LTE Band 12 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	0.00	0	Right	Cheek	QPSK	1	25	00831	1:1	0.506	1.016	0.514	A7
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	-0.03	1	Right	Cheek	QPSK	25	12	00831	1:1	0.407	1.019	0.415	
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	-0.06	0	Right	Tilt	QPSK	1	25	00831	1:1	0.270	1.016	0.274	
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	0.19	1	Right	Tilt	QPSK	25	12	00831	1:1	0.207	1.019	0.211	
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	0.04	0	Left	Cheek	QPSK	1	25	00831	1:1	0.445	1.016	0.452	
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	-0.15	1	Left	Cheek	QPSK	25	12	00831	1:1	0.334	1.019	0.340	
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	-0.16	0	Left	Tilt	QPSK	1	25	00831	1:1	0.270	1.016	0.274	
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	-0.14	1	Left	Tilt	QPSK	25	12	00831	1:1	0.195	1.019	0.199	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT																			
Spatial Peak									Head										
Uncontrolled Exposure/General Population									1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-8
LTE Band 26 (Cell) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	-0.11	0	Right	Cheek	QPSK	1	0	00815	1:1	0.541	1.050	0.568	A8
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	0.10	1	Right	Cheek	QPSK	36	18	00815	1:1	0.373	1.023	0.382	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	0.03	0	Right	Tilt	QPSK	1	0	00815	1:1	0.342	1.050	0.359	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	-0.02	1	Right	Tilt	QPSK	36	18	00815	1:1	0.221	1.023	0.226	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	0.12	0	Left	Cheek	QPSK	1	0	00815	1:1	0.420	1.050	0.441	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	0.10	1	Left	Cheek	QPSK	36	18	00815	1:1	0.286	1.023	0.293	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	0.02	0	Left	Tilt	QPSK	1	0	00815	1:1	0.316	1.050	0.332	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	0.20	1	Left	Tilt	QPSK	36	18	00815	1:1	0.203	1.023	0.208	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

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Table 11-9
LTE Band 66 (AWS) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	0.17	0	Right	Cheek	QPSK	1	50	00823	1:1	0.405	1.005	0.407	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	0.11	1	Right	Cheek	QPSK	50	0	00823	1:1	0.316	1.012	0.320	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	-0.02	0	Right	Tilt	QPSK	1	50	00823	1:1	0.350	1.005	0.352	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	0.05	1	Right	Tilt	QPSK	50	0	00823	1:1	0.272	1.012	0.275	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	0.01	0	Left	Cheek	QPSK	1	50	00823	1:1	0.574	1.005	0.577	A9
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	0.07	1	Left	Cheek	QPSK	50	0	00823	1:1	0.456	1.012	0.461	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	-0.10	0	Left	Tilt	QPSK	1	50	00823	1:1	0.310	1.005	0.312	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	0.15	1	Left	Tilt	QPSK	50	0	00823	1:1	0.267	1.012	0.270	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-10
LTE Band 25 (PCS) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	-0.11	0	Right	Cheek	QPSK	1	99	00823	1:1	0.357	1.026	0.366	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	0.02	1	Right	Cheek	QPSK	50	0	00823	1:1	0.285	1.040	0.296	
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	0.12	0	Right	Tilt	QPSK	1	99	00823	1:1	0.157	1.026	0.161	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	0.13	1	Right	Tilt	QPSK	50	0	00823	1:1	0.123	1.040	0.128	
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	0.04	0	Left	Cheek	QPSK	1	99	00823	1:1	0.552	1.026	0.566	A10
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	-0.10	1	Left	Cheek	QPSK	50	0	00823	1:1	0.483	1.040	0.502	
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	-0.03	0	Left	Tilt	QPSK	1	99	00823	1:1	0.212	1.026	0.218	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	0.03	1	Left	Tilt	QPSK	50	0	00823	1:1	0.162	1.040	0.168	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-11
DTS Head SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2437	6	802.11b	DSSS	22	16.0	15.60	0.14	Right	Cheek	00898	1	99.9	0.769	0.516	1.096	1.001	0.566	
2437	6	802.11b	DSSS	22	16.0	15.60	-0.13	Right	Tilt	00898	1	99.9	0.750	0.537	1.096	1.001	0.589	
2412	1	802.11b	DSSS	22	16.0	15.46	-0.08	Left	Cheek	00898	1	99.9	1.669	1.020	1.132	1.001	1.156	
2437	6	802.11b	DSSS	22	16.0	15.60	0.13	Left	Cheek	00898	1	99.9	1.375	1.080	1.096	1.001	1.185	
2462	11	802.11b	DSSS	22	16.0	15.59	-0.13	Left	Cheek	00898	1	99.9	1.644	1.090	1.099	1.001	1.199	A11
2437	6	802.11b	DSSS	22	16.0	15.60	0.07	Left	Tilt	00898	1	99.9	1.116	0.726	1.096	1.001	0.796	
2462	11	802.11b	DSSS	22	16.0	15.59	-0.18	Left	Cheek	00898	1	99.9	1.691	1.090	1.099	1.001	1.199	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram									

Note: Blue entry represents variability measurement.

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**Table 11-12
NII Head SAR**

FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
5200	40	802.11a	OFDM	20	12.5	11.81	0.05	Right	Cheek	00906	6	99.1	1.189	0.561	1.172	1.009	0.663	
5200	40	802.11a	OFDM	20	12.5	11.81	0.04	Right	Tilt	00906	6	99.1	1.066	-	1.172	1.009	-	
5200	40	802.11a	OFDM	20	12.5	11.81	0.14	Left	Cheek	00906	6	99.1	2.583	1.050	1.172	1.009	1.242	
5220	44	802.11a	OFDM	20	12.5	11.69	-0.09	Left	Cheek	00906	6	99.1	2.550	1.040	1.205	1.009	1.264	
5240	48	802.11a	OFDM	20	12.5	11.74	0.13	Left	Cheek	00906	6	99.1	2.570	1.010	1.191	1.009	1.214	
5180	36	802.11a	OFDM	20	11.0	10.61	0.18	Left	Cheek	00906	6	99.1	1.821	0.765	1.094	1.009	0.844	
5200	40	802.11a	OFDM	20	12.5	11.81	0.14	Left	Tilt	00906	6	99.1	2.142	0.858	1.172	1.009	1.015	
5240	48	802.11a	OFDM	20	12.5	11.74	0.14	Left	Tilt	00906	6	99.1	2.141	0.834	1.191	1.009	1.002	
5260	52	802.11a	OFDM	20	12.5	11.90	0.12	Right	Cheek	00906	6	99.1	1.481	0.707	1.148	1.009	0.819	
5280	56	802.11a	OFDM	20	12.5	11.86	0.14	Right	Cheek	00906	6	99.1	1.150	0.678	1.159	1.009	0.793	
5260	52	802.11a	OFDM	20	12.5	11.90	0.17	Right	Tilt	00906	6	99.1	1.216	0.640	1.148	1.009	0.741	
5260	52	802.11a	OFDM	20	12.5	11.90	-0.14	Left	Cheek	00906	6	99.1	2.422	1.060	1.148	1.009	1.228	
5280	56	802.11a	OFDM	20	12.5	11.86	0.07	Left	Cheek	00906	6	99.1	2.693	1.090	1.159	1.009	1.275	A12
5300	60	802.11a	OFDM	20	12.5	11.82	0.06	Left	Cheek	00906	6	99.1	2.509	1.080	1.169	1.009	1.274	
5320	64	802.11a	OFDM	20	11.0	10.33	0.19	Left	Cheek	00906	6	99.1	1.844	0.779	1.167	1.009	0.917	
5260	52	802.11a	OFDM	20	12.5	11.90	0.13	Left	Tilt	00906	6	99.1	2.153	0.862	1.148	1.009	0.998	
5280	56	802.11a	OFDM	20	12.5	11.86	0.13	Left	Tilt	00906	6	99.1	2.087	0.842	1.159	1.009	0.985	
5280	56	802.11a	OFDM	20	12.5	11.86	0.17	Left	Cheek	00906	6	99.1	2.210	1.030	1.159	1.009	1.205	
5580	116	802.11a	OFDM	20	12.5	11.94	0.00	Right	Cheek	00906	6	99.1	1.969	0.919	1.138	1.009	1.055	
5700	140	802.11a	OFDM	20	12.5	11.94	0.10	Right	Cheek	00906	6	99.1	2.095	0.977	1.138	1.009	1.122	
5580	116	802.11a	OFDM	20	12.5	11.94	0.10	Right	Tilt	00906	6	99.1	1.763	0.850	1.138	1.009	0.976	
5700	140	802.11a	OFDM	20	12.5	11.94	0.20	Right	Tilt	00906	6	99.1	1.848	0.887	1.138	1.009	1.018	
5580	116	802.11a	OFDM	20	12.5	11.94	0.12	Left	Cheek	00906	6	99.1	2.593	0.997	1.138	1.009	1.145	
5700	140	802.11a	OFDM	20	12.5	11.94	-0.16	Left	Cheek	00906	6	99.1	2.434	0.937	1.138	1.009	1.076	
5580	116	802.11a	OFDM	20	12.5	11.94	-0.10	Left	Tilt	00906	6	99.1	2.143	0.862	1.138	1.009	0.990	
5700	140	802.11a	OFDM	20	12.5	11.94	0.14	Left	Tilt	00906	6	99.1	2.181	0.833	1.138	1.009	0.956	
5580	116	802.11a	OFDM	20	12.5	11.94	0.09	Left	Cheek	00906	6	99.1	2.245	0.970	1.138	1.009	1.114	
5745	149	802.11a	OFDM	20	12.5	11.91	0.10	Right	Cheek	00906	6	99.1	1.957	0.946	1.146	1.009	1.094	
5785	157	802.11a	OFDM	20	12.5	12.05	-0.19	Right	Cheek	00906	6	99.1	2.110	1.010	1.109	1.009	1.130	
5745	149	802.11a	OFDM	20	12.5	11.91	0.14	Right	Tilt	00906	6	99.1	1.796	0.811	1.146	1.009	0.938	
5785	157	802.11a	OFDM	20	12.5	12.05	0.18	Right	Tilt	00906	6	99.1	1.959	0.904	1.109	1.009	1.012	
5745	149	802.11a	OFDM	20	12.5	11.91	0.13	Left	Cheek	00906	6	99.1	2.395	0.925	1.146	1.009	1.070	
5785	157	802.11a	OFDM	20	12.5	12.05	0.20	Left	Cheek	00906	6	99.1	2.099	0.931	1.109	1.009	1.042	
5745	149	802.11a	OFDM	20	12.5	11.91	0.15	Left	Tilt	00906	6	99.1	2.232	0.830	1.146	1.009	0.960	
5785	157	802.11a	OFDM	20	12.5	12.05	0.19	Left	Tilt	00906	6	99.1	1.722	0.790	1.109	1.009	0.884	
5785	157	802.11a	OFDM	20	12.5	12.05	0.00	Right	Cheek	00906	6	99.1	2.007	0.918	1.109	1.009	1.027	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT									Head									
Spatial Peak									1.6 W/kg (mW/g)									
Uncontrolled Exposure/General Population									averaged over 1 gram									

Note: Blue entry represents variability measurement.

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11.2 Standalone Body-Worn SAR Data

Table 11-13
GSM/UMTS Body-Worn SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
MHz	Ch.											(W/kg)			
824.20	128	GSM 850	GSM	33.7	33.53	-0.05	10 mm	00823	1	1:8.3	back	0.664	1.040	0.691	A13
836.60	190	GSM 850	GSM	33.7	33.70	0.02	10 mm	00823	1	1:8.3	back	0.641	1.000	0.641	
848.80	251	GSM 850	GSM	33.7	33.42	0.00	10 mm	00823	1	1:8.3	back	0.604	1.067	0.644	
836.60	190	GSM 850	GPRS	29.7	29.58	0.02	10 mm	00823	3	1:2.76	back	0.628	1.028	0.646	
1880.00	661	GSM 1900	GSM	30.7	30.70	-0.17	10 mm	00815	1	1:8.3	back	0.325	1.000	0.325	
1880.00	661	GSM 1900	GPRS	25.7	25.54	-0.13	10 mm	00815	4	1:2.076	back	0.382	1.038	0.397	A15
826.40	4132	UMTS 850	RMC	24.7	24.53	-0.02	10 mm	00823	N/A	1:1	back	0.726	1.040	0.755	A17
836.60	4183	UMTS 850	RMC	24.7	24.51	-0.12	10 mm	00823	N/A	1:1	back	0.714	1.045	0.746	
846.60	4233	UMTS 850	RMC	24.7	24.48	-0.08	10 mm	00823	N/A	1:1	back	0.654	1.052	0.688	
1712.40	1312	UMTS 1750	RMC	24.7	24.60	-0.08	10 mm	00807	N/A	1:1	back	0.708	1.023	0.724	
1732.40	1412	UMTS 1750	RMC	24.7	24.52	0.00	10 mm	00807	N/A	1:1	back	0.757	1.042	0.789	
1752.60	1513	UMTS 1750	RMC	24.7	24.61	-0.01	10 mm	00807	N/A	1:1	back	0.768	1.021	0.784	A18
1852.40	9262	UMTS 1900	RMC	24.7	24.55	-0.21	10 mm	00815	N/A	1:1	back	0.600	1.035	0.621	
1880.00	9400	UMTS 1900	RMC	24.7	24.65	-0.13	10 mm	00815	N/A	1:1	back	0.657	1.012	0.665	
1907.60	9538	UMTS 1900	RMC	24.7	24.46	-0.20	10 mm	00815	N/A	1:1	back	0.684	1.057	0.723	A20
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-14
LTE Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	-0.04	0	00831	QPSK	1	0	10 mm	back	1:1	0.414	1.021	0.423	A21
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	0.02	1	00831	QPSK	50	25	10 mm	back	1:1	0.350	1.005	0.352	
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	-0.03	0	00831	QPSK	1	25	10 mm	back	1:1	0.726	1.016	0.738	A22
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	0.02	1	00831	QPSK	25	12	10 mm	back	1:1	0.552	1.019	0.562	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	-0.09	0	00807	QPSK	1	0	10 mm	back	1:1	0.737	1.050	0.774	A23
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	-0.17	1	00807	QPSK	36	18	10 mm	back	1:1	0.505	1.023	0.517	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	0.03	0	00831	QPSK	1	50	10 mm	back	1:1	0.879	1.005	0.883	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.7	24.50	-0.07	0	00831	QPSK	1	0	10 mm	back	1:1	0.891	1.047	0.933	A24
1770.00	132572	High	LTE Band 66 (AWS)	20	24.7	24.55	0.04	0	00831	QPSK	1	50	10 mm	back	1:1	0.791	1.035	0.819	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	0.11	1	00831	QPSK	50	0	10 mm	back	1:1	0.694	1.012	0.702	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.7	23.61	0.03	1	00831	QPSK	100	0	10 mm	back	1:1	0.688	1.021	0.702	
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	-0.13	0	00815	QPSK	1	99	10 mm	back	1:1	0.561	1.026	0.576	A26
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	0.00	1	00815	QPSK	50	0	10 mm	back	1:1	0.450	1.040	0.468	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram										

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**Table 11-15
DTS Body-Worn SAR**

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2412	1	802.11b	DSSS	22	19.0	18.55	0.15	10 mm	00906	1	back	99.9	0.615	0.425	1.109	1.001	0.472	A28
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram									

**Table 11-16
NII Body-Worn SAR**

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
5300	60	802.11a	OFDM	20	16.0	15.64	-0.15	10 mm	00906	6	back	99.1	1.386	0.639	1.086	1.009	0.700	
5520	104	802.11a	OFDM	20	16.0	15.40	0.03	10 mm	00906	6	back	99.1	1.490	0.615	1.148	1.009	0.712	
5660	132	802.11a	OFDM	20	16.0	15.54	-0.11	10 mm	00906	6	back	99.1	1.531	0.639	1.112	1.009	0.717	A29
5700	140	802.11a	OFDM	20	16.0	15.50	-0.03	10 mm	00906	6	back	99.1	1.528	0.631	1.122	1.009	0.714	
5785	157	802.11a	OFDM	20	16.0	15.56	0.01	10 mm	00906	6	back	99.1	1.492	0.618	1.107	1.009	0.690	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram									

**Table 11-17
DSS Body-Worn SAR**

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)			(W/kg)	
2441	39	Bluetooth	FHSS	10.0	9.49	-0.12	10 mm	00906	1	back	77.3	0.049	1.125	1.294	0.071	A31
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram									

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11.3 Standalone Hotspot SAR Data

Table 11-18
GPRS/UMTS Hotspot SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
824.20	128	GSM 850	GPRS	29.7	29.61	0.08	10 mm	00823	3	1:2.76	back	0.640	1.021	0.653	
836.60	190	GSM 850	GPRS	29.7	29.58	0.02	10 mm	00823	3	1:2.76	back	0.628	1.028	0.646	
848.80	251	GSM 850	GPRS	29.7	29.59	0.05	10 mm	00823	3	1:2.76	back	0.599	1.026	0.615	
836.60	190	GSM 850	GPRS	29.7	29.58	0.03	10 mm	00823	3	1:2.76	front	0.440	1.028	0.452	
836.60	190	GSM 850	GPRS	29.7	29.58	0.05	10 mm	00823	3	1:2.76	bottom	0.215	1.028	0.221	
824.20	128	GSM 850	GPRS	29.7	29.61	-0.13	10 mm	00823	3	1:2.76	right	0.673	1.021	0.687	
836.60	190	GSM 850	GPRS	29.7	29.58	-0.01	10 mm	00823	3	1:2.76	right	0.762	1.028	0.783	A14
848.80	251	GSM 850	GPRS	29.7	29.59	-0.14	10 mm	00823	3	1:2.76	right	0.734	1.026	0.753	
836.60	190	GSM 850	GPRS	29.7	29.58	0.12	10 mm	00823	3	1:2.76	left	0.383	1.028	0.394	
1880.00	661	GSM 1900	GPRS	25.7	25.54	-0.13	10 mm	00815	4	1:2.076	back	0.382	1.038	0.397	
1880.00	661	GSM 1900	GPRS	25.7	25.54	-0.14	10 mm	00815	4	1:2.076	front	0.388	1.038	0.403	A16
1880.00	661	GSM 1900	GPRS	25.7	25.54	0.16	10 mm	00815	4	1:2.076	bottom	0.265	1.038	0.275	
1880.00	661	GSM 1900	GPRS	25.7	25.54	-0.11	10 mm	00815	4	1:2.076	left	0.357	1.038	0.371	
826.40	4132	UMTS 850	RMC	24.7	24.53	-0.02	10 mm	00823	N/A	1:1	back	0.726	1.040	0.755	A17
836.60	4183	UMTS 850	RMC	24.7	24.51	-0.12	10 mm	00823	N/A	1:1	back	0.714	1.045	0.746	
846.60	4233	UMTS 850	RMC	24.7	24.48	-0.08	10 mm	00823	N/A	1:1	back	0.654	1.052	0.688	
836.60	4183	UMTS 850	RMC	24.7	24.51	0.02	10 mm	00823	N/A	1:1	front	0.524	1.045	0.548	
836.60	4183	UMTS 850	RMC	24.7	24.51	0.00	10 mm	00823	N/A	1:1	bottom	0.246	1.045	0.257	
836.60	4183	UMTS 850	RMC	24.7	24.51	-0.02	10 mm	00823	N/A	1:1	right	0.658	1.045	0.688	
836.60	4183	UMTS 850	RMC	24.7	24.51	-0.02	10 mm	00823	N/A	1:1	left	0.412	1.045	0.431	
1712.40	1312	UMTS 1750	RMC	24.7	24.60	-0.08	10 mm	00807	N/A	1:1	back	0.708	1.023	0.724	
1732.40	1412	UMTS 1750	RMC	24.7	24.52	0.00	10 mm	00807	N/A	1:1	back	0.757	1.042	0.789	
1752.60	1513	UMTS 1750	RMC	24.7	24.61	-0.01	10 mm	00807	N/A	1:1	back	0.768	1.021	0.784	
1712.40	1312	UMTS 1750	RMC	24.7	24.60	0.15	10 mm	00807	N/A	1:1	front	0.820	1.023	0.839	
1732.40	1412	UMTS 1750	RMC	24.7	24.52	-0.03	10 mm	00807	N/A	1:1	front	0.888	1.042	0.925	A19
1752.60	1513	UMTS 1750	RMC	24.7	24.61	-0.03	10 mm	00807	N/A	1:1	front	0.870	1.021	0.888	
1732.40	1412	UMTS 1750	RMC	24.7	24.52	0.00	10 mm	00807	N/A	1:1	bottom	0.507	1.042	0.528	
1732.40	1412	UMTS 1750	RMC	24.7	24.52	-0.03	10 mm	00807	N/A	1:1	left	0.481	1.042	0.501	
1852.40	9262	UMTS 1900	RMC	24.7	24.55	-0.21	10 mm	00815	N/A	1:1	back	0.600	1.035	0.621	
1880.00	9400	UMTS 1900	RMC	24.7	24.65	-0.13	10 mm	00815	N/A	1:1	back	0.657	1.012	0.665	
1907.60	9538	UMTS 1900	RMC	24.7	24.46	-0.20	10 mm	00815	N/A	1:1	back	0.684	1.057	0.723	A20
1880.00	9400	UMTS 1900	RMC	24.7	24.65	-0.02	10 mm	00815	N/A	1:1	front	0.638	1.012	0.646	
1880.00	9400	UMTS 1900	RMC	24.7	24.65	-0.12	10 mm	00815	N/A	1:1	bottom	0.414	1.012	0.419	
1880.00	9400	UMTS 1900	RMC	24.7	24.65	-0.06	10 mm	00815	N/A	1:1	left	0.494	1.012	0.500	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT							Body								
Spatial Peak							1.6 W/kg (mW/g)								
Uncontrolled Exposure/General Population							averaged over 1 gram								

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Table 11-19
LTE Band 71 Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	-0.04	0	00831	QPSK	1	0	10 mm	back	1:1	0.414	1.021	0.423	A21
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	0.02	1	00831	QPSK	50	25	10 mm	back	1:1	0.350	1.005	0.352	
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	-0.13	0	00831	QPSK	1	0	10 mm	front	1:1	0.257	1.021	0.262	
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	-0.02	1	00831	QPSK	50	25	10 mm	front	1:1	0.226	1.005	0.227	
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	0.04	0	00831	QPSK	1	0	10 mm	bottom	1:1	0.091	1.021	0.093	
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	0.10	1	00831	QPSK	50	25	10 mm	bottom	1:1	0.075	1.005	0.075	
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	0.10	0	00831	QPSK	1	0	10 mm	right	1:1	0.247	1.021	0.252	
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	-0.07	1	00831	QPSK	50	25	10 mm	right	1:1	0.241	1.005	0.242	
680.50	133297	Mid	LTE Band 71	20	24.7	24.61	-0.03	0	00831	QPSK	1	0	10 mm	left	1:1	0.175	1.021	0.179	
680.50	133297	Mid	LTE Band 71	20	23.7	23.68	0.09	1	00831	QPSK	50	25	10 mm	left	1:1	0.159	1.005	0.160	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-20
LTE Band 12 Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	-0.03	0	00831	QPSK	1	25	10 mm	back	1:1	0.726	1.016	0.738	A22
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	0.02	1	00831	QPSK	25	12	10 mm	back	1:1	0.552	1.019	0.562	
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	0.06	0	00831	QPSK	1	25	10 mm	front	1:1	0.505	1.016	0.513	
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	0.03	1	00831	QPSK	25	12	10 mm	front	1:1	0.372	1.019	0.379	
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	0.12	0	00831	QPSK	1	25	10 mm	bottom	1:1	0.129	1.016	0.131	
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	0.11	1	00831	QPSK	25	12	10 mm	bottom	1:1	0.101	1.019	0.103	
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	0.02	0	00831	QPSK	1	25	10 mm	right	1:1	0.366	1.016	0.372	
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	0.02	1	00831	QPSK	25	12	10 mm	right	1:1	0.275	1.019	0.280	
707.50	23095	Mid	LTE Band 12	10	24.7	24.63	0.05	0	00831	QPSK	1	25	10 mm	left	1:1	0.381	1.016	0.387	
707.50	23095	Mid	LTE Band 12	10	23.7	23.62	0.06	1	00831	QPSK	25	12	10 mm	left	1:1	0.297	1.019	0.303	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT																			
Spatial Peak																			
Uncontrolled Exposure/General Population								Body											
								1.6 W/kg (mW/g)											
								averaged over 1 gram											

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Table 11-21
LTE Band 26 (Cell) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	-0.09	0	00807	QPSK	1	0	10 mm	back	1:1	0.737	1.050	0.774	A23
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	-0.17	1	00807	QPSK	36	18	10 mm	back	1:1	0.505	1.023	0.517	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	-0.05	0	00807	QPSK	1	0	10 mm	front	1:1	0.568	1.050	0.596	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	0.09	1	00807	QPSK	36	18	10 mm	front	1:1	0.395	1.023	0.404	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	-0.03	0	00807	QPSK	1	0	10 mm	bottom	1:1	0.254	1.050	0.267	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	-0.06	1	00807	QPSK	36	18	10 mm	bottom	1:1	0.181	1.023	0.185	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	-0.04	0	00807	QPSK	1	0	10 mm	right	1:1	0.666	1.050	0.699	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	0.08	1	00807	QPSK	36	18	10 mm	right	1:1	0.452	1.023	0.462	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.7	24.49	0.05	0	00807	QPSK	1	0	10 mm	left	1:1	0.408	1.050	0.428	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.7	23.60	-0.12	1	00807	QPSK	36	18	10 mm	left	1:1	0.277	1.023	0.283	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body											
Spatial Peak								1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

Table 11-22
LTE Band 66 (AWS) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	0.03	0	00831	QPSK	1	50	10 mm	back	1:1	0.879	1.005	0.883	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.7	24.50	-0.07	0	00831	QPSK	1	0	10 mm	back	1:1	0.891	1.047	0.933	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.7	24.55	0.04	0	00831	QPSK	1	50	10 mm	back	1:1	0.791	1.035	0.819	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	0.11	1	00831	QPSK	50	0	10 mm	back	1:1	0.694	1.012	0.702	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.7	23.61	0.03	1	00831	QPSK	100	0	10 mm	back	1:1	0.688	1.021	0.702	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	-0.06	0	00831	QPSK	1	50	10 mm	front	1:1	0.958	1.005	0.963	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.7	24.50	0.06	0	00831	QPSK	1	0	10 mm	front	1:1	1.040	1.047	1.089	A25
1770.00	132572	High	LTE Band 66 (AWS)	20	24.7	24.55	0.08	0	00831	QPSK	1	50	10 mm	front	1:1	0.841	1.035	0.870	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	0.03	1	00831	QPSK	50	0	10 mm	front	1:1	0.748	1.012	0.757	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.7	23.61	-0.11	1	00831	QPSK	100	0	10 mm	front	1:1	0.755	1.021	0.771	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	-0.05	0	00831	QPSK	1	50	10 mm	bottom	1:1	0.561	1.005	0.564	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	-0.03	1	00831	QPSK	50	0	10 mm	bottom	1:1	0.419	1.012	0.424	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.7	24.68	-0.10	0	00831	QPSK	1	50	10 mm	left	1:1	0.451	1.005	0.453	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.7	23.65	-0.08	1	00831	QPSK	50	0	10 mm	left	1:1	0.322	1.012	0.326	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.7	24.50	0.06	0	00831	QPSK	1	0	10 mm	front	1:1	0.977	1.047	1.023	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body											
Spatial Peak								1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

Note: Blue entry represents variability measurement.

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Table 11-23
LTE Band 25 (PCS) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	-0.13	0	00815	QPSK	1	99	10 mm	back	1:1	0.561	1.026	0.576	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	0.00	1	00815	QPSK	50	0	10 mm	back	1:1	0.450	1.040	0.468	
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	-0.12	0	00815	QPSK	1	99	10 mm	front	1:1	0.598	1.026	0.614	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	24.7	24.58	-0.18	0	00815	QPSK	1	0	10 mm	front	1:1	0.645	1.028	0.663	
1905.00	26590	High	LTE Band 25 (PCS)	20	24.7	24.56	-0.12	0	00815	QPSK	1	50	10 mm	front	1:1	0.647	1.033	0.668	A27
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	0.01	1	00815	QPSK	50	0	10 mm	front	1:1	0.459	1.040	0.477	
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	0.15	0	00815	QPSK	1	99	10 mm	bottom	1:1	0.397	1.026	0.407	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	0.10	1	00815	QPSK	50	0	10 mm	bottom	1:1	0.320	1.040	0.333	
1860.00	26140	Low	LTE Band 25 (PCS)	20	24.7	24.59	-0.07	0	00815	QPSK	1	99	10 mm	left	1:1	0.475	1.026	0.487	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.7	23.53	-0.09	1	00815	QPSK	50	0	10 mm	left	1:1	0.431	1.040	0.448	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-24
WLAN Hotspot SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
MHz	Ch.												W/kg	(W/kg)				
2412	1	802.11b	DSSS	22	19.0	18.55	0.15	10 mm	00906	1	back	99.9	0.615	0.425	1.109	1.001	0.472	A28
2412	1	802.11b	DSSS	22	19.0	18.55	-0.01	10 mm	00906	1	front	99.9	0.569	0.381	1.109	1.001	0.423	
2412	1	802.11b	DSSS	22	19.0	18.55	0.09	10 mm	00906	1	top	99.9	0.228	-	1.109	1.001	-	
2412	1	802.11b	DSSS	22	19.0	18.55	-0.06	10 mm	00906	1	right	99.9	0.305	-	1.109	1.001	-	
5240	48	802.11a	OFDM	20	16.0	15.76	0.04	10 mm	00906	6	back	99.1	1.459	0.656	1.057	1.009	0.700	
5240	48	802.11a	OFDM	20	16.0	15.76	0.01	10 mm	00906	6	front	99.1	1.064	0.549	1.057	1.009	0.586	
5240	48	802.11a	OFDM	20	16.0	15.76	0.02	10 mm	00906	6	top	99.1	0.711	-	1.057	1.009	-	
5200	40	802.11a	OFDM	20	16.0	15.70	0.19	10 mm	00906	6	right	99.1	1.582	0.785	1.072	1.009	0.849	A30
5220	44	802.11a	OFDM	20	16.0	15.72	0.04	10 mm	00906	6	right	99.1	1.554	0.771	1.067	1.009	0.830	
5240	48	802.11a	OFDM	20	16.0	15.76	-0.02	10 mm	00906	6	right	99.1	1.563	0.748	1.057	1.009	0.798	
5785	157	802.11a	OFDM	20	16.0	15.56	0.01	10 mm	00906	6	back	99.1	1.492	0.618	1.107	1.009	0.690	
5785	157	802.11a	OFDM	20	16.0	15.56	-0.02	10 mm	00906	6	front	99.1	1.085	0.515	1.107	1.009	0.575	
5785	157	802.11a	OFDM	20	16.0	15.56	0.19	10 mm	00906	6	top	99.1	0.733	-	1.107	1.009	-	
5785	157	802.11a	OFDM	20	16.0	15.56	-0.02	10 mm	00906	6	right	99.1	1.409	0.626	1.107	1.009	0.699	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram										

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11.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01r03, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01v01r04, variability SAR tests were performed when the measured SAR results for a frequency band were greater than or equal to 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v02r01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D01v03r01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
3. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.
4. GPRS was additionally evaluated for head and body-worn exposure conditions to address possible VoIP scenarios.

UMTS Notes:

1. UMTS mode in was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required per the 3G Test Reduction Procedure in KDB Publication 941225 D01v03r01.
2. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.

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LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r04. The general test procedures used for testing can be found in Section 8.5.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

WLAN Notes:

1. For held-to-ear and hotspot operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg for 1g evaluations, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 8.6.5 for more information.
3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg for 1g evaluations. See Section 8.6.6 for more information.
4. When the maximum reported 1g averaged SAR is ≤ 0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.
5. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.

Bluetooth Notes

1. Bluetooth SAR was measured with the device connected to a call box with hopping disabled with DH5 operation and Tx Tests test mode type. Per October 2016 TCB Workshop Notes, the reported SAR was scaled to the 100% transmission duty factor to determine compliance. See Section 9.5 for the time domain plot and calculation for the duty factor of the device.

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12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitters such as 802.11 and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

12.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per FCC KDB Publication 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1g SAR for all the simultaneous transmitting antennas in a specific physical test configuration is ≤ 1.6 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1g or 10g SAR.

12.3 Head SAR Simultaneous Transmission Analysis

Table 12-1
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2			1	2	1+2
Head SAR	Right Cheek	0.416	0.566	0.982	Head SAR	Right Cheek	0.233	0.566	0.799
	Right Tilt	0.283	0.589	0.872		Right Tilt	0.091	0.589	0.680
	Left Cheek	0.333	1.199	1.532		Left Cheek	0.335	1.199	1.534
	Left Tilt	0.241	0.796	1.037		Left Tilt	0.134	0.796	0.930

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2			1	2	1+2	1+2
Head SAR	Right Cheek	0.399	0.566	0.965	Head SAR	Right Cheek	0.316	0.566	0.882	N/A
	Right Tilt	0.261	0.589	0.850		Right Tilt	0.116	0.589	0.705	N/A
	Left Cheek	0.302	1.199	1.501		Left Cheek	0.415	1.199	See Note 1	0.02
	Left Tilt	0.217	0.796	1.013		Left Tilt	0.161	0.796	0.957	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2			1	2	1+2	1+2
Head SAR	Right Cheek	0.473	0.566	1.039	Head SAR	Right Cheek	0.494	0.566	1.060	N/A
	Right Tilt	0.296	0.589	0.885		Right Tilt	0.348	0.589	0.937	N/A
	Left Cheek	0.359	1.199	1.558		Left Cheek	0.575	1.199	See Note 1	0.02
	Left Tilt	0.269	0.796	1.065		Left Tilt	0.395	0.796	1.191	N/A

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Head SAR	Right Cheek	0.447	0.566	1.013	N/A
	Right Tilt	0.166	0.589	0.755	N/A
	Left Cheek	0.595	1.199	See Note 1	0.03
	Left Tilt	0.244	0.796	1.040	N/A

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Simult Tx	Configuration	LTE Band 71 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2			1	2	1+2	
Head SAR	Right Cheek	0.300	0.566	0.866	Head SAR	Right Cheek	0.514	0.566	1.080	N/A
	Right Tilt	0.133	0.589	0.722		Right Tilt	0.274	0.589	0.863	N/A
	Left Cheek	0.239	1.199	1.438		Left Cheek	0.452	1.199	See Note 1	0.03
	Left Tilt	0.121	0.796	0.917		Left Tilt	0.274	0.796	1.070	N/A

Simult Tx	Configuration	LTE Band 26 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR	Simult Tx	Configuration	LTE Band 66 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2				1	2	1+2	
Head SAR	Right Cheek	0.568	0.566	1.134	N/A	Head SAR	Right Cheek	0.407	0.566	0.973	N/A
	Right Tilt	0.359	0.589	0.948	N/A		Right Tilt	0.352	0.589	0.941	N/A
	Left Cheek	0.441	1.199	See Note 1	0.04		Left Cheek	0.577	1.199	See Note 1	0.03
	Left Tilt	0.332	0.796	1.128	N/A		Left Tilt	0.312	0.796	1.108	N/A

Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	
Head SAR	Right Cheek	0.366	0.566	0.932	N/A
	Right Tilt	0.161	0.589	0.750	N/A
	Left Cheek	0.566	1.199	See Note 1	0.02
	Left Tilt	0.218	0.796	1.014	N/A

Table 12-2
Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR	Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2				1	2	1+2	
Head SAR	Right Cheek	0.416	1.130	1.546	N/A	Head SAR	Right Cheek	0.233	1.130	1.363	N/A
	Right Tilt	0.283	1.018	1.301	N/A		Right Tilt	0.091	1.018	1.109	N/A
	Left Cheek	0.333	1.275	See Note 1	0.03		Left Cheek	0.335	1.275	See Note 1	0.02
	Left Tilt	0.241	1.015	1.256	N/A		Left Tilt	0.134	1.015	1.149	N/A

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR	Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2				1	2	1+2	
Head SAR	Right Cheek	0.399	1.130	1.529		Head SAR	Right Cheek	0.316	1.130	1.446	N/A
	Right Tilt	0.261	1.018	1.279			Right Tilt	0.116	1.018	1.134	N/A
	Left Cheek	0.302	1.275	1.577			Left Cheek	0.415	1.275	See Note 1	0.02
	Left Tilt	0.217	1.015	1.232			Left Tilt	0.161	1.015	1.176	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR	Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2				1	2	1+2	
Head SAR	Right Cheek	0.473	1.130	See Note 1	0.03	Head SAR	Right Cheek	0.494	1.130	See Note 1	0.03
	Right Tilt	0.296	1.018	1.314	N/A		Right Tilt	0.348	1.018	1.366	N/A
	Left Cheek	0.359	1.275	See Note 1	0.03		Left Cheek	0.575	1.275	See Note 1	0.02
	Left Tilt	0.269	1.015	1.284	N/A		Left Tilt	0.395	1.015	1.410	N/A

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Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Head SAR	Right Cheek	0.447	1.130	1.577	N/A
	Right Tilt	0.166	1.018	1.184	N/A
	Left Cheek	0.595	1.275	See Note 1	0.03
	Left Tilt	0.244	1.015	1.259	N/A

Simult Tx	Configuration	LTE Band 71 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2			1	2	1+2	
Head SAR	Right Cheek	0.300	1.130	1.430	Head SAR	Right Cheek	0.514	1.130	See Note 1	0.03
	Right Tilt	0.133	1.018	1.151		Right Tilt	0.274	1.018	1.292	N/A
	Left Cheek	0.239	1.275	1.514		Left Cheek	0.452	1.275	See Note 1	0.03
	Left Tilt	0.121	1.015	1.136		Left Tilt	0.274	1.015	1.289	N/A

Simult Tx	Configuration	LTE Band 26 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR	Simult Tx	Configuration	LTE Band 66 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2				1	2	1+2	
Head SAR	Right Cheek	0.568	1.130	See Note 1	0.03	Head SAR	Right Cheek	0.407	1.130	1.537	N/A
	Right Tilt	0.359	1.018	1.377	N/A		Right Tilt	0.352	1.018	1.370	N/A
	Left Cheek	0.441	1.275	See Note 1	0.04		Left Cheek	0.577	1.275	See Note 1	0.03
	Left Tilt	0.332	1.015	1.347	N/A		Left Tilt	0.312	1.015	1.327	N/A

Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Head SAR	Right Cheek	0.366	1.130	1.496	N/A
	Right Tilt	0.161	1.018	1.179	N/A
	Left Cheek	0.566	1.275	See Note 1	0.03
	Left Tilt	0.218	1.015	1.233	N/A

Notes:

1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D01v06. See Section 12.6 for detailed SPLS ratio analysis.

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12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-3
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body-Worn	GSM/GPRS 850	0.691	0.472	1.163
	GSM/GPRS 1900	0.397	0.472	0.869
	UMTS 850	0.755	0.472	1.227
	UMTS 1750	0.789	0.472	1.261
	UMTS 1900	0.723	0.472	1.195
	LTE Band 71	0.423	0.472	0.895
	LTE Band 12	0.738	0.472	1.210
	LTE Band 26 (Cell)	0.774	0.472	1.246
	LTE Band 66 (AWS)	0.933	0.472	1.405
	LTE Band 25 (PCS)	0.576	0.472	1.048

Table 12-4
Simultaneous Transmission Scenario with 2.4 GHz Bluetooth (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body-Worn	GSM/GPRS 850	0.691	0.071	0.762
	GSM/GPRS 1900	0.397	0.071	0.468
	UMTS 850	0.755	0.071	0.826
	UMTS 1750	0.789	0.071	0.860
	UMTS 1900	0.723	0.071	0.794
	LTE Band 71	0.423	0.071	0.494
	LTE Band 12	0.738	0.071	0.809
	LTE Band 26 (Cell)	0.774	0.071	0.845
	LTE Band 66 (AWS)	0.933	0.071	1.004
	LTE Band 25 (PCS)	0.576	0.071	0.647

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Table 12-5
Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body-Worn	GSM/GPRS 850	0.691	0.717	1.408	N/A
	GSM/GPRS 1900	0.397	0.717	1.114	N/A
	UMTS 850	0.755	0.717	1.472	N/A
	UMTS 1750	0.789	0.717	1.506	N/A
	UMTS 1900	0.723	0.717	1.440	N/A
	LTE Band 71	0.423	0.717	1.140	N/A
	LTE Band 12	0.738	0.717	1.455	N/A
	LTE Band 26 (Cell)	0.774	0.717	1.491	N/A
	LTE Band 66 (AWS)	0.933	0.717	See Note 1	0.02
	LTE Band 25 (PCS)	0.576	0.717	1.293	N/A

Table 12-6
Simultaneous Transmission Scenario with 2.4 GHz Bluetooth and 5 GHz WLAN (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)			SPLSR		
		1	2	3	1+2	1+3	1+2+3	1+2	1+3	2+3
Body-Worn	GSM/GPRS 850	0.691	0.071	0.717	0.762	1.408	1.479	N/A	N/A	N/A
	GSM/GPRS 1900	0.397	0.071	0.717	0.468	1.114	1.185	N/A	N/A	N/A
	UMTS 850	0.755	0.071	0.717	0.826	1.472	1.543	N/A	N/A	N/A
	UMTS 1750	0.789	0.071	0.717	0.860	1.506	1.577	N/A	N/A	N/A
	UMTS 1900	0.723	0.071	0.717	0.794	1.440	1.511	N/A	N/A	N/A
	LTE Band 71	0.423	0.071	0.717	0.494	1.140	1.211	N/A	N/A	N/A
	LTE Band 12	0.738	0.071	0.717	0.809	1.455	1.526	N/A	N/A	N/A
	LTE Band 26 (Cell)	0.774	0.071	0.717	0.845	1.491	1.562	N/A	N/A	N/A
	LTE Band 66 (AWS)	0.933	0.071	0.717	1.004	See Note 1	See Note 1	0.01	0.02	0.04
	LTE Band 25 (PCS)	0.576	0.071	0.717	0.647	1.293	1.364	N/A	N/A	N/A

Notes:

1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D01v06. See Section 12.6 for detailed SPLS ratio analysis.

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12.5 Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v02r01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR (“-”).

(*) For test positions that were not required to be evaluated for WLAN SAR per FCC KDB publication 248227, the worst case WLAN SAR result for the applicable exposure conditions was used for simultaneous transmission analysis.

Table 12-7
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	GPRS 850	0.783	0.472	1.255
	GPRS 1900	0.403	0.472	0.875
	UMTS 850	0.755	0.472	1.227
	UMTS 1750	0.925	0.472	1.397
	UMTS 1900	0.723	0.472	1.195
	LTE Band 71	0.423	0.472	0.895
	LTE Band 12	0.738	0.472	1.210
	LTE Band 26 (Cell)	0.774	0.472	1.246
	LTE Band 66 (AWS)	1.089	0.472	1.561
	LTE Band 25 (PCS)	0.668	0.472	1.140

Table 12-8
Simultaneous Transmission Scenario with 5 GHz WLAN (Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	GPRS 850	0.783	0.849	See Table Below
	GPRS 1900	0.403	0.849	1.252
	UMTS 850	0.755	0.849	See Table Below
	UMTS 1750	0.925	0.849	See Table Below
	UMTS 1900	0.723	0.849	1.572
	LTE Band 71	0.423	0.849	1.272
	LTE Band 12	0.738	0.849	1.587
	LTE Band 26 (Cell)	0.774	0.849	See Table Below
	LTE Band 66 (AWS)	1.089	0.849	See Table Below
	LTE Band 25 (PCS)	0.668	0.849	1.517

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Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2	1+2			1	2	1+2
Hotspot SAR	Back	0.653	0.700	1.353	N/A	Hotspot SAR	Back	0.755	0.700	1.455
	Front	0.452	0.586	1.038	N/A		Front	0.548	0.586	1.134
	Top	-	0.849*	0.849	N/A		Top	-	0.849*	0.849
	Bottom	0.221	-	0.221	N/A		Bottom	0.257	-	0.257
	Right	0.783	0.849	See Note 1	0.03		Right	0.688	0.849	1.537
	Left	0.394	-	0.394	N/A		Left	0.431	-	0.431

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 26 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2			1	2	1+2
Hotspot SAR	Back	0.789	0.700	1.489	Hotspot SAR	Back	0.774	0.700	1.474
	Front	0.925	0.586	1.511		Front	0.596	0.586	1.182
	Top	-	0.849*	0.849		Top	-	0.849*	0.849
	Bottom	0.528	-	0.528		Bottom	0.267	-	0.267
	Right	-	0.849	0.849		Right	0.699	0.849	1.548
	Left	0.501	-	0.501		Left	0.428	-	0.428

Simult Tx	Configuration	LTE Band 66 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Hotspot SAR	Back	0.933	0.700	See Note 1	0.20
	Front	1.089	0.586	See Note 1	0.20
	Top	-	0.849*	0.849	N/A
	Bottom	0.564	-	0.564	N/A
	Right	-	0.849	0.849	N/A
	Left	0.453	-	0.453	N/A

Notes:

- No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D01v06. See Section 12.6 for detailed SPLS ratio analysis.

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12.6 SPLSR Evaluation and Analysis

Per FCC KDB Publication 447498 D01v06, when the sum of the standalone transmitters is more than 1.6 W/kg for 1g, the SAR sum to peak locations can be analyzed to determine SAR distribution overlaps. When the SAR peak to location ratio (shown below) for each pair of antennas is

≤ 0.04 for 1g, simultaneous SAR evaluation is not required. The distance between the transmitters was calculated using the following formula.

$$\text{Distance}_{\text{Tx1} - \text{Tx2}} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2} \text{ (Head)}$$

$$\text{Distance}_{\text{Tx1} - \text{Tx2}} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \text{ (Body-Worn, Hotspot)}$$

$$\text{SPLS Ratio} = \frac{(SAR_1 + SAR_2)^{1.5}}{R_i}$$

12.6.1 Right Cheek SPLSR Evaluation and Analysis

Table 12-9
Peak SAR Locations for Right Cheek

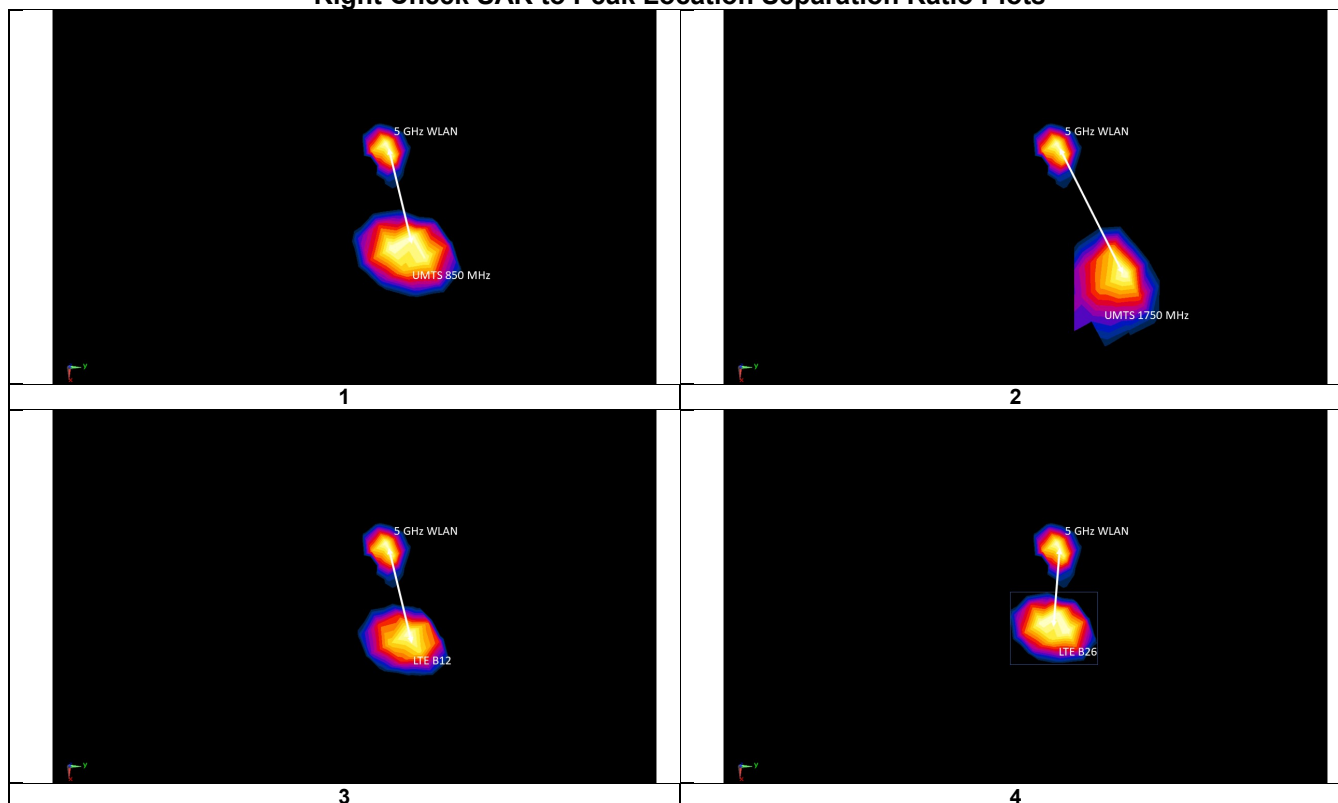
Mode/Band	x (mm)	y (mm)	z (mm)	Reported SAR (W/kg)
5 GHz WLAN	-0.31	-285.81	-169.11	1.130
UMTS 850	60.39	-268.25	-175.40	0.473
UMTS 1750	65.85	-253.81	-174.83	0.494
LTE B12	63.05	-256.52	-174.19	0.514
LTE B26	60.98	-266.21	-175.24	0.568

Table 12-10
Right Cheek SAR to Peak Location Separation Ratio Calculations

Antenna Pair		Standalone SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio	Plot Number
Ant "a"	Ant "b"	a	b	a+b	D _{a-b}	(a+b) ^{1.5} /D _{a-b}	
UMTS 850	5 GHz WLAN	0.473	1.130	1.603	63.50	0.03	1
UMTS 1750	5 GHz WLAN	0.494	1.130	1.624	73.71	0.03	2
LTE B12	5 GHz WLAN	0.514	1.130	1.644	69.99	0.03	3
LTE B26	5 GHz WLAN	0.568	1.130	1.698	64.64	0.03	4

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Table 12-11
Right Cheek SAR to Peak Location Separation Ratio Plots



12.6.2 Left Cheek SPLSR Evaluation and Analysis

Table 12-12
Peak SAR Locations for Left Cheek

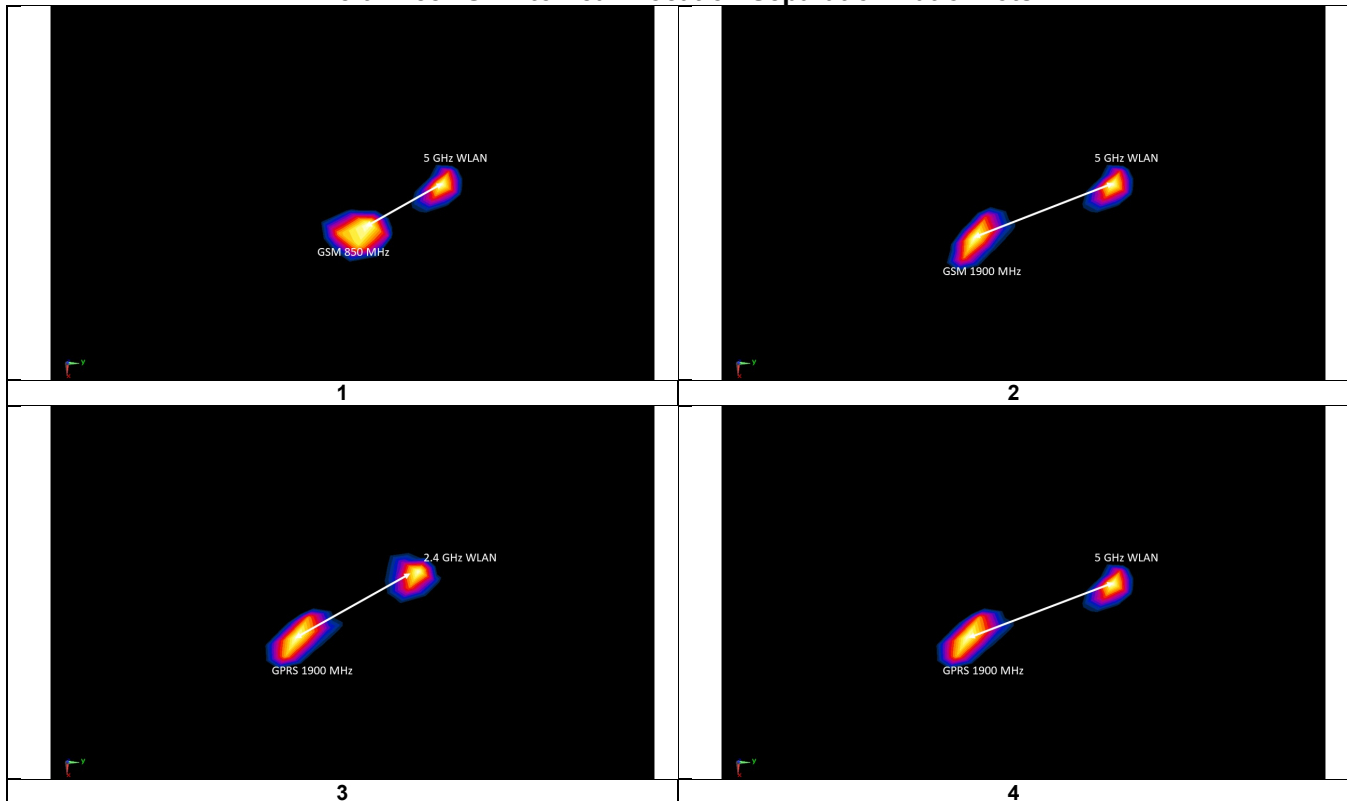
Mode/Band	x (mm)	y (mm)	z (mm)	Reported SAR (W/kg)
2.4 GHz WLAN	32.24	332.52	-174.24	1.199
5 GHz WLAN	27.19	335.28	-174.44	1.275
GSM 850	58.47	275.46	-177.42	0.333
GSM 1900	66.11	251.37	-173.98	0.335
GPRS 1900	66.10	251.37	-173.98	0.415
UMTS 850	59.07	273.42	-177.30	0.359
UMTS 1750	68.30	242.54	-172.38	0.575
UMTS 1900	73.82	248.85	-171.81	0.595
LTE Band 12	66.79	275.12	-176.57	0.452
LTE Band 26	58.55	281.76	-177.50	0.441
LTE Band 66 (AWS)	64.53	250.49	-174.08	0.577
LTE Band 25 (PCS)	71.46	246.72	-172.08	0.566

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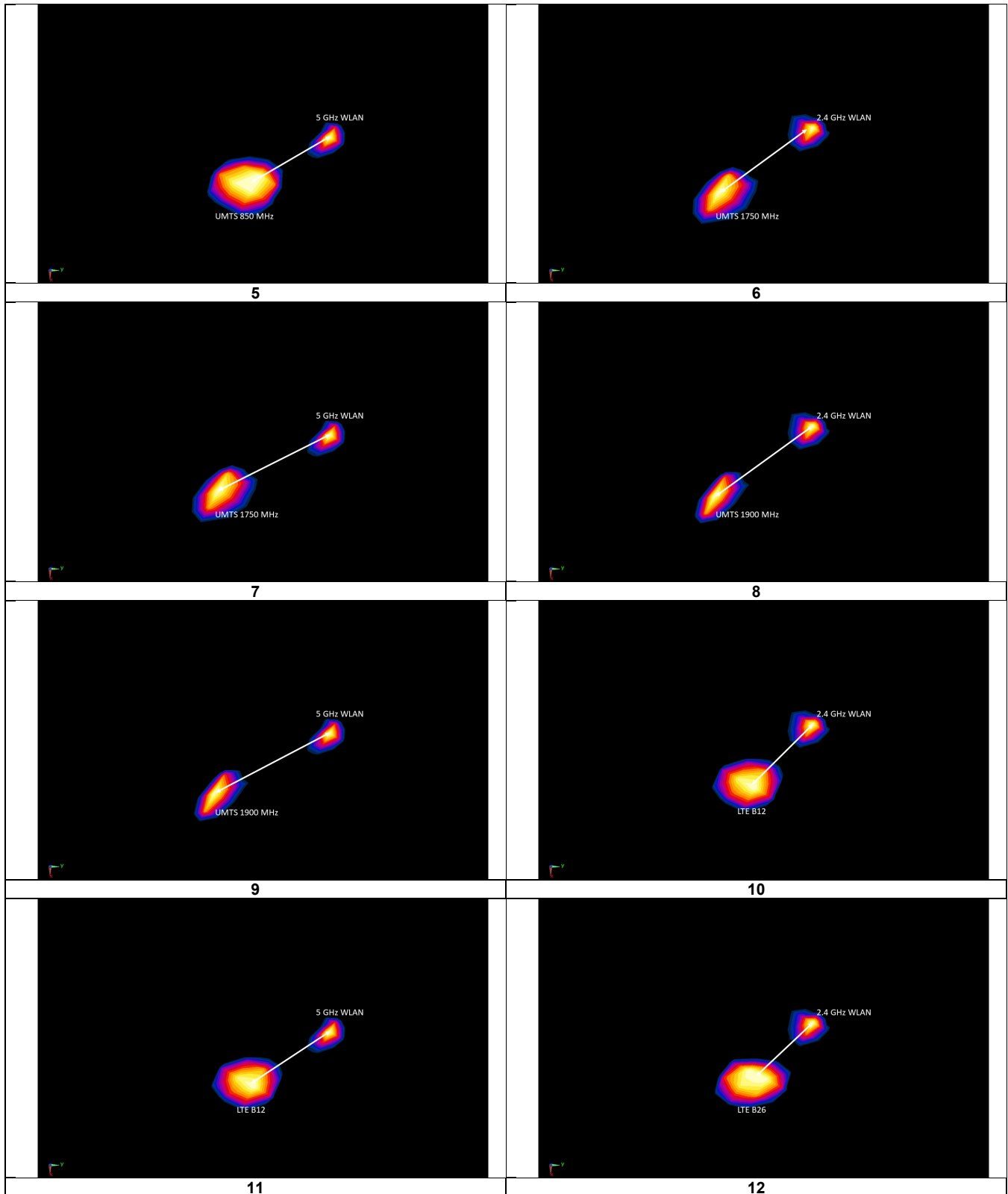
Table 12-13
Left Cheek SAR to Peak Location Separation Ratio Calculations

Antenna Pair		Standalone SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio	Plot Number
Ant "a"	Ant "b"	a	b	a+b	D _{a-b}	$(a+b)^{1.5}/D_{a-b}$	
GSM 850	5 GHz WLAN	0.333	1.275	1.608	67.57	0.03	1
GSM 1900	5 GHz WLAN	0.335	1.275	1.61	92.50	0.02	2
GPRS 1900	2.4 GHz WLAN	0.415	1.199	1.614	87.93	0.02	3
GPRS 1900	5 GHz WLAN	0.415	1.275	1.69	92.49	0.02	4
UMTS 850	5 GHz WLAN	0.359	1.275	1.634	69.65	0.03	5
UMTS 1750	2.4 GHz WLAN	0.575	1.199	1.774	96.95	0.02	6
UMTS 1750	5 GHz WLAN	0.575	1.275	1.85	101.46	0.02	7
UMTS 1900	2.4 GHz WLAN	0.595	1.199	1.794	93.46	0.03	8
UMTS 1900	5 GHz WLAN	0.595	1.275	1.87	98.24	0.03	9
LTE Band 12	2.4 GHz WLAN	0.452	1.199	1.651	67.04	0.03	10
LTE Band 12	5 GHz WLAN	0.452	1.275	1.727	72.05	0.03	11
LTE Band 26	2.4 GHz WLAN	0.441	1.199	1.64	57.27	0.04	12
LTE Band 26	5 GHz WLAN	0.441	1.275	1.716	62.11	0.04	13
LTE Band 66 (AWS)	2.4 GHz WLAN	0.577	1.199	1.776	88.16	0.03	14
LTE Band 66 (AWS)	5 GHz WLAN	0.577	1.275	1.852	92.65	0.03	15
LTE Band 25 (PCS)	2.4 GHz WLAN	0.566	1.199	1.765	94.36	0.02	16
LTE Band 25 (PCS)	5 GHz WLAN	0.566	1.275	1.841	99.04	0.03	17

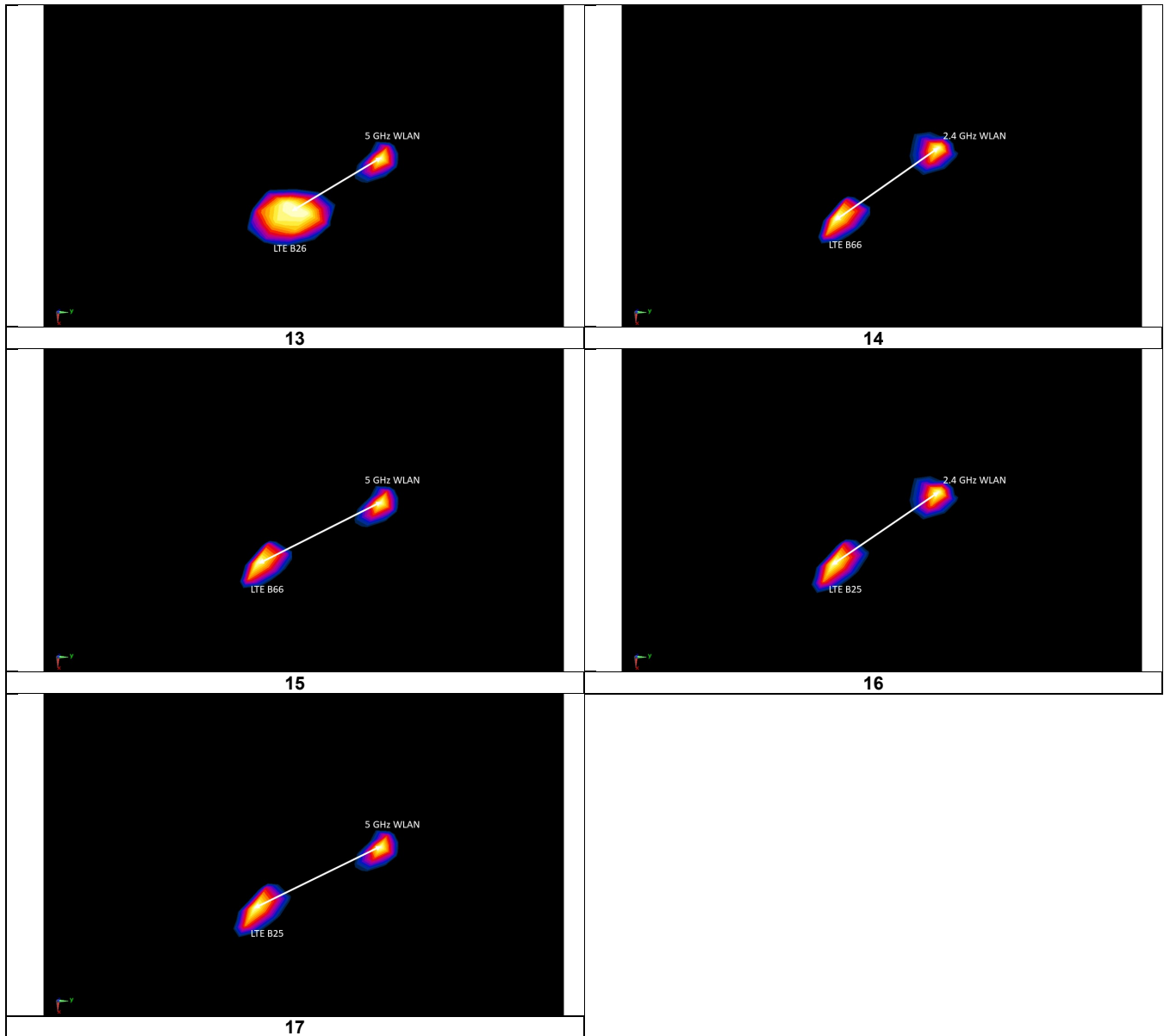
Table 12-14
Left Cheek SAR to Peak Location Separation Ratio Plots



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12.6.3

Back Side SPLSR Evaluation and Analysis

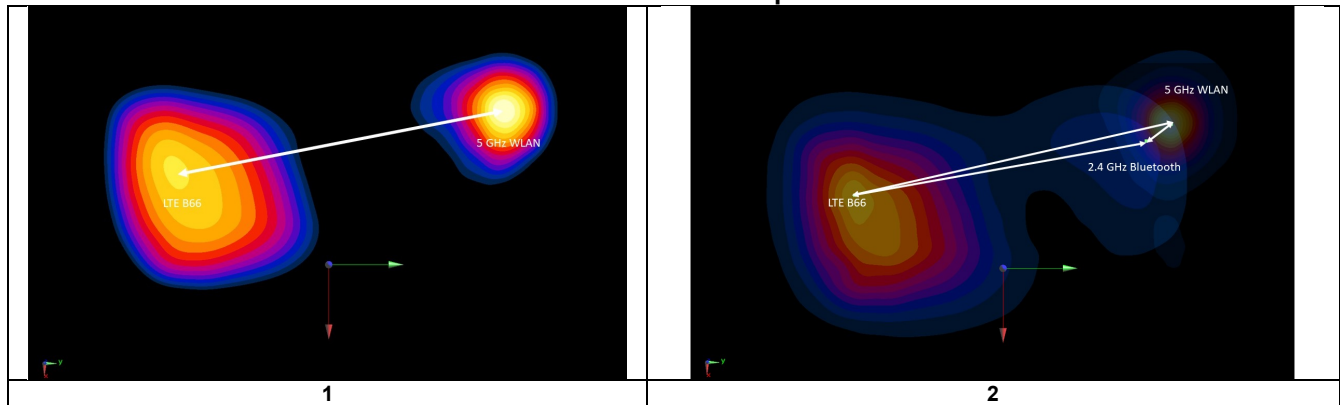
Table 12-15
Peak SAR Locations for Body Back Side

Mode/Band	x (mm)	y (mm)	Reported SAR (W/kg)
2.4 GHz Bluetooth	-51.20	52.00	0.071
5 GHz WLAN	-51.00	69.00	0.717
LTE Band 66 (AWS)	-27.50	-55.50	0.933

Table 12-16
Back Side SAR to Peak Location Separation Ratio Calculations

Antenna Pair		Standalone SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio	Plot Number
Ant "a"	Ant "b"	a	b	a+b	D _{a-b}	$(a+b)^{1.5}/D_{a-b}$	
LTE Band 66 (AWS)	5 GHz WLAN	0.933	0.717	1.65	126.70	0.02	1,2
2.4 GHz Bluetooth	5 GHz WLAN	0.071	0.717	0.788	17.00	0.04	2
LTE Band 66 (AWS)	2.4 GHz Bluetooth	0.933	0.071	1.004	110.08	0.01	

Table 12-17
Back Side SAR to Peak Location Separation Ratio Plots



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Front Side SPLSR Evaluation and Analysis

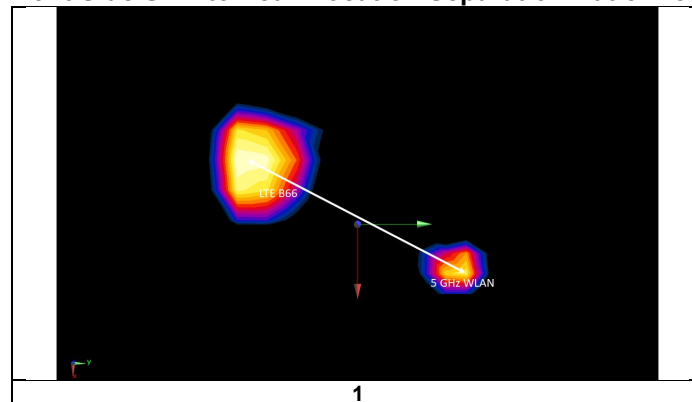
Table 12-18
Peak SAR Locations for Hotspot Front Side

Mode/Band	x (mm)	y (mm)	Reported SAR (W/kg)
5 GHz WLAN	13.00	62.00	0.586
LTE B66 (AWS)	-30.50	-55.50	1.089

Table 12-19
Front Side SAR to Peak Location Separation Ratio Calculations

Antenna Pair		Standalone SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio	Plot Number
Ant "a"	Ant "b"	a	b	a+b	D _{a-b}	$(a+b)^{1.5}/D_{a-b}$	
LTE B66 (AWS)	5 GHz WLAN	1.089	0.586	1.675	125.29	0.02	1

Table 12-20
Front Side SAR to Peak Location Separation Ratio Plots



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12.6.5

Right Edge SPLSR Evaluation and Analysis

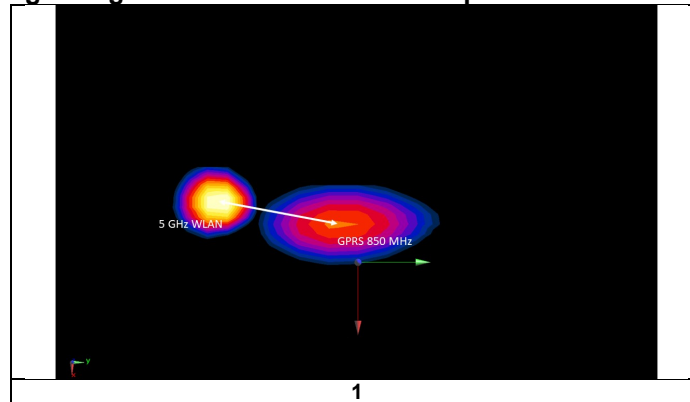
Table 12-21
Peak SAR Locations for Hotspot Right Edge

Mode/Band	x (mm)	y (mm)	Reported SAR (W/kg)
5 GHz WLAN	-30.50	-64.00	0.849
GPRS 850	-19.50	-2.50	0.783

Table 12-22
Right Edge SAR to Peak Location Separation Ratio Calculations

Antenna Pair		Standalone SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio	Plot Number
Ant "a"	Ant "b"	a	b	a+b	D _{a-b}	$(a+b)^{1.5}/D_{a-b}$	
GPRS 850	5 GHz WLAN	0.783	0.849	1.632	62.48	0.03	1

Table 12-23
Right Edge SAR to Peak Location Separation Ratio Plots



12.7 Simultaneous Transmission Conclusion

The above numerical summed SAR results and SPLSR analysis are sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06 and IEEE 1528- 2013 Section 6.3.4.1.

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13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

- 1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
- 2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg ($\sim 10\%$ from the 1g SAR limit).
- 3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .
- 4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

Table 13-1
Head SAR Measurement Variability Results

HEAD VARIABILITY RESULTS														
Band	FREQUENCY		Mode/Band	Service	Side	Test Position	Data Rate (Mbps)	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.						(W/kg)	(W/kg)		(W/kg)			
2450	2462.00	11	802.11b, 22 MHz Bandwidth	DSSS	Left	Cheek	1	1.090	1.090	1.00	N/A	N/A	N/A	N/A
5250	5280.00	56	802.11a, 20 MHz Bandwidth	OFDM	Left	Cheek	6	1.090	1.030	1.06	N/A	N/A	N/A	N/A
5600	5580.00	116	802.11a, 20 MHz Bandwidth	OFDM	Left	Cheek	6	0.997	0.970	1.03	N/A	N/A	N/A	N/A
5750	5785.00	157	802.11a, 20 MHz Bandwidth	OFDM	Right	Cheek	6	1.010	0.918	1.10	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT					Head 1.6 W/kg (mW/g) averaged over 1 gram									
Spatial Peak														
Uncontrolled Exposure/General Population														

Table 13-2
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS													
Band	FREQUENCY		Mode	Service	Side	Spacing	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.						(W/kg)		(W/kg)		(W/kg)	
1750	1745.00	132322	LTE Band 66 (AWS), 20 MHz Bandwidth	QPSK, 1 RB, 0 RB Offset	front	10 mm	1.040	0.977	1.06	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT						Body							
Spatial Peak						1.6 W/kg (mW/g)							
Uncontrolled Exposure/General Population						averaged over 1 gram							

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13.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

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14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	E4438C	ESG Vector Signal Generator	3/24/2017	Biennial	3/24/2019	MY42082385
Agilent	E4432B	ESG-D Series Signal Generator	4/19/2018	Annual	4/19/2019	US40053896
Agilent	N5182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Agilent	N5182A-506	MXG Vector Signal Generator	6/19/2018	Annual	6/19/2019	MY48180366
Agilent	8753ES	S-Parameter Network Analyzer	7/30/2018	Annual	7/30/2019	MY40000670
Agilent	8753ES	S-Parameter Vector Network Analyzer	8/30/2018	Annual	8/30/2019	MY40003841
Agilent	E5515C	Wireless Communications Test Set	5/22/2018	Biennial	5/22/2020	GB43193563
Agilent	E5515C	Wireless Communications Test Set	2/7/2018	Triennial	2/7/2021	GB43304447
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB44450273
Amplifier Research	1551G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	1551G6	Amplifier	CBT	N/A	CBT	433974
Anritsu	ML2496A	Power Meter	6/19/2018	Annual	6/19/2019	1306009
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1126066
Anritsu	MT8821C	Radio Communication Analyzer	11/6/2018	Annual	11/6/2019	6200901190
Anritsu	MT8821C	Radio Communication Analyzer	1/25/2019	Annual	1/25/2020	6261895213
Anritsu	MA24106A	USB Power Sensor	6/5/2018	Annual	6/5/2019	1231538
Anritsu	MA24106A	USB Power Sensor	6/5/2018	Annual	6/5/2019	1231535
Anritsu	MA24106A	USB Power Sensor	6/5/2018	Annual	6/5/2019	1244515
Anritsu	MA24106A	USB Power Sensor	7/16/2018	Annual	7/16/2019	1520505
Anritsu	MT8862A	Wireless Connectivity Test Set	7/3/2018	Annual	7/3/2019	6261782395
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
COMTECH	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M155A00-009
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647811
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647802
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647812
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766816
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766817
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766801
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766777
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	3/30/2018	Annual	3/30/2019	11401010036
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mitutoyo	CD-6°CSX	Digital Caliper	4/18/2018	Biennial	4/18/2020	13264165
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-53W2	Attenuator (3dB)	CBT	N/A	CBT	120
Narda	EHP-200AC	Electric & Magnetic Field Probe	6/12/2018	Annual	6/12/2019	170WX70211
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	NC-100	Torque Wrench	4/18/2018	Annual	4/18/2019	N/A
Pasternack	NC-100	Torque Wrench	4/18/2018	Annual	4/18/2019	1445
Pasternack	NC-100	Torque Wrench	5/23/2018	Biennial	5/23/2020	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	5/18/2018	Annual	5/18/2019	109892
Rohde & Schwarz	CMW500	Radio Communication Tester	11/5/2018	Annual	11/5/2019	140148
Rohde & Schwarz	CMW500	Radio Communication Tester	11/14/2018	Annual	11/14/2019	100976
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	1/30/2019	Annual	1/30/2020	162125
SPEAG	D1750V2	1750 MHz SAR Dipole	5/9/2017	Biennial	5/9/2019	1148
SPEAG	D1900V2	1900 MHz SAR Dipole	10/23/2018	Annual	10/23/2019	54080
SPEAG	D1900V2	1900 MHz SAR Dipole	10/23/2018	Annual	10/23/2019	54149
SPEAG	D2450V2	2450 MHz SAR Dipole	8/16/2018	Annual	8/16/2019	981
SPEAG	D2450V2	2450 MHz SAR Dipole	9/11/2017	Biennial	9/11/2019	797
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/21/2016	Triennial	9/21/2019	1191
SPEAG	D750V3	750 MHz Dipole	3/7/2017	Biennial	3/7/2019	1054
SPEAG	D750V3	750 MHz SAR Dipole	1/15/2018	Biennial	1/15/2020	1003
SPEAG	D835V2	835 MHz SAR Dipole	10/19/2018	Annual	10/19/2019	44047
SPEAG	D835V2	835 MHz SAR Dipole	1/22/2019	Annual	1/22/2020	44132
SPEAG	D835V2	835 MHz SAR Dipole	10/19/2018	Annual	10/19/2019	44133
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/7/2018	Annual	3/7/2019	1368
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/11/2018	Annual	4/11/2019	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2018	Annual	7/11/2019	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/3/2018	Annual	10/3/2019	1558
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/22/2018	Annual	8/22/2019	1450
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/15/2019	Annual	1/15/2020	1530
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/22/2018	Annual	8/22/2019	1041
SPEAG	ES3DV3	SAR Probe	3/13/2018	Annual	3/13/2019	3319
SPEAG	EX3DV4	SAR Probe	4/18/2018	Annual	4/18/2019	7357
SPEAG	EX3DV4	SAR Probe	6/25/2018	Annual	6/25/2019	7409
SPEAG	EX3DV4	SAR Probe	7/20/2018	Annual	7/20/2019	7410
SPEAG	EX3DV4	SAR Probe	8/23/2018	Annual	8/23/2019	7308
SPEAG	EX3DV4	SAR Probe	1/24/2019	Annual	1/24/2020	7488
SPEAG	EX3DV4	SAR Probe	1/25/2019	Annual	1/25/2020	3589

Note:

1. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
2. Each equipment was used solely within its calibration period.

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15 MEASUREMENT UNCERTAINTIES

a	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	Tol. (± %)	Prob. Dist.	Div.	c _i 1gm	c _i 10 gms	1gm u _i (± %)	10gms u _i (± %)	v _i
Measurement System								
Probe Calibration	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	2.0	R	1.73	1.0	1.0	1.2	1.2	∞
Linearity	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	0.25	R	1.73	1.0	1.0	0.1	0.1	∞
Readout Electronics	0.3	N	1	1.0	1.0	0.3	0.3	∞
Response Time	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions - Noise	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
RF Ambient Conditions - Reflections	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	6.7	R	1.73	1.0	1.0	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Test Sample Related								
Test Sample Positioning	2.7	N	1	1.0	1.0	2.7	2.7	35
Device Holder Uncertainty	1.67	N	1	1.0	1.0	1.7	1.7	5
Output Power Variation - SAR drift measurement	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
SAR Scaling	0.0	R	1.73	1.0	1.0	0.0	0.0	∞
Phantom & Tissue Parameters								
Phantom Uncertainty (Shape & Thickness tolerances)	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	4.2	N	1	0.78	0.71	3.3	3.0	10
Liquid Permittivity - measurement uncertainty	4.1	N	1	0.23	0.26	1.0	1.1	10
Liquid Conductivity - Temperature Uncertainty	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Uncertainty	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)	RSS					11.5	11.3	60
Expanded Uncertainty (95% CONFIDENCE LEVEL)	k=2					23.0	22.6	

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16 CONCLUSION

16.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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FCC ID: ZNFX220TB	 SAR EVALUATION REPORT 		Approved by: Quality Manager
Document S/N: 1M1902110024-01-R1.ZNF	Test Dates: 02/11/19 – 03/06/19	DUT Type: Portable Handset	Page 78 of 78

APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFX220TB; Type: Portable Handset; Serial: 00831

Communication System: UID 0, GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.6$ MHz; $\sigma = 0.882$ S/m; $\epsilon_r = 39.519$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Test Date: 02-11-2019; Ambient Temp: 21.1°C; Tissue Temp: 20.3°C

Probe: EX3DV4 - SN7410; ConvF(9.81, 9.81, 9.81) @ 836.6 MHz; Calibrated: 7/20/2018

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/11/2018

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: GSM 850, Right Head, Cheek, Mid.ch

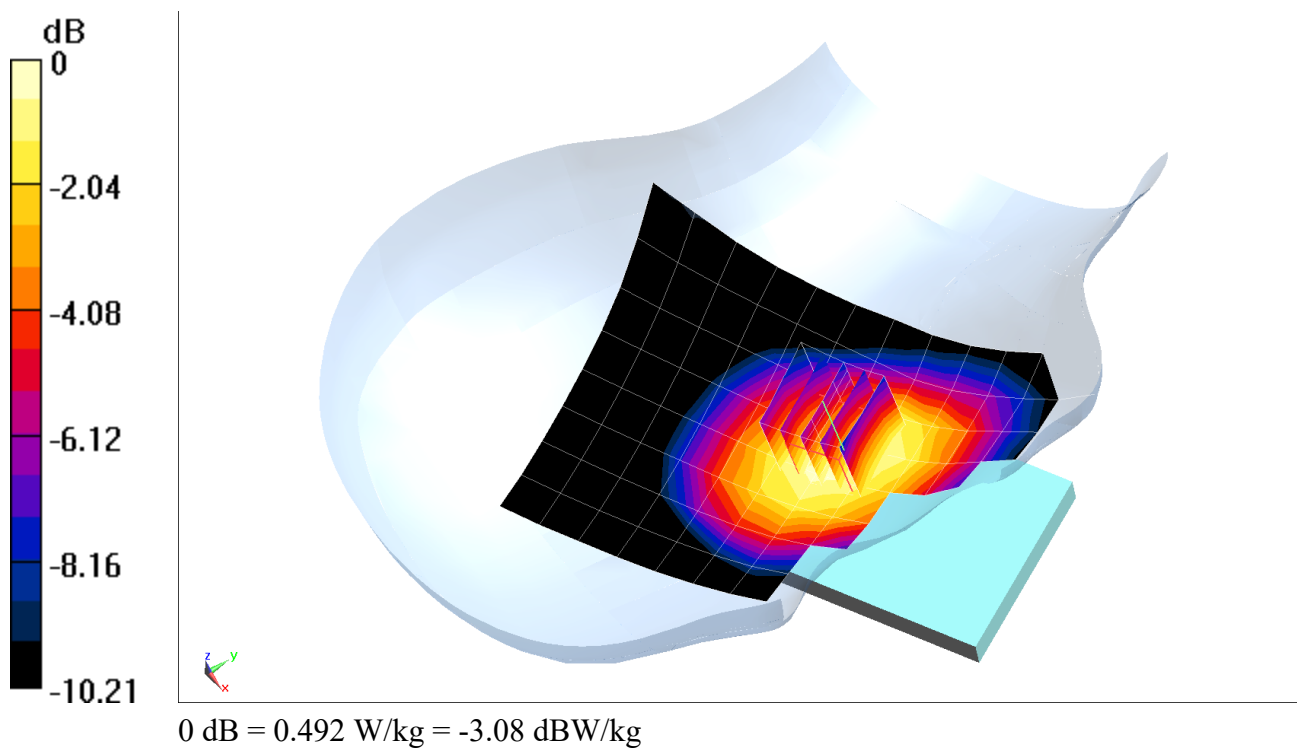
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.41 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.544 W/kg

SAR(1 g) = 0.416 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFX220TB; Type: Portable Handset; Serial: 00823

Communication System: UID 0, GSM GPRS; 4 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:2.076

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.411 \text{ S/m}$; $\epsilon_r = 39.006$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 02-26-19; Ambient Temp: 23.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN7357; ConvF(8.47, 8.47, 8.47) @ 1880 MHz; Calibrated: 4/18/2018

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/11/2018

Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: GPRS 1900, Left Head, Cheek, Mid.ch, 4 Tx slots

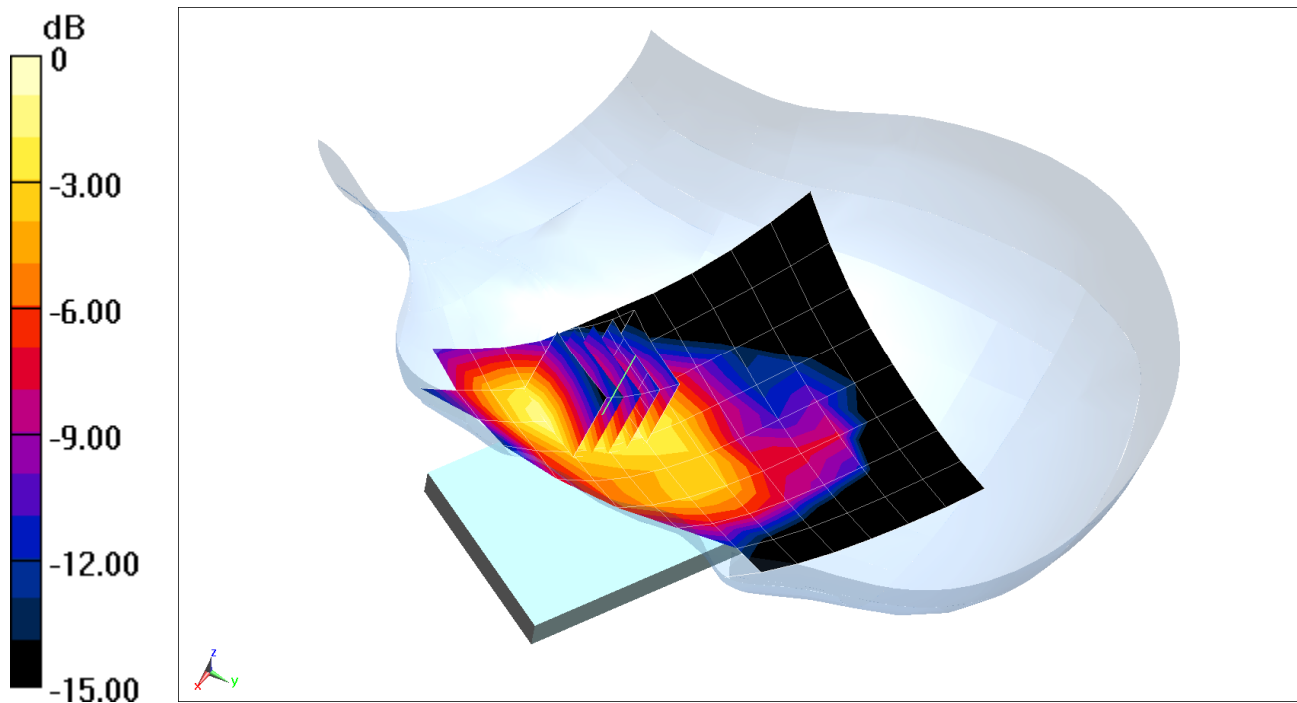
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 17.15 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.668 W/kg

SAR(1 g) = 0.400 W/kg



0 dB = 0.542 W/kg = -2.66 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFX220TB; Type: Portable Handset; Serial: 00815

Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.882 \text{ S/m}$; $\epsilon_r = 39.519$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 02-11-2019; Ambient Temp: 21.1°C; Tissue Temp: 20.3°C

Probe: EX3DV4 - SN7410; ConvF(9.81, 9.81, 9.81) @ 836.6 MHz; Calibrated: 7/20/2018

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/11/2018

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 850, Right Head, Cheek, Mid.ch

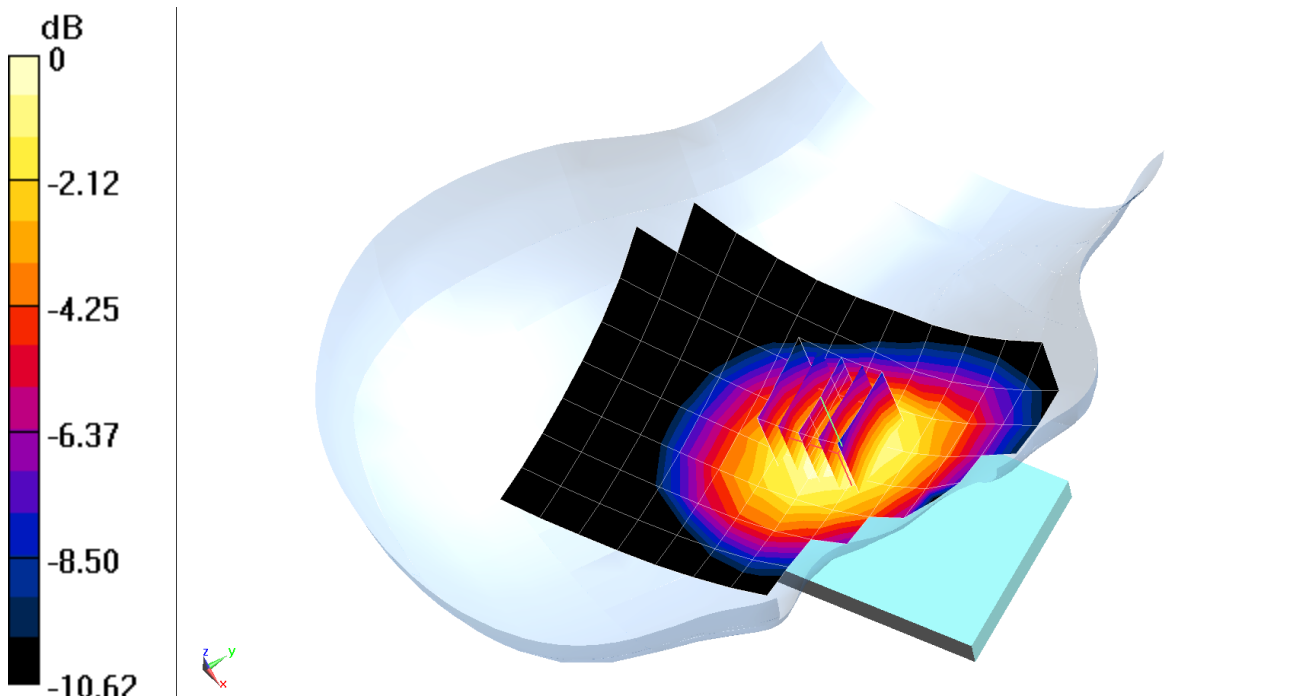
Area Scan (9x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 23.03 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.587 W/kg

SAR(1 g) = 0.453 W/kg



0 dB = 0.537 W/kg = -2.70 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFX220TB; Type: Portable Handset; Serial: 00823

Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1

Medium: 1750 Head Medium parameters used (interpolated):

$f = 1732.4 \text{ MHz}$; $\sigma = 1.327 \text{ S/m}$; $\epsilon_r = 39.221$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 02-26-2019; Ambient Temp: 23.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN7357; ConvF(8.8, 8.8, 8.8) @ 1732.4 MHz; Calibrated: 4/18/2018

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/11/2018

Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 1750, Left Head, Cheek, Mid.ch

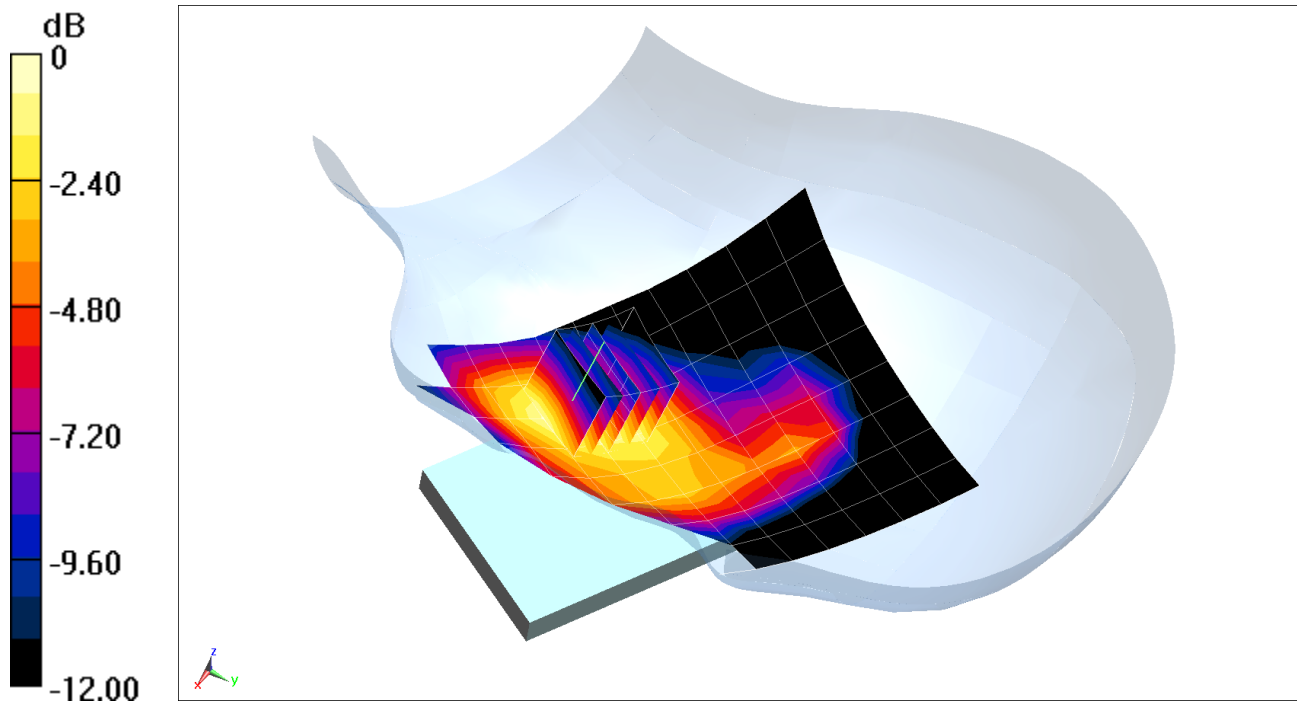
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 20.76 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.834 W/kg

SAR(1 g) = 0.552 W/kg



0 dB = 0.705 W/kg = -1.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFX220TB; Type: Portable Handset; Serial: 00823

Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.411 \text{ S/m}$; $\epsilon_r = 39.006$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 02-26-2019; Ambient Temp: 23.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN7357; ConvF(8.47, 8.47, 8.47) @ 1880 MHz; Calibrated: 4/18/2018

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/11/2018

Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 1900, Left Head, Cheek, Mid.ch

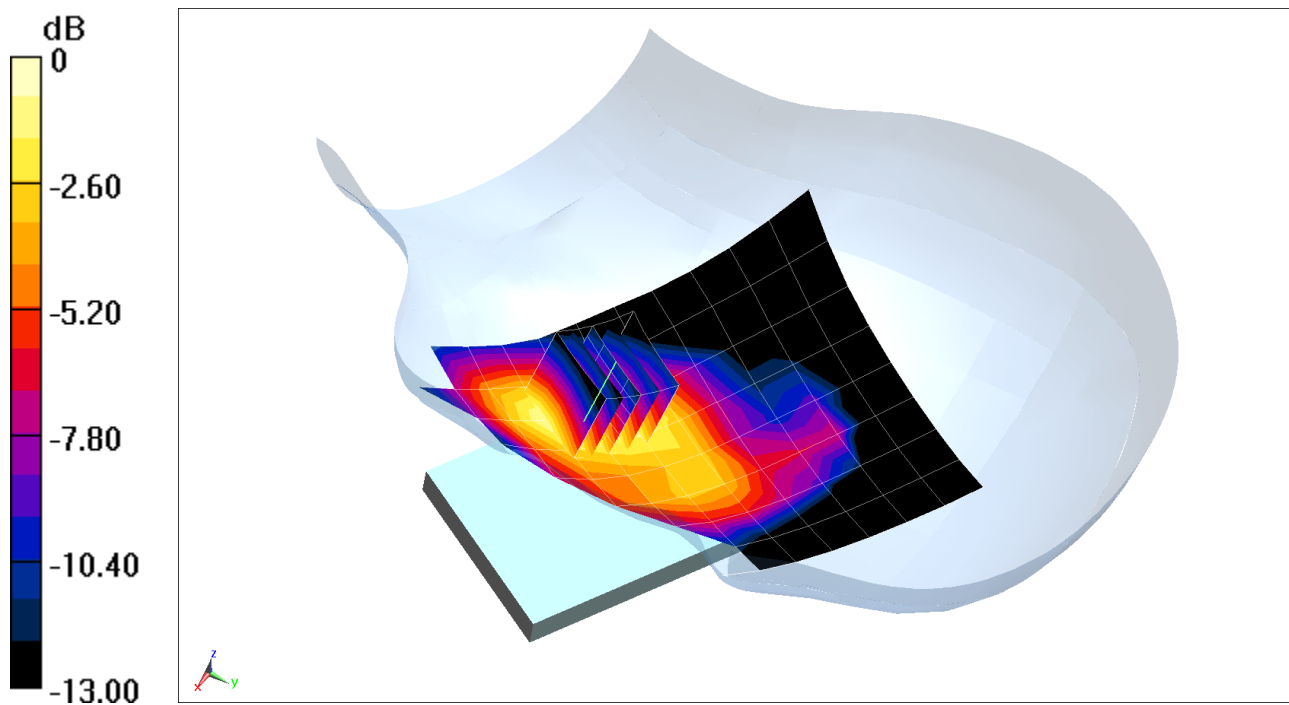
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 20.89 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.977 W/kg

SAR(1 g) = 0.588 W/kg



0 dB = 0.798 W/kg = -0.98 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFX220TB; Type: Portable Handset; Serial: 00831

Communication System: UID 0, LTE Band 71; Frequency: 680.5 MHz; Duty Cycle: 1:1

Medium: 750 Head Medium parameters used (interpolated):

$f = 680.5$ MHz; $\sigma = 0.871$ S/m; $\epsilon_r = 42.162$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Test Date: 02-14-2019; Ambient Temp: 22.9°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7410; ConvF(10.13, 10.13, 10.13) @ 680.5 MHz; Calibrated: 7/20/2018

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/11/2018

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

**Mode: LTE Band 71, Right Head, Cheek, Mid.ch, 20 MHz Bandwidth, QPSK,
1 RB, 0 RB Offset**

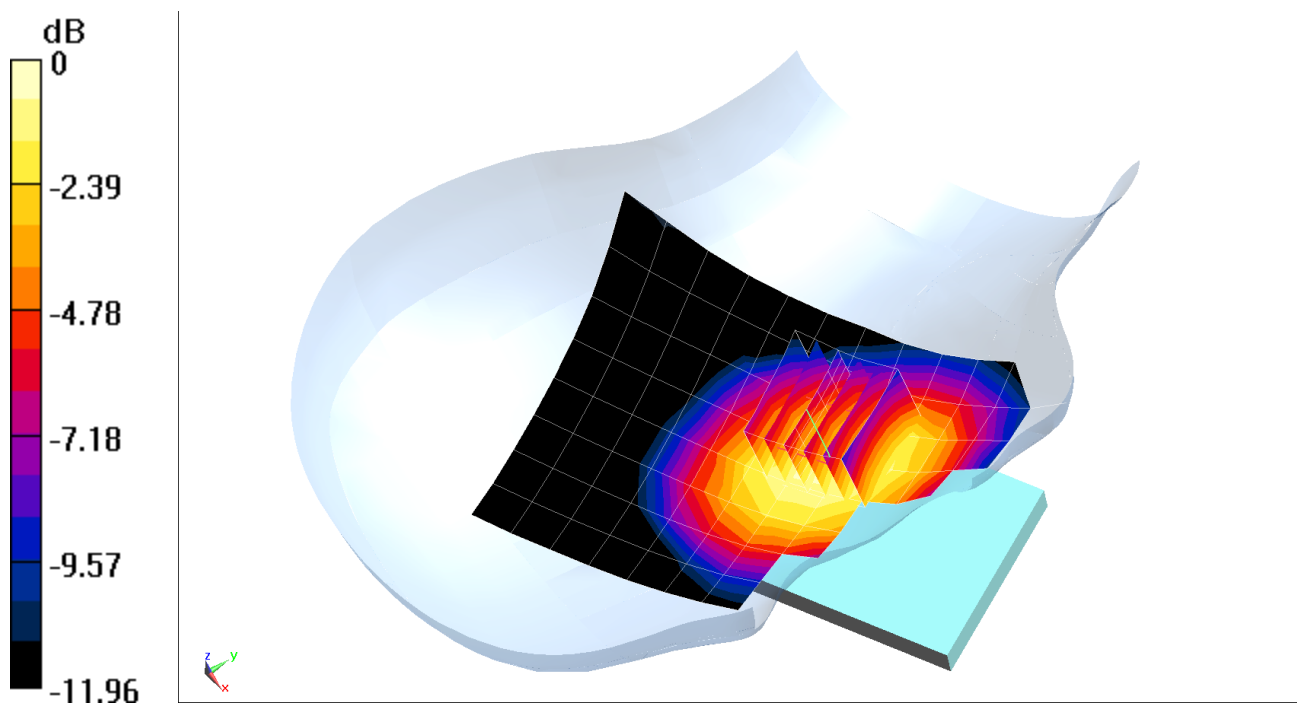
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.87 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.385 W/kg

SAR(1 g) = 0.294 W/kg



0 dB = 0.345 W/kg = -4.62 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFX220TB; Type: Portable Handset; Serial: 00831

Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1

Medium: 750 Head Medium parameters used (interpolated):

$f = 707.5$ MHz; $\sigma = 0.883$ S/m; $\epsilon_r = 42.138$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Test Date: 02-14-2019; Ambient Temp: 22.9°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7410; ConvF(10.13, 10.13, 10.13) @ 707.5 MHz; Calibrated: 7/20/2018

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/11/2018

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

**Mode: LTE Band 12, Right Head, Cheek, Mid.ch, 10 MHz Bandwidth, QPSK,
1 RB, 25 RB Offset**

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.80 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.679 W/kg

SAR(1 g) = 0.506 W/kg

