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SAR EVALUATION REPORT

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

Date of Testing:
05/14/19 - 05/31/19
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
1M1905140072-01-R1.ZNF

FCC ID: ZNFL322DL

APPLICANT: LG ELECTRONICS U.S.A., INC.

DUT Type: Portable Handset
Application Type: Class II Permissive Change
FCC Rule Part(s): CFR §2.1093
Model: LG L322DL
Additional Model(s): LGL322DL, L322DL, LM-X320WM, LMX320WM, X320WM, LM-X320QMG, LMX320QMG, X320QMG, LM-X320QML, LMX320QML, X320QML, LM-X320QM6, LMX320QM6, X320QM6
Permissive Change(s): See FCC Change Document
Date of Original Certification: 06/05/2019

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	0.28	0.40	0.41
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.43	0.40	0.41
PCE	UMTS 850	826.40 - 846.60 MHz	0.32	0.45	0.48
PCE	UMTS 1750	1712.4 - 1752.6 MHz	0.70	1.07	1.07
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.79	0.83	0.85
PCE	Cell. CDMA/EVDO	824.70 - 848.31 MHz	0.30	0.50	0.47
PCE	PCS CDMA/EVDO	1851.25 - 1908.75 MHz	0.74	0.83	0.76
PCE	LTE Band 71	665.5 - 695.5 MHz	0.19	0.29	0.32
PCE	LTE Band 12	699.7 - 715.3 MHz	0.21	0.27	0.32
PCE	LTE Band 17	706.5 - 713.5 MHz	N/A	N/A	N/A
PCE	LTE Band 13	779.5 - 784.5 MHz	0.25	0.34	0.45
PCE	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.28	0.45	0.47
PCE	LTE Band 66 (AWS)	1710.7 - 1779.3 MHz	0.55	1.08	1.08
PCE	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	N/A	N/A	N/A
PCE	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	0.93	0.79	0.82
DTS	2.4 GHz WLAN	2412 - 2462 MHz	1.25	0.38	0.45
DSS/DTS	Bluetooth	2402 - 2480 MHz	< 0.1	N/A	N/A
Simultaneous SAR per KDB 690783 D01v01r03:			1.57	1.46	1.53

Note: This revised Test Report (S/N: 1M1905140072-01-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 Ortanez
President

The SAR Tick is an initiative of the Mobile & Wireless Forum (MWF). While a product may be considered eligible, use of the SAR Tick logo requires an agreement with the MWF. Further details can be obtained by emailing: sartick@mwfai.info.

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TABLE OF CONTENTS

1 DEVICE UNDER TEST 3

2 LTE INFORMATION 10

3 INTRODUCTION 11

4 DOSIMETRIC ASSESSMENT 12

5 DEFINITION OF REFERENCE POINTS 13

6 TEST CONFIGURATION POSITIONS 14

7 RF EXPOSURE LIMITS 17

8 FCC MEASUREMENT PROCEDURES 18

9 RF CONDUCTED POWERS 25

10 SYSTEM VERIFICATION 47

11 SAR DATA SUMMARY 50

12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS 65

13 SAR MEASUREMENT VARIABILITY 75

14 EQUIPMENT LIST 76

15 MEASUREMENT UNCERTAINTIES 77

16 CONCLUSION 78

17 REFERENCES 79

APPENDIX A: SAR TEST PLOTS

APPENDIX B: SAR DIPOLE VERIFICATION PLOTS

APPENDIX C: PROBE AND DIPOLE CALIBRATION CERTIFICATES

APPENDIX D: SAR TISSUE SPECIFICATIONS

APPENDIX E: SAR SYSTEM VALIDATION

APPENDIX F: DUT ANTENNA DIAGRAM & SAR TEST SETUP PHOTOGRAPHS

APPENDIX G: POWER REDUCTION VERIFICATION

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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
Cell. CDMA/EVDO	Voice/Data	824.70 - 848.31 MHz
PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz
LTE Band 71	Voice/Data	665.5 - 695.5 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 17	Voice/Data	706.5 - 713.5 MHz
LTE Band 13	Voice/Data	779.5 - 784.5 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 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2462 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.

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.

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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**	**31.0**	**29.0**	**28.0**	**26.5**	**26.5**	**25.5**	**24.5**
	Nominal	**33.2**	**33.2**	**30.5**	**28.5**	**27.5**	**26.0**	**26.0**	**25.0**	**24.0**
GSM/GPRS/EDGE 1900	Maximum	**30.7**	**30.7**	**27.5**	**26.5**	**25.5**	**25.5**	**25.5**	**24.5**	**23.5**
	Nominal	**30.2**	**30.2**	**27.0**	**26.0**	**25.0**	**25.0**	**25.0**	**24.0**	**23.0**

Mode / Band		Modulated Average (dBm)			
		3GPP WCDMA	*3GPP HSDPA*	*3GPP HSUPA*	*3GPP DC-HSDPA*
UMTS Band 5 (850 MHz)	Maximum	**25.3**	**25.3**	**25.3**	**25.3**
	Nominal	**24.8**	**24.8**	**24.8**	**24.8**
UMTS Band 4 (1750 MHz)	Maximum	**24.8**	**24.8**	**24.8**	**24.8**
	Nominal	**24.3**	**24.3**	**24.3**	**24.3**
UMTS Band 2 (1900 MHz)	Maximum	**24.8**	**24.8**	**24.8**	**24.8**
	Nominal	**24.3**	**24.3**	**24.3**	**24.3**

Mode / Band		Modulated Average (dBm)
Cell. CDMA/EVDO	Maximum	**25.3**
	Nominal	**24.8**
PCS CDMA/EVDO	Maximum	**24.8**
	Nominal	**24.3**

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Mode / Band		Modulated Average (dBm)
LTE Band 71	Maximum	**25.3**
	Nominal	**24.8**
LTE Band 12	Maximum	**25.3**
	Nominal	**24.8**
LTE Band 17	Maximum	**25.3**
	Nominal	**24.8**
LTE Band 13	Maximum	**25.3**
	Nominal	**24.8**
LTE Band 5 (Cell)	Maximum	**25.3**
	Nominal	**24.8**
LTE Band 66 (AWS)	Maximum	**24.8**
	Nominal	**24.3**
LTE Band 4 (AWS)	Maximum	**24.8**
	Nominal	**24.3**
LTE Band 2 (PCS)	Maximum	**24.8**
	Nominal	**24.3**

Mode / Band		Modulated Average				
		Ch 1	Ch 2	Ch 3-9	Ch 10	Ch 11
IEEE 802.11b	Maximum	**19.5**				
	Nominal	**18.5**				
IEEE 802.11g	Maximum	**16.5**	**17.5**	**17.5**	**17.5**	**15.0**
	Nominal	**15.5**	**16.5**	**16.5**	**16.5**	**14.0**
IEEE 802.11n	Maximum	**15.5**	**16.5**	**16.5**	**16.5**	**14.0**
	Nominal	**14.5**	**15.5**	**15.5**	**15.5**	**13.0**

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Mode / Band		Modulated Average (dBm)
Bluetooth	Maximum	8
	Nominal	7
Bluetooth LE	Maximum	-1
	Nominal	-2

1.3.2 Reduced Output Power

Mode / Band		Modulated Average (dBm)				
		Ch 1	Ch 2	Ch 3-9	Ch 10	Ch 11
IEEE 802.11b	Maximum	**16.5**				
	Nominal	**15.5**				
IEEE 802.11g	Maximum	**15.5**	**16.5**	**16.5**	**16.5**	**14.0**
	Nominal	**14.5**	**15.5**	**15.5**	**15.5**	**13.0**
IEEE 802.11n	Maximum	**15.5**	**16.5**	**16.5**	**16.5**	**14.0**
	Nominal	**14.5**	**15.5**	**15.5**	**15.5**	**13.0**

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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
Cell. EVDO	Yes	Yes	No	Yes	Yes	Yes
PCS EVDO	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 13	Yes	Yes	No	Yes	Yes	Yes
LTE Band 5 (Cell)	Yes	Yes	No	Yes	Yes	Yes
LTE Band 66 (AWS)	Yes	Yes	No	Yes	No	Yes
LTE Band 2 (PCS)	Yes	Yes	No	Yes	No	Yes
2.4 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.

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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.

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Notes
1	1x CDMA voice + 2.4 GHz WI-FI	Yes	Yes	N/A	
2	1x CDMA voice + 2.4 GHz Bluetooth	Yes^	Yes	N/A	^Bluetooth Tethering is considered
3	GSM voice + 2.4 GHz WI-FI	Yes	Yes	N/A	
4	GSM voice + 2.4 GHz Bluetooth	Yes^	Yes	N/A	^Bluetooth Tethering is considered
5	UMTS + 2.4 GHz WI-FI	Yes	Yes	Yes	
6	UMTS + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	^Bluetooth Tethering is considered
7	LTE + 2.4 GHz WI-FI	Yes	Yes	Yes	
8	LTE + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	^Bluetooth Tethering is considered
9	CDMA/EVDO data + 2.4 GHz WI-FI	Yes*	Yes*	Yes	* Pre-installed VOIP applications are considered
10	CDMA/EVDO data + 2.4 GHz Bluetooth	Yes*^	Yes*	Yes^	* Pre-installed VOIP applications are considered ^Bluetooth Tethering is considered
11	GPRS/EDGE + 2.4 GHz WI-FI	Yes*	Yes*	Yes	* Pre-installed VOIP applications are considered
12	GPRS/EDGE + 2.4 GHz Bluetooth	Yes*^	Yes*	Yes^	* Pre-installed VOIP applications are considered ^Bluetooth Tethering is considered

1. 2.4 GHz WLAN, and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
2. All licensed modes share the same antenna path and cannot transmit simultaneously.
3. 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.
4. Per the manufacturer, WIFI Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Therefore, there are no simultaneous transmission scenarios involving WIFI direct beyond that listed in the above table.
5. This device supports VOLTE and VoWIFI.
6. This device supports Bluetooth Tethering.

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1.6 Miscellaneous SAR Test Considerations

(A) WIFI/BT

Per FCC KDB 447498 D01v06, the 1g SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, body-worn and Hotspot Bluetooth SAR was not required; [(6/10)* √2.480] = 0.9< 3.0. Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

(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.

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, 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 17 (706.5 - 713.5 MHz)		
	LTE Band 13 (779.5 - 784.5 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 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 17: 5 MHz, 10 MHz		
	LTE Band 13: 5 MHz, 10 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 MHz		
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
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 17: 5 MHz	706.5 (23755)	710 (23790)	713.5 (23825)
LTE Band 17: 10 MHz	709 (23780)	710 (23790)	711 (23800)
LTE Band 13: 5 MHz	779.5 (23205)	782 (23230)	784.5 (23255)
LTE Band 13: 10 MHz	N/A	782 (23230)	N/A
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 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	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 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/m^3)
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 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

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

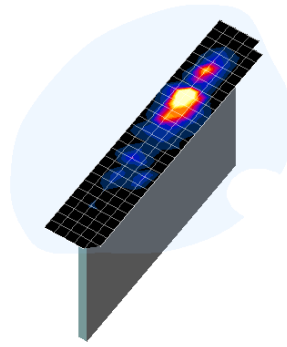

Figure 4-1
Sample SAR Area Scan

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.

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		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 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 DEFINITION OF REFERENCE POINTS

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].

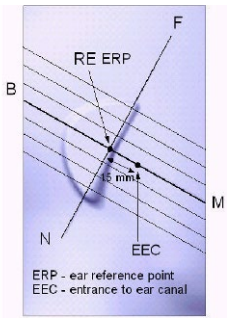

Figure 5-1
Close-Up Side view of ERP

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 than 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.

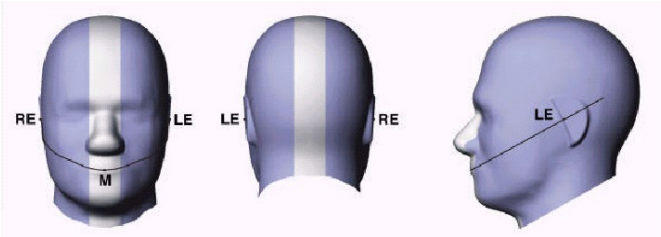

Figure 5-2
Front, back and side view of SAM Twin Phantom

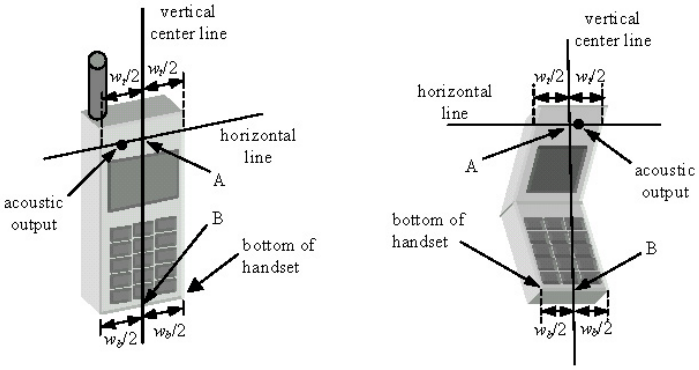

Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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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 ε = 3 and loss tangent δ = 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 was 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 / 15º 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 15degrees.
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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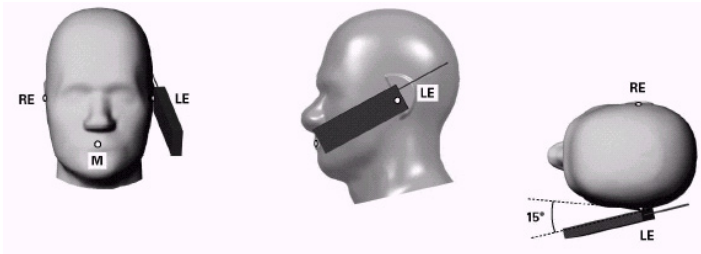

Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

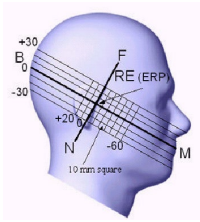

Figure 6-3
Side view w/ relevant markings

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.

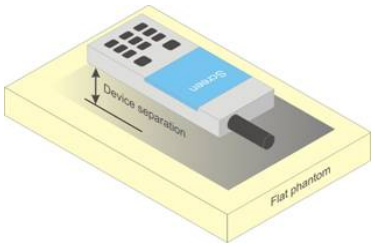

Figure 6-4
Sample Body-Worn Diagram

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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 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 x W ≥ 9 cm x 5 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 *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (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 CDMA2000

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

8.4.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by FCC KDB Publication 941225 D01v03r01 “3G SAR Measurement Procedures.” Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in the “All Up” condition.

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1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 8-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH_0 and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 8-2 was applied.

Table 8-1
Parameters for Max. Power for RC1

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 8-2
Parameters for Max. Power for RC3

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-86
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

5. FCHs were configured at full rate for maximum SAR with “All Up” power control bits.

8.4.2 Head SAR Measurements

SAR for next to the ear head exposure is measured in RC3 with the handset configured to transmit at fullrate in SO55. The 3G SAR test reduction procedure is applied to RC1 with RC3 as the primary mode; otherwise, SAR is required for the channel with maximum measured output in RC1 using the head exposure configuration that results in the highest reported SAR in RC3.

Head SAR is additionally evaluated using EVDO Rev. A to support compliance for VoIP operations. See Section 8.4.5 for EVDO Rev. A configuration parameters.

8.4.3 Body-worn SAR Measurements

SAR for body-worn exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. The 3G SAR test reduction procedure is applied to the multiple code channel configuration (FCH+SCHn), with FCH only as the primary mode. Otherwise, SAR is required for multiple code channel configuration (FCH + SCHn), with FCH at full rate and SCH0 enabled at 9600 bps, using the highest reported SAR configuration for FCH only. When multiple code channels are enabled, the transmitter output can shift by more than 0.5 dB and may lead to higher SAR drifts and SCH dropouts.

The 3G SAR test reduction procedure is applied to body-worn accessory SAR in RC1 with RC3 as the primary mode. Otherwise, SAR is required for RC1, with SO55 and full rate, using the highest reported SAR configuration for body-worn accessory exposure in RC3.

8.4.4 Body-worn SAR Measurements for EVDO Devices

For handsets with EVDO capabilities, the 3G SAR test reduction procedure is applied to EVDO Rev. 0 with 1x RTT RC3 as the primary mode to determine body-worn accessory test requirements. Otherwise, body-worn accessory SAR is required for Rev. 0, at 153.6 kbps, using the highest reported SAR configuration for body-worn accessory exposure in RC3.

The 3G SAR test reduction procedure is applied to Rev. A, with Rev. 0 as the primary mode to determine body-worn accessory SAR test requirements. When SAR is not required for Rev. 0, the 3G SAR test reduction is applied with 1x RTT RC3 as the primary mode.

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When SAR is required for EVDO Rev. A, SAR is measured with a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations, using the highest reported SAR configuration for body-worn accessory exposure in Rev. 0 or 1x RTT RC3, as appropriate.

8.4.5 Body SAR Measurements for EVDO Hotspot

Hotspot Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. The 3G SAR test reduction procedure is applied to Rev. A, Subtype 2 Physical layer configuration, with Rev. 0 as the primary mode; otherwise, SAR is measured for Rev. A using the highest reported SAR configuration for body-worn accessory exposure in Rev. 0. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations.

For EVDO data devices that also support 1x RTT voice and/or data operations, the 3G SAR test reduction procedure is applied to 1x RTT RC3 and RC1 with EVDO Rev. 0 and Rev. A as the respective primary modes. Otherwise, the 'Body-Worn Accessory SAR' procedures in the '3GPP2 CDMA 2000 1x Handsets' section are applied.

8.5 SAR Measurement Conditions for UMTS

8.5.1 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.

8.5.2 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.

8.5.3 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.

8.5.4 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

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12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

8.5.5 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.

8.5.6 SAR Measurements Conditions for DC-HSPA

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

8.6 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).

8.6.1 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.

8.6.2 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.

8.6.3 A-MPR

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

8.6.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r04:

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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 ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

8.7 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.

8.7.1 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.

8.7.2 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.

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8.7.3 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:

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. 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, 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 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.

8.7.4 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 8.7.4).

8.7.5 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.

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

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the same for equivalent OFDM configurations; for example, 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 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.

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9 RF CONDUCTED POWERS

9.1 CDMA Conducted Powers

Table 9-1
Maximum Conducted Power

Band	Channel	Rule Part	Frequency	SO55 [dBm]	SO55 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC		MHz	RC1	RC3	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	1013	22H	824.7	24.79	24.85	24.76	24.69	24.68	24.76
	384	22H	836.52	24.84	24.87	24.70	24.74	24.84	24.67
	777	22H	848.31	24.86	24.94	24.86	24.71	24.91	24.91
PCS	25	24E	1851.25	24.76	24.79	24.76	24.64	24.72	24.76
	600	24E	1880	24.74	24.80	24.56	24.31	24.66	24.55
	1175	24E	1908.75	24.79	24.77	24.77	24.51	24.72	24.71

Note: RC1 is only applicable for IS-95 compatibility.

Figure 9-1
Power Measurement Setup

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9.2 GSM Conducted Powers

Table 9-2
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	33.21	33.22	30.36	28.75	**27.58**	26.28	25.89	25.20	24.08
	190	32.85	32.58	29.95	28.30	**27.46**	25.95	25.58	24.76	23.65
	251	33.13	32.83	30.17	28.55	**27.45**	26.11	25.73	24.90	23.86
GSM 1900	512	29.85	29.95	26.76	25.84	**24.85**	25.13	24.98	24.08	22.87
	661	29.80	29.78	26.79	25.88	**24.79**	25.04	24.93	24.04	22.94
	810	29.69	29.79	26.74	25.66	**24.73**	24.98	24.77	23.85	22.76

GSM 850	**Targets:**	33.2	33.2	30.5	28.5	**27.5**	26.0	26.0	25.0	24.0
GSM 1900		30.2	30.2	27.0	26.0	**25.0**	25.0	25.0	24.0	23.0

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	24.18	24.19	24.34	24.49	**24.57**	17.25	19.87	20.94	21.07
	190	23.82	23.55	23.93	24.04	**24.45**	16.92	19.56	20.50	20.64
	251	24.10	23.80	24.15	24.29	**24.44**	17.08	19.71	20.64	20.85
GSM 1900	512	20.82	20.92	20.74	21.58	**21.84**	16.10	18.96	19.82	19.86
	661	20.77	20.75	20.77	21.62	**21.78**	16.01	18.91	19.78	19.93
	810	20.66	20.76	20.72	21.40	**21.72**	15.95	18.75	19.59	19.75

GSM 850	**Frame Avg.Targets:**	24.17	24.17	24.48	24.24	**24.49**	16.97	19.98	20.74	20.99
GSM 1900		21.17	21.17	20.98	21.74	**21.99**	15.97	18.98	19.74	19.99

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Note:

1. 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.
2. 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.
3. 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

Figure 9-2
Power Measurement Setup

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9.3 UMTS Conducted Powers

Table 9-3
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	25.10	25.18	25.30	24.75	24.79	24.80	24.51	24.60	24.71	-
99		12.2 kbps AMR	25.17	25.16	25.24	24.74	24.79	24.80	24.51	24.47	24.51	-
6	HSDPA	Subtest 1	25.21	25.30	25.29	24.51	24.66	24.68	24.75	24.80	24.79	0
6		Subtest 2	25.29	25.30	25.24	24.52	24.67	24.68	24.73	24.79	24.78	0
6		Subtest 3	24.83	24.88	24.79	24.01	24.23	24.12	24.28	24.34	24.51	0.5
6		Subtest 4	24.82	24.88	24.78	23.92	24.22	24.13	24.30	24.29	24.48	0.5
6	HSUPA	Subtest 1	24.91	24.62	24.71	24.18	23.70	24.03	24.15	24.05	24.08	0
6		Subtest 2	23.33	23.64	23.06	22.80	23.00	22.79	22.66	22.57	22.83	2
6		Subtest 3	23.76	23.93	23.67	23.18	23.22	23.08	23.61	23.26	23.32	1
6		Subtest 4	23.42	23.12	23.26	22.60	22.88	22.71	22.88	22.72	22.91	2
6		Subtest 5	25.00	24.74	24.76	24.45	24.37	24.30	24.47	24.51	24.63	0
8	DC-HSDPA	Subtest 1	25.00	25.10	24.99	24.46	24.46	24.41	24.65	24.51	24.70	0
8		Subtest 2	25.11	25.10	25.11	24.39	24.43	24.50	24.57	24.56	24.66	0
8		Subtest 3	24.73	24.64	24.66	23.96	23.99	23.93	24.12	24.07	24.28	0.5
8		Subtest 4	24.72	24.66	24.64	23.98	23.98	23.90	24.12	24.19	24.29	0.5

DC-HSDPA considerations

- 3GPP Specification 34.121-1 Release 8 Ver 8.10.0 was used for DC-HSDPA guidance
- H-Set 12 (QPSK) was confirmed to be used during DC-HSDPA measurements
- The DUT supports UE category 24 for HSDPA

Figure 9-3
Power Measurement Setup

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9.4 LTE Conducted Powers

9.4.1 LTE Band 71

Table 9-4
LTE Band 71 Conducted Powers - 20 MHz Bandwidth

LTE Band 71 20 MHz Bandwidth					
Modulation	**RB Size**	**RB Offset**	**Mid Channel 133297 (680.5 MHz) Conducted Power [dBm]**	**MPR Allowed per 3GPP [dB]**	**MPR [dB]**
QPSK	1	0	24.78	0	0
	1	50	**25.25**		0
	1	99	24.86		0
	50	0	23.31	0-1	1
	50	25	**23.50**		1
	50	50	23.35		1
	100	0	23.26		1
16QAM	1	0	23.30	0-1	1
	1	50	24.05		1
	1	99	23.57		1
	50	0	22.52	0-2	2
	50	25	22.57		2
	50	50	22.50		2
	100	0	22.60		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.

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Table 9-5
LTE Band 71 Conducted Powers - 15 MHz Bandwidth

LTE Band 71 15 MHz Bandwidth					
Modulation	**RB Size**	**RB Offset**	**Mid Channel** **133297** **(680.5 MHz)** **Conducted Power [dBm]**	**MPR Allowed per 3GPP [dB]**	**MPR [dB]**
QPSK	1	0	24.80	0	0
	1	36	25.08		0
	1	74	25.18		0
	36	0	23.29	0-1	1
	36	18	23.33		1
	36	37	23.29		1
	75	0	23.29		1
16QAM	1	0	23.21	0-1	1
	1	36	23.30		1
	1	74	23.30		1
	36	0	22.33	0-2	2
	36	18	22.51		2
	36	37	22.55		2
	75	0	22.24		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 9-6
LTE Band 71 Conducted Powers - 10 MHz Bandwidth

LTE Band 71 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 133172 (668.0 MHz)	Mid Channel 133297 (680.5 MHz)	High Channel 133422 (693.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	25.09	24.92	24.91	0	0
	1	25	25.09	25.00	25.23		0
	1	49	24.86	24.99	25.00		0
	25	0	23.23	23.31	23.32	0-1	1
	25	12	23.30	23.45	23.40		1
	25	25	23.33	23.35	23.42		1
	50	0	23.23	23.33	23.32		1
16QAM	1	0	23.15	23.65	23.43	0-1	1
	1	25	23.37	23.70	23.25		1
	1	49	23.23	23.71	23.27		1
	25	0	22.29	22.35	22.70	0-2	2
	25	12	22.64	22.57	22.59		2
	25	25	22.55	22.46	22.58		2
	50	0	22.35	22.25	22.39		2

Table 9-7
LTE Band 71 Conducted Powers - 5 MHz Bandwidth

LTE Band 71 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 133147 (665.5 MHz)	Mid Channel 133297 (680.5 MHz)	High Channel 133447 (695.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.83	24.87	24.99	0	0
	1	12	24.99	25.04	25.30		0
	1	24	25.02	25.07	25.03		0
	12	0	23.23	23.24	23.54	0-1	1
	12	6	23.26	23.39	23.52		1
	12	13	23.22	23.35	23.34		1
	25	0	23.18	23.25	23.39		1
16QAM	1	0	23.10	23.20	23.66	0-1	1
	1	12	23.15	23.25	23.35		1
	1	24	23.14	23.16	23.31		1
	12	0	22.08	22.34	22.50	0-2	2
	12	6	22.32	22.47	22.34		2
	12	13	22.06	22.31	22.32		2
	25	0	22.14	22.34	22.30		2

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9.4.2 LTE Band 12

Table 9-8
LTE Band 12 Conducted Powers - 10 MHz Bandwidth

LTE Band 12 10 MHz Bandwidth					
Modulation	**RB Size**	**RB Offset**	**Mid Channel** **23095** **(707.5 MHz)** **Conducted Power [dBm]**	**MPR Allowed per 3GPP [dB]**	**MPR [dB]**
QPSK	1	0	25.23	0	0
	1	25	**25.28**		0
	1	49	25.21		0
	25	0	23.32	0-1	1
	25	12	**23.36**		1
	25	25	23.35		1
	50	0	23.28		1
16QAM	1	0	23.54	0-1	1
	1	25	23.50		1
	1	49	23.34		1
	25	0	22.48	0-2	2
	25	12	22.47		2
	25	25	22.48		2
	50	0	22.50		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.

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

LTE Band 12 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23035 (701.5 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23155 (713.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	25.20	24.88	24.99	0	0
	1	12	25.21	24.93	25.04		0
	1	24	25.11	24.90	24.99		0
	12	0	23.26	23.22	23.16	0-1	1
	12	6	23.29	23.25	23.30		1
	12	13	23.38	23.26	23.14		1
	25	0	23.33	23.21	23.19		1
16QAM	1	0	23.38	23.25	23.25	0-1	1
	1	12	23.61	23.14	23.16		1
	1	24	23.25	23.15	23.17		1
	12	0	22.22	22.39	22.22	0-2	2
	12	6	22.30	22.23	22.39		2
	12	13	22.29	22.24	22.14		2
	25	0	22.39	22.32	22.42		2

Table 9-10
LTE Band 12 Conducted Powers - 3 MHz Bandwidth

LTE Band 12 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23025 (700.5 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23165 (714.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	25.05	25.06	25.04	0	0
	1	7	25.14	25.18	25.14		0
	1	14	24.96	25.06	24.99		0
	8	0	23.24	23.31	23.70	0-1	1
	8	4	23.35	23.20	23.29		1
	8	7	23.37	23.25	23.31		1
	15	0	23.32	23.27	23.27		1
16QAM	1	0	23.37	23.65	23.66	0-1	1
	1	7	23.50	23.70	23.75		1
	1	14	23.25	23.61	23.54		1
	8	0	22.34	22.31	22.54	0-2	2
	8	4	22.33	22.37	22.28		2
	8	7	22.33	22.20	22.17		2
	15	0	22.38	22.31	22.37		2

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Table 9-11
LTE Band 12 Conducted Powers -1.4 MHz Bandwidth

LTE Band 12 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23017 (699.7 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23173 (715.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	25.15	25.22	25.17	0	0
	1	2	25.18	25.28	24.82		0
	1	5	25.08	25.15	24.90		0
	3	0	25.08	24.88	25.14		0
	3	2	25.15	25.04	24.97		0
	3	3	25.16	25.01	24.90		0
	6	0	23.23	23.30	23.35	0-1	1
16QAM	1	0	23.21	23.31	23.56	0-1	1
	1	2	23.31	23.35	23.51		1
	1	5	23.20	23.30	23.34		1
	3	0	23.30	23.43	23.28		1
	3	2	23.20	23.56	23.28		1
	3	3	23.25	23.52	23.27		1
	6	0	22.55	22.45	22.25	0-2	2

9.4.3 LTE Band 13

Table 9-12
LTE Band 13 Conducted Powers - 10 MHz Bandwidth

LTE Band 13 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23230 (782.0 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	**25.30**	0	0
	1	25	25.26		0
	1	49	25.23		0
	25	0	23.42	0-1	1
	25	12	23.51		1
	25	25	**23.58**		1
	50	0	23.57		1
16QAM	1	0	23.96	0-1	1
	1	25	24.29		1
	1	49	24.30		1
	25	0	22.52	0-2	2
	25	12	22.75		2
	25	25	22.72		2
	50	0	22.53		2

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Table 9-13
LTE Band 13 Conducted Powers - 5 MHz Bandwidth

LTE Band 13 5 MHz Bandwidth					
Modulation	**RB Size**	**RB Offset**	**Mid Channel** **23230** **(782.0 MHz)** **Conducted Power [dBm]**	**MPR Allowed per 3GPP [dB]**	**MPR [dB]**
QPSK	1	0	24.93	0	0
	1	12	25.06		0
	1	24	25.00		0
	12	0	23.23	0-1	1
	12	6	23.46		1
	12	13	23.43		1
	25	0	23.33		1
16QAM	1	0	23.27	0-1	1
	1	12	23.95		1
	1	24	23.21		1
	12	0	22.28	0-2	2
	12	6	22.44		2
	12	13	22.33		2
	25	0	22.37		2

Note: LTE Band 13 at 5 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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9.4.4 LTE Band 5 (Cell)

Table 9-14
LTE Band 5 (Cell) Conducted Powers - 10 MHz Bandwidth

LTE Band 5 (Cell) 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 20525 (836.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	**25.30**	0	0
	1	25	25.25		0
	1	49	25.14		0
	25	0	23.32	0-1	1
	25	12	23.33		1
	25	25	**23.37**		1
	50	0	23.33		1
16QAM	1	0	23.32	0-1	1
	1	25	23.35		1
	1	49	23.36		1
	25	0	22.38	0-2	2
	25	12	22.49		2
	25	25	22.45		2
	50	0	22.32		2

Note: LTE Band 5 (Cell) 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 9-15
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth

LTE Band 5 (Cell) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20425 (826.5 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20625 (846.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	25.23	24.91	25.23	0	0
	1	12	25.13	25.12	25.27		0
	1	24	24.89	25.04	25.03		0
	12	0	23.23	23.31	23.36	0-1	1
	12	6	23.35	23.38	23.36		1
	12	13	23.31	23.31	23.30		1
	25	0	23.24	23.36	23.29		1
16QAM	1	0	23.74	23.18	23.60	0-1	1
	1	12	23.86	23.46	23.79		1
	1	24	23.56	23.32	23.27		1
	12	0	22.24	22.32	22.40	0-2	2
	12	6	22.34	22.24	22.43		2
	12	13	22.36	22.24	22.29		2
	25	0	22.31	22.44	22.32		2

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Table 9-16
LTE Band 5 (Cell) Conducted Powers - 3 MHz Bandwidth

LTE Band 5 (Cell) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20415 (825.5 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20635 (847.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.91	25.21	25.16	0	0
	1	7	25.10	25.24	25.28		0
	1	14	25.18	25.25	25.15		0
	8	0	23.25	23.27	23.33	0-1	1
	8	4	23.18	23.34	23.42		1
	8	7	23.22	23.38	23.34		1
	15	0	23.19	23.37	23.36		1
16QAM	1	0	23.23	23.28	23.35	0-1	1
	1	7	23.28	23.67	23.50		1
	1	14	23.20	23.41	23.28		1
	8	0	22.43	22.27	22.48	0-2	2
	8	4	22.36	22.33	22.36		2
	8	7	22.38	22.29	22.46		2
	15	0	22.23	22.42	22.29		2

Table 9-17
LTE Band 5 (Cell) Conducted Powers -1.4 MHz Bandwidth

LTE Band 5 (Cell) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20407 (824.7 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20643 (848.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.90	25.04	24.98	0	0
	1	2	25.10	24.94	25.09		0
	1	5	24.86	24.95	24.98		0
	3	0	24.99	25.16	24.98		0
	3	2	24.96	25.16	25.02		0
	3	3	24.86	25.04	25.03		0
	6	0	23.33	23.41	23.44	0-1	1
16QAM	1	0	23.55	23.66	23.44	0-1	1
	1	2	23.26	23.73	23.45		1
	1	5	23.23	23.62	23.45		1
	3	0	23.25	23.34	23.10		1
	3	2	23.30	23.36	23.11		1
	3	3	23.25	23.30	23.14		1
	6	0	22.53	22.56	22.34	0-2	2

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9.4.5 LTE Band 66 (AWS)

Table 9-18
LTE Band 66 (AWS) Conducted Powers - 20 MHz Bandwidth

LTE Band 66 (AWS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 132072 (1720.0 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132572 (1770.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.39	**24.80**	24.42	0	0
	1	50	24.55	24.72	24.61		0
	1	99	24.44	24.66	24.50		0
	50	0	22.90	**22.97**	22.79	0-1	1
	50	25	22.84	22.96	22.75		1
	50	50	22.77	22.84	22.76		1
	100	0	22.79	22.93	22.74		1
16QAM	1	0	23.03	23.15	23.26	0-1	1
	1	50	22.83	23.24	23.46		1
	1	99	22.62	23.12	23.44		1
	50	0	21.66	21.95	21.71	0-2	2
	50	25	21.77	22.05	21.73		2
	50	50	21.71	21.95	21.70		2
	100	0	21.61	21.88	21.80		2

Table 9-19
LTE Band 66 (AWS) Conducted Powers - 15 MHz Bandwidth

LTE Band 66 (AWS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 132047 (1717.5 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132597 (1772.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.60	24.62	24.46	0	0
	1	36	24.57	24.65	24.68		0
	1	74	24.25	24.66	24.61		0
	36	0	22.63	22.97	22.83	0-1	1
	36	18	22.75	22.91	22.92		1
	36	37	22.84	22.89	22.83		1
	75	0	22.76	22.89	22.85		1
16QAM	1	0	22.78	22.76	22.82	0-1	1
	1	36	22.67	22.76	22.74		1
	1	74	22.60	22.67	22.69		1
	36	0	21.64	21.92	21.97	0-2	2
	36	18	21.63	21.80	21.73		2
	36	37	21.70	21.82	21.77		2
	75	0	21.70	22.03	21.86		2

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Table 9-20
LTE Band 66 (AWS) Conducted Powers - 10 MHz Bandwidth

LTE Band 66 (AWS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 132022 (1715.0 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132622 (1775.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.43	24.56	24.40	0	0
	1	25	24.28	24.63	24.65		0
	1	49	24.37	24.31	24.31		0
	25	0	22.63	22.90	22.75	0-1	1
	25	12	22.69	22.95	22.77		1
	25	25	22.76	22.80	22.71		1
	50	0	22.81	22.94	22.84		1
16QAM	1	0	22.45	22.74	22.65	0-1	1
	1	25	22.63	23.02	22.88		1
	1	49	22.47	22.74	22.68		1
	25	0	21.46	21.83	21.89	0-2	2
	25	12	21.60	22.05	21.84		2
	25	25	21.70	21.88	21.69		2
	50	0	21.72	21.98	21.75		2

Table 9-21
LTE Band 66 (AWS) Conducted Powers - 5 MHz Bandwidth

LTE Band 66 (AWS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 131997 (1712.5 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132647 (1777.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.23	24.30	24.46	0	0
	1	12	24.72	24.38	24.71		0
	1	24	24.32	24.36	24.48		0
	12	0	22.76	22.90	22.81	0-1	1
	12	6	22.74	23.03	22.77		1
	12	13	22.77	22.99	22.78		1
	25	0	22.74	22.96	22.86		1
16QAM	1	0	22.74	22.56	22.83	0-1	1
	1	12	22.85	22.47	22.96		1
	1	24	22.74	22.44	22.74		1
	12	0	21.74	21.71	21.79	0-2	2
	12	6	21.84	21.92	21.75		2
	12	13	21.78	21.84	21.72		2
	25	0	21.76	21.85	21.81		2

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Table 9-22
LTE Band 66 (AWS) Conducted Powers - 3 MHz Bandwidth

LTE Band 66 (AWS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 131987 (1711.5 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132657 (1778.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.18	24.44	24.56	0	0
	1	7	24.62	24.76	24.66		0
	1	14	24.39	24.46	24.51		0
	8	0	22.65	22.88	22.90	0-1	1
	8	4	22.69	23.01	22.82		1
	8	7	22.69	22.98	22.85		1
	15	0	22.78	22.95	22.86		1
16QAM	1	0	22.65	22.86	22.76	0-1	1
	1	7	22.81	23.36	22.67		1
	1	14	22.88	22.84	22.69		1
	8	0	21.62	21.77	21.96	0-2	2
	8	4	21.62	21.79	21.91		2
	8	7	21.62	21.76	21.87		2
	15	0	21.88	21.86	21.74		2

Table 9-23
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 131979 (1710.7 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132665 (1779.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.29	24.79	24.33	0	0
	1	2	24.48	24.60	24.35		0
	1	5	24.54	24.61	24.32		0
	3	0	24.41	24.61	24.52		0
	3	2	24.42	24.75	24.60		0
	3	3	24.31	24.66	24.52		0
	6	0	22.66	22.98	22.79	0-1	1
16QAM	1	0	22.84	22.99	22.79	0-1	1
	1	2	22.93	23.26	22.66		1
	1	5	22.76	23.45	22.64		1
	3	0	22.59	22.86	22.94		1
	3	2	22.78	22.89	22.94		1
	3	3	22.55	22.86	22.98		1
	6	0	21.77	21.91	21.88	0-2	2

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9.4.6 LTE Band 2 (PCS)

Table 9-24
LTE Band 2 (PCS) Conducted Powers - 20 MHz Bandwidth

LTE Band 2 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18700 (1860.0 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19100 (1900.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.68	24.26	24.43	0	0
	1	50	24.75	**24.78**	24.68		0
	1	99	24.48	24.30	24.52		0
	50	0	22.88	22.96	22.88	0-1	1
	50	25	22.88	**23.01**	22.95		1
	50	50	22.78	22.89	22.87		1
	100	0	22.80	22.92	22.96		1
16QAM	1	0	23.22	23.01	22.75	0-1	1
	1	50	23.26	23.75	23.05		1
	1	99	22.88	23.42	22.87		1
	50	0	21.94	21.85	21.89	0-2	2
	50	25	21.84	22.00	21.87		2
	50	50	21.81	21.91	21.79		2
	100	0	21.91	21.91	21.76		2

Table 9-25
LTE Band 2 (PCS) Conducted Powers - 15 MHz Bandwidth

LTE Band 2 (PCS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18675 (1857.5 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19125 (1902.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.78	24.68	24.47	0	0
	1	36	24.41	24.78	24.55		0
	1	74	24.66	24.73	24.65		0
	36	0	22.87	23.01	22.97	0-1	1
	36	18	22.96	22.93	22.87		1
	36	37	22.81	22.92	22.86		1
	75	0	22.87	22.87	22.97		1
16QAM	1	0	23.39	23.21	23.13	0-1	1
	1	36	23.30	23.10	23.34		1
	1	74	23.26	22.84	23.17		1
	36	0	21.93	21.85	21.72	0-2	2
	36	18	21.94	21.91	21.92		2
	36	37	21.86	21.97	21.77		2
	75	0	22.03	21.91	21.96		2

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Table 9-26
LTE Band 2 (PCS) Conducted Powers - 10 MHz Bandwidth

LTE Band 2 (PCS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18650 (1855.0 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19150 (1905.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.80	24.78	24.65	0	0
	1	25	24.78	24.80	24.77		0
	1	49	24.78	24.79	24.78		0
	25	0	23.08	22.94	22.98	0-1	1
	25	12	22.98	23.03	22.93		1
	25	25	22.81	22.95	22.86		1
	50	0	23.00	22.98	22.92		1
16QAM	1	0	23.16	23.17	23.24	0-1	1
	1	25	23.09	22.98	23.15		1
	1	49	22.85	23.13	23.26		1
	25	0	22.25	21.87	21.84	0-2	2
	25	12	21.97	21.96	22.17		2
	25	25	22.15	21.98	21.90		2
	50	0	22.05	21.95	21.88		2

Table 9-27
LTE Band 2 (PCS) Conducted Powers - 5 MHz Bandwidth

LTE Band 2 (PCS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18625 (1852.5 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19175 (1907.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.52	24.59	24.66	0	0
	1	12	24.66	24.70	24.68		0
	1	24	24.45	24.55	24.68		0
	12	0	23.10	22.91	22.98	0-1	1
	12	6	23.18	22.99	23.05		1
	12	13	23.03	22.99	22.96		1
	25	0	23.01	22.91	23.03		1
16QAM	1	0	22.67	22.80	22.71	0-1	1
	1	12	23.02	22.79	23.28		1
	1	24	22.74	22.73	23.07		1
	12	0	21.94	21.91	21.85	0-2	2
	12	6	21.79	21.99	21.89		2
	12	13	22.00	21.93	21.84		2
	25	0	22.09	21.88	21.87		2

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Table 9-28
LTE Band 2 (PCS) Conducted Powers - 3 MHz Bandwidth

LTE Band 2 (PCS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18615 (1851.5 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19185 (1908.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.75	24.48	24.61	0	0
	1	7	24.78	24.78	24.68		0
	1	14	24.67	24.77	24.66		0
	8	0	22.92	23.04	22.80	0-1	1
	8	4	22.95	23.07	22.88		1
	8	7	22.89	23.10	22.88		1
	15	0	22.98	23.03	22.95		1
16QAM	1	0	23.01	23.28	22.85	0-1	1
	1	7	23.07	23.49	23.00		1
	1	14	22.91	23.23	22.89		1
	8	0	21.95	22.23	21.70	0-2	2
	8	4	21.96	22.34	21.84		2
	8	7	21.97	22.25	21.78		2
	15	0	21.98	21.86	21.97		2

Table 9-29
LTE Band 2 (PCS) Conducted Powers -1.4 MHz Bandwidth

LTE Band 2 (PCS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18607 (1850.7 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19193 (1909.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.45	24.75	24.66	0	0
	1	2	24.51	24.77	24.79		0
	1	5	24.27	24.74	24.79		0
	3	0	24.70	24.61	24.60		0
	3	2	24.68	24.65	24.70		0
	3	3	24.65	24.71	24.72		0
	6	0	22.89	22.91	23.01	0-1	1
16QAM	1	0	23.13	22.93	22.97	0-1	1
	1	2	23.24	22.86	22.84		1
	1	5	23.47	23.14	22.81		1
	3	0	23.04	23.21	23.17		1
	3	2	23.08	23.19	23.13		1
	3	3	23.18	23.25	23.17		1
	6	0	21.93	22.03	21.96	0-2	2

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9.5 WLAN Conducted Powers

Table 9-30
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
		Average	Average	Average
2412	1	19.11	15.92	14.86
2417	2	N/A	16.82	15.92
2437	6	19.24	16.91	15.96
2457	10	N/A	16.84	15.97
2462	11	**19.44**	14.59	13.61

Table 9-31
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
		Average	Average	Average
2412	1	15.51	14.51	14.86
2417	2	15.66	15.54	15.92
2437	6	15.68	15.61	15.96
2457	10	15.84	15.53	15.97
2462	11	**15.79**	13.04	13.61

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.
- 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.

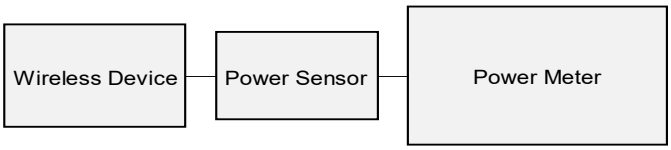

Figure 9-4
Power Measurement Setup

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9.6 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	7.50	5.621
2441	1.0	39	**7.98**	6.273
2480	1.0	78	7.29	5.357
2402	2.0	0	6.87	4.864
2441	2.0	39	7.36	5.447
2480	2.0	78	6.68	4.651
2402	3.0	0	6.90	4.903
2441	3.0	39	7.40	5.489
2480	3.0	78	6.72	4.697

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

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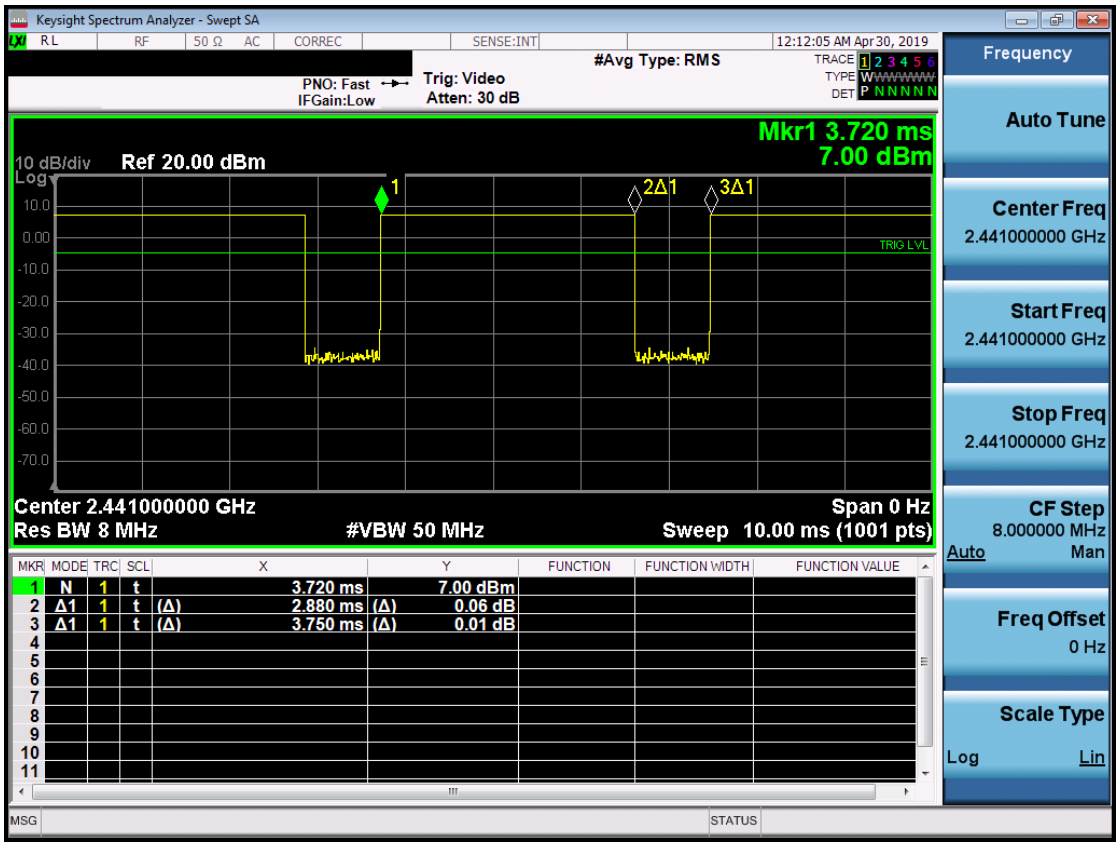

Figure 9-5
Bluetooth Transmission Plot

Equation 9-1
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.88ms}{3.75ms} * 100\% = 76.8\%$$

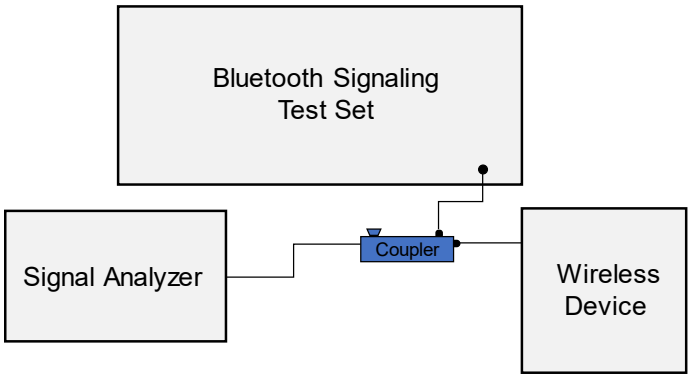

Figure 9-6
Power Measurement Setup

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10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Head 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
5/14/2019	750H	21.5	680	0.881	43.592	0.888	42.305	-0.79%	3.04%
			695	0.886	43.536	0.889	42.227	-0.34%	3.10%
			700	0.887	43.518	0.889	42.201	-0.22%	3.12%
			710	0.891	43.487	0.890	42.149	0.11%	3.17%
			740	0.901	43.407	0.893	41.994	0.90%	3.36%
			755	0.906	43.370	0.894	41.916	1.34%	3.47%
			770	0.911	43.327	0.895	41.838	1.79%	3.56%
			785	0.916	43.281	0.896	41.760	2.23%	3.64%
5/20/2019	835H	21.7	820	0.877	41.112	0.899	41.578	-2.45%	-1.12%
			835	0.892	40.922	0.900	41.500	-0.89%	-1.39%
			850	0.907	40.735	0.916	41.500	-0.98%	-1.84%
5/23/2019	1750H	22.0	1710	1.347	39.695	1.348	40.142	-0.07%	-1.11%
			1750	1.371	39.625	1.371	40.079	0.00%	-1.13%
			1790	1.392	39.549	1.394	40.016	-0.14%	-1.17%
5/14/2019	1900H	19.5	1850	1.422	39.948	1.400	40.000	1.57%	-0.13%
			1880	1.443	39.889	1.400	40.000	3.07%	-0.28%
			1910	1.463	39.835	1.400	40.000	4.50%	-0.41%
5/17/2019	1900H	22.6	1850	1.429	38.878	1.400	40.000	2.07%	-2.81%
			1880	1.447	38.823	1.400	40.000	3.36%	-2.94%
			1910	1.465	38.769	1.400	40.000	4.64%	-3.08%
5/20/2019	1900H	22.1	1850	1.424	40.670	1.400	40.000	1.71%	1.68%
			1880	1.442	40.631	1.400	40.000	3.00%	1.58%
			1910	1.460	40.596	1.400	40.000	4.29%	1.49%
5/20/2019	2450H	21.4	2400	1.778	38.867	1.756	39.289	1.25%	-1.07%
			2450	1.816	38.797	1.800	39.200	0.89%	-1.03%
			2500	1.855	38.723	1.855	39.136	0.00%	-1.06%

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Table 10-2
Body 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
5/20/2019	750B	23.0	680	0.912	57.100	0.958	55.804	-4.80%	2.32%
			695	0.917	57.064	0.959	55.745	-4.38%	2.37%
			700	0.918	57.055	0.959	55.726	-4.28%	2.38%
			710	0.922	57.039	0.960	55.687	-3.96%	2.43%
			740	0.933	57.008	0.963	55.570	-3.12%	2.59%
			755	0.939	56.975	0.964	55.512	-2.59%	2.64%
			770	0.944	56.933	0.965	55.453	-2.18%	2.67%
			785	0.949	56.887	0.966	55.395	-1.76%	2.69%
5/20/2019	835B	19.9	820	1.005	52.909	0.969	55.258	3.72%	-4.25%
			835	1.012	52.880	0.970	55.200	4.33%	-4.20%
			850	1.018	52.846	0.988	55.154	3.04%	-4.18%
5/17/2019	1750B	22.2	1710	1.431	52.337	1.463	53.537	-2.19%	-2.24%
			1750	1.476	52.189	1.488	53.432	-0.81%	-2.33%
			1790	1.519	52.020	1.514	53.326	0.33%	-2.45%
5/31/2019	1750B	22.6	1710	1.446	52.041	1.463	53.537	-1.16%	-2.79%
			1750	1.490	51.853	1.488	53.432	0.13%	-2.96%
			1790	1.535	51.696	1.514	53.326	1.39%	-3.06%
5/15/2019	1900B	22.7	1850	1.521	52.154	1.520	53.300	0.07%	-2.15%
			1880	1.552	52.031	1.520	53.300	2.11%	-2.38%
			1910	1.586	51.946	1.520	53.300	4.34%	-2.54%
5/19/2019	1900B	23.0	1850	1.512	52.543	1.520	53.300	-0.53%	-1.42%
			1880	1.544	52.457	1.520	53.300	1.58%	-1.58%
			1910	1.578	52.373	1.520	53.300	3.82%	-1.74%
5/15/2019	2450B	21.3	2400	1.984	52.742	1.902	52.767	4.31%	-0.05%
			2450	2.031	52.652	1.950	52.700	4.15%	-0.09%
			2500	2.079	52.583	2.021	52.636	2.87%	-0.10%

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 ±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 10-3
System Verification Results

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)	$Deviation_{1g}$ (%)
H	750	HEAD	05/14/2019	21.6	21.5	0.200	1003	7409	1.760	8.280	8.800	6.28%
H	835	HEAD	05/20/2019	20.8	21.7	0.200	4d132	7409	1.940	9.590	9.700	1.15%
E	1750	HEAD	05/23/2019	23.2	22.0	0.100	1150	3589	3.800	36.500	38.000	4.11%
E	1900	HEAD	05/14/2019	23.6	21.5	0.100	5d148	3589	3.970	39.100	39.700	1.53%
E	1900	HEAD	05/17/2019	23.0	22.6	0.100	5d148	3589	3.930	39.100	39.300	0.51%
D	1900	HEAD	05/20/2019	23.2	22.1	0.100	5d148	3914	4.140	39.100	41.400	5.88%
E	2450	HEAD	05/20/2019	23.1	21.4	0.100	797	3589	5.280	52.700	52.800	0.19%
I	750	BODY	05/20/2019	22.4	22.2	0.200	1003	7357	1.760	8.580	8.800	2.56%
J	835	BODY	05/20/2019	20.2	19.5	0.200	4d132	7488	2.030	9.670	10.150	4.96%
D	1750	BODY	05/17/2019	23.1	22.2	0.100	1008	3914	3.950	37.400	39.500	5.61%
D	1750	BODY	05/31/2019	23.0	22.6	0.100	1008	3914	3.960	37.400	39.600	5.88%
G	1900	BODY	05/15/2019	22.8	21.7	0.100	5d080	7410	4.180	39.200	41.800	6.63%
G	1900	BODY	05/19/2019	21.3	21.3	0.100	5d080	7410	4.200	39.200	42.000	7.14%
L	2450	BODY	05/15/2019	21.6	20.2	0.100	719	7308	4.960	50.100	49.600	-1.00%

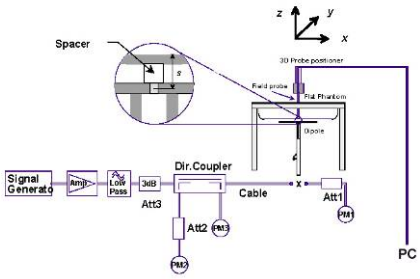

Figure 10-1
System Verification Setup Diagram

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	32.85	0.00	Right	Cheek	63401	1	1:8.3	0.215	1.216	0.261	
836.60	190	GSM 850	GSM	33.7	32.85	-0.04	Right	Tilt	63401	1	1:8.3	0.127	1.216	0.154	
836.60	190	GSM 850	GSM	33.7	32.85	0.08	Left	Cheek	63401	1	1:8.3	0.181	1.216	0.220	
836.60	190	GSM 850	GSM	33.7	32.85	0.11	Left	Tilt	63401	1	1:8.3	0.117	1.216	0.142	
836.60	190	GSM 850	GPRS	28.0	27.46	0.02	Right	Cheek	63401	4	1:2.076	0.248	1.132	0.281	A1
836.60	190	GSM 850	GPRS	28.0	27.46	0.01	Right	Tilt	63401	4	1:2.076	0.141	1.132	0.160	
836.60	190	GSM 850	GPRS	28.0	27.46	-0.01	Left	Cheek	63401	4	1:2.076	0.205	1.132	0.232	
836.60	190	GSM 850	GPRS	28.0	27.46	0.03	Left	Tilt	63401	4	1:2.076	0.139	1.132	0.157	
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	29.80	0.00	Right	Cheek	63401	1	1:8.3	0.176	1.230	0.216	
1880.00	661	GSM 1900	GSM	30.7	29.80	0.02	Right	Tilt	63401	1	1:8.3	0.139	1.230	0.171	
1880.00	661	GSM 1900	GSM	30.7	29.80	0.03	Left	Cheek	63401	1	1:8.3	0.340	1.230	0.418	
1880.00	661	GSM 1900	GSM	30.7	29.80	0.09	Left	Tilt	63401	1	1:8.3	0.129	1.230	0.159	
1880.00	661	GSM 1900	GPRS	25.5	24.79	0.06	Right	Cheek	63401	4	1:2.076	0.180	1.178	0.212	
1880.00	661	GSM 1900	GPRS	25.5	24.79	0.03	Right	Tilt	63401	4	1:2.076	0.149	1.178	0.176	
1880.00	661	GSM 1900	GPRS	25.5	24.79	0.07	Left	Cheek	63401	4	1:2.076	0.367	1.178	0.432	A2
1880.00	661	GSM 1900	GPRS	25.5	24.79	0.04	Left	Tilt	63401	4	1:2.076	0.139	1.178	0.164	
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	25.3	25.18	0.00	Right	Cheek	63401	1:1	0.314	1.028	0.323	A3
836.60	4183	UMTS 850	RMC	25.3	25.18	-0.06	Right	Tilt	63401	1:1	0.152	1.028	0.156	
836.60	4183	UMTS 850	RMC	25.3	25.18	0.04	Left	Cheek	63401	1:1	0.258	1.028	0.265	
836.60	4183	UMTS 850	RMC	25.3	25.18	0.12	Left	Tilt	63401	1:1	0.164	1.028	0.169	
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	24.8	24.79	0.06	Right	Cheek	63351	1:1	0.310	1.002	0.311	
1732.40	1412	UMTS 1750	RMC	24.8	24.79	-0.04	Right	Tilt	63351	1:1	0.375	1.002	0.376	
1712.40	1312	UMTS 1750	RMC	24.8	24.75	0.08	Left	Cheek	63351	1:1	0.646	1.012	0.654	
1732.40	1412	UMTS 1750	RMC	24.8	24.79	0.01	Left	Cheek	63351	1:1	0.639	1.002	0.640	
1752.60	1513	UMTS 1750	RMC	24.8	24.80	0.00	Left	Cheek	63351	1:1	0.700	1.000	0.700	A4
1732.40	1412	UMTS 1750	RMC	24.8	24.79	0.05	Left	Tilt	63351	1:1	0.273	1.002	0.274	
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	24.8	24.60	-0.01	Right	Cheek	63351	1:1	0.283	1.047	0.296	
1880.00	9400	UMTS 1900	RMC	24.8	24.60	0.05	Right	Tilt	63351	1:1	0.268	1.047	0.281	
1852.40	9262	UMTS 1900	RMC	24.8	24.51	0.00	Left	Cheek	63351	1:1	0.701	1.069	0.749	
1880.00	9400	UMTS 1900	RMC	24.8	24.60	0.12	Left	Cheek	63351	1:1	0.695	1.047	0.728	
1907.60	9538	UMTS 1900	RMC	24.8	24.71	0.04	Left	Cheek	63351	1:1	0.773	1.021	0.789	A5
1880.00	9400	UMTS 1900	RMC	24.8	24.60	-0.17	Left	Tilt	63351	1:1	0.281	1.047	0.294	
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
Cell. CDMA 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)	
836.52	384	Cell. CDMA	RC3 / SO55	25.3	24.87	0.03	Right	Cheek	63401	1:1	0.264	1.104	0.291	A6
836.52	384	Cell. CDMA	RC3 / SO55	25.3	24.87	-0.02	Right	Tilt	63401	1:1	0.149	1.104	0.164	
836.52	384	Cell. CDMA	RC3 / SO55	25.3	24.87	0.09	Left	Cheek	63401	1:1	0.245	1.104	0.270	
836.52	384	Cell. CDMA	RC3 / SO55	25.3	24.87	-0.12	Left	Tilt	63401	1:1	0.142	1.104	0.157	
836.52	384	Cell. CDMA	EVDO Rev. A	25.3	24.67	0.07	Right	Cheek	63401	1:1	0.258	1.156	0.298	
836.52	384	Cell. CDMA	EVDO Rev. A	25.3	24.67	0.04	Right	Tilt	63401	1:1	0.141	1.156	0.163	
836.52	384	Cell. CDMA	EVDO Rev. A	25.3	24.67	0.00	Left	Cheek	63401	1:1	0.224	1.156	0.259	
836.52	384	Cell. CDMA	EVDO Rev. A	25.3	24.67	0.10	Left	Tilt	63401	1:1	0.131	1.156	0.151	
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
PCS CDMA 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	600	PCS CDMA	RC3 / SO55	24.8	24.80	0.05	Right	Cheek	63401	1:1	0.370	1.000	0.370	
1880.00	600	PCS CDMA	RC3 / SO55	24.8	24.80	0.08	Right	Tilt	63401	1:1	0.285	1.000	0.285	
1851.25	25	PCS CDMA	RC3 / SO55	24.8	24.79	-0.01	Left	Cheek	63401	1:1	0.671	1.002	0.672	
1880.00	600	PCS CDMA	RC3 / SO55	24.8	24.80	-0.04	Left	Cheek	63401	1:1	0.675	1.000	0.675	
1908.75	1175	PCS CDMA	RC3 / SO55	24.8	24.77	0.05	Left	Cheek	63401	1:1	0.657	1.007	0.662	
1880.00	600	PCS CDMA	RC3 / SO55	24.8	24.80	0.13	Left	Tilt	63401	1:1	0.250	1.000	0.250	
1880.00	600	PCS CDMA	EVDO Rev. A	24.8	24.55	0.12	Right	Cheek	63401	1:1	0.372	1.059	0.394	
1880.00	600	PCS CDMA	EVDO Rev. A	24.8	24.55	0.01	Right	Tilt	63401	1:1	0.270	1.059	0.286	
1851.25	25	PCS CDMA	EVDO Rev. A	24.8	24.76	0.12	Left	Cheek	63401	1:1	0.720	1.009	0.726	A7
1880.00	600	PCS CDMA	EVDO Rev. A	24.8	24.55	0.12	Left	Cheek	63401	1:1	0.702	1.059	0.743	
1908.75	1175	PCS CDMA	EVDO Rev. A	24.8	24.71	-0.02	Left	Cheek	63401	1:1	0.709	1.021	0.724	
1880.00	600	PCS CDMA	EVDO Rev. A	24.8	24.55	0.06	Left	Tilt	63401	1:1	0.245	1.059	0.259	
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 11-8
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	25.3	25.25	0.06	0	Right	Cheek	QPSK	1	50	63401	1:1	0.187	1.012	0.189	A8
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	0.03	1	Right	Cheek	QPSK	50	25	63401	1:1	0.157	1.202	0.189	
680.50	133297	Mid	LTE Band 71	20	25.3	25.25	-0.09	0	Right	Tilt	QPSK	1	50	63401	1:1	0.095	1.012	0.096	
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	0.06	1	Right	Tilt	QPSK	50	25	63401	1:1	0.079	1.202	0.095	
680.50	133297	Mid	LTE Band 71	20	25.3	25.25	0.05	0	Left	Cheek	QPSK	1	50	63401	1:1	0.170	1.012	0.172	
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	0.00	1	Left	Cheek	QPSK	50	25	63401	1:1	0.140	1.202	0.168	
680.50	133297	Mid	LTE Band 71	20	25.3	25.25	0.05	0	Left	Tilt	QPSK	1	50	63401	1:1	0.092	1.012	0.093	
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	0.05	1	Left	Tilt	QPSK	50	25	63401	1:1	0.074	1.202	0.089	
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 11-9
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	25.3	25.28	-0.13	0	Right	Cheek	QPSK	1	25	63401	1:1	0.204	1.005	0.205	A9
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	0.02	1	Right	Cheek	QPSK	25	12	63401	1:1	0.155	1.242	0.193	
707.50	23095	Mid	LTE Band 12	10	25.3	25.28	0.06	0	Right	Tilt	QPSK	1	25	63401	1:1	0.101	1.005	0.102	
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	-0.11	1	Right	Tilt	QPSK	25	12	63401	1:1	0.081	1.242	0.101	
707.50	23095	Mid	LTE Band 12	10	25.3	25.28	0.00	0	Left	Cheek	QPSK	1	25	63401	1:1	0.186	1.005	0.187	
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	0.07	1	Left	Cheek	QPSK	25	12	63401	1:1	0.148	1.242	0.184	
707.50	23095	Mid	LTE Band 12	10	25.3	25.28	0.01	0	Left	Tilt	QPSK	1	25	63401	1:1	0.100	1.005	0.101	
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	0.06	1	Left	Tilt	QPSK	25	12	63401	1:1	0.080	1.242	0.099	
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 13 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)	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	-0.08	0	Right	Cheek	QPSK	1	0	63401	1:1	0.249	1.000	0.249	A10
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.11	1	Right	Cheek	QPSK	25	25	63401	1:1	0.195	1.180	0.230	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	-0.01	0	Right	Tilt	QPSK	1	0	63401	1:1	0.154	1.000	0.154	
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.08	1	Right	Tilt	QPSK	25	25	63401	1:1	0.115	1.180	0.136	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	0.04	0	Left	Cheek	QPSK	1	0	63401	1:1	0.200	1.000	0.200	
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.04	1	Left	Cheek	QPSK	25	25	63401	1:1	0.149	1.180	0.176	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	-0.10	0	Left	Tilt	QPSK	1	0	63401	1:1	0.156	1.000	0.156	
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.05	1	Left	Tilt	QPSK	25	25	63401	1:1	0.106	1.180	0.125	
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 11-11
LTE Band 5 (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)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	-0.04	0	Right	Cheek	QPSK	1	0	63401	1:1	0.266	1.000	0.266	A11
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	0.04	1	Right	Cheek	QPSK	25	25	63401	1:1	0.229	1.239	0.284	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	0.09	0	Right	Tilt	QPSK	1	0	63401	1:1	0.144	1.000	0.144	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	-0.01	1	Right	Tilt	QPSK	25	25	63401	1:1	0.115	1.239	0.142	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	0.13	0	Left	Cheek	QPSK	1	0	63401	1:1	0.252	1.000	0.252	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	0.13	1	Left	Cheek	QPSK	25	25	63401	1:1	0.202	1.239	0.250	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	0.05	0	Left	Tilt	QPSK	1	0	63401	1:1	0.150	1.000	0.150	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	0.08	1	Left	Tilt	QPSK	25	25	63401	1:1	0.115	1.239	0.142	
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 11-12
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)	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	0.09	0	Right	Cheek	QPSK	1	0	63351	1:1	0.347	1.000	0.347	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	0.15	1	Right	Cheek	QPSK	50	0	63351	1:1	0.208	1.211	0.252	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	-0.02	0	Right	Tilt	QPSK	1	0	63351	1:1	0.419	1.000	0.419	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	0.02	1	Right	Tilt	QPSK	50	0	63351	1:1	0.243	1.211	0.294	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	0.10	0	Left	Cheek	QPSK	1	0	63351	1:1	0.551	1.000	0.551	A12
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	0.05	1	Left	Cheek	QPSK	50	0	63351	1:1	0.365	1.211	0.442	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	0.02	0	Left	Tilt	QPSK	1	0	63351	1:1	0.242	1.000	0.242	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	-0.05	1	Left	Tilt	QPSK	50	0	63351	1:1	0.158	1.211	0.191	
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 11-13
LTE Band 2 (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)	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	0.12	0	Right	Cheek	QPSK	1	50	63351	1:1	0.409	1.005	0.411	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	0.01	1	Right	Cheek	QPSK	50	25	63351	1:1	0.372	1.199	0.446	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	0.03	0	Right	Tilt	QPSK	1	50	63351	1:1	0.306	1.005	0.308	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	-0.04	1	Right	Tilt	QPSK	50	25	63351	1:1	0.279	1.199	0.335	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.8	24.75	-0.09	0	Left	Cheek	QPSK	1	50	63351	1:1	0.752	1.012	0.761	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	0.04	0	Left	Cheek	QPSK	1	50	63351	1:1	0.794	1.005	0.798	
1900.00	19100	High	LTE Band 2 (PCS)	20	24.8	24.68	0.08	0	Left	Cheek	QPSK	1	50	63351	1:1	0.854	1.028	0.878	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.8	22.88	0.05	1	Left	Cheek	QPSK	50	25	63351	1:1	0.643	1.236	0.795	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	0.05	1	Left	Cheek	QPSK	50	25	63351	1:1	0.673	1.199	0.807	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.8	22.95	-0.03	1	Left	Cheek	QPSK	50	25	63351	1:1	0.715	1.216	0.869	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.8	22.96	0.00	1	Left	Cheek	QPSK	100	0	63351	1:1	0.732	1.213	0.888	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	-0.01	0	Left	Tilt	QPSK	1	50	63351	1:1	0.311	1.005	0.313	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	0.05	1	Left	Tilt	QPSK	50	25	63351	1:1	0.249	1.199	0.299	
1900.00	19100	High	LTE Band 2 (PCS)	20	24.8	24.68	0.16	0	Left	Cheek	QPSK	1	50	63351	1:1	0.903	1.028	**0.928**	A13
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 indicates variability data.

Table 11-14
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)	
2462	11	802.11b	DSSS	22	16.5	15.79	0.11	Right	Cheek	63039	1	99.9	0.734	0.492	1.178	1.001	0.580	
2462	11	802.11b	DSSS	22	16.5	15.79	0.19	Right	Tilt	63039	1	99.9	0.808	0.557	1.178	1.001	0.657	
2412	1	802.11b	DSSS	22	16.5	15.51	0.04	Left	Cheek	63039	1	99.9	1.227	0.796	1.256	1.001	1.001	
2437	6	802.11b	DSSS	22	16.5	15.68	0.11	Left	Cheek	63039	1	99.9	1.408	0.917	1.208	1.001	1.109	
2462	11	802.11b	DSSS	22	16.5	15.79	0.05	Left	Cheek	63039	1	99.9	1.685	1.060	1.178	1.001	**1.250**	A14
2462	11	802.11b	DSSS	22	16.5	15.79	0.07	Left	Tilt	63039	1	99.9	1.007	0.599	1.178	1.001	0.706	
2462	11	802.11b	DSSS	22	16.5	15.79	0.14	Left	Cheek	63039	1	99.9	0.969	1.020	1.178	1.001	1.203	
2437	6	802.11g	OFDM	20	16.5	15.61	-0.02	Right	Cheek	63039	6	99.5	0.672	0.437	1.227	1.005	0.539	
2437	6	802.11g	OFDM	20	16.5	15.61	0.06	Right	Tilt	63039	6	99.5	0.703	0.481	1.227	1.005	0.593	
2417	2	802.11g	OFDM	20	16.5	15.54	-0.08	Left	Cheek	63039	6	99.5	1.285	0.818	1.247	1.005	1.025	
2437	6	802.11g	OFDM	20	16.5	15.61	0.06	Left	Cheek	63039	6	99.5	1.407	0.911	1.227	1.005	1.123	
2457	10	802.11g	OFDM	20	16.5	15.53	0.07	Left	Cheek	63039	6	99.5	1.501	0.992	1.250	1.005	**1.246**	
2437	6	802.11g	OFDM	20	16.5	15.61	0.20	Left	Tilt	63039	6	99.5	0.920	0.561	1.227	1.005	0.692	
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Note: Blue entry indicates variability data.

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Table 11-15
DSS Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)			(W/kg)	
2441.00	39	Bluetooth	FHSS	8.0	7.98	0.15	Right	Cheek	63039	1	76.8	0.023	1.005	1.302	0.030	
2441.00	39	Bluetooth	FHSS	8.0	7.98	-0.04	Right	Tilt	63039	1	76.8	0.024	1.005	1.302	0.031	
2441.00	39	Bluetooth	FHSS	8.0	7.98	0.04	Left	Cheek	63039	1	76.8	0.046	1.005	1.302	**0.060**	A15
2441.00	39	Bluetooth	FHSS	8.0	7.98	0.04	Left	Tilt	63039	1	76.8	0.030	1.005	1.302	0.039	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Head 1.6 W/kg (mW/g)** averaged over 1 gram									

11.2 Standalone Body-Worn SAR Data

Table 11-16
GSM/UMTS/CDMA 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)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.7	32.85	-0.06	10 mm	63351	1	1:8.3	back	0.294	1.216	0.358	
836.60	190	GSM 850	GPRS	28.0	27.46	-0.04	10 mm	63351	4	1:2.076	back	0.349	1.132	0.395	A16
1880.00	661	GSM 1900	GSM	30.7	29.80	0.04	10 mm	63351	1	1:8.3	back	0.299	1.230	0.368	
1880.00	661	GSM 1900	GPRS	25.5	24.79	0.00	10 mm	63351	4	1:2.076	back	0.336	1.178	0.396	A18
836.60	4183	UMTS 850	RMC	25.3	25.18	-0.02	10 mm	63351	N/A	1:1	back	0.435	1.028	0.447	A20
1712.40	1312	UMTS 1750	RMC	24.8	24.75	0.03	10 mm	63351	N/A	1:1	back	1.060	1.012	1.073	A22
1732.40	1412	UMTS 1750	RMC	24.8	24.79	0.08	10 mm	63351	N/A	1:1	back	0.979	1.002	0.981	
1752.60	1513	UMTS 1750	RMC	24.8	24.80	0.02	10 mm	63351	N/A	1:1	back	0.978	1.000	0.978	
1712.40	1312	UMTS 1750	RMC	24.8	24.75	0.11	10 mm	63351	N/A	1:1	back	1.030	1.012	1.042	
1852.40	9262	UMTS 1900	RMC	24.8	24.51	-0.08	10 mm	63401	N/A	1:1	back	0.775	1.069	0.828	A23
1880.00	9400	UMTS 1900	RMC	24.8	24.60	0.02	10 mm	63401	N/A	1:1	back	0.643	1.047	0.673	
1907.60	9538	UMTS 1900	RMC	24.8	24.71	0.05	10 mm	63401	N/A	1:1	back	0.753	1.021	0.769	
836.52	384	Cell. CDMA	TDSO / SO32	25.3	24.74	0.00	10 mm	63351	N/A	1:1	back	0.437	1.138	0.497	A25
1851.25	25	PCS CDMA	TDSO / SO32	24.8	24.64	-0.03	10 mm	63351	N/A	1:1	back	0.689	1.038	0.715	
1880.00	600	PCS CDMA	TDSO / SO32	24.8	24.31	0.12	10 mm	63351	N/A	1:1	back	0.720	1.119	0.806	
1908.75	1175	PCS CDMA	TDSO / SO32	24.8	24.51	0.12	10 mm	63351	N/A	1:1	back	0.772	1.069	0.825	A27
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Body 1.6 W/kg (mW/g)** averaged over 1 gram									

Note: Blue entry indicates variability data.

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Table 11-17
LTE Body-Worn SAR

FREQUENCY MHz	FREQUENCY Ch.		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) (W/kg)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
680.50	133297	Mid	LTE Band 71	20	25.3	25.25	-0.06	0	63401	QPSK	1	50	10 mm	back	1:1	0.282	1.012	0.285	A29
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	-0.12	1	63401	QPSK	50	25	10 mm	back	1:1	0.234	1.202	0.281	
707.50	23095	Mid	LTE Band 12	10	25.3	25.28	-0.13	0	63401	QPSK	1	25	10 mm	back	1:1	0.266	1.005	0.267	A31
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	0.11	1	63401	QPSK	25	12	10 mm	back	1:1	0.205	1.242	0.255	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	-0.02	0	63401	QPSK	1	0	10 mm	back	1:1	0.344	1.000	0.344	A33
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.00	1	63401	QPSK	25	25	10 mm	back	1:1	0.258	1.180	0.304	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	0.02	0	63351	QPSK	1	0	10 mm	back	1:1	0.452	1.000	0.452	A35
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	0.03	1	63351	QPSK	25	25	10 mm	back	1:1	0.335	1.239	0.415	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.8	24.55	0.13	0	63351	QPSK	1	50	10 mm	back	1:1	1.020	1.059	**1.080**	A37
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	0.00	0	63351	QPSK	1	0	10 mm	back	1:1	0.994	1.000	0.994	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.8	24.61	0.03	0	63351	QPSK	1	50	10 mm	back	1:1	0.901	1.045	0.942	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	0.01	1	63351	QPSK	50	0	10 mm	back	1:1	0.655	1.211	0.793	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.93	-0.03	1	63351	QPSK	100	0	10 mm	back	1:1	0.634	1.222	0.775	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.8	24.75	-0.03	0	63401	QPSK	1	50	10 mm	back	1:1	0.718	1.012	0.727	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	-0.12	0	63401	QPSK	1	50	10 mm	back	1:1	0.718	1.005	0.722	
1900.00	19100	High	LTE Band 2 (PCS)	20	24.8	24.68	0.18	0	63401	QPSK	1	50	10 mm	back	1:1	0.770	1.028	0.792	A38
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	0.00	1	63401	QPSK	50	25	10 mm	back	1:1	0.642	1.199	0.770	
									Body 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-18
DTS Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY MHz	FREQUENCY Ch.	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 W/kg	SAR (1g) (W/kg)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
2462	11	802.11b	DSSS	22	19.5	19.44	0.02	10 mm	63039	1	back	99.9	0.519	0.374	1.014	1.001	**0.380**	A40
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 11-19
GPRS/UMTS/CDMA 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)	
836.60	190	GSM 850	GPRS	28.0	27.46	-0.04	10 mm	63351	4	1:2.076	back	0.349	1.132	0.395	
836.60	190	GSM 850	GPRS	28.0	27.46	0.12	10 mm	63351	4	1:2.076	front	0.360	1.132	0.408	A17
836.60	190	GSM 850	GPRS	28.0	27.46	-0.03	10 mm	63351	4	1:2.076	bottom	0.159	1.132	0.180	
836.60	190	GSM 850	GPRS	28.0	27.46	-0.06	10 mm	63351	4	1:2.076	right	0.358	1.132	0.405	
836.60	190	GSM 850	GPRS	28.0	27.46	0.09	10 mm	63351	4	1:2.076	left	0.247	1.132	0.280	
1880.00	661	GSM 1900	GPRS	25.5	24.79	0.00	10 mm	63351	4	1:2.076	back	0.336	1.178	0.396	
1880.00	661	GSM 1900	GPRS	25.5	24.79	-0.05	10 mm	63351	4	1:2.076	front	0.287	1.178	0.338	
1880.00	661	GSM 1900	GPRS	25.5	24.79	0.03	10 mm	63351	4	1:2.076	bottom	0.258	1.178	0.304	
1880.00	661	GSM 1900	GPRS	25.5	24.79	0.11	10 mm	63351	4	1:2.076	left	0.346	1.178	0.408	A19
836.60	4183	UMTS 850	RMC	25.3	25.18	-0.02	10 mm	63351	N/A	1:1	back	0.435	1.028	0.447	
836.60	4183	UMTS 850	RMC	25.3	25.18	0.01	10 mm	63351	N/A	1:1	front	0.425	1.028	0.437	
836.60	4183	UMTS 850	RMC	25.3	25.18	-0.01	10 mm	63351	N/A	1:1	bottom	0.193	1.028	0.198	
836.60	4183	UMTS 850	RMC	25.3	25.18	-0.01	10 mm	63351	N/A	1:1	right	0.465	1.028	0.478	A21
836.60	4183	UMTS 850	RMC	25.3	25.18	-0.05	10 mm	63351	N/A	1:1	left	0.282	1.028	0.290	
1712.40	1312	UMTS 1750	RMC	24.8	24.75	0.03	10 mm	63351	N/A	1:1	back	1.060	1.012	1.073	A22
1732.40	1412	UMTS 1750	RMC	24.8	24.79	0.08	10 mm	63351	N/A	1:1	back	0.979	1.002	0.981	
1752.60	1513	UMTS 1750	RMC	24.8	24.80	0.02	10 mm	63351	N/A	1:1	back	0.978	1.000	0.978	
1732.40	1412	UMTS 1750	RMC	24.8	24.79	0.10	10 mm	63351	N/A	1:1	front	0.758	1.002	0.760	
1732.40	1412	UMTS 1750	RMC	24.8	24.79	-0.13	10 mm	63351	N/A	1:1	bottom	0.500	1.002	0.501	
1712.40	1312	UMTS 1750	RMC	24.8	24.75	0.11	10 mm	63351	N/A	1:1	left	0.808	1.012	0.818	
1732.40	1412	UMTS 1750	RMC	24.8	24.79	0.04	10 mm	63351	N/A	1:1	left	0.804	1.002	0.806	
1752.60	1513	UMTS 1750	RMC	24.8	24.80	-0.03	10 mm	63351	N/A	1:1	left	0.847	1.000	0.847	
1712.40	1312	UMTS 1750	RMC	24.8	24.75	0.11	10 mm	63351	N/A	1:1	back	1.030	1.012	1.042	
1852.40	9262	UMTS 1900	RMC	24.8	24.51	-0.08	10 mm	63401	N/A	1:1	back	0.775	1.069	0.828	
1880.00	9400	UMTS 1900	RMC	24.8	24.60	0.02	10 mm	63401	N/A	1:1	back	0.643	1.047	0.673	
1907.60	9538	UMTS 1900	RMC	24.8	24.71	0.05	10 mm	63401	N/A	1:1	back	0.753	1.021	0.769	
1880.00	9400	UMTS 1900	RMC	24.8	24.60	0.07	10 mm	63401	N/A	1:1	front	0.647	1.047	0.677	
1880.00	9400	UMTS 1900	RMC	24.8	24.60	-0.04	10 mm	63401	N/A	1:1	bottom	0.502	1.047	0.526	
1852.40	9262	UMTS 1900	RMC	24.8	24.51	-0.04	10 mm	63401	N/A	1:1	left	0.790	1.069	0.845	
1880.00	9400	UMTS 1900	RMC	24.8	24.60	0.02	10 mm	63401	N/A	1:1	left	0.718	1.047	0.752	
1907.60	9538	UMTS 1900	RMC	24.8	24.71	0.18	10 mm	63401	N/A	1:1	left	0.805	1.021	0.822	A24
836.52	384	Cell. CDMA	EVDO Rev. 0	25.3	24.84	-0.02	10 mm	63351	N/A	1:1	back	0.403	1.112	0.448	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.3	24.84	-0.02	10 mm	63351	N/A	1:1	front	0.395	1.112	0.439	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.3	24.84	-0.20	10 mm	63351	N/A	1:1	bottom	0.173	1.112	0.192	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.3	24.84	0.01	10 mm	63351	N/A	1:1	right	0.419	1.112	0.466	A26
836.52	384	Cell. CDMA	EVDO Rev. 0	25.3	24.84	0.09	10 mm	63351	N/A	1:1	left	0.250	1.112	0.278	
1851.25	25	PCS CDMA	EVDO Rev. 0	24.8	24.72	-0.05	10 mm	63351	N/A	1:1	back	0.660	1.019	0.673	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.8	24.66	-0.14	10 mm	63351	N/A	1:1	back	0.731	1.033	0.755	
1908.75	1175	PCS CDMA	EVDO Rev. 0	24.8	24.72	0.04	10 mm	63351	N/A	1:1	back	0.744	1.019	0.758	A28
1880.00	600	PCS CDMA	EVDO Rev. 0	24.8	24.66	0.17	10 mm	63351	N/A	1:1	front	0.720	1.033	0.744	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.8	24.66	-0.07	10 mm	63351	N/A	1:1	bottom	0.499	1.033	0.515	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.8	24.66	0.04	10 mm	63351	N/A	1:1	left	0.713	1.033	0.737	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

Note: Blue entry indicates variability data.

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REV 21.3 M
02/15/2019

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Table 11-20
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	25.3	25.25	-0.06	0	63401	QPSK	1	50	10 mm	back	1:1	0.282	1.012	0.285	
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	-0.12	1	63401	QPSK	50	25	10 mm	back	1:1	0.234	1.202	0.281	
680.50	133297	Mid	LTE Band 71	20	25.3	25.25	0.06	0	63401	QPSK	1	50	10 mm	front	1:1	0.312	1.012	0.316	A30
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	0.00	1	63401	QPSK	50	25	10 mm	front	1:1	0.259	1.202	0.311	
680.50	133297	Mid	LTE Band 71	20	25.3	25.25	-0.13	0	63401	QPSK	1	50	10 mm	bottom	1:1	0.183	1.012	0.185	
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	-0.11	1	63401	QPSK	50	25	10 mm	bottom	1:1	0.149	1.202	0.179	
680.50	133297	Mid	LTE Band 71	20	25.3	25.25	0.15	0	63401	QPSK	1	50	10 mm	right	1:1	0.202	1.012	0.204	
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	-0.09	1	63401	QPSK	50	25	10 mm	right	1:1	0.172	1.202	0.207	
680.50	133297	Mid	LTE Band 71	20	25.3	25.25	0.11	0	63401	QPSK	1	50	10 mm	left	1:1	0.149	1.012	0.151	
680.50	133297	Mid	LTE Band 71	20	24.3	23.50	-0.04	1	63401	QPSK	50	25	10 mm	left	1:1	0.123	1.202	0.148	
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 11-21
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	25.3	25.28	-0.13	0	63401	QPSK	1	25	10 mm	back	1:1	0.266	1.005	0.267	
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	0.11	1	63401	QPSK	25	12	10 mm	back	1:1	0.205	1.242	0.255	
707.50	23095	Mid	LTE Band 12	10	25.3	25.28	0.08	0	63401	QPSK	1	25	10 mm	front	1:1	0.321	1.005	0.323	A32
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	-0.10	1	63401	QPSK	25	12	10 mm	front	1:1	0.244	1.242	0.303	
707.50	23095	Mid	LTE Band 12	10	25.3	25.28	0.07	0	63401	QPSK	1	25	10 mm	bottom	1:1	0.128	1.005	0.129	
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	-0.02	1	63401	QPSK	25	12	10 mm	bottom	1:1	0.100	1.242	0.124	
707.50	23095	Mid	LTE Band 12	10	25.3	25.28	-0.03	0	63401	QPSK	1	25	10 mm	right	1:1	0.270	1.005	0.271	
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	0.05	1	63401	QPSK	25	12	10 mm	right	1:1	0.200	1.242	0.248	
707.50	23095	Mid	LTE Band 12	10	25.3	25.28	-0.13	0	63401	QPSK	1	25	10 mm	left	1:1	0.171	1.005	0.172	
707.50	23095	Mid	LTE Band 12	10	24.3	23.36	0.00	1	63401	QPSK	25	12	10 mm	left	1:1	0.133	1.242	0.165	
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 11-22
LTE Band 13 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)	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	-0.02	0	63401	QPSK	1	0	10 mm	back	1:1	0.344	1.000	0.344	
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.00	1	63401	QPSK	25	25	10 mm	back	1:1	0.258	1.180	0.304	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	-0.02	0	63401	QPSK	1	0	10 mm	front	1:1	0.385	1.000	0.385	
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.01	1	63401	QPSK	25	25	10 mm	front	1:1	0.274	1.180	0.323	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	0.02	0	63401	QPSK	1	0	10 mm	bottom	1:1	0.217	1.000	0.217	
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	-0.01	1	63401	QPSK	25	25	10 mm	bottom	1:1	0.159	1.180	0.188	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	0.00	0	63401	QPSK	1	0	10 mm	right	1:1	0.449	1.000	0.449	A34
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.08	1	63401	QPSK	25	25	10 mm	right	1:1	0.320	1.180	0.378	
782.00	23230	Mid	LTE Band 13	10	25.3	25.30	-0.02	0	63401	QPSK	1	0	10 mm	left	1:1	0.279	1.000	0.279	
782.00	23230	Mid	LTE Band 13	10	24.3	23.58	0.03	1	63401	QPSK	25	25	10 mm	left	1:1	0.198	1.180	0.234	
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 11-23
LTE Band 5 (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)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	0.02	0	63351	QPSK	1	0	10 mm	back	1:1	0.452	1.000	0.452	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	0.03	1	63351	QPSK	25	25	10 mm	back	1:1	0.335	1.239	0.415	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	-0.01	0	63351	QPSK	1	0	10 mm	front	1:1	0.446	1.000	0.446	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	0.07	1	63351	QPSK	25	25	10 mm	front	1:1	0.341	1.239	0.422	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	-0.12	0	63351	QPSK	1	0	10 mm	bottom	1:1	0.181	1.000	0.181	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	0.00	1	63351	QPSK	25	25	10 mm	bottom	1:1	0.154	1.239	0.191	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	-0.10	0	63351	QPSK	1	0	10 mm	right	1:1	0.465	1.000	0.465	A36
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	0.03	1	63351	QPSK	25	25	10 mm	right	1:1	0.358	1.239	0.444	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.3	25.30	-0.12	0	63351	QPSK	1	0	10 mm	left	1:1	0.266	1.000	0.266	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.3	23.37	-0.11	1	63351	QPSK	25	25	10 mm	left	1:1	0.209	1.239	0.259	
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 11-24
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	24.8	24.55	0.13	0	63351	QPSK	1	50	10 mm	back	1:1	1.020	1.059	1.080	A37
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	0.00	0	63351	QPSK	1	0	10 mm	back	1:1	0.994	1.000	0.994	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.8	24.61	0.03	0	63351	QPSK	1	50	10 mm	back	1:1	0.901	1.045	0.942	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	0.01	1	63351	QPSK	50	0	10 mm	back	1:1	0.655	1.211	0.793	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.93	-0.03	1	63351	QPSK	100	0	10 mm	back	1:1	0.634	1.222	0.775	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.8	24.55	-0.13	0	63351	QPSK	1	50	10 mm	front	1:1	0.829	1.059	0.878	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	0.04	0	63351	QPSK	1	0	10 mm	front	1:1	0.863	1.000	0.863	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.8	24.61	-0.14	0	63351	QPSK	1	50	10 mm	front	1:1	0.799	1.045	0.835	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	0.08	1	63351	QPSK	50	0	10 mm	front	1:1	0.564	1.211	0.683	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.93	0.06	1	63351	QPSK	100	0	10 mm	front	1:1	0.547	1.222	0.668	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	-0.19	0	63351	QPSK	1	0	10 mm	bottom	1:1	0.528	1.000	0.528	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	-0.06	1	63351	QPSK	50	0	10 mm	bottom	1:1	0.337	1.211	0.408	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.8	24.55	0.16	0	63351	QPSK	1	50	10 mm	left	1:1	0.724	1.059	0.767	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.8	24.80	-0.12	0	63351	QPSK	1	0	10 mm	left	1:1	0.795	1.000	0.795	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.8	24.61	-0.12	0	63351	QPSK	1	50	10 mm	left	1:1	0.853	1.045	0.891	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.97	0.03	1	63351	QPSK	50	0	10 mm	left	1:1	0.510	1.211	0.618	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.8	22.93	0.10	1	63351	QPSK	100	0	10 mm	left	1:1	0.507	1.222	0.620	
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 11-25
LTE Band 2 (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	18700	Low	LTE Band 2 (PCS)	20	24.8	24.75	-0.03	0	63401	QPSK	1	50	10 mm	back	1:1	0.718	1.012	0.727	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	-0.12	0	63401	QPSK	1	50	10 mm	back	1:1	0.718	1.005	0.722	
1900.00	19100	High	LTE Band 2 (PCS)	20	24.8	24.68	0.18	0	63401	QPSK	1	50	10 mm	back	1:1	0.770	1.028	0.792	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	0.00	1	63401	QPSK	50	25	10 mm	back	1:1	0.642	1.199	0.770	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	0.14	0	63401	QPSK	1	50	10 mm	front	1:1	0.615	1.005	0.618	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	0.09	1	63401	QPSK	50	25	10 mm	front	1:1	0.523	1.199	0.627	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	0.00	0	63401	QPSK	1	50	10 mm	bottom	1:1	0.560	1.005	0.563	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	-0.02	1	63401	QPSK	50	25	10 mm	bottom	1:1	0.495	1.199	0.594	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.8	24.75	0.16	0	63401	QPSK	1	50	10 mm	left	1:1	0.812	1.012	0.822	A39
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.8	24.78	0.02	0	63401	QPSK	1	50	10 mm	left	1:1	0.740	1.005	0.744	
1900.00	19100	High	LTE Band 2 (PCS)	20	24.8	24.68	-0.01	0	63401	QPSK	1	50	10 mm	left	1:1	0.802	1.028	0.824	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.8	23.01	-0.09	1	63401	QPSK	50	25	10 mm	left	1:1	0.664	1.199	0.796	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.8	22.96	0.15	1	63401	QPSK	100	0	10 mm	left	1:1	0.661	1.213	0.802	
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 11-26
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)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2462	11	802.11b	DSSS	22	19.5	19.44	0.02	10 mm	63039	1	back	99.9	0.519	0.374	1.014	1.001	0.380	
2462	11	802.11b	DSSS	22	19.5	19.44	-0.12	10 mm	63039	1	front	99.9	0.497	-	1.014	1.001	-	
2462	11	802.11b	DSSS	22	19.5	19.44	0.03	10 mm	63039	1	top	99.9	0.652	0.446	1.014	1.001	**0.453**	A41
2462	11	802.11b	DSSS	22	19.5	19.44	0.08	10 mm	63039	1	right	99.9	0.459	-	1.014	1.001	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram										

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 > ½ dB, instead of the middle channel, the highest output power channel was used.

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4. GPRS was additionally evaluated for head and body-worn exposure conditions to address possible VoIP scenarios.

CDMA Notes:

1. Head SAR for CDMA2000 mode was tested under RC3/SO55 per FCC KDB Publication 941225 D01v03r01.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. EVDO Rev0 and RevA and TDSO / SO32 FCH+SCH SAR tests were not required per the 3G SAR Test Reduction Procedure in FCC KDB Publication 941225 D01v03r01.
3. CDMA Wireless Router SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 according to KDB 941225 D01v03r01 procedures for data devices. Wireless Router SAR tests for Subtype 2 of Rev.A and 1x RTT configurations were not required per the 3G SAR Test Reduction Policy in KDB Publication 941225 D01v03r01.
4. Head SAR was additionally evaluated using EVDO Rev. A to determine compliance for VoIP operations.
5. 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 > ½ dB, instead of the middle channel, the highest output power channel was used.

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 > ½ dB, instead of the middle channel, the highest output power channel was used.

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 8.6.4.
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 required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 8.7.3 for more information.

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3. 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.
4. 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 9.6 for the time domain plot and calculation for the duty factor of the device.
2. Head Bluetooth SAR was evaluated for BT BR tethering applications.

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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 a 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.

When standalone SAR is not required to be measured, per FCC KDB 447498 D01v06 4.3.2 b), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$\text{Estimated SAR} = \frac{\sqrt{f(GHz)}}{7.5} * \frac{(\text{Max Power of channel, mW})}{\text{Min. Separation Distance, mm}}$$

Table 12-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2480	8.00	10	0.126

Note: Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

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12.3 Head SAR Simultaneous Transmission Analysis

Table 12-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Head SAR	GSM/GPRS 850	0.281	1.250	1.531
	GSM/GPRS 1900	0.432	1.250	See Table Below
	UMTS 850	0.323	1.250	**1.573**
	UMTS 1750	0.700	1.250	See Table Below
	UMTS 1900	0.789	1.250	See Table Below
	Cell. CDMA/EVDO	0.298	1.250	1.548
	PCS CDMA/EVDO	0.743	1.250	See Table Below
	LTE Band 71	0.189	1.250	1.439
	LTE Band 12	0.205	1.250	1.455
	LTE Band 13	0.249	1.250	1.499
	LTE Band 5 (Cell)	0.284	1.250	1.534
	LTE Band 66 (AWS)	0.551	1.250	See Table Below
	LTE Band 2 (PCS)	0.928	1.250	See Table Below

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
Head SAR	Right Cheek	0.212	0.580	0.792	N/A
	Right Tilt	0.176	0.657	0.833	N/A
	Left Cheek	0.432	1.250	See Note 1	0.03
	Left Tilt	0.164	0.706	**0.870**	N/A

Simult Tx	Configuration	GSM 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	0.216	0.580	0.796	N/A
	Right Tilt	0.171	0.657	0.828	N/A
	Left Cheek	0.418	1.250	See Note 1	0.03
	Left Tilt	0.159	0.706	**0.865**	N/A

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
Head SAR	Right Cheek	0.311	0.580	0.891	N/A
	Right Tilt	0.376	0.657	**1.033**	N/A
	Left Cheek	0.700	1.250	See Note 1	0.03
	Left Tilt	0.274	0.706	0.980	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	0.296	0.580	0.876	N/A
	Right Tilt	0.281	0.657	0.938	N/A
	Left Cheek	0.789	1.250	See Note 1	0.03
	Left Tilt	0.294	0.706	**1.000**	N/A

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Simult Tx	Configuration	PCS CDMA 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	0.370	0.580	0.950	N/A
	Right Tilt	0.285	0.657	0.942	N/A
	Left Cheek	0.675	1.250	See Note 1	0.03
	Left Tilt	0.250	0.706	**0.956**	N/A

Simult Tx	Configuration	PCS EVDO 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	0.394	0.580	**0.974**	N/A
	Right Tilt	0.286	0.657	0.943	N/A
	Left Cheek	0.743	1.250	See Note 1	0.03
	Left Tilt	0.259	0.706	0.965	N/A

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
Head SAR	Right Cheek	0.347	0.580	0.927	N/A
	Right Tilt	0.419	0.657	**1.076**	N/A
	Left Cheek	0.551	1.250	See Note 1	0.03
	Left Tilt	0.242	0.706	0.948	N/A

Simult Tx	Configuration	LTE Band 2 (PCS) 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	0.446	0.580	**1.026**	N/A
	Right Tilt	0.335	0.657	0.992	N/A
	Left Cheek	0.928	1.250	See Note 1	0.04
	Left Tilt	0.313	0.706	1.019	N/A

Table 12-3
Simultaneous Transmission Scenario with Bluetooth (Held to Ear)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Head SAR	GSM/GPRS 850	0.281	0.060	0.341
	GSM/GPRS 1900	0.432	0.060	0.492
	UMTS 850	0.323	0.060	0.383
	UMTS 1750	0.700	0.060	0.760
	UMTS 1900	0.789	0.060	0.849
	Cell. CDMA/EVDO	0.298	0.060	0.358
	PCS CDMA/EVDO	0.743	0.060	0.803
	LTE Band 71	0.189	0.060	0.249
	LTE Band 12	0.205	0.060	0.265
	LTE Band 13	0.249	0.060	0.309
	LTE Band 5 (Cell)	0.284	0.060	0.344
	LTE Band 66 (AWS)	0.551	0.060	0.611
	LTE Band 2 (PCS)	0.928	0.060	**0.988**

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12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-4
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	0.395	0.380	0.775
	GSM/GPRS 1900	0.396	0.380	0.776
	UMTS 850	0.447	0.380	0.827
	UMTS 1750	1.073	0.380	1.453
	UMTS 1900	0.828	0.380	1.208
	Cell. CDMA	0.497	0.380	0.877
	PCS CDMA	0.825	0.380	1.205
	LTE Band 71	0.285	0.380	0.665
	LTE Band 12	0.267	0.380	0.647
	LTE Band 13	0.344	0.380	0.724
	LTE Band 5 (Cell)	0.452	0.380	0.832
	LTE Band 66 (AWS)	1.080	0.380	**1.460**
	LTE Band 2 (PCS)	0.792	0.380	1.172

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Table 12-5
Simultaneous Transmission Scenario with 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	0.395	0.126	0.521
	GSM/GPRS 1900	0.396	0.126	0.522
	UMTS 850	0.447	0.126	0.573
	UMTS 1750	1.073	0.126	1.199
	UMTS 1900	0.828	0.126	0.954
	Cell. CDMA	0.497	0.126	0.623
	PCS CDMA	0.825	0.126	0.951
	LTE Band 71	0.285	0.126	0.411
	LTE Band 12	0.267	0.126	0.393
	LTE Band 13	0.344	0.126	0.470
	LTE Band 5 (Cell)	0.452	0.126	0.578
	LTE Band 66 (AWS)	1.080	0.126	**1.206**
	LTE Band 2 (PCS)	0.792	0.126	0.918

Note: Bluetooth SAR was not required to be measured per FCC KDB Publication 447498 D01v06. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.

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12.5 Hotspot SAR Simultaneous Transmission Analysis

Table 12-6
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	0.408	0.453	0.861
	GPRS 1900	0.408	0.453	0.861
	UMTS 850	0.478	0.453	0.931
	UMTS 1750	1.073	0.453	1.526
	UMTS 1900	0.845	0.453	1.298
	Cell. EVDO	0.466	0.453	0.919
	PCS EVDO	0.758	0.453	1.211
	LTE Band 71	0.316	0.453	0.769
	LTE Band 12	0.323	0.453	0.776
	LTE Band 13	0.449	0.453	0.902
	LTE Band 5 (Cell)	0.465	0.453	0.918
	LTE Band 66 (AWS)	1.080	0.453	**1.533**
	LTE Band 2 (PCS)	0.824	0.453	1.277

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Table 12-7
Simultaneous Transmission Scenario with Bluetooth (Hotspot 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
Hotspot SAR	GPRS 850	0.408	0.126	0.534
	GPRS 1900	0.408	0.126	0.534
	UMTS 850	0.478	0.126	0.604
	UMTS 1750	1.073	0.126	1.199
	UMTS 1900	0.845	0.126	0.971
	Cell. EVDO	0.466	0.126	0.592
	PCS EVDO	0.758	0.126	0.884
	LTE Band 71	0.316	0.126	0.442
	LTE Band 12	0.323	0.126	0.449
	LTE Band 13	0.449	0.126	0.575
	LTE Band 5 (Cell)	0.465	0.126	0.591
	LTE Band 66 (AWS)	1.080	0.126	**1.206**
	LTE Band 2 (PCS)	0.824	0.126	0.950

Note: Bluetooth SAR was not required to be measured per FCC KDB Publication 447498 D01v06. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.

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.

Note: Bluetooth SAR was not required to be measured per FCC KDB Publication 447498 D01v06. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.

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

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

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12.6.1 Head SPLSR Evaluation and Analysis

Table 12-8
Peak SAR Locations for Left Cheek Head

Mode/Band	x (mm)	y (mm)	z (mm)
2.4 GHz WLAN	3.40	326.98	-174.22
GSM 1900	39.69	251.64	-174.13
GPRS 1900	39.22	251.91	-174.23
UMTS 1750	43.62	249.47	-173.16
UMTS 1900	39.71	251.64	-174.27
PCS CDMA	45.61	251.62	-173.86
PCS EVDO	45.61	251.62	-173.89
LTE Band 66 (AWS)	40.14	251.39	-174.10
LTE Band 2 (PCS)	37.79	254.39	-174.80

Table 12-9
Left Cheek Head 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 1900	2.4 GHz WLAN	0.418	1.250	1.668	83.62	0.03	1
GPRS 1900	2.4 GHz WLAN	0.432	1.250	1.682	83.18	0.03	2
UMTS 1750	2.4 GHz WLAN	0.700	1.250	1.95	87.33	0.03	3
UMTS 1900	2.4 GHz WLAN	0.789	1.250	2.039	83.63	0.03	4
PCS CDMA	2.4 GHz WLAN	0.675	1.250	1.925	86.38	0.03	5
PCS EVDO	2.4 GHz WLAN	0.743	1.250	1.993	86.38	0.03	6
LTE Band 66 (AWS)	2.4 GHz WLAN	0.551	1.250	1.801	84.05	0.03	7
LTE Band 2 (PCS)	2.4 GHz WLAN	0.928	1.250	2.178	80.33	0.04	8

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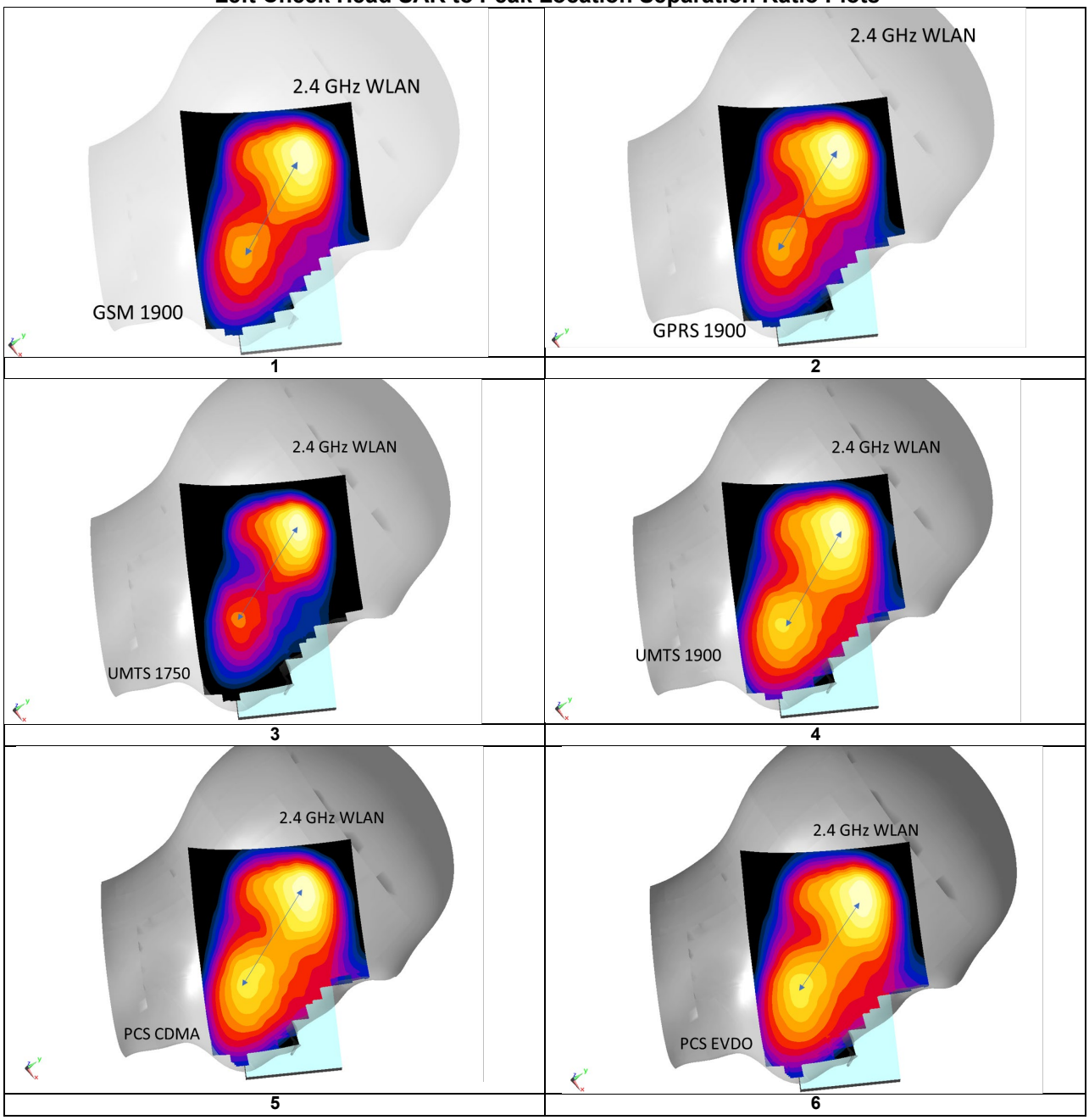
Table 12-10
Left Cheek Head SAR to Peak Location Separation Ratio Plots



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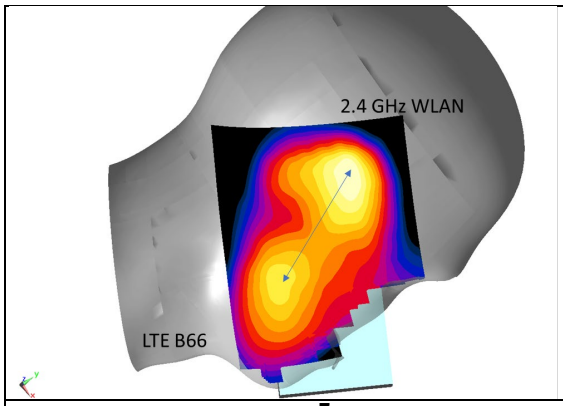

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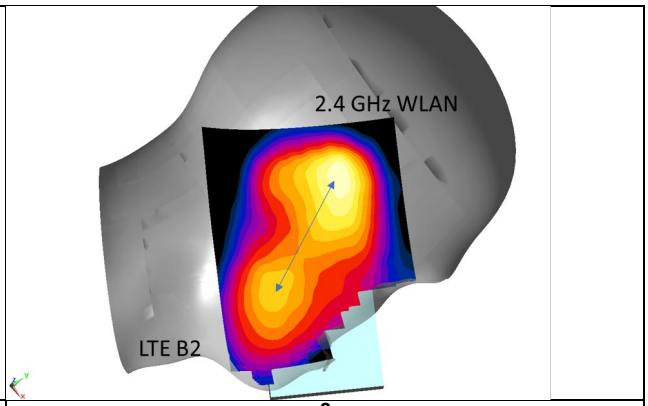

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12.7 Simultaneous Transmission Conclusion

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 (~ 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)		(W/kg)	
1900	1900.00	19100	LTE Band 2 (PCS), 20 MHz Bandwidth	QPSK, 1 RB, 50 RB Offset	Left	Cheek	N/A	0.854	0.903	1.06	N/A	N/A	N/A	N/A
2450	2462.00	11	802.11b, 22 MHz Bandwidth	DSSS	Left	Cheek	1	1.060	1.020	1.04	N/A	N/A	N/A	N/A
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 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)		(W/kg)	
1750	1712.40	1312	UMTS 1750	RMC	back	10 mm	1.060	1.030	1.03	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					Body 1.6 W/kg (mW/g) averaged over 1 gram								

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	8648D	(9kHz-4GHz) Signal Generator	4/29/2019	Annual	4/29/2020	3613A00315
Agilent	N9020A	MXA Signal Analyzer	4/20/2019	Annual	4/20/2020	US46470561
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB44450273
Agilent	E5515C	Wireless Communications Test Set	2/7/2018	Triennial	2/7/2021	GB43304447
Agilent	E5515C	Wireless Communications Test Set	5/22/2018	Biennial	5/22/2020	GB43193563
Agilent	8753ES	S-Parameter Network Analyzer	3/11/2019	Annual	3/11/2020	US39170122
Agilent	E4438C	ESG Vector Signal Generator	3/11/2019	Biennial	3/11/2021	MY42082659
Agilent	8753ES	S-Parameter Network Analyzer	7/30/2018	Annual	7/30/2019	MY40000670
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Agilent	N5182A-506	MXG Vector Signal Generator	6/19/2018	Annual	6/19/2019	MY48180366
Agilent	34405A	Digital Multimeter	6/21/2017	Biennial	6/21/2019	TW46220115
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433976
Amplifier Research	150A100C	DC Amplifier	CBT	N/A	CBT	348812
Anritsu	MT8821C	Radio Communication Analyzer	11/6/2018	Annual	11/6/2019	6200901190
Anritsu	MT8820C	Radio Communication Analyzer	3/29/2019	Annual	3/29/2020	6201300731
Anritsu	ML2496A	Power Meter	6/19/2018	Annual	6/19/2019	1306009
Anritsu	MT8821C	Radio Communication Analyzer	7/24/2018	Annual	7/24/2019	6201664756
Anritsu	MA24106A	USB Power Sensor	9/20/2018	Annual	9/20/2019	1344545
Anritsu	MA24106A	USB Power Sensor	9/20/2018	Annual	9/20/2019	1344559
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1339008
Anritsu	MT8862A	Wireless Connectivity Test Set	7/3/2018	Annual	7/3/2019	6261782395
Anritsu	MG3692C	Signal Generator	10/5/2018	Annual	10/5/2019	163005
Anritsu	MT8000A	Radio Communication Test Station	11/14/2018	Annual	11/14/2019	6261914237
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647811
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766816
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
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
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-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
Rohde & Schwarz	CMW500	Radio Communication Tester	6/9/2018	Annual	6/9/2019	108843
Rohde & Schwarz	CMW500	Radio Communication Tester	11/5/2018	Annual	11/5/2019	140148
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	5/29/2018	Annual	5/29/2019	161662
SPEAG	D1765V2	1765 MHz SAR Dipole	5/23/2018	Annual	5/23/2019	1008
SPEAG	D1750V2	1750 MHz SAR Dipole	10/22/2018	Annual	10/22/2019	1150
SPEAG	D1900V2	1900 MHz SAR Dipole	10/23/2018	Annual	10/23/2019	5d080
SPEAG	D1900V2	1900 MHz SAR Dipole	2/21/2019	Annual	2/21/2020	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	8/17/2017	Biennial	8/17/2019	719
SPEAG	D2450V2	2450 MHz SAR Dipole	9/11/2017	Biennial	9/11/2019	797
SPEAG	D750V3	750 MHz SAR Dipole	1/15/2018	Biennial	1/15/2020	1003
SPEAG	D835V2	835 MHz SAR Dipole	1/22/2019	Annual	1/22/2020	4d132
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2018	Annual	7/11/2019	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/18/2019	Annual	4/18/2020	1407
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	DAE4	Dasy Data Acquisition Electronics	10/3/2018	Annual	10/3/2019	1558
SPEAG	DAK-12	Dielectric Assessment Kit (10MHz - 3GHz)	3/13/2019	Annual	3/13/2020	1102
SPEAG	EX3DV4	SAR Probe	1/25/2019	Annual	1/25/2020	3589
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	EX3DV4	SAR Probe	8/23/2018	Annual	8/23/2019	7308
SPEAG	EX3DV4	SAR Probe	4/24/2019	Annual	4/24/2020	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	1/24/2019	Annual	1/24/2020	7488

Note: 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.
Note: 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 Unceritainty	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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APPENDIX A: SAR TEST DATA

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PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

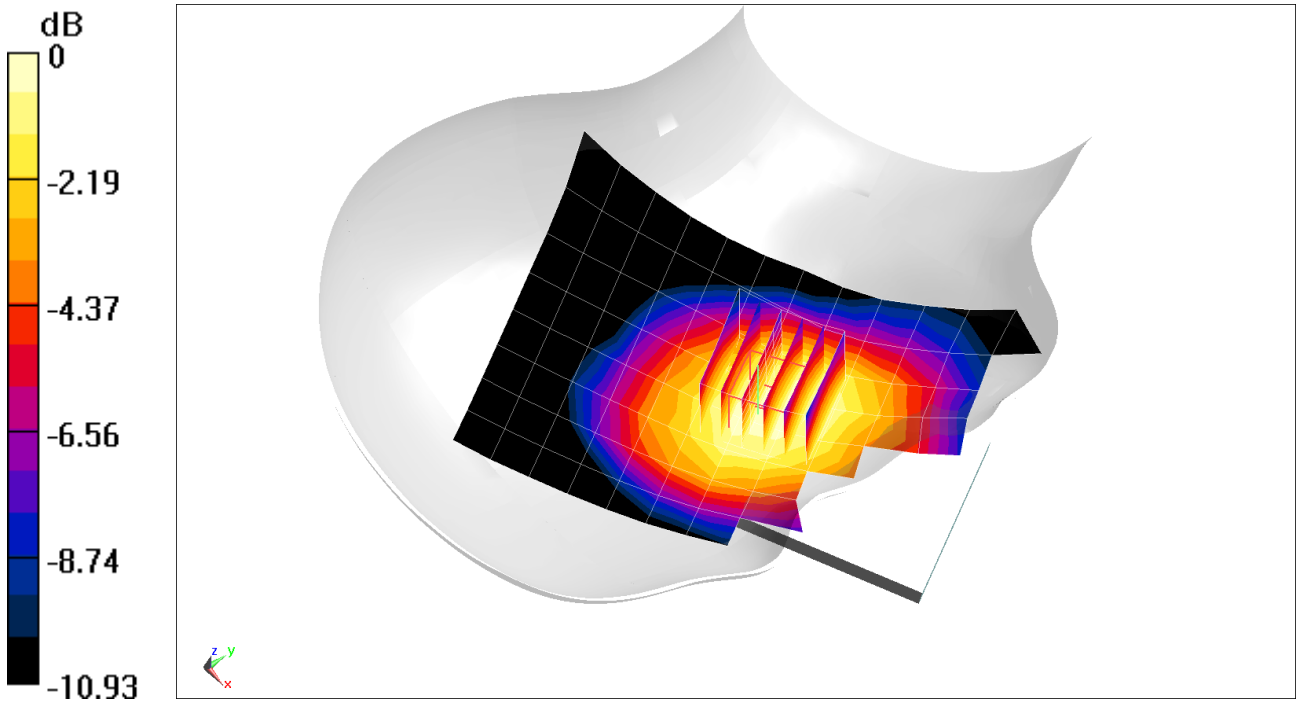
Communication System: UID 0, _GSM GPRS; 4 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:2.076
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.894 S/m; ε_r = 40.902; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-20-2019; Ambient Temp: 20.8°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN7409; ConvF(9.67, 9.67, 9.67) @ 836.6 MHz; Calibrated: 6/25/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: Left 30-SAM V5.0; Type: QD 000 P40 CD; Serial: 1715
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: GPRS 850, Right Head, Cheek, Mid.ch, 4 Tx slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.95 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.319 W/kg
SAR(1 g) = 0.248 W/kg



0 dB = 0.294 W/kg = -5.32 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

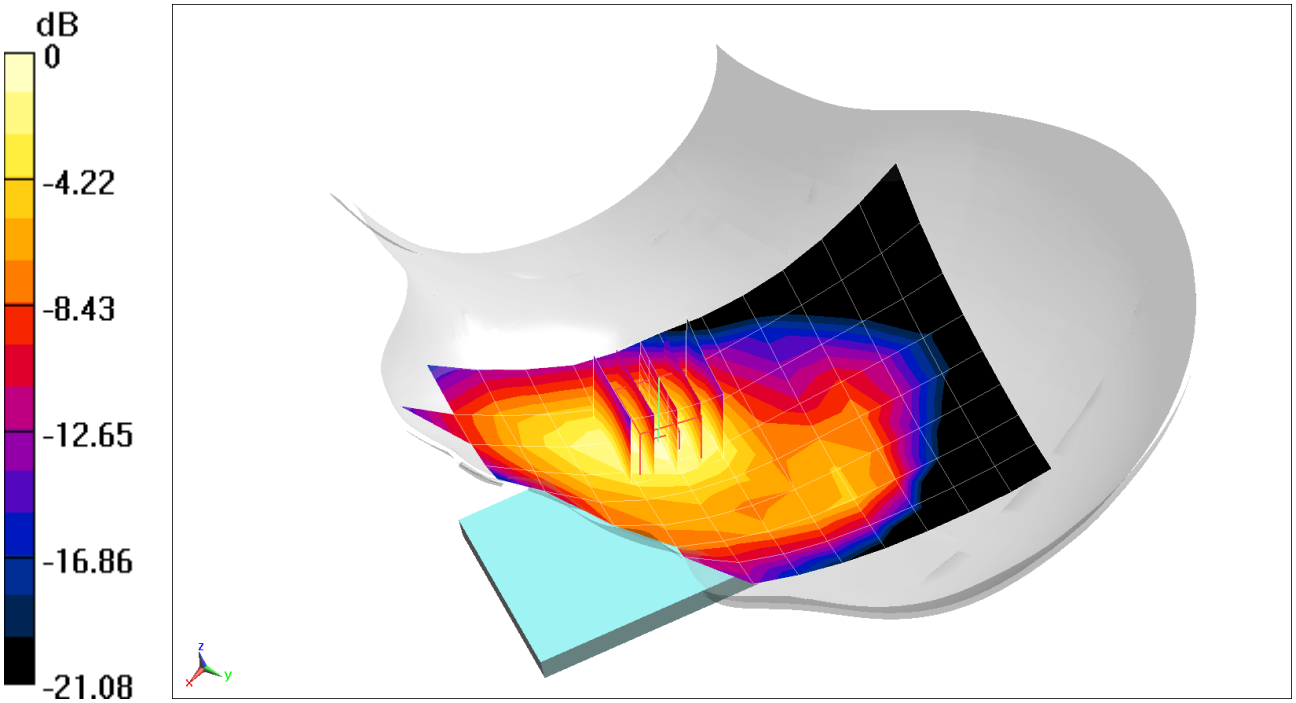
Communication System: UID 0, _GSM GPRS; 4 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:2.076
Medium: 1900 Head; Medium parameters used:
f = 1880 MHz; σ = 1.447 S/m; ε_r = 38.823; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-17-2019; Ambient Temp: 23.0°C; Tissue Temp: 22.6°C

Probe: EX3DV4 - SN3589; ConvF(7.08, 7.08, 7.08) @ 1880 MHz; Calibrated: 1/25/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/22/2018
Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1647
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 (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.65 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.588 W/kg
SAR(1 g) = 0.367 W/kg



0 dB = 0.513 W/kg = -2.90 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

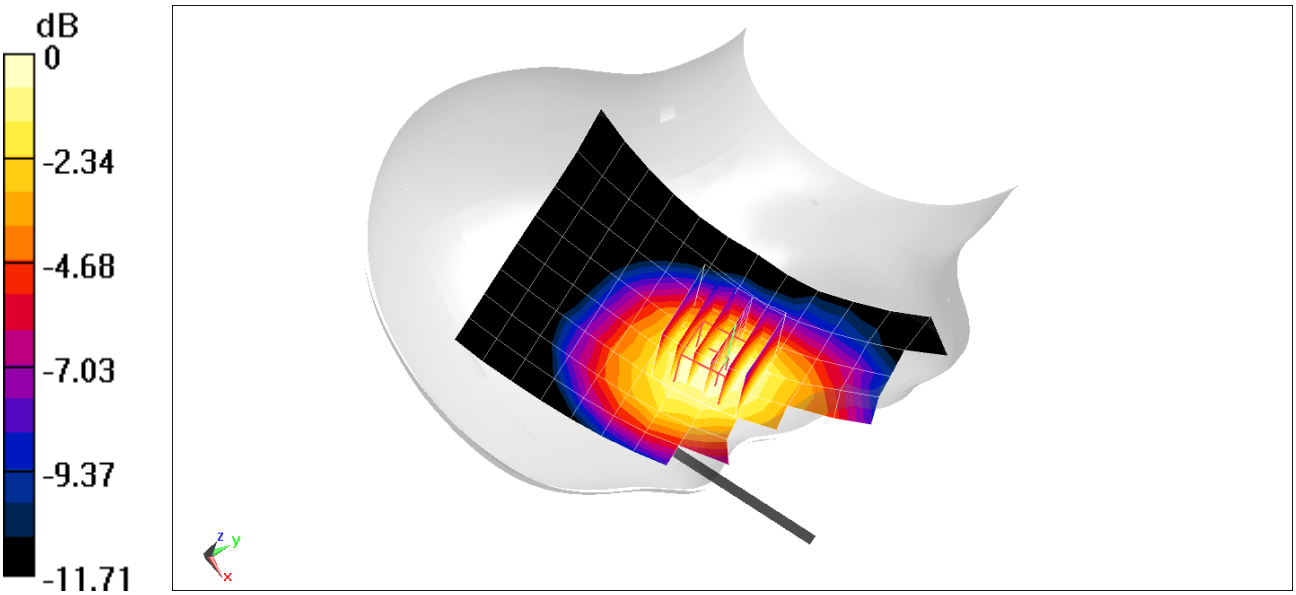
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.894 S/m; ε_r = 40.902; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-20-2019; Ambient Temp: 20.8°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN7409; ConvF(9.67, 9.67, 9.67) @ 836.6 MHz; Calibrated: 6/25/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: Left 30-SAM V5.0; Type: QD 000 P40 CD; Serial: 1715
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.04 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.404 W/kg
SAR(1 g) = 0.314 W/kg



0 dB = 0.369 W/kg = -4.33 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

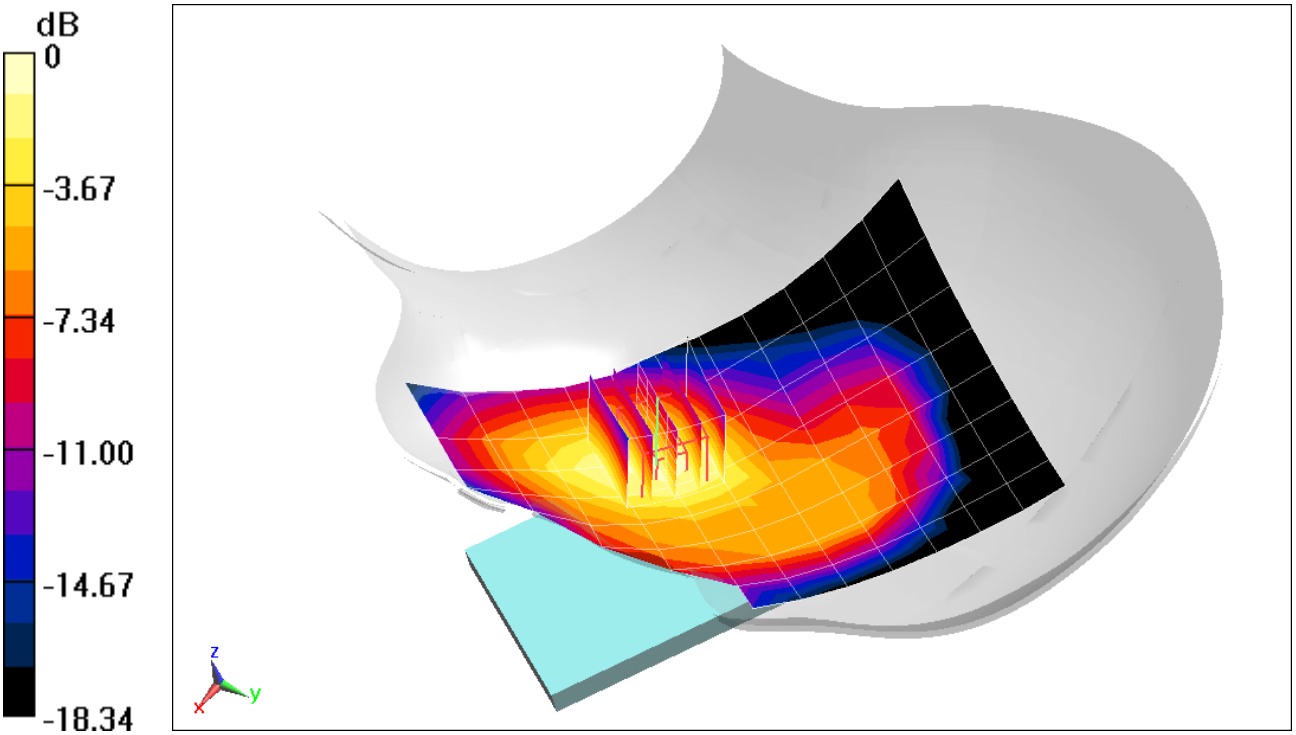
Communication System: UID 0, UMTS; Frequency: 1752.6 MHz; Duty Cycle: 1:1
Medium: 1750 Head; Medium parameters used (interpolated):
f = 1752.6 MHz; σ = 1.372 S/m; ε_r = 39.62; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-23-2019; Ambient Temp: 23.2°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN3589; ConvF(7.31, 7.31, 7.31) @ 1752.6 MHz; Calibrated: 1/25/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/22/2018
Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1647
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 1750, Left Head, Cheek, High.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 = 23.50 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 1.10 W/kg
SAR(1 g) = 0.700 W/kg



0 dB = 0.951 W/kg = -0.22 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

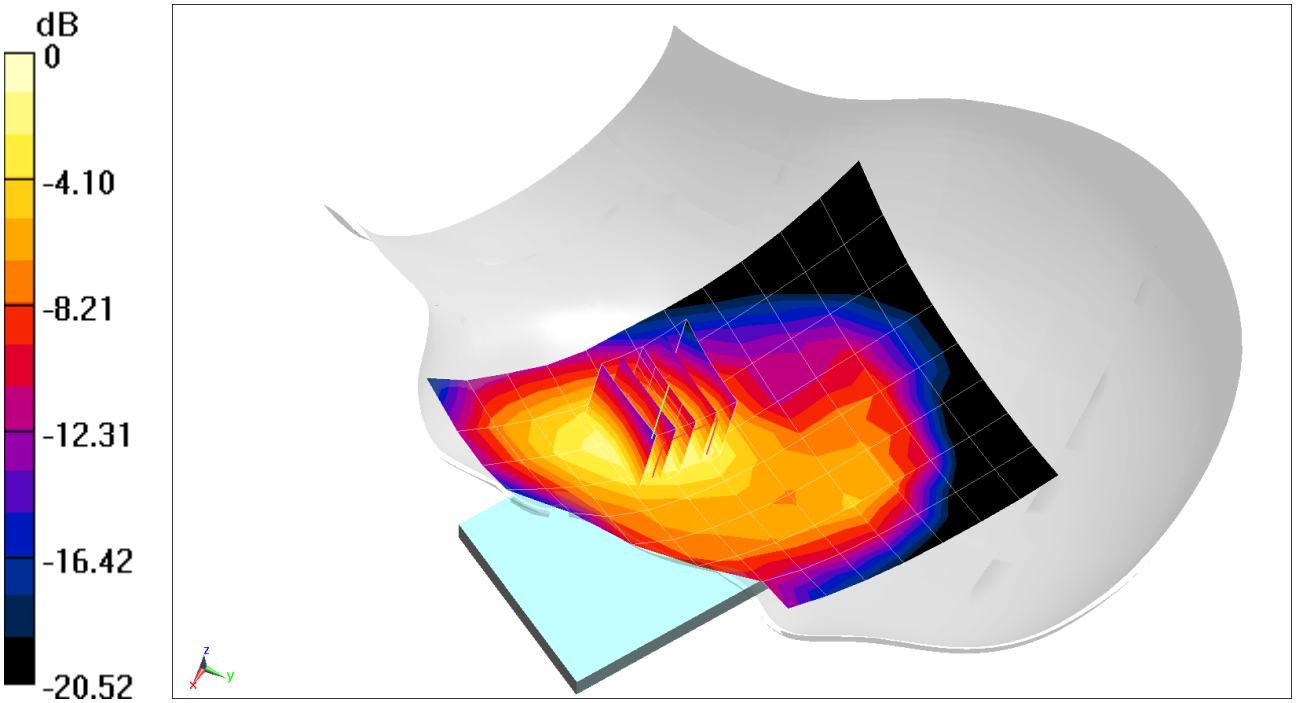
Communication System: UID 0, UMTS; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used (interpolated):
f = 1907.6 MHz; σ = 1.461 S/m; ε_r = 39.839; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-14-2019; Ambient Temp: 23.6°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN3589; ConvF(7.08, 7.08, 7.08) @ 1907.6 MHz; Calibrated: 1/25/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/22/2018
Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1647
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 1900, Left Head, Cheek, High.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 = 24.00 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.773 W/kg



0 dB = 1.07 W/kg = 0.29 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

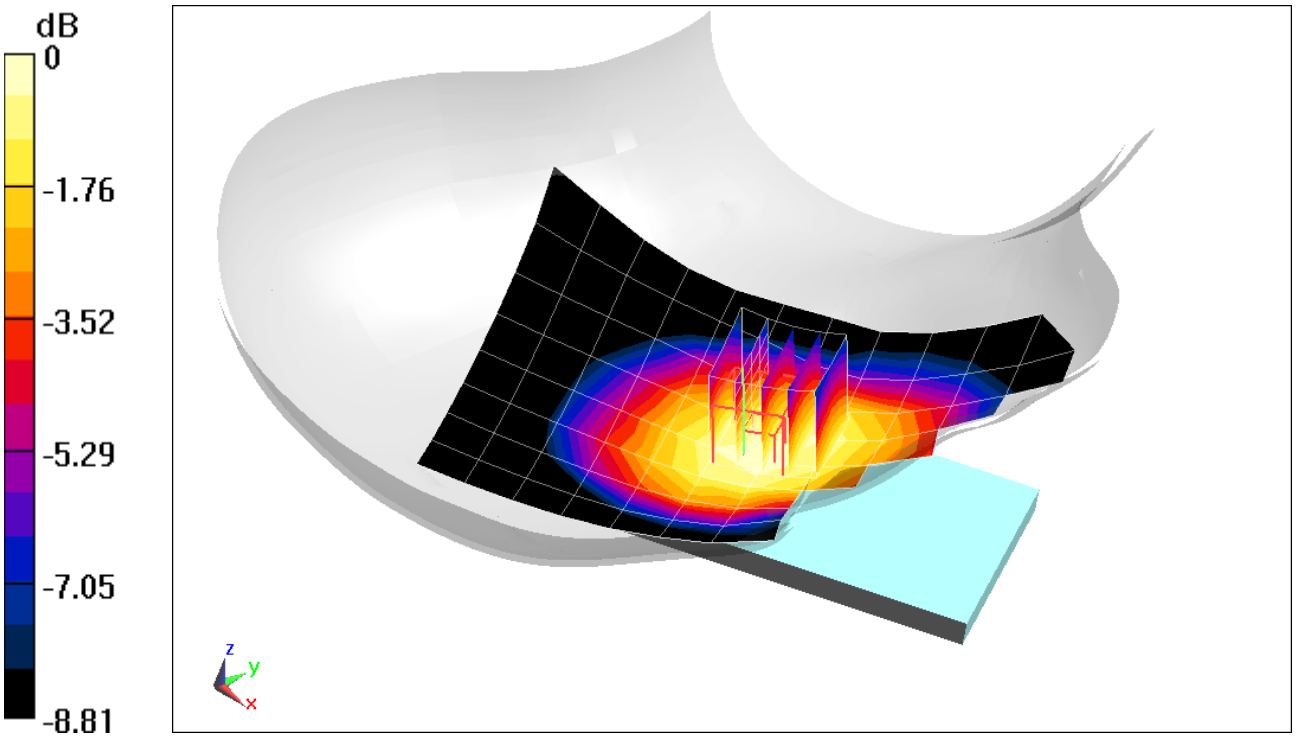
Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.894 S/m; ε_r = 40.903; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-20-2019; Ambient Temp: 20.8°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN7409; ConvF(9.67, 9.67, 9.67) @ 836.52 MHz; Calibrated: 6/25/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: Left 30-SAM V5.0; Type: QD 000 P40 CD; Serial: 1715
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: Cell. CDMA, Right Head, Cheek, Mid.ch

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.45 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.331 W/kg
SAR(1 g) = 0.264 W/kg



0 dB = 0.307 W/kg = -5.13 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

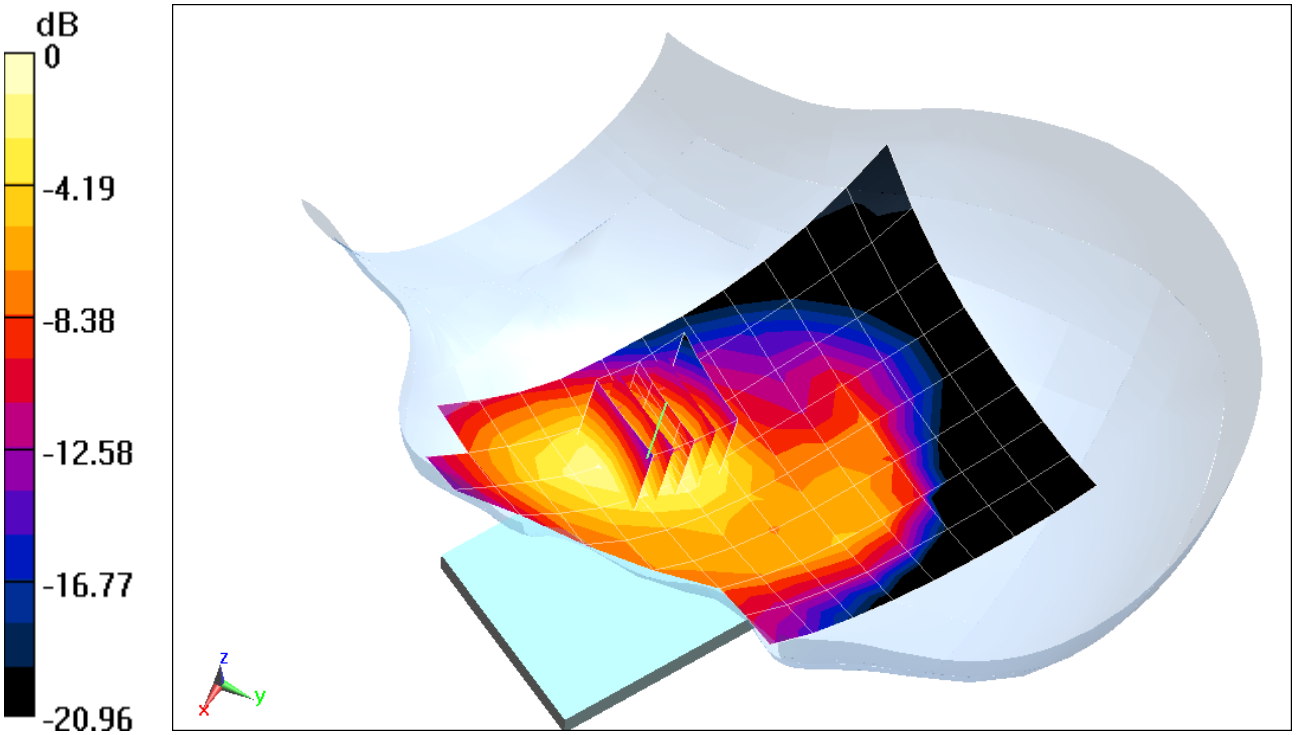
Communication System: UID 0, CDMA; Frequency: 1851.25 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used (interpolated):
f = 1851.25 MHz; σ = 1.425 S/m; ε_r = 40.668; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-20-2019; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: EX3DV4 - SN3914; ConvF(7.8, 7.8, 7.8) @ 1851.25 MHz; Calibrated: 2/19/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/14/2019
Phantom: Left For Head SAM (30) with CRP v5.0; Type: QD000P40CD; Serial: TP:1687
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: PCS EVDO Rev A, Left Head, Cheek, Low.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 = 23.62 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.10 W/kg
SAR(1 g) = 0.720 W/kg



0 dB = 0.971 W/kg = -0.13 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

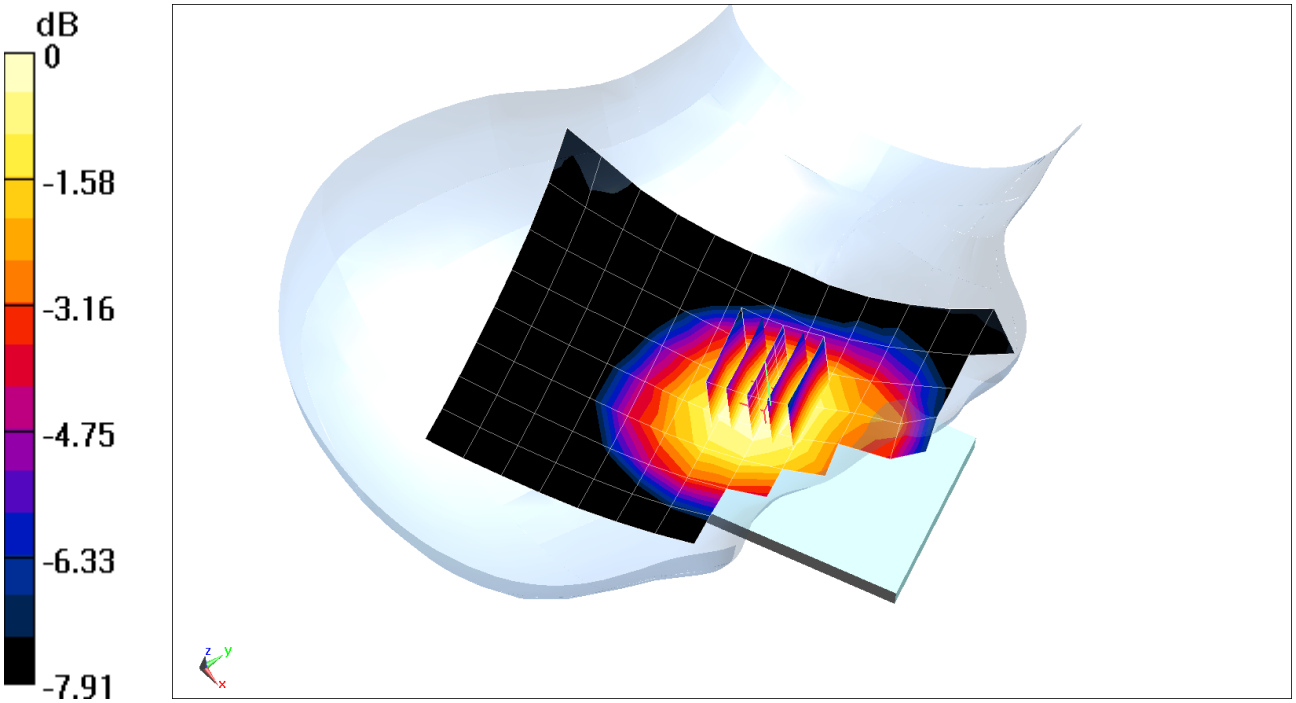
Communication System: UID 0, LTE Band 71; Frequency: 680.5 MHz; Duty Cycle: 1:1
Medium: 750 Head; Medium parameters used (interpolated):
f = 680.5 MHz; σ = 0.881 S/m; ε_r = 43.59; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2019; Ambient Temp: 21.6°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7409; ConvF(9.91, 9.91, 9.91) @ 680.5 MHz; Calibrated: 6/25/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM 30 with CRP v5.0 right; Type: QD000P40CD; Serial: TP:1759
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, 50 RB Offset

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.18 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.228 W/kg
SAR(1 g) = 0.187 W/kg



0 dB = 0.215 W/kg = -6.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

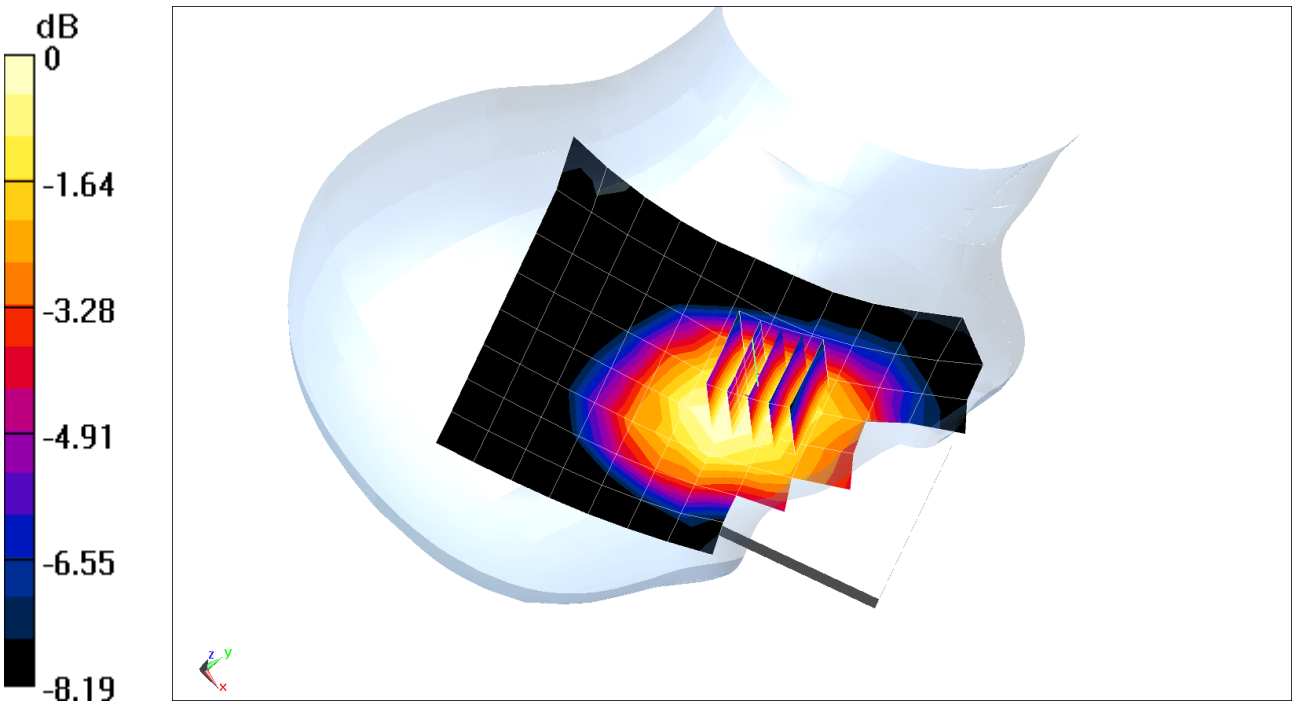
Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Head; Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.89 S/m; ε_r = 43.495; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2019; Ambient Temp: 21.6°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7409; ConvF(9.91, 9.91, 9.91) @ 707.5 MHz; Calibrated: 6/25/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM 30 with CRP v5.0 right; Type: QD000P40CD; Serial: TP:1759
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 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.52 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.260 W/kg
SAR(1 g) = 0.204 W/kg



0 dB = 0.239 W/kg = -6.22 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

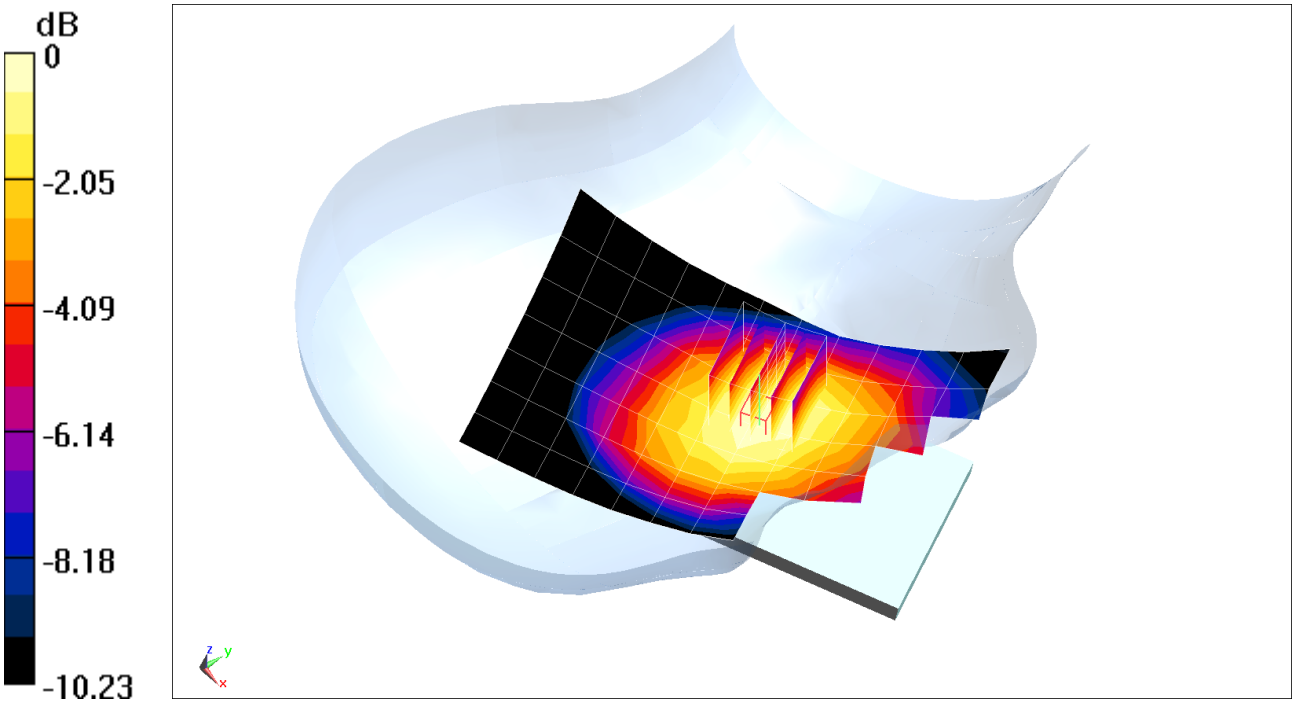
Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: 750 Head; Medium parameters used (interpolated):
f = 782 MHz; σ = 0.915 S/m; ε_r = 43.29; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2019; Ambient Temp: 21.6°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7409; ConvF(9.91, 9.91, 9.91) @ 782 MHz; Calibrated: 6/25/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM 30 with CRP v5.0 right; Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 13, Right Head, Cheek, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.33 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.309 W/kg
SAR(1 g) = 0.249 W/kg



0 dB = 0.288 W/kg = -5.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

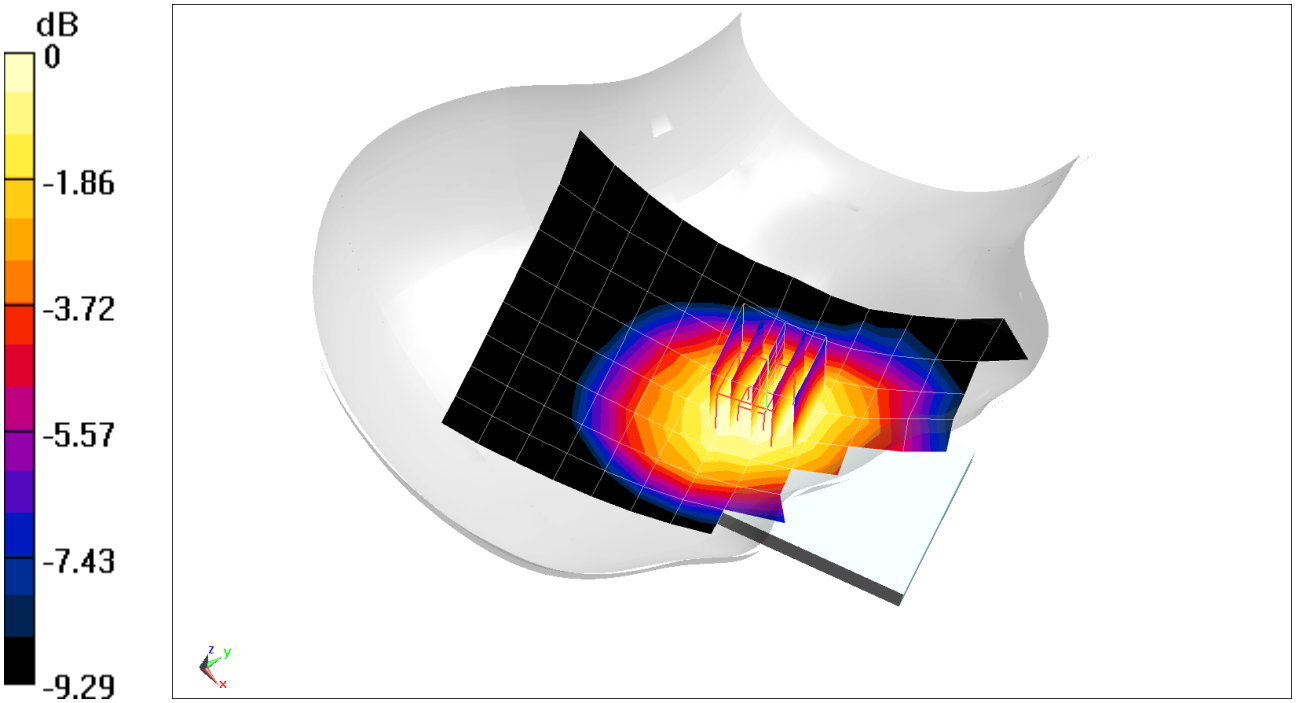
Communication System: UID 0, LTE Band 5 (Cell.); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.5 MHz; σ = 0.893 S/m; ε_r = 40.903; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-20-2019; Ambient Temp: 20.8°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN7409; ConvF(9.67, 9.67, 9.67) @ 836.5 MHz; Calibrated: 6/25/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: Left 30-SAM V5.0; Type: QD 000 P40 CD; Serial: 1715
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 5 (Cell.), Right Head, Cheek, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.16 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.332 W/kg
SAR(1 g) = 0.266 W/kg



0 dB = 0.309 W/kg = -5.10 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

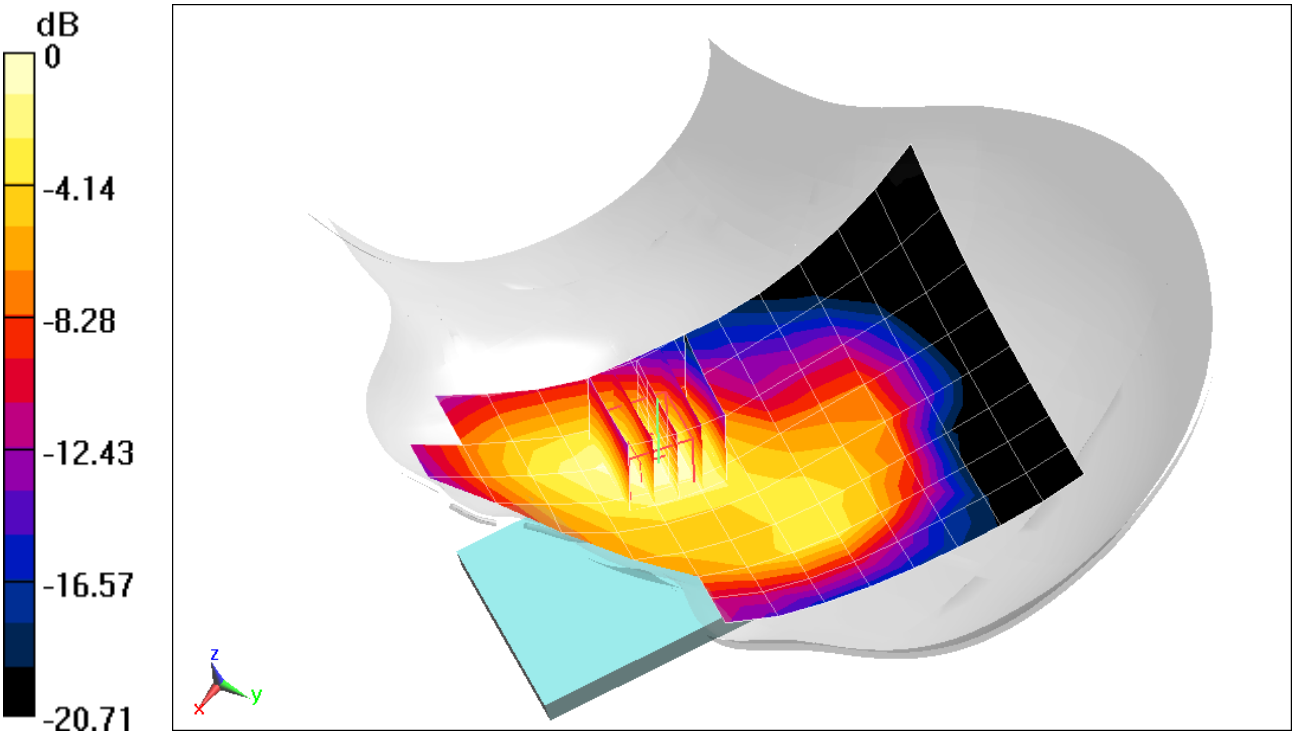
Communication System: UID 0, LTE Band 66 (AWS); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: 1750 Head; Medium parameters used (interpolated):
f = 1745 MHz; σ = 1.368 S/m; ε_r = 39.634; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-23-2019; Ambient Temp: 23.2°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN3589; ConvF(7.31, 7.31, 7.31) @ 1745 MHz; Calibrated: 1/25/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/22/2018
Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1647
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 66 (AWS), Left Head, Cheek, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.80 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.858 W/kg
SAR(1 g) = 0.551 W/kg



0 dB = 0.747 W/kg = -1.27 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

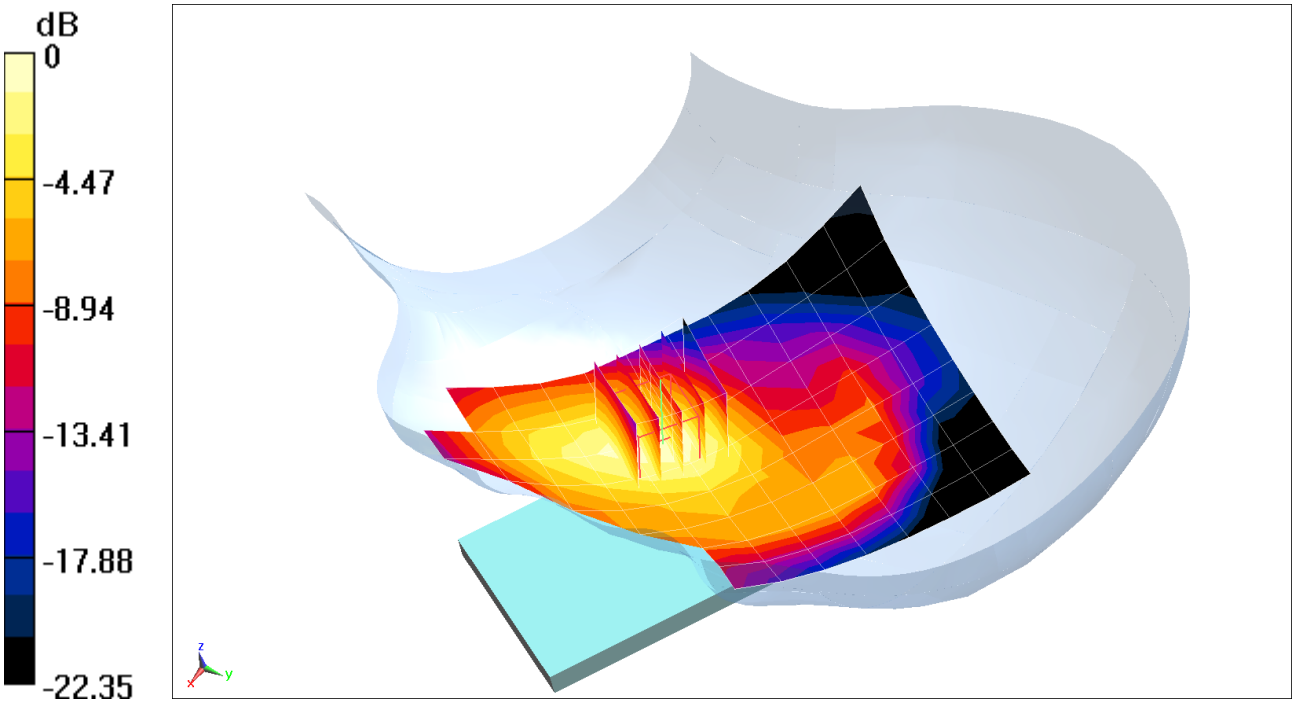
Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.454 S/m; ε_r = 40.608; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-20-2019; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: EX3DV4 - SN3914; ConvF(7.8, 7.8, 7.8) @ 1900 MHz; Calibrated: 2/19/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/14/2019
Phantom: Left For Head SAM with CRP v5.0; Type: QD000P40CD; Serial: TP:1687
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 2 (PCS), Left Head, Cheek, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.90 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.903 W/kg



0 dB = 1.24 W/kg = 0.93 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63039

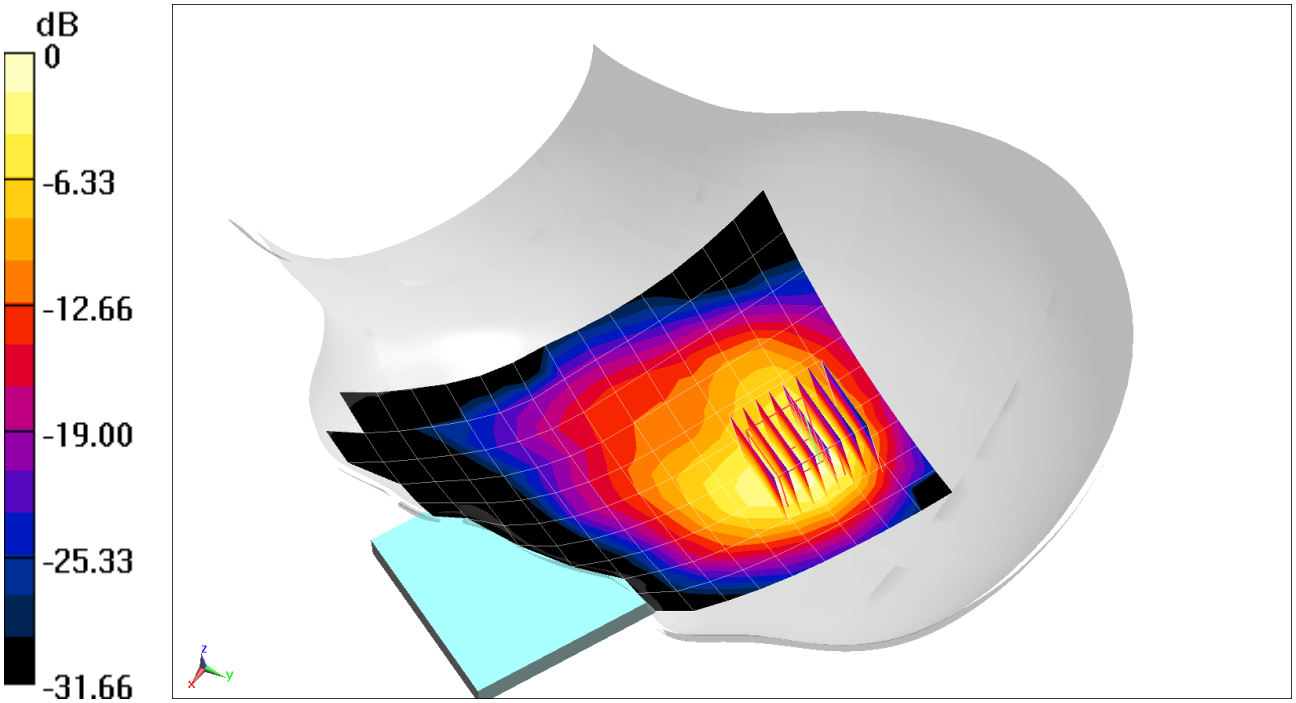
Communication System: UID 0, _IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: 2450 Head; Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.825 S/m; ε_r = 38.779; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-20-2019; Ambient Temp: 23.1°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN3589; ConvF(6.46, 6.46, 6.46) @ 2462 MHz; Calibrated: 1/25/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/22/2018
Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1647
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Left Head, Cheek, Ch 11, 1 Mbps

Area Scan (11x16x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.03 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 2.34 W/kg
SAR(1 g) = 1.06 W/kg



0 dB = 1.78 W/kg = 2.50 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63039

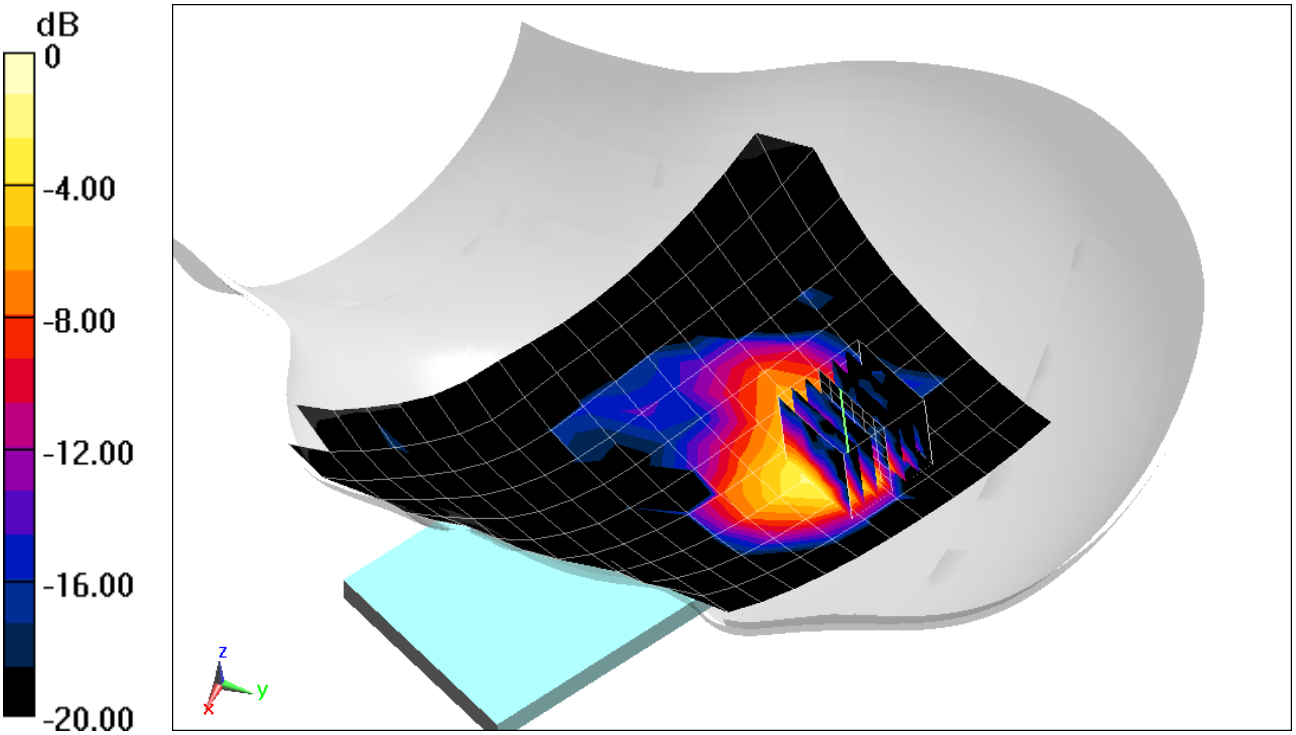
Communication System: UID 0, Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1.302
Medium: 2450 Head; Medium parameters used (interpolated):
f = 2441 MHz; σ = 1.809 S/m; ε_r = 38.81; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-20-2019; Ambient Temp: 23.1°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN3589; ConvF(6.46, 6.46, 6.46) @ 2441 MHz; Calibrated: 1/25/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/22/2018
Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1647
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: Bluetooth, Left Head, Cheek, Ch 39, 1 Mbps

Area Scan (11x19x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.098 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.110 W/kg
SAR(1 g) = 0.046 W/kg



0 dB = 0.0818 W/kg = -10.87 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

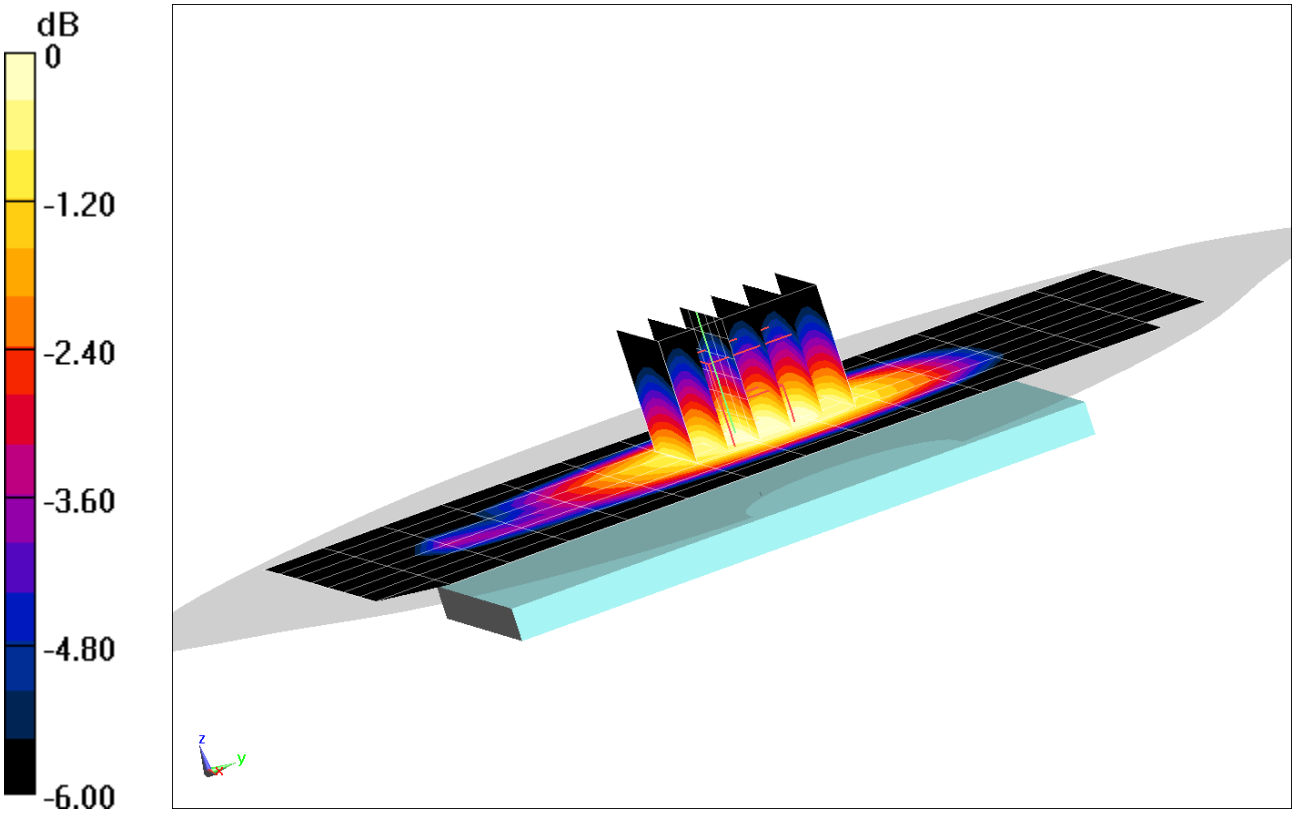
Communication System: UID 0, _GSM GPRS; 4 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:2.076
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.013 S/m; ε_r = 52.876; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 20.2°C; Tissue Temp: 19.5°C

Probe: EX3DV4 - SN7488; ConvF(11.03, 11.03, 11.03) @ 836.6 MHz; Calibrated: 1/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1530; Calibrated: 1/15/2019
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 4 Tx Slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.75 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.471 W/kg
SAR(1 g) = 0.349 W/kg



0 dB = 0.425 W/kg = -3.72 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

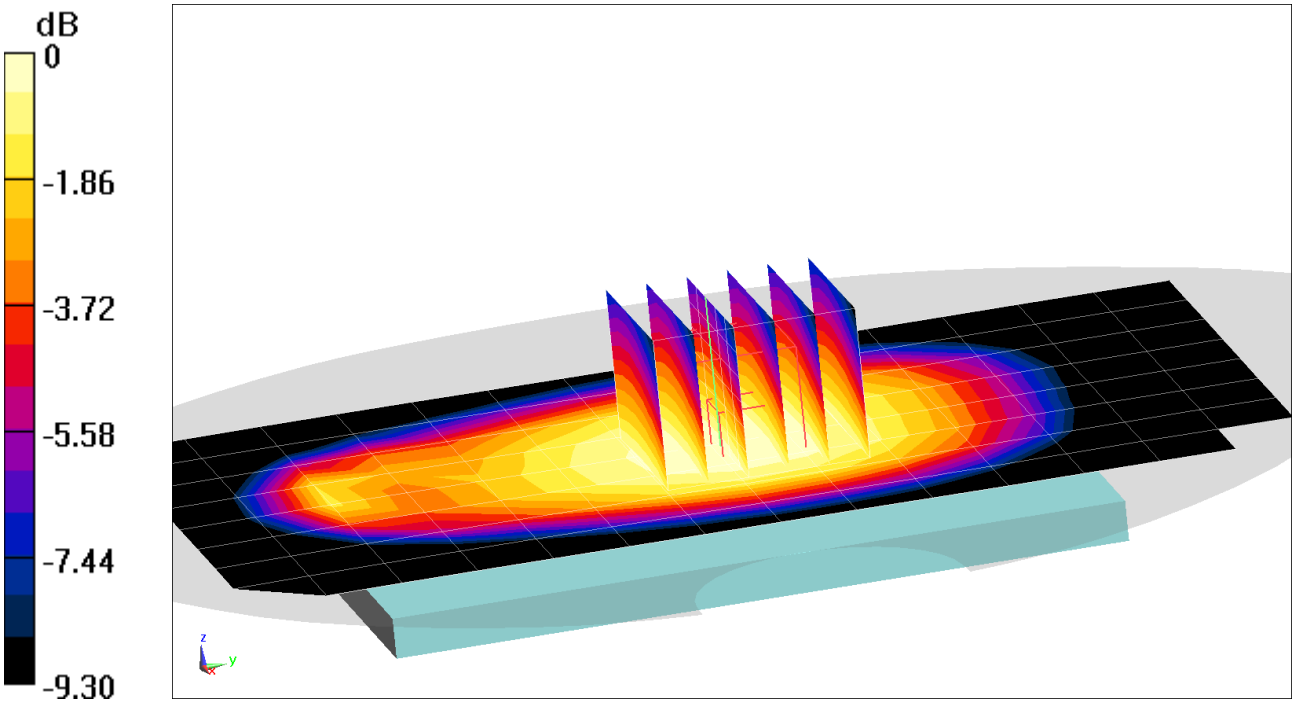
Communication System: UID 0, _GSM GPRS; 4 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:2.076
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.013 S/m; ε_r = 52.876; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 20.2°C; Tissue Temp: 19.5°C

Probe: EX3DV4 - SN7488; ConvF(11.03, 11.03, 11.03) @ 836.6 MHz; Calibrated: 1/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1530; Calibrated: 1/15/2019
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: GPRS 850, Body SAR, Front side, Mid.ch, 4 Tx Slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.61 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.482 W/kg
SAR(1 g) = 0.360 W/kg



0 dB = 0.438 W/kg = -3.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

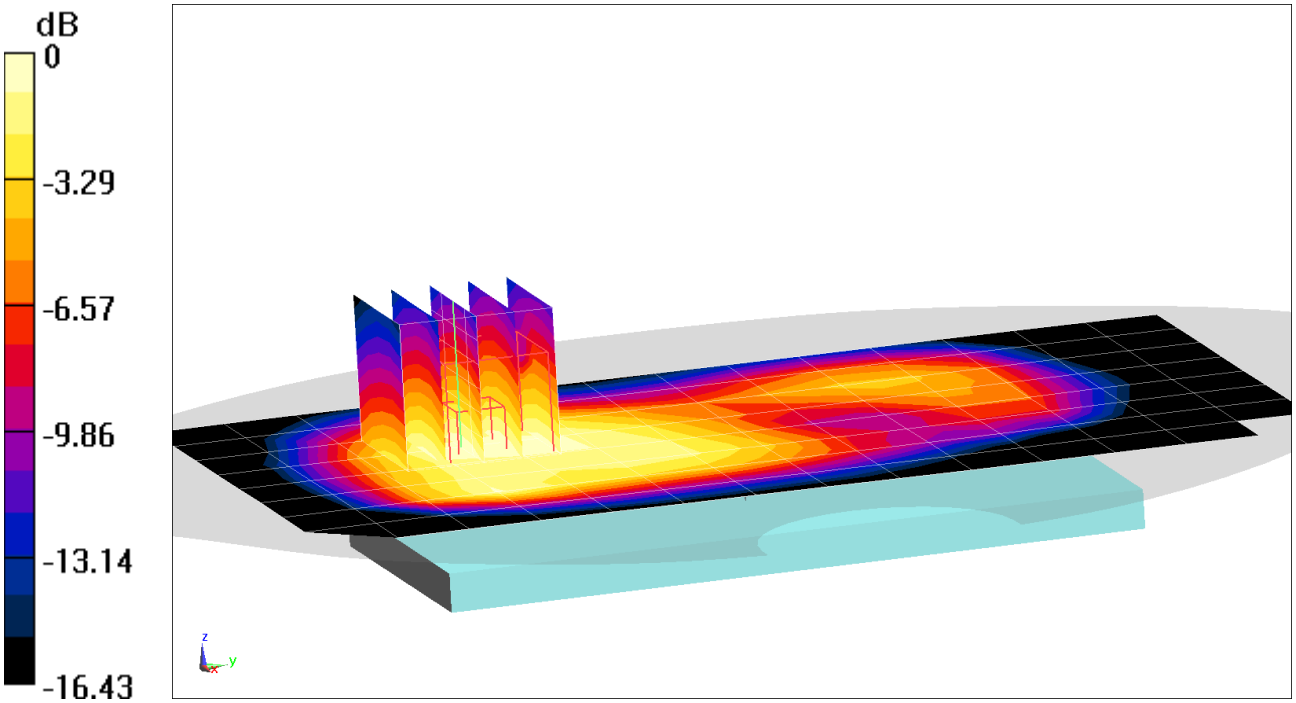
Communication System: UID 0, _GSM GPRS; 4 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:2.076
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.544 S/m; ε_r = 52.457; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-19-2019; Ambient Temp: 21.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7410; ConvF(7.78, 7.78, 7.78) @ 1880 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: Front; Type: QD 000 P40 CD; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: GPRS 1900, Body SAR, Back side, Mid.ch, 4 Tx Slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.27 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.524 W/kg
SAR(1 g) = 0.336 W/kg



0 dB = 0.454 W/kg = -3.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

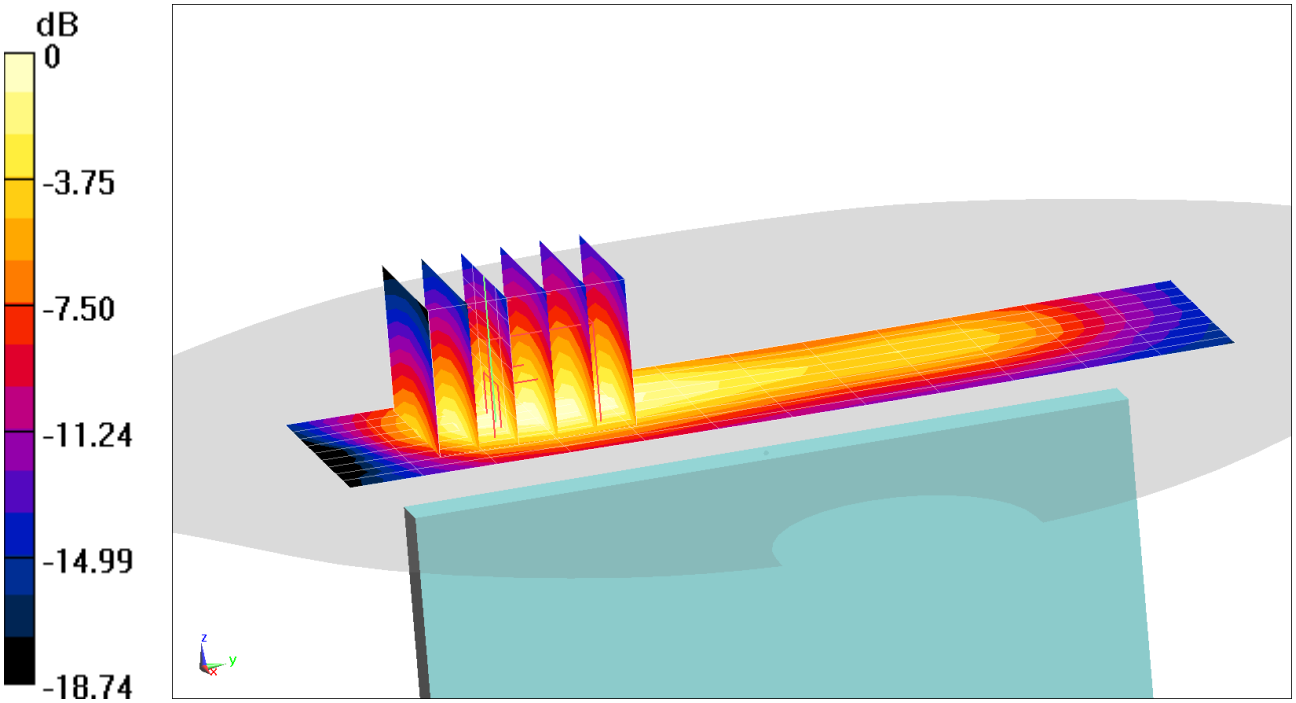
Communication System: UID 0, _GSM GPRS; 4 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:2.076
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.544 S/m; ε_r = 52.457; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-19-2019; Ambient Temp: 21.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7410; ConvF(7.78, 7.78, 7.78) @ 1880 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: Front; Type: QD 000 P40 CD; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: GPRS 1900, Body SAR, Left Edge, Mid.ch, 4 Tx Slots

Area Scan (10x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.87 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 0.599 W/kg
SAR(1 g) = 0.346 W/kg



0 dB = 0.500 W/kg = -3.01 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

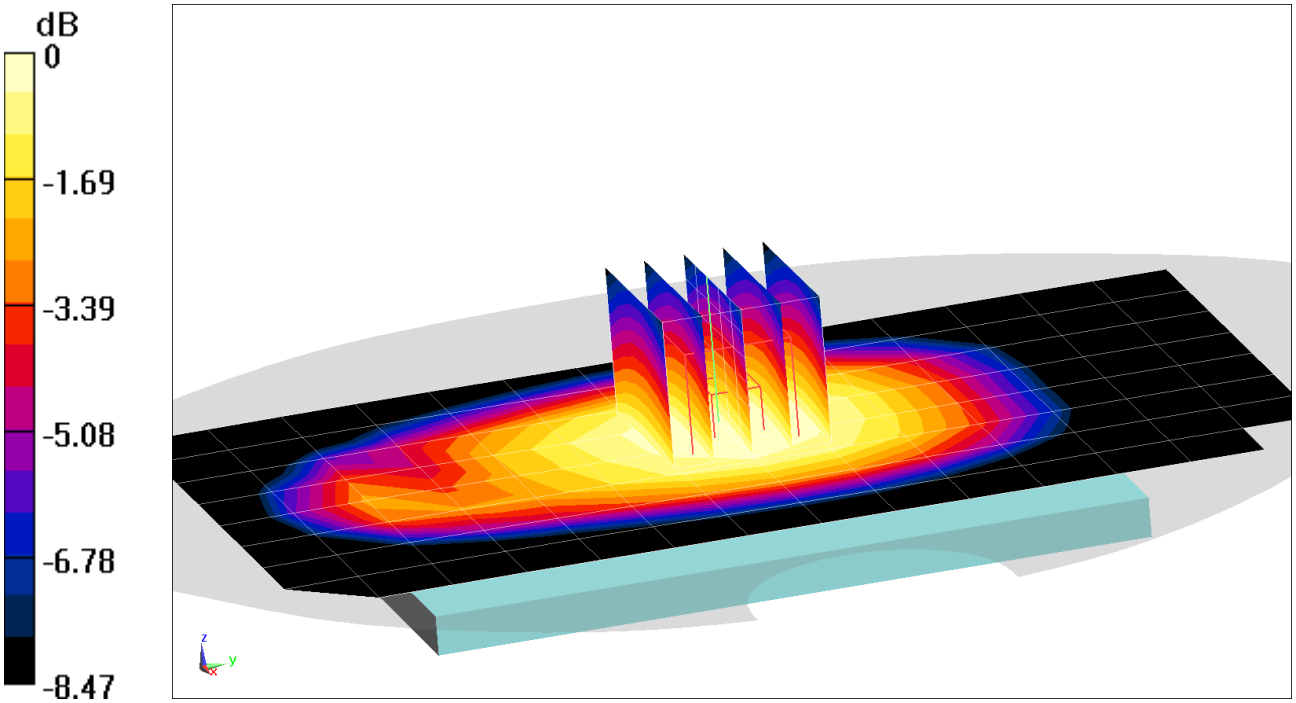
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.013 S/m; ε_r = 52.876; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 5-20-2019; Ambient Temp: 20.2°C; Tissue Temp: 19.5°C

Probe: EX3DV4 - SN7488; ConvF(11.03, 11.03, 11.03) @ 836.6 MHz; Calibrated: 1/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1530; Calibrated: 1/15/2019
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 850, Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.96 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.583 W/kg
SAR(1 g) = 0.435 W/kg



0 dB = 0.529 W/kg = -2.77 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

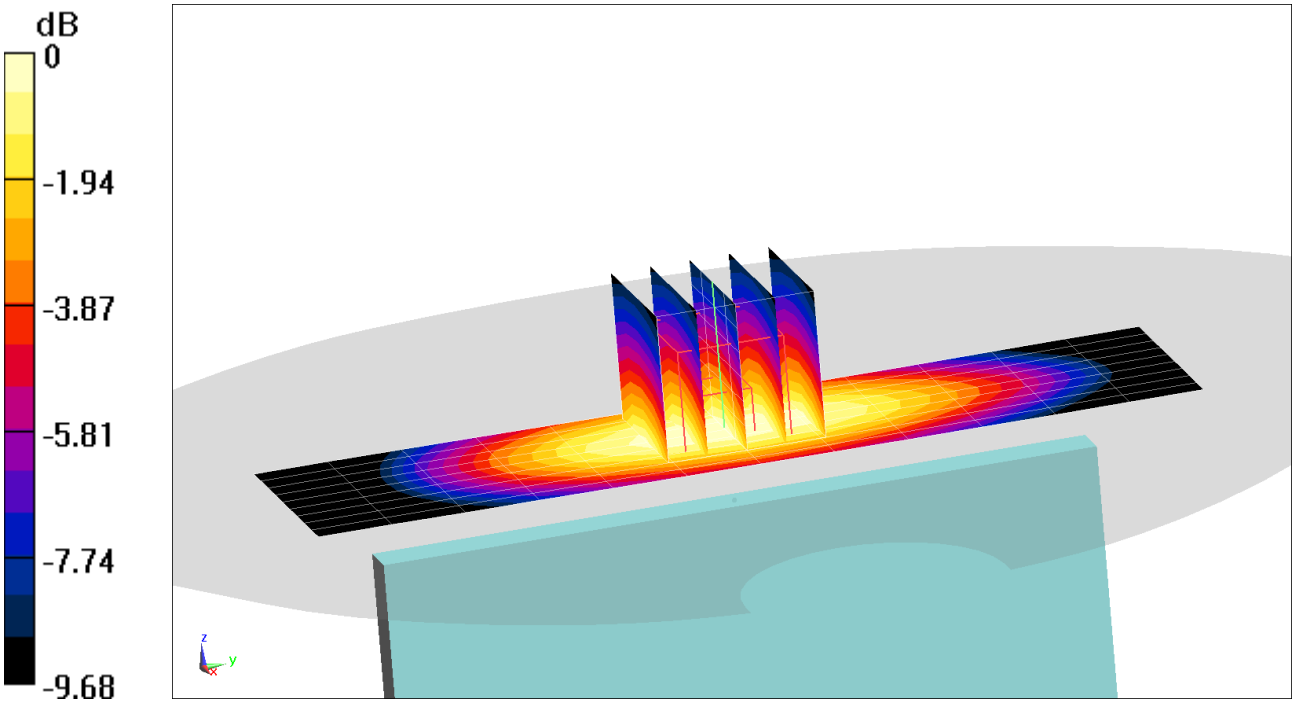
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.013 S/m; ε_r = 52.876; ρ = 1000 kg/m^3
Phantom section Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 20.2°C; Tissue Temp: 19.5°C

Probe: EX3DV4 - SN7488; ConvF(11.03, 11.03, 11.03) @ 836.6 MHz; Calibrated: 1/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1530; Calibrated: 1/15/2019
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 850, Body SAR, Right Edge, Mid.ch

Area Scan (10x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.83 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.702 W/kg
SAR(1 g) = 0.465 W/kg



0 dB = 0.617 W/kg = -2.10 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

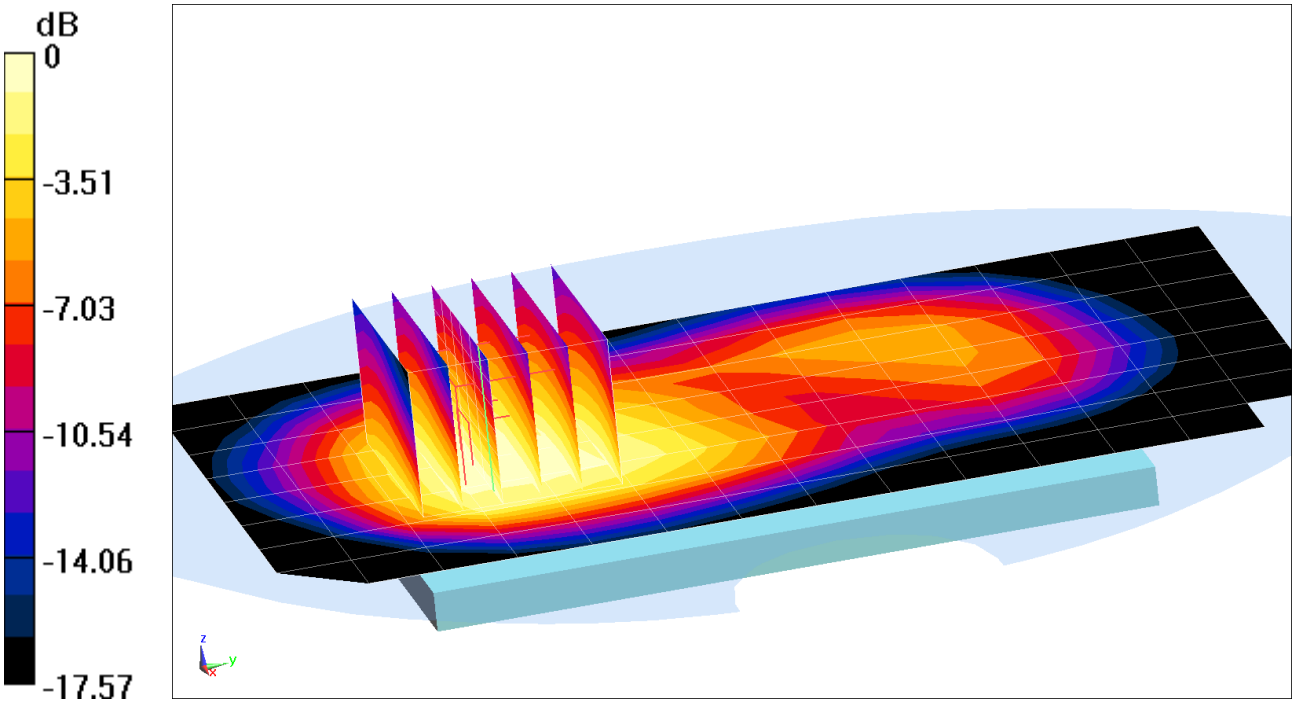
Communication System: UID 0, UMTS; Frequency: 1712.4 MHz; Duty Cycle: 1:1
Medium: 1750 Body; Medium parameters used (interpolated):
f = 1712.4 MHz; σ = 1.434 S/m; ε_r = 52.328; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-17-2019; Ambient Temp: 23.1°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN3914; ConvF(7.89, 7.89, 7.89) @ 1712.4 MHz; Calibrated: 2/19/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/14/2019
Phantom: SAM with CRP v5.0 Front; Type: QD000P40CD; Serial: 1646
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 1750, Body SAR, Back side, Low.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.05 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.72 W/kg
SAR(1 g) = 1.06 W/kg



0 dB = 1.44 W/kg = 1.58 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

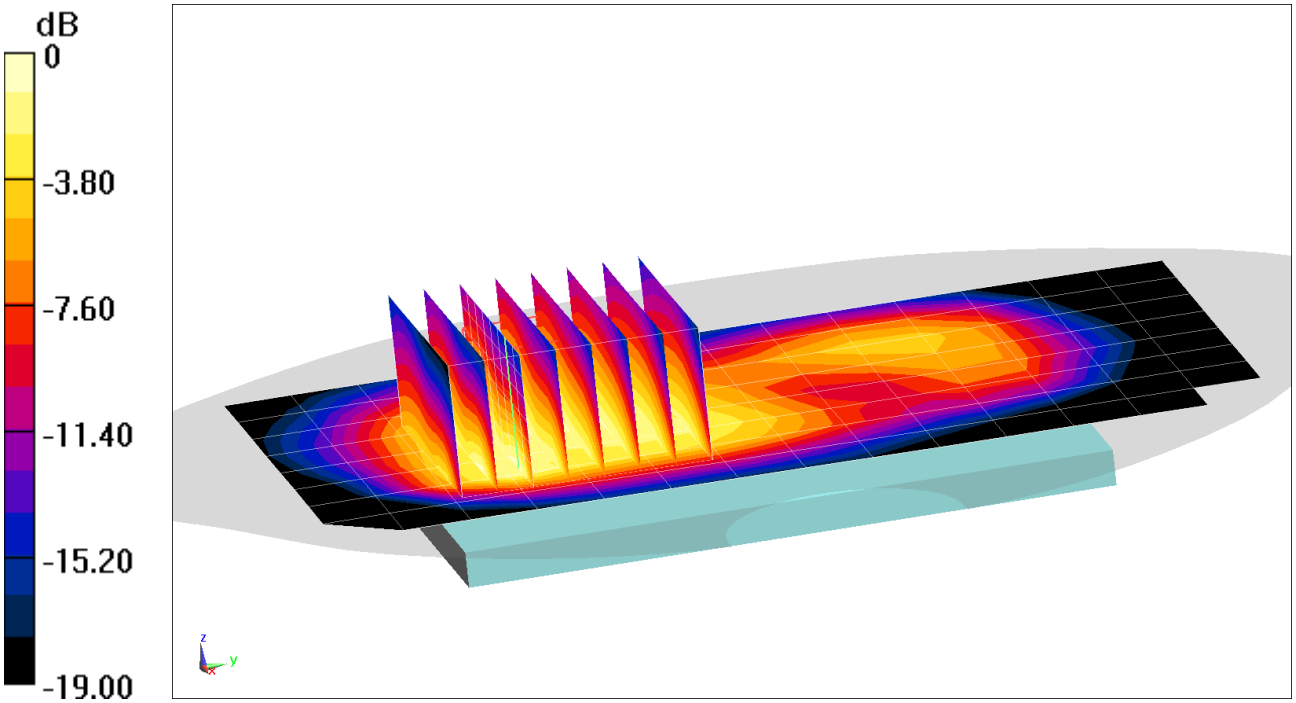
Communication System: UID 0, UMTS; Frequency: 1852.4 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1852.4 MHz; σ = 1.523 S/m; ε_r = 52.144; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-15-2019; Ambient Temp: 22.8°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN7410; ConvF(7.78, 7.78, 7.78) @ 1852.4 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: Front; Type: QD 000 P40 CD; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 1900, Body SAR, Back side, Low.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.94 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.775 W/kg



0 dB = 1.10 W/kg = 0.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

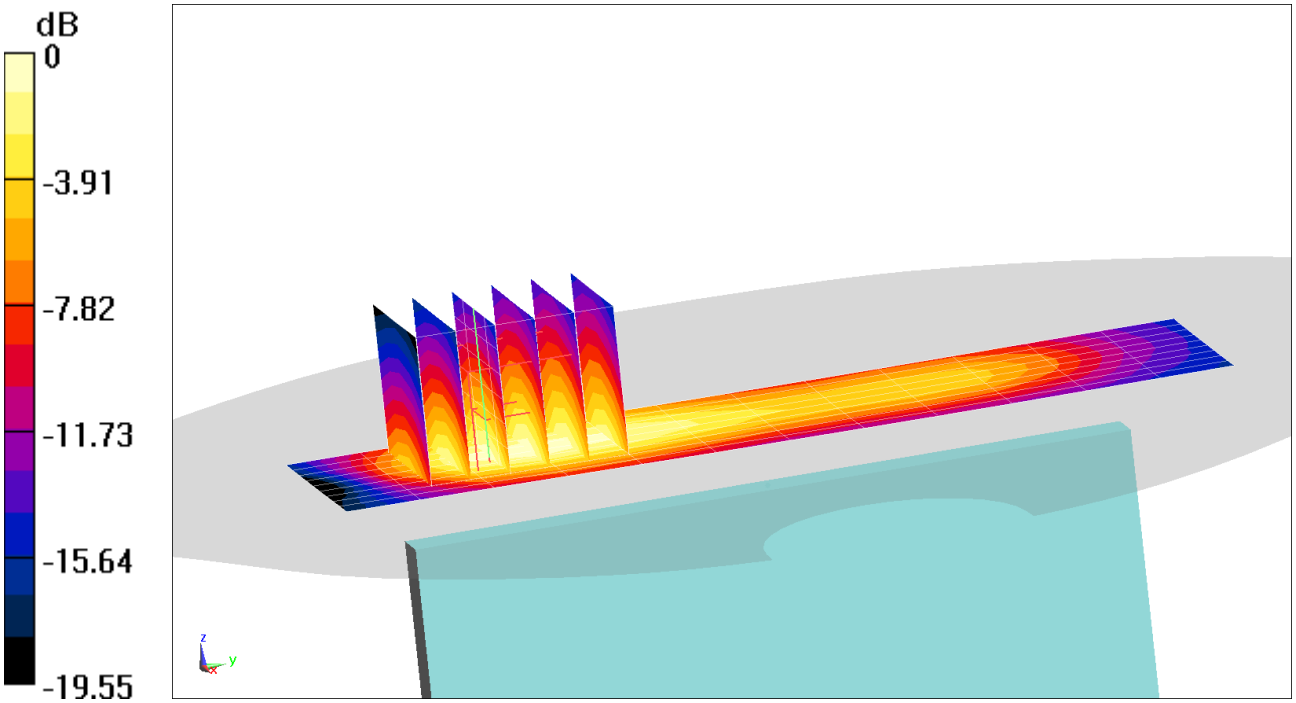
Communication System: UID 0, UMTS; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1907.6 MHz; σ = 1.583 S/m; ε_r = 51.953; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-15-2019; Ambient Temp: 22.8°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN7410; ConvF(7.78, 7.78, 7.78) @ 1907.6 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: Front; Type: QD 000 P40 CD; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: UMTS 1900, Body SAR, Left Edge, High.ch

Area Scan (10x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.95 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.805 W/kg



0 dB = 1.17 W/kg = 0.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

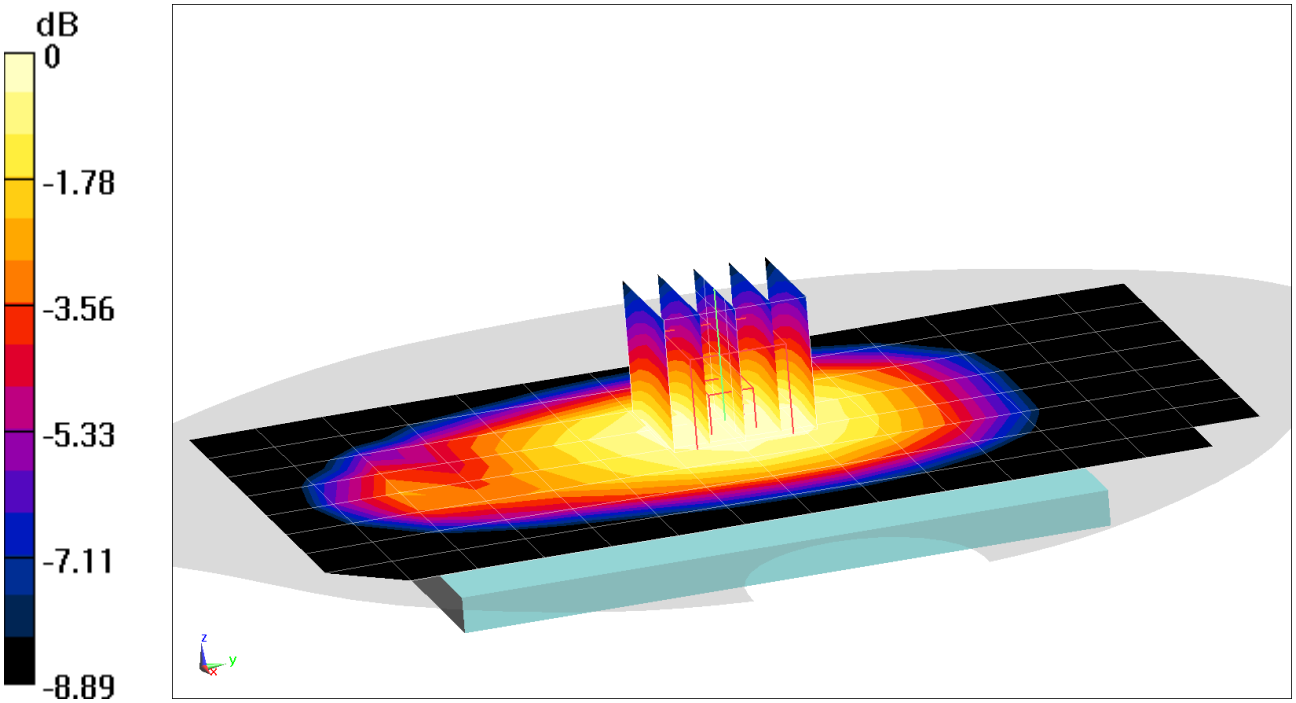
Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.52 MHz; σ = 1.013 S/m; ε_r = 52.877; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 20.2°C; Tissue Temp: 19.5°C

Probe: EX3DV4 - SN7488; ConvF(11.03, 11.03, 11.03) @ 836.52 MHz; Calibrated: 1/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1530; Calibrated: 1/15/2019
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: Cell. CDMA, Body SAR, Back side, 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 = 20.99 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.596 W/kg
SAR(1 g) = 0.437 W/kg



0 dB = 0.540 W/kg = -2.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

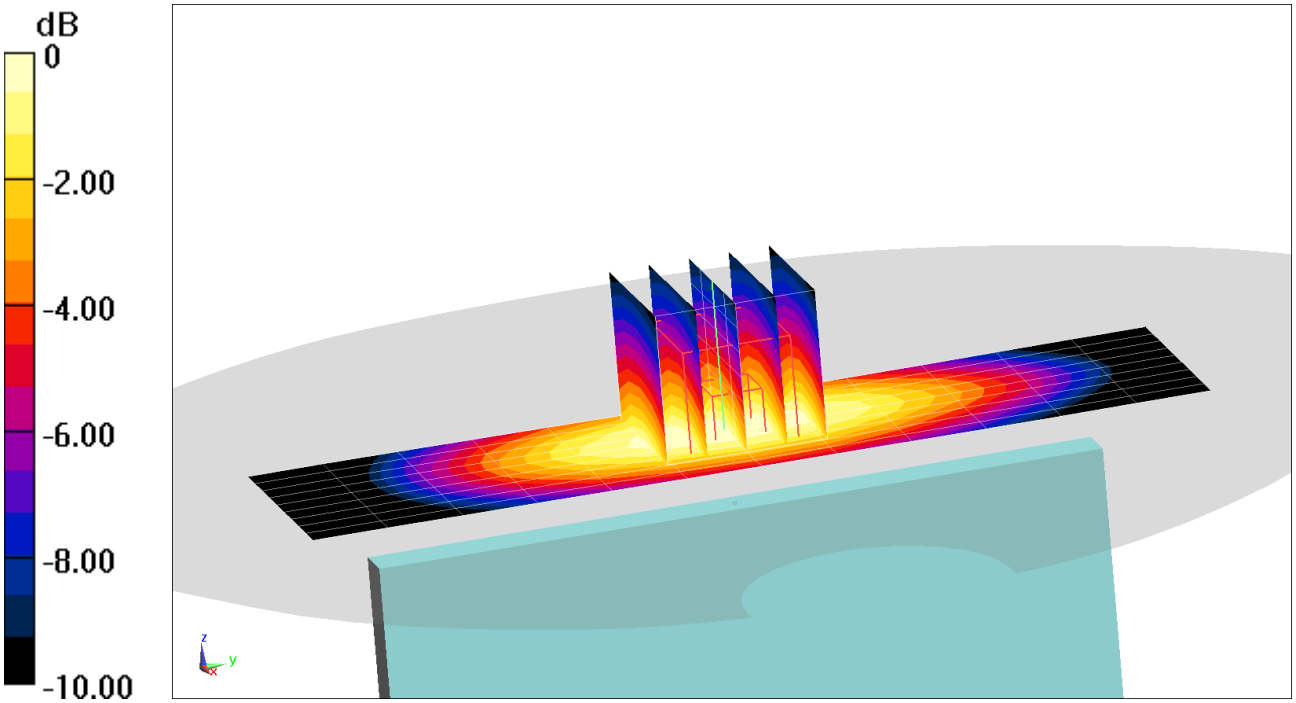
Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.52 MHz; σ = 1.013 S/m; ε_r = 52.877; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 20.2°C; Tissue Temp: 19.5°C

Probe: EX3DV4 - SN7488; ConvF(11.03, 11.03, 11.03) @ 836.52 MHz; Calibrated: 1/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1530; Calibrated: 1/15/2019
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: Cell. EVDO Rev.0 , Body SAR, Right Edge, Mid.ch

Area Scan (10x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.87 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.643 W/kg
SAR(1 g) = 0.419 W/kg



0 dB = 0.562 W/kg = -2.50 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

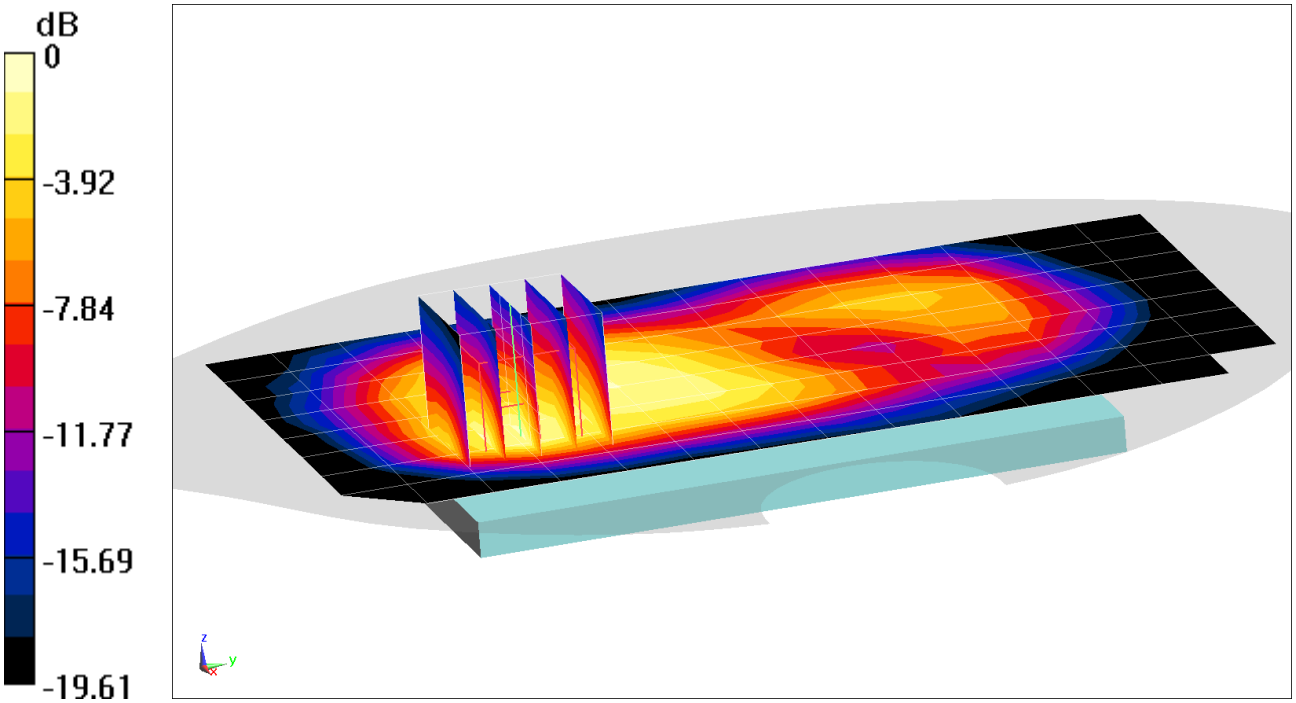
Communication System: UID 0, CDMA; Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1908.75 MHz; σ = 1.577 S/m; ε_r = 52.376; ρ = 1000 kg/m^3
Phantom section Flat Section; Space: 1.0 cm

Test Date: 05-19-2019; Ambient Temp: 21.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7410; ConvF(7.78, 7.78, 7.78) @ 1908.75 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: Front; Type: QD 000 P40 CD; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: PCS CDMA, Body SAR, Back side, High.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 = 23.50 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.49 W/kg
SAR(1 g) = 0.772 W/kg



0 dB = 1.20 W/kg = 0.79 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63351

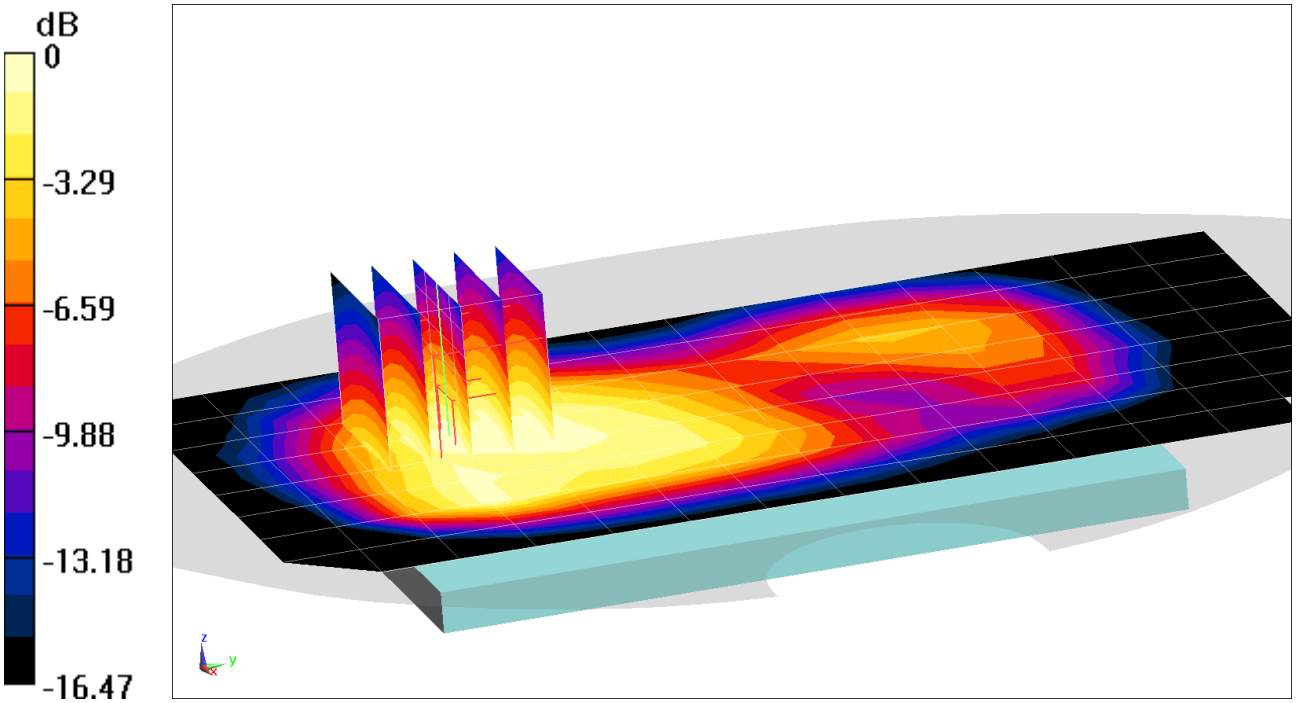
Communication System: UID 0, CDMA; Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1908.75 MHz; σ = 1.577 S/m; ε_r = 52.376; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-19-2019; Ambient Temp: 21.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7410; ConvF(7.78, 7.78, 7.78) @ 1908.75 MHz; Calibrated: 7/20/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/11/2018
Phantom: Front; Type: QD 000 P40 CD; Serial: 1686
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: PCS EVDO Rev.0, Body SAR, Back side, High.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.48 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.744 W/kg



0 dB = 1.00 W/kg = 0.00 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

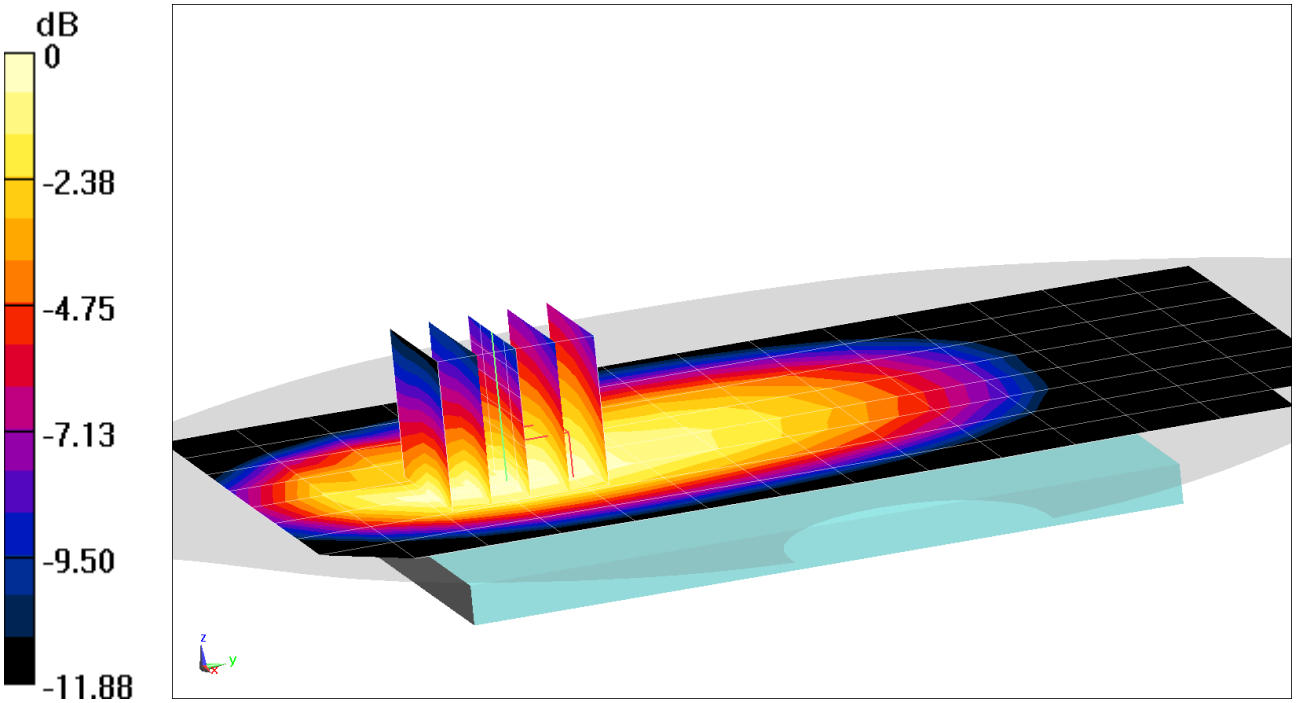
Communication System: UID 0, LTE Band 71; Frequency: 680.5 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 680.5 MHz; σ = 0.912 S/m; ε_r = 57.099; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 22.4°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7357; ConvF(10.19, 10.19, 10.19) @ 680.5 MHz; Calibrated: 4/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/18/2019
Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 71, Body SAR, Back side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.86 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.430 W/kg
SAR(1 g) = 0.282 W/kg



0 dB = 0.365 W/kg = -4.38 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

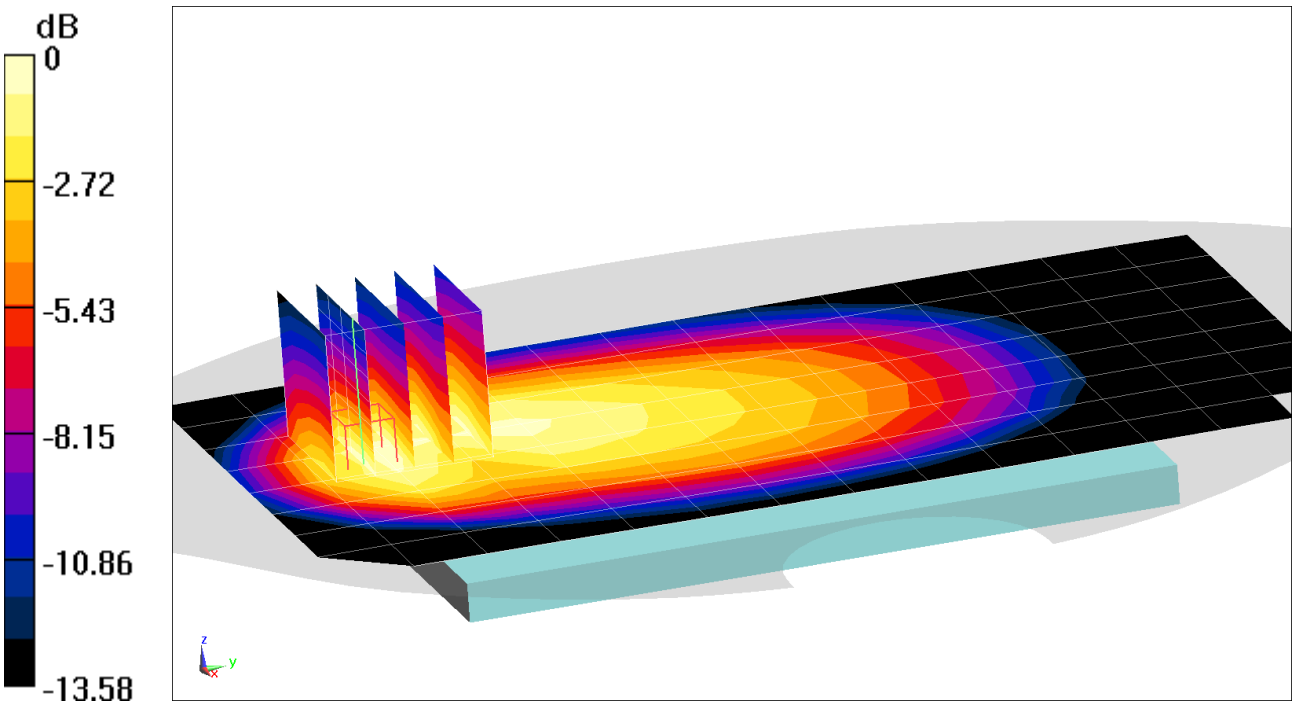
Communication System: UID 0, LTE Band 71; Frequency: 680.5 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 680.5 MHz; σ = 0.912 S/m; ε_r = 57.099; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 22.4°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7357; ConvF(10.19, 10.19, 10.19) @ 680.5 MHz; Calibrated: 4/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/18/2019
Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 71, Body SAR, Front side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.49 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.586 W/kg
SAR(1 g) = 0.312 W/kg



0 dB = 0.475 W/kg = -3.23 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

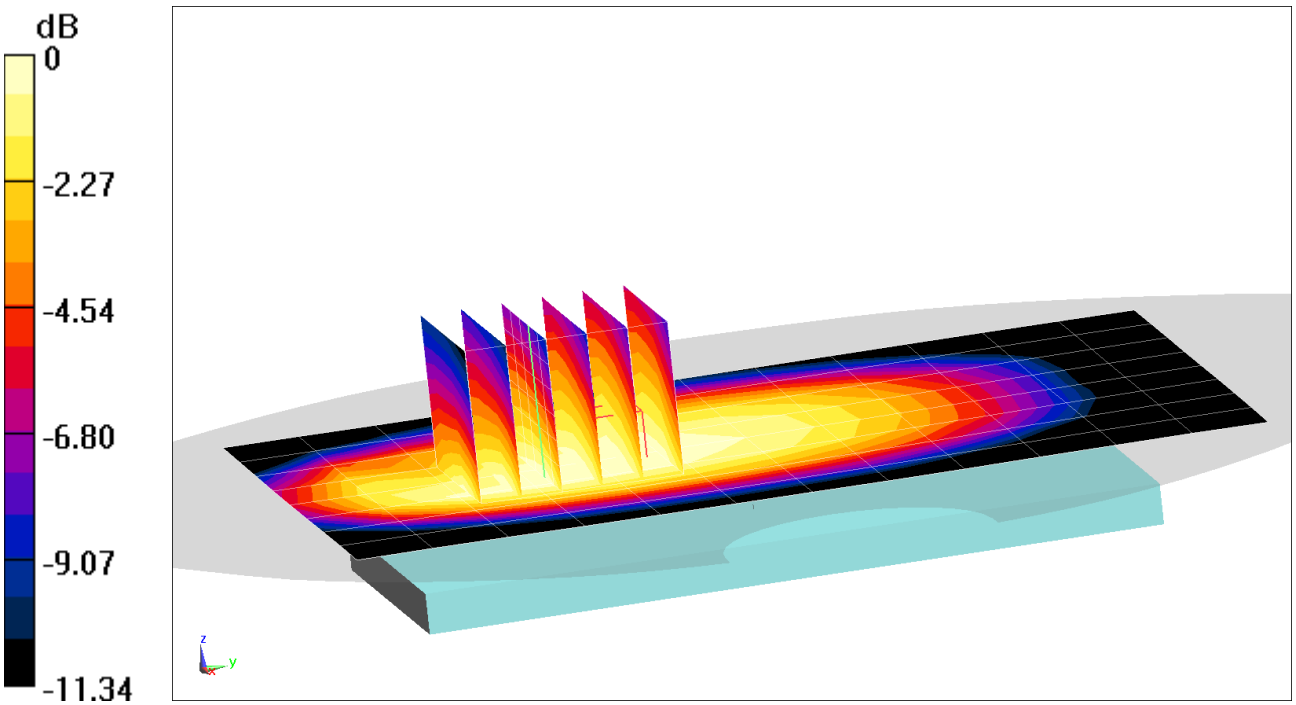
Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.921 S/m; ε_r = 57.043; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 22.4°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7357; ConvF(10.19, 10.19, 10.19) @ 707.5 MHz; Calibrated: 4/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/18/2019
Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 12, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.82 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.362 W/kg
SAR(1 g) = 0.266 W/kg



0 dB = 0.324 W/kg = -4.89 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

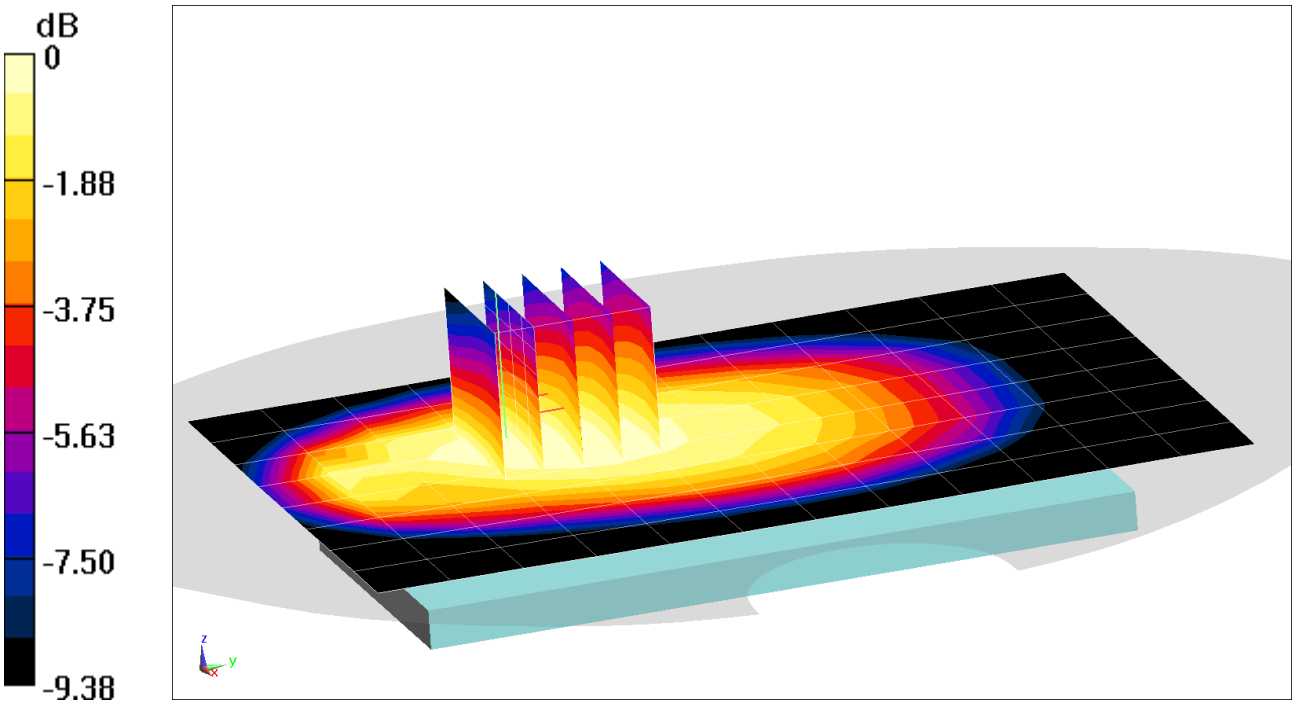
Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.921 S/m; ε_r = 57.043; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 22.4°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7357; ConvF(10.19, 10.19, 10.19) @ 707.5 MHz; Calibrated: 4/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/18/2019
Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 12, Body SAR, Front side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.85 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.433 W/kg
SAR(1 g) = 0.321 W/kg



0 dB = 0.390 W/kg = -4.09 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

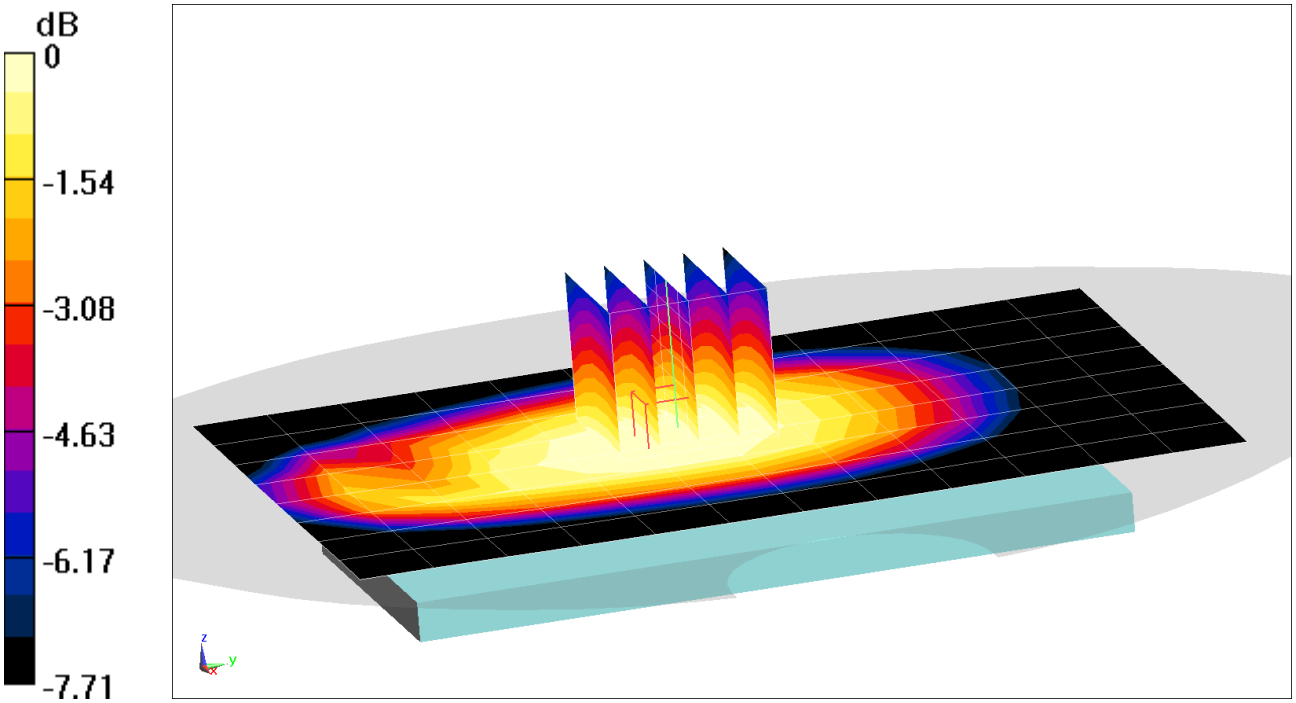
Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 782 MHz; σ = 0.948 S/m; ε_r = 56.896; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 22.4°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7357; ConvF(10.19, 10.19, 10.19) @ 782 MHz; Calibrated: 4/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/18/2019
Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 13, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.20 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.441 W/kg
SAR(1 g) = 0.344 W/kg



0 dB = 0.405 W/kg = -3.93 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFL322DL; Type: Portable Handset; Serial: 63401

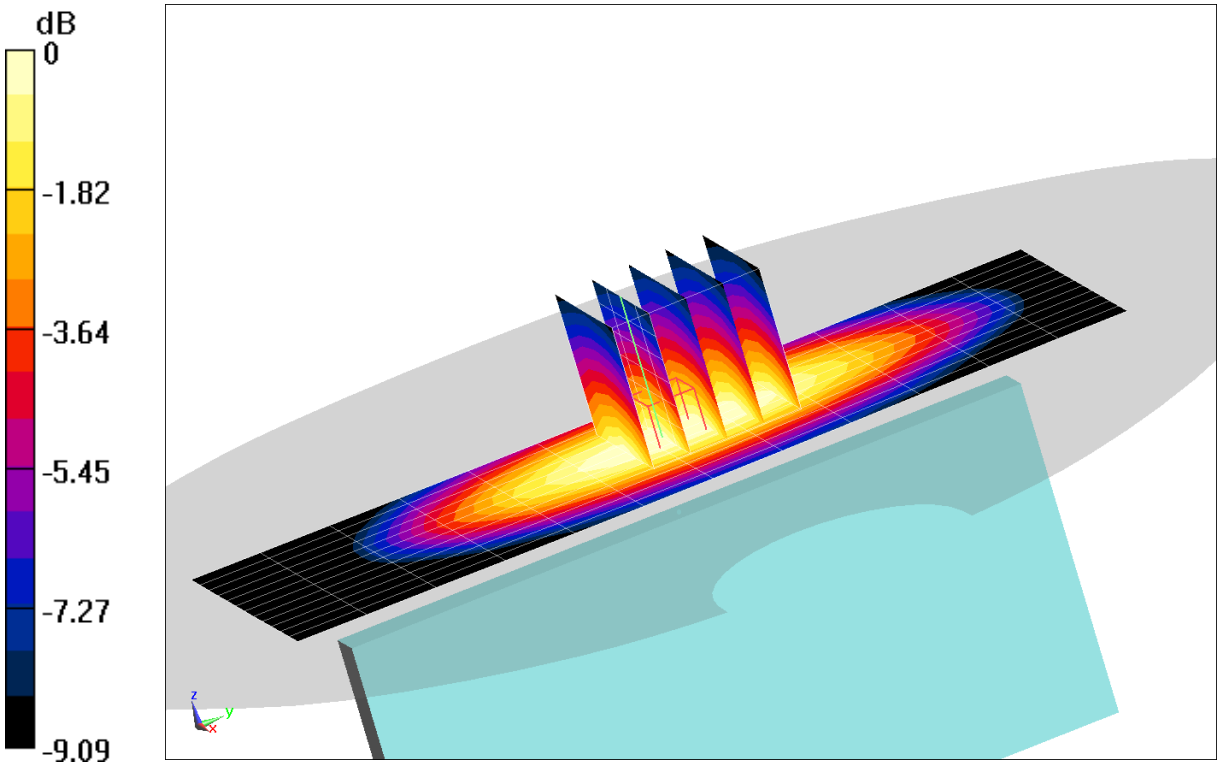
Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 782 MHz; σ = 0.948 S/m; ε_r = 56.896; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2019; Ambient Temp: 22.4°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7357; ConvF(10.19, 10.19, 10.19) @ 782 MHz; Calibrated: 4/24/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/18/2019
Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7450)

Mode: LTE Band 13, Body SAR, Right Edge, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (13x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.29 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.653 W/kg
SAR(1 g) = 0.449 W/kg



0 dB = 0.580 W/kg = -2.37 dBW/kg