



SAR EVALUATION REPORT

Applicant Name:

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

Date of Testing:

03/17/15 - 04/01/15

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

0Y1503160589-R1.ZNF

FCC ID:

ZNFH810

APPLICANT:

LG ELECTRONICS MOBILECOMM U.S.A., INC.

DUT Type:

Portable Handset

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093

Model(s):

LG-H810, H810, LGH810, LG-H812, H812, LGH812

Equipment Class	Band & Mode	Tx Frequency	SAR			
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)	10 gm Extremity (W/kg)
PCE	GSMGPRS/EDGE 850	824.20 - 848.80 MHz	0.46	0.65	0.70	
PCE	UMTS 850	826.40 - 846.60 MHz	0.45	0.58	0.62	
PCE	UMTS 1750	1712.4 - 1752.5 MHz	1.02	0.82	0.82	
PCE	GSMGPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.65	0.35	0.53	
PCE	UMTS 1900	1852.4 - 1907.6 MHz	1.00	0.68	1.01	
PCE	LTE Band 12	699.7 - 715.3 MHz	0.40	0.51	0.52	
PCE	LTE Band 13	779.5 - 784.5 MHz	0.30	0.45	0.67	
PCE	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.36	0.62	0.68	
PCE	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	1.00	0.71	0.71	
PCE	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	1.03	0.59	1.06	
PCE	LTE Band 7	2502.5 - 2567.5 MHz	0.38	0.54	0.54	
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.47	0.18	0.18	
DTS	Bluetooth LE	2402 - 2480 MHz	N/A			
NIJ	5.2 GHz WLAN	5180 - 5240 MHz	0.44	0.18		0.50
NIJ	5.3 GHz WLAN	5260 - 5320 MHz	0.52	0.22		0.55
NIJ	5.5 GHz WLAN	5500 - 5700 MHz	0.37	0.18		0.30
NIJ	5.8 GHz WLAN	5745 - 5825 MHz	0.30	0.11	0.22	
DSS	Bluetooth	2402 - 2480 MHz		<0.1		<0.1
Simultaneous SAR per KDB 690783 D01v01r03:			1.45	1.04	1.06	0.55

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 1.9 of this report; for North American frequency bands only.

This revised Test Report (S/N: 0Y1503160589-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.

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



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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
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.5 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 17	Voice/Data	706.5 - 713.5 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 13	Voice/Data	779.5 - 784.5 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
LTE Band 7	Voice/Data	2502.5 - 2567.5 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
Bluetooth LE	Data	2402 - 2480 MHz
5.2 GHz WLAN	Data	5180 - 5240 MHz
5.3 GHz WLAN	Data	5260 - 5320 MHz
5.5 GHz WLAN	Data	5500 - 5700 MHz
5.8 GHz WLAN	Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz

1.2 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 D01v05.

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	33.2	33.2	31.2	29.2	28.2	27.2	26.2	25.4	24.2
	Nominal	32.7	32.7	30.7	28.7	27.7	26.7	25.7	24.9	23.7
GSM/GPRS/EDGE 1900	Maximum	30.2	30.2	28.2	26.2	25.2	26.2	25.2	24.4	23.4
	Nominal	29.7	29.7	27.7	25.7	24.7	25.7	24.7	23.9	22.9

Mode / Band		Modulated Average (dBm)			
		3GPP WCDMA Rel 99	3GPP HSDPA Rel 5	3GPP HSUPA Rel 6	3GPP DC-HSDPA Rel 8
UMTS Band 5 (850 MHz)	Maximum	23.7			
	Nominal	23.2			
UMTS Band 4 (1750 MHz)	Maximum	24.7			
	Nominal	24.2			
UMTS Band 2 (1900 MHz)	Maximum	24.2			
	Nominal	23.7			

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Mode / Band		Modulated Average (dBm)
LTE Band 17/12	Maximum	24.4
	Nominal	23.9
LTE Band 13	Maximum	24.4
	Nominal	23.9
LTE Band 5 (Cell)	Maximum	24.4
	Nominal	23.9
LTE Band 4 (AWS)	Maximum	24.7
	Nominal	24.2
LTE Band 2 (PCS)	Maximum	24.2
	Nominal	23.7
LTE Band 7	Maximum	23.7
	Nominal	23.2
Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	16.0
	Nominal	15.0
IEEE 802.11g (2.4 GHz)	Maximum	15.0
	Nominal	14.0
IEEE 802.11n (2.4 GHz)	Maximum	14.0
	Nominal	13.0
IEEE 802.11ac (2.4 GHz)	Maximum	12.0
	Nominal	11.0
IEEE 802.11a (5 GHz)	Maximum	12.0
	Nominal	11.0
IEEE 802.11n (5 GHz, 20 MHz)	Maximum	11.0
	Nominal	10.0
IEEE 802.11n (5 GHz, 40 MHz)	Maximum	11.0
	Nominal	10.0
IEEE 802.11ac (5 GHz, 20 MHz)	Maximum	11.0
	Nominal	10.0
IEEE 802.11ac (5 GHz, 40 MHz)	Maximum	11.0
	Nominal	10.0
IEEE 802.11ac (5 GHz, 80 MHz)	Maximum	11.0
	Nominal	10.0
Bluetooth (1 Mbps)	Maximum	10.5
	Nominal	9.5
Bluetooth (2 Mbps)	Maximum	7.5
	Nominal	6.5
Bluetooth (3 Mbps)	Maximum	7.0
	Nominal	6.0
Bluetooth LE	Peak Power	7.0

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1.3 DUT Antenna Locations

1. A diagram showing the location of the device antennas can be found in Appendix F. Exact antenna dimensions and separation distances are shown in the Technical Descriptions.
2. Since the diagonal dimension of this device is more than 160 mm and less than 200 mm, it is considered a “phablet.”.

Table 1-1
Sides for SAR Testing

Mode	Exposure Condition	Back	Front	Top	Bottom	Right	Left
GPRS 850	Hotspot	Yes	Yes	No	Yes	Yes	Yes
UMTS 850	Hotspot	Yes	Yes	No	Yes	Yes	Yes
UMTS 1750	Hotspot	Yes	Yes	No	Yes	No	Yes
GPRS 1900	Hotspot	Yes	Yes	No	Yes	No	Yes
UMTS 1900	Hotspot	Yes	Yes	No	Yes	No	Yes
LTE Band 12	Hotspot	Yes	Yes	No	Yes	Yes	Yes
LTE Band 13	Hotspot	Yes	Yes	No	Yes	Yes	Yes
LTE Band 5 (Cell)	Hotspot	Yes	Yes	No	Yes	Yes	Yes
LTE Band 4 (AWS)	Hotspot	Yes	Yes	No	Yes	No	Yes
LTE Band 2 (PCS)	Hotspot	Yes	Yes	No	Yes	No	Yes
LTE Band 7	Hotspot	Yes	Yes	No	Yes	No	Yes
2.4 GHz WLAN	Hotspot	Yes	Yes	Yes	No	Yes	No
5.8 GHz WLAN	Hotspot	Yes	Yes	Yes	No	Yes	No
5.2 - 5.7 GHz WLAN	Extremity	Yes	Yes	Yes	No	Yes	No
Bluetooth	Extremity	Yes	Yes	Yes	No	Yes	No

Note: Particular DUT edges were not required to be evaluated for Wireless Router SAR or Extremity SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v01 guidance, page 2 and FCC KDB 648474 D04v01r01. The distances between the transmit antennas and the edges of the device are included in the filing. When wireless router mode is enabled, 5.2-5.7 GHz WLAN operations are disabled.

1.4 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the device. The NFC antenna location diagram can be found in appendix F. The NFC antenna is integrated into the device; therefore all SAR tests were performed with the NFC antenna.

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1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D05v01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 1-1 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

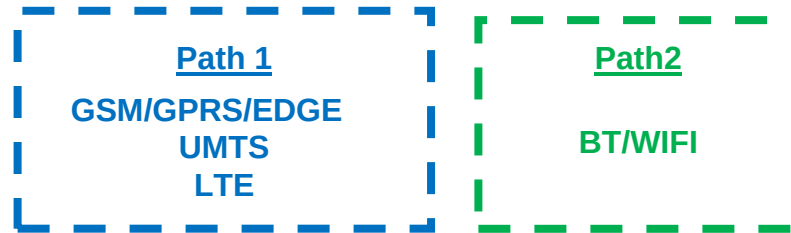


Figure 1-1
Simultaneous Transmission Paths

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v05 3) procedures.

Table 1-2
Simultaneous Transmission Scenarios

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

- 2.4 GHz WLAN, 5 GHz WLAN, and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
- All licensed modes share the same antenna path and cannot transmit simultaneously.
- When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCC]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.
- Per the manufacturer, WIFI Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Simultaneous transmission scenarios involving WIFI direct are specified above.
- 5 GHz Wireless Router is only supported for the 5.8 GHz Band by S/W, therefore 5.2-5.7 GHz Bands were not evaluated for wireless router conditions.
- 5.8 GHz WIFI supports Hotspot and WIFI-Direct (GO/GC).
- This device supports VoLTE.

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1.6 SAR Test Exclusions Applied

(A) WIFI/BT

Since Wireless Router operations are not allowed by the chipset firmware using 5.2-5.7 GHz WIFI, only 2.4 GHz and 5.8 GHz WIFI Hotspot SAR tests and combinations are considered for SAR with respect to Wireless Router configurations according to FCC KDB 941225 D06v01.

Per FCC KDB 447498 D01v05, the 1g SAR exclusion threshold for distances <50mm is defined by the following equation:

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

Based on the maximum conducted power of Bluetooth LE (rounded to the nearest mW) and the antenna to user separation distance, body-worn Bluetooth LE SAR was not required; $[(5/10) * \sqrt{2.480}] = 0.8 < 3.0$. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

Per FCC KDB 447498 D01v05, the 10g SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{\text{Max Power of Channel (mW)}}{\text{Test Separation Dist (mm)}} * \sqrt{\text{Frequency(GHz)}} \leq 7.5$$

Based on the maximum conducted power of Bluetooth LE (rounded to the nearest mW) and the antenna to user separation distance, extremity Bluetooth LE SAR was not required; $[(5/5) * \sqrt{2.480}] = 1.6 < 7.5$. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation. Bluetooth 10g SAR measurement was additionally evaluated per manufacturer's request.

This device supports 40 MHz Bandwidth for IEEE 802.11n for 5 GHz WIFI only.

This device supports IEEE 802.11ac with the following features:

- a) Up to 80 MHz Bandwidth only
- b) No aggregate channel configurations
- c) 1 Tx antenna output
- d) 256 QAM is supported
- e) New 5 GHz channels 138, 142, and 144 are supported

Per FCC KDB Publication 648474 D04v01r01, this device is considered a "phablet" since the diagonal dimension is greater than 160mm and less than 200mm. Extremity SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg. Because wireless router operations are not supported for 5.2 – 5.7 GHz WLAN, extremity SAR tests were performed. Extremity SAR was not evaluated for 2.4 GHz and 5.8 GHz WLAN operations since wireless router 1g SAR was < 1.2 W/kg.

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(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 D01v02.

This device supports both LTE B12 and LTE B17. Since the supported frequency span for LTE B17 falls completely within the supported frequency span for LTE B12, both LTE bands have the same target power, and both LTE bands share the same transmission path, SAR was only assessed for LTE B12.

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 D05v02.

This device supports inter-band LTE Carrier Aggregation (CA) in the downlink only. All uplink communications are identical to Release 8 specifications. Per FCC Guidance, LTE CA SAR was not needed for testing since the data sent by uplink on uplink physical channels does not change between Rel 8 and Rel 10.

Per FCC KDB Publication 648474 D04v01r01, this device is considered a "phablet" since the diagonal dimension is greater than 160mm and less than 200mm. Therefore, extremity SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.

1.7 Power Reduction for SAR

There is no power reduction used for any band/mode implemented in this device for SAR purposes.

1.8 Quick Cover

This DUT may be used with a standard battery cover or with an optional quick cover which features an extension to wrap around and protect the front side of the device. Per FCC KDB Publication 648474 D03, SAR was measured using the standard battery cover and then repeated with the quick cover for the configuration with the highest measured SAR for each wireless technology, frequency band, operating mode, and exposure condition. Additional head and extremity tests using the quick cover were performed with the cover extension both open and closed. Additional body-worn and hotspot tests were performed with the cover extension closed because operations near the body with the cover extension open are not expected. Since reported SAR did not exceed 1.2 W/kg, additional testing with the quick cover was not required.

1.9 Guidance Applied

- IEEE 1528-2003
- FCC KDB Publication 941225 D01v03, D05v02r03, D06v01r01 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v01r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05r02 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r03, D02v01r01 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D03-D04 (Phablet Procedures, Wireless Charging Cover)
- April 2013 TCB Workshop Notes (IEEE 802.11ac)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

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1.10 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.

	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number	Extremity Serial Number
GSM/GPRS/EDGE 850	0682-1	0682-1	0682-1	-
UMTS 850	0682-1	0682-1	0682-1	-
UMTS 1750	0682-1	0682-1	0682-1	-
GSM/GPRS/EDGE 1900	0681-3	0681-3	0681-3	-
UMTS 1900	0677-1	0677-1	0677-1	-
LTE Band 12	0716-7	0716-7	0716-7	-
LTE Band 13	0716-7	0716-7	0716-7	-
LTE Band 5 (Cell)	0677-1	0716-7	0716-7	-
LTE Band 4 (AWS)	0716-7	0716-7	0716-7	-
LTE Band 2 (PCS)	0716-7	0716-7	0716-7	-
LTE Band 7	0716-7	0716-7	0716-7	-
2.4 GHz WLAN	0683-9	0683-9	0683-9	-
5.2 - 5.7 GHz WLAN	0683-9	0683-9	-	0683-9
5.8 GHz WLAN	0683-9	0683-9	0683-9	-
Bluetooth	-	0683-9	-	0683-9

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LTE INFORMATION

LTE Information									
FCC ID		ZNFH810							
Form Factor		Portable Handset							
Frequency Range of each LTE transmission band		LTE Band 17 (706.5 - 713.5 MHz)							
		LTE Band 12 (699.7 - 715.3 MHz)							
		LTE Band 13 (779.5 - 784.5 MHz)							
		LTE Band 5 (Cell) (824.7 - 848.3 MHz)							
		LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)							
		LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)							
		LTE Band 7 (2502.5 - 2567.5 MHz)							
Channel Bandwidth idths		LTE Band 17: 5 MHz, 10 MHz							
		LTE Band 12: 1.4 MHz, 3 MHz, 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 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							
		LTE Band 7: 5 MHz, 10 MHz, 15 MHz, 20 MHz							
Channel Numbers and Frequencies (MHz)		Low	Mid	High					
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 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 13: 5 MHz		779.5 (23205)	782 (23230)	784.5 (23255)					
LTE Band 13: 10 MHz		782 (23230)	782 (23230)	782 (23230)					
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 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)					
LTE Band 7: 5 MHz		2502.5 (20775)	2535 (21100)	2567.5 (21425)					
LTE Band 7: 10 MHz		2505 (20800)	2535 (21100)	2565 (21400)					
LTE Band 7: 15 MHz		2507.5 (20825)	2535 (21100)	2562.5 (21375)					
LTE Band 7: 20 MHz		2510 (20850)	2535 (21100)	2560 (21350)					
UE Category		6							
Modulations Supported in UL		QPSK, 16QAM							
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3-6.2.5? (manufacturer attestation to be provided)		YES							
A-MPR (Additional MPR) disabled for SAR Testing?		YES							
LTE Carrier Aggregation Possible Combinations	LTE-B1 (PCC) + LTE-B1 (SCC)	LTE-B1 (PCC) + LTE-B1 (SCC)	LTE-B1 (PCC) + LTE-B1 (SCC)	LTE-B1 (PCC) + LTE-B1 (SCC)	LTE-B1 (PCC) + LTE-B1 (SCC)	LTE-B1 (PCC) + LTE-B1 (SCC)	LTE-B1 (PCC) + LTE-B1 (SCC)	LTE-B1 (PCC) + LTE-B1 (SCC)	
	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	
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	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	SMAR (B1) + SMAR (B1)	
	LTE Carrier Aggregation Additional Information		This device does not support M-LT features on 3GPP Release 10. It supports a maximum of 2 carriers in the downlink only. All uplink communications are identical to the Release 8 Specifications. Uplink communications are done on the PCC. Due to carrier capability, only the combinations listed above are supported. The following LTE Release 10 features are not supported: Relay, HetNet, Enhanced MIMO, eIC, WPT Offloading, MDM, eMBMA, Cross-Carrier Scheduling, Enhanced SC-FDMA.						

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3 INTRODUCTION

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

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

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

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

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

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DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01 and IEEE 1528-2013:

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (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 D01v01 (See Table 4-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
 - a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
 - b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
 - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

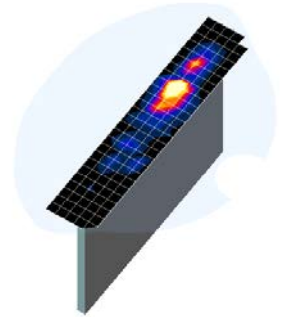


Figure 4-1
Sample SAR Area Scan

Table 4-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01*

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

*Also compliant to IEEE 1528-2013 Table 6

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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].

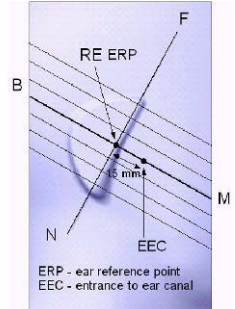


Figure 5-1
Close-Up Side view
of ERP

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 then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at its top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.



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

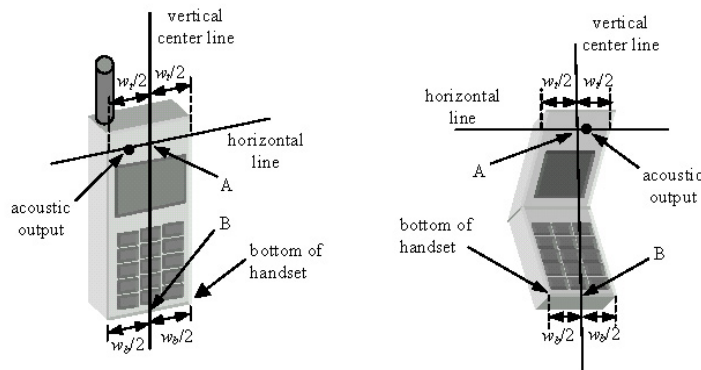


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 Device Holder

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

6.2 Positioning for Cheek

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

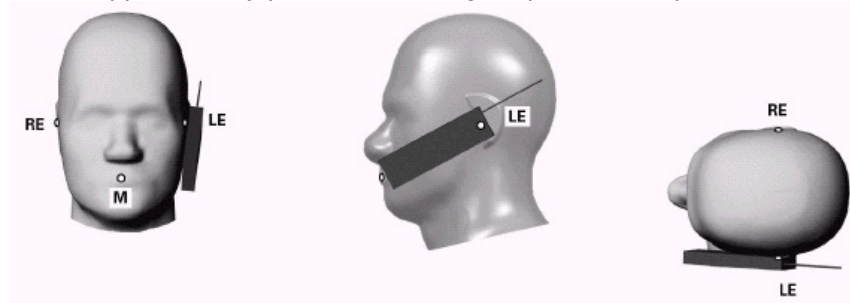


Figure 6-1 Front, Side and Top View of Cheek Position

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

6.3 Positioning for Ear / 15° Tilt

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

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

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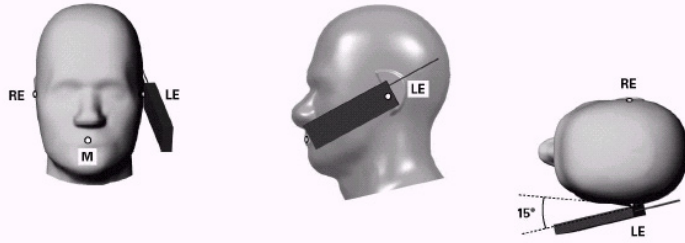


Figure 6-2 Front, Side and Top View of Ear/15° Tilt Position

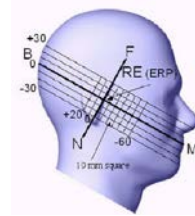


Figure 6-3 Side view w/ relevant markings

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

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

Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04 v01. 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 D04v01, 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 D01v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

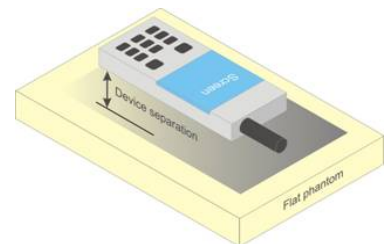


Figure 6-4 Sample Body-Worn Diagram

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

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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 1-g body and 10-g extremity SAR Exclusion Thresholds found in KDB Publication 44798 D01v05 should be applied to determine SAR test requirements.

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC minitables that support voice calls next to the ear, the phablets procedures outlined in KDB Publication 648474 D04 v01r01DR04 should be applied to evaluate SAR compliance. A device marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance. In addition to the normally required head and body-worn accessory SAR test procedures required for handsets, the UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna ≤ 25 mm from that surface or edge, in direct contact with the phantom, for 10-g SAR. The UMPC mini-tablet 1-g SAR at 5 mm is not required.

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 D06 v01 where SAR test considerations for handsets ($L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v05 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

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7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

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

7.2 Controlled Environment

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

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

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

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

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8.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v05, 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 D01v01r02.

8.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01v03, 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 tuneup 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 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

The device was 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 were 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 was 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 deviated by more than 5%, the SAR test and drift measurements were repeated.

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8.4 SAR Measurement Conditions for UMTS

8.4.1 Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121 (release 5), 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.

8.4.2 Head SAR Measurements for Handsets

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

8.4.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all “1s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn 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 DPDCHn, for the highest reported SAR configuration in 12.2 kbps RMC.

8.4.4 SAR Measurements for Handsets 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 HSet 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

8.4.5 SAR Measurements for Handsets 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.

8.4.6 SAR Measurement Conditions for DC-HSDPA

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 HSDSCH Cell are required to perform the power measurement and for the results to be acceptable.

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8.5 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

8.5.1 Spectrum Plots for RB Configurations

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

8.5.2 MPR

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

8.5.3 A-MPR

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

8.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r01:

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

8.5.5 Downlink Carrier Aggregation

LTE Carrier Aggregation (CA) measurements are made in accordance to 3GPP TS 36.521-1 V10.4.0 (2012-12). The RRC connection is only handled by one cell, the Primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds the Secondary component carrier (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to release 8 specifications on the

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PCC. Additional output powers are measured using two carriers in the downlink for the release 8 configurations with the highest output power among all channels, RB configurations and bandwidths for each uplink band. Per FCC KDB Publication 941225 D05A v01r01, no SAR measurements are required when the average output power with downlink carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink carrier aggregation inactive.

8.6 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n/ac transmitters. 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 D01v01r02 for more details.

8.6.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

8.6.2 Frequency Channel Configurations [24]

For 2.4 GHz, the highest average RF output power channel between the low, mid and high channel at the lowest data rate was selected for SAR evaluation in 802.11b mode. 802.11g/n modes and higher data rates for 802.11b were additionally required for SAR if the output power of the respective mode was 0.25 dB or higher than the powers of the SAR configurations tested in the 802.11b mode.

For 5 GHz, the highest average RF output power channel across the default test channels at the lowest data rate was selected for SAR evaluation in 802.11a. When the adjacent channels are higher in power than the default channels, these “required channels” were considered instead of the default channels for SAR testing. 802.11n modes and higher data rates for 802.11a/n were required only if the respective mode was higher than 0.25 dB or more than the 802.11a mode. 802.11ac SAR was evaluated for highest 802.11a configuration in each 5 GHz band and each exposure condition. 802.11ac modes were additionally required for SAR if the output power for the respective mode was more than 0.25 dB higher than powers of 802.11a modes.

If the maximum extrapolated peak SAR of the zoom scan for the highest output channel was less than 1.6 W/kg and if the 1g averaged SAR was less than 0.8 W/kg, SAR testing was not required for the other test channels in the band.

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9.1 GSM Conducted Powers

		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	32.95	33.02	31.08	29.19	28.20	27.18	26.20	25.40	24.20
	190	33.08	33.14	31.18	29.17	27.92	27.17	26.10	25.32	24.04
	251	32.72	32.79	31.10	28.49	27.91	26.95	25.97	25.23	23.93
GSM 1900	512	29.92	30.06	27.27	25.89	24.51	25.60	24.88	23.79	22.96
	661	29.86	30.01	28.02	26.00	25.15	25.85	25.11	24.10	23.18
	810	29.92	30.05	28.00	25.83	25.08	25.79	25.03	23.99	23.08
		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	23.92	23.99	25.06	24.93	25.19	18.15	20.18	21.14	21.19
	190	24.05	24.11	25.16	24.91	24.91	18.14	20.08	21.06	21.03
	251	23.69	23.76	25.08	24.23	24.90	17.92	19.95	20.97	20.92
GSM 1900	512	20.89	21.03	21.25	21.63	21.50	16.57	18.86	19.53	19.95
	661	20.83	20.98	22.00	21.74	22.14	16.82	19.09	19.84	20.17
	810	20.89	21.02	21.98	21.57	22.07	16.76	19.01	19.73	20.07
GSM 850	Frame	23.67	23.67	24.68	24.44	24.69	17.67	19.68	20.64	20.69
GSM 1900	Avg. Targets:	20.67	20.67	21.68	21.44	21.69	16.67	18.68	19.64	19.89

Note:

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

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

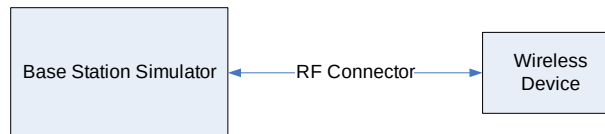


Figure 9-1
Power Measurement Setup

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9.2 UMTS Conducted Powers

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	1862	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	23.42	23.49	23.16	24.50	24.30	24.29	24.15	24.02	24.00	-
99		12.2 kbps AMR	23.33	23.48	23.36	24.33	24.43	24.42	24.01	24.04	23.94	-
6	HSDPA	Subtest 1	23.51	23.27	23.26	24.63	24.51	24.56	23.81	24.00	23.64	0
6		Subtest 2	23.41	23.30	23.21	24.65	24.34	24.51	23.91	23.61	23.52	0
6		Subtest 3	22.88	22.72	22.78	24.19	23.79	24.05	23.28	23.32	23.16	0.5
6		Subtest 4	22.84	22.82	22.86	24.18	23.81	24.04	23.21	23.49	23.28	0.5
6	HSUPA	Subtest 1	22.09	22.51	22.44	23.55	23.25	23.45	23.39	23.68	23.14	0
6		Subtest 2	20.62	21.22	21.18	21.65	21.45	21.83	21.12	21.11	20.88	2
6		Subtest 3	21.21	21.26	21.13	21.88	22.00	22.16	21.51	21.42	21.36	1
6		Subtest 4	20.74	21.39	21.08	21.65	21.43	21.38	21.23	21.32	21.10	2
6		Subtest 5	22.21	22.49	22.46	23.21	23.06	23.64	23.38	23.64	23.05	0
8	DC-HSDPA	Subtest 1	23.67	23.61	23.46	24.68	24.39	24.59	23.85	24.16	23.92	0
8		Subtest 2	23.59	23.64	23.41	24.58	24.51	24.60	23.65	24.00	23.61	0
8		Subtest 3	23.07	23.17	23.02	24.04	23.91	23.89	23.20	23.51	23.34	0.5
8		Subtest 4	23.16	23.15	23.09	24.01	24.02	23.82	23.29	23.21	23.02	0.5

DC-HSDPA considerations

- 3GPP Specification 34.121-1 Release 8 Ver 8.10.10 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 DC-HSDPA

It is expected by the manufacturer that MPR for some HSPA subtests may be up to 1 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.



Figure 9-2
Power Measurement Setup

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9.3 LTE Conducted Powers

9.3.1 LTE Band 12

Table 9-1
LTE Band 12 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	707.5	23095	10	QPSK	1	0	24.03	0	0
	707.5	23095	10	QPSK	1	25	24.15	0	0
	707.5	23095	10	QPSK	1	49	24.06	0	0
	707.5	23095	10	QPSK	25	0	23.21	0-1	1
	707.5	23095	10	QPSK	25	12	23.15	0-1	1
	707.5	23095	10	QPSK	25	25	23.13	0-1	1
	707.5	23095	10	QPSK	50	0	23.15	0-1	1
	707.5	23095	10	16QAM	1	0	22.78	0-1	1
	707.5	23095	10	16QAM	1	25	22.75	0-1	1
	707.5	23095	10	16QAM	1	49	22.81	0-1	1
	707.5	23095	10	16QAM	25	0	22.12	0-2	2
	707.5	23095	10	16QAM	25	12	22.05	0-2	2
	707.5	23095	10	16QAM	25	25	22.01	0-2	2
	707.5	23095	10	16QAM	50	0	22.04	0-2	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 9-2
LTE Band 12 Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	701.5	23035	5	QPSK	1	0	23.91	0	0
	701.5	23035	5	QPSK	1	12	24.16	0	0
	701.5	23035	5	QPSK	1	24	24.33	0	0
	701.5	23035	5	QPSK	12	0	22.80	0-1	1
	701.5	23035	5	QPSK	12	6	22.91	0-1	1
	701.5	23035	5	QPSK	12	13	23.05	0-1	1
	701.5	23035	5	QPSK	25	0	22.87	0-1	1
	701.5	23035	5	16-QAM	1	0	22.72	0-1	1
	701.5	23035	5	16-QAM	1	12	23.05	0-1	1
	701.5	23035	5	16-QAM	1	24	23.22	0-1	1
	701.5	23035	5	16-QAM	12	0	21.52	0-2	2
	701.5	23035	5	16-QAM	12	6	21.76	0-2	2
Mid	707.5	23095	5	QPSK	1	0	24.27	0	0
	707.5	23095	5	QPSK	1	12	24.16	0	0
	707.5	23095	5	QPSK	1	24	23.98	0	0
	707.5	23095	5	QPSK	12	0	22.90	0-1	1
	707.5	23095	5	QPSK	12	6	22.96	0-1	1
	707.5	23095	5	QPSK	12	13	22.75	0-1	1
	707.5	23095	5	QPSK	25	0	22.84	0-1	1
	707.5	23095	5	16-QAM	1	0	23.12	0-1	1
	707.5	23095	5	16-QAM	1	12	22.93	0-1	1
	707.5	23095	5	16-QAM	1	24	22.65	0-1	1
	707.5	23095	5	16-QAM	12	0	21.75	0-2	2
	707.5	23095	5	16-QAM	12	6	21.95	0-2	2
High	713.5	23155	5	QPSK	1	0	24.01	0	0
	713.5	23155	5	QPSK	1	12	24.11	0	0
	713.5	23155	5	QPSK	1	24	24.27	0	0
	713.5	23155	5	QPSK	12	0	22.67	0-1	1
	713.5	23155	5	QPSK	12	6	23.12	0-1	1
	713.5	23155	5	QPSK	12	13	22.87	0-1	1
	713.5	23155	5	QPSK	25	0	22.78	0-1	1
	713.5	23155	5	16-QAM	1	0	22.91	0-1	1
	713.5	23155	5	16-QAM	1	12	22.75	0-1	1
	713.5	23155	5	16-QAM	1	24	22.72	0-1	1
	713.5	23155	5	16-QAM	12	0	22.00	0-2	2
	713.5	23155	5	16-QAM	12	6	21.99	0-2	2
	713.5	23155	5	16-QAM	12	13	22.06	0-2	2
	713.5	23155	5	16-QAM	25	0	21.96	0-2	2

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	700.5	23025	3	QPSK	1	0	23.94	0	0
	700.5	23025	3	QPSK	1	7	24.09	0	0
	700.5	23025	3	QPSK	1	14	24.25	0	0
	700.5	23025	3	QPSK	8	0	22.80	0-1	1
	700.5	23025	3	QPSK	8	4	22.97	0-1	1
	700.5	23025	3	QPSK	8	7	22.95	0-1	1
	700.5	23025	3	QPSK	15	0	22.96	0-1	1
	700.5	23025	3	16-QAM	1	0	22.78	0-1	1
	700.5	23025	3	16-QAM	1	7	23.09	0-1	1
	700.5	23025	3	16-QAM	1	14	23.17	0-1	1
	700.5	23025	3	16-QAM	8	0	21.72	0-2	2
	700.5	23025	3	16-QAM	8	4	21.61	0-2	2
Mid	707.5	23095	3	QPSK	1	0	24.15	0	0
	707.5	23095	3	QPSK	1	7	24.32	0	0
	707.5	23095	3	QPSK	1	14	23.79	0	0
	707.5	23095	3	QPSK	8	0	23.07	0-1	1
	707.5	23095	3	QPSK	8	4	23.04	0-1	1
	707.5	23095	3	QPSK	8	7	22.68	0-1	1
	707.5	23095	3	QPSK	15	0	22.88	0-1	1
	707.5	23095	3	16-QAM	1	0	23.29	0-1	1
	707.5	23095	3	16-QAM	1	7	22.76	0-1	1
	707.5	23095	3	16-QAM	1	14	22.64	0-1	1
	707.5	23095	3	16-QAM	8	0	21.95	0-2	2
	707.5	23095	3	16-QAM	8	4	21.97	0-2	2
High	707.5	23095	3	16-QAM	8	7	21.84	0-2	2
	707.5	23095	3	16-QAM	15	0	21.98	0-2	2
	714.5	23165	3	QPSK	1	0	24.19	0	0
	714.5	23165	3	QPSK	1	7	24.15	0	0
	714.5	23165	3	QPSK	1	14	24.16	0	0
	714.5	23165	3	QPSK	8	0	22.54	0-1	1
	714.5	23165	3	QPSK	8	4	23.07	0-1	1
	714.5	23165	3	QPSK	8	7	22.84	0-1	1
	714.5	23165	3	QPSK	15	0	22.91	0-1	1
	714.5	23165	3	16-QAM	1	0	22.86	0-1	1
	714.5	23165	3	16-QAM	1	7	22.75	0-1	1
	714.5	23165	3	16-QAM	1	14	22.88	0-1	1
	714.5	23165	3	16-QAM	8	0	21.91	0-2	2
	714.5	23165	3	16-QAM	8	4	21.88	0-2	2
	714.5	23165	3	16-QAM	8	7	22.22	0-2	2
	714.5	23165	3	16-QAM	8	0	21.96	0-2	2
	714.5	23165	3	16-QAM	15	0	21.96	0-2	2
	714.5	23165	3	16-QAM	15	0	21.96	0-2	2

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Table 9-4
LTE Band 12 Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	699.7	23017	1.4	QPSK	1	0	23.83	0	0
	699.7	23017	1.4	QPSK	1	2	24.02	0	0
	699.7	23017	1.4	QPSK	1	5	24.28	0	0
	699.7	23017	1.4	QPSK	3	0	23.77	0	0
	699.7	23017	1.4	QPSK	3	2	24.01	0	0
	699.7	23017	1.4	QPSK	3	3	24.05	0	0
	699.7	23017	1.4	QPSK	6	0	23.10	0-1	1
	699.7	23017	1.4	16-QAM	1	0	22.94	0-1	1
	699.7	23017	1.4	16-QAM	1	2	22.99	0-1	1
	699.7	23017	1.4	16-QAM	1	5	23.17	0-1	1
	699.7	23017	1.4	16-QAM	3	0	22.60	0-1	1
	699.7	23017	1.4	16-QAM	3	2	22.65	0-1	1
	699.7	23017	1.4	16-QAM	3	3	22.70	0-1	1
Mid	699.7	23017	1.4	16-QAM	6	0	22.00	0-2	2
	707.5	23095	1.4	QPSK	1	0	23.98	0	0
	707.5	23095	1.4	QPSK	1	2	24.31	0	0
	707.5	23095	1.4	QPSK	1	5	23.69	0	0
	707.5	23095	1.4	QPSK	3	0	24.10	0	0
	707.5	23095	1.4	QPSK	3	2	24.21	0	0
	707.5	23095	1.4	QPSK	3	3	23.84	0	0
	707.5	23095	1.4	QPSK	6	0	22.74	0-1	1
	707.5	23095	1.4	16-QAM	1	0	23.33	0-1	1
	707.5	23095	1.4	16-QAM	1	2	22.73	0-1	1
	707.5	23095	1.4	16-QAM	1	5	22.50	0-1	1
	707.5	23095	1.4	16-QAM	3	0	22.92	0-1	1
	707.5	23095	1.4	16-QAM	3	2	23.10	0-1	1
	707.5	23095	1.4	16-QAM	3	3	22.80	0-1	1
High	707.5	23095	1.4	16-QAM	6	0	22.12	0-2	2
	715.3	23173	1.4	QPSK	1	0	24.02	0	0
	715.3	23173	1.4	QPSK	1	2	24.08	0	0
	715.3	23173	1.4	QPSK	1	5	24.14	0	0
	715.3	23173	1.4	QPSK	3	0	23.51	0	0
	715.3	23173	1.4	QPSK	3	2	23.97	0	0
	715.3	23173	1.4	QPSK	3	3	23.64	0	0
	715.3	23173	1.4	QPSK	6	0	23.01	0-1	1
	715.3	23173	1.4	16-QAM	1	0	22.95	0-1	1
	715.3	23173	1.4	16-QAM	1	2	22.75	0-1	1
	715.3	23173	1.4	16-QAM	1	5	22.83	0-1	1
	715.3	23173	1.4	16-QAM	3	0	22.98	0-1	1
	715.3	23173	1.4	16-QAM	3	2	22.91	0-1	1
	715.3	23173	1.4	16-QAM	3	3	23.06	0-1	1
	715.3	23173	1.4	16-QAM	6	0	21.91	0-2	2

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LTE Band 13

Table 9-5
LTE Band 13 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	782.0	23230	10	QPSK	1	0	24.39	0	0
	782.0	23230	10	QPSK	1	25	24.37	0	0
	782.0	23230	10	QPSK	1	49	24.40	0	0
	782.0	23230	10	QPSK	25	0	23.34	0-1	1
	782.0	23230	10	QPSK	25	12	23.33	0-1	1
	782.0	23230	10	QPSK	25	25	23.39	0-1	1
	782.0	23230	10	QPSK	50	0	23.37	0-1	1
	782.0	23230	10	16QAM	1	0	23.27	0-1	1
	782.0	23230	10	16QAM	1	25	23.21	0-1	1
	782.0	23230	10	16QAM	1	49	23.38	0-1	1
	782.0	23230	10	16QAM	25	0	22.35	0-2	2
	782.0	23230	10	16QAM	25	12	22.36	0-2	2
	782.0	23230	10	16QAM	25	25	22.38	0-2	2
	782.0	23230	10	16QAM	50	0	22.37	0-2	2

Table 9-6
LTE Band 13 Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	782.0	23230	5	QPSK	1	0	24.18	0	0
	782.0	23230	5	QPSK	1	12	24.39	0	0
	782.0	23230	5	QPSK	1	24	24.34	0	0
	782.0	23230	5	QPSK	12	0	23.33	0-1	1
	782.0	23230	5	QPSK	12	6	23.08	0-1	1
	782.0	23230	5	QPSK	12	13	23.29	0-1	1
	782.0	23230	5	QPSK	25	0	23.38	0-1	1
	782.0	23230	5	16-QAM	1	0	23.18	0-1	1
	782.0	23230	5	16-QAM	1	12	23.28	0-1	1
	782.0	23230	5	16-QAM	1	24	23.36	0-1	1
	782.0	23230	5	16-QAM	12	0	22.06	0-2	2
	782.0	23230	5	16-QAM	12	6	22.40	0-2	2
	782.0	23230	5	16-QAM	12	13	22.20	0-2	2
	782.0	23230	5	16-QAM	25	0	22.27	0-2	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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LTE Band 5 (Cell)

Table 9-7
LTE Band 5 (Cell) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	836.5	20525	10	QPSK	1	0	24.15	0	0
	836.5	20525	10	QPSK	1	25	24.06	0	0
	836.5	20525	10	QPSK	1	49	24.05	0	0
	836.5	20525	10	QPSK	25	0	22.98	0-1	1
	836.5	20525	10	QPSK	25	12	22.97	0-1	1
	836.5	20525	10	QPSK	25	25	22.99	0-1	1
	836.5	20525	10	QPSK	50	0	22.95	0-1	1
	836.5	20525	10	16QAM	1	0	23.36	0-1	1
	836.5	20525	10	16QAM	1	25	23.32	0-1	1
	836.5	20525	10	16QAM	1	49	23.40	0-1	1
	836.5	20525	10	16QAM	25	0	22.06	0-2	2
	836.5	20525	10	16QAM	25	12	21.97	0-2	2
	836.5	20525	10	16QAM	25	25	22.00	0-2	2
	836.5	20525	10	16QAM	50	0	21.98	0-2	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.

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Table 9-8
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	826.5	20425	5	QPSK	1	0	23.98	0	0
	826.5	20425	5	QPSK	1	12	24.28	0	0
	826.5	20425	5	QPSK	1	24	24.12	0	0
	826.5	20425	5	QPSK	12	0	23.26	0-1	1
	826.5	20425	5	QPSK	12	6	23.27	0-1	1
	826.5	20425	5	QPSK	12	13	23.30	0-1	1
	826.5	20425	5	QPSK	25	0	23.25	0-1	1
	826.5	20425	5	16-QAM	1	0	23.39	0-1	1
	826.5	20425	5	16-QAM	1	12	23.29	0-1	1
	826.5	20425	5	16-QAM	1	24	23.39	0-1	1
	826.5	20425	5	16-QAM	12	0	22.37	0-2	2
	826.5	20425	5	16-QAM	12	6	22.30	0-2	2
	826.5	20425	5	16-QAM	12	13	22.39	0-2	2
	826.5	20425	5	16-QAM	25	0	22.30	0-2	2
Mid	836.5	20525	5	QPSK	1	0	23.98	0	0
	836.5	20525	5	QPSK	1	12	24.08	0	0
	836.5	20525	5	QPSK	1	24	24.06	0	0
	836.5	20525	5	QPSK	12	0	22.90	0-1	1
	836.5	20525	5	QPSK	12	6	23.04	0-1	1
	836.5	20525	5	QPSK	12	13	23.11	0-1	1
	836.5	20525	5	QPSK	25	0	23.03	0-1	1
	836.5	20525	5	16-QAM	1	0	23.06	0-1	1
	836.5	20525	5	16-QAM	1	12	23.17	0-1	1
	836.5	20525	5	16-QAM	1	24	23.07	0-1	1
	836.5	20525	5	16-QAM	12	0	22.02	0-2	2
	836.5	20525	5	16-QAM	12	6	22.15	0-2	2
	836.5	20525	5	16-QAM	12	13	22.22	0-2	2
	836.5	20525	5	16-QAM	25	0	22.08	0-2	2
High	846.5	20625	5	QPSK	1	0	24.37	0	0
	846.5	20625	5	QPSK	1	12	24.14	0	0
	846.5	20625	5	QPSK	1	24	24.05	0	0
	846.5	20625	5	QPSK	12	0	23.32	0-1	1
	846.5	20625	5	QPSK	12	6	23.22	0-1	1
	846.5	20625	5	QPSK	12	13	23.26	0-1	1
	846.5	20625	5	QPSK	25	0	23.29	0-1	1
	846.5	20625	5	16-QAM	1	0	23.37	0-1	1
	846.5	20625	5	16-QAM	1	12	23.27	0-1	1
	846.5	20625	5	16-QAM	1	24	23.20	0-1	1
	846.5	20625	5	16-QAM	12	0	22.40	0-2	2
	846.5	20625	5	16-QAM	12	6	22.31	0-2	2
	846.5	20625	5	16-QAM	12	13	22.34	0-2	2
	846.5	20625	5	16-QAM	25	0	22.34	0-2	2

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	825.5	20415	3	QPSK	1	0	24.15	0	0
	825.5	20415	3	QPSK	1	7	24.37	0	0
	825.5	20415	3	QPSK	1	14	24.33	0	0
	825.5	20415	3	QPSK	8	0	23.09	0-1	1
	825.5	20415	3	QPSK	8	4	23.14	0-1	1
	825.5	20415	3	QPSK	8	7	23.24	0-1	1
	825.5	20415	3	QPSK	15	0	23.27	0-1	1
	825.5	20415	3	16-QAM	1	0	23.29	0-1	1
	825.5	20415	3	16-QAM	1	7	23.19	0-1	1
	825.5	20415	3	16-QAM	1	14	23.36	0-1	1
	825.5	20415	3	16-QAM	8	0	22.02	0-2	2
	825.5	20415	3	16-QAM	8	4	22.10	0-2	2
	825.5	20415	3	16-QAM	8	7	22.32	0-2	2
	825.5	20415	3	16-QAM	15	0	22.30	0-2	2
Mid	836.5	20525	3	QPSK	1	0	24.15	0	0
	836.5	20525	3	QPSK	1	7	24.34	0	0
	836.5	20525	3	QPSK	1	14	24.10	0	0
	836.5	20525	3	QPSK	8	0	23.07	0-1	1
	836.5	20525	3	QPSK	8	4	23.25	0-1	1
	836.5	20525	3	QPSK	8	7	23.28	0-1	1
	836.5	20525	3	QPSK	15	0	23.20	0-1	1
	836.5	20525	3	16-QAM	1	0	23.23	0-1	1
	836.5	20525	3	16-QAM	1	7	23.29	0-1	1
	836.5	20525	3	16-QAM	1	14	23.24	0-1	1
	836.5	20525	3	16-QAM	8	0	22.07	0-2	2
	836.5	20525	3	16-QAM	8	4	22.20	0-2	2
	836.5	20525	3	16-QAM	8	7	22.27	0-2	2
	836.5	20525	3	16-QAM	15	0	22.25	0-2	2
High	847.5	20635	3	QPSK	1	0	24.33	0	0
	847.5	20635	3	QPSK	1	7	24.35	0	0
	847.5	20635	3	QPSK	1	14	24.17	0	0
	847.5	20635	3	QPSK	8	0	23.29	0-1	1
	847.5	20635	3	QPSK	8	4	23.34	0-1	1
	847.5	20635	3	QPSK	8	7	23.27	0-1	1
	847.5	20635	3	QPSK	15	0	23.33	0-1	1
	847.5	20635	3	16-QAM	1	0	23.25	0-1	1
	847.5	20635	3	16-QAM	1	7	23.35	0-1	1
	847.5	20635	3	16-QAM	1	14	23.36	0-1	1
	847.5	20635	3	16-QAM	8	0	22.37	0-2	2
	847.5	20635	3	16-QAM	8	4	22.40	0-2	2
	847.5	20635	3	16-QAM	8	7	22.36	0-2	2
	847.5	20635	3	16-QAM	15	0	22.33	0-2	2

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Table 9-10
LTE Band 5 (Cell) Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	824.7	20407	1.4	QPSK	1	0	23.87	0	0
	824.7	20407	1.4	QPSK	1	2	24.34	0	0
	824.7	20407	1.4	QPSK	1	5	24.40	0	0
	824.7	20407	1.4	QPSK	3	0	23.85	0	0
	824.7	20407	1.4	QPSK	3	2	24.29	0	0
	824.7	20407	1.4	QPSK	3	3	24.07	0	0
	824.7	20407	1.4	QPSK	6	0	23.38	0-1	1
	824.7	20407	1.4	16-QAM	1	0	23.24	0-1	1
	824.7	20407	1.4	16-QAM	1	2	23.00	0-1	1
	824.7	20407	1.4	16-QAM	1	5	23.20	0-1	1
	824.7	20407	1.4	16-QAM	3	0	22.75	0-1	1
	824.7	20407	1.4	16-QAM	3	2	22.83	0-1	1
	824.7	20407	1.4	16-QAM	3	3	23.11	0-1	1
	824.7	20407	1.4	16-QAM	6	0	22.35	0-2	2
Mid	836.5	20525	1.4	QPSK	1	0	24.34	0	0
	836.5	20525	1.4	QPSK	1	2	24.12	0	0
	836.5	20525	1.4	QPSK	1	5	24.05	0	0
	836.5	20525	1.4	QPSK	3	0	24.07	0	0
	836.5	20525	1.4	QPSK	3	2	24.27	0	0
	836.5	20525	1.4	QPSK	3	3	24.37	0	0
	836.5	20525	1.4	QPSK	6	0	23.00	0-1	1
	836.5	20525	1.4	16-QAM	1	0	22.98	0-1	1
	836.5	20525	1.4	16-QAM	1	2	23.33	0-1	1
	836.5	20525	1.4	16-QAM	1	5	23.07	0-1	1
	836.5	20525	1.4	16-QAM	3	0	23.23	0-1	1
	836.5	20525	1.4	16-QAM	3	2	23.00	0-1	1
	836.5	20525	1.4	16-QAM	3	3	23.29	0-1	1
	836.5	20525	1.4	16-QAM	6	0	22.32	0-2	2
High	848.3	20643	1.4	QPSK	1	0	24.12	0	0
	848.3	20643	1.4	QPSK	1	2	24.15	0	0
	848.3	20643	1.4	QPSK	1	5	24.10	0	0
	848.3	20643	1.4	QPSK	3	0	24.06	0	0
	848.3	20643	1.4	QPSK	3	2	24.24	0	0
	848.3	20643	1.4	QPSK	3	3	24.38	0	0
	848.3	20643	1.4	QPSK	6	0	23.26	0-1	1
	848.3	20643	1.4	16-QAM	1	0	23.39	0-1	1
	848.3	20643	1.4	16-QAM	1	2	23.21	0-1	1
	848.3	20643	1.4	16-QAM	1	5	23.23	0-1	1
	848.3	20643	1.4	16-QAM	3	0	23.21	0-1	1
	848.3	20643	1.4	16-QAM	3	2	23.23	0-1	1
	848.3	20643	1.4	16-QAM	3	3	23.37	0-1	1
	848.3	20643	1.4	16-QAM	6	0	22.40	0-2	2

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9.3.4

LTE Band 4 (AWS)

Table 9-11

LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	1732.5	20175	20	QPSK	1	0	24.22	0	0
	1732.5	20175	20	QPSK	1	50	24.54	0	0
	1732.5	20175	20	QPSK	1	99	24.29	0	0
	1732.5	20175	20	QPSK	50	0	23.24	0-1	1
	1732.5	20175	20	QPSK	50	25	23.46	0-1	1
	1732.5	20175	20	QPSK	50	50	23.37	0-1	1
	1732.5	20175	20	QPSK	100	0	23.32	0-1	1
	1732.5	20175	20	16QAM	1	0	23.00	0-1	1
	1732.5	20175	20	16QAM	1	50	23.37	0-1	1
	1732.5	20175	20	16QAM	1	99	23.20	0-1	1
	1732.5	20175	20	16QAM	50	0	22.20	0-2	2
	1732.5	20175	20	16QAM	50	25	22.50	0-2	2
	1732.5	20175	20	16QAM	50	50	22.41	0-2	2
	1732.5	20175	20	16QAM	100	0	22.28	0-2	2

Note: LTE Band 4 (AWS) 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 9-12
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1717.5	20025	15	QPSK	1	0	24.16	0	0
	1717.5	20025	15	QPSK	1	36	24.48	0	0
	1717.5	20025	15	QPSK	1	74	24.23	0	0
	1717.5	20025	15	QPSK	36	0	23.18	0-1	1
	1717.5	20025	15	QPSK	36	18	23.40	0-1	1
	1717.5	20025	15	QPSK	36	37	23.31	0-1	1
	1717.5	20025	15	QPSK	75	0	23.26	0-1	1
	1717.5	20025	15	16QAM	1	0	22.94	0-1	1
	1717.5	20025	15	16QAM	1	36	23.29	0-1	1
	1717.5	20025	15	16QAM	1	74	23.15	0-1	1
	1717.5	20025	15	16QAM	36	0	22.14	0-2	2
	1717.5	20025	15	16QAM	36	18	22.46	0-2	2
	1717.5	20025	15	16QAM	36	37	22.35	0-2	2
	1717.5	20025	15	16QAM	75	0	22.22	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	24.10	0	0
	1732.5	20175	15	QPSK	1	36	23.78	0	0
	1732.5	20175	15	QPSK	1	74	24.00	0	0
	1732.5	20175	15	QPSK	36	0	23.02	0-1	1
	1732.5	20175	15	QPSK	36	18	23.16	0-1	1
	1732.5	20175	15	QPSK	36	37	23.22	0-1	1
	1732.5	20175	15	QPSK	75	0	23.16	0-1	1
	1732.5	20175	15	16QAM	1	0	23.20	0-1	1
	1732.5	20175	15	16QAM	1	36	23.28	0-1	1
	1732.5	20175	15	16QAM	1	74	23.17	0-1	1
	1732.5	20175	15	16QAM	36	0	22.16	0-2	2
	1732.5	20175	15	16QAM	36	18	22.25	0-2	2
	1732.5	20175	15	16QAM	36	37	22.20	0-2	2
	1732.5	20175	15	16QAM	75	0	22.18	0-2	2
High	1747.5	20325	15	QPSK	1	0	24.11	0	0
	1747.5	20325	15	QPSK	1	36	24.47	0	0
	1747.5	20325	15	QPSK	1	74	24.21	0	0
	1747.5	20325	15	QPSK	36	0	23.17	0-1	1
	1747.5	20325	15	QPSK	36	18	23.39	0-1	1
	1747.5	20325	15	QPSK	36	37	23.30	0-1	1
	1747.5	20325	15	QPSK	75	0	23.25	0-1	1
	1747.5	20325	15	16QAM	1	0	22.93	0-1	1
	1747.5	20325	15	16QAM	1	36	23.30	0-1	1
	1747.5	20325	15	16QAM	1	74	23.16	0-1	1
	1747.5	20325	15	16QAM	36	0	22.19	0-2	2
	1747.5	20325	15	16QAM	36	18	22.45	0-2	2
	1747.5	20325	15	16QAM	36	37	22.30	0-2	2
	1747.5	20325	15	16QAM	75	0	22.21	0-2	2

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Table 9-13
LTE Band 4 (AWS) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1715	20000	10	QPSK	1	0	24.13	0	0
	1715	20000	10	QPSK	1	25	24.56	0	0
	1715	20000	10	QPSK	1	49	24.22	0	0
	1715	20000	10	QPSK	25	0	23.16	0-1	1
	1715	20000	10	QPSK	25	12	23.38	0-1	1
	1715	20000	10	QPSK	25	25	23.27	0-1	1
	1715	20000	10	QPSK	50	0	23.25	0-1	1
	1715	20000	10	16QAM	1	0	22.92	0-1	1
	1715	20000	10	16QAM	1	25	23.27	0-1	1
	1715	20000	10	16QAM	1	49	23.13	0-1	1
	1715	20000	10	16QAM	25	0	22.18	0-2	2
	1715	20000	10	16QAM	25	12	22.44	0-2	2
	1715	20000	10	16QAM	25	25	22.33	0-2	2
	1715	20000	10	16QAM	50	0	22.19	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	24.08	0	0
	1732.5	20175	10	QPSK	1	25	23.76	0	0
	1732.5	20175	10	QPSK	1	49	23.98	0	0
	1732.5	20175	10	QPSK	25	0	23.03	0-1	1
	1732.5	20175	10	QPSK	25	12	23.14	0-1	1
	1732.5	20175	10	QPSK	25	25	23.20	0-1	1
	1732.5	20175	10	QPSK	50	0	23.14	0-1	1
	1732.5	20175	10	16QAM	1	0	23.18	0-1	1
	1732.5	20175	10	16QAM	1	25	23.26	0-1	1
	1732.5	20175	10	16QAM	1	49	23.15	0-1	1
	1732.5	20175	10	16QAM	25	0	22.14	0-2	2
	1732.5	20175	10	16QAM	25	12	22.23	0-2	2
	1732.5	20175	10	16QAM	25	25	22.18	0-2	2
	1732.5	20175	10	16QAM	50	0	22.21	0-2	2
High	1750	20350	10	QPSK	1	0	24.09	0	0
	1750	20350	10	QPSK	1	25	24.49	0	0
	1750	20350	10	QPSK	1	49	24.18	0	0
	1750	20350	10	QPSK	25	0	23.15	0-1	1
	1750	20350	10	QPSK	25	12	23.33	0-1	1
	1750	20350	10	QPSK	25	25	23.28	0-1	1
	1750	20350	10	QPSK	50	0	23.23	0-1	1
	1750	20350	10	16QAM	1	0	22.91	0-1	1
	1750	20350	10	16QAM	1	25	23.30	0-1	1
	1750	20350	10	16QAM	1	49	23.14	0-1	1
	1750	20350	10	16QAM	25	0	22.17	0-2	2
	1750	20350	10	16QAM	25	12	22.41	0-2	2
	1750	20350	10	16QAM	25	25	22.25	0-2	2
	1750	20350	10	16QAM	50	0	22.15	0-2	2

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Table 9-14
LTE Band 4 (AWS) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1712.5	19975	5	QPSK	1	0	24.04	0	0
	1712.5	19975	5	QPSK	1	12	24.10	0	0
	1712.5	19975	5	QPSK	1	24	24.17	0	0
	1712.5	19975	5	QPSK	12	0	22.94	0-1	1
	1712.5	19975	5	QPSK	12	6	23.03	0-1	1
	1712.5	19975	5	QPSK	12	13	23.07	0-1	1
	1712.5	19975	5	QPSK	25	0	23.03	0-1	1
	1712.5	19975	5	16-QAM	1	0	22.97	0-1	1
	1712.5	19975	5	16-QAM	1	12	23.09	0-1	1
	1712.5	19975	5	16-QAM	1	24	23.16	0-1	1
	1712.5	19975	5	16-QAM	12	0	22.00	0-2	2
	1712.5	19975	5	16-QAM	12	6	22.06	0-2	2
	1712.5	19975	5	16-QAM	12	13	22.11	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	24.30	0	0
	1732.5	20175	5	QPSK	1	12	24.16	0	0
	1732.5	20175	5	QPSK	1	24	24.01	0	0
	1732.5	20175	5	QPSK	12	0	23.19	0-1	1
	1732.5	20175	5	QPSK	12	6	23.19	0-1	1
	1732.5	20175	5	QPSK	12	13	23.10	0-1	1
	1732.5	20175	5	QPSK	25	0	23.14	0-1	1
	1732.5	20175	5	16-QAM	1	0	23.10	0-1	1
	1732.5	20175	5	16-QAM	1	12	23.04	0-1	1
	1732.5	20175	5	16-QAM	1	24	23.46	0-1	1
	1732.5	20175	5	16-QAM	12	0	22.14	0-2	2
	1732.5	20175	5	16-QAM	12	6	22.25	0-2	2
	1732.5	20175	5	16-QAM	12	13	22.16	0-2	2
	1732.5	20175	5	16-QAM	25	0	22.09	0-2	2
High	1752.5	20375	5	QPSK	1	0	24.21	0	0
	1752.5	20375	5	QPSK	1	12	24.26	0	0
	1752.5	20375	5	QPSK	1	24	24.27	0	0
	1752.5	20375	5	QPSK	12	0	23.26	0-1	1
	1752.5	20375	5	QPSK	12	6	23.25	0-1	1
	1752.5	20375	5	QPSK	12	13	23.12	0-1	1
	1752.5	20375	5	QPSK	25	0	23.18	0-1	1
	1752.5	20375	5	16-QAM	1	0	23.10	0-1	1
	1752.5	20375	5	16-QAM	1	12	23.02	0-1	1
	1752.5	20375	5	16-QAM	1	24	23.08	0-1	1
	1752.5	20375	5	16-QAM	12	0	22.22	0-2	2
	1752.5	20375	5	16-QAM	12	6	22.19	0-2	2
	1752.5	20375	5	16-QAM	12	13	22.16	0-2	2
	1752.5	20375	5	16-QAM	25	0	22.17	0-2	2

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Table 9-15
LTE Band 4 (AWS) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1711.5	19965	3	QPSK	1	0	24.18	0	0
	1711.5	19965	3	QPSK	1	7	24.15	0	0
	1711.5	19965	3	QPSK	1	14	24.23	0	0
	1711.5	19965	3	QPSK	8	0	23.02	0-1	1
	1711.5	19965	3	QPSK	8	4	22.97	0-1	1
	1711.5	19965	3	QPSK	8	7	23.12	0-1	1
	1711.5	19965	3	QPSK	15	0	23.08	0-1	1
	1711.5	19965	3	16-QAM	1	0	23.02	0-1	1
	1711.5	19965	3	16-QAM	1	7	23.14	0-1	1
	1711.5	19965	3	16-QAM	1	14	23.21	0-1	1
	1711.5	19965	3	16-QAM	8	0	22.10	0-2	2
	1711.5	19965	3	16-QAM	8	4	22.11	0-2	2
	1711.5	19965	3	16-QAM	8	7	22.16	0-2	2
Mid	1732.5	20175	3	QPSK	1	0	24.32	0	0
	1732.5	20175	3	QPSK	1	7	24.21	0	0
	1732.5	20175	3	QPSK	1	14	24.12	0	0
	1732.5	20175	3	QPSK	8	0	23.24	0-1	1
	1732.5	20175	3	QPSK	8	4	23.21	0-1	1
	1732.5	20175	3	QPSK	8	7	23.15	0-1	1
	1732.5	20175	3	QPSK	15	0	23.19	0-1	1
	1732.5	20175	3	16-QAM	1	0	23.15	0-1	1
	1732.5	20175	3	16-QAM	1	7	23.09	0-1	1
	1732.5	20175	3	16-QAM	1	14	23.51	0-1	1
	1732.5	20175	3	16-QAM	8	0	22.19	0-2	2
	1732.5	20175	3	16-QAM	8	4	22.30	0-2	2
	1732.5	20175	3	16-QAM	8	7	22.21	0-2	2
	1732.5	20175	3	16-QAM	15	0	22.14	0-2	2
High	1753.5	20385	3	QPSK	1	0	24.26	0	0
	1753.5	20385	3	QPSK	1	7	24.30	0	0
	1753.5	20385	3	QPSK	1	14	24.24	0	0
	1753.5	20385	3	QPSK	8	0	23.31	0-1	1
	1753.5	20385	3	QPSK	8	4	23.30	0-1	1
	1753.5	20385	3	QPSK	8	7	23.17	0-1	1
	1753.5	20385	3	QPSK	15	0	23.23	0-1	1
	1753.5	20385	3	16-QAM	1	0	23.15	0-1	1
	1753.5	20385	3	16-QAM	1	7	23.07	0-1	1
	1753.5	20385	3	16-QAM	1	14	23.13	0-1	1
	1753.5	20385	3	16-QAM	8	0	22.30	0-2	2
	1753.5	20385	3	16-QAM	8	4	22.24	0-2	2
	1753.5	20385	3	16-QAM	8	7	22.21	0-2	2
	1753.5	20385	3	16-QAM	15	0	22.26	0-2	2

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Table 9-16
LTE Band 4 (AWS) Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1710.7	19957	1.4	QPSK	1	0	24.01	0	0
	1710.7	19957	1.4	QPSK	1	2	24.22	0	0
	1710.7	19957	1.4	QPSK	1	5	24.13	0	0
	1710.7	19957	1.4	QPSK	3	0	23.91	0	0
	1710.7	19957	1.4	QPSK	3	2	24.03	0	0
	1710.7	19957	1.4	QPSK	3	3	24.04	0	0
	1710.7	19957	1.4	QPSK	6	0	23.00	0-1	1
	1710.7	19957	1.4	16-QAM	1	0	22.94	0-1	1
	1710.7	19957	1.4	16-QAM	1	2	23.06	0-1	1
	1710.7	19957	1.4	16-QAM	1	5	23.13	0-1	1
	1710.7	19957	1.4	16-QAM	3	0	22.97	0-1	1
	1710.7	19957	1.4	16-QAM	3	2	23.03	0-1	1
	1710.7	19957	1.4	16-QAM	3	3	23.09	0-1	1
Mid	1710.7	19957	1.4	16-QAM	6	0	22.02	0-2	2
	1732.5	20175	1.4	QPSK	1	0	24.27	0	0
	1732.5	20175	1.4	QPSK	1	2	24.13	0	0
	1732.5	20175	1.4	QPSK	1	5	23.98	0	0
	1732.5	20175	1.4	QPSK	3	0	24.16	0	0
	1732.5	20175	1.4	QPSK	3	2	24.15	0	0
	1732.5	20175	1.4	QPSK	3	3	24.03	0	0
	1732.5	20175	1.4	QPSK	6	0	23.11	0-1	1
	1732.5	20175	1.4	16-QAM	1	0	23.07	0-1	1
	1732.5	20175	1.4	16-QAM	1	2	23.01	0-1	1
	1732.5	20175	1.4	16-QAM	1	5	23.43	0-1	1
	1732.5	20175	1.4	16-QAM	3	0	23.18	0-1	1
	1732.5	20175	1.4	16-QAM	3	2	23.22	0-1	1
High	1732.5	20175	1.4	16-QAM	3	3	23.26	0-1	1
	1732.5	20175	1.4	16-QAM	6	0	22.06	0-2	2
	1754.3	20393	1.4	QPSK	1	0	24.18	0	0
	1754.3	20393	1.4	QPSK	1	2	24.23	0	0
	1754.3	20393	1.4	QPSK	1	5	24.24	0	0
	1754.3	20393	1.4	QPSK	3	0	24.20	0	0
	1754.3	20393	1.4	QPSK	3	2	24.12	0	0
	1754.3	20393	1.4	QPSK	3	3	24.07	0	0
	1754.3	20393	1.4	QPSK	6	0	23.15	0-1	1
	1754.3	20393	1.4	16-QAM	1	0	23.07	0-1	1
	1754.3	20393	1.4	16-QAM	1	2	22.99	0-1	1
	1754.3	20393	1.4	16-QAM	1	5	23.05	0-1	1
	1754.3	20393	1.4	16-QAM	3	0	23.14	0-1	1
	1754.3	20393	1.4	16-QAM	3	2	23.16	0-1	1
	1754.3	20393	1.4	16-QAM	3	3	23.11	0-1	1
	1754.3	20393	1.4	16-QAM	6	0	22.03	0-2	2

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LTE Band 2 (PCS)

Table 9-17

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1860	18700	20	QPSK	1	0	23.93	0	0
	1860	18700	20	QPSK	1	50	23.86	0	0
	1860	18700	20	QPSK	1	99	23.97	0	0
	1860	18700	20	QPSK	50	0	22.91	0-1	1
	1860	18700	20	QPSK	50	25	22.87	0-1	1
	1860	18700	20	QPSK	50	50	22.96	0-1	1
	1860	18700	20	QPSK	100	0	22.92	0-1	1
	1860	18700	20	16QAM	1	0	22.83	0-1	1
	1860	18700	20	16QAM	1	50	22.83	0-1	1
	1860	18700	20	16QAM	1	99	23.01	0-1	1
	1860	18700	20	16QAM	50	0	21.79	0-2	2
	1860	18700	20	16QAM	50	25	21.86	0-2	2
	1860	18700	20	16QAM	50	50	21.84	0-2	2
	1860	18700	20	16QAM	100	0	21.85	0-2	2
Mid	1880.0	18900	20	QPSK	1	0	23.94	0	0
	1880.0	18900	20	QPSK	1	50	23.81	0	0
	1880.0	18900	20	QPSK	1	99	23.84	0	0
	1880.0	18900	20	QPSK	50	0	22.82	0-1	1
	1880.0	18900	20	QPSK	50	25	22.94	0-1	1
	1880.0	18900	20	QPSK	50	50	22.95	0-1	1
	1880.0	18900	20	QPSK	100	0	22.83	0-1	1
	1880.0	18900	20	16QAM	1	0	22.93	0-1	1
	1880.0	18900	20	16QAM	1	50	22.82	0-1	1
	1880.0	18900	20	16QAM	1	99	22.70	0-1	1
	1880.0	18900	20	16QAM	50	0	21.83	0-2	2
	1880.0	18900	20	16QAM	50	25	21.96	0-2	2
	1880.0	18900	20	16QAM	50	50	21.91	0-2	2
	1880.0	18900	20	16QAM	100	0	21.86	0-2	2
High	1900	19100	20	QPSK	1	0	23.70	0	0
	1900	19100	20	QPSK	1	50	23.80	0	0
	1900	19100	20	QPSK	1	99	23.30	0	0
	1900	19100	20	QPSK	50	0	22.59	0-1	1
	1900	19100	20	QPSK	50	25	22.75	0-1	1
	1900	19100	20	QPSK	50	50	22.86	0-1	1
	1900	19100	20	QPSK	100	0	22.73	0-1	1
	1900	19100	20	16QAM	1	0	22.51	0-1	1
	1900	19100	20	16QAM	1	50	22.65	0-1	1
	1900	19100	20	16QAM	1	99	22.37	0-1	1
	1900	19100	20	16QAM	50	0	21.50	0-2	2
	1900	19100	20	16QAM	50	25	21.71	0-2	2
	1900	19100	20	16QAM	50	50	21.82	0-2	2
	1900	19100	20	16QAM	100	0	21.69	0-2	2

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Table 9-18
LTE Band 2 (PCS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1857.5	18675	15	QPSK	1	0	23.95	0	0
	1857.5	18675	15	QPSK	1	36	23.79	0	0
	1857.5	18675	15	QPSK	1	74	23.81	0	0
	1857.5	18675	15	QPSK	36	0	23.03	0-1	1
	1857.5	18675	15	QPSK	36	18	22.76	0-1	1
	1857.5	18675	15	QPSK	36	37	22.85	0-1	1
	1857.5	18675	15	QPSK	75	0	22.79	0-1	1
	1857.5	18675	15	16QAM	1	0	22.67	0-1	1
	1857.5	18675	15	16QAM	1	36	22.79	0-1	1
	1857.5	18675	15	16QAM	1	74	23.00	0-1	1
	1857.5	18675	15	16QAM	36	0	21.67	0-2	2
	1857.5	18675	15	16QAM	36	18	21.75	0-2	2
	1857.5	18675	15	16QAM	36	37	21.73	0-2	2
Mid	1857.5	18675	15	16QAM	75	0	21.83	0-2	2
	1880.0	18900	15	QPSK	1	0	23.74	0	0
	1880.0	18900	15	QPSK	1	36	23.70	0	0
	1880.0	18900	15	QPSK	1	74	23.73	0	0
	1880.0	18900	15	QPSK	36	0	22.73	0-1	1
	1880.0	18900	15	QPSK	36	18	22.83	0-1	1
	1880.0	18900	15	QPSK	36	37	22.84	0-1	1
	1880.0	18900	15	QPSK	75	0	22.72	0-1	1
	1880.0	18900	15	16QAM	1	0	22.78	0-1	1
	1880.0	18900	15	16QAM	1	36	22.71	0-1	1
	1880.0	18900	15	16QAM	1	74	22.59	0-1	1
	1880.0	18900	15	16QAM	36	0	21.72	0-2	2
	1880.0	18900	15	16QAM	36	18	21.85	0-2	2
	1880.0	18900	15	16QAM	36	37	21.80	0-2	2
High	1880.0	18900	15	16QAM	75	0	21.74	0-2	2
	1902.5	19125	15	QPSK	1	0	23.60	0	0
	1902.5	19125	15	QPSK	1	36	23.60	0	0
	1902.5	19125	15	QPSK	1	74	23.22	0	0
	1902.5	19125	15	QPSK	36	0	22.48	0-1	1
	1902.5	19125	15	QPSK	36	18	22.65	0-1	1
	1902.5	19125	15	QPSK	36	37	22.72	0-1	1
	1902.5	19125	15	QPSK	75	0	22.62	0-1	1
	1902.5	19125	15	16QAM	1	0	22.40	0-1	1
	1902.5	19125	15	16QAM	1	36	22.54	0-1	1
	1902.5	19125	15	16QAM	1	74	22.43	0-1	1
	1902.5	19125	15	16QAM	36	0	21.39	0-2	2
	1902.5	19125	15	16QAM	36	18	21.57	0-2	2
	1902.5	19125	15	16QAM	36	37	21.75	0-2	2
	1902.5	19125	15	16QAM	75	0	21.63	0-2	2

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Table 9-19
LTE Band 2 (PCS) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1855	18650	10	QPSK	1	0	24.01	0	0
	1855	18650	10	QPSK	1	25	23.85	0	0
	1855	18650	10	QPSK	1	49	23.79	0	0
	1855	18650	10	QPSK	25	0	22.86	0-1	1
	1855	18650	10	QPSK	25	12	22.82	0-1	1
	1855	18650	10	QPSK	25	25	22.91	0-1	1
	1855	18650	10	QPSK	50	0	22.85	0-1	1
	1855	18650	10	16QAM	1	0	22.73	0-1	1
	1855	18650	10	16QAM	1	25	22.78	0-1	1
	1855	18650	10	16QAM	1	49	22.96	0-1	1
	1855	18650	10	16QAM	25	0	21.73	0-2	2
	1855	18650	10	16QAM	25	12	21.81	0-2	2
	1855	18650	10	16QAM	25	25	21.79	0-2	2
	1855	18650	10	16QAM	50	0	21.77	0-2	2
Mid	1880.0	18900	10	QPSK	1	0	23.80	0	0
	1880.0	18900	10	QPSK	1	25	23.76	0	0
	1880.0	18900	10	QPSK	1	49	23.79	0	0
	1880.0	18900	10	QPSK	25	0	22.79	0-1	1
	1880.0	18900	10	QPSK	25	12	22.89	0-1	1
	1880.0	18900	10	QPSK	25	25	22.90	0-1	1
	1880.0	18900	10	QPSK	50	0	22.78	0-1	1
	1880.0	18900	10	16QAM	1	0	22.84	0-1	1
	1880.0	18900	10	16QAM	1	25	22.77	0-1	1
	1880.0	18900	10	16QAM	1	49	22.65	0-1	1
	1880.0	18900	10	16QAM	25	0	21.78	0-2	2
	1880.0	18900	10	16QAM	25	12	21.91	0-2	2
	1880.0	18900	10	16QAM	25	25	21.86	0-2	2
	1880.0	18900	10	16QAM	50	0	21.80	0-2	2
High	1905	19150	10	QPSK	1	0	23.66	0	0
	1905	19150	10	QPSK	1	25	23.66	0	0
	1905	19150	10	QPSK	1	49	23.28	0	0
	1905	19150	10	QPSK	25	0	22.54	0-1	1
	1905	19150	10	QPSK	25	12	22.71	0-1	1
	1905	19150	10	QPSK	25	25	22.81	0-1	1
	1905	19150	10	QPSK	50	0	22.68	0-1	1
	1905	19150	10	16QAM	1	0	22.46	0-1	1
	1905	19150	10	16QAM	1	25	22.60	0-1	1
	1905	19150	10	16QAM	1	49	22.32	0-1	1
	1905	19150	10	16QAM	25	0	21.45	0-2	2
	1905	19150	10	16QAM	25	12	21.63	0-2	2
	1905	19150	10	16QAM	25	25	21.80	0-2	2
	1905	19150	10	16QAM	50	0	21.64	0-2	2

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Table 9-20
LTE Band 2 (PCS) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1852.5	18625	5	QPSK	1	0	23.84	0	0
	1852.5	18625	5	QPSK	1	12	23.83	0	0
	1852.5	18625	5	QPSK	1	24	23.94	0	0
	1852.5	18625	5	QPSK	12	0	22.88	0-1	1
	1852.5	18625	5	QPSK	12	6	22.84	0-1	1
	1852.5	18625	5	QPSK	12	13	22.90	0-1	1
	1852.5	18625	5	QPSK	25	0	22.89	0-1	1
	1852.5	18625	5	16-QAM	1	0	22.79	0-1	1
	1852.5	18625	5	16-QAM	1	12	22.80	0-1	1
	1852.5	18625	5	16-QAM	1	24	22.98	0-1	1
	1852.5	18625	5	16-QAM	12	0	21.76	0-2	2
	1852.5	18625	5	16-QAM	12	6	21.75	0-2	2
	1852.5	18625	5	16-QAM	12	13	21.81	0-2	2
	1852.5	18625	5	16-QAM	25	0	21.82	0-2	2
Mid	1880.0	18900	5	QPSK	1	0	23.88	0	0
	1880.0	18900	5	QPSK	1	12	23.78	0	0
	1880.0	18900	5	QPSK	1	24	23.81	0	0
	1880.0	18900	5	QPSK	12	0	22.80	0-1	1
	1880.0	18900	5	QPSK	12	6	22.91	0-1	1
	1880.0	18900	5	QPSK	12	13	22.92	0-1	1
	1880.0	18900	5	QPSK	25	0	22.80	0-1	1
	1880.0	18900	5	16-QAM	1	0	22.90	0-1	1
	1880.0	18900	5	16-QAM	1	12	22.79	0-1	1
	1880.0	18900	5	16-QAM	1	24	22.70	0-1	1
	1880.0	18900	5	16-QAM	12	0	21.80	0-2	2
	1880.0	18900	5	16-QAM	12	6	21.93	0-2	2
	1880.0	18900	5	16-QAM	12	13	21.88	0-2	2
	1880.0	18900	5	16-QAM	25	0	21.83	0-2	2
High	1907.5	19175	5	QPSK	1	0	23.67	0	0
	1907.5	19175	5	QPSK	1	12	23.68	0	0
	1907.5	19175	5	QPSK	1	24	23.27	0	0
	1907.5	19175	5	QPSK	12	0	22.56	0-1	1
	1907.5	19175	5	QPSK	12	6	22.70	0-1	1
	1907.5	19175	5	QPSK	12	13	22.83	0-1	1
	1907.5	19175	5	QPSK	25	0	22.70	0-1	1
	1907.5	19175	5	16-QAM	1	0	22.43	0-1	1
	1907.5	19175	5	16-QAM	1	12	22.63	0-1	1
	1907.5	19175	5	16-QAM	1	24	22.34	0-1	1
	1907.5	19175	5	16-QAM	12	0	21.47	0-2	2
	1907.5	19175	5	16-QAM	12	6	21.68	0-2	2
	1907.5	19175	5	16-QAM	12	13	21.79	0-2	2
	1907.5	19175	5	16-QAM	25	0	21.65	0-2	2

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Table 9-21
LTE Band 2 (PCS) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1851.5	18615	3	QPSK	1	0	23.92	0	0
	1851.5	18615	3	QPSK	1	7	23.76	0	0
	1851.5	18615	3	QPSK	1	14	23.78	0	0
	1851.5	18615	3	QPSK	8	0	23.00	0-1	1
	1851.5	18615	3	QPSK	8	4	22.73	0-1	1
	1851.5	18615	3	QPSK	8	7	22.82	0-1	1
	1851.5	18615	3	QPSK	15	0	22.76	0-1	1
	1851.5	18615	3	16-QAM	1	0	22.76	0-1	1
	1851.5	18615	3	16-QAM	1	7	22.76	0-1	1
	1851.5	18615	3	16-QAM	1	14	22.97	0-1	1
	1851.5	18615	3	16-QAM	8	0	22.03	0-2	2
	1851.5	18615	3	16-QAM	8	4	21.72	0-2	2
	1851.5	18615	3	16-QAM	8	7	21.70	0-2	2
	1851.5	18615	3	16-QAM	15	0	21.80	0-2	2
Mid	1880.0	18900	3	QPSK	1	0	23.71	0	0
	1880.0	18900	3	QPSK	1	7	23.67	0	0
	1880.0	18900	3	QPSK	1	14	23.70	0	0
	1880.0	18900	3	QPSK	8	0	22.87	0-1	1
	1880.0	18900	3	QPSK	8	4	22.80	0-1	1
	1880.0	18900	3	QPSK	8	7	22.81	0-1	1
	1880.0	18900	3	QPSK	15	0	22.69	0-1	1
	1880.0	18900	3	16-QAM	1	0	22.75	0-1	1
	1880.0	18900	3	16-QAM	1	7	22.68	0-1	1
	1880.0	18900	3	16-QAM	1	14	22.56	0-1	1
	1880.0	18900	3	16-QAM	8	0	21.69	0-2	2
	1880.0	18900	3	16-QAM	8	4	21.82	0-2	2
	1880.0	18900	3	16-QAM	8	7	21.77	0-2	2
	1880.0	18900	3	16-QAM	15	0	21.71	0-2	2
High	1908.5	19185	3	QPSK	1	0	23.57	0	0
	1908.5	19185	3	QPSK	1	7	23.58	0	0
	1908.5	19185	3	QPSK	1	14	23.68	0	0
	1908.5	19185	3	QPSK	8	0	22.45	0-1	1
	1908.5	19185	3	QPSK	8	4	22.62	0-1	1
	1908.5	19185	3	QPSK	8	7	22.70	0-1	1
	1908.5	19185	3	QPSK	15	0	22.59	0-1	1
	1908.5	19185	3	16-QAM	1	0	22.37	0-1	1
	1908.5	19185	3	16-QAM	1	7	22.69	0-1	1
	1908.5	19185	3	16-QAM	1	14	22.77	0-1	1
	1908.5	19185	3	16-QAM	8	0	21.36	0-2	2
	1908.5	19185	3	16-QAM	8	4	21.63	0-2	2
	1908.5	19185	3	16-QAM	8	7	21.72	0-2	2
	1908.5	19185	3	16-QAM	15	0	21.55	0-2	2

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Table 9-22
LTE Band 2 (PCS) Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1850.7	18607	1.4	QPSK	1	0	23.85	0	0
	1850.7	18607	1.4	QPSK	1	2	23.78	0	0
	1850.7	18607	1.4	QPSK	1	5	23.89	0	0
	1850.7	18607	1.4	QPSK	3	0	23.87	0	0
	1850.7	18607	1.4	QPSK	3	2	23.70	0	0
	1850.7	18607	1.4	QPSK	3	3	24.00	0	0
	1850.7	18607	1.4	QPSK	6	0	22.84	0-1	1
	1850.7	18607	1.4	16-QAM	1	0	22.75	0-1	1
	1850.7	18607	1.4	16-QAM	1	2	22.75	0-1	1
	1850.7	18607	1.4	16-QAM	1	5	22.93	0-1	1
	1850.7	18607	1.4	16-QAM	3	0	22.63	0-1	1
	1850.7	18607	1.4	16-QAM	3	2	22.78	0-1	1
	1850.7	18607	1.4	16-QAM	3	3	22.74	0-1	1
Mid	1850.7	18607	1.4	16-QAM	6	0	21.77	0-2	2
	1880.0	18900	1.4	QPSK	1	0	23.83	0	0
	1880.0	18900	1.4	QPSK	1	2	23.73	0	0
	1880.0	18900	1.4	QPSK	1	5	23.76	0	0
	1880.0	18900	1.4	QPSK	3	0	23.75	0	0
	1880.0	18900	1.4	QPSK	3	2	23.86	0	0
	1880.0	18900	1.4	QPSK	3	3	23.90	0	0
	1880.0	18900	1.4	QPSK	6	0	22.75	0-1	1
	1880.0	18900	1.4	16-QAM	1	0	22.85	0-1	1
	1880.0	18900	1.4	16-QAM	1	2	22.74	0-1	1
	1880.0	18900	1.4	16-QAM	1	5	22.62	0-1	1
	1880.0	18900	1.4	16-QAM	3	0	22.75	0-1	1
	1880.0	18900	1.4	16-QAM	3	2	22.88	0-1	1
	1880.0	18900	1.4	16-QAM	3	3	22.83	0-1	1
High	1880.0	18900	1.4	16-QAM	6	0	21.78	0-2	2
	1909.3	19193	1.4	QPSK	1	0	23.62	0	0
	1909.3	19193	1.4	QPSK	1	2	23.63	0	0
	1909.3	19193	1.4	QPSK	1	5	23.22	0	0
	1909.3	19193	1.4	QPSK	3	0	23.53	0	0
	1909.3	19193	1.4	QPSK	3	2	23.67	0	0
	1909.3	19193	1.4	QPSK	3	3	24.03	0	0
	1909.3	19193	1.4	QPSK	6	0	22.65	0-1	1
	1909.3	19193	1.4	16-QAM	1	0	22.43	0-1	1
	1909.3	19193	1.4	16-QAM	1	2	22.57	0-1	1
	1909.3	19193	1.4	16-QAM	1	5	22.29	0-1	1
	1909.3	19193	1.4	16-QAM	3	0	22.42	0-1	1
	1909.3	19193	1.4	16-QAM	3	2	22.63	0-1	1
	1909.3	19193	1.4	16-QAM	3	3	22.75	0-1	1
	1909.3	19193	1.4	16-QAM	6	0	21.61	0-2	2

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9.3.6

LTE Band 7

Table 9-23
LTE Band 7 Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2510	20850	20	QPSK	1	0	23.37	0	0
	2510	20850	20	QPSK	1	50	23.39	0	0
	2510	20850	20	QPSK	1	99	23.56	0	0
	2510	20850	20	QPSK	50	0	22.42	0-1	1
	2510	20850	20	QPSK	50	25	22.27	0-1	1
	2510	20850	20	QPSK	50	50	22.30	0-1	1
	2510	20850	20	QPSK	100	0	22.36	0-1	1
	2510	20850	20	16QAM	1	0	22.32	0-1	1
	2510	20850	20	16QAM	1	50	22.41	0-1	1
	2510	20850	20	16QAM	1	99	22.57	0-1	1
	2510	20850	20	16QAM	50	0	21.37	0-2	2
	2510	20850	20	16QAM	50	25	21.25	0-2	2
Mid	2535.0	21100	20	QPSK	1	0	23.37	0	0
	2535.0	21100	20	QPSK	1	50	23.40	0	0
	2535.0	21100	20	QPSK	1	99	23.20	0	0
	2535.0	21100	20	QPSK	50	0	22.21	0-1	1
	2535.0	21100	20	QPSK	50	25	22.25	0-1	1
	2535.0	21100	20	QPSK	50	50	22.18	0-1	1
	2535.0	21100	20	QPSK	100	0	22.23	0-1	1
	2535.0	21100	20	16QAM	1	0	22.35	0-1	1
	2535.0	21100	20	16QAM	1	50	22.36	0-1	1
	2535.0	21100	20	16QAM	1	99	22.15	0-1	1
	2535.0	21100	20	16QAM	50	0	21.14	0-2	2
	2535.0	21100	20	16QAM	50	25	21.16	0-2	2
High	2560	21350	20	QPSK	1	0	23.60	0	0
	2560	21350	20	QPSK	1	50	23.41	0	0
	2560	21350	20	QPSK	1	99	23.31	0	0
	2560	21350	20	QPSK	50	0	22.43	0-1	1
	2560	21350	20	QPSK	50	25	22.35	0-1	1
	2560	21350	20	QPSK	50	50	22.32	0-1	1
	2560	21350	20	QPSK	100	0	22.27	0-1	1
	2560	21350	20	16QAM	1	0	22.61	0-1	1
	2560	21350	20	16QAM	1	50	22.45	0-1	1
	2560	21350	20	16QAM	1	99	22.55	0-1	1
	2560	21350	20	16QAM	50	0	21.19	0-2	2
	2560	21350	20	16QAM	50	25	21.24	0-2	2
	2560	21350	20	16QAM	50	50	21.14	0-2	2
	2560	21350	20	16QAM	100	0	21.19	0-2	2

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Table 9-24
LTE Band 7 Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2507.5	20825	15	QPSK	1	0	23.35	0	0
	2507.5	20825	15	QPSK	1	36	23.53	0	0
	2507.5	20825	15	QPSK	1	74	23.46	0	0
	2507.5	20825	15	QPSK	36	0	22.39	0-1	1
	2507.5	20825	15	QPSK	36	18	22.48	0-1	1
	2507.5	20825	15	QPSK	36	37	22.53	0-1	1
	2507.5	20825	15	QPSK	75	0	22.61	0-1	1
	2507.5	20825	15	16QAM	1	0	22.40	0-1	1
	2507.5	20825	15	16QAM	1	36	22.62	0-1	1
	2507.5	20825	15	16QAM	1	74	22.44	0-1	1
	2507.5	20825	15	16QAM	36	0	21.19	0-2	2
	2507.5	20825	15	16QAM	36	18	21.16	0-2	2
Mid	2507.5	20825	15	16QAM	36	37	21.07	0-2	2
	2507.5	20825	15	16QAM	75	0	21.28	0-2	2
	2535.0	21100	15	QPSK	1	0	23.39	0	0
	2535.0	21100	15	QPSK	1	36	23.56	0	0
	2535.0	21100	15	QPSK	1	74	23.32	0	0
	2535.0	21100	15	QPSK	36	0	22.39	0-1	1
	2535.0	21100	15	QPSK	36	18	22.09	0-1	1
	2535.0	21100	15	QPSK	36	37	22.29	0-1	1
	2535.0	21100	15	QPSK	75	0	22.27	0-1	1
	2535.0	21100	15	16QAM	1	0	22.26	0-1	1
	2535.0	21100	15	16QAM	1	36	22.43	0-1	1
	2535.0	21100	15	16QAM	1	74	22.11	0-1	1
High	2535.0	21100	15	16QAM	36	0	21.34	0-2	2
	2535.0	21100	15	16QAM	36	18	21.14	0-2	2
	2535.0	21100	15	16QAM	36	37	21.10	0-2	2
	2535.0	21100	15	16QAM	75	0	21.04	0-2	2
	2562.5	21375	15	QPSK	1	0	23.28	0	0
	2562.5	21375	15	QPSK	1	36	23.59	0	0
	2562.5	21375	15	QPSK	1	74	23.30	0	0
	2562.5	21375	15	QPSK	36	0	22.21	0-1	1
	2562.5	21375	15	QPSK	36	18	22.44	0-1	1
	2562.5	21375	15	QPSK	36	37	22.42	0-1	1
	2562.5	21375	15	QPSK	75	0	22.24	0-1	1
	2562.5	21375	15	16QAM	1	0	22.65	0-1	1
	2562.5	21375	15	16QAM	1	36	22.35	0-1	1
	2562.5	21375	15	16QAM	1	74	22.47	0-1	1
	2562.5	21375	15	16QAM	36	0	21.23	0-2	2
	2562.5	21375	15	16QAM	36	18	21.41	0-2	2
	2562.5	21375	15	16QAM	36	37	21.37	0-2	2
	2562.5	21375	15	16QAM	75	0	21.39	0-2	2

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Table 9-25
LTE Band 7 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2505	20800	10	QPSK	1	0	23.54	0	0
	2505	20800	10	QPSK	1	25	23.42	0	0
	2505	20800	10	QPSK	1	49	23.21	0	0
	2505	20800	10	QPSK	25	0	22.32	0-1	1
	2505	20800	10	QPSK	25	12	22.31	0-1	1
	2505	20800	10	QPSK	25	25	22.16	0-1	1
	2505	20800	10	QPSK	50	0	22.70	0-1	1
	2505	20800	10	16QAM	1	0	22.28	0-1	1
	2505	20800	10	16QAM	1	25	22.57	0-1	1
	2505	20800	10	16QAM	1	49	22.19	0-1	1
	2505	20800	10	16QAM	25	0	21.36	0-2	2
	2505	20800	10	16QAM	25	12	21.31	0-2	2
	2505	20800	10	16QAM	25	25	21.31	0-2	2
	2505	20800	10	16QAM	50	0	21.09	0-2	2
Mid	2535.0	21100	10	QPSK	1	0	23.58	0	0
	2535.0	21100	10	QPSK	1	25	23.51	0	0
	2535.0	21100	10	QPSK	1	49	23.41	0	0
	2535.0	21100	10	QPSK	25	0	22.60	0-1	1
	2535.0	21100	10	QPSK	25	12	22.23	0-1	1
	2535.0	21100	10	QPSK	25	25	22.04	0-1	1
	2535.0	21100	10	QPSK	50	0	22.49	0-1	1
	2535.0	21100	10	16QAM	1	0	22.46	0-1	1
	2535.0	21100	10	16QAM	1	25	22.66	0-1	1
	2535.0	21100	10	16QAM	1	49	22.12	0-1	1
	2535.0	21100	10	16QAM	25	0	21.14	0-2	2
	2535.0	21100	10	16QAM	25	12	21.02	0-2	2
	2535.0	21100	10	16QAM	25	25	21.25	0-2	2
	2535.0	21100	10	16QAM	50	0	21.09	0-2	2
High	2565	21400	10	QPSK	1	0	23.38	0	0
	2565	21400	10	QPSK	1	25	23.60	0	0
	2565	21400	10	QPSK	1	49	23.42	0	0
	2565	21400	10	QPSK	25	0	22.26	0-1	1
	2565	21400	10	QPSK	25	12	22.67	0-1	1
	2565	21400	10	QPSK	25	25	22.40	0-1	1
	2565	21400	10	QPSK	50	0	22.19	0-1	1
	2565	21400	10	16QAM	1	0	22.65	0-1	1
	2565	21400	10	16QAM	1	25	22.31	0-1	1
	2565	21400	10	16QAM	1	49	22.49	0-1	1
	2565	21400	10	16QAM	25	0	21.35	0-2	2
	2565	21400	10	16QAM	25	12	21.40	0-2	2
	2565	21400	10	16QAM	25	25	21.53	0-2	2
	2565	21400	10	16QAM	50	0	21.40	0-2	2

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Table 9-26
LTE Band 7 Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2502.5	20775	5	QPSK	1	0	23.66	0	0
	2502.5	20775	5	QPSK	1	12	23.37	0	0
	2502.5	20775	5	QPSK	1	24	23.06	0	0
	2502.5	20775	5	QPSK	12	0	22.22	0-1	1
	2502.5	20775	5	QPSK	12	6	22.22	0-1	1
	2502.5	20775	5	QPSK	12	13	22.60	0-1	1
	2502.5	20775	5	QPSK	25	0	22.45	0-1	1
	2502.5	20775	5	16-QAM	1	0	22.21	0-1	1
	2502.5	20775	5	16-QAM	1	12	22.63	0-1	1
	2502.5	20775	5	16-QAM	1	24	22.12	0-1	1
	2502.5	20775	5	16-QAM	12	0	21.52	0-2	2
	2502.5	20775	5	16-QAM	12	6	21.33	0-2	2
Mid	2502.5	20775	5	16-QAM	12	13	21.41	0-2	2
	2502.5	20775	5	16-QAM	25	0	21.20	0-2	2
	2535.0	21100	5	QPSK	1	0	23.35	0	0
	2535.0	21100	5	QPSK	1	12	23.49	0	0
	2535.0	21100	5	QPSK	1	24	23.32	0	0
	2535.0	21100	5	QPSK	12	0	22.36	0-1	1
	2535.0	21100	5	QPSK	12	6	22.31	0-1	1
	2535.0	21100	5	QPSK	12	13	22.02	0-1	1
	2535.0	21100	5	QPSK	25	0	22.51	0-1	1
	2535.0	21100	5	16-QAM	1	0	22.50	0-1	1
	2535.0	21100	5	16-QAM	1	12	22.48	0-1	1
	2535.0	21100	5	16-QAM	1	24	22.16	0-1	1
High	2535.0	21100	5	16-QAM	12	0	21.23	0-2	2
	2535.0	21100	5	16-QAM	12	6	20.80	0-2	2
	2535.0	21100	5	16-QAM	12	13	21.48	0-2	2
	2535.0	21100	5	16-QAM	25	0	21.18	0-2	2
	2567.5	21425	5	QPSK	1	0	23.22	0	0
	2567.5	21425	5	QPSK	1	12	23.62	0	0
	2567.5	21425	5	QPSK	1	24	23.57	0	0
	2567.5	21425	5	QPSK	12	0	22.01	0-1	1
	2567.5	21425	5	QPSK	12	6	22.56	0-1	1
	2567.5	21425	5	QPSK	12	13	22.30	0-1	1
	2567.5	21425	5	QPSK	25	0	21.97	0-1	1
	2567.5	21425	5	16-QAM	1	0	22.61	0-1	1
	2567.5	21425	5	16-QAM	1	12	22.52	0-1	1
	2567.5	21425	5	16-QAM	1	24	22.68	0-1	1
	2567.5	21425	5	16-QAM	12	0	21.34	0-2	2
	2567.5	21425	5	16-QAM	12	6	21.58	0-2	2
	2567.5	21425	5	16-QAM	12	13	21.32	0-2	2
	2567.5	21425	5	16-QAM	25	0	21.42	0-2	2

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9.3.7 LTE Carrier Aggregation Conducted Powers

Table 9-27

LTE Carrier Aggregation Conducted Powers – Band 4 (PCC) 10 MHz BW + Band 17 (SCC) 10 MHz BW

Band 4 (PCC) 10 MHz BW + Band 17 (SCC) 10 MHz BW					
1715 MHz / ch. 20000 + 740 MHz / ch. 5790	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	25	24.22	24.56

Table 9-28

LTE Carrier Aggregation Conducted Powers – Band 17 (PCC) 10 MHz BW + Band 4 (SCC) 10 MHz BW

Band 17 (PCC) 10 MHz BW + Band 4 (SCC) 10 MHz BW					
710.0 MHz / ch. 23790 + 2132.5 MHz / ch. 2175	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	25	24.14	24.17

Table 9-29

LTE Carrier Aggregation Conducted Powers – Band 2 (PCC) 10 MHz BW + Band 17 (SCC) 10 MHz BW

Band 2 (PCC) 10 MHz BW + Band 17 (SCC) 10 MHz BW					
1855 MHz / ch.18650 + 740 MHz / ch. 5790	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	0	24.15	24.01

Table 9-30

LTE Carrier Aggregation Conducted Powers – Band 17 (PCC) 10 MHz BW + Band 2 (SCC) 10 MHz BW

Band 17 (PCC) 10 MHz BW + Band 2 (SCC) 10 MHz BW					
710.0 MHz / ch. 23790 + 1960.0 MHz / ch. 900	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	25	24.22	24.17

Table 9-31

LTE Carrier Aggregation Conducted Powers – Band 4 (PCC) 10 MHz BW + Band 12 (SCC) 10 MHz BW

Band 4 (PCC) 10 MHz BW + Band 12 (SCC) 10 MHz BW					
1715 MHz / ch. 20000 + 737.7 MHz / ch. 5095	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	25	24.30	24.56

Table 9-32

LTE Carrier Aggregation Conducted Powers – Band 12 (PCC) 5 MHz BW + Band 4 (SCC) 10 MHz BW

Band 12 (PCC) 5 MHz BW + Band 4 (SCC) 10 MHz BW					
701.5 MHz / ch.23035 + 2132.5 MHz / ch. 2175	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	24	23.81	24.33

Table 9-33

LTE Carrier Aggregation Conducted Powers – Band 2 (PCC) 10 MHz BW + Band 12 (SCC) 10 MHz BW

Band 2 (PCC) 10 MHz BW + Band 12 (SCC) 10 MHz BW					
1855 MHz / ch.18650 + 737.7 MHz / ch. 5095	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	0	24.02	24.01

Table 9-34

LTE Carrier Aggregation Conducted Powers – Band 12 (PCC) 5 MHz BW + Band 2 (SCC) 10 MHz BW

Band 12 (PCC) 5 MHz BW + Band 2 (SCC) 10 MHz BW					
701.5 MHz / ch.23035 + 1960.0 MHz / ch. 900	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	24	23.99	24.33

Table 9-35

LTE Carrier Aggregation Conducted Powers – Band 4 (PCC) 10 MHz BW + Band 5 (SCC) 10 MHz BW

Band 4 (PCC) 10 MHz BW + Band 5 (SCC) 10 MHz BW					
1715 MHz / ch. 20000 + 881.5 MHz / ch. 2525	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	25	24.27	24.56

Table 9-36

LTE Carrier Aggregation Conducted Powers – Band 5 (PCC) 5 MHz BW + Band 4 (SCC) 20 MHz BW

Band 5 (PCC) 5 MHz BW + Band 4 (SCC) 20 MHz BW					
846.5 MHz / ch.20625 + 2132.5 MHz / ch. 2175	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	0	23.99	24.37

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Table 9-37

LTE Carrier Aggregation Conducted Powers – Band 2 (PCC) 10 MHz BW + Band 5 (SCC) 10 MHz BW

Band 2 (PCC) 10 MHz BW + Band 5 (SCC) 10 MHz BW					
1855 MHz / ch.18650 + 881.5 MHz / ch. 2525	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	0	24.00	24.01

Table 9-38

LTE Carrier Aggregation Conducted Powers – Band 5 (PCC) 5 MHz BW + Band 2 (SCC) 20 MHz BW

Band 5 (PCC) 5 MHz BW + Band 2 (SCC) 20 MHz BW					
846.5 MHz / ch.20625 + 1960.0 MHz / ch. 900	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	0	23.95	24.37

Table 9-39

LTE Carrier Aggregation Conducted Powers – Band 2 (PCC) 10 MHz BW + Band 29 (SCC) 10 MHz BW

Band 2 (PCC) 10 MHz BW + Band 29 (SCC) 10 MHz BW					
1855 MHz / ch.18650 + 722.5 MHz / ch. 9715	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	0	24.04	24.01

Table 9-40

LTE Carrier Aggregation Conducted Powers – Band 4 (PCC) 10 MHz BW + Band 29 (SCC) 10 MHz BW

Band 4 (PCC) 10 MHz BW + Band 29 (SCC) 10 MHz BW					
1715 MHz / ch. 20000 + 722.5 MHz / ch. 9715	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	25	24.41	24.56

Table 9-41

LTE Carrier Aggregation Conducted Powers – Band 2 (PCC) 10 MHz BW + Band 4 (SCC) 20 MHz BW

Band 2 (PCC) 10 MHz BW + Band 4 (SCC) 20 MHz BW					
1855 MHz / ch.18650 + 2132.5 MHz / ch. 2175	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	0	23.97	24.01

Table 9-42

LTE Carrier Aggregation Conducted Powers – Band 4 (PCC) 10 MHz BW + Band 2 (SCC) 20 MHz BW

Band 4 (PCC) 10 MHz BW + Band 2 (SCC) 20 MHz BW					
1715 MHz / ch. 20000 + 1960.0 MHz / ch. 900	Modulation	PCC UL# RB	PCC UL RB Offset	LTE Rel 10 Tx.Power (dBm)	Rel. 8 Tx.Power (dBm)
	QPSK	1	25	24.33	24.56

Notes:

1. The device does not support all Rel. 10 Carrier Aggregation features due to modem chipset limitation.
2. The device only supports LTE downlink Carrier Aggregation. Uplink Carrier Aggregation is not supported. Power measurements were performed with two DL carriers for the Release 8 configuration that had the highest output power (across all bandwidths, channels and RB Configurations) for each band
3. This device only supports inter-band CA with 2 carriers (B4+B17, B17+B4, B2+B17, B17+B2, B4+B12, B12+B4, B2+B12, B12+B2, B4+B5, B5+B4, B2+B5, B5+B2, B2+B29, B4+B29, B4+B2, B2+B4).
4. All control and acknowledge data is sent on uplink channels that operate identical to release 8 specifications.

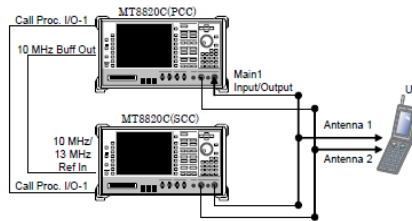


Figure 9-2
Power Measurement Setup

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9.4 WLAN Conducted Powers

Table 9-43
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	802.11b Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1*	15.74	15.82	15.94	15.95
802.11b	2437	6*	15.78	15.96	15.99	15.92
802.11b	2462	11*	15.75	15.97	15.98	15.97

Table 9-44
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	14.74	14.81	14.76	14.76	14.92	14.80	14.98	14.95
802.11g	2437	6	14.72	14.76	14.71	14.56	14.95	14.74	14.98	14.89
802.11g	2462	11	13.19	13.11	13.03	13.04	13.29	13.04	13.44	13.28

Table 9-45
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	2412	1	13.54	13.56	13.48	13.78	13.70	13.80	13.76	13.91
802.11n	2437	6	13.66	13.68	13.71	13.90	13.91	13.91	13.90	13.88
802.11n	2462	11	12.85	12.71	12.76	13.05	12.99	13.04	13.12	13.09

Table 9-46
IEEE 802.11ac Average RF Power

802.11ac (2.4GHz) Conducted Power [dBm]			
Mode	Freq [MHz]	Channel	Data Rate
			6.5 Mbps
802.11ac	2412	1	11.61
802.11ac	2437	6	11.70
802.11ac	2462	11	10.56

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Table 9-47
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	802.11a Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	11.71	11.72	11.65	11.46	11.91	11.37	11.92	11.87
802.11a	5200	40	11.77	11.79	11.70	11.59	11.95	11.45	11.96	11.93
802.11a	5220	44	11.66	11.70	11.63	11.49	11.82	11.34	11.89	11.85
802.11a	5240	48*	11.60	11.65	11.49	11.37	11.76	11.29	11.82	11.79
802.11a	5260	52*	11.62	11.56	11.42	11.30	11.67	11.20	11.79	11.71
802.11a	5280	56	11.48	11.38	11.23	11.12	11.60	11.04	11.57	11.54
802.11a	5300	60	11.35	11.23	11.20	11.00	11.41	10.95	11.57	11.42
802.11a	5320	64*	11.45	11.38	11.27	11.15	11.44	11.07	11.56	11.61
802.11a	5500	100	11.41	11.25	11.14	11.05	11.47	11.16	11.61	11.51
802.11a	5520	104*	11.31	11.19	11.08	11.02	11.39	11.00	11.48	11.48
802.11a	5540	108	11.21	11.00	11.03	10.88	11.34	10.96	11.36	11.27
802.11a	5560	112	11.13	10.99	10.83	10.78	11.18	10.91	11.36	11.28
802.11a	5580	116*	11.12	10.93	10.86	10.75	11.23	10.88	11.37	11.21
802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5660	132	10.90	10.80	10.69	10.54	10.92	10.67	11.12	11.00
802.11a	5680	136*	10.90	10.73	10.57	10.56	10.92	10.63	11.10	10.92
802.11a	5700	140	10.87	10.67	10.58	10.45	10.89	10.62	11.03	10.92
802.11a	5720	144	10.86	10.74	10.74	10.69	10.93	10.70	10.96	11.01
802.11a	5745	149*	10.91	10.89	10.75	10.72	11.06	10.61	11.01	10.93
802.11a	5765	153	11.02	11.00	10.82	10.78	11.10	10.68	11.12	11.13
802.11a	5785	157*	11.07	11.07	10.92	10.96	11.30	10.80	11.25	11.00
802.11a	5805	161	11.04	11.05	10.85	10.88	11.18	10.68	11.12	11.04
802.11a	5825	165*	10.99	10.89	10.82	10.84	11.14	10.62	11.13	10.95

(*) – indicates default channels per KDB Publication 248227 D01v01r02. When the adjacent channels are higher in power than the default channels, these “required channels” are considered for SAR testing instead of the default channels.

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Table 9-48
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	10.28	10.37	10.39	10.65	10.71	10.62	10.54	10.52
802.11n	5200	40	10.21	10.28	10.33	10.63	10.61	10.50	10.45	10.39
802.11n	5220	44	10.11	10.24	10.25	10.46	10.55	10.40	10.38	10.35
802.11n	5240	48	10.27	10.42	10.36	10.61	10.67	10.56	10.52	10.58
802.11n	5260	52	10.23	10.17	10.39	10.49	10.54	10.53	10.48	10.42
802.11n	5280	56	10.31	10.28	10.49	10.57	10.66	10.67	10.56	10.55
802.11n	5300	60	10.12	10.06	10.25	10.37	10.44	10.46	10.37	10.29
802.11n	5320	64	10.19	10.18	10.40	10.37	10.55	10.56	10.41	10.34
802.11n	5500	100	10.35	10.27	10.33	10.56	10.55	10.61	10.63	10.59
802.11n	5520	104	10.34	10.33	10.34	10.55	10.59	10.59	10.62	10.52
802.11n	5540	108	10.25	10.11	10.28	10.41	10.41	10.48	10.56	10.51
802.11n	5560	112	10.25	10.22	10.23	10.49	10.44	10.53	10.49	10.47
802.11n	5580	116	10.14	10.04	10.15	10.35	10.30	10.38	10.39	10.34
802.11n	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5660	132	10.06	10.03	10.03	10.27	10.33	10.33	10.33	10.34
802.11n	5680	136	9.91	9.83	9.89	10.10	10.12	10.15	10.21	10.22
802.11n	5700	140	9.93	9.80	9.97	10.12	10.18	10.20	10.19	10.14
802.11n	5720	144	9.94	9.82	10.03	10.04	10.10	10.13	10.14	10.06
802.11n	5745	149	9.77	9.72	9.71	9.87	10.01	9.81	9.91	9.99
802.11n	5765	153	9.94	9.92	9.93	10.10	10.14	10.03	10.11	10.18
802.11n	5785	157	10.12	10.04	10.10	10.26	10.36	10.15	10.29	10.39
802.11n	5805	161	10.05	9.98	10.00	10.14	10.27	10.08	10.16	10.29
802.11n	5825	165	10.01	9.98	10.01	10.10	10.24	10.10	10.15	10.23

Table 9-49
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5	27	40.5	54	81	108	121.5	135
802.11n	5190	38	10.47	10.38	10.51	10.63	10.53	10.68	10.54	10.56
802.11n	5230	46	10.41	10.10	10.05	10.47	10.49	10.26	10.34	10.24
802.11n	5270	54	10.33	10.41	10.42	10.46	10.44	10.41	10.39	10.46
802.11n	5310	62	10.17	10.18	10.22	10.55	10.44	10.39	10.52	10.49
802.11n	5510	102	9.89	9.95	9.86	10.09	10.08	10.07	10.11	10.18
802.11n	5550	110	9.94	10.00	9.92	10.18	10.17	10.04	9.94	9.93
802.11n	5590	118	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5630	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5670	134	9.88	10.02	9.87	10.15	10.18	9.96	9.90	9.81
802.11n	5710	142	9.74	9.92	9.76	10.02	10.07	9.88	9.73	9.75
802.11n	5755	151	9.51	9.40	9.35	9.45	9.47	9.52	9.41	9.55
802.11n	5795	159	9.56	9.48	9.36	9.50	9.52	9.53	9.50	9.57

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Table 9-50
IEEE 802.11ac Average RF Power – 80 MHz Bandwidth

Mode	Freq [MHz]	Channel	80MHz BW 802.11ac (5GHz) Conducted Power [dBm]									
			Data Rate [Mbps]									
			29.3	58.5	87.8	117	175.5	234	263.3	292.5	351	390
802.11ac	5210	42	10.60	10.56	10.60	10.81	10.83	10.79	10.84	10.82	10.79	10.82
802.11ac	5290	58	10.73	10.67	10.71	10.96	10.93	10.94	10.93	10.96	10.96	10.96
802.11ac	5530	106	9.74	9.64	9.68	9.98	9.97	9.95	9.89	9.88	9.84	9.93
802.11ac	5690	138	9.54	9.55	9.48	9.73	9.70	9.72	9.68	9.66	9.63	9.75
802.11ac	5775	155	10.09	9.94	9.98	10.33	10.28	10.32	10.29	10.31	10.29	10.30

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012/April 2013 FCC/TCB Meeting Notes:

- For 2.4 GHz operations, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not required since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode. Additional tests for 802.11n/ac were additionally evaluated and included in this report per manufacturer request.
- For 5 GHz operations, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz) were not required since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode. Additional tests for 802.11n/ac were additionally evaluated and included in this report per manufacturer request.
- Full SAR tests for all IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.

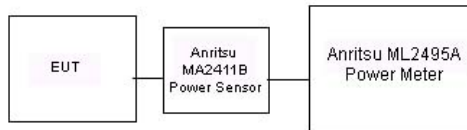


Figure 9-3
Power Measurement Setup for Bandwidths < 50 MHz

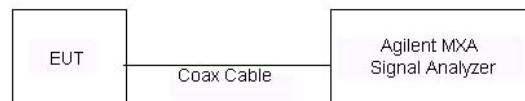


Figure 9-4
Power Measurement Setup for Bandwidths > 50 MHz

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9.5 Bluetooth Conducted Powers

Table 9-51
Bluetooth RF Conducted Powers

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
			[dBm]	[mW]
2402	1.0	0	10.10	10.236
2441	1.0	39	10.31	10.728
2480	1.0	78	8.20	6.601
2402	2.0	0	6.64	4.608
2441	2.0	39	6.53	4.502
2480	2.0	78	4.07	2.554
2402	3.0	0	6.69	4.671
2441	3.0	39	6.58	4.548
2480	3.0	78	4.14	2.594

Notes:

- The bolded data rate and channel above were tested for SAR.
- Bluetooth 1g body-worn and 10g extremity SAR was evaluated per manufacturer's request.

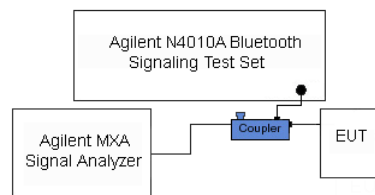


Figure 9-5
Power Measurement Setup

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10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Measured Tissue Properties – Head

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
03/25/2015	750H	21.8	695	0.855	41.707	0.889	42.227	-3.82%	-1.23%
			710	0.870	41.474	0.890	42.149	-2.25%	-1.60%
			725	0.883	41.277	0.891	42.071	-0.90%	-1.89%
			740	0.898	41.103	0.893	41.994	0.56%	-2.12%
			755	0.911	40.903	0.894	41.916	1.90%	-2.42%
			770	0.926	40.714	0.895	41.838	3.46%	-2.69%
			785	0.940	40.518	0.896	41.760	4.91%	-2.97%
03/25/2015	835H	22.0	820	0.885	40.469	0.899	41.578	-1.56%	-2.67%
			835	0.899	40.279	0.900	41.500	-0.11%	-2.94%
			850	0.913	40.097	0.916	41.500	-0.33%	-3.38%
03/26/2015	1750H	22.8	1710	1.304	39.722	1.348	40.142	-3.26%	-1.05%
			1750	1.341	39.510	1.371	40.079	-2.19%	-1.42%
			1790	1.386	39.277	1.394	40.016	-0.57%	-1.85%
03/30/2015	1750H	23.3	1710	1.314	38.419	1.348	40.142	-2.52%	-4.29%
			1750	1.358	38.261	1.371	40.079	-0.95%	-4.54%
			1790	1.391	38.055	1.394	40.016	-0.22%	-4.90%
03/23/2015	1900H	21.6	1850	1.379	40.155	1.400	40.000	-1.50%	0.39%
			1880	1.409	40.048	1.400	40.000	0.64%	0.12%
			1910	1.443	39.906	1.400	40.000	3.07%	-0.24%
03/23/2015	2450H - 2600H	21.4	2401	1.776	39.180	1.756	39.287	1.14%	-0.27%
			2450	1.829	38.982	1.800	39.200	1.61%	-0.56%
			2499	1.884	38.812	1.853	39.138	1.67%	-0.83%
			2500	1.883	38.810	1.855	39.136	1.51%	-0.83%
			2550	1.943	38.638	1.909	39.073	1.78%	-1.11%
			2600	1.998	38.444	1.964	39.009	1.73%	-1.45%
03/30/2015	5200H - 5800H	21.3	5200	4.461	35.157	4.655	35.986	-4.17%	-2.30%
			5220	4.489	35.126	4.676	35.963	-4.00%	-2.33%
			5260	4.527	35.074	4.717	35.917	-4.03%	-2.35%
			5280	4.553	35.066	4.737	35.894	-3.88%	-2.31%
			5300	4.569	35.023	4.758	35.871	-3.97%	-2.36%
			5320	4.588	35.004	4.778	35.849	-3.98%	-2.36%
			5500	4.765	34.765	4.963	35.643	-3.99%	-2.46%
			5520	4.785	34.714	4.983	35.620	-3.97%	-2.54%
			5540	4.802	34.719	5.004	35.597	-4.04%	-2.47%
			5560	4.830	34.664	5.024	35.574	-3.86%	-2.56%
			5600	4.865	34.615	5.065	35.529	-3.95%	-2.57%
			5765	5.031	34.410	5.234	35.340	-3.88%	-2.63%
			5785	5.050	34.378	5.255	35.317	-3.90%	-2.66%
			5800	5.069	34.342	5.270	35.300	-3.81%	-2.71%

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Table 10-2
Measured Tissue Properties – Body

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
03/24/2015	750B	22.1	695	0.924	55.511	0.959	55.745	-3.65%	-0.42%
			710	0.936	55.316	0.960	55.687	-2.50%	-0.67%
			725	0.950	55.208	0.961	55.629	-1.14%	-0.76%
			740	0.965	55.021	0.963	55.570	0.21%	-0.99%
			755	0.977	54.880	0.964	55.512	1.35%	-1.14%
			770	0.994	54.768	0.965	55.453	3.01%	-1.24%
			785	1.012	54.590	0.966	55.395	4.76%	-1.45%
03/19/2015	835B	22.0	820	0.945	53.089	0.969	55.258	-2.48%	-3.93%
			835	0.961	52.937	0.970	55.200	-0.93%	-4.10%
			850	0.978	52.768	0.988	55.154	-1.01%	-4.33%
03/23/2015	1750B	21.8	1710	1.432	52.326	1.463	53.537	-2.12%	-2.26%
			1750	1.477	52.150	1.488	53.432	-0.74%	-2.40%
			1790	1.524	52.001	1.514	53.326	0.66%	-2.48%
03/19/2015	1900B	23.5	1850	1.470	51.925	1.520	53.300	-3.29%	-2.58%
			1880	1.499	51.828	1.520	53.300	-1.38%	-2.76%
			1910	1.533	51.696	1.520	53.300	0.86%	-3.01%
03/30/2015	1900B	22.2	1850	1.514	52.414	1.520	53.300	-0.39%	-1.66%
			1880	1.548	52.312	1.520	53.300	1.84%	-1.85%
			1910	1.587	52.191	1.520	53.300	4.41%	-2.08%
03/17/2015	2450B	22.4	2401	1.958	50.991	1.903	52.765	2.89%	-3.36%
			2450	2.028	50.797	1.950	52.700	4.00%	-3.61%
			2499	2.089	50.607	2.019	52.638	3.47%	-3.86%
04/01/2015	2450B	23.0	2401	1.932	51.440	1.903	52.765	1.52%	-2.51%
			2450	1.997	51.257	1.950	52.700	2.41%	-2.74%
			2499	2.064	51.067	2.019	52.638	2.23%	-2.98%
03/19/2015	2600B	24.1	2500	2.017	50.822	2.021	52.636	-0.20%	-3.45%
			2550	2.087	50.602	2.092	52.573	-0.24%	-3.75%
			2600	2.147	50.438	2.163	52.509	-0.74%	-3.94%
03/23/2015	5200B-5800B	24.5	5200	5.395	48.053	5.299	49.014	1.81%	-1.96%
			5220	5.430	48.022	5.323	48.987	2.01%	-1.97%
			5260	5.475	47.984	5.369	48.933	1.97%	-1.94%
			5280	5.483	47.934	5.393	48.906	1.67%	-1.99%
			5300	5.499	47.886	5.416	48.879	1.53%	-2.03%
			5500	5.716	47.553	5.650	48.607	1.17%	-2.17%
			5520	5.737	47.530	5.673	48.580	1.13%	-2.16%
			5540	5.766	47.480	5.696	48.553	1.23%	-2.21%
			5560	5.785	47.438	5.720	48.526	1.14%	-2.24%
			5600	5.841	47.378	5.766	48.471	1.30%	-2.25%
			5765	6.084	47.160	5.959	48.248	2.10%	-2.26%
			5785	6.110	47.086	5.982	48.220	2.14%	-2.35%
			5800	6.149	47.074	6.000	48.200	2.48%	-2.34%

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 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

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10.2 Test System Verification

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

Table 10-3
System Verification Results – 1g

System Verification												
TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation _{1g} (%)
J	750	HEAD	03/25/2015	22.4	21.9	0.100	1003	3022	0.856	8.090	8.560	5.81%
K	835	HEAD	03/25/2015	23.8	22.0	0.100	4d133	3288	0.945	9.200	9.450	2.72%
G	1750	HEAD	03/26/2015	23.8	22.7	0.100	1008	3213	3.700	36.900	37.000	0.27%
B	1750	HEAD	03/30/2015	23.9	23.3	0.100	1051	3334	3.600	36.200	36.000	-0.55%
G	1900	HEAD	03/23/2015	24.2	21.9	0.100	5d141	3213	4.240	40.100	42.400	5.74%
K	2450	HEAD	03/23/2015	23.8	21.9	0.100	719	3288	5.590	52.100	55.900	7.29%
K	2600	HEAD	03/23/2015	23.8	21.9	0.100	1071	3288	6.060	57.500	60.600	5.39%
H	5200	HEAD	03/30/2015	21.9	21.3	0.050	1057	3920	3.770	81.500	75.400	-7.48%
H	5300	HEAD	03/30/2015	22.0	21.3	0.050	1057	3920	3.830	84.700	76.600	-9.56%
H	5500	HEAD	03/30/2015	22.0	21.3	0.050	1057	3920	3.860	84.300	77.200	-8.42%
H	5600	HEAD	03/30/2015	22.3	21.3	0.050	1057	3920	3.890	83.800	77.800	-7.16%
H	5800	HEAD	03/30/2015	22.1	21.3	0.050	1057	3920	4.090	81.100	81.800	0.86%
D	750	BODY	03/24/2015	23.8	22.3	0.100	1003	3263	0.916	8.460	9.160	8.27%
C	835	BODY	03/19/2015	24.4	22.0	0.100	4d132	3333	0.956	9.140	9.560	4.60%
E	1750	BODY	03/23/2015	22.4	21.8	0.100	1008	3332	3.520	37.600	35.200	-6.38%
D	1900	BODY	03/19/2015	23.9	23.5	0.100	5d149	3263	3.860	40.400	38.600	-4.46%
J	1900	BODY	03/30/2015	23.6	21.0	0.100	5d149	3022	4.320	40.400	43.200	6.93%
G	2450	BODY	03/17/2015	24.3	22.4	0.100	719	3213	5.290	51.800	52.900	2.12%
K	2450	BODY	04/01/2015	24.4	23.0	0.100	719	3288	5.300	51.800	53.000	2.32%
G	2600	BODY	03/19/2015	24.1	23.0	0.100	1071	3213	5.680	56.900	56.800	-0.18%
A	5200	BODY	03/23/2015	22.4	22.5	0.050	1191	3914	3.860	77.800	77.200	-0.77%
A	5300	BODY	03/23/2015	22.4	22.5	0.050	1191	3914	4.050	79.900	81.000	1.38%
A	5500	BODY	03/23/2015	22.4	22.5	0.050	1191	3914	4.090	83.100	81.800	-1.56%
A	5600	BODY	03/23/2015	22.5	22.5	0.050	1191	3914	4.050	84.100	81.000	-3.69%
A	5800	BODY	03/23/2015	22.4	22.5	0.050	1191	3914	3.800	78.000	76.000	-2.56%

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Table 10-4
System Verification Results – 10g

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR _{10g} (W/kg)	1 W Target SAR _{10g} (W/kg)	1 W Normalized SAR _{10g} (W/kg)	Deviation _{10g} (%)
K	2450	BODY	04/01/2015	24.4	23.0	0.100	719	3288	2.430	24.000	24.300	1.25%
A	5200	BODY	03/23/2015	22.4	22.5	0.050	1191	3914	1.070	21.600	21.400	-0.93%
A	5300	BODY	03/23/2015	22.4	22.5	0.050	1191	3914	1.110	22.300	22.200	-0.45%
A	5500	BODY	03/23/2015	22.4	22.5	0.050	1191	3914	1.130	23.000	22.600	-1.74%
A	5600	BODY	03/23/2015	22.5	22.5	0.050	1191	3914	1.110	23.300	22.200	-4.72%

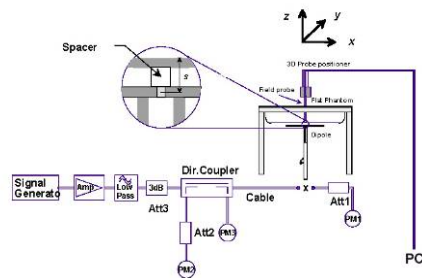


Figure 10-1
System Verification Setup Diagram



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	Cover Type	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.2	33.08	-0.02	Right	Cheek	Standard	0682-1	1	1:8.3	0.417	1.028	0.429	
836.60	190	GSM 850	GSM	33.2	33.08	0.02	Right	Cheek	Quick Cover (Open)	0682-1	1	1:8.3	0.367	1.028	0.377	
836.60	190	GSM 850	GSM	33.2	33.08	-0.10	Right	Cheek	Quick Cover (Closed)	0682-1	1	1:8.3	0.331	1.028	0.340	
836.60	190	GSM 850	GSM	33.2	33.08	0.04	Right	Tilt	Standard	0682-1	1	1:8.3	0.193	1.028	0.198	
836.60	190	GSM 850	GSM	33.2	33.08	0.03	Left	Cheek	Standard	0682-1	1	1:8.3	0.335	1.028	0.344	
836.60	190	GSM 850	GSM	33.2	33.08	0.05	Left	Tilt	Standard	0682-1	1	1:8.3	0.217	1.028	0.223	
836.60	190	GSM 850	GPRS	28.2	27.92	0.15	Right	Cheek	Standard	0682-1	4	1:2.076	0.427	1.067	0.456	A1
836.60	190	GSM 850	GPRS	28.2	27.92	0.08	Right	Cheek	Quick Cover (Open)	0682-1	4	1:2.076	0.425	1.067	0.453	
836.60	190	GSM 850	GPRS	28.2	27.92	0.03	Right	Cheek	Quick Cover (Closed)	0682-1	4	1:2.076	0.374	1.067	0.399	
836.60	190	GSM 850	GPRS	28.2	27.92	0.03	Right	Tilt	Standard	0682-1	4	1:2.076	0.211	1.067	0.225	
836.60	190	GSM 850	GPRS	28.2	27.92	-0.07	Left	Cheek	Standard	0682-1	4	1:2.076	0.358	1.067	0.382	
836.60	190	GSM 850	GPRS	28.2	27.92	0.17	Left	Tilt	Standard	0682-1	4	1:2.076	0.253	1.067	0.270	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-2
UMTS 850 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.											(W/kg)			
836.60	4183	UMTS 850	RMC	23.7	23.49	0.05	Right	Cheek	Standard	0682-1	1:1	0.393	1.050	0.413	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.05	Right	Cheek	Quick Cover (Open)	0682-1	1:1	0.431	1.050	0.453	A2
836.60	4183	UMTS 850	RMC	23.7	23.49	0.01	Right	Cheek	Quick Cover (Closed)	0682-1	1:1	0.369	1.050	0.387	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.12	Right	Tilt	Standard	0682-1	1:1	0.202	1.050	0.212	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.14	Left	Cheek	Standard	0682-1	1:1	0.330	1.050	0.347	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.13	Left	Tilt	Standard	0682-1	1:1	0.213	1.050	0.224	
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 11-3
UMTS 1750 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.											(W/kg)			
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.03	Right	Cheek	Standard	0682-1	1:1	0.413	1.096	0.453	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.04	Right	Tilt	Standard	0682-1	1:1	0.348	1.096	0.381	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.07	Left	Cheek	Standard	0682-1	1:1	0.651	1.096	0.713	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.04	Left	Cheek	Quick Cover (Open)	0682-1	1:1	0.665	1.096	0.729	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.07	Left	Cheek	Quick Cover (Closed)	0682-1	1:1	0.927	1.096	1.016	A3
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.07	Left	Tilt	Standard	0682-1	1:1	0.318	1.096	0.349	
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 11-4
GSM 1900 Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	30.2	29.86	-0.06	Right	Cheek	Standard	0681-3	1	1:8.3	0.198	1.081	0.214	
1880.00	661	GSM 1900	GSM	30.2	29.86	0.05	Right	Tilt	Standard	0681-3	1	1:8.3	0.201	1.081	0.217	
1880.00	661	GSM 1900	GSM	30.2	29.86	-0.09	Left	Cheek	Standard	0681-3	1	1:8.3	0.432	1.081	0.467	
1880.00	661	GSM 1900	GSM	30.2	29.86	0.00	Left	Cheek	Quick Cover (Open)	0681-3	1	1:8.3	0.483	1.081	0.522	
1880.00	661	GSM 1900	GSM	30.2	29.86	0.04	Left	Cheek	Quick Cover (Closed)	0681-3	1	1:8.3	0.497	1.081	0.537	
1880.00	661	GSM 1900	GSM	30.2	29.86	0.14	Left	Tilt	Standard	0681-3	1	1:8.3	0.219	1.081	0.237	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.04	Right	Cheek	Standard	0681-3	4	1:2.076	0.261	1.012	0.264	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.07	Right	Tilt	Standard	0681-3	4	1:2.076	0.227	1.012	0.230	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.05	Left	Cheek	Standard	0681-3	4	1:2.076	0.592	1.012	0.599	
1880.00	661	GSM 1900	GPRS	25.2	25.15	0.02	Left	Cheek	Quick Cover (Open)	0681-3	4	1:2.076	0.642	1.012	0.650	A4
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.09	Left	Cheek	Quick Cover (Closed)	0681-3	4	1:2.076	0.505	1.012	0.511	
1880.00	661	GSM 1900	GPRS	25.2	25.15	0.09	Left	Tilt	Standard	0681-3	4	1:2.076	0.245	1.012	0.248	
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	Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.06	Right	Cheek	Standard	0677-1	1:1	0.391	1.042	0.407	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.17	Right	Tilt	Standard	0677-1	1:1	0.389	1.042	0.405	
1852.40	9262	UMTS 1900	RMC	24.2	24.15	-0.05	Left	Cheek	Standard	0677-1	1:1	0.893	1.012	0.904	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.03	Left	Cheek	Standard	0677-1	1:1	0.962	1.042	1.002	A5
1880.00	9400	UMTS 1900	RMC	24.2	24.02	-0.01	Left	Cheek	Quick Cover (Open)	0677-1	1:1	0.951	1.042	0.991	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.02	Left	Cheek	Quick Cover (Closed)	0677-1	1:1	0.932	1.042	0.971	
1907.60	9538	UMTS 1900	RMC	24.2	24.00	0.04	Left	Cheek	Standard	0677-1	1:1	0.928	1.047	0.972	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.16	Left	Tilt	Standard	0677-1	1:1	0.425	1.042	0.443	
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 11-6
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	Cover Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.															(W/kg)		(W/kg)		
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	-0.05	0	Right	Cheek	Standard	QPSK	1	25	0716-7	1:1	0.381	1.059	0.403	A6
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	0.04	0	Right	Cheek	Quick Cover (Open)	QPSK	1	25	0716-7	1:1	0.369	1.059	0.391	
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	0.13	0	Right	Cheek	Quick Cover (Closed)	QPSK	1	25	0716-7	1:1	0.321	1.059	0.340	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	0.04	1	Right	Cheek	Standard	QPSK	25	0	0716-7	1:1	0.341	1.045	0.356	
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	0.09	0	Right	Tilt	Standard	QPSK	1	25	0716-7	1:1	0.175	1.059	0.185	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	0.07	1	Right	Tilt	Standard	QPSK	25	0	0716-7	1:1	0.155	1.045	0.162	
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	-0.02	0	Left	Cheek	Standard	QPSK	1	25	0716-7	1:1	0.338	1.059	0.358	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	0.03	1	Left	Cheek	Standard	QPSK	25	0	0716-7	1:1	0.279	1.045	0.292	
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	-0.02	0	Left	Tilt	Standard	QPSK	1	25	0716-7	1:1	0.191	1.059	0.202	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	-0.07	1	Left	Tilt	Standard	QPSK	25	0	0716-7	1:1	0.162	1.045	0.169	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT										Head										
Spatial Peak										1.6 W/kg (mW/g)										
Uncontrolled Exposure/General Population										averaged over 1 gram										

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Table 11-7
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	Cover Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #	
MHz	Ch.																			
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	-0.01	0	Right	Cheek	Standard	QPSK	1	49	0716-7	1:1	0.253	1.000	0.253	A7
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	-0.03	0	Right	Cheek	Quick Cover (Open)	QPSK	1	49	0716-7	1:1	0.299	1.000	0.299	
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	-0.03	0	Right	Cheek	Quick Cover (Closed)	QPSK	1	49	0716-7	1:1	0.271	1.000	0.271	
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.06	1	Right	Cheek	Standard	QPSK	25	25	0716-7	1:1	0.210	1.002	0.210	
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	0.20	0	Right	Tilt	Standard	QPSK	1	49	0716-7	1:1	0.140	1.000	0.140	
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.05	1	Right	Tilt	Standard	QPSK	25	25	0716-7	1:1	0.107	1.002	0.107	
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	0.00	0	Left	Cheek	Standard	QPSK	1	49	0716-7	1:1	0.206	1.000	0.206	
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.03	1	Left	Cheek	Standard	QPSK	25	25	0716-7	1:1	0.173	1.002	0.173	
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	-0.02	0	Left	Tilt	Standard	QPSK	1	49	0716-7	1:1	0.145	1.000	0.145	
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.04	1	Left	Tilt	Standard	QPSK	25	25	0716-7	1:1	0.124	1.002	0.124	
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 11-8
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	Cover Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.															(W/kg)		(W/kg)		
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.06	0	Right	Cheek	Standard	QPSK	1	0	0677-1	1:1	0.305	1.059	0.323	A8
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.02	0	Right	Cheek	Quick Cover (Open)	QPSK	1	0	0677-1	1:1	0.338	1.059	0.358	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.01	0	Right	Cheek	Quick Cover (Closed)	QPSK	1	0	0677-1	1:1	0.326	1.059	0.345	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	0.09	1	Right	Cheek	Standard	QPSK	25	25	0677-1	1:1	0.230	1.099	0.253	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.08	0	Right	Tilt	Standard	QPSK	1	0	0677-1	1:1	0.216	1.059	0.229	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	0.06	1	Right	Tilt	Standard	QPSK	25	25	0677-1	1:1	0.150	1.099	0.165	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.14	0	Left	Cheek	Standard	QPSK	1	0	0677-1	1:1	0.303	1.059	0.321	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	0.02	1	Left	Cheek	Standard	QPSK	25	25	0677-1	1:1	0.266	1.099	0.292	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.16	0	Left	Tilt	Standard	QPSK	1	0	0677-1	1:1	0.200	1.059	0.212	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	0.07	1	Left	Tilt	Standard	QPSK	25	25	0677-1	1:1	0.165	1.099	0.181	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT									Head											
Spatial Peak									1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population									averaged over 1 gram											

Table 11-9
LTE Band 4 (AWS) Head SAR

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Cover Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #		
MHz	Ch.																				
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	-0.04	0	Right	Cheek	Standard	QPSK	1	50	0716-7	1:1	0.374	1.038	0.388		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	-0.01	1	Right	Cheek	Standard	QPSK	50	25	0716-7	1:1	0.297	1.057	0.314		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	-0.05	0	Right	Tilt	Standard	QPSK	1	50	0716-7	1:1	0.403	1.038	0.418		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	0.05	1	Right	Tilt	Standard	QPSK	50	25	0716-7	1:1	0.319	1.057	0.337		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.10	0	Left	Cheek	Standard	QPSK	1	50	0716-7	1:1	0.825	1.038	0.856	A9	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.03	0	Left	Cheek	Quick Cover (Open)	QPSK	1	50	0716-7	1:1	0.698	1.038	0.725		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.05	0	Left	Cheek	Quick Cover (Closed)	QPSK	1	50	0716-7	1:1	0.965	1.038	1.002		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	0.03	1	Left	Cheek	Standard	QPSK	50	25	0716-7	1:1	0.627	1.057	0.663		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.32	-0.03	1	Left	Cheek	Standard	QPSK	100	0	0716-7	1:1	0.629	1.091	0.686		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.04	0	Left	Tilt	Standard	QPSK	1	50	0716-7	1:1	0.341	1.038	0.354		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	0.02	1	Left	Tilt	Standard	QPSK	50	25	0716-7	1:1	0.278	1.057	0.294		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	-0.06	0	Left	Cheek	Quick Cover (Closed)	QPSK	1	50	0716-7	1:1	0.961	1.038	0.998		
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 measurements.

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Table 11-10
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	Cover Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)	(W/kg)		
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	0.17	0	Right	Cheek	Standard	QPSK	1	99	0716-7	1:1	0.383	1.054	0.404	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	-0.02	1	Right	Cheek	Standard	QPSK	50	50	0716-7	1:1	0.304	1.057	0.321	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	0.19	0	Right	Tilt	Standard	QPSK	1	99	0716-7	1:1	0.368	1.054	0.388	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	0.07	1	Right	Tilt	Standard	QPSK	50	50	0716-7	1:1	0.278	1.057	0.294	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	0.00	0	Left	Cheek	Standard	QPSK	1	99	0716-7	1:1	0.855	1.054	0.901	
1880.00	18900	Md	LTE Band 2 (PCS)	20	24.2	23.94	0.09	0	Left	Cheek	Standard	QPSK	1	0	0716-7	1:1	0.965	1.062	1.025	A10
1880.00	18900	Md	LTE Band 2 (PCS)	20	24.2	23.94	0.04	0	Left	Cheek	Quick Cover (Open)	QPSK	1	0	0716-7	1:1	0.909	1.062	0.965	
1880.00	18900	Md	LTE Band 2 (PCS)	20	24.2	23.94	-0.14	0	Left	Cheek	Quick Cover (Closed)	QPSK	1	0	0716-7	1:1	0.727	1.062	0.772	
1900.00	19100	High	LTE Band 2 (PCS)	20	24.2	23.80	-0.01	0	Left	Cheek	Standard	QPSK	1	50	0716-7	1:1	0.935	1.096	1.025	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	-0.07	1	Left	Cheek	Standard	QPSK	50	50	0716-7	1:1	0.635	1.057	0.671	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.92	0.04	1	Left	Cheek	Standard	QPSK	100	0	0716-7	1:1	0.683	1.067	0.729	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	-0.18	0	Left	Tilt	Standard	QPSK	1	99	0716-7	1:1	0.381	1.054	0.402	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	0.03	1	Left	Tilt	Standard	QPSK	50	50	0716-7	1:1	0.334	1.057	0.353	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-11
LTE Band 7 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Cover Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.															(W/kg)		(W/kg)		
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.03	0	Right	Cheek	Standard	QPSK	1	0	0716-7	1:1	0.245	1.023	0.251	A11
2560.00	21350	High	LTE Band 7	20	22.7	22.43	0.13	1	Right	Cheek	Standard	QPSK	50	0	0716-7	1:1	0.152	1.064	0.162	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.03	0	Right	Tilt	Standard	QPSK	1	0	0716-7	1:1	0.346	1.023	0.354	
2560.00	21350	High	LTE Band 7	20	22.7	22.43	0.04	1	Right	Tilt	Standard	QPSK	50	0	0716-7	1:1	0.248	1.064	0.264	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.03	0	Left	Cheek	Standard	QPSK	1	0	0716-7	1:1	0.372	1.023	0.381	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.20	0	Left	Cheek	Quick Cover (Open)	QPSK	1	0	0716-7	1:1	0.212	1.023	0.217	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	0.08	0	Left	Cheek	Quick Cover (Closed)	QPSK	1	0	0716-7	1:1	0.198	1.023	0.203	
2560.00	21350	High	LTE Band 7	20	22.7	22.43	-0.05	1	Left	Cheek	Standard	QPSK	50	0	0716-7	1:1	0.285	1.064	0.303	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	0.10	0	Left	Tilt	Standard	QPSK	1	0	0716-7	1:1	0.181	1.023	0.185	
2560.00	21350	High	LTE Band 7	20	22.7	22.43	0.12	1	Left	Tilt	Standard	QPSK	50	0	0716-7	1:1	0.146	1.064	0.155	
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 11-12
DTS Head SAR**

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maxiumum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.													(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	22	16.0	15.78	0.05	Right	Cheek	Standard	0683-9	1	1:1	0.245	1.052	0.258	
2437	6	IEEE 802.11b	DSSS	22	16.0	15.78	-0.04	Right	Tilt	Standard	0683-9	1	1:1	0.243	1.052	0.256	
2437	6	IEEE 802.11b	DSSS	22	16.0	15.78	-0.01	Left	Cheek	Standard	0683-9	1	1:1	0.343	1.052	0.361	
2437	6	IEEE 802.11b	DSSS	22	16.0	15.78	0.06	Left	Tilt	Standard	0683-9	1	1:1	0.399	1.052	0.420	
2437	6	IEEE 802.11b	DSSS	22	16.0	15.78	0.01	Left	Tilt	Quick Cover (Open)	0683-9	1	1:1	0.447	1.052	0.470	AI2
2437	6	IEEE 802.11b	DSSS	22	16.0	15.78	0.08	Left	Tilt	Quick Cover (Closed)	0683-9	1	1:1	0.396	1.052	0.417	
2437	6	IEEE 802.11n	OFDM	20	14.0	13.66	-0.10	Left	Tilt	Standard	0683-9	6.5	1:1	0.228	1.081	0.246	
2437	6	IEEE 802.11ac	OFDM	20	12.0	11.70	0.13	Left	Tilt	Standard	0683-9	6.5	1:1	0.138	1.072	0.148	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak									Head 1.6 W/kg (mW/g) averaged over 1 gram								
Uncontrolled Exposure/General Population																	

**Table 11-13
NII Head SAR**

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Bandwidth [MHz]	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.													(W/kg)		(W/kg)	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	0.13	Right	Cheek	Standard	0683-9	6	1:1	0.390	1.054	0.411	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	0.04	Right	Tilt	Standard	0683-9	6	1:1	0.421	1.054	0.444	
5210	42	IEEE 802.11ac	80	OFDM	11.0	10.60	0.18	Right	Tilt	Standard	0683-9	29.3	1:1	0.092	1.096	0.101	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	0.12	Left	Cheek	Standard	0683-9	6	1:1	0.350	1.054	0.369	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	0.10	Left	Tilt	Standard	0683-9	6	1:1	0.409	1.054	0.431	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.01	Right	Cheek	Standard	0683-9	6	1:1	0.451	1.091	0.492	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.07	Right	Tilt	Standard	0683-9	6	1:1	0.479	1.091	0.523	A13
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.08	Right	Tilt	Quick Cover (Open)	0683-9	6	1:1	0.466	1.091	0.508	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.16	Right	Tilt	Quick Cover (Closed)	0683-9	6	1:1	0.469	1.091	0.512	
5270	54	IEEE 802.11n	40	OFDM	11.0	10.33	0.12	Right	Tilt	Standard	0683-9	13.5	1:1	0.341	1.167	0.398	
5290	58	IEEE 802.11ac	80	OFDM	11.0	10.73	0.02	Right	Tilt	Standard	0683-9	29.3	1:1	0.128	1.064	0.136	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.12	Left	Cheek	Standard	0683-9	6	1:1	0.386	1.091	0.421	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.06	Left	Tilt	Standard	0683-9	6	1:1	0.456	1.091	0.497	
5320	64	IEEE 802.11a	20	OFDM	12.0	11.45	0.12	Left	Tilt	Standard	0683-9	6	1:1	0.413	1.135	0.469	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	0.07	Right	Cheek	Standard	0683-9	6	1:1	0.290	1.146	0.332	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	0.07	Right	Tilt	Standard	0683-9	6	1:1	0.324	1.146	0.371	
5550	110	IEEE 802.11n	40	OFDM	11.0	9.94	0.07	Right	Tilt	Standard	0683-9	13.5	1:1	0.181	1.276	0.231	
5530	106	IEEE 802.11ac	80	OFDM	11.0	9.74	0.08	Right	Tilt	Standard	0683-9	29.3	1:1	0.121	1.337	0.162	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	0.02	Left	Cheek	Standard	0683-9	6	1:1	0.225	1.146	0.258	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	0.18	Left	Tilt	Standard	0683-9	6	1:1	0.274	1.146	0.314	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.17	Right	Cheek	Standard	0683-9	6	1:1	0.215	1.239	0.266	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.03	Right	Tilt	Standard	0683-9	6	1:1	0.240	1.239	0.297	
5795	159	IEEE 802.11n	40	OFDM	11.0	9.56	0.04	Right	Tilt	Standard	0683-9	13.5	1:1	0.144	1.393	0.201	
5775	155	IEEE 802.11ac	80	OFDM	11.0	10.09	0.03	Right	Tilt	Standard	0683-9	29.3	1:1	0.146	1.233	0.180	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.01	Left	Cheek	Standard	0683-9	6	1:1	0.212	1.239	0.263	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.00	Left	Tilt	Standard	0683-9	6	1:1	0.228	1.239	0.282	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT																	
Spatial Peak									Head								
Uncontrolled Exposure/General Population									1.6 W/kg (mW/g) averaged over 1 gram								

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11.2 Standalone Body-Worn SAR Data

Table 11-14
GSM/UMTS Body-Worn SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.2	33.08	0.00	10 mm	Standard	0682-1	1	1.8.3	back	0.522	1.028	0.537	
836.60	190	GSM 850	GSM	33.2	33.08	-0.02	10 mm	Quick Cover (Closed)	0682-1	1	1.8.3	back	0.453	1.028	0.466	
836.60	190	GSM 850	GPRS	28.2	27.92	-0.02	10 mm	Standard	0682-1	4	1.2.076	back	0.607	1.067	0.648	A14
836.60	190	GSM 850	GPRS	28.2	27.92	-0.02	10 mm	Quick Cover (Closed)	0682-1	4	1.2.076	back	0.548	1.067	0.585	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.04	10 mm	Standard	0682-1	N/A	1:1	back	0.554	1.050	0.582	A16
836.60	4183	UMTS 850	RMC	23.7	23.49	-0.01	10 mm	Quick Cover (Closed)	0682-1	N/A	1:1	back	0.511	1.050	0.537	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.02	10 mm	Standard	0682-1	N/A	1:1	back	0.664	1.096	0.728	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.02	10 mm	Quick Cover (Closed)	0682-1	N/A	1:1	back	0.751	1.096	0.823	A18
1880.00	661	GSM 1900	GSM	30.2	29.86	0.02	10 mm	Standard	0681-3	1	1.8.3	back	0.253	1.081	0.273	
1880.00	661	GSM 1900	GSM	30.2	29.86	-0.09	10 mm	Quick Cover (Closed)	0681-3	1	1.8.3	back	0.284	1.081	0.307	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.04	10 mm	Standard	0681-3	4	1.2.076	back	0.310	1.012	0.314	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.10	10 mm	Quick Cover (Closed)	0681-3	4	1.2.076	back	0.350	1.012	0.354	A19
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.00	10 mm	Standard	0677-1	N/A	1:1	back	0.653	1.042	0.680	A21
1880.00	9400	UMTS 1900	RMC	24.2	24.02	-0.02	10 mm	Quick Cover (Closed)	0677-1	N/A	1:1	back	0.560	1.042	0.584	
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 11-15
LTE Body-Worn SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Cover Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.															(W/kg)		(W/kg)		
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	0.05	0	Standard	0716-7	QPSK	1	25	10 mm	back	1.1	0.483	1.059	0.511	A23
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	-0.06	0	Quick Cover (Closed)	0716-7	QPSK	1	25	10 mm	back	1.1	0.293	1.059	0.310	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	-0.01	1	Standard	0716-7	QPSK	25	0	10 mm	back	1.1	0.361	1.045	0.377	
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	0.06	0	Standard	0716-7	QPSK	1	49	10 mm	back	1.1	0.448	1.000	0.448	A25
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	-0.02	0	Quick Cover (Closed)	0716-7	QPSK	1	49	10 mm	back	1.1	0.265	1.000	0.265	
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.00	1	Standard	0716-7	QPSK	25	25	10 mm	back	1.1	0.369	1.002	0.370	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.00	0	Standard	0716-7	QPSK	1	0	10 mm	back	1.1	0.587	1.059	0.622	A27
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	-0.01	0	Quick Cover (Closed)	0716-7	QPSK	1	0	10 mm	back	1.1	0.511	1.059	0.541	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	0.02	1	Standard	0716-7	QPSK	25	25	10 mm	back	1.1	0.485	1.099	0.533	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.07	0	Standard	0716-7	QPSK	1	50	10 mm	back	1.1	0.599	1.038	0.622	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.05	0	Quick Cover (Closed)	0716-7	QPSK	1	50	10 mm	back	1.1	0.687	1.038	0.713	A29
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	0.03	1	Standard	0716-7	QPSK	50	25	10 mm	back	1.1	0.471	1.057	0.498	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	-0.06	0	Standard	0716-7	QPSK	1	99	10 mm	back	1.1	0.504	1.054	0.531	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	0.02	0	Quick Cover (Closed)	0716-7	QPSK	1	99	10 mm	back	1.1	0.562	1.054	0.592	A30
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	0.00	1	Standard	0716-7	QPSK	50	50	10 mm	back	1.1	0.431	1.057	0.456	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.02	0	Standard	0716-7	QPSK	1	0	10 mm	back	1.1	0.525	1.023	0.537	A32
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.05	0	Quick Cover (Closed)	0716-7	QPSK	1	0	10 mm	back	1.1	0.430	1.023	0.440	
2560.00	21350	High	LTE Band 7	20	22.7	22.43	-0.10	1	Standard	0716-7	QPSK	50	0	10 mm	back	1.1	0.359	1.064	0.382	
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 11-16
DTS Body-Worn SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Bandwidth [MHz]	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Num ber	Data Rate (Mbps)	Side	Duty Cycle	SAR [1g]	Scaling Factor	Scaled SAR [1g]	Plot #
MHz	Ch.													(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	22	DSSS	16.0	15.78	-0.18	10 mm	Standard	0683-9	1	back	1:1	0.171	1.052	0.180	A34
2437	6	IEEE 802.11b	22	DSSS	16.0	15.78	-0.03	10 mm	Quick Cover (Closed)	0683-9	1	back	1:1	0.138	1.052	0.145	
2437	6	IEEE 802.11n	20	OFDM	14.0	13.66	-0.14	10 mm	Standard	0683-9	6.5	back	1:1	0.096	1.081	0.104	
2437	6	IEEE 802.11ac	20	OFDM	12.0	11.70	0.01	10 mm	Standard	0683-9	6.5	back	1:1	0.054	1.072	0.058	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-17
NII Body-Worn SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Bandwidth [MHz]	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.													(W/kg)		(W/kg)	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	-0.13	10 mm	Standard	0683-9	6	back	1:1	0.166	1.054	0.175	
5210	42	IEEE 802.11ac	80	OFDM	11.0	10.60	0.02	10 mm	Standard	0683-9	29.3	back	1:1	0.032	1.096	0.035	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.14	10 mm	Standard	0683-9	6	back	1:1	0.174	1.091	0.190	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	-0.02	10 mm	Quick Cover (Closed)	0683-9	6	back	1:1	0.203	1.091	0.221	A35
5270	54	IEEE 802.11n	40	OFDM	11.0	10.33	0.02	10 mm	Standard	0683-9	13.5	back	1:1	0.119	1.167	0.139	
5290	58	IEEE 802.11ac	80	OFDM	11.0	10.73	0.04	10 mm	Standard	0683-9	29.3	back	1:1	0.045	1.064	0.048	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	0.00	10 mm	Standard	0683-9	6	back	1:1	0.156	1.146	0.179	
5550	110	IEEE 802.11n	40	OFDM	11.0	9.94	0.01	10 mm	Standard	0683-9	13.5	back	1:1	0.097	1.276	0.124	
5530	106	IEEE 802.11ac	80	OFDM	11.0	9.74	0.02	10 mm	Standard	0683-9	29.3	back	1:1	0.061	1.337	0.082	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.18	10 mm	Standard	0683-9	6	back	1:1	0.085	1.239	0.105	
5795	159	IEEE 802.11n	40	OFDM	11.0	9.56	0.04	10 mm	Standard	0683-9	13.5	back	1:1	0.046	1.393	0.064	
5775	155	IEEE 802.11ac	80	OFDM	11.0	10.09	0.18	10 mm	Standard	0683-9	29.3	back	1:1	0.050	1.233	0.062	
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 11-18
DSS Body-Worn SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2441	39	Bluetooth	FHSS	10.5	10.31	-0.07	10 mm	Standard	0683-9	1	back	1:1	0.012	1.045	0.013	
2441	39	Bluetooth	FHSS	10.5	10.31	0.02	10 mm	Quick Cover (Closed)	0683-9	1	back	1:1	0.016	1.045	0.017	A37
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 Wireless Router SAR Data

Table 11-19
GPRS/UMTS Hotspot SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
836.60	190	GSM 850	GPRS	28.2	27.92	-0.02	10 mm	Standard	0682-1	4	1:2.076	back	0.607	1.067	0.648	
836.60	190	GSM 850	GPRS	28.2	27.92	-0.02	10 mm	Standard	0682-1	4	1:2.076	front	0.622	1.067	0.664	
836.60	190	GSM 850	GPRS	28.2	27.92	-0.01	10 mm	Standard	0682-1	4	1:2.076	bottom	0.462	1.067	0.493	
836.60	190	GSM 850	GPRS	28.2	27.92	0.03	10 mm	Standard	0682-1	4	1:2.076	right	0.652	1.067	0.696	A15
836.60	190	GSM 850	GPRS	28.2	27.92	-0.03	10 mm	Quick Cover (Closed)	0682-1	4	1:2.076	right	0.609	1.067	0.650	
836.60	190	GSM 850	GPRS	28.2	27.92	-0.03	10 mm	Standard	0682-1	4	1:2.076	left	0.362	1.067	0.386	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.04	10 mm	Standard	0682-1	N/A	1:1	back	0.554	1.050	0.582	
836.60	4183	UMTS 850	RMC	23.7	23.49	-0.11	10 mm	Standard	0682-1	N/A	1:1	front	0.593	1.050	0.623	A17
836.60	4183	UMTS 850	RMC	23.7	23.49	-0.10	10 mm	Quick Cover (Closed)	0682-1	N/A	1:1	front	0.423	1.050	0.444	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.04	10 mm	Standard	0682-1	N/A	1:1	bottom	0.245	1.050	0.257	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.02	10 mm	Standard	0682-1	N/A	1:1	right	0.586	1.050	0.615	
836.60	4183	UMTS 850	RMC	23.7	23.49	0.03	10 mm	Standard	0682-1	N/A	1:1	left	0.360	1.050	0.378	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.02	10 mm	Standard	0682-1	N/A	1:1	back	0.664	1.096	0.728	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.02	10 mm	Quick Cover (Closed)	0682-1	N/A	1:1	back	0.751	1.096	0.823	A18
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.02	10 mm	Standard	0682-1	N/A	1:1	front	0.623	1.096	0.683	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.02	10 mm	Standard	0682-1	N/A	1:1	bottom	0.545	1.096	0.597	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.03	10 mm	Standard	0682-1	N/A	1:1	left	0.562	1.096	0.616	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.04	10 mm	Standard	0681-3	4	1:2.076	back	0.310	1.012	0.314	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.05	10 mm	Standard	0681-3	4	1:2.076	front	0.519	1.012	0.525	A20
1880.00	661	GSM 1900	GPRS	25.2	25.15	0.04	10 mm	Quick Cover (Closed)	0681-3	4	1:2.076	front	0.333	1.012	0.337	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.12	10 mm	Standard	0681-3	4	1:2.076	bottom	0.287	1.012	0.290	
1880.00	661	GSM 1900	GPRS	25.2	25.15	-0.11	10 mm	Standard	0681-3	4	1:2.076	left	0.446	1.012	0.451	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.00	10 mm	Standard	0677-1	N/A	1:1	back	0.653	1.042	0.680	
1852.40	9262	UMTS 1900	RMC	24.2	24.15	-0.07	10 mm	Standard	0677-1	N/A	1:1	front	0.851	1.012	0.861	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	-0.04	10 mm	Standard	0677-1	N/A	1:1	front	0.788	1.042	0.821	
1907.60	9538	UMTS 1900	RMC	24.2	24.00	-0.05	10 mm	Standard	0677-1	N/A	1:1	front	0.835	1.047	0.874	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.00	10 mm	Standard	0677-1	N/A	1:1	bottom	0.496	1.042	0.517	
1852.40	9262	UMTS 1900	RMC	24.2	24.15	-0.03	10 mm	Standard	0677-1	N/A	1:1	left	0.952	1.012	0.963	
1880.00	9400	UMTS 1900	RMC	24.2	24.02	-0.01	10 mm	Standard	0677-1	N/A	1:1	left	0.967	1.042	1.008	A22
1880.00	9400	UMTS 1900	RMC	24.2	24.02	0.00	10 mm	Quick Cover (Closed)	0677-1	N/A	1:1	left	0.925	1.042	0.964	
1907.60	9538	UMTS 1900	RMC	24.2	24.00	-0.01	10 mm	Standard	0677-1	N/A	1:1	left	0.832	1.047	0.871	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT							Body									
Spatial Peak							1.6 W/kg (mW/g)									
Uncontrolled Exposure/General Population							averaged over 1 gram									

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Table 11-20
LTE Band 12 Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Cover Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)		Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.															(W/kg)				
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	0.05	0	Standard	0716-7	QPSK	1	25	10 mm	back	1:1	0.483	1.059	0.511	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	-0.01	1	Standard	0716-7	QPSK	25	0	10 mm	back	1:1	0.361	1.045	0.377	
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	-0.01	0	Standard	0716-7	QPSK	1	25	10 mm	front	1:1	0.487	1.059	0.516	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	0.01	1	Standard	0716-7	QPSK	25	0	10 mm	front	1:1	0.355	1.045	0.371	
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	-0.06	0	Standard	0716-7	QPSK	1	25	10 mm	bottom	1:1	0.331	1.059	0.351	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	-0.04	1	Standard	0716-7	QPSK	25	0	10 mm	bottom	1:1	0.223	1.045	0.233	
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	-0.02	0	Standard	0716-7	QPSK	1	25	10 mm	right	1:1	0.492	1.059	0.521	A24
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	0.09	0	Quick Cover (Closed)	0716-7	QPSK	1	25	10 mm	right	1:1	0.312	1.059	0.330	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	0.08	1	Standard	0716-7	QPSK	25	0	10 mm	right	1:1	0.363	1.045	0.379	
707.50	23095	Mid	LTE Band 12	10	24.4	24.15	0.03	0	Standard	0716-7	QPSK	1	25	10 mm	left	1:1	0.293	1.059	0.310	
707.50	23095	Mid	LTE Band 12	10	23.4	23.21	0.02	1	Standard	0716-7	QPSK	25	0	10 mm	left	1:1	0.221	1.045	0.231	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT																				
Spatial Peak								1.6 W/kg (mW/g)												
Uncontrolled Exposure/General Population								averaged over 1 gram												

Table 11-21
LTE Band 13 Hotspot SAR

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Cover Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)		Scaling Factor	Scaled SAR (1g)		Plot #
MHz	Ch.															(W/kg)	(W/kg)				
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	0.06	0	Standard	0716-7	QPSK	1	49	10 mm	back	1:1	0.448	1.000	0.448		
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.00	1	Standard	0716-7	QPSK	25	25	10 mm	back	1:1	0.369	1.002	0.370		
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	0.01	0	Standard	0716-7	QPSK	1	49	10 mm	front	1:1	0.672	1.000	0.672	A26	
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	-0.02	0	Quick Cover (Closed)	0716-7	QPSK	1	49	10 mm	front	1:1	0.271	1.000	0.271		
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	-0.01	1	Standard	0716-7	QPSK	25	25	10 mm	front	1:1	0.541	1.002	0.542		
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	0.04	0	Standard	0716-7	QPSK	1	49	10 mm	bottom	1:1	0.376	1.000	0.376		
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.05	1	Standard	0716-7	QPSK	25	25	10 mm	bottom	1:1	0.286	1.002	0.287		
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	0.02	0	Standard	0716-7	QPSK	1	49	10 mm	right	1:1	0.214	1.000	0.214		
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.03	1	Standard	0716-7	QPSK	25	25	10 mm	right	1:1	0.205	1.002	0.205		
782.00	23230	Mid	LTE Band 13	10	24.4	24.40	0.15	0	Standard	0716-7	QPSK	1	49	10 mm	left	1:1	0.067	1.000	0.067		
782.00	23230	Mid	LTE Band 13	10	23.4	23.39	0.02	1	Standard	0716-7	QPSK	25	25	10 mm	left	1:1	0.057	1.002	0.057		
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body													
Spatial Peak								1.6 W/kg (mW/g)													
Uncontrolled Exposure/General Population								averaged over 1 gram													

Table 11-22
LTE Band 5 (Cell) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Cover Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.															(W/kg)		(W/kg)		
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.00	0	Standard	0716-7	QPSK	1	0	10 mm	back	1:1	0.587	1.059	0.622	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	0.02	1	Standard	0716-7	QPSK	25	25	10 mm	back	1:1	0.485	1.099	0.533	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	0.10	0	Standard	0716-7	QPSK	1	0	10 mm	front	1:1	0.631	1.059	0.668	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	-0.09	1	Standard	0716-7	QPSK	25	25	10 mm	front	1:1	0.530	1.099	0.582	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	-0.01	0	Standard	0716-7	QPSK	1	0	10 mm	bottom	1:1	0.491	1.059	0.520	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	0.01	1	Standard	0716-7	QPSK	25	25	10 mm	bottom	1:1	0.364	1.099	0.400	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	-0.01	0	Standard	0716-7	QPSK	1	0	10 mm	right	1:1	0.639	1.059	0.677	A28
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	-0.03	0	Quick Cover (Closed)	0716-7	QPSK	1	0	10 mm	right	1:1	0.433	1.059	0.459	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	-0.01	1	Standard	0716-7	QPSK	25	25	10 mm	right	1:1	0.548	1.099	0.602	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.4	24.15	-0.07	0	Standard	0716-7	QPSK	1	0	10 mm	left	1:1	0.391	1.059	0.414	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.4	22.99	0.04	1	Standard	0716-7	QPSK	25	25	10 mm	left	1:1	0.277	1.099	0.304	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT									Body											
Spatial Peak									1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population									averaged over 1 gram											

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Table 11-23
LTE Band 4 (AWS) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Cover Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.															(W/kg)		(W/kg)		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.07	0	Standard	0716-7	QPSK	1	50	10 mm	back	1:1	0.599	1.038	0.622	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.05	0	Quick Cover (Closed)	0716-7	QPSK	1	50	10 mm	back	1:1	0.687	1.038	0.713	A29
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	0.03	1	Standard	0716-7	QPSK	50	25	10 mm	back	1:1	0.471	1.057	0.498	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	-0.01	0	Standard	0716-7	QPSK	1	50	10 mm	front	1:1	0.593	1.038	0.616	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	0.04	1	Standard	0716-7	QPSK	50	25	10 mm	front	1:1	0.473	1.057	0.500	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	-0.05	0	Standard	0716-7	QPSK	1	50	10 mm	bottom	1:1	0.597	1.038	0.620	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	0.04	1	Standard	0716-7	QPSK	50	25	10 mm	bottom	1:1	0.483	1.057	0.511	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.54	0.01	0	Standard	0716-7	QPSK	1	50	10 mm	left	1:1	0.573	1.038	0.595	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.46	0.04	1	Standard	0716-7	QPSK	50	25	10 mm	left	1:1	0.449	1.057	0.475	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-24
LTE Band 2 (PCS) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Cover Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	-0.06	0	Standard	0716-7	QPSK	1	99	10 mm	back	1:1	0.504	1.054	0.531	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	0.00	1	Standard	0716-7	QPSK	50	50	10 mm	back	1:1	0.431	1.057	0.456	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	0.00	0	Standard	0716-7	QPSK	1	99	10 mm	front	1:1	0.751	1.054	0.792	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	-0.07	1	Standard	0716-7	QPSK	50	50	10 mm	front	1:1	0.625	1.057	0.661	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	0.08	0	Standard	0716-7	QPSK	1	99	10 mm	bottom	1:1	0.500	1.054	0.527	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	-0.03	1	Standard	0716-7	QPSK	50	50	10 mm	bottom	1:1	0.391	1.057	0.413	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.2	23.97	-0.04	0	Standard	0716-7	QPSK	1	99	10 mm	left	1:1	1.000	1.054	1.054	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.2	23.94	0.00	0	Standard	0716-7	QPSK	1	0	10 mm	left	1:1	1.000	1.062	1.062	A31
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.2	23.94	-0.01	0	Quick Cover (Closed)	0716-7	QPSK	1	0	10 mm	left	1:1	0.814	1.062	0.864	
1900.00	19100	High	LTE Band 2 (PCS)	20	24.2	23.80	0.07	0	Standard	0716-7	QPSK	1	50	10 mm	left	1:1	0.947	1.096	1.038	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.96	0.04	1	Standard	0716-7	QPSK	50	50	10 mm	left	1:1	0.704	1.057	0.744	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.2	22.92	0.00	1	Standard	0716-7	QPSK	100	0	10 mm	left	1:1	0.680	1.067	0.726	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.2	23.94	0.05	0	Standard	0716-7	QPSK	1	0	10 mm	left	1:1	0.901	1.062	0.957	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body												
Spatial Peak								1.6 W/kg (mW/g)												
Uncontrolled Exposure/General Population								averaged over 1 gram												

Note: Blue entry indicates variability measurements.

Table 11-25
LTE Band 7 Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Cover Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #	
MHz	Ch.															(W/kg)		(W/kg)		
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.02	0	Standard	0716-7	QPSK	1	0	10 mm	back	1:1	0.525	1.023	0.537	
2560.00	21350	High	LTE Band 7	20	22.7	22.43	-0.10	1	Standard	0716-7	QPSK	50	0	10 mm	back	1:1	0.359	1.064	0.382	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.02	0	Standard	0716-7	QPSK	1	0	10 mm	front	1:1	0.531	1.023	0.543	A33
2560.00	21350	High	LTE Band 7	20	23.7	23.60	0.00	0	Quick Cover (Closed)	0716-7	QPSK	1	0	10 mm	front	1:1	0.374	1.023	0.383	
2560.00	21350	High	LTE Band 7	20	22.7	22.43	0.03	1	Standard	0716-7	QPSK	50	0	10 mm	front	1:1	0.379	1.064	0.403	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	-0.03	0	Standard	0716-7	QPSK	1	0	10 mm	bottom	1:1	0.140	1.023	0.143	
2560.00	21350	High	LTE Band 7	20	22.7	22.43	-0.01	1	Standard	0716-7	QPSK	50	0	10 mm	bottom	1:1	0.104	1.064	0.111	
2560.00	21350	High	LTE Band 7	20	23.7	23.60	0.05	0	Standard	0716-7	QPSK	1	0	10 mm	left	1:1	0.396	1.023	0.405	
2560.00	21350	High	LTE Band 7	20	22.7	22.43	0.02	1	Standard	0716-7	QPSK	50	0	10 mm	left	1:1	0.282	1.064	0.300	
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	Bandwidth [MHz]	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.													(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	22	DSSS	16.0	15.78	-0.18	10 mm	Standard	0683-9	1	back	1:1	0.171	1.052	0.180	A34
2437	6	IEEE 802.11b	22	DSSS	16.0	15.78	-0.03	10 mm	Quick Cover (Closed)	0683-9	1	back	1:1	0.138	1.052	0.145	
2437	6	IEEE 802.11n	20	OFDM	14.0	13.66	-0.14	10 mm	Standard	0683-9	6.5	back	1:1	0.096	1.081	0.104	
2437	6	IEEE 802.11ac	20	OFDM	12.0	11.70	0.01	10 mm	Standard	0683-9	6.5	back	1:1	0.054	1.072	0.058	
2437	6	IEEE 802.11b	22	DSSS	16.0	15.78	0.18	10 mm	Standard	0683-9	1	front	1:1	0.094	1.052	0.099	
2437	6	IEEE 802.11b	22	DSSS	16.0	15.78	-0.02	10 mm	Standard	0683-9	1	top	1:1	0.145	1.052	0.153	
2437	6	IEEE 802.11b	22	DSSS	16.0	15.78	-0.02	10 mm	Standard	0683-9	1	right	1:1	0.039	1.052	0.041	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.18	10 mm	Standard	0683-9	6	back	1:1	0.085	1.239	0.105	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.15	10 mm	Standard	0683-9	6	front	1:1	0.061	1.239	0.076	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.05	10 mm	Standard	0683-9	6	top	1:1	0.181	1.239	0.224	A36
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.20	10 mm	Quick Cover (Closed)	0683-9	6	top	1:1	0.162	1.239	0.201	
5795	159	IEEE 802.11n	40	OFDM	11.0	9.56	0.00	10 mm	Standard	0683-9	13.5	top	1:1	0.101	1.393	0.141	
5775	155	IEEE 802.11ac	80	OFDM	11.0	10.09	0.09	10 mm	Standard	0683-9	29.3	top	1:1	0.112	1.233	0.138	
5785	157	IEEE 802.11a	20	OFDM	12.0	11.07	0.19	10 mm	Standard	0683-9	6	right	1:1	0.094	1.239	0.116	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram								

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11.4 Standalone Extremity SAR Data

Table 11-27
WLAN Extremity SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Bandwidth [MHz]	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (10g)	Scaling Factor	Scaled SAR (10g)	Plot #
MHz	Ch.													(W/kg)		(W/kg)	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	-0.11	0 mm	Standard	0683-9	6	back	1:1	0.332	1.054	0.350	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	0.00	0 mm	Standard	0683-9	6	front	1:1	0.146	1.054	0.154	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	0.03	0 mm	Standard	0683-9	6	top	1:1	0.474	1.054	0.500	
5210	42	IEEE 802.11ac	80	OFDM	11.0	10.60	-0.17	0 mm	Standard	0683-9	29.3	top	1:1	0.106	1.096	0.116	
5200	40	IEEE 802.11a	20	OFDM	12.0	11.77	0.08	0 mm	Standard	0683-9	6	right	1:1	0.017	1.054	0.018	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	-0.01	0 mm	Standard	0683-9	6	back	1:1	0.374	1.091	0.408	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.12	0 mm	Standard	0683-9	6	front	1:1	0.153	1.091	0.167	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.02	0 mm	Standard	0683-9	6	top	1:1	0.499	1.091	0.544	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.08	0 mm	Quick Cover (Open)	0683-9	6	top	1:1	0.494	1.091	0.539	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.11	0 mm	Quick Cover (Closed)	0683-9	6	top	1:1	0.502	1.091	0.548	A38
5270	54	IEEE 802.11n	40	OFDM	11.0	10.33	-0.12	0 mm	Standard	0683-9	13.5	top	1:1	0.355	1.167	0.414	
5290	58	IEEE 802.11ac	80	OFDM	11.0	10.73	-0.16	0 mm	Standard	0683-9	29.3	top	1:1	0.140	1.064	0.149	
5260	52	IEEE 802.11a	20	OFDM	12.0	11.62	0.05	0 mm	Standard	0683-9	6	right	1:1	0.018	1.091	0.020	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	-0.15	0 mm	Standard	0683-9	6	back	1:1	0.254	1.146	0.291	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	0.07	0 mm	Standard	0683-9	6	front	1:1	0.089	1.146	0.102	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	0.08	0 mm	Standard	0683-9	6	top	1:1	0.260	1.146	0.298	
5550	110	IEEE 802.11n	40	OFDM	11.0	9.94	-0.06	0 mm	Standard	0683-9	13.5	top	1:1	0.153	1.276	0.195	
5530	106	IEEE 802.11ac	80	OFDM	11.0	9.74	-0.03	0 mm	Standard	0683-9	29.3	top	1:1	0.104	1.337	0.139	
5500	100	IEEE 802.11a	20	OFDM	12.0	11.41	0.00	0 mm	Standard	0683-9	6	right	1:1	0.002	1.146	0.002	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Hand 4.0 W/kg (mW/g) averaged over 10 grams								

Table 11-28
Bluetooth Extremity SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (10g)	Scaling Factor	Scaled SAR (10g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2441	39	Bluetooth	FHSS	10.5	10.31	0.18	0 mm	Standard	0683-9	1	back	1:1	0.035	1.045	0.037	
2441	39	Bluetooth	FHSS	10.5	10.31	-0.09	0 mm	Quick Cover (Open)	0683-9	1	back	1:1	0.022	1.045	0.023	
2441	39	Bluetooth	FHSS	10.5	10.31	0.01	0 mm	Quick Cover (Closed)	0683-9	1	back	1:1	0.044	1.045	0.046	A39
2441	39	Bluetooth	FHSS	10.5	10.31	0.09	0 mm	Standard	0683-9	1	front	1:1	0.025	1.045	0.026	
2441	39	Bluetooth	FHSS	10.5	10.31	-0.07	0 mm	Standard	0683-9	1	top	1:1	0.022	1.045	0.023	
2441	39	Bluetooth	FHSS	10.5	10.31	0.19	0 mm	Standard	0683-9	1	right	1:1	0.006	1.045	0.006	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Hand 4.0 W/kg (mW/g) averaged over 10 grams									

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11.5 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, and FCC KDB Publication 447498 D01v05.
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 D01v05.
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 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 13 for variability analysis.
8. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).
9. Per FCC KDB Publication 648474 D04v01r01, this device is considered a "phablet" since the diagonal dimension is > 160 mm and < 200 mm. Therefore, hand SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.
10. Per FCC KDB Publication 648474 D03, SAR was measured using the standard battery cover and then repeated with the quick cover for the configuration with the highest measured SAR for each wireless technology, frequency band, operating mode, and exposure condition. Since reported SAR did not exceed 1.2 W/kg, additional testing with the quick cover was not required.
11. Head and Extremity tests using the quick cover were performed with the cover extension both open and closed. Body-worn and Hotspot tests were performed with the cover extension closed because operations near the body with the cover extension open are not expected.

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR. GPRS was additionally evaluated for head and body-worn voice calls to cover VoIP.
2. Justification for reduced test configurations per KDB Publication 941225 D03v01 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. 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 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.

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UMTS Notes:

1. UMTS mode in was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r01. The general test procedures used for testing can be found in Section 8.5.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
4. Per FCC Guidance, LTE CA SAR was not needed for testing since the data sent by uplink on the uplink physical channels does not change between Rel. 8 and Rel. 10.

BT/WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI operations: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n/ac) were not required since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode. Some additional IEEE 802.11n/ac SAR tests for the highest measured SAR positions were included in this report per manufacturer's request.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 5 GHz WIFI operations: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz bandwidths) were not required since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode. Some additional IEEE 802.11n and IEEE 802.11ac SAR tests for the highest measured SAR positions were included in this report per manufacturer's request.
3. Per April 2013 TCB Workshop notes, full SAR tests for all IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.
4. When Hotspot is enabled, 5.2-5.7 GHz bands are disabled. Therefore no 5.2 – 5.7 GHz WIFI Wireless Router SAR Data was required.
5. WIFI transmission was verified using an uncalibrated spectrum analyzer.
6. When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is < 1.6 W/kg and the reported 1g averaged SAR is < 0.8 W/kg, SAR testing on other default channels was not required.
7. The channel and data rate with the highest average output power were evaluated for Bluetooth.

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12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05 are applicable to handsets with built-in unlicensed transmitters such as 802.11a/b/g/n/ac 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 447498 D01v05 IV.C.1.iii and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific physical test configuration is ≤ 1.6 W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g/10g SAR for simultaneous transmission assessment involving that transmitter.

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

$$\text{Estimated 10g SAR} = \frac{\sqrt{f(\text{GHz})}}{18.75} * \frac{(\text{Max Power of channel, mW})}{\text{Min. Separation Distance, mm}}$$

Table 12-1
Estimated SAR

Mode	Exposure Condition	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
		[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth LE	Body-Worn	2480	7.00	10	0.105

Note:

1. Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.
2. Main Antenna SAR Testing was not required for extremity exposure conditions per FCC KDB 648474. Therefore, no further analysis was required to determine that possible simultaneous scenarios would not exceed the SAR limit.

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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)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.429	0.258	0.687	Head SAR	Right Cheek	0.456	0.258	0.714
	Right Tilt	0.198	0.256	0.454		Right Tilt	0.225	0.256	0.481
	Left Cheek	0.344	0.361	0.705		Left Cheek	0.382	0.361	0.743
	Left Tilt	0.223	0.470	0.693		Left Tilt	0.270	0.470	0.740
Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.453	0.258	0.711	Head SAR	Right Cheek	0.453	0.258	0.711
	Right Tilt	0.212	0.256	0.468		Right Tilt	0.381	0.256	0.637
	Left Cheek	0.347	0.361	0.708		Left Cheek	1.016	0.361	1.377
	Left Tilt	0.224	0.470	0.694		Left Tilt	0.349	0.470	0.819
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.214	0.258	0.472	Head SAR	Right Cheek	0.264	0.258	0.522
	Right Tilt	0.217	0.256	0.473		Right Tilt	0.230	0.256	0.486
	Left Cheek	0.537	0.361	0.898		Left Cheek	0.650	0.361	1.011
	Left Tilt	0.237	0.470	0.707		Left Tilt	0.248	0.470	0.718
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.407	0.258	0.665	Head SAR	Right Cheek	0.403	0.258	0.661
	Right Tilt	0.405	0.256	0.661		Right Tilt	0.185	0.256	0.441
	Left Cheek	1.002	0.361	1.363		Left Cheek	0.358	0.361	0.719
	Left Tilt	0.443	0.470	0.913		Left Tilt	0.202	0.470	0.672
Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.299	0.258	0.557	Head SAR	Right Cheek	0.358	0.258	0.616
	Right Tilt	0.140	0.256	0.396		Right Tilt	0.229	0.256	0.485
	Left Cheek	0.206	0.361	0.567		Left Cheek	0.321	0.361	0.682
	Left Tilt	0.145	0.470	0.615		Left Tilt	0.212	0.470	0.682
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.388	0.258	0.646	Head SAR	Right Cheek	0.404	0.258	0.662
	Right Tilt	0.418	0.256	0.674		Right Tilt	0.388	0.256	0.644
	Left Cheek	1.002	0.361	1.363		Left Cheek	1.025	0.361	1.386
	Left Tilt	0.354	0.470	0.824		Left Tilt	0.402	0.470	0.872
		Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)			
		Head SAR	Right Cheek	0.251	0.258	0.509			
			Right Tilt	0.354	0.256	0.610			
			Left Cheek	0.381	0.361	0.742			
			Left Tilt	0.185	0.470	0.655			

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Table 12-3
Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.429	0.492	0.921	Head SAR	Right Cheek	0.456	0.492	0.948
	Right Tilt	0.198	0.523	0.721		Right Tilt	0.225	0.523	0.748
	Left Cheek	0.344	0.421	0.765		Left Cheek	0.382	0.421	0.803
	Left Tilt	0.223	0.497	0.720		Left Tilt	0.270	0.497	0.767
Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.453	0.492	0.945	Head SAR	Right Cheek	0.453	0.492	0.945
	Right Tilt	0.212	0.523	0.735		Right Tilt	0.381	0.523	0.904
	Left Cheek	0.347	0.421	0.768		Left Cheek	1.016	0.421	1.437
	Left Tilt	0.224	0.497	0.721		Left Tilt	0.349	0.497	0.846
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.214	0.492	0.706	Head SAR	Right Cheek	0.264	0.492	0.756
	Right Tilt	0.217	0.523	0.740		Right Tilt	0.230	0.523	0.753
	Left Cheek	0.537	0.421	0.958		Left Cheek	0.650	0.421	1.071
	Left Tilt	0.237	0.497	0.734		Left Tilt	0.248	0.497	0.745
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.407	0.492	0.899	Head SAR	Right Cheek	0.403	0.492	0.895
	Right Tilt	0.405	0.523	0.928		Right Tilt	0.185	0.523	0.708
	Left Cheek	1.002	0.421	1.423		Left Cheek	0.358	0.421	0.779
	Left Tilt	0.443	0.497	0.940		Left Tilt	0.202	0.497	0.699
Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.299	0.492	0.791	Head SAR	Right Cheek	0.358	0.492	0.850
	Right Tilt	0.140	0.523	0.663		Right Tilt	0.229	0.523	0.752
	Left Cheek	0.206	0.421	0.627		Left Cheek	0.321	0.421	0.742
	Left Tilt	0.145	0.497	0.642		Left Tilt	0.212	0.497	0.709
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.388	0.492	0.880	Head SAR	Right Cheek	0.404	0.492	0.896
	Right Tilt	0.418	0.523	0.941		Right Tilt	0.388	0.523	0.911
	Left Cheek	1.002	0.421	1.423		Left Cheek	1.025	0.421	1.446
	Left Tilt	0.354	0.497	0.851		Left Tilt	0.402	0.497	0.899
		Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)			
		Head SAR	Right Cheek	0.251	0.492	0.743			
			Right Tilt	0.354	0.523	0.877			
			Left Cheek	0.381	0.421	0.802			
			Left Tilt	0.185	0.497	0.682			

The worst case 5 GHz WIFI reported SAR for each head configuration was considered for simultaneous SAR exclusion via summation of standalone SAR, regardless of whether the WIFI channel has WIFI Hotspot capability, for simplicity to determine compliance. Please note that the actual simultaneous transmission SAR will not exceed the summed levels indicated.

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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)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.537	0.180	0.717
Back Side	GPRS 850	0.648	0.180	0.828
Back Side	UMTS 850	0.582	0.180	0.762
Back Side	UMTS 1750	0.823	0.180	1.003
Back Side	GSM 1900	0.307	0.180	0.487
Back Side	GPRS 1900	0.354	0.180	0.534
Back Side	UMTS 1900	0.680	0.180	0.860
Back Side	LTE Band 12	0.511	0.180	0.691
Back Side	LTE Band 13	0.448	0.180	0.628
Back Side	LTE Band 5 (Cell)	0.622	0.180	0.802
Back Side	LTE Band 4 (AWS)	0.713	0.180	0.893
Back Side	LTE Band 2 (PCS)	0.592	0.180	0.772
Back Side	LTE Band 7	0.537	0.180	0.717

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

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.537	0.221	0.758
Back Side	GPRS 850	0.648	0.221	0.869
Back Side	UMTS 850	0.582	0.221	0.803
Back Side	UMTS 1750	0.823	0.221	1.044
Back Side	GSM 1900	0.307	0.221	0.528
Back Side	GPRS 1900	0.354	0.221	0.575
Back Side	UMTS 1900	0.680	0.221	0.901
Back Side	LTE Band 12	0.511	0.221	0.732
Back Side	LTE Band 13	0.448	0.221	0.669
Back Side	LTE Band 5 (Cell)	0.622	0.221	0.843
Back Side	LTE Band 4 (AWS)	0.713	0.221	0.934
Back Side	LTE Band 2 (PCS)	0.592	0.221	0.813
Back Side	LTE Band 7	0.537	0.221	0.758

The worst case 5 GHz WIFI reported SAR for each body-worn configuration was considered for simultaneous SAR exclusion via summation of standalone SAR, regardless of whether the WIFI channel has WIFI Hotspot capability, for simplicity to determine compliance. Please note that the actual simultaneous transmission SAR will not exceed the summed levels indicated.

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Table 12-6
Simultaneous Transmission Scenario with Bluetooth LE (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	Bluetooth LE SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.537	0.105	0.642
Back Side	GPRS 850	0.648	0.105	0.753
Back Side	UMTS 850	0.582	0.105	0.687
Back Side	UMTS 1750	0.823	0.105	0.928
Back Side	GSM 1900	0.307	0.105	0.412
Back Side	GPRS 1900	0.354	0.105	0.459
Back Side	UMTS 1900	0.680	0.105	0.785
Back Side	LTE Band 12	0.511	0.105	0.616
Back Side	LTE Band 13	0.448	0.105	0.553
Back Side	LTE Band 5 (Cell)	0.622	0.105	0.727
Back Side	LTE Band 4 (AWS)	0.713	0.105	0.818
Back Side	LTE Band 2 (PCS)	0.592	0.105	0.697
Back Side	LTE Band 7	0.537	0.105	0.642

Note: Estimated Bluetooth LE SAR results were used in the table above as they were more conservative than measured Bluetooth SAR.

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12.5 Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR ("–").

Table 12-7
Simultaneous Transmission Scenario (2.4 GHz Hotspot)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.648	0.180	0.828	Body SAR	Back	0.582	0.180	0.762
	Front	0.664	0.099	0.763		Front	0.623	0.099	0.722
	Top	-	0.153	0.153		Top	-	0.153	0.153
	Bottom	0.493	-	0.493		Bottom	0.257	-	0.257
	Right	0.696	0.041	0.737		Right	0.615	0.041	0.656
	Left	0.386	-	0.386		Left	0.378	-	0.378
Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.823	0.180	1.003	Body SAR	Back	0.314	0.180	0.494
	Front	0.683	0.099	0.782		Front	0.525	0.099	0.624
	Top	-	0.153	0.153		Top	-	0.153	0.153
	Bottom	0.597	-	0.597		Bottom	0.290	-	0.290
	Right	-	0.041	0.041		Right	-	0.041	0.041
	Left	0.616	-	0.616		Left	0.451	-	0.451
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.680	0.180	0.860	Body SAR	Back	0.511	0.180	0.691
	Front	0.874	0.099	0.973		Front	0.516	0.099	0.615
	Top	-	0.153	0.153		Top	-	0.153	0.153
	Bottom	0.517	-	0.517		Bottom	0.351	-	0.351
	Right	-	0.041	0.041		Right	0.521	0.041	0.562
	Left	1.008	-	1.008		Left	0.310	-	0.310
Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.448	0.180	0.628	Body SAR	Back	0.622	0.180	0.802
	Front	0.672	0.099	0.771		Front	0.668	0.099	0.767
	Top	-	0.153	0.153		Top	-	0.153	0.153
	Bottom	0.376	-	0.376		Bottom	0.520	-	0.520
	Right	0.214	0.041	0.255		Right	0.677	0.041	0.718
	Left	0.067	-	0.067		Left	0.414	-	0.414
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.713	0.180	0.893	Body SAR	Back	0.531	0.180	0.711
	Front	0.616	0.099	0.715		Front	0.792	0.099	0.891
	Top	-	0.153	0.153		Top	-	0.153	0.153
	Bottom	0.620	-	0.620		Bottom	0.527	-	0.527
	Right	-	0.041	0.041		Right	-	0.041	0.041
	Left	0.595	-	0.595		Left	1.062	-	1.062
		Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)			
		Body SAR	Back	0.537	0.180	0.717			
			Front	0.543	0.099	0.642			
			Top	-	0.153	0.153			
			Bottom	0.143	-	0.143			
			Right	-	0.041	0.041			
		Left	0.405	-	0.405				

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Table 12-8
Simultaneous Transmission Scenario (5 GHz Hotspot)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.648	0.105	0.753	Body SAR	Back	0.582	0.105	0.687
	Front	0.664	0.076	0.740		Front	0.623	0.076	0.699
	Top	-	0.224	0.224		Top	-	0.224	0.224
	Bottom	0.493	-	0.493		Bottom	0.257	-	0.257
	Right	0.696	0.116	0.812		Right	0.615	0.116	0.731
	Left	0.386	-	0.386		Left	0.378	-	0.378
Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.823	0.105	0.928	Body SAR	Back	0.314	0.105	0.419
	Front	0.683	0.076	0.759		Front	0.525	0.076	0.601
	Top	-	0.224	0.224		Top	-	0.224	0.224
	Bottom	0.597	-	0.597		Bottom	0.290	-	0.290
	Right	-	0.116	0.116		Right	-	0.116	0.116
	Left	0.616	-	0.616		Left	0.451	-	0.451
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.680	0.105	0.785	Body SAR	Back	0.511	0.105	0.616
	Front	0.874	0.076	0.950		Front	0.516	0.076	0.592
	Top	-	0.224	0.224		Top	-	0.224	0.224
	Bottom	0.517	-	0.517		Bottom	0.351	-	0.351
	Right	-	0.116	0.116		Right	0.521	0.116	0.637
	Left	1.008	-	1.008		Left	0.310	-	0.310
Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.448	0.105	0.553	Body SAR	Back	0.622	0.105	0.727
	Front	0.672	0.076	0.748		Front	0.668	0.076	0.744
	Top	-	0.224	0.224		Top	-	0.224	0.224
	Bottom	0.376	-	0.376		Bottom	0.520	-	0.520
	Right	0.214	0.116	0.330		Right	0.677	0.116	0.793
	Left	0.067	-	0.067		Left	0.414	-	0.414
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.713	0.105	0.818	Body SAR	Back	0.531	0.105	0.636
	Front	0.616	0.076	0.692		Front	0.792	0.076	0.868
	Top	-	0.224	0.224		Top	-	0.224	0.224
	Bottom	0.620	-	0.620		Bottom	0.527	-	0.527
	Right	-	0.116	0.116		Right	-	0.116	0.116
	Left	0.595	-	0.595		Left	1.062	-	1.062
		Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)			
		Body SAR	Back	0.537	0.105	0.642			
			Front	0.543	0.076	0.619			
			Top	-	0.224	0.224			
			Bottom	0.143	-	0.143			
			Right	-	0.116	0.116			
			Left	0.405	-	0.405			

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12.6 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is 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 D01v05 and IEEE 1528-2013 Section 6.3.4.1.2.

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13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

- 1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
- 2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg ($\sim 10\%$ from the 1-g 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
- 5) 10g extremity SAR measurement variability analysis applies a factor of 2.5 to the procedures outlined above.

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)	3rd Repeated SAR (1g)
	MHz	Ch.						(W/kg)	(W/kg)		(W/kg)	(W/kg)
1750	1732.50	20175	LTE Band 4 (AWS)	QPSK, 1 RB, 50 RB Offset	Left	Cheek	N/A	0.965	0.961	1.00	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT						Head Spatial Peak 1.6 W/kg (mW/g) Uncontrolled Exposure/General Population 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)	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.					(W/kg)	(W/kg)		(W/kg)	(W/kg)	(W/kg)
1900	1880.00	18900	LTE Band 2 (PCS)	QPSK, 1 RB, 0 RB Offset	left	10 mm	1.000	0.901	1.11	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT						Body Spatial Peak 1.6 W/kg (mW/g) Uncontrolled Exposure/General Population averaged over 1 gram						

13.2 Measurement Uncertainty

The measured SAR was < 1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

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14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/30/2014	Annual	10/30/2015	1833460
Agilent	8753E	(30kHz-6GHz) Network Analyzer	12/30/2014	Annual	12/30/2015	JP38020182
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
SPEAG	D1750V2	1750 MHz SAR Dipole	4/10/2014	Annual	4/10/2015	1051
SPEAG	D1765V2	1765 MHz SAR Dipole	5/7/2014	Annual	5/7/2015	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	4/9/2014	Annual	4/9/2015	5d141
SPEAG	D1900V2	1900 MHz SAR Dipole	7/23/2014	Annual	7/23/2015	5d149
SPEAG	D2450V2	2450 MHz SAR Dipole	8/11/2014	Annual	8/11/2015	719
SPEAG	D2600V2	2600 MHz SAR Dipole	10/20/2014	Annual	10/20/2015	1071
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
SPEAG	D5GHZV2	5 GHz SAR Dipole	1/21/2015	Annual	1/21/2016	1057
SPEAG	D5GHZV2	5 GHz SAR Dipole	9/25/2014	Annual	9/25/2015	1191
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
SPEAG	D750V3	750 MHz Dipole	1/16/2015	Annual	1/16/2016	1003
SPEAG	D835V2	835 MHz SAR Dipole	7/24/2014	Annual	7/24/2015	4d133
SPEAG	D835V2	835 MHz SAR Dipole	1/16/2015	Annual	1/16/2016	4d132
Amplifier Research	1551G6	Amplifier	CBT	N/A	CBT	433971
Amplifier Research	1551G6	Amplifier	CBT	N/A	CBT	433972
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Rohde & Schwarz	CMU200	Base Station Simulator	6/6/2014	Annual	6/6/2015	109892
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/14/2014	Annual	5/14/2015	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/12/2014	Annual	8/12/2015	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2014	Annual	9/17/2015	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/18/2014	Annual	9/18/2015	1364
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/23/2014	Annual	10/23/2015	1408
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/31/2014	Annual	10/31/2015	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/12/2014	Annual	12/12/2015	1415
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/19/2015	Annual	1/19/2016	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/18/2015	Annual	2/18/2016	665
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	10/21/2014	Annual	10/21/2015	1091
Mitutoyo	CD-6"CSX	Digital Caliper	5/8/2014	Biennial	5/8/2016	13264162
Fisher Scientific	15-077-960	Digital Thermometer	12/4/2013	Biennial	12/4/2015	130764551
Control Company	4052	Long Stem Thermometer	9/27/2013	Biennial	9/27/2015	130567447
Fisher Scientific	S407993	Long Stem Thermometer	11/4/2013	Biennial	11/4/2015	130671826
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
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
Agilent	N9020A	MXA Signal Analyzer	10/27/2014	Annual	10/27/2015	US46470561
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	7/15/2014	Annual	7/15/2015	1039
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Anritsu	ML2495A	Power Meter	7/12/2013	Biennial	7/12/2015	1328004
Anritsu	MA2411B	Pulse Power Sensor	11/13/2014	Annual	11/13/2015	1339018
Anritsu	MT8820C	Radio Communication Analyzer	8/28/2014	Annual	8/28/2015	6201240328
Anritsu	MT8820C	Radio Communication Analyzer	9/19/2014	Annual	9/19/2015	6201144418
Rohde & Schwarz	CMW500	Radio Communication Tester	6/3/2014	Annual	6/3/2015	108843
Rohde & Schwarz	CMW500	Radio Communication Tester	7/9/2014	Annual	7/9/2015	106578
SPEAG	ES3DV3	SAR Probe	5/15/2014	Annual	5/15/2015	3263
SPEAG	ES3DV2	SAR Probe	8/19/2014	Annual	8/19/2015	3022
SPEAG	ES3DV3	SAR Probe	9/18/2014	Annual	9/18/2015	3332
SPEAG	ES3DV3	SAR Probe	9/24/2014	Annual	9/24/2015	3288
SPEAG	ES3DV3	SAR Probe	10/24/2014	Annual	10/24/2015	3333
SPEAG	EX3DV4	SAR Probe	12/12/2014	Annual	12/12/2015	3920
SPEAG	ES3DV3	SAR Probe	12/16/2014	Annual	12/16/2015	3334
SPEAG	ES3DV3	SAR Probe	1/20/2015	Annual	1/20/2016	3213
SPEAG	EX3DV4	SAR Probe	2/10/2015	Annual	2/10/2016	3914
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
COMTECH	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M155A00-009
Agilent	8753ES	S-Parameter Network Analyzer	1/20/2015	Annual	1/20/2016	US39170122
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	N/A
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
Gigatronics	8651A	Universal Power Meter	10/30/2014	Annual	10/30/2015	8650319
Anritsu	MA24106A	USB Power Sensor	3/2/2015	Annual	3/2/2016	1344555
Anritsu	MA24106A	USB Power Sensor	3/2/2015	Annual	3/2/2016	1344556
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477877
Control Company	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	122014488
Agilent	E5515C	Wireless Communications Test Set	2/23/2015	Biennial	2/23/2017	GB41450275
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB44450273

Note:

1. All equipment was used solely within its calibration period.
2. 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.

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15 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 3000 MHz:

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c _i 1gm	c _i 10 gms	1gm u _i (± %)	10gms u _i (± %)	v _i
Measurement System									
Probe Calibration	E.2.1	6.0	N	1	1.0	1.0	6.0	6.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary E ffect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout E lectronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)							RSS	12.1	11.7
Expanded Uncertainty (95% CONFIDENCE LEVEL)							k=2	24.2	23.5

The above measurement uncertainties are according to IEEE Std. 1528-2003

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Applicable for frequencies up to 6 GHz:

a	b	c	d	e= f(d,k)	f	g	h = c x i/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c _i 1gm	c _i 10 gms	1gm u _i (± %)	10gms u _i (± %)	v _i
Measurement System									
Probe Calibration	E.2.1	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary E ffect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout E lectronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	E.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)							RSS	12.4	12.0
Expanded Uncertainty (95% CONFIDENCE LEVEL)							k=2	24.7	24.0

The above measurement uncertainties are according to IEEE Std. 1528-2003

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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 Industry 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

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0682-1

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):

$f = 836.6 \text{ MHz}$; $\sigma = 0.9 \text{ S/m}$; $\epsilon_r = 40.26$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-25-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3288; ConvF(6.51, 6.51, 6.51); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

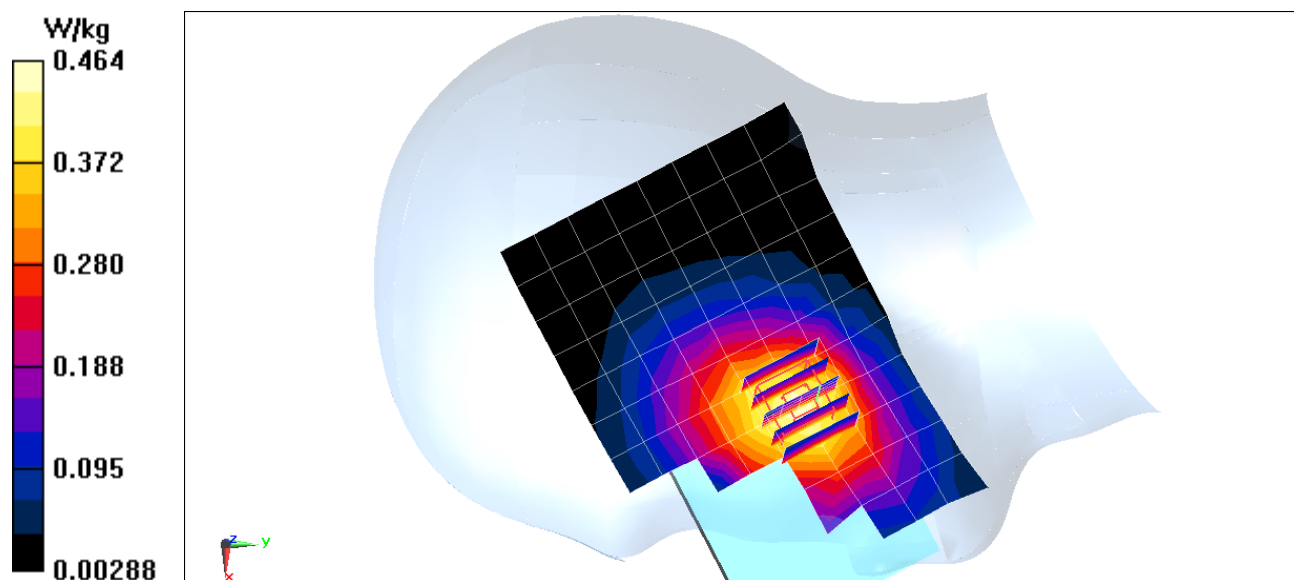
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 22.46 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.556 W/kg

SAR(1 g) = 0.427 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0682-1

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

Medium: 835 Head, Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.9 \text{ S/m}$; $\epsilon_r = 40.26$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-25-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3288; ConvF(6.51, 6.51, 6.51); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: UMTS 850, Right Head, Cheek, Mid.ch, Quick Cover (Open)

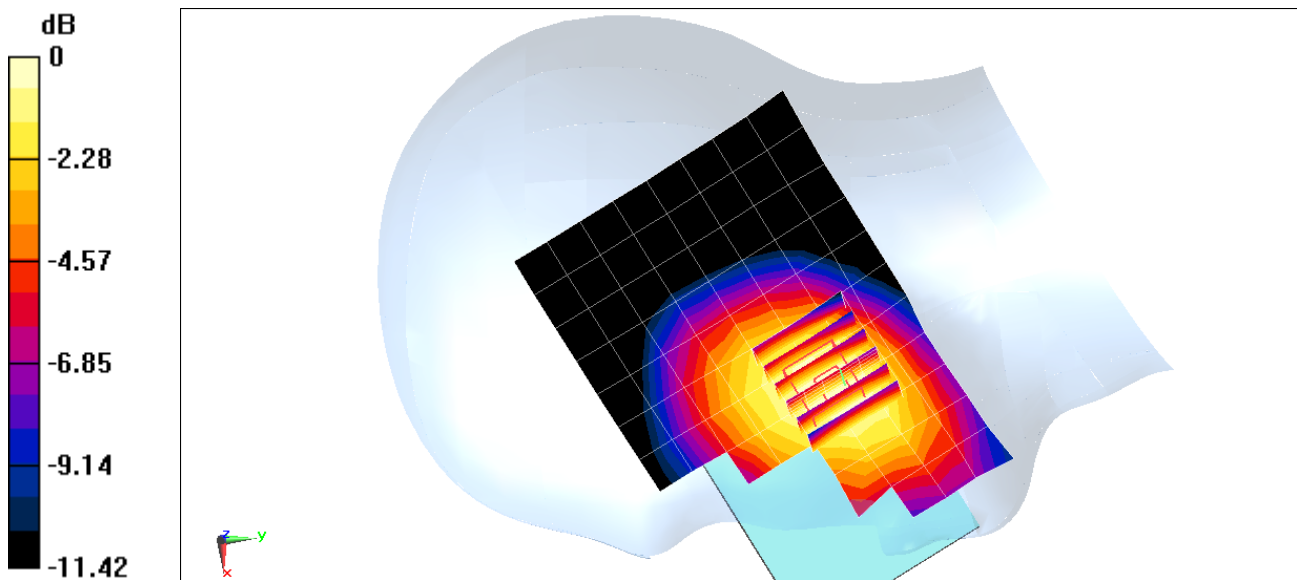
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 22.61 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.563 W/kg

SAR(1 g) = 0.431 W/kg



0 dB = 0.473 W/kg = -3.25 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0682-1

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

Medium: 1750 Head, Medium parameters used (interpolated):

$f = 1732.4 \text{ MHz}$; $\sigma = 1.339 \text{ S/m}$; $\epsilon_r = 38.331$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-30-2015; Ambient Temp: 23.9°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3334; ConvF(5.21, 5.21, 5.21); Calibrated: 12/16/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 12/12/2014

Phantom: Sub Twin Sam v5.0; Type: QD000P40CD; Serial: TP:1626

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: AWS UMTS, Left Head, Cheek, Mid.ch, Quick Cover (Closed)

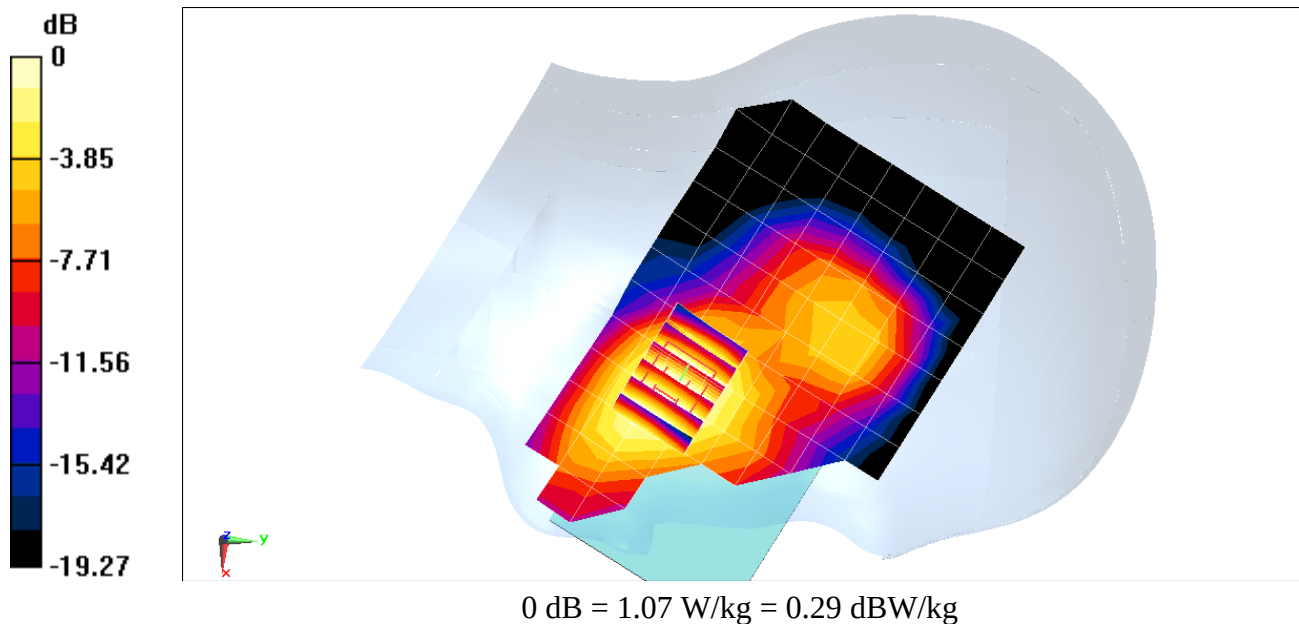
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x6x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 25.64 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 1.36 W/kg

SAR(1 g) = 0.927 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0681-3

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

Medium: 1900 Head, Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.409 \text{ S/m}$; $\epsilon_r = 40.048$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-23-2015; Ambient Temp: 24.2°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3213; ConvF(5.06, 5.06, 5.06); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: GPRS 1900, Left Head, Cheek, Mid.ch, 4 Tx slots, Quick Cover (Open)

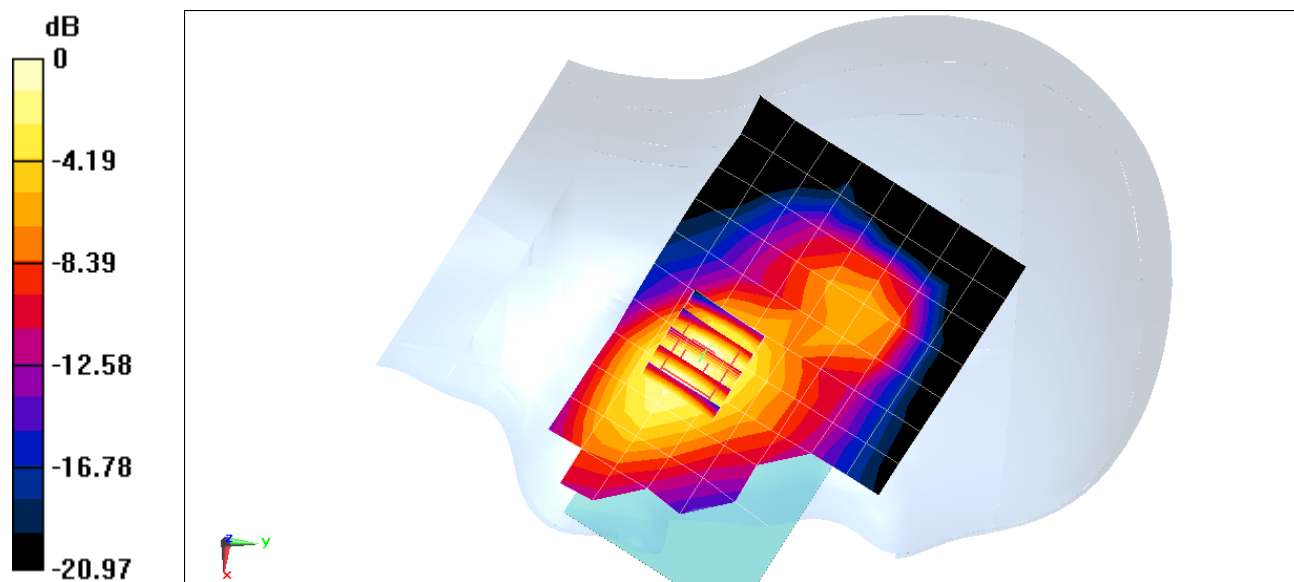
Area Scan (9x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 22.25 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.02 W/kg

SAR(1 g) = 0.642 W/kg



0 dB = 0.756 W/kg = -1.21 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0677-1

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

Medium: 1900 Head, Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.409 \text{ S/m}$; $\epsilon_r = 40.048$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-23-2015; Ambient Temp: 24.2°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3213; ConvF(5.06, 5.06, 5.06); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

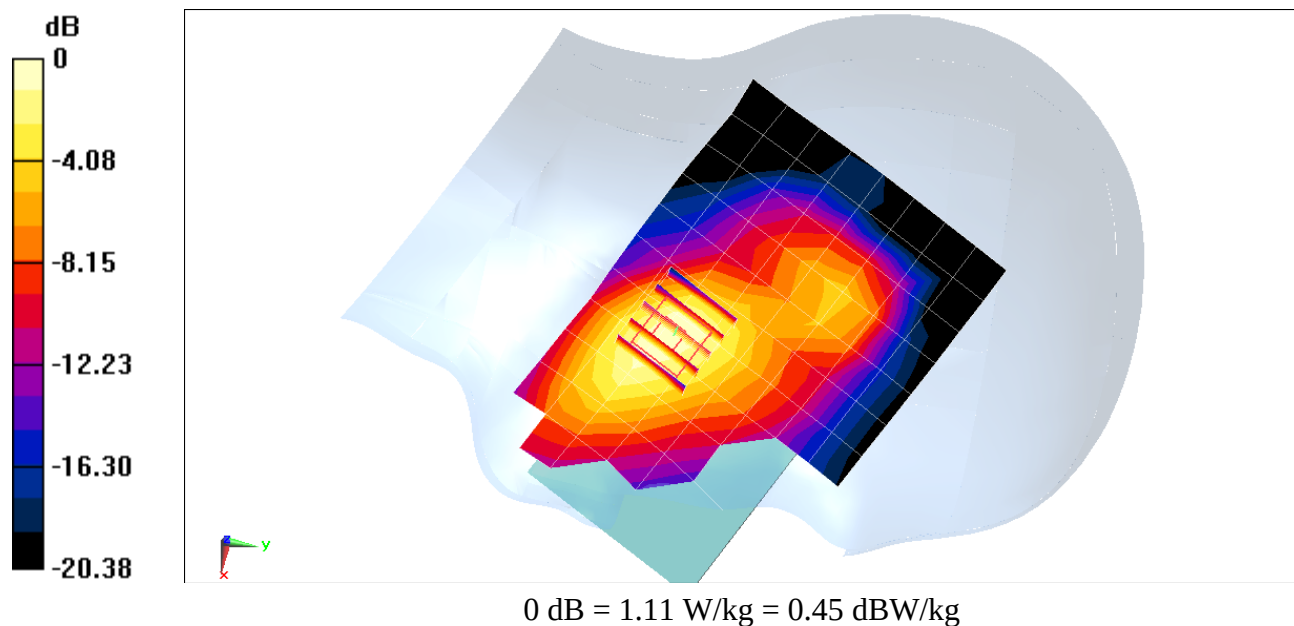
Area Scan (9x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 27.28 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.47 W/kg

SAR(1 g) = 0.962 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

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

Medium: 750 Head, Medium parameters used (interpolated):

$f = 707.5 \text{ MHz}$; $\sigma = 0.867 \text{ S/m}$; $\epsilon_r = 41.513$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-25-2015; Ambient Temp: 22.4°C; Tissue Temp: 21.9°C

Probe: ES3DV2 - SN3022; ConvF(6.39, 6.39, 6.39); Calibrated: 8/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/12/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

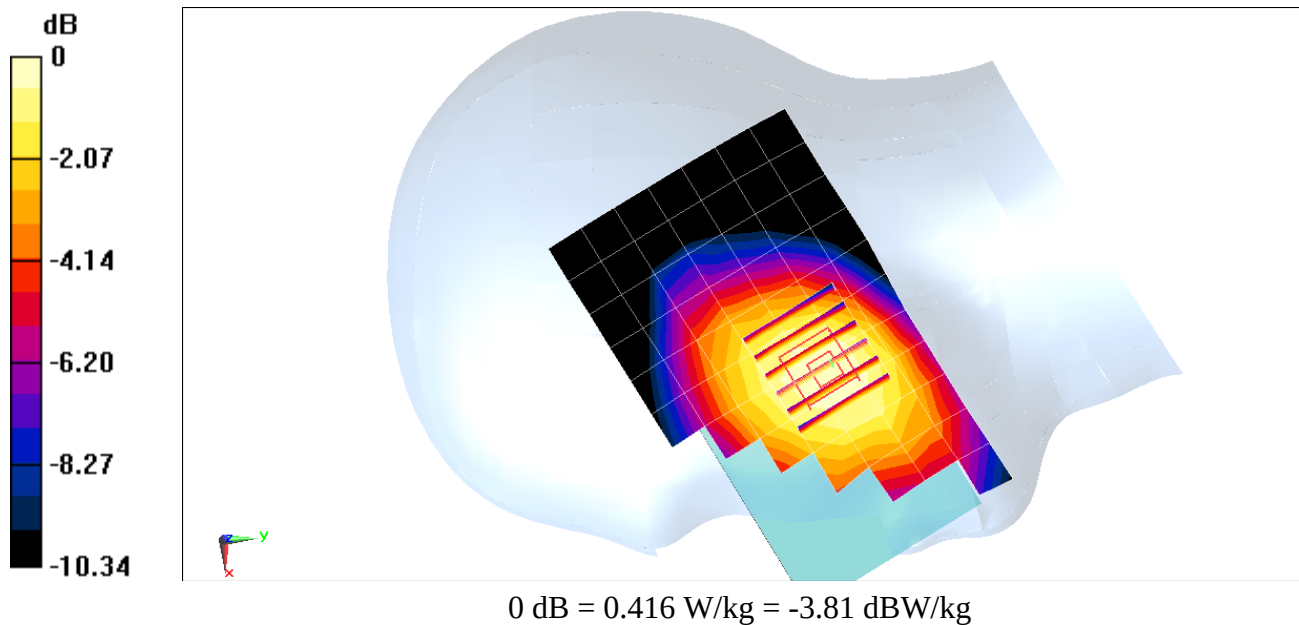
Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 22.19 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.470 W/kg

SAR(1 g) = 0.381 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 750 Head, Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 0.937 \text{ S/m}$; $\epsilon_r = 40.557$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-25-2015; Ambient Temp: 22.4°C; Tissue Temp: 21.9°C

Probe: ES3DV2 - SN3022; ConvF(6.39, 6.39, 6.39); Calibrated: 8/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/12/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 13, Right Head, Cheek, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, Quick Cover (Open)**

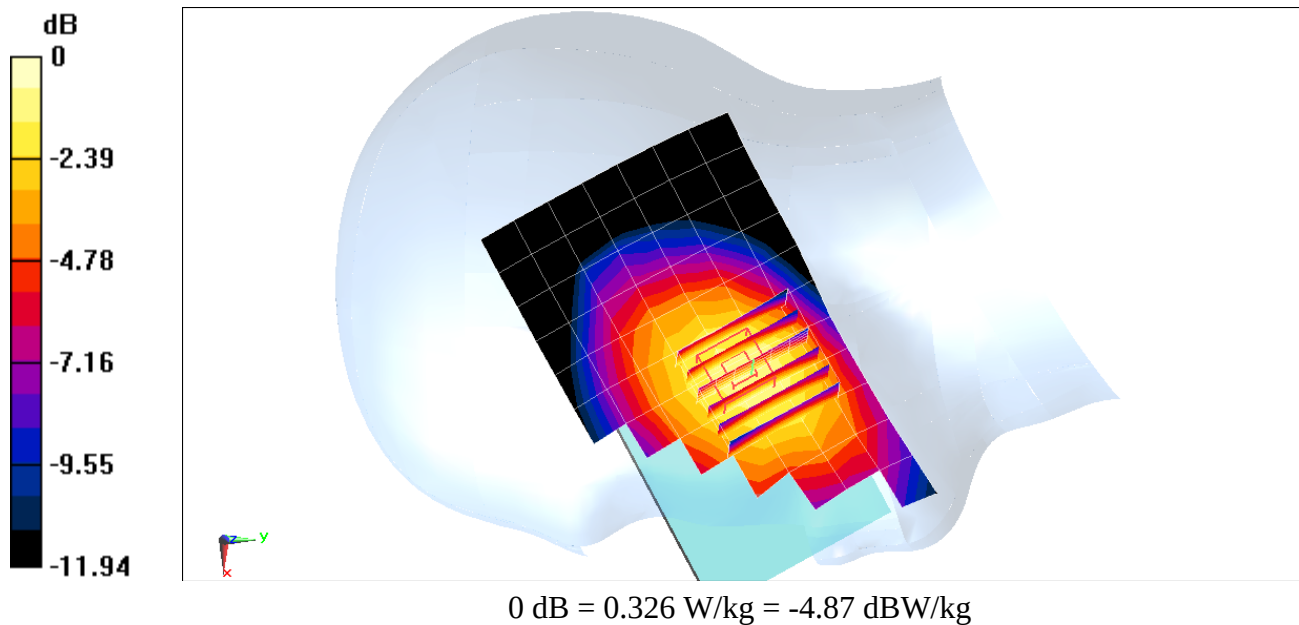
Area Scan (8x14x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (7x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.17 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.376 W/kg

SAR(1 g) = 0.299 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0677-1

Communication System: UID 0, LTE Band 5 (Cell.); Frequency: 836.5 MHz; Duty Cycle: 1:1

Medium: 835 Head, Medium parameters used (interpolated):

$f = 836.5 \text{ MHz}$; $\sigma = 0.9 \text{ S/m}$; $\epsilon_r = 40.261$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-25-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3288; ConvF(6.51, 6.51, 6.51); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

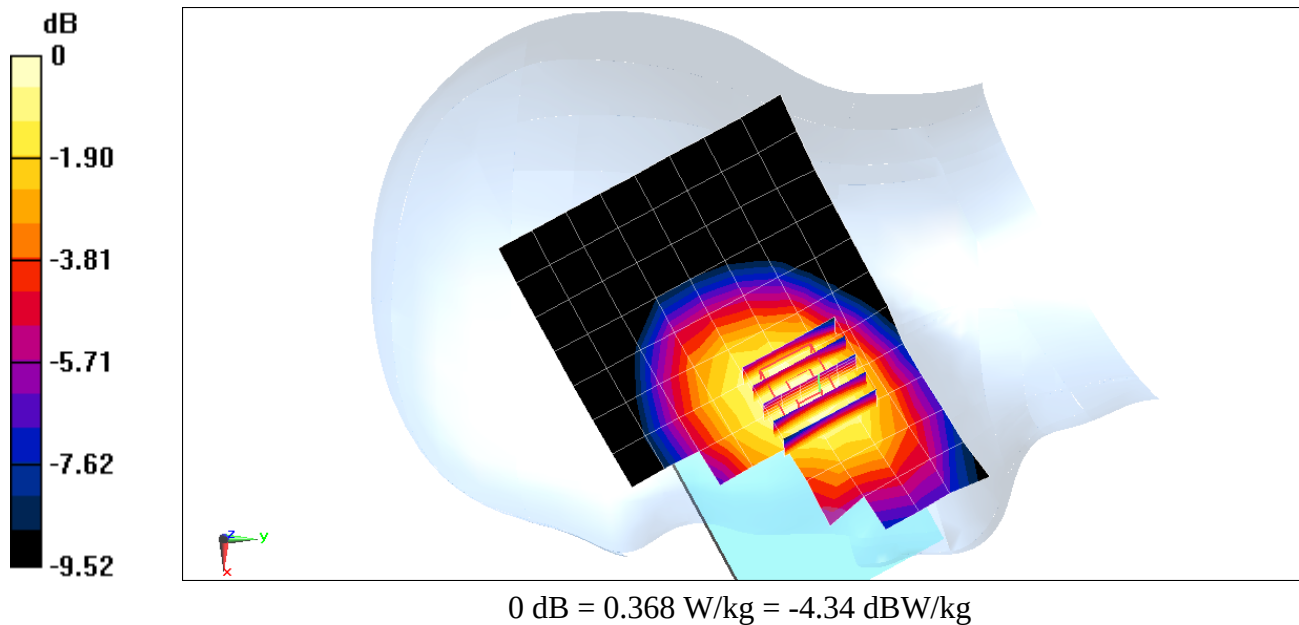
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 20.93 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.428 W/kg

SAR(1 g) = 0.338 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE RF Band 4; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: 1750 Head, Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$; $\sigma = 1.325 \text{ S/m}$; $\epsilon_r = 39.603$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-26-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3213; ConvF(5.22, 5.22, 5.22); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 4 (AWS), Left Head, Cheek, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset, Quick Cover (Closed)**

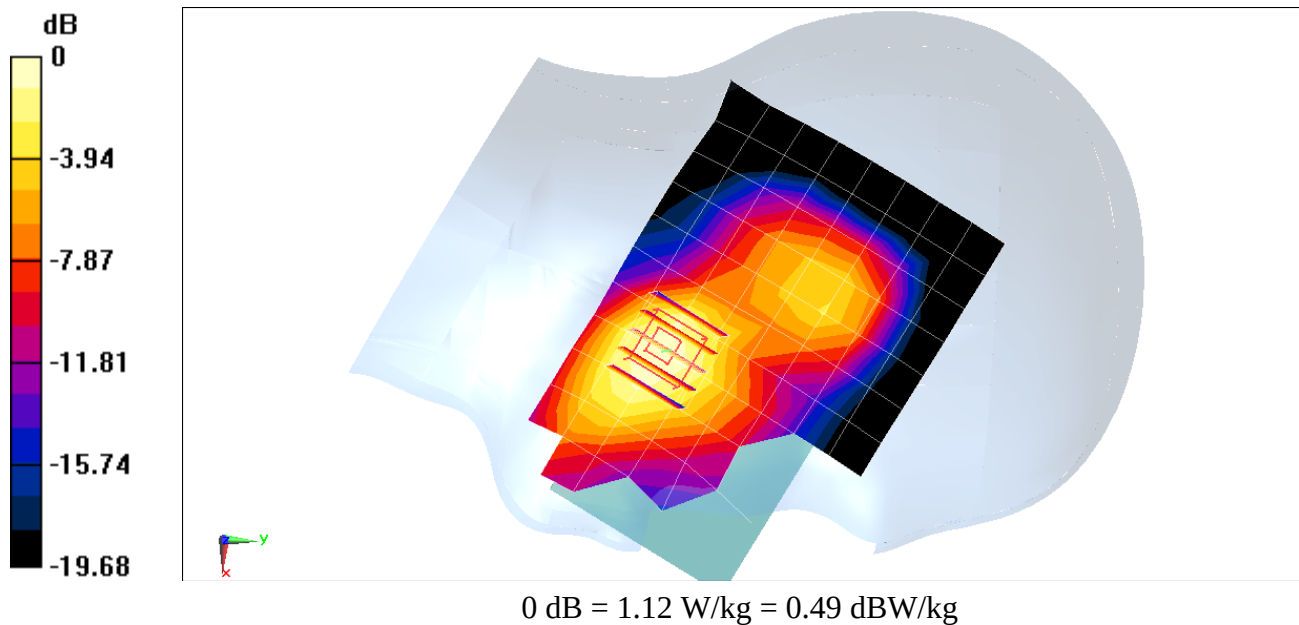
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 29.92 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.41 W/kg

SAR(1 g) = 0.965 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Head, Medium parameters used:

$f = 1880$ MHz; $\sigma = 1.409$ S/m; $\epsilon_r = 40.048$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Test Date: 03-23-2015; Ambient Temp: 24.2°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3213; ConvF(5.06, 5.06, 5.06); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 2 (PCS), Left Head, Cheek, Mid.ch, QPSK,
20 MHz Bandwidth, 1 RB, 0 RB Offset, Standard Cover**

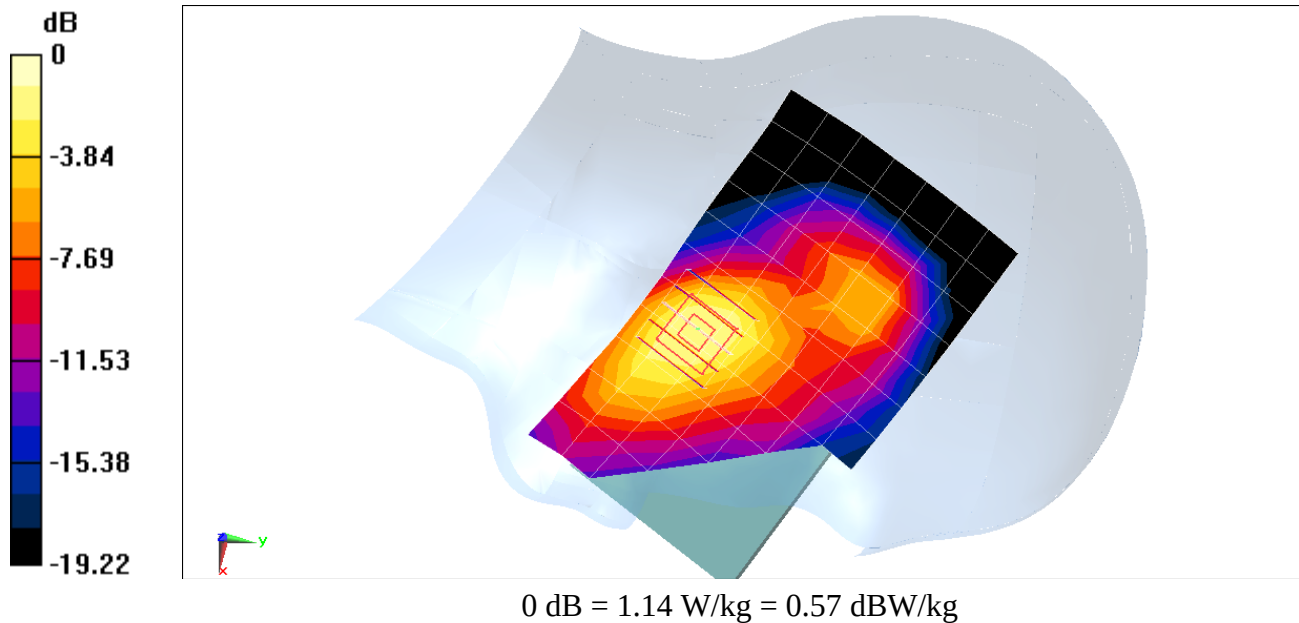
Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 28.63 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 1.47 W/kg

SAR(1 g) = 0.965 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

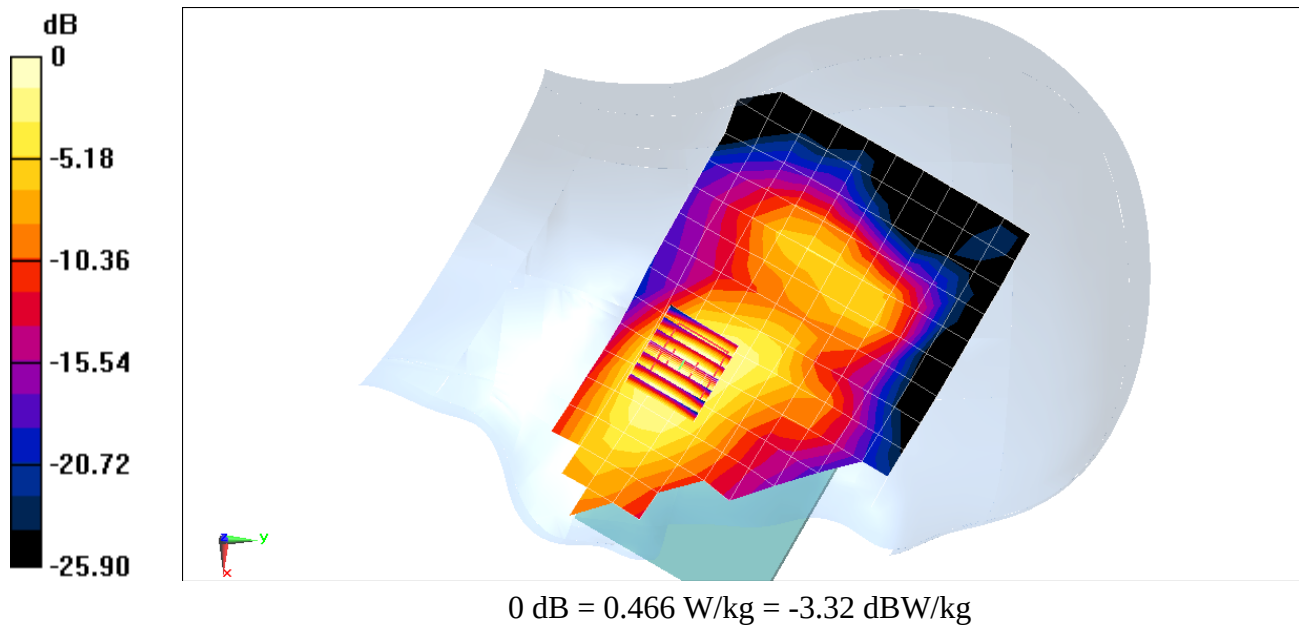
Communication System: UID 0, LTE Band 7; Frequency: 2560 MHz; Duty Cycle: 1:1
Medium: 2600 Head, Medium parameters used (interpolated):
 $f = 2560 \text{ MHz}$; $\sigma = 1.954 \text{ S/m}$; $\epsilon_r = 38.599$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left Section

Test Date: 03-23-2015; Ambient Temp: 23.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3288; ConvF(4.44, 4.44, 4.44); Calibrated: 9/24/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2014
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 7, Left Head, Cheek, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Cover**

Area Scan (11x18x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$
Reference Value = 15.07 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.671 W/kg
SAR(1 g) = 0.372 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0683-9

Communication System: UID 0, IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Head, Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$; $\sigma = 1.815 \text{ S/m}$; $\epsilon_r = 39.035$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 03-23-2015; Ambient Temp: 23.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3288; ConvF(4.56, 4.56, 4.56); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11b, Left Head, Tilt, Ch 06, 1 Mbps, Quick Cover (Open)

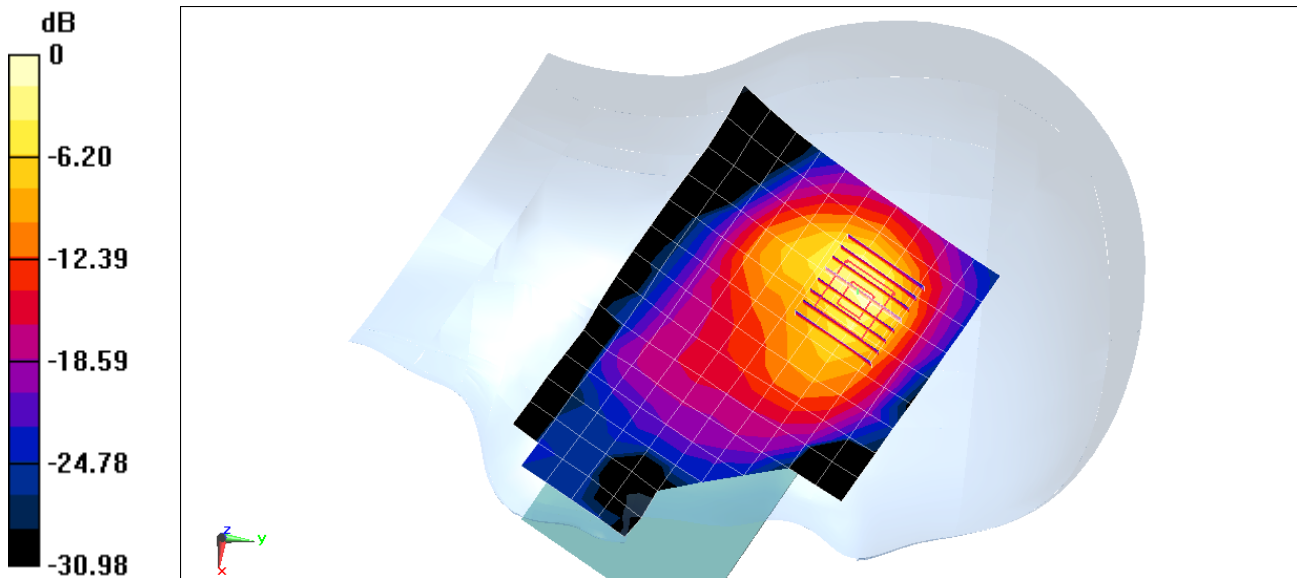
Area Scan (11x18x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 15.77 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.00 W/kg

SAR(1 g) = 0.447 W/kg



0 dB = 0.596 W/kg = -2.25 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0683-9

Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5260 MHz; Duty Cycle: 1:1

Medium: 5GHz, Medium parameters used:

$f = 5260 \text{ MHz}$; $\sigma = 4.527 \text{ S/m}$; $\epsilon_r = 35.074$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 03-30-2015; Ambient Temp: 22.0°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3920; ConvF(4.69, 4.69, 4.69); Calibrated: 12/12/2014;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/18/2015

Phantom: SAM with CRP v5.0; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.3 GHz, Right Head, Tilt, Ch 52, 6 Mbps, Standard Cover

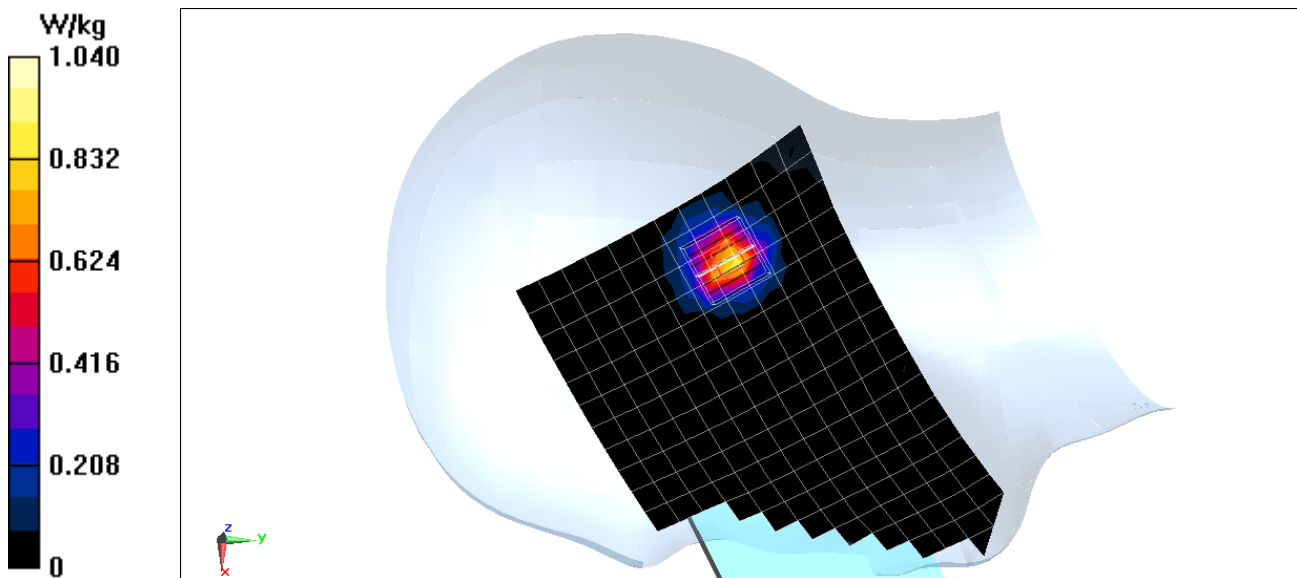
Area Scan (13x19x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Reference Value = 10.87 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.57 W/kg

SAR(1 g) = 0.479 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0682-1

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):

$f = 836.6 \text{ MHz}$; $\sigma = 0.963 \text{ S/m}$; $\epsilon_r = 52.919$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3333; ConvF(6.12, 6.12, 6.12); Calibrated: 10/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1408; Calibrated: 10/23/2014

Phantom: Sub TWIN SAM; Type: QD000P40CC; Serial: TP-1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

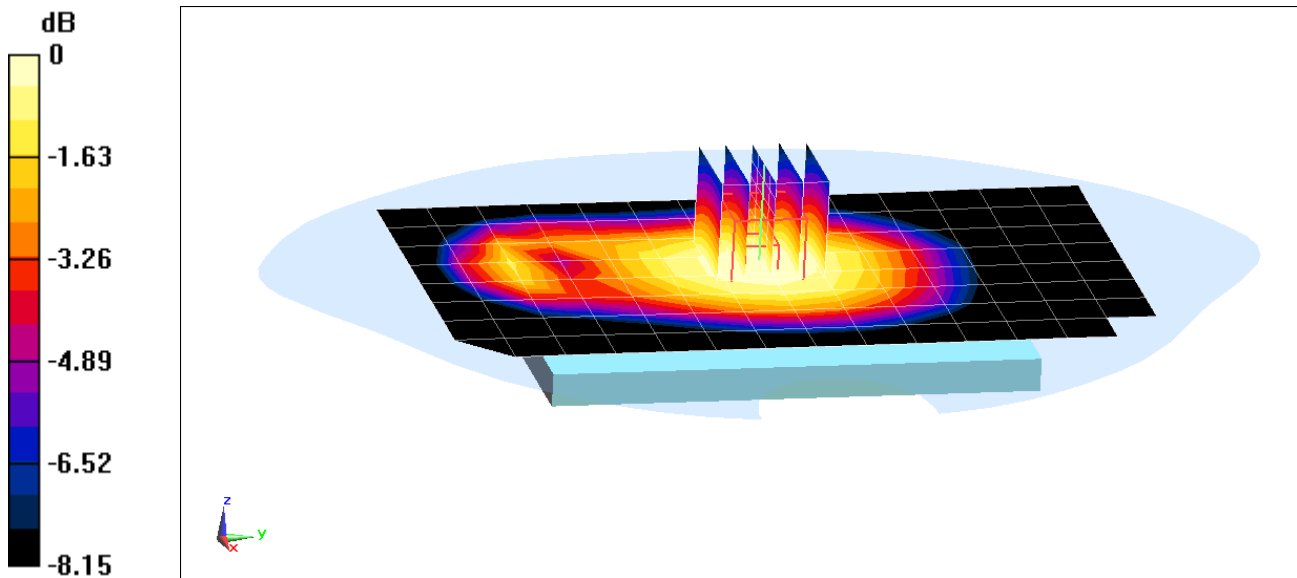
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 25.79 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.757 W/kg

SAR(1 g) = 0.607 W/kg



0 dB = 0.668 W/kg = -1.75 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0682-1

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; $\sigma = 0.963$ S/m; $\epsilon_r = 52.919$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3333; ConvF(6.12, 6.12, 6.12); Calibrated: 10/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1408; Calibrated: 10/23/2014

Phantom: Sub TWIN SAM; Type: QD000P40CC; Serial: TP-1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: GPRS 850, Body SAR, Right Edge, Mid.ch, 4 Tx Slots, Standard Cover

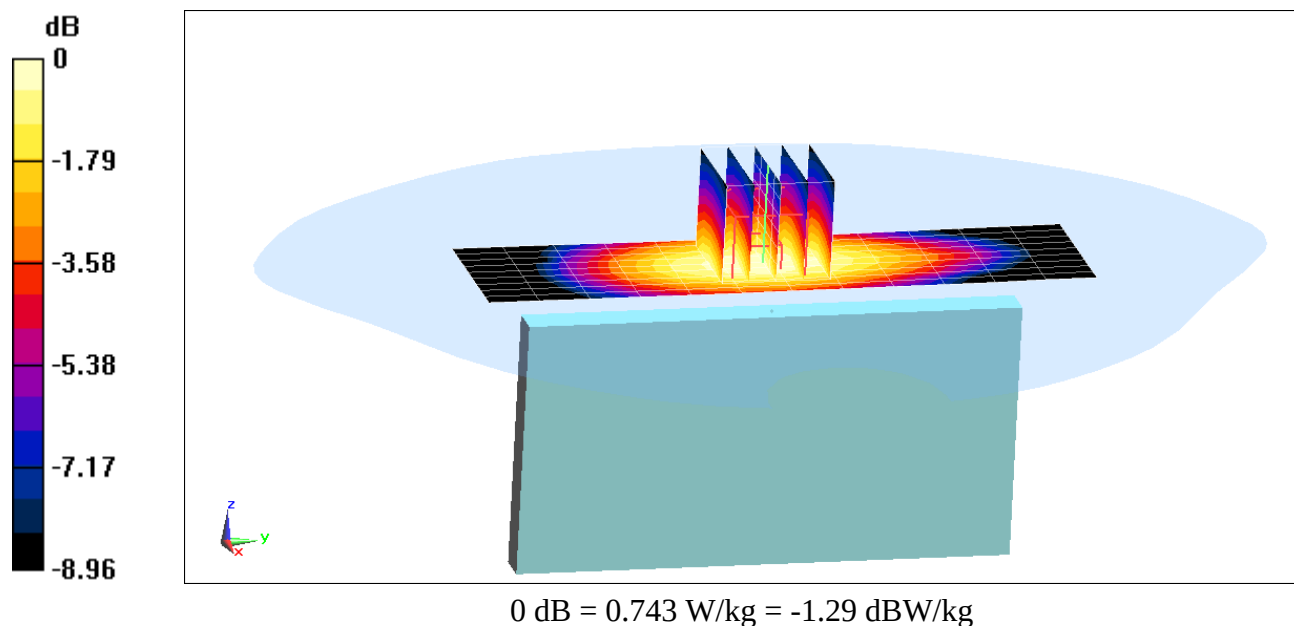
Area Scan (10x13x1): Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 26.97 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.881 W/kg

SAR(1 g) = 0.652 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0682-1

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

Medium: 835 Body, Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.963 \text{ S/m}$; $\epsilon_r = 52.919$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3333; ConvF(6.12, 6.12, 6.12); Calibrated: 10/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1408; Calibrated: 10/23/2014

Phantom: Sub TWIN SAM; Type: QD000P40CC; Serial: TP-1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

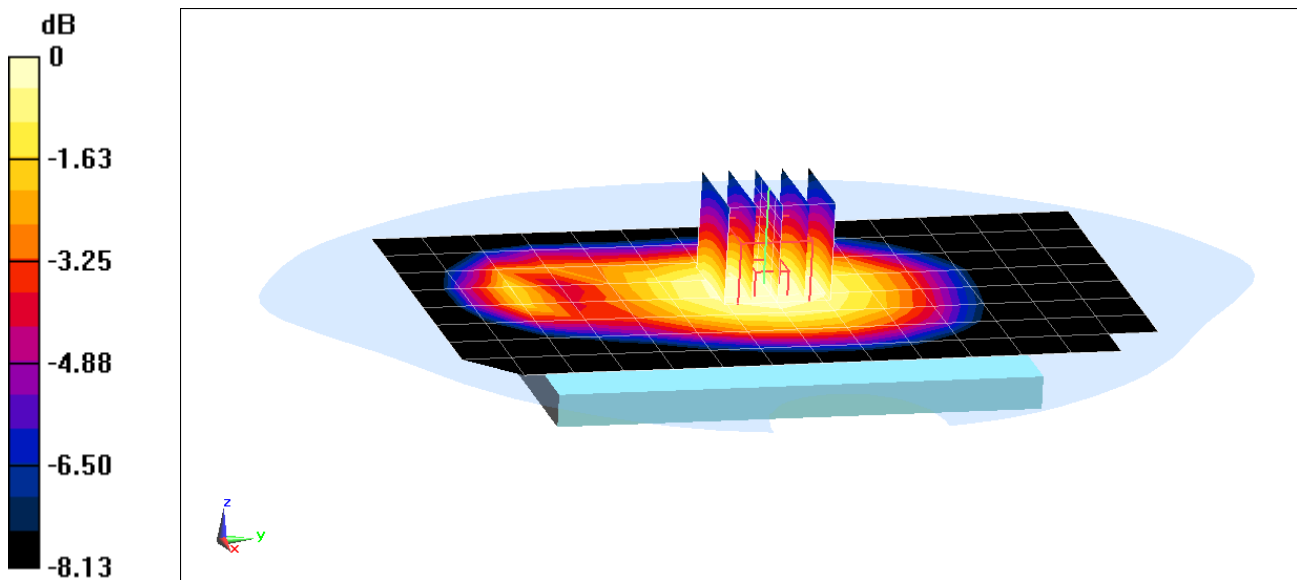
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 24.57 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.698 W/kg

SAR(1 g) = 0.554 W/kg



0 dB = 0.606 W/kg = -2.18 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0682-1

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

Medium: 835 Body, Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.963 \text{ S/m}$; $\epsilon_r = 52.919$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3333; ConvF(6.12, 6.12, 6.12); Calibrated: 10/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1408; Calibrated: 10/23/2014

Phantom: Sub TWIN SAM; Type: QD000P40CC; Serial: TP-1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: UMTS 850, Body SAR, Front side, Mid.ch, Standard Cover

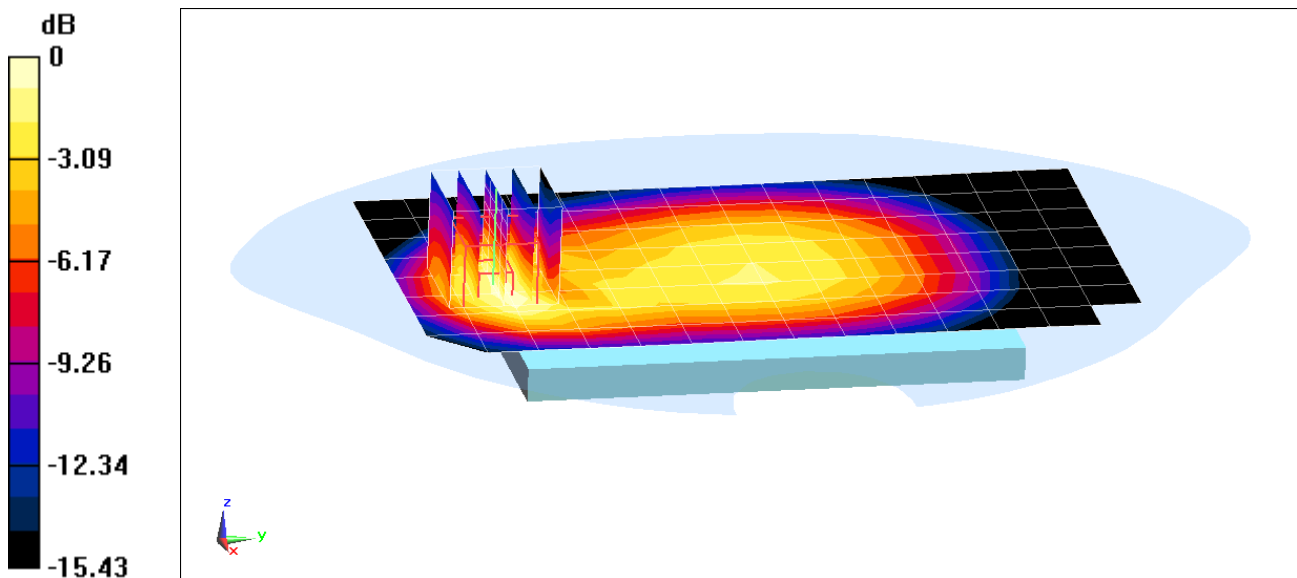
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 26.09 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 1.02 W/kg

SAR(1 g) = 0.593 W/kg



0 dB = 0.737 W/kg = -1.33 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0682-1

Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used (interpolated):
 $f = 1732.4 \text{ MHz}$; $\sigma = 1.457 \text{ S/m}$; $\epsilon_r = 52.227$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3332; ConvF(4.88, 4.88, 4.88); Calibrated: 9/18/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2014
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: AWS UMTS, Body SAR, Back side, Mid.ch, Quick Cover (Closed)

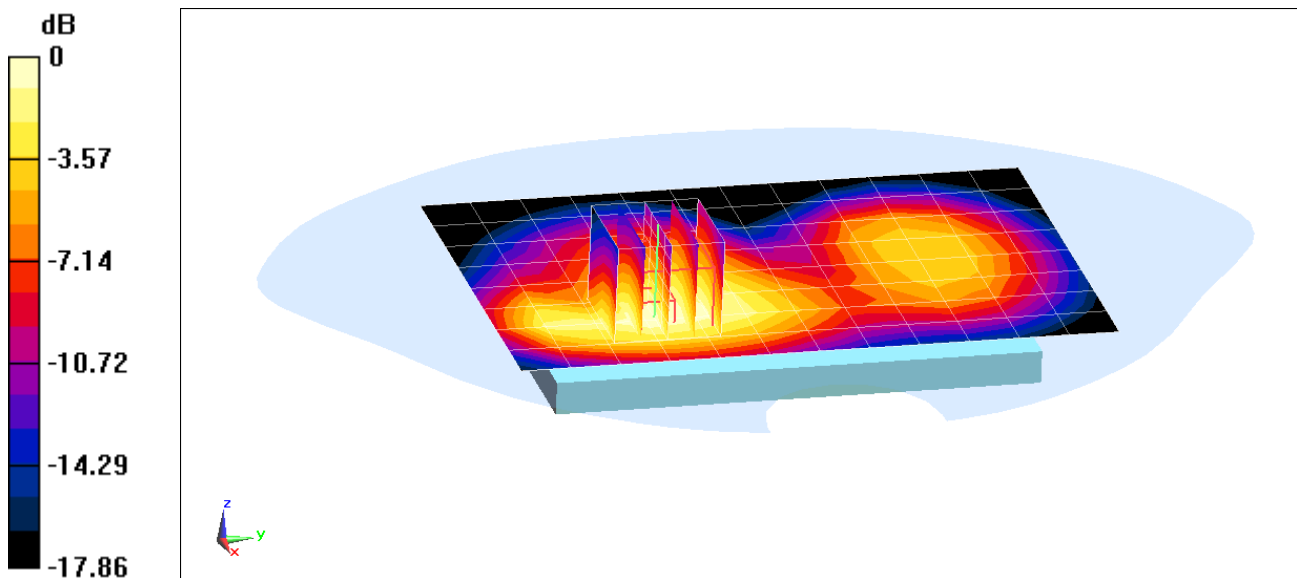
Area Scan (9x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 24.11 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.13 W/kg

SAR(1 g) = 0.751 W/kg



0 dB = 0.885 W/kg = -0.53 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0681-3

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; $\sigma = 1.499$ S/m; $\epsilon_r = 51.828$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 23.9°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3263; ConvF(4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: GPRS 1900, Body SAR, Back side, Mid.ch, 4 Tx Slots, Quick Cover (Closed)

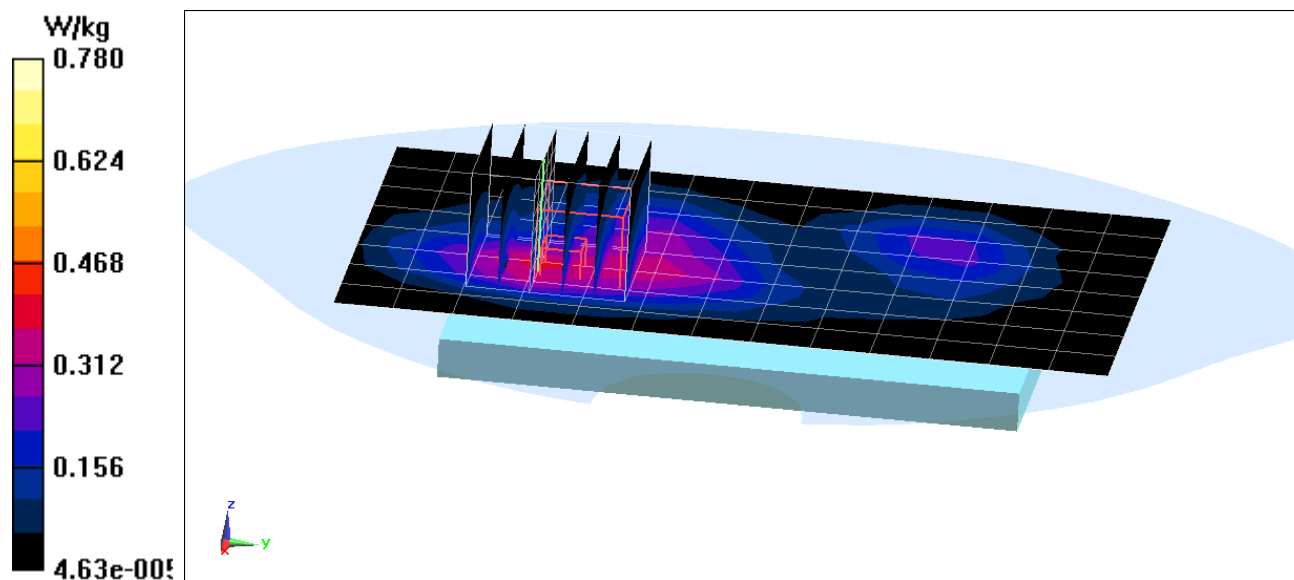
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 15.77 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.560 W/kg

SAR(1 g) = 0.350 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0681-3

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; $\sigma = 1.499$ S/m; $\epsilon_r = 51.828$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 23.9°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3263; ConvF(4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: GPRS 1900, Body SAR, Front side, Mid.ch, 4 Tx Slots, Standard Cover

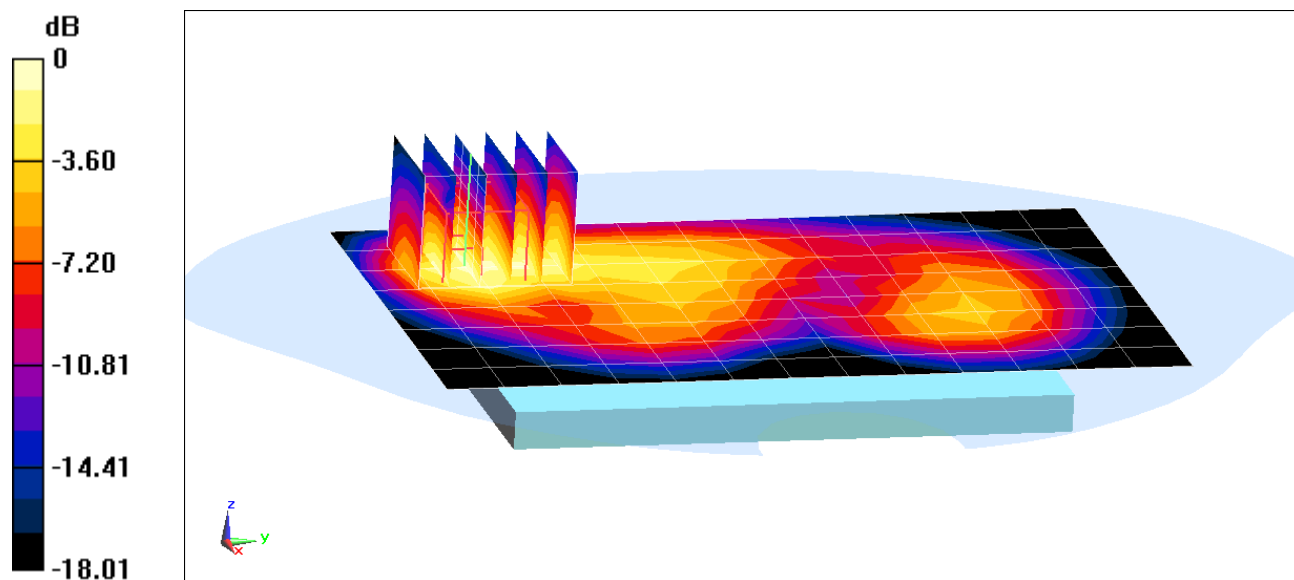
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 18.44 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.02 W/kg

SAR(1 g) = 0.519 W/kg



0 dB = 0.627 W/kg = -2.03 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0677-1

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

Medium: 1900 Body, Medium parameters used:

$f = 1880$ MHz; $\sigma = 1.499$ S/m; $\epsilon_r = 51.828$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 23.9°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3263; ConvF(4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: UMTS 1900, Body SAR, Back side, Mid.ch, Standard Cover

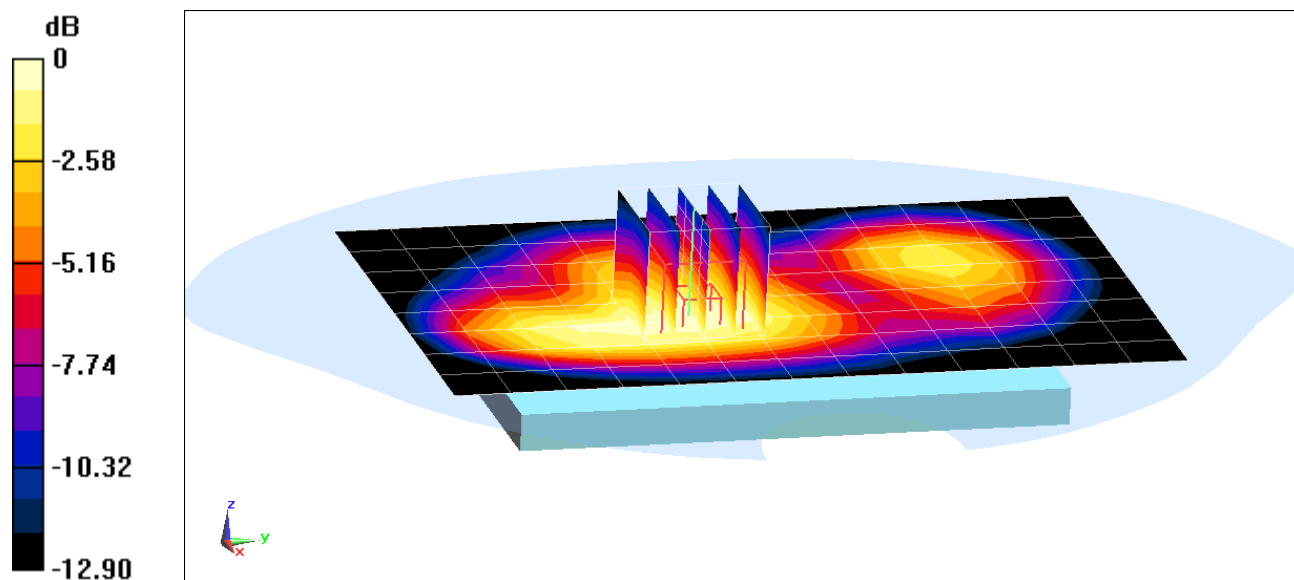
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 21.93 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.971 W/kg

SAR(1 g) = 0.653 W/kg



0 dB = 0.753 W/kg = -1.23 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0677-1

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

Medium: 1900 Body, Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.499 \text{ S/m}$; $\epsilon_r = 51.828$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 23.9°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3263; ConvF(4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: UMTS 1900, Body SAR, Left Edge, Mid.ch, Standard Cover

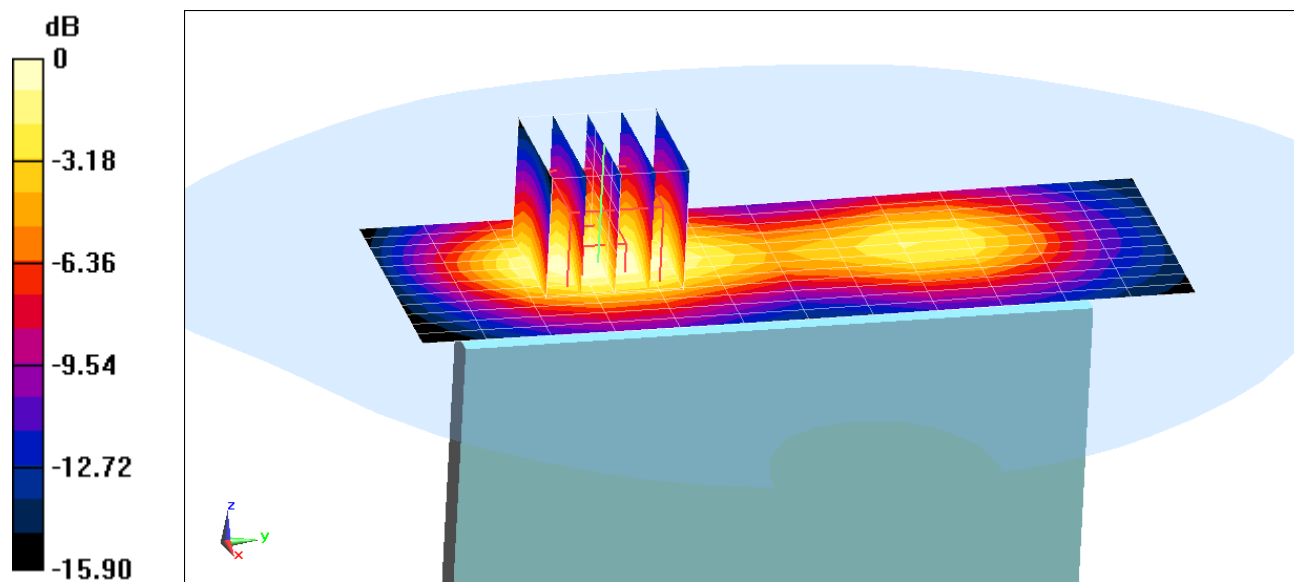
Area Scan (13x13x1): Measurement grid: $dx=5\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 26.80 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.56 W/kg

SAR(1 g) = 0.967 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

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

Medium: 750 Body, Medium parameters used (interpolated):

$f = 707.5 \text{ MHz}$; $\sigma = 0.934 \text{ S/m}$; $\epsilon_r = 55.349$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-24-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF(6.19, 6.19, 6.19); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

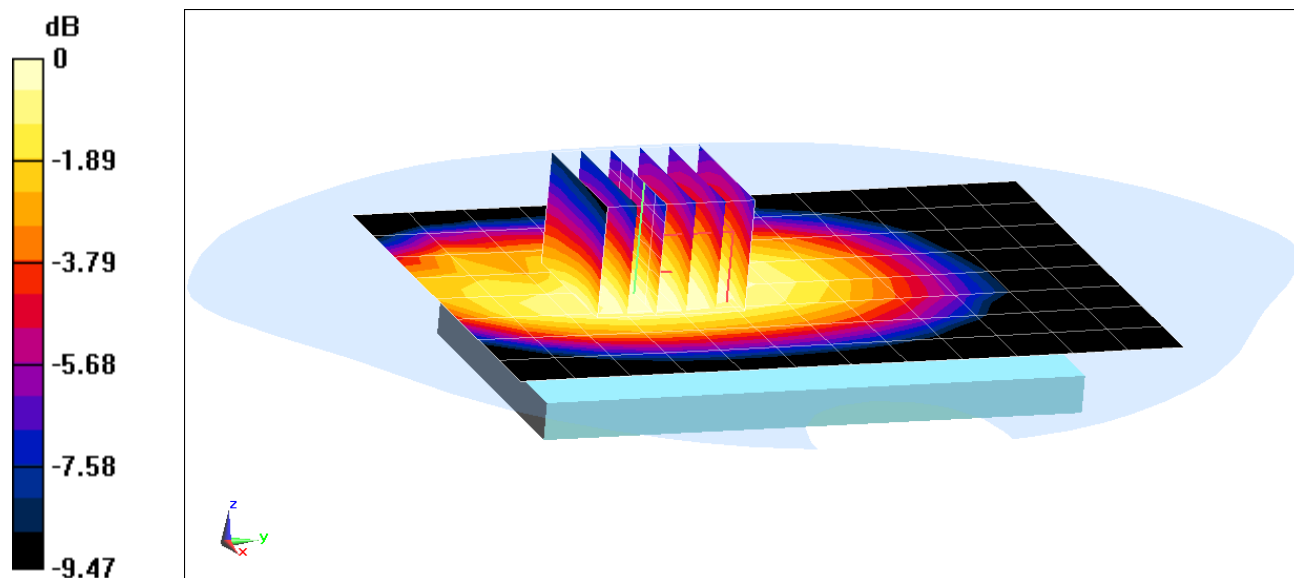
Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 23.47 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.611 W/kg

SAR(1 g) = 0.483 W/kg



0 dB = 0.527 W/kg = -2.78 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

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

Medium: 750 Body, Medium parameters used (interpolated):

$f = 707.5 \text{ MHz}$; $\sigma = 0.934 \text{ S/m}$; $\epsilon_r = 55.349$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-24-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF(6.19, 6.19, 6.19); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 12, Body SAR, Right Edge, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset, Standard Cover**

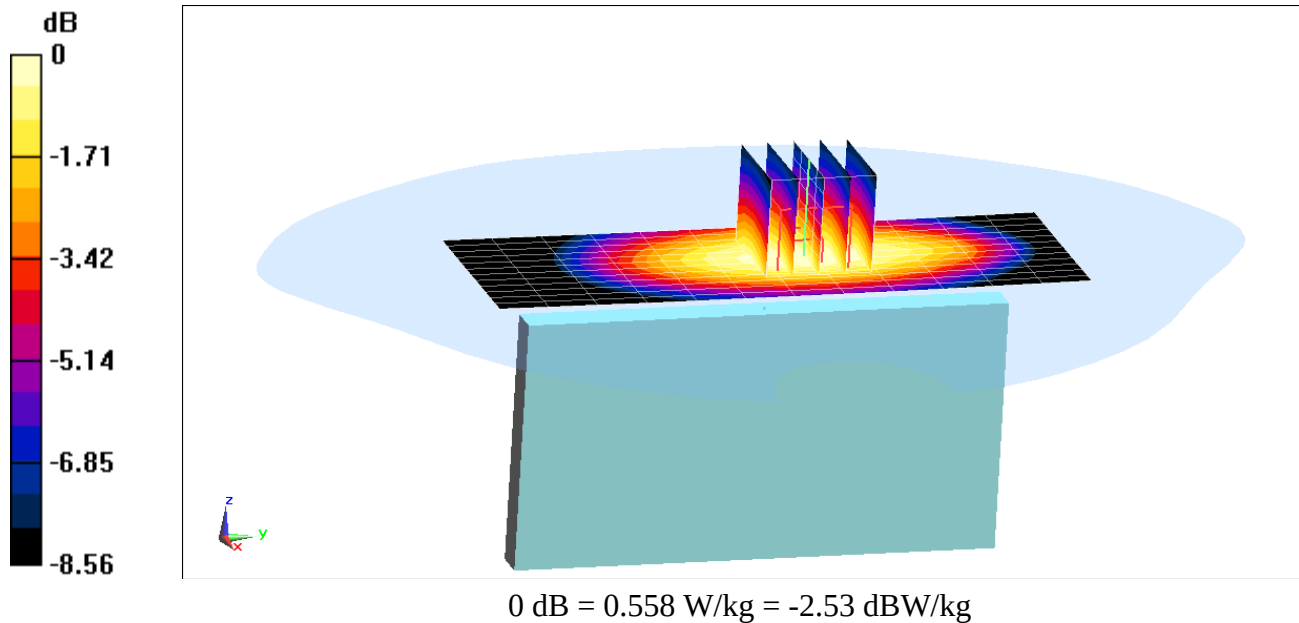
Area Scan (13x13x1): Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 23.85 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.673 W/kg

SAR(1 g) = 0.492 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 750 Body, Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 1.008 \text{ S/m}$; $\epsilon_r = 54.626$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-24-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF(6.19, 6.19, 6.19); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 13, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, Standard Cover**

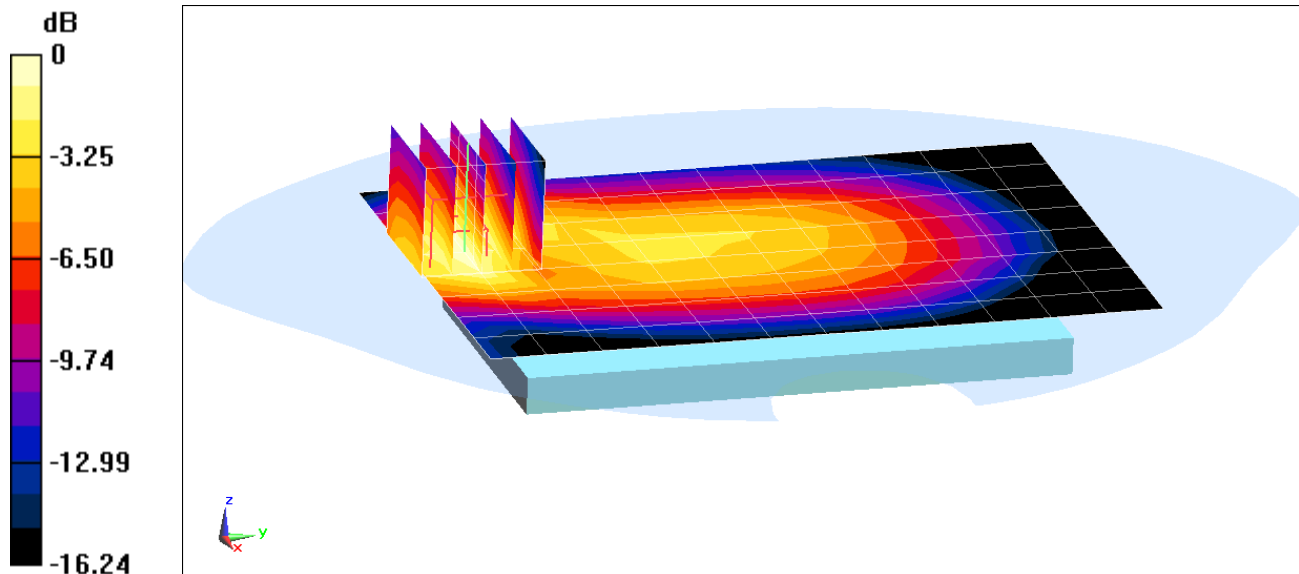
Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 22.27 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.728 W/kg

SAR(1 g) = 0.448 W/kg



0 dB = 0.539 W/kg = -2.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 750 Body, Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 1.008 \text{ S/m}$; $\epsilon_r = 54.626$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-24-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF(6.19, 6.19, 6.19); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 13, Body SAR, Front side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, Standard Cover**

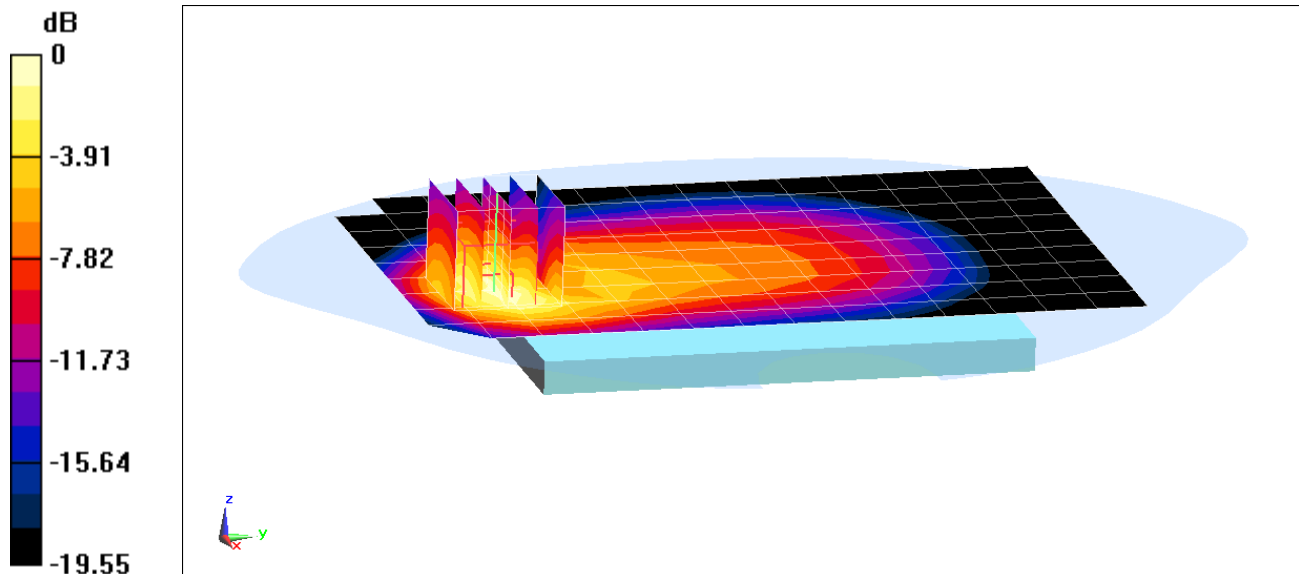
Area Scan (10x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 26.54 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.19 W/kg

SAR(1 g) = 0.672 W/kg



0 dB = 0.834 W/kg = -0.79 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1

Medium: 835 Body, Medium parameters used (interpolated):

$f = 836.5$ MHz; $\sigma = 0.963$ S/m; $\epsilon_r = 52.92$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3333; ConvF(6.12, 6.12, 6.12); Calibrated: 10/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1408; Calibrated: 10/23/2014

Phantom: Sub TWIN SAM; Type: QD000P40CC; Serial: TP-1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 5 (Cell.), Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Cover**

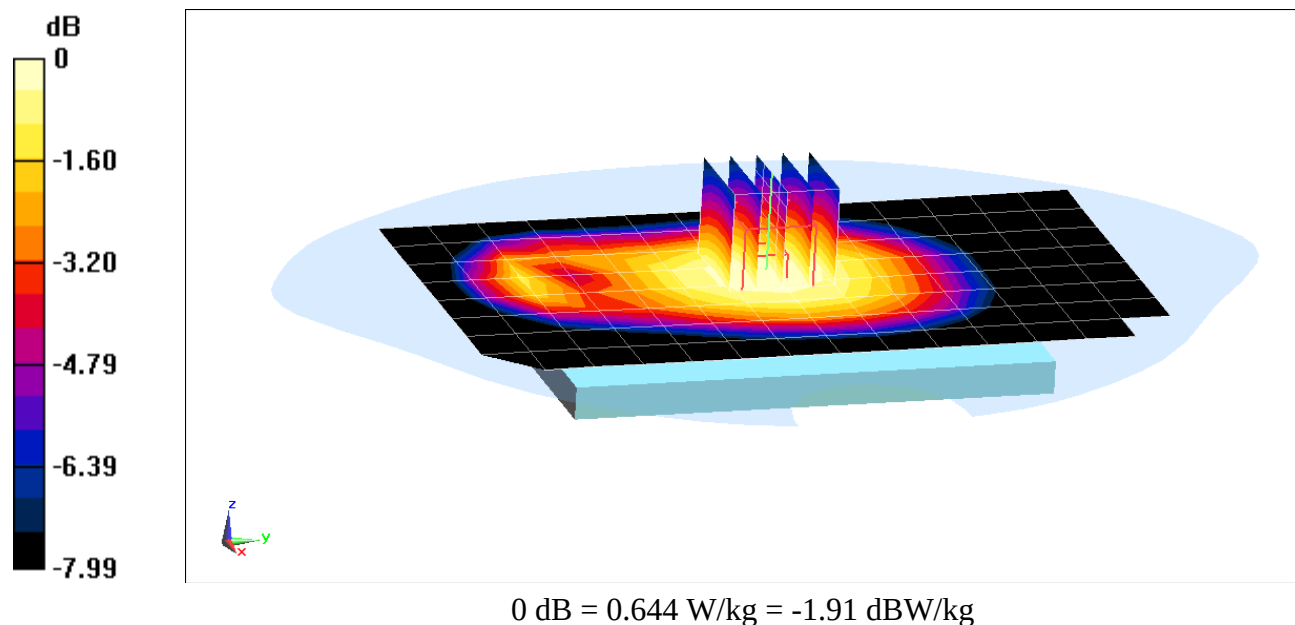
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 25.58 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.737 W/kg

SAR(1 g) = 0.587 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 5 (Cell.); Frequency: 836.5 MHz; Duty Cycle: 1:1

Medium: 835 Body, Medium parameters used (interpolated):

$f = 836.5$ MHz; $\sigma = 0.963$ S/m; $\epsilon_r = 52.92$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3333; ConvF(6.12, 6.12, 6.12); Calibrated: 10/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1408; Calibrated: 10/23/2014

Phantom: Sub TWIN SAM; Type: QD000P40CC; Serial: TP-1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 5 (Cell.), Body SAR, Right Edge, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Cover**

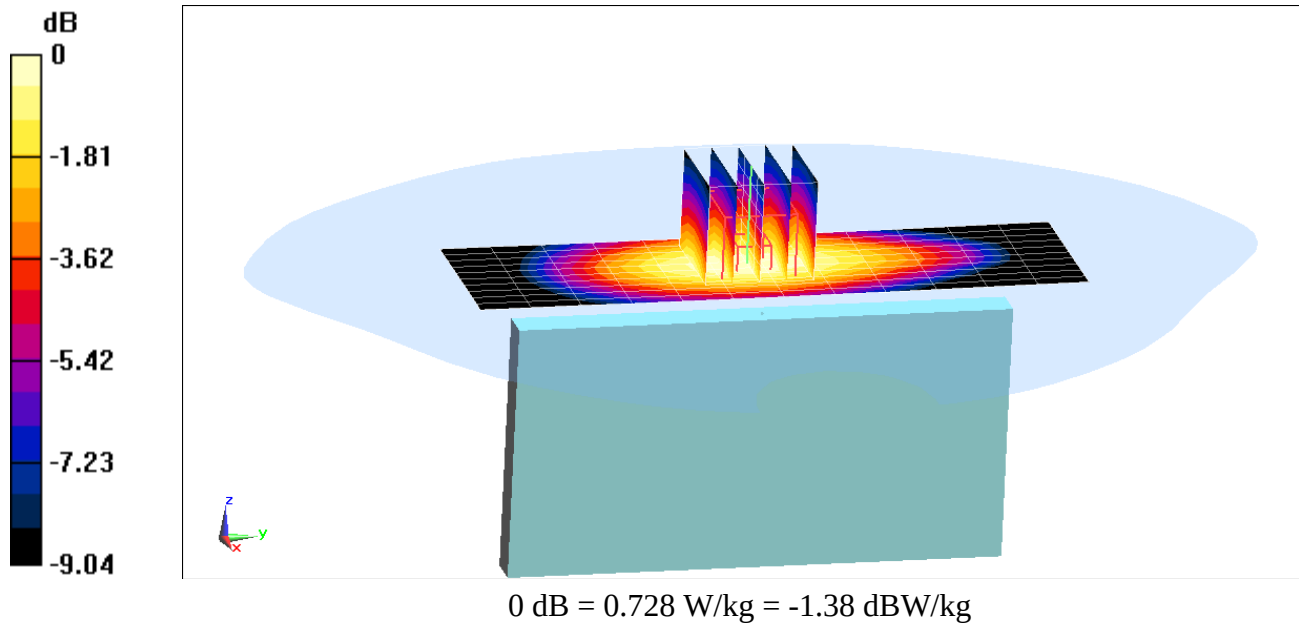
Area Scan (11x13x1): Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 26.94 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.884 W/kg

SAR(1 g) = 0.639 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: 1750 Body, Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$; $\sigma = 1.457 \text{ S/m}$; $\epsilon_r = 52.227$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3332; ConvF(4.88, 4.88, 4.88); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset, Quick Cover (Closed)**

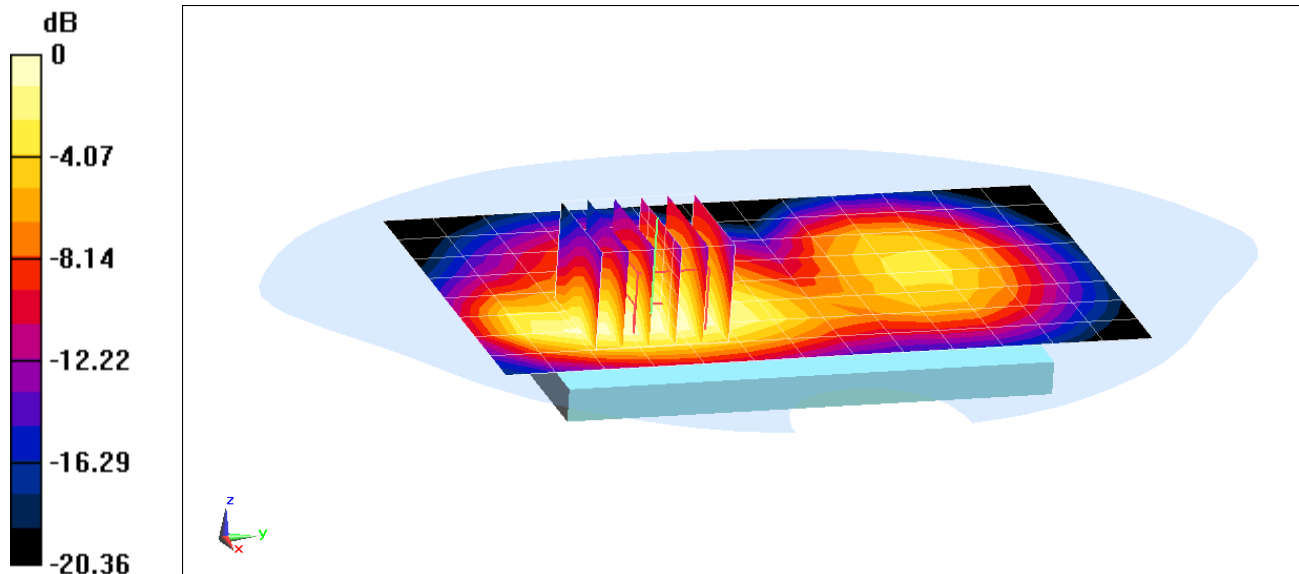
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 22.54 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.05 W/kg

SAR(1 g) = 0.687 W/kg



0 dB = 0.776 W/kg = -1.10 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1860 MHz; Duty Cycle: 1:1

Medium: 1900 Body, Medium parameters used (interpolated):

$f = 1860 \text{ MHz}$; $\sigma = 1.525 \text{ S/m}$; $\epsilon_r = 52.38$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-30-2015; Ambient Temp: 23.6°C; Tissue Temp: 21.0°C

Probe: ES3DV2 - SN3022; ConvF(4.49, 4.49, 4.49); Calibrated: 8/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/12/2014

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 2 (PCS), Body SAR, Back side, Low.ch,
20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset, Quick Cover (Closed)**

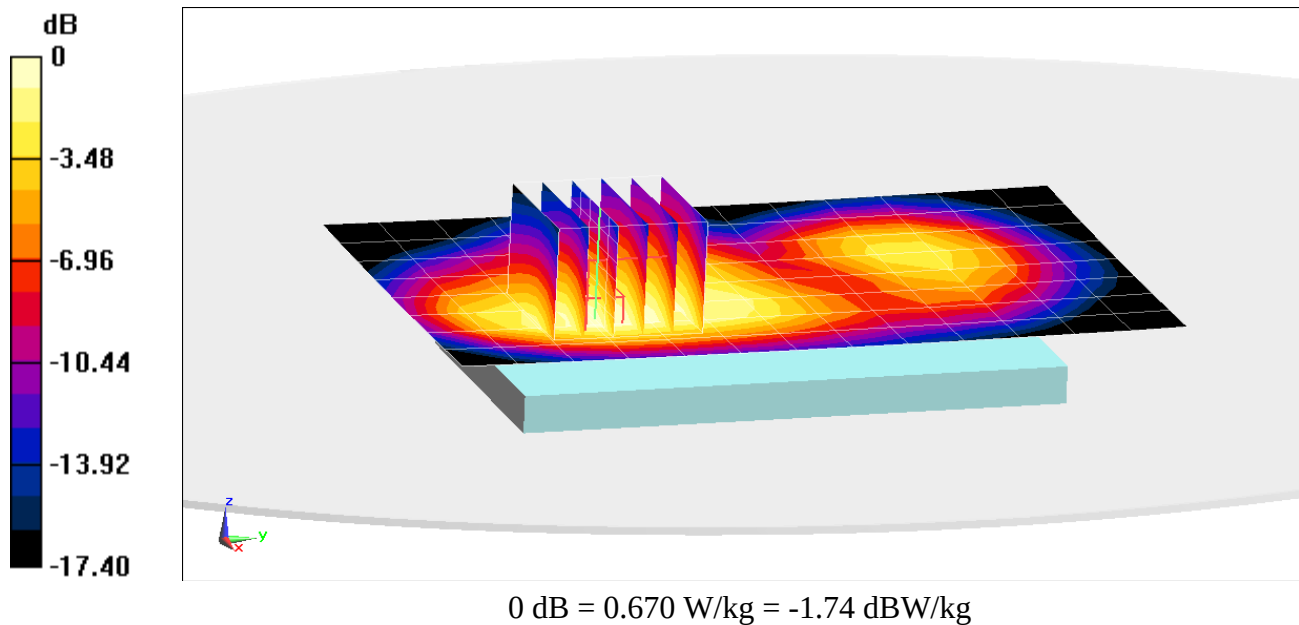
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 20.59 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.882 W/kg

SAR(1 g) = 0.562 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body, Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.499 \text{ S/m}$; $\epsilon_r = 51.828$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 23.9°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3263; ConvF(4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 2 (PCS), Body SAR, Left Edge, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Cover**

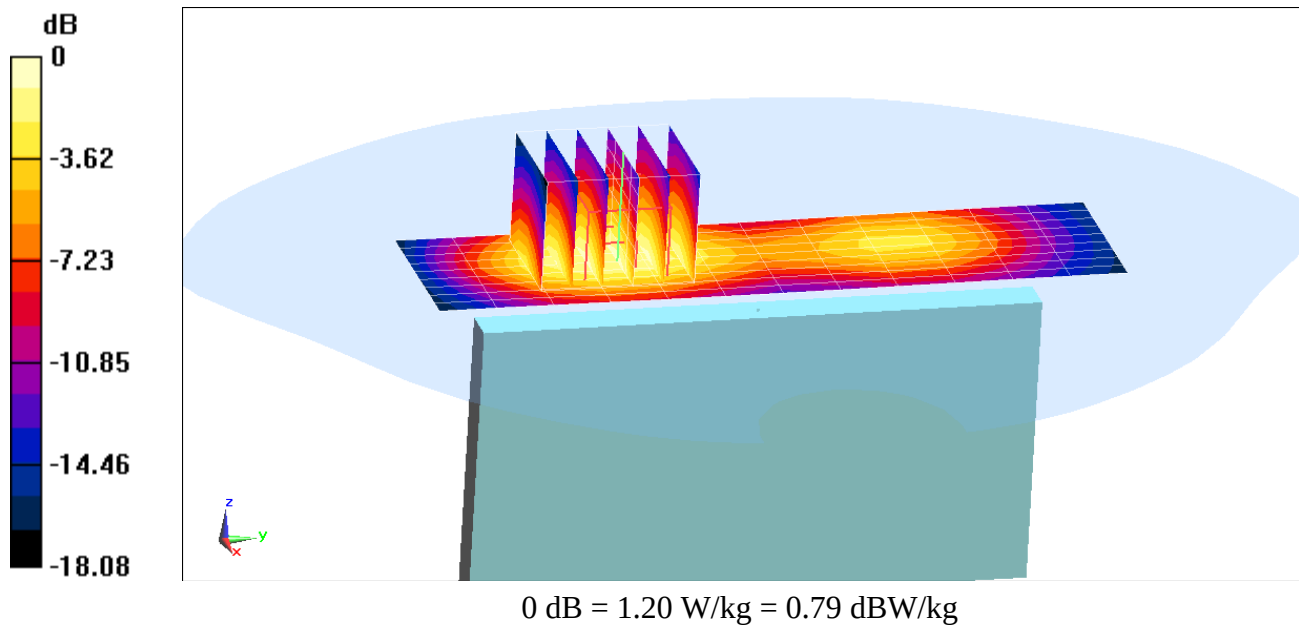
Area Scan (10x13x1): Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 27.06 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 1.61 W/kg

SAR(1 g) = 1 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 7; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: 2600 Body, Medium parameters used (interpolated):

$f = 2560 \text{ MHz}$; $\sigma = 2.099 \text{ S/m}$; $\epsilon_r = 50.569$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.1°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3213; ConvF(4.2, 4.2, 4.2); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 7, Body SAR, Back side, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Cover**

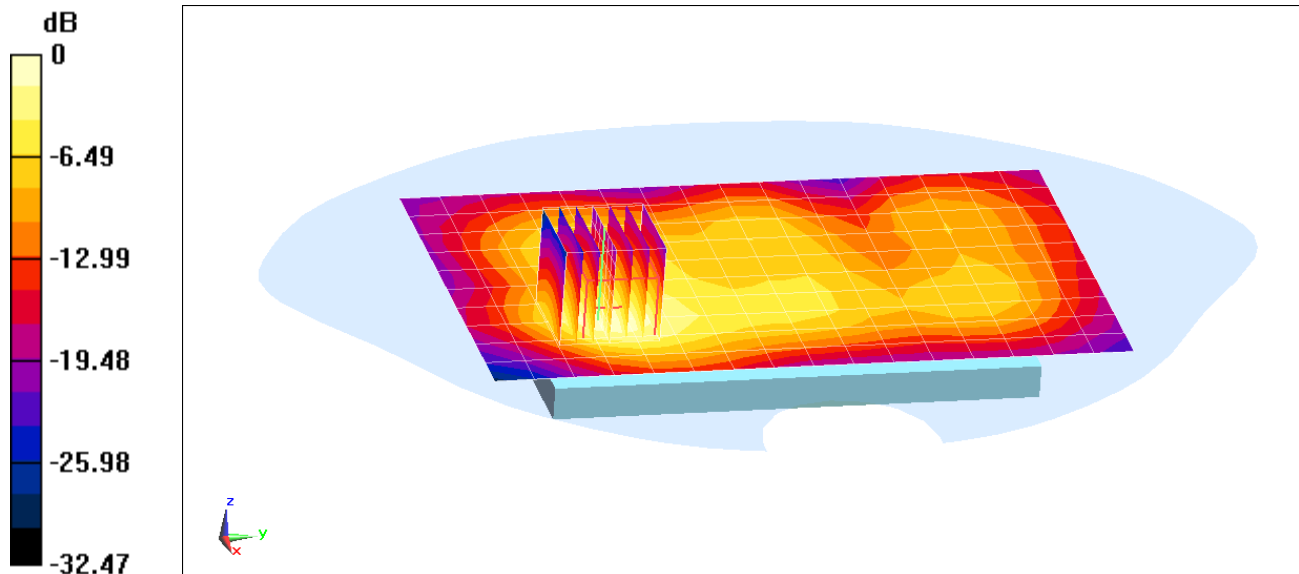
Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.80 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.19 W/kg

SAR(1 g) = 0.525 W/kg



0 dB = 0.694 W/kg = -1.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0716-7

Communication System: UID 0, LTE Band 7; Frequency: 2560 MHz; Duty Cycle: 1:1

Medium: 2600 Body, Medium parameters used (interpolated):

$f = 2560 \text{ MHz}$; $\sigma = 2.099 \text{ S/m}$; $\epsilon_r = 50.569$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.1°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3213; ConvF(4.2, 4.2, 4.2); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 7, Body SAR, Front side, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Cover**

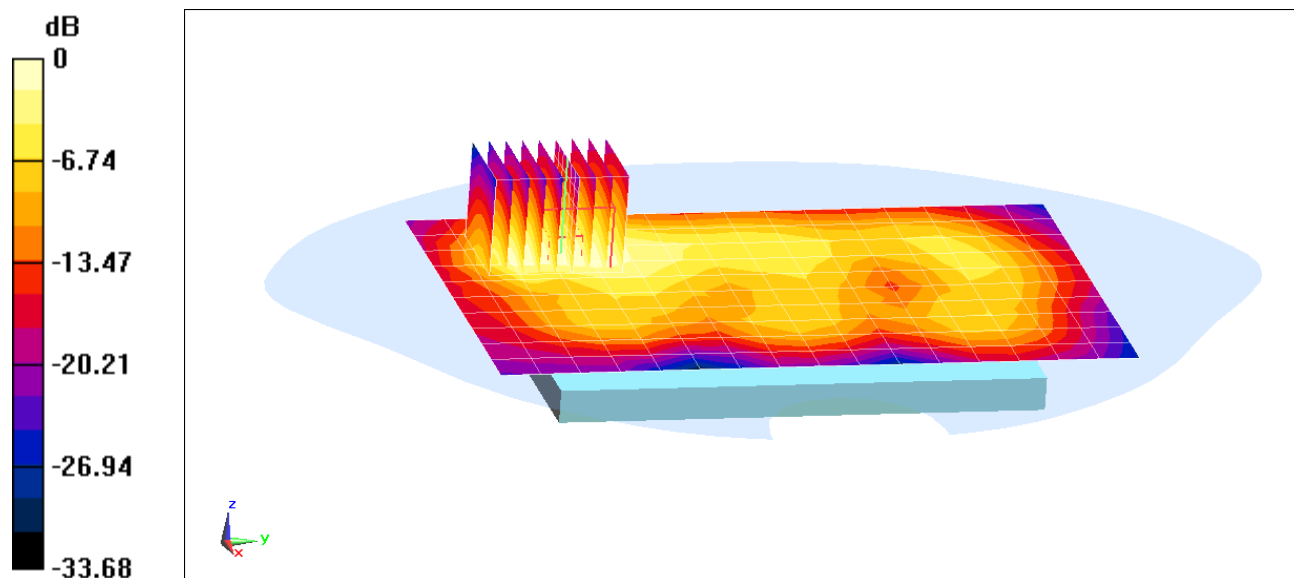
Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x9x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.47 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.13 W/kg

SAR(1 g) = 0.531 W/kg



0 dB = 0.677 W/kg = -1.69 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0683-9

Communication System: UID 0, IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Body, Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$; $\sigma = 2.009 \text{ S/m}$; $\epsilon_r = 50.848$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-17-2015; Ambient Temp: 24.3°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3213; ConvF(4.37, 4.37, 4.37); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11b, Body SAR, Ch 6, 1 Mbps, Back Side, Standard Cover

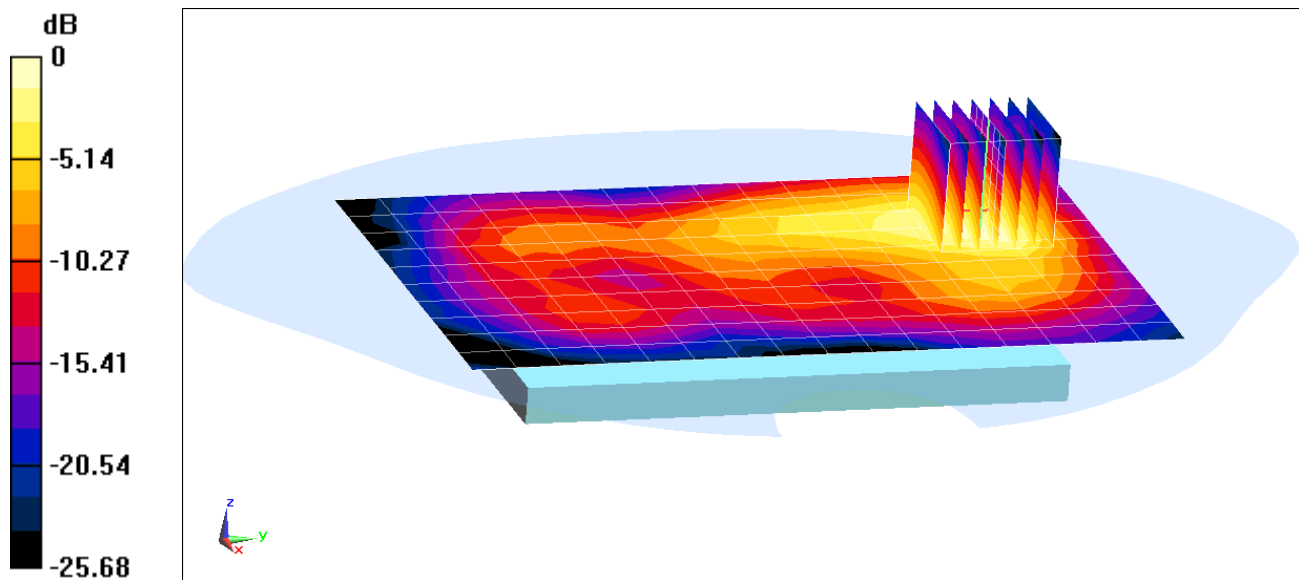
Area Scan (11x17x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 9.977 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.366 W/kg

SAR(1 g) = 0.171 W/kg



0 dB = 0.225 W/kg = -6.48 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0683-9

Communication System: UID 0, IEEE 802.11a; Frequency: 5260 MHz; Duty Cycle: 1:1

Medium: 5GHz Body, Medium parameters used:

$f = 5260 \text{ MHz}$; $\sigma = 5.475 \text{ S/m}$; $\epsilon_r = 47.984$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(4.33, 4.33, 4.33); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Sub ; Type: QD000P40CC; Serial: TP:1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.3 GHz, Body SAR, Ch 52, 6 Mbps, Back Side, Quick Cover (Closed)

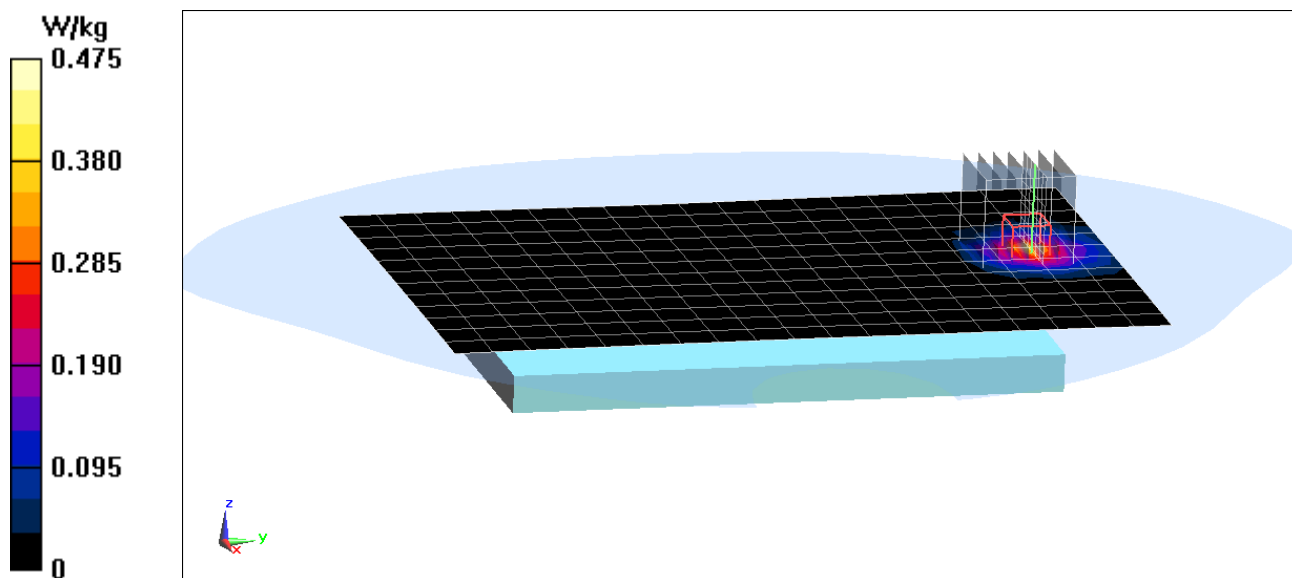
Area Scan (13x20x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 6.336 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.795 W/kg

SAR(1 g) = 0.203 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0683-9

Communication System: UID 0, IEEE 802.11a; Frequency: 5785 MHz; Duty Cycle: 1:1

Medium: 5GHz Body, Medium parameters used:

$f = 5785 \text{ MHz}$; $\sigma = 6.11 \text{ S/m}$; $\epsilon_r = 47.086$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(4.01, 4.01, 4.01); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Sub ; Type: QD000P40CC; Serial: TP:1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Ch 157, 6 Mbps, Top Edge, Standard Cover

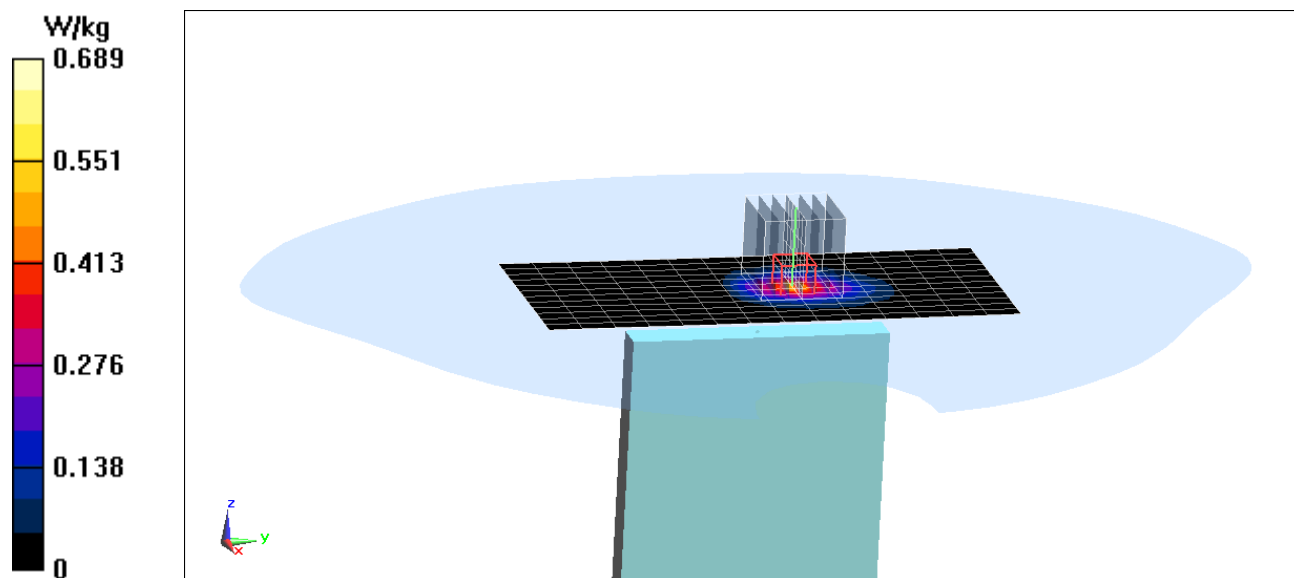
Area Scan (13x15x1): Measurement grid: dx=5mm, dy=10mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 5.734 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.769 W/kg

SAR(1 g) = 0.181 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0683-9

Communication System: UID 0, Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1

Medium: 2450 Body, Medium parameters used (interpolated):

$f = 2441 \text{ MHz}$; $\sigma = 1.985 \text{ S/m}$; $\epsilon_r = 51.291$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-01-2015; Ambient Temp: 24.4°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3288; ConvF(4.36, 4.36, 4.36); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Bluetooth, Body SAR, Ch 39, 1 Mbps, Back Side, Quick Cover (Closed)

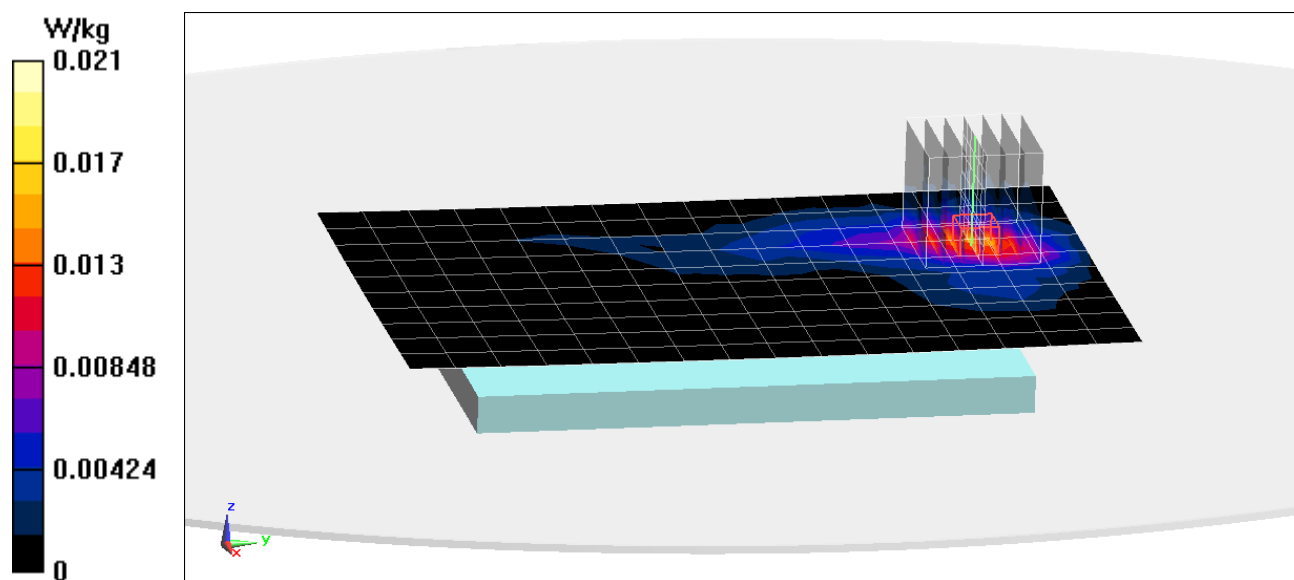
Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.983 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.0620 W/kg

SAR(1 g) = 0.016 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0683-9

Communication System: UID 0, IEEE 802.11a; Frequency: 5260 MHz; Duty Cycle: 1:1

Medium: 5GHz Body, Medium parameters used:

$f = 5260 \text{ MHz}$; $\sigma = 5.475 \text{ S/m}$; $\epsilon_r = 47.984$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(4.33, 4.33, 4.33); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Sub ; Type: QD000P40CC; Serial: TP:1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: IEEE 802.11a, 5.3 GHz, Extremity SAR,
Ch 52, 6 Mbps, Top Edge, Quick Cover (Closed)**

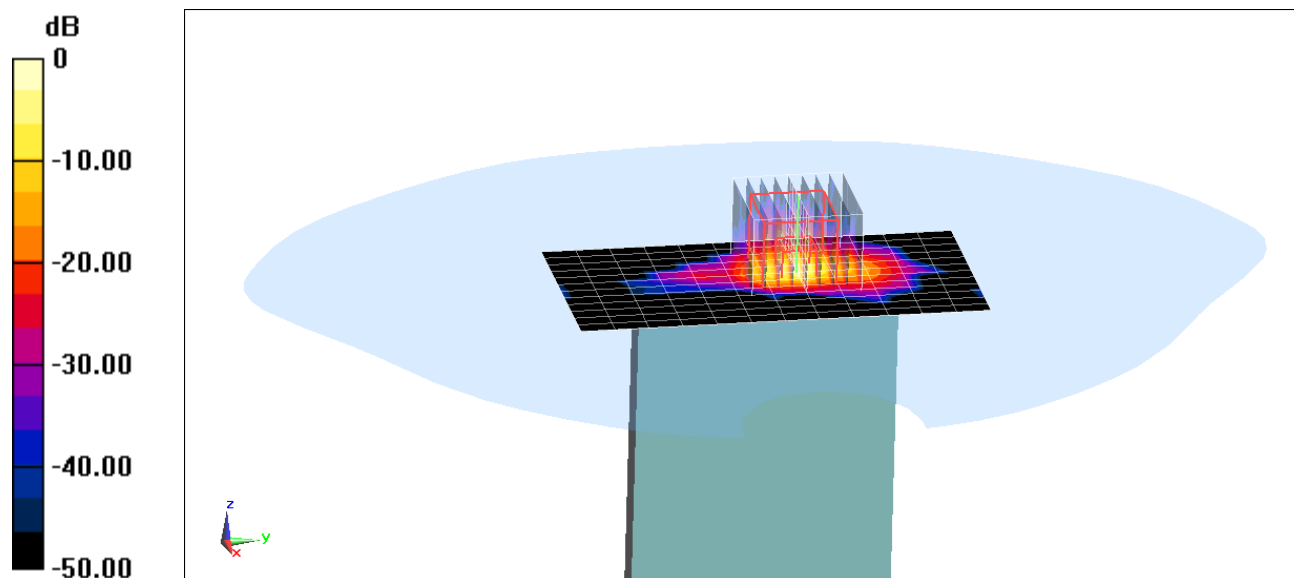
Area Scan (13x13x1): Measurement grid: dx=5mm, dy=10mm

Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 25.32 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 16.2 W/kg

SAR(10 g) = 0.502 W/kg



0 dB = 8.89 W/kg = 9.49 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFH810; Type: Portable Handset; Serial: 0683-9

Communication System: UID 0, Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1

Medium: 2450 Body, Medium parameters used (interpolated):

$f = 2441 \text{ MHz}$; $\sigma = 1.985 \text{ S/m}$; $\epsilon_r = 51.291$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-01-2015; Ambient Temp: 24.4°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3288; ConvF(4.36, 4.36, 4.36); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Bluetooth, Extremity SAR, Ch 39, 1 Mbps, Back Side, Quick Cover (Closed)

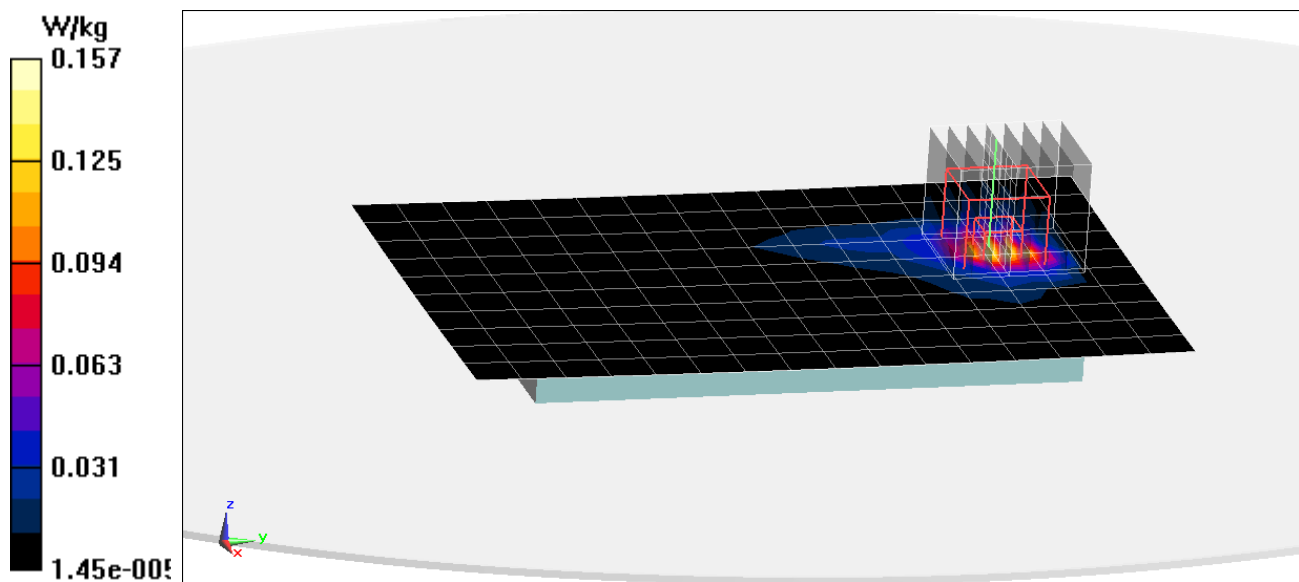
Area Scan (11x17x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

Zoom Scan (7x8x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 7.633 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.358 W/kg

SAR(10 g) = 0.044 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1003

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 750 Head, Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.907 \text{ S/m}$; $\epsilon_r = 40.97$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-25-2015; Ambient Temp: 22.4°C; Tissue Temp: 21.9°C

Probe: ES3DV2 - SN3022; ConvF(6.39, 6.39, 6.39); Calibrated: 8/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/12/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

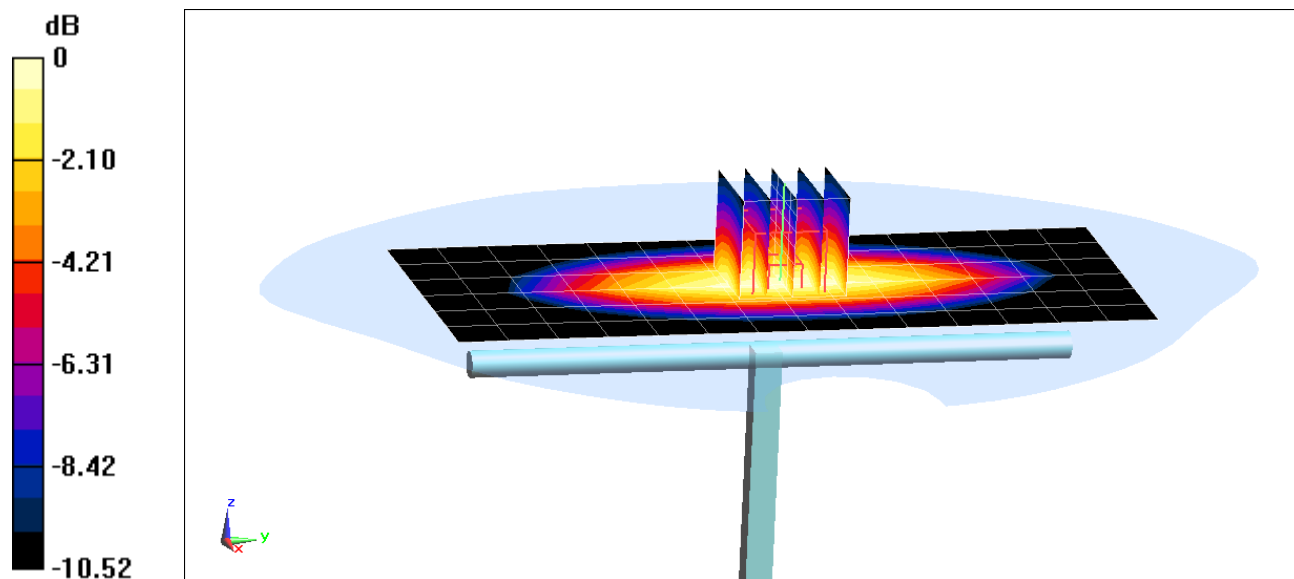
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.27 W/kg

SAR(1 g) = 0.856 W/kg

Deviation(1 g) = 5.81%



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d133

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Head, Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.899 \text{ S/m}$; $\epsilon_r = 40.279$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-25-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3288; ConvF(6.51, 6.51, 6.51); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

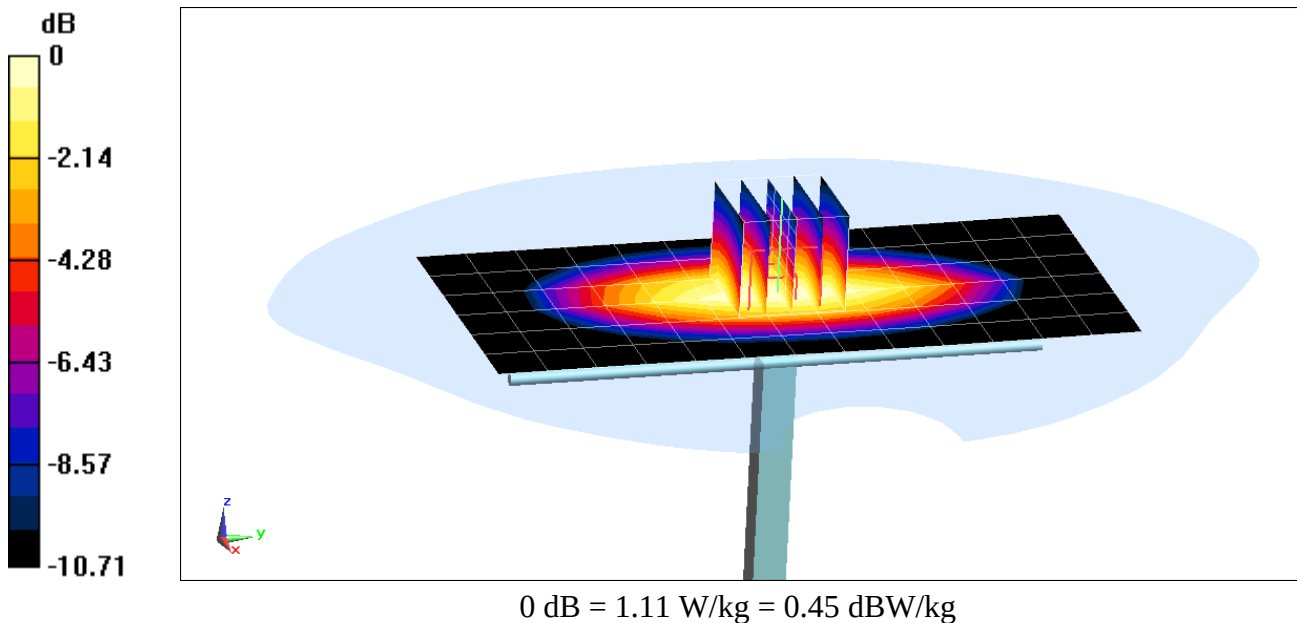
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.40 W/kg

SAR(1 g) = 0.945 W/kg

Deviation(1 g) = 2.72%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1765V2; Serial: 1008

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Head, Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.341 \text{ S/m}$; $\epsilon_r = 39.51$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-26-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3213; ConvF(5.22, 5.22, 5.22); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1750 MHz System Verification

Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm

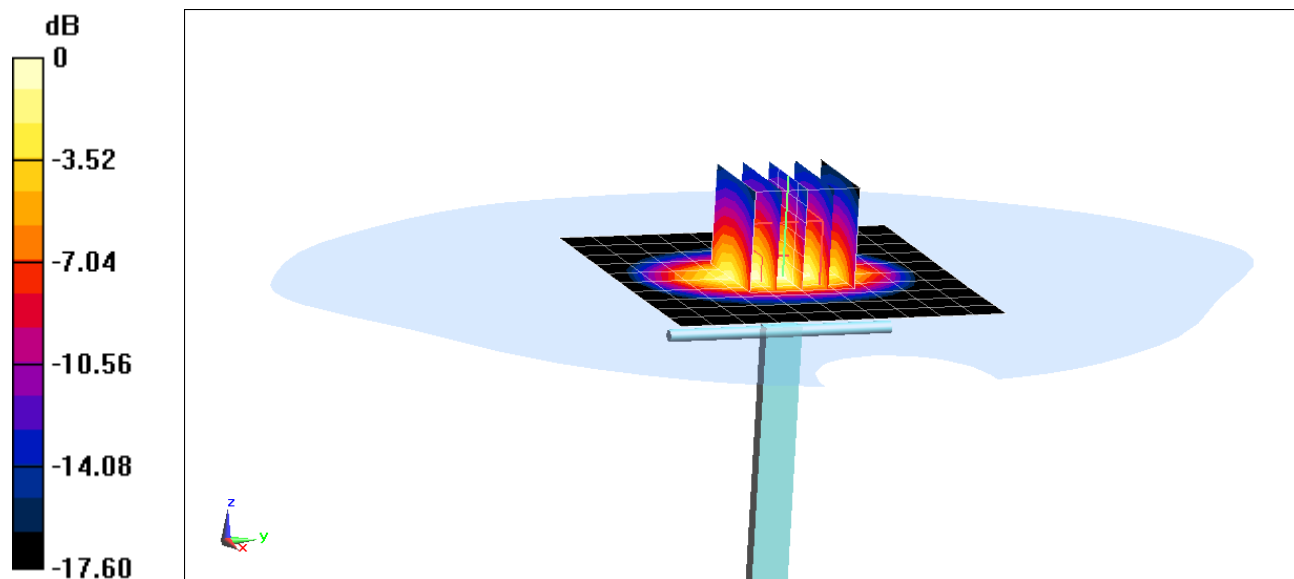
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 6.65 W/kg

SAR(1 g) = 3.7 W/kg

Deviation(1 g) = 0.27%



0 dB = 4.60 W/kg = 6.63 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1051

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Head, Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.358 \text{ S/m}$; $\epsilon_r = 38.261$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-30-2015; Ambient Temp: 23.9°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3334; ConvF(5.21, 5.21, 5.21); Calibrated: 12/16/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 12/12/2014

Phantom: Sub Twin Sam v5.0; Type: QD000P40CD; Serial: TP:1626

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1750 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

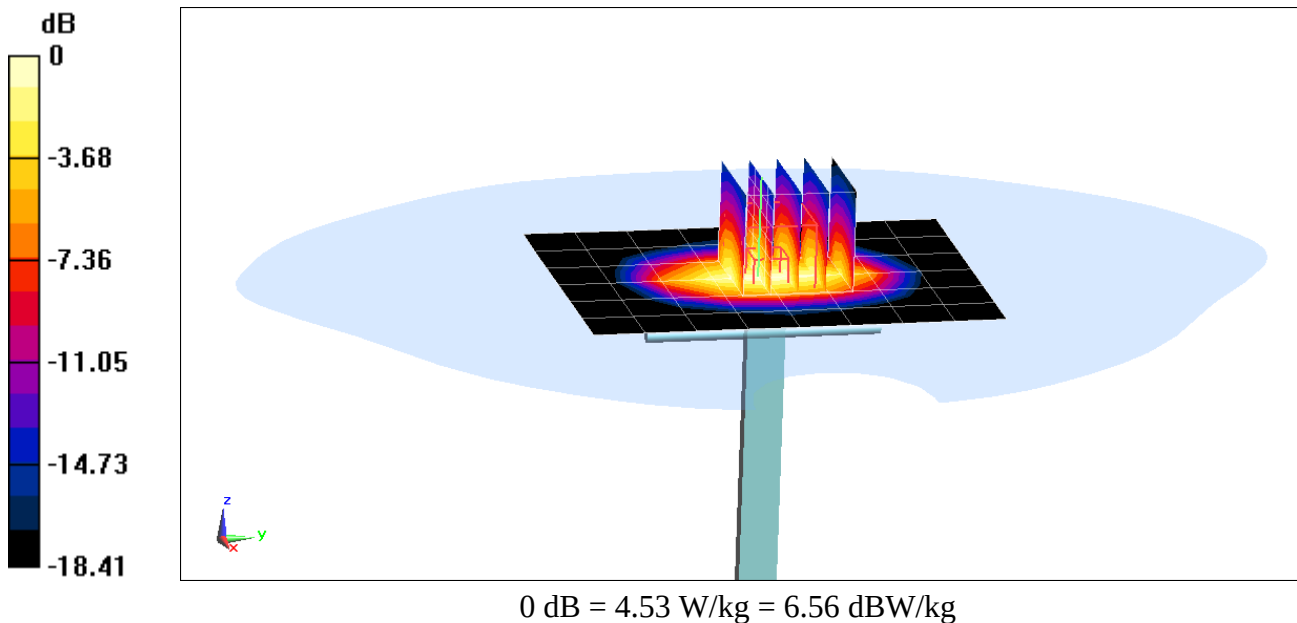
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 6.43 W/kg

SAR(1 g) = 3.6 W/kg

Deviation(1 g) = -0.55%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141

Communication System: UID 10000, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Head, Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.432 \text{ S/m}$; $\epsilon_r = 39.953$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 24.2°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3213; ConvF(5.06, 5.06, 5.06); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

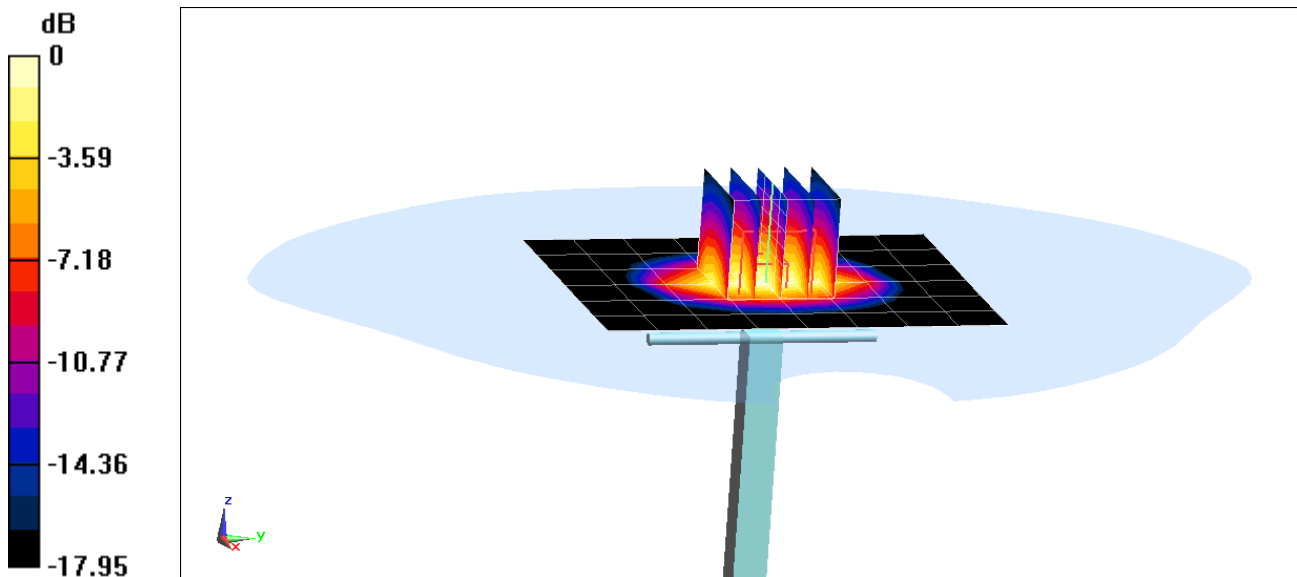
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.72 W/kg

SAR(1 g) = 4.24 W/kg

Deviation(1 g) = 5.74%



0 dB = 5.39 W/kg = 7.32 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 719

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Head, Medium parameters used:

$f = 2450$ MHz; $\sigma = 1.829$ S/m; $\epsilon_r = 38.982$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 23.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3288; ConvF(4.56, 4.56, 4.56); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

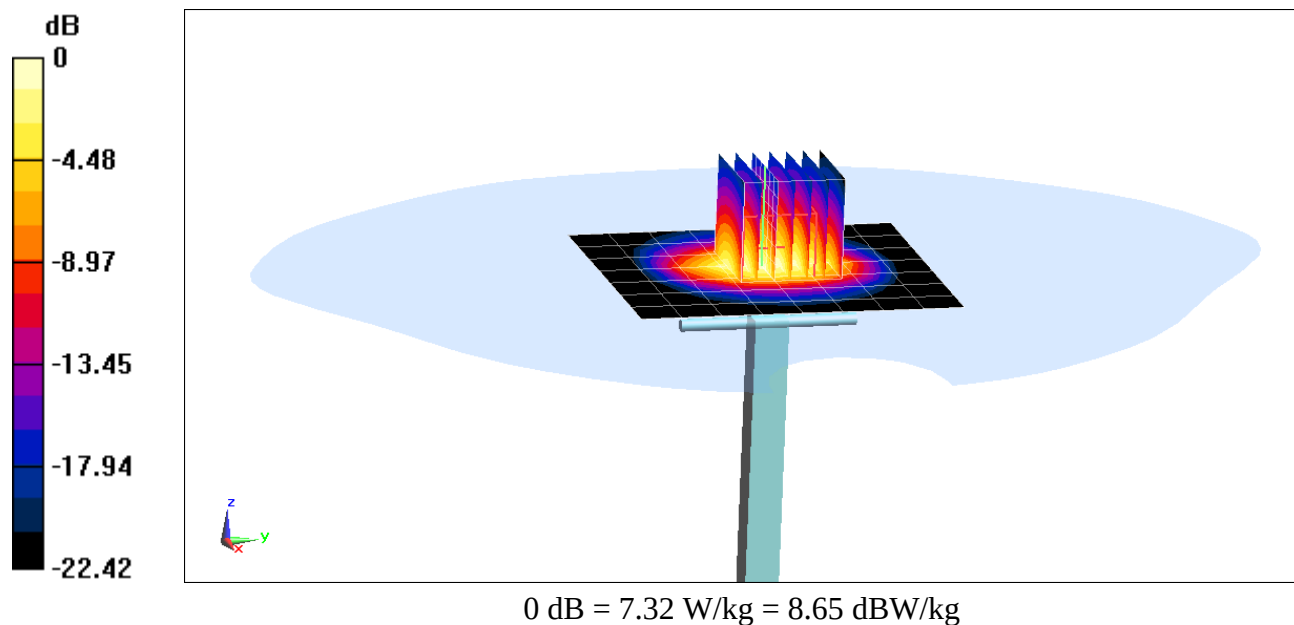
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 11.7 W/kg

SAR(1 g) = 5.59 W/kg

Deviation(1 g) = 7.29%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1071

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: 2600 Head, Medium parameters used:

$f = 2600$ MHz; $\sigma = 1.998$ S/m; $\epsilon_r = 38.444$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 23.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3288; ConvF(4.44, 4.44, 4.44); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2600 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

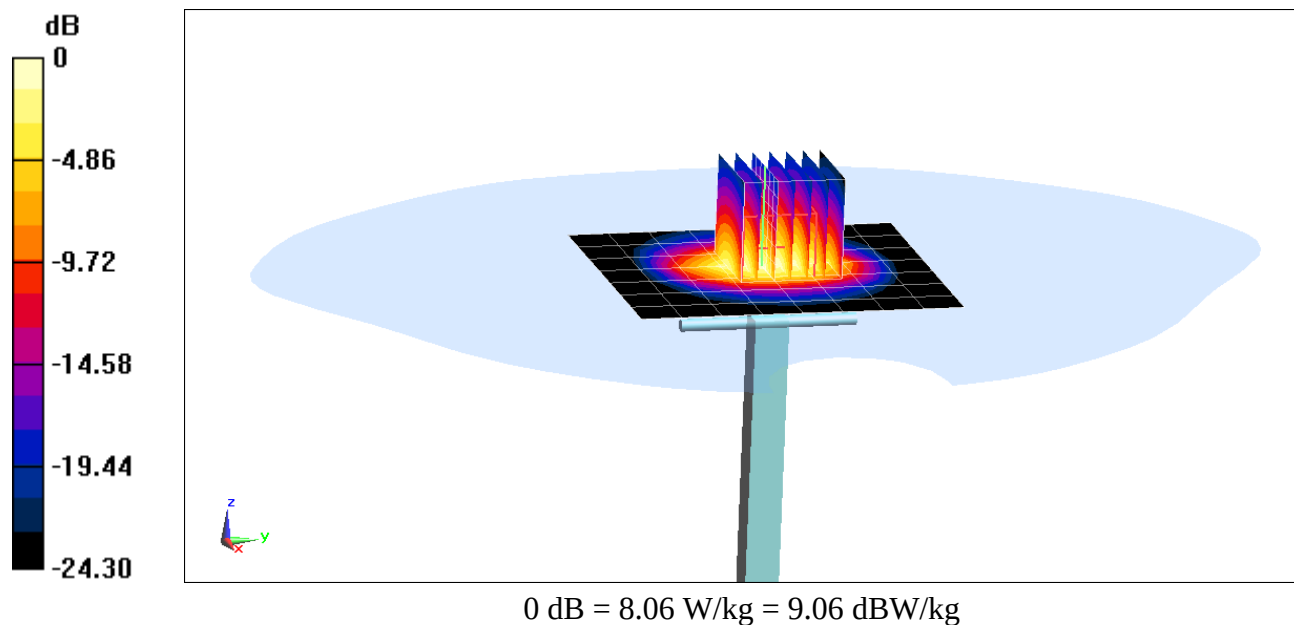
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 13.4 W/kg

SAR(1 g) = 6.06 W/kg

Deviation(1 g) = 5.39%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057

Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5GHz, Medium parameters used:

$f = 5200 \text{ MHz}$; $\sigma = 4.461 \text{ S/m}$; $\epsilon_r = 35.157$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-30-2015; Ambient Temp: 21.9°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3920; ConvF(4.87, 4.87, 4.87); Calibrated: 12/12/2014;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/18/2015

Phantom: SAM, Left; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5200 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

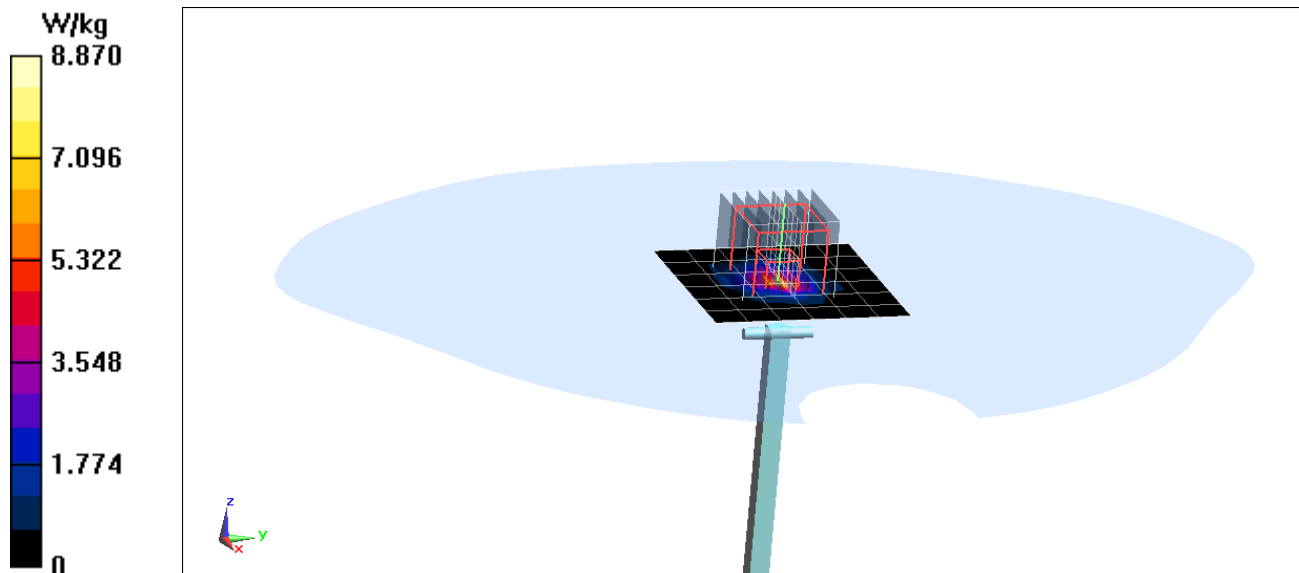
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 15.3 W/kg

SAR(1 g) = 3.77 W/kg

Deviation(1 g) = -7.48%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1057

Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: 5GHz, Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 4.569 \text{ S/m}$; $\epsilon_r = 35.023$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-30-2015; Ambient Temp: 22.0°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3920; ConvF(4.69, 4.69, 4.69); Calibrated: 12/12/2014;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/18/2015

Phantom: SAM, Left; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

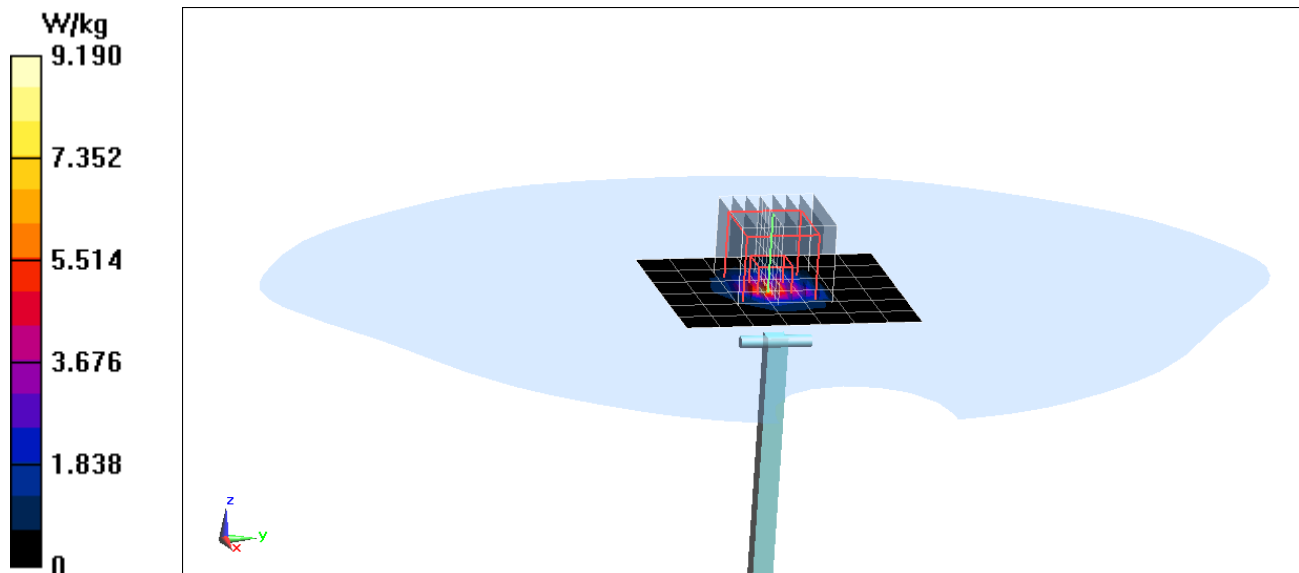
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 15.7 W/kg

SAR(1 g) = 3.83 W/kg

Deviation(1 g) = -9.56%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057

Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5GHz, Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 4.765 \text{ S/m}$; $\epsilon_r = 34.765$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-30-2015; Ambient Temp: 22.0°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3920; ConvF(4.44, 4.44, 4.44); Calibrated: 12/12/2014;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/18/2015

Phantom: SAM, Left; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

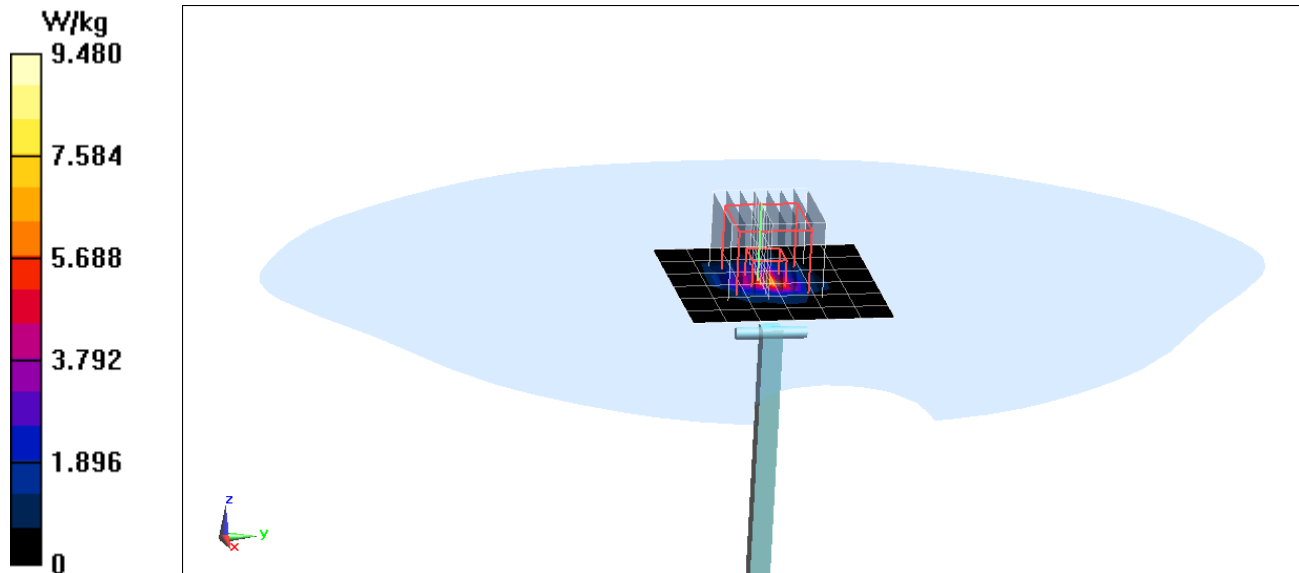
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 16.2 W/kg

SAR(1 g) = 3.86 W/kg

Deviation(1 g) = -8.42%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: 1057

Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5GHz, Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 4.865 \text{ S/m}$; $\epsilon_r = 34.615$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-30-2015; Ambient Temp: 22.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3920; ConvF(4.35, 4.35, 4.35); Calibrated: 12/12/2014;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/18/2015

Phantom: SAM, Left; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5600 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

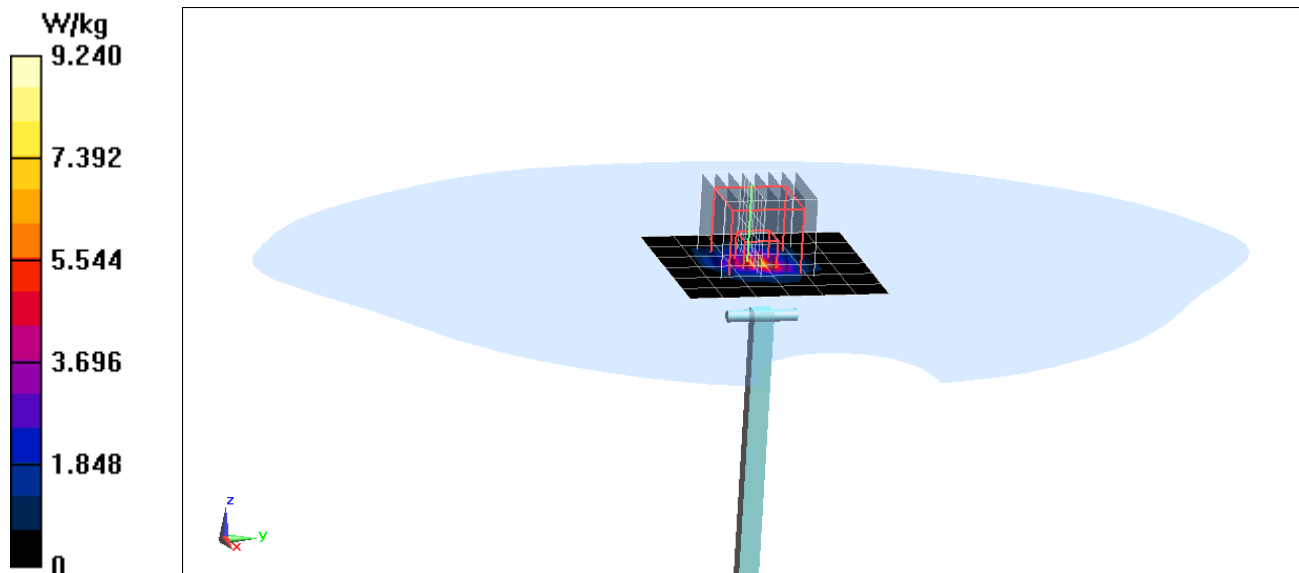
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 16.6 W/kg

SAR(1 g) = 3.89 W/kg

Deviation(1 g) = -7.16%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5GHz, Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 5.069 \text{ S/m}$; $\epsilon_r = 34.342$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-30-2015; Ambient Temp: 22.1°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3920; ConvF(4.27, 4.27, 4.27); Calibrated: 12/12/2014;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/18/2015

Phantom: SAM, Left; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

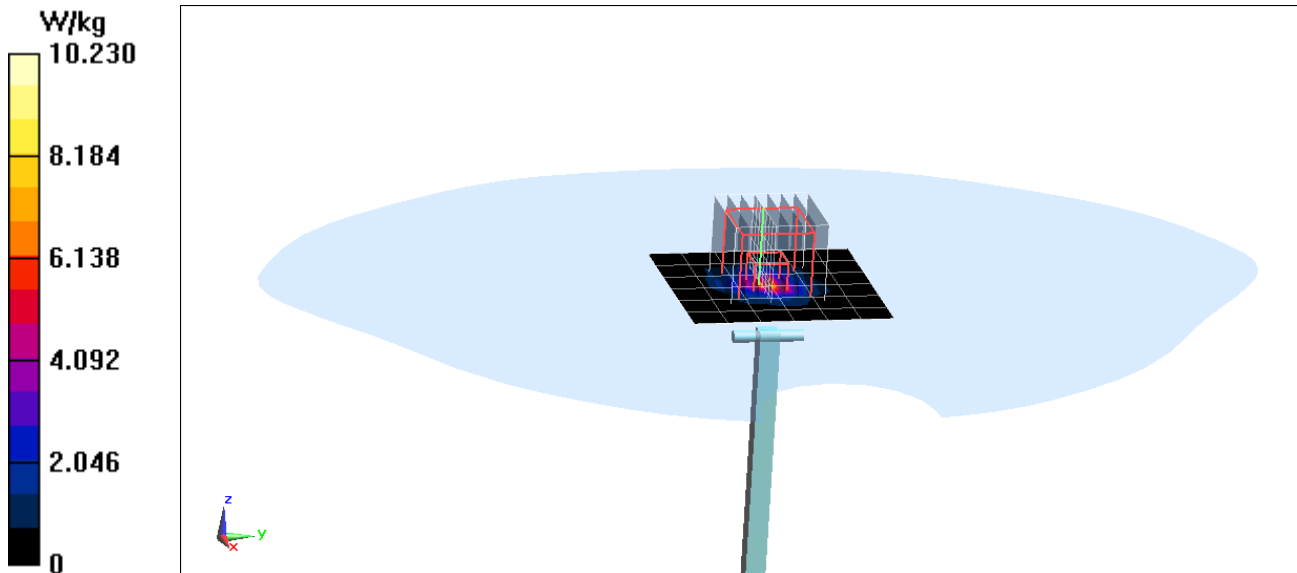
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 4.09 W/kg

Deviation(1 g) = 0.86%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1003

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 750 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.973 \text{ S/m}$; $\epsilon_r = 54.927$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-24-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF(6.19, 6.19, 6.19); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

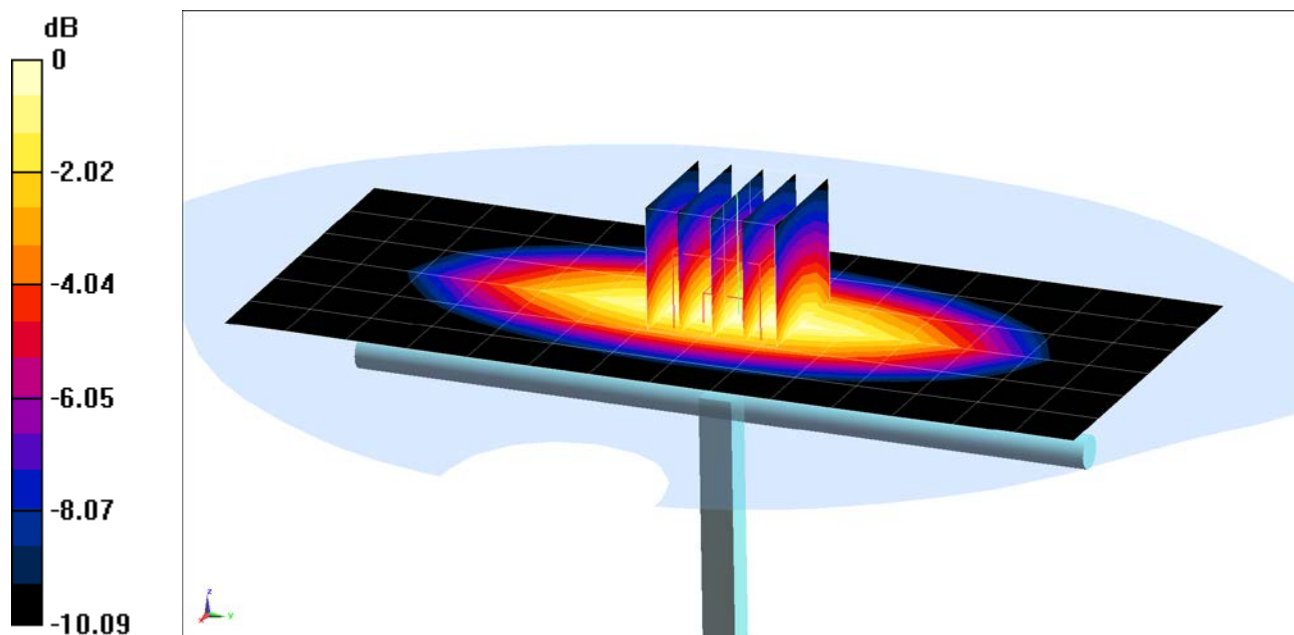
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.35 W/kg

SAR(1 g) = 0.916 W/kg

Deviation(1 g) = 8.27%



0 dB = 1.06 W/kg = 0.25 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d132

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body, Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.961 \text{ S/m}$; $\epsilon_r = 52.937$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-19-2015; Ambient Temp: 24.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3333; ConvF(6.12, 6.12, 6.12); Calibrated: 10/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1408; Calibrated: 10/23/2014

Phantom: Sub TWIN SAM; Type: QD000P40CC; Serial: TP-1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

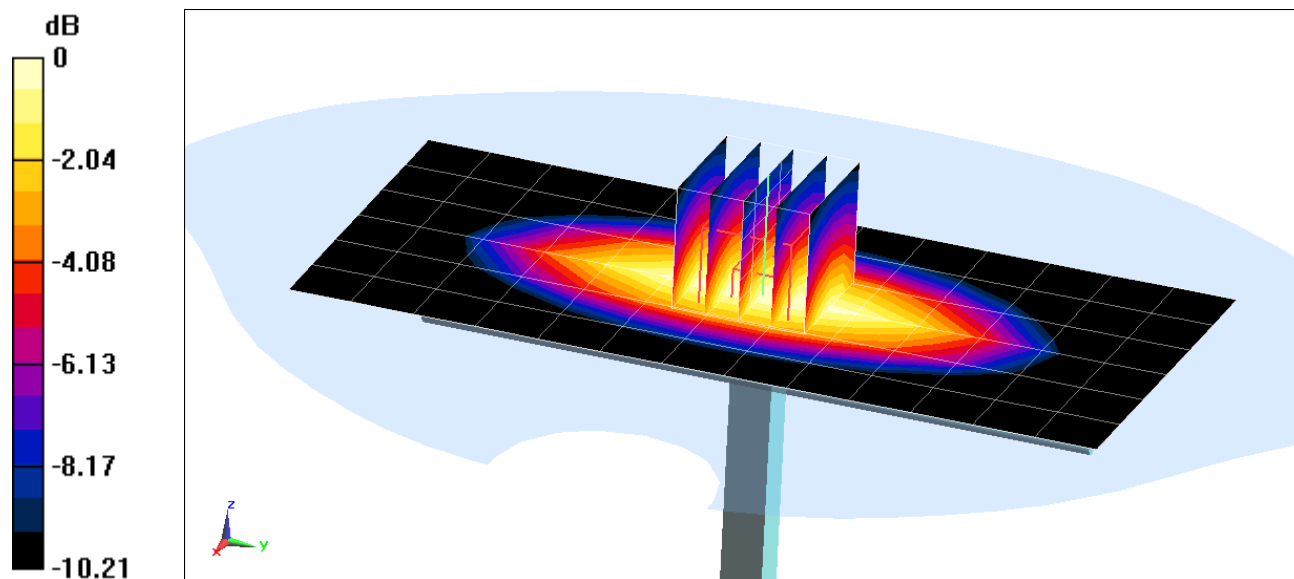
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.39 W/kg

SAR(1 g) = 0.956 W/kg

Deviation(1 g) = 4.60%



0 dB = 1.12 W/kg = 0.49 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1765V2; Serial: 1008

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Body Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.477 \text{ S/m}$; $\epsilon_r = 52.15$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3332; ConvF(4.88, 4.88, 4.88); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1750 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

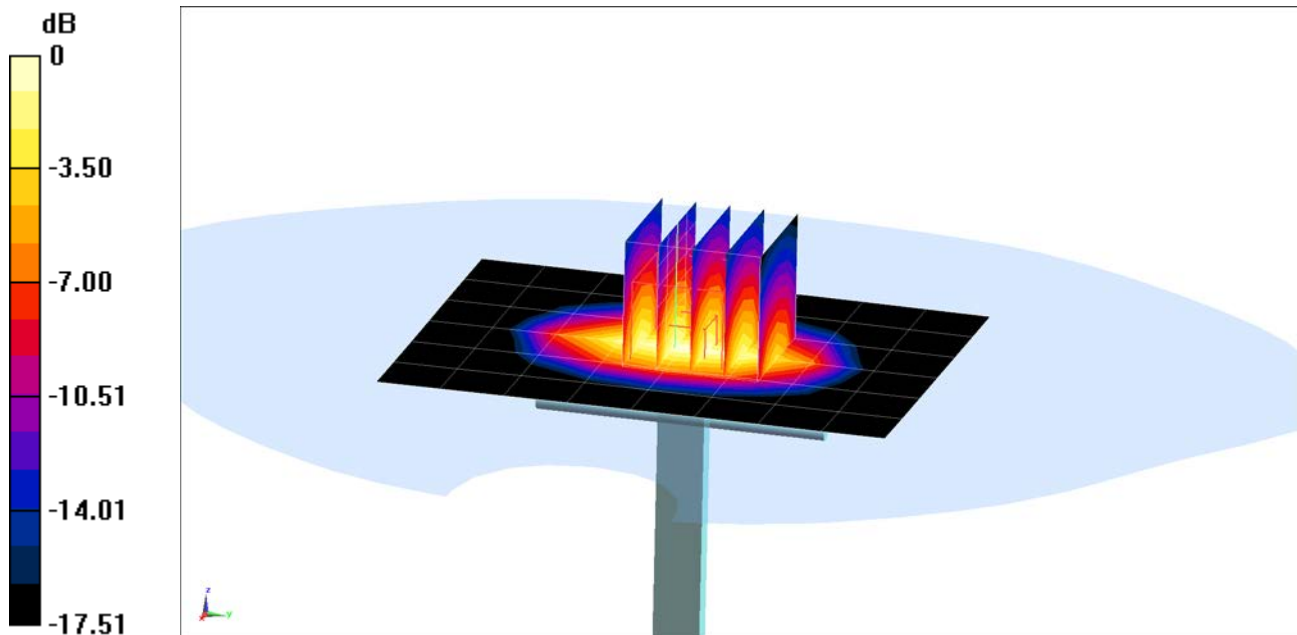
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 6.16 W/kg

SAR(1 g) = 3.52 W/kg

Deviation(1 g) = -6.38%



0 dB = 4.37 W/kg = 6.40 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body, Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.522 \text{ S/m}$; $\epsilon_r = 51.74$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 23.9°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3263; ConvF(4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

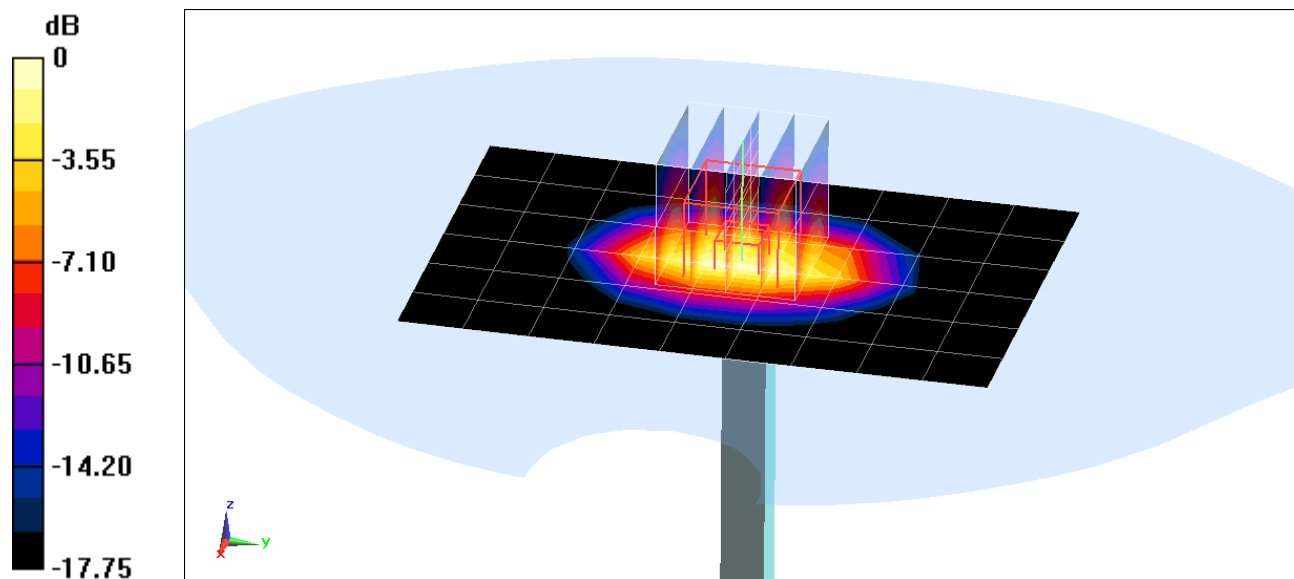
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 6.96 W/kg

SAR(1 g) = 3.86 W/kg

Deviation(1 g) = -4.46%



0 dB = 4.92 W/kg = 6.92 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900$ MHz; $\sigma = 1.574$ S/m; $\epsilon_r = 52.231$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-30-2015; Ambient Temp: 23.6°C; Tissue Temp: 21.0°C

Probe: ES3DV2 - SN3022; ConvF(4.49, 4.49, 4.49); Calibrated: 8/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/12/2014

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

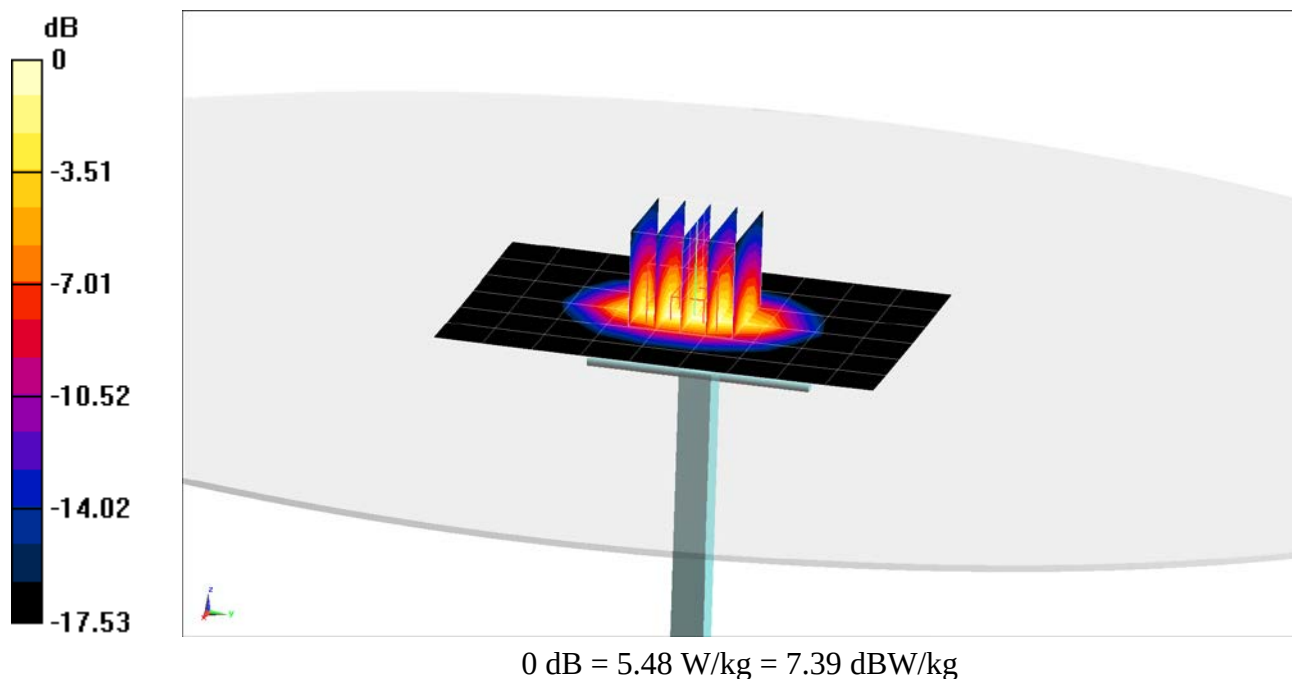
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.59 W/kg

SAR(1 g) = 4.32 W/kg

Deviation(1 g) = 6.93%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 719

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 2.028 \text{ S/m}$; $\epsilon_r = 50.797$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-17-2015; Ambient Temp: 24.3°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3213; ConvF(4.37, 4.37, 4.37); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

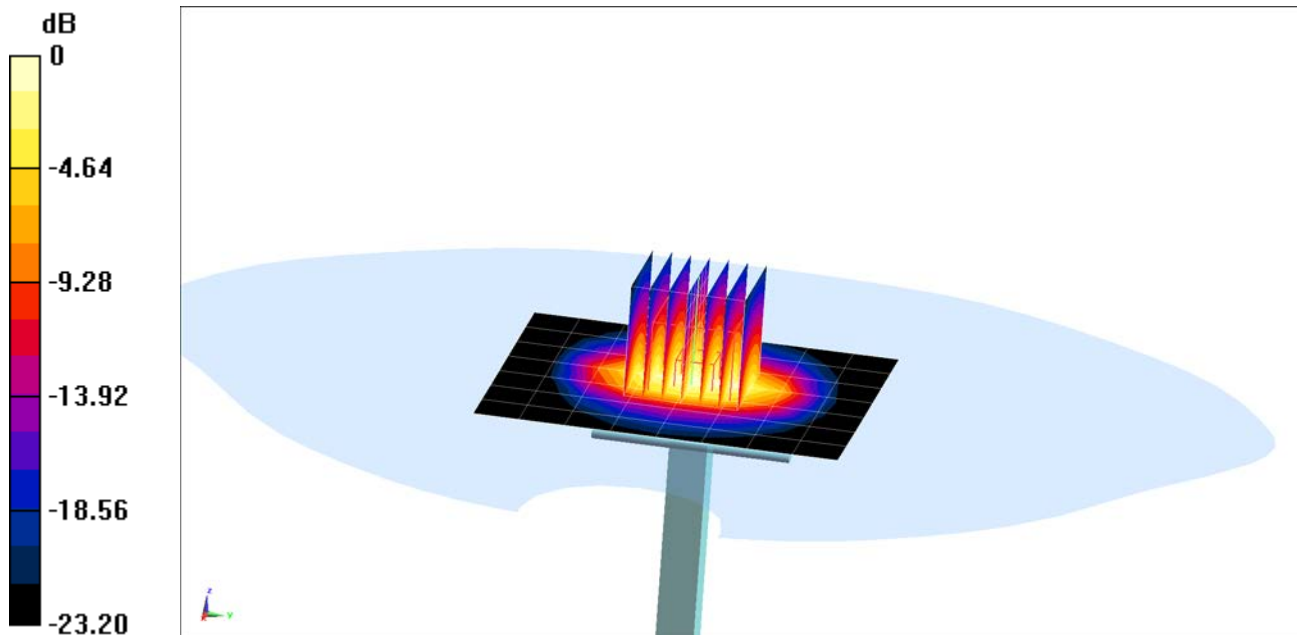
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 11.5 W/kg

SAR(1 g) = 5.29 W/kg

Deviation(1 g) = 2.12%



0 dB = 6.74 W/kg = 8.29 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 719

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body, Medium parameters used:

$f = 2450$ MHz; $\sigma = 1.997$ S/m; $\epsilon_r = 51.257$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-01-2015; Ambient Temp: 24.4°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3288; ConvF(4.36, 4.36, 4.36); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

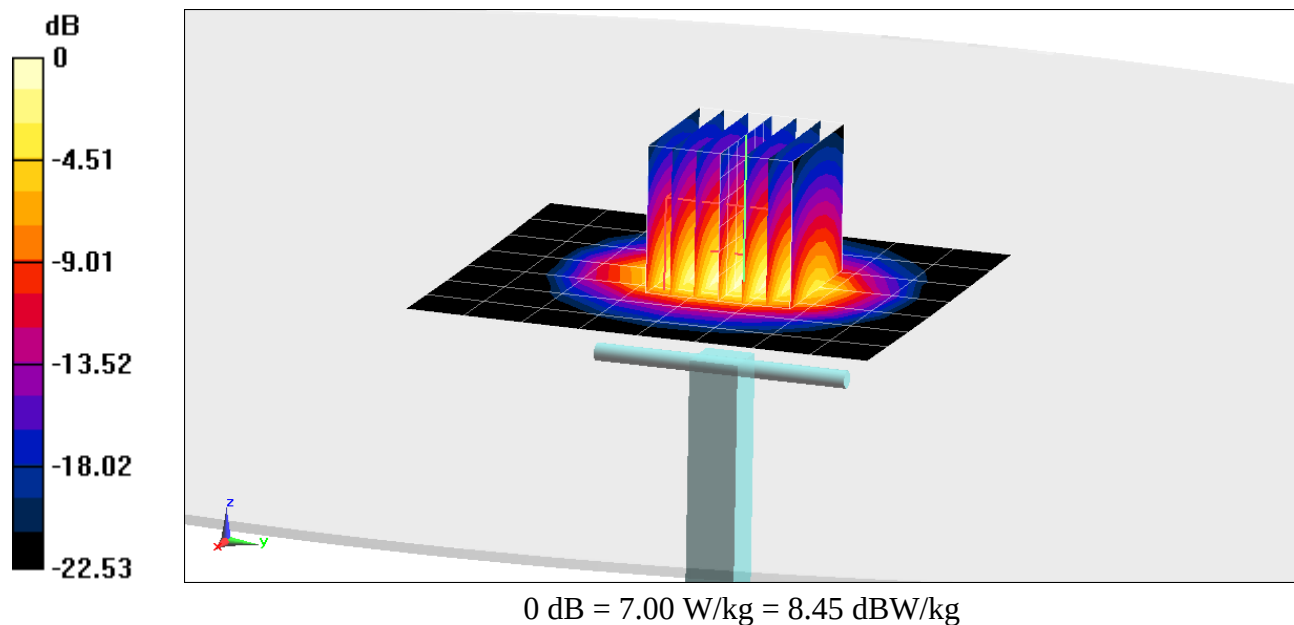
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 11.5 W/kg

SAR(1 g) = 5.3 W/kg; SAR(10 g) = 2.43 W/kg

Deviation(1 g) = 2.32%; Deviation(10 g) = 1.25%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1071

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: 2600 Body, Medium parameters used:

$f = 2600$ MHz; $\sigma = 2.147$ S/m; $\epsilon_r = 50.438$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-19-2015; Ambient Temp: 24.1°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3213; ConvF(4.2, 4.2, 4.2); Calibrated: 1/20/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 1/19/2015

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

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2600 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

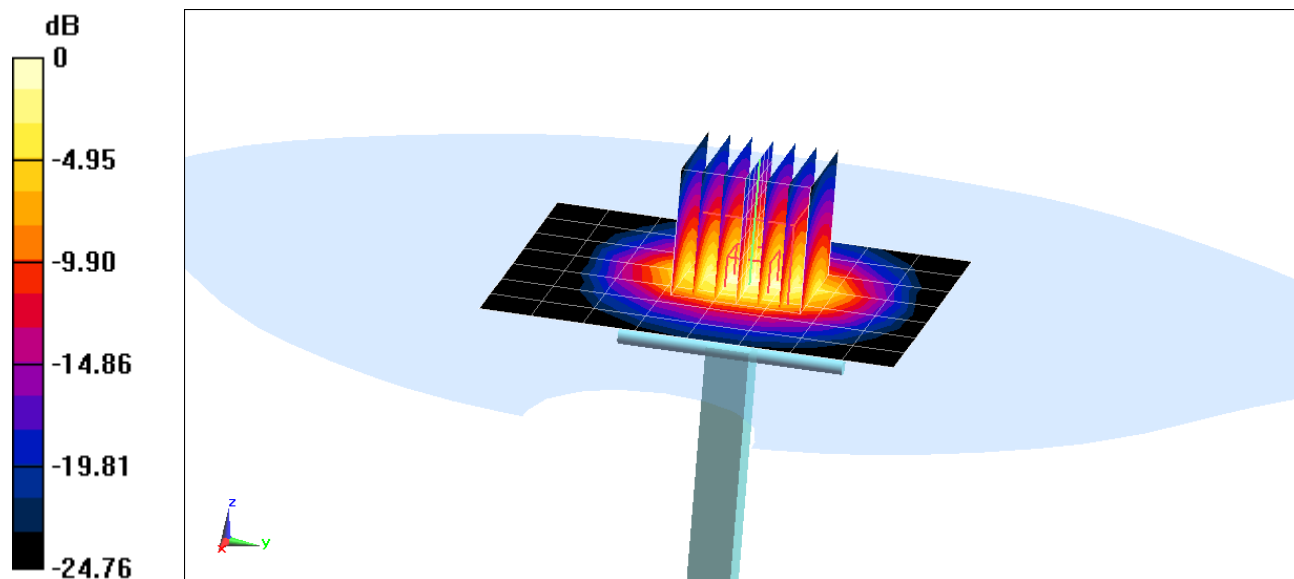
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 13.4 W/kg

SAR(1 g) = 5.68 W/kg

Deviation(1 g) = -0.18%



0 dB = 7.57 W/kg = 8.79 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1191

Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5200 \text{ MHz}$; $\sigma = 5.395 \text{ S/m}$; $\epsilon_r = 48.053$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(4.5, 4.5, 4.5); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Sub ; Type: QD000P40CC; Serial: TP:1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5200 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

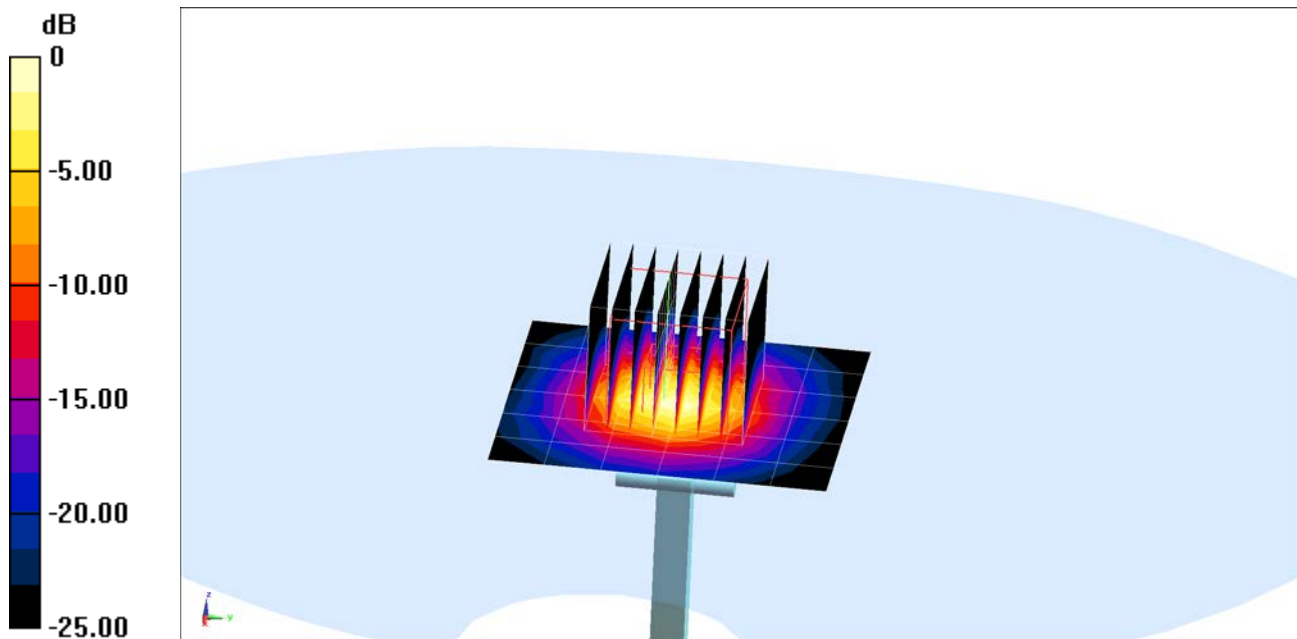
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 16.2 W/kg

SAR(1 g) = 3.86 W/kg; SAR(10 g) = 1.07 W/kg

Deviation(1 g) = -0.77%; Deviation(10 g) = -0.93%



0 dB = 9.30 W/kg = 9.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1191

Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 5.499 \text{ S/m}$; $\epsilon_r = 47.886$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(4.33, 4.33, 4.33); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Sub ; Type: QD000P40CC; Serial: TP:1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

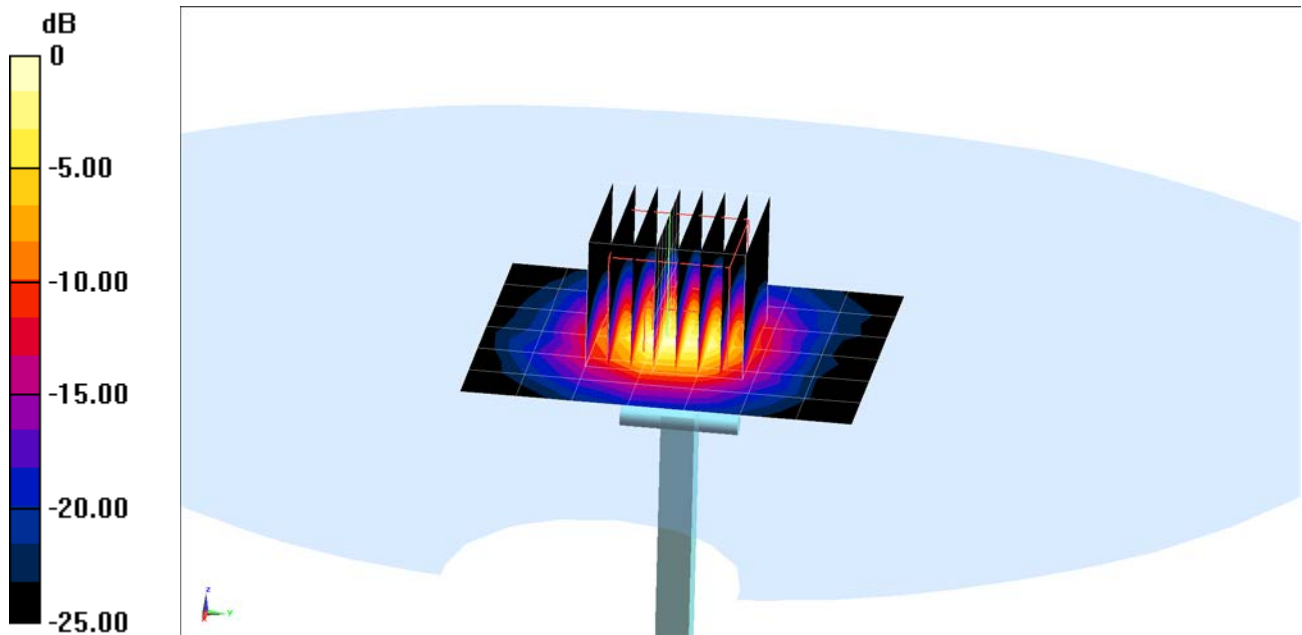
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 17.5 W/kg

SAR(1 g) = 4.05 W/kg; SAR(10 g) = 1.11 W/kg

Deviation(1 g) = 1.38%; Deviation(10 g) = -0.45%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1191

Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 5.716 \text{ S/m}$; $\epsilon_r = 47.553$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(3.91, 3.91, 3.91); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Sub ; Type: QD000P40CC; Serial: TP:1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

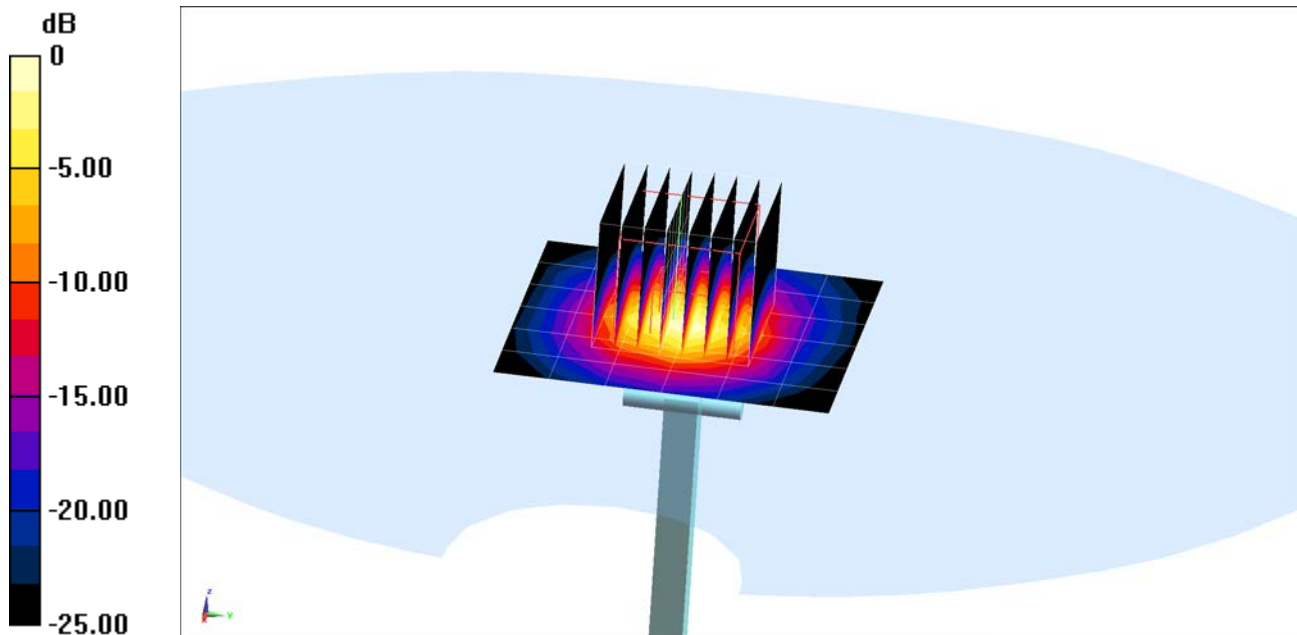
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 17.9 W/kg

SAR(1 g) = 4.09 W/kg; SAR(10 g) = 1.13 W/kg

Deviation(1 g) = -1.56%; Deviation(10 g) = -1.74%



0 dB = 9.75 W/kg = 9.89 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: 1191

Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 5.841 \text{ S/m}$; $\epsilon_r = 47.378$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.5°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(3.89, 3.89, 3.89); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Sub ; Type: QD000P40CC; Serial: TP:1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5600 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

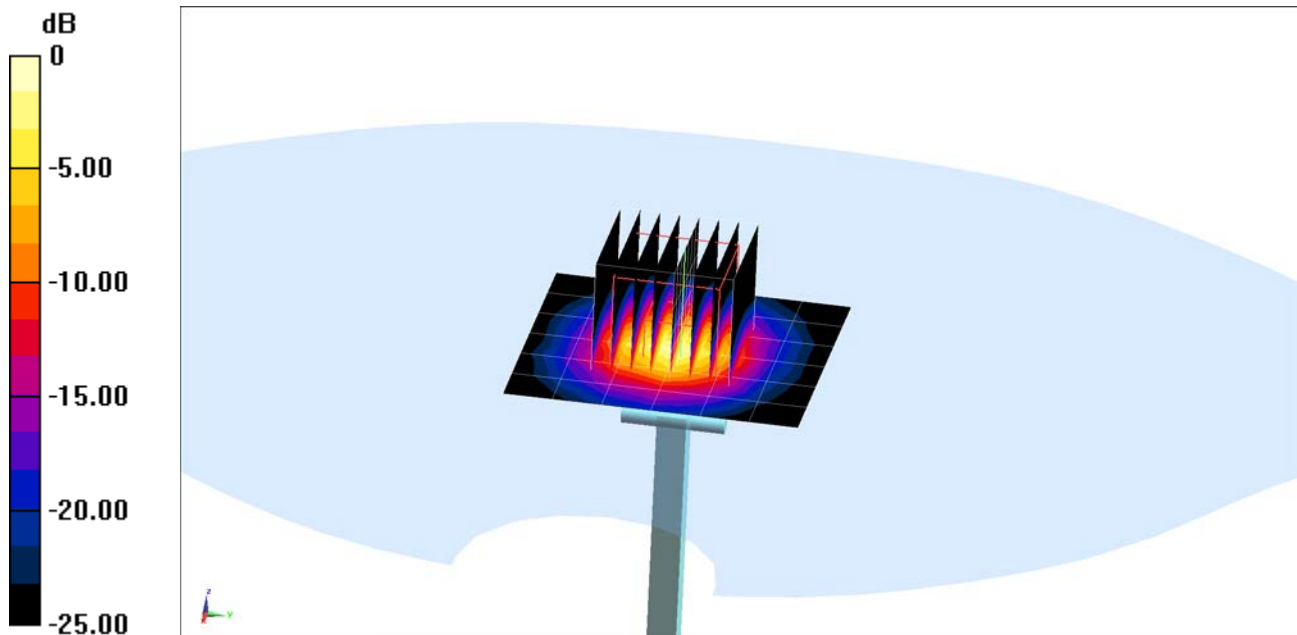
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 4.05 W/kg; SAR(10 g) = 1.11 W/kg

Deviation(1 g) = -3.69%; Deviation(10 g) = -4.72%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1191

Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 6.149 \text{ S/m}$; $\epsilon_r = 47.074$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-23-2015; Ambient Temp: 22.4°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(4.01, 4.01, 4.01); Calibrated: 2/10/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/31/2014

Phantom: SAM Sub ; Type: QD000P40CC; Serial: TP:1357

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

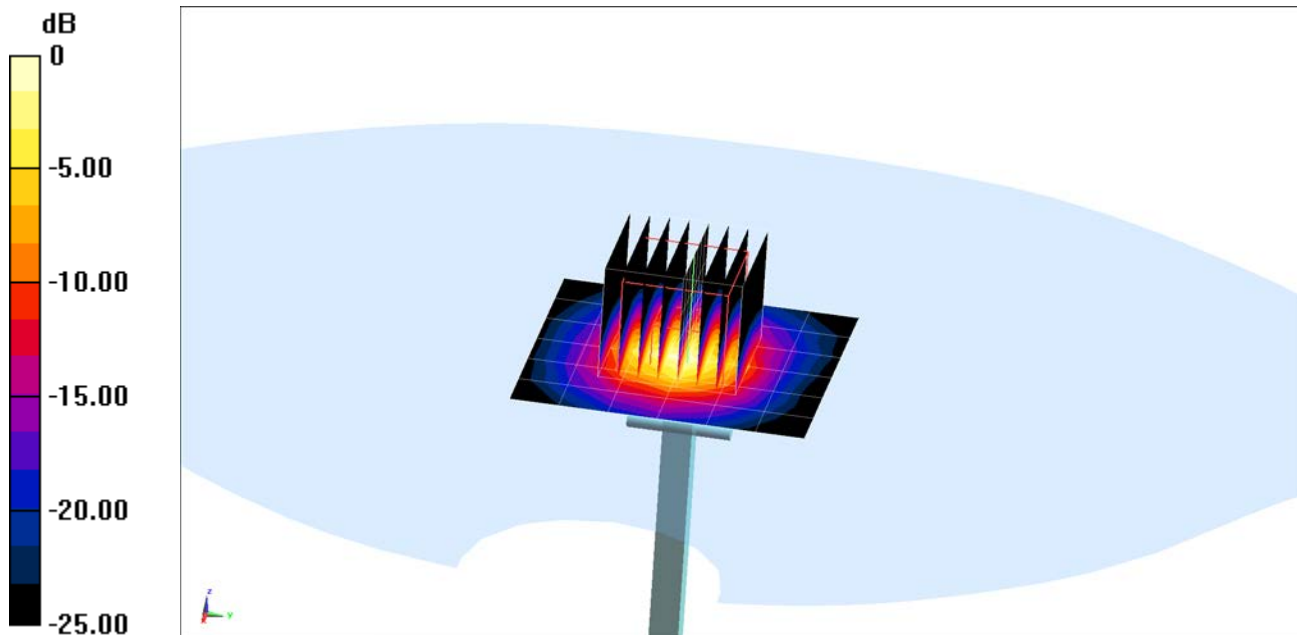
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Input Power = 17.0 dBm (50 mW)

Peak SAR (extrapolated) = 17.7 W/kg

SAR(1 g) = 3.8 W/kg

Deviation(1 g) = -2.56%



0 dB = 9.51 W/kg = 9.78 dBW/kg

APPENDIX C: PROBE CALIBRATION



Accreditation No.: **SCS 0108**

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Certificate No: **D750V3-1003_Jan15**

Client **PC Test**

CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1003**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

CC
2/3/15

Calibration date: **January 16, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Name**
Michael Weber **Function**
Laboratory Technician

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: January 19, 2015

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.7 $\pm$ 6 %	0.91 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.09 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.32 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.0 $\pm$ 6 %	0.99 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.46 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.58 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 Ω - 1.4 j Ω
Return Loss	- 28.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.3 Ω - 3.8 j Ω
Return Loss	- 27.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.043 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 21, 2009

DASY5 Validation Report for Head TSL

Date: 16.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1003

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.91 \text{ S/m}$; $\epsilon_r = 41.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.44, 6.44, 6.44); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

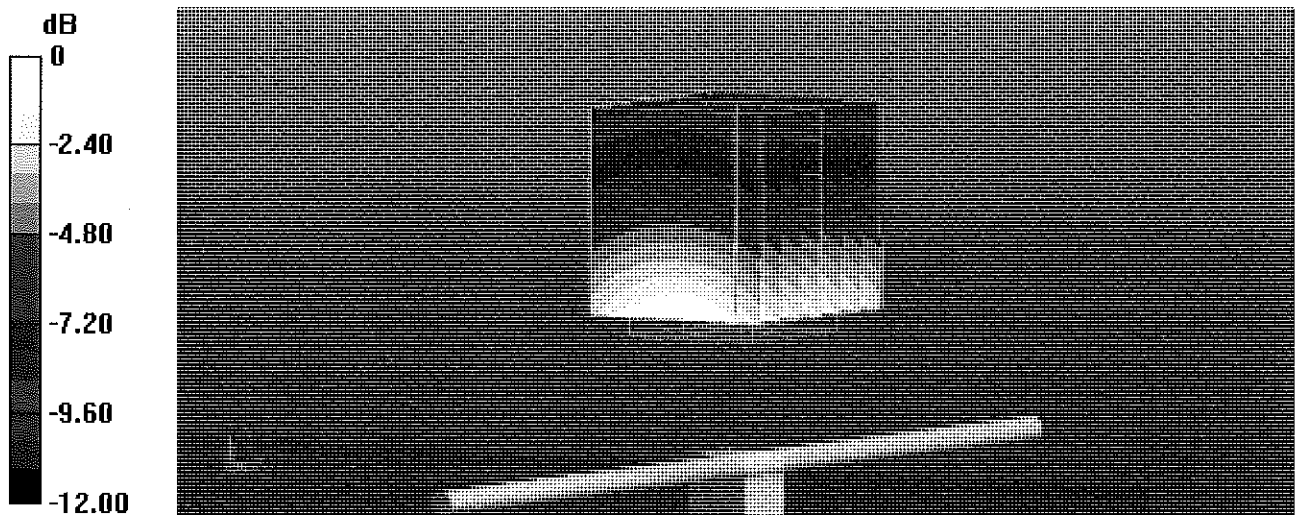
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.08 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.05 W/kg

SAR(1 g) = 2.06 W/kg; SAR(10 g) = 1.35 W/kg

Maximum value of SAR (measured) = 2.41 W/kg

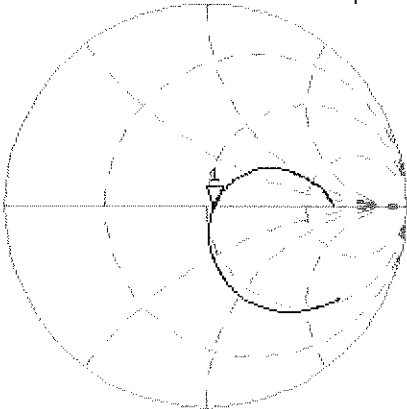


0 dB = 2.41 W/kg = 3.82 dBW/kg

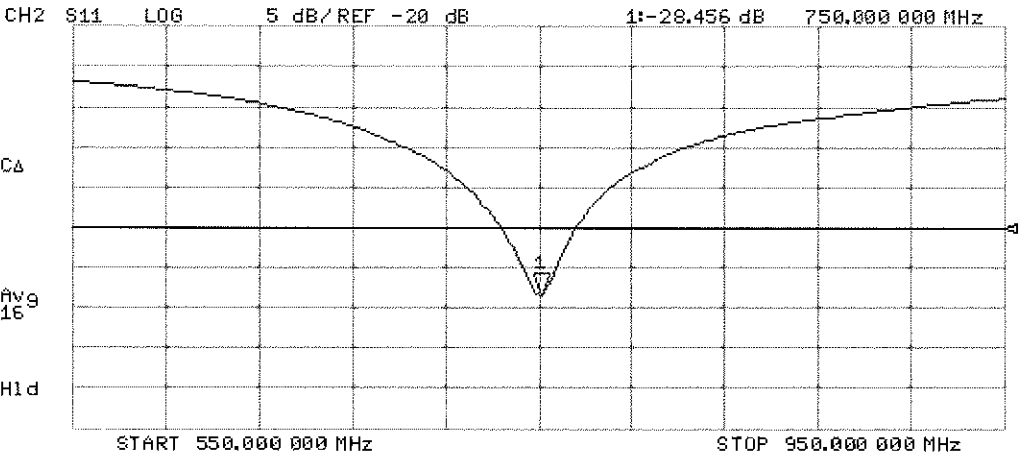
Impedance Measurement Plot for Head TSL

16 Jan 2015 16:07:22
[CH1] S11 1 U FS 1: 53.666 Ω -1.3730 Δ 154.55 pF 750.000 000 MHz

*
Del
CA



Avg
16
H1d



DASY5 Validation Report for Body TSL

Date: 16.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1003

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.99 \text{ S/m}$; $\epsilon_r = 56$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.21, 6.21, 6.21); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

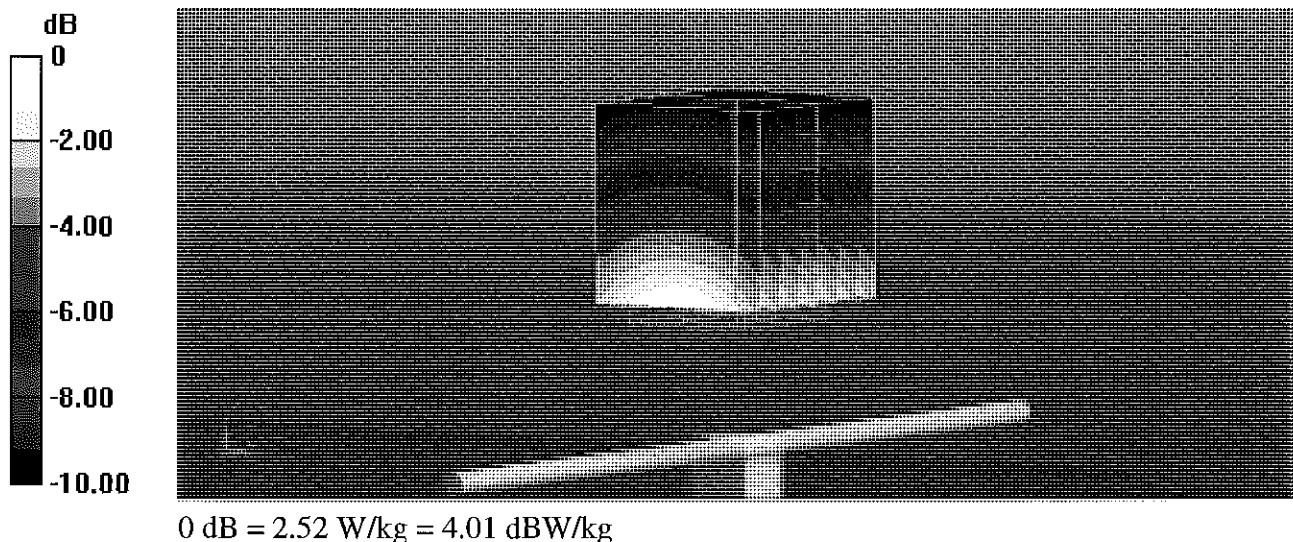
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 52.21 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.16 W/kg

SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.42 W/kg

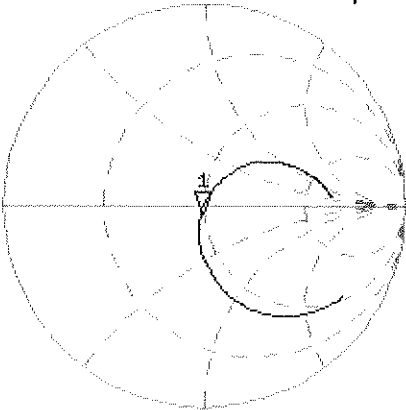
Maximum value of SAR (measured) = 2.52 W/kg



Impedance Measurement Plot for Body TSL

16 Jan 2015 13:37:35
[CH1] S11 1 U FS 1: 48.268 Ω -3.7676 Ω 56.324 pF 750.000 000 MHz

*
De1
CA

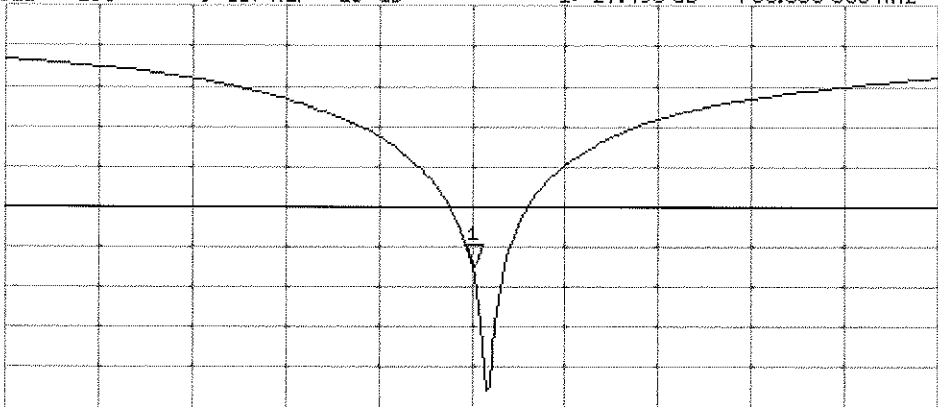


Avg
16
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-27.498 dB 750.000 000 MHz

CA

Avg
16
H1d



START 550.000 000 MHz STOP 950.000 000 MHz



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d133_Jul14**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d133**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

CC
W/CM

Calibration date: **July 24, 2014**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8763E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Name** **Function** **Signature**
Jeton Kastrali **Laboratory Technician**

Approved by: **Name** **Technical Manager**
Katja Pokovic

Issued: July 24, 2014

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.1 $\pm$ 6 %	0.94 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.20 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.96 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.8 $\pm$ 6 %	1.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.35 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.15 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.6 Ω - 1.0 j Ω
Return Loss	- 34.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8 Ω - 3.3 j Ω
Return Loss	- 27.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.395 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 22, 2011

DASY5 Validation Report for Head TSL

Date: 24.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d133

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.94 \text{ S/m}$; $\epsilon_r = 41.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:

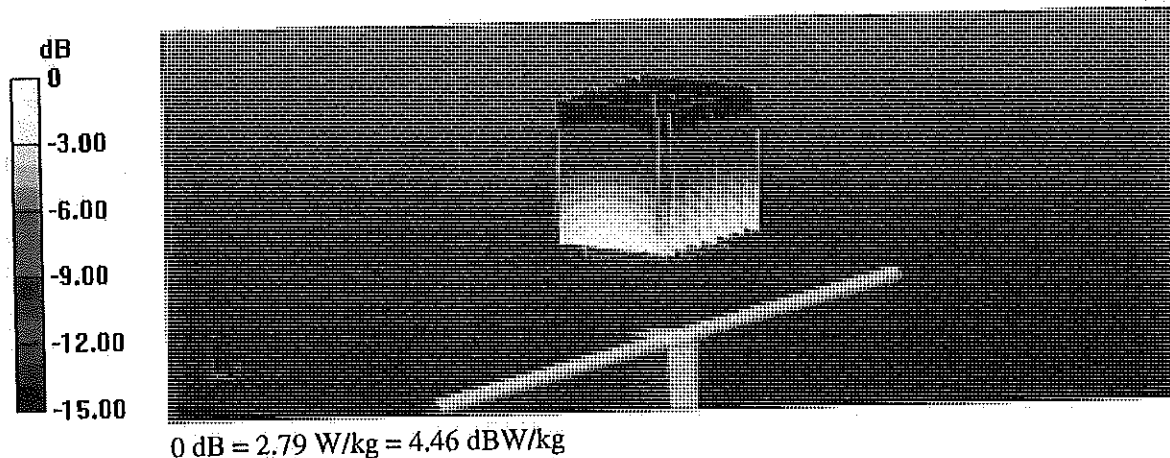
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.07 V/m; Power Drift = 0.03 dB

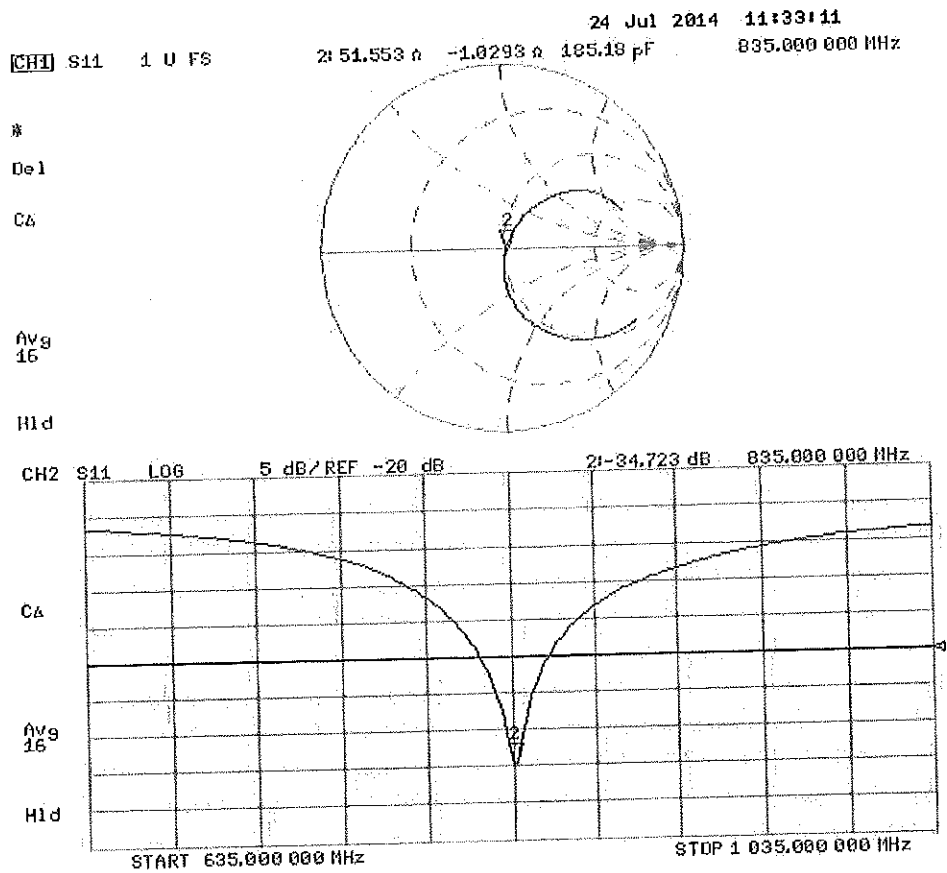
Peak SAR (extrapolated) = 3.58 W/kg

SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.53 W/kg

Maximum value of SAR (measured) = 2.79 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d133

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 1.02$ S/m; $\epsilon_r = 53.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

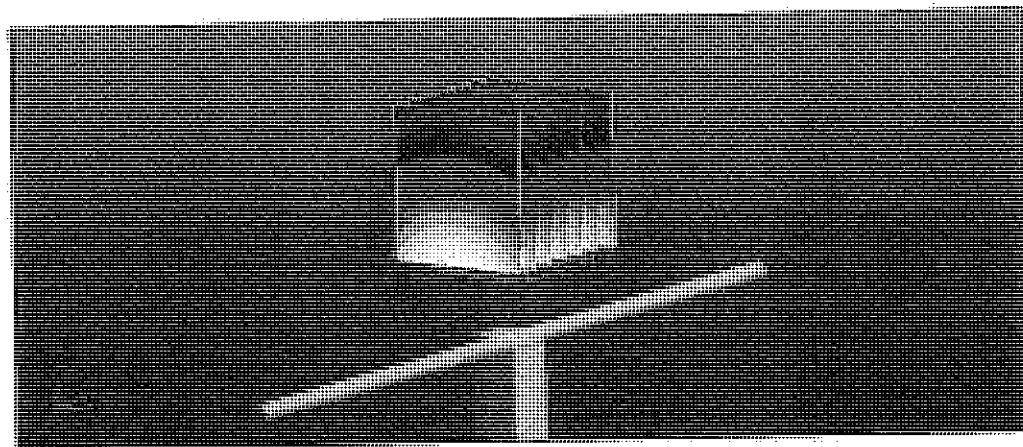
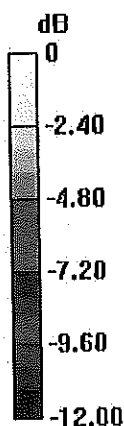
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.61 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.59 W/kg

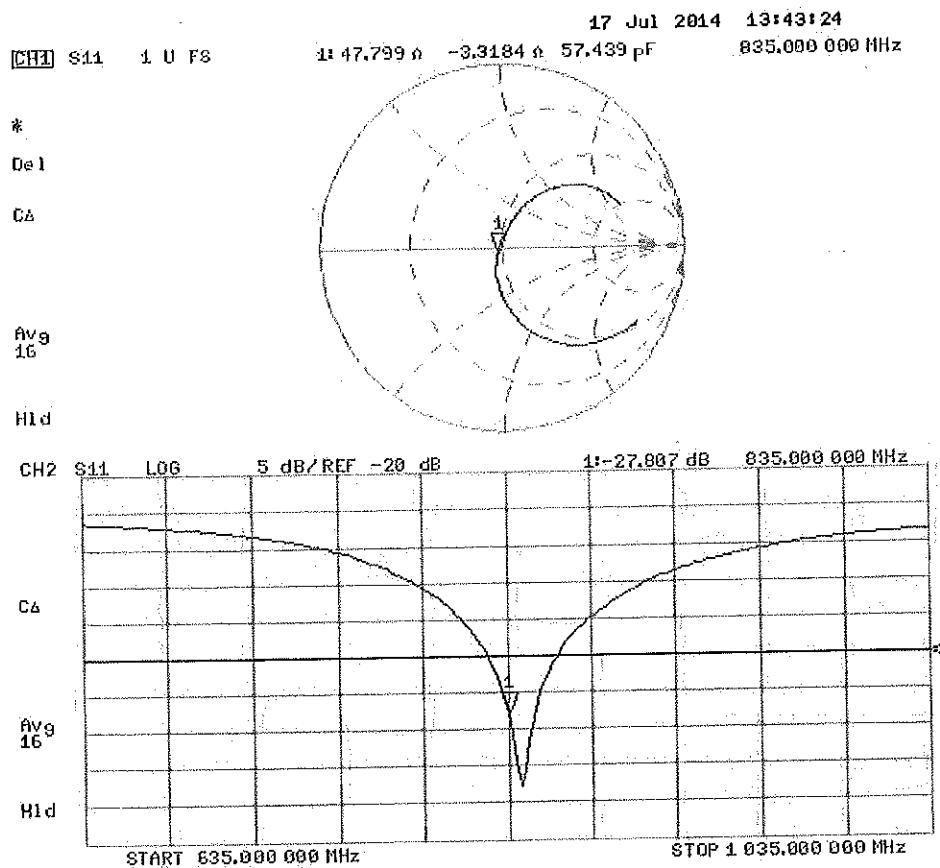
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.59 W/kg

Maximum value of SAR (measured) = 2.84 W/kg



0 dB = 2.84 W/kg = 4.53 dBW/kg

Impedance Measurement Plot for Body TSL





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D835V2-4d132_Jan15**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d132**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

CC
 2/3/15

Calibration date: **January 16, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Michael Weber** Function: **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: January 19, 2015

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Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.5 $\pm$ 6 %	0.93 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.25 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.04 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	55.8 $\pm$ 6 %	1.01 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.35 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.14 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.98 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8 Ω - 2.3 j Ω
Return Loss	- 30.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 Ω - 4.3 j Ω
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.385 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 22, 2011

DASY5 Validation Report for Head TSL

Date: 16.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d132

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.93 \text{ S/m}$; $\epsilon_r = 41.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.2, 6.2, 6.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

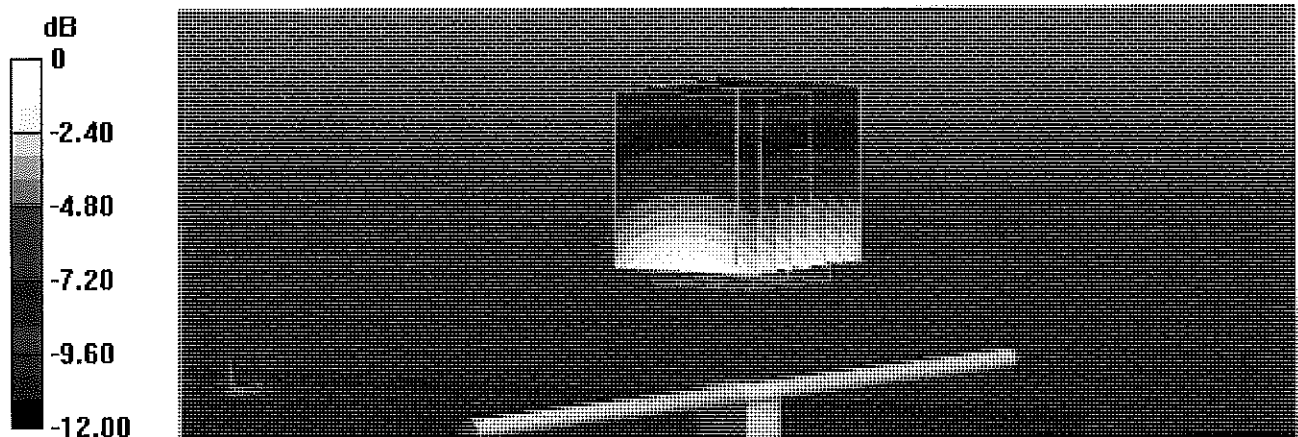
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.27 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.51 W/kg

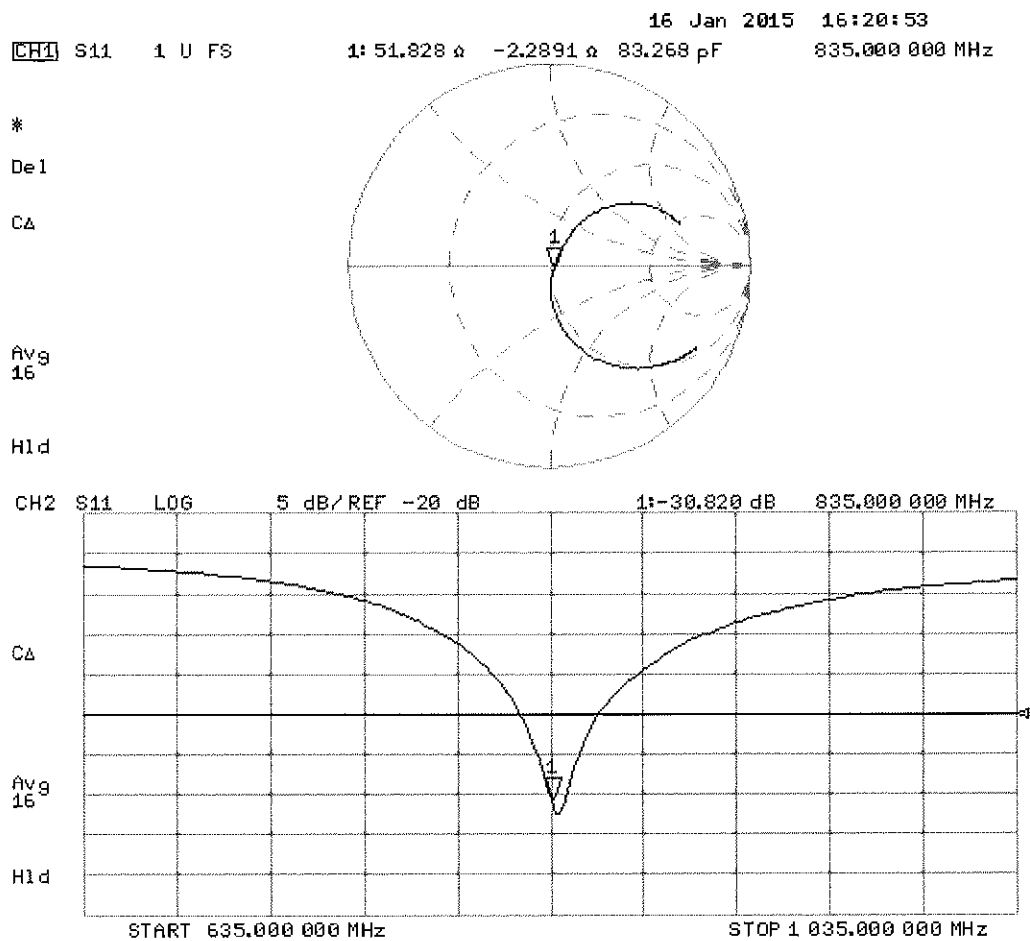
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.54 W/kg

Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 4.42 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d132

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 1.01 \text{ S/m}$; $\epsilon_r = 55.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.17, 6.17, 6.17); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

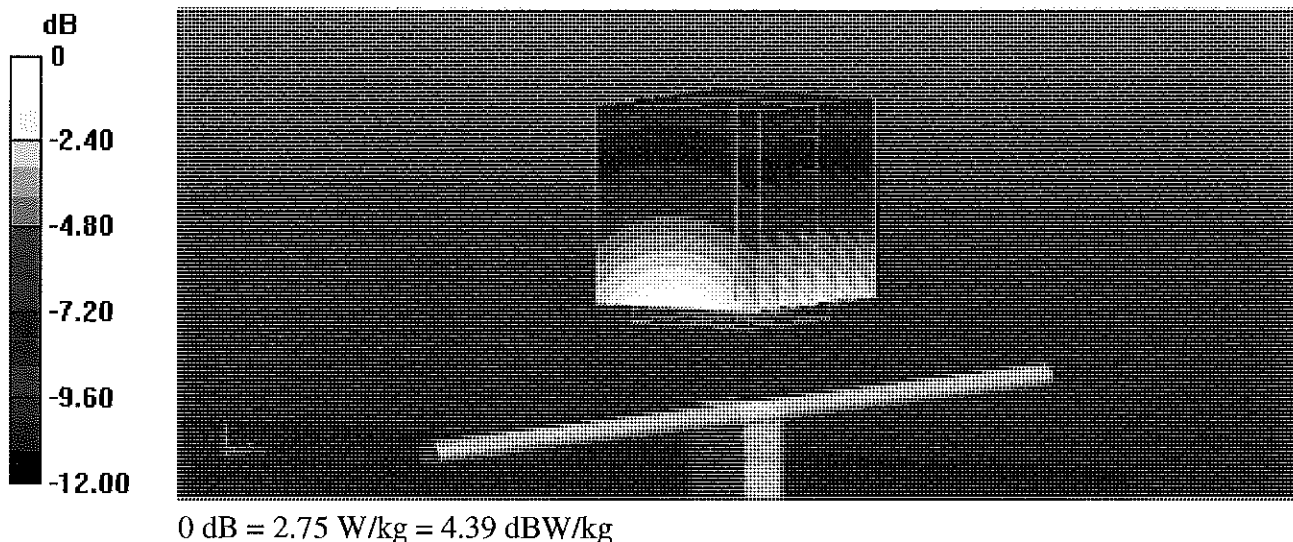
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 54.27 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.47 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.53 W/kg

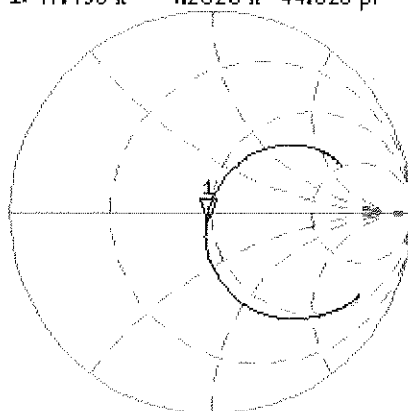
Maximum value of SAR (measured) = 2.75 W/kg



Impedance Measurement Plot for Body TSL

16 Jan 2015 13:51:19
 CH1 S11 1 U FS 1: 47.498 Ω -4.2520 Ω 44.828 pF 835.000 000 MHz

*
 Del
 CA



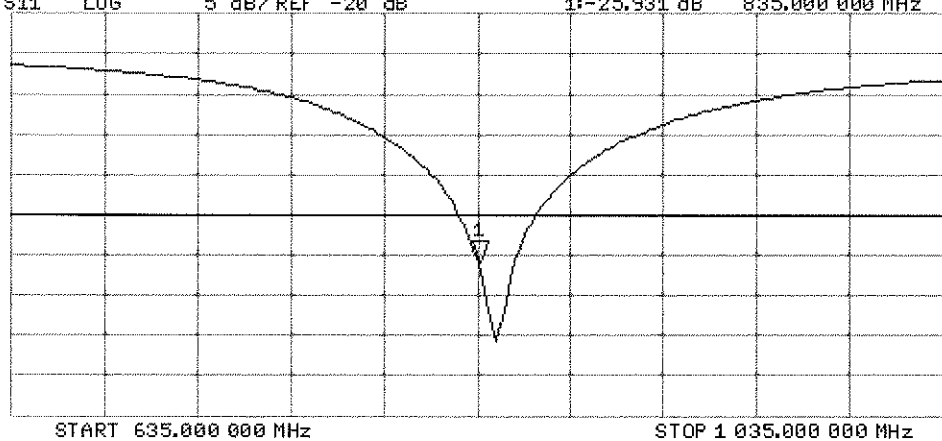
Avg
 16
 H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-25.931 dB 835.000 000 MHz

CA

Avg
 16

H1d





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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1765V2-1008_May14**

CALIBRATION CERTIFICATE

Object **D1765V2 - SN: 1008**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

CCV
 6/2/14

Calibration date: **May 07, 2014**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 12, 2014

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Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.0 $\pm$ 6 %	1.36 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.9 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.87 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.5 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.2 $\pm$ 6 %	1.48 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.02 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.1 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.7 Ω - 6.1 j Ω
Return Loss	- 23.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.7 Ω - 6.4 j Ω
Return Loss	- 20.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.211 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2005

DASY5 Validation Report for Head TSL

Date: 07.05.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN: 1008

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.36$ S/m; $\epsilon_r = 39$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.23, 5.23, 5.23); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

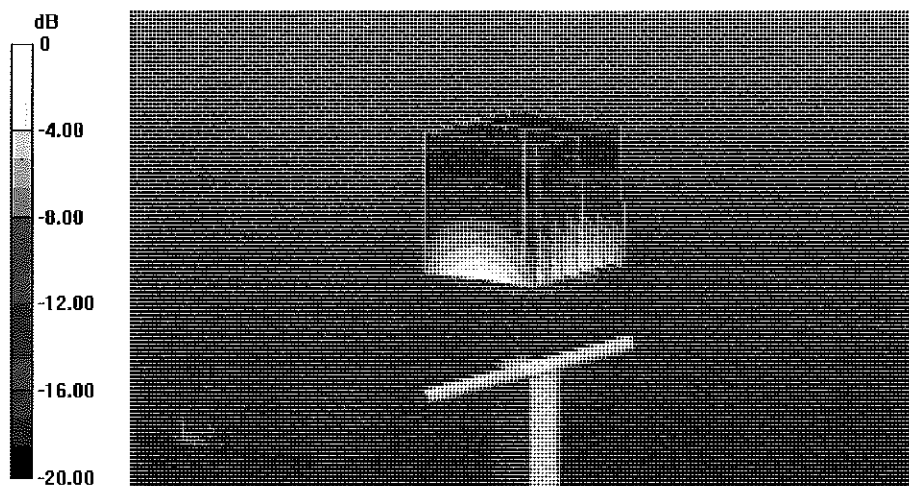
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.06 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.7 W/kg

SAR(1 g) = 9.23 W/kg; SAR(10 g) = 4.87 W/kg

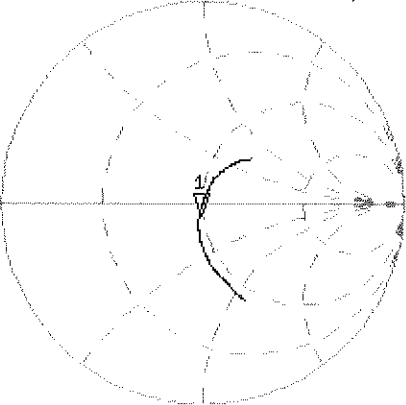
Maximum value of SAR (measured) = 11.7 W/kg



Impedance Measurement Plot for Head TSL

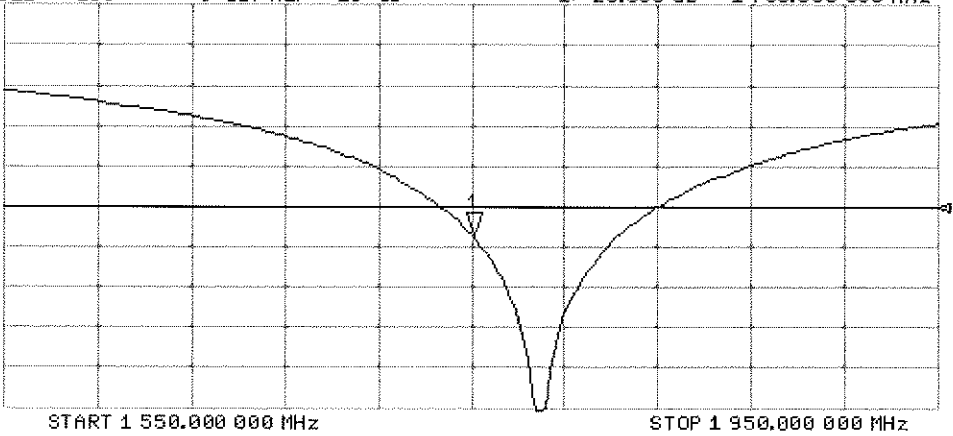
7 May 2014 09:22:36
[CH1] S11 1 U FS 1: 47.709 Ω -6.0566 Ω 15.016 pF 1 750.000 000 MHz

*
De1
CA
Avg
16
H1d



CH2 S11 LOG 5 dB/REF -20 dB 1:-23.588 dB 1 750.000 000 MHz

CA
Avg
16
H1d



DASY5 Validation Report for Body TSL

Date: 07.05.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN: 1008

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.48$ S/m; $\epsilon_r = 52.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.89, 4.89, 4.89); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

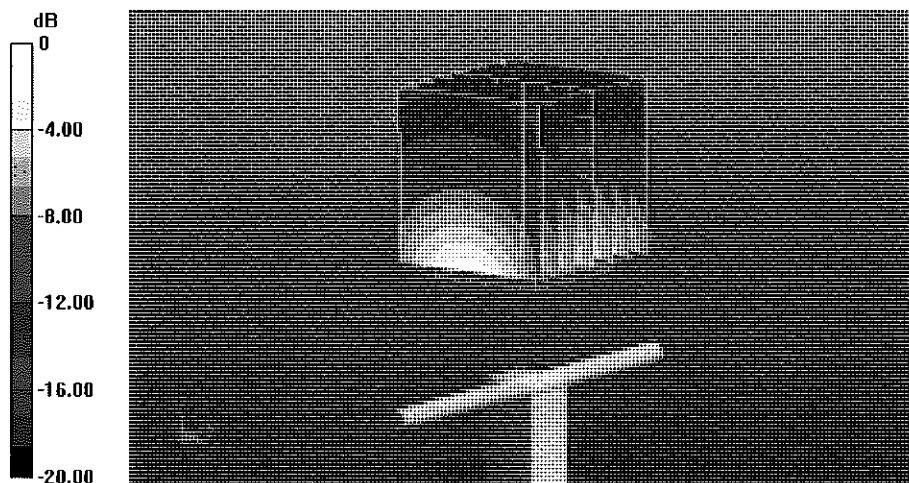
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.01 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 16.3 W/kg

SAR(1 g) = 9.41 W/kg; SAR(10 g) = 5.02 W/kg

Maximum value of SAR (measured) = 11.8 W/kg

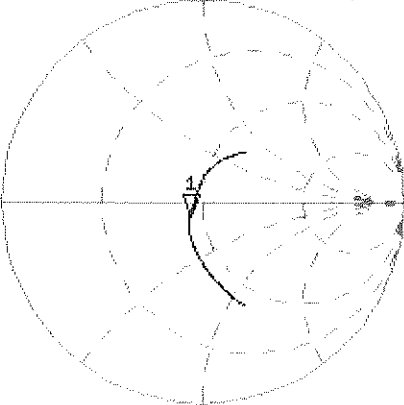


0 dB = 11.8 W/kg = 10.72 dBW/kg

Impedance Measurement Plot for Body TSL

7 May 2014 09:21:55
[CH1] S11 1 U FS 1: 43.727 $\angle$ -6.3691 $\angle$ 14.279 pF 1 750.000 000 MHz

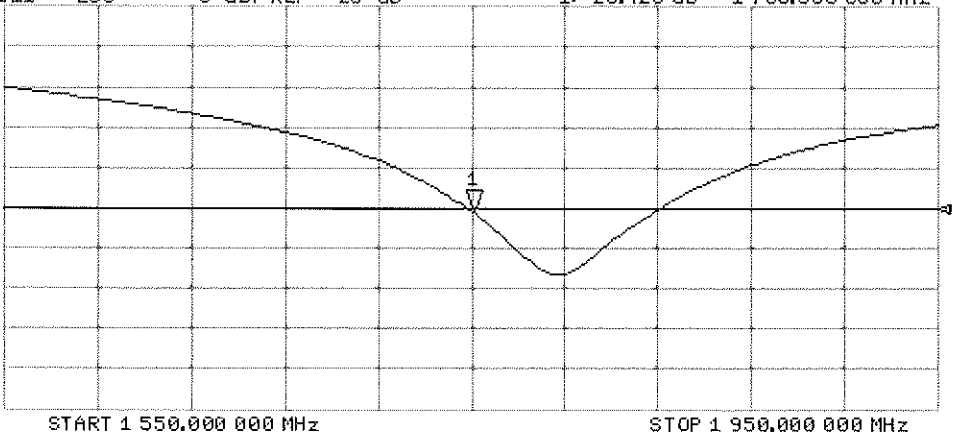
*
De1
CA



Avg
16
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-20.428 dB 1 750.000 000 MHz

CA
Avg
16
H1d



**Calibration Laboratory of
Schmid & Partner
Engineering AG**
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1750V2-1051_Apr14**

CALIBRATION CERTIFICATE

Object **D1750V2 - SN: 1051**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **April 10, 2014**

✓
KOK
5/7/14

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by:	Name Israe El-Naouq	Function Laboratory Technician	Signature
Approved by:	Kalja Pokovic	Technical Manager	

Issued: April 10, 2014

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Accreditation No.: **SCS 108**

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.1 $\pm$ 6 %	1.35 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.0 $\pm$ 6 %	1.48 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.1 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$50.7 \Omega + 0.4 j\Omega$
Return Loss	- 41.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$46.8 \Omega + 0.8 j\Omega$
Return Loss	- 29,3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.222 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 19, 2010

DASY5 Validation Report for Head TSL

Date: 10.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1051

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.35$ S/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.23, 5.23, 5.23); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: I001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

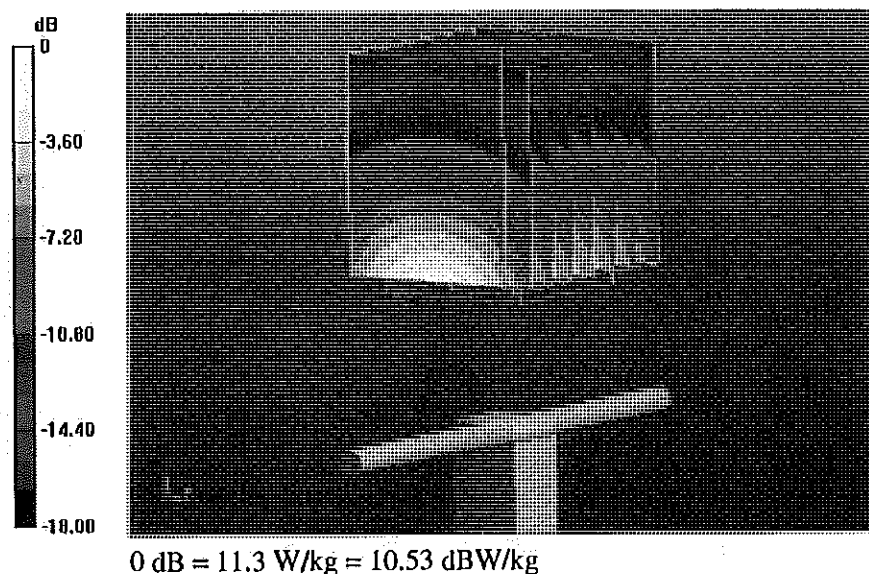
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.631 V/m; Power Drift = 0.00 dB

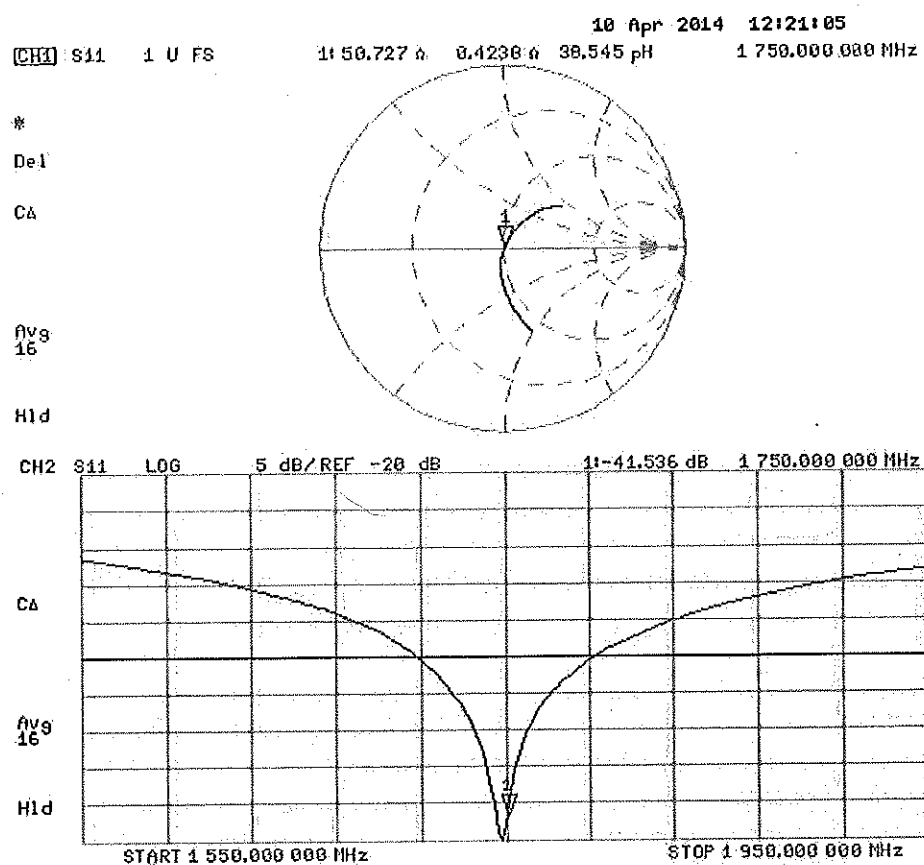
Peak SAR (extrapolated) = 16.2 W/kg

SAR(1 g) = 9.02 W/kg; SAR(10 g) = 4.79 W/kg

Maximum value of SAR (measured) = 11.3 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1051

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.48$ S/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.89, 4.89, 4.89); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

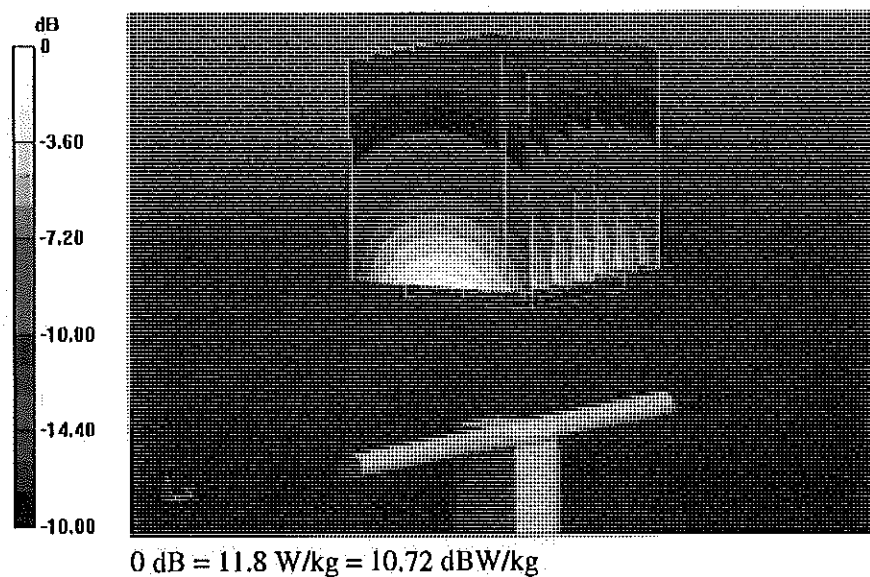
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.321 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 16.1 W/kg

SAR(1 g) = 9.37 W/kg; SAR(10 g) = 5.04 W/kg

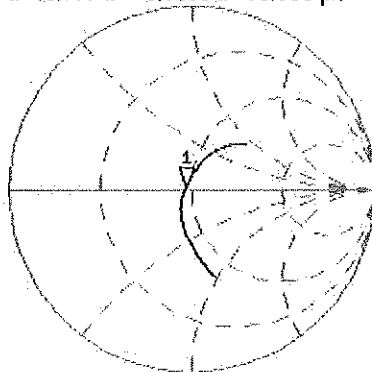
Maximum value of SAR (measured) = 11.8 W/kg



Impedance Measurement Plot for Body TSL

10 Apr 2014 12:20:40
 [CH1] S11 1 U FS 1: 46.787 Ω 0.8086 Ω 73.538 pH 1 750.000 000 MHz

*
 Del
 CA



Av9
 16

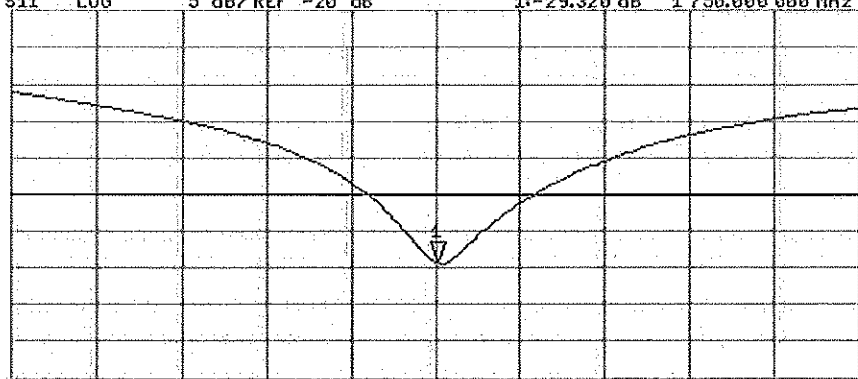
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -29.320 dB 1 750.000 000 MHz

CA

Av9
 16

H1d





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d141_Apr14**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d141**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **April 09, 2014**

✓
Kok
5/7/14

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292763	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 801	25-Apr-13 (No. DAE4-801_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Claudio Leubler** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Technical Manager

Signature

Issued: April 9, 2014

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.1 $\pm$ 6 %	1.36 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.91 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.1 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.8 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.4 $\pm$ 6 %	1.52 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.6 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.8 \Omega + 5.5 j\Omega$
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.8 \Omega + 6.3 j\Omega$
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 09.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d141

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.36$ S/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/ $P_{in}=250$ mW, $d=10$ mm/Zoom Scan (7x7x7)/Cube 0:

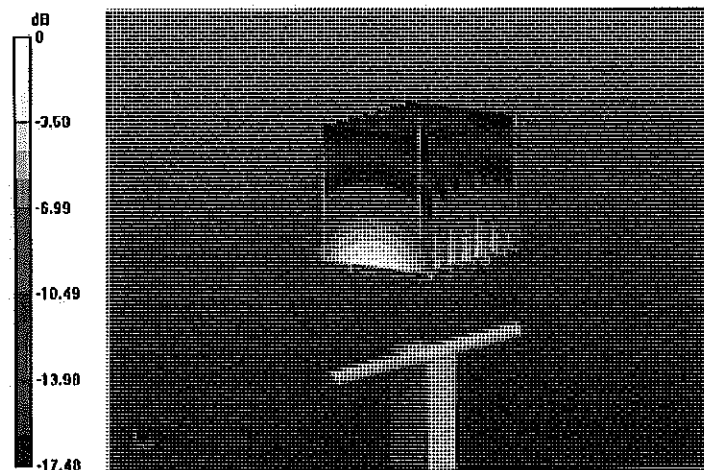
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 99.080 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 9.91 W/kg; SAR(10 g) = 5.17 W/kg

Maximum value of SAR (measured) = 12.5 W/kg

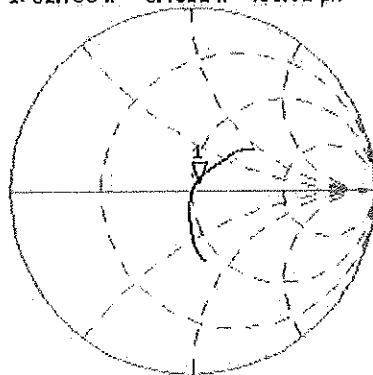


0 dB = 12.5 W/kg = 10.97 dBW/kg

Impedance Measurement Plot for Head TSL

9 Apr 2014 11:03:32
 CH1 S11 1 U FS 1 52.760 n 5.4512 n 456.62 pF 1 900.000 000 MHz

*
 Del
 CA



AVG
 16

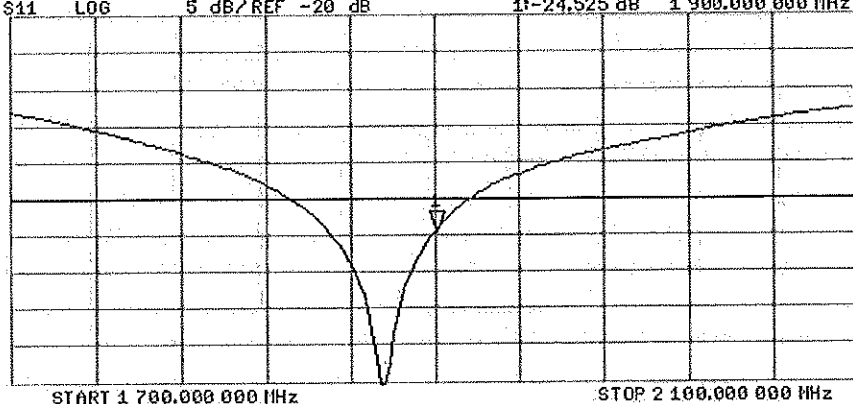
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1 24.525 dB 1 900.000 000 MHz

CA

AVG
 16

H1d



DASY5 Validation Report for Body TSL

Date: 09.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d141

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.52$ S/m; $\epsilon_r = 52.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

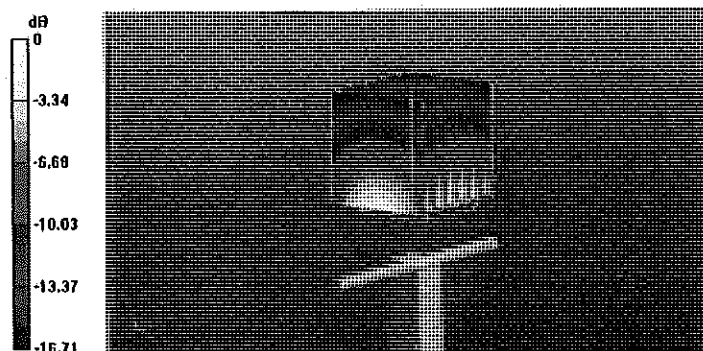
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.820 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 17.9 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.41 W/kg

Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

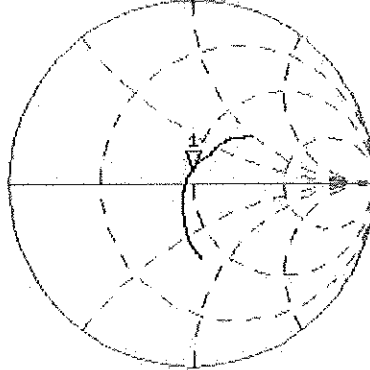
Impedance Measurement Plot for Body TSL

9 Apr 2014 11:02:32
 CH1 S11 1 U FS 1: 48.752 Ω 6.3320 Ω 530.41 μ H 1 900.000 000 MHz

*
 Del
 CA

Avg
 16

↑

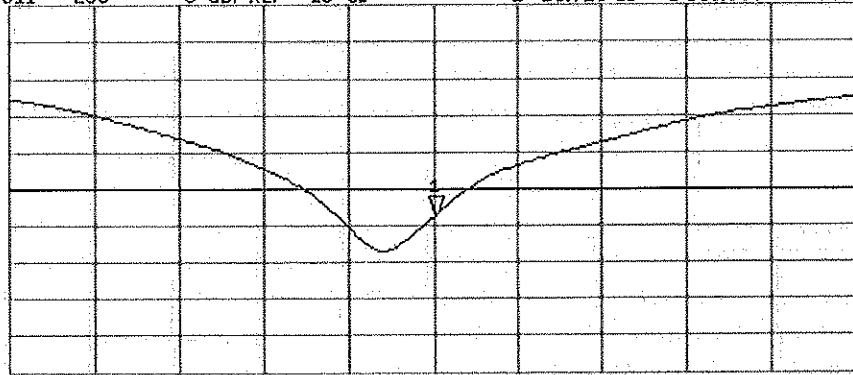


CH2 S11 LOG 5 dB/REF -20 dB 1: -23.715 dB 1 900.000 000 MHz

CA

Avg
 16

↑



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d149_Jul14**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d149**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

CC
 11/5/14

Calibration date: **July 23, 2014**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (In house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (In house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (In house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 23, 2014

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.5 $\pm$ 6 %	1.38 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.0 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.5 $\pm$ 6 %	1.51 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.33 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.3 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.6 \Omega + 5.5 j\Omega$
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.8 \Omega + 6.1 j\Omega$
Return Loss	- 24.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 23.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.38 \text{ S/m}$; $\epsilon_r = 39.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 100I
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, $d=10\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:

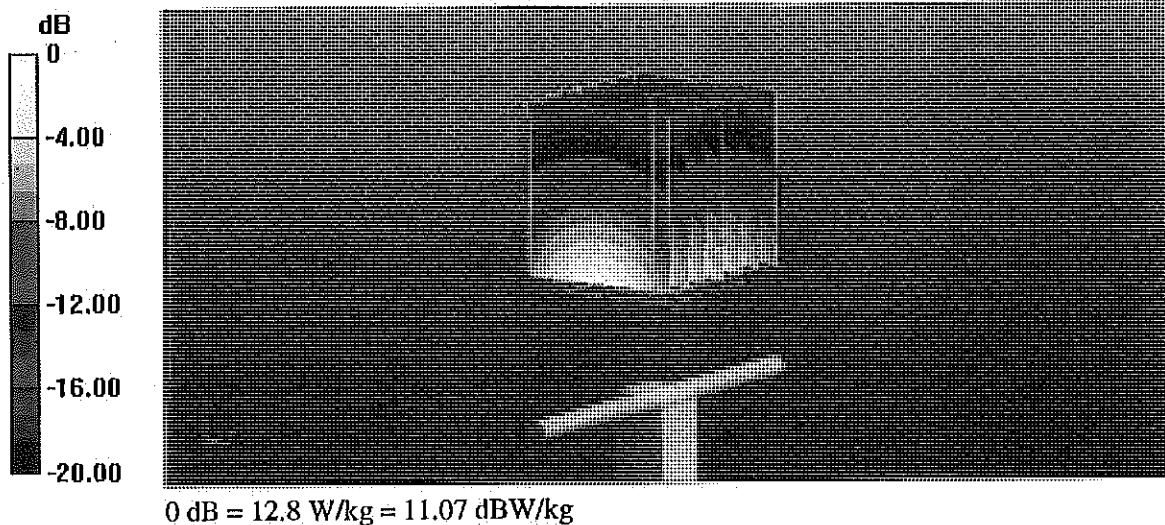
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 98.92 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 10 W/kg; SAR(10 g) = 5.24 W/kg

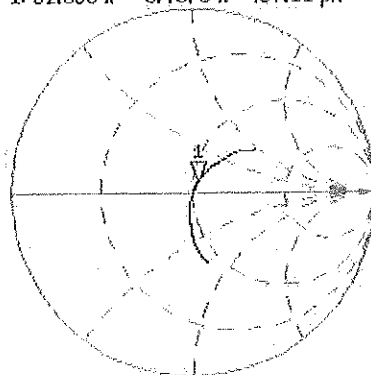
Maximum value of SAR (measured) = 12.8 W/kg



Impedance Measurement Plot for Head TSL

23 Jul 2014 10:46:05
 [CH1] S11 1 U FS 1: 52.600 Ω 5.4570 Ω 457.11 pF 1 900.000 000 MHz

*
 Del
 Cor



Avg
 16

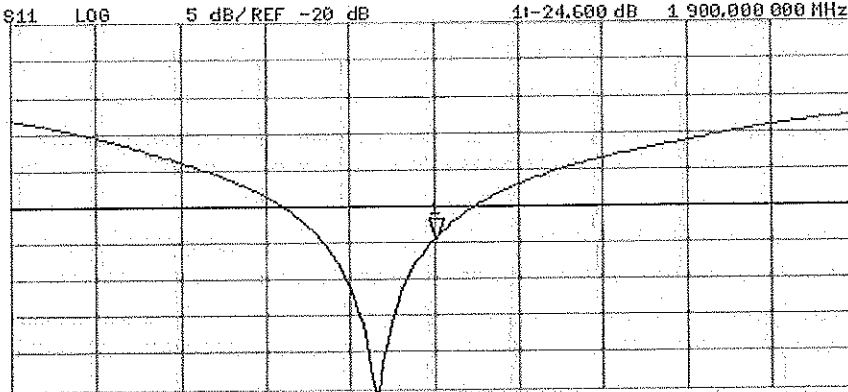
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -24.600 dB 1 900.000 000 MHz

Cor

Avg
 16

H1d



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 23.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.51$ S/m; $\epsilon_r = 52.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

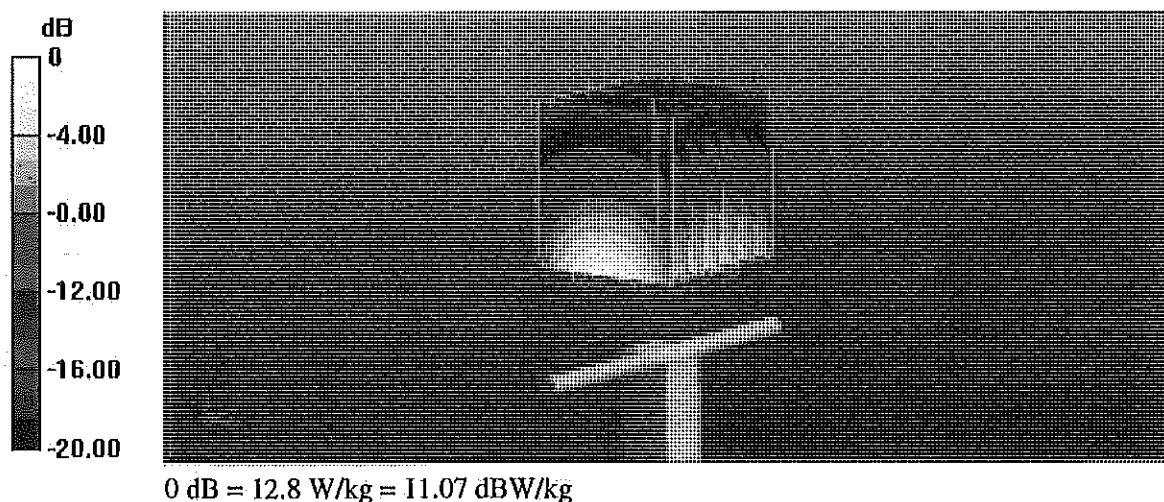
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.83 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 17.6 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.33 W/kg

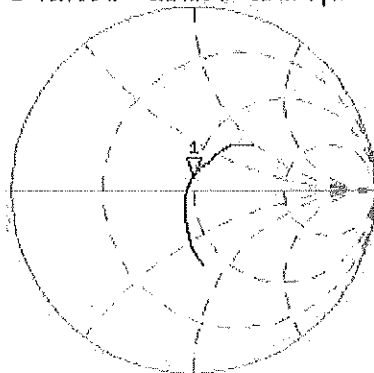
Maximum value of SAR (measured) = 12.8 W/kg



Impedance Measurement Plot for Body TSL

23 Jul 2014 10:45:45
 CH1 S11 1 U FS 1: 48.789 Ω 6.1426 Ω 514.54 μH 1 900.000 000 MHz

*
 Del
 Cor



Avg
 16

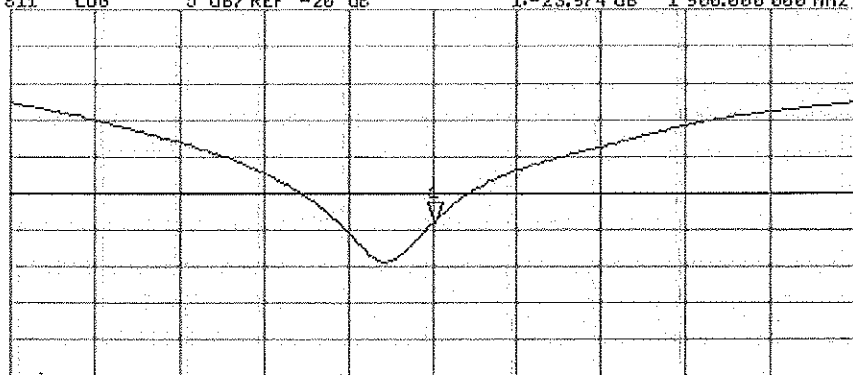
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -23.974 dB 1 900.000 000 MHz

Cor

Avg
 16

H1d



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2450V2-719_Aug14**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 719**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 11, 2014**

✓ KOK
9/8/14

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Michael Weber** Function: **Laboratory Technician**

Signature

M. Weber

Approved by: **Katja Pokovic** Technical Manager

Katja Pokovic

Issued: August 12, 2014

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.0 $\pm$ 6 %	1.82 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.1 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.5 $\pm$ 6 %	2.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.8 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.0 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.9 \Omega + 3.0 j\Omega$
Return Loss	- 25.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.9 \Omega + 5.8 j\Omega$
Return Loss	- 24.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 11.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 38$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

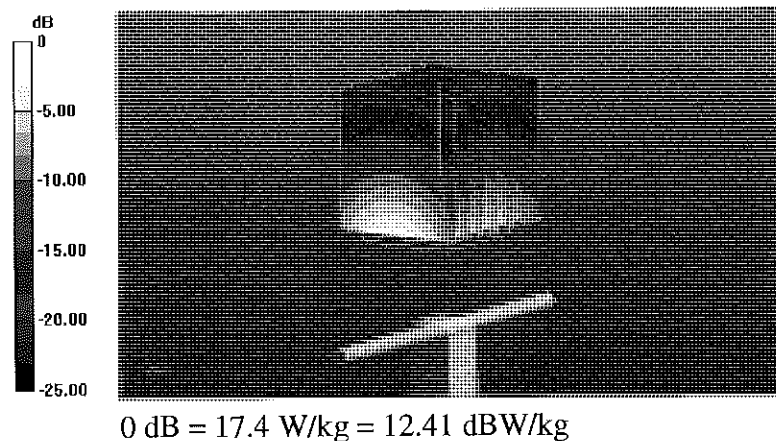
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.6 V/m; Power Drift = 0.03 dB

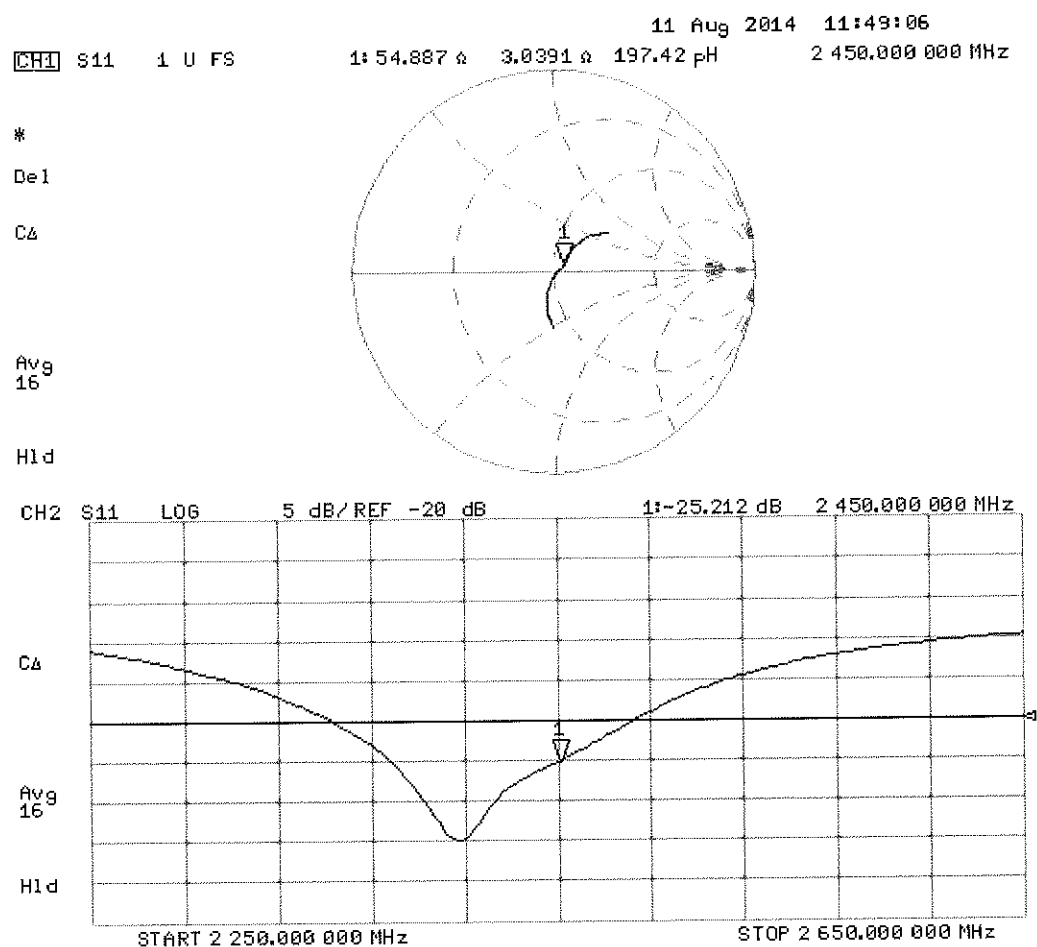
Peak SAR (extrapolated) = 27.5 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.09 W/kg

Maximum value of SAR (measured) = 17.4 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ S/m; $\epsilon_r = 50.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

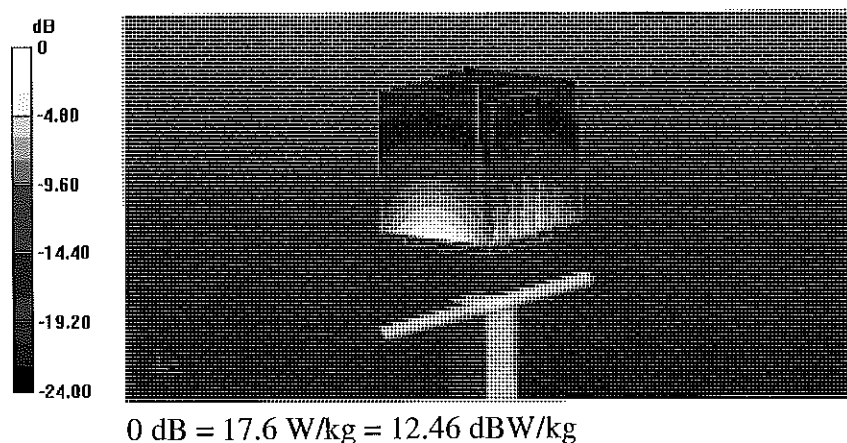
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.08 V/m; Power Drift = -0.01 dB

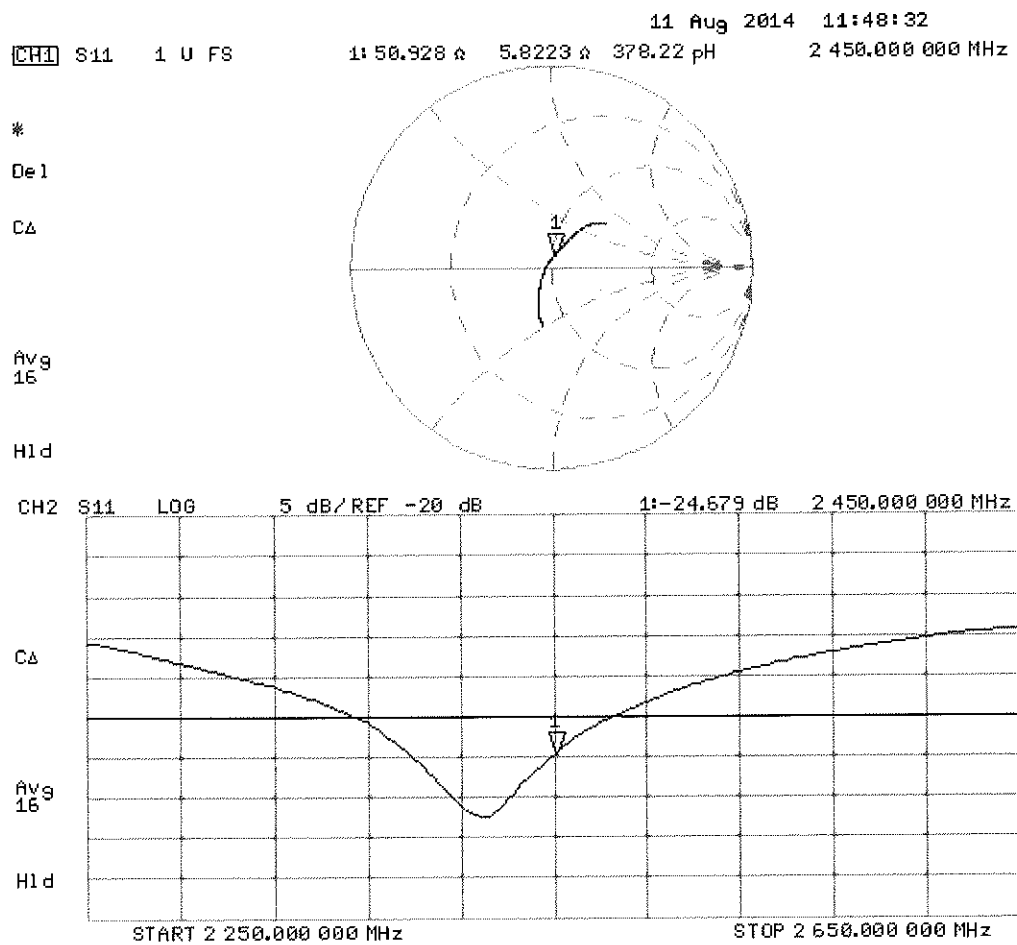
Peak SAR (extrapolated) = 27.9 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.1 W/kg

Maximum value of SAR (measured) = 17.6 W/kg



Impedance Measurement Plot for Body TSL





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2600V2-1071_Oct14**

CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1071**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

CC
 WMP

Calibration date: **October 20, 2014**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (In house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Michael Weber** Function: **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: October 20, 2014

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.8 $\pm$ 6 %	2.03 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	57.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW Input power	6.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.9 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.8 $\pm$ 6 %	2.22 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW Input power	14.5 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	56.9 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW Input power	6.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	25.4 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.7 Ω - 5.2 j Ω
Return Loss	- 25.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.9 Ω - 4.2 j Ω
Return Loss	- 24.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 17, 2013

DASY5 Validation Report for Head TSL

Date: 20.10.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1071

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.03$ S/m; $\epsilon_r = 37.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.46, 4.46, 4.46); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

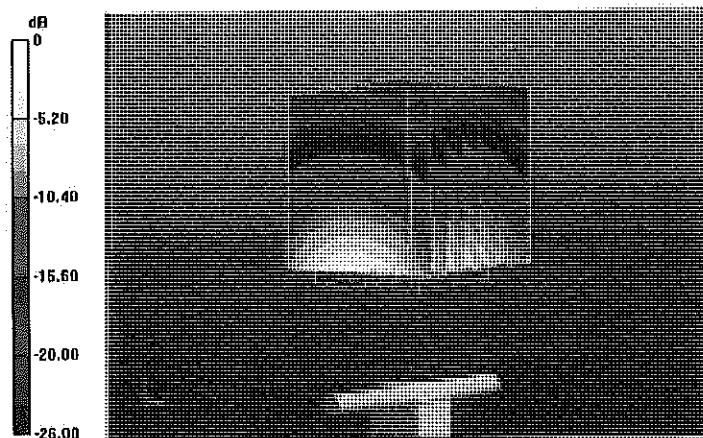
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.3 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 31.0 W/kg

SAR(1 g) = 14.7 W/kg; SAR(10 g) = 6.57 W/kg

Maximum value of SAR (measured) = 19.7 W/kg

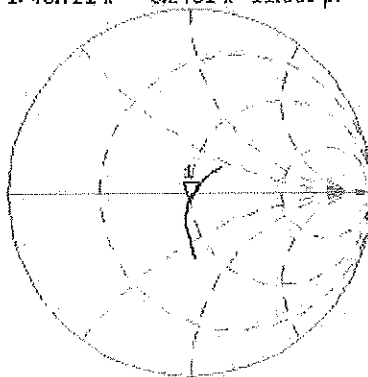


0 dB = 19.7 W/kg = 12.94 dBW/kg

Impedance Measurement Plot for Head TSL

20 Oct 2014 11:58:04
 CH1 S11 1 U.FS 1: 48.721 Ω -5.2461 Ω 11.668 pF 2 600.000 000 MHz

*
 Del
 CA



AVG
 16

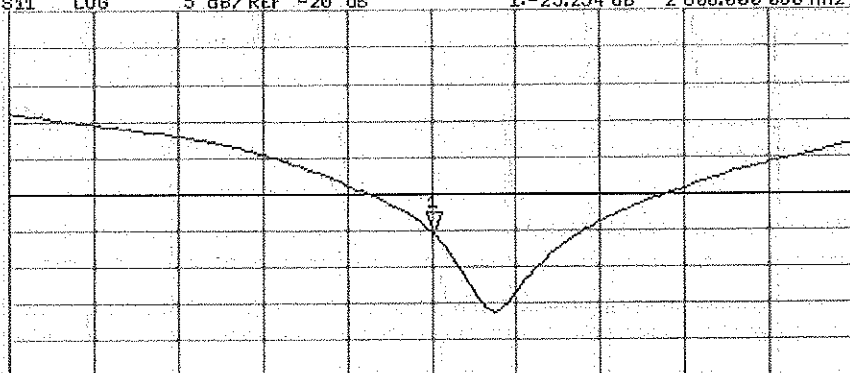
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -25.254 dB 2 600.000 000 MHz

CA

AVG
 16

H1d



START 2 400.000 000 MHz

STOP 2 800.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 20.10.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1071

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.22$ S/m; $\epsilon_r = 50.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.24, 4.24, 4.24); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, $d=10$ mm/Zoom Scan (7x7x7)/Cube 0:

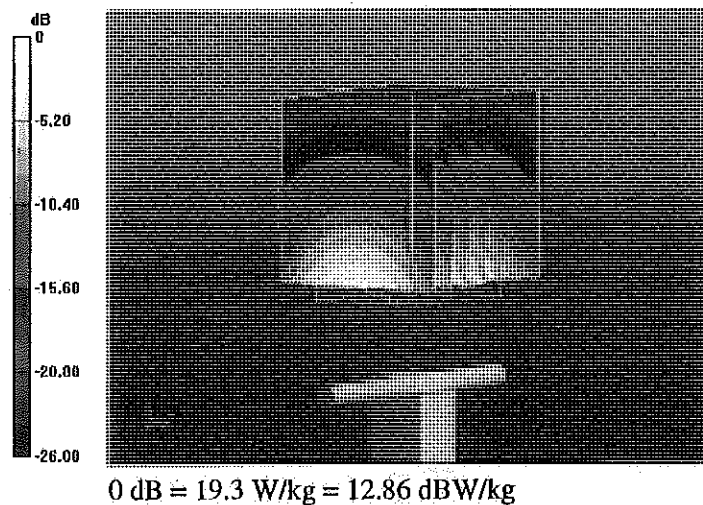
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 97.02 V/m; Power Drift = 0.00 dB

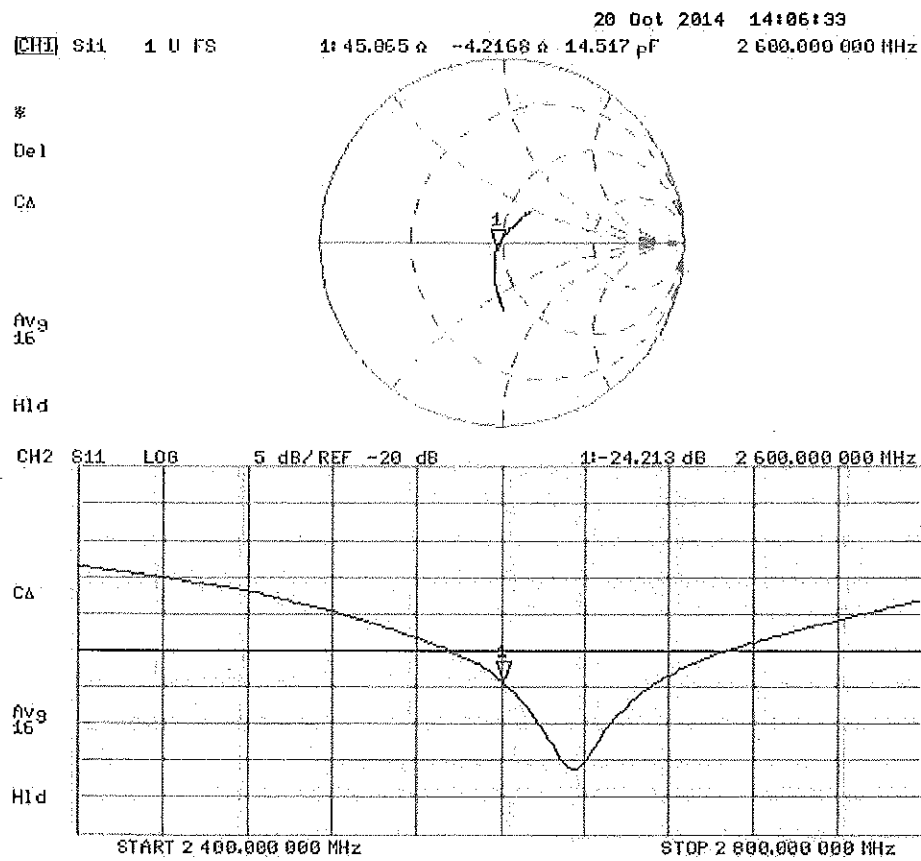
Peak SAR (extrapolated) = 31.0 W/kg

SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.43 W/kg

Maximum value of SAR (measured) = 19.3 W/kg



Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D5GHzV2-1057_Jan15**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1057**

Calibration procedure(s) **QA CAL-22.v2**
Calibration procedure for dipole validation kits between 3-6 GHz

CC
2/3/15

Calibration date: **January 21, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe EX3DV4	SN: 3503	30-Dec-14 (No. EX3-3503_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Name** Michael Weber **Function** Laboratory Technician

Signature

Approved by: **Name** Katja Pokovic **Function** Technical Manager

Issued: January 22, 2015

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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz $\pm$ 1 MHz 5300 MHz $\pm$ 1 MHz 5500 MHz $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	36.3 $\pm$ 6 %	4.56 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.5 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg $\pm$ 19.5 % (k=2)

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.66 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.7 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.1 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.9 ± 6 %	4.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.8 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.7 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	5.18 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.4 ± 6 %	5.42 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	73.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.05 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.2 ± 6 %	5.55 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.9 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.9 ± 6 %	5.82 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	79.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.19 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.0 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.7 ± 6 %	5.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.75 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.5 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.4 ± 6 %	6.25 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	49.0 Ω - 9.4 j Ω
Return Loss	- 20.4 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	48.3 Ω - 4.2 j Ω
Return Loss	- 26.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.2 Ω - 5.0 j Ω
Return Loss	- 25.9 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.4 Ω - 4.8 j Ω
Return Loss	- 24.1 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	51.8 Ω - 2.6 j Ω
Return Loss	- 30.1 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.2 Ω - 8.4 j Ω
Return Loss	- 21.2 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	48.6 Ω - 3.6 j Ω
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	49.4 Ω - 4.1 j Ω
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	55.1 Ω - 4.0 j Ω
Return Loss	- 24.2 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	51.6 Ω - 1.6 j Ω
Return Loss	- 33.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 27, 2006

DASY5 Validation Report for Head TSL

Date: 21.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1057

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.56$ S/m; $\epsilon_r = 36.3$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 4.66$ S/m; $\epsilon_r = 36.1$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.86$ S/m; $\epsilon_r = 35.9$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 4.97$ S/m; $\epsilon_r = 35.6$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.18$ S/m; $\epsilon_r = 35.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51); Calibrated: 30.12.2014, ConvF(5.21, 5.21, 5.21); Calibrated: 30.12.2014, ConvF(5.12, 5.12, 5.12); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.51 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 29.8 W/kg

SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.31 W/kg

Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.30 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 32.1 W/kg

SAR(1 g) = 8.47 W/kg; SAR(10 g) = 2.41 W/kg

Maximum value of SAR (measured) = 20.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.33 V/m; Power Drift = 0.07 dB

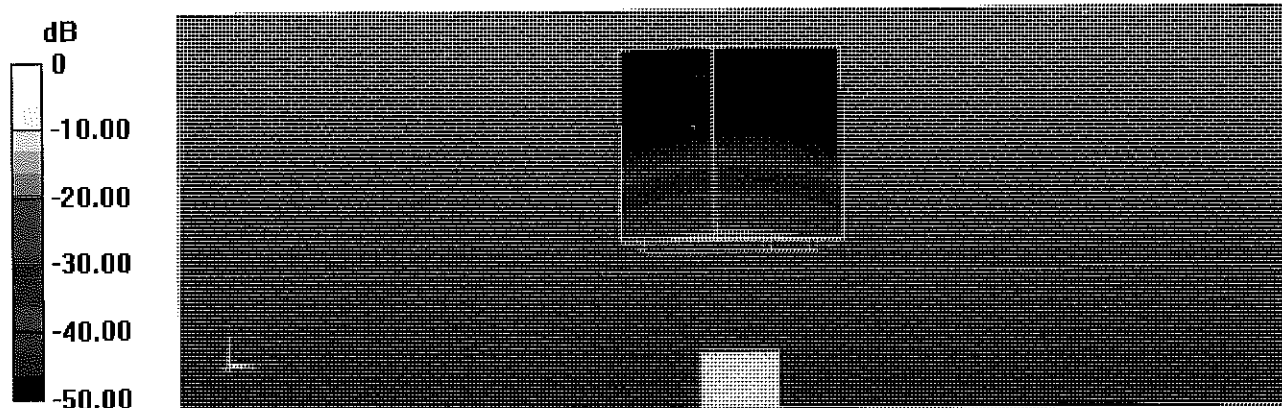
Peak SAR (extrapolated) = 33.5 W/kg

SAR(1 g) = 8.43 W/kg; SAR(10 g) = 2.38 W/kg

Maximum value of SAR (measured) = 20.6 W/kg

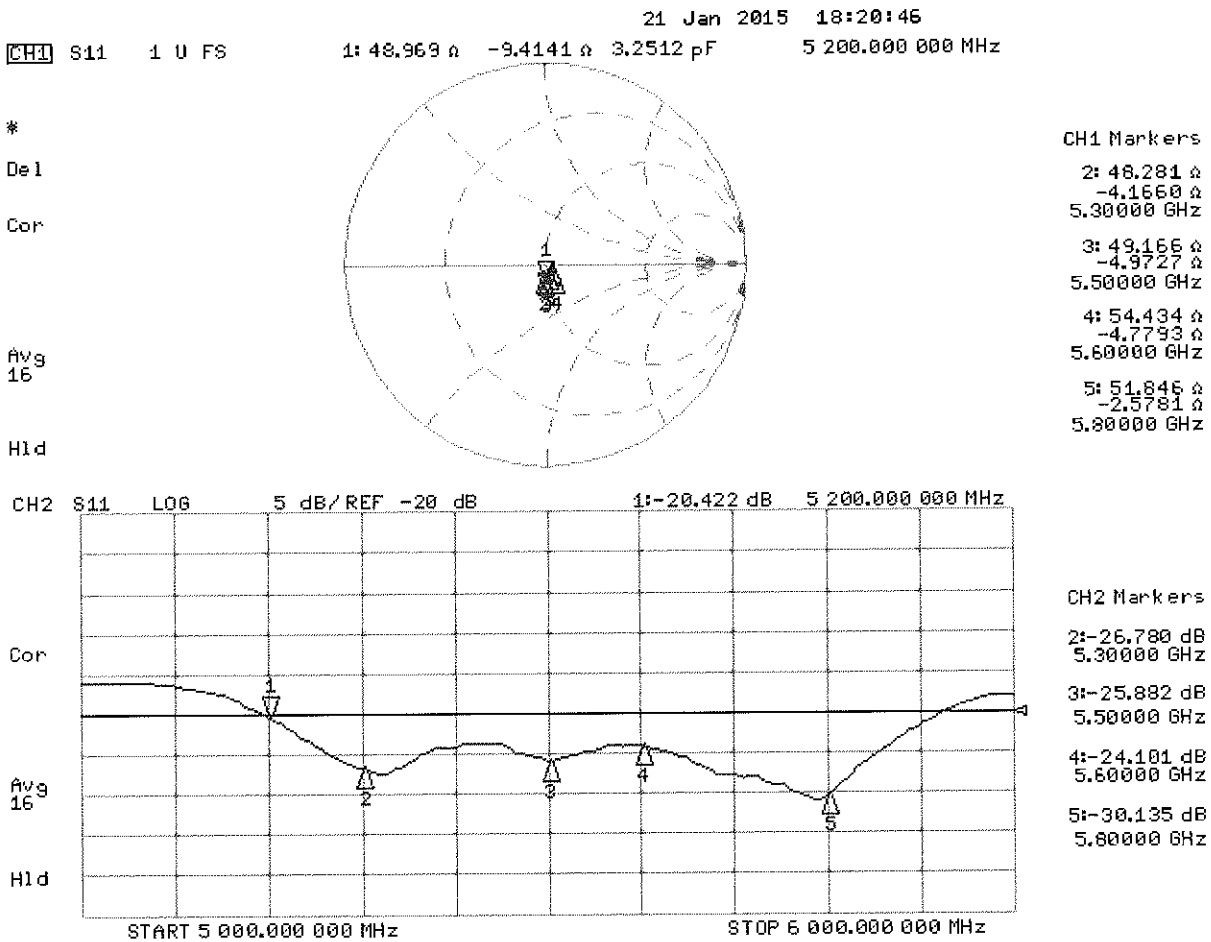
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.47 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.34 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.29 W/kg
Maximum value of SAR (measured) = 19.8 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 20.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1057

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.42$ S/m; $\epsilon_r = 49.4$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 5.55$ S/m; $\epsilon_r = 49.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 5.82$ S/m; $\epsilon_r = 48.9$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 5.96$ S/m; $\epsilon_r = 48.7$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.25$ S/m; $\epsilon_r = 48.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95); Calibrated: 30.12.2014, ConvF(4.78, 4.78, 4.78); Calibrated: 30.12.2014, ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.76 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 28.9 W/kg

SAR(1 g) = 7.37 W/kg; SAR(10 g) = 2.05 W/kg

Maximum value of SAR (measured) = 17.4 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.35 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 29.8 W/kg

SAR(1 g) = 7.41 W/kg; SAR(10 g) = 2.08 W/kg

Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.04 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 33.7 W/kg

SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.19 W/kg

Maximum value of SAR (measured) = 19.2 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.74 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 34.1 W/kg

SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.14 W/kg

Maximum value of SAR (measured) = 19.1 W/kg

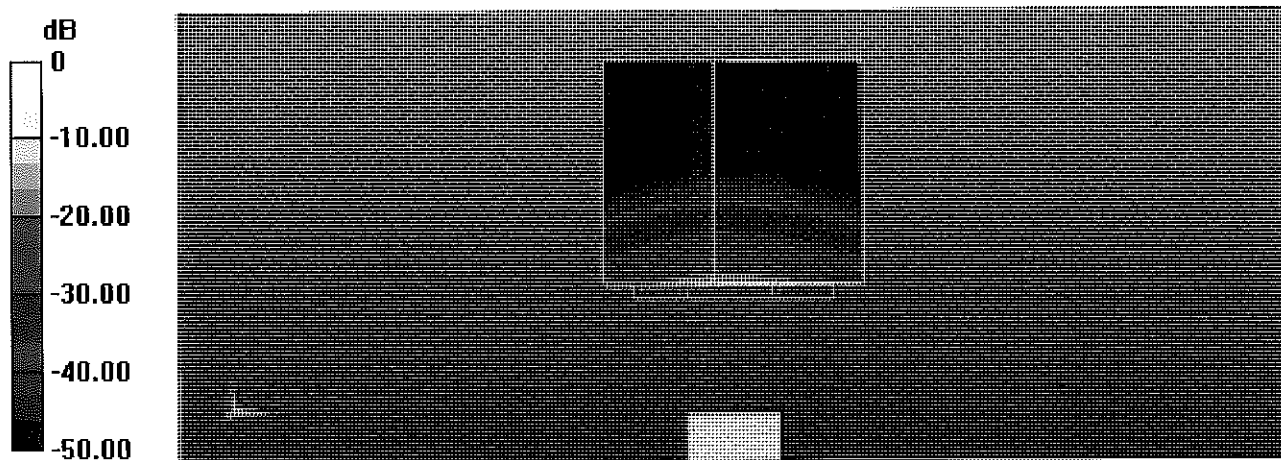
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 55.86 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 34.7 W/kg

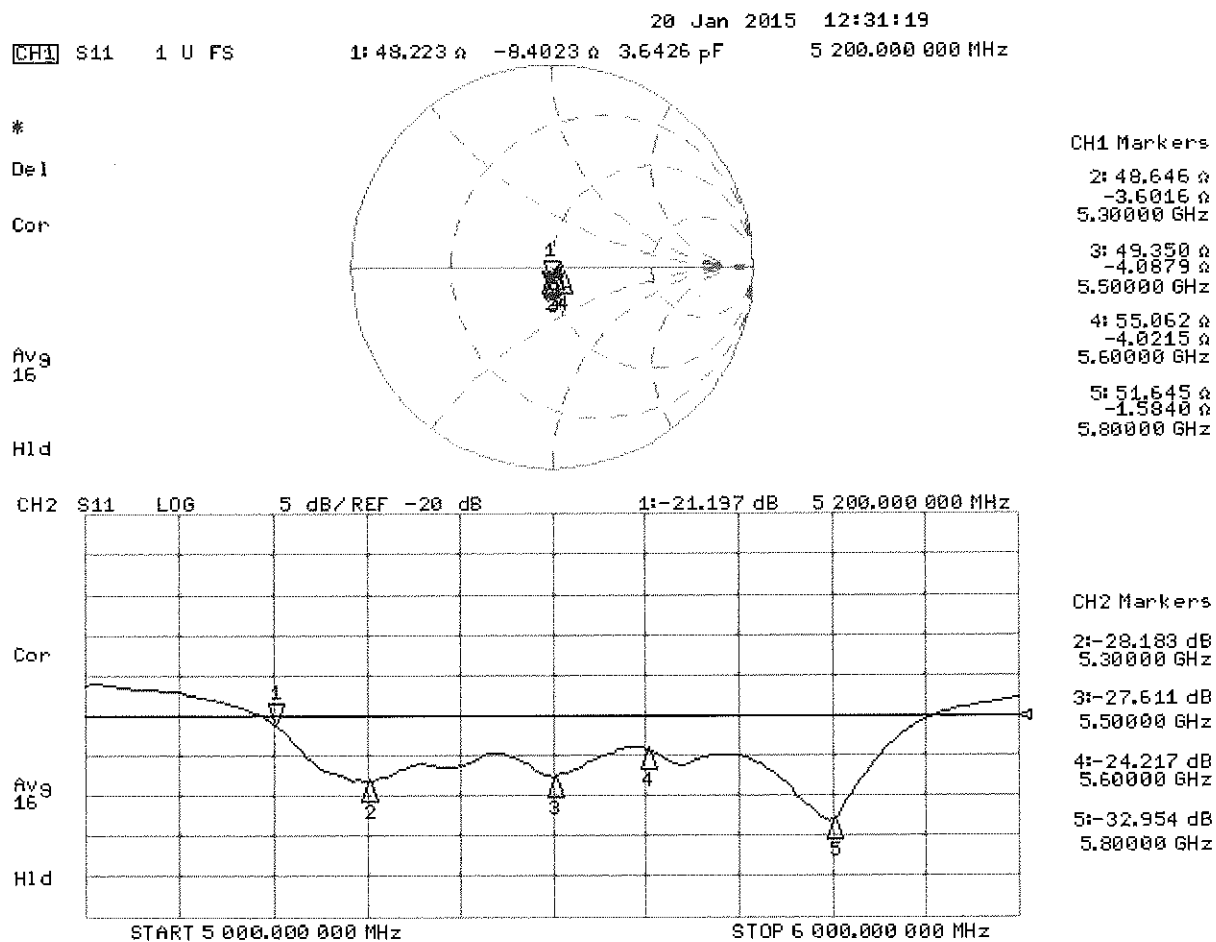
SAR(1 g) = 7.49 W/kg; SAR(10 g) = 2.06 W/kg

Maximum value of SAR (measured) = 18.6 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D5GHzV2-1191_Sep14**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1191**

Calibration procedure(s) **QA CAL-22.v2**
Calibration procedure for dipole validation kits between 3-6 GHz

CC
11/14

Calibration date: **September 25, 2014**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility; environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe EX3DV4	SN: 3503	30-Dec-13 (No. EX3-3503_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Claudio Leubler** **Laboratory Technician**

Approved by: **Katja Pokovic** **Technical Manager**

Signature

Issued: September 25, 2014

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
- c) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz $\pm$ 1 MHz 5300 MHz $\pm$ 1 MHz 5500 MHz $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	34.9 $\pm$ 6 %	4.54 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.1 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg $\pm$ 19.5 % (k=2)

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.64 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.64 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	85.8 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.5 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	88.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	86.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.49 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.7 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.1 ± 6 %	5.14 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.40 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.84 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.6 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.53 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.05 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	79.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.3 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.79 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	83.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.0 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	5.93 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	84.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.3 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.1 ± 6 %	6.21 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.5 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.8 Ω - 9.9 j Ω
Return Loss	- 20.1 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	54.5 Ω - 1.5 j Ω
Return Loss	- 26.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.6 Ω - 2.0 j Ω
Return Loss	- 33.9 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.5 Ω - 4.4 j Ω
Return Loss	- 22.7 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.6 Ω + 4.4 j Ω
Return Loss	- 22.6 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.9 Ω - 8.1 j Ω
Return Loss	- 21.8 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	54.5 Ω + 0.1 j Ω
Return Loss	- 27.3 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	50.2 Ω - 0.6 j Ω
Return Loss	- 43.8 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	57.5 Ω - 3.2 j Ω
Return Loss	- 22.4 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	57.2 Ω + 5.2 j Ω
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 01, 2014

DASY5 Validation Report for Head TSL

Date: 25.09.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1191

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.54$ S/m; $\epsilon_r = 34.9$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5300$ MHz; $\sigma = 4.64$ S/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5500$ MHz; $\sigma = 4.83$ S/m; $\epsilon_r = 34.5$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5600$ MHz; $\sigma = 4.93$ S/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.14$ S/m; $\epsilon_r = 34.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.52, 5.52, 5.52); Calibrated: 30.12.2013, ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2013, ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.86, 4.86, 4.86); Calibrated: 30.12.2013, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.20 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 30.0 W/kg

SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.33 W/kg

Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.90 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 32.7 W/kg

SAR(1 g) = 8.64 W/kg; SAR(10 g) = 2.47 W/kg

Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.91 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 35.3 W/kg

SAR(1 g) = 8.93 W/kg; SAR(10 g) = 2.54 W/kg

Maximum value of SAR (measured) = 20.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.29 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 34.8 W/kg

SAR(1 g) = 8.76 W/kg; SAR(10 g) = 2.49 W/kg

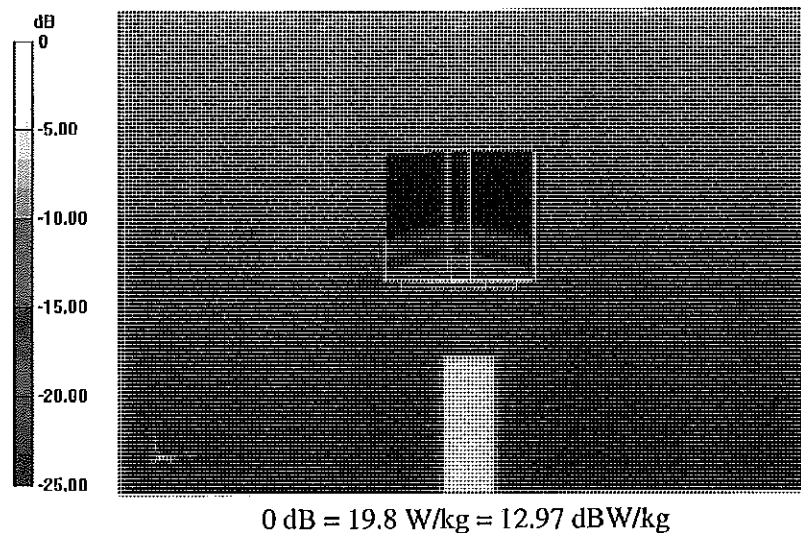
Maximum value of SAR (measured) = 20.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 62.74 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 34.4 W/kg

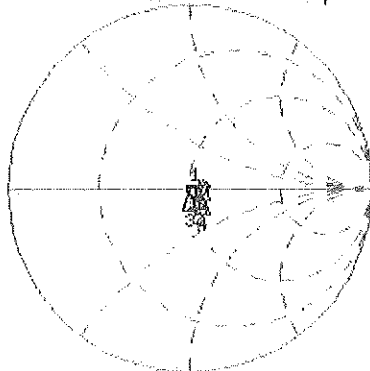
SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.35 W/kg



Impedance Measurement Plot for Head TSL

25 Sep 2014 11:07:52
 CH1 S11 1 U FS 1: 51.911 Ω -9.9180 Ω 3.0060 pF 5 200.000 000 MHz

 Del
 Cor
 Avg
 0
 H1d

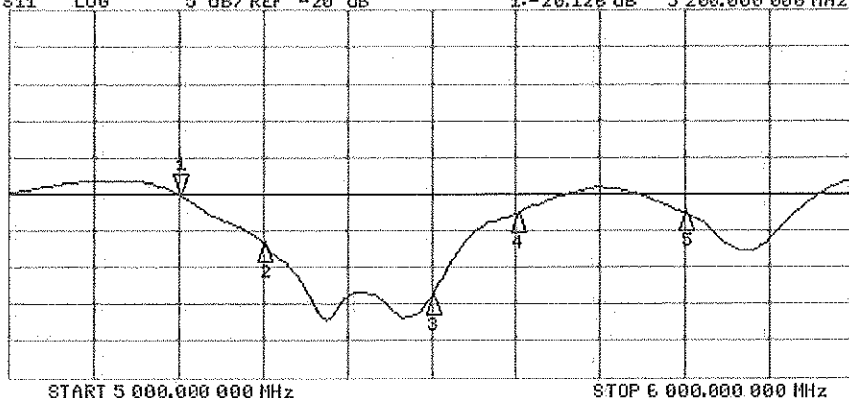


CH1 Markers

2: 54.518 Ω
 -1.5078 Ω
 5.30000 GHz
 3: 49.566 Ω
 -1.9707 Ω
 5.50000 GHz
 4: 56.516 Ω
 -4.3633 Ω
 5.60000 GHz
 5: 56.555 Ω
 4.3904 Ω
 5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1:-20.126 dB 5 200.000 000 MHz

Cor
 Avg
 0
 H1d



CH2 Markers

2:-26.825 dB
 5.30000 GHz
 3:-33.870 dB
 5.50000 GHz
 4:-22.660 dB
 5.60000 GHz
 5:-22.611 dB
 5.80000 GHz

DASY5 Validation Report for Body TSL

Date: 24.09.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1191

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.4$ S/m; $\epsilon_r = 47.1$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5300$ MHz; $\sigma = 5.53$ S/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.79$ S/m; $\epsilon_r = 46.6$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.93$ S/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.21$ S/m; $\epsilon_r = 46.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013, ConvF(4.52, 4.52, 4.52); Calibrated: 30.12.2013, ConvF(4.3, 4.3, 4.3); Calibrated: 30.12.2013, ConvF(4.47, 4.47, 4.47); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.46 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.7 W/kg

SAR(1 g) = 7.84 W/kg; SAR(10 g) = 2.18 W/kg

Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.42 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 32.1 W/kg

SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.25 W/kg

Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.44 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 35.8 W/kg

SAR(1 g) = 8.37 W/kg; SAR(10 g) = 2.32 W/kg

Maximum value of SAR (measured) = 20.4 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.44 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 37.0 W/kg

SAR(1 g) = 8.48 W/kg; SAR(10 g) = 2.35 W/kg

Maximum value of SAR (measured) = 20.9 W/kg

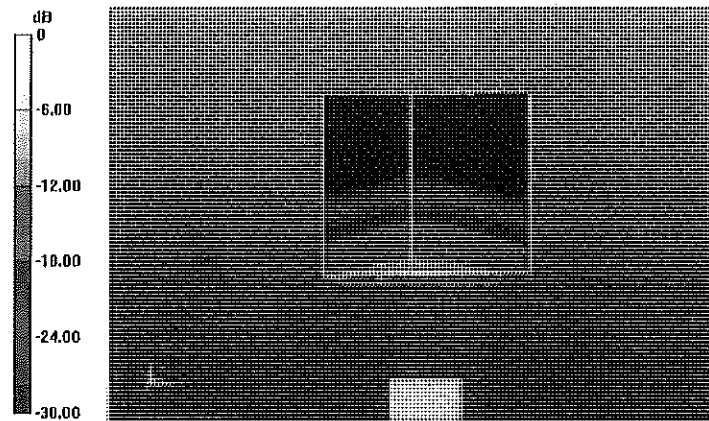
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 56.69 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 36.4 W/kg

SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.17 W/kg

Maximum value of SAR (measured) = 19.7 W/kg

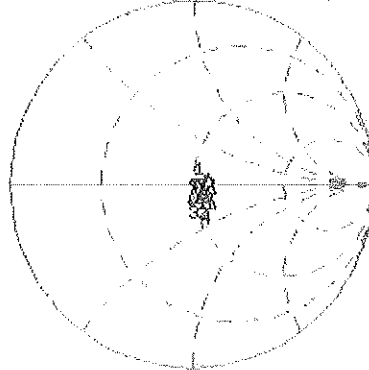


0 dB = 19.7 W/kg = 12.94 dBW/kg

Impedance Measurement Plot for Body TSL

24 Sep 2014 11:05:50
 [CH1] S11 1 U FS 1: 51.867 Ω -8.0566 Ω 3.7989 pF 5 200.000 000 MHz

 Del
 Cor
 Avg
 16
 H1d

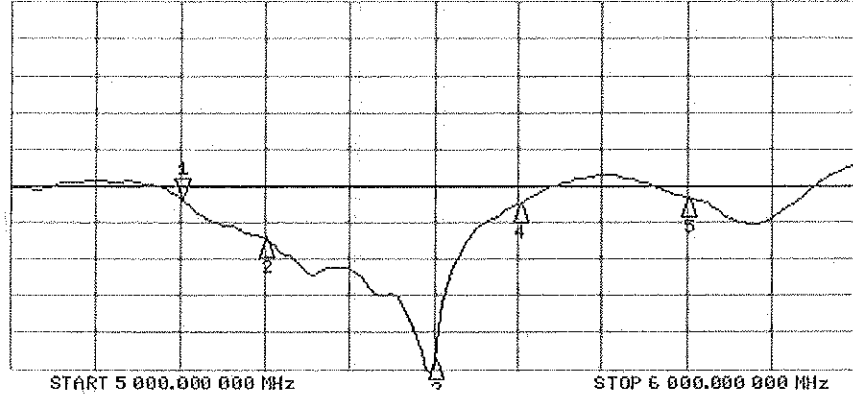


CH1 Markers

2: 54.531 Ω
 0.1015 Ω
 5.30000 GHz
 3: 50.207 Ω
 -613.28 Ω
 5.50000 GHz
 4: 57.480 Ω
 -3.1563 Ω
 5.60000 GHz
 5: 57.150 Ω
 5.1934 Ω
 5.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -21.835 dB 5 200.000 000 MHz

Cor
 Avg
 16
 H1d



CH2 Markers

2: -27.251 dB
 5.30000 GHz
 3: -43.776 dB
 5.50000 GHz
 4: -22.442 dB
 5.60000 GHz
 5: -21.682 dB
 5.80000 GHz