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SAR EVALUATION REPORT

Applicant Name:
Samsung Electronics Co., Ltd.
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Gyeonggi-do, 16677, Korea

Date of Testing:
07/09/18 - 08/06/18
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
1M1806280135-01.A3L

FCC ID: **A3LSC01L**

APPLICANT: **SAMSUNG ELECTRONICS CO., LTD.**

DUT Type: Portable Handset
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model: SC-01L

Equipment Class	Band & Mode	Tx Frequency	SAR			
			1g Head (W/kg)	1g Body-Worn (W/kg)	1g Hotspot (W/kg)	10g Phablet (W/kg)
PCE	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	0.18	0.29	1.02	N/A
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	< 0.1	0.34	0.70	3.27
PCE	UMTS 850	826.40 - 846.60 MHz	0.22	0.37	0.80	N/A
PCE	LTE Band 12	699.7 - 715.3 MHz	0.12	0.23	0.35	N/A
PCE	LTE Band 17	706.5 - 713.5 MHz	N/A	N/A	N/A	N/A
PCE	LTE Band 13	779.5 - 784.5 MHz	0.14	0.30	0.51	N/A
PCE	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.14	0.24	0.59	N/A
PCE	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	< 0.1	0.39	0.89	N/A
PCE	LTE Band 41	2498.5 - 2687.5 MHz	< 0.1	0.22	0.50	1.10
DTS	2.4 GHz WLAN	2412 - 2472 MHz	0.78	0.17	0.49	N/A
NII	U-NII-1	5180 - 5240 MHz	N/A	N/A	N/A	N/A
NII	U-NII-2A	5260 - 5320 MHz	0.25	0.34	N/A	1.68
NII	U-NII-2C	5500 - 5720 MHz	0.31	0.28	N/A	1.62
NII	U-NII-3	5745 - 5825 MHz	0.30	0.25	0.42	N/A
DSS/DTS	Bluetooth	2402 - 2480 MHz	0.90	< 0.1	0.10	N/A
Simultaneous SAR per KDB 690783 D01v01r03:			1.42	1.30	1.59	3.95

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

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

Randy Ortanez
President

TESTING CERT#2041.01

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T A B L E   O F   C O N T E N T S

1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 17	Voice/Data	706.5 - 713.5 MHz
LTE Band 13	Voice/Data	779.5 - 784.5 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 41	Voice/Data	2498.5 - 2687.5 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2472 MHz
U-NII-1	Voice/Data	5180 - 5240 MHz
U-NII-2A	Voice/Data	5260 - 5320 MHz
U-NII-2C	Voice/Data	5500 - 5720 MHz
U-NII-3	Voice/Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
ANT+	Data	2402 - 2480 MHz
MST	Data	555 Hz - 8.33 kHz

1.2 Power Reduction for SAR

This device utilizes a power reduction mechanism for some wireless modes and bands for SAR compliance under portable hotspot conditions and under some conditions when the device is being used in close proximity to the user's hand. All hotspot SAR evaluations for this device were performed at the maximum allowed output power when hotspot is enabled. FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device when being used in phablet use conditions. Detailed descriptions of the power reduction mechanism are included in the operational description.

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

1.3 Nominal and Maximum Output Power Specifications

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

1.3.1 Maximum PCE Power

Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		1 TX Slot	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*
GSM/GPRS/EDGE 850	Maximum	**33.8**	**33.8**	**33.0**	**29.6**	**27.7**	**28.5**	**26.2**	**24.2**	**22.3**
	Nominal	**32.8**	**32.8**	**32.0**	**28.6**	**26.7**	**27.5**	**25.2**	**23.2**	**21.3**
GSM/GPRS/EDGE 1900	Maximum	**30.7**	**30.7**	**29.0**	**27.0**	**25.2**	**26.8**	**26.0**	**23.7**	**22.3**
	Nominal	**29.7**	**29.7**	**28.0**	**26.0**	**24.2**	**25.8**	**25.0**	**22.7**	**21.3**

Mode / Band		Modulated Average (dBm)		
		3GPP WCDMA	*3GPP HSDPA*	*3GPP HSUPA*
UMTS Band 5 (850 MHz)	Maximum	**25.0**	**24.0**	**23.6**
	Nominal	**24.0**	**23.0**	**22.6**

Mode / Band		Modulated Average (dBm)
LTE Band 12	Maximum	**23.5**
	Nominal	**22.5**
LTE Band 17	Maximum	**23.5**
	Nominal	**22.5**
LTE Band 13	Maximum	**23.5**
	Nominal	**22.5**
LTE Band 5 (Cell)	Maximum	**23.5**
	Nominal	**22.5**
LTE Band 4 (AWS)	Maximum	**23.5**
	Nominal	**22.5**
LTE Band 41	Maximum	**25.0**
	Nominal	**24.0**

1.3.2 Reduced PCE Power – Hotspot Mode Activated

Mode / Band		Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		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 1900	Maximum	**27.2**	**25.3**	**23.1**	**21.2**	**25.8**	**25.0**	**22.6**	**20.6**
	Nominal	**26.2**	**24.3**	**22.1**	**20.2**	**24.8**	**24.0**	**21.6**	**19.6**

Mode / Band		Modulated Average (dBm)
LTE Band 4 (AWS)	Maximum	**22.5**
	Nominal	**21.5**
LTE Band 41	Maximum	**23.0**
	Nominal	**22.0**

1.3.3 Reduced PCE Power – Grip Sensor Activated

Mode / Band		Modulated Average (dBm)
LTE Band 41	Maximum	**23.0**
	Nominal	**22.0**

1.3.4 Maximum Bluetooth and WLAN Output Power

Mode / Band		Modulated Average - Single Tx Chain (dBm)				
	Channel	1	2-10	11	12	13
IEEE 802.11b (2.4 GHz)	Maximum	21.0				
	Nominal	20.0				
IEEE 802.11g (2.4 GHz)	Maximum	**17.0**	**18.0**	**17.0**	**13.0**	**11.0**
	Nominal	**16.0**	**17.0**	**16.0**	**12.0**	**10.0**
IEEE 802.11n (2.4 GHz)	Maximum	**17.0**	**18.0**	**17.0**	**13.0**	**8.0**
	Nominal	**16.0**	**17.0**	**16.0**	**12.0**	**7.0**

Mode / Band		Modulated Average - Single Tx Chain (dBm)										
		20 MHz Bandwidth				40 MHz Bandwidth				80 MHz Bandwidth		
	Channel	36	40-60	64	100-165	38	46-54	62	102-159	42-58	106	122-155
IEEE 802.11a (5 GHz)	Maximum	**17.0**	**18.0**	**16.0**	**17.5**							
	Nominal	**16.0**	**17.0**	**15.0**	**16.5**							
IEEE 802.11n (5 GHz)	Maximum	**18.0**			**17.5**	**15.0**	**17.0**	**15.0**	**17.0**			
	Nominal	**17.0**			**16.5**	**14.0**	**16.0**	**14.0**	**16.0**			
IEEE 802.11ac (5 GHz)	Maximum	**18.0**			**17.5**	**16.0**	**17.0**	**15.0**	**17.0**	**14.0**	**15.0**	**16.0**
	Nominal	**17.0**			**16.5**	**15.0**	**16.0**	**14.0**	**16.0**	**13.0**	**14.0**	**15.0**

Mode / Band		Modulated Average - MIMO (dBm)				
	Channel	1	2-10	11	12	13
IEEE 802.11g (2.4 GHz)	Maximum	**20.0**	**21.0**	**20.0**	**16.0**	**14.0**
	Nominal	**19.0**	**20.0**	**19.0**	**15.0**	**13.0**
IEEE 802.11n (2.4 GHz)	Maximum	**20.0**	**21.0**	**20.0**	**16.0**	**11.0**
	Nominal	**19.0**	**20.0**	**19.0**	**15.0**	**10.0**

Mode / Band		Modulated Average - MIMO (dBm)										
		20 MHz Bandwidth				40 MHz Bandwidth				80 MHz Bandwidth		
	Channel	36	40-60	64	100-165	38	46-54	62	102-159	42-58	106	122-155
IEEE 802.11a (5 GHz)	Maximum	**20.0**	**21.0**	**19.0**	**20.5**							
	Nominal	**19.0**	**20.0**	**18.0**	**19.5**							
IEEE 802.11n (5 GHz)	Maximum	**21.0**			**20.5**	**18.0**	**20.0**	**18.0**	**20.0**			
	Nominal	**20.0**			**19.5**	**17.0**	**19.0**	**17.0**	**19.0**			
IEEE 802.11ac (5 GHz)	Maximum	**21.0**			**20.5**	**19.0**	**20.0**	**18.0**	**20.0**	**17.0**	**18.0**	**19.0**
	Nominal	**20.0**			**19.5**	**18.0**	**19.0**	**17.0**	**19.0**	**16.0**	**17.0**	**18.0**

Mode / Band		Modulated Average (dBm)
Bluetooth (1 Mbps)	Maximum	**16.5**
	Nominal	**15.5**
Bluetooth (EDR)	Maximum	**11.0**
	Nominal	**10.0**
Bluetooth LE	Maximum	**10.0**
	Nominal	**9.0**

1.3.5 Reduced WLAN Output Power

Mode / Band		Modulated Average - Single Tx Chain (dBm)		
	Channel	1-11	12	13
IEEE 802.11b (2.4 GHz)	Maximum	17.0		
	Nominal	16.0		
IEEE 802.11g (2.4 GHz)	Maximum	17.0	13.0	11.0
	Nominal	16.0	12.0	10.0
IEEE 802.11n (2.4 GHz)	Maximum	17.0	13.0	8.0
	Nominal	16.0	12.0	7.0

Mode / Band		Modulated Average - Single Tx Chain (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11a (5 GHz)	Maximum	14.0		
	Nominal	13.0		
IEEE 802.11n (5 GHz)	Maximum	14.0	14.0	
	Nominal	13.0	13.0	
IEEE 802.11ac (5 GHz)	Maximum	14.0	14.0	14.0
	Nominal	13.0	13.0	13.0

Mode / Band		Modulated Average - MIMO (dBm)		
	Channel	1-11	12	13
IEEE 802.11g (2.4 GHz)	Maximum	20.0	16.0	14.0
	Nominal	19.0	15.0	13.0
IEEE 802.11n (2.4 GHz)	Maximum	20.0	16.0	11.0
	Nominal	19.0	15.0	10.0

Mode / Band		Modulated Average - MIMO (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11a (5 GHz)	Maximum	17.0		
	Nominal	16.0		
IEEE 802.11n (5 GHz)	Maximum	17.0	17.0	
	Nominal	16.0	16.0	
IEEE 802.11ac (5 GHz)	Maximum	17.0	17.0	17.0
	Nominal	16.0	16.0	16.0

1.3.6 Maximum Output Power During Conditions with Simultaneous 2.4 GHz WLAN and 5 GHz WLAN

	# Tx	5 GHz WIFI [dBm]		2.4 GHz WIFI [dBm]		802.11 Modes
		Ant1	Ant2	Ant1	Ant2	
2.4 GHz + 5 GHz	2	A	-	-	B	2.4 GHz: b,g,n 5 GHz: a,n,ac
	2	-	A	B	-	
	2	A	-	B	-	
	2	-	A	-	B	
	3	A	A	B	-	2.4 GHz: b, g, n 5 GHz: n, ac, a (CDD + STBC only)
	3	A	A	-	B	
	3	A	-	B	B	2.4 GHz: n, g (CDD + STBC only) 5 GHz: a, n, ac
	3	-	A	B	B	
	4	A	A	B	B	2.4 GHz: n, g (CDD + STBC only) 5 GHz: n, ac, a (CDD + STBC only)

A = 13.0 dBm
B = 16.0 dBm
2.4 GHz WLAN Channel 12 will operate with Single Tx target power of 12.0 dBm
2.4 GHz WLAN Channel 13 will operate with Single Tx target power of 7.0 dBm
(Upper tolerance: target + 1.0 dB)

1.3.7 Reduced Output Power During Conditions with Simultaneous 2.4 GHz WLAN and 5 GHz WLAN

	# Tx	5 GHz WIFI [dBm]		2.4 GHz WIFI [dBm]		802.11 Modes
		Ant1	Ant2	Ant1	Ant2	
2.4 GHz + 5 GHz	2	A	-	-	B	2.4 GHz: b,g,n 5 GHz: a,n,ac
	2	-	A	B	-	
	2	A	-	B	-	
	2	-	A	-	B	
	3	A	A	B	-	2.4 GHz: b, g, n 5 GHz: n, ac, a (CDD + STBC only)
	3	A	A	-	B	
	3	A	-	B	B	2.4 GHz: n, g (CDD + STBC only) 5 GHz: a, n, ac
	3	-	A	B	B	
	4	A	A	B	B	2.4 GHz: n, g (CDD + STBC only) 5 GHz: n, ac, a (CDD + STBC only)

A = 12.0 dBm
B = 13.0 dBm
2.4 GHz WLAN Channel 12 will operate with Single Tx target power of 12.0 dBm
2.4 GHz WLAN Channel 13 will operate with Single Tx target power of 7.0 dBm
(Upper tolerance: target + 1.0 dB)

1.4 DUT Antenna Locations

The overall dimensions of this device are > 9 x 5 cm. A diagram showing the location of the device antennas can be found in Appendix F. Since the diagonal dimension of this device is > 160 mm and <200 mm, it is considered a "phablet."

Table 1-1
Device Edges/Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	Yes	Yes
GPRS 1900	Yes	Yes	No	Yes	Yes	Yes
UMTS 850	Yes	Yes	No	Yes	Yes	Yes
LTE Band 12	Yes	Yes	No	Yes	Yes	Yes
LTE Band 13	Yes	Yes	No	Yes	Yes	Yes
LTE Band 5 (Cell)	Yes	Yes	No	Yes	Yes	Yes
LTE Band 4 (AWS)	Yes	Yes	No	Yes	Yes	Yes
LTE Band 41	Yes	Yes	No	Yes	No	Yes
2.4 GHz WLAN Ant 1	Yes	Yes	Yes	No	No	Yes
2.4 GHz WLAN Ant 2	Yes	Yes	Yes	No	No	Yes
5 GHz WLAN Ant 1	Yes	Yes	Yes	No	No	Yes
5 GHz WLAN Ant 2	Yes	Yes	Yes	No	No	Yes
Bluetooth	Yes	Yes	Yes	No	No	Yes

Note: Particular DUT edges were not required to be evaluated for wireless router SAR or phablet SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v02r01 Section III and FCC KDB Publication 648474 D04v01r03. The distances between the transmit antennas and the edges of the device are included in the filing. When wireless router mode is enabled, U-NII-1, U-NII-2A, U-NII-2C operations are disabled.

1.5 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the device for this model. Therefore, all SAR tests were performed with the device which already incorporates the NFC antenna. A diagram showing the location of the NFC antenna can be found in Appendix F.

1.6 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, 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.

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

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Phablet	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	Yes^	Yes	N/A	Yes	^Bluetooth Tethering is considered
4	GSM voice + 2.4 GHz WI-FI MIMO	Yes	Yes	N/A	Yes	
5	GSM voice + 5 GHz WI-FI MIMO	Yes	Yes	N/A	Yes	
6	GSM voice + 2.4 GHz WI-FI + 5 GHz WI-FI	Yes	Yes	N/A	Yes	
7	GSM voice + 2.4 GHz WI-FI MIMO + 5 GHz WI-FI MIMO	Yes	Yes	N/A	Yes	
8	UMTS + 2.4 GHz WI-FI	Yes	Yes	Yes	Yes	
9	UMTS + 5 GHz WI-FI	Yes	Yes	Yes	Yes	
10	UMTS + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	Yes	^Bluetooth Tethering is considered
11	UMTS + 2.4 GHz WI-FI MIMO	Yes	Yes	Yes	Yes	
12	UMTS + 5 GHz WI-FI MIMO	Yes	Yes	Yes	Yes	
13	UMTS + 2.4 GHz WI-FI + 5 GHz WI-FI	Yes	Yes	Yes	Yes	
14	UMTS + 2.4 GHz WI-FI MIMO + 5 GHz WI-FI MIMO	Yes	Yes	Yes	Yes	
15	LTE + 2.4 GHz WI-FI	Yes	Yes	Yes	Yes	
16	LTE + 5 GHz WI-FI	Yes	Yes	Yes	Yes	
17	LTE + 2.4 GHz Bluetooth	Yes^	Yes	Yes^	Yes	^Bluetooth Tethering is considered
18	LTE + 2.4 GHz WI-FI MIMO	Yes	Yes	Yes	Yes	
19	LTE + 5 GHz WI-FI MIMO	Yes	Yes	Yes	Yes	
20	LTE + 2.4 GHz WI-FI + 5 GHz WI-FI	Yes	Yes	Yes	Yes	
21	LTE + 2.4 GHz WI-FI MIMO + 5 GHz WI-FI MIMO	Yes	Yes	Yes	Yes	
22	GPRS/EDGE + 2.4 GHz WI-FI	N/A	N/A	Yes	Yes	
23	GPRS/EDGE + 5 GHz WI-FI	N/A	N/A	Yes	Yes	
24	GPRS/EDGE + 2.4 GHz Bluetooth	N/A	N/A	Yes^	Yes	^Bluetooth Tethering is considered
25	GPRS/EDGE + 2.4 GHz WI-FI MIMO	N/A	N/A	Yes	Yes	
26	GPRS/EDGE + 5 GHz WI-FI MIMO	N/A	N/A	Yes	Yes	
27	GPRS/EDGE + 2.4 GHz WI-FI + 5 GHz WI-FI	N/A	N/A	Yes	Yes	
28	GPRS/EDGE + 2.4 GHz WI-FI MIMO + 5 GHz WI-FI MIMO	N/A	N/A	Yes	Yes	

1. Bluetooth cannot transmit simultaneously with WLAN.
2. All licensed modes share the same antenna path and cannot transmit simultaneously.
3. When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.
4. Per the manufacturer, WIFI Direct is not expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Therefore, there are no simultaneous transmission scenarios involving WIFI direct beyond that listed in the above table.
5. 5 GHz Wireless Router is only supported for the U-NII-3 by S/W, therefore U-NII-1, U-NII2A, and U-NII2C were not evaluated for wireless router conditions.
6. This device supports 2x2 MIMO Tx for WLAN 802.11n/ac. 802.11a/g/n/ac supports CDD and STBC and 802.11n/ac additionally supports SDM. Each WLAN antenna can transmit independently or together when operating with MIMO.
7. This device supports VOLTE.
8. This device supports VoWIFI.
9. This device supports Bluetooth Tethering.

1.7 Miscellaneous SAR Test Considerations

(A) WIFI/BT

Since U-NII-1 and U-NII-2A bands have the same maximum output power and the highest reported SAR for U-NII-2A is less than 1.2 W/kg, SAR is not required for U-NII-1 band according to FCC KDB Publication 248227 D01v02r02.

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

This device supports IEEE 802.11ac with the following features:
- a) Up to 80 MHz Bandwidth only
- b) No aggregate channel configurations
- c) 2 Tx antenna output
- d) 256 QAM is supported
- e) TDWR and Band gap channels are supported

Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" since the diagonal dimension is greater than 160mm and less than 200mm. Phablet 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 U-NII-2A & U-NII-2C WLAN, phablet SAR tests were performed. Phablet SAR was not evaluated for 2.4 GHz WLAN, Bluetooth, and U-NII-3 WLAN operations since wireless router 1g SAR was < 1.2 W/kg.

This device supports channel 1-13 for 2.4 GHz WLAN. However, due to the reduced output power for channels 12 and 13, channels 1, 6, and 11 were considered for SAR testing per KDB 248227 D01v02r02.

(B) Licensed Transmitter(s)

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

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

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

Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" since the diagonal dimension is greater than 160mm and less than 200mm. Therefore, phablet SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.

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

This device supports 64QAM on the uplink and 256QAM on the downlink for LTE Operations. Conducted powers for 64QAM uplink configurations were measured per Section 5.1 of FCC KDB Publication 941225

D05v02r05. SAR was not required for 64QAM since the highest maximum output power for 64 QAM is ≤ ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg, per Section 5.2.4 of FCC KDB Publication 941225 D05v02r05

1.8 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01, D05v02r04, D06v02r01 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D04v01r03 (Phablet Procedures)
- FCC KDB Publication 616217 D04v01r02 (Proximity Sensor)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

1.9 Device Serial Numbers

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

2 LTE INFORMATION

LTE Information					
FCC ID	**A3LSC01L**				
Form Factor	Portable Handset				
Frequency Range of each LTE transmission band	LTE Band 12 (699.7 - 715.3 MHz)				
	LTE Band 17 (706.5 - 713.5 MHz)				
	LTE Band 13 (779.5 - 784.5 MHz)				
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)				
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)				
	LTE Band 41 (2498.5 - 2687.5 MHz)				
Channel Bandwidths	LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 17: 5 MHz, 10 MHz				
	LTE Band 13: 5 MHz, 10 MHz				
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 41: 5 MHz, 10 MHz, 15 MHz, 20 MHz				
Channel Numbers and Frequencies (MHz)	Low	Low-Mid	Mid	Mid-High	High
LTE Band 12: 1.4 MHz	699.7 (23017)		707.5 (23095)	715.3 (23173)	
LTE Band 12: 3 MHz	700.5 (23025)		707.5 (23095)	714.5 (23165)	
LTE Band 12: 5 MHz	701.5 (23035)		707.5 (23095)	713.5 (23155)	
LTE Band 12: 10 MHz	704 (23060)		707.5 (23095)	711 (23130)	
LTE Band 17: 5 MHz	706.5 (23755)		710 (23790)	713.5 (23825)	
LTE Band 17: 10 MHz	709 (23780)		710 (23790)	711 (23800)	
LTE Band 13: 5 MHz	779.5 (23205)		782 (23230)	784.5 (23255)	
LTE Band 13: 10 MHz	N/A		782 (23230)	N/A	
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)		836.5 (20525)	848.3 (20643)	
LTE Band 5 (Cell): 3 MHz	825.5 (20415)		836.5 (20525)	847.5 (20635)	
LTE Band 5 (Cell): 5 MHz	826.5 (20425)		836.5 (20525)	846.5 (20625)	
LTE Band 5 (Cell): 10 MHz	829 (20450)		836.5 (20525)	844 (20600)	
LTE Band 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 41: 5 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 10 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 15 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 20 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
UE Category	DL UE Cat 18 (QPSK, 16QAM, 64QAM, 256QAM) UL UE Cat 13 (QPSK, 16QAM, 64QAM)				
Modulations Supported in UL	QPSK, 16QAM, 64QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES				
A-MPR (Additional MPR) disabled for SAR Testing?	YES				
LTE Additional Information	This device does not support full CA features on 3GPP Release 14. All uplink communications are identical to the Release 8 Specifications. The following LTE Release 14 Features are not supported: Carrier Aggregation, Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, MDH, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.				

3 INTRODUCTION

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

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

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

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

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

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

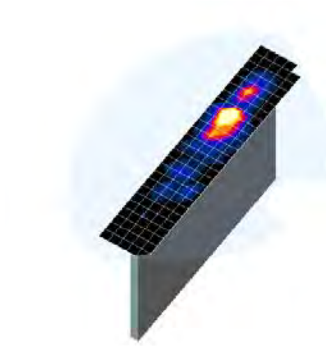

Figure 4-1
Sample SAR Area Scan

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

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

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

*Also compliant to IEEE 1528-2013 Table 6

5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

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

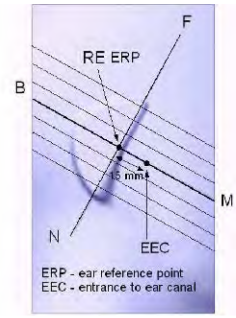

Figure 5-1
Close-Up Side view of ERP

5.2 HANDSET REFERENCE POINTS

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

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

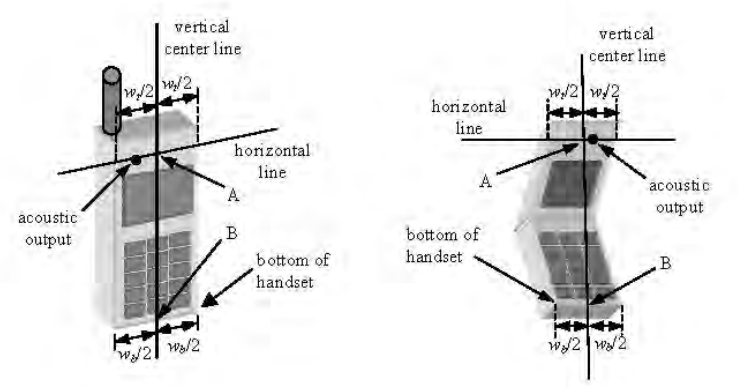

Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

6 TEST CONFIGURATION POSITIONS

6.1 Device Holder

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

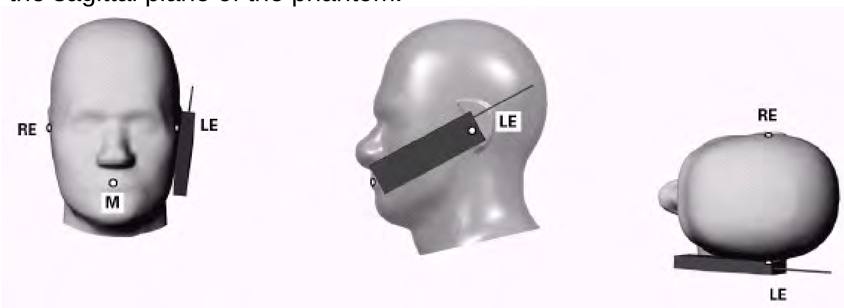

Figure 6-1 Front, Side and Top View of Cheek Position

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 was respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 6-2).

6.3 Positioning for Ear / 15º Tilt

With the test device aligned in the "Cheek Position":

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

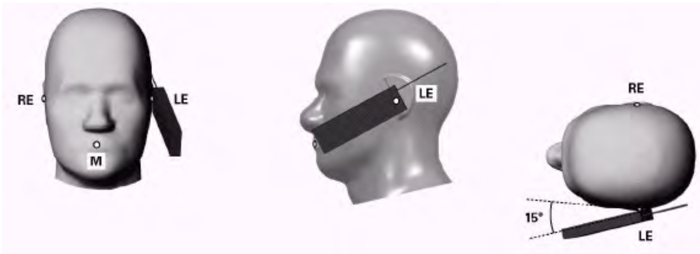

Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

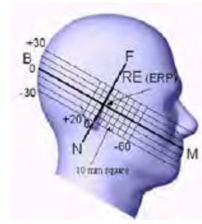

Figure 6-3
Side view w/ relevant markings

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

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

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

6.5 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6-4). Per FCC KDB Publication 648474 D04v01r03, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

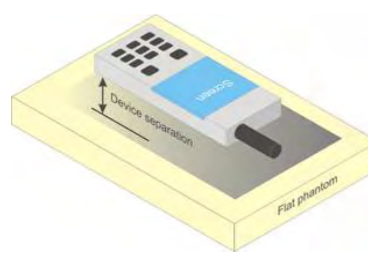

Figure 6-4
Sample Body-Worn Diagram

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented.
Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

6.6 Extremity Exposure Configurations

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

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

6.7 Wireless Router Configurations

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

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

6.8 Phablet Configurations

For smart phones with a display diagonal dimension > 150 mm or an overall diagonal dimension > 160 mm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, the phablets procedures outlined in KDB Publication 648474 D04v01r03 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 10g SAR. The UMPC mini-tablet 1g SAR at 5 mm is not required. When hotspot mode applies, 10g SAR is required only for the surfaces and edges with hotspot mode 1g SAR > 1.2 W/kg.

6.9 Proximity Sensor Considerations

This device uses a power reduction mechanism to reduce output powers in certain use conditions when the device is used close the user's body.

When the device's antenna is within a certain distance of the user, the sensor activates and reduces the maximum allowed output power. However, the sensor is not active when the device is moved beyond the sensor triggering distance and the maximum output power is no longer limited. Therefore, additional evaluation is needed in the vicinity of the triggering distance to ensure SAR is compliant when the device is allowed to operate at a non-reduced output power level. FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device at these additional test positions. Sensor triggering distance summary data is included in Appendix G.

The sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions since the sensor entirely covers the antennas.

7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

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

7.2 Controlled Environment

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

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

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

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

8 FCC MEASUREMENT PROCEDURES

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

8.1 Measured and Reported SAR

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

8.2 3G SAR Test Reduction Procedure

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

8.3 Procedures Used to Establish RF Signal for SAR

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

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

8.4 SAR Measurement Conditions for UMTS

8.4.1 Output Power Verification

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

8.4.2 Head SAR Measurements

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

8.4.3 Body SAR Measurements

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

8.4.4 SAR Measurements with Rel 5 HSDPA

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

8.4.5 SAR Measurements with Rel 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA.

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

8.5 SAR Measurement Conditions for LTE

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

8.5.1 Spectrum Plots for RB Configurations

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

8.5.2 MPR

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

8.5.3 A-MPR

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

8.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r04:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
   i. The required channel and offset combination with the highest maximum output power is required for SAR.
   ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
   iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ 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 TDD

LTE TDD testing is performed using the SAR test guidance provided in FCC KDB 941225 D05v02r04. TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225 D05v02r04. SAR testing is performed using the extended cyclic prefix listed in 3GPP TS 36.211 Section 4.

8.6 SAR Testing with 802.11 Transmitters

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

8.6.1 General Device Setup

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

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

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

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

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

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

8.6.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

8.6.5 2.4 GHz SAR Test Requirements

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

1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is › 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

8.6.6 OFDM Transmission Mode and SAR Test Channel Selection

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

8.6.7 Initial Test Configuration Procedure

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

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements (See Section 8.6.6). When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

8.6.8 Subsequent Test Configuration Procedures

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is ≤ 1.2 W/kg, no additional SAR tests for the subsequent test configurations are required. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

8.6.9 MIMO SAR considerations

Per KDB Publication 248227 D01v02r02, the simultaneous SAR provisions in KDB Publication 447498 D01v06 should be applied to determine simultaneous transmission SAR test exclusion for WIFI MIMO. If the sum of 1g single transmission chain SAR measurements is <1.6 W/kg, no additional SAR measurements for MIMO are required. Alternatively, SAR for MIMO can be measured with all antennas transmitting simultaneously at the specified maximum output power of MIMO operation. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

9 RF CONDUCTED POWERS

9.1 GSM Conducted Powers

Table 9-1
Maximum Conducted Power

Maximum Burst-Averaged Output Power										
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	32.97	32.97	**31.77**	28.96	27.08	27.38	25.27	23.24	21.20
	190	33.00	32.98	**31.56**	28.88	27.02	27.25	25.30	23.32	21.23
	251	32.82	32.80	**31.52**	28.73	26.90	27.29	25.17	23.16	21.05
GSM 1900	512	29.96	29.92	28.22	**25.67**	23.88	25.67	24.56	22.18	21.14
	661	29.87	29.86	28.28	**25.65**	23.99	25.76	24.51	22.25	21.24
	810	30.00	29.93	28.02	**25.43**	23.81	25.74	24.54	22.33	21.44

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	23.94	23.94	**25.75**	24.70	24.07	18.35	19.25	18.98	18.19
	190	23.97	23.95	**25.54**	24.62	24.01	18.22	19.28	19.06	18.22
	251	23.79	23.77	**25.50**	24.47	23.89	18.26	19.15	18.90	18.04
GSM 1900	512	20.93	20.89	22.20	**21.41**	20.87	16.64	18.54	17.92	18.13
	661	20.84	20.83	22.26	**21.39**	20.98	16.73	18.49	17.99	18.23
	810	20.97	20.90	22.00	**21.17**	20.80	16.71	18.52	18.07	18.43
GSM 850	**Frame Avg.Targets:**	23.77	23.77	**25.98**	24.34	23.69	18.47	19.18	18.94	18.29
GSM 1900		20.67	20.67	21.98	**21.74**	21.19	16.77	18.98	18.44	18.29

Table 9-2
Reduced Conducted Power

Maximum Burst-Averaged Output Power									
		GPRS/EDGE Data (GMSK)				*EDGE Data (8-PSK)*			
Band	Channel	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 1900	512	26.36	**24.14**	22.33	20.62	24.71	23.57	21.48	19.87
	661	26.35	**24.31**	22.40	20.83	24.69	23.54	21.49	20.11
	810	26.34	**24.21**	22.50	20.84	24.67	23.66	21.59	20.12

Calculated Maximum Frame-Averaged Output Power									
		GPRS/EDGE Data (GMSK)				*EDGE Data (8-PSK)*			
Band	Channel	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 1900	512	17.33	**18.12**	18.07	17.61	15.68	17.55	17.22	16.86
	661	17.32	**18.29**	18.14	17.82	15.66	17.52	17.23	17.10
	810	17.31	**18.19**	18.24	17.83	15.64	17.64	17.33	17.11
GSM 1900	Frame Avg.Targets:	17.17	**18.28**	17.84	17.19	15.77	17.98	17.34	16.59

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

GSM Class: B
GPRS Multislot class: 33 (Max 4 Tx uplink slots)
EDGE Multislot class: 33 (Max 4 Tx uplink slots)
DTM Multislot Class: N/A

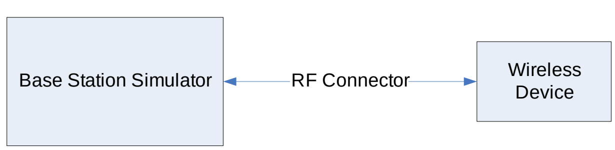

Figure 9-1
Power Measurement Setup

9.2 UMTS Conducted Powers

Table 9-3
Maximum Conducted Power

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	
99	WCDMA	12.2 kbps RMC	24.26	24.20	24.16	-
99		12.2 kbps AMR	24.28	24.21	24.10	-
6	HSDPA	Subtest 1	23.10	22.94	22.91	0
6		Subtest 2	23.13	23.00	22.92	0
6		Subtest 3	22.67	22.49	22.45	0.5
6		Subtest 4	22.66	22.50	22.47	0.5
6	HSUPA	Subtest 1	23.16	23.02	23.00	0
6		Subtest 2	19.13	18.98	18.95	2
6		Subtest 3	20.13	19.98	19.96	1
6		Subtest 4	19.13	18.96	18.94	2
6		Subtest 5	23.18	23.04	22.98	0

This device does not support DC-HSDPA.

It is expected by the manufacturer that MPR for some HSPA subtests may be up to 2 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.

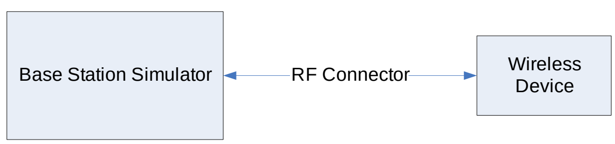

Figure 9-2
Power Measurement Setup

9.3 LTE Conducted Powers

9.3.1 LTE Band 12

Table 9-4
LTE Band 12 Conducted Powers - 10 MHz Bandwidth

LTE Band 12 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23095 (707.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	22.69	0	0
	1	25	**22.70**		0
	1	49	22.57		0
	25	0	21.80	0-1	1
	25	12	**21.81**		1
	25	25	21.71		1
	50	0	21.75		1
16QAM	1	0	21.95	0-1	1
	1	25	22.02		1
	1	49	21.92		1
	25	0	20.88	0-2	2
	25	12	20.89		2
	25	25	20.75		2
	50	0	20.82		2
64QAM	1	0	20.98	0-2	2
	1	25	21.00		2
	1	49	20.85		2
	25	0	19.87	0-3	3
	25	12	19.88		3
	25	25	19.80		3
	50	0	19.82		3

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

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

LTE Band 12 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23035 (701.5 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23155 (713.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.64	22.72	22.68	0	0
	1	12	22.61	22.67	22.62		0
	1	24	22.66	22.63	22.54		0
	12	0	21.71	21.77	21.70	0-1	1
	12	6	21.70	21.77	21.70		1
	12	13	21.74	21.69	21.67		1
	25	0	21.81	21.71	21.71		1
16QAM	1	0	21.96	22.09	22.00	0-1	1
	1	12	21.93	22.04	21.92		1
	1	24	21.98	21.95	21.92		1
	12	0	20.80	20.92	20.82	0-2	2
	12	6	20.80	20.88	20.80		2
	12	13	20.83	20.81	20.77		2
	25	0	20.84	20.82	20.76		2
64QAM	1	0	20.93	21.00	21.01	0-2	2
	1	12	20.90	20.95	20.89		2
	1	24	20.94	20.97	20.84		2
	12	0	19.83	19.90	19.81	0-3	3
	12	6	19.83	19.88	19.84		3
	12	13	19.89	19.86	19.75		3
	25	0	19.86	19.83	19.76		3

Table 9-6
LTE Band 12 Conducted Powers - 3 MHz Bandwidth

LTE Band 12 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23025 (700.5 MHz)	23095 (707.5 MHz)	23165 (714.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.62	22.66	22.66	0	0
	1	7	22.69	22.75	22.71		0
	1	14	22.60	22.63	22.54		0
	8	0	21.69	21.73	21.69	0-1	1
	8	4	21.69	21.74	21.68		1
	8	7	21.64	21.71	21.65		1
	15	0	21.69	21.70	21.67		1
16QAM	1	0	21.94	21.95	21.98	0-1	1
	1	7	22.03	22.12	22.05		1
	1	14	21.94	22.03	21.96		1
	8	0	20.80	20.84	20.79	0-2	2
	8	4	20.80	20.85	20.79		2
	8	7	20.75	20.82	20.74		2
	15	0	20.73	20.77	20.73		2
64QAM	1	0	20.93	20.98	20.94	0-2	2
	1	7	21.00	21.05	20.98		2
	1	14	20.85	20.93	20.82		2
	8	0	19.80	19.82	19.77	0-3	3
	8	4	19.80	19.83	19.78		3
	8	7	19.76	19.78	19.73		3
	15	0	19.75	19.81	19.73		3

Table 9-7
LTE Band 12 Conducted Powers -1.4 MHz Bandwidth

LTE Band 12 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23017 (699.7 MHz)	23095 (707.5 MHz)	23173 (715.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.53	22.60	22.53	0	0
	1	2	22.60	22.68	22.58		0
	1	5	22.53	22.59	22.50		0
	3	0	22.57	22.66	22.58		0
	3	2	22.62	22.70	22.60		0
	3	3	22.56	22.64	22.58		0
	6	0	21.62	21.66	21.60	0-1	1
16QAM	1	0	21.92	21.95	21.87	0-1	1
	1	2	21.95	21.96	21.94		1
	1	5	21.85	21.91	21.80		1
	3	0	21.81	21.83	21.73		1
	3	2	21.81	21.84	21.80		1
	3	3	21.74	21.83	21.74		1
	6	0	20.77	20.79	20.73	0-2	2
64QAM	1	0	20.82	20.87	20.79	0-2	2
	1	2	20.90	20.91	20.89		2
	1	5	20.82	20.85	20.81		2
	3	0	20.77	20.80	20.70		2
	3	2	20.81	20.84	20.77		2
	3	3	20.78	20.78	20.76		2
	6	0	19.72	19.76	19.68	0-3	3

9.3.2 LTE Band 13

Table 9-8
LTE Band 13 Conducted Powers - 10 MHz Bandwidth

LTE Band 13 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23230 (782.0 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	22.48	0	0
	1	25	22.47		0
	1	49	**22.52**		0
	25	0	**21.61**	0-1	1
	25	12	21.54		1
	25	25	21.56		1
	50	0	21.55		1
16QAM	1	0	21.85	0-1	1
	1	25	21.79		1
	1	49	21.91		1
	25	0	20.67	0-2	2
	25	12	20.61		2
	25	25	20.65		2
	50	0	20.60		2
64QAM	1	0	20.81	0-2	2
	1	25	20.78		2
	1	49	20.87		2
	25	0	19.67	0-3	3
	25	12	19.66		3
	25	25	19.66		3
	50	0	19.65		3

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

LTE Band 13 5 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23230 (782.0 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	22.50	0	0
	1	12	22.42		0
	1	24	22.47		0
	12	0	21.54	0-1	1
	12	6	21.53		1
	12	13	21.46		1
	25	0	21.54		1
16QAM	1	0	21.88	0-1	1
	1	12	21.81		1
	1	24	21.90		1
	12	0	20.67	0-2	2
	12	6	20.68		2
	12	13	20.59		2
	25	0	20.63		2
64QAM	1	0	20.82	0-2	2
	1	12	20.82		2
	1	24	20.88		2
	12	0	19.66	0-3	3
	12	6	19.65		3
	12	13	19.60		3
	25	0	19.61		3

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.

9.3.3 LTE Band 5 (Cell)

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

LTE Band 5 (Cell) 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 20525 (836.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	**22.40**	0	0
	1	25	22.36		0
	1	49	22.31		0
	25	0	21.41	0-1	1
	25	12	**21.43**		1
	25	25	21.39		1
	50	0	21.42		1
16QAM	1	0	21.70	0-1	1
	1	25	21.69		1
	1	49	21.62		1
	25	0	20.48	0-2	2
	25	12	20.51		2
	25	25	20.46		2
	50	0	20.48		2
64QAM	1	0	20.74	0-2	2
	1	25	20.60		2
	1	49	20.59		2
	25	0	19.52	0-3	3
	25	12	19.54		3
	25	25	19.48		3
	50	0	19.53		3

Note: LTE Band 5 (Cell) at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 9-11
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth

LTE Band 5 (Cell) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20425 (826.5 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20625 (846.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.23	22.34	22.36	0	0
	1	12	22.20	22.29	22.29		0
	1	24	22.20	22.30	22.28		0
	12	0	21.30	21.40	21.40	0-1	1
	12	6	21.31	21.41	21.38		1
	12	13	21.29	21.36	21.39		1
	25	0	21.29	21.37	21.38		1
16QAM	1	0	21.60	21.64	21.74	0-1	1
	1	12	21.58	21.65	21.70		1
	1	24	21.49	21.56	21.57		1
	12	0	20.38	20.49	20.45	0-2	2
	12	6	20.41	20.52	20.50		2
	12	13	20.37	20.47	20.44		2
	25	0	20.38	20.46	20.44		2
64QAM	1	0	20.52	20.61	20.62	0-2	2
	1	12	20.50	20.60	20.69		2
	1	24	20.48	20.59	20.55		2
	12	0	19.37	19.51	19.48	0-3	3
	12	6	19.39	19.47	19.50		3
	12	13	19.35	19.43	19.47		3
	25	0	19.34	19.45	19.45		3

Table 9-12
LTE Band 5 (Cell) Conducted Powers - 3 MHz Bandwidth

LTE Band 5 (Cell) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20415 (825.5 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20635 (847.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.22	22.32	22.33	0	0
	1	7	22.31	22.40	22.39		0
	1	14	22.19	22.28	22.27		0
	8	0	21.24	21.35	21.33	0-1	1
	8	4	21.26	21.37	21.36		1
	8	7	21.25	21.34	21.30		1
	15	0	21.28	21.37	21.35		1
16QAM	1	0	21.53	21.64	21.64	0-1	1
	1	7	21.68	21.75	21.75		1
	1	14	21.56	21.59	21.58		1
	8	0	20.38	20.45	20.46	0-2	2
	8	4	20.41	20.49	20.46		2
	8	7	20.35	20.44	20.41		2
	15	0	20.33	20.45	20.39		2
64QAM	1	0	20.49	20.57	20.58	0-2	2
	1	7	20.64	20.73	20.66		2
	1	14	20.45	20.59	20.54		2
	8	0	19.33	19.42	19.44	0-3	3
	8	4	19.37	19.44	19.44		3
	8	7	19.33	19.42	19.39		3
	15	0	19.35	19.43	19.41		3

Table 9-13
LTE Band 5 (Cell) Conducted Powers -1.4 MHz Bandwidth

LTE Band 5 (Cell) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20407 (824.7 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20643 (848.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.12	22.25	22.24	0	0
	1	2	22.20	22.34	22.32		0
	1	5	22.14	22.26	22.22		0
	3	0	22.19	22.30	22.28		0
	3	2	22.22	22.32	22.31		0
	3	3	22.18	22.32	22.31		0
	6	0	21.19	21.32	21.28	0-1	1
16QAM	1	0	21.44	21.60	21.61	0-1	1
	1	2	21.55	21.65	21.62		1
	1	5	21.49	21.61	21.52		1
	3	0	21.41	21.51	21.48		1
	3	2	21.38	21.54	21.55		1
	3	3	21.37	21.47	21.48		1
	6	0	20.35	20.47	20.41	0-2	2
64QAM	1	0	20.41	20.55	20.54	0-2	2
	1	2	20.48	20.56	20.58		2
	1	5	20.39	20.52	20.52		2
	3	0	20.37	20.47	20.43		2
	3	2	20.38	20.51	20.49		2
	3	3	20.37	20.47	20.46		2
	6	0	19.27	19.41	19.38	0-3	3

9.3.4 LTE Band 4 (AWS)

Table 9-14
LTE Band 4 (AWS) Maximum Conducted Powers - 20 MHz Bandwidth

LTE Band 4 (AWS) 20 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 20175 (1732.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	**22.36**	0	0
	1	50	22.13		0
	1	99	22.17		0
	50	0	21.24	0-1	1
	50	25	**21.25**		1
	50	50	21.22		1
	100	0	21.24		1
16QAM	1	0	21.70	0-1	1
	1	50	21.44		1
	1	99	21.43		1
	50	0	20.36	0-2	2
	50	25	20.33		2
	50	50	20.30		2
	100	0	20.34		2
64QAM	1	0	20.68	0-2	2
	1	50	20.36		2
	1	99	20.47		2
	50	0	19.40	0-3	3
	50	25	19.38		3
	50	50	19.36		3
	100	0	19.37		3

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.

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

LTE Band 4 (AWS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20025 (1717.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20325 (1747.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.46	22.31	22.29	0	0
	1	36	22.21	22.13	22.13		0
	1	74	22.24	22.15	22.18		0
	36	0	21.31	21.21	21.31	0-1	1
	36	18	21.32	21.20	21.23		1
	36	37	21.22	21.18	21.25		1
	75	0	21.23	21.20	21.25		1
16QAM	1	0	21.72	21.63	21.59	0-1	1
	1	36	21.60	21.40	21.46		1
	1	74	21.47	21.47	21.49		1
	36	0	20.42	20.34	20.34	0-2	2
	36	18	20.41	20.30	20.35		2
	36	37	20.28	20.27	20.30		2
	75	0	20.28	20.26	20.33		2
64QAM	1	0	20.77	20.62	20.61	0-2	2
	1	36	20.54	20.45	20.46		2
	1	74	20.55	20.48	20.55		2
	36	0	19.48	19.36	19.42	0-3	3
	36	18	19.44	19.35	19.39		3
	36	37	19.35	19.32	19.36		3
	75	0	19.36	19.35	19.39		3

Table 9-16
LTE Band 4 (AWS) Maximum Conducted Powers - 10 MHz Bandwidth

LTE Band 4 (AWS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20000 (1715.0 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20350 (1750.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.33	22.14	22.25	0	0
	1	25	22.17	22.09	22.17		0
	1	49	22.23	22.10	22.12		0
	25	0	21.29	21.20	21.26	0-1	1
	25	12	21.32	21.20	21.26		1
	25	25	21.27	21.18	21.25		1
	50	0	21.28	21.17	21.22		1
16QAM	1	0	21.64	21.46	21.57	0-1	1
	1	25	21.51	21.41	21.49		1
	1	49	21.57	21.41	21.49		1
	25	0	20.40	20.27	20.32	0-2	2
	25	12	20.33	20.27	20.34		2
	25	25	20.33	20.26	20.32		2
	50	0	20.33	20.25	20.33		2
64QAM	1	0	20.68	20.46	20.56	0-2	2
	1	25	20.52	20.43	20.46		2
	1	49	20.55	20.44	20.48		2
	25	0	19.44	19.37	19.42	0-3	3
	25	12	19.44	19.34	19.42		3
	25	25	19.44	19.33	19.39		3
	50	0	19.44	19.32	19.43		3

Table 9-17
LTE Band 4 (AWS) Maximum Conducted Powers - 5 MHz Bandwidth

LTE Band 4 (AWS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19975 (1712.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20375 (1752.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.30	22.15	22.22	0	0
	1	12	22.28	22.07	22.19		0
	1	24	22.20	22.11	22.17		0
	12	0	21.37	21.19	21.25	0-1	1
	12	6	21.35	21.23	21.28		1
	12	13	21.26	21.17	21.21		1
	25	0	21.26	21.20	21.24		1
16QAM	1	0	21.63	21.46	21.52	0-1	1
	1	12	21.62	21.41	21.51		1
	1	24	21.51	21.44	21.43		1
	12	0	20.47	20.27	20.36	0-2	2
	12	6	20.46	20.33	20.34		2
	12	13	20.37	20.27	20.31		2
	25	0	20.34	20.24	20.32		2
64QAM	1	0	20.57	20.38	20.48	0-2	2
	1	12	20.55	20.36	20.42		2
	1	24	20.43	20.42	20.45		2
	12	0	19.44	19.30	19.34	0-3	3
	12	6	19.45	19.29	19.36		3
	12	13	19.34	19.24	19.34		3
	25	0	19.33	19.26	19.33		3

Table 9-18
LTE Band 4 (AWS) Maximum Conducted Powers - 3 MHz Bandwidth

LTE Band 4 (AWS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19965 (1711.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20385 (1753.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.23	22.08	22.16	0	0
	1	7	22.37	22.16	22.25		0
	1	14	22.25	22.06	22.14		0
	8	0	21.31	21.13	21.20	0-1	1
	8	4	21.34	21.17	21.21		1
	8	7	21.32	21.13	21.21		1
	15	0	21.33	21.14	21.22		1
16QAM	1	0	21.57	21.42	21.54	0-1	1
	1	7	21.66	21.49	21.55		1
	1	14	21.66	21.43	21.48		1
	8	0	20.39	20.25	20.32	0-2	2
	8	4	20.46	20.26	20.36		2
	8	7	20.45	20.24	20.29		2
	15	0	20.39	20.22	20.27		2
64QAM	1	0	20.52	20.33	20.47	0-2	2
	1	7	20.65	20.49	20.58		2
	1	14	20.60	20.38	20.41		2
	8	0	19.44	19.33	19.35	0-3	3
	8	4	19.49	19.32	19.40		3
	8	7	19.47	19.29	19.34		3
	15	0	19.46	19.31	19.35		3

Table 9-19
LTE Band 4 (AWS) Maximum Conducted Powers -1.4 MHz Bandwidth

LTE Band 4 (AWS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19957 (1710.7 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20393 (1754.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	22.17	21.99	22.08	0	0
	1	2	22.23	22.04	22.13		0
	1	5	22.18	22.00	22.06		0
	3	0	22.19	22.06	22.10		0
	3	2	22.22	22.08	22.13		0
	3	3	22.19	22.04	22.11		0
	6	0	21.23	21.07	21.14	0-1	1
16QAM	1	0	21.49	21.33	21.41	0-1	1
	1	2	21.53	21.38	21.39		1
	1	5	21.45	21.26	21.41		1
	3	0	21.39	21.25	21.30		1
	3	2	21.42	21.29	21.36		1
	3	3	21.41	21.20	21.28		1
	6	0	20.41	20.20	20.28	0-2	2
64QAM	1	0	20.51	20.34	20.39	0-2	2
	1	2	20.55	20.37	20.43		2
	1	5	20.46	20.29	20.35		2
	3	0	20.40	20.28	20.33		2
	3	2	20.48	20.32	20.38		2
	3	3	20.40	20.28	20.35		2
	6	0	19.40	19.25	19.29	0-3	3

Table 9-20
LTE Band 4 (AWS) Reduced Conducted Powers - 20 MHz Bandwidth

LTE Band 4 (AWS) 20 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 20175 (1732.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	**21.45**	0	0
	1	50	21.19		0
	1	99	21.23		0
	50	0	**21.32**	0-1	0
	50	25	21.31		0
	50	50	21.30		0
	100	0	21.31		0
16QAM	1	0	21.79	0-1	0
	1	50	21.46		0
	1	99	21.56		0
	50	0	20.44	0-2	1
	50	25	20.37		1
	50	50	20.39		1
	100	0	20.39		1
64QAM	1	0	20.71	0-2	1
	1	50	20.46		1
	1	99	20.52		1
	50	0	19.47	0-3	2
	50	25	19.45		2
	50	50	19.40		2
	100	0	19.40		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.

Table 9-21
LTE Band 4 (AWS) Reduced Conducted Powers - 15 MHz Bandwidth

LTE Band 4 (AWS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20025 (1717.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20325 (1747.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	21.33	21.43	21.30	0	0
	1	36	21.21	21.23	21.20		0
	1	74	21.06	21.27	21.21		0
	36	0	21.27	21.20	21.26	0-1	0
	36	18	21.30	21.20	21.24		0
	36	37	21.25	21.16	21.24		0
	75	0	21.18	21.22	21.27		0
16QAM	1	0	21.74	21.65	21.45	0-1	0
	1	36	21.68	21.40	21.35		0
	1	74	21.63	21.50	21.40		0
	36	0	20.46	20.42	20.34	0-2	1
	36	18	20.41	20.41	20.34		1
	36	37	20.34	20.38	20.34		1
	75	0	20.31	20.32	20.41		1
64QAM	1	0	20.73	21.07	20.25	0-2	1
	1	36	20.57	20.88	20.14		1
	1	74	20.53	20.97	20.15		1
	36	0	19.50	19.38	19.51	0-3	2
	36	18	19.52	19.39	19.49		2
	36	37	19.40	19.34	19.46		2
	75	0	19.30	19.44	19.44		2

Table 9-22
LTE Band 4 (AWS) Reduced Conducted Powers - 10 MHz Bandwidth

LTE Band 4 (AWS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20000 (1715.0 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20350 (1750.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	21.27	21.15	21.18	0	0
	1	25	21.18	21.09	21.10		0
	1	49	21.24	21.11	21.12		0
	25	0	21.28	21.23	21.30	0-1	0
	25	12	21.27	21.24	21.31		0
	25	25	21.26	21.23	21.29		0
	50	0	21.25	21.19	21.29		0
16QAM	1	0	21.50	21.57	21.27	0-1	0
	1	25	21.34	21.55	21.40		0
	1	49	21.39	21.56	21.42		0
	25	0	20.37	20.32	20.39	0-2	1
	25	12	20.34	20.31	20.38		1
	25	25	20.40	20.31	20.32		1
	50	0	20.39	20.33	20.41		1
64QAM	1	0	20.22	20.49	20.42	0-2	1
	1	25	20.13	20.45	20.39		1
	1	49	20.13	20.50	20.37		1
	25	0	19.46	19.32	19.46	0-3	2
	25	12	19.43	19.38	19.46		2
	25	25	19.46	19.34	19.45		2
	50	0	19.43	19.32	19.35		2

Table 9-23
LTE Band 4 (AWS) Reduced Conducted Powers - 5 MHz Bandwidth

LTE Band 4 (AWS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19975 (1712.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20375 (1752.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	21.37	21.17	21.29	0	0
	1	12	21.32	21.16	21.26		0
	1	24	21.29	21.18	21.33		0
	12	0	21.32	21.24	21.29	0-1	0
	12	6	21.34	21.24	21.30		0
	12	13	21.24	21.22	21.30		0
	25	0	21.23	21.22	21.30		0
16QAM	1	0	21.78	21.59	21.73	0-1	0
	1	12	21.76	21.55	21.69		0
	1	24	21.67	21.65	21.71		0
	12	0	20.43	20.24	20.41	0-2	1
	12	6	20.43	20.28	20.40		1
	12	13	20.30	20.28	20.37		1
	25	0	20.29	20.33	20.35		1
64QAM	1	0	20.56	20.65	20.53	0-2	1
	1	12	20.57	20.59	20.49		1
	1	24	20.46	20.64	20.50		1
	12	0	19.38	19.35	19.35	0-3	2
	12	6	19.41	19.38	19.38		2
	12	13	19.33	19.33	19.33		2
	25	0	19.32	19.31	19.42		2

Table 9-24
LTE Band 4 (AWS) Reduced Conducted Powers - 3 MHz Bandwidth

LTE Band 4 (AWS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19965 (1711.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20385 (1753.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	21.22	21.10	21.16	0	0
	1	7	21.34	21.16	21.19		0
	1	14	21.22	21.08	21.12		0
	8	0	21.24	21.16	21.22	0-1	0
	8	4	21.30	21.20	21.24		0
	8	7	21.28	21.15	21.19		0
	15	0	21.29	21.18	21.25		0
16QAM	1	0	21.42	21.47	21.47	0-1	0
	1	7	21.49	21.60	21.50		0
	1	14	21.38	21.50	21.42		0
	8	0	20.21	20.15	20.34	0-2	1
	8	4	20.26	20.18	20.37		1
	8	7	20.22	20.17	20.33		1
	15	0	20.32	20.28	20.25		1
64QAM	1	0	20.11	20.42	20.44	0-2	1
	1	7	20.33	20.55	20.49		1
	1	14	20.17	20.41	20.37		1
	8	0	19.44	19.28	19.35	0-3	2
	8	4	19.46	19.33	19.35		2
	8	7	19.44	19.30	19.31		2
	15	0	19.42	19.30	19.37		2

Table 9-25
LTE Band 4 (AWS) Reduced Conducted Powers -1.4 MHz Bandwidth

LTE Band 4 (AWS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19957 (1710.7 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20393 (1754.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	21.17	21.17	21.05	0	0
	1	2	21.22	21.25	21.12		0
	1	5	21.18	21.20	21.08		0
	3	0	21.17	21.07	21.15		0
	3	2	21.27	21.16	21.24		0
	3	3	21.21	21.06	21.16		0
	6	0	21.15	21.09	21.19	0-1	0
16QAM	1	0	21.28	21.06	21.38	0-1	0
	1	2	21.38	21.12	21.42		0
	1	5	21.34	21.10	21.36		0
	3	0	21.42	21.13	21.19		0
	3	2	21.47	21.21	21.29		0
	3	3	21.40	21.18	21.24		0
	6	0	20.28	20.25	20.24	0-2	1
64QAM	1	0	20.09	20.35	20.32	0-2	1
	1	2	20.20	20.49	20.41		1
	1	5	20.05	20.32	20.38		1
	3	0	20.34	20.44	20.25		1
	3	2	20.42	20.55	20.37		1
	3	3	20.37	20.48	20.30		1
	6	0	19.59	19.16	19.41	0-3	2

9.3.5 LTE Band 41

Table 9-26
LTE Band 41 Maximum Conducted Powers - 20 MHz Bandwidth

LTE Band 41 20 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	24.66	24.77	24.67	24.92	**24.99**	0	0
	1	50	24.63	24.65	24.52	24.61	24.98		0
	1	99	24.63	24.49	24.51	24.65	24.93		0
	50	0	23.76	23.82	23.70	23.96	23.99	0-1	1
	50	25	23.69	23.65	23.63	23.74	23.98		1
	50	50	23.68	23.56	23.63	23.78	**24.00**		1
	100	0	23.77	23.67	23.69	23.94	23.96		1
16QAM	1	0	24.00	23.99	23.99	23.97	23.98	0-1	1
	1	50	23.96	23.98	23.84	23.87	23.97		1
	1	99	23.97	23.84	23.82	23.93	23.98		1
	50	0	22.80	22.95	22.73	23.00	22.95	0-2	2
	50	25	22.80	22.78	22.76	22.94	22.94		2
	50	50	22.84	22.73	22.74	22.79	22.99		2
	100	0	22.89	22.76	22.69	23.00	22.94		2
64QAM	1	0	22.50	22.59	22.43	22.68	22.90	0-2	2
	1	50	22.43	22.36	22.33	22.43	22.82		2
	1	99	22.42	22.26	22.30	22.44	22.87		2
	50	0	21.80	21.94	21.80	21.81	21.89	0-3	3
	50	25	21.85	21.72	21.72	21.85	21.95		3
	50	50	21.82	21.73	21.73	21.83	21.96		3
	100	0	21.80	21.79	21.77	21.99	21.94		3

Table 9-27
LTE Band 41 Maximum Conducted Powers - 15 MHz Bandwidth

LTE Band 41 15 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	24.69	24.79	24.63	24.81	24.86	0	0
	1	36	24.66	24.66	24.56	24.68	24.79		0
	1	74	24.71	24.54	24.50	24.65	24.81		0
	36	0	23.76	23.83	23.65	23.83	23.92	0-1	1
	36	18	23.77	23.65	23.60	23.77	23.89		1
	36	37	23.73	23.64	23.59	23.76	23.90		1
	75	0	23.71	23.67	23.58	23.78	23.85		1
16QAM	1	0	23.94	24.00	23.96	24.00	24.00	0-1	1
	1	36	23.94	23.94	23.86	23.98	23.98		1
	1	74	23.98	23.85	23.86	23.96	23.92		1
	36	0	22.81	22.84	22.69	22.82	22.93	0-2	2
	36	18	22.82	22.76	22.74	22.86	22.90		2
	36	37	22.79	22.70	22.69	22.86	22.86		2
	75	0	22.83	22.77	22.68	22.83	22.98		2
64QAM	1	0	22.51	22.56	22.41	22.62	22.64	0-2	2
	1	36	22.43	22.47	22.33	22.51	22.54		2
	1	74	22.46	22.34	22.30	22.48	22.61		2
	36	0	21.81	21.84	21.74	21.83	21.96	0-3	3
	36	18	21.83	21.71	21.69	21.92	21.98		3
	36	37	21.73	21.69	21.68	21.75	21.91		3
	75	0	21.88	21.75	21.74	21.91	21.99		3

Table 9-28
LTE Band 41 Maximum Conducted Powers - 10 MHz Bandwidth

LTE Band 41 10 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	24.65	24.77	24.60	24.71	24.84	0	0
	1	25	24.68	24.70	24.58	24.73	24.82		0
	1	49	24.65	24.59	24.57	24.64	24.86		0
	25	0	23.75	23.76	23.65	23.76	23.91	0-1	1
	25	12	23.74	23.62	23.59	23.77	23.84		1
	25	25	23.66	23.61	23.52	23.68	23.81		1
	50	0	23.78	23.67	23.69	23.72	23.94		1
16QAM	1	0	23.95	24.00	23.87	23.97	23.99	0-1	1
	1	25	23.97	23.98	23.86	23.99	24.00		1
	1	49	23.93	23.88	23.75	23.95	23.98		1
	25	0	22.71	22.77	22.59	22.81	22.85	0-2	2
	25	12	22.81	22.63	22.63	22.71	22.93		2
	25	25	22.76	22.63	22.59	22.72	22.89		2
	50	0	22.83	22.78	22.70	22.83	23.00		2
64QAM	1	0	22.44	22.50	22.35	22.50	22.62	0-2	2
	1	25	22.49	22.46	22.37	22.49	22.58		2
	1	49	22.45	22.35	22.33	22.42	22.65		2
	25	0	21.87	21.94	21.75	21.88	21.98	0-3	3
	25	12	21.81	21.80	21.78	21.88	21.98		3
	25	25	21.87	21.74	21.70	21.83	21.96		3
	50	0	21.82	21.77	21.69	21.87	22.00		3

Table 9-29
LTE Band 41 Maximum Conducted Powers - 5 MHz Bandwidth

LTE Band 41 5 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	24.60	24.61	24.49	24.67	24.80	0	0
	1	12	24.69	24.76	24.54	24.70	24.88		0
	1	24	24.60	24.48	24.46	24.65	24.80		0
	12	0	23.66	23.76	23.65	23.77	23.91	0-1	1
	12	6	23.73	23.74	23.59	23.75	23.87		1
	12	13	23.70	23.57	23.55	23.71	23.83		1
	25	0	23.62	23.61	23.60	23.78	23.84		1
16QAM	1	0	23.90	23.96	23.87	23.95	24.00	0-1	1
	1	12	24.00	23.96	23.87	23.98	23.98		1
	1	24	23.88	23.84	23.86	23.95	23.95		1
	12	0	22.76	22.82	22.60	22.82	22.91	0-2	2
	12	6	22.78	22.81	22.65	22.78	22.94		2
	12	13	22.69	22.67	22.60	22.73	22.94		2
	25	0	22.70	22.59	22.57	22.80	22.90		2
64QAM	1	0	22.44	22.43	22.33	22.48	22.54	0-2	2
	1	12	22.47	22.49	22.32	22.57	22.62		2
	1	24	22.41	22.34	22.29	22.45	22.57		2
	12	0	21.77	21.83	21.68	21.85	21.99	0-3	3
	12	6	21.79	21.87	21.72	21.89	22.00		3
	12	13	21.81	21.74	21.71	21.80	21.97		3
	25	0	21.85	21.77	21.74	21.91	22.00		3

Table 9-30
LTE Band 41 Reduced Conducted Powers - 20 MHz Bandwidth

LTE Band 41 20 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	22.76	22.87	22.73	22.99	**23.00**	0	0
	1	50	22.72	22.74	22.56	22.74	22.86		0
	1	99	22.72	22.61	22.57	22.73	22.95		0
	50	0	22.77	22.90	22.72	22.98	**23.00**	0-1	0
	50	25	22.80	22.73	22.69	22.89	22.97		0
	50	50	22.78	22.63	22.67	22.82	22.93		0
	100	0	22.81	22.71	22.75	22.98	22.96		0
16QAM	1	0	23.00	22.94	22.93	22.91	22.97	0-1	0
	1	50	23.00	22.92	22.86	22.99	22.99		0
	1	99	22.94	22.81	22.83	22.96	22.98		0
	50	0	22.95	22.99	22.81	23.00	22.95	0-2	0
	50	25	22.88	22.86	22.83	22.98	22.94		0
	50	50	22.86	22.72	22.79	22.91	22.96		0
	100	0	22.91	22.79	22.78	22.93	22.95		0
64QAM	1	0	22.58	22.67	22.54	22.79	22.74	0-2	0
	1	50	22.41	22.48	22.40	22.53	22.67		0
	1	99	22.49	22.35	22.37	22.42	22.75		0
	50	0	21.91	21.85	21.89	22.00	21.98	0-3	1
	50	25	21.92	21.80	21.81	21.92	21.94		1
	50	50	21.89	21.81	21.76	21.91	21.96		1
	100	0	21.84	21.86	21.84	21.94	21.94		1

Table 9-31
LTE Band 41 Reduced Conducted Powers - 15 MHz Bandwidth

LTE Band 41 15 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	22.65	22.66	22.60	22.71	23.00	0	0
	1	36	22.56	22.55	22.46	22.53	22.91		0
	1	74	22.53	22.50	22.44	22.58	22.93		0
	36	0	22.64	22.72	22.49	22.69	22.98	0-1	0
	36	18	22.64	22.53	22.53	22.67	22.86		0
	36	37	22.66	22.56	22.51	22.67	22.80		0
	75	0	22.62	22.60	22.55	22.59	22.80		0
16QAM	1	0	22.89	23.00	22.88	22.94	23.00	0-1	0
	1	36	22.84	22.91	22.77	22.89	22.92		0
	1	74	22.90	22.75	22.77	22.78	22.95		0
	36	0	22.71	22.73	22.61	22.76	22.92	0-2	0
	36	18	22.71	22.64	22.64	22.69	22.95		0
	36	37	22.67	22.57	22.53	22.68	22.87		0
	75	0	22.70	22.69	22.63	22.71	22.95		0
64QAM	1	0	22.36	22.48	22.28	22.52	22.60	0-2	0
	1	36	22.34	22.33	22.21	22.39	22.50		0
	1	74	22.36	22.21	22.20	22.35	22.54		0
	36	0	21.73	21.79	21.64	21.82	21.90	0-3	1
	36	18	21.74	21.57	21.62	21.78	21.97		1
	36	37	21.70	21.60	21.57	21.71	21.89		1
	75	0	21.73	21.68	21.63	21.78	21.99		1

Table 9-32
LTE Band 41 Reduced Conducted Powers - 10 MHz Bandwidth

LTE Band 41 10 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	22.50	22.60	22.52	22.68	22.92	0	0
	1	25	22.53	22.56	22.43	22.63	22.86		0
	1	49	22.50	22.43	22.38	22.57	22.92		0
	25	0	22.63	22.68	22.49	22.69	22.91	0-1	0
	25	12	22.60	22.53	22.52	22.62	22.95		0
	25	25	22.55	22.51	22.44	22.63	22.90		0
	50	0	22.56	22.56	22.49	22.63	22.94		0
16QAM	1	0	22.91	22.92	22.76	22.94	22.99	0-1	0
	1	25	22.86	22.87	22.78	22.92	22.95		0
	1	49	22.83	22.72	22.71	22.87	22.94		0
	25	0	22.62	22.71	22.53	22.71	22.80	0-2	0
	25	12	22.68	22.56	22.52	22.70	22.86		0
	25	25	22.63	22.47	22.47	22.64	22.85		0
	50	0	22.69	22.65	22.60	22.71	22.89		0
64QAM	1	0	22.35	22.41	22.33	22.43	22.57	0-2	0
	1	25	22.35	22.39	22.25	22.38	22.48		0
	1	49	22.31	22.26	22.25	22.35	22.53		0
	25	0	21.73	21.85	21.63	21.80	21.94	0-3	1
	25	12	21.79	21.71	21.72	21.81	21.95		1
	25	25	21.73	21.64	21.58	21.72	21.91		1
	50	0	21.78	21.67	21.66	21.75	21.91		1

Table 9-33
LTE Band 41 Reduced Conducted Powers - 5 MHz Bandwidth

LTE Band 41 5 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	22.45	22.55	22.50	22.61	22.88	0	0
	1	12	22.53	22.60	22.50	22.63	22.91		0
	1	24	22.51	22.51	22.43	22.58	22.89		0
	12	0	22.59	22.60	22.51	22.66	22.89	0-1	0
	12	6	22.58	22.58	22.49	22.69	22.93		0
	12	13	22.55	22.44	22.44	22.59	22.97		0
	25	0	22.59	22.48	22.51	22.61	22.95		0
16QAM	1	0	22.85	22.92	22.75	22.86	22.96	0-1	0
	1	12	22.94	22.91	22.81	22.92	23.00		0
	1	24	22.79	22.70	22.73	22.83	22.98		0
	12	0	22.64	22.72	22.54	22.65	22.83	0-2	0
	12	6	22.69	22.70	22.57	22.72	22.85		0
	12	13	22.65	22.56	22.56	22.66	22.77		0
	25	0	22.61	22.58	22.57	22.68	22.87		0
64QAM	1	0	22.31	22.35	22.29	22.39	22.51	0-2	0
	1	12	22.29	22.36	22.31	22.37	22.53		0
	1	24	22.31	22.27	22.20	22.35	22.50		0
	12	0	21.70	21.76	21.63	21.74	21.92	0-3	1
	12	6	21.73	21.75	21.62	21.74	21.90		1
	12	13	21.65	21.67	21.66	21.78	21.93		1
	25	0	21.75	21.65	21.68	21.75	21.92		1

9.4 WLAN Conducted Powers

Table 9-34
2.4 GHz WLAN Maximum Average RF Power – Ant 1

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	20.56	16.42	16.33
2417	2	N/A	17.90	17.69
2437	6	**20.98**	17.83	17.76
2457	10	N/A	17.81	17.75
2462	11	20.49	16.28	16.19

Table 9-35
2.4 GHz WLAN Maximum Average RF Power – Ant 2

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	**20.92**	16.42	16.77
2417	2	20.44	17.28	17.98
2437	6	20.67	17.47	17.34
2457	10	20.73	17.49	17.40
2462	11	20.72	16.43	16.28

Table 9-36
2.4 GHz WLAN Maximum Average RF Power – MIMO

2.4GHz 802.11n Conducted Power [dBm]				
Freq [MHz]	Channel	ANT1	ANT2	MIMO
2412	1	16.33	16.77	19.57
2417	2	**17.69**	**17.98**	**20.85**
2437	6	17.76	17.34	20.57
2457	10	17.75	17.40	20.59
2462	11	16.19	16.28	19.25

Table 9-37
5 GHz WLAN Maximum Average RF Power – Ant 1

5GHz (20MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11a	802.11n	802.11ac
		Average	Average	Average
5180	36	16.70	17.69	17.65
5200	40	17.72	17.62	17.69
5220	44	17.78	17.61	17.68
5240	48	17.82	17.79	17.80
5260	52	17.55	17.45	17.60
5280	56	17.63	17.49	17.54
5300	60	**17.65**	17.48	17.50
5320	64	15.72	17.54	17.57
5500	100	16.86	16.93	16.97
5600	120	16.88	17.03	16.98
5620	124	17.02	17.06	16.99
5720	144	**17.06**	17.03	17.06
5745	149	**16.92**	17.00	16.92
5785	157	16.85	16.97	17.01
5825	165	16.86	16.83	16.92

Table 9-38
5 GHz WLAN Maximum Average RF Power – Ant 2

5GHz (20MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11a	802.11n	802.11ac
		Average	Average	Average
5180	36	16.35	17.14	17.19
5200	40	17.24	17.28	17.22
5220	44	17.24	17.17	17.24
5240	48	17.33	17.13	17.16
5260	52	**17.32**	17.27	17.18
5280	56	17.15	17.19	17.14
5300	60	17.15	17.16	17.15
5320	64	15.49	17.25	17.20
5500	100	16.46	16.55	16.47
5600	120	16.72	16.70	16.60
5620	124	**16.78**	16.70	16.71
5720	144	16.65	16.87	16.71
5745	149	16.59	16.59	16.68
5785	157	16.68	16.72	16.63
5825	165	**16.71**	16.64	16.66

Table 9-39
5 GHz WLAN Maximum Average RF Power – MIMO

5GHz (20MHz) 802.11n Conducted Power [dBm]				
Freq [MHz]	Channel	ANT1	ANT2	MIMO
5180	36	17.69	17.14	20.43
5200	40	17.62	17.28	20.46
5220	44	17.61	17.17	20.41
5240	48	17.79	17.13	20.48
5260	52	17.45	17.27	20.37
5280	56	17.49	17.19	20.35
5300	60	17.48	17.16	20.33
5320	64	**17.54**	**17.25**	**20.41**
5500	100	16.93	16.55	19.75
5600	120	17.03	16.70	19.88
5620	124	17.06	16.70	19.89
5720	144	**17.03**	**16.87**	**19.96**
5745	149	17.00	16.59	19.81
5785	157	**16.97**	**16.72**	**19.86**
5825	165	16.83	16.64	19.75

Table 9-40
Maximum Output Powers During Conditions with 2.4 GHz and 5 GHz WLAN

5GHz 802.11ac (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	ANT1	ANT2
5210	42	13.51	13.56
5290	58	13.38	13.51
5530	106	13.74	13.74
5610	122	13.72	13.82
5690	138	13.89	13.98
5775	155	**13.67**	**13.81**

Table 9-41
2.4 GHz WLAN Reduced Average RF Power – Ant 1

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	16.95	16.34	16.33
2437	6	16.10	16.65	16.28
2462	11	**16.99**	16.42	16.19

Table 9-42
2.4 GHz WLAN Reduced Average RF Power – Ant 2

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	16.61	16.91	16.77
2437	6	16.39	16.56	16.36
2462	11	**16.95**	16.36	16.28

Table 9-43
5 GHz WLAN Reduced Average RF Power – Ant 1

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
5210	42	13.51
5290	58	**13.38**
5530	106	13.74
5610	122	13.72
5690	138	**13.89**
5775	155	**13.67**

Table 9-44
5 GHz WLAN Reduced Average RF Power – Ant 2

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
5210	42	13.56
5290	58	**13.51**
5530	106	13.74
5610	122	13.82
5690	138	**13.98**
5775	155	**13.81**

Table 9-45
Reduced Output Powers During Conditions with 2.4 GHz and 5 GHz WLAN

2.4GHz 802.11n Conducted Power [dBm]			
Freq [MHz]	Channel	ANT1	ANT2
2412	1	**13.45**	**13.96**
2437	6	13.57	13.64
2462	11	13.37	13.79

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

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.
- The bolded data rate and channel above were tested for SAR.

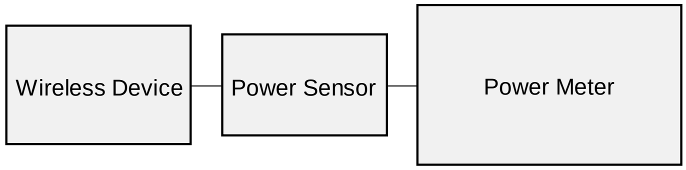

Figure 9-3
Power Measurement Setup

9.5 Bluetooth Conducted Powers

Table 9-46
Bluetooth Average RF Power

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
			[dBm]	[mW]
2402	1.0	0	15.77	37.757
2441	1.0	39	**16.42**	43.813
2480	1.0	78	16.37	43.381
2402	2.0	0	9.97	9.927
2441	2.0	39	10.13	10.301
2480	2.0	78	10.34	10.824
2402	3.0	0	10.03	10.067
2441	3.0	39	10.21	10.495
2480	3.0	78	10.39	10.950

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

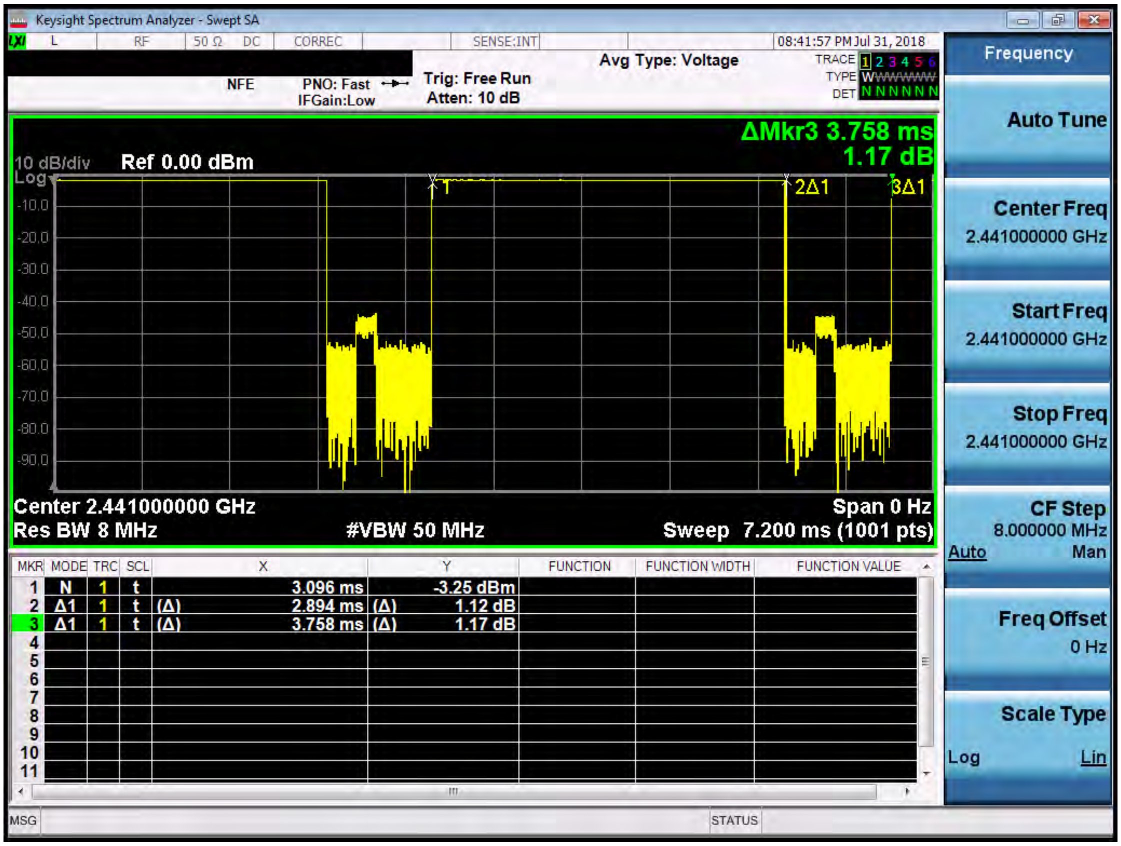

Figure 9-4
Bluetooth Transmission Plot

Equation 9-1
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.894ms}{3.758ms} * 100\% = 77.0\%$$

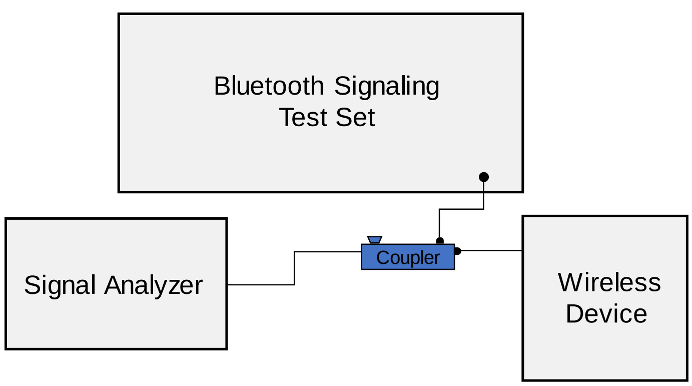

Figure 9-5
Power Measurement Setup

10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Measured Head Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
07/19/2018	750H	21.8	700	0.872	40.624	0.889	42.201	-1.91%	-3.74%
			710	0.877	40.601	0.890	42.149	-1.46%	-3.67%
			740	0.887	40.504	0.893	41.994	-0.67%	-3.55%
			755	0.891	40.498	0.894	41.916	-0.34%	-3.38%
			770	0.898	40.365	0.895	41.838	0.34%	-3.52%
			785	0.904	40.335	0.896	41.760	0.89%	-3.41%
07/16/2018	835H	21.2	820	0.922	41.578	0.899	41.578	2.56%	0.00%
			835	0.927	41.540	0.900	41.500	3.00%	0.10%
			850	0.932	41.497	0.916	41.500	1.75%	-0.01%
07/16/2018	1750H	20.8	1710	1.305	41.233	1.348	40.142	-3.19%	2.72%
			1750	1.331	41.186	1.371	40.079	-2.92%	2.76%
			1790	1.356	41.086	1.394	40.016	-2.73%	2.67%
07/12/2018	1900H	22.8	1850	1.432	40.058	1.400	40.000	2.29%	0.15%
			1880	1.446	40.050	1.400	40.000	3.29%	0.12%
			1910	1.469	40.000	1.400	40.000	4.93%	0.00%
07/16/2018	2450H	21.6	2400	1.793	39.195	1.756	39.289	2.11%	-0.24%
			2450	1.852	39.033	1.800	39.200	2.89%	-0.43%
			2500	1.907	38.828	1.855	39.136	2.80%	-0.79%
07/18/2018	2450H	22.8	2400	1.796	39.035	1.756	39.289	2.28%	-0.65%
			2450	1.853	38.837	1.800	39.200	2.94%	-0.93%
			2500	1.909	38.650	1.855	39.136	2.91%	-1.24%
08/03/2018	2450H	22.5	2600	2.022	39.225	1.964	39.009	2.95%	0.55%
			2650	2.081	39.027	2.018	38.945	3.12%	0.21%
			2700	2.138	38.836	2.073	38.882	3.14%	-0.12%
07/19/2018	5200H-5800H	21.2	5240	4.565	35.819	4.696	35.940	-2.79%	-0.34%
			5260	4.580	35.710	4.717	35.917	-2.90%	-0.58%
			5280	4.599	35.745	4.737	35.894	-2.91%	-0.42%
			5300	4.620	35.639	4.758	35.871	-2.90%	-0.65%
			5600	4.982	35.117	5.065	35.529	-1.64%	-1.16%
			5680	5.052	34.968	5.147	35.437	-1.85%	-1.32%
			5700	5.086	34.983	5.168	35.414	-1.59%	-1.22%
			5745	5.140	34.864	5.214	35.363	-1.42%	-1.41%
			5765	5.136	34.827	5.234	35.340	-1.87%	-1.45%
			5785	5.174	34.781	5.255	35.317	-1.54%	-1.52%

Table 10-2
Measured Body Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
07/23/2018	750B	20.9	700	0.943	53.177	0.959	55.726	-1.67%	-4.57%
			710	0.947	53.152	0.960	55.687	-1.35%	-4.55%
			740	0.958	53.070	0.963	55.570	-0.52%	-4.50%
			755	0.963	53.039	0.964	55.512	-0.10%	-4.45%
			770	0.969	53.013	0.965	55.453	0.41%	-4.40%
			785	0.975	52.983	0.966	55.395	0.93%	-4.35%
07/23/2018	835B	20.5	820	0.992	53.511	0.969	55.258	2.37%	-3.16%
			835	0.998	53.485	0.970	55.200	2.89%	-3.11%
			850	1.004	53.452	0.988	55.154	1.62%	-3.09%
07/16/2018	1750B	20.4	1710	1.461	51.712	1.463	53.537	-0.14%	-3.41%
			1750	1.490	51.674	1.488	53.432	0.13%	-3.29%
			1790	1.521	51.602	1.514	53.326	0.46%	-3.23%
07/16/2018	1900B	21.4	1850	1.509	51.758	1.520	53.300	-0.72%	-2.89%
			1880	1.541	51.653	1.520	53.300	1.38%	-3.09%
			1910	1.579	51.555	1.520	53.300	3.88%	-3.27%
07/23/2018	2450B	21.8	2400	1.947	50.814	1.902	52.767	2.37%	-3.70%
			2450	2.007	50.654	1.950	52.700	2.92%	-3.88%
			2500	2.062	50.487	2.021	52.636	2.03%	-4.08%
08/06/2018	2450B	22.1	2600	2.216	50.531	2.163	52.509	2.45%	-3.77%
			2650	2.278	50.394	2.234	52.445	1.97%	-3.91%
			2700	2.341	50.220	2.305	52.382	1.56%	-4.13%
07/09/2018	5200B-5800B	21.8	5240	5.453	48.252	5.346	48.960	2.00%	-1.45%
			5260	5.481	48.187	5.369	48.933	2.09%	-1.52%
			5300	5.529	48.153	5.416	48.879	2.09%	-1.49%
			5600	5.941	47.649	5.766	48.471	3.04%	-1.70%
			5620	5.959	47.626	5.790	48.444	2.92%	-1.69%
			5700	6.073	47.473	5.883	48.336	3.23%	-1.79%
			5745	6.150	47.377	5.936	48.275	3.61%	-1.86%
			5765	6.176	47.352	5.959	48.248	3.64%	-1.86%
			5785	6.204	47.321	5.982	48.220	3.71%	-1.86%
			5825	6.261	47.239	6.029	48.166	3.85%	-1.92%
08/06/2018	5200B-5800B	21.9	5240	5.488	47.872	5.346	48.960	2.66%	-2.22%
			5260	5.510	47.839	5.369	48.933	2.63%	-2.24%
			5280	5.528	47.803	5.393	48.906	2.50%	-2.26%
			5300	5.564	47.764	5.416	48.879	2.73%	-2.28%
			5320	5.588	47.763	5.439	48.851	2.74%	-2.23%
			5600	5.965	47.257	5.766	48.471	3.45%	-2.50%
			5620	5.985	47.240	5.790	48.444	3.37%	-2.49%
			5700	6.106	47.100	5.883	48.336	3.79%	-2.56%
			5745	6.184	47.021	5.936	48.275	4.18%	-2.60%
			5765	6.214	46.956	5.959	48.248	4.28%	-2.68%

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

10.2 Test System Verification

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

Table 10-3
System Verification Results – 1g

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	$Deviation_{1g}$ (%)
E	750	HEAD	07/19/2018	22.0	21.8	0.200	1161	3213	1.570	8.170	7.850	-3.92%
E	835	HEAD	07/16/2018	21.9	21.2	0.200	4d047	3213	1.950	9.130	9.750	6.79%
H	1750	HEAD	07/16/2018	21.3	20.8	0.100	1148	7409	3.650	36.400	36.500	0.27%
E	1900	HEAD	07/12/2018	24.0	22.8	0.100	5d148	3213	4.130	40.100	41.300	2.99%
G	2450	HEAD	07/16/2018	22.4	21.5	0.100	797	3332	5.290	52.700	52.900	0.38%
G	2450	HEAD	07/18/2018	22.7	21.4	0.100	719	3332	5.460	51.900	54.600	5.20%
G	2600	HEAD	08/03/2018	22.4	21.5	0.100	1071	3332	5.860	56.300	58.600	4.09%
H	5250	HEAD	07/19/2018	23.5	21.2	0.050	1191	7409	3.920	78.900	78.400	-0.63%
H	5600	HEAD	07/19/2018	23.5	21.2	0.050	1191	7409	3.900	83.600	78.000	-6.70%
H	5750	HEAD	07/19/2018	23.5	21.2	0.050	1191	7409	3.720	79.100	74.400	-5.94%
E	750	BODY	07/23/2018	23.9	20.9	0.200	1161	3213	1.810	8.430	9.050	7.35%
J	835	BODY	07/23/2018	20.4	20.0	0.200	4d133	3347	2.050	9.410	10.250	8.93%
J	1750	BODY	07/16/2018	20.1	20.4	0.100	1008	3347	3.770	37.400	37.700	0.80%
I	1900	BODY	07/16/2018	21.3	21.3	0.100	5d080	7406	4.090	39.100	40.900	4.60%
K	2450	BODY	07/23/2018	22.4	21.8	0.100	797	3319	5.070	51.100	50.700	-0.78%
K	2600	BODY	08/06/2018	22.2	22.1	0.100	1064	3319	5.730	54.700	57.300	4.75%
D	5250	BODY	07/09/2018	21.5	20.8	0.050	1237	7357	3.580	76.900	71.600	-6.89%
D	5600	BODY	07/09/2018	21.5	20.8	0.050	1237	7357	3.960	78.500	79.200	0.89%
D	5750	BODY	07/09/2018	21.5	20.8	0.050	1237	7357	3.700	77.100	74.000	-4.02%

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)	Source SN	Probe SN	Measured SAR_{10g} (W/kg)	1 W Target SAR_{10g} (W/kg)	1 W Normalized SAR_{10g} (W/kg)	$Deviation_{10g}$ (%)
I	1900	BODY	07/16/2018	21.3	21.3	0.100	5d080	7406	2.080	20.700	20.800	0.48%
K	2600	BODY	08/06/2018	22.2	22.1	0.100	1064	3319	2.520	24.400	25.200	3.28%
D	5250	BODY	08/06/2018	22.1	21.4	0.050	1237	7357	1.000	21.500	20.000	-6.98%
D	5600	BODY	08/06/2018	22.1	21.4	0.050	1237	7357	1.140	22.100	22.800	3.17%
D	5750	BODY	08/06/2018	22.1	21.4	0.050	1237	7357	1.060	21.400	21.200	-0.93%

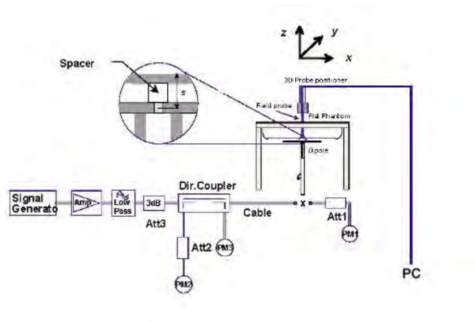

Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
GSM 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.8	33.00	0.04	Right	Cheek	E1209	1:8.3	0.153	1.202	0.184	A1
836.60	190	GSM 850	GSM	33.8	33.00	0.01	Right	Tilt	E1209	1:8.3	0.079	1.202	0.095	
836.60	190	GSM 850	GSM	33.8	33.00	0.01	Left	Cheek	E1209	1:8.3	0.124	1.202	0.149	
836.60	190	GSM 850	GSM	33.8	33.00	0.00	Left	Tilt	E1209	1:8.3	0.084	1.202	0.101	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-2
GSM 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	30.7	29.87	0.09	Right	Cheek	E1209	1:8.3	0.030	1.211	0.036	
1880.00	661	GSM 1900	GSM	30.7	29.87	0.15	Right	Tilt	E1209	1:8.3	0.012	1.211	0.015	
1880.00	661	GSM 1900	GSM	30.7	29.87	0.17	Left	Cheek	E1209	1:8.3	0.032	1.211	0.039	A2
1880.00	661	GSM 1900	GSM	30.7	29.87	0.14	Left	Tilt	E1209	1:8.3	0.010	1.211	0.012	
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 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	25.0	24.20	-0.01	Right	Cheek	E1209	1:1	0.180	1.202	**0.216**	A3
836.60	4183	UMTS 850	RMC	25.0	24.20	0.00	Right	Tilt	E1209	1:1	0.096	1.202	0.115	
836.60	4183	UMTS 850	RMC	25.0	24.20	0.08	Left	Cheek	E1209	1:1	0.151	1.202	0.182	
836.60	4183	UMTS 850	RMC	25.0	24.20	-0.03	Left	Tilt	E1209	1:1	0.099	1.202	0.119	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-4
LTE Band 12 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	-0.03	0	Right	Cheek	QPSK	1	25	E1205	1:1	0.095	1.202	0.114	
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	0.03	1	Right	Cheek	QPSK	25	12	E1205	1:1	0.077	1.172	0.090	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	0.01	0	Right	Tilt	QPSK	1	25	E1205	1:1	0.057	1.202	0.069	
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	-0.06	1	Right	Tilt	QPSK	25	12	E1205	1:1	0.047	1.172	0.055	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	0.14	0	Left	Cheek	QPSK	1	25	E1205	1:1	0.100	1.202	0.120	A4
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	0.06	1	Left	Cheek	QPSK	25	12	E1205	1:1	0.080	1.172	0.094	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	0.05	0	Left	Tilt	QPSK	1	25	E1205	1:1	0.081	1.202	0.097	
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	0.01	1	Left	Tilt	QPSK	25	12	E1205	1:1	0.061	1.172	0.071	
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
LTE Band 13 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	-0.02	0	Right	Cheek	QPSK	1	49	E1205	1:1	0.112	1.253	0.140	A5
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	0.07	1	Right	Cheek	QPSK	25	0	E1205	1:1	0.093	1.227	0.114	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	0.05	0	Right	Tilt	QPSK	1	49	E1205	1:1	0.055	1.253	0.069	
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	-0.01	1	Right	Tilt	QPSK	25	0	E1205	1:1	0.040	1.227	0.049	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	0.00	0	Left	Cheek	QPSK	1	49	E1205	1:1	0.087	1.253	0.109	
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	0.02	1	Left	Cheek	QPSK	25	0	E1205	1:1	0.079	1.227	0.097	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	-0.03	0	Left	Tilt	QPSK	1	49	E1205	1:1	0.073	1.253	0.091	
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	-0.01	1	Left	Tilt	QPSK	25	0	E1205	1:1	0.056	1.227	0.069	
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 5 (Cell) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	0.04	0	Right	Cheek	QPSK	1	0	E1209	1:1	0.110	1.288	0.142	A6
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	0.00	1	Right	Cheek	QPSK	25	12	E1209	1:1	0.095	1.279	0.122	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	-0.03	0	Right	Tilt	QPSK	1	0	E1209	1:1	0.064	1.288	0.082	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	0.03	1	Right	Tilt	QPSK	25	12	E1209	1:1	0.049	1.279	0.063	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	-0.01	0	Left	Cheek	QPSK	1	0	E1209	1:1	0.086	1.288	0.111	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	0.08	1	Left	Cheek	QPSK	25	12	E1209	1:1	0.074	1.279	0.095	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	0.01	0	Left	Tilt	QPSK	1	0	E1209	1:1	0.083	1.288	0.107	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	0.09	1	Left	Tilt	QPSK	25	12	E1209	1:1	0.064	1.279	0.082	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-7
LTE Band 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	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.36	0.12	0	Right	Cheek	QPSK	1	0	E1199	1:1	0.037	1.300	0.048	A7
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.25	0.17	1	Right	Cheek	QPSK	50	25	E1199	1:1	0.022	1.334	0.029	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.36	0.19	0	Right	Tilt	QPSK	1	0	E1199	1:1	0.025	1.300	0.033	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.25	0.15	1	Right	Tilt	QPSK	50	25	E1199	1:1	0.011	1.334	0.015	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.36	0.19	0	Left	Cheek	QPSK	1	0	E1199	1:1	0.031	1.300	0.040	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.25	0.18	1	Left	Cheek	QPSK	50	25	E1199	1:1	0.020	1.334	0.027	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.36	0.05	0	Left	Tilt	QPSK	1	0	E1199	1:1	0.024	1.300	0.031	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.25	0.11	1	Left	Tilt	QPSK	50	25	E1199	1:1	0.013	1.334	0.017	
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 41 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	0.16	0	Right	Cheek	QPSK	1	0	E1203	1:1.58	0.047	1.002	0.047	
2680.00	41490	High	LTE Band 41	20	24.0	24.00	0.15	1	Right	Cheek	QPSK	50	50	E1203	1:1.58	0.033	1.000	0.033	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	0.11	0	Right	Tilt	QPSK	1	0	E1203	1:1.58	0.048	1.002	0.048	
2680.00	41490	High	LTE Band 41	20	24.0	24.00	0.13	1	Right	Tilt	QPSK	50	50	E1203	1:1.58	0.033	1.000	0.033	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	0.18	0	Left	Cheek	QPSK	1	0	E1203	1:1.58	0.050	1.002	0.050	A8
2680.00	41490	High	LTE Band 41	20	24.0	24.00	0.17	1	Left	Cheek	QPSK	50	50	E1203	1:1.58	0.033	1.000	0.033	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	0.15	0	Left	Tilt	QPSK	1	0	E1203	1:1.58	0.027	1.002	0.027	
2680.00	41490	High	LTE Band 41	20	24.0	24.00	-0.08	1	Left	Tilt	QPSK	50	50	E1203	1:1.58	0.022	1.000	0.022	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-9
DTS Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.													W/kg	(W/kg)			(W/kg)	
2462	11	802.11b	DSSS	22	17.0	16.99	0.17	Right	Cheek	1	E1077	1	98.9	0.513	0.422	1.002	1.011	0.427	
2462	11	802.11b	DSSS	22	17.0	16.99	0.03	Right	Tilt	1	E1077	1	98.9	0.388	0.301	1.002	1.011	0.305	
2462	11	802.11b	DSSS	22	17.0	16.99	-0.17	Left	Cheek	1	E1077	1	98.9	0.169	-	1.002	1.011	-	
2462	11	802.11b	DSSS	22	17.0	16.99	0.10	Left	Tilt	1	E1077	1	98.9	0.213	-	1.002	1.011	-	
2412	1	802.11b	DSSS	22	17.0	16.61	0.00	Right	Cheek	2	E1077	1	99.0	0.756	0.701	1.094	1.010	0.775	
2437	6	802.11b	DSSS	22	17.0	16.39	-0.03	Right	Cheek	2	E1077	1	99.0	0.646	0.525	1.151	1.010	0.610	
2462	11	802.11b	DSSS	22	17.0	16.95	0.10	Right	Cheek	2	E1077	1	99.0	0.693	0.756	1.012	1.010	0.773	A9
2462	11	802.11b	DSSS	22	17.0	16.95	0.03	Right	Tilt	2	E1077	1	99.0	0.666	0.624	1.012	1.010	0.638	
2462	11	802.11b	DSSS	22	17.0	16.95	0.05	Left	Cheek	2	E1077	1	99.0	0.347	-	1.012	1.010	-	
2462	11	802.11b	DSSS	22	17.0	16.95	0.06	Left	Tilt	2	E1077	1	99.0	0.279	-	1.012	1.010	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-10
DTS MIMO Head SAR for Conditions with 2.4 GHz and 5 GHz WLAN SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.															W/kg	(W/kg)			(W/kg)	
2412	1	802.11n	OFDM	20	14.0	13.45	14.0	13.96	0.02	Right	Cheek	MIMO	E1084	13	98.7	0.703	0.661	1.135	1.013	0.760	
2437	6	802.11n	OFDM	20	14.0	13.57	14.0	13.64	0.09	Right	Cheek	MIMO	E1084	13	98.7	0.596	0.546	1.104	1.013	0.611	
2462	11	802.11n	OFDM	20	14.0	13.37	14.0	13.79	0.16	Right	Cheek	MIMO	E1084	13	98.7	0.686	0.656	1.156	1.013	0.768	
2412	1	802.11n	OFDM	20	14.0	13.45	14.0	13.96	0.04	Right	Tilt	MIMO	E1084	13	98.7	0.533	0.606	1.135	1.013	0.697	
2412	1	802.11n	OFDM	20	14.0	13.45	14.0	13.96	0.01	Left	Cheek	MIMO	E1084	13	98.7	0.320	-	1.135	1.013	-	
2412	1	802.11n	OFDM	20	14.0	13.45	14.0	13.96	-0.06	Left	Tilt	MIMO	E1084	13	98.7	0.308	-	1.135	1.013	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram											

DTS MIMO was additionally evaluated at the maximum allowed output power during operations with Simultaneous 2.4 GHz and 5 GHz WLAN. 5 GHz WIFI was not transmitting during the above evaluations.

Table 11-11
NII Head SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.													W/kg	(W/kg)			(W/kg)	
5290	58	802.11ac	OFDM	80	14.0	13.38	-0.18	Right	Cheek	1	E1083	29.3	94.8	0.056	0.018	1.153	1.055	0.022	
5290	58	802.11ac	OFDM	80	14.0	13.38	0.19	Right	Tilt	1	E1083	29.3	94.8	0.036	-	1.153	1.055	-	
5290	58	802.11ac	OFDM	80	14.0	13.38	0.15	Left	Cheek	1	E1083	29.3	94.8	0.049	-	1.153	1.055	-	
5290	58	802.11ac	OFDM	80	14.0	13.38	0.16	Left	Tilt	1	E1083	29.3	94.8	0.037	-	1.153	1.055	-	
5290	58	802.11ac	OFDM	80	14.0	13.51	0.15	Right	Cheek	2	E1083	29.3	93.2	0.312	0.205	1.119	1.073	0.246	
5290	58	802.11ac	OFDM	80	14.0	13.51	0.15	Right	Tilt	2	E1083	29.3	93.2	0.252	-	1.119	1.073	-	
5290	58	802.11ac	OFDM	80	14.0	13.51	-0.17	Left	Cheek	2	E1083	29.3	93.2	0.111	-	1.119	1.073	-	
5290	58	802.11ac	OFDM	80	14.0	13.51	-0.17	Left	Tilt	2	E1083	29.3	93.2	0.130	-	1.119	1.073	-	
5690	138	802.11ac	OFDM	80	14.0	13.89	0.14	Right	Cheek	1	E1083	29.3	94.8	0.086	-	1.026	1.055	-	
5690	138	802.11ac	OFDM	80	14.0	13.89	0.13	Right	Tilt	1	E1083	29.3	94.8	0.119	0.040	1.026	1.055	0.043	
5690	138	802.11ac	OFDM	80	14.0	13.89	0.10	Left	Cheek	1	E1083	29.3	94.8	0.054	-	1.026	1.055	-	
5690	138	802.11ac	OFDM	80	14.0	13.89	0.16	Left	Tilt	1	E1083	29.3	94.8	0.052	-	1.026	1.055	-	
5690	138	802.11ac	OFDM	80	14.0	13.98	-0.17	Right	Cheek	2	E1083	29.3	93.2	0.560	0.289	1.005	1.073	**0.312**	A10
5690	138	802.11ac	OFDM	80	14.0	13.98	0.20	Right	Tilt	2	E1083	29.3	93.2	0.392	-	1.005	1.073	-	
5690	138	802.11ac	OFDM	80	14.0	13.98	-0.13	Left	Cheek	2	E1083	29.3	93.2	0.300	-	1.005	1.073	-	
5690	138	802.11ac	OFDM	80	14.0	13.98	-0.14	Left	Tilt	2	E1083	29.3	93.2	0.302	-	1.005	1.073	-	
5775	155	802.11ac	OFDM	80	14.0	13.67	0.19	Right	Cheek	1	E1083	29.3	94.8	0.155	-	1.079	1.055	-	
5775	155	802.11ac	OFDM	80	14.0	13.67	0.16	Right	Tilt	1	E1083	29.3	94.8	0.242	0.079	1.079	1.055	0.090	
5775	155	802.11ac	OFDM	80	14.0	13.67	-0.18	Left	Cheek	1	E1083	29.3	94.8	0.081	-	1.079	1.055	-	
5775	155	802.11ac	OFDM	80	14.0	13.67	-0.19	Left	Tilt	1	E1083	29.3	94.8	0.086	-	1.079	1.055	-	
5775	155	802.11ac	OFDM	80	14.0	13.81	0.17	Right	Cheek	2	E1083	29.3	93.2	0.486	0.271	1.045	1.073	0.304	
5775	155	802.11ac	OFDM	80	14.0	13.81	0.17	Right	Tilt	2	E1083	29.3	93.2	0.331	-	1.045	1.073	-	
5775	155	802.11ac	OFDM	80	14.0	13.81	0.13	Left	Cheek	2	E1083	29.3	93.2	0.251	-	1.045	1.073	-	
5775	155	802.11ac	OFDM	80	14.0	13.81	0.13	Left	Tilt	2	E1083	29.3	93.2	0.230	-	1.045	1.073	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-12
DSS Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle %	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)			(W/kg)	
2402.00	0	Bluetooth	FHSS	16.5	15.77	-0.12	Right	Cheek	E1083	1	77	0.515	1.183	1.299	0.791	
2441.00	39	Bluetooth	FHSS	16.5	16.42	0.13	Right	Cheek	E1083	1	77	0.674	1.019	1.299	0.892	
2480.00	78	Bluetooth	FHSS	16.5	16.37	0.01	Right	Cheek	E1083	1	77	0.625	1.030	1.299	0.836	
2402.00	0	Bluetooth	FHSS	16.5	15.77	-0.09	Right	Tilt	E1083	1	77	0.480	1.183	1.299	0.738	
2441.00	39	Bluetooth	FHSS	16.5	16.42	-0.01	Right	Tilt	E1083	1	77	0.682	1.019	1.299	**0.903**	A11
2480.00	78	Bluetooth	FHSS	16.5	16.37	0.05	Right	Tilt	E1083	1	77	0.529	1.030	1.299	0.708	
2441.00	39	Bluetooth	FHSS	16.5	16.42	0.14	Left	Cheek	E1083	1	77	0.249	1.019	1.299	0.330	
2441.00	39	Bluetooth	FHSS	16.5	16.42	0.16	Left	Tilt	E1083	1	77	0.215	1.019	1.299	0.285	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram									

11.2 Standalone Body-Worn SAR Data

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

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.8	33.00	-0.08	15 mm	E1205	1	1:8.3	back	0.241	1.202	0.290	A12
1880.00	661	GSM 1900	GSM	30.7	29.87	0.00	15 mm	E1205	1	1:8.3	back	0.277	1.211	0.335	A14
836.60	4183	UMTS 850	RMC	25.0	24.20	0.00	15 mm	E1205	N/A	1:1	back	0.311	1.202	0.374	A16
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-14
LTE Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	-0.02	0	E1128	QPSK	1	25	15 mm	back	1:1	0.194	1.202	0.233	A18
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	0.03	1	E1128	QPSK	25	12	15 mm	back	1:1	0.158	1.172	0.185	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	0.02	0	E1128	QPSK	1	49	15 mm	back	1:1	0.236	1.253	0.296	A20
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	0.01	1	E1128	QPSK	25	0	15 mm	back	1:1	0.181	1.227	0.222	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	-0.03	0	E1205	QPSK	1	0	15 mm	back	1:1	0.186	1.288	0.240	A22
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	0.01	1	E1205	QPSK	25	12	15 mm	back	1:1	0.158	1.279	0.202	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.36	-0.04	0	E1199	QPSK	1	0	15 mm	back	1:1	0.303	1.300	**0.394**	A24
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.25	-0.04	1	E1199	QPSK	50	25	15 mm	back	1:1	0.202	1.334	0.269	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	-0.07	0	E1203	QPSK	1	0	15 mm	back	1:1.58	0.222	1.002	0.222	A26
2680.00	41490	High	LTE Band 41	20	24.0	24.00	0.10	1	E1203	QPSK	50	50	15 mm	back	1:1.58	0.170	1.000	0.170	
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
DTS Body-Worn SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.													W/kg	(W/kg)			(W/kg)	
2437	6	802.11b	DSSS	22	21.0	20.98	0.07	15 mm	1	E1084	1	back	98.9	0.160	0.140	1.005	1.011	0.142	
2412	1	802.11b	DSSS	22	21.0	20.92	-0.09	15 mm	2	E1084	1	back	99.0	0.199	0.165	1.019	1.010	0.170	A28
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-16
NII Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.													W/kg	(W/kg)			(W/kg)	
5300	60	802.11a	OFDM	20	18.0	17.65	-0.06	15 mm	1	E1084	6	back	93.5	0.414	0.227	1.084	1.070	0.263	
5260	52	802.11a	OFDM	20	18.0	17.32	0.19	15 mm	2	E1084	6	back	93.5	0.570	0.268	1.169	1.070	0.335	A30
5720	144	802.11a	OFDM	20	17.5	17.06	0.16	15 mm	1	E1084	6	back	93.5	0.161	0.079	1.107	1.070	0.094	
5620	124	802.11a	OFDM	20	17.5	16.78	0.17	15 mm	2	E1084	6	back	93.5	0.500	0.225	1.180	1.070	0.284	
5745	149	802.11a	OFDM	20	17.5	16.92	0.13	15 mm	1	E1084	6	back	93.5	0.158	0.056	1.143	1.070	0.068	
5825	165	802.11a	OFDM	20	17.5	16.71	0.14	15 mm	2	E1084	6	back	93.5	0.450	0.197	1.199	1.070	0.253	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-17
DSS Body-Worn SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)			(W/kg)	
2441	39	Bluetooth	FHSS	16.5	16.42	-0.01	15 mm	E1084	1	back	77	0.030	1.019	1.299	0.040	A32
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram									

11.3 Standalone Hotspot SAR Data

Table 11-18
GPRS/UMTS Hotspot SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
824.20	128	GSM 850	GPRS	33.0	31.77	-0.03	10 mm	E1205	2	1:4.15	back	0.546	1.327	0.725	
836.60	190	GSM 850	GPRS	33.0	31.56	-0.10	10 mm	E1205	2	1:4.15	back	0.636	1.393	0.886	
848.80	251	GSM 850	GPRS	33.0	31.52	-0.01	10 mm	E1205	2	1:4.15	back	0.727	1.406	**1.022**	A13
836.60	190	GSM 850	GPRS	33.0	31.56	0.01	10 mm	E1205	2	1:4.15	front	0.423	1.393	0.589	
836.60	190	GSM 850	GPRS	33.0	31.56	-0.10	10 mm	E1205	2	1:4.15	bottom	0.413	1.393	0.575	
836.60	190	GSM 850	GPRS	33.0	31.56	-0.02	10 mm	E1205	2	1:4.15	right	0.306	1.393	0.426	
836.60	190	GSM 850	GPRS	33.0	31.56	0.15	10 mm	E1205	2	1:4.15	left	0.083	1.393	0.116	
1880.00	661	GSM 1900	GPRS	25.3	24.31	-0.02	10 mm	E1205	2	1:4.15	back	0.311	1.256	0.391	
1880.00	661	GSM 1900	GPRS	25.3	24.31	0.08	10 mm	E1205	2	1:4.15	front	0.246	1.256	0.309	
1850.20	512	GSM 1900	GPRS	25.3	24.14	0.02	10 mm	E1205	2	1:4.15	bottom	0.448	1.306	0.585	
1880.00	661	GSM 1900	GPRS	25.3	24.31	-0.06	10 mm	E1205	2	1:4.15	bottom	0.544	1.256	0.683	A15
1909.80	810	GSM 1900	GPRS	25.3	24.21	0.00	10 mm	E1205	2	1:4.15	bottom	0.541	1.285	0.695	
1880.00	661	GSM 1900	GPRS	25.3	24.31	0.10	10 mm	E1205	2	1:4.15	right	0.035	1.256	0.044	
1880.00	661	GSM 1900	GPRS	25.3	24.31	0.01	10 mm	E1205	2	1:4.15	left	0.029	1.256	0.036	
826.40	4132	UMTS 850	RMC	25.0	24.26	0.01	10 mm	E1205	N/A	1:1	back	0.530	1.186	0.629	
836.60	4183	UMTS 850	RMC	25.0	24.20	0.00	10 mm	E1205	N/A	1:1	back	0.641	1.202	0.770	
846.60	4233	UMTS 850	RMC	25.0	24.16	0.02	10 mm	E1205	N/A	1:1	back	0.660	1.213	0.801	A17
836.60	4183	UMTS 850	RMC	25.0	24.20	-0.01	10 mm	E1205	N/A	1:1	front	0.461	1.202	0.554	
836.60	4183	UMTS 850	RMC	25.0	24.20	-0.05	10 mm	E1205	N/A	1:1	bottom	0.412	1.202	0.495	
836.60	4183	UMTS 850	RMC	25.0	24.20	-0.04	10 mm	E1205	N/A	1:1	right	0.279	1.202	0.335	
836.60	4183	UMTS 850	RMC	25.0	24.20	0.03	10 mm	E1205	N/A	1:1	left	0.089	1.202	0.107	
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 11-19
LTE Band 12 Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	-0.09	0	E1128	QPSK	1	25	10 mm	back	1:1	0.293	1.202	0.352	A19
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	0.02	1	E1128	QPSK	25	12	10 mm	back	1:1	0.237	1.172	0.278	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	0.03	0	E1128	QPSK	1	25	10 mm	front	1:1	0.242	1.202	0.291	
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	-0.06	1	E1128	QPSK	25	12	10 mm	front	1:1	0.197	1.172	0.231	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	-0.08	0	E1128	QPSK	1	25	10 mm	bottom	1:1	0.204	1.202	0.245	
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	-0.06	1	E1128	QPSK	25	12	10 mm	bottom	1:1	0.163	1.172	0.191	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	0.03	0	E1128	QPSK	1	25	10 mm	right	1:1	0.262	1.202	0.315	
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	-0.02	1	E1128	QPSK	25	12	10 mm	right	1:1	0.219	1.172	0.257	
707.50	23095	Mid	LTE Band 12	10	23.5	22.70	-0.01	0	E1128	QPSK	1	25	10 mm	left	1:1	0.095	1.202	0.114	
707.50	23095	Mid	LTE Band 12	10	22.5	21.81	0.02	1	E1128	QPSK	25	12	10 mm	left	1:1	0.079	1.172	0.093	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-20
LTE Band 13 Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	-0.03	0	E1128	QPSK	1	49	10 mm	back	1:1	0.406	1.253	0.509	A21
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	-0.04	1	E1128	QPSK	25	0	10 mm	back	1:1	0.328	1.227	0.402	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	-0.06	0	E1128	QPSK	1	49	10 mm	front	1:1	0.316	1.253	0.396	
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	-0.04	1	E1128	QPSK	25	0	10 mm	front	1:1	0.259	1.227	0.318	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	-0.09	0	E1128	QPSK	1	49	10 mm	bottom	1:1	0.254	1.253	0.318	
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	-0.09	1	E1128	QPSK	25	0	10 mm	bottom	1:1	0.207	1.227	0.254	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	-0.05	0	E1128	QPSK	1	49	10 mm	right	1:1	0.206	1.253	0.258	
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	0.01	1	E1128	QPSK	25	0	10 mm	right	1:1	0.186	1.227	0.228	
782.00	23230	Mid	LTE Band 13	10	23.5	22.52	0.10	0	E1128	QPSK	1	49	10 mm	left	1:1	0.063	1.253	0.079	
782.00	23230	Mid	LTE Band 13	10	22.5	21.61	0.04	1	E1128	QPSK	25	0	10 mm	left	1:1	0.054	1.227	0.066	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-21
LTE Band 5 (Cell) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	-0.01	0	E1205	QPSK	1	0	10 mm	back	1:1	0.454	1.288	0.585	A23
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	0.00	1	E1205	QPSK	25	12	10 mm	back	1:1	0.385	1.279	0.492	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	0.01	0	E1205	QPSK	1	0	10 mm	front	1:1	0.340	1.288	0.438	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	-0.01	1	E1205	QPSK	25	12	10 mm	front	1:1	0.286	1.279	0.366	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	0.01	0	E1205	QPSK	1	0	10 mm	bottom	1:1	0.261	1.288	0.336	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	-0.03	1	E1205	QPSK	25	12	10 mm	bottom	1:1	0.224	1.279	0.286	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	-0.03	0	E1205	QPSK	1	0	10 mm	right	1:1	0.211	1.288	0.272	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	-0.01	1	E1205	QPSK	25	12	10 mm	right	1:1	0.158	1.279	0.202	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	22.40	0.01	0	E1205	QPSK	1	0	10 mm	left	1:1	0.043	1.288	0.055	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	21.43	-0.02	1	E1205	QPSK	25	12	10 mm	left	1:1	0.041	1.279	0.052	
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 11-22
LTE Band 4 (AWS) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.45	-0.04	0	E1199	QPSK	1	0	10 mm	back	1:1	0.526	1.274	0.670	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.32	-0.01	0	E1199	QPSK	50	0	10 mm	back	1:1	0.489	1.312	0.642	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.45	0.02	0	E1199	QPSK	1	0	10 mm	front	1:1	0.393	1.274	0.501	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.32	0.06	0	E1199	QPSK	50	0	10 mm	front	1:1	0.352	1.312	0.462	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.45	-0.11	0	E1199	QPSK	1	0	10 mm	bottom	1:1	0.701	1.274	0.893	A25
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.32	-0.04	0	E1199	QPSK	50	0	10 mm	bottom	1:1	0.630	1.312	0.827	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.31	-0.05	0	E1199	QPSK	100	0	10 mm	bottom	1:1	0.593	1.315	0.780	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.45	-0.03	0	E1199	QPSK	1	0	10 mm	right	1:1	0.133	1.274	0.169	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.32	-0.12	0	E1199	QPSK	50	0	10 mm	right	1:1	0.122	1.312	0.160	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.45	-0.08	0	E1199	QPSK	1	0	10 mm	left	1:1	0.026	1.274	0.033	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.32	0.07	0	E1199	QPSK	50	0	10 mm	left	1:1	0.025	1.312	0.033	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-23
LTE Band 41 Hotspot SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.00	0	E1203	QPSK	1	0	10 mm	back	1:1.58	0.248	1.000	0.248	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	-0.04	0	E1203	QPSK	50	0	10 mm	back	1:1.58	0.240	1.000	0.240	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.01	0	E1203	QPSK	1	0	10 mm	front	1:1.58	0.210	1.000	0.210	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.05	0	E1203	QPSK	50	0	10 mm	front	1:1.58	0.206	1.000	0.206	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	-0.04	0	E1203	QPSK	1	0	10 mm	bottom	1:1.58	0.499	1.000	0.499	A27
2680.00	41490	High	LTE Band 41	20	23.0	23.00	-0.07	0	E1203	QPSK	50	0	10 mm	bottom	1:1.58	0.489	1.000	0.489	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.21	0	E1203	QPSK	1	0	10 mm	left	1:1.58	0.092	1.000	0.092	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.00	0	E1203	QPSK	50	0	10 mm	left	1:1.58	0.087	1.000	0.087	

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 11-24
WLAN Hotspot SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.	Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan W/kg	SAR (1g) (W/kg)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
2437	6	802.11b	DSSS	22	21.0	20.98	0.07	10 mm	1	E1084	1	back	98.9	0.374	0.389	1.005	1.011	0.395	
2437	6	802.11b	DSSS	22	21.0	20.98	0.18	10 mm	1	E1084	1	front	98.9	0.209	-	1.005	1.011	-	
2437	6	802.11b	DSSS	22	21.0	20.98	0.16	10 mm	1	E1084	1	top	98.9	0.454	0.409	1.005	1.011	0.416	
2437	6	802.11b	DSSS	22	21.0	20.98	0.21	10 mm	1	E1084	1	left	98.9	0.223	-	1.005	1.011	-	
2412	1	802.11b	DSSS	22	21.0	20.92	-0.01	10 mm	2	E1084	1	back	99.0	0.540	0.413	1.019	1.010	0.425	
2412	1	802.11b	DSSS	22	21.0	20.92	0.09	10 mm	2	E1084	1	front	99.0	0.352	-	1.019	1.010	-	
2412	1	802.11b	DSSS	22	21.0	20.92	-0.12	10 mm	2	E1084	1	top	99.0	0.641	0.478	1.019	1.010	0.492	A29
2412	1	802.11b	DSSS	22	21.0	20.92	-0.14	10 mm	2	E1084	1	left	99.0	0.259	-	1.019	1.010	-	
5745	149	802.11a	OFDM	20	17.5	16.92	0.17	10 mm	1	E1084	6	back	93.5	0.273	0.125	1.143	1.070	0.153	
5745	149	802.11a	OFDM	20	17.5	16.92	0.18	10 mm	1	E1084	6	front	93.5	0.031	-	1.143	1.070	-	
5745	149	802.11a	OFDM	20	17.5	16.92	0.19	10 mm	1	E1084	6	top	93.5	0.162	-	1.143	1.070	-	
5745	149	802.11a	OFDM	20	17.5	16.92	0.11	10 mm	1	E1084	6	left	93.5	0.013	-	1.143	1.070	-	
5825	165	802.11a	OFDM	20	17.5	16.71	0.06	10 mm	2	E1084	6	back	93.5	0.770	0.325	1.199	1.070	0.417	A31
5825	165	802.11a	OFDM	20	17.5	16.71	0.18	10 mm	2	E1084	6	front	93.5	0.131	-	1.199	1.070	-	
5825	165	802.11a	OFDM	20	17.5	16.71	0.18	10 mm	2	E1084	6	top	93.5	0.137	-	1.199	1.070	-	
5825	165	802.11a	OFDM	20	17.5	16.71	0.16	10 mm	2	E1084	6	left	93.5	0.190	0.054	1.199	1.070	0.069	

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 11-25
DTS MIMO Hotspot SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.	Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan W/kg	SAR (1g) (W/kg)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
2417	2	802.11n	OFDM	20	18.0	17.69	18.0	17.98	0.13	10 mm	E1084	13	back	98.7	0.299	0.264	1.074	1.013	0.287	
2417	2	802.11n	OFDM	20	18.0	17.69	18.0	17.98	0.11	10 mm	E1084	13	front	98.7	0.182	-	1.074	1.013	-	
2417	2	802.11n	OFDM	20	18.0	17.69	18.0	17.98	0.21	10 mm	E1084	13	top	98.7	0.381	0.366	1.074	1.013	0.398	
2417	2	802.11n	OFDM	20	18.0	17.69	18.0	17.98	0.19	10 mm	E1084	13	left	98.7	0.214	-	1.074	1.013	-	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT	Body
Spatial Peak	1.6 W/kg (mW/g)
Uncontrolled Exposure/General Population	averaged over 1 gram

To achieve the 21 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 18 dBm.

Table 11-26
NII MIMO Hotspot SAR for Conditions with 2.4 GHz and 5 GHz WLAN SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.														W/kg	(W/kg)			(W/kg)	
5775	155	802.11ac	OFDM	80	14.0	13.67	14.0	13.81	0.10	10 mm	E1084	58.5	back	91.3	0.256	0.087	1.079	1.095	0.103	
5775	155	802.11ac	OFDM	80	14.0	13.67	14.0	13.81	0.20	10 mm	E1084	58.5	front	91.3	0.016	-	1.079	1.095	-	
5775	155	802.11ac	OFDM	80	14.0	13.67	14.0	13.81	0.18	10 mm	E1084	58.5	top	91.3	0.070	-	1.079	1.095	-	
5775	155	802.11ac	OFDM	80	14.0	13.67	14.0	13.81	0.20	10 mm	E1084	58.5	left	91.3	0.036	-	1.079	1.095	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram										

NII MIMO was additionally evaluated at the maximum allowed output power during operations with Simultaneous 2.4 GHz and 5 GHz WLAN. 2.4 GHz WIFI was not transmitting during the above evaluations.

Table 11-27
DSS Hotspot SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)			(W/kg)	
2441	39	Bluetooth	FHSS	16.5	16.42	-0.09	10 mm	E1084	1	back	77	0.075	1.019	1.299	0.099	A33
2441	39	Bluetooth	FHSS	16.5	16.42	0.13	10 mm	E1084	1	front	77	0.056	1.019	1.299	0.074	
2441	39	Bluetooth	FHSS	16.5	16.42	0.00	10 mm	E1084	1	top	77	0.071	1.019	1.299	0.094	
2441	39	Bluetooth	FHSS	16.5	16.42	-0.04	10 mm	E1084	1	left	77	0.044	1.019	1.299	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								

11.4 Standalone Phablet SAR Data

Table 11-28
GPRS Phablet SAR Data

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (10g)	Scaling Factor	Reported SAR (10g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1850.20	512	GSM 1900	GPRS	27.0	25.67	-0.13	0 mm	E1205	3	1:2.76	bottom	2.390	1.358	3.246	
1880.00	661	GSM 1900	GPRS	27.0	25.65	-0.06	0 mm	E1205	3	1:2.76	bottom	2.330	1.365	3.180	
1909.80	810	GSM 1900	GPRS	27.0	25.43	-0.13	0 mm	E1205	3	1:2.76	bottom	1.980	1.435	2.841	
1850.20	512	GSM 1900	GPRS	27.0	25.67	0.00	0 mm	E1205	3	1:2.76	bottom	2.410	1.358	3.273	A34
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Phablet 4.0 W/kg (mW/g) averaged over 10 grams							

Note: Blue entry indicates Variability measurement.

Table 11-29
LTE Phablet SAR Data

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (10g)	Scaling Factor	Reported SAR (10g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	0.00	0	E1203	QPSK	1	0	7 mm	back	1:1.58	0.313	1.002	0.314	
2680.00	41490	High	LTE Band 41	20	24.0	24.00	0.00	1	E1203	QPSK	50	50	7 mm	back	1:1.58	0.227	1.000	0.227	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	-0.01	0	E1203	QPSK	1	0	5 mm	front	1:1.58	0.328	1.002	0.329	
2680.00	41490	High	LTE Band 41	20	24.0	24.00	0.06	1	E1203	QPSK	50	50	5 mm	front	1:1.58	0.242	1.000	0.242	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	-0.02	0	E1203	QPSK	1	0	10 mm	bottom	1:1.58	0.431	1.002	0.432	
2680.00	41490	High	LTE Band 41	20	24.0	24.00	-0.05	1	E1203	QPSK	50	50	10 mm	bottom	1:1.58	0.316	1.000	0.316	
2680.00	41490	High	LTE Band 41	20	25.0	24.99	-0.05	0	E1203	QPSK	1	0	0 mm	left	1:1.58	0.452	1.002	0.453	
2680.00	41490	High	LTE Band 41	20	24.0	24.00	-0.07	1	E1203	QPSK	50	50	0 mm	left	1:1.58	0.352	1.000	0.352	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.06	0	E1203	QPSK	1	0	0 mm	back	1:1.58	0.958	1.000	0.958	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	-0.07	0	E1203	QPSK	50	0	0 mm	back	1:1.58	0.935	1.000	0.935	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.04	0	E1203	QPSK	1	0	0 mm	front	1:1.58	0.791	1.000	0.791	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.05	0	E1203	QPSK	50	0	0 mm	front	1:1.58	0.771	1.000	0.771	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.01	0	E1203	QPSK	1	0	0 mm	bottom	1:1.58	1.100	1.000	1.100	A35
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.03	0	E1203	QPSK	50	0	0 mm	bottom	1:1.58	1.070	1.000	1.070	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Phablet 4.0 W/kg (mW/g) averaged over 10 grams											

Table 11-30
WLAN Phablet SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (10g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (10g)	Plot #
MHz	Ch.													W/kg	(W/kg)			(W/kg)	
5300	60	802.11a	OFDM	20	18.0	17.65	-0.11	0 mm	1	E1084	6	back	93.5	21.769	1.200	1.084	1.070	1.392	
5300	60	802.11a	OFDM	20	18.0	17.65	0.10	0 mm	1	E1084	6	front	93.5	0.407	-	1.084	1.070	-	
5300	60	802.11a	OFDM	20	18.0	17.65	-0.12	0 mm	1	E1084	6	top	93.5	1.295	0.147	1.084	1.070	0.171	
5300	60	802.11a	OFDM	20	18.0	17.65	0.10	0 mm	1	E1084	6	left	93.5	0.146	-	1.084	1.070	-	
5260	52	802.11a	OFDM	20	18.0	17.32	-0.16	0 mm	2	E1084	6	back	93.5	18.988	1.340	1.169	1.070	**1.676**	
5280	56	802.11a	OFDM	20	18.0	17.15	-0.19	0 mm	2	E1084	6	back	93.5	19.683	1.220	1.216	1.070	1.587	
5300	60	802.11a	OFDM	20	18.0	17.15	-0.15	0 mm	2	E1084	6	back	93.5	19.172	1.240	1.216	1.070	1.613	
5260	52	802.11a	OFDM	20	18.0	17.32	0.10	0 mm	2	E1084	6	front	93.5	1.337	0.165	1.169	1.070	0.206	
5260	52	802.11a	OFDM	20	18.0	17.32	0.14	0 mm	2	E1084	6	top	93.5	1.311	-	1.169	1.070	-	
5260	52	802.11a	OFDM	20	18.0	17.32	0.10	0 mm	2	E1084	6	left	93.5	1.030	-	1.169	1.070	-	
5720	144	802.11a	OFDM	20	17.5	17.06	0.15	0 mm	1	E1084	6	back	93.5	7.892	0.567	1.107	1.070	0.672	
5720	144	802.11a	OFDM	20	17.5	17.06	0.12	0 mm	1	E1084	6	front	93.5	0.424	-	1.107	1.070	-	
5720	144	802.11a	OFDM	20	17.5	17.06	-0.11	0 mm	1	E1084	6	top	93.5	1.471	-	1.107	1.070	-	
5720	144	802.11a	OFDM	20	17.5	17.06	0.10	0 mm	1	E1084	6	left	93.5	0.265	-	1.107	1.070	-	
5620	124	802.11a	OFDM	20	17.5	16.78	-0.17	0 mm	2	E1084	6	back	93.5	16.735	1.280	1.180	1.070	1.616	
5620	124	802.11a	OFDM	20	17.5	16.78	0.10	0 mm	2	E1084	6	front	93.5	4.604	0.448	1.180	1.070	0.566	
5620	124	802.11a	OFDM	20	17.5	16.78	0.10	0 mm	2	E1084	6	top	93.5	2.795	-	1.180	1.070	-	
5620	124	802.11a	OFDM	20	17.5	16.78	0.10	0 mm	2	E1084	6	left	93.5	1.101	-	1.180	1.070	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Phablet 4.0 W/kg (mW/g) averaged over 10 grams										

Table 11-31
WLAN MIMO Phablet SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power (Ant 1) [dBm]	Conducted Power (Ant 1) [dBm]	Maximum Allowed Power (Ant 2) [dBm]	Conducted Power (Ant 2) [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (10g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (10g)	Plot #
MHz	Ch.															W/kg	(W/kg)			(W/kg)	
5260	52	802.11n	OFDM	20	18.0	17.45	18.0	17.27	-0.02	0 mm	MIMO	E1077	13	back	97.3	39.739	2.460	1.183	1.028	2.992	A36
5280	56	802.11n	OFDM	20	18.0	17.49	18.0	17.19	-0.01	0 mm	MIMO	E1077	13	back	97.3	36.255	2.390	1.205	1.028	2.961	
5320	64	802.11n	OFDM	20	18.0	17.54	18.0	17.25	0.00	0 mm	MIMO	E1077	13	back	97.3	18.563	2.250	1.189	1.028	2.750	
5320	64	802.11n	OFDM	20	18.0	17.54	18.0	17.25	0.12	0 mm	MIMO	E1077	13	front	97.3	1.692	-	1.189	1.028	-	
5320	64	802.11n	OFDM	20	18.0	17.54	18.0	17.25	-0.11	0 mm	MIMO	E1077	13	top	97.3	2.625	0.350	1.189	1.028	0.428	
5320	64	802.11n	OFDM	20	18.0	17.54	18.0	17.25	0.11	0 mm	MIMO	E1077	13	left	97.3	0.938	-	1.189	1.028	-	
5720	144	802.11n	OFDM	20	17.5	17.03	17.5	16.87	0.00	0 mm	MIMO	E1077	13	back	97.3	18.720	1.440	1.156	1.028	1.711	
5720	144	802.11n	OFDM	20	17.5	17.03	17.5	16.87	0.14	0 mm	MIMO	E1077	13	front	97.3	3.518	0.419	1.156	1.028	0.498	
5720	144	802.11n	OFDM	20	17.5	17.03	17.5	16.87	0.14	0 mm	MIMO	E1077	13	top	97.3	2.986	-	1.156	1.028	-	
5720	144	802.11n	OFDM	20	17.5	17.03	17.5	16.87	0.16	0 mm	MIMO	E1077	13	left	97.3	0.981	-	1.156	1.028	-	
5260	52	802.11n	OFDM	20	18.0	17.45	18.0	17.27	-0.05	0 mm	MIMO	E1077	13	back	97.3	12.605	2.430	1.183	1.028	2.955	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Phablet 4.0 W/kg (mW/g) averaged over 10 grams											

Note:

1. For channels 52, 56 and 64, to achieve the 21 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 18 dBm. For channel 144, to achieve the 20.5 dBm maximum allowed MIMO power shown in the documentation, each antenna transmits at a maximum allowed power of 17.5 dBm.
2. Blue entry indicates Variability measurement.

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 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 15 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01r03, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01v01r04, variability SAR tests were performed when the measured SAR results for a frequency band were greater than or equal to 0.8 W/kg for 1g and 2.0 W/kg for 10g. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v02r01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).
10. Per FCC KDB Publication 648474 D04v01r03, this device is considered a "phablet" since the diagonal dimension is > 160 mm and < 200 mm. Therefore, phablet SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.
11. This device utilizes power reduction for some wireless modes and technologies, as outlined in Section1.3. The maximum output power allowed for each transmitter and exposure condition was evaluated for SAR compliance based on expected use conditions and simultaneous transmission scenarios.

12. Unless otherwise noted, when 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds below.
13. Additional SAR tests for phablet SAR were evaluated per KDB 616217 Section 6 (See Section 6.9 for more information).

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D01v03r01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
3. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.

UMTS Notes:

1. UMTS mode in was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required per the 3G Test Reduction Procedure in KDB Publication 941225 D01v03r01.
2. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r04. The general test procedures used for testing can be found in Section 8.5.4.
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 KDB Publication 447498 D01v06, when the reported LTE Band 41 SAR measured at the highest output power channel in a given a test configuration was > 0.6 W/kg for 1g evaluations, testing at the other channels was required for such test configurations.
5. TDD LTE was tested per the guidance provided in FCC KDB Publication 941225 D05v02r04. Testing was performed using UL-DL configuration 0 with 6 UL subframes and 2 S subframes using extended cyclic prefix only and special subframe configuration 6. SAR tests were performed at maximum output power and worst-case transmission duty factor in extended cyclic prefix. Per 3GPP 36.211 Section 4, the duty factor for special subframe configuration 6 using extended cyclic prefix is 0.633.

WLAN Notes:

1. For held-to-ear, hotspot, and phablet operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg for 1g evaluations, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.

2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 8.6.5 for more information.
3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg for 1g evaluations. See Section 8.6.6 for more information.
4. Per KDB Publication 248227 D01v02r02, SAR for MIMO was evaluated by following the simultaneous SAR provisions from KDB Publication 447498 D01v06 by either evaluating the sum of the 1g SAR values of each antenna transmitting independently or making a SAR measurement with both antennas transmitting simultaneously. Please see Section 12 for complete analysis.
5. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.
6. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.
7. When 10-g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

Bluetooth Notes

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

12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

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

12.2 Simultaneous Transmission Procedures

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

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

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

12.3 Head SAR Simultaneous Transmission Analysis

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Head SAR	GSM 850	0.184	0.427	0.775	0.611	0.959	1.386
	GSM 1900	0.039	0.427	0.775	0.466	0.814	1.241
	UMTS 850	0.216	0.427	0.775	0.643	0.991	**1.418**
	LTE Band 12	0.120	0.427	0.775	0.547	0.895	1.322
	LTE Band 13	0.140	0.427	0.775	0.567	0.915	1.342
	LTE Band 5 (Cell)	0.142	0.427	0.775	0.569	0.917	1.344
	LTE Band 4 (AWS)	0.048	0.427	0.775	0.475	0.823	1.250
	LTE Band 41	0.050	0.427	0.775	0.477	0.825	1.252

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Head SAR	GSM 850	0.184	0.090	0.312	0.274	0.496	0.586
	GSM 1900	0.039	0.090	0.312	0.129	0.351	0.441
	UMTS 850	0.216	0.090	0.312	0.306	0.528	**0.618**
	LTE Band 12	0.120	0.090	0.312	0.210	0.432	0.522
	LTE Band 13	0.140	0.090	0.312	0.230	0.452	0.542
	LTE Band 5 (Cell)	0.142	0.090	0.312	0.232	0.454	0.544
	LTE Band 4 (AWS)	0.048	0.090	0.312	0.138	0.360	0.450
	LTE Band 41	0.050	0.090	0.312	0.140	0.362	0.452

Table 12-3
Simultaneous Transmission Scenario with 2.4 GHz WLAN MIMO and 5 GHz WLAN MIMO (Held to Ear)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN MIMO at 13 dBm SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
		1	2	3	4	1+2+3+4
Head SAR	GSM 850	0.184	0.768	0.090	0.312	1.354
	GSM 1900	0.039	0.768	0.090	0.312	1.209
	UMTS 850	0.216	0.768	0.090	0.312	**1.386**
	LTE Band 12	0.120	0.768	0.090	0.312	1.290
	LTE Band 13	0.140	0.768	0.090	0.312	1.310
	LTE Band 5 (Cell)	0.142	0.768	0.090	0.312	1.312
	LTE Band 4 (AWS)	0.048	0.768	0.090	0.312	1.218
	LTE Band 41	0.050	0.768	0.090	0.312	1.220

Table 12-4
Simultaneous Transmission Scenario with Bluetooth (Held to Ear)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Head SAR	GSM 850	0.184	0.903	1.087
	GSM 1900	0.039	0.903	0.942
	UMTS 850	0.216	0.903	**1.119**
	LTE Band 12	0.120	0.903	1.023
	LTE Band 13	0.140	0.903	1.043
	LTE Band 5 (Cell)	0.142	0.903	1.045
	LTE Band 4 (AWS)	0.048	0.903	0.951
	LTE Band 41	0.050	0.903	0.953

12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-5
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 1.5 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Body-Worn	GSM 850	0.290	0.142	0.170	0.432	0.460	0.602
	GSM 1900	0.335	0.142	0.170	0.477	0.505	0.647
	UMTS 850	0.374	0.142	0.170	0.516	0.544	0.686
	LTE Band 12	0.233	0.142	0.170	0.375	0.403	0.545
	LTE Band 13	0.296	0.142	0.170	0.438	0.466	0.608
	LTE Band 5 (Cell)	0.240	0.142	0.170	0.382	0.410	0.552
	LTE Band 4 (AWS)	0.394	0.142	0.170	0.536	0.564	**0.706**
	LTE Band 41	0.222	0.142	0.170	0.364	0.392	0.534

Table 12-6
Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 1.5 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Body-Worn	GSM 850	0.290	0.263	0.335	0.553	0.625	0.888
	GSM 1900	0.335	0.263	0.335	0.598	0.670	0.933
	UMTS 850	0.374	0.263	0.335	0.637	0.709	0.972
	LTE Band 12	0.233	0.263	0.335	0.496	0.568	0.831
	LTE Band 13	0.296	0.263	0.335	0.559	0.631	0.894
	LTE Band 5 (Cell)	0.240	0.263	0.335	0.503	0.575	0.838
	LTE Band 4 (AWS)	0.394	0.263	0.335	0.657	0.729	**0.992**
	LTE Band 41	0.222	0.263	0.335	0.485	0.557	0.820

Table 12-7
Simultaneous Transmission Scenario with 2.4 GHz WLAN MIMO and 5 GHz WLAN MIMO (Body-Worn at 1.5 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
		1	2	3	4	5	1+2+3+4+5
Body-Worn	GSM 850	0.290	0.142	0.170	0.263	0.335	1.200
	GSM 1900	0.335	0.142	0.170	0.263	0.335	1.245
	UMTS 850	0.374	0.142	0.170	0.263	0.335	1.284
	LTE Band 12	0.233	0.142	0.170	0.263	0.335	1.143
	LTE Band 13	0.296	0.142	0.170	0.263	0.335	1.206
	LTE Band 5 (Cell)	0.240	0.142	0.170	0.263	0.335	1.150
	LTE Band 4 (AWS)	0.394	0.142	0.170	0.263	0.335	**1.304**
	LTE Band 41	0.222	0.142	0.170	0.263	0.335	1.132

Table 12-8
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 1.5 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body-Worn	GSM 850	0.290	0.040	0.330
	GSM 1900	0.335	0.040	0.375
	UMTS 850	0.374	0.040	0.414
	LTE Band 12	0.233	0.040	0.273
	LTE Band 13	0.296	0.040	0.336
	LTE Band 5 (Cell)	0.240	0.040	0.280
	LTE Band 4 (AWS)	0.394	0.040	**0.434**
	LTE Band 41	0.222	0.040	0.262

12.5 Hotspot SAR Simultaneous Transmission Analysis

Table 12-9
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Hotspot SAR	GPRS 850	1.022	0.416	0.492	1.438	**1.514**	See Table Below
	GPRS 1900	0.695	0.416	0.492	1.111	1.187	See Table Below
	UMTS 850	0.801	0.416	0.492	1.217	1.293	See Table Below
	LTE Band 12	0.352	0.416	0.492	0.768	0.844	1.260
	LTE Band 13	0.509	0.416	0.492	0.925	1.001	1.417
	LTE Band 5 (Cell)	0.585	0.416	0.492	1.001	1.077	1.493
	LTE Band 4 (AWS)	0.893	0.416	0.492	1.309	1.385	See Table Below
	LTE Band 41	0.499	0.416	0.492	0.915	0.991	1.407

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	Back	1.022	0.287	**1.309**
	Front	0.589	0.398*	0.987
	Top	-	0.398	0.398
	Bottom	0.575	-	0.575
	Right	0.426	-	0.426
	Left	0.116	0.398*	0.514

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	Back	0.391	0.287	0.678
	Front	0.309	0.398*	**0.707**
	Top	-	0.398	0.398
	Bottom	0.695	-	0.695
	Right	0.044	-	0.044
	Left	0.036	0.398*	0.434

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	Back	0.801	0.287	**1.088**
	Front	0.554	0.398*	0.952
	Top	-	0.398	0.398
	Bottom	0.495	-	0.495
	Right	0.335	-	0.335
	Left	0.107	0.398*	0.505

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	Back	0.670	0.287	**0.957**
	Front	0.501	0.398*	0.899
	Top	-	0.398	0.398
	Bottom	0.893	-	0.893
	Right	0.169	-	0.169
	Left	0.033	0.398*	0.431

Table 12-10
Simultaneous Transmission Scenario with 5 GHz WLAN (Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Hotspot SAR	GPRS 850	1.022	0.153	0.417	1.175	1.439	**1.592**
	GPRS 1900	0.695	0.153	0.417	0.848	1.112	1.265
	UMTS 850	0.801	0.153	0.417	0.954	1.218	1.371
	LTE Band 12	0.352	0.153	0.417	0.505	0.769	0.922
	LTE Band 13	0.509	0.153	0.417	0.662	0.926	1.079
	LTE Band 5 (Cell)	0.585	0.153	0.417	0.738	1.002	1.155
	LTE Band 4 (AWS)	0.893	0.153	0.417	1.046	1.310	1.463
	LTE Band 41	0.499	0.153	0.417	0.652	0.916	1.069

Table 12-11
Simultaneous Transmission Scenario with 2.4 GHz WLAN MIMO and 5 GHz WLAN MIMO (Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN MIMO at 13 dBm SAR (W/kg)	Σ SAR (W/kg)
		1	2	3	1+2+3
Hotspot SAR	GPRS 850	1.022	0.398	0.103	**1.523**
	GPRS 1900	0.695	0.398	0.103	1.196
	UMTS 850	0.801	0.398	0.103	1.302
	LTE Band 12	0.352	0.398	0.103	0.853
	LTE Band 13	0.509	0.398	0.103	1.010
	LTE Band 5 (Cell)	0.585	0.398	0.103	1.086
	LTE Band 4 (AWS)	0.893	0.398	0.103	1.394
	LTE Band 41	0.499	0.398	0.103	1.000

Table 12-12
Simultaneous Transmission Scenario with Bluetooth (Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	GPRS 850	1.022	0.099	**1.121**
	GPRS 1900	0.695	0.099	0.794
	UMTS 850	0.801	0.099	0.900
	LTE Band 12	0.352	0.099	0.451
	LTE Band 13	0.509	0.099	0.608
	LTE Band 5 (Cell)	0.585	0.099	0.684
	LTE Band 4 (AWS)	0.893	0.099	0.992
	LTE Band 41	0.499	0.099	0.598

12.6 Phablet Simultaneous Transmission Analysis

Per FCC KDB Publication 648474 D04 Handset SAR, Phablet SAR tests were not required if wireless router 1g SAR (scaled to the maximum output power, including tolerance) < 1.2 W/kg. Therefore, no further analysis beyond the tables included in this section was required to determine that possible simultaneous transmission scenarios would not exceed the SAR limit.

For SAR summation, the highest reported SAR across all test distances was used as the most conservative evaluation for simultaneous transmission analysis for each device edge.

Table 12-13
Simultaneous Transmission Scenario with 5 GHz WLAN (Phablet)

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Phablet SAR	Back	-	1.392	1.676	1.392	**1.676**	3.068
	Front	-	1.392*	0.566	1.392	0.566	1.958
	Top	-	0.171	1.676*	0.171	1.676	1.847
	Bottom	3.273	-	-	**3.273**	**3.273**	**3.273**
	Left	-	1.392*	1.676*	1.392	1.676	3.068

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	1+2	1+3
Phablet SAR	Back	0.958	1.392	1.676	2.350	**2.634**
	Front	0.791	1.392*	0.566	2.183	1.357
	Top	-	0.171	1.676*	0.171	1.676
	Bottom	1.100	-	-	1.100	1.100
	Left	0.453	1.392*	1.676*	1.845	2.129

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Phablet SAR	Back	0.958	2.992	**3.950**
	Front	0.791	0.498	1.289
	Top	-	0.428	0.428
	Bottom	1.100	-	1.100
	Left	0.453	2.992*	3.445

12.7 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 D01v06 and IEEE 1528-2013 Section 6.3.4.1.2.

13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

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

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

1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2) A second repeated measurement was preformed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1g SAR limit).
3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg
5) When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

Table 13-1
Phablet SAR Measurement Variability Results

PHABLET VARIABILITY RESULTS															
Band	FREQUENCY		Mode	Service	# of Time Slots	Data Rate (Mbps)	Side	Spacing	Measured SAR (10g)	1st Repeated SAR (10g)	Ratio	2nd Repeated SAR (10g)	Ratio	3rd Repeated SAR (10g)	Ratio
	MHz	Ch.							(W/kg)	(W/kg)		(W/kg)		(W/kg)	
1900	1850.20	512	GSM 1900	GPRS	3	N/A	bottom	0 mm	2.390	2.410	1.01	N/A	N/A	N/A	N/A
5250	5260.00	52	802.11n, 20 MHz Bandwidth	OFDM, MIMO	N/A	13	back	0 mm	2.460	2.430	1.01	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Phablet 4.0 W/kg (mW/g) averaged over 10 grams						

13.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for 1g and <3.75 W/kg for 10g for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8753ES	S-Parameter Vector Network Analyzer	8/17/2017	Annual	8/17/2018	MY40003841
Agilent	E4432B	ESG-D Series Signal Generator	4/19/2018	Annual	4/19/2019	US40053896
Agilent	E4438C	ESG Vector Signal Generator	3/24/2017	Biennial	3/24/2019	MY42082385
Agilent	E5515C	8960 Series 10 Wireless Communications Test Set	11/15/2017	Annual	11/15/2018	GB42230325
Agilent	E5515C	Wireless Communications Test Set	5/22/2018	Biennial	5/22/2020	GB43193563
Agilent	E5515C	Wireless Communications Test Set	2/7/2018	Triennial	2/7/2021	GB43304447
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB44450273
Agilent	N5182A	MXG Vector Signal Generator	11/1/2017	Annual	11/1/2018	MY47420603
Agilent	N5182A	MXG Vector Signal Generator	1/24/2018	Annual	1/24/2019	MY47420651
Agilent	N5182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Agilent	N5182A-506	MXG Vector Signal	6/19/2018	Annual	6/19/2019	MY48180366
Agilent	N9020A	MXA Signal Analyzer	1/24/2018	Annual	1/24/2019	US46470561
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Anritsu	MA24106A	USB Power Sensor	6/5/2018	Annual	6/5/2019	1231535
Anritsu	MA24106A	USB Power Sensor	6/5/2018	Annual	6/5/2019	1231538
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1339018
Anritsu	ML2495A	Power Meter	10/22/2017	Annual	10/22/2018	941001
Anritsu	ML2495A	Power Meter	11/28/2017	Annual	11/28/2018	1039008
Anritsu	MT8820C	Radio Communication Analyzer	3/20/2018	Annual	3/20/2019	6201144419
Anritsu	MT8862A	Wireless Connectivity Test Set	7/3/2018	Annual	7/3/2019	6261782395
Control Company	4040	Therm./ Clock/ Humidity Monitor	3/1/2017	Biennial	3/1/2019	170152009
Control Company	4352	Ultra Long Stem Thermometer	3/3/2017	Biennial	3/3/2019	170155534
Mini Circuits	PWR-4GHS	USB Power Sensor	1/22/2018	Annual	1/22/2019	11710030062
Mini Circuits	PWR-4GHS	USB Power Sensor	1/20/2018	Annual	1/20/2019	11710030063
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mitutoyo	CD-6"CSX	Digital Caliper	4/18/2018	Biennial	4/18/2020	13264165
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	NC-100	Torque Wrench	4/18/2018	Annual	4/18/2019	1445
Rohde & Schwarz	CMW500	Radio Communication Tester	11/3/2017	Annual	11/3/2018	100976
Rohde & Schwarz	CMW500	Radio Communication Tester	10/13/2017	Annual	10/13/2018	102060
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	1/19/2018	Annual	1/19/2019	164948
Seekonk	NC-100	Torque Wrench (8" lb)	5/10/2018	Biennial	5/10/2020	21053
SPEAG	D750V3	750 MHz SAR Dipole	7/13/2016	Triennial	7/13/2019	1161
SPEAG	D835V2	835 MHz SAR Dipole	7/13/2016	Triennial	7/13/2019	4d047
SPEAG	D835V2	835 MHz SAR Dipole	7/11/2017	Biennial	7/11/2019	4d133
SPEAG	D1750V2	1750 MHz SAR Dipole	5/9/2017	Biennial	5/9/2019	1148
SPEAG	D1765V2	1765 MHz SAR Dipole	5/23/2018	Annual	5/23/2019	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	7/8/2016	Triennial	7/8/2019	5d080
SPEAG	D1900V2	1900 MHz SAR Dipole	2/7/2018	Annual	2/7/2019	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	8/17/2017	Biennial	8/17/2019	719
SPEAG	D2450V2	2450 MHz SAR Dipole	9/11/2017	Annual	9/11/2018	797
SPEAG	D2600V2	2600 MHz SAR Dipole	6/7/2017	Biennial	6/7/2019	1064
SPEAG	D2600V2	2600 MHz SAR Dipole	9/13/2016	Biennial	9/13/2018	1071
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/21/2016	Biennial	9/21/2018	1191
SPEAG	D5GHzV2	5 GHz SAR Dipole	8/15/2017	Annual	8/15/2018	1237
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/22/2018	Annual	5/22/2019	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/9/2018	Annual	2/9/2019	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/9/2017	Annual	8/9/2018	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/7/2018	Annual	3/7/2019	1368
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/11/2018	Annual	4/11/2019	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/9/2017	Annual	11/9/2018	1450
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/12/2017	Annual	9/12/2018	1091
SPEAG	ES3DV3	SAR Probe	2/13/2018	Annual	2/13/2019	3213
SPEAG	ES3DV3	SAR Probe	3/13/2018	Annual	3/13/2019	3319
SPEAG	ES3DV3	SAR Probe	8/14/2017	Annual	8/14/2018	3332
SPEAG	ES3DV3	SAR Probe	3/27/2018	Annual	3/27/2019	3347
SPEAG	EX3DV4	SAR Probe	4/18/2018	Annual	4/18/2019	7357
SPEAG	EX3DV4	SAR Probe	5/22/2018	Annual	5/22/2019	7406
SPEAG	EX3DV4	SAR Probe	6/25/2018	Annual	6/25/2019	7409

Note:

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

15 MEASUREMENT UNCERTAINTIES

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

16 CONCLUSION

16.1 Measurement Conclusion

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

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

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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1209

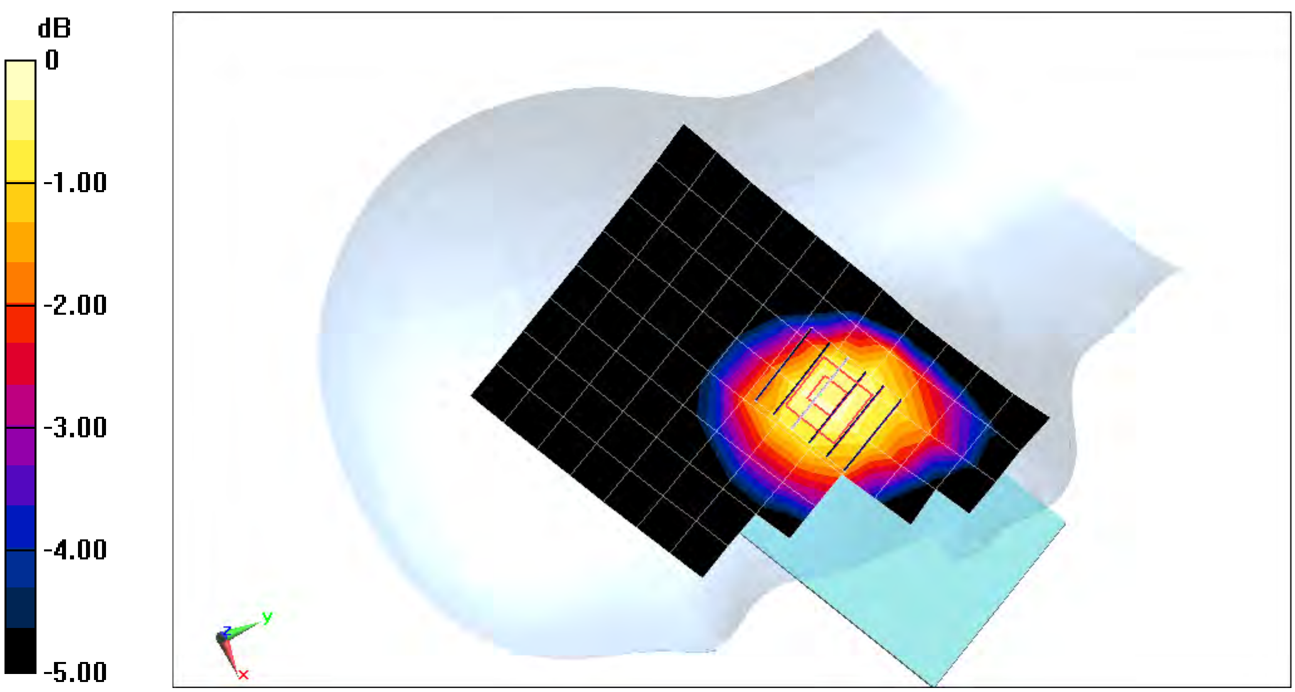
Communication System: UID 0, GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.928 S/m; ε_r = 41.535; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-16-2018; Ambient Temp: 21.9°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3213; ConvF(6.42, 6.42, 6.42); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.34 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.193 W/kg
SAR(1 g) = 0.153 W/kg



0 dB = 0.170 W/kg = -7.70 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1209

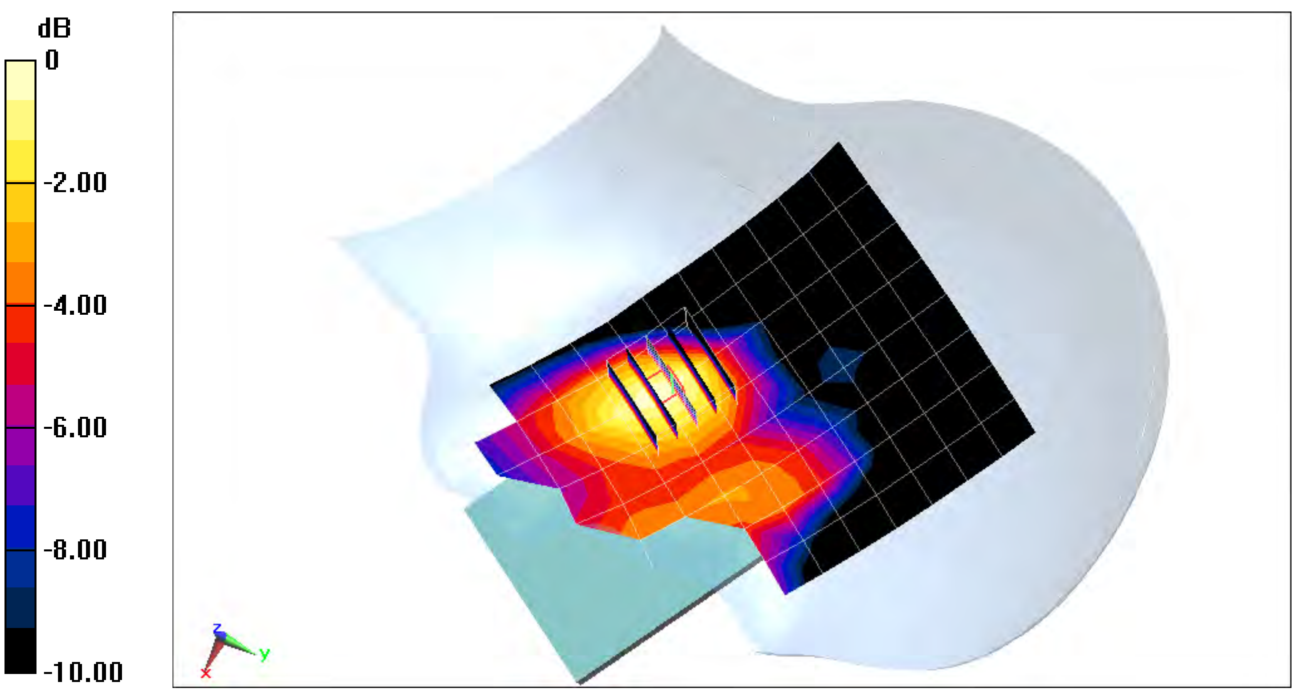
Communication System: UID 0, GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: 1900 Head; Medium parameters used:
$f = 1880$ MHz; $\sigma = 1.446$ S/m; $\varepsilon_r = 40.05$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

Test Date: 07-12-2018; Ambient Temp: 24.0°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3213; ConvF(5.3, 5.3, 5.3); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.819 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.0510 W/kg
SAR(1 g) = 0.032 W/kg



0 dB = 0.0364 W/kg = -14.39 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1209

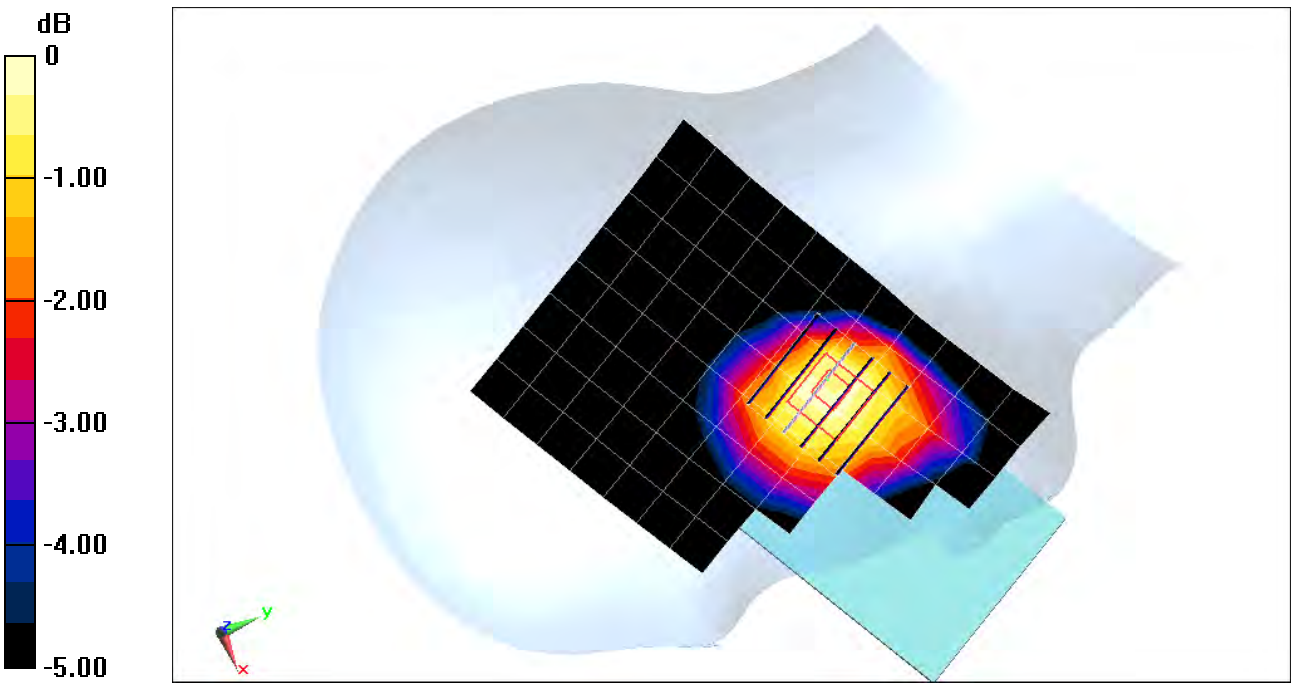
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Head; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.928 S/m; ε_r = 41.535; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-16-2018; Ambient Temp: 21.9°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3213; ConvF(6.42, 6.42, 6.42); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.46 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.233 W/kg
SAR(1 g) = 0.180 W/kg



0 dB = 0.199 W/kg = -7.01 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

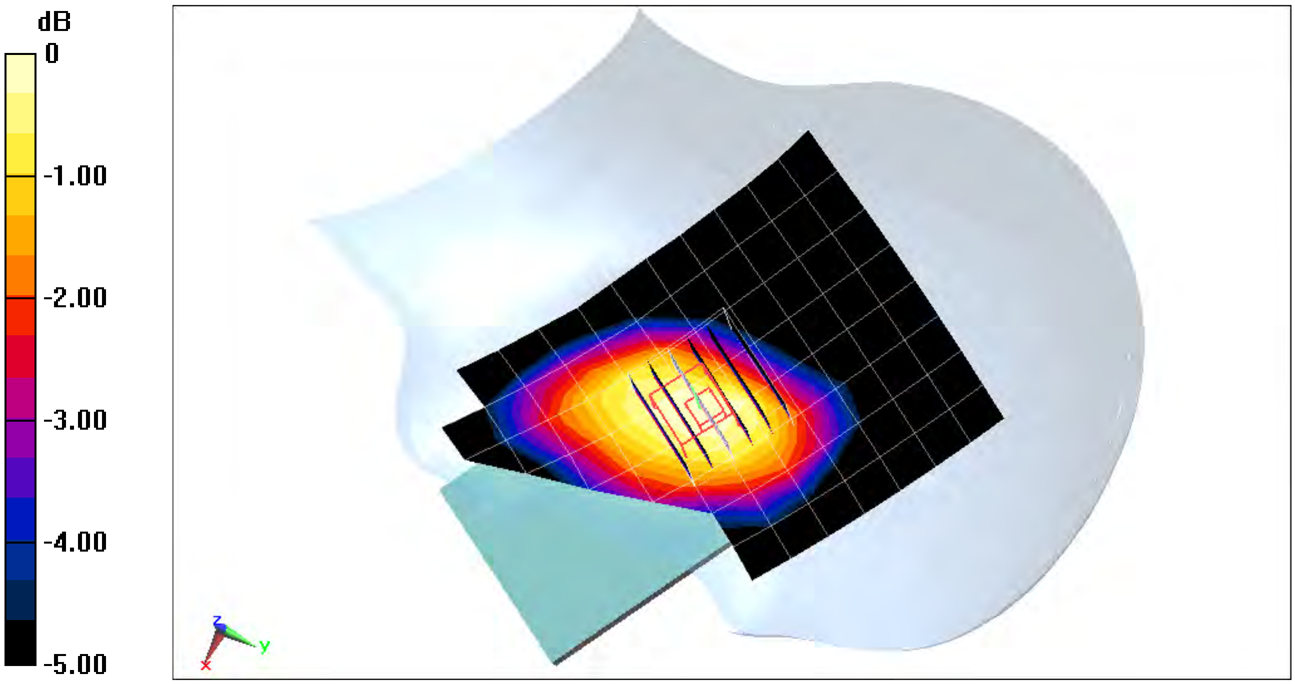
Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Head; Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.876 S/m; ε_r = 40.607; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 07-19-2018; Ambient Temp: 22.0°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3213; ConvF(6.75, 6.75, 6.75); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.40 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.127 W/kg
SAR(1 g) = 0.100 W/kg



0 dB = 0.110 W/kg = -9.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

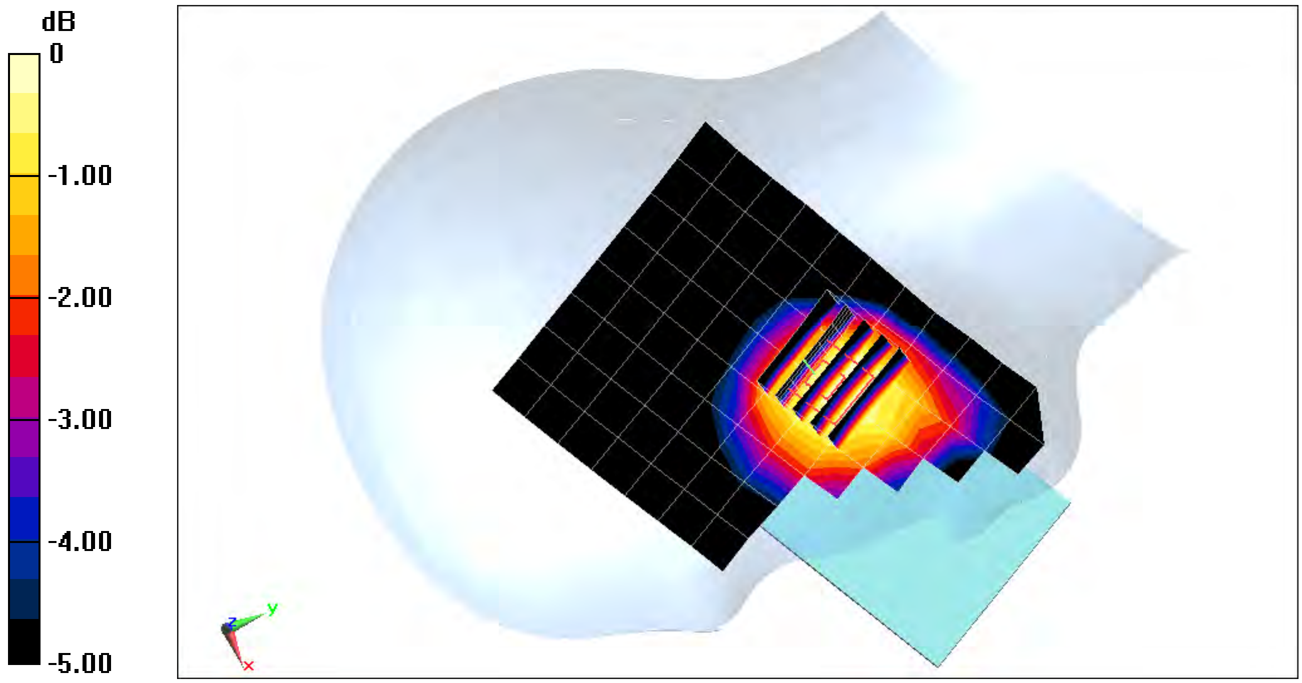
Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: 750 Head; Medium parameters used (interpolated):
f = 782 MHz; σ = 0.903 S/m; ε_r = 40.341; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-19-2018; Ambient Temp: 22.0°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3213; ConvF(6.75, 6.75, 6.75); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: LTE Band 13, Right Head, Cheek, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.84 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.143 W/kg
SAR(1 g) = 0.112 W/kg



0 dB = 0.122 W/kg = -9.14 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1209

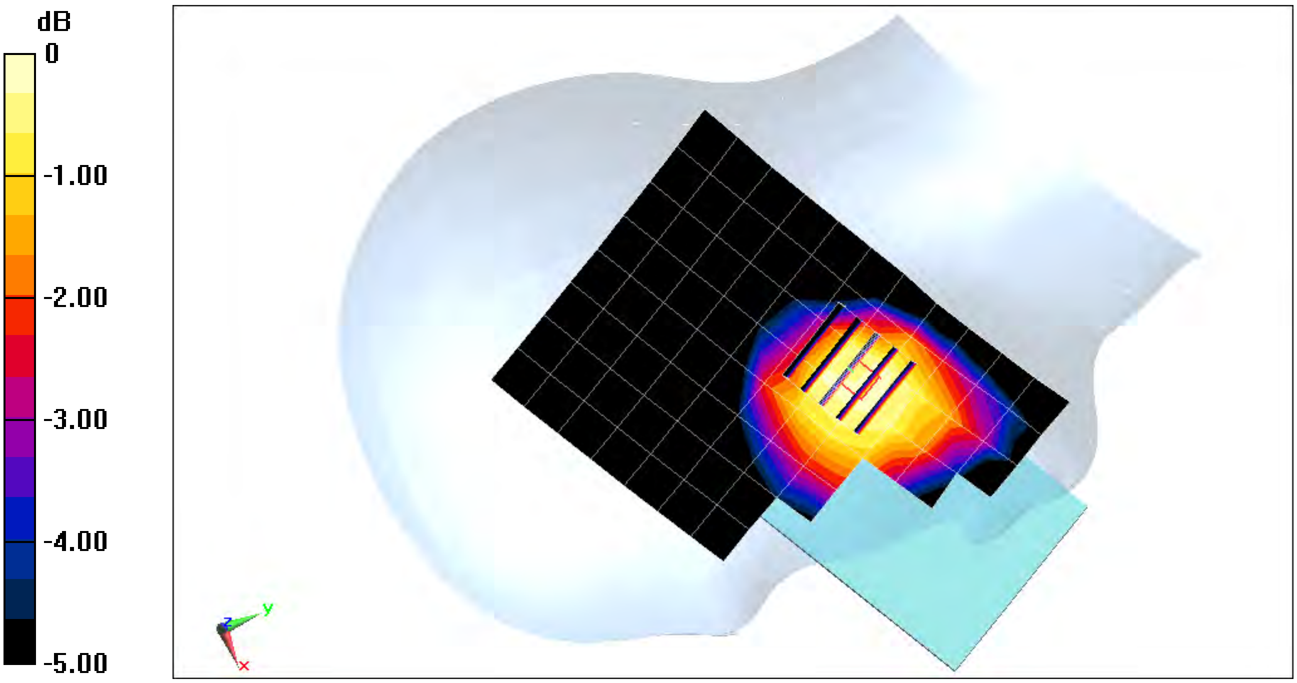
Communication System: UID 0, LTE Band 5 (Cell.); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Head; Medium parameters used (interpolated):
$f = 836.5$ MHz; $\sigma = 0.927$ S/m; $\varepsilon_r = 41.536$; $\rho = 1000$ kg/m^3
Phantom section: Right Section

Test Date: 07-16-2018; Ambient Temp: 21.9°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3213; ConvF(6.42, 6.42, 6.42); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.77 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.141 W/kg
SAR(1 g) = 0.110 W/kg



0 dB = 0.121 W/kg = -9.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1199

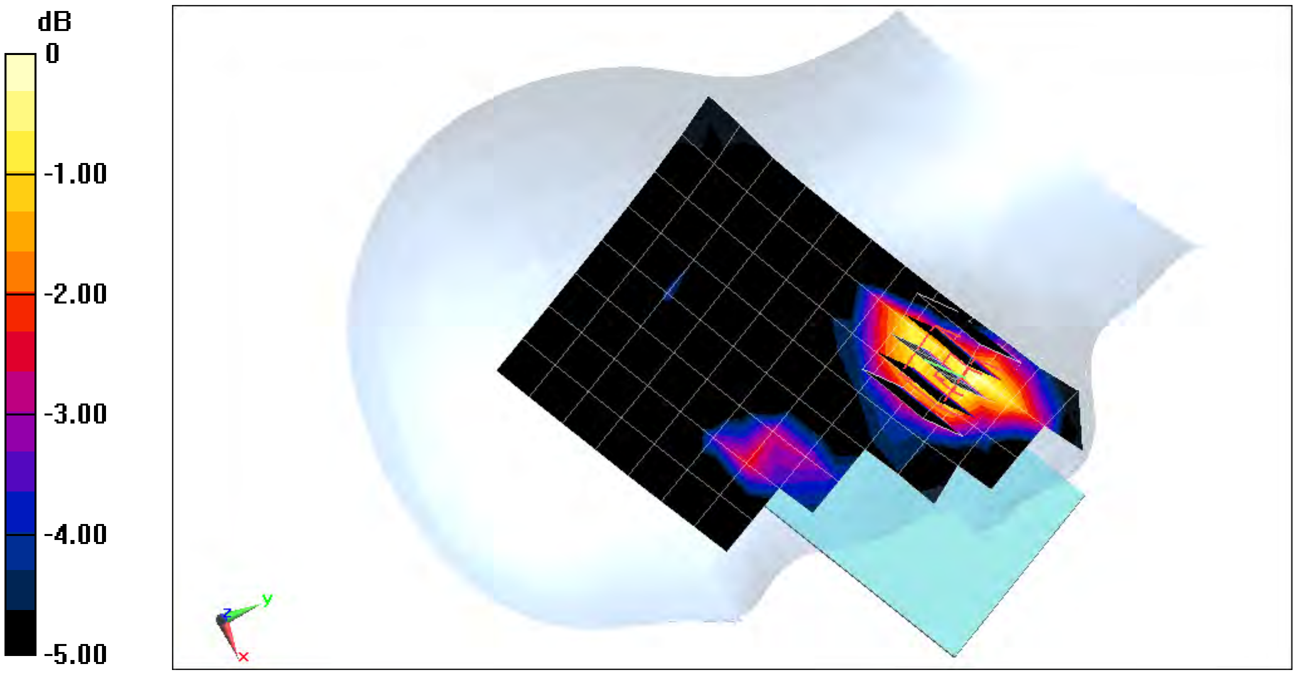
Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Head; Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.32 S/m; ε_r = 41.207; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-16-2018; Ambient Temp: 21.3°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7409; ConvF(8.43, 8.43, 8.43); Calibrated: 6/25/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM with CRP (Left); Type: SAM; Serial: 1715
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: LTE Band 4 (AWS), Right Head, Cheek, Mid.ch
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.737 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.0570 W/kg
SAR(1 g) = 0.037 W/kg



0 dB = 0.0502 W/kg = -12.99 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1203

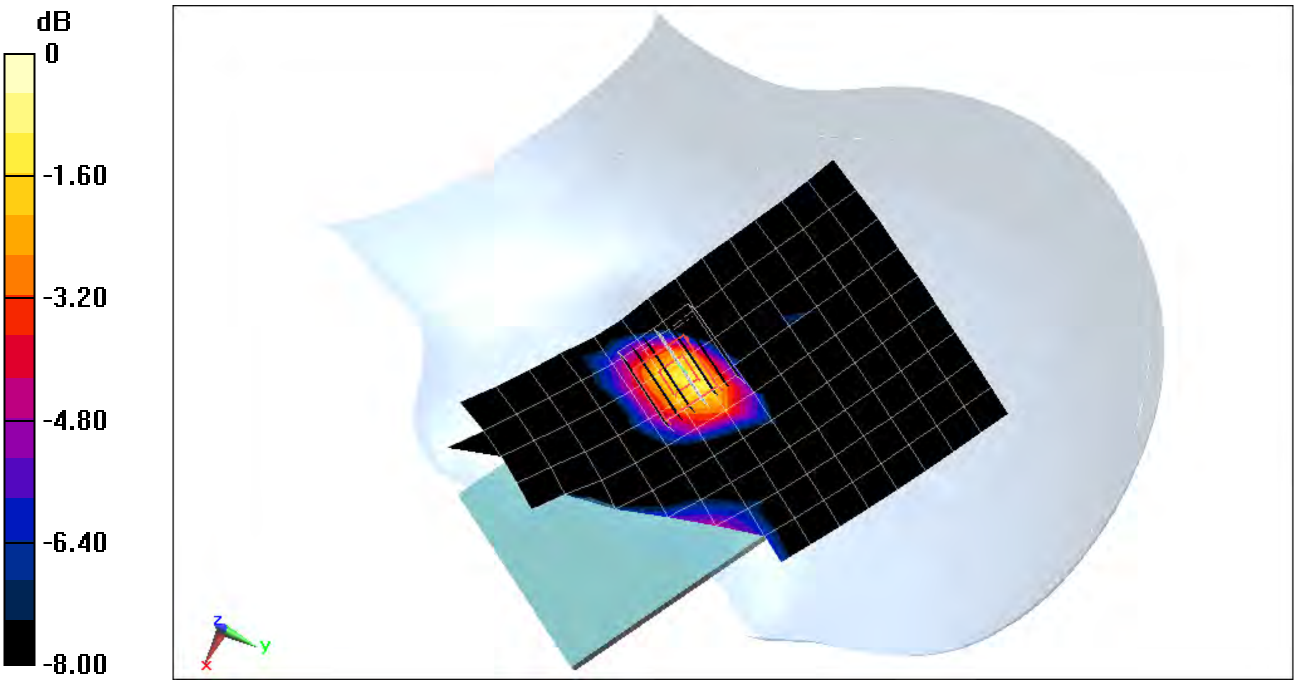
Communication System: UID 0, LTE Band 41 (Class 3); Frequency: 2680 MHz; Duty Cycle: 1:1.58
Medium: 2450 Head; Medium parameters used (interpolated):
f = 2680 MHz; σ = 2.115 S/m; ε_r = 38.912; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 08-03-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.5°C

Probe: ES3DV3 - SN3332; ConvF(4.56, 4.56, 4.56); Calibrated: 8/14/2017;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 8/9/2017
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

**Mode: LTE Band 41, Left Head, Cheek, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

Area Scan (10x17x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.642 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.0960 W/kg
SAR(1 g) = 0.050 W/kg



0 dB = 0.0500 W/kg = -13.01 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1077

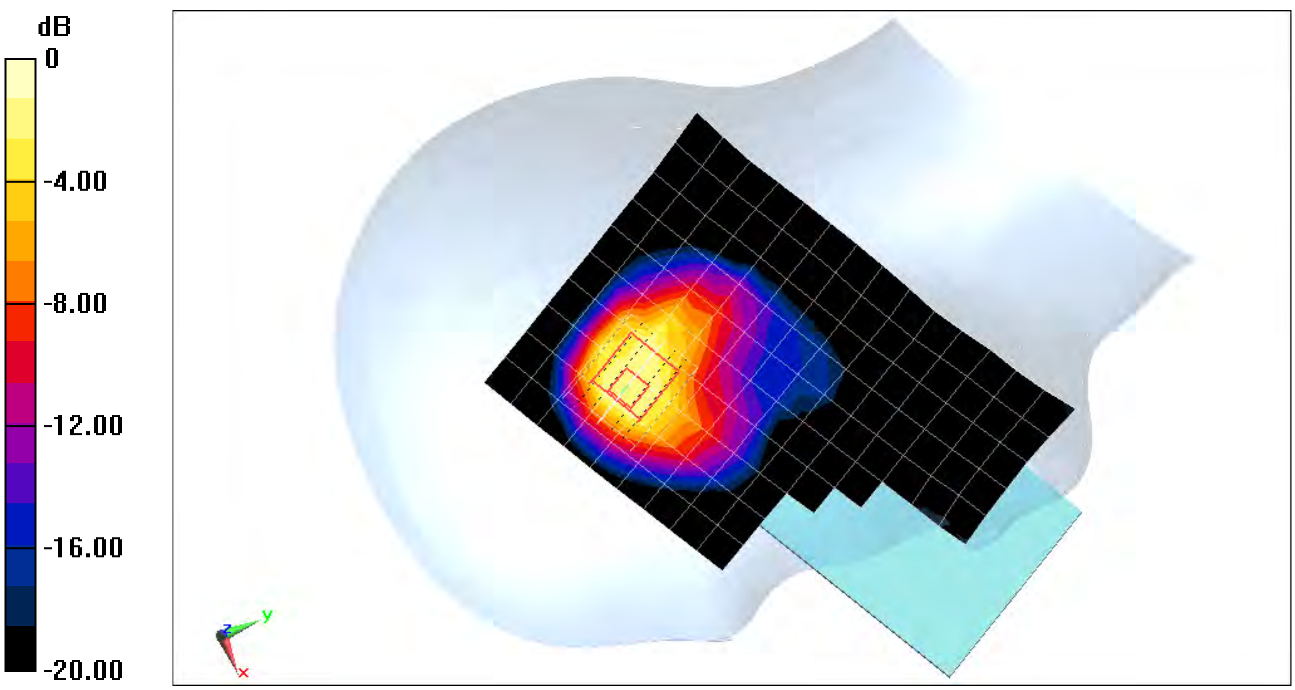
Communication System: UID 0, _IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: 2450 Head; Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.865 S/m; ε_r = 38.984; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-16-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.5°C

Probe: ES3DV3 - SN3332; ConvF(4.68, 4.68, 4.68); Calibrated: 8/14/2017;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 8/9/2017
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Antenna 2,
Right Head, Cheek, Ch 11, 1 Mbps

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.41 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 1.82 W/kg
SAR(1 g) = 0.756 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1083

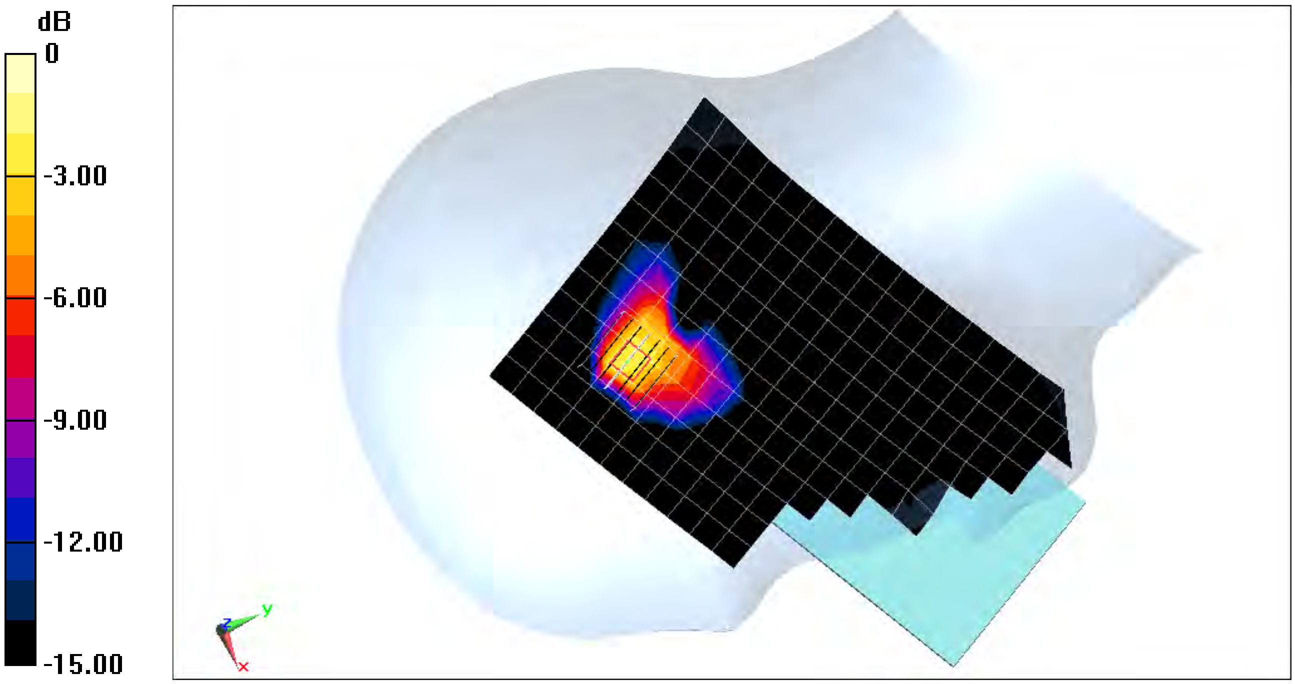
Communication System: UID 0, 802.11ac 5.2-5.8 GHz Band; Frequency: 5690 MHz; Duty Cycle: 1:1
Medium: 5GHz Head; Medium parameters used (interpolated):
$f = 5690$ MHz; $\sigma = 5.069$ S/m; $\varepsilon_r = 34.975$; $\rho = 1000$ kg/m^3
Phantom section: Right Section

Test Date: 07-19-2018; Ambient Temp: 23.5°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7409; ConvF(4.82, 4.82, 4.82); Calibrated: 6/25/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM with CRP (Left); Type: SAM; Serial: 1715
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: IEEE 802.11ac, U-NII-2C, 80 MHz Bandwidth, Antenna 2
Right Head, Cheek, Ch 138, 29.3 Mbps

Area Scan (13x22x1): 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 = 1.336 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 1.64 W/kg
SAR(1 g) = 0.289 W/kg



0 dB = 0.889 W/kg = -0.51 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1083

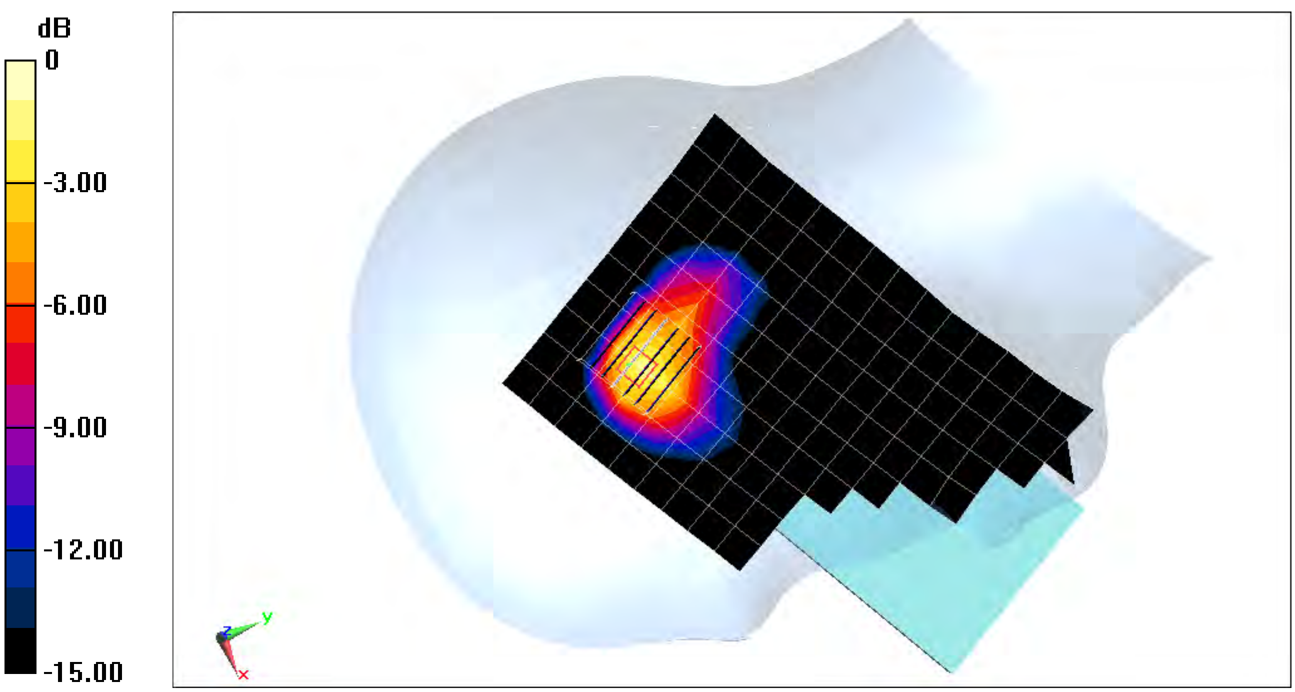
Communication System: UID 0, Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1.299
Medium: 2450 Head; Medium parameters used (interpolated):
f = 2441 MHz; σ = 1.843 S/m; ε_r = 38.873; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-18-2018; Ambient Temp: 22.7°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3332; ConvF(4.68, 4.68, 4.68); Calibrated: 8/14/2017;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 8/9/2017
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: Bluetooth, Right Head, Tilt, Ch 39, 1 Mbps

Area Scan (11x19x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.01 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.83 W/kg
SAR(1 g) = 0.682 W/kg



0 dB = 0.959 W/kg = -0.18 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

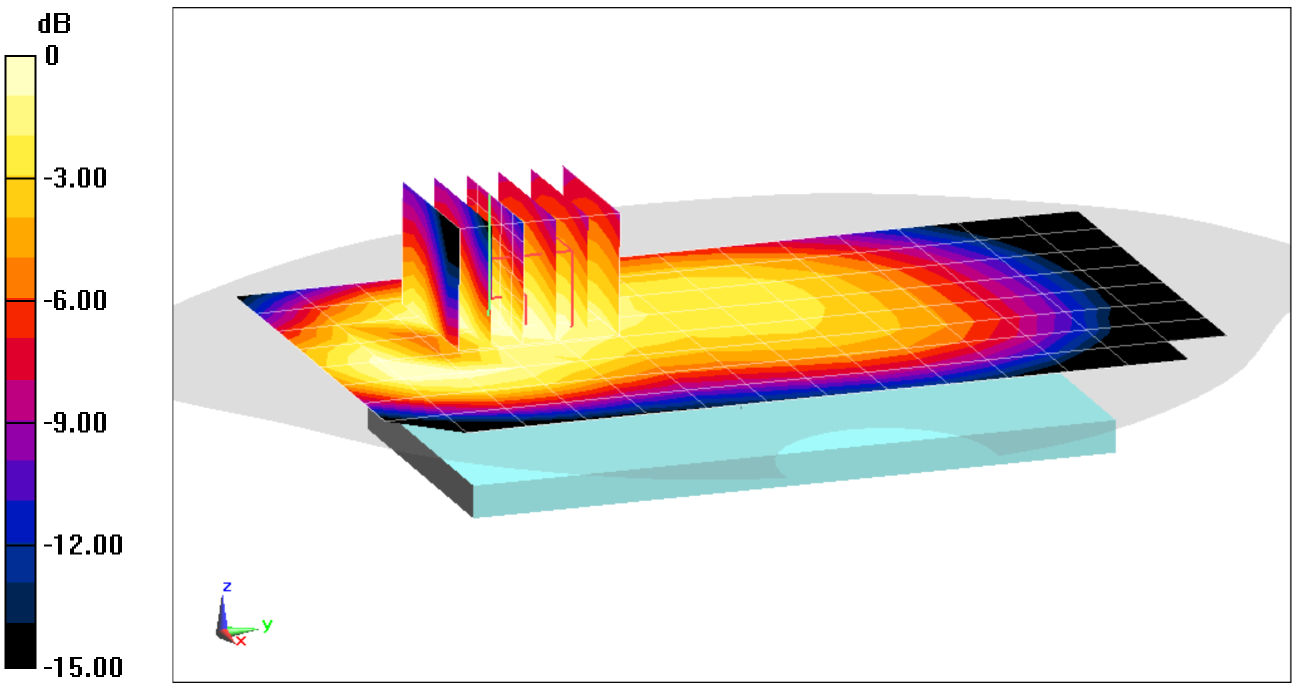
Communication System: UID 0, GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.999 S/m; ε_r = 53.481; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 20.4°C; Tissue Temp: 20.0°C

Probe: ES3DV3 - SN3347; ConvF(6.37, 6.37, 6.37); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: GSM 850, Body SAR, Back Side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.28 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.332 W/kg
SAR(1 g) = 0.241 W/kg



0 dB = 0.271 W/kg = -5.67 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

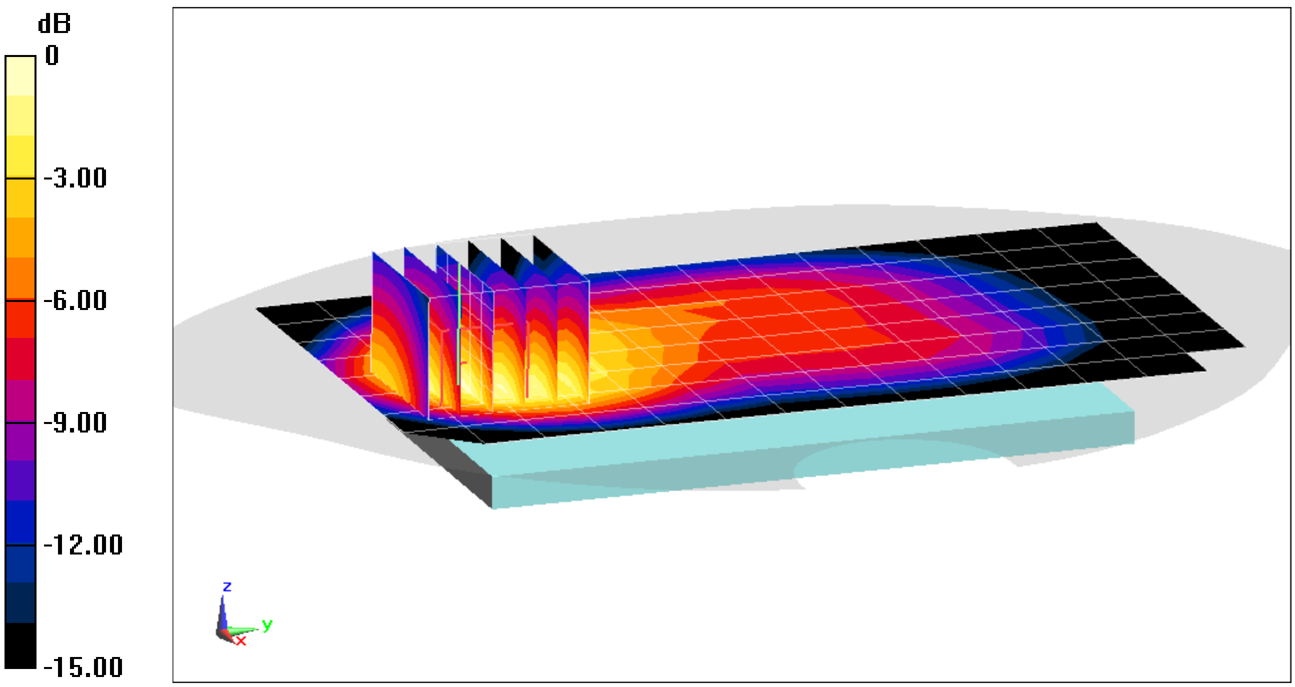
Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 848.8 MHz; Duty Cycle: 1:4.15
Medium: 835 Body; Medium parameters used (interpolated):
f = 848.8 MHz; σ = 1.004 S/m; ε_r = 53.455; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-23-2018; Ambient Temp: 20.4°C; Tissue Temp: 20.0°C

Probe: ES3DV3 - SN3347; ConvF(6.37, 6.37, 6.37); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: GPRS 850, Body SAR, Back Side, High.ch, 2 Tx Slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.06 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.727 W/kg



0 dB = 0.876 W/kg = -0.57 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

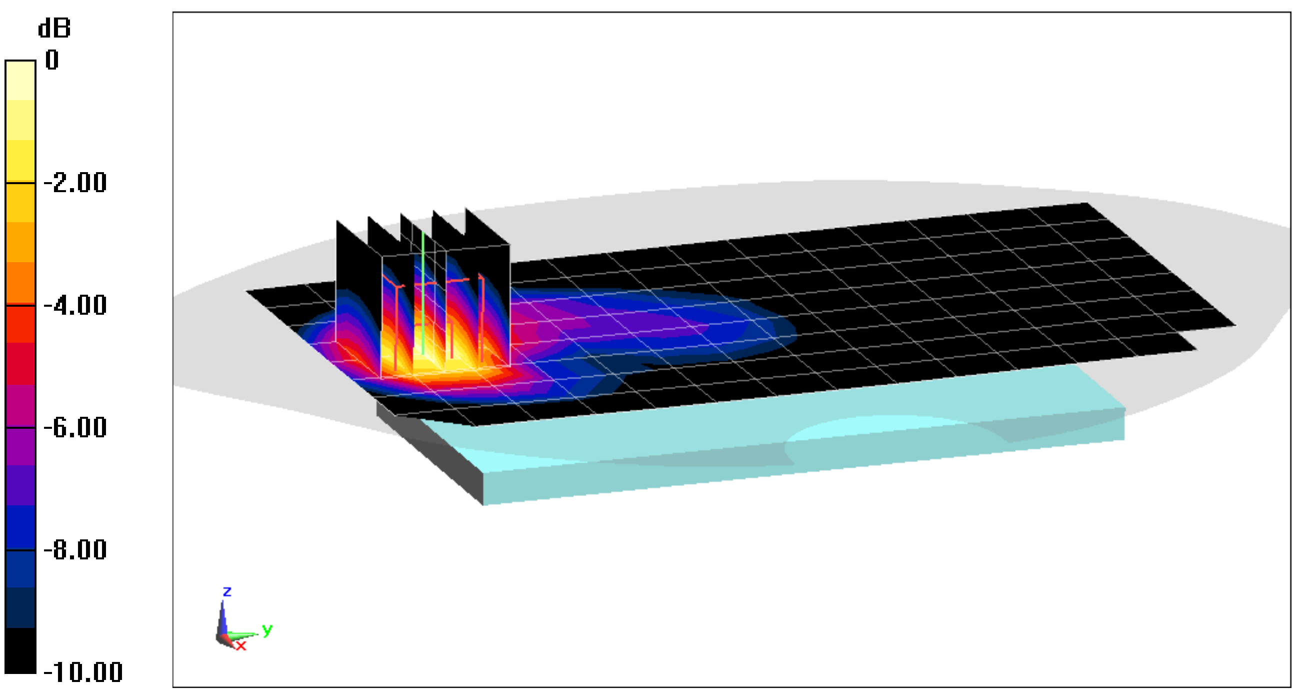
Communication System: UID 0, GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.541 S/m; ε_r = 51.653; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-16-2018; Ambient Temp: 21.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7406; ConvF(7.74, 7.74, 7.74); Calibrated: 5/22/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/22/2018
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: GSM 1900, Body SAR, Back Side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.99 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.451 W/kg
SAR(1 g) = 0.277 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

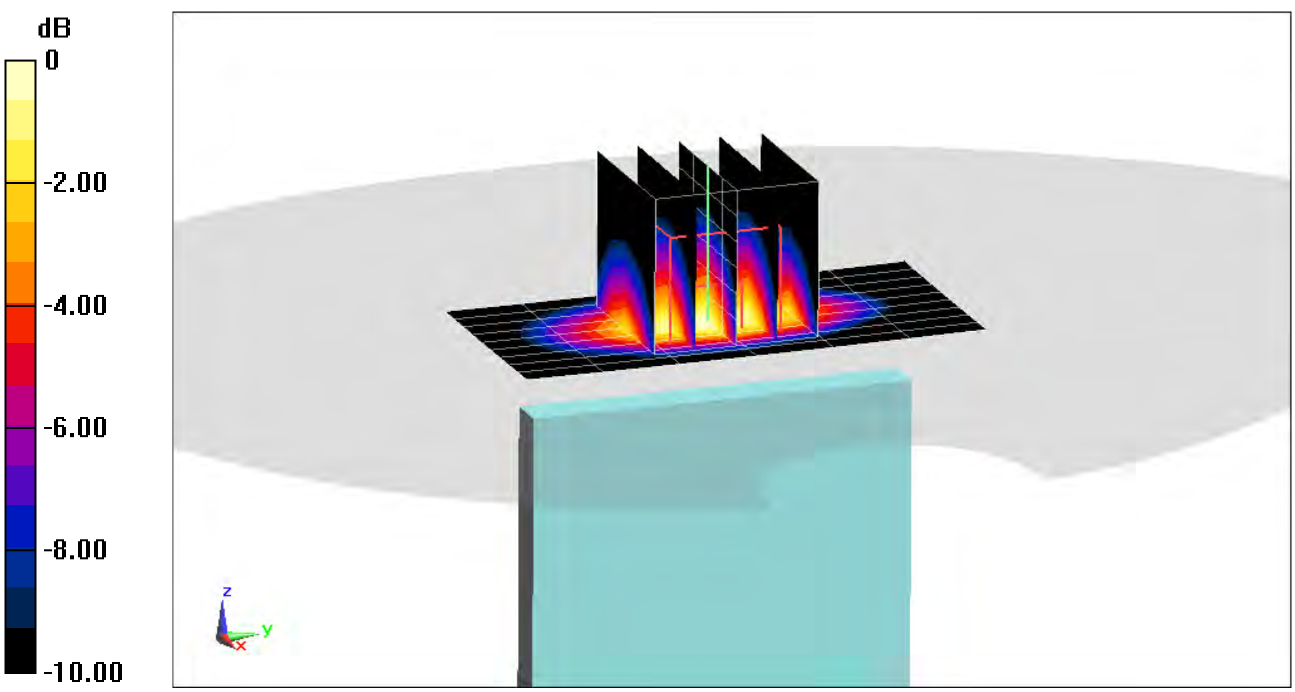
Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: 1900 Body; Medium parameters used:
f = 1880 MHz; σ = 1.541 S/m; ε_r = 51.653; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-16-2018; Ambient Temp: 21.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7406; ConvF(7.74, 7.74, 7.74); Calibrated: 5/22/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/22/2018
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: GPRS 1900, Body SAR, Bottom Edge, Mid.ch, 2 Tx Slots

Area Scan (10x7x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.01 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.956 W/kg
SAR(1 g) = 0.544 W/kg



0 dB = 0.810 W/kg = -0.92 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

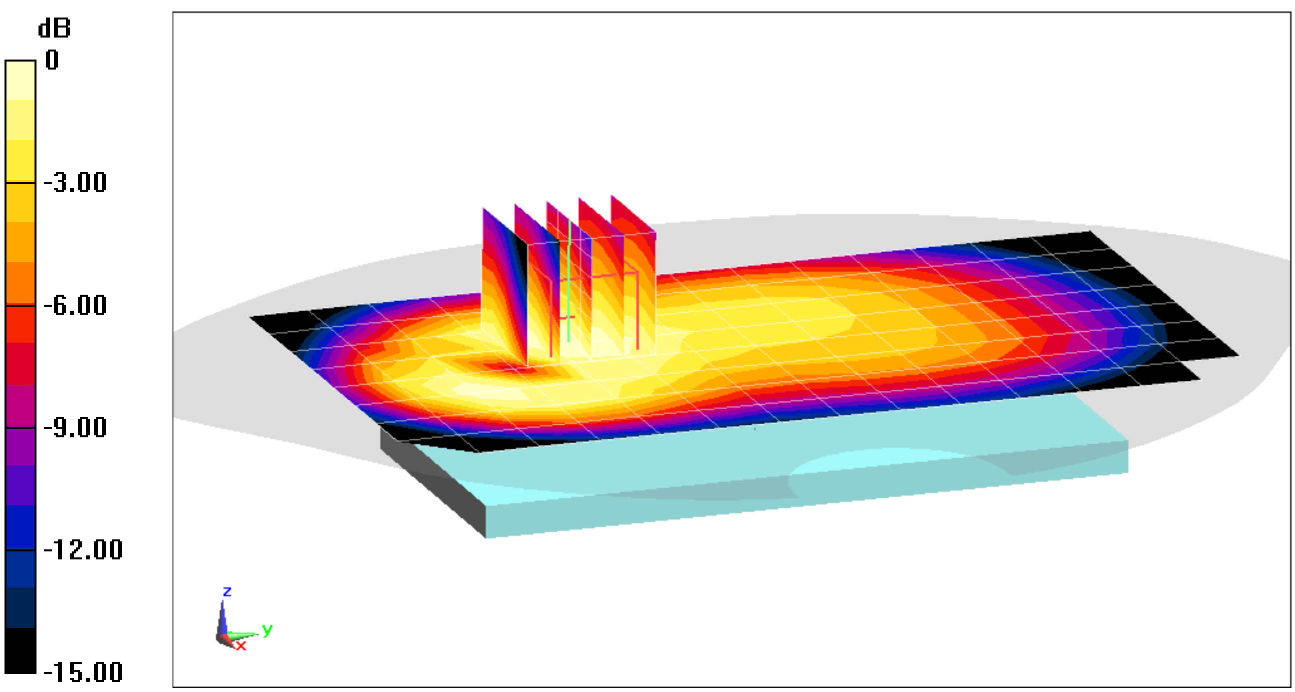
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.999 S/m; ε_r = 53.481; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 20.4°C; Tissue Temp: 20.0°C

Probe: ES3DV3 - SN3347; ConvF(6.37, 6.37, 6.37); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.42 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.432 W/kg
SAR(1 g) = 0.311 W/kg



0 dB = 0.353 W/kg = -4.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

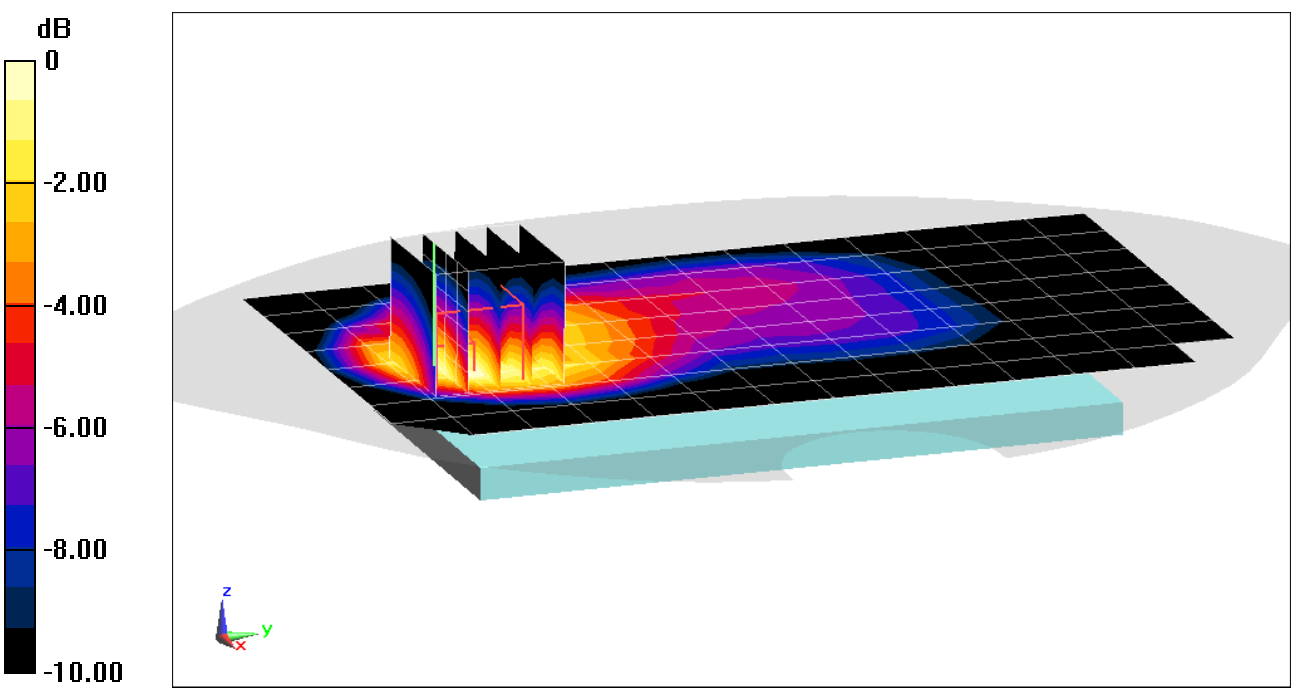
Communication System: UID 0, UMTS; Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used (interpolated):
f = 846.6 MHz; σ = 1.003 S/m; ε_r = 53.459; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-23-2018; Ambient Temp: 20.4°C; Tissue Temp: 20.0°C

Probe: ES3DV3 - SN3347; ConvF(6.37, 6.37, 6.37); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: UMTS 850, Body SAR, Back Side, High.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.65 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.12 W/kg
SAR(1 g) = 0.660 W/kg



0 dB = 0.781 W/kg = -1.07 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1128

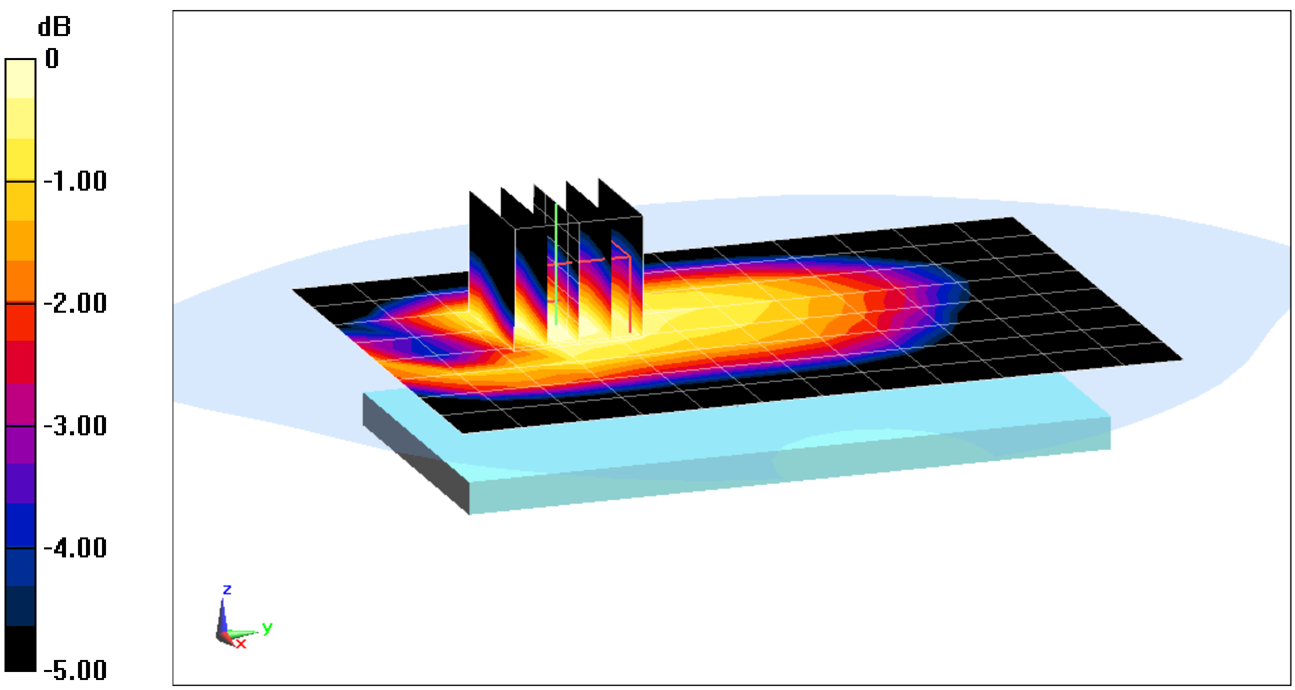
Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.946 S/m; ε_r = 53.158; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 23.9°C; Tissue Temp: 20.9°C

Probe: ES3DV3 - SN3213; ConvF(6.3, 6.3, 6.3); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: 1648
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.80 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.254 W/kg
SAR(1 g) = 0.194 W/kg



0 dB = 0.214 W/kg = -6.70 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1128

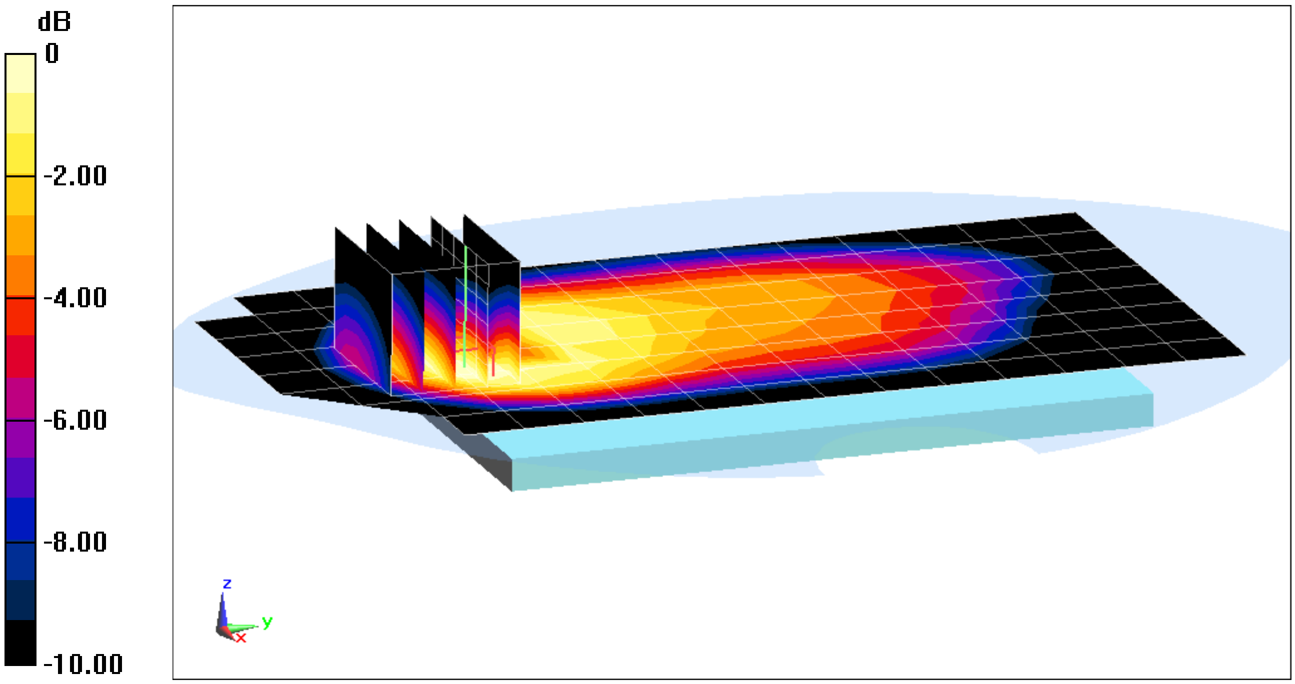
Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.946 S/m; ε_r = 53.158; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-23-2018; Ambient Temp: 23.9°C; Tissue Temp: 20.9°C

Probe: ES3DV3 - SN3213; ConvF(6.3, 6.3, 6.3); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: 1648
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x16x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.16 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.518 W/kg
SAR(1 g) = 0.293 W/kg



0 dB = 0.347 W/kg = -4.60 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1128

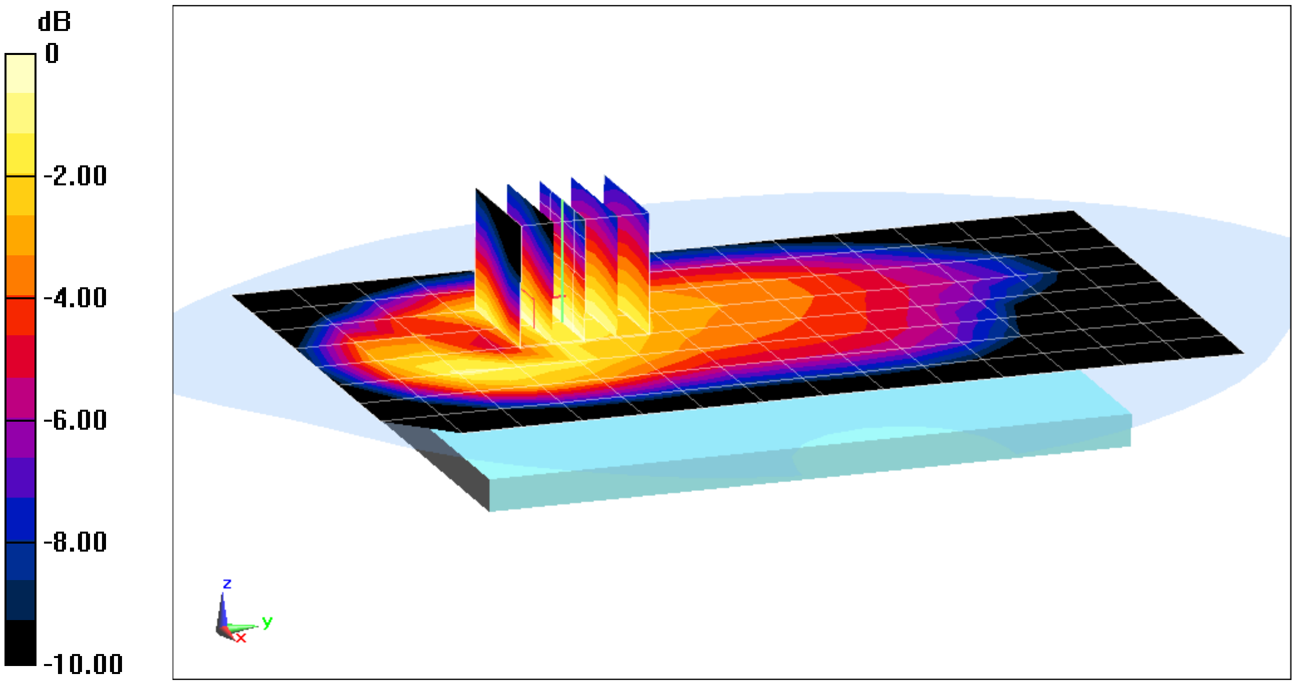
Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 782 MHz; σ = 0.974 S/m; ε_r = 52.989; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 23.9°C; Tissue Temp: 20.9°C

Probe: ES3DV3 - SN3213; ConvF(6.3, 6.3, 6.3); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: 1648
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.06 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.325 W/kg
SAR(1 g) = 0.236 W/kg



0 dB = 0.261 W/kg = -5.83 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1128

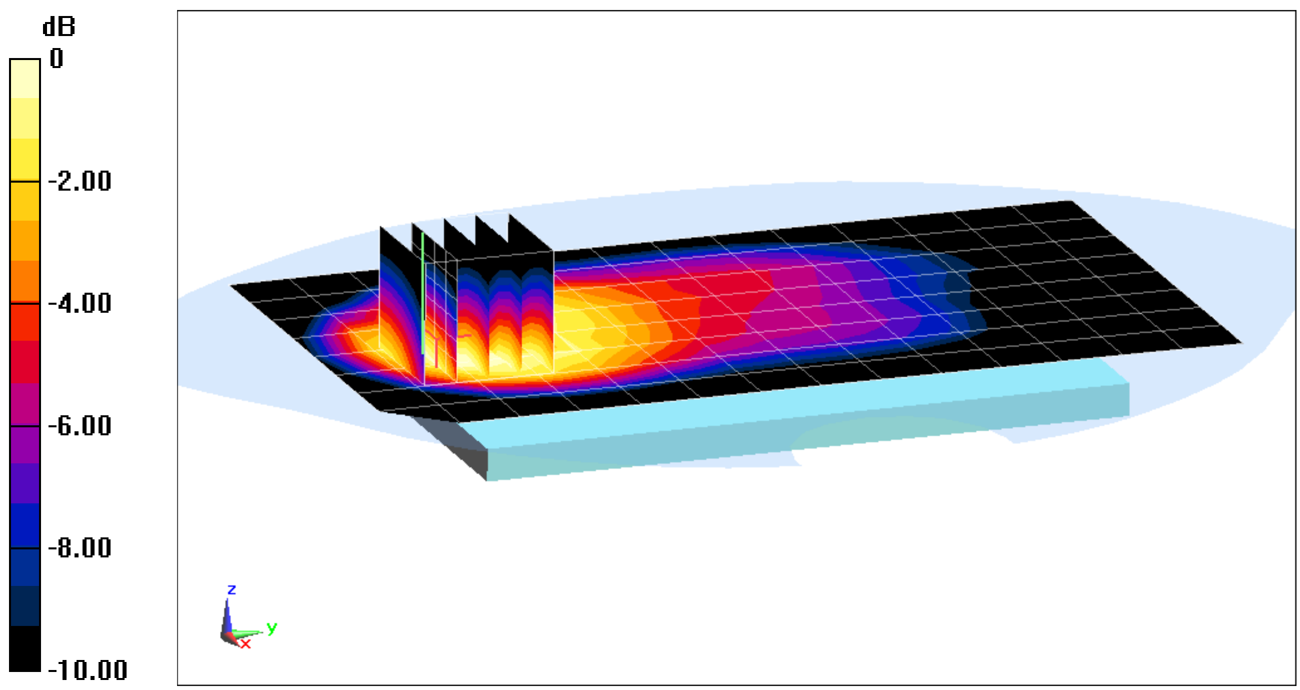
Communication System: UID 0, LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 782 MHz; σ = 0.974 S/m; ε_r = 52.989; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-23-2018; Ambient Temp: 23.9°C; Tissue Temp: 20.9°C

Probe: ES3DV3 - SN3213; ConvF(6.3, 6.3, 6.3); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: 1648
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.31 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.702 W/kg
SAR(1 g) = 0.406 W/kg



0 dB = 0.490 W/kg = -3.10 dBW/kg

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

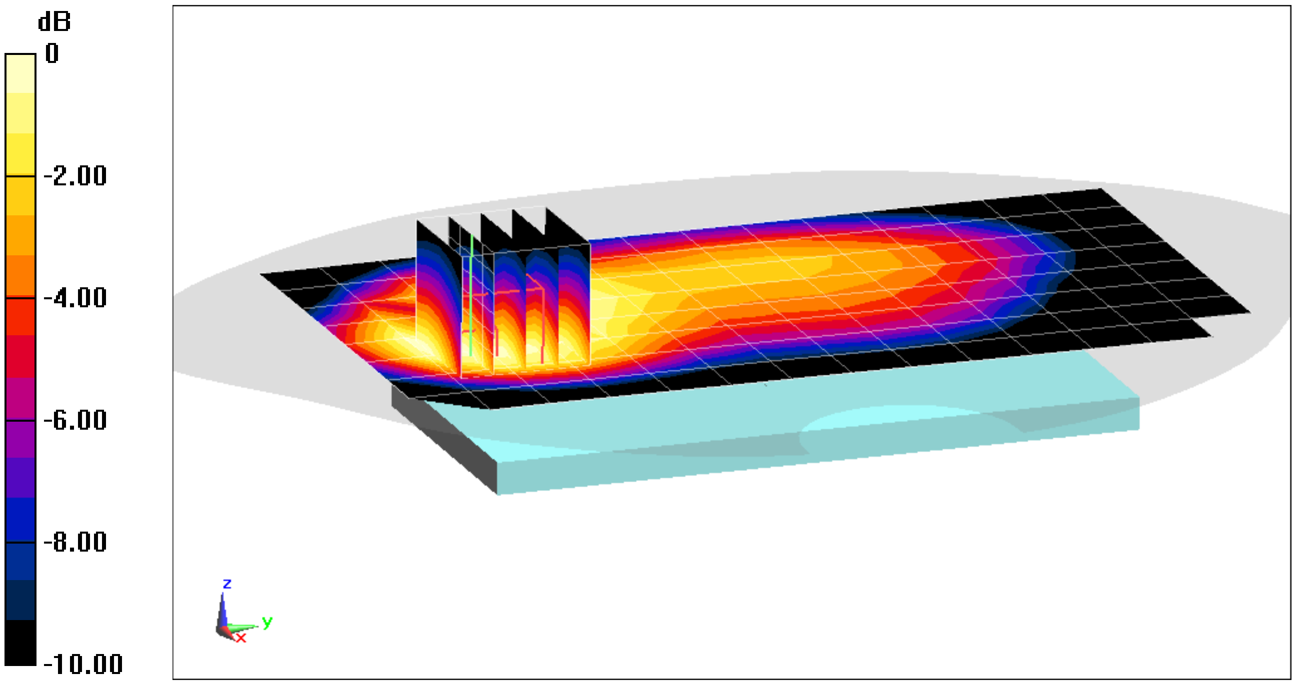
Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used (interpolated):
$f = 836.5$ MHz; $\sigma = 0.999$ S/m; $\varepsilon_r = 53.482$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 20.4°C; Tissue Temp: 20.0°C

Probe: ES3DV3 - SN3347; ConvF(6.37, 6.37, 6.37); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.21 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.291 W/kg
SAR(1 g) = 0.186 W/kg



0 dB = 0.214 W/kg = -6.70 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

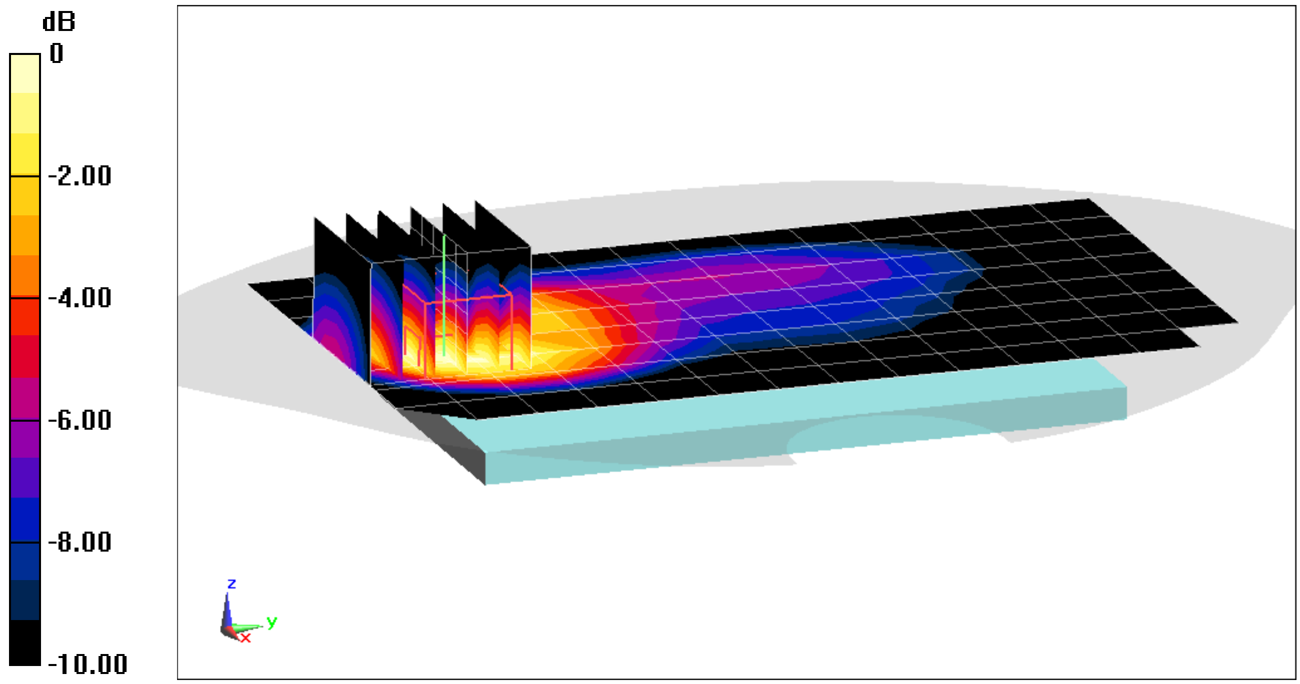
Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used (interpolated):
f = 836.5 MHz; σ = 0.999 S/m; ε_r = 53.482; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-23-2018; Ambient Temp: 20.4°C; Tissue Temp: 20.0°C

Probe: ES3DV3 - SN3347; ConvF(6.37, 6.37, 6.37); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.02 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.777 W/kg
SAR(1 g) = 0.454 W/kg



0 dB = 0.534 W/kg = -2.72 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1199

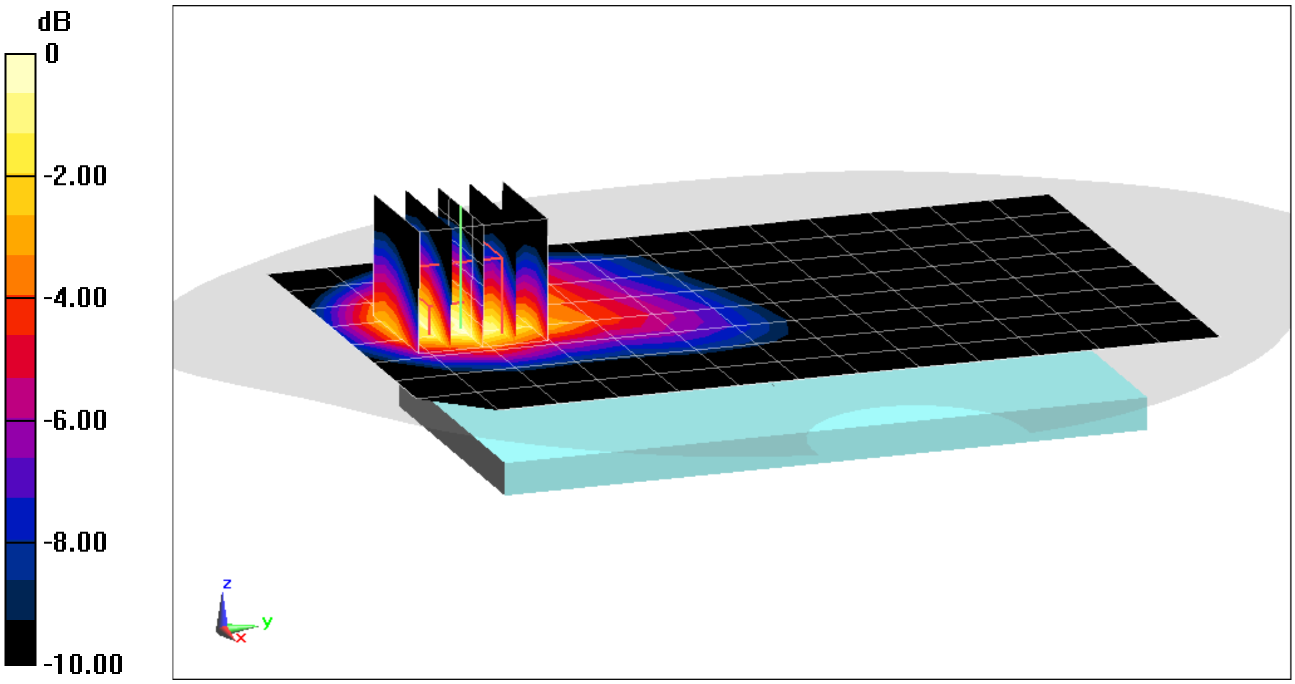
Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Body; Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.477 S/m; ε_r = 51.691; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-16-2018; Ambient Temp: 20.1°C; Tissue Temp: 20.4°C

Probe: ES3DV3 - SN3347; ConvF(5.17, 5.17, 5.17); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: LTE Band 4 (AWS), Body SAR, Back Side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.08 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.465 W/kg
SAR(1 g) = 0.303 W/kg



0 dB = 0.353 W/kg = -4.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1199

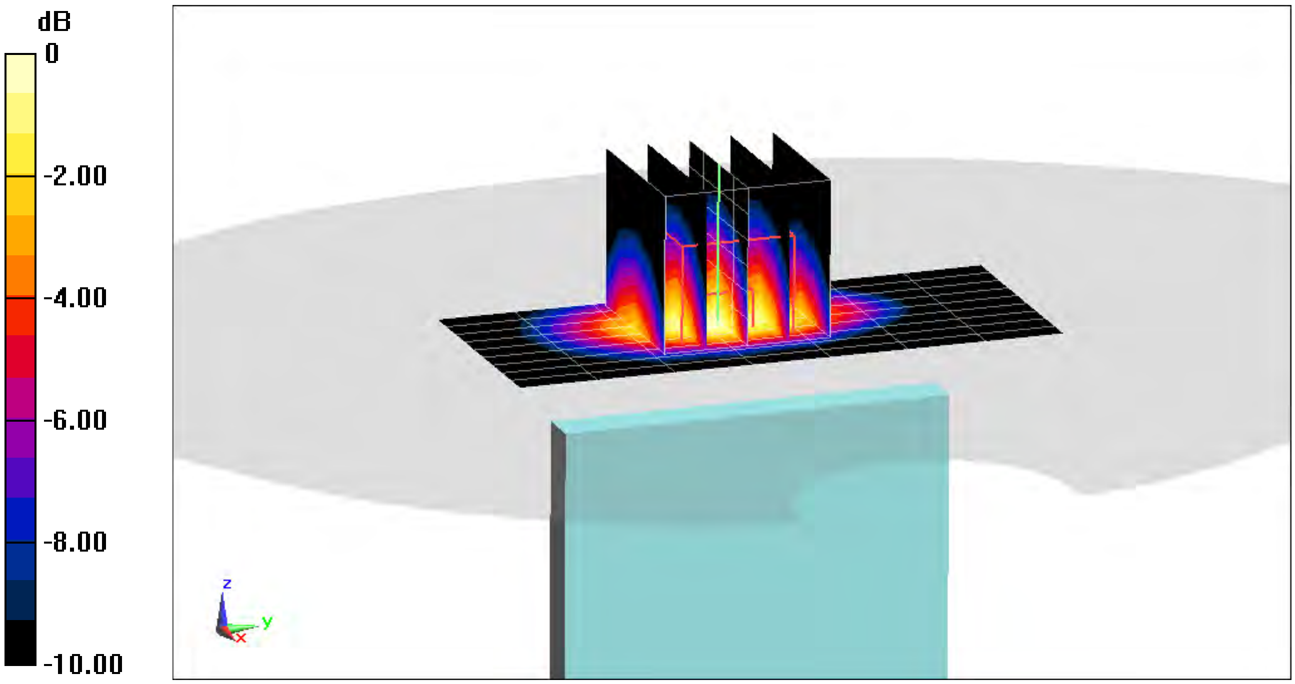
Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Body; Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.477 S/m; ε_r = 51.691; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-16-2018; Ambient Temp: 20.1°C; Tissue Temp: 20.4°C

Probe: ES3DV3 - SN3347; ConvF(5.17, 5.17, 5.17); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: LTE Band 4 (AWS), Body SAR, Bottom Edge, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (10x8x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.19 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.13 W/kg
SAR(1 g) = 0.701 W/kg



0 dB = 0.867 W/kg = -0.62 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1203

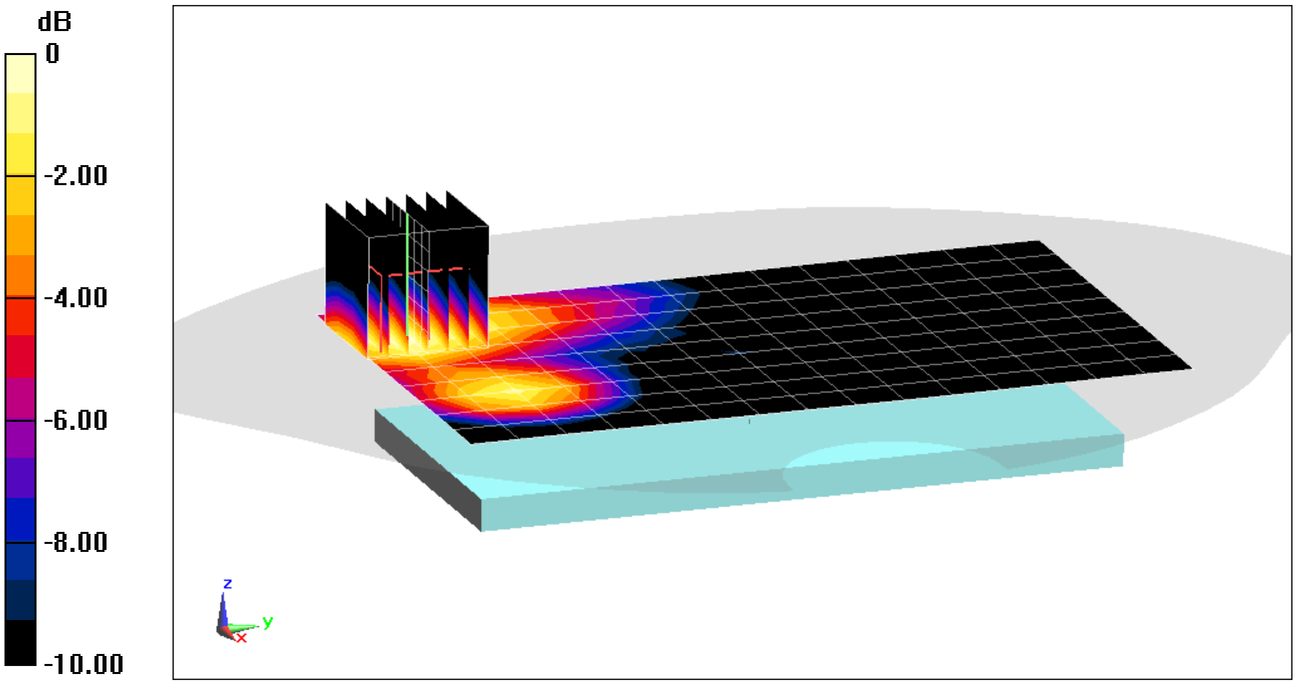
Communication System: UID 0, LTE Band 41; Frequency: 2680 MHz; Duty Cycle: 1:1.58
Medium: 2450 Body; Medium parameters used (interpolated):
f = 2680 MHz; σ = 2.316 S/m; ε_r = 50.29; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-06-2018; Ambient Temp: 22.2°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3319; ConvF(4.33, 4.33, 4.33); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

**Mode: LTE Band 41, Body SAR, Back Side, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.37 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.427 W/kg
SAR(1 g) = 0.222 W/kg



0 dB = 0.272 W/kg = -5.65 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1203

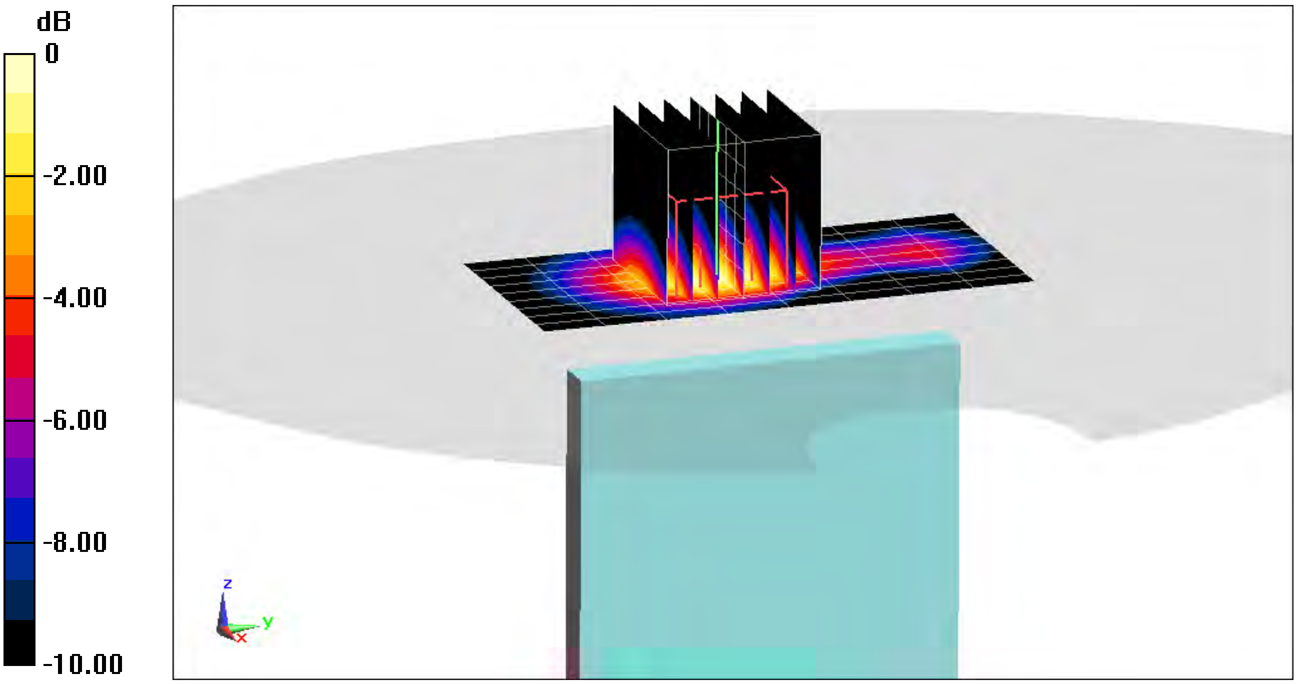
Communication System: UID 0, _LTE Band 41; Frequency: 2680 MHz; Duty Cycle: 1:1.58
Medium: 2450 Body; Medium parameters used (interpolated):
f = 2680 MHz; σ = 2.316 S/m; ε_r = 50.29; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-06-2018; Ambient Temp: 22.2°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3319; ConvF(4.33, 4.33, 4.33); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: LTE Band 41, Body SAR, Bottom Edge, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (10x9x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.91 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.02 W/kg
SAR(1 g) = 0.499 W/kg



0 dB = 0.649 W/kg = -1.88 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1084

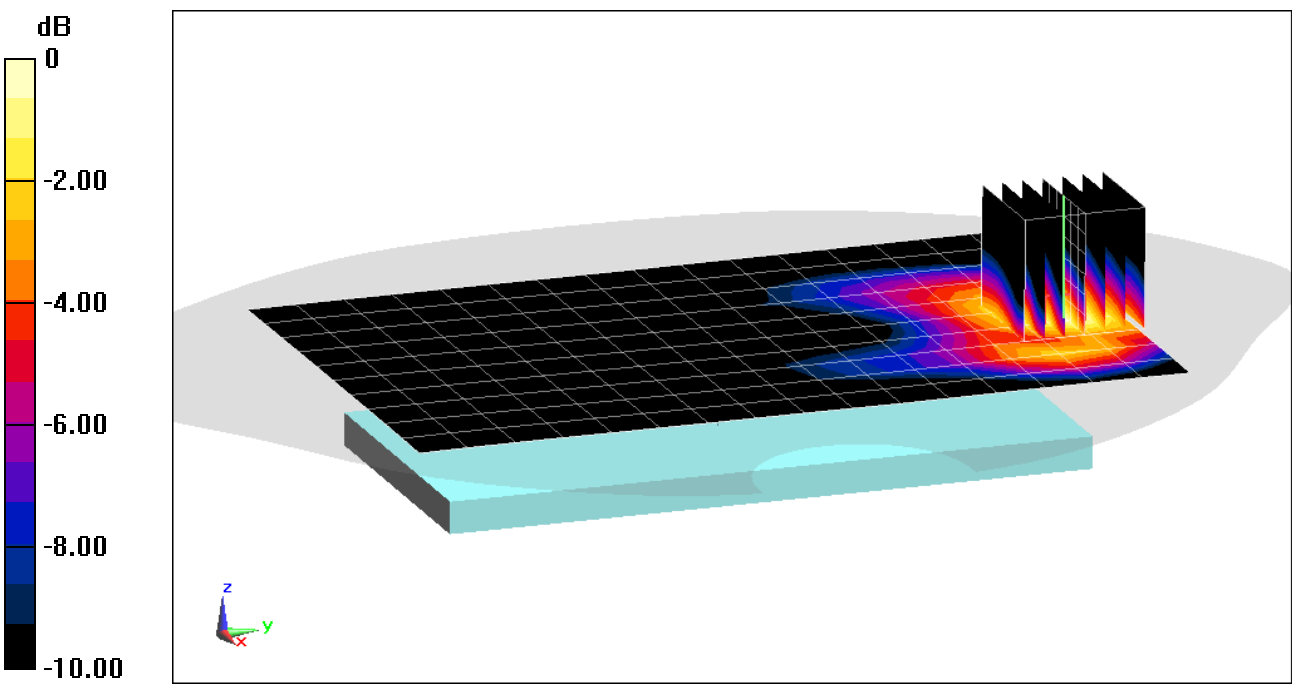
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.961 S/m; ε_r = 50.776; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3319; ConvF(4.51, 4.51, 4.51); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Antenna 2, Body SAR, Back Side, Ch 1, 1 Mbps

Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.09 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.303 W/kg
SAR(1 g) = 0.165 W/kg



0 dB = 0.210 W/kg = -6.78 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1084

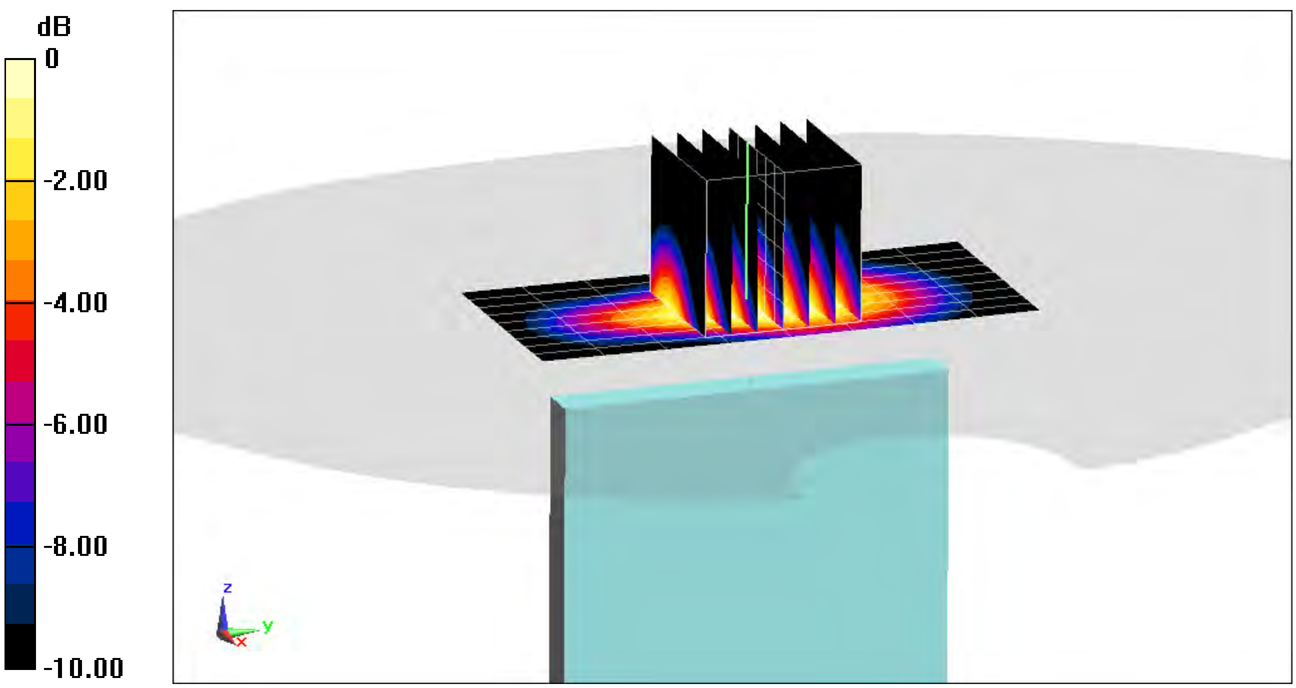
Communication System: UID 0, _IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.961 S/m; ε_r = 50.776; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-23-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3319; ConvF(4.51, 4.51, 4.51); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

**Mode: IEEE 802.11b, 22 MHz Bandwidth, Antenna 2,
Body SAR, Top Edge, Ch 1, 1 Mbps**

Area Scan (10x9x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.99 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.869 W/kg
SAR(1 g) = 0.478 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1084

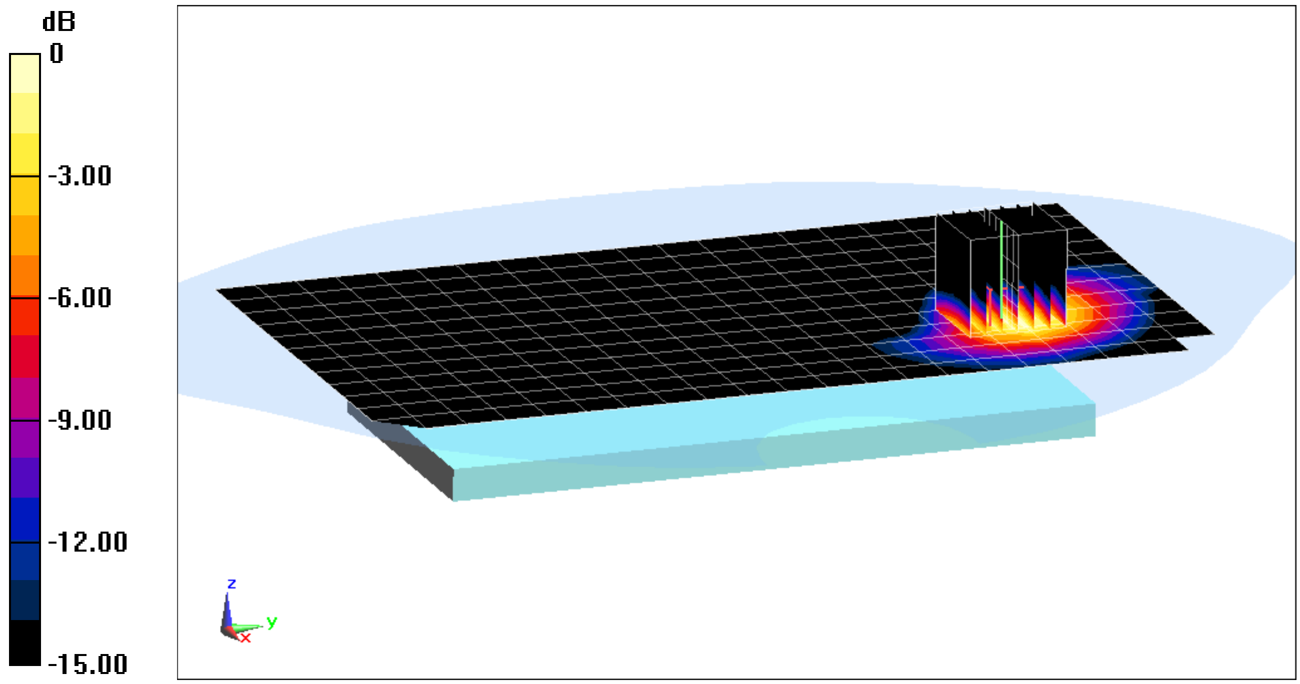
Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5260 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used:
f = 5260 MHz; σ = 5.481 S/m; ε_r = 48.187; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-09-2018; Ambient Temp: 21.5°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7357; ConvF(4.78, 4.78, 4.78); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

**Mode: IEEE 802.11a, UNII-2A, 20 MHz Bandwidth, Antenna 2,
Body SAR, Back Side, Ch 52, 6 Mbps**

Area Scan (13x22x1): 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 = 7.304 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.923 W/kg
SAR(1 g) = 0.268 W/kg



0 dB = 0.597 W/kg = -2.24 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1084

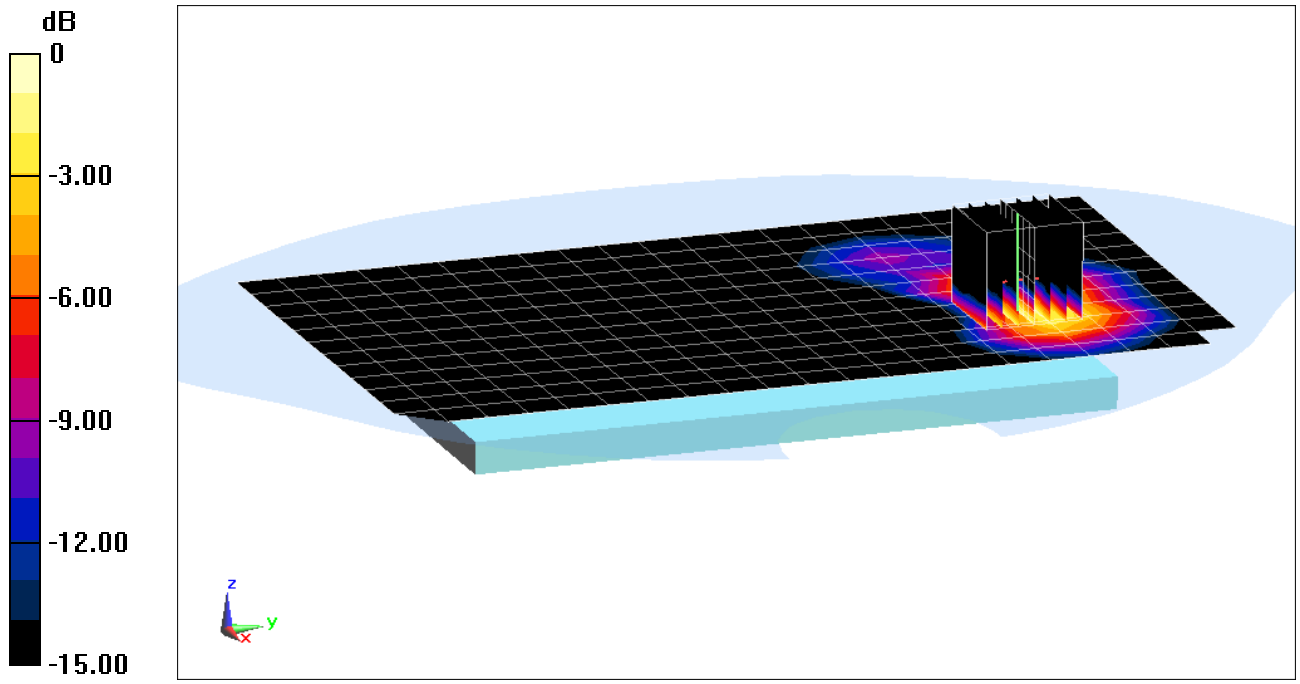
Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5825 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used:
f = 5825 MHz; $\sigma = 6.261$ S/m; $\varepsilon_r = 47.239$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-09-2018; Ambient Temp: 21.5°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7357; ConvF(4.21, 4.21, 4.21); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: IEEE 802.11a, UNII-3, 20 MHz Bandwidth, Antenna 2,
Body SAR, Back Side, Ch 165, 6 Mbps

Area Scan (13x22x1): 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 = 7.406 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.325 W/kg



0 dB = 0.796 W/kg = -0.99 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1084

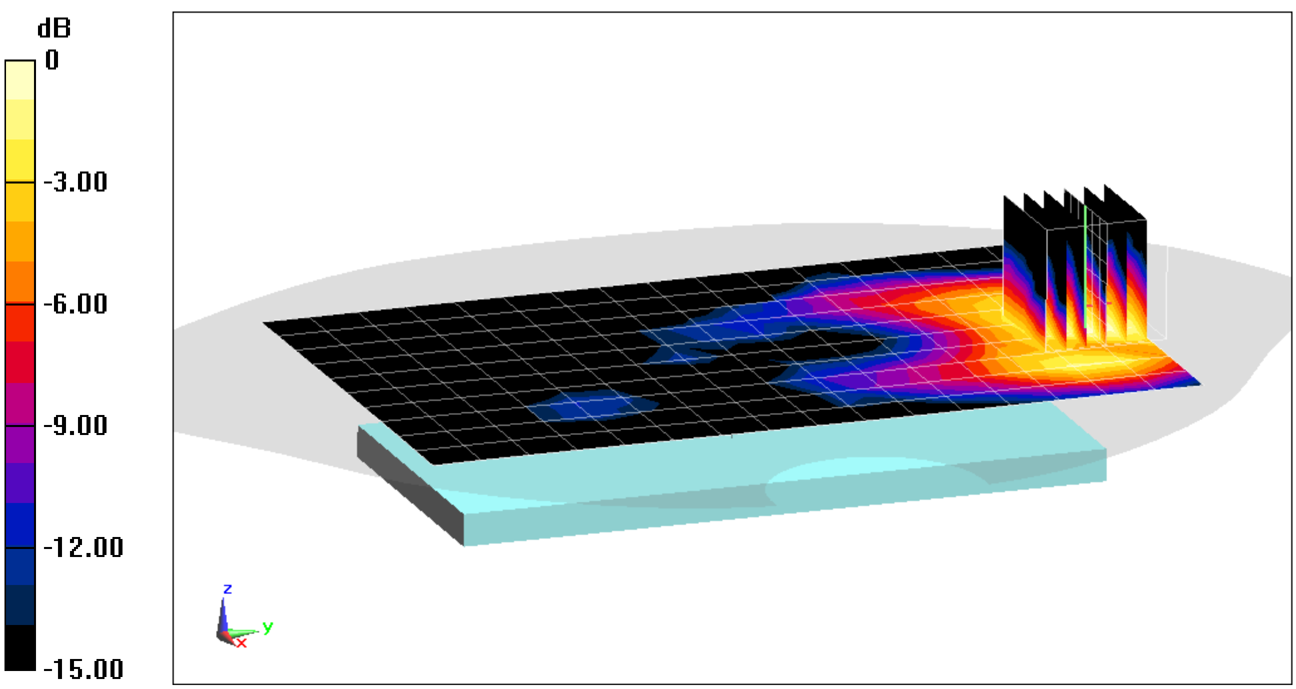
Communication System: UID 0, Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1.299
Medium: 2450 Body; Medium parameters used (interpolated):
f = 2441 MHz; σ = 1.996 S/m; ε_r = 50.683; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3319; ConvF(4.51, 4.51, 4.51); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: Bluetooth, Body SAR, Ch 39, 1 Mbps, Back Side

Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x6x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.195 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.0560 W/kg
SAR(1 g) = 0.030 W/kg



0 dB = 0.0383 W/kg = -14.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1084

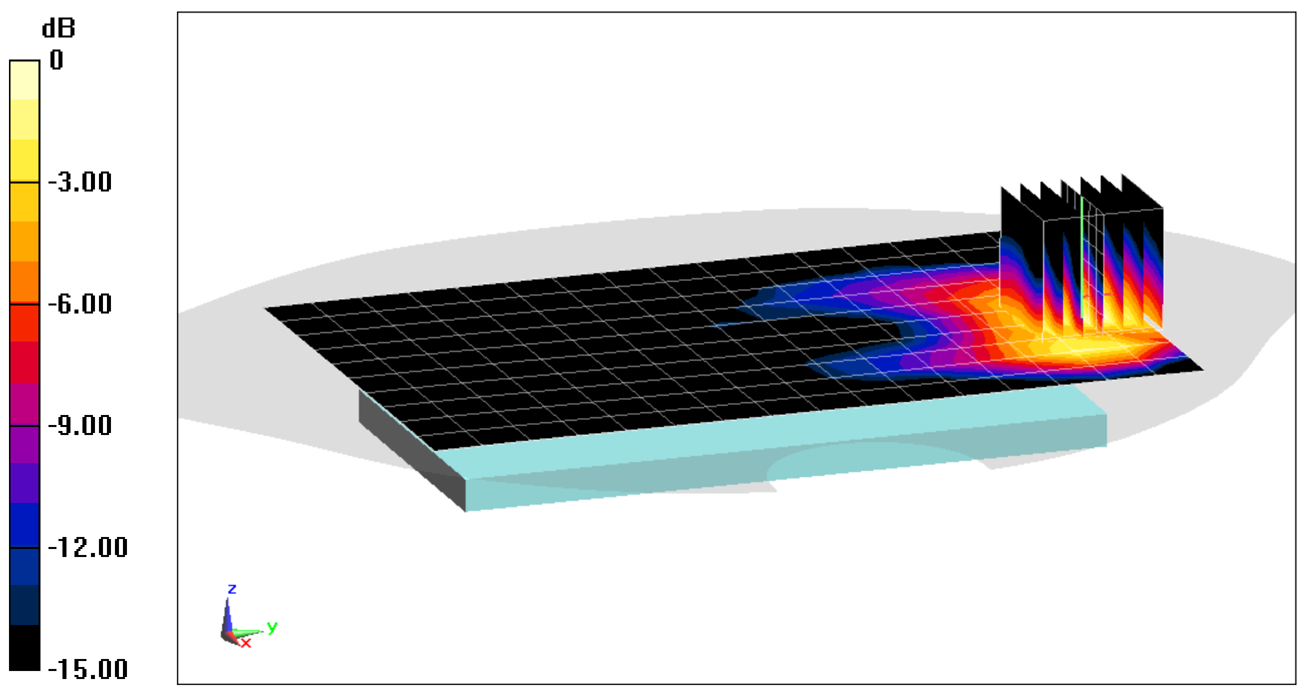
Communication System: UID 0, Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1.299
Medium: 2450 Body; Medium parameters used (interpolated):
f = 2441 MHz; σ = 1.996 S/m; ε_r = 50.683; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-23-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3319; ConvF(4.51, 4.51, 4.51); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: Bluetooth, Body SAR, Ch 39, 1 Mbps, Back Side

Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.710 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.150 W/kg
SAR(1 g) = 0.075 W/kg



0 dB = 0.0989 W/kg = -10.05 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1205

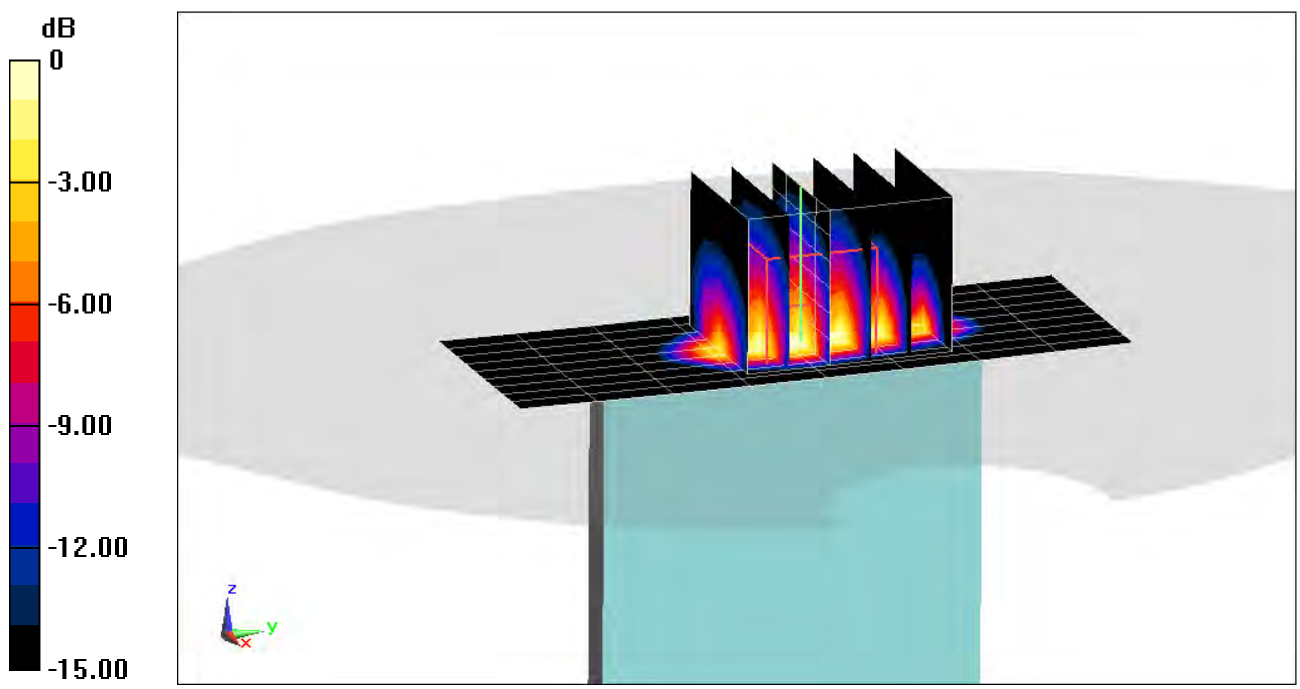
Communication System: UID 0, _GSM GPRS; 3 Tx slots; Frequency: 1850.2 MHz; Duty Cycle: 1:2.76
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1850.2 MHz; σ = 1.509 S/m; ε_r = 51.757; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-16-2018; Ambient Temp: 21.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7406; ConvF(7.74, 7.74, 7.74); Calibrated: 5/22/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/22/2018
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: GPRS 1900, Phablet SAR, Bottom Edge, Low.ch, 3 Tx Slots

Area Scan (10x9x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 62.61 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 11.2 W/kg
SAR(10 g) = 2.41 W/kg



0 dB = 9.13 W/kg = 9.60 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1203

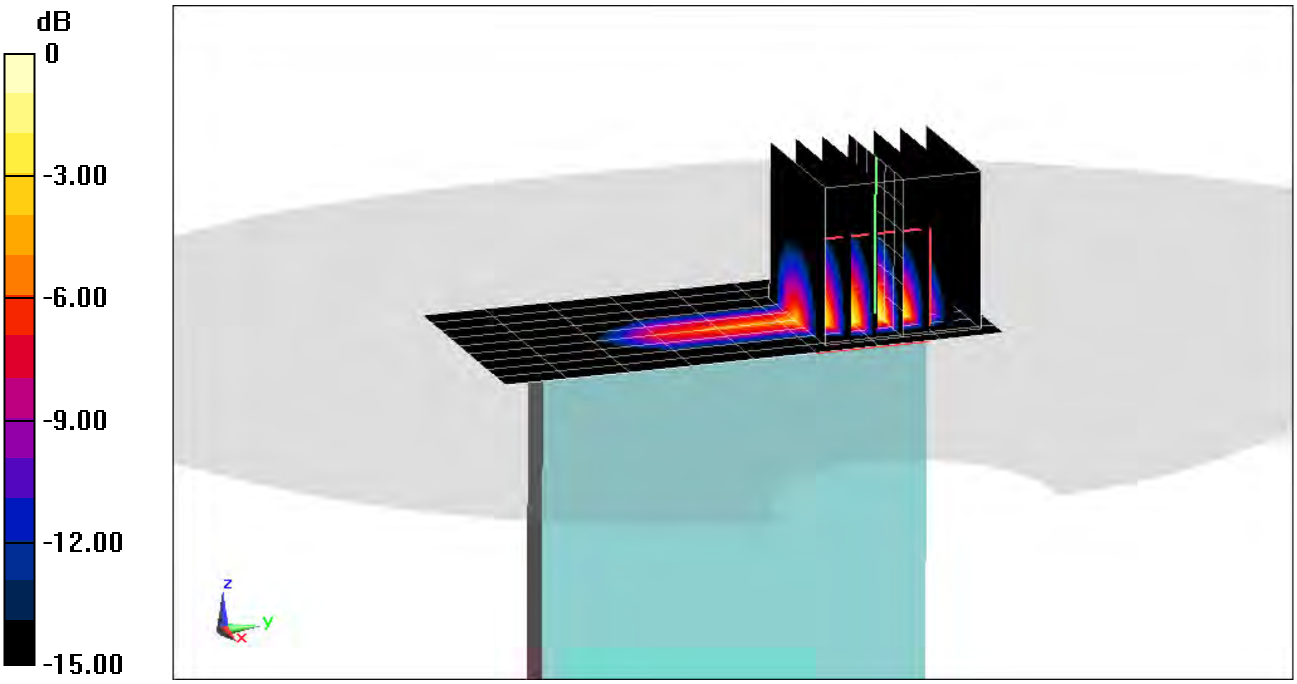
Communication System: UID 0, _LTE Band 41; Frequency: 2680 MHz; Duty Cycle: 1:1.58
Medium: 2450 Body; Medium parameters used (interpolated):
$f = 2680$ MHz; $\sigma = 2.316$ S/m; $\varepsilon_r = 50.29$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 08-06-2018; Ambient Temp: 22.2°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3319; ConvF(4.33, 4.33, 4.33); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: LTE Band 41, Phablet SAR, Bottom Edge, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (10x9x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 44.41 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 12.6 W/kg
SAR(10 g) = 1.1 W/kg



0 dB = 5.76 W/kg = 7.60 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSC01L; Type: Portable Handset; Serial: E1077

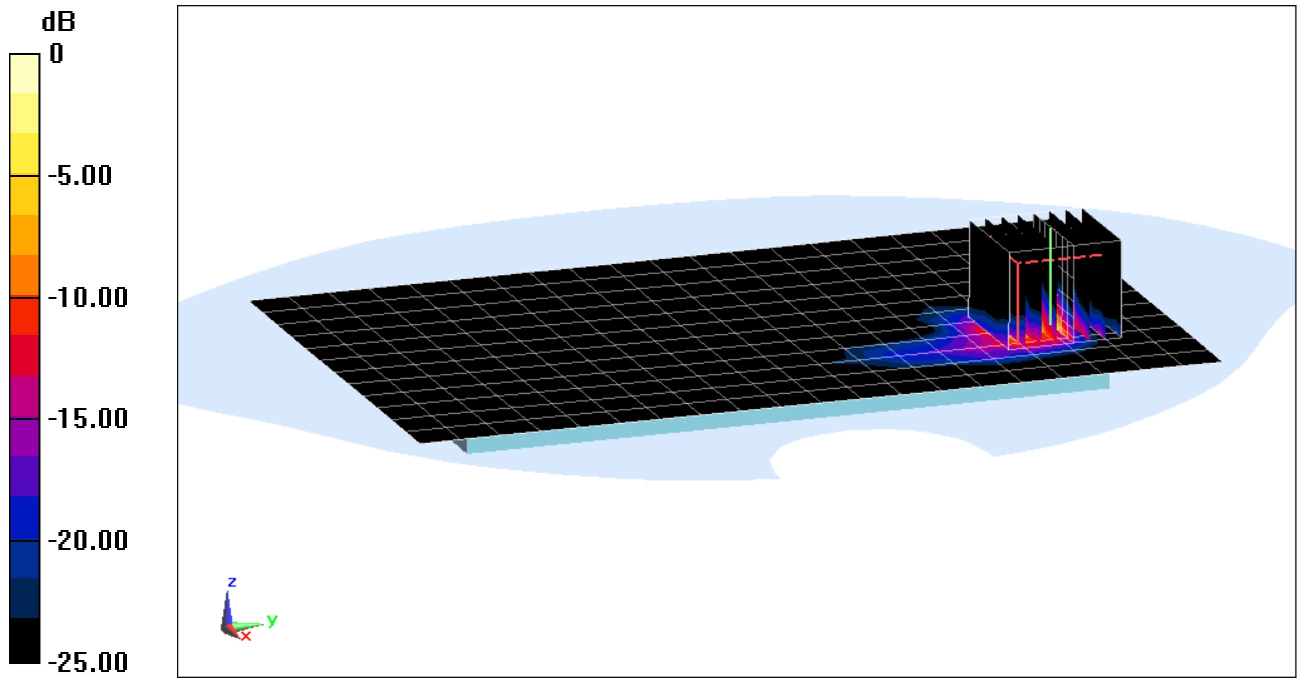
Communication System: UID 0, 802.11n 5.2-5.8 GHz Band; Frequency: 5260 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used:
f = 5260 MHz; σ = 5.51 S/m; ε_r = 47.839; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 08-06-2018; Ambient Temp: 22.1°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN7357; ConvF(4.78, 4.78, 4.78); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

Mode: IEEE 802.11n, U-NII-2A, 20 MHz Bandwidth, MIMO, Phablet SAR, Back Side, Ch 52, 13 Mbps

Area Scan (13x21x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 56.92 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 116 W/kg
SAR(10 g) = 2.46 W/kg



0 dB = 59.8 W/kg = 17.77 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1161

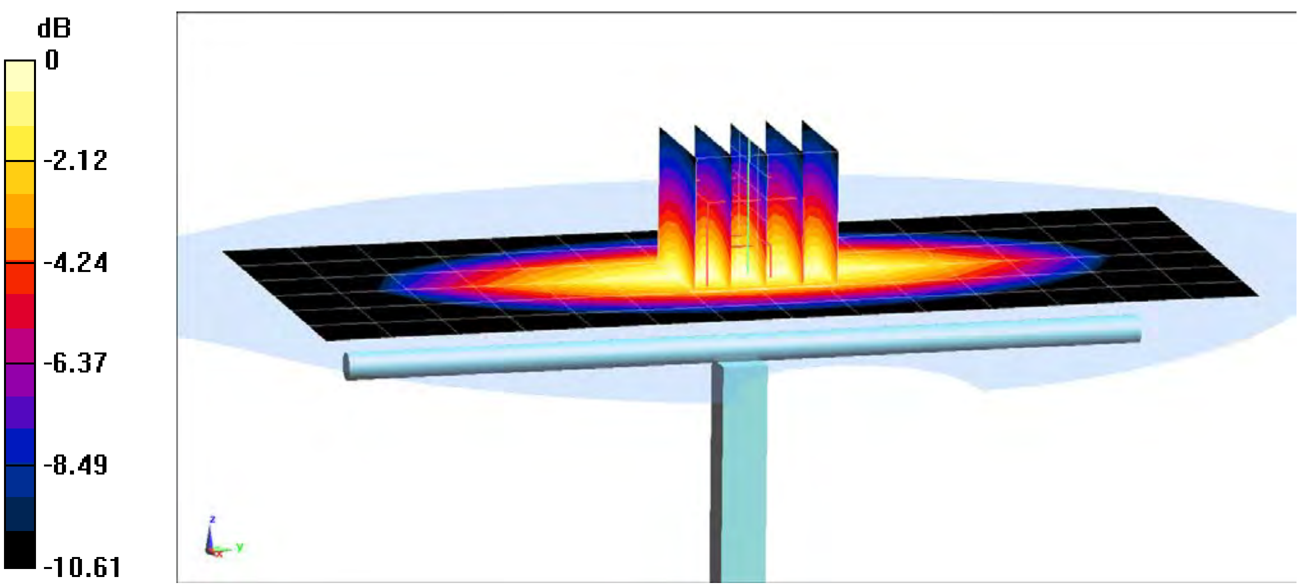
Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: 750 Head; Medium parameters used (interpolated):
f = 750 MHz; σ = 0.89 S/m; ε_r = 40.5; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-19-2018; Ambient Temp: 22.0°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3213; ConvF(6.75, 6.75, 6.75); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10; SEMCAD X Version 14.6.10 (7417)

750 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.36 W/kg
SAR(1 g) = 1.57 W/kg
Deviation(1 g) = -3.92%



0 dB = 1.83 W/kg = 2.62 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d047

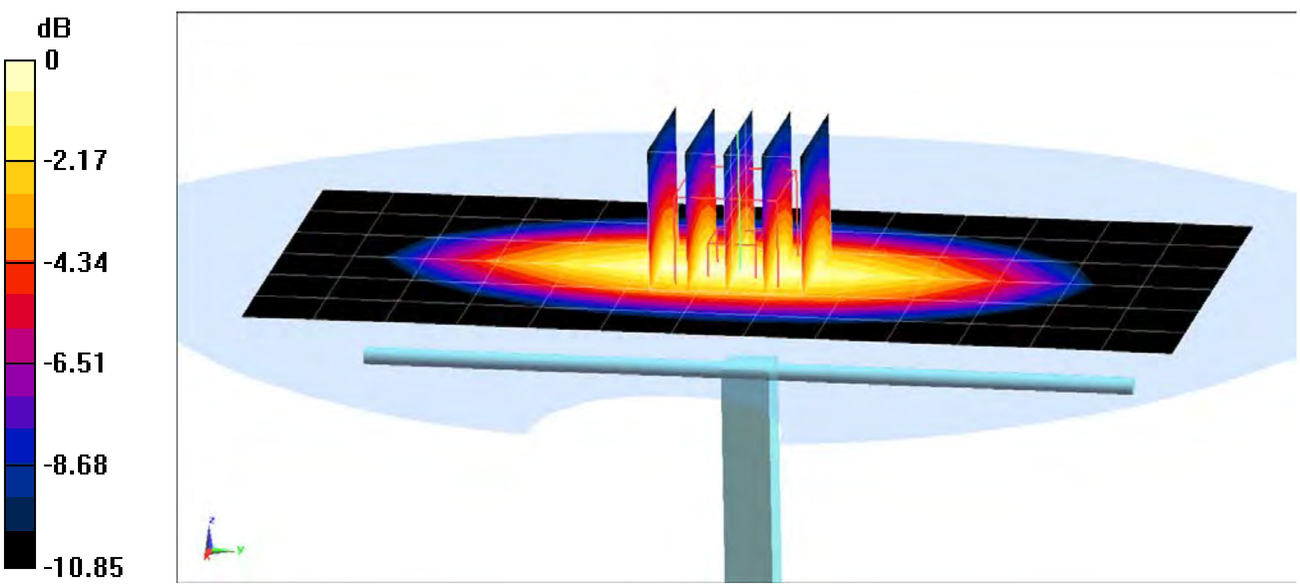
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Head; Medium parameters used:
f = 835 MHz; σ = 0.927 S/m; ε_r = 41.54; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-16-2018; Ambient Temp: 21.9°C; Tissue Temp: 21.2°C

Probe: ES3DV3 - SN3213; ConvF(6.42, 6.42, 6.42); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10; SEMCAD X Version 14.6.10 (7417)

835 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.94 W/kg
SAR(1 g) = 1.95 W/kg
Deviation(1 g) = 6.79%



0 dB = 2.29 W/kg = 3.60 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1148

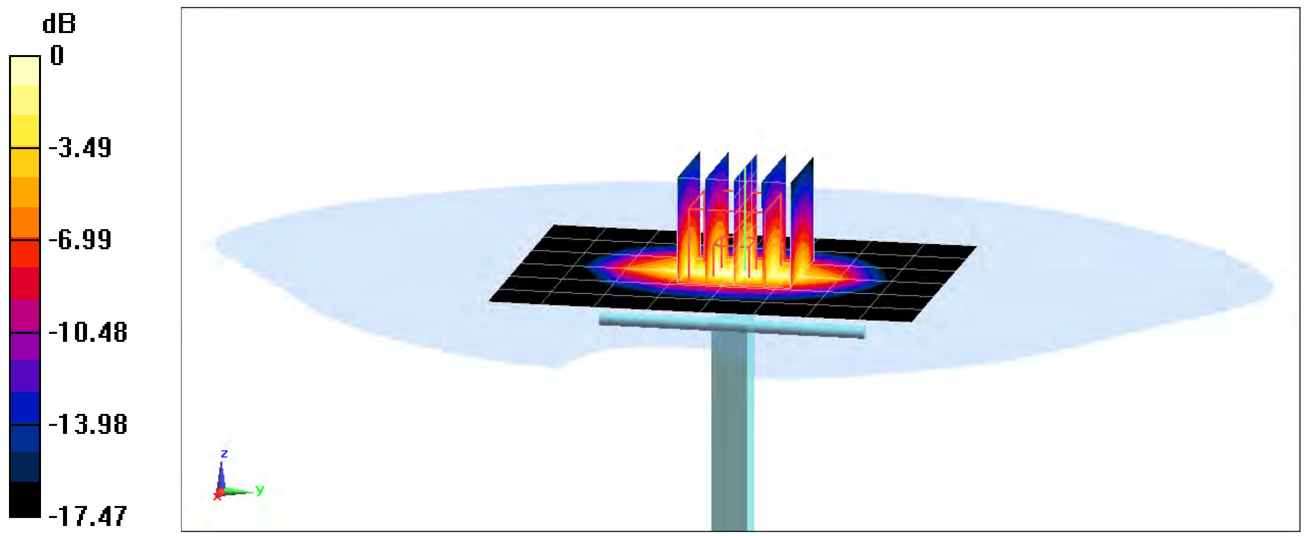
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 Head; Medium parameters used:
f = 1750 MHz; $\sigma = 1.331$ S/m; $\varepsilon_r = 41.186$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-16-2018; Ambient Temp: 21.3°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7409; ConvF(8.43, 8.43, 8.43); Calibrated: 6/25/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM with CRP (Left); Type: SAM; Serial: 1715
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

1750 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 6.73 W/kg
SAR(1 g) = 3.65 W/kg
Deviation(1 g) = 0.27%



0 dB = 5.58 W/kg = 7.47 dBW/kg

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d148

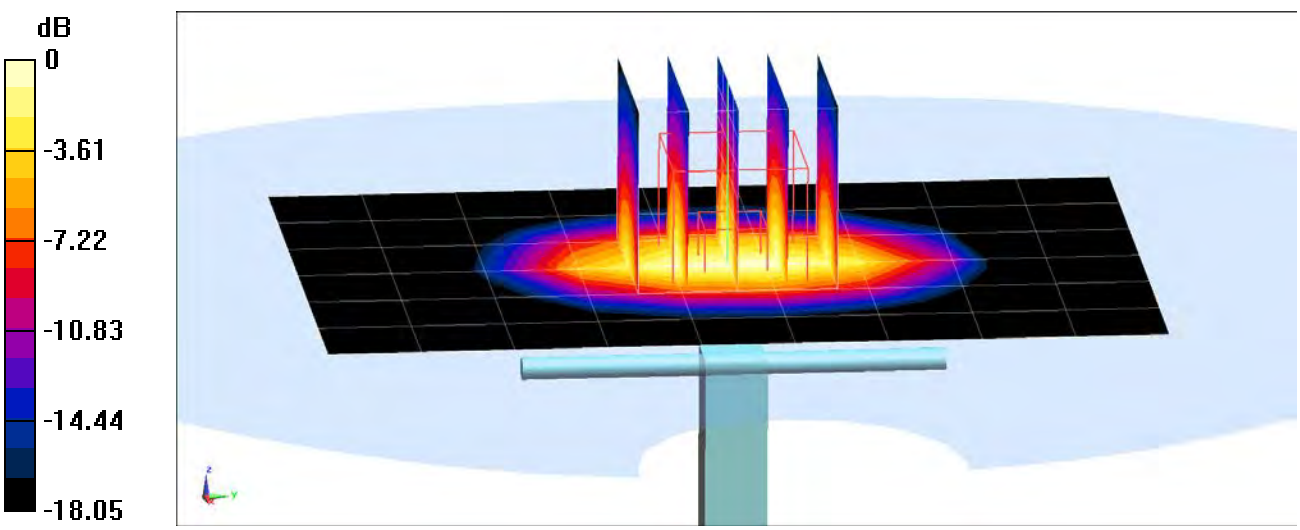
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.461 S/m; ε_r = 40.017; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-12-2018; Ambient Temp: 24.0°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3213; ConvF(5.3, 5.3, 5.3); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.10; SEMCAD X Version 14.6.10 (7417)

1900 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 7.64 W/kg
SAR(1 g) = 4.13 W/kg
Deviation(1 g) = 2.99%



0 dB = 5.25 W/kg = 7.20 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 797

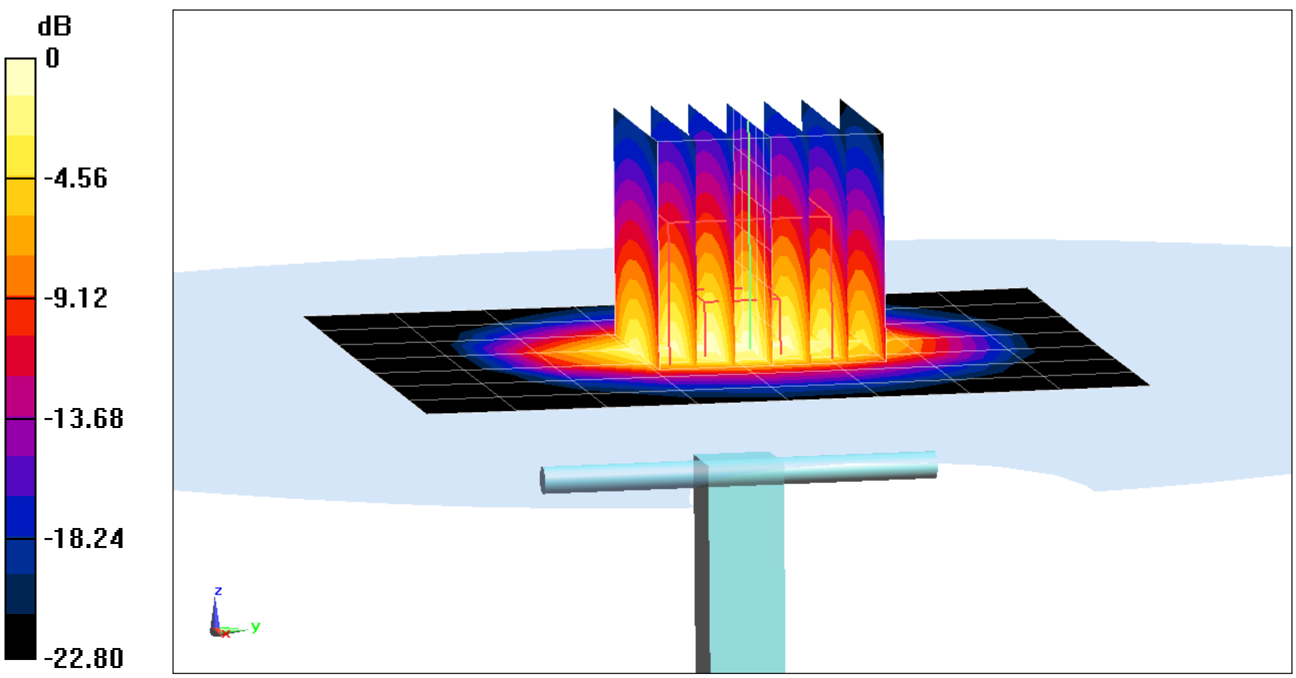
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head; Medium parameters used:
f = 2450 MHz; σ = 1.852 S/m; ε_r = 39.033; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-16-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.5°C

Probe: ES3DV3 - SN3332; ConvF(4.68, 4.68, 4.68); Calibrated: 8/14/2017;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 8/9/2017
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 10.8 W/kg
SAR(1 g) = 5.29 W/kg
Deviation(1 g) = 0.38%



0 dB = 6.93 W/kg = 8.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 719

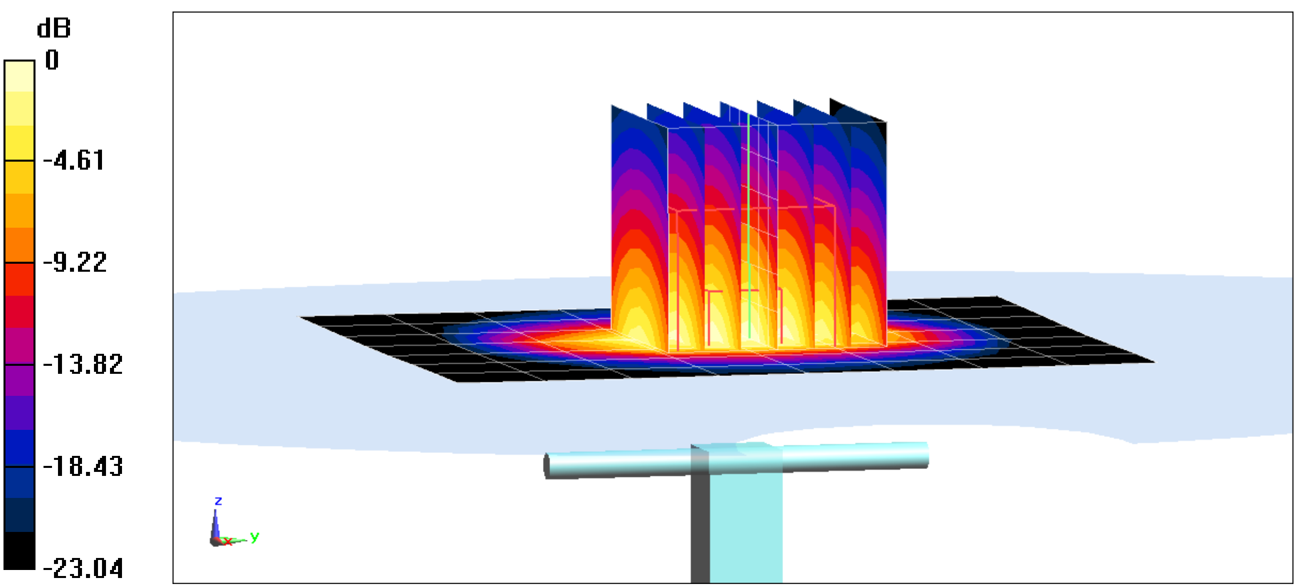
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head; Medium parameters used:
f = 2450 MHz; σ = 1.853 S/m; ε_r = 38.837; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-18-2018; Ambient Temp: 22.7°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3332; ConvF(4.68, 4.68, 4.68); Calibrated: 8/14/2017;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 8/9/2017
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 11.2 W/kg
SAR(1 g) = 5.46 W/kg
Deviation(1 g) = 5.20%



0 dB = 7.20 W/kg = 8.57 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1071

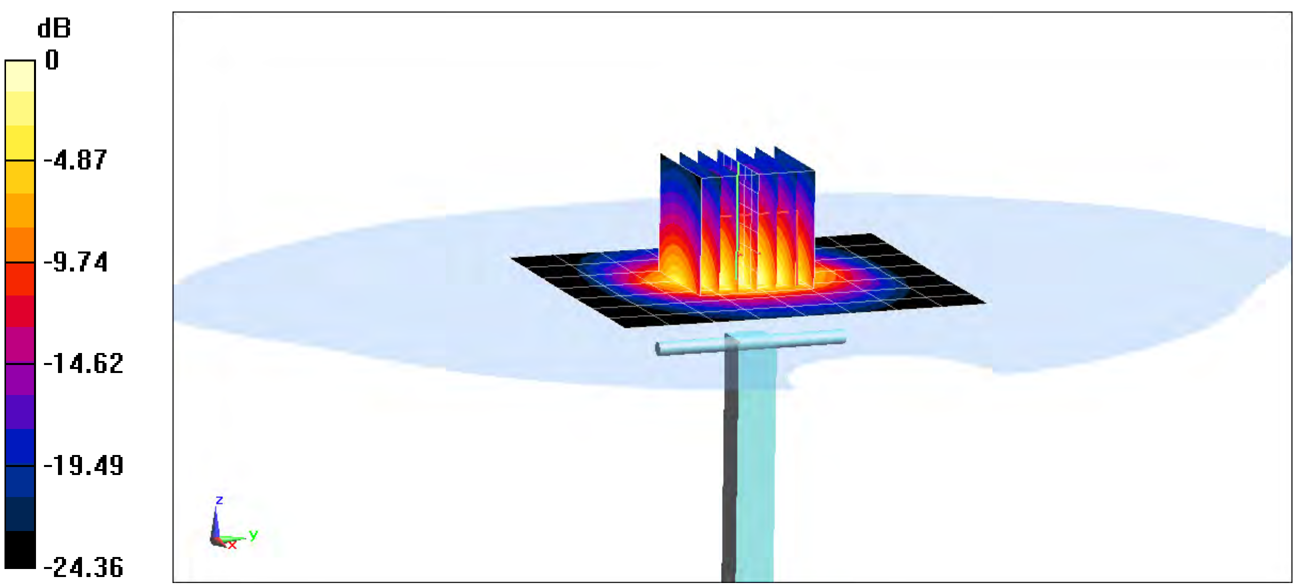
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2450 Head; Medium parameters used:
f = 2600 MHz; $\sigma = 2.022$ S/m; $\varepsilon_r = 39.225$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-03-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.5°C

Probe: ES3DV3 - SN3332; ConvF(4.56, 4.56, 4.56); Calibrated: 8/14/2017;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 8/9/2017
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

2600 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 13.0 W/kg
SAR(1 g) = 5.86 W/kg
Deviation(1 g) = 4.09%



0 dB = 7.58 W/kg = 8.80 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1191

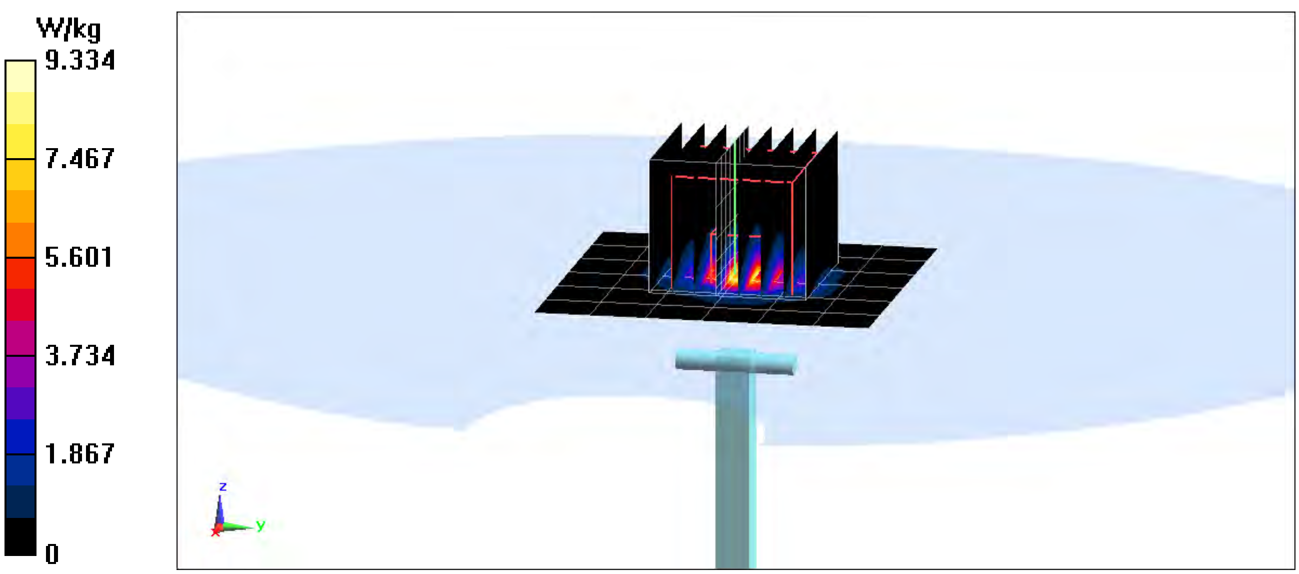
Communication System: UID 0, CW; Frequency: 5250 MHz; Duty Cycle: 1:1
Medium: 5GHz Head; Medium parameters used (interpolated):
f = 5250 MHz; σ = 4.572 S/m; ε_r = 35.765; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-19-2018; Ambient Temp: 23.5°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7409; ConvF(5.2, 5.2, 5.2); Calibrated: 6/25/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM with CRP (Left); Type: SAM; Serial: 1715
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5250 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 16.0 W/kg
SAR(1 g) = 3.92 W/kg
Deviation(1 g) = -0.63%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1191

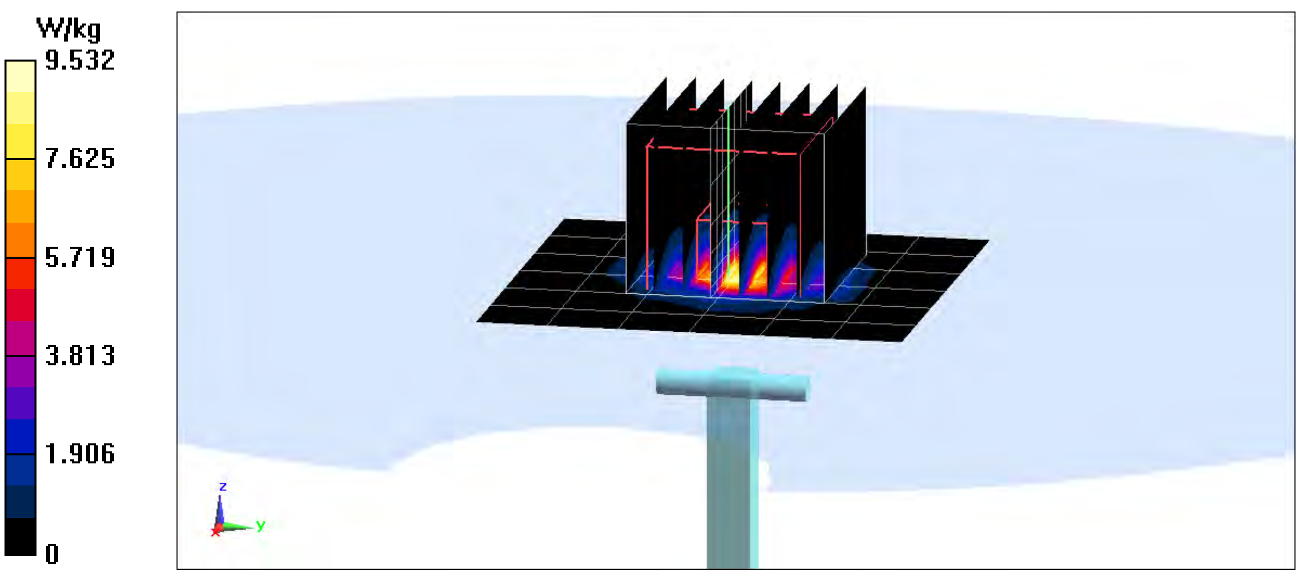
Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5GHz Head; Medium parameters used:
f = 5600 MHz; σ = 4.982 S/m; ε_r = 35.117; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-19-2018; Ambient Temp: 23.5°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7409; ConvF(4.77, 4.77, 4.77); Calibrated: 6/25/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM with CRP (Left); Type: SAM; Serial: 1715
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5600 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 17.3 W/kg
SAR(1 g) = 3.9 W/kg
Deviation(1 g) = -6.70%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1191

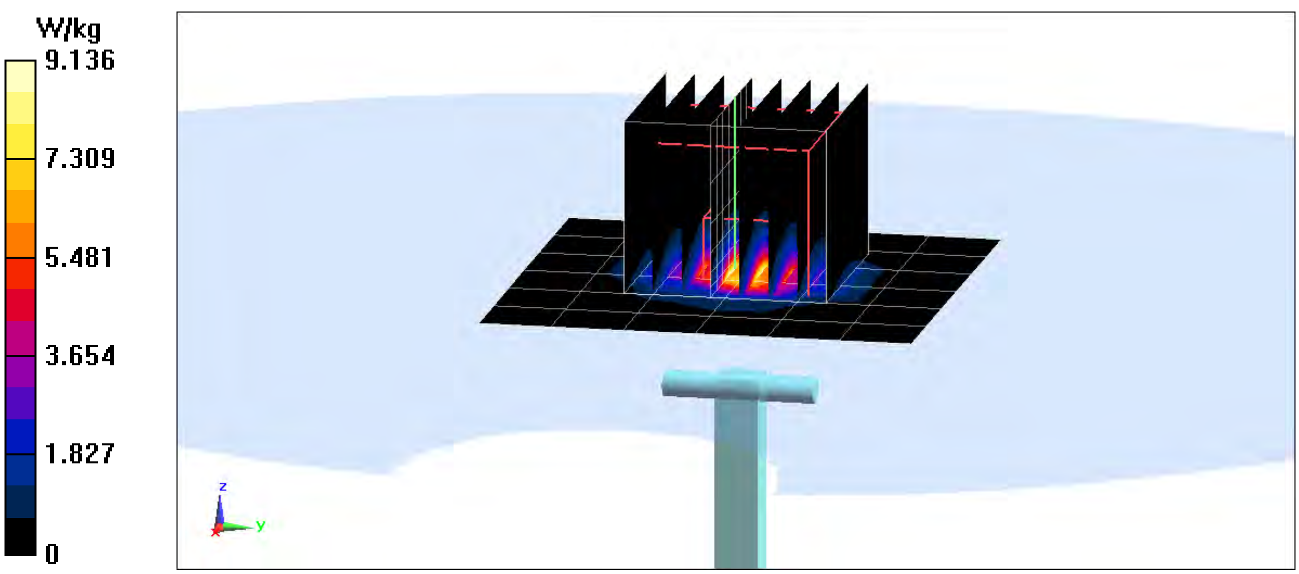
Communication System: UID 0, CW; Frequency: 5750 MHz; Duty Cycle: 1:1
Medium: 5GHz Head; Medium parameters used (interpolated):
f = 5750 MHz; σ = 5.139 S/m; ε_r = 34.855; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-19-2018; Ambient Temp: 23.5°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7409; ConvF(4.82, 4.82, 4.82); Calibrated: 6/25/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2018
Phantom: SAM with CRP (Left); Type: SAM; Serial: 1715
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5750 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 3.72 W/kg
Deviation(1 g) = -5.94%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1161

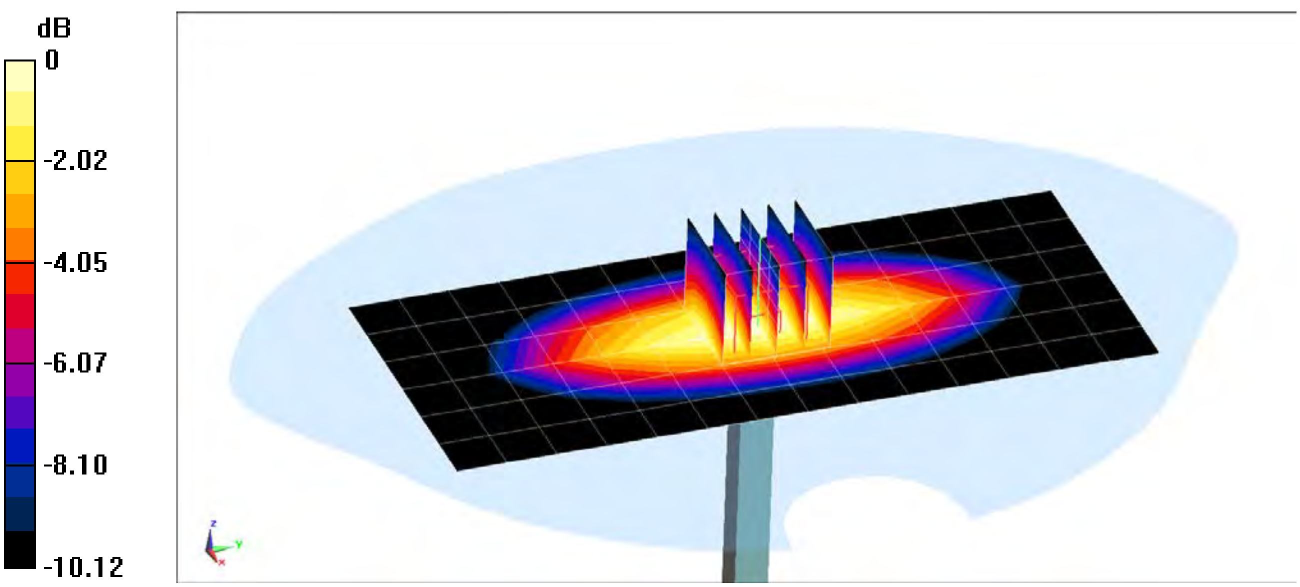
Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: 750 Body; Medium parameters used (interpolated):
f = 750 MHz; σ = 0.961 S/m; ε_r = 53.049; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 23.9°C; Tissue Temp: 20.9°C

Probe: ES3DV3 - SN3213; ConvF(6.3, 6.3, 6.3); Calibrated: 2/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 2/9/2018
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: 1648
Measurement SW: DASY52, Version 52.10; SEMCAD X Version 14.6.10 (7417)

750 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.68 W/kg
SAR(1 g) = 1.81 W/kg
Deviation(1 g) = 7.35%



0 dB = 2.11 W/kg = 3.24 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

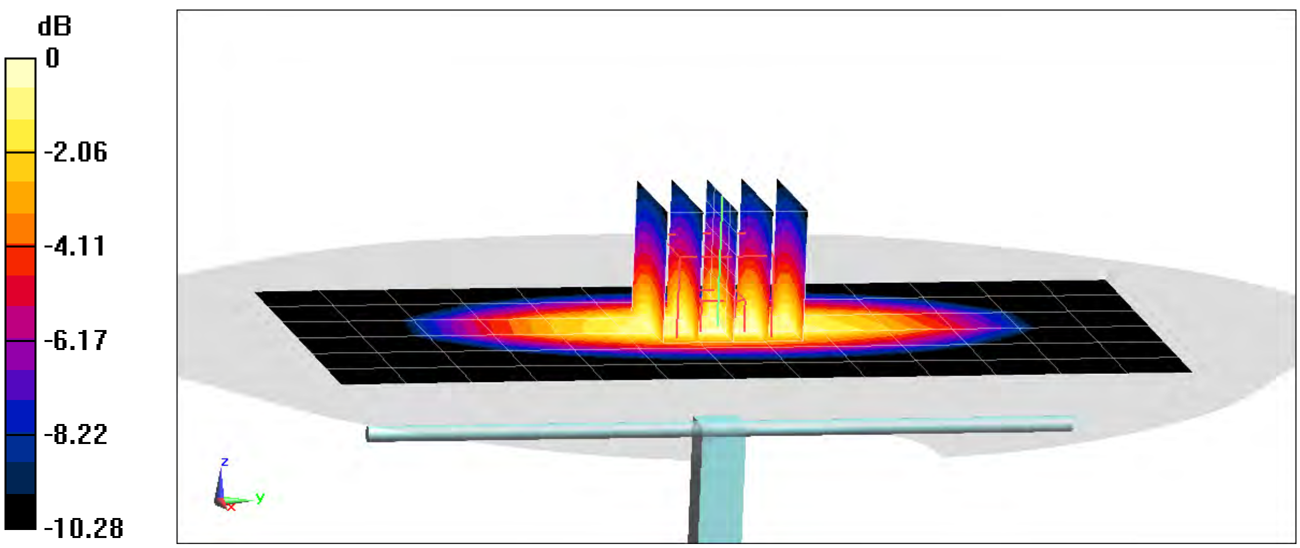
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used:
f = 835 MHz; σ = 0.998 S/m; ε_r = 53.485; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2018; Ambient Temp: 20.4°C; Tissue Temp: 20.0°C

Probe: ES3DV3 - SN3347; ConvF(6.37, 6.37, 6.37); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

835 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 3.02 W/kg
SAR(1 g) = 2.05 W/kg
Deviation(1 g) = 8.93%



0 dB = 2.40 W/kg = 3.80 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

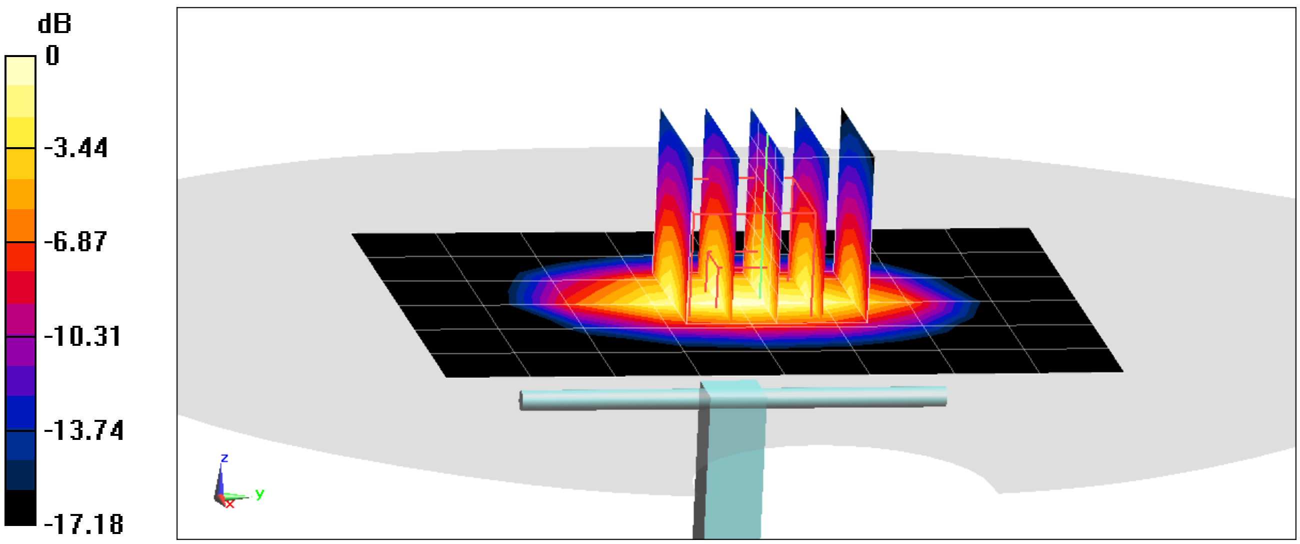
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 Body; Medium parameters used:
$f = 1750$ MHz; $\sigma = 1.49$ S/m; $\varepsilon_r = 51.674$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-16-2018; Ambient Temp: 20.1°C; Tissue Temp: 20.4°C

Probe: ES3DV3 - SN3347; ConvF(5.17, 5.17, 5.17); Calibrated: 3/27/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 11/9/2017
Phantom: Twin-SAM V5.0 Right; Type: QD 000 P40 CD; Serial: 1800
Measurement SW: DASY52, Version 52.10; SEMCAD X Version 14.6.10 (7417)

1750 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 6.58 W/kg
SAR(1 g) = 3.77 W/kg
Deviation(1 g) = 0.80%



0 dB = 4.67 W/kg = 6.69 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d080

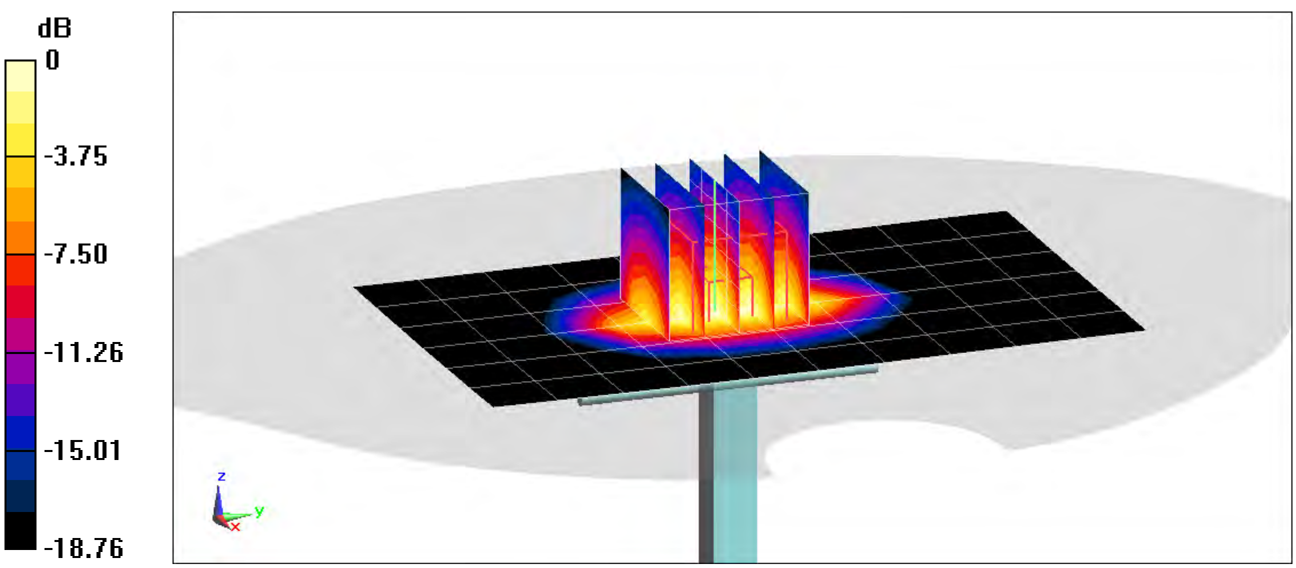
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.566 S/m; ε_r = 51.588; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-16-2018; Ambient Temp: 21.3°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7406; ConvF(7.74, 7.74, 7.74); Calibrated: 5/22/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/22/2018
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1167
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

1900 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 7.67 W/kg
SAR(1 g) = 4.09 W/kg; SAR(10 g) = 2.08 W/kg
Deviation(1 g) = 4.60%; Deviation(10 g) = 0.48%



0 dB = 6.42 W/kg = 8.08 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 797

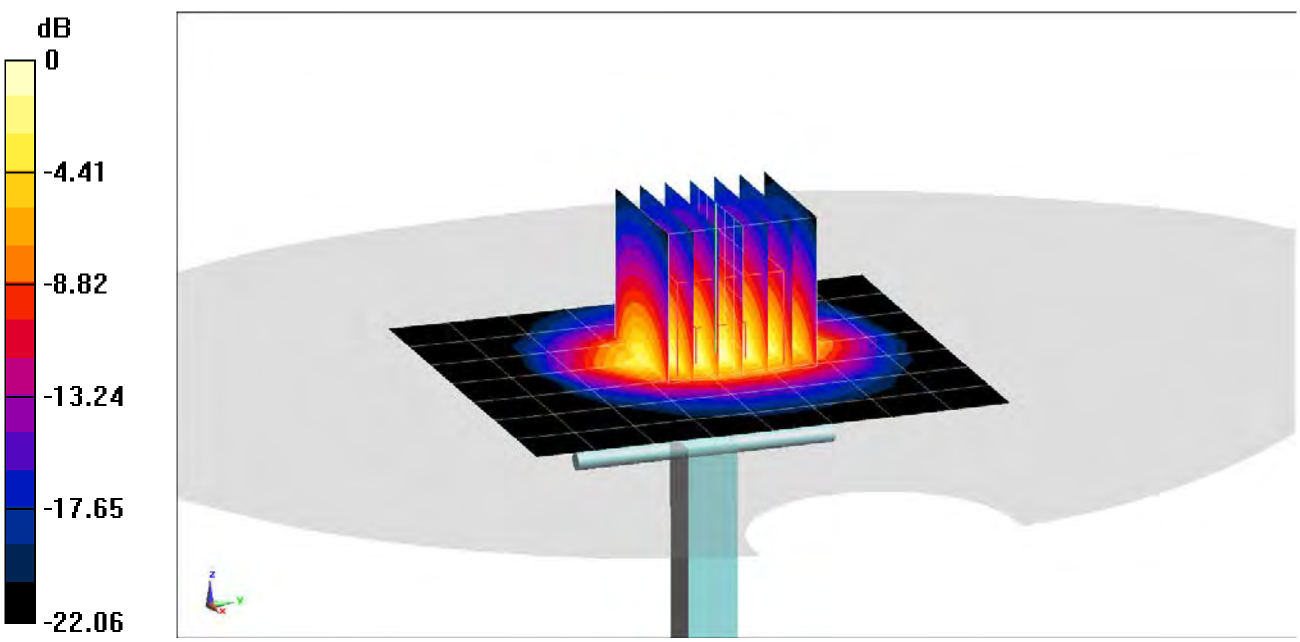
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used:
f = 2450 MHz; σ = 2.007 S/m; ε_r = 50.654; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-23-2018; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3319; ConvF(4.51, 4.51, 4.51); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 10.6 W/kg
SAR(1 g) = 5.07 W/kg
Deviation(1 g) = -0.78%



0 dB = 6.76 W/kg = 8.30 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1064

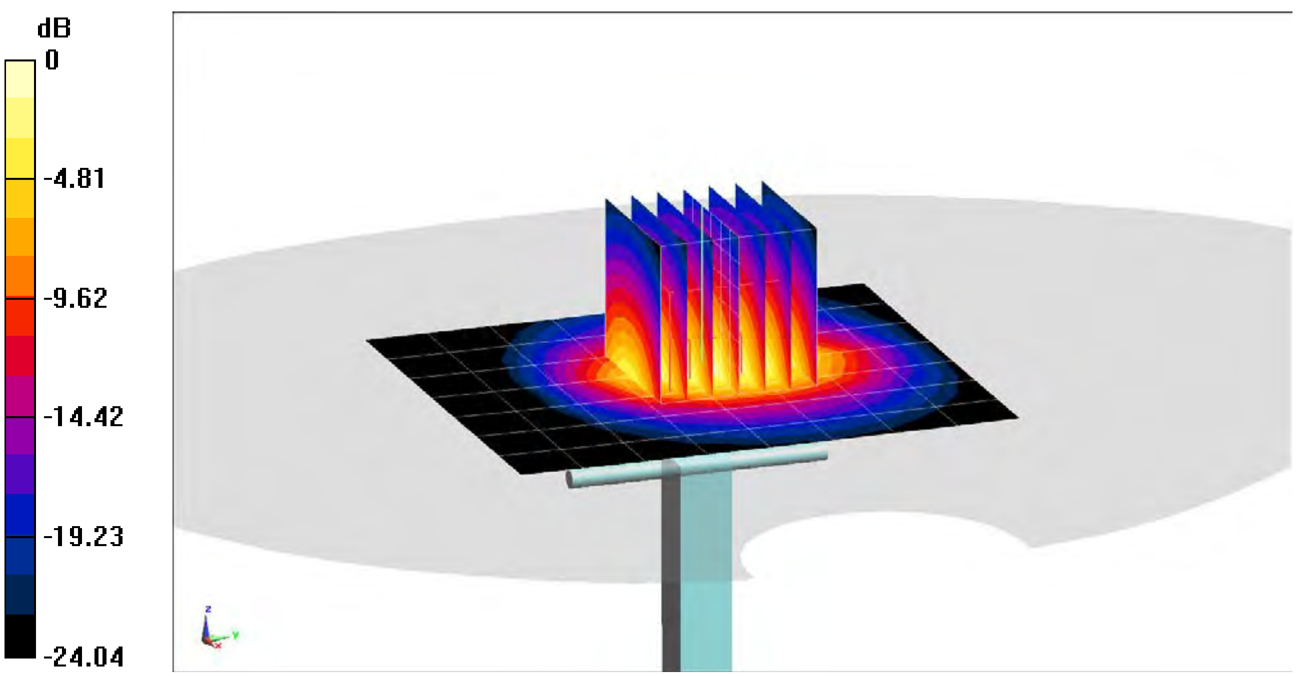
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used:
f = 2600 MHz; σ = 2.216 S/m; ε_r = 50.531; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-06-2018; Ambient Temp: 22.2°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3319; ConvF(4.33, 4.33, 4.33); Calibrated: 3/13/2018;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 3/7/2018
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1375
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

2600 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 12.7 W/kg
SAR(1 g) = 5.73 W/kg; SAR(10 g) = 2.52 W/kg
Deviation(1 g) = 4.75%; Deviation(10 g) = 3.28%



0 dB = 7.40 W/kg = 8.69 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1237

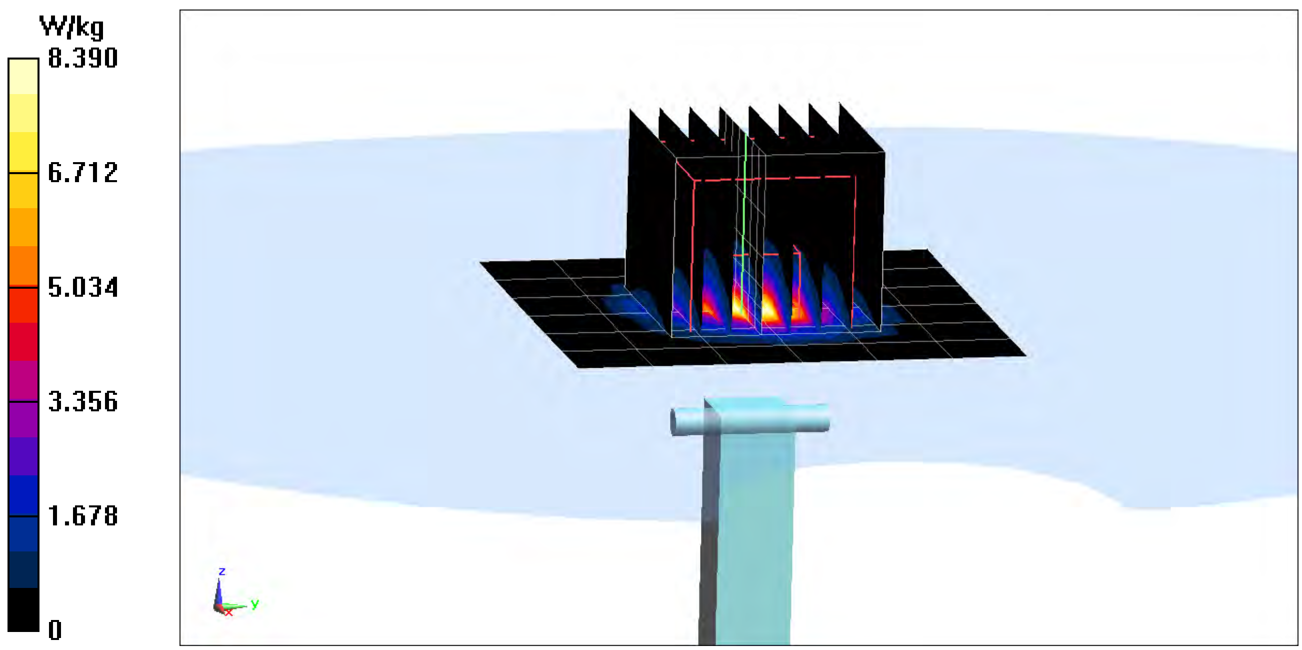
Communication System: UID 0, CW; Frequency: 5250 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5250 MHz; σ = 5.467 S/m; ε_r = 48.22; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-09-2018; Ambient Temp: 21.5°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7357; ConvF(4.78, 4.78, 4.78); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5250 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 14.8 W/kg
SAR(1 g) = 3.58 W/kg
Deviation(1 g) = -6.89%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1237

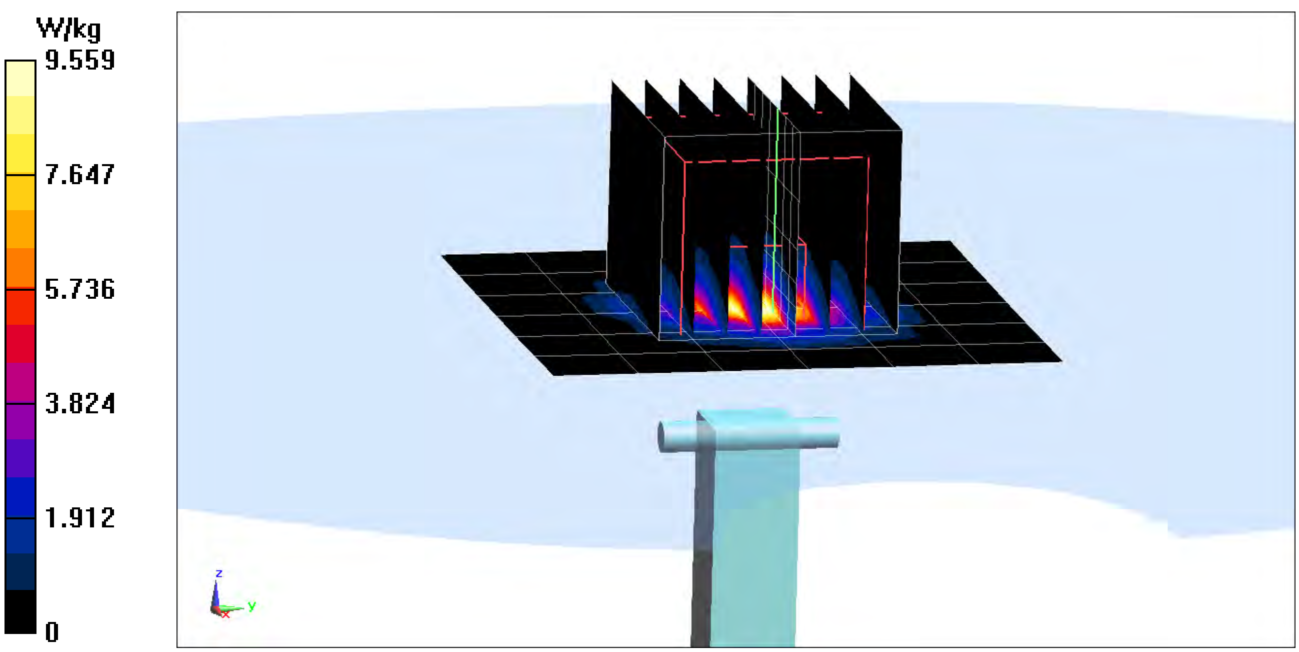
Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used:
f = 5600 MHz; σ = 5.941 S/m; ε_r = 47.649; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-09-2018; Ambient Temp: 21.5°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7357; ConvF(4.2, 4.2, 4.2); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5600 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 18.0 W/kg
SAR(1 g) = 3.96 W/kg
Deviation(1 g) = 0.89%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1237

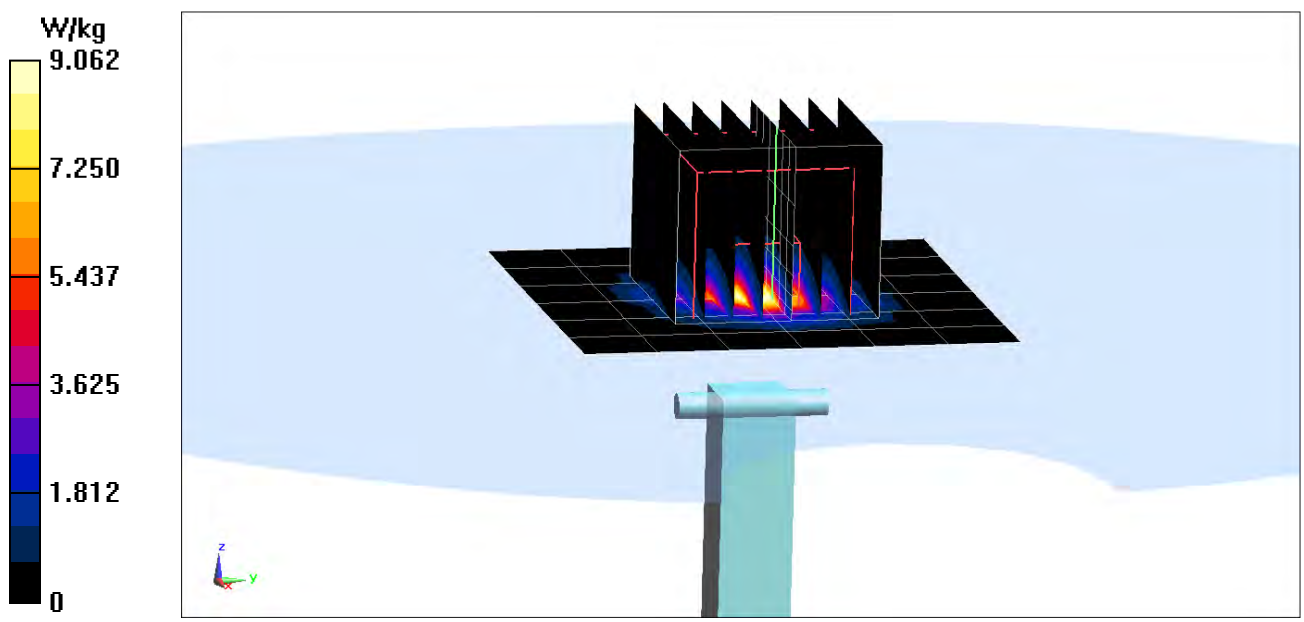
Communication System: UID 0, CW; Frequency: 5750 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5750 MHz; σ = 6.156 S/m; ε_r = 47.371; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-09-2018; Ambient Temp: 21.5°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7357; ConvF(4.21, 4.21, 4.21); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5750 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 3.7 W/kg
Deviation(1 g) = -4.02%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1237

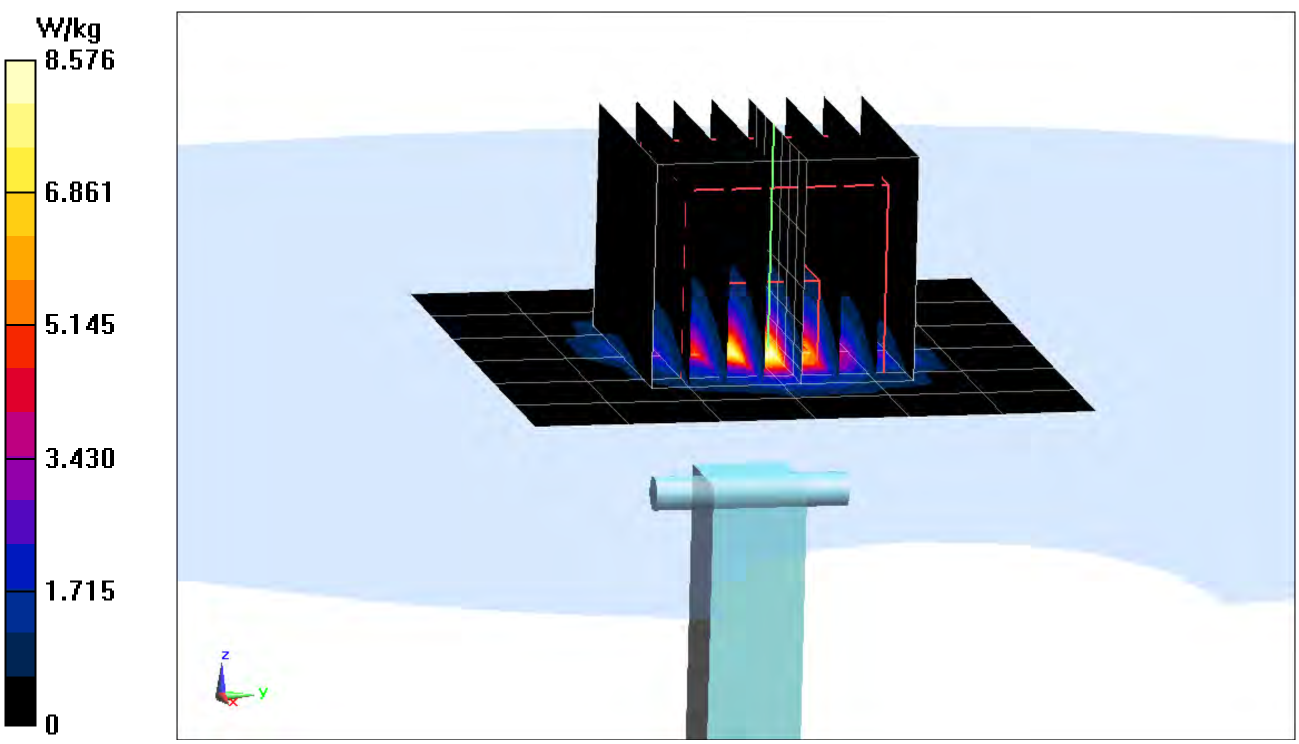
Communication System: UID 0, CW; Frequency: 5250 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used (interpolated):
f = 5250 MHz; σ = 5.499 S/m; ε_r = 47.855; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-06-2018; Ambient Temp: 22.1°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN7357; ConvF(4.78, 4.78, 4.78); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5250 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 14.3 W/kg
SAR(10 g) = 1 W/kg
Deviation(10 g) = -6.98%



DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1237

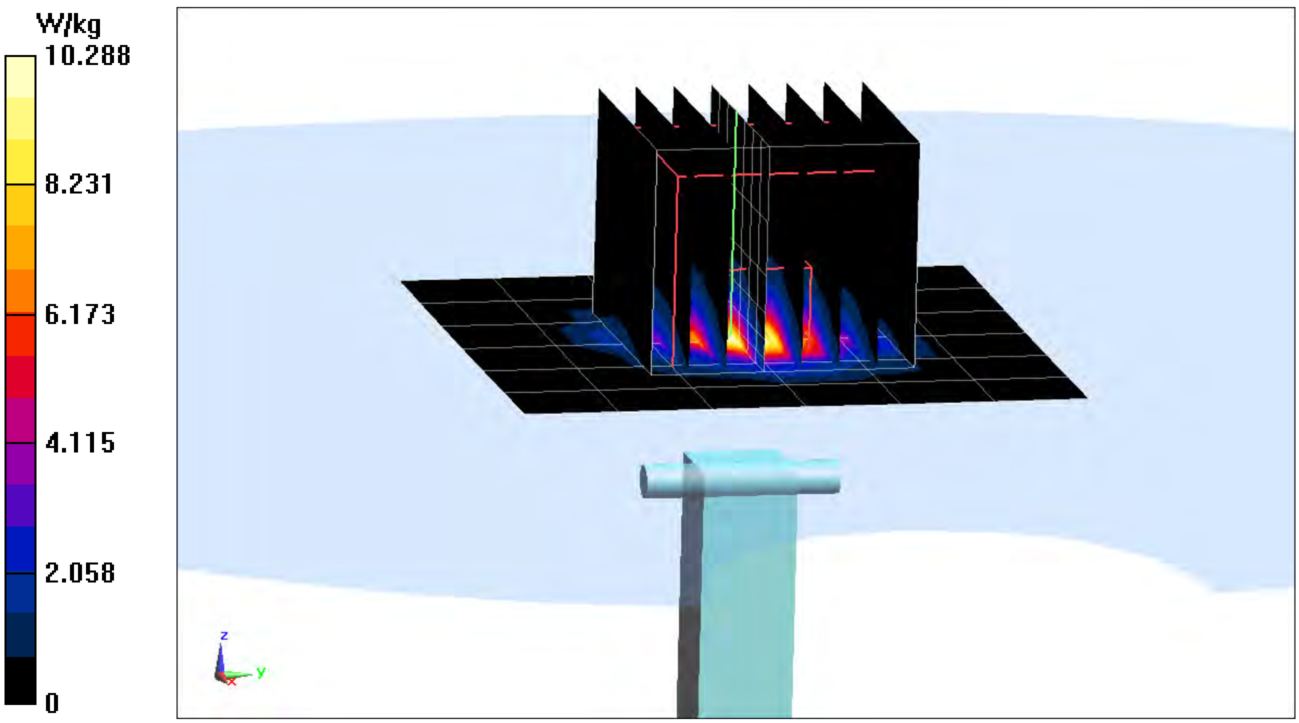
Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5600 MHz; σ = 5.965 S/m; ε_r = 47.257; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-06-2018; Ambient Temp: 22.1°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN7357; ConvF(4.2, 4.2, 4.2); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5600 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 18.3 W/kg
SAR(10 g) = 1.14 W/kg
Deviation(10 g) = 3.17%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1237

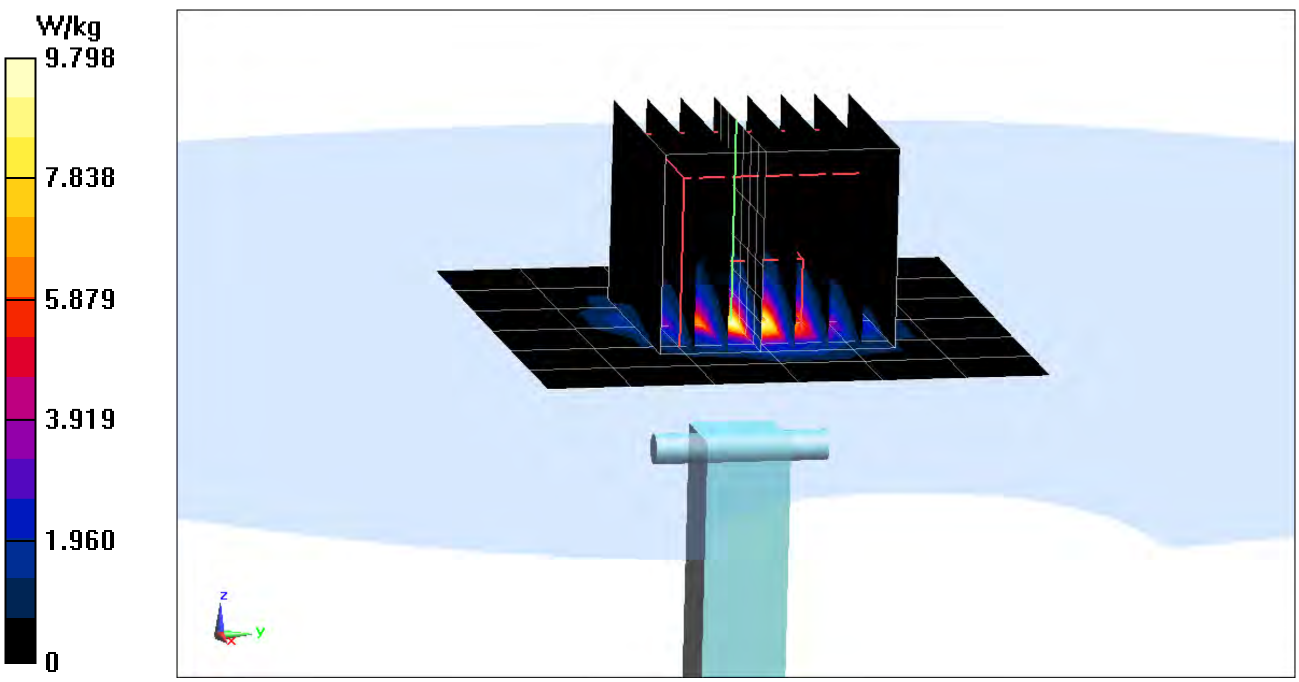
Communication System: UID 0, CW; Frequency: 5750 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used (interpolated):
f = 5750 MHz; $\sigma = 6.191$ S/m; $\varepsilon_r = 47.005$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-06-2018; Ambient Temp: 22.1°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN7357; ConvF(4.21, 4.21, 4.21); Calibrated: 4/18/2018;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/11/2018
Phantom: SAM with CRP v5.0 Left; Type: QD000P40CD; Serial: 1687
Measurement SW: DASY52, Version 52.10;SEMCAD X Version 14.6.10 (7417)

5750 MHz System Verification at 17.0 dBm (50 mW)

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
Peak SAR (extrapolated) = 18.0 W/kg
SAR(10 g) = 1.06 W/kg
Deviation(10 g) = -0.93%



APPENDIX C: PROBE CALIBRATION

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

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 0108**

Client **PC Test**

Certificate No: **D750V3-1161_Jul16**

CALIBRATION CERTIFICATE

Object	D750V3 - SN:1161
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 13, 2016

√PN 8/9/16

Extended BN ✓ 7/18/2018

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 NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 13, 2016

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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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 ± 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 ± 0.2) °C	40.9 ± 6 %	0.91 mho/m ± 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	2.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.17 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.39 W/kg ± 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 ± 0.2) °C	55.1 ± 6 %	0.99 mho/m ± 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	**8.43 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.53 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.6 Ω - 0.9 jΩ
Return Loss	- 25.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.2 Ω - 4.0 jΩ
Return Loss	- 28.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.033 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	November 19, 2015

DASY5 Validation Report for Head TSL

Date: 13.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1161

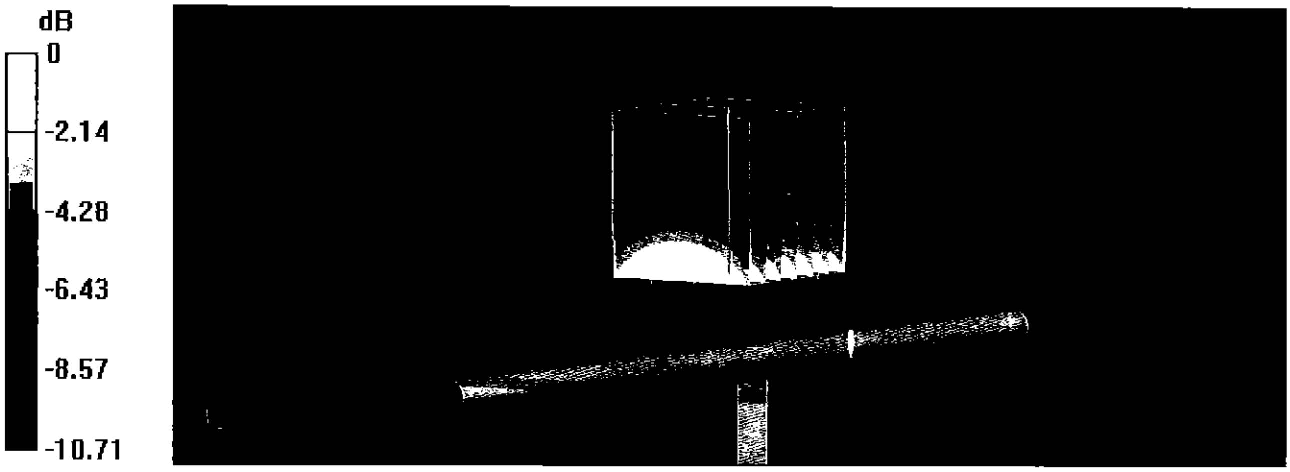
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.91$ S/m; $\varepsilon_r = 40.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.07, 10.07, 10.07); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

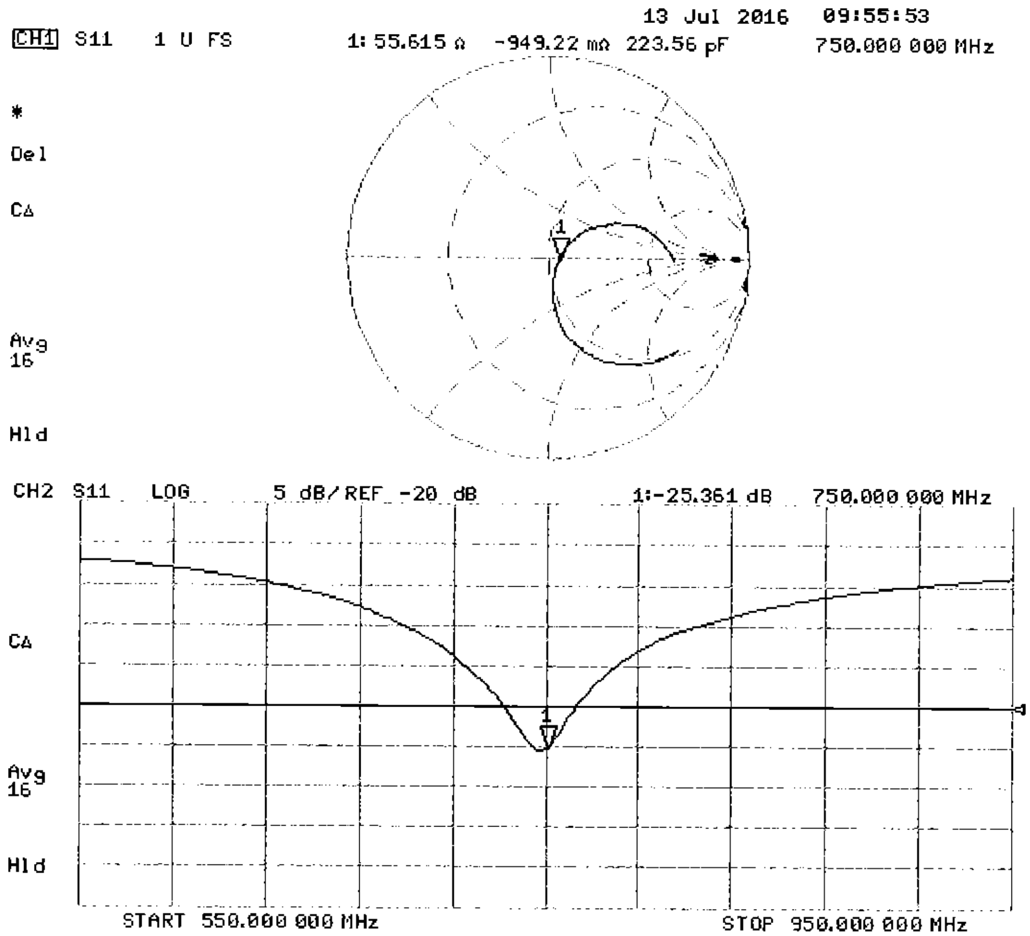
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.07 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.13 W/kg
SAR(1 g) = 2.09 W/kg; SAR(10 g) = 1.37 W/kg
Maximum value of SAR (measured) = 2.80 W/kg



0 dB = 2.80 W/kg = 4.47 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

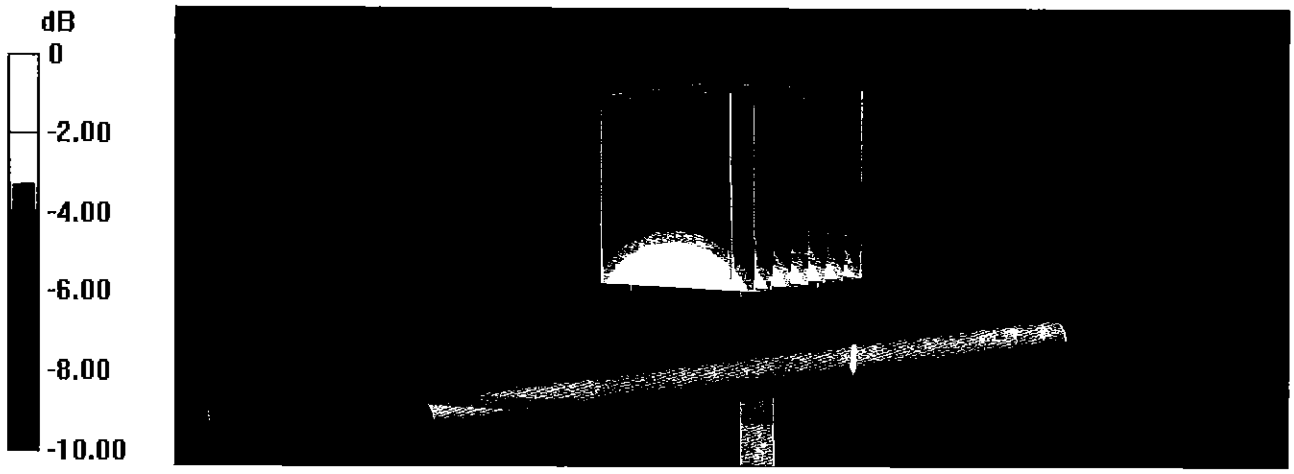
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1161

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.99 S/m; ε_r = 55.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

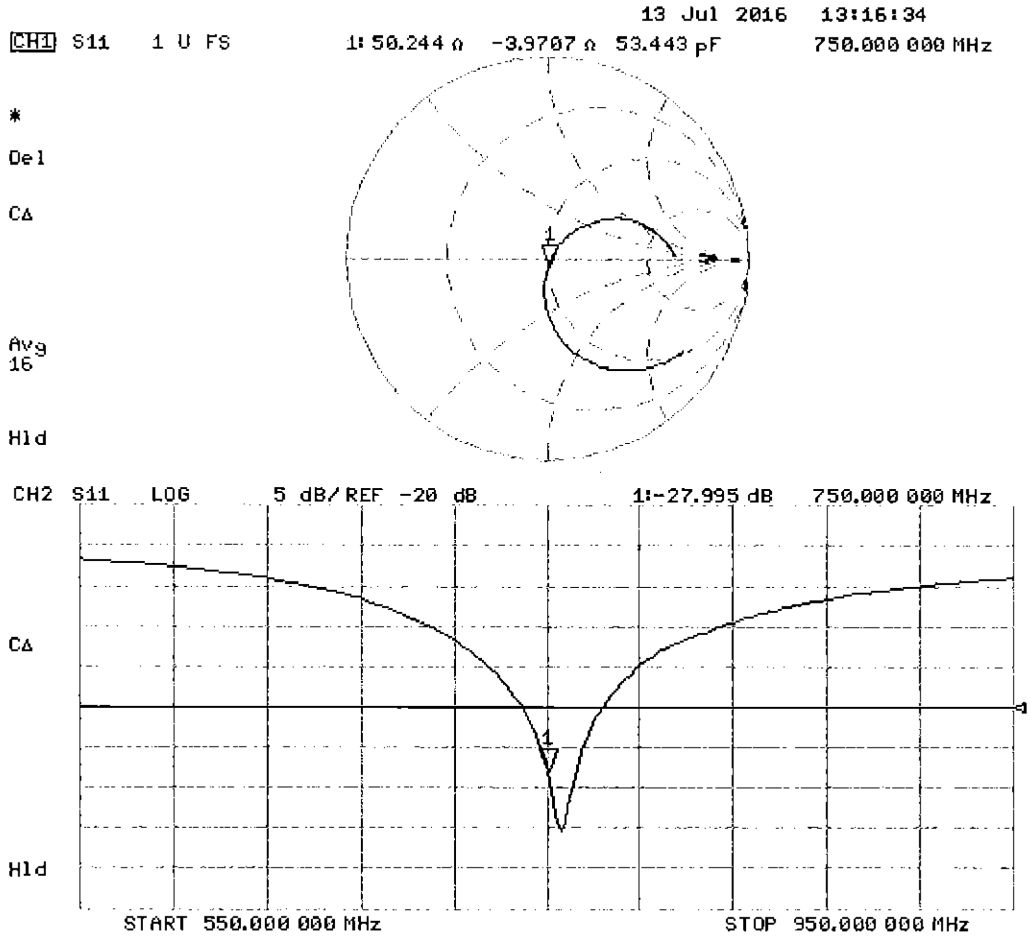
- Probe: EX3DV4 - SN7349; ConvF(9.99, 9.99, 9.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 56.33 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.22 W/kg
SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.41 W/kg
Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 4.58 dBW/kg

Impedance Measurement Plot for Body TSL



PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. +1.410.290.6652 / Fax +1.410.290.6654
http://www.pctest.com

Certification of Calibration

Object D750V3 – SN: 1161

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Calibration date: July 12, 2017

Description: SAR Validation Dipole at 750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/1/2017	Annual	6/1/2018	MY53401181
Agilent	8753ES	S-Parameter Network Analyzer	10/26/2016	Annual	10/26/2017	US39170118
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/8/2017	Annual	3/8/2018	1368
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/14/2017	Annual	6/14/2018	1334
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/10/2017	Annual	5/10/2018	1070
SPEAG	ES3DV3	SAR Probe	11/15/2016	Annual	11/15/2017	3334
SPEAG	ES3DV3	SAR Probe	3/14/2017	Annual	3/14/2018	3319
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1207364
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1339018
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Agilent	N5182A	MXG Vector Signal Generator	2/28/2017	Annual	2/28/2018	MY47420800
Seekonk	NC-100	Torque Wrench	11/6/2015	Biennial	11/6/2017	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

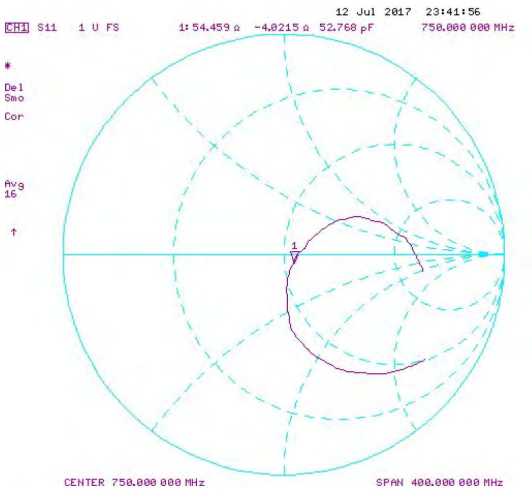
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

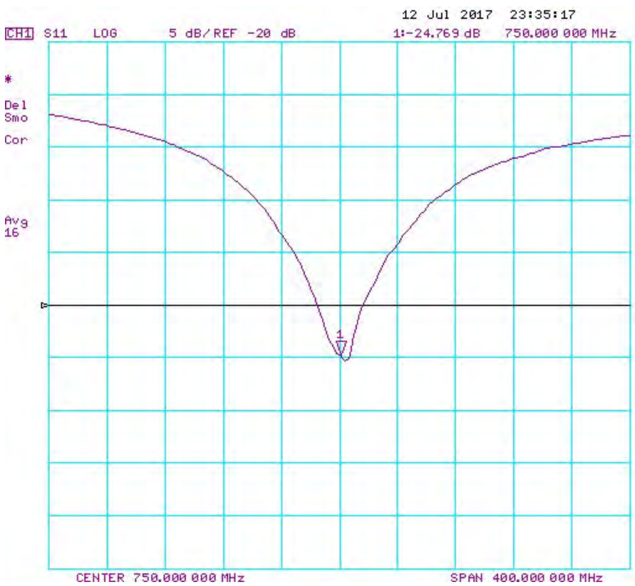
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
7/13/2016	7/12/2017	1.033	1.63	1.65	0.98%	1.08	1.09	1.11%	55.6	54.5	1.1	-0.9	-4.0	3.1	-25.4	-24.8	2.40%	PASS

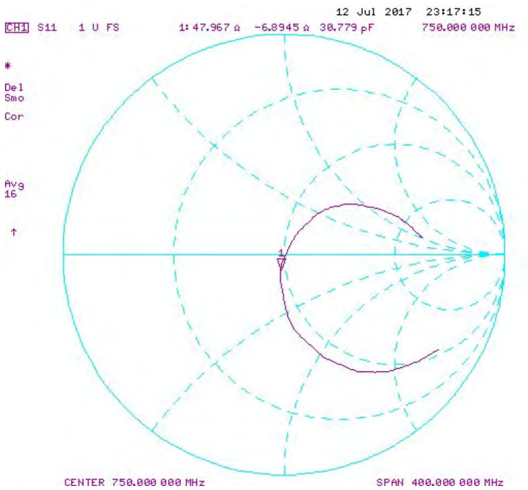
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
7/13/2016	7/12/2017	1.033	1.69	1.75	3.80%	1.11	1.17	5.79%	50.2	48.0	2.2	-4.0	-6.9	2.9	-28.0	-23.9	14.60%	PASS

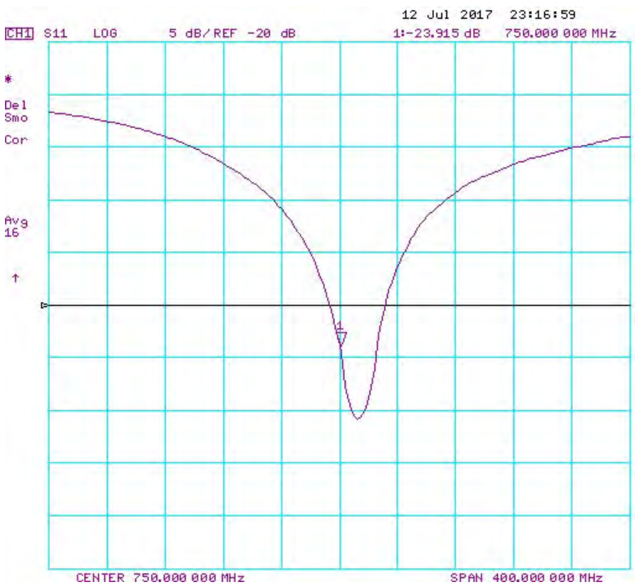
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Certification of Calibration

Object	D750V3 – SN: 1161
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	07/12/2018
Description:	SAR Validation Dipole at 750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4438C	ESG Vector Signal Generator	3/24/2017	Biennial	3/24/2019	MY42082385
Agilent	8753ES	S-Parameter Network Analyzer	9/14/2017	Annual	9/14/2018	US39170118
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	ML2495A	Power Meter	11/28/2017	Annual	11/28/2018	1039008
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	11/15/2017	Annual	11/15/2018	1339007
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/9/2018	Annual	2/9/2019	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/12/2017	Annual	9/12/2018	1091
SPEAG	ES3DV3	SAR Probe	2/13/2018	Annual	2/13/2019	3213
SPEAG	ES3DV3	SAR Probe	6/25/2018	Annual	6/25/2019	7409

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

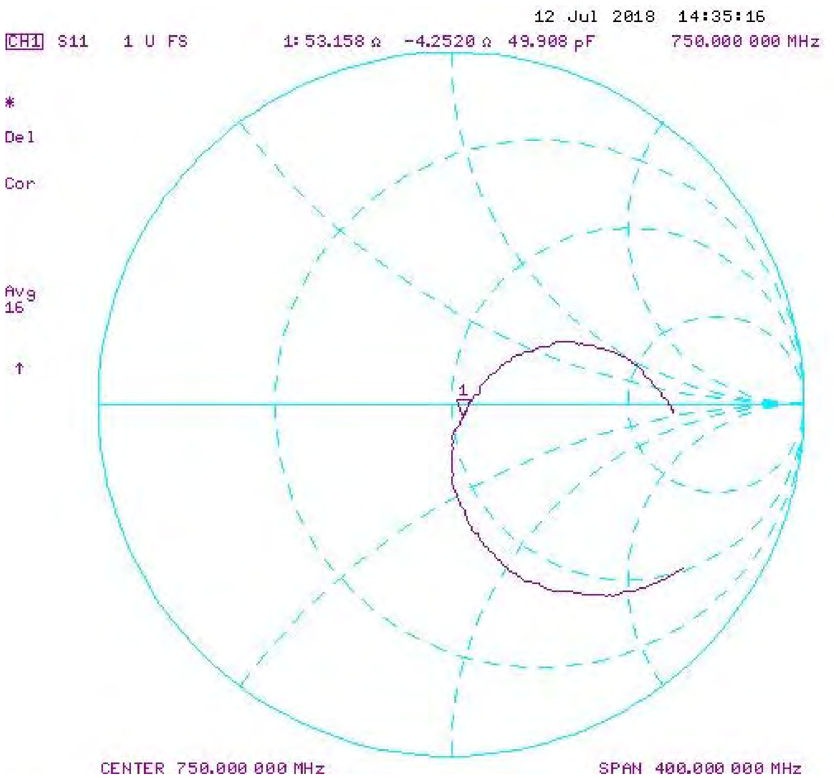
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

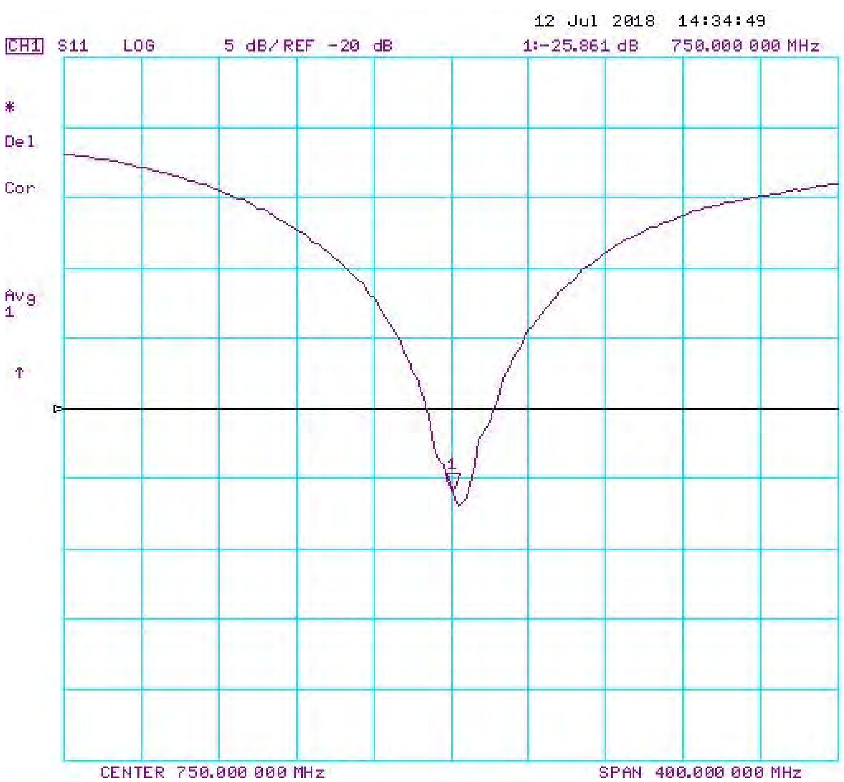
The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
7/13/2016	7/12/2018	1.033	1.63	1.58	-3.30%	1.08	1.03	-4.45%	55.6	53.2	2.4	-0.9	-4.3	3.4	-25.4	-25.9	-2.00%	PASS

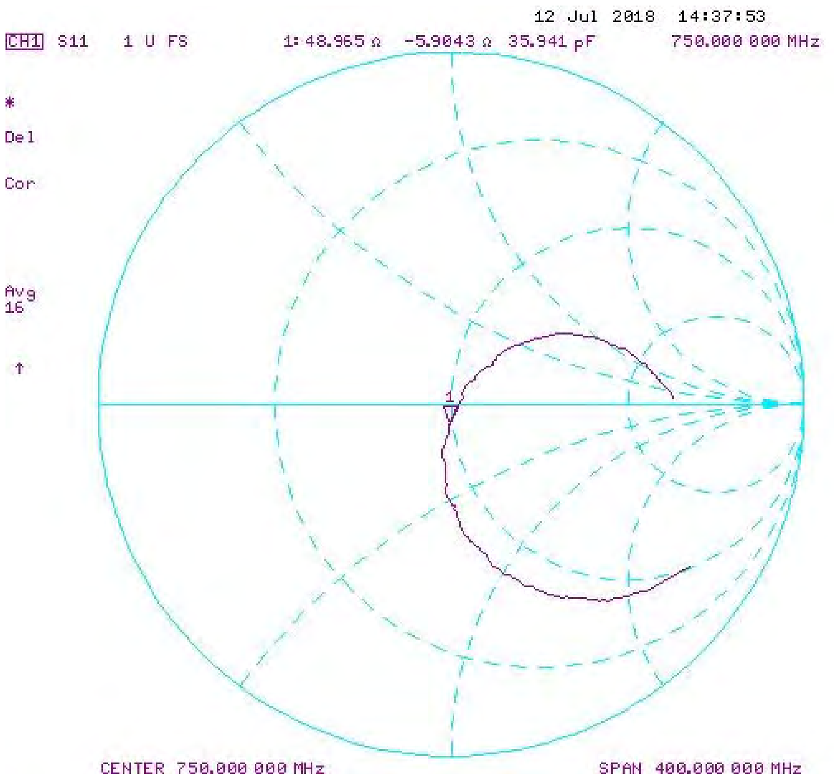
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
7/13/2016	7/12/2018	1.033	1.69	1.74	3.20%	1.11	1.15	3.98%	50.2	49.0	1.2	-4.0	-5.9	1.9	-28.0	-24.4	12.90%	PASS

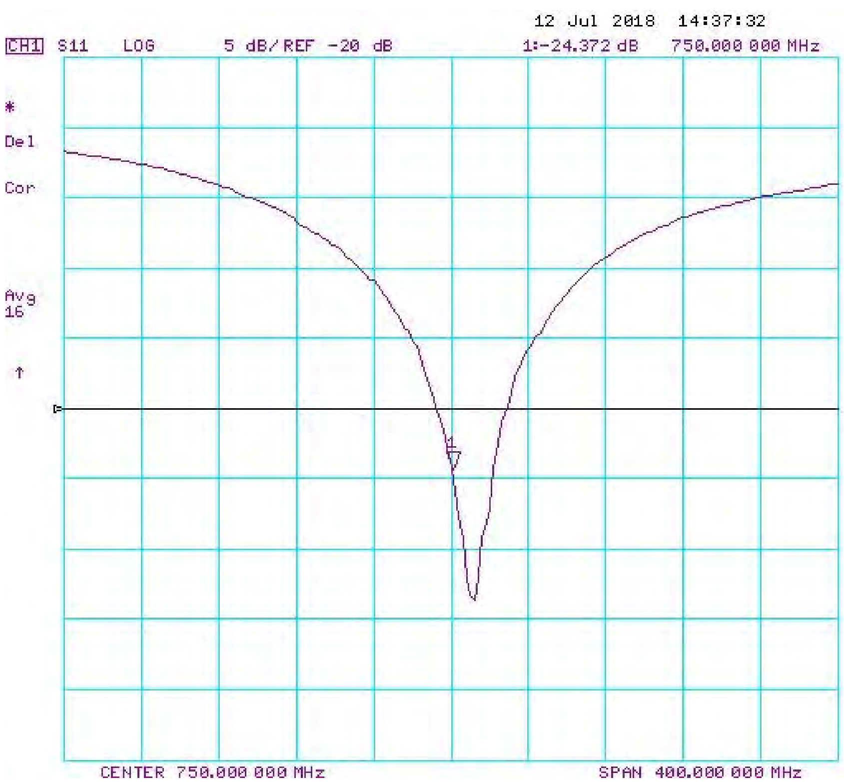
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

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 0108**

Client **PC Test**

Certificate No: **D835V2-4d047_Jul16**

CALIBRATION CERTIFICATE

Object	D835V2 - SN:4d047
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 13, 2016

BN✓ 7/16/2016
Extended BN✓ 7/18/2018

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 NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	[signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: July 13, 2016

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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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 ± 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 ± 0.2) °C	40.6 ± 6 %	0.94 mho/m ± 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	**9.13 W/kg ± 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	**5.95 W/kg ± 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 ± 0.2) °C	54.9 ± 6 %	1.01 mho/m ± 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	2.47 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.57 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.24 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω - 5.9 jΩ
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.8 Ω - 8.2 jΩ
Return Loss	- 20.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	None 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	August 16, 2006

DASY5 Validation Report for Head TSL

Date: 13.07.201

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:4d047

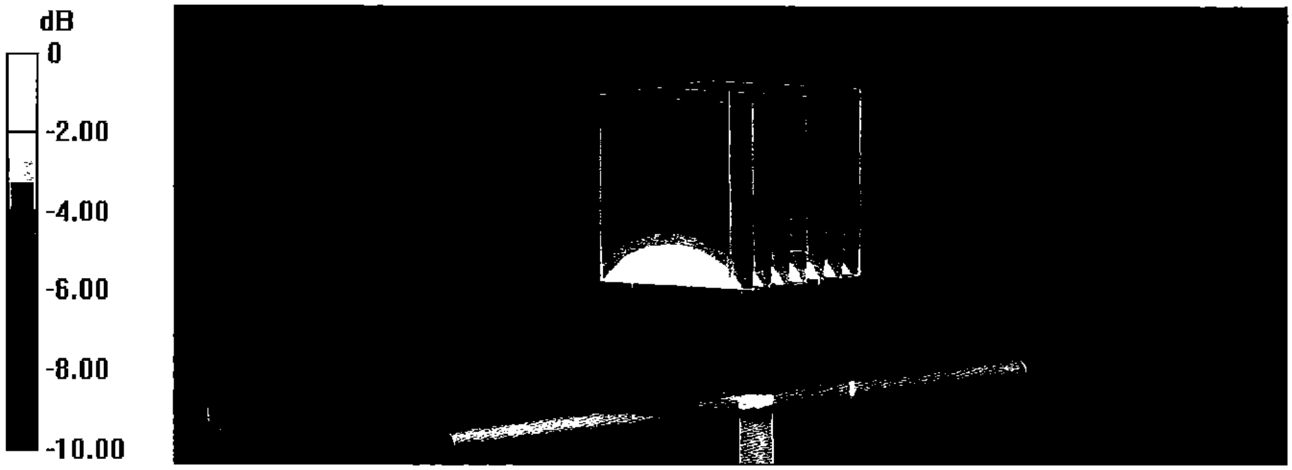
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 40.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.72, 9.72, 9.72); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

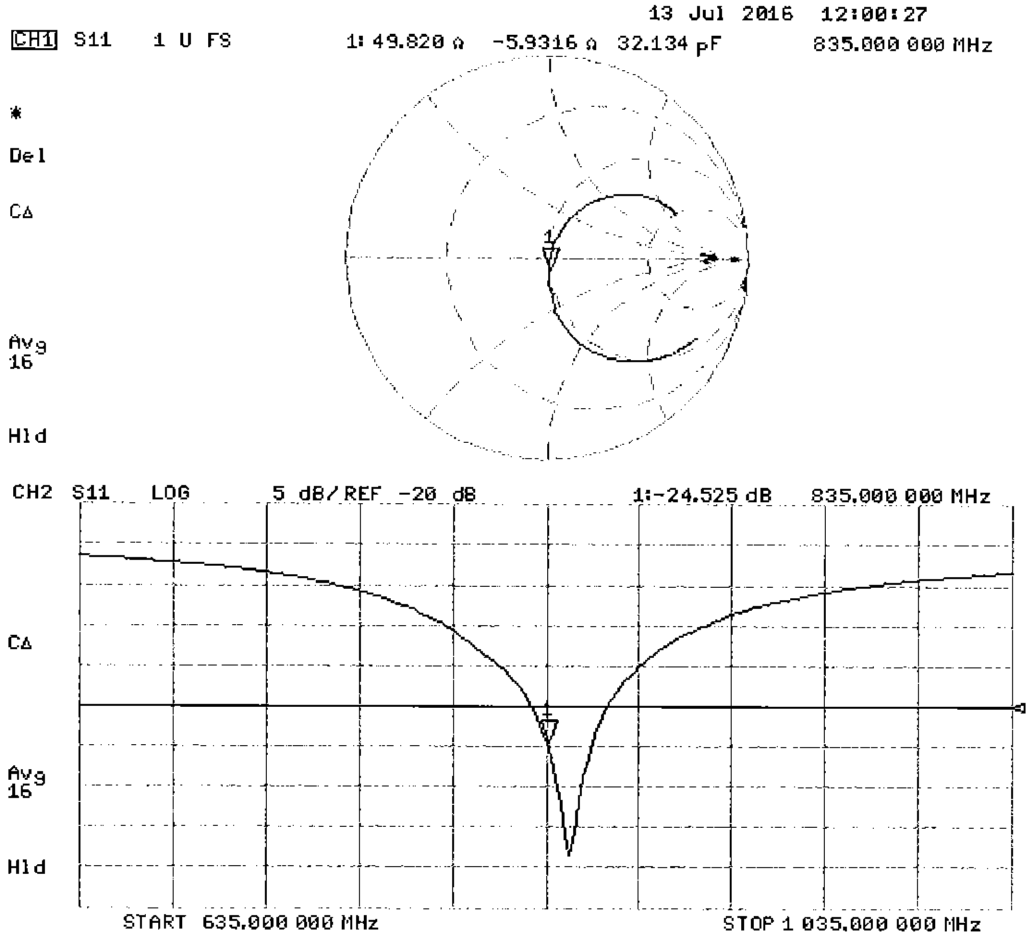
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.98 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 3.17 W/kg



0 dB = 3.17 W/kg = 5.01 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:4d047

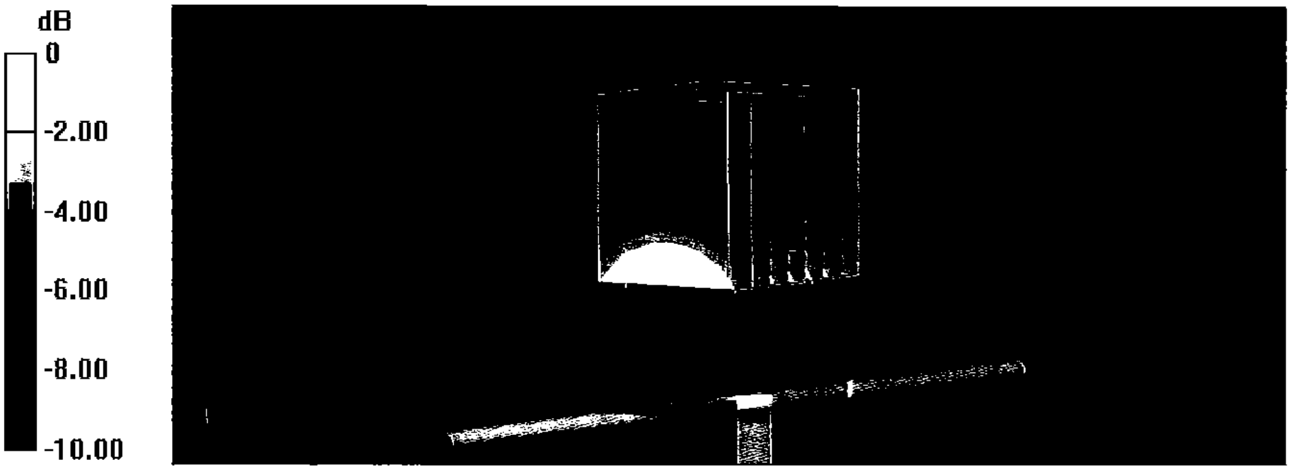
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.73, 9.73, 9.73); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

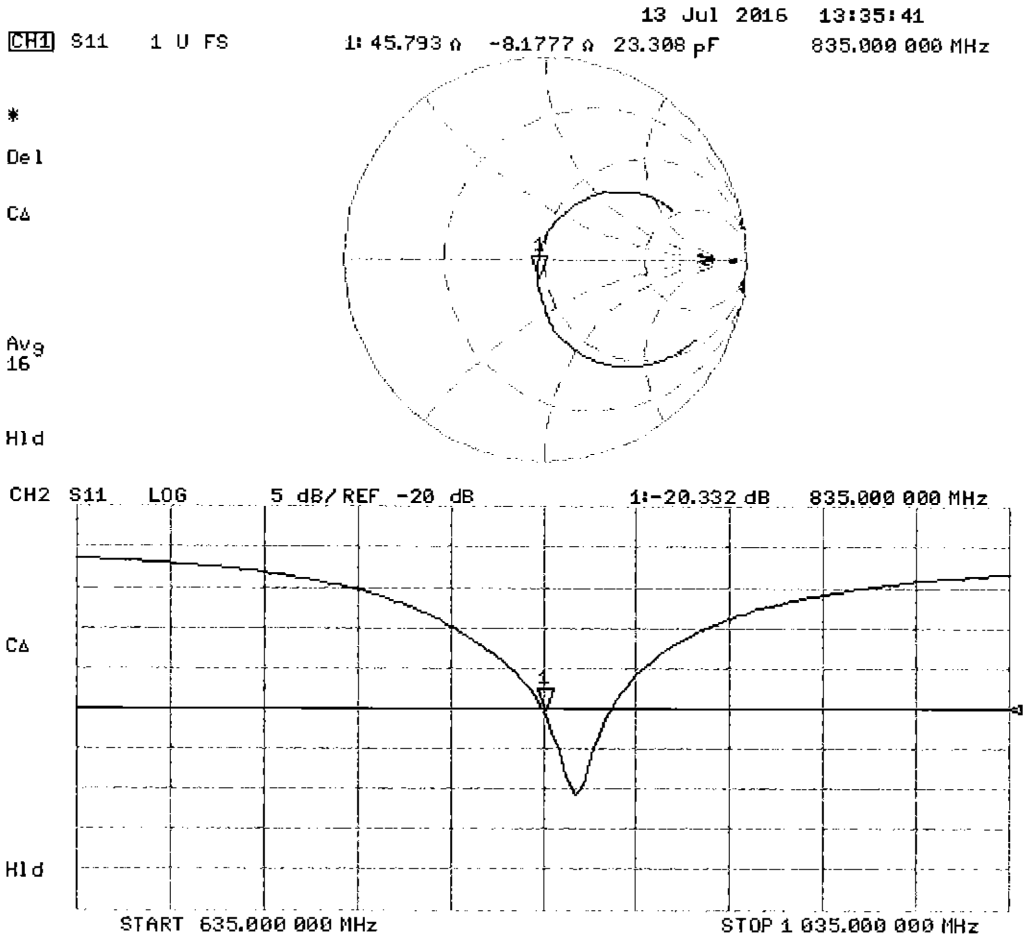
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.88 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.67 W/kg
SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.6 W/kg
Maximum value of SAR (measured) = 3.27 W/kg



0 dB = 3.27 W/kg = 5.15 dBW/kg

Impedance Measurement Plot for Body TSL



PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. +1.410.290.6652 / Fax +1.410.290.6654
http://www.pctest.com

Certification of Calibration

Object D835V2 – SN: 4d047

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Calibration date: July 13, 2017

Description: SAR Validation Dipole at 835 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/1/2017	Annual	6/1/2018	MY53401181
Agilent	8753ES	S-Parameter Network Analyzer	10/26/2016	Annual	10/26/2017	US39170118
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/8/2017	Annual	3/8/2018	1368
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/13/2017	Annual	3/13/2018	1415
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/10/2017	Annual	5/10/2018	1070
SPEAG	ES3DV3	SAR Probe	3/14/2017	Annual	3/14/2018	3209
SPEAG	ES3DV3	SAR Probe	3/14/2017	Annual	3/14/2018	3319
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1207364
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1339018
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Agilent	N5182A	MXG Vector Signal Generator	2/28/2017	Annual	2/28/2018	MY47420800
Seekonk	NC-100	Torque Wrench	11/6/2015	Biennial	11/6/2017	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

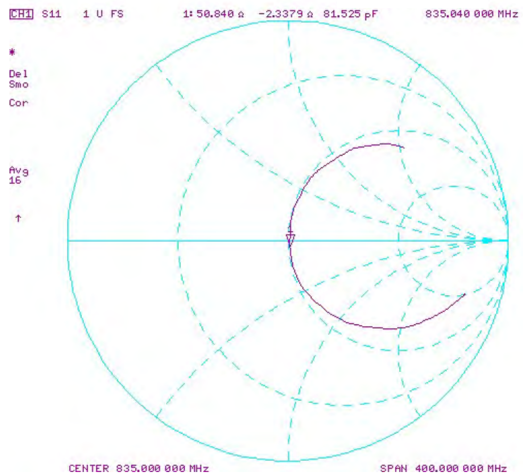
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

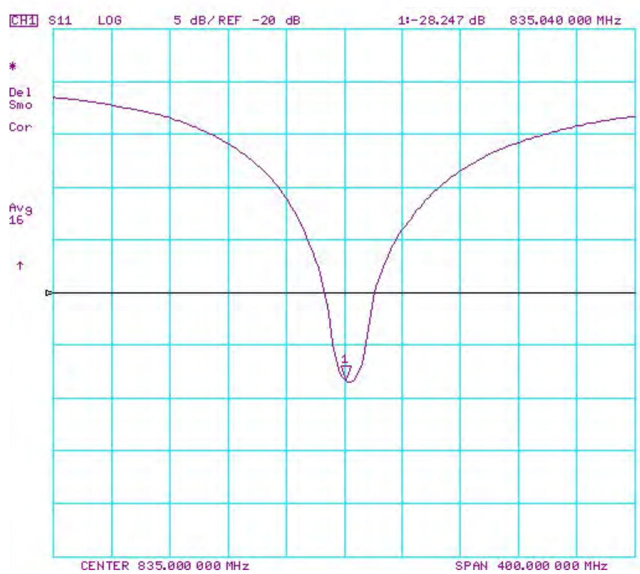
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
7/13/2016	7/13/2017	0	1.83	1.95	6.79%	1.19	1.28	7.56%	49.8	50.8	1	-5.9	-2.3	3.6	-24.5	-28.2	-15.10%	PASS

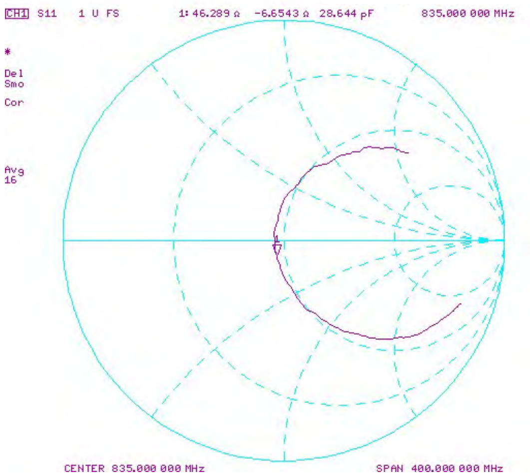
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
7/13/2016	7/13/2017	0	1.91	1.99	3.97%	1.25	1.31	4.97%	45.8	46.3	0.5	-8.2	-6.7	1.5	-20.3	-22.5	-10.80%	PASS

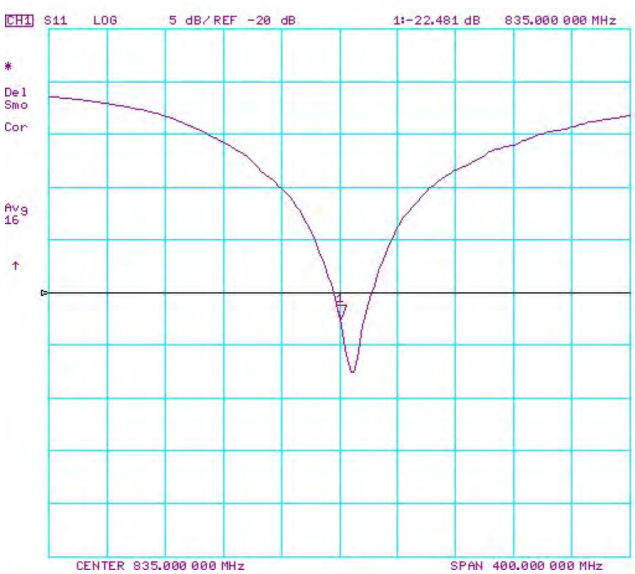
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Certification of Calibration

Object	D835V2 – SN: 4d047
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	07/12/2018
Description:	SAR Validation Dipole at 835 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4438C	ESG Vector Signal Generator	3/24/2017	Biennial	3/24/2019	MY42082385
Agilent	8753ES	S-Parameter Network Analyzer	9/14/2017	Annual	9/14/2018	US39170118
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	ML2495A	Power Meter	11/28/2017	Annual	11/28/2018	1039008
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	11/15/2017	Annual	11/15/2018	1339007
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/9/2018	Annual	2/9/2019	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/9/2017	Annual	11/9/2018	1450
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/12/2017	Annual	9/12/2018	1091
SPEAG	ES3DV3	SAR Probe	2/13/2018	Annual	2/13/2019	3213
SPEAG	ES3DV3	SAR Probe	3/27/2018	Annual	3/27/2019	3347

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

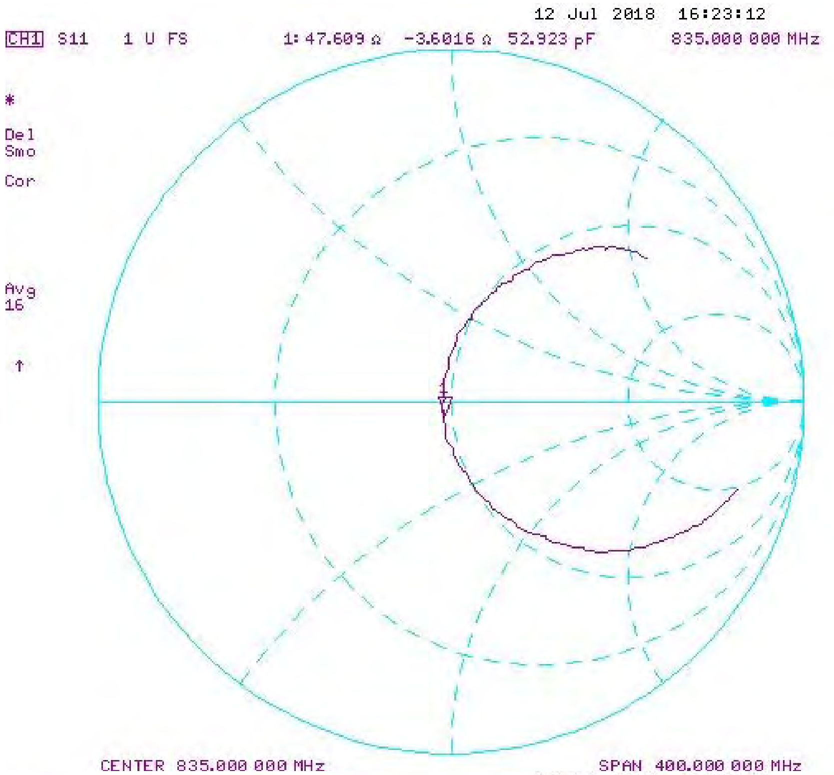
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

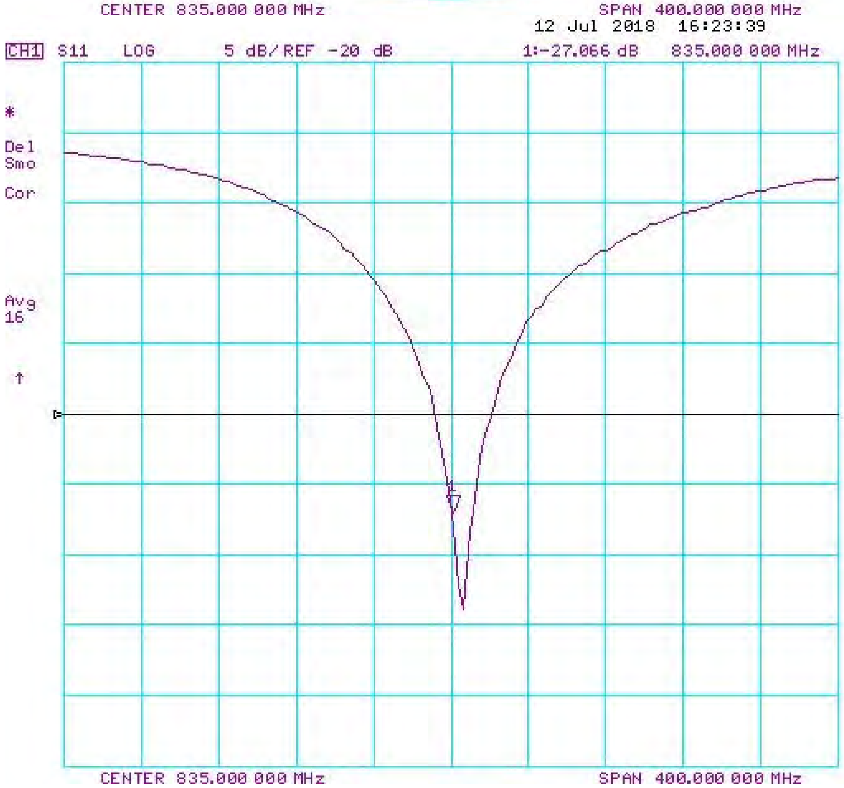
The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
7/13/2016	7/12/2018	0	1.826	1.890	3.50%	1.190	1.240	4.20%	49.8	47.6	2.2	-5.9	-3.6	2.3	-24.5	-27.1	-10.60%	PASS

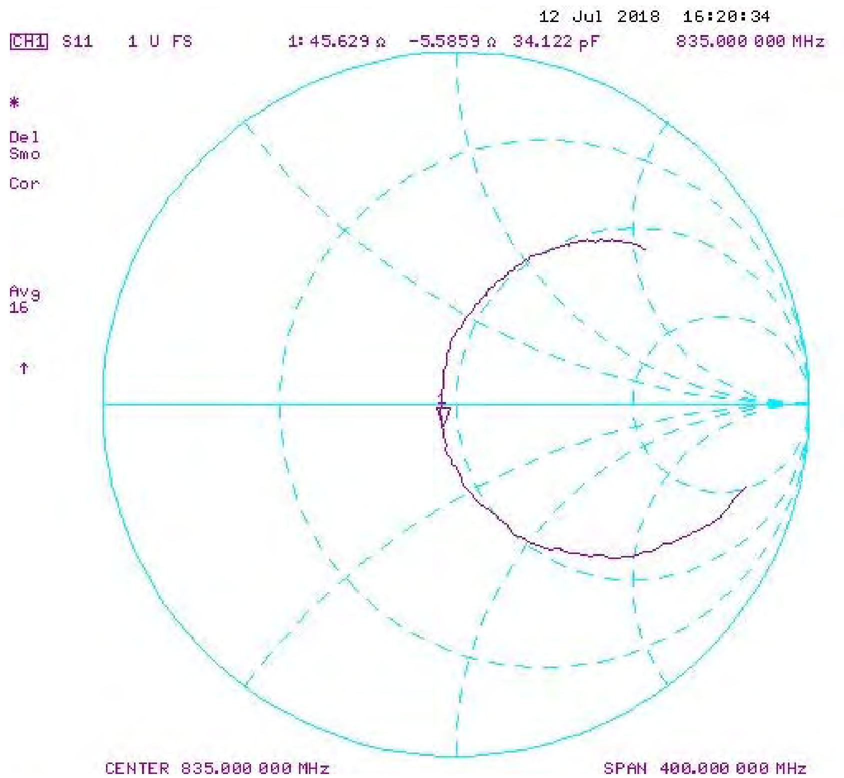
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
7/13/2016	7/12/2018	0	1.914	1.910	-0.21%	1.248	1.260	0.96%	45.8	45.6	0.2	-8.2	-5.6	2.6	-20.3	-22.6	-11.30%	PASS

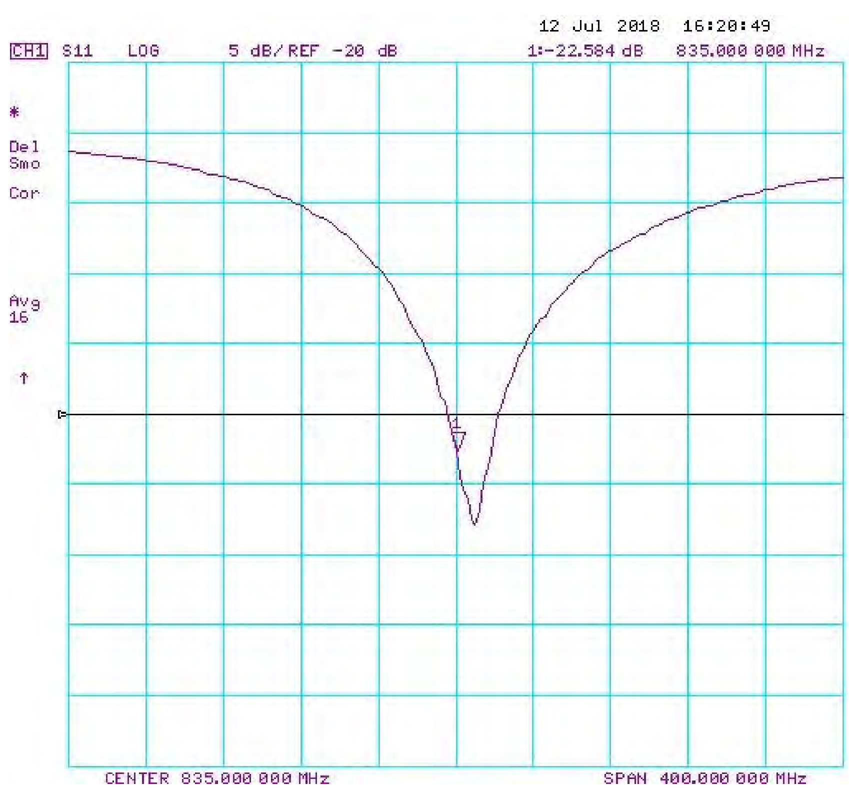
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Object:	Date Issued:	Page 4 of 4
D835V2 – SN: 4d047	07/12/2018	

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

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 0108

Client **PC Test**

Certificate No: D1750V2-1148_May17

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1148
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	May 09, 2017

BN ✓ 05-23-2017
BN ✓ 05-09-2018

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 NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-Dec-16 (No. EX3-7349_Dec16)	Dec-17
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 11, 2017

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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.0
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 ± 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 ± 0.2) °C	39.0 ± 6 %	1.36 mho/m ± 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	9.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.83 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.3 W/kg ± 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 ± 0.2) °C	53.7 ± 6 %	1.47 mho/m ± 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	9.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.93 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.8 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω - 0.7 jΩ
Return Loss	- 42.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.7 Ω - 0.5 jΩ
Return Loss	- 26.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.223 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 30, 2014

DASY5 Validation Report for Head TSL

Date: 09.05.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1148

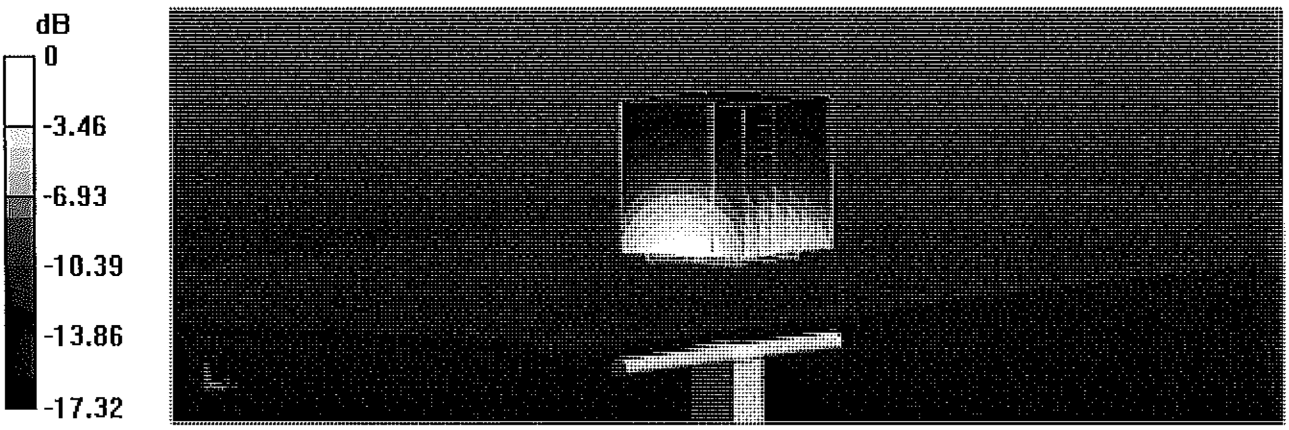
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.36 S/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.46, 8.46, 8.46); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

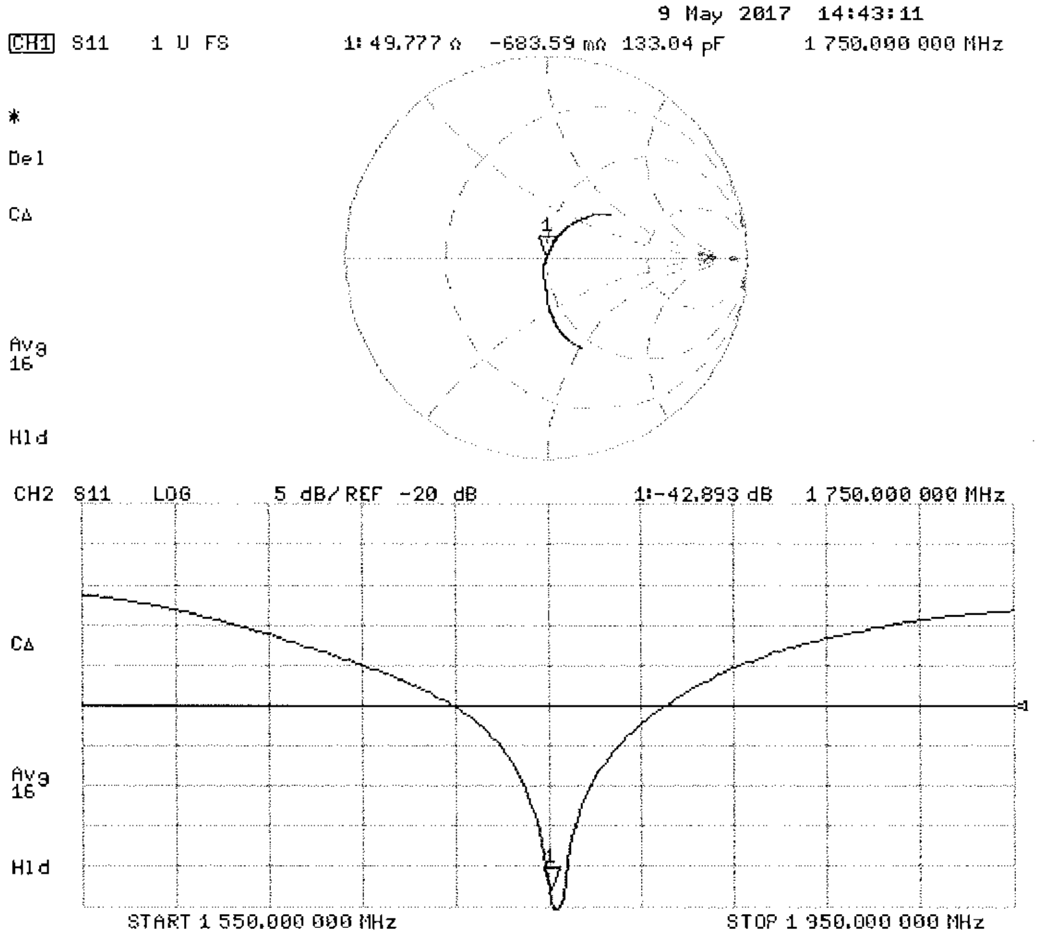
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.4 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 16.5 W/kg
SAR(1 g) = 9.11 W/kg; SAR(10 g) = 4.83 W/kg
Maximum value of SAR (measured) = 13.9 W/kg



0 dB = 13.9 W/kg = 11.43 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 09.05.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1148

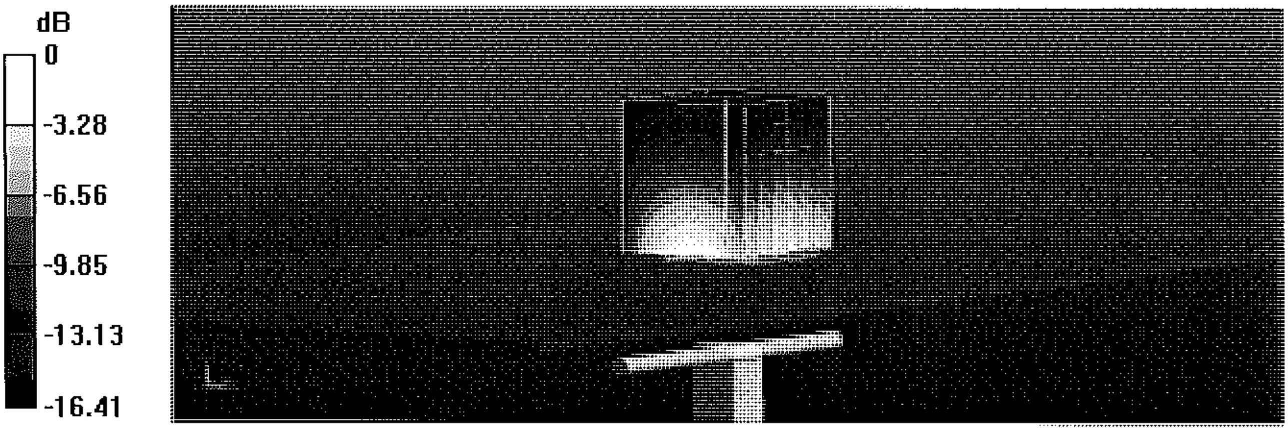
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.47 S/m; ε_r = 53.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.25, 8.25, 8.25); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

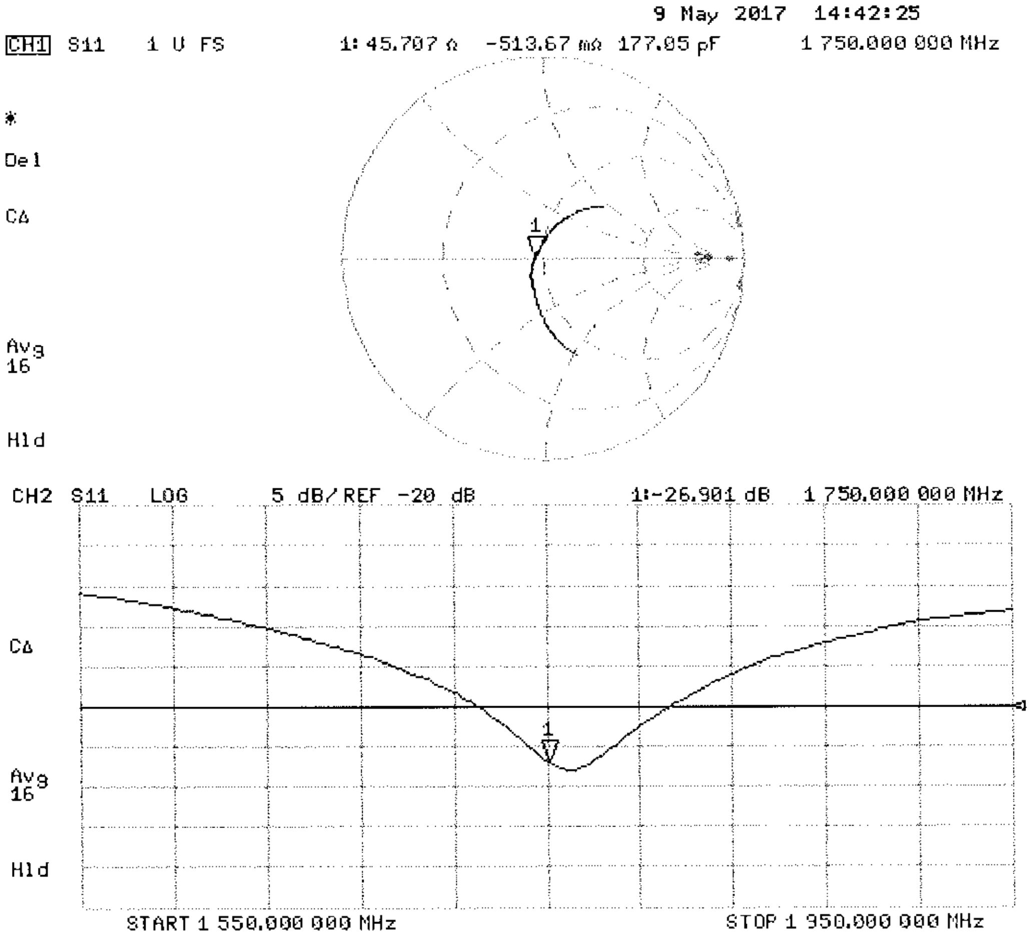
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.49 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 15.9 W/kg
SAR(1 g) = 9.17 W/kg; SAR(10 g) = 4.93 W/kg
Maximum value of SAR (measured) = 13.1 W/kg



0 dB = 13.1 W/kg = 11.17 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object	D1750V2 – SN: 1148
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	May 09, 2018
Description:	SAR Validation Dipole at 1750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/1/2017	Annual	6/1/2018	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/9/2018	Annual	2/9/2019	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/21/2017	Annual	6/21/2018	1333
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/12/2017	Annual	9/12/2018	1091
SPEAG	ES3DV3	SAR Probe	9/18/2017	Annual	9/18/2018	3287
SPEAG	ES3DV3	SAR Probe	2/13/2018	Annual	2/13/2019	3213
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1339018
Agilent	N5182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Agilent	8753ES	S-Parameter Network Analyzer	9/14/2017	Annual	9/14/2018	US39170118
Pasternack	NC-100	Torque Wrench	4/18/2018	Annual	4/18/2019	1445
Anritsu	ML2495A	Power Meter	10/22/2017	Annual	10/22/2018	941001

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

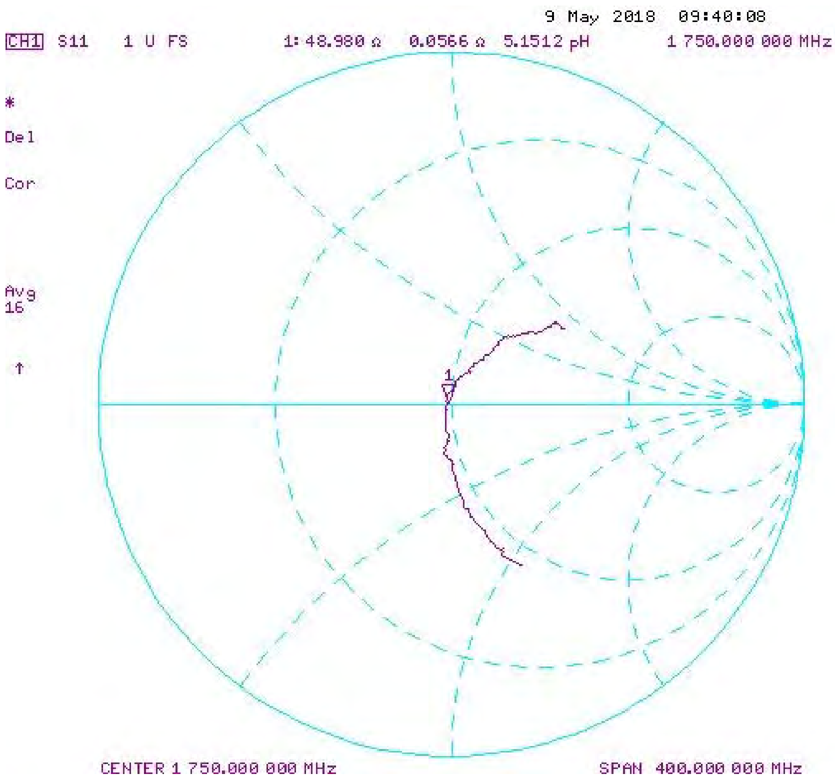
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

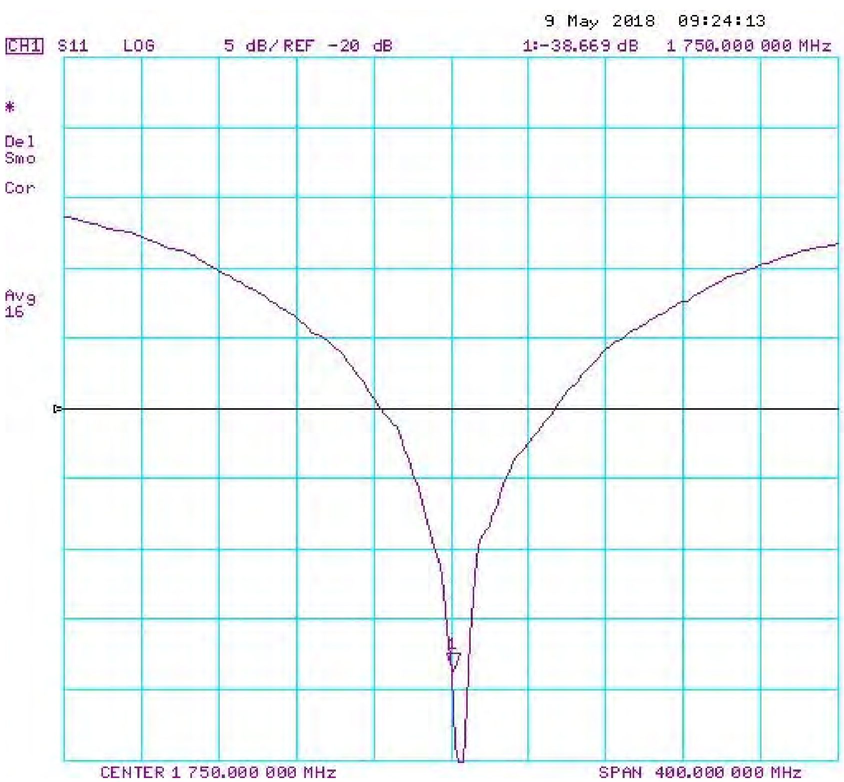
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5/9/2017	5/9/2018	1.223	3.64	3.59	-1.37%	1.93	1.91	-1.04%	49.8	49.0	0.8	-0.7	0.1	0.8	-42.9	-38.7	9.90%	PASS

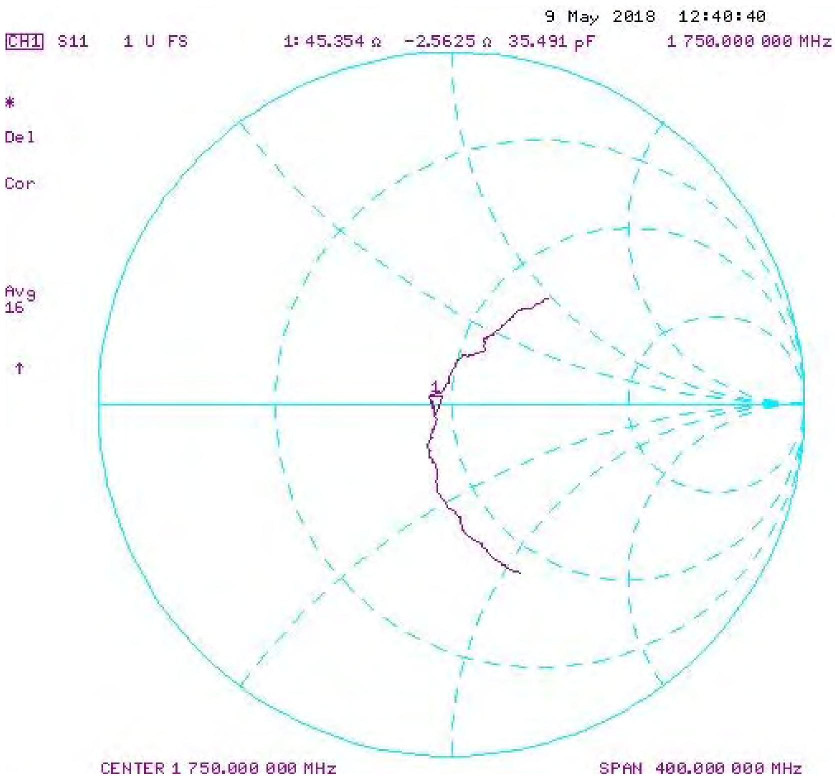
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
5/9/2017	5/9/2018	1.223	3.7	3.88	4.86%	1.98	2.06	4.04%	45.7	45.4	0.3	-0.5	-2.6	2.1	-26.9	-25.0	7.20%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL



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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: D1900V2-5d148_Feb18

CALIBRATION CERTIFICATE

Object	D1900V2 - SN:5d148
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 07, 2018

BN✓ 03-02-2018

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 NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 7, 2018

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.0
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 ± 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 ± 0.2) °C	40.7 ± 6 %	1.39 mho/m ± 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	9.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.0 W/kg ± 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 ± 0.2) °C	55.2 ± 6 %	1.48 mho/m ± 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	9.68 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1 Ω + 5.8 jΩ
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8 Ω + 6.5 jΩ
Return Loss	- 23.1 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: 07.02.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d148

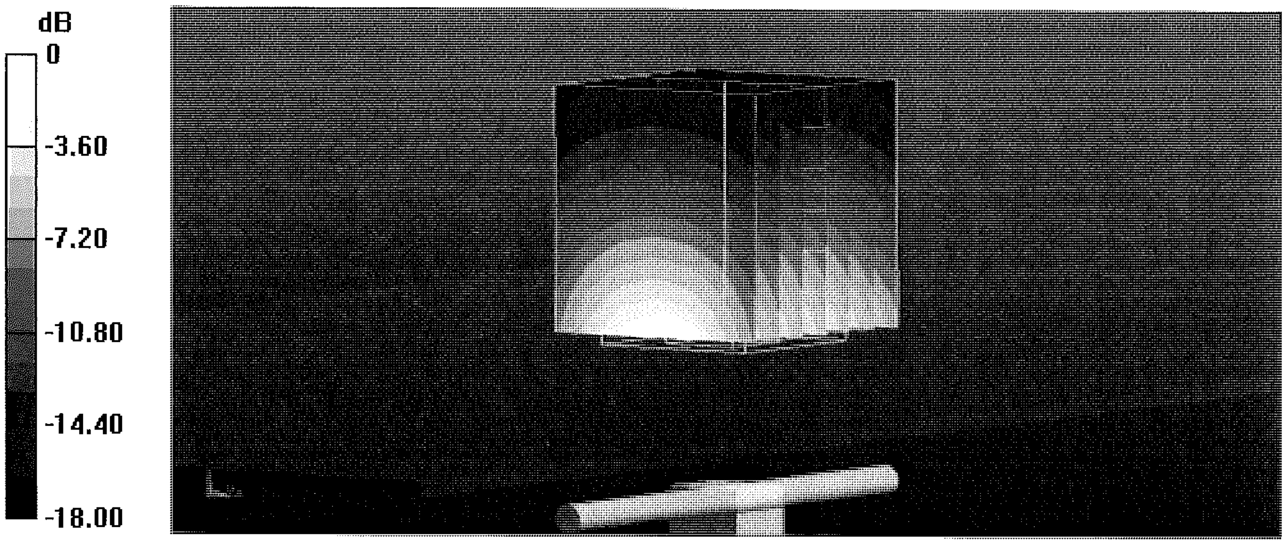
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.39$ S/m; $\varepsilon_r = 40.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.18, 8.18, 8.18); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

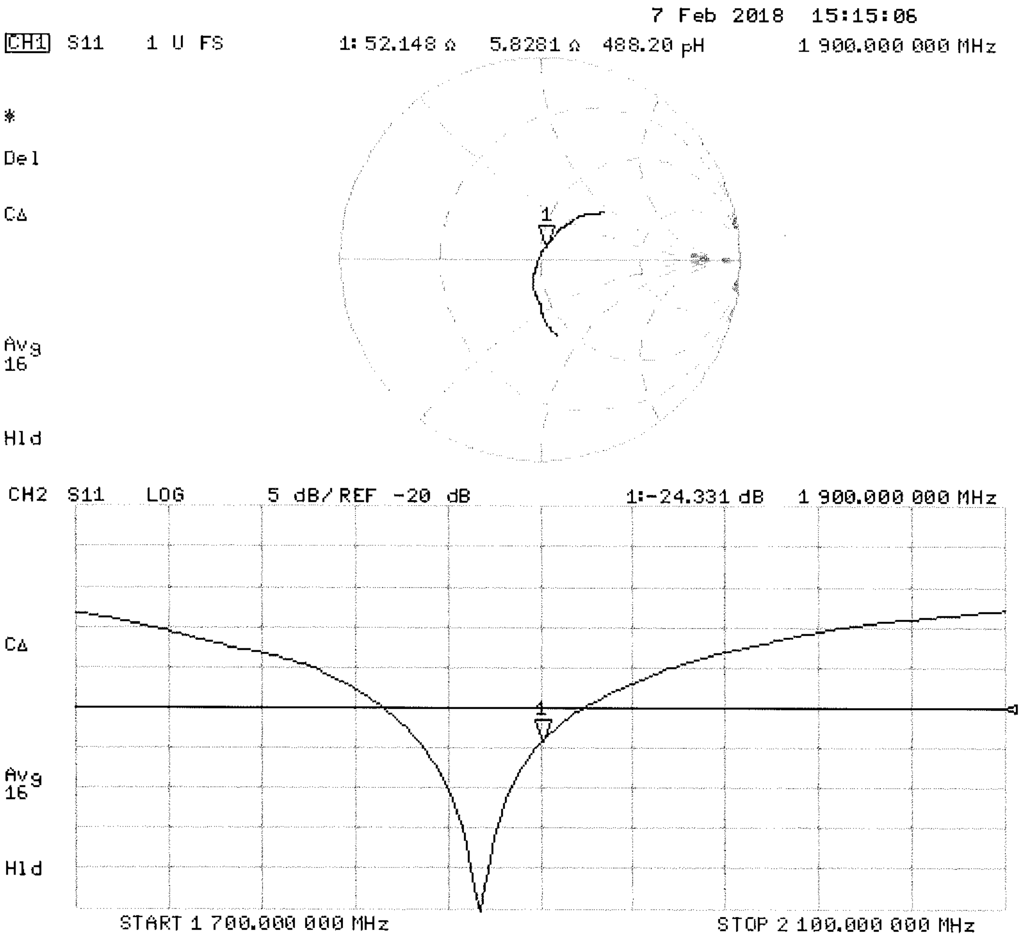
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 109.6 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 9.95 W/kg; SAR(10 g) = 5.22 W/kg
Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 07.02.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d148

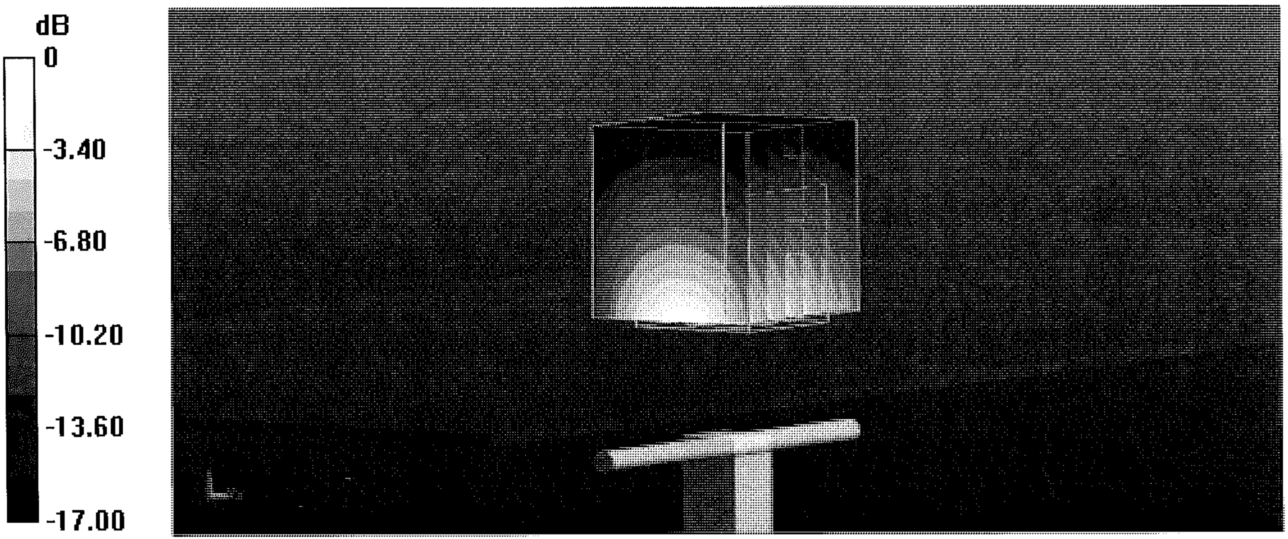
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.48 S/m; ε_r = 55.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.15, 8.15, 8.15); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

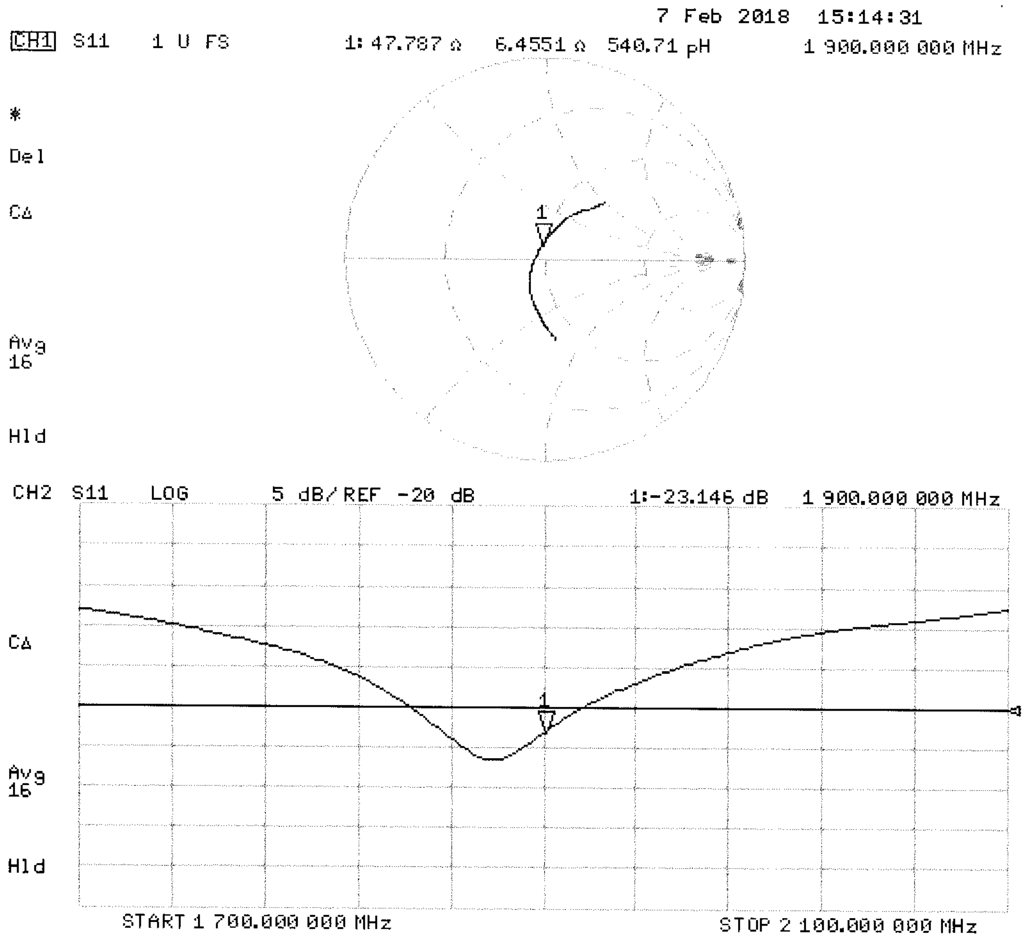
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.0 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 9.68 W/kg; SAR(10 g) = 5.14 W/kg
Maximum value of SAR (measured) = 14.4 W/kg



0 dB = 14.4 W/kg = 11.58 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: D2450V2-797_Sep17

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:797
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 11, 2017

SC ✓
10/03/2017

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 NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-May-17 (No. EX3-7349_May17)	May-18
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 11, 2017

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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:

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.0
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 ± 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 ± 0.2) °C	37.8 ± 6 %	1.86 mho/m ± 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	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.8 W/kg ± 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 ± 0.2) °C	51.9 ± 6 %	2.04 mho/m ± 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	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.2 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.8 Ω + 7.4 jΩ
Return Loss	- 21.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7 Ω + 9.1 jΩ
Return Loss	- 20.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 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 24, 2006

DASY5 Validation Report for Head TSL

Date: 11.09.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 797

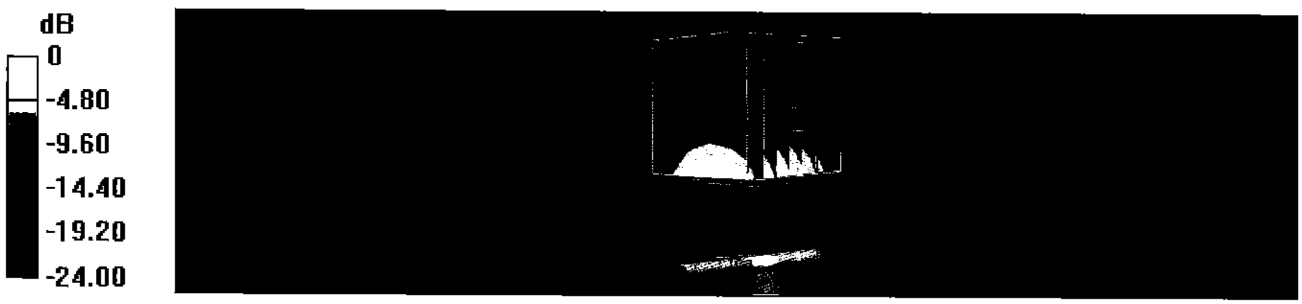
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.12, 8.12, 8.12); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

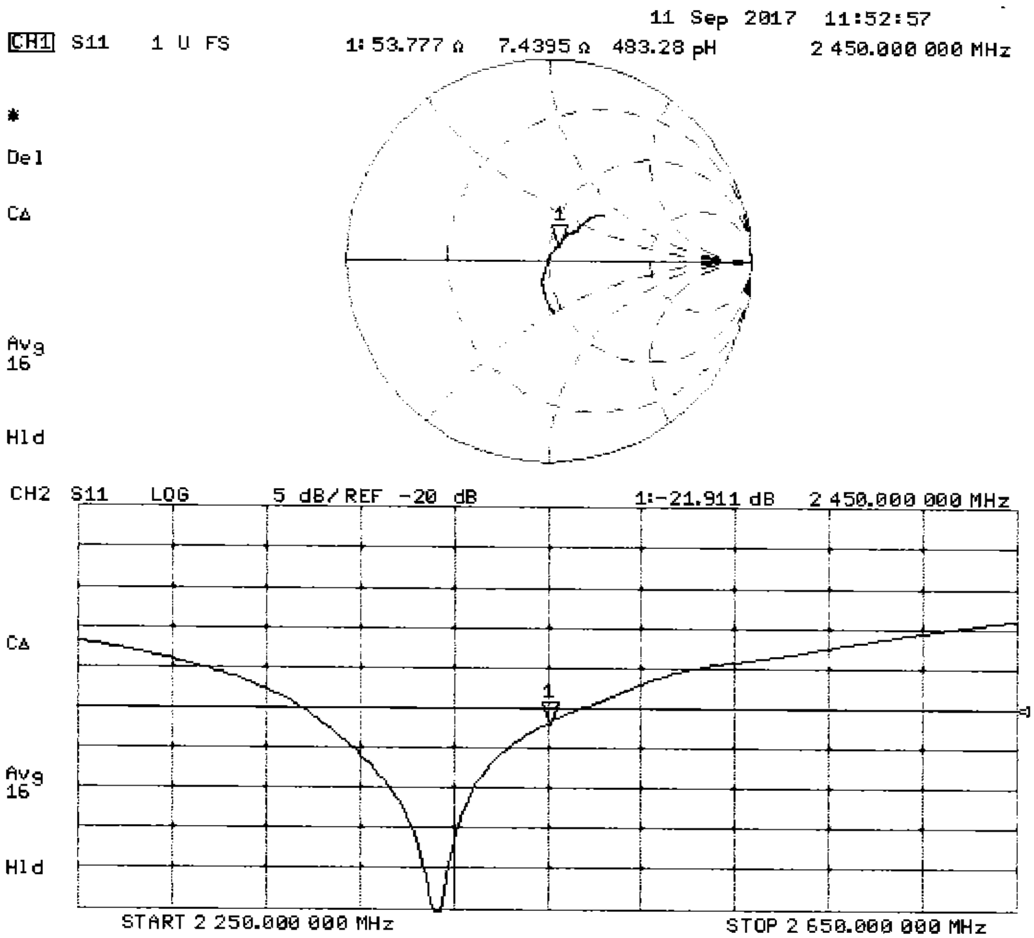
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 113.5 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.28 W/kg
Maximum value of SAR (measured) = 21.6 W/kg



0 dB = 21.6 W/kg = 13.34 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.09.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 797

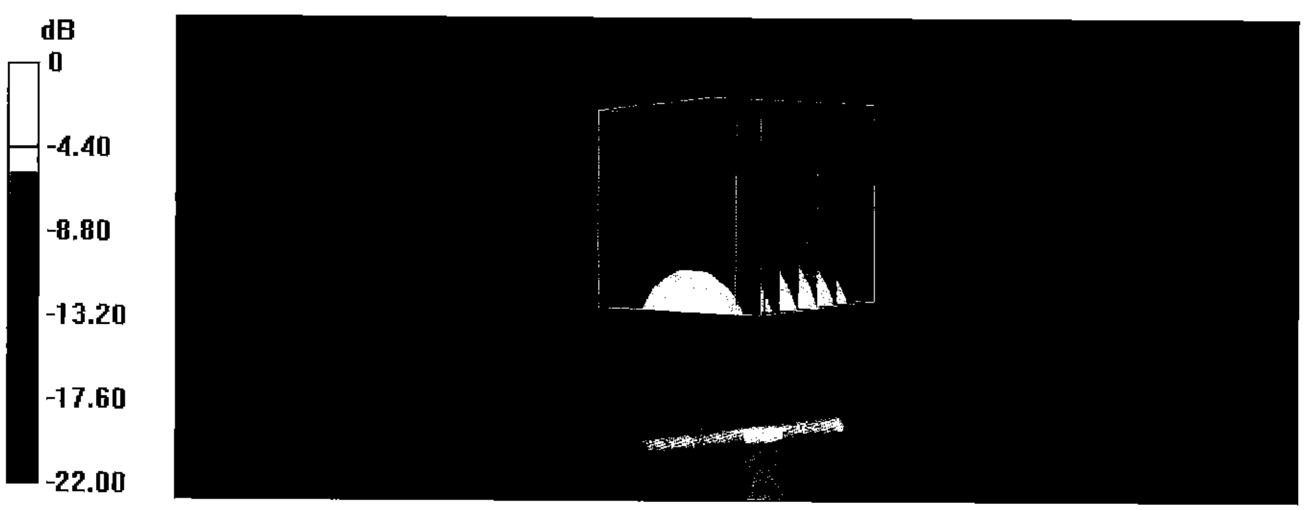
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.04 S/m; ε_r = 51.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.1, 8.1, 8.1); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

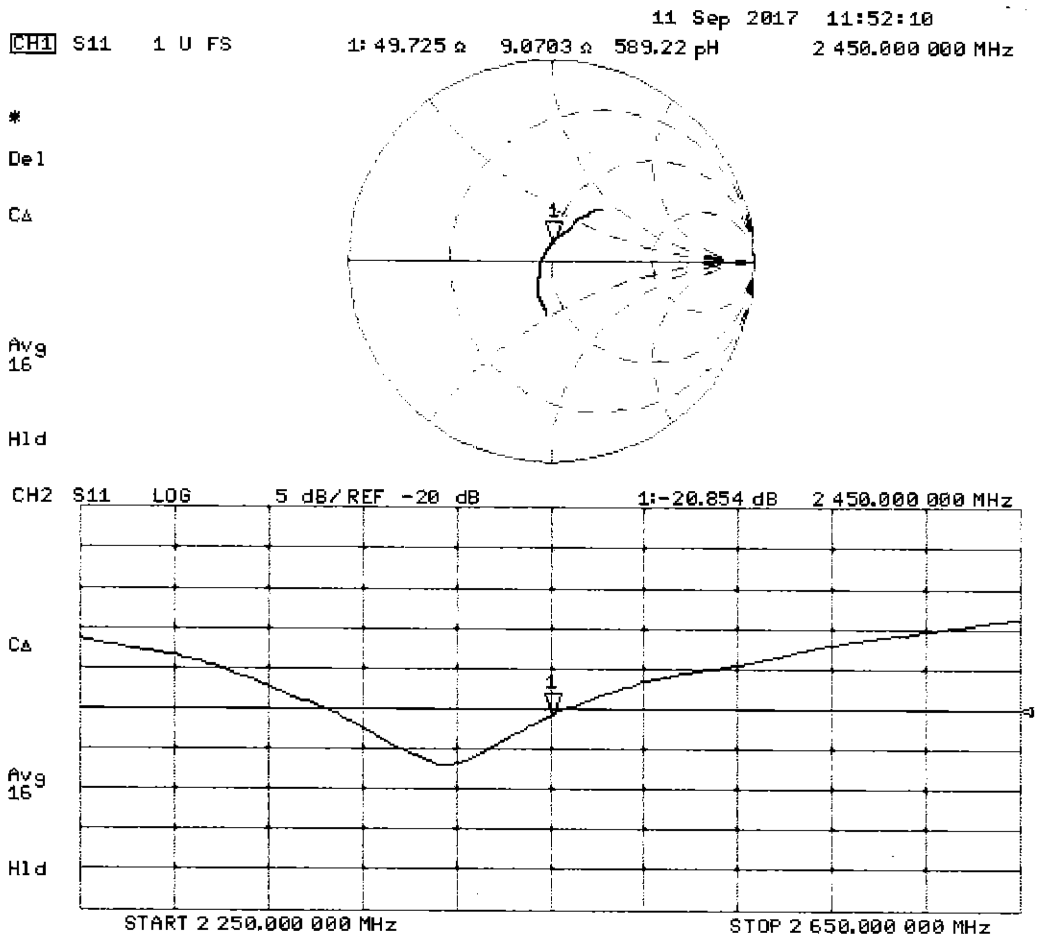
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.4 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 25.6 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.14 W/kg
Maximum value of SAR (measured) = 20.3 W/kg



0 dB = 20.3 W/kg = 13.07 dBW/kg

Impedance Measurement Plot for Body TSL



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

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 0108**

Client **PC Test**

Certificate No: **D2450V2-719_Aug17**

CALIBRATION CERTIFICATE

Object D2450V2 - SN:719

Calibration procedure(s) QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

PM ✓ 8/27/17
Extended BN 7/19/2018

Calibration date: August 17, 2017

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 NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-May-17 (No. EX3-7349_May17)	May-18
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 17, 2017

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.0
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 ± 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 ± 0.2) °C	37.8 ± 6 %	1.86 mho/m ± 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	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 W/kg ± 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 ± 0.2) °C	51.9 ± 6 %	2.03 mho/m ± 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	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.7 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.7 Ω + 7.0 jΩ
Return Loss	- 21.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.4 Ω + 8.1 jΩ
Return Loss	- 21.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 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: 17.08.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

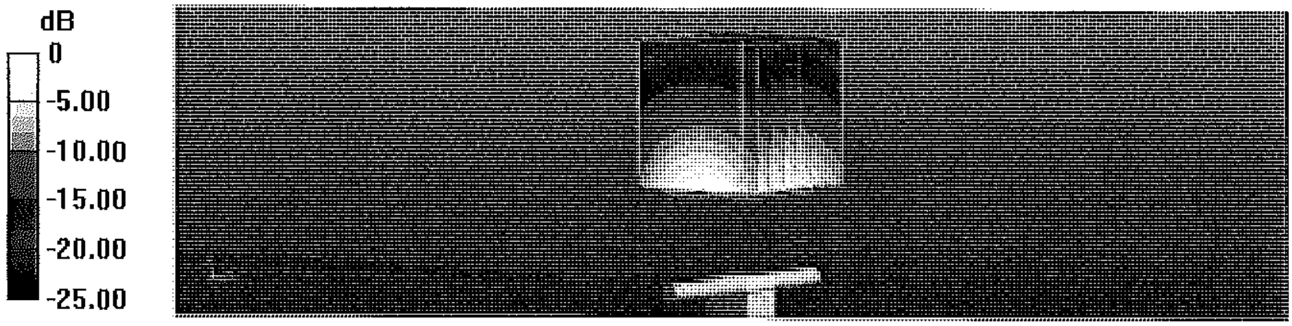
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.12, 8.12, 8.12); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

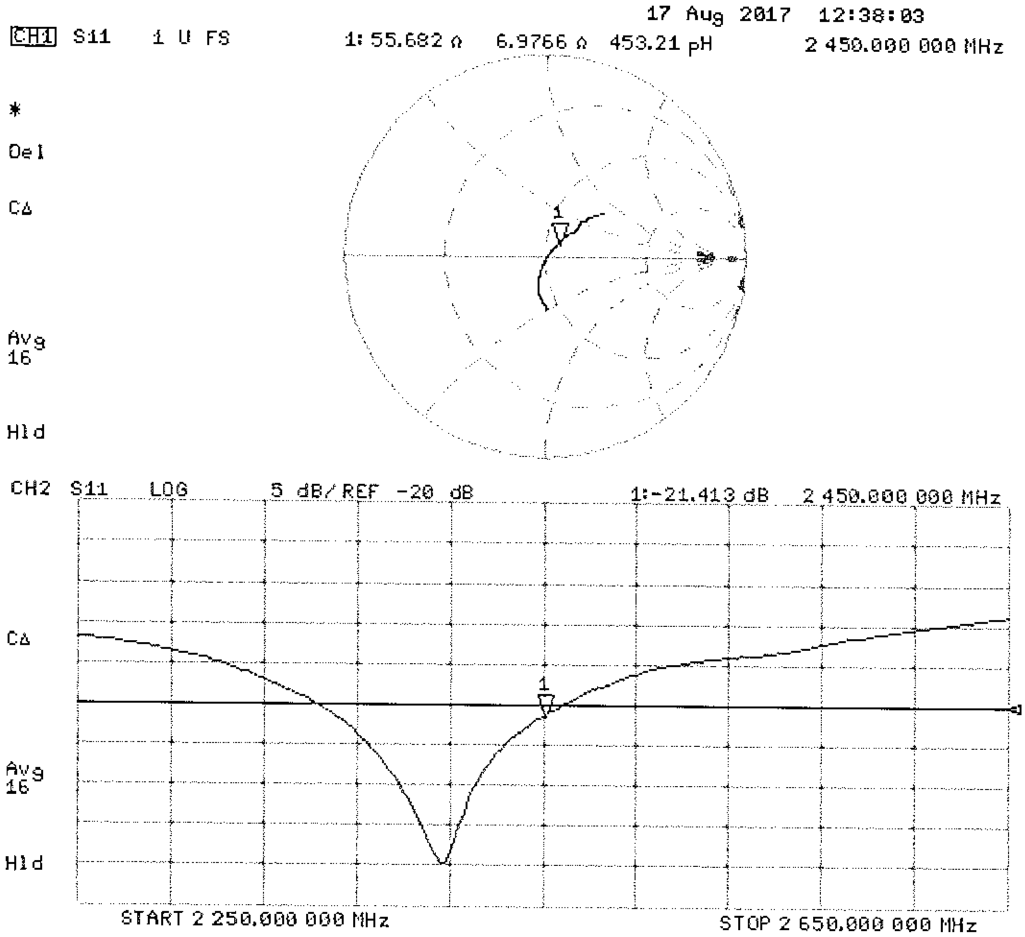
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 112.8 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.15 W/kg
Maximum value of SAR (measured) = 21.6 W/kg



0 dB = 21.6 W/kg = 13.34 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.08.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

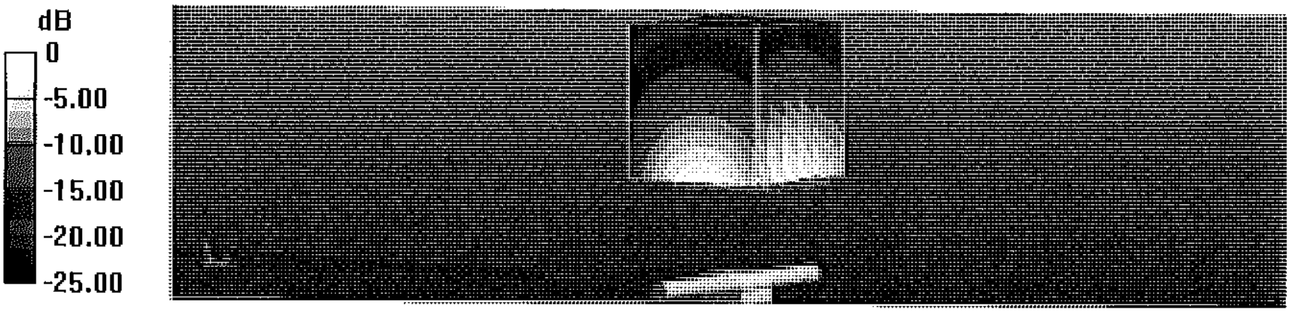
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 51.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.1, 8.1, 8.1); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

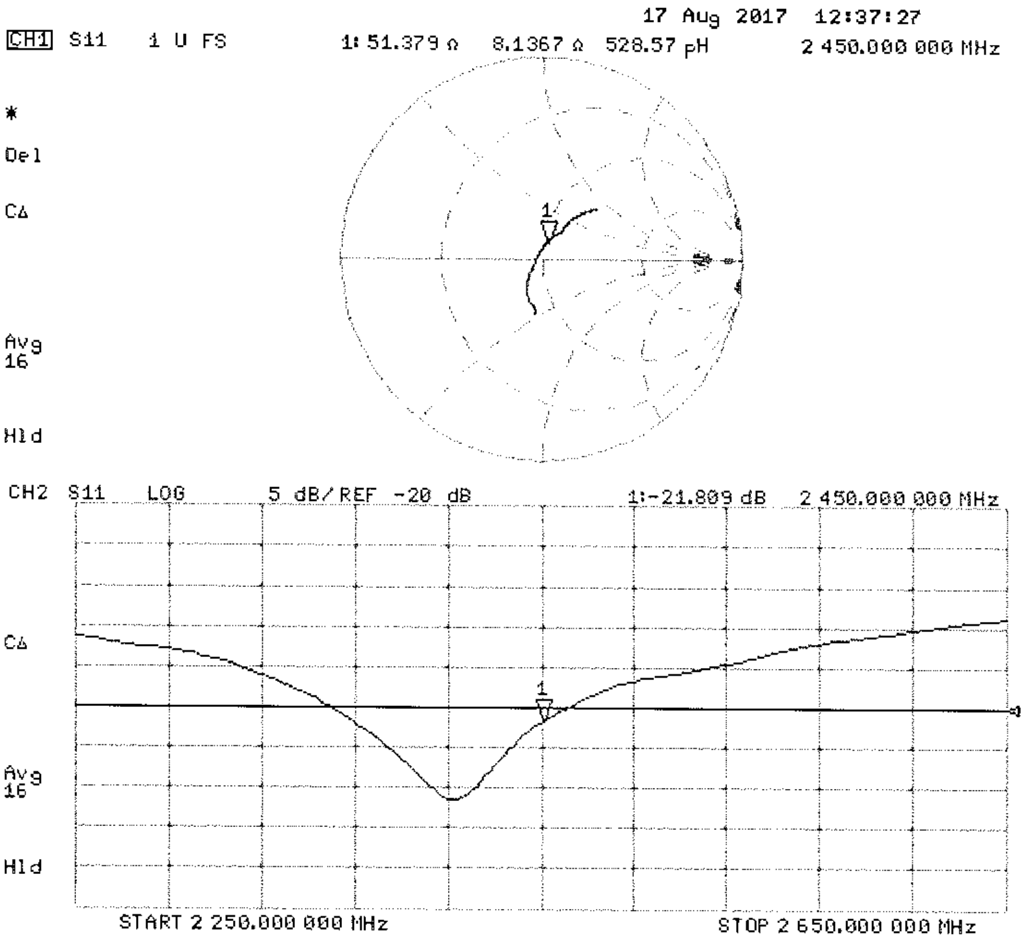
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.0 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 25.2 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 6 W/kg
Maximum value of SAR (measured) = 19.8 W/kg



0 dB = 19.8 W/kg = 12.97 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object D2450V2 – SN: 719

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extended Calibration date: 07/18/2018

Description: SAR Validation Dipole at 2450 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4438C	ESG Vector Signal Generator	3/24/2017	Biennial	3/24/2019	MY42082385
Agilent	8753ES	S-Parameter Network Analyzer	9/14/2017	Annual	9/14/2018	US39170118
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	ML2495A	Power Meter	11/28/2017	Annual	11/28/2018	1039008
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	11/15/2017	Annual	11/15/2018	1339007
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/7/2018	Annual	3/7/2019	1368
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/9/2017	Annual	8/9/2018	1323
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/12/2017	Annual	9/12/2018	1091
SPEAG	ES3DV3	SAR Probe	3/13/2018	Annual	3/13/2019	3319
SPEAG	ES3DV3	SAR Probe	8/14/2017	Annual	8/14/2018	3332

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

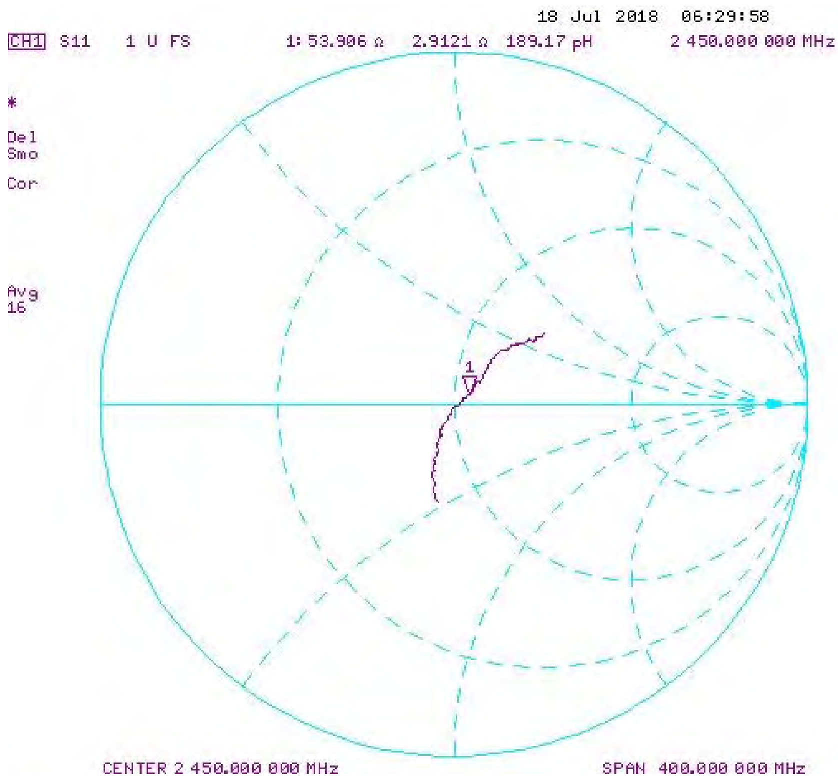
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

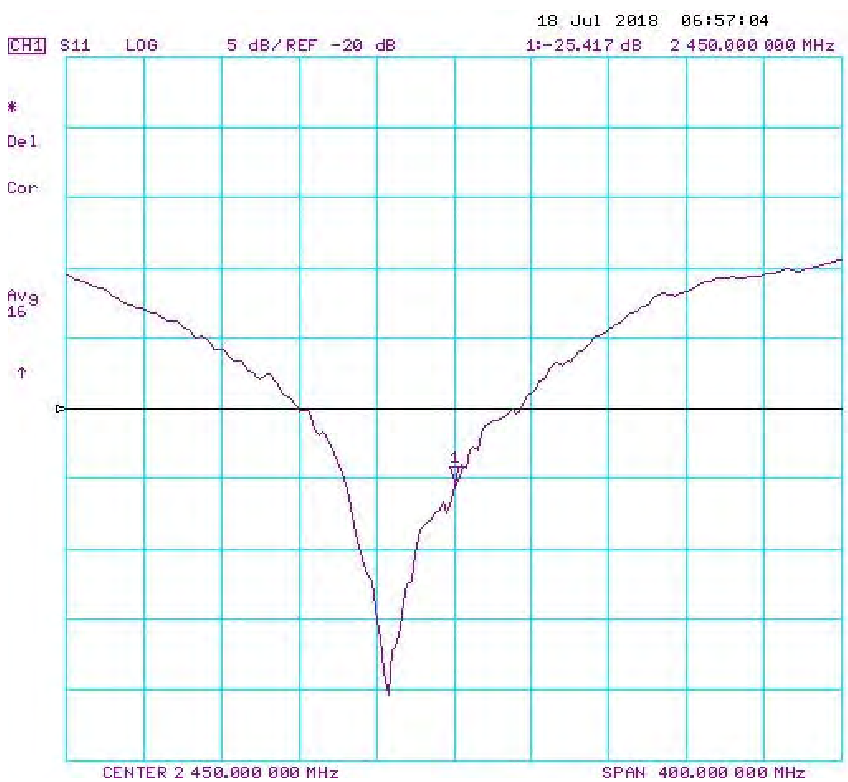
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
8/17/2017	7/18/2018	1.150	5.19	5.46	5.20%	2.43	2.51	3.29%	55.7	53.9	1.8	7.0	2.9	4.1	-21.4	-25.4	-18.70%	PASS

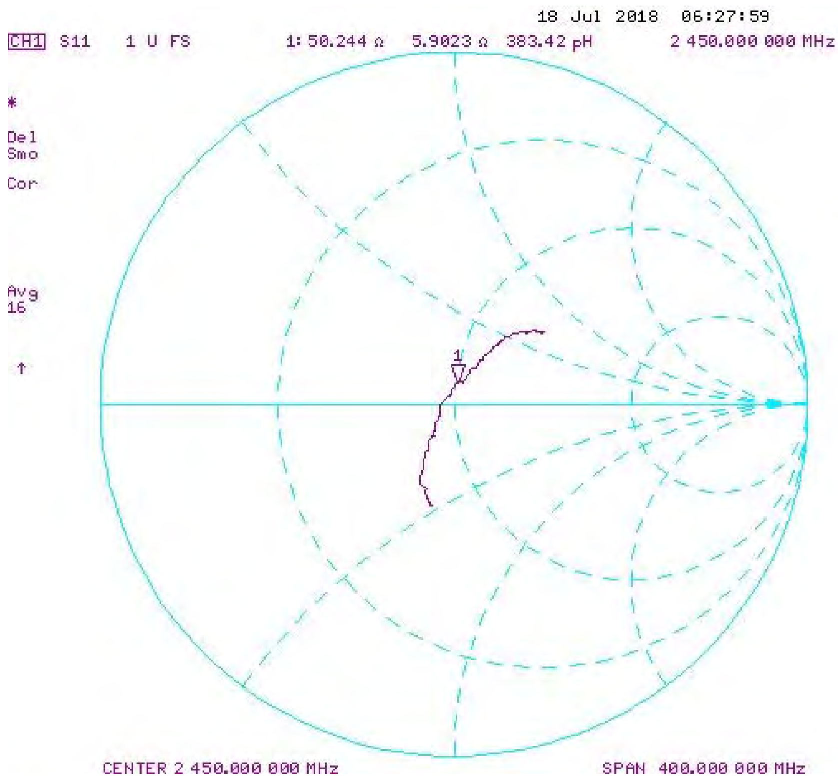
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
8/17/2017	7/18/2018	1.150	5.01	5.19	3.59%	2.37	2.38	0.42%	51.4	50.2	1.2	8.1	5.9	2.2	-21.8	-24.6	-12.80%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL



Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

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 0108

Client **PC Test**

Certificate No: D2600V2-1071_Sep16

CALIBRATION CERTIFICATE

Object	D2600V2 - SN:1071
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 13, 2016

BN ✓ 09-28-2016 Extended 9/2017 SC ✓

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 NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 13, 2016

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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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 ± 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 ± 0.2) °C	37.3 ± 6 %	2.05 mho/m ± 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	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**56.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.3 W/kg ± 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 ± 0.2) °C	51.1 ± 6 %	2.22 mho/m ± 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	13.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**54.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.5 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.9 Ω - 6.7 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1 Ω - 2.1 jΩ
Return Loss	- 26.7 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: 13.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1071

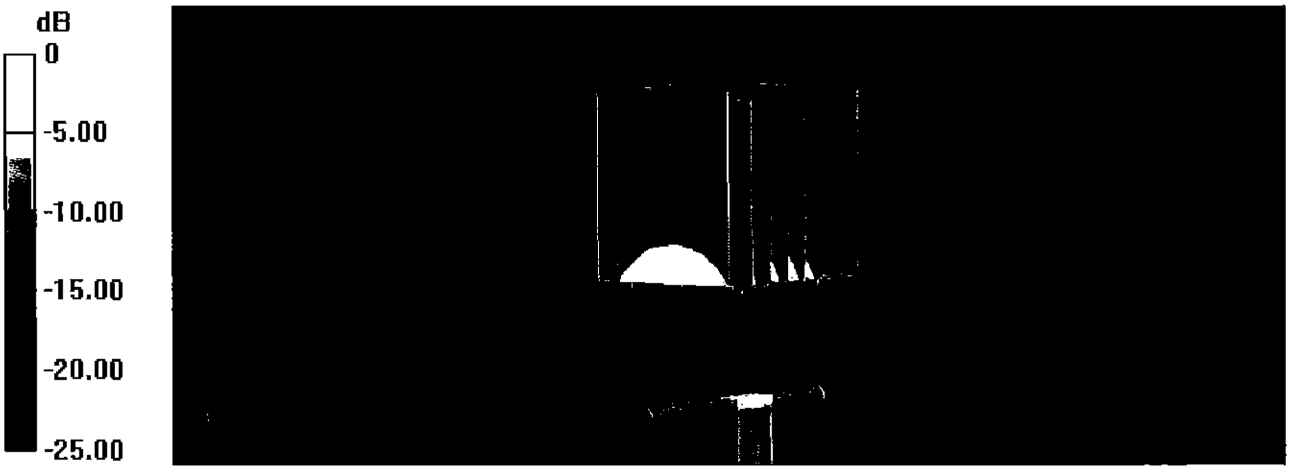
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.05 S/m; ε_r = 37.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.56, 7.56, 7.56); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

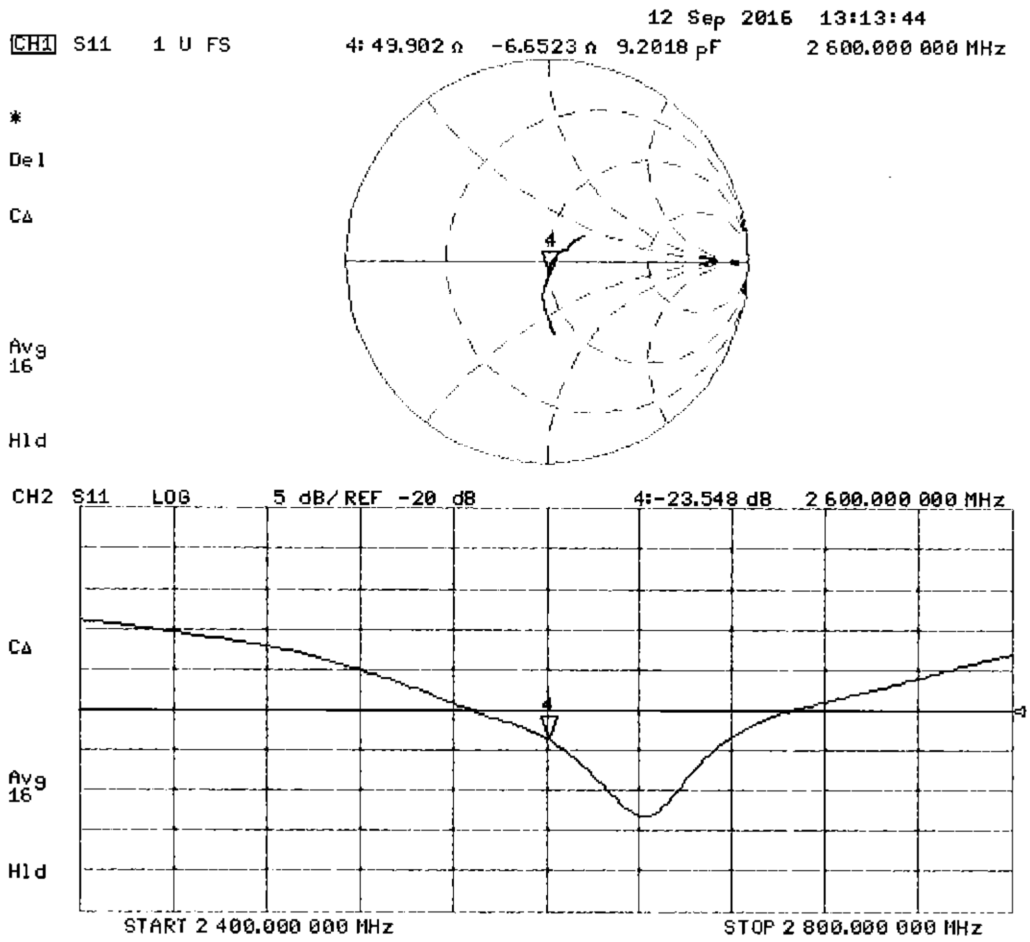
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 115.1 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 30.4 W/kg
SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.45 W/kg
Maximum value of SAR (measured) = 24.6 W/kg



0 dB = 24.6 W/kg = 13.91 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.09.2016

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; σ = 2.22 S/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

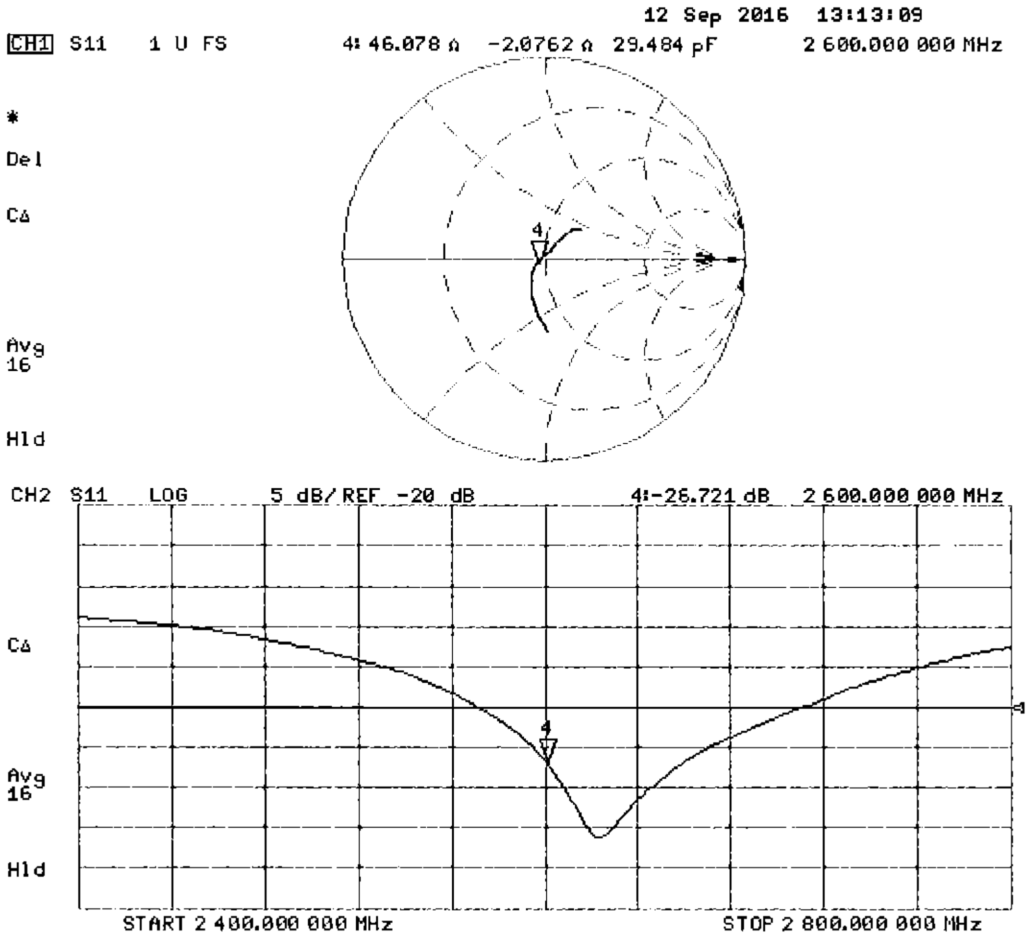
- Probe: EX3DV4 - SN7349; ConvF(7.48, 7.48, 7.48); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 107.7 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.2 W/kg
Maximum value of SAR (measured) = 23.3 W/kg

0 dB = 23.3 W/kg = 13.67 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object D2600V2 – SN: 1071

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Calibration date: 09/07/2017

Description: SAR Validation Dipole at 2600 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/1/2017	Annual	6/1/2018	MY53401181
Agilent	8753ES	S-Parameter Network Analyzer	10/26/2016	Annual	10/26/2017	US39170118
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/13/2017	Annual	7/13/2018	1322
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/10/2017	Annual	5/10/2018	1070
SPEAG	EX3DV4	SAR Probe	7/17/2017	Annual	7/17/2018	7410
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1207364
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1339018
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Agilent	N5182A	MXG Vector Signal Generator	2/28/2017	Annual	2/28/2018	MY47420800
Seekonk	NC-100	Torque Wrench	11/6/2015	Biennial	11/6/2017	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path.

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

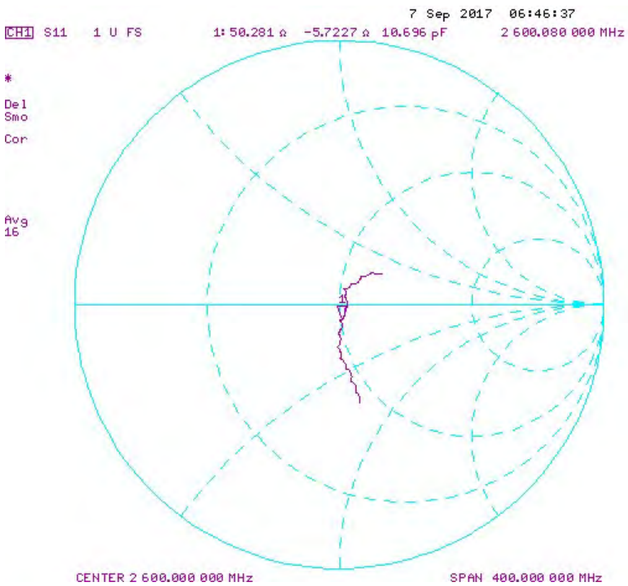
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

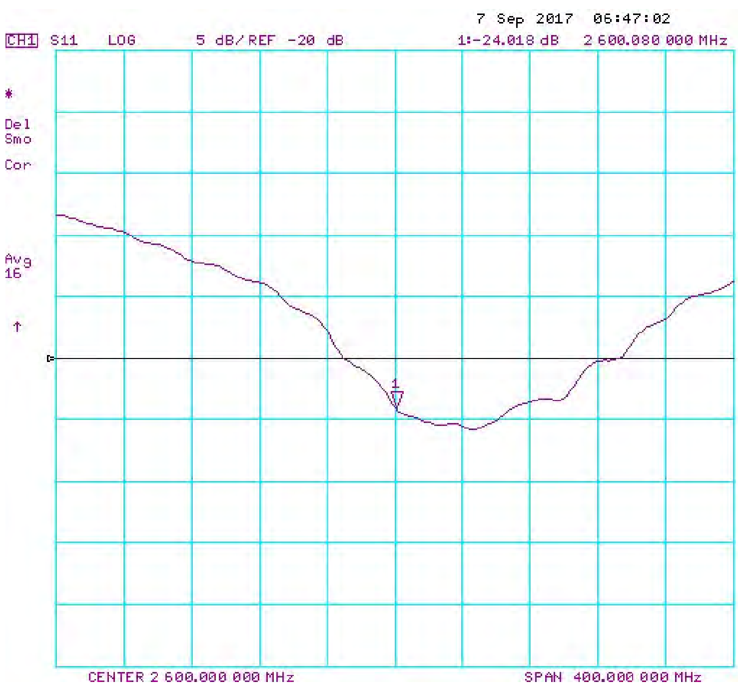
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
9/13/2016	9/7/2017	1.153	5.63	5.73	1.78%	2.53	2.52	-0.40%	49.9	50.3	0.4	-6.7	-5.7	1.0	-23.5	-24.0	-2.10%	PASS

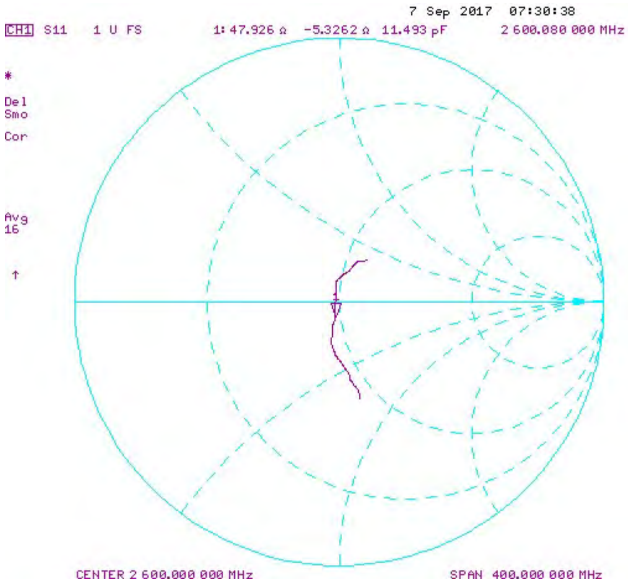
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
9/13/2016	9/7/2017	1.153	5.42	5.34	-1.48%	2.45	2.33	-4.90%	46.1	47.9	1.8	-2.1	-5.3	3.2	-26.7	-25.0	6.40%	PASS

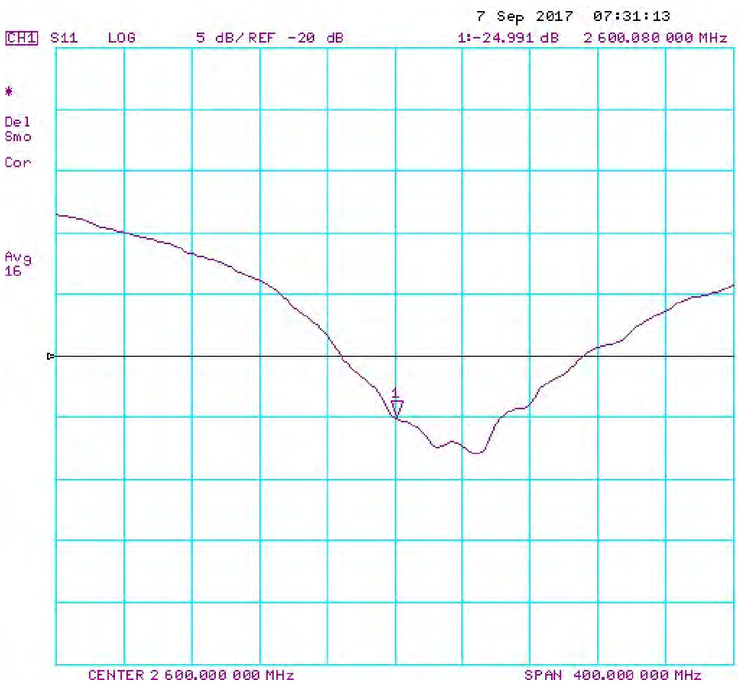
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

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 0108

Client **PC Test**

Certificate No: D5GHzV2-1191_Sep16

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1191
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	September 21, 2016

BN✓ 09-28-2016

Extended 09/2017 SC✓

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 NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 3503	30-Jun-16 (No. EX3-3503_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	Leif Klysner
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: September 22, 2016

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) 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 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
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 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	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.5 ± 6 %	4.59 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.96 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.9 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	**22.6 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	34.0 ± 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	8.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.6 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.8 ± 6 %	5.08 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.4 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.4 ± 6 %	5.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.74 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (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	**21.6 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	46.8 ± 6 %	6.00 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	7.96 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	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	6.21 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.65 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.2 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	55.7 Ω - 4.3 jΩ
Return Loss	- 23.4 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	58.3 Ω - 3.2 jΩ
Return Loss	- 21.8 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	58.1 Ω + 4.8 jΩ
Return Loss	- 21.2 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	56.1 Ω - 3.7 jΩ
Return Loss	- 23.4 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	58.9 Ω - 1.7 jΩ
Return Loss	- 21.7 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	59.5 Ω + 6.9 jΩ
Return Loss	- 19.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.204 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	August 28, 2003

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DASY5 Validation Report for Head TSL

Date: 21.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1191

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.59 S/m; ε_r = 34.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.93 S/m; ε_r = 34; ρ = 1000 kg/m^3 , Medium parameters used: f = 5750 MHz; σ = 5.08 S/m; ε_r = 33.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

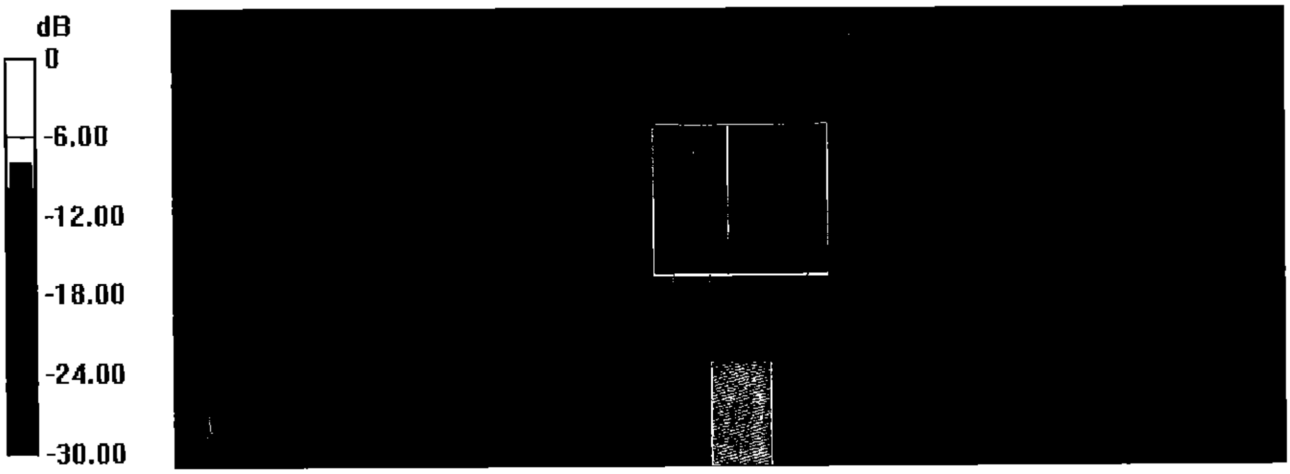
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.42, 5.42, 5.42); Calibrated: 30.06.2016, ConvF(4.89, 4.89, 4.89); Calibrated: 30.06.2016, ConvF(4.85, 4.85, 4.85); Calibrated: 30.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.49 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 28.6 W/kg
SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.29 W/kg
Maximum value of SAR (measured) = 18.2 W/kg

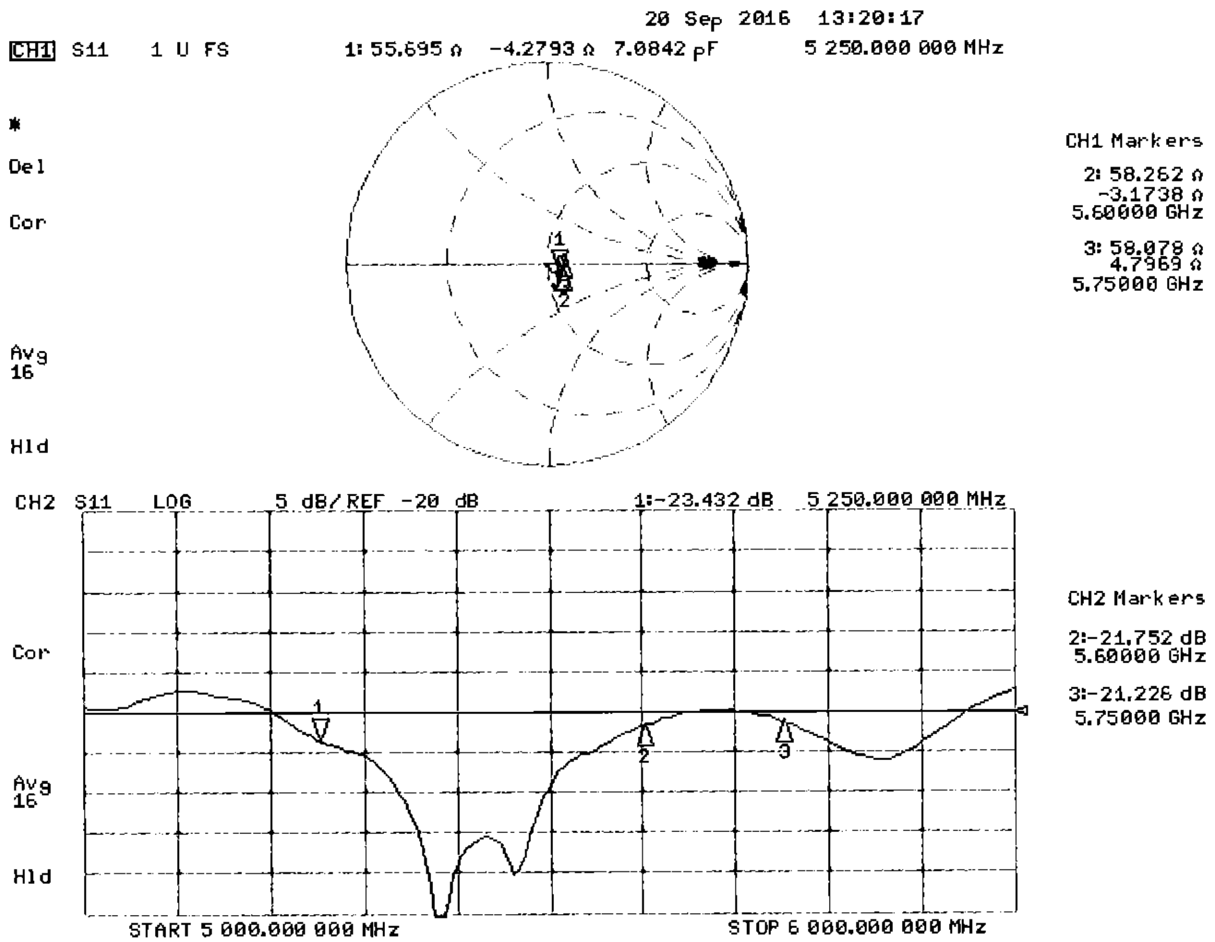
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 69.34 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 8.45 W/kg; SAR(10 g) = 2.41 W/kg
Maximum value of SAR (measured) = 20.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.15 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 20.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1191

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 5.52 S/m; ε_r = 47.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 6 S/m; ε_r = 46.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5750 MHz; σ = 6.21 S/m; ε_r = 46.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

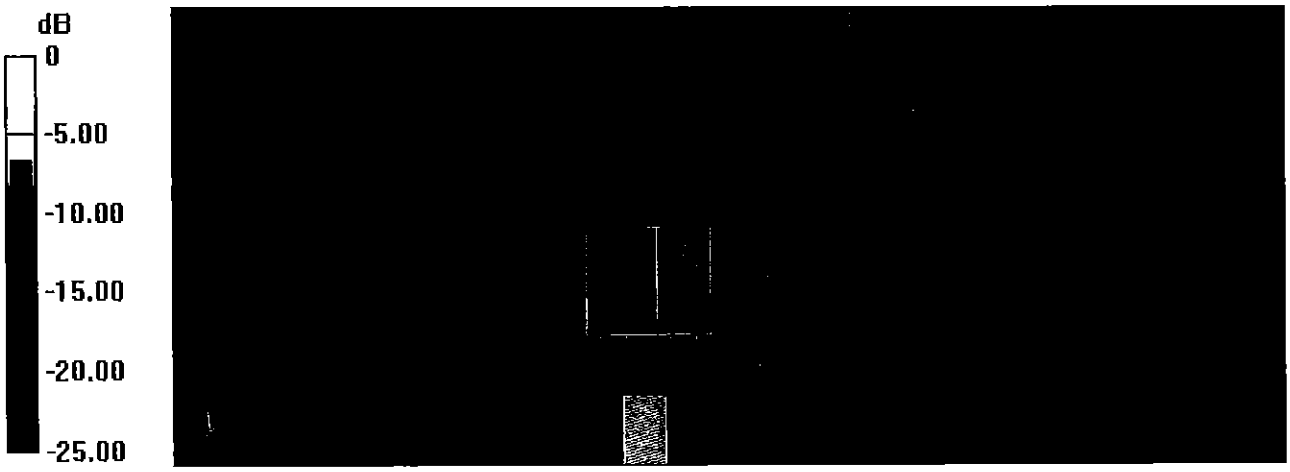
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.85, 4.85, 4.85); Calibrated: 30.06.2016, ConvF(4.35, 4.35, 4.35); Calibrated: 30.06.2016, ConvF(4.3, 4.3, 4.3); Calibrated: 30.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.49 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 29.1 W/kg
SAR(1 g) = 7.74 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 17.7 W/kg

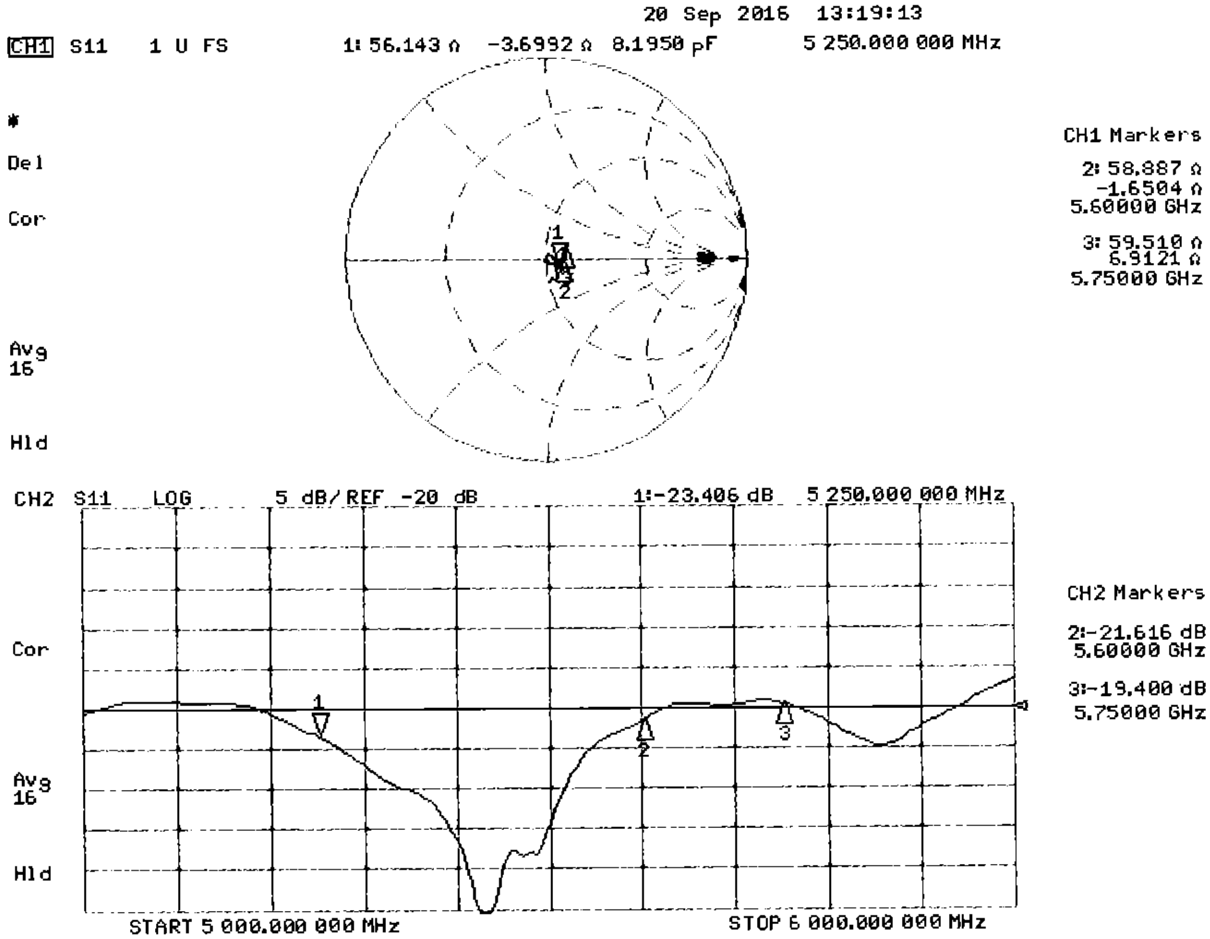
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.85 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.24 W/kg
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.21 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 32.7 W/kg
SAR(1 g) = 7.65 W/kg; SAR(10 g) = 2.14 W/kg
Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 17.7 W/kg = 12.48 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object	D5GHzV2 – SN: 1191
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extension Calibration date:	9/19/2017
Description:	SAR Validation Dipole at 5250, 5600, and 5750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/1/2017	Annual	6/1/2018	MY53401181
Agilent	8753ES	S-Parameter Network Analyzer	10/26/2016	Annual	10/26/2017	US39170118
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	5/10/2017	Annual	5/10/2018	1070
SPEAG	EX3DV4	SAR Probe	1/13/2017	Annual	1/13/2018	3589
SPEAG	EX3DV4	SAR Probe	2/13/2017	Annual	2/13/2018	3914
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/16/2017	Annual	1/16/2018	1466
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/9/2017	Annual	2/9/2018	665
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1207364
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1339018
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Agilent	N5182A	MXG Vector Signal Generator	2/28/2017	Annual	2/28/2018	MY47420800
Seekonk	NC-100	Torque Wrench	11/6/2015	Biennial	11/6/2017	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O’Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

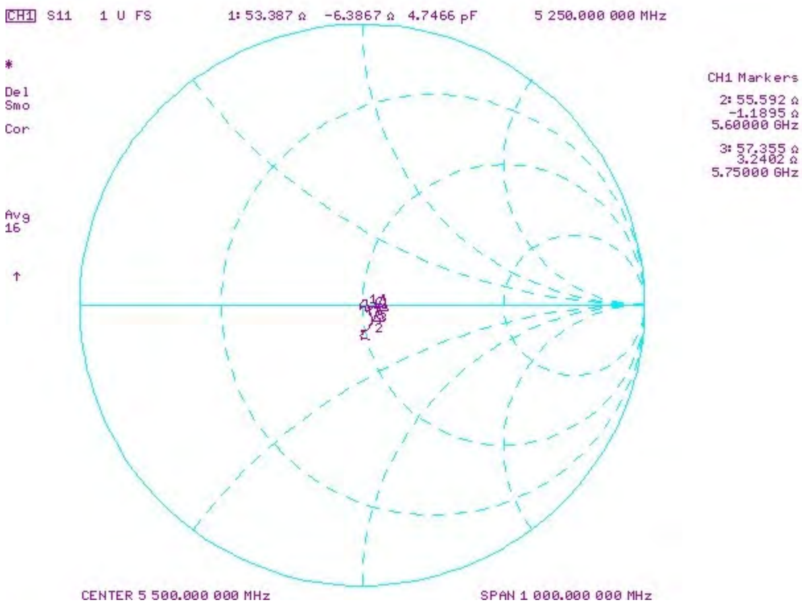
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

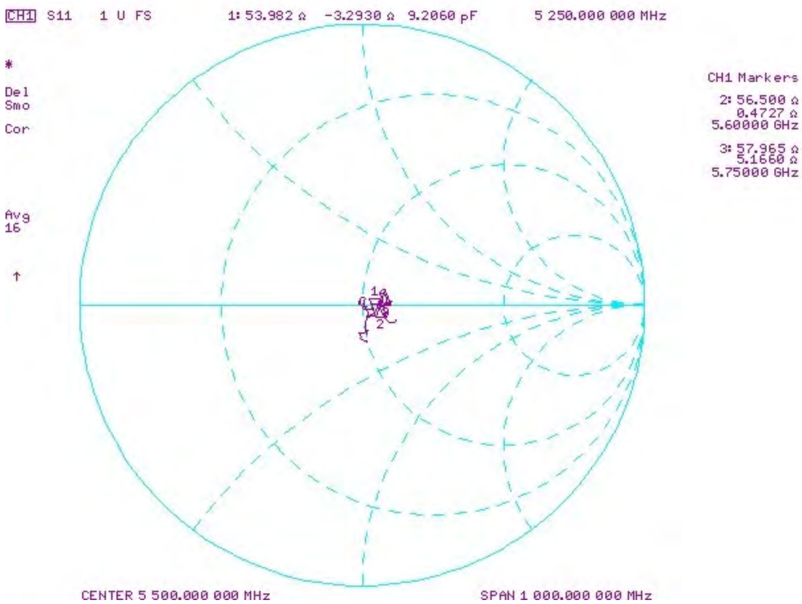
Frequency (MHz)	Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 17.0 dBm	Measured Head SAR (1g) W/kg @ 17.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 17.0 dBm	Measured Head SAR (10g) W/kg @ 17.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5250	9/21/2016	9/19/2017	1.204	3.95	3.70	-6.21%	1.13	1.05	-7.08%	55.7	53.4	2.3	-4.3	-6.4	2.1	-23.4	-26.9	-15.00%	PASS
5600	9/21/2016	9/19/2017	1.204	4.18	4.03	-3.59%	1.19	1.13	-5.04%	58.3	55.6	2.7	-3.2	-1.2	2.0	-21.8	-26.1	-19.80%	PASS
5750	9/21/2016	9/19/2017	1.204	3.96	3.94	-0.38%	1.12	1.10	-1.79%	58.1	57.4	0.7	4.8	3.2	1.6	-21.2	-21.0	0.90%	PASS

Frequency (MHz)	Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 17.0 dBm	Measured Body SAR (1g) W/kg @ 17.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 17.0 dBm	Measured Body SAR (10g) W/kg @ 17.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
5250	9/21/2016	9/19/2017	1.204	3.85	3.80	-1.30%	1.08	1.06	-1.85%	56.1	54.0	2.1	-3.7	-3.3	0.4	-23.4	-26.0	-11.10%	PASS
5600	9/21/2016	9/19/2017	1.204	3.96	4.06	2.53%	1.11	1.13	1.80%	58.9	56.5	2.4	-1.7	0.5	2.2	-21.7	-24.5	-12.80%	PASS
5750	9/21/2016	9/19/2017	1.204	3.81	3.66	-3.81%	1.06	1.02	-3.77%	59.5	58.0	1.5	6.9	5.2	1.7	-19.4	-21.1	-8.70%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL



Impedance & Return-Loss Measurement Plot for Body TSL



Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

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 0108**

Client **PC Test**

Certificate No: **D835V2-4d133_Jul17**

CALIBRATION CERTIFICATE

Object: D835V2 - SN:4d133

BN ✓ 8/3/2017

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Extended BN ✓ 7/18/2018

Calibration date: July 11, 2017

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 NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-May-17 (No. EX3-7349_May17)	May-18
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Johannes Kurikka	Laboratory Technician	[signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: July 12, 2017

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.0
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 ± 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 ± 0.2) °C	40.8 ± 6 %	0.91 mho/m ± 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	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.52 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (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	**6.10 W/kg ± 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 ± 0.2) °C	54.8 ± 6 %	1.01 mho/m ± 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	2.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.41 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.16 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0 Ω - 2.9 jΩ
Return Loss	- 30.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 Ω - 6.8 jΩ
Return Loss	- 22.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.196 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: 11.07.2017

Test Laboratory: SPEAG, Zurich, Switzerland

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

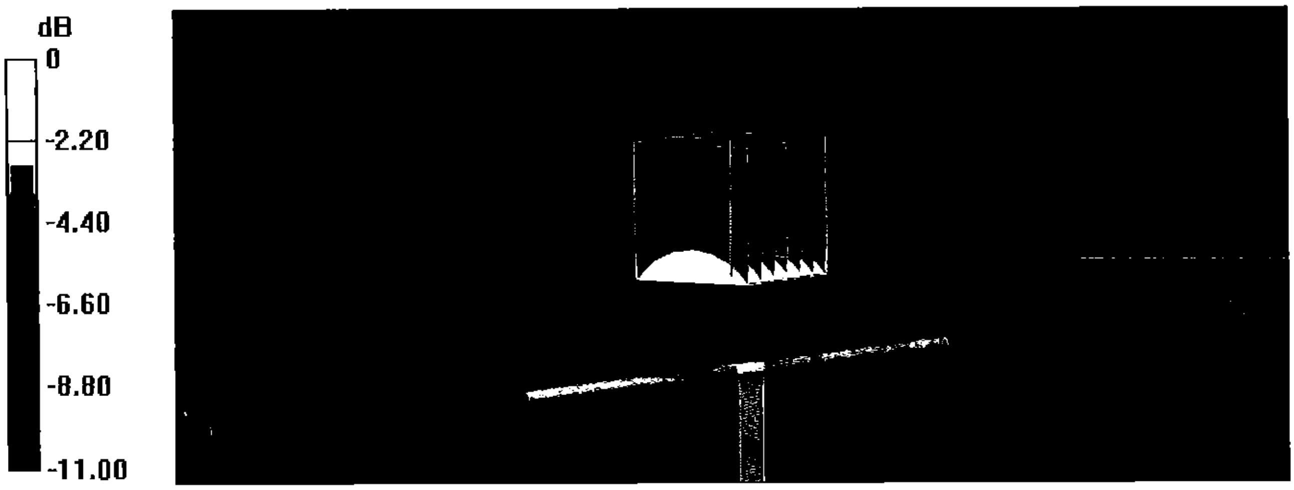
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.91 S/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.07, 10.07, 10.07); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

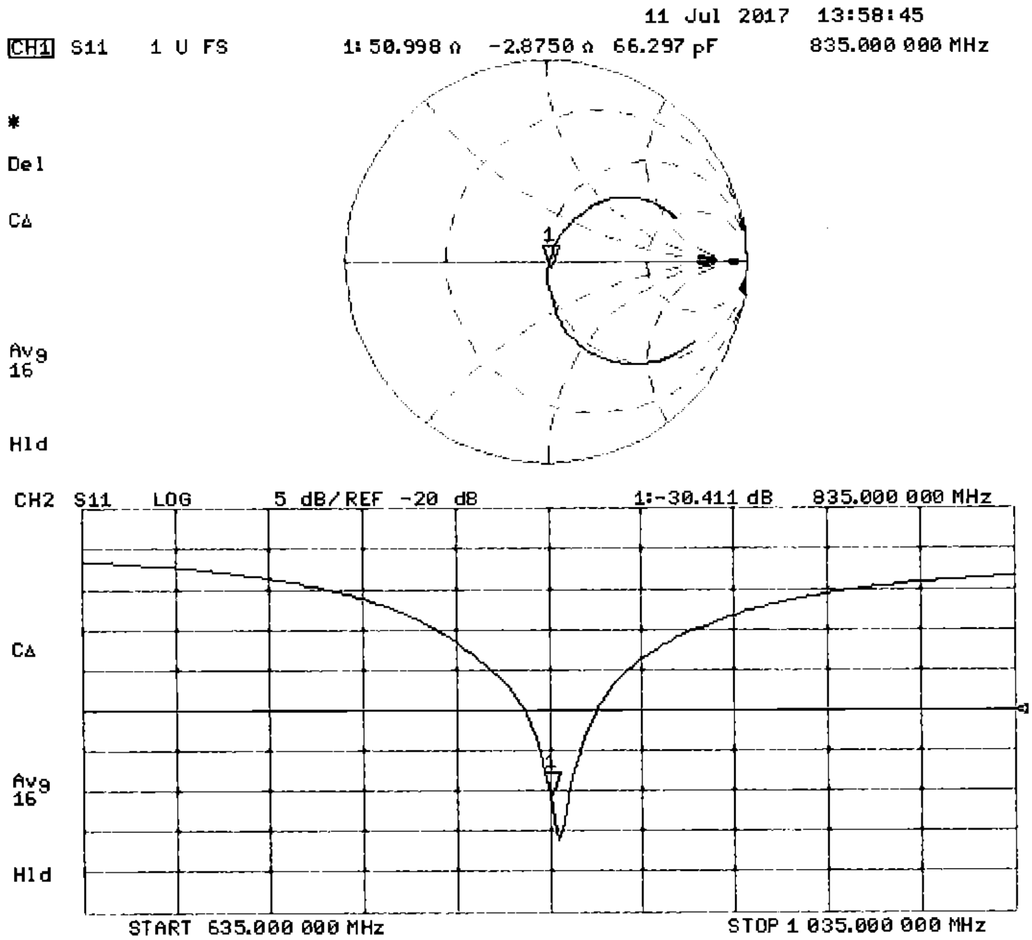
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 62.84 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.74 W/kg
SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.54 W/kg
Maximum value of SAR (measured) = 3.28 W/kg



0 dB = 3.28 W/kg = 5.16 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.07.2017

Test Laboratory: SPEAG, Zurich, Switzerland

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

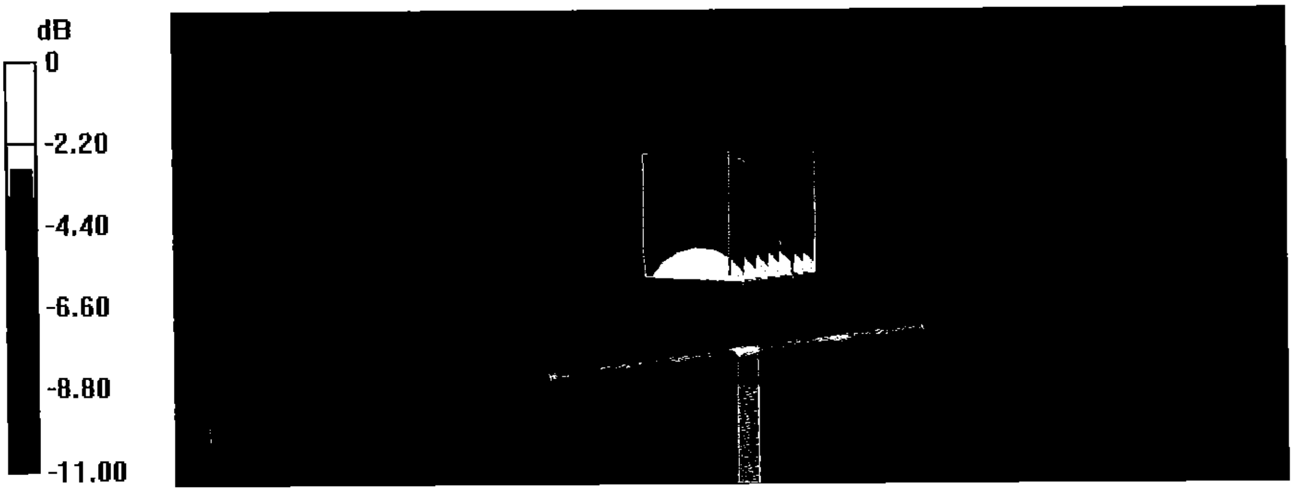
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 54.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.2, 10.2, 10.2); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

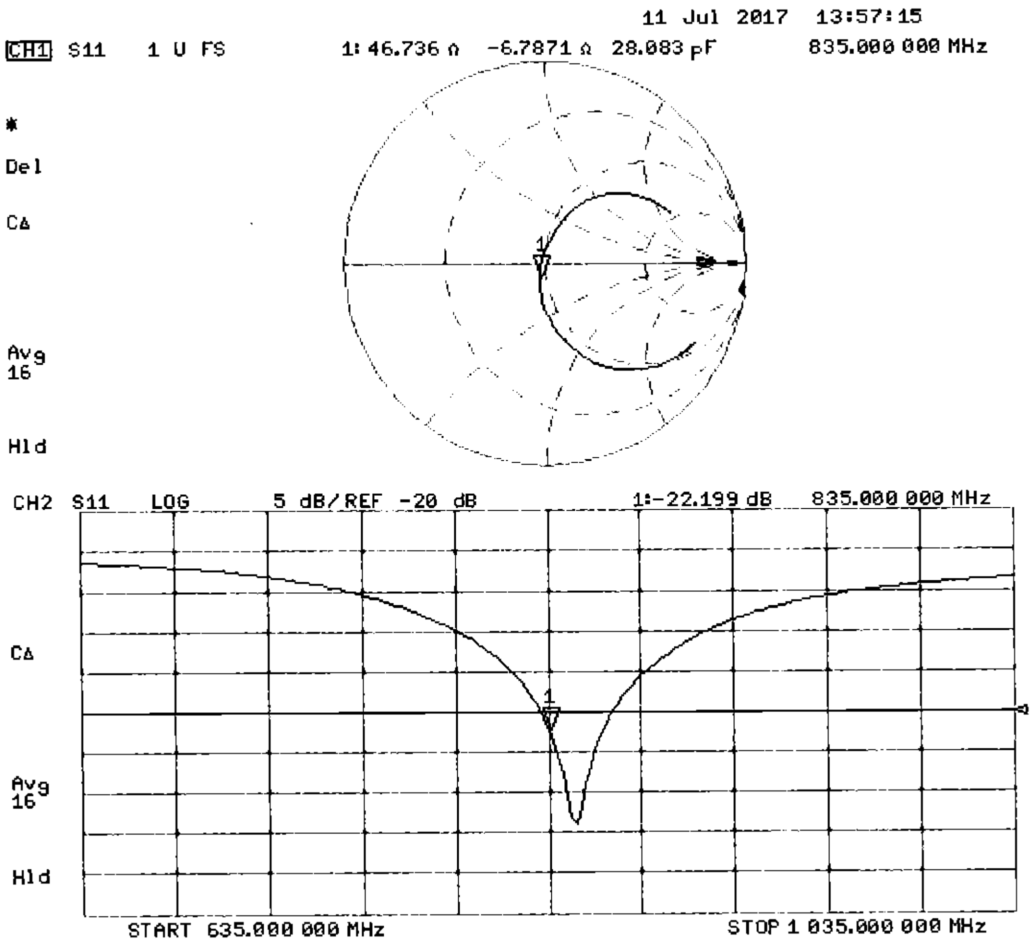
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.25 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.67 W/kg
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.58 W/kg
Maximum value of SAR (measured) = 3.21 W/kg



0 dB = 3.21 W/kg = 5.07 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object D835V2 – SN: 4d133

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extended Calibration date: 07/11/2018

Description: SAR Validation Dipole at 835 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4438C	ESG Vector Signal Generator	3/24/2017	Biennial	3/24/2019	MY42082385
Agilent	8753ES	S-Parameter Network Analyzer	9/14/2017	Annual	9/14/2018	US39170118
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	ML2495A	Power Meter	11/28/2017	Annual	11/28/2018	1039008
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	11/15/2017	Annual	11/15/2018	1339007
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/9/2017	Annual	11/9/2018	1450
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/12/2017	Annual	9/12/2018	1091
SPEAG	EX3DV4	SAR Probe	6/25/2018	Annual	6/25/2019	7409
SPEAG	ES3DV3	SAR Probe	3/27/2018	Annual	3/27/2019	3347

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

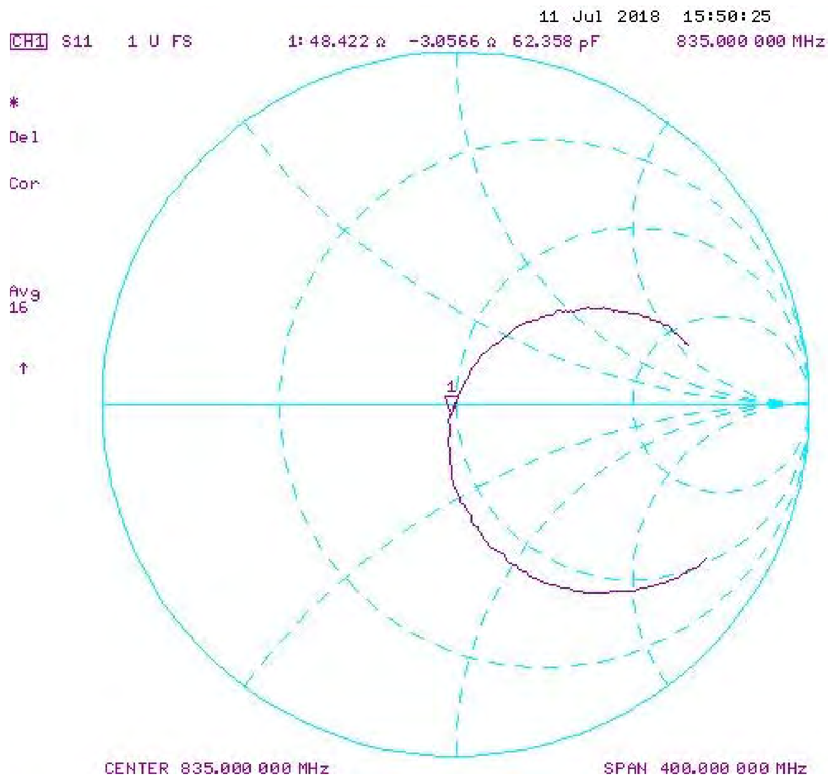
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

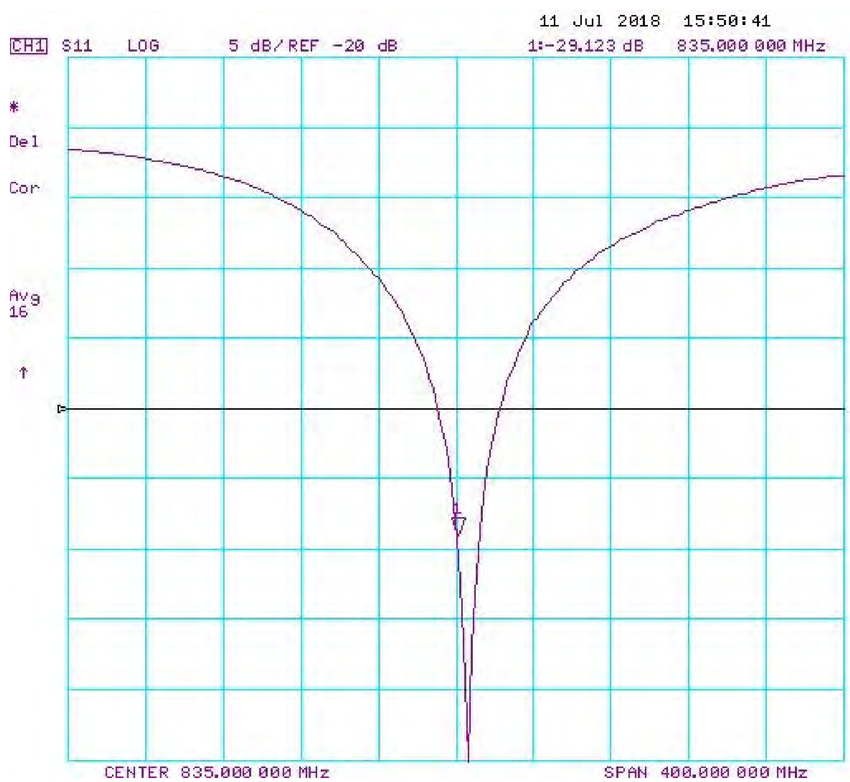
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
7/11/2017	7/11/2018	1.196	1.904	2.020	6.09%	1.220	1.310	7.38%	51.0	48.4	2.6	-2.9	-3.1	0.2	-30.4	-29.1	4.30%	PASS

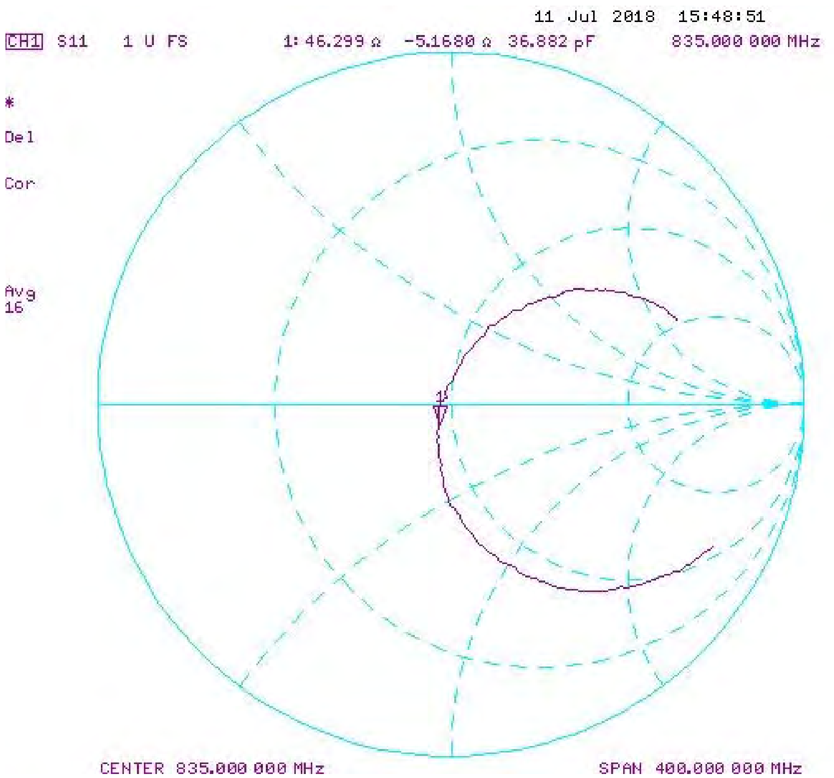
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
7/11/2017	7/11/2018	1.196	1.882	2.030	7.86%	1.232	1.340	8.77%	46.7	46.3	0.4	-6.8	-5.2	1.6	-22.2	-23.6	-6.30%	PASS

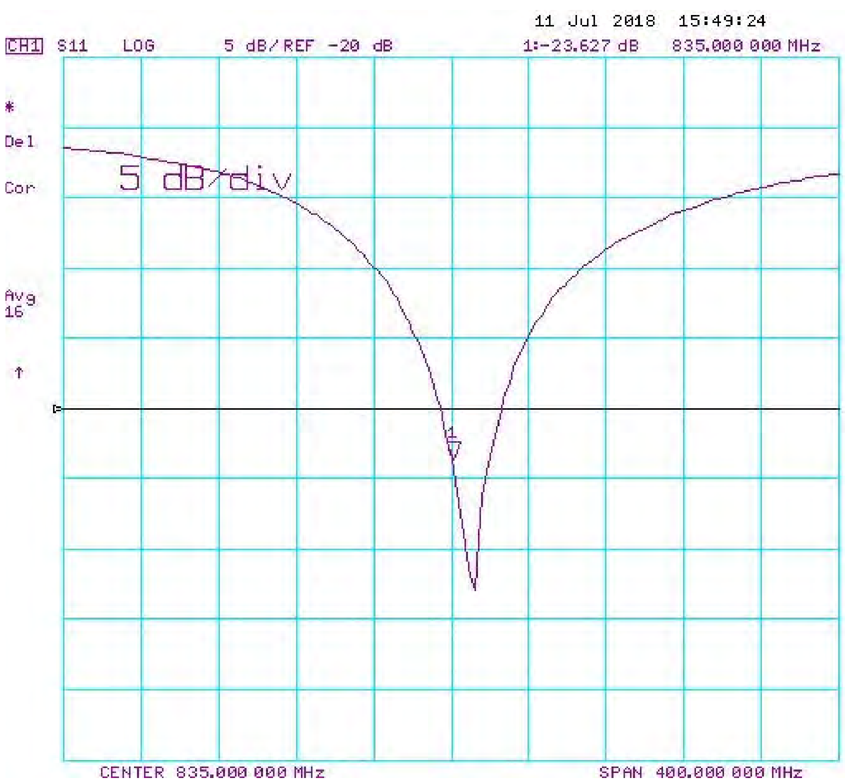
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

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 0108

Client PC Test

Certificate No: D1765V2-1008_May18

CALIBRATION CERTIFICATE

Object	D1765V2 - SN:1008
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	May 23, 2018

BN ✓ 7/16/2018

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 NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Manu Seitz	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 23, 2018

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5.0 mm	
Frequency	1750 MHz ± 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 ± 0.2) °C	39.0 ± 6 %	1.34 mho/m ± 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	8.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.71 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.0 W/kg ± 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 ± 0.2) °C	53.2 ± 6 %	1.46 mho/m ± 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	9.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.92 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.9 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.7 Ω - 6.5 jΩ
Return Loss	- 23.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.3 Ω - 6.0 jΩ
Return Loss	- 20.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.210 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

Appendix (Additional assessments outside the scope of SCS 0108)

Measurement Conditions

DASY system configuration, as far as not given on page 1 and 3.

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L

SAR result with SAM Head (Top)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**37.4 W/kg ± 17.5 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.9 W/kg ± 16.9 % (k=2)**

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**38.2 W/kg ± 17.5 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.4 W/kg ± 16.9 % (k=2)**

SAR result with SAM Head (Neck)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**37.4 W/kg ± 17.5 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.2 W/kg ± 16.9 % (k=2)**

SAR result with SAM Head (Ear)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	7.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**28.7 W/kg ± 17.5 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.01 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**16.1 W/kg ± 16.9 % (k=2)**

DASY5 Validation Report for Head TSL

Date: 15.05.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN:1008

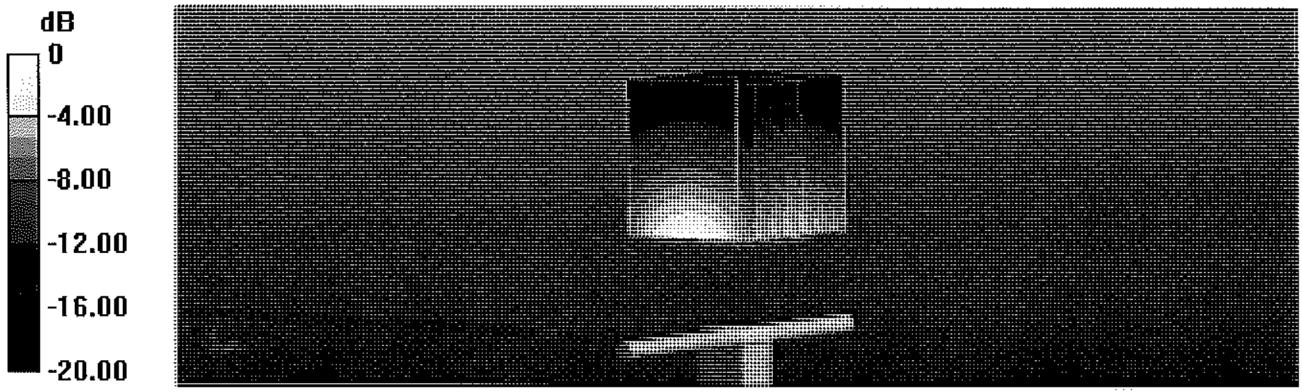
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 S/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

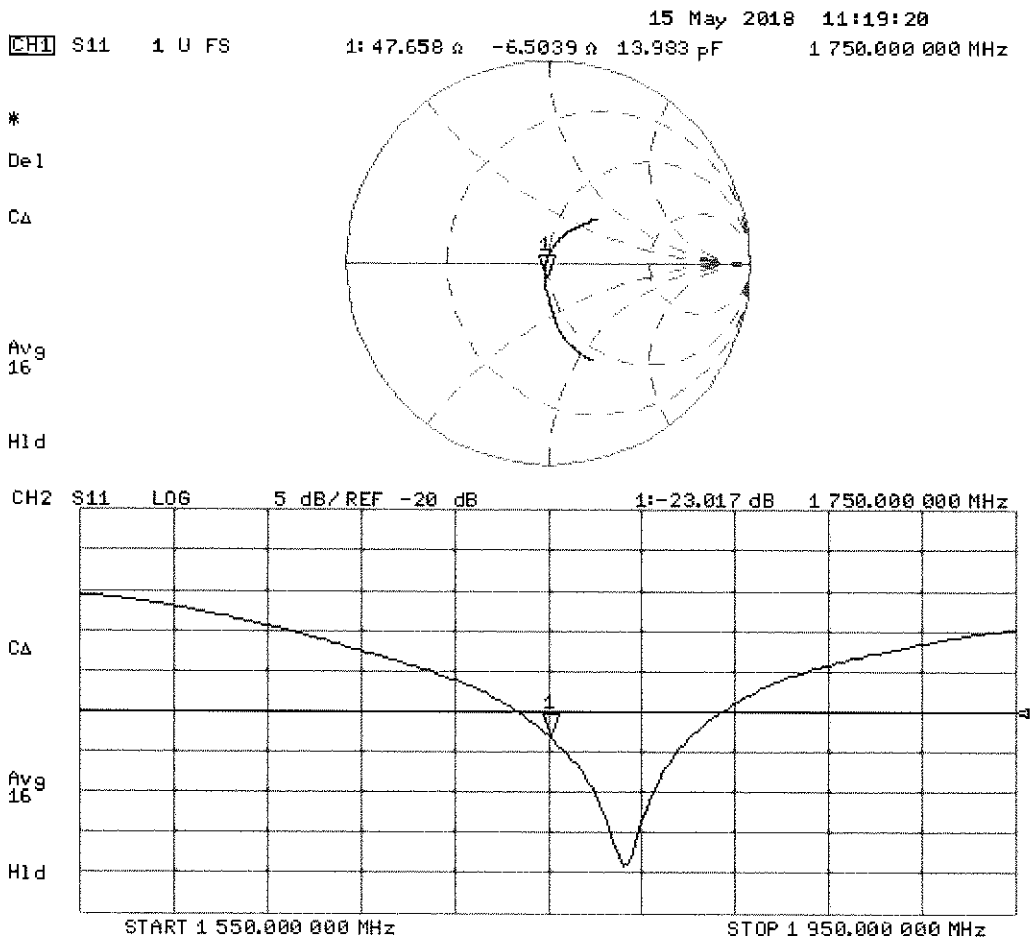
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.6 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 8.94 W/kg; SAR(10 g) = 4.71 W/kg
Maximum value of SAR (measured) = 13.8 W/kg



0 dB = 13.8 W/kg = 11.40 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 15.05.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN:1008

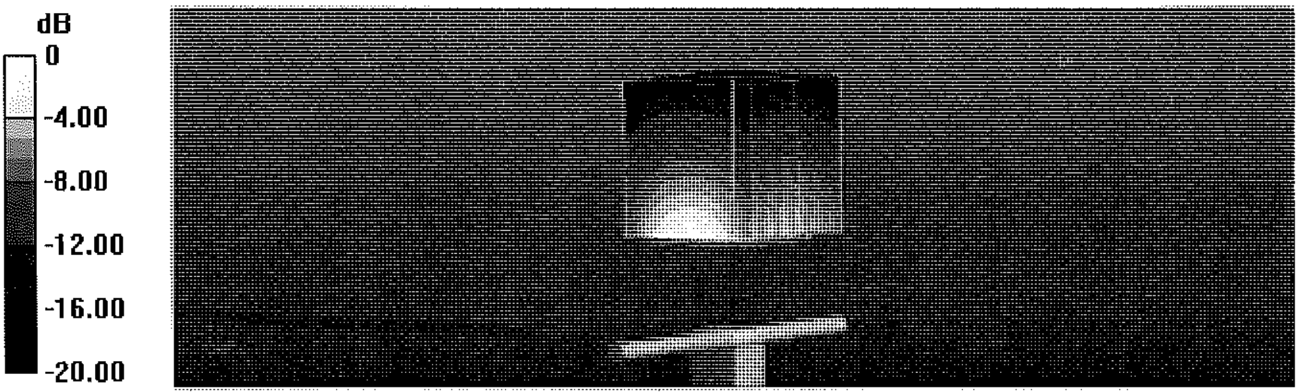
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.46 S/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

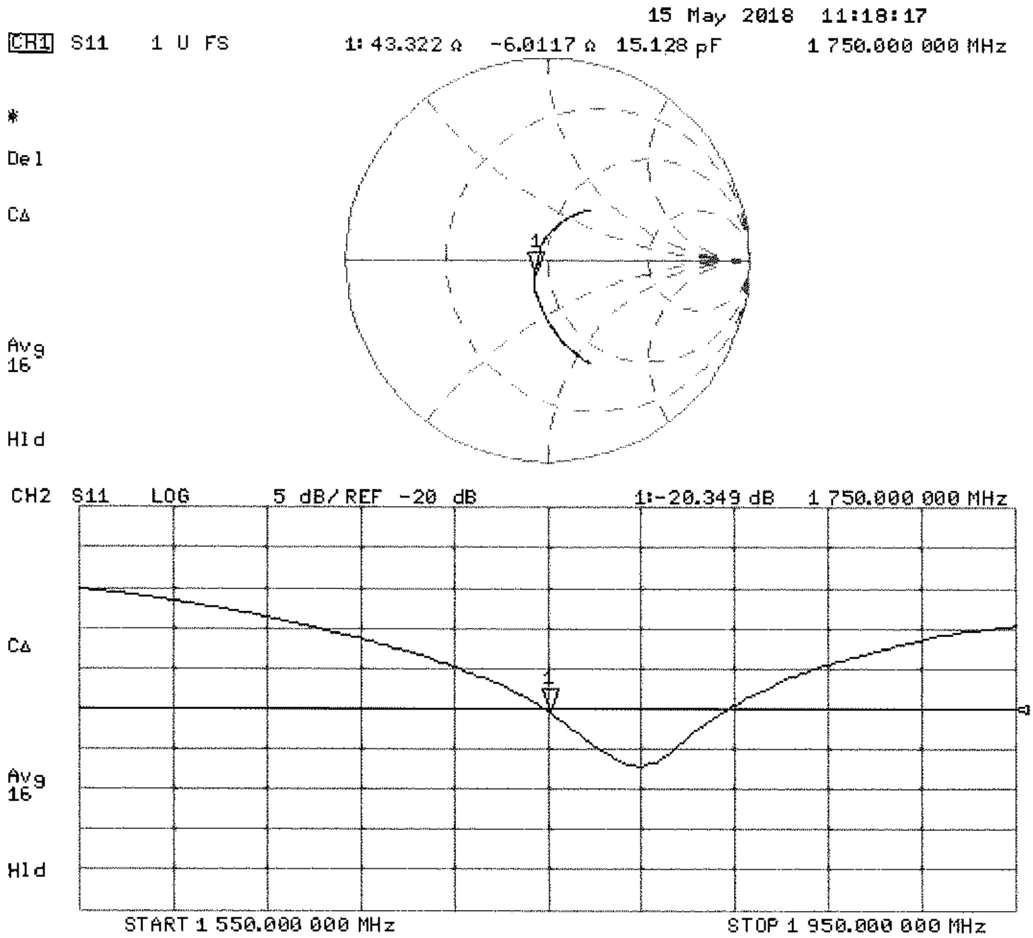
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.4 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.21 W/kg; SAR(10 g) = 4.92 W/kg
Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg = 11.37 dBW/kg

Impedance Measurement Plot for Body TSL



DASY5 Validation Report for SAM Head

Date: 23.05.2018

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; σ = 1.37 S/m; ε_r = 41.8; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

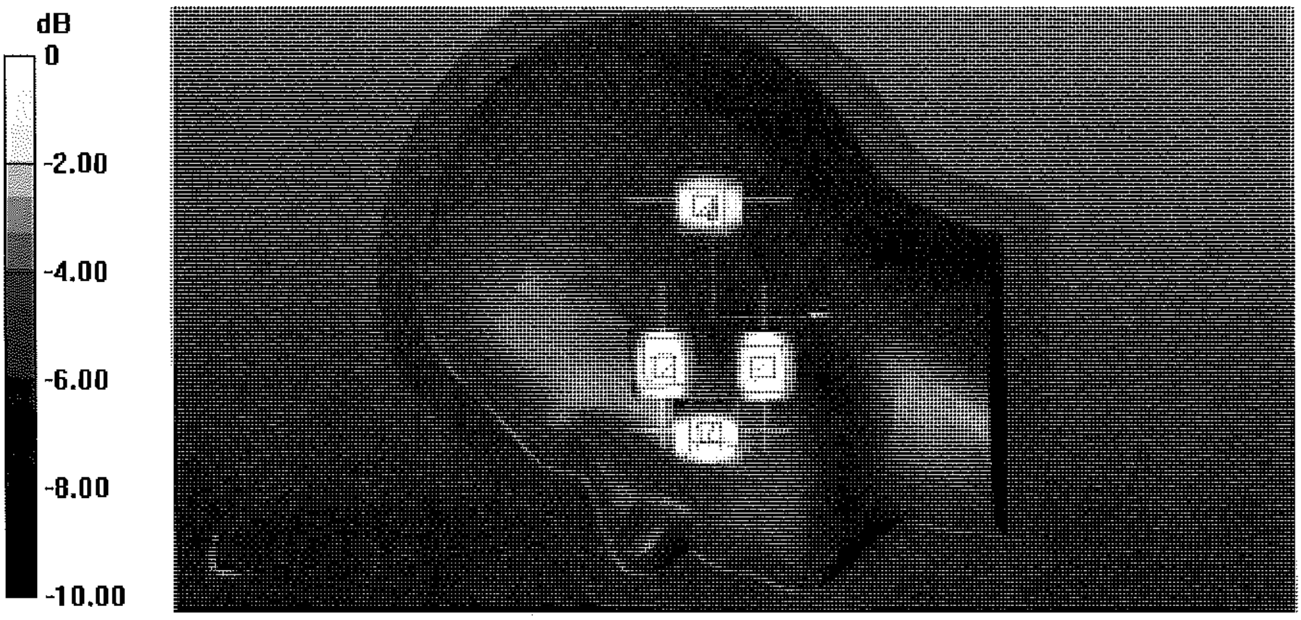
- Probe: EX3DV4 - SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: SAM Head
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

SAM/Head/Top/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.8 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 9.26 W/kg; SAR(10 g) = 4.95 W/kg
Maximum value of SAR (measured) = 13.9 W/kg

SAM/Head/Mouth/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.2 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 16.6 W/kg
SAR(1 g) = 9.47 W/kg; SAR(10 g) = 5.06 W/kg
Maximum value of SAR (measured) = 13.7 W/kg

SAM/Head/Neck/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.7 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 15.8 W/kg
SAR(1 g) = 9.26 W/kg; SAR(10 g) = 5.02 W/kg
Maximum value of SAR (measured) = 13.8 W/kg

SAM/Head/Ear/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.46 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 11.8 W/kg
SAR(1 g) = 7.12 W/kg; SAR(10 g) = 4.01 W/kg
Maximum value of SAR (measured) = 10.3 W/kg



0 dB = 10.3 W/kg = 10.13 dBW/kg

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S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

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 0108**

Client **PC Test**

Certificate No: **D1900V2-5d080_Jul16**

CALIBRATION CERTIFICATE

Object: D1900V2 - SN:5d080

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: July 08, 2016

BN✓ 7/16/2016
Extended BN✓ 7/18/2018

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 NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 13, 2016

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) 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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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 ± 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 ± 0.2) °C	39.8 ± 6 %	1.38 mho/m ± 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	9.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**39.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.5 W/kg ± 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 ± 0.2) °C	52.7 ± 6 %	1.51 mho/m ± 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	9.75 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1 Ω + 5.3 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 Ω + 6.8 jΩ
Return Loss	- 22.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.192 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	June 28, 2006

DASY5 Validation Report for Head TSL

Date: 08.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

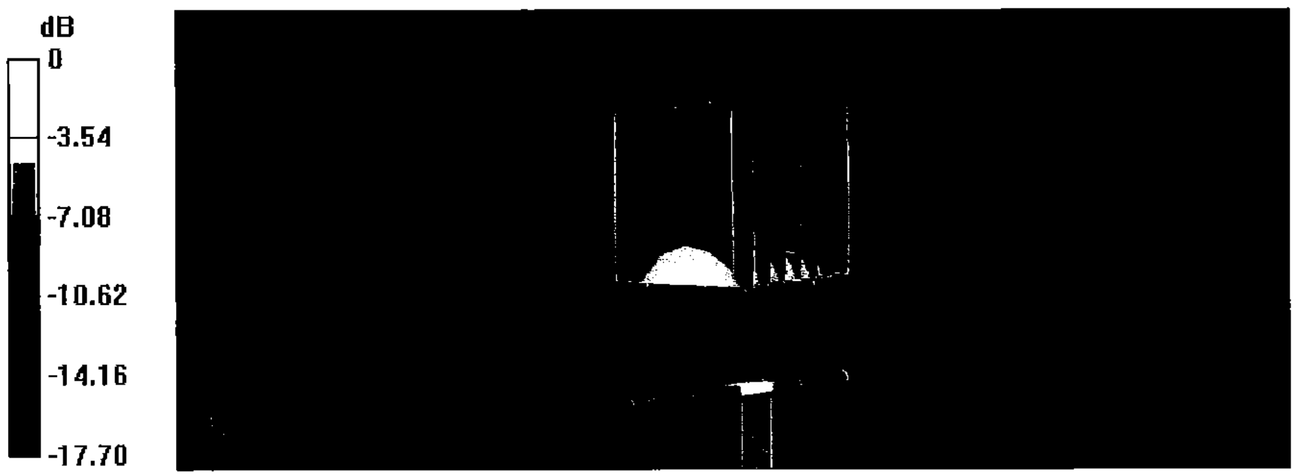
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.38$ S/m; $\varepsilon_r = 39.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.99, 7.99, 7.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

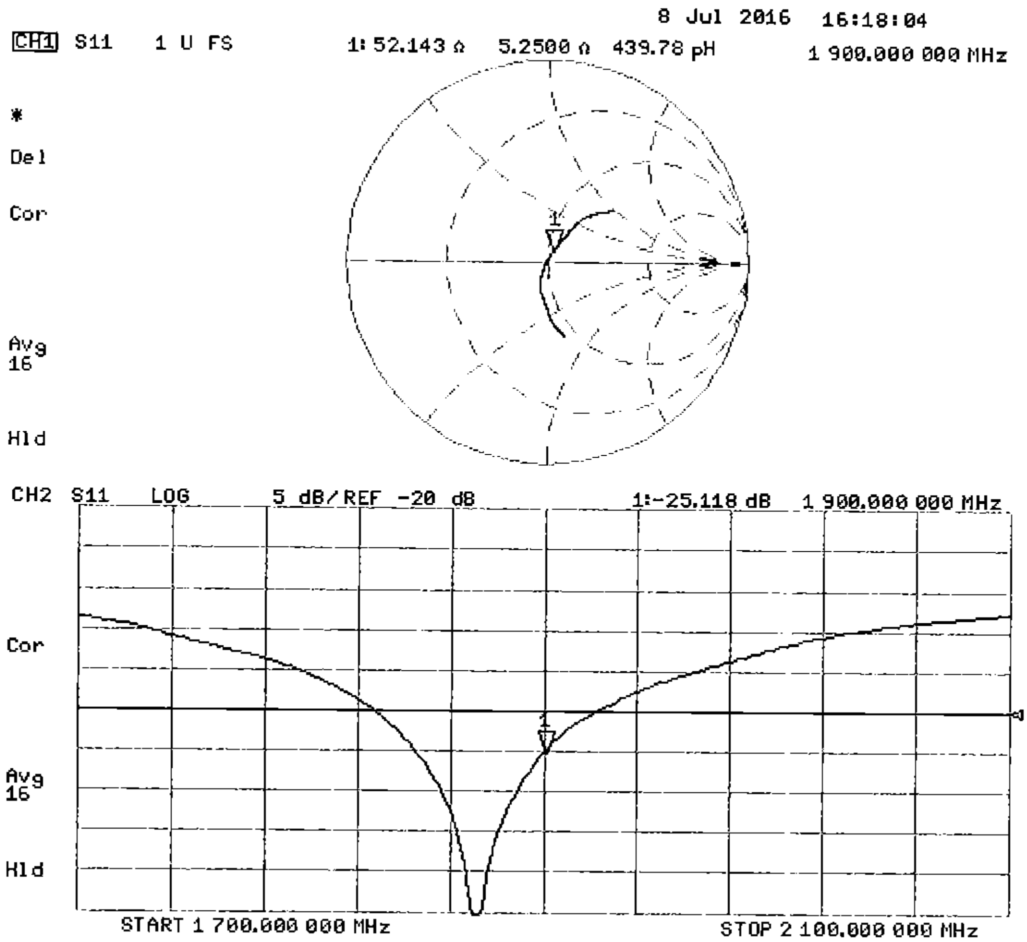
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.6 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 18.4 W/kg
SAR(1 g) = 9.76 W/kg; SAR(10 g) = 5.1 W/kg
Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.51$ S/m; $\varepsilon_r = 52.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

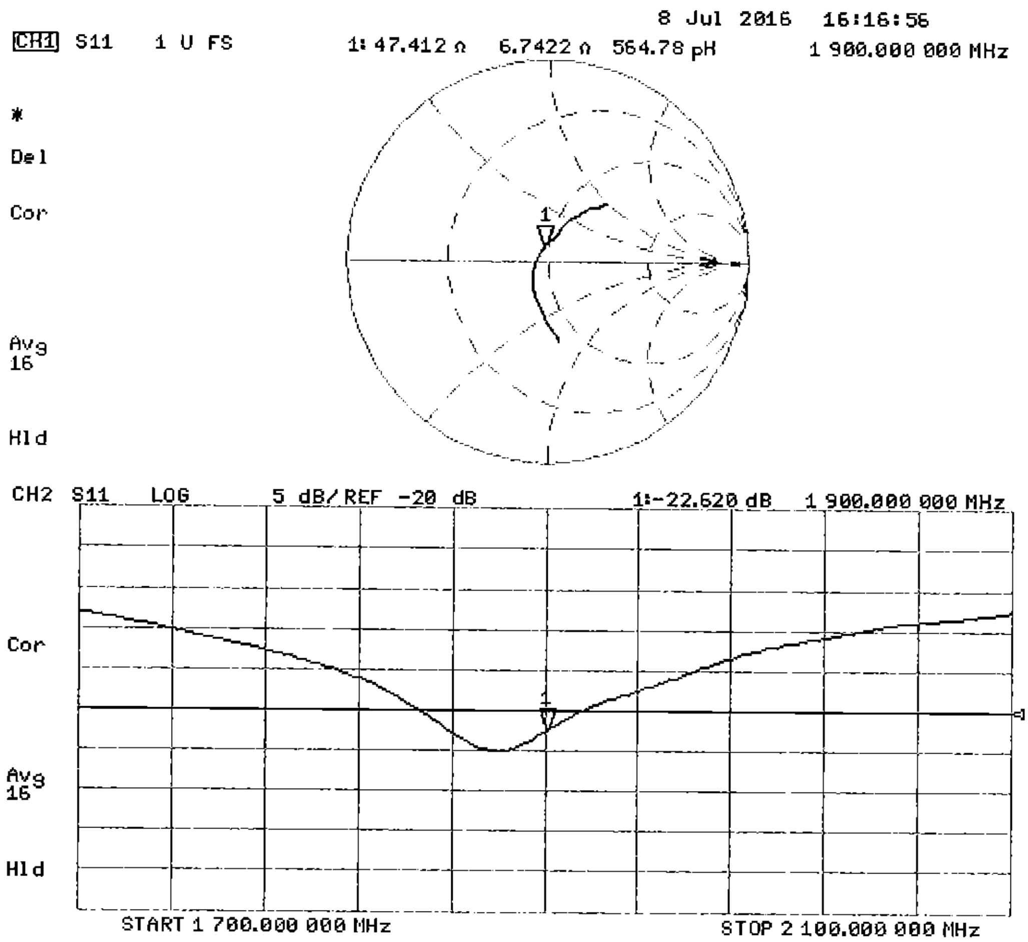
- Probe: EX3DV4 - SN7349; ConvF(8.03, 8.03, 8.03); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 103.1 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 9.75 W/kg; SAR(10 g) = 5.17 W/kg
Maximum value of SAR (measured) = 14.7 W/kg

0 dB = 14.7 W/kg = 11.67 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object D1900V2 – SN: 5d080

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Calibration date: July 06, 2017

Description: SAR Validation Dipole at 1900 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/1/2017	Annual	6/1/2018	MY53401181
Agilent	8753ES	S-Parameter Network Analyzer	10/26/2016	Annual	10/26/2017	US39170118
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/13/2017	Annual	3/13/2018	1415
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/10/2017	Annual	5/10/2018	1070
SPEAG	ES3DV3	SAR Probe	3/14/2017	Annual	3/14/2018	3209
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1207364
Anritsu	MA2411B	Pulse Power Sensor	2/10/2017	Annual	2/10/2018	1339018
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Agilent	N5182A	MXG Vector Signal Generator	2/28/2017	Annual	2/28/2018	MY47420800
Seekonk	NC-100	Torque Wrench	11/6/2015	Biennial	11/6/2017	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

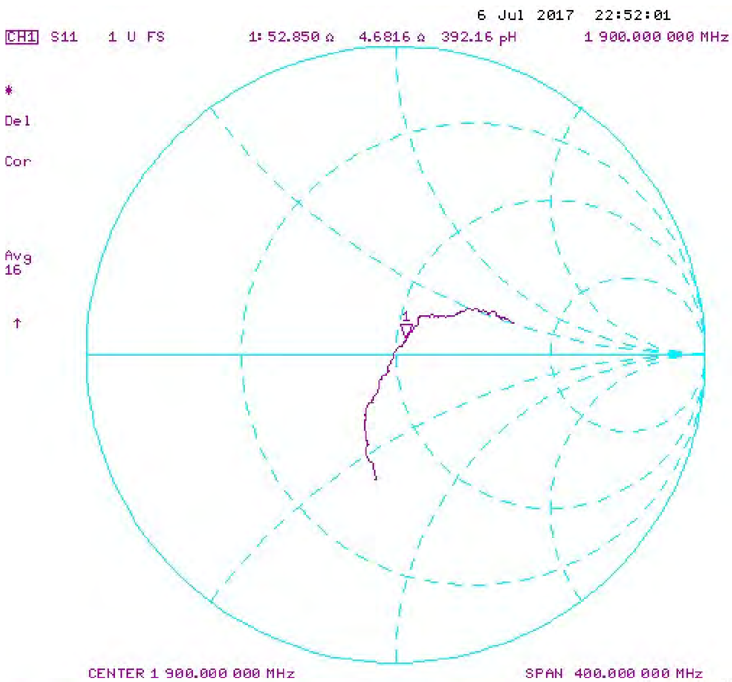
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

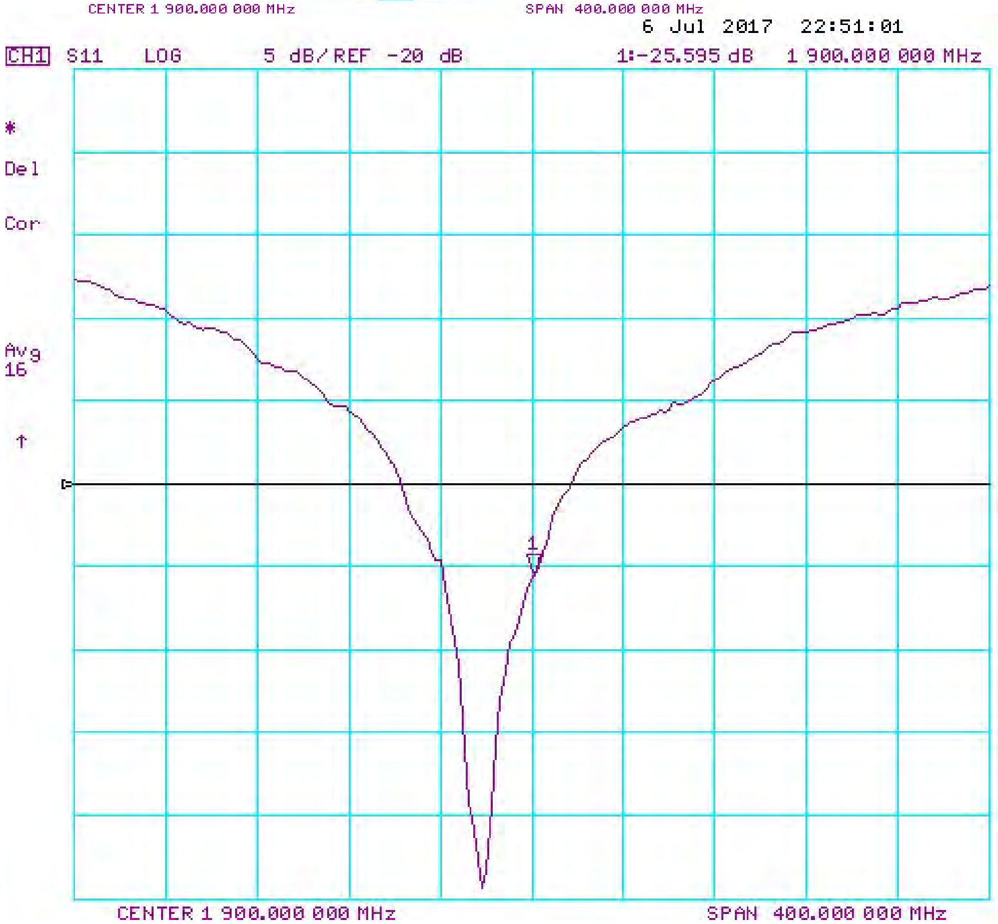
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
7/8/2016	7/6/2017	1.192	3.93	3.86	-1.78%	2.05	2	-2.44%	52.1	52.9	0.8	5.3	4.7	0.6	-25.1	-25.6	-2.00%	PASS

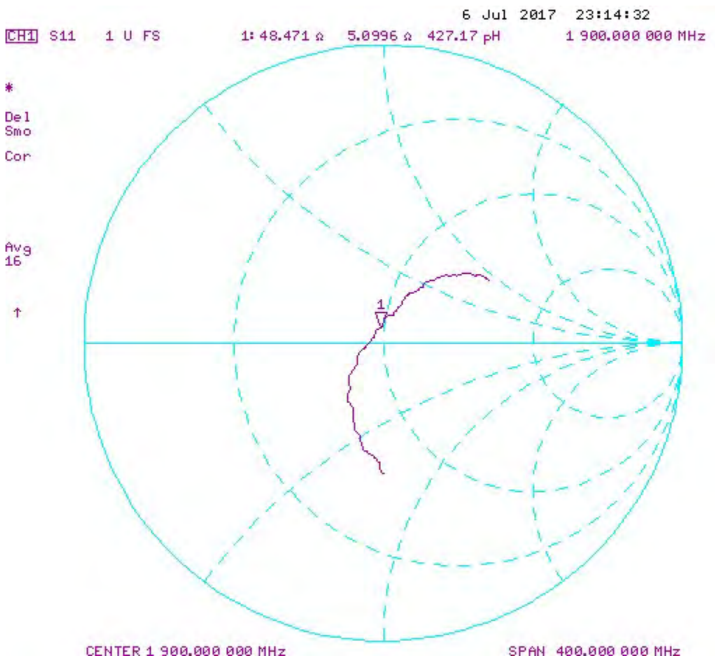
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
7/8/2016	7/6/2017	1.192	3.91	4.05	3.58%	2.07	2.11	1.93%	47.4	48.5	1.1	6.8	5.1	1.7	-22.6	-25.5	-12.80%	PASS

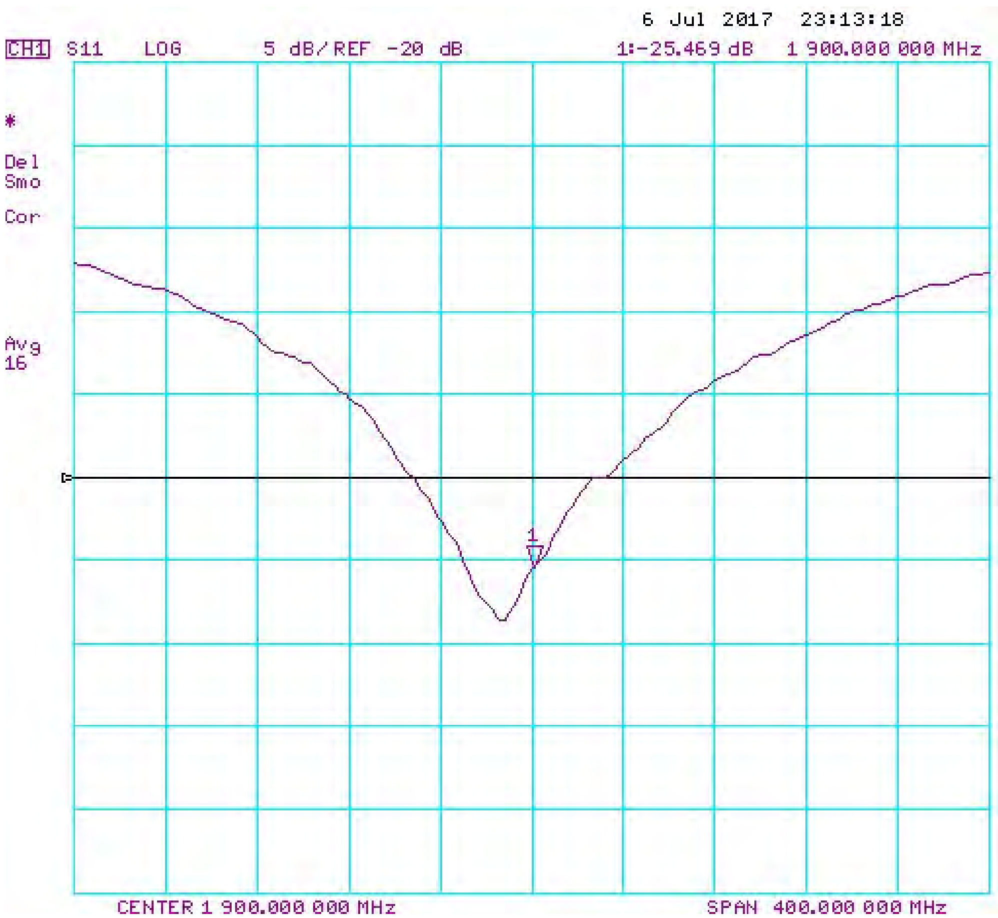
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Object:	Date Issued:	Page 4 of 4
D1900V2 – SN: 5d080	07/06/2017	

PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. +1.410.290.6652 / Fax +1.410.290.6654
http://www.pctest.com

Certification of Calibration

Object: D1900V2 – SN: 5d080

Calibration procedure(s): Procedure for Calibration Extension for SAR Dipoles.

Extended Calibration date: 07/06/2018

Description: SAR Validation Dipole at 1900 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4438C	ESG Vector Signal Generator	3/24/2017	Biennial	3/24/2019	MY42082385
Agilent	8753ES	S-Parameter Network Analyzer	9/14/2017	Annual	9/14/2018	US39170118
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	ML2495A	Power Meter	11/28/2017	Annual	11/28/2018	1039008
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	11/15/2017	Annual	11/15/2018	1339007
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/9/2018	Annual	2/9/2019	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/22/2018	Annual	5/22/2019	859
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/12/2017	Annual	9/12/2018	1091
SPEAG	ES3DV3	SAR Probe	2/13/2018	Annual	2/13/2019	3213
SPEAG	EX3DV4	SAR Probe	5/22/2018	Annual	5/22/2019	7406

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK