



SAR EVALUATION REPORT

Applicant Name:

Samsung Electronics Co., Ltd.
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Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:

06/01/16 - 06/30/16

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

0Y1606010993-R1.A3L

FCC ID:

A3LSMN930KOR

APPLICANT:

SAMSUNG ELECTRONICS CO., LTD.

DUT Type:

Portable Handset

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093

Model(s):

SM-N930S, SM-N930K, SM-N930L

Equipment Class	Band & Mode	Tx Frequency	SAR			
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)	10 gm Phablet (W/kg)
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	< 0.1	0.21	0.42	N/A
PCE	UMTS 850	826.40 - 846.60 MHz	0.20	0.57	0.57	N/A
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.11	0.31	0.60	N/A
PCE	LTE Band 12	699.7 - 715.3 MHz	< 0.1	0.11	0.14	N/A
PCE	LTE Band 17	706.5 - 713.5 MHz	N/A	N/A	N/A	N/A
PCE	LTE Band 26 (Cell)	814.7 - 848.3 MHz	0.20	0.56	0.64	N/A
PCE	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.26	0.59	0.65	N/A
PCE	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	0.13	0.45	0.75	N/A
PCE	LTE Band 25 (PCS)	1850.7 - 1914.3 MHz	0.16	0.50	0.93	N/A
PCE	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	N/A	N/A	N/A	N/A
PCE	LTE Band 41	2506 - 2680 MHz	< 0.1	0.30	0.84	N/A
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.57	0.51	0.51	N/A
NIH	U-NII-1	5180 - 5240 MHz	N/A	N/A	N/A	N/A
NIH	U-NII-2A	5260 - 5320 MHz	0.31	0.21	N/A	1.08
NIH	U-NII-2C	5500 - 5720 MHz	0.30	0.38	N/A	1.97
NIH	U-NII-3	5745 - 5825 MHz	0.21	0.50	0.50	N/A
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A	N/A	N/A	N/A
Simultaneous SAR per KDB 690783 D01v01r03:			1.13	1.59	1.59	2.64

This revised Test Report (S/N: 0Y1606010993-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.8 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



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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 12	Data	699.7 - 715.3 MHz
LTE Band 17	Data	706.5 - 713.5 MHz
LTE Band 26 (Cell)	Data	814.7 - 848.3 MHz
LTE Band 5 (Cell)	Data	824.7 - 848.3 MHz
LTE Band 4 (AWS)	Data	1710.7 - 1754.3 MHz
LTE Band 25 (PCS)	Data	1850.7 - 1914.3 MHz
LTE Band 2 (PCS)	Data	1850.7 - 1909.3 MHz
LTE Band 41	Data	2506 - 2680 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
ANT+	Data	2402 - 2480 MHz
MST	Data	1 - 8.3 kHz

1.2 Power Reduction for SAR

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

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1.3 Nominal and Maximum Output Power Specifications

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

1.3.1 Maximum PCE Power – Ant A

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 1900	Maximum	30.0	30.0	27.0	25.5	24.5	26.5	24.5	22.5	21.5
	Nominal	29.5	29.5	26.5	25.0	24.0	26.0	24.0	22.0	21.0

Mode / Band		Modulated Average (dBm)		
		3GPP WCDMA	3GPP HSDPA	3GPP HSUPA
UMTS Band 5 (850 MHz)	Maximum	23.5	23.5	23.5
	Nominal	23.0	23.0	23.0
UMTS Band 2 (1900 MHz)	Maximum	23.0	23.0	23.0
	Nominal	22.5	22.5	22.5
Mode / Band		Modulated Average (dBm)		
LTE Band 12	Maximum	23.5		
	Nominal	23.0		
LTE Band 17	Maximum	23.5		
	Nominal	23.0		
LTE Band 26 (Cell)	Maximum	23.5		
	Nominal	23.0		
LTE Band 5 (Cell)	Maximum	24.0		
	Nominal	23.5		
LTE Band 4 (AWS)	Maximum	23.5		
	Nominal	23.0		
LTE Band 25 (PCS)	Maximum	23.5		
	Nominal	23.0		
LTE Band 2 (PCS)	Maximum	23.5		
	Nominal	23.0		
LTE Band 41	Maximum	23.0		
	Nominal	22.5		

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1.3.2 Maximum PCE Power – Ant B

Mode / Band		Modulated Average (dBm)
LTE Band 5 (Cell)	Maximum	23.5
	Nominal	23.0

1.3.3 Maximum WLAN/BT Power

Mode / Band		Modulated Average - Single Tx Chain (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	19.5
	Nominal	19.0
IEEE 802.11g (2.4 GHz)	Maximum	17.5
	Nominal	17.0
IEEE 802.11n (2.4 GHz)	Maximum	15.5
	Nominal	15.0
Bluetooth	Maximum	11.5
	Nominal	11.0
Bluetooth LE	Maximum	7.5
	Nominal	7.0

Mode / Band		Modulated Average - Single Tx Chain (dBm)		
		20 MHz Bandwidth		80 MHz Bandwidth
		Ch. 36-48	Ch. 52-165	
IEEE 802.11a (5 GHz)	Maximum	15.5	17.5	
	Nominal	15.0	17.0	
IEEE 802.11n (5 GHz)	Maximum	15.5	17.5	
	Nominal	15.0	17.0	
IEEE 802.11ac (5 GHz)	Maximum	15.5	17.5	
	Nominal	15.0	17.0	

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Mode / Band		Modulated Average - MIMO (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11g (2.4 GHz)	Maximum	18.5		
	Nominal	18.0		
IEEE 802.11n (2.4 GHz)	Maximum	18.5		
	Nominal	18.0		
		Ch. 36-48	Ch. 52-165	
IEEE 802.11a (5 GHz)	Maximum	15.5	17.5	
	Nominal	15.0	17.0	
IEEE 802.11n (5 GHz)	Maximum	15.5	17.5	15.5
	Nominal	15.0	17.0	15.0
IEEE 802.11ac (5 GHz)	Maximum	15.5	17.5	15.5
	Nominal	15.0	17.0	14.5
				14.0

1.3.4 Reduced WLAN/BT Power

Mode / Band		Modulated Average - Single Tx Chain (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	12.5
	Nominal	12.0
IEEE 802.11g (2.4 GHz)	Maximum	12.5
	Nominal	12.0
IEEE 802.11n (2.4 GHz)	Maximum	12.5
	Nominal	12.0

Mode / Band		Modulated Average - Single Tx Chain (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11a (5 GHz)	Maximum	10.5		
	Nominal	10.0		
IEEE 802.11n (5 GHz)	Maximum	10.5	10.5	
	Nominal	10.0	10.0	
IEEE 802.11ac (5 GHz)	Maximum	10.5	10.5	10.5
	Nominal	10.0	10.0	10.0
Mode / Band		Modulated Average - MIMO (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11g (2.4 GHz)	Maximum	15.5		
	Nominal	15.0		
IEEE 802.11n (2.4 GHz)	Maximum	15.5		
	Nominal	15.0		
IEEE 802.11a (5 GHz)	Maximum	13.5		
	Nominal	13.0		
IEEE 802.11n (5 GHz)	Maximum	13.5	13.5	
	Nominal	13.0	13.0	
IEEE 802.11ac (5 GHz)	Maximum	13.5	13.5	13.5
	Nominal	13.0	13.0	13.0

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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
GSM/GPRS 1900	Yes	Yes	No	Yes	No	Yes
UMTS 850	Yes	Yes	No	Yes	Yes	Yes
UMTS 1900	Yes	Yes	No	Yes	No	Yes
LTE Band 12	Yes	Yes	No	Yes	Yes	Yes
LTE Band 26 (Cell)	Yes	Yes	No	Yes	Yes	Yes
LTE Band 5 (Cell) Ant A	Yes	Yes	No	Yes	Yes	Yes
LTE Band 5 (Cell) Ant B	Yes	Yes	Yes	No	Yes	Yes
LTE Band 4 (AWS)	Yes	Yes	No	Yes	No	Yes
LTE Band 25 (PCS)	Yes	Yes	No	Yes	No	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

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.

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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. Possible transmission paths for the DUT are shown in Figure 1-1 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.



Figure 1-1
Simultaneous Transmission Paths

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 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 W-Fi	Yes	Yes	N/A	Yes	
2	GSM voice + 5 GHz W-Fi	Yes	Yes	N/A	Yes	
3	GSM voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	Yes	
4	GSM voice + 2.4 GHz W-Fi MIMO	Yes	Yes	N/A	Yes	
5	GSM voice + 5 GHz W-Fi MIMO	Yes	Yes	N/A	Yes	
6	GSM voice + 2.4 GHz W-Fi + 5 GHz W-Fi	Yes	Yes	N/A	Yes	
7	UMTS + 2.4 GHz W-Fi	Yes	Yes	Yes	Yes	
8	UMTS + 5 GHz W-Fi	Yes	Yes	Yes	Yes	
9	UMTS + 2.4 GHz Bluetooth	N/A	Yes	N/A	Yes	
10	UMTS + 2.4 GHz W-Fi MIMO	Yes	Yes	Yes	Yes	
11	UMTS + 5 GHz W-Fi MIMO	Yes	Yes	Yes	Yes	
12	UMTS + 2.4 GHz W-Fi + 5 GHz W-Fi	Yes	Yes	Yes	Yes	
13	LTE + 2.4 GHz W-Fi	Yes*	Yes*	Yes	Yes	*-Pre-installed VOIP applications are considered.
14	LTE + 5 GHz W-Fi	Yes*	Yes*	Yes	Yes	*-Pre-installed VOIP applications are considered.
15	LTE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	Yes	*-Pre-installed VOIP applications are considered.
16	LTE + 2.4 GHz W-Fi MIMO	Yes*	Yes*	Yes	Yes	*-Pre-installed VOIP applications are considered.
17	LTE + 5 GHz W-Fi MIMO	Yes*	Yes*	Yes	Yes	*-Pre-installed VOIP applications are considered.
18	LTE + 2.4 GHz W-Fi + 5 GHz W-Fi	Yes*	Yes*	Yes	Yes	*-Pre-installed VOIP applications are considered.
19	GPRS/EDGE + 2.4 GHz W-Fi	N/A	N/A	Yes	Yes	
20	GPRS/EDGE + 5 GHz W-Fi	N/A	N/A	Yes	Yes	
21	GPRS/EDGE + 2.4 GHz Bluetooth	N/A	N/A	N/A	Yes	
22	GPRS/EDGE + 2.4 GHz W-Fi MIMO	N/A	N/A	Yes	Yes	
23	GPRS/EDGE + 5 GHz W-Fi MIMO	N/A	N/A	Yes	Yes	
24	GPRS/EDGE + 2.4 GHz W-Fi + 5 GHz W-Fi	N/A	N/A	Yes	Yes	

1. Ant A and Ant B operate in a switched condition only and cannot transmit simultaneously.
2. All licensed modes share the same antenna path and cannot transmit simultaneously.
3. 2.4 GHz WLAN, 5 GHz WLAN, and 2.4 GHz Bluetooth that share the same antenna path cannot all transmit simultaneously.

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4. 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.
5. 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.
6. 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.
7. This device supports 2x2 MIMO Tx for WLAN 802.11a/g/n/ac. Each WLAN antenna can transmit independently or together when operating with MIMO.
8. This device does not support VoLTE.

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.

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

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, body-worn Bluetooth SAR was not required; $[(14/10) * \sqrt{2.480}] = 2.2 < 3.0$. Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

Per FCC KDB 447498 D01v06, the 10g SAR exclusion threshold for distances <50mm is defined by the following equation:

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, phablet Bluetooth SAR was not required; $[(14/5) * \sqrt{2.480}] = 4.4 < 7.5$. Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

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

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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-1, U-NII-2A & U-NII-2C WLAN, phablet SAR tests were performed. Phablet SAR was not evaluated for 2.4 GHz and U-NII-3 WLAN operations since wireless router 1g SAR was < 1.2 W/kg.

(B) Licensed Transmitter(s)

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

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

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

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

This device supports both LTE B25 (PCS) and LTE B2 (PCS). Since the supported frequency span for LTE B2 (PCS) falls completely within the supported frequency span for LTE B25 (PCS), both LTE bands have the same target power, and both LTE bands share the same transmission path, SAR was only assessed for LTE B25 (PCS).

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. Phablet SAR was not evaluated for licensed technologies since wireless router 1g SAR was < 1.2 W/kg for these modes.

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)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

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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.

	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number	Phablet Serial Number
GSM/GPRS/EDGE 1900	05AA2	05AA2	05AA2	-
UMTS 850	8485A	8485A	8485A	-
UMTS 1900	05AD2	05AD2	05AD2	-
LTE Band 12	05AD2	05AD2	05AD2	-
LTE Band 26 (Cell)	8485A	8485A	8485A	-
LTE Band 5 (Cell)	8485A, 0548E	8485A, 0548E	8485A, 0548E	-
LTE Band 4 (AWS)	05AA2	05AA2	05AA2	-
LTE Band 25 (PCS)	8433D	8433D	8433D	-
LTE Band 41	05A82	0548E	0548E	-
2.4 GHz WLAN	252AF	252AF	252AF	-
5 GHz WLAN	252AE	252AE	252AE	252AE

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LTE INFORMATION

LTE Information					
FCC ID	A3LSMN930KOR				
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 26 (Cell) (814.7 - 848.3 MHz)				
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)				
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)				
	LTE Band 25 (PCS) (1850.7 - 1914.3 MHz)				
	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)				
Channel Bandwidths	LTE Band 41 (2506 - 2680 MHz)				
	LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 17: 5 MHz, 10 MHz				
	LTE Band 26 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz				
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 25 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
Channel Numbers and Frequencies (MHz)	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 41: 5 MHz, 10 MHz, 15 MHz, 20 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 26 (Cell): 1.4 MHz	814.7 (26697)		831.5 (26865)		848.3 (27033)
LTE Band 26 (Cell): 3 MHz	815.5 (26705)		831.5 (26865)		847.5 (27025)
LTE Band 26 (Cell): 5 MHz	816.5 (26715)		831.5 (26865)		846.5 (27015)
LTE Band 26 (Cell): 10 MHz	819 (26740)		831.5 (26865)		844 (26990)
LTE Band 26 (Cell): 15 MHz	821.5 (26765)		831.5 (26865)		841.5 (26965)
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)		836.5 (20525)		848.3 (20643)
LTE Band 5 (Cell): 3 MHz	825.5 (20415)		836.5 (20525)		847.5 (20635)
LTE Band 5 (Cell): 5 MHz	826.5 (20425)		836.5 (20525)		846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829 (20450)		836.5 (20525)		844 (20600)
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)		1732.5 (20175)		1754.3 (20393)
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)		1732.5 (20175)		1753.5 (20385)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)		1732.5 (20175)		1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715 (20000)		1732.5 (20175)		1750 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)		1732.5 (20175)		1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720 (20050)		1732.5 (20175)		1745 (20300)
LTE Band 25 (PCS): 1.4 MHz	1850.7 (26047)		1882.5 (26365)		1914.3 (26683)
LTE Band 25 (PCS): 3 MHz	1851.5 (26055)		1882.5 (26365)		1913.5 (26675)
LTE Band 25 (PCS): 5 MHz	1852.5 (26065)		1882.5 (26365)		1912.5 (26665)
LTE Band 25 (PCS): 10 MHz	1855 (26090)		1882.5 (26365)		1910 (26640)
LTE Band 25 (PCS): 15 MHz	1857.5 (26115)		1882.5 (26365)		1907.5 (26615)
LTE Band 25 (PCS): 20 MHz	1860 (26140)		1882.5 (26365)		1905 (26590)
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)		1880 (18900)		1909.3 (19193)
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)		1880 (18900)		1908.5 (19185)
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)		1880 (18900)		1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)		1880 (18900)		1905 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)		1880 (18900)		1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860 (18700)		1880 (18900)		1900 (19100)
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	6				
Modulations Supported in UL	QPSK, 16QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES				
A-MPR (Additional MPR) disabled for SAR Testing?	YES				
LTE Release 10 Additional Information	This device does not support full CA features on 3GPP Release 10. All uplink communications are identical to the Release 8 Specifications. The following LTE Release 10 Features are not supported: Carrier Aggregation, Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, MDH, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.				

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3 INTRODUCTION

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

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

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

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

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

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4 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:

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

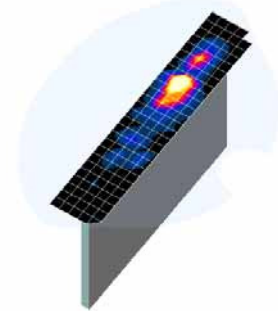


Figure 4-1
Sample SAR Area Scan

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

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

*Also compliant to IEEE 1528-2013 Table 6

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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].

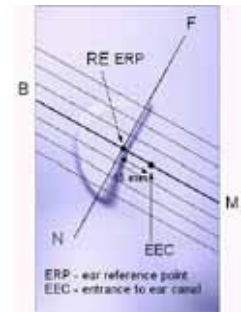


Figure 5-1
Close-Up Side view
of ERP

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



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

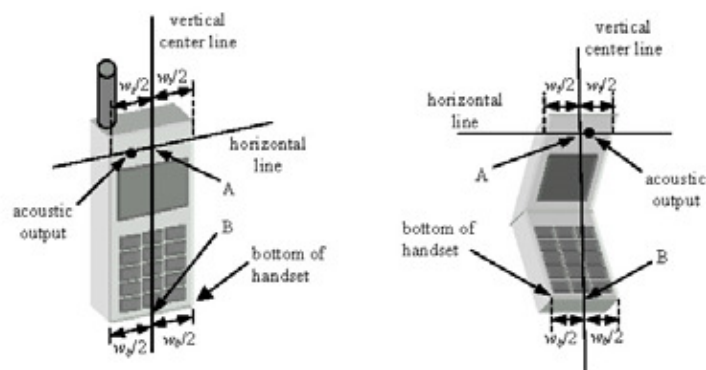


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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6 TEST CONFIGURATION POSITIONS

6.1 Device Holder

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

6.2 Positioning for Cheek

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



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

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

6.3 Positioning for Ear / 15° Tilt

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

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

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

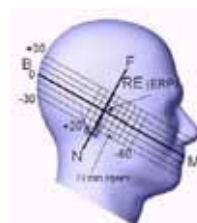


Figure 6-3 Side view w/ relevant markings

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

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

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

6.5 Body-Worn Accessory Configurations

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

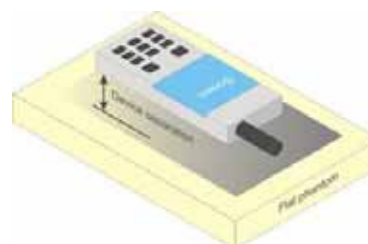


Figure 6-4 Sample Body-Worn Diagram

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

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

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

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

6.6 Extremity Exposure Configurations

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

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

6.7 Wireless Router Configurations

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

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

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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 10-g SAR. The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g SAR is required only for the surfaces and edges with hotspot mode 1-g SAR > 1.2 W/kg.

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7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

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

7.2 Controlled Environment

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

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

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

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

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8 FCC MEASUREMENT PROCEDURES

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

8.1 Measured and Reported SAR

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

8.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01v03r01, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is

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8.4.2 Head SAR Measurements

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

8.4.3 Body SAR Measurements

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

8.4.4 SAR Measurements with Rel 5 HSDPA

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

8.4.5 SAR Measurements with Rel 6 HSUPA

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

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

8.5 SAR Measurement Conditions for LTE

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

8.5.1 Spectrum Plots for RB Configurations

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

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.

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8.5.3 A-MPR

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

8.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r04:

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

8.5.5 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.

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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 10-g 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 10-g 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

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required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed. When 10-g 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 10-g 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 10-g 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 10-g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

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9 RF CONDUCTED POWERS

9.1 GSM Conducted Powers

Maximum Burst-Averaged Output Power										
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 1900	512	29.54	29.63	26.06	24.97	23.31	24.82	22.55	21.52	20.38
	661	29.49	29.57	26.23	24.84	23.20	24.78	22.50	21.32	20.39
	810	29.87	29.94	26.50	25.29	23.69	25.26	23.04	21.79	20.68

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 1900	512	20.51	20.60	20.04	20.71	20.30	15.79	16.53	17.26	17.37
	661	20.46	20.54	20.21	20.58	20.19	15.75	16.48	17.06	17.38
	810	20.84	20.91	20.48	21.03	20.68	16.23	17.02	17.53	17.67

GSM 1900	Frame Avg. Targets:	20.47	20.47	20.48	20.74	20.99	16.97	17.98	17.74	17.99
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Note:

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

GSM Class: B

GPRS Multislot class: 33 (Max 4 Tx uplink slots)

EDGE Multislot class: 33 (Max 4 Tx uplink slots)

DTM Multislot Class: N/A

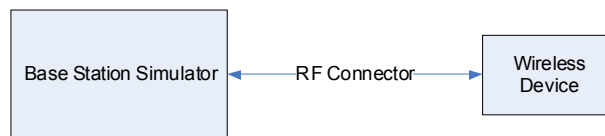


Figure 9-1
Power Measurement Setup

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9.2 UMTS Conducted Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	22.48	22.25	22.29	21.95	22.15	22.19	-
99		12.2 kbps AMR	22.44	22.22	22.28	21.97	22.13	22.19	-
6	HSDPA	Subtest 1	22.63	22.38	22.45	22.00	22.30	22.35	0
6		Subtest 2	22.62	22.39	22.44	22.12	22.31	22.36	0
6		Subtest 3	22.42	22.21	22.23	22.10	22.33	22.29	0.5
6		Subtest 4	22.43	22.23	22.25	22.09	22.32	22.39	0.5
6	HSUPA	Subtest 1	21.91	21.68	21.70	21.20	21.53	21.54	0
6		Subtest 2	21.43	21.24	21.30	21.13	21.34	21.37	2
6		Subtest 3	21.79	21.58	21.59	21.21	21.43	21.47	1
6		Subtest 4	21.47	21.21	21.31	21.13	21.33	21.37	2
6		Subtest 5	22.63	22.42	22.45	21.97	22.26	22.31	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

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9.3 LTE Conducted Powers

9.3.1

LTE Band 12

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

LTE Band 12 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23095 (707.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	23.21	0	0
	1	25	23.19		0
	1	49	23.15		0
	25	0	22.33	0-1	1
	25	12	22.32		1
	25	25	22.30		1
	50	0	22.31		1
16QAM	1	0	22.25	0-1	1
	1	25	22.18		1
	1	49	22.15		1
	25	0	21.27	0-2	2
	25	12	21.29		2
	25	25	21.25		2
	50	0	21.30		2

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

Table 9-2
LTE Band 12 Conducted Powers - 5 MHz Bandwidth

LTE Band 12 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23035 (701.5 MHz)	23095 (707.5 MHz)	23155 (713.5 MHz)		
			Conducted Power [dBm]	Conducted Power [dBm]	Conducted Power [dBm]		
QPSK	1	0	23.44	23.23	23.42	0	0
	1	12	23.39	23.11	23.42		0
	1	24	23.41	23.15	23.36		0
	12	0	22.34	22.33	22.27	0-1	1
	12	6	22.32	22.37	22.29		1
	12	13	22.27	22.34	22.29		1
	25	0	22.32	22.34	22.27		1
16QAM	1	0	22.41	22.27	22.31	0-1	1
	1	12	22.17	22.32	22.24		1
	1	24	22.43	22.40	22.34		1
	12	0	21.38	21.39	21.33	0-2	2
	12	6	21.38	21.25	21.24		2
	12	13	21.32	21.30	21.25		2
	25	0	21.34	21.34	21.26		2

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Table 9-3
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	23.34	23.38	23.19	0	0
	1	7	23.26	23.30	23.18		0
	1	14	23.32	23.29	23.17		0
	8	0	22.32	22.28	22.23	0-1	1
	8	4	22.27	22.31	22.22		1
	8	7	22.26	22.36	22.22		1
	15	0	22.28	22.29	22.22		1
16QAM	1	0	22.46	22.49	22.18	0-1	1
	1	7	22.44	22.39	22.26		1
	1	14	22.38	22.45	22.17		1
	8	0	21.38	21.25	21.27	0-2	2
	8	4	21.37	21.34	21.27		2
	8	7	21.34	21.25	21.29		2
	15	0	21.25	21.37	21.30		2

Table 9-4
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	23.29	23.34	23.25	0	0
	1	2	23.32	23.29	23.15		0
	1	5	23.27	23.28	23.26		0
	3	0	23.42	23.31	23.19		0
	3	2	23.41	23.34	23.18		0
	3	3	23.31	23.35	23.16		0
	6	0	22.31	22.28	22.17	0-1	1
16QAM	1	0	22.45	22.29	22.29	0-1	1
	1	2	22.26	22.31	22.08		1
	1	5	22.20	22.20	22.11		1
	3	0	22.37	22.36	22.17		1
	3	2	22.41	22.27	22.25		1
	3	3	22.40	22.39	22.15		1
	6	0	21.34	21.32	21.16	0-2	2

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9.3.2

LTE Band 26 (Cell)

Table 9-5
LTE Band 26 (Cell) Conducted Powers - 15 MHz Bandwidth

LTE Band 26 (Cell) 15 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26865 (831.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	22.90	0	0
	1	36	22.85		0
	1	74	22.83		0
	36	0	21.97	0-1	1
	36	18	21.95		1
	36	37	21.96		1
	75	0	21.96		1
16QAM	1	0	22.10	0-1	1
	1	36	22.09		1
	1	74	22.08		1
	36	0	20.95	0-2	2
	36	18	20.98		2
	36	37	20.99		2
	75	0	20.96		2

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

Table 9-6
LTE Band 26 (Cell) Conducted Powers - 10 MHz Bandwidth

LTE Band 26 (Cell) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26740 (819.0 MHz)	26865 (831.5 MHz)	26990 (844.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.24	23.15	23.22	0	0
	1	25	23.26	23.05	23.05		0
	1	49	23.20	23.07	22.95		0
	25	0	22.22	22.10	22.08	0-1	1
	25	12	22.18	22.11	22.03		1
	25	25	22.17	22.08	21.98		1
	50	0	22.17	22.08	22.01		1
16QAM	1	0	22.35	22.10	22.09	0-1	1
	1	25	22.33	22.01	22.05		1
	1	49	22.27	22.02	21.94		1
	25	0	21.25	21.15	21.06	0-2	2
	25	12	21.21	21.12	21.01		2
	25	25	21.24	21.14	20.97		2
	50	0	21.16	21.07	21.03		2

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

LTE Band 26 (Cell) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26715 (816.5 MHz)	26865 (831.5 MHz)	27015 (846.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.19	23.10	23.17	0	0
	1	12	23.37	23.22	23.33		0
	1	24	23.33	23.23	23.02		0
	12	0	22.21	22.13	22.05	0-1	1
	12	6	22.23	22.10	22.01		1
	12	13	22.18	22.11	21.97		1
	25	0	22.18	22.05	22.00		1
16QAM	1	0	22.28	22.03	22.05	0-1	1
	1	12	22.19	22.22	21.94		1
	1	24	22.36	21.98	22.15		1
	12	0	21.27	21.05	21.03	0-2	2
	12	6	21.23	21.04	21.03		2
	12	13	21.23	21.07	20.94		2
	25	0	21.19	21.06	21.02		2

Table 9-8
LTE Band 26 (Cell) Conducted Powers - 3 MHz Bandwidth

LTE Band 26 (Cell) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26705 (815.5 MHz)	26865 (831.5 MHz)	27025 (847.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.39	23.16	23.04	0	0
	1	7	23.24	23.39	23.29		0
	1	14	23.17	23.05	23.12		0
	8	0	22.22	21.94	22.15	0-1	1
	8	4	22.12	22.19	21.99		1
	8	7	22.22	22.25	21.95		1
	15	0	21.98	22.07	22.20		1
16QAM	1	0	22.35	21.95	21.87	0-1	1
	1	7	22.07	22.20	22.09		1
	1	14	22.16	21.87	22.12		1
	8	0	21.45	20.93	21.01	0-2	2
	8	4	21.39	20.85	20.91		2
	8	7	21.15	20.94	20.98		2
	15	0	21.10	20.86	20.94		2

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

LTE Band 26 (Cell) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26697 (814.7 MHz)	26865 (831.5 MHz)	27033 (848.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.18	22.87	23.02	0	0
	1	2	23.02	23.07	23.02		0
	1	5	23.05	22.96	23.13		0
	3	0	22.99	23.33	22.98		0
	3	2	22.87	22.88	23.11		0
	3	3	23.23	23.16	22.88		0
	6	0	22.20	21.88	22.20	0-1	1
16QAM	1	0	22.03	21.91	22.26	0-1	1
	1	2	22.29	22.22	22.00		1
	1	5	22.43	21.81	22.01		1
	3	0	22.20	22.15	21.80		1
	3	2	22.06	22.15	21.69		1
	3	3	22.06	22.13	21.90		1
	6	0	21.22	20.90	21.15	0-2	2

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LTE Band 5 (Cell)

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

LTE Band 5 (Cell) 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20525 (836.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	23.92	0	0
	1	25	23.86		0
	1	49	23.82		0
	25	0	22.82	0-1	1
	25	12	22.81		1
	25	25	22.78		1
	50	0	22.77		1
16QAM	1	0	23.00	0-1	1
	1	25	22.99		1
	1	49	22.95		1
	25	0	21.76	0-2	2
	25	12	21.80		2
	25	25	21.76		2
	50	0	21.81		2

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

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

LTE Band 5 (Cell) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20425 (826.5 MHz)	20525 (836.5 MHz)	20625 (846.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.34	23.28	23.44	0	0
	1	12	23.45	23.40	23.42		0
	1	24	23.12	23.25	23.28		0
	12	0	22.32	22.47	22.36	0-1	1
	12	6	22.47	22.49	22.48		1
	12	13	22.42	22.26	22.19		1
	25	0	22.58	22.53	22.68		1
16QAM	1	0	22.81	22.88	22.74	0-1	1
	1	12	22.98	22.97	22.96		1
	1	24	22.91	22.90	22.99		1
	12	0	21.26	21.30	21.33	0-2	2
	12	6	21.33	21.48	21.42		2
	12	13	21.46	21.34	21.53		2
	25	0	21.47	21.39	21.20		2

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

LTE Band 5 (Cell) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20415 (825.5 MHz)	20525 (836.5 MHz)	20635 (847.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.48	23.10	23.62	0	0
	1	7	23.36	23.24	23.43		0
	1	14	23.21	23.13	23.21		0
	8	0	22.34	22.27	22.44	0-1	1
	8	4	22.53	22.67	22.38		1
	8	7	22.39	22.42	22.25		1
	15	0	22.48	22.33	22.51		1
16QAM	1	0	22.92	22.99	22.94	0-1	1
	1	7	22.82	22.91	23.00		1
	1	14	22.94	22.88	22.97		1
	8	0	21.39	21.31	21.48	0-2	2
	8	4	21.27	21.58	21.61		2
	8	7	21.42	21.34	21.64		2
	15	0	21.55	21.39	21.38		2

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

LTE Band 5 (Cell) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20407 (824.7 MHz)	20525 (836.5 MHz)	20643 (848.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.25	23.28	23.37	0	0
	1	2	23.62	23.36	23.33		0
	1	5	23.05	23.16	23.20		0
	3	0	23.19	23.48	23.30		0
	3	2	23.50	23.31	23.64		0
	3	3	23.24	23.08	23.28		0
	6	0	22.41	22.65	22.88	0-1	1
16QAM	1	0	22.97	22.86	22.81	0-1	1
	1	2	22.88	22.90	22.96		1
	1	5	22.92	22.92	22.90		1
	3	0	22.43	22.28	22.20		1
	3	2	22.43	22.28	22.24		1
	3	3	22.33	22.49	22.62		1
	6	0	21.29	21.52	21.02	0-2	2

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LTE Band 5 (Cell)

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

LTE Band 5 (Cell) 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20525 (836.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	21.62	0	0
	1	25	21.64		0
	1	49	21.60		0
	25	0	20.63	0-1	1
	25	12	20.59		1
	25	25	20.57		1
	50	0	20.62		1
16QAM	1	0	20.82	0-1	1
	1	25	20.98		1
	1	49	20.96		1
	25	0	19.66	0-2	2
	25	12	19.67		2
	25	25	19.61		2
	50	0	19.66		2

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

Table 9-15
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth- Ant B

LTE Band 5 (Cell) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20425 (826.5 MHz)	20525 (836.5 MHz)	20625 (846.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.03	21.90	22.09	0	0
	1	12	22.08	21.82	22.01		0
	1	24	22.09	21.87	22.07		0
	12	0	21.26	20.69	21.13	0-1	1
	12	6	21.25	20.68	21.12		1
	12	13	21.24	20.71	21.05		1
	25	0	21.13	20.69	21.09		1
16QAM	1	0	21.86	21.13	21.75	0-1	1
	1	12	21.93	21.14	21.81		1
	1	24	21.78	21.10	21.79		1
	12	0	20.28	19.75	20.21	0-2	2
	12	6	20.26	19.76	20.16		2
	12	13	20.24	19.76	20.12		2
	25	0	20.00	19.73	20.10		2

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

LTE Band 5 (Cell) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20415 (825.5 MHz)	20525 (836.5 MHz)	20635 (847.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	21.96	21.75	22.12	0	0
	1	7	22.02	21.72	22.13		0
	1	14	22.03	21.72	22.13		0
	8	0	21.27	20.67	21.12	0-1	1
	8	4	21.25	20.73	21.10		1
	8	7	21.26	20.72	21.14		1
	15	0	21.29	20.69	21.12		1
16QAM	1	0	21.85	21.19	21.92	0-1	1
	1	7	21.79	21.22	21.90		1
	1	14	21.61	21.53	21.60		1
	8	0	20.29	19.71	20.14	0-2	2
	8	4	20.25	19.84	20.13		2
	8	7	20.37	19.82	20.09		2
	15	0	20.30	19.78	20.12		2

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

LTE Band 5 (Cell) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20407 (824.7 MHz)	20525 (836.5 MHz)	20643 (848.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	21.97	21.60	22.13	0	0
	1	2	21.91	21.63	22.10		0
	1	5	21.99	21.63	22.13		0
	3	0	22.37	21.74	22.19		0
	3	2	22.36	21.73	22.18		0
	3	3	22.33	21.75	22.14		0
	6	0	21.28	20.73	21.14	0-1	1
16QAM	1	0	21.68	20.91	21.30	0-1	1
	1	2	21.56	21.06	21.69		1
	1	5	21.72	20.92	21.39		1
	3	0	21.82	21.24	21.74		1
	3	2	21.79	21.15	21.54		1
	3	3	21.86	21.12	21.55		1
	6	0	20.34	19.82	20.12	0-2	2

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LTE Band 4 (AWS)

Table 9-18
LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth

LTE Band 4 (AWS) 20 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20175 (1732.5 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	22.81	0	0
	1	50	22.74		0
	1	99	22.68		0
	50	0	21.65	0-1	1
	50	25	21.69		1
	50	50	21.58		1
	100	0	21.63		1
16QAM	1	0	21.72	0-1	1
	1	50	21.77		1
	1	99	21.65		1
	50	0	20.60	0-2	2
	50	25	20.61		2
	50	50	20.52		2
	100	0	20.42		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 9-19
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth

LTE Band 4 (AWS) 15 MHzBandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20025 (1717.5 MHz)	20175 (1732.5 MHz)	20325 (1747.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.11	22.81	23.08	0	0
	1	36	23.10	22.72	23.06		0
	1	74	23.02	22.67	23.02		0
	36	0	21.95	21.87	22.02	0-1	1
	36	18	21.85	21.83	22.01		1
	36	37	21.83	21.81	22.00		1
	75	0	21.90	21.84	21.99		1
16QAM	1	0	22.17	21.96	22.08	0-1	1
	1	36	22.19	21.91	22.09		1
	1	74	22.15	21.86	22.05		1
	36	0	20.92	20.91	21.04	0-2	2
	36	18	20.89	20.85	21.03		2
	36	37	20.91	20.84	20.98		2
	75	0	20.84	20.87	21.07		2

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Table 9-20
LTE Band 4 (AWS) Conducted Powers - 10 MHz Bandwidth

LTE Band 4 (AWS) 10 MHzBandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			20000 (1715.0 MHz)	20175 (1732.5 MHz)	20350 (1750.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.08	22.73	23.07	0	0
	1	25	23.07	22.68	23.03		0
	1	49	23.04	22.70	23.04		0
	25	0	21.93	21.83	22.02	0-1	1
	25	12	21.91	21.80	22.01		1
	25	25	21.88	21.79	21.99		1
	50	0	21.89	21.79	22.04		1
16QAM	1	0	22.13	21.75	22.11	0-1	1
	1	25	22.08	21.79	22.19		1
	1	49	22.03	21.73	22.14		1
	25	0	20.89	20.85	21.01	0-2	2
	25	12	20.88	20.79	21.02		2
	25	25	20.88	20.80	20.98		2
	50	0	20.93	20.84	20.93		2

Table 9-21
LTE Band 4 (AWS) Conducted Powers - 5 MHz Bandwidth

LTE Band 4 (AWS) 5 MHzBandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			19975 (1712.5 MHz)	20175 (1732.5 MHz)	20375 (1752.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.91	22.69	22.85	0	0
	1	12	22.90	22.71	22.84		0
	1	24	22.93	22.73	22.81		0
	12	0	21.83	21.84	21.94	0-1	1
	12	6	21.80	21.82	21.92		1
	12	13	21.78	21.81	21.90		1
	25	0	21.81	21.83	21.93		1
16QAM	1	0	21.74	21.78	21.76	0-1	1
	1	12	21.77	21.68	21.67		1
	1	24	21.79	21.65	21.72		1
	12	0	20.81	20.81	20.99	0-2	2
	12	6	20.79	20.83	21.00		2
	12	13	20.81	20.85	21.02		2
	25	0	20.87	20.80	20.92		2

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Table 9-22
LTE Band 4 (AWS) Conducted Powers - 3 MHz Bandwidth

LTE Band 4 (AWS) 3 MHzBandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			19965 (1711.5 MHz)	20175 (1732.5 MHz)	20385 (1753.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.88	22.72	22.93	0	0
	1	7	22.91	22.69	22.91		0
	1	14	22.89	22.68	22.90		0
	8	0	21.89	21.85	21.94	0-1	1
	8	4	21.91	21.83	21.95		1
	8	7	21.90	21.79	21.89		1
	15	0	21.91	21.81	22.04		1
16QAM	1	0	22.12	21.71	21.89	0-1	1
	1	7	22.07	21.67	21.85		1
	1	14	22.09	21.66	21.83		1
	8	0	20.86	20.69	20.94	0-2	2
	8	4	20.91	20.72	20.96		2
	8	7	20.89	20.67	21.00		2
	15	0	20.87	20.81	21.01		2

Table 9-23
LTE Band 4 (AWS) Conducted Powers -1.4 MHz Bandwidth

LTE Band 4 (AWS) 1.4 MHzBandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			19957 (1710.7 MHz)	20175 (1732.5 MHz)	20393 (1754.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.06	22.92	22.89	0	0
	1	2	23.08	22.91	22.91		0
	1	5	23.03	22.89	23.00		0
	3	0	23.02	22.86	23.01		0
	3	2	23.05	22.83	23.05		0
	3	3	23.06	22.82	23.04		0
	6	0	22.03	21.84	21.91	0-1	1
16QAM	1	0	21.73	21.41	21.74	0-1	1
	1	2	21.70	21.52	21.72		1
	1	5	21.67	21.53	21.79		1
	3	0	21.96	21.67	21.99		1
	3	2	21.94	21.63	21.97		1
	3	3	21.91	21.64	21.99		1
	6	0	20.83	20.89	20.99	0-2	2

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LTE Band 25 (PCS)

Table 9-24
LTE Band 25 (PCS) Conducted Powers - 20 MHz Bandwidth

LTE Band 25 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26140 (1860.0 MHz)	26365 (1882.5 MHz)	26590 (1905.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.23	22.24	22.17	0	0
	1	50	22.19	22.16	22.14		0
	1	99	22.05	22.13	22.11		0
	50	0	21.12	21.16	21.03	0-1	1
	50	25	21.10	21.19	21.03		1
	50	50	21.04	21.13	21.01		1
	100	0	21.05	21.14	20.98		1
16QAM	1	0	21.00	21.33	21.05	0-1	1
	1	50	20.99	21.18	21.04		1
	1	99	20.80	21.16	21.03		1
	50	0	19.98	20.21	20.00	0-2	2
	50	25	19.98	20.18	20.02		2
	50	50	19.92	20.14	20.00		2
	100	0	19.83	20.09	19.89		2

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

LTE Band 25 (PCS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26115 (1857.5 MHz)	26365 (1882.5 MHz)	26615 (1907.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.17	22.37	22.16	0	0
	1	36	22.12	22.24	22.11		0
	1	74	22.06	22.24	22.06		0
	36	0	21.08	21.25	21.12	0-1	1
	36	18	21.08	21.20	21.18		1
	36	37	21.02	21.20	21.11		1
	75	0	21.11	21.23	21.12		1
16QAM	1	0	21.29	21.43	21.17	0-1	1
	1	36	21.22	21.51	21.16		1
	1	74	21.46	21.15	21.12		1
	36	0	20.05	20.26	20.19	0-2	2
	36	18	20.08	20.26	20.17		2
	36	37	20.03	20.20	20.16		2
	75	0	20.11	20.21	20.17		2

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Table 9-26
LTE Band 25 (PCS) Conducted Powers - 10 MHz Bandwidth

LTE Band 25 (PCS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26090 (1855.0 MHz)	26365 (1882.5 MHz)	26640 (1910.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.00	22.10	22.13	0	0
	1	25	22.03	22.08	22.09		0
	1	49	21.91	22.08	21.99		0
	25	0	21.02	21.20	21.15	0-1	1
	25	12	21.01	21.16	21.18		1
	25	25	21.02	21.17	21.11		1
	50	0	21.03	21.19	21.14		1
16QAM	1	0	21.26	21.26	21.18	0-1	1
	1	25	21.16	21.27	21.19		1
	1	49	21.22	21.12	21.12		1
	25	0	20.05	20.26	20.22	0-2	2
	25	12	19.98	20.26	20.17		2
	25	25	20.03	20.22	20.16		2
	50	0	20.02	20.21	20.17		2

Table 9-27
LTE Band 25 (PCS) Conducted Powers - 5 MHz Bandwidth

LTE Band 25 (PCS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26065 (1852.5 MHz)	26365 (1882.5 MHz)	26665 (1912.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.10	22.06	22.53	0	0
	1	12	22.11	22.10	22.67		0
	1	24	22.13	22.03	22.16		0
	12	0	21.02	21.22	21.15	0-1	1
	12	6	21.01	21.21	21.11		1
	12	13	21.03	21.20	21.13		1
	25	0	21.04	21.22	21.11		1
16QAM	1	0	20.98	21.46	21.22	0-1	1
	1	12	21.05	21.47	21.15		1
	1	24	20.88	21.27	21.13		1
	12	0	20.09	20.33	20.16	0-2	2
	12	6	20.05	20.24	20.16		2
	12	13	20.09	20.22	20.12		2
	25	0	20.08	20.26	20.13		2

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Table 9-28
LTE Band 25 (PCS) Conducted Powers - 3 MHz Bandwidth

LTE Band 25 (PCS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26055 (1851.5 MHz)	26365 (1882.5 MHz)	26675 (1913.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	21.94	22.15	22.05	0	0
	1	7	22.00	22.15	22.02		0
	1	14	21.99	22.17	22.09		0
	8	0	21.00	21.19	21.11	0-1	1
	8	4	21.02	21.16	21.12		1
	8	7	21.04	21.19	21.11		1
	15	0	21.05	21.19	21.10		1
16QAM	1	0	20.92	21.05	21.29	0-1	1
	1	7	20.90	21.02	21.41		1
	1	14	21.12	21.25	21.02		1
	8	0	20.17	20.30	20.13	0-2	2
	8	4	20.07	20.28	20.14		2
	8	7	20.08	20.27	20.15		2
	15	0	20.06	20.22	20.14		2

Table 9-29
LTE Band 25 (PCS) Conducted Powers -1.4 MHz Bandwidth

LTE Band 25 (PCS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			26047 (1850.7 MHz)	26365 (1882.5 MHz)	26683 (1914.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.09	22.22	22.13	0	0
	1	2	22.09	22.22	22.11		0
	1	5	22.11	22.18	22.06		0
	3	0	22.15	22.22	22.11		0
	3	2	22.13	22.23	22.05		0
	3	3	22.12	22.22	22.06		0
	6	0	21.11	21.21	21.10	0-1	1
16QAM	1	0	21.15	21.25	20.95	0-1	1
	1	2	20.75	21.27	20.88		1
	1	5	21.08	21.15	20.93		1
	3	0	21.12	21.34	21.02		1
	3	2	21.13	21.31	21.07		1
	3	3	21.12	21.28	21.00		1
	6	0	20.04	20.23	20.11	0-2	2

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LTE Band 41

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

LTE Band 41 20 MHzBandwidth									
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	22.46	21.72	22.78	22.65	23.00	0	0
	1	50	22.45	21.68	22.76	22.66	22.99		0
	1	99	22.41	21.62	22.71	22.87	22.89		0
	50	0	21.54	21.11	21.77	21.93	21.97	0-1	1
	50	25	21.53	21.03	21.74	21.91	21.87		1
	50	50	21.56	21.00	21.73	21.89	21.78		1
	100	0	21.55	20.93	21.71	21.90	21.77		1
16QAM	1	0	21.56	21.25	21.83	21.87	21.87	0-1	1
	1	50	21.54	21.28	21.82	21.90	21.85		1
	1	99	21.56	21.29	21.80	21.92	21.81		1
	50	0	20.65	20.09	21.00	20.82	20.81	0-2	2
	50	25	20.69	20.11	20.99	20.83	20.79		2
	50	50	20.66	20.07	20.97	20.83	20.78		2
	100	0	20.67	20.04	21.00	21.00	20.84		2

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

LTE Band 41 15 MHzBandwidth									
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	22.38	21.70	22.91	22.46	22.91	0	0
	1	36	22.62	21.88	22.81	22.63	22.96		0
	1	74	22.30	21.67	22.86	22.99	22.84		0
	36	0	21.42	21.25	21.94	21.87	21.93	0-1	1
	36	18	21.49	21.14	21.83	21.86	21.85		1
	36	37	21.42	21.01	21.59	21.97	21.63		1
	75	0	21.66	20.84	21.85	21.70	21.77		1
16QAM	1	0	21.70	21.31	21.69	21.83	21.82	0-1	1
	1	36	21.56	21.19	21.80	21.96	21.91		1
	1	74	21.45	21.23	21.96	21.95	21.81		1
	36	0	20.85	20.01	20.99	20.94	20.77	0-2	2
	36	18	20.67	20.21	20.94	20.84	20.75		2
	36	37	20.80	20.20	20.89	20.72	20.92		2
	75	0	20.74	20.12	20.82	20.82	20.72		2

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

LTE Band 41 10 MHzBandwidth									
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	22.20	21.62	22.82	22.28	22.93	0	0
	1	25	22.69	21.94	22.76	22.54	22.78		0
	1	49	22.17	21.80	22.74	22.99	22.87		0
	25	0	21.32	21.28	22.00	21.70	21.78	0-1	1
	25	12	21.58	20.96	21.85	21.70	21.90		1
	25	25	21.40	21.05	21.75	21.98	21.79		1
	50	0	21.80	20.78	21.65	21.79	21.78		1
16QAM	1	0	21.72	21.43	21.88	21.66	21.88	0-1	1
	1	25	21.59	21.38	21.80	21.95	21.87		1
	1	49	21.35	21.25	21.95	21.99	21.98		1
	25	0	20.72	20.12	20.83	20.88	20.79	0-2	2
	25	12	20.79	20.39	20.90	20.86	20.57		2
	25	25	20.86	20.07	20.74	20.55	20.79		2
	50	0	20.91	20.08	20.67	20.74	20.89		2

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

LTE Band 41 5 MHzBandwidth									
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	22.08	21.54	22.84	22.21	22.87	0	0
	1	12	22.54	21.90	22.79	22.66	22.91		0
	1	24	22.14	21.64	22.88	22.89	22.89		0
	12	0	21.26	21.46	21.96	21.86	21.71	0-1	1
	12	6	21.64	20.81	21.65	21.55	21.83		1
	12	13	21.42	21.18	21.65	21.79	21.68		1
	25	0	21.60	20.59	21.71	21.66	21.98		1
16QAM	1	0	21.54	21.47	21.90	21.68	21.87	0-1	1
	1	12	21.44	21.40	21.88	21.84	21.90		1
	1	24	21.42	21.13	21.85	21.69	21.96		1
	12	0	20.58	20.29	20.85	20.86	20.78	0-2	2
	12	6	20.93	20.25	20.88	20.99	20.51		2
	12	13	20.84	19.88	20.73	20.36	20.97		2
	25	0	20.86	20.20	20.60	20.66	20.79		2

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9.4 WLAN Conducted Powers

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

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]	
		IEEE Transmission Mode	
		802.11b	802.11g
2412	1	18.36	16.71
2437	6	19.34	16.81
2462	11	18.31	16.65

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

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]	
		IEEE Transmission Mode	
		802.11b	802.11g
2412	1	18.67	16.74
2437	6	18.41	16.99
2462	11	18.47	16.56

Table 9-36
2.4 GHz WLAN Reduced Average RF Power- Antenna 1 (Held to Ear)

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]		
		IEEE Transmission Mode		
		802.11b	802.11g	802.11n
2412	1	11.75	11.43	11.34
2437	6	11.81	11.64	11.13
2462	11	11.59	11.24	12.45

Table 9-37
2.4 GHz WLAN Reduced Average RF Power – Antenna 2 (Held to Ear)

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]		
		IEEE Transmission Mode		
		802.11b	802.11g	802.11n
2412	1	11.84	11.33	10.90
2437	6	12.01	11.46	11.20
2462	11	11.32	10.90	12.45

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Table 9-38
5 GHz WLAN Maximum Average RF Power- Antenna 1

Freq [MHz]	Channel	5GHz (20MHz) Conducted Power [dBm]		
		IEEE Transmission Mode		
		802.11a	802.11n	802.11ac
5180	36	15.44	14.45	14.50
5200	40	15.32	14.51	15.48
5220	44	15.26	15.48	15.46
5240	48	15.07	15.46	15.48
5260	52	16.83	17.33	17.40
5280	56	17.19	17.36	17.29
5300	60	17.22	17.39	17.33
5320	64	16.53	17.48	17.45
5500	100	16.43	17.25	17.23
5600	120	17.00	16.95	17.01
5620	124	17.03	16.88	16.96
5720	144	16.75	16.57	16.78
5745	149	17.17	17.13	17.07
5785	157	17.16	17.00	16.89
5825	165	16.89	16.79	16.69

Table 9-39
5 GHz WLAN Maximum Average RF Power – Antenna 2

Freq [MHz]	Channel	5GHz (20MHz) Conducted Power [dBm]		
		IEEE Transmission Mode		
		802.11a	802.11n	802.11ac
5180	36	14.63	15.19	15.08
5200	40	14.53	15.04	15.11
5220	44	14.43	15.02	15.06
5240	48	14.60	14.89	15.00
5260	52	17.44	16.71	16.69
5280	56	17.40	16.57	16.63
5300	60	17.32	16.57	16.41
5320	64	17.17	16.52	16.53
5500	100	16.77	16.78	17.01
5600	120	16.49	16.54	16.50
5620	124	16.51	16.53	16.43
5720	144	16.48	16.26	16.39
5745	149	16.93	16.96	17.04
5785	157	16.77	16.84	16.93
5825	165	16.73	16.84	16.74

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Table 9-40
5 GHz WLAN Reduced Average RF Power- Antenna 1 (Held to Ear)

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
5210	42	10.11
5290	58	10.26
5530	106	10.15
5610	122	10.19
5690	138	9.96
5775	155	9.65

Table 9-41
5 GHz WLAN Reduced Average RF Power- Antenna 2 (Held to Ear)

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
5210	42	9.45
5290	58	10.33
5530	106	9.68
5610	122	10.38
5690	138	10.12
5775	155	9.64

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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.

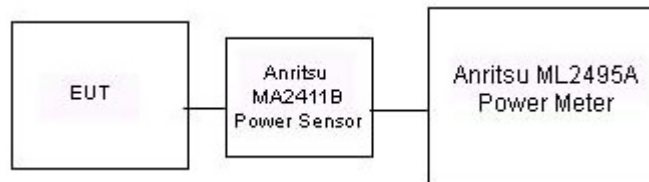


Figure 9-3
Power Measurement Setup

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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
6/2/2016	750H	21.7	700	0.850	42.172	0.889	42.201	-4.39%	-0.07%
			710	0.861	42.028	0.890	42.149	-3.26%	-0.29%
			740	0.888	41.619	0.893	41.994	-0.56%	-0.89%
			755	0.902	41.411	0.894	41.916	0.89%	-1.20%
6/6/2016	835H	22.9	820	0.914	43.136	0.899	41.578	1.67%	3.75%
			835	0.928	42.969	0.900	41.500	3.11%	3.54%
			850	0.943	42.784	0.916	41.500	2.95%	3.09%
6/30/2016	835H	22.8	820	0.901	42.937	0.899	41.578	0.22%	3.27%
			835	0.907	42.814	0.900	41.500	0.78%	3.17%
			850	0.929	42.650	0.916	41.500	1.42%	2.77%
6/6/2016	1750H	21.7	1710	1.321	39.255	1.348	40.142	-2.00%	-2.21%
			1750	1.359	39.049	1.371	40.079	-0.88%	-2.57%
			1790	1.402	38.875	1.394	40.016	0.57%	-2.85%
6/3/2016	1900H	22.2	1850	1.368	39.219	1.400	40.000	-2.29%	-1.95%
			1880	1.398	39.087	1.400	40.000	-0.14%	-2.28%
			1910	1.435	39.002	1.400	40.000	2.50%	-2.49%
6/13/2016	2450H	23.4	2400	1.797	39.953	1.756	39.289	2.33%	1.69%
			2450	1.857	39.758	1.800	39.200	3.17%	1.42%
			2500	1.913	39.565	1.855	39.136	3.13%	1.10%
6/3/2016	2600H	23.5	2600	2.040	39.880	1.964	39.009	3.87%	2.23%
			2650	2.103	39.642	2.018	38.945	4.21%	1.79%
			2700	2.168	39.480	2.073	38.882	4.58%	1.54%
06/13/2016	5200H-5800H	21.1	5240	4.643	35.181	4.696	35.940	-1.13%	-2.11%
			5260	4.673	35.130	4.717	35.917	-0.93%	-2.19%
			5280	4.690	35.118	4.737	35.894	-0.99%	-2.16%
			5300	4.709	35.079	4.758	35.871	-1.03%	-2.21%
			5600	4.999	34.662	5.065	35.529	-1.30%	-2.44%
			5620	5.040	34.611	5.086	35.506	-0.90%	-2.52%
			5745	5.171	34.423	5.214	35.363	-0.82%	-2.66%
			5765	5.195	34.433	5.234	35.340	-0.75%	-2.57%
			5785	5.201	34.443	5.255	35.317	-1.03%	-2.47%
			5800	5.219	34.377	5.270	35.300	-0.97%	-2.61%

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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
6/6/2016	750B	21.6	700	0.928	55.191	0.959	55.726	-3.23%	-0.96%
			710	0.937	55.076	0.960	55.687	-2.40%	-1.10%
			740	0.965	54.772	0.963	55.570	0.21%	-1.44%
			755	0.980	54.630	0.964	55.512	1.66%	-1.59%
6/29/2016	835B	21.2	820	0.999	54.564	0.969	55.258	3.10%	-1.26%
			835	1.014	54.395	0.970	55.200	4.54%	-1.46%
			850	1.029	54.248	0.988	55.154	4.15%	-1.64%
6/6/2016	1750B	20.7	1710	1.462	52.026	1.463	53.537	-0.07%	-2.82%
			1750	1.507	51.834	1.488	53.432	1.28%	-2.99%
			1790	1.552	51.697	1.514	53.326	2.51%	-3.05%
6/6/2016	1900B	23.0	1850	1.494	52.701	1.520	53.300	-1.71%	-1.12%
			1880	1.526	52.626	1.520	53.300	0.39%	-1.26%
			1910	1.559	52.536	1.520	53.300	2.57%	-1.43%
6/1/2016	2450B	22.2	2400	1.946	51.651	1.902	52.767	2.31%	-2.11%
			2450	2.012	51.444	1.950	52.700	3.18%	-2.38%
			2500	2.082	51.240	2.021	52.636	3.02%	-2.65%
6/4/2016	2450B	23.5	2400	1.938	51.273	1.902	52.767	1.89%	-2.83%
			2450	2.004	51.048	1.950	52.700	2.77%	-3.13%
			2500	2.075	50.870	2.021	52.636	2.67%	-3.36%
6/1/2016	2600B	22.2	2550	2.151	51.060	2.092	52.573	2.82%	-2.88%
			2600	2.216	50.857	2.163	52.509	2.45%	-3.15%
			2650	2.284	50.644	2.234	52.445	2.24%	-3.43%
			2700	2.353	50.452	2.305	52.382	2.08%	-3.68%
06/13/2016	5200B-5800B	22.3	5240	5.512	47.117	5.346	48.960	3.11%	-3.76%
			5260	5.542	47.105	5.369	48.933	3.22%	-3.74%
			5300	5.593	47.010	5.416	48.879	3.27%	-3.82%
			5500	5.841	46.683	5.650	48.607	3.38%	-3.96%
			5600	5.969	46.504	5.766	48.471	3.52%	-4.06%
			5620	6.020	46.449	5.790	48.444	3.97%	-4.12%
			5745	6.182	46.207	5.936	48.275	4.14%	-4.28%
			5765	6.215	46.187	5.959	48.248	4.30%	-4.27%
			5800	6.245	46.144	6.000	48.200	4.08%	-4.27%

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

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10.2 Test System Verification

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

Table 10-3
1g System Verification Results

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation _{1g} (%)
K	750	HEAD	06/02/2016	24.0	21.7	0.200	1046	3022	1.580	8.200	7.900	-3.66%
K	835	HEAD	06/06/2016	23.4	22.9	0.200	4d119	3022	1.750	9.140	8.750	-4.27%
I	835	HEAD	06/30/2016	22.8	22.8	0.200	4d119	3333	1.780	9.140	8.900	-2.63%
E	1750	HEAD	06/06/2016	23.2	21.7	0.100	1008	7406	3.400	36.700	34.000	-7.36%
I	1900	HEAD	06/03/2016	23.0	22.2	0.100	5d141	3333	4.150	38.500	41.500	7.79%
K	2450	HEAD	06/13/2016	22.4	23.4	0.100	719	3022	5.320	54.200	53.200	-1.85%
K	2600	HEAD	06/03/2016	24.0	23.5	0.100	1004	3022	5.840	55.700	58.400	4.85%
J	5250	HEAD	06/13/2016	20.4	21.1	0.050	1191	7357	3.880	82.500	77.600	-5.94%
J	5600	HEAD	06/13/2016	20.4	21.1	0.050	1191	7357	4.110	84.500	82.200	-2.72%
J	5750	HEAD	06/13/2016	20.4	21.1	0.050	1191	7357	3.940	80.000	78.800	-1.50%
G	750	BODY	06/06/2016	22.8	21.6	0.200	1054	3334	1.710	8.560	8.550	-0.12%
E	835	BODY	06/29/2016	23.2	21.2	0.200	4d119	7406	1.830	9.140	9.150	0.11%
E	1750	BODY	06/06/2016	21.3	20.7	0.100	1008	7406	3.800	37.300	38.000	1.88%
H	1900	BODY	06/06/2016	22.3	22.8	0.100	5d141	3319	4.100	39.600	41.000	3.54%
G	2450	BODY	06/01/2016	22.0	22.0	0.100	882	3334	5.200	49.400	52.000	5.26%
G	2450	BODY	06/04/2016	23.0	23.5	0.100	882	3334	5.280	49.400	52.800	6.88%
G	2600	BODY	06/01/2016	22.0	22.0	0.100	1071	3334	5.770	54.900	57.700	5.10%
D	5250	BODY	06/13/2016	23.0	22.3	0.050	1120	3914	3.690	75.600	73.800	-2.38%
D	5600	BODY	06/13/2016	23.0	22.3	0.050	1120	3914	3.840	80.800	76.800	-4.95%
D	5750	BODY	06/13/2016	23.0	22.3	0.050	1120	3914	3.480	76.500	69.600	-9.02%

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Table 10-4
10g System Verification Results

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR _{10g} (W/kg)	1 W Target SAR _{10g} (W/kg)	1 W Normalized SAR _{10g} (W/kg)	Deviation _{10g} (%)
D	5250	BODY	06/13/2016	23.0	22.3	0.050	1120	3914	1.040	21.200	20.800	-1.89%
D	5600	BODY	06/13/2016	23.0	22.3	0.050	1120	3914	1.080	22.600	21.600	-4.42%

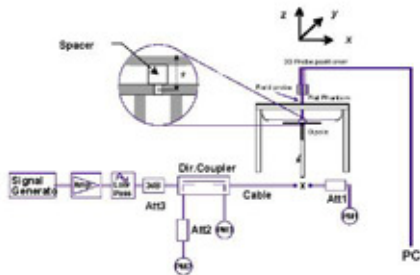


Figure 10-1
System Verification Setup Diagram



Figure 10-2
System Verification Setup Photo

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11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
GSM 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	30.0	29.49	0.18	Right	Cheek	05AA2	1:8.3	0.043	1.125	0.048	
1880.00	661	GSM 1900	GSM	30.0	29.49	0.07	Right	Tilt	05AA2	1:8.3	0.028	1.125	0.032	
1880.00	661	GSM 1900	GSM	30.0	29.49	-0.16	Left	Cheek	05AA2	1:8.3	0.060	1.125	0.068	A1
1880.00	661	GSM 1900	GSM	30.0	29.49	0.08	Left	Tilt	05AA2	1:8.3	0.026	1.125	0.029	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11-2
UMTS 850 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Ant. State	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	23.5	22.25	-0.04	Right	Cheek	7	8485A	1:1	0.150	1.334	0.200	A2
836.60	4183	UMTS 850	RMC	23.5	22.25	0.05	Right	Tilt	7	8485A	1:1	0.071	1.334	0.095	
836.60	4183	UMTS 850	RMC	23.5	22.25	0.08	Left	Cheek	7	8485A	1:1	0.096	1.334	0.128	
836.60	4183	UMTS 850	RMC	23.5	22.25	0.09	Left	Tilt	7	8485A	1:1	0.089	1.334	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 11-3
UMTS 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	23.0	22.15	0.12	Right	Cheek	05AD2	1:1	0.056	1.216	0.068	
1880.00	9400	UMTS 1900	RMC	23.0	22.15	0.06	Right	Tilt	05AD2	1:1	0.039	1.216	0.047	
1880.00	9400	UMTS 1900	RMC	23.0	22.15	0.09	Left	Cheek	05AD2	1:1	0.089	1.216	0.108	A3
1880.00	9400	UMTS 1900	RMC	23.0	22.15	0.13	Left	Tilt	05AD2	1:1	0.036	1.216	0.044	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram						

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Table 11-4
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	23.21	0.19	0	Right	Cheek	QPSK	1	0	05AD2	1:1	0.011	1.069	0.012	A4
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	0.15	1	Right	Cheek	QPSK	25	0	05AD2	1:1	0.008	1.040	0.008	
707.50	23095	Mid	LTE Band 12	10	23.5	23.21	0.18	0	Right	Tilt	QPSK	1	0	05AD2	1:1	0.005	1.069	0.005	
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	0.12	1	Right	Tilt	QPSK	25	0	05AD2	1:1	0.003	1.040	0.003	
707.50	23095	Mid	LTE Band 12	10	23.5	23.21	0.15	0	Left	Cheek	QPSK	1	0	05AD2	1:1	0.010	1.069	0.011	
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	0.16	1	Left	Cheek	QPSK	25	0	05AD2	1:1	0.006	1.040	0.006	
707.50	23095	Mid	LTE Band 12	10	23.5	23.21	0.17	0	Left	Tilt	QPSK	1	0	05AD2	1:1	0.002	1.069	0.002	
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	0.11	1	Left	Tilt	QPSK	25	0	05AD2	1:1	0.001	1.040	0.001	
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 26 (Cell) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	-0.01	0	Right	Cheek	QPSK	1	0	8485A	1:1	0.172	1.148	0.197	A5
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	-0.05	1	Right	Cheek	QPSK	36	0	8485A	1:1	0.148	1.130	0.167	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	0.04	0	Right	Tilt	QPSK	1	0	8485A	1:1	0.061	1.148	0.070	
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	0.00	1	Right	Tilt	QPSK	36	0	8485A	1:1	0.054	1.130	0.061	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	0.11	0	Left	Cheek	QPSK	1	0	8485A	1:1	0.102	1.148	0.117	
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	0.07	1	Left	Cheek	QPSK	36	0	8485A	1:1	0.086	1.130	0.097	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	0.02	0	Left	Tilt	QPSK	1	0	8485A	1:1	0.085	1.148	0.098	
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	0.06	1	Left	Tilt	QPSK	36	0	8485A	1:1	0.073	1.130	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										

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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	Antenna Config.	Ant. State	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	24.0	23.92	0.06	0	Right	Cheek	Ant A	7	QPSK	1	0	8485A	1:1	0.168	1.019	0.171	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	0.07	1	Right	Cheek	Ant A	7	QPSK	25	0	8485A	1:1	0.150	1.042	0.156	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.92	0.01	0	Right	Tilt	Ant A	7	QPSK	1	0	8485A	1:1	0.081	1.019	0.083	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	0.00	1	Right	Tilt	Ant A	7	QPSK	25	0	8485A	1:1	0.069	1.042	0.072	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.92	-0.02	0	Left	Cheek	Ant A	7	QPSK	1	0	8485A	1:1	0.118	1.019	0.120	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	0.09	1	Left	Cheek	Ant A	7	QPSK	25	0	8485A	1:1	0.097	1.042	0.101	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.92	0.02	0	Left	Tilt	Ant A	7	QPSK	1	0	8485A	1:1	0.093	1.019	0.095	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	0.05	1	Left	Tilt	Ant A	7	QPSK	25	0	8485A	1:1	0.091	1.042	0.095	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.04	0	Right	Cheek	Ant B	N/A	QPSK	1	25	0548E	1:1	0.171	1.535	0.262	A6
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.09	1	Right	Cheek	Ant B	N/A	QPSK	25	0	0548E	1:1	0.137	1.538	0.211	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.06	0	Right	Tilt	Ant B	N/A	QPSK	1	25	0548E	1:1	0.105	1.535	0.161	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.06	1	Right	Tilt	Ant B	N/A	QPSK	25	0	0548E	1:1	0.081	1.538	0.125	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.02	0	Left	Cheek	Ant B	N/A	QPSK	1	25	0548E	1:1	0.161	1.535	0.247	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.01	1	Left	Cheek	Ant B	N/A	QPSK	25	0	0548E	1:1	0.126	1.538	0.194	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	-0.02	0	Left	Tilt	Ant B	N/A	QPSK	1	25	0548E	1:1	0.124	1.535	0.190	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	-0.01	1	Left	Tilt	Ant B	N/A	QPSK	25	0	0548E	1:1	0.100	1.538	0.154	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT									Head												
Spatial Peak									1.6 W/kg (mW/g)												
Uncontrolled Exposure/General Population									averaged over 1 gram												

Table 11-7
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	22.81	0.03	0	Right	Cheek	QPSK	1	0	05AA2	1:1	0.065	1.172	0.076	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	-0.03	1	Right	Cheek	QPSK	50	25	05AA2	1:1	0.051	1.205	0.061	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.81	0.10	0	Right	Tilt	QPSK	1	0	05AA2	1:1	0.055	1.172	0.064	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	0.08	1	Right	Tilt	QPSK	50	25	05AA2	1:1	0.045	1.205	0.054	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.81	0.02	0	Left	Cheek	QPSK	1	0	05AA2	1:1	0.109	1.172	0.128	A7
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	0.08	1	Left	Cheek	QPSK	50	25	05AA2	1:1	0.083	1.205	0.100	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.81	0.02	0	Left	Tilt	QPSK	1	0	05AA2	1:1	0.054	1.172	0.063	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	0.12	1	Left	Tilt	QPSK	50	25	05AA2	1:1	0.042	1.205	0.051	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT																			
Spatial Peak									Head										
Uncontrolled Exposure/General Population									1.6 W/kg (mW/g) averaged over 1 gram										

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Table 11-8
LTE Band 25 (PCS) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	-0.09	0	Right	Cheek	QPSK	1	0	8433D	1:1	0.093	1.337	0.124	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	0.08	1	Right	Cheek	QPSK	50	25	8433D	1:1	0.066	1.352	0.089	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	0.06	0	Right	Tilt	QPSK	1	0	8433D	1:1	0.061	1.337	0.082	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	0.08	1	Right	Tilt	QPSK	50	25	8433D	1:1	0.044	1.352	0.059	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	0.03	0	Left	Cheek	QPSK	1	0	8433D	1:1	0.120	1.337	0.160	A8
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	0.09	1	Left	Cheek	QPSK	50	25	8433D	1:1	0.091	1.352	0.123	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	0.05	0	Left	Tilt	QPSK	1	0	8433D	1:1	0.067	1.337	0.090	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	0.09	1	Left	Tilt	QPSK	50	25	8433D	1:1	0.043	1.352	0.058	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-9
LTE Band 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	23.0	23.00	0.17	0	Right	Cheek	QPSK	1	0	05A82	1:1.58	0.032	1.000	0.032	
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.16	1	Right	Cheek	QPSK	50	0	05A82	1:1.58	0.022	1.007	0.022	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.16	0	Right	Tilt	QPSK	1	0	05A82	1:1.58	0.024	1.000	0.024	
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.17	1	Right	Tilt	QPSK	50	0	05A82	1:1.58	0.016	1.007	0.016	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.19	0	Left	Cheek	QPSK	1	0	05A82	1:1.58	0.036	1.000	0.036	A9
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.19	1	Left	Cheek	QPSK	50	0	05A82	1:1.58	0.028	1.007	0.028	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.18	0	Left	Tilt	QPSK	1	0	05A82	1:1.58	0.011	1.000	0.011	
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.11	1	Left	Tilt	QPSK	50	0	05A82	1:1.58	0.009	1.007	0.009	
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 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)	
2437	6	802.11b	DSSS	22	12.5	11.81	-0.21	Right	Cheek	1	252AF	1	99.0	0.458	0.479	1.172	1.011	0.568	A10
2437	6	802.11b	DSSS	22	12.5	11.81	0.12	Right	Tilt	1	252AF	1	99.0	0.351	0.328	1.172	1.011	0.389	
2437	6	802.11b	DSSS	22	12.5	11.81	-0.15	Left	Cheek	1	252AF	1	99.0	0.246	-	1.172	1.011	-	
2437	6	802.11b	DSSS	22	12.5	11.81	0.02	Left	Tilt	1	252AF	1	99.0	0.136	-	1.172	1.011	-	
2437	6	802.11b	DSSS	22	12.5	12.01	0.11	Right	Cheek	2	252AF	1	99.9	0.145	0.140	1.119	1.001	0.157	
2437	6	802.11b	DSSS	22	12.5	12.01	0.03	Right	Tilt	2	252AF	1	99.9	0.109	-	1.119	1.001	-	
2437	6	802.11b	DSSS	22	12.5	12.01	0.18	Left	Cheek	2	252AF	1	99.9	0.046	-	1.119	1.001	-	
2437	6	802.11b	DSSS	22	12.5	12.01	-0.21	Left	Tilt	2	252AF	1	99.9	0.058	-	1.119	1.001	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

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**Table 11-11
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	10.5	10.26	0.13	Right	Cheek	1	252AE	29.3	94.3	0.607	0.274	1.057	1.060	0.307	A11
5290	58	802.11ac	OFDM	80	10.5	10.26	0.11	Right	Tilt	1	252AE	29.3	94.3	0.488	-	1.057	1.060	-	
5290	58	802.11ac	OFDM	80	10.5	10.26	0.12	Left	Cheek	1	252AE	29.3	94.3	0.294	-	1.057	1.060	-	
5290	58	802.11ac	OFDM	80	10.5	10.26	0.14	Left	Tilt	1	252AE	29.3	94.3	0.233	-	1.057	1.060	-	
5290	58	802.11ac	OFDM	80	10.5	10.33	0.19	Right	Cheek	2	252AE	29.3	94.1	0.414	0.159	1.040	1.062	0.176	
5290	58	802.11ac	OFDM	80	10.5	10.33	0.19	Right	Tilt	2	252AE	29.3	94.1	0.363	-	1.040	1.062	-	
5290	58	802.11ac	OFDM	80	10.5	10.33	-0.10	Left	Cheek	2	252AE	29.3	94.1	0.302	-	1.040	1.062	-	
5290	58	802.11ac	OFDM	80	10.5	10.33	0.18	Left	Tilt	2	252AE	29.3	94.1	0.154	-	1.040	1.062	-	
5610	122	802.11ac	OFDM	80	10.5	10.19	0.14	Right	Cheek	1	252AE	29.3	94.3	0.344	0.122	1.074	1.060	0.139	
5610	122	802.11ac	OFDM	80	10.5	10.19	0.17	Right	Tilt	1	252AE	29.3	94.3	0.295	-	1.074	1.060	-	
5610	122	802.11ac	OFDM	80	10.5	10.19	0.21	Left	Cheek	1	252AE	29.3	94.3	0.146	-	1.074	1.060	-	
5610	122	802.11ac	OFDM	80	10.5	10.19	-0.20	Left	Tilt	1	252AE	29.3	94.3	0.116	-	1.074	1.060	-	
5610	122	802.11ac	OFDM	80	10.5	10.38	0.10	Right	Cheek	2	252AE	29.3	94.1	0.730	-	1.028	1.062	-	
5610	122	802.11ac	OFDM	80	10.5	10.38	0.15	Right	Tilt	2	252AE	29.3	94.1	0.631	-	1.028	1.062	-	
5610	122	802.11ac	OFDM	80	10.5	10.38	-0.14	Left	Cheek	2	252AE	29.3	94.1	0.961	0.274	1.028	1.062	0.299	
5610	122	802.11ac	OFDM	80	10.5	10.38	0.06	Left	Tilt	2	252AE	29.3	94.1	0.740	-	1.028	1.062	-	
5775	155	802.11ac	OFDM	80	10.5	9.65	0.12	Right	Cheek	1	252AE	29.3	94.3	0.115	0.039	1.216	1.060	0.050	
5775	155	802.11ac	OFDM	80	10.5	9.65	0.20	Right	Tilt	1	252AE	29.3	94.3	0.098	-	1.216	1.060	-	
5775	155	802.11ac	OFDM	80	10.5	9.65	0.15	Left	Cheek	1	252AE	29.3	94.3	0.049	-	1.216	1.060	-	
5775	155	802.11ac	OFDM	80	10.5	9.65	0.12	Left	Tilt	1	252AE	29.3	94.3	0.039	-	1.216	1.060	-	
5775	155	802.11ac	OFDM	80	10.5	9.64	0.16	Right	Cheek	2	252AE	29.3	94.1	0.364	-	1.219	1.062	-	
5775	155	802.11ac	OFDM	80	10.5	9.64	0.18	Right	Tilt	2	252AE	29.3	94.1	0.376	-	1.219	1.062	-	
5775	155	802.11ac	OFDM	80	10.5	9.64	-0.17	Left	Cheek	2	252AE	29.3	94.1	0.720	0.164	1.219	1.062	0.212	
5775	155	802.11ac	OFDM	80	10.5	9.64	0.07	Left	Tilt	2	252AE	29.3	94.1	0.655	-	1.219	1.062	-	
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 11-12
GSM/UMTS Body-Worn SAR Data**

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Ant. State	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	30.0	29.49	-0.02	10 mm	N/A	05AA2	1	1:8.3	back	0.188	1.125	0.212	A12
836.60	4183	UMTS 850	RMC	23.5	22.25	0.03	10 mm	7	8485A	N/A	1:1	back	0.425	1.334	0.567	A14
1880.00	9400	UMTS 1900	RMC	23.0	22.15	0.02	10 mm	N/A	05AD2	N/A	1:1	back	0.255	1.216	0.310	A15
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram								

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Table 11-13
LTE Body-Worn SAR

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Antenna Config.	Device Serial Number	Ant. State	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	23.21	-0.02	0	Ant A	05AD2	N/A	QPSK	1	0	10 mm	back	1:1	0.098	1.069	0.105	A17
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	-0.08	1	Ant A	05AD2	N/A	QPSK	25	0	10 mm	back	1:1	0.078	1.040	0.081	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	0.00	0	Ant A	8485A	NA	QPSK	1	0	10 mm	back	1:1	0.491	1.148	0.564	A19
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	0.04	1	Ant A	8485A	NA	QPSK	36	0	10 mm	back	1:1	0.403	1.130	0.455	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.92	0.07	0	Ant A	8485A	7	QPSK	1	0	10 mm	back	1:1	0.574	1.019	0.585	A21
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	0.00	1	Ant A	8485A	7	QPSK	25	0	10 mm	back	1:1	0.477	1.042	0.497	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.15	0	Ant B	0548E	N/A	QPSK	1	25	10 mm	back	1:1	0.018	1.535	0.028	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.11	1	Ant B	0548E	N/A	QPSK	25	0	10 mm	back	1:1	0.014	1.538	0.022	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.81	0.00	0	Ant A	05AA2	N/A	QPSK	1	0	10 mm	back	1:1	0.380	1.172	0.445	A23
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	0.01	1	Ant A	05AA2	N/A	QPSK	50	25	10 mm	back	1:1	0.300	1.205	0.362	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	-0.01	0	Ant A	8433D	N/A	QPSK	1	0	10 mm	back	1:1	0.372	1.337	0.497	A25
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	0.03	1	Ant A	8433D	N/A	QPSK	50	25	10 mm	back	1:1	0.283	1.352	0.383	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.07	0	Ant A	0548E	N/A	QPSK	1	0	10 mm	back	1:1.58	0.300	1.000	0.300	A27
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.02	1	Ant A	0548E	N/A	QPSK	50	0	10 mm	back	1:1.58	0.232	1.007	0.234	
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 11-14
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	19.5	19.34	-0.06	10 mm	1	252AF	1	back	99.0	0.601	0.482	1.038	1.011	0.506	A29
2412	1	802.11b	DSSS	22	19.5	18.67	-0.01	10 mm	2	252AF	1	back	99.9	0.409	0.415	1.211	1.001	0.503	
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 11-15
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	17.5	17.22	-0.18	10 mm	1	252AE	6	back	98.6	0.085	0.046	1.067	1.014	0.050	
5260	52	802.11a	OFDM	20	17.5	17.44	-0.08	10 mm	2	252AE	6	back	98.6	0.403	0.204	1.014	1.015	0.210	
5620	124	802.11a	OFDM	20	17.5	17.03	-0.16	10 mm	1	252AE	6	back	98.6	0.209	0.110	1.114	1.014	0.124	
5500	100	802.11a	OFDM	20	17.5	16.77	-0.11	10 mm	2	252AE	6	back	98.6	0.570	0.320	1.183	1.015	0.384	
5745	149	802.11a	OFDM	20	17.5	17.17	-0.11	10 mm	1	252AE	6	back	98.6	0.219	0.106	1.079	1.014	0.116	
5745	149	802.11a	OFDM	20	17.5	16.93	0.16	10 mm	2	252AE	6	back	98.6	0.842	0.432	1.140	1.015	0.500	A30
ANSI / IEEE C95.1 1992 - SAFETY LIMIT										Body									
Spatial Peak										1.6 W/kg (mW/g)									
Uncontrolled Exposure/General Population										averaged over 1 gram									

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11.3 Standalone Hotspot SAR Data

Table 11-16
GPRS/UMTS Hotspot SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Ant. State	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GPRS	24.5	23.20	-0.01	10 mm	N/A	05AA2	4	1:2.076	back	0.196	1.349	0.264	
1880.00	661	GSM 1900	GPRS	24.5	23.20	0.15	10 mm	N/A	05AA2	4	1:2.076	front	0.193	1.349	0.260	
1880.00	661	GSM 1900	GPRS	24.5	23.20	0.00	10 mm	N/A	05AA2	4	1:2.076	bottom	0.314	1.349	0.424	A13
1880.00	661	GSM 1900	GPRS	24.5	23.20	-0.04	10 mm	N/A	05AA2	4	1:2.076	left	0.132	1.349	0.178	
836.60	4183	UMTS 850	RMC	23.5	22.25	0.03	10 mm	7	8485A	N/A	1:1	back	0.425	1.334	0.567	A14
836.60	4183	UMTS 850	RMC	23.5	22.25	0.06	10 mm	7	8485A	N/A	1:1	front	0.424	1.334	0.566	
836.60	4183	UMTS 850	RMC	23.5	22.25	-0.05	10 mm	7	8485A	N/A	1:1	bottom	0.281	1.334	0.375	
836.60	4183	UMTS 850	RMC	23.5	22.25	0.04	10 mm	7	8485A	N/A	1:1	right	0.229	1.334	0.305	
836.60	4183	UMTS 850	RMC	23.5	22.25	0.02	10 mm	7	8485A	N/A	1:1	left	0.045	1.334	0.060	
1880.00	9400	UMTS 1900	RMC	23.0	22.15	0.02	10 mm	N/A	05AD2	N/A	1:1	back	0.255	1.216	0.310	
1880.00	9400	UMTS 1900	RMC	23.0	22.15	0.00	10 mm	N/A	05AD2	N/A	1:1	front	0.251	1.216	0.305	
1880.00	9400	UMTS 1900	RMC	23.0	22.15	-0.02	10 mm	N/A	05AD2	N/A	1:1	bottom	0.494	1.216	0.601	A16
1880.00	9400	UMTS 1900	RMC	23.0	22.15	0.02	10 mm	N/A	05AD2	N/A	1:1	left	0.193	1.216	0.235	
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
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	23.21	-0.02	0	05AD2	QPSK	1	0	10 mm	back	1:1	0.098	1.069	0.105	
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	-0.08	1	05AD2	QPSK	25	0	10 mm	back	1:1	0.078	1.040	0.081	
707.50	23095	Mid	LTE Band 12	10	23.5	23.21	0.07	0	05AD2	QPSK	1	0	10 mm	front	1:1	0.131	1.069	0.140	A18
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	0.08	1	05AD2	QPSK	25	0	10 mm	front	1:1	0.104	1.040	0.108	
707.50	23095	Mid	LTE Band 12	10	23.5	23.21	-0.07	0	05AD2	QPSK	1	0	10 mm	bottom	1:1	0.036	1.069	0.038	
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	-0.08	1	05AD2	QPSK	25	0	10 mm	bottom	1:1	0.030	1.040	0.031	
707.50	23095	Mid	LTE Band 12	10	23.5	23.21	0.10	0	05AD2	QPSK	1	0	10 mm	right	1:1	0.016	1.069	0.017	
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	0.21	1	05AD2	QPSK	25	0	10 mm	right	1:1	0.011	1.040	0.011	
707.50	23095	Mid	LTE Band 12	10	23.5	23.21	0.19	0	05AD2	QPSK	1	0	10 mm	left	1:1	0.025	1.069	0.027	
707.50	23095	Mid	LTE Band 12	10	22.5	22.33	-0.08	1	05AD2	QPSK	25	0	10 mm	left	1:1	0.019	1.040	0.020	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

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Table 11-18
LTE Band 26 (Cell) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	0.00	0	8485A	QPSK	1	0	10 mm	back	1:1	0.491	1.148	0.564	
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	0.04	1	8485A	QPSK	36	0	10 mm	back	1:1	0.403	1.130	0.455	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	-0.06	0	8485A	QPSK	1	0	10 mm	front	1:1	0.561	1.148	0.644	A20
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	0.00	1	8485A	QPSK	36	0	10 mm	front	1:1	0.456	1.130	0.515	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	-0.04	0	8485A	QPSK	1	0	10 mm	bottom	1:1	0.298	1.148	0.342	
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	-0.04	1	8485A	QPSK	36	0	10 mm	bottom	1:1	0.240	1.130	0.271	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	-0.01	0	8485A	QPSK	1	0	10 mm	right	1:1	0.268	1.148	0.308	
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	0.02	1	8485A	QPSK	36	0	10 mm	right	1:1	0.199	1.130	0.225	
831.50	26865	Mid	LTE Band 26 (Cell)	15	23.5	22.90	0.01	0	8485A	QPSK	1	0	10 mm	left	1:1	0.060	1.148	0.069	
831.50	26865	Mid	LTE Band 26 (Cell)	15	22.5	21.97	-0.06	1	8485A	QPSK	36	0	10 mm	left	1:1	0.056	1.130	0.063	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body 1.6 W/kg (mW/g) averaged over 1 gram											
Spatial Peak																			
Uncontrolled Exposure/General Population																			

Table 11-19
LTE Band 5 (Cell) Hotspot SAR

MEASUREMENT RESULTS																					
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Antenna Config.	Device Serial Number	Ant. State	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	24.0	23.92	0.07	0	Ant A	8485A	7	QPSK	1	0	10 mm	back	1:1	0.574	1.019	0.585	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	0.00	1	Ant A	8485A	7	QPSK	25	0	10 mm	back	1:1	0.477	1.042	0.497	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.92	-0.02	0	Ant A	8485A	7	QPSK	1	0	10 mm	front	1:1	0.635	1.019	0.647	A22
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	-0.01	1	Ant A	8485A	7	QPSK	25	0	10 mm	front	1:1	0.543	1.042	0.566	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.92	-0.02	0	Ant A	8485A	7	QPSK	1	0	10 mm	bottom	1:1	0.325	1.019	0.331	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	0.01	1	Ant A	8485A	7	QPSK	25	0	10 mm	bottom	1:1	0.289	1.042	0.301	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.92	-0.04	0	Ant A	8485A	7	QPSK	1	0	10 mm	right	1:1	0.276	1.019	0.281	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	0.02	1	Ant A	8485A	7	QPSK	25	0	10 mm	right	1:1	0.255	1.042	0.266	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.92	-0.04	0	Ant A	8485A	7	QPSK	1	0	10 mm	left	1:1	0.119	1.019	0.121	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.82	-0.01	1	Ant A	8485A	7	QPSK	25	0	10 mm	left	1:1	0.104	1.042	0.108	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.15	0	Ant B	0548E	N/A	QPSK	1	25	10 mm	back	1:1	0.018	1.535	0.028	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.11	1	Ant B	0548E	N/A	QPSK	25	0	10 mm	back	1:1	0.014	1.538	0.022	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.20	0	Ant B	0548E	N/A	QPSK	1	25	10 mm	front	1:1	0.026	1.535	0.040	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.03	1	Ant B	0548E	N/A	QPSK	25	0	10 mm	front	1:1	0.021	1.538	0.032	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.13	0	Ant B	0548E	N/A	QPSK	1	25	10 mm	top	1:1	0.011	1.535	0.017	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.16	1	Ant B	0548E	N/A	QPSK	25	0	10 mm	top	1:1	0.008	1.538	0.012	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.20	0	Ant B	0548E	N/A	QPSK	1	25	10 mm	right	1:1	0.003	1.535	0.005	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.11	1	Ant B	0548E	N/A	QPSK	25	0	10 mm	right	1:1	0.002	1.538	0.003	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	21.64	0.12	0	Ant B	0548E	N/A	QPSK	1	25	10 mm	left	1:1	0.014	1.535	0.021	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	20.63	0.15	1	Ant B	0548E	N/A	QPSK	25	0	10 mm	left	1:1	0.012	1.538	0.018	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body													
Spatial Peak								1.6 W/kg (mW/g)													
Uncontrolled Exposure/General Population								averaged over 1 gram													

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Table 11-20
LTE Band 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	23.5	22.81	0.00	0	05AA2	QPSK	1	0	10 mm	back	1:1	0.380	1.172	0.445	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	0.01	1	05AA2	QPSK	50	25	10 mm	back	1:1	0.300	1.205	0.362	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.81	-0.02	0	05AA2	QPSK	1	0	10 mm	front	1:1	0.378	1.172	0.443	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	-0.01	1	05AA2	QPSK	50	25	10 mm	front	1:1	0.310	1.205	0.374	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.81	0.00	0	05AA2	QPSK	1	0	10 mm	bottom	1:1	0.642	1.172	0.752	A24
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	0.00	1	05AA2	QPSK	50	25	10 mm	bottom	1:1	0.546	1.205	0.658	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	22.81	-0.03	0	05AA2	QPSK	1	0	10 mm	left	1:1	0.293	1.172	0.343	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	21.69	0.00	1	05AA2	QPSK	50	25	10 mm	left	1:1	0.240	1.205	0.289	
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 25 (PCS) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	-0.01	0	8433D	QPSK	1	0	10 mm	back	1:1	0.372	1.337	0.497	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	0.03	1	8433D	QPSK	50	25	10 mm	back	1:1	0.283	1.352	0.383	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	0.09	0	8433D	QPSK	1	0	10 mm	front	1:1	0.370	1.337	0.495	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	0.00	1	8433D	QPSK	50	25	10 mm	front	1:1	0.288	1.352	0.389	
1860.00	26140	Low	LTE Band 25 (PCS)	20	23.5	22.23	0.01	0	8433D	QPSK	1	0	10 mm	bottom	1:1	0.692	1.340	0.927	A26
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	0.08	0	8433D	QPSK	1	0	10 mm	bottom	1:1	0.662	1.337	0.885	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.5	22.17	-0.03	0	8433D	QPSK	1	0	10 mm	bottom	1:1	0.565	1.358	0.767	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	-0.01	1	8433D	QPSK	50	25	10 mm	bottom	1:1	0.478	1.352	0.646	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.14	0.01	1	8433D	QPSK	100	0	10 mm	bottom	1:1	0.476	1.368	0.651	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.5	22.24	0.01	0	8433D	QPSK	1	0	10 mm	left	1:1	0.336	1.337	0.449	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.5	21.19	0.00	1	8433D	QPSK	50	25	10 mm	left	1:1	0.243	1.352	0.329	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

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Table 11-22
LTE Band 41 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)		
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.07	0	0548E	QPSK	1	0	10 mm	back	1:1.58	0.300	1.000	0.300	
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.02	1	0548E	QPSK	50	0	10 mm	back	1:1.58	0.232	1.007	0.234	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	0.01	0	0548E	QPSK	1	0	10 mm	front	1:1.58	0.325	1.000	0.325	
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.04	1	0548E	QPSK	50	0	10 mm	front	1:1.58	0.253	1.007	0.255	
2506.00	39750	Low	LTE Band 41	20	23.0	22.46	-0.07	0	0548E	QPSK	1	0	10 mm	bottom	1:1.58	0.541	1.132	0.612	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	21.72	-0.06	0	0548E	QPSK	1	0	10 mm	bottom	1:1.58	0.622	1.343	0.835	
2593.00	40620	Mid	LTE Band 41	20	23.0	22.78	-0.11	0	0548E	QPSK	1	0	10 mm	bottom	1:1.58	0.710	1.052	0.747	A28
2636.50	41055	Mid-High	LTE Band 41	20	23.0	22.87	0.02	0	0548E	QPSK	1	99	10 mm	bottom	1:1.58	0.621	1.030	0.640	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	-0.04	0	0548E	QPSK	1	0	10 mm	bottom	1:1.58	0.622	1.000	0.622	
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.01	1	0548E	QPSK	50	0	10 mm	bottom	1:1.58	0.469	1.007	0.472	
2636.50	41055	Mid-High	LTE Band 41	20	22.0	21.90	-0.03	1	0548E	QPSK	100	0	10 mm	bottom	1:1.58	0.460	1.023	0.471	
2680.00	41490	High	LTE Band 41	20	23.0	23.00	-0.11	0	0548E	QPSK	1	0	10 mm	left	1:1.58	0.148	1.000	0.148	
2680.00	41490	High	LTE Band 41	20	22.0	21.97	0.14	1	0548E	QPSK	50	0	10 mm	left	1:1.58	0.146	1.007	0.147	
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 11-23
WLAN Hotspot 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	19.5	19.34	-0.06	10 mm	1	252AF	1	back	99.0	0.601	0.482	1.038	1.011	0.506	A29
2437	6	802.11b	DSSS	22	19.5	19.34	0.13	10 mm	1	252AF	1	front	99.0	0.447	0.388	1.038	1.011	0.407	
2437	6	802.11b	DSSS	22	19.5	19.34	0.12	10 mm	1	252AF	1	top	99.0	0.216	-	1.038	1.011	-	
2437	6	802.11b	DSSS	22	19.5	19.34	0.12	10 mm	1	252AF	1	left	99.0	0.184	-	1.038	1.011	-	
2412	1	802.11b	DSSS	22	19.5	18.67	-0.01	10 mm	2	252AF	1	back	99.9	0.409	0.415	1.211	1.001	0.503	
2412	1	802.11b	DSSS	22	19.5	18.67	-0.14	10 mm	2	252AF	1	front	99.9	0.203	-	1.211	1.001	-	
2412	1	802.11b	DSSS	22	19.5	18.67	-0.09	10 mm	2	252AF	1	top	99.9	0.259	0.224	1.211	1.001	0.272	
2412	1	802.11b	DSSS	22	19.5	18.67	-0.17	10 mm	2	252AF	1	left	99.9	0.181	-	1.211	1.001	-	
5745	149	802.11a	OFDM	20	17.5	17.17	-0.11	10 mm	1	252AE	6	back	98.6	0.219	-	1.079	1.014	-	
5745	149	802.11a	OFDM	20	17.5	17.17	0.19	10 mm	1	252AE	6	front	98.6	0.238	0.149	1.079	1.014	0.163	
5745	149	802.11a	OFDM	20	17.5	17.17	0.11	10 mm	1	252AE	6	top	98.6	0.115	-	1.079	1.014	-	
5745	149	802.11a	OFDM	20	17.5	17.17	0.12	10 mm	1	252AE	6	left	98.6	0.095	-	1.079	1.014	-	
5745	149	802.11a	OFDM	20	17.5	16.93	0.16	10 mm	2	252AE	6	back	98.6	0.842	0.432	1.140	1.015	0.500	A30
5745	149	802.11a	OFDM	20	17.5	16.93	-0.19	10 mm	2	252AE	6	front	98.6	0.343	0.196	1.140	1.015	0.227	
5745	149	802.11a	OFDM	20	17.5	16.93	0.17	10 mm	2	252AE	6	top	98.6	0.274	-	1.140	1.015	-	
5745	149	802.11a	OFDM	20	17.5	16.93	0.16	10 mm	2	252AE	6	left	98.6	0.198	-	1.140	1.015	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body											
Spatial Peak								1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

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11.4 Standalone Phablet SAR Data

Table 11-24
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) (W/kg)	Plot #
MHz	Ch.													W/kg	(W/kg)			(W/kg)	
5300	60	802.11a	OFDM	20	17.5	17.22	0.05	0 mm	1	252AE	6	back	98.6	1.698	0.170	1.067	1.014	0.184	
5300	60	802.11a	OFDM	20	17.5	17.22	0.14	0 mm	1	252AE	6	front	98.6	1.326	-	1.067	1.014	-	
5300	60	802.11a	OFDM	20	17.5	17.22	-0.14	0 mm	1	252AE	6	top	98.6	0.571	-	1.067	1.014	-	
5300	60	802.11a	OFDM	20	17.5	17.22	0.11	0 mm	1	252AE	6	left	98.6	0.189	-	1.067	1.014	-	
5260	52	802.11a	OFDM	20	17.5	17.44	0.19	0 mm	2	252AE	6	back	98.6	6.153	1.050	1.014	1.015	1.081	
5260	52	802.11a	OFDM	20	17.5	17.44	-0.20	0 mm	2	252AE	6	front	98.6	5.369	0.675	1.014	1.015	0.695	
5260	52	802.11a	OFDM	20	17.5	17.44	0.18	0 mm	2	252AE	6	top	98.6	1.509	-	1.014	1.015	-	
5260	52	802.11a	OFDM	20	17.5	17.44	-0.20	0 mm	2	252AE	6	left	98.6	0.711	-	1.014	1.015	-	
5620	124	802.11a	OFDM	20	17.5	17.03	0.02	0 mm	1	252AE	6	back	98.6	5.956	0.594	1.114	1.014	0.671	
5620	124	802.11a	OFDM	20	17.5	17.03	-0.18	0 mm	1	252AE	6	front	98.6	2.353	-	1.114	1.014	-	
5620	124	802.11a	OFDM	20	17.5	17.03	0.08	0 mm	1	252AE	6	top	98.6	0.889	-	1.114	1.014	-	
5620	124	802.11a	OFDM	20	17.5	17.03	0.14	0 mm	1	252AE	6	left	98.6	0.707	-	1.114	1.014	-	
5500	100	802.11a	OFDM	20	17.5	16.77	-0.19	0 mm	2	252AE	6	back	98.6	14.009	1.640	1.183	1.015	1.969	A31
5500	100	802.11a	OFDM	20	17.5	16.77	0.05	0 mm	2	252AE	6	front	98.6	5.332	0.664	1.183	1.015	0.797	
5500	100	802.11a	OFDM	20	17.5	16.77	0.14	0 mm	2	252AE	6	top	98.6	1.277	-	1.183	1.015	-	
5500	100	802.11a	OFDM	20	17.5	16.77	0.15	0 mm	2	252AE	6	left	98.6	0.788	-	1.183	1.015	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Phablet											
Spatial Peak								4.0 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 10 grams											

11.5 SAR Test Notes

General Notes:

- 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.
- Batteries are fully charged at the beginning of the SAR measurements.
- Liquid tissue depth was at least 15.0 cm for all frequencies.
- 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.
- SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
- Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
- 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.
- Per FCC KDB Publication 865664 D01v01r04, variability SAR tests were not required since measured SAR results for all frequency bands were less than 0.8 W/kg. Please see Section 14 for variability analysis.
- 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).
- 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.

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11. This device utilizes power reduction for some wireless modes and technologies, as outlined in Section 1.3. 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. This device supports dynamic antenna tuning for some low frequency bands. Per FCC Guidance, SAR was measured according to the normally required SAR measurement configurations with the tuner active. The auto-tune state determined by the device was verified before and after each SAR measurement and is listed in the tables above. Please see Section 13 for supplemental data.

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 then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.

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 then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 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 (scaled) for LTE Band 41 SAR measured at the highest output power channel in a given a test configuration was > 0.6 W/kg, 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 and hotspot operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for

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the initial test position is ≤ 0.4 W/kg, 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. 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. 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 or all test channels were measured.
6. When 10-g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.
7. 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.

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12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

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

12.2 Simultaneous Transmission Procedures

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

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

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

Table 12-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2480	11.50	10	0.294

Note: Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

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

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12.3 Head SAR Simultaneous Transmission Analysis

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN 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 1900	0.068	0.568	0.157	0.636	0.225	0.793
	UMTS 850	0.200	0.568	0.157	0.768	0.357	0.925
	UMTS 1900	0.108	0.568	0.157	0.676	0.265	0.833
	LTE Band 12	0.012	0.568	0.157	0.580	0.169	0.737
	LTE Band 26 (Cell)	0.197	0.568	0.157	0.765	0.354	0.922
	LTE Band 5 (Cell)	0.262	0.568	0.157	0.830	0.419	0.987
	LTE Band 4 (AWS)	0.128	0.568	0.157	0.696	0.285	0.853
	LTE Band 25 (PCS)	0.160	0.568	0.157	0.728	0.317	0.885
	LTE Band 41	0.036	0.568	0.157	0.604	0.193	0.761

Table 12-3
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 1900	0.068	0.307	0.299	0.375	0.367	0.674
	UMTS 850	0.200	0.307	0.299	0.507	0.499	0.806
	UMTS 1900	0.108	0.307	0.299	0.415	0.407	0.714
	LTE Band 12	0.012	0.307	0.299	0.319	0.311	0.618
	LTE Band 26 (Cell)	0.197	0.307	0.299	0.504	0.496	0.803
	LTE Band 5 (Cell)	0.262	0.307	0.299	0.569	0.561	0.868
	LTE Band 4 (AWS)	0.128	0.307	0.299	0.435	0.427	0.734
	LTE Band 25 (PCS)	0.160	0.307	0.299	0.467	0.459	0.766
	LTE Band 41	0.036	0.307	0.299	0.343	0.335	0.642

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Table 12-4
Simultaneous Transmission Scenario with 2.4 GHz Ant 1 and 5 GHz Ant 2 WLAN (Held to Ear)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 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 1900	0.068	0.568	0.299	0.636	0.367	0.935
	UMTS 850	0.200	0.568	0.299	0.768	0.499	1.067
	UMTS 1900	0.108	0.568	0.299	0.676	0.407	0.975
	LTE Band 12	0.012	0.568	0.299	0.580	0.311	0.879
	LTE Band 26 (Cell)	0.197	0.568	0.299	0.765	0.496	1.064
	LTE Band 5 (Cell)	0.262	0.568	0.299	0.830	0.561	1.129
	LTE Band 4 (AWS)	0.128	0.568	0.299	0.696	0.427	0.995
	LTE Band 25 (PCS)	0.160	0.568	0.299	0.728	0.459	1.027
	LTE Band 41	0.036	0.568	0.299	0.604	0.335	0.903

Table 12-5
Simultaneous Transmission Scenario with 2.4 GHz Ant 2 and 5 GHz Ant 1 WLAN (Held to Ear)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Head SAR	GSM 1900	0.068	0.157	0.307	0.225	0.375	0.532
	UMTS 850	0.200	0.157	0.307	0.357	0.507	0.664
	UMTS 1900	0.108	0.157	0.307	0.265	0.415	0.572
	LTE Band 12	0.012	0.157	0.307	0.169	0.319	0.476
	LTE Band 26 (Cell)	0.197	0.157	0.307	0.354	0.504	0.661
	LTE Band 5 (Cell)	0.262	0.157	0.307	0.419	0.569	0.726
	LTE Band 4 (AWS)	0.128	0.157	0.307	0.285	0.435	0.592
	LTE Band 25 (PCS)	0.160	0.157	0.307	0.317	0.467	0.624
	LTE Band 41	0.036	0.157	0.307	0.193	0.343	0.500

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12.4 Body-Worn Simultaneous Transmission Analysis

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN 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 1900	0.212	0.506	0.503	0.718	0.715	1.221
	UMTS 850	0.567	0.506	0.503	1.073	1.070	1.576
	UMTS 1900	0.310	0.506	0.503	0.816	0.813	1.319
	LTE Band 12	0.105	0.506	0.503	0.611	0.608	1.114
	LTE Band 26 (Cell)	0.564	0.506	0.503	1.070	1.067	1.573
	LTE Band 5 (Cell)	0.585	0.506	0.503	1.091	1.088	1.594
	LTE Band 4 (AWS)	0.445	0.506	0.503	0.951	0.948	1.454
	LTE Band 25 (PCS)	0.497	0.506	0.503	1.003	1.000	1.506
	LTE Band 41	0.300	0.506	0.503	0.806	0.803	1.309

Table 12-7
Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN 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 1900	0.212	0.124	0.500	0.336	0.712	0.836
	UMTS 850	0.567	0.124	0.500	0.691	1.067	1.191
	UMTS 1900	0.310	0.124	0.500	0.434	0.810	0.934
	LTE Band 12	0.105	0.124	0.500	0.229	0.605	0.729
	LTE Band 26 (Cell)	0.564	0.124	0.500	0.688	1.064	1.188
	LTE Band 5 (Cell)	0.585	0.124	0.500	0.709	1.085	1.209
	LTE Band 4 (AWS)	0.445	0.124	0.500	0.569	0.945	1.069
	LTE Band 25 (PCS)	0.497	0.124	0.500	0.621	0.997	1.121
	LTE Band 41	0.300	0.124	0.500	0.424	0.800	0.924

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Table 12-8
Simultaneous Transmission Scenario with 2.4 GHz Ant 1 and 5 GHz Ant 2 WLAN (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 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 1900	0.212	0.506	0.500	0.718	0.712	1.218
	UMTS 850	0.567	0.506	0.500	1.073	1.067	1.573
	UMTS 1900	0.310	0.506	0.500	0.816	0.810	1.316
	LTE Band 12	0.105	0.506	0.500	0.611	0.605	1.111
	LTE Band 26 (Cell)	0.564	0.506	0.500	1.070	1.064	1.570
	LTE Band 5 (Cell)	0.585	0.506	0.500	1.091	1.085	1.591
	LTE Band 4 (AWS)	0.445	0.506	0.500	0.951	0.945	1.451
	LTE Band 25 (PCS)	0.497	0.506	0.500	1.003	0.997	1.503
	LTE Band 41	0.300	0.506	0.500	0.806	0.800	1.306

Table 12-9
Simultaneous Transmission Scenario with 2.4 GHz Ant 2 and 5 GHz Ant 1 WLAN (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Body-Worn	GSM 1900	0.212	0.503	0.124	0.715	0.336	0.839
	UMTS 850	0.567	0.503	0.124	1.070	0.691	1.194
	UMTS 1900	0.310	0.503	0.124	0.813	0.434	0.937
	LTE Band 12	0.105	0.503	0.124	0.608	0.229	0.732
	LTE Band 26 (Cell)	0.564	0.503	0.124	1.067	0.688	1.191
	LTE Band 5 (Cell)	0.585	0.503	0.124	1.088	0.709	1.212
	LTE Band 4 (AWS)	0.445	0.503	0.124	0.948	0.569	1.072
	LTE Band 25 (PCS)	0.497	0.503	0.124	1.000	0.621	1.124
	LTE Band 41	0.300	0.503	0.124	0.803	0.424	0.927

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Table 12-10
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body-Worn	GSM 1900	0.212	0.294	0.506
	UMTS 850	0.567	0.294	0.861
	UMTS 1900	0.310	0.294	0.604
	LTE Band 12	0.105	0.294	0.399
	LTE Band 26 (Cell)	0.564	0.294	0.858
	LTE Band 5 (Cell)	0.585	0.294	0.879
	LTE Band 4 (AWS)	0.445	0.294	0.739
	LTE Band 25 (PCS)	0.497	0.294	0.791
	LTE Band 41	0.300	0.294	0.594

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

12.5 Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 648474 D04 Handset SAR v01r01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR ("–").

Table 12-11
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 1900	0.424	0.506	0.503	0.930	0.927	1.433
	UMTS 850	0.567	0.506	0.503	1.073	1.070	1.576
	UMTS 1900	0.601	0.506	0.503	1.107	1.104	See Note 1
	LTE Band 12	0.140	0.506	0.503	0.646	0.643	1.149
	LTE Band 26 (Cell)	0.644	0.506	0.503	1.150	1.147	See Note 1
	LTE Band 5 (Cell)	0.647	0.506	0.503	1.153	1.150	See Note 1
	LTE Band 4 (AWS)	0.752	0.506	0.503	1.258	1.255	See Note 1
	LTE Band 25 (PCS)	0.927	0.506	0.503	1.433	1.430	See Note 1
	LTE Band 41	0.835	0.506	0.503	1.341	1.338	See Note 1

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Table 12-12
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 1900	0.424	0.163	0.500	0.587	0.924	1.087
	UMTS 850	0.567	0.163	0.500	0.730	1.067	1.230
	UMTS 1900	0.601	0.163	0.500	0.764	1.101	1.264
	LTE Band 12	0.140	0.163	0.500	0.303	0.640	0.803
	LTE Band 26 (Cell)	0.644	0.163	0.500	0.807	1.144	1.307
	LTE Band 5 (Cell)	0.647	0.163	0.500	0.810	1.147	1.310
	LTE Band 4 (AWS)	0.752	0.163	0.500	0.915	1.252	1.415
	LTE Band 25 (PCS)	0.927	0.163	0.500	1.090	1.427	1.590
	LTE Band 41	0.835	0.163	0.500	0.998	1.335	1.498

Table 12-13
Simultaneous Transmission Scenario with 2.4 GHz Ant 1 and 5 GHz Ant 2 WLAN (Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 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 1900	0.424	0.506	0.500	0.930	0.924	1.430
	UMTS 850	0.567	0.506	0.500	1.073	1.067	1.573
	UMTS 1900	0.601	0.506	0.500	1.107	1.101	See Note 1
	LTE Band 12	0.140	0.506	0.500	0.646	0.640	1.146
	LTE Band 26 (Cell)	0.644	0.506	0.500	1.150	1.144	See Note 1
	LTE Band 5 (Cell)	0.647	0.506	0.500	1.153	1.147	See Note 1
	LTE Band 4 (AWS)	0.752	0.506	0.500	1.258	1.252	See Note 1
	LTE Band 25 (PCS)	0.927	0.506	0.500	1.433	1.427	See Note 1
	LTE Band 41	0.835	0.506	0.500	1.341	1.335	See Note 1

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Table 12-14
Simultaneous Transmission Scenario with 2.4 GHz Ant 2 and 5 GHz Ant 1 WLAN (Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)		
		1	2	3	1+2	1+3	1+2+3
Hotspot SAR	GPRS 1900	0.424	0.503	0.163	0.927	0.587	1.090
	UMTS 850	0.567	0.503	0.163	1.070	0.730	1.233
	UMTS 1900	0.601	0.503	0.163	1.104	0.764	1.267
	LTE Band 12	0.140	0.503	0.163	0.643	0.303	0.806
	LTE Band 26 (Cell)	0.644	0.503	0.163	1.147	0.807	1.310
	LTE Band 5 (Cell)	0.647	0.503	0.163	1.150	0.810	1.313
	LTE Band 4 (AWS)	0.752	0.503	0.163	1.255	0.915	1.418
	LTE Band 25 (PCS)	0.927	0.503	0.163	1.430	1.090	1.593
	LTE Band 41	0.835	0.503	0.163	1.338	0.998	1.501

Note 1: Individual Simultaneous SAR Tables

Table 12-15
Simultaneous Transmission Scenario with UMTS 1900 and WLAN (Hotspot at 1.0 cm)

Simult Tx	Configuration	UMTS 1900 Ant A 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	Back	0.310	0.506	0.503	0.816	0.813	1.319
	Front	0.305	0.407	0.503*	0.712	0.808	1.215
	Top	-	0.506*	0.272	0.506	0.272	0.778
	Bottom	0.601	-	-	0.601	0.601	0.601
	Right	-	-	-	0.000	0.000	0.000
	Left	0.235	0.506*	0.503*	0.741	0.738	1.244
Simult Tx	Configuration	UMTS 1900 Ant A SAR (W/kg)	2.4 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	Back	0.310	0.506	0.500	0.816	0.810	1.316
	Front	0.305	0.407	0.227	0.712	0.532	0.939
	Top	-	0.506*	0.500*	0.506	0.500	1.006
	Bottom	0.601	-	-	0.601	0.601	0.601
	Right	-	-	-	0.000	0.000	0.000
	Left	0.235	0.506*	0.500*	0.741	0.735	1.241

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Table 12-16
Simultaneous Transmission Scenario with LTE B26 and WLAN (Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 26 (Cell) Ant A 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	Back	0.564	0.506	0.503	1.070	1.067	1.573
	Front	0.644	0.407	0.503*	1.051	1.147	1.554
	Top	-	0.506*	0.272	0.506	0.272	0.778
	Bottom	0.342	-	-	0.342	0.342	0.342
	Right	0.308	-	-	0.308	0.308	0.308
	Left	0.069	0.506*	0.503*	0.575	0.572	1.078
Simult Tx	Configuration	LTE Band 26 (Cell) Ant A SAR (W/kg)	2.4 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	Back	0.564	0.506	0.500	1.070	1.064	1.570
	Front	0.644	0.407	0.227	1.051	0.871	1.278
	Top	-	0.506*	0.500*	0.506	0.500	1.006
	Bottom	0.342	-	-	0.342	0.342	0.342
	Right	0.308	-	-	0.308	0.308	0.308
	Left	0.069	0.506*	0.500*	0.575	0.569	1.075

Table 12-17
Simultaneous Transmission Scenario with LTE B5 and WLAN (Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 5 (Cell) Ant A 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	Back	0.585	0.506	0.503	1.091	1.088	1.594
	Front	0.647	0.407	0.503*	1.054	1.150	1.557
	Top	-	0.506*	0.272	0.506	0.272	0.778
	Bottom	0.331	-	-	0.331	0.331	0.331
	Right	0.281	-	-	0.281	0.281	0.281
	Left	0.121	0.506*	0.503*	0.627	0.624	1.130
Simult Tx	Configuration	LTE Band 5 (Cell) Ant B 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	Back	0.028	0.506	0.503	0.534	0.531	1.037
	Front	0.040	0.407	0.503*	0.447	0.543	0.950
	Top	0.017	0.506*	0.272	0.523	0.289	0.795
	Bottom	-	-	-	0.000	0.000	0.000
	Right	0.005	-	-	0.005	0.005	0.005
	Left	0.021	0.506*	0.503*	0.527	0.524	1.030

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Simult Tx	Configuration	LTE Band 5 (Cell) Ant A SAR (W/kg)	2.4 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	Back	0.585	0.506	0.500	1.091	1.085	1.591
	Front	0.647	0.407	0.227	1.054	0.874	1.281
	Top	-	0.506*	0.500*	0.506	0.500	1.006
	Bottom	0.331	-	-	0.331	0.331	0.331
	Right	0.281	-	-	0.281	0.281	0.281
	Left	0.121	0.506*	0.500*	0.627	0.621	1.127
Simult Tx	Configuration	LTE Band 5 (Cell) Ant B SAR (W/kg)	2.4 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	Back	0.028	0.506	0.500	0.534	0.528	1.034
	Front	0.040	0.407	0.227	0.447	0.267	0.674
	Top	0.017	0.506*	0.500*	0.523	0.517	1.023
	Bottom	-	-	-	0.000	0.000	0.000
	Right	0.005	-	-	0.005	0.005	0.005
	Left	0.021	0.506*	0.500*	0.527	0.521	1.027

Table 12-18
Simultaneous Transmission Scenario with LTE B4 and WLAN (Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 4 (AWS) Ant A 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	Back	0.445	0.506	0.503	0.951	0.948	1.454
	Front	0.443	0.407	0.503*	0.850	0.946	1.353
	Top	-	0.506*	0.272	0.506	0.272	0.778
	Bottom	0.752	-	-	0.752	0.752	0.752
	Right	-	-	-	0.000	0.000	0.000
	Left	0.343	0.506*	0.503*	0.849	0.846	1.352
Simult Tx	Configuration	LTE Band 4 (AWS) Ant A SAR (W/kg)	2.4 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	Back	0.445	0.506	0.500	0.951	0.945	1.451
	Front	0.443	0.407	0.227	0.850	0.670	1.077
	Top	-	0.506*	0.500*	0.506	0.500	1.006
	Bottom	0.752	-	-	0.752	0.752	0.752
	Right	-	-	-	0.000	0.000	0.000
	Left	0.343	0.506*	0.500*	0.849	0.843	1.349

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Table 12-19
Simultaneous Transmission Scenario with LTE Band 25 and WLAN (Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 25 (PCS) Ant A 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	Back	0.497	0.506	0.503	1.003	1.000	1.506
	Front	0.495	0.407	0.503*	0.902	0.998	1.405
	Top	-	0.506*	0.272	0.506	0.272	0.778
	Bottom	0.927	-	-	0.927	0.927	0.927
	Right	-	-	-	0.000	0.000	0.000
	Left	0.449	0.506*	0.503*	0.955	0.952	1.458
Simult Tx	Configuration	LTE Band 25 (PCS) Ant A SAR (W/kg)	2.4 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	Back	0.497	0.506	0.500	1.003	0.997	1.503
	Front	0.495	0.407	0.227	0.902	0.722	1.129
	Top	-	0.506*	0.500*	0.506	0.500	1.006
	Bottom	0.927	-	-	0.927	0.927	0.927
	Right	-	-	-	0.000	0.000	0.000
	Left	0.449	0.506*	0.500*	0.955	0.949	1.455

Table 12-20
Simultaneous Transmission Scenario with LTE Band 41 and WLAN (Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 41 Ant A 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	Back	0.300	0.506	0.503	0.806	0.803	1.309
	Front	0.325	0.407	0.503*	0.732	0.828	1.235
	Top	-	0.506*	0.272	0.506	0.272	0.778
	Bottom	0.835	-	-	0.835	0.835	0.835
	Right	-	-	-	0.000	0.000	0.000
	Left	0.148	0.506*	0.503*	0.654	0.651	1.157
Simult Tx	Configuration	LTE Band 41 Ant A SAR (W/kg)	2.4 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	Back	0.300	0.506	0.500	0.806	0.800	1.306
	Front	0.325	0.407	0.227	0.732	0.552	0.959
	Top	-	0.506*	0.500*	0.506	0.500	1.006
	Bottom	0.835	-	-	0.835	0.835	0.835
	Right	-	-	-	0.000	0.000	0.000
	Left	0.148	0.506*	0.500*	0.654	0.648	1.154

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12.6 Phablet SAR Simultaneous Transmission Analysis

Main antenna, 2.4 GHz WIFI/BT SAR testing was not required for extremity exposure conditions per FCC KDB 648474 D04v01r02. Therefore, no further analysis beyond **Table 12-21** was required to determine that possible simultaneous scenarios would not exceed the SAR limit.

Table 12-21
Simultaneous Transmission Scenario for MIMO 5 GHz WLAN (Phablet at 0.0 cm)

Exposure Condition	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Phablet SAR	0.671	1.969	2.640

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.

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13 ADDITIONAL TUNER TESTING PER FCC GUIDANCE

The following test procedures were followed to demonstrate that the SAR results in Section 11 represented the appropriate SAR test conditions. For bands with dynamic tuning implemented, SAR was measured according to the required FCC SAR test procedures with the dynamic tuner active to allow the device to automatically tune to the antenna state for the respective RF exposure test configurations. Additional single point SAR time-sweep measurements were evaluated for other tuner states to determine that the other tuner configurations would result in equivalent or lower SAR values. The additional tuner hardware has no influence to the antenna characteristics, other than impedance matching. All channels within LTE Band 5 and UMTS B5 use the identical 25 tuning states.

To evaluate all of the tuner states, the 25 tuner states were divided evenly among band, mode and exposure combinations so that at least one single point SAR measurement was measured among the configurations. Single point time-sweep measurements were performed at the peak SAR location determined by the zoom scan of the configuration with the highest reported SAR for each combination. While inserting and removing the USB cable between single point SAR measurements, the device was ensured to capture the same physical point SAR that generated the highest SAR. The SAR probe remained stationary at the same position throughout the entire series of single point measurements for each combination.

The operational description contains more information about the design and implementation of the dynamic antenna tuning.

Table 13-1
Supplemental Head SAR Data

Mode	Service/ Modulation	Frequency (MHz)	Channel	RB Size	RB offset	Test Position	Spacing	Measured 1g SAR (W/kg)	Average Value of Time Sweep (W/kg)								
									Auto-Tune (State 7)	Default (State 7)	State 1	State 5	State 9	State 10	State 15	State 20	State 22
LTE B5	QPSK	836.5	20525	1	0	Right Cheek	N/A	0.168	0.211	0.206	0.191	0.060	0.173	0.069	0.192	0.126	0.043
Mode	Service/ Modulation	Frequency (MHz)	Channel	RB Size	RB offset	Test Position	Spacing	Measured 1g SAR (W/kg)	Average Value of Time Sweep (W/kg)								
									Auto-Tune (State 7)	Default (State 7)	State 4	State 6	State 10	State 12	State 17	State 21	State 25
UMTS B5	RMC	836.6	4183	N/A	N/A	Right Cheek	N/A	0.150	0.172	0.164	0.102	0.130	0.056	0.046	0.160	0.048	0.152

Table 13-2
Supplemental Body SAR Data

Mode	Service/ Modulation	Frequency (MHz)	Channel	RB Size	RB offset	Test Position	Spacing	Measured 1g SAR (W/kg)	Average Value of Time Sweep (W/kg)								
									Auto-Tune (State 7)	Default (State 7)	State 1	State 3	State 8	State 11	State 13	State 18	State 24
LTE B5	QPSK	836.5	20525	1	0	Front Side	10 mm	0.635	0.837	0.841	0.798	0.331	0.831	0.301	0.227	0.599	0.812
Mode	Service/ Modulation	Frequency (MHz)	Channel	RB Size	RB offset	Test Position	Spacing	Measured 1g SAR (W/kg)	Average Value of Time Sweep (W/kg)								
									Auto-Tune (State 7)	Default (State 7)	State 2	State 4	State 14	State 16	State 19	State 21	State 23
UMTS B5	RMC	836.6	4183	N/A	N/A	Back Side	10 mm	0.425	0.727	0.723	0.595	0.462	0.431	0.670	0.302	0.200	0.509

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14 SAR MEASUREMENT VARIABILITY

14.1 Measurement Variability

Per FCC KDB Publication 865664 D01, SAR measurement variability was not assessed for any frequency band since all measured 1g SAR values were less than 0.80 W/kg and all measured 10g SAR values were less than 2.00 W/kg.

14.2 Measurement Uncertainty

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

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15 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	8753E	(30kHz-6GHz) Network Analyzer	3/2/2016	Annual	3/2/2017	JP38020182
Agilent	8753ES	S-Parameter Network Analyzer	11/4/2015	Annual	11/4/2016	US39170118
Agilent	E4432B	ESG-D Series Signal Generator	3/5/2016	Annual	3/5/2017	US40053896
Agilent	E4438C	ESG Vector Signal Generator	3/13/2015	Biennial	3/13/2017	MY42082659
Agilent	E5515C	Wireless Communications Test Set	11/4/2014	Biennial	11/4/2016	GB43193563
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/2/2016	Annual	3/2/2017	MY45470194
Agilent	N5182A	MKG Vector Signal Generator	3/5/2016	Annual	3/5/2017	MY47420800
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433978
Anritsu	MA24106A	USB Power Sensor	3/4/2016	Annual	3/4/2017	1344557
Anritsu	MA24106A	USB Power Sensor	3/28/2016	Annual	3/28/2017	1344554
Anritsu	MA2411B	Pulse Power Sensor	12/7/2015	Annual	12/7/2016	1339018
Anritsu	MA2411B	Pulse Power Sensor	2/28/2016	Annual	2/28/2017	1207470
Anritsu	MA2481A	Power Sensor	3/3/2016	Annual	3/3/2017	5318
Anritsu	MA2481A	Power Sensor	3/3/2016	Annual	3/3/2017	2400
Anritsu	ML2438A	Power Meter	3/3/2016	Annual	3/3/2017	1070030
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	1039008
Anritsu	ML2496A	Power Meter	2/28/2016	Annual	2/28/2017	1306009
Anritsu	ML2496A	Power Meter	3/5/2016	Annual	3/5/2017	1351001
Anritsu	MT8820C	Radio Communication Analyzer	7/24/2015	Annual	7/24/2016	6209091190
Anritsu	MT8820C	Radio Communication Analyzer	9/1/2015	Annual	9/1/2016	6201144419
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M155A00-009
Control Company	4040	Digital Thermometer	3/18/2015	Biennial	3/18/2017	150194896
Control Company	4352	Ultra Long Stem Thermometer	3/8/2016	Biennial	3/8/2018	160261701
Control Company	4353	Long Stem Thermometer	3/5/2015	Biennial	3/5/2017	150149565
Gigatronics	80701A	(0.05-18GHz) Power Sensor	11/4/2015	Annual	11/4/2016	1833460
Gigatronics	8651A	Universal Power Meter	11/4/2015	Annual	11/4/2016	8650319
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
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	3/2/2016	Biennial	3/2/2018	13264162
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
Pasternack	NC-100	Torque Wrench	11/6/2015	Biennial	11/6/2017	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	3/29/2016	Annual	3/29/2017	836371/0079
Rohde & Schwarz	CMW500	Radio Communication Tester	4/27/2016	Annual	4/27/2017	101699
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/2/2016	Biennial	3/2/2018	N/A
SPEAG	DAK-12	Dielectric Assessment Kit (10MHz - 3GHz)	3/1/2016	Annual	3/1/2017	1102
SPEAG	DAK-3.5	Dielectric Assessment Kit	10/20/2015	Annual	10/20/2016	1091
SPEAG	ES3DV2	SAR Probe	8/26/2015	Annual	8/26/2016	3022
SPEAG	EX3DV4	SAR Probe	4/19/2016	Annual	4/19/2017	7406
SPEAG	ES3DV3	SAR Probe	10/29/2015	Annual	10/29/2016	3333
SPEAG	EX3DV4	SAR Probe	4/19/2016	Annual	4/19/2017	7357
SPEAG	ES3DV3	SAR Probe	11/17/2015	Annual	11/17/2016	3334
SPEAG	ES3DV3	SAR Probe	3/18/2016	Annual	3/18/2017	3319
SPEAG	EX3DV4	SAR Probe	2/22/2016	Annual	2/22/2017	3914
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/16/2015	Annual	9/16/2016	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/14/2016	Annual	4/14/2017	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/27/2015	Annual	10/27/2016	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/19/2016	Annual	2/19/2017	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/11/2015	Annual	11/11/2016	1415
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/14/2016	Annual	3/14/2017	1368
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/18/2016	Annual	2/18/2017	1272
SPEAG	D750V3	750 MHz SAR Dipole	2/16/2016	Annual	2/16/2017	1046
SPEAG	D1765V2	1765 MHz SAR Dipole	5/11/2016	Annual	5/11/2017	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	4/12/2016	Annual	4/12/2017	50141
SPEAG	D2450V2	2450 MHz SAR Dipole	8/20/2015	Annual	8/20/2016	719
SPEAG	D2600V2	2600 MHz SAR Dipole	4/19/2016	Annual	4/19/2017	1004
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/16/2015	Annual	9/16/2016	1191
SPEAG	D750V3	750 MHz Dipole	3/16/2016	Annual	3/16/2017	1054
SPEAG	D835V2	835 MHz SAR Dipole	4/14/2016	Annual	4/14/2017	40119
SPEAG	D2600V2	2600 MHz SAR Dipole	10/21/2015	Annual	10/21/2016	1071
SPEAG	D5GHzV2	5 GHz SAR Dipole	2/25/2016	Annual	2/25/2017	1120
SPEAG	D2450V2	2450 MHz SAR Dipole	2/18/2016	Annual	2/18/2017	882

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

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16 MEASUREMENT UNCERTAINTIES

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

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17 CONCLUSION

17.1 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: A3LSMN930KOR; Type: Portable Handset; Serial: 05AA2

Communication System: UID 0, GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.398 \text{ S/m}$; $\epsilon_r = 39.087$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 06-03-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/27/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: 1757

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

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

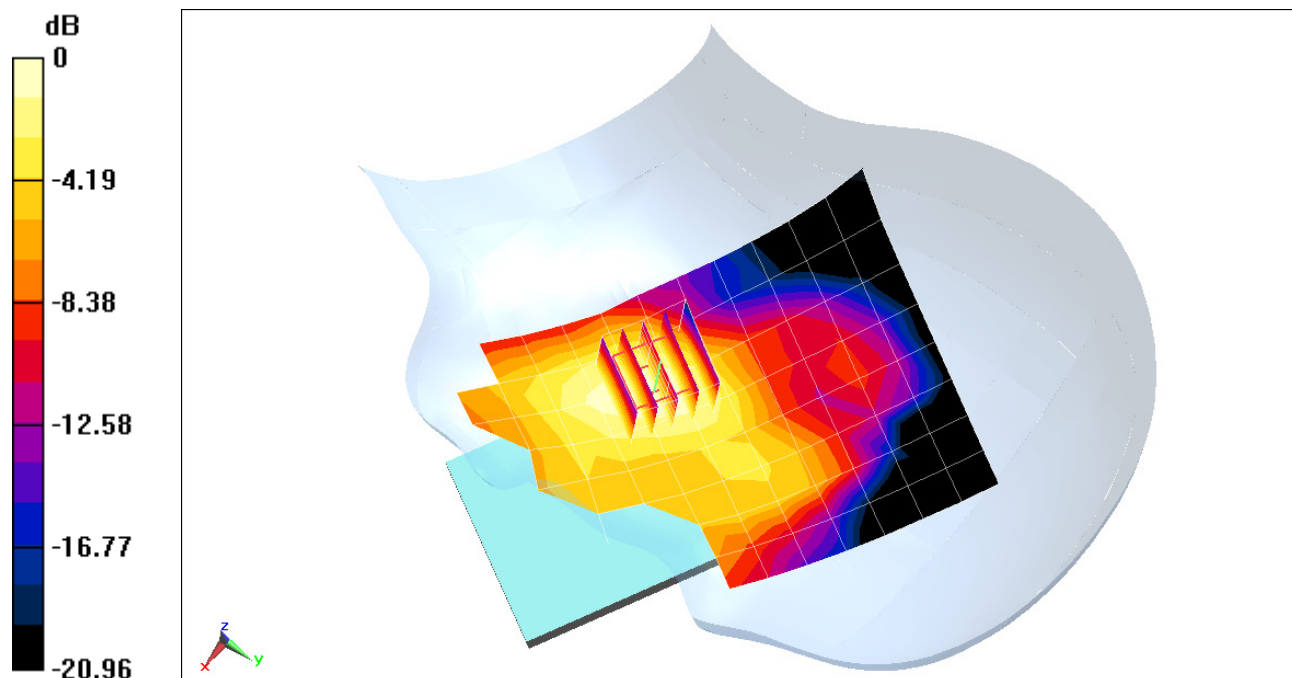
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 7.054 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 0.0940 W/kg

SAR(1 g) = 0.060 W/kg



0 dB = 0.0702 W/kg = -11.54 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8485A

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

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.909 \text{ S/m}$; $\epsilon_r = 42.797$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-30-2016; Ambient Temp: 22.8°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3333; ConvF(6.16, 6.16, 6.16); Calibrated: 10/29/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/27/2015

Phantom: SAM Front; Type: QD000P40CD; Serial: TP:1758

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

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

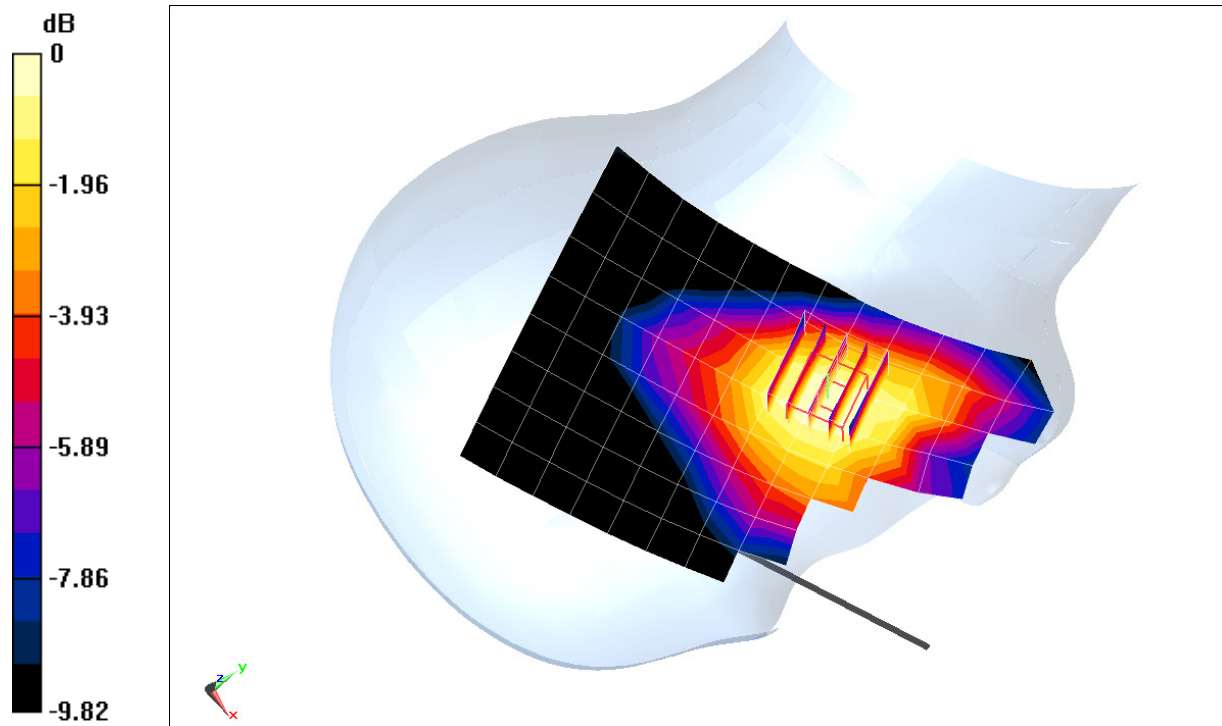
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 13.35 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.186 W/kg

SAR(1 g) = 0.150 W/kg



0 dB = 0.164 W/kg = -7.85 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AD2

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

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.398 \text{ S/m}$; $\epsilon_r = 39.087$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 06-03-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/27/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: 1757

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

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

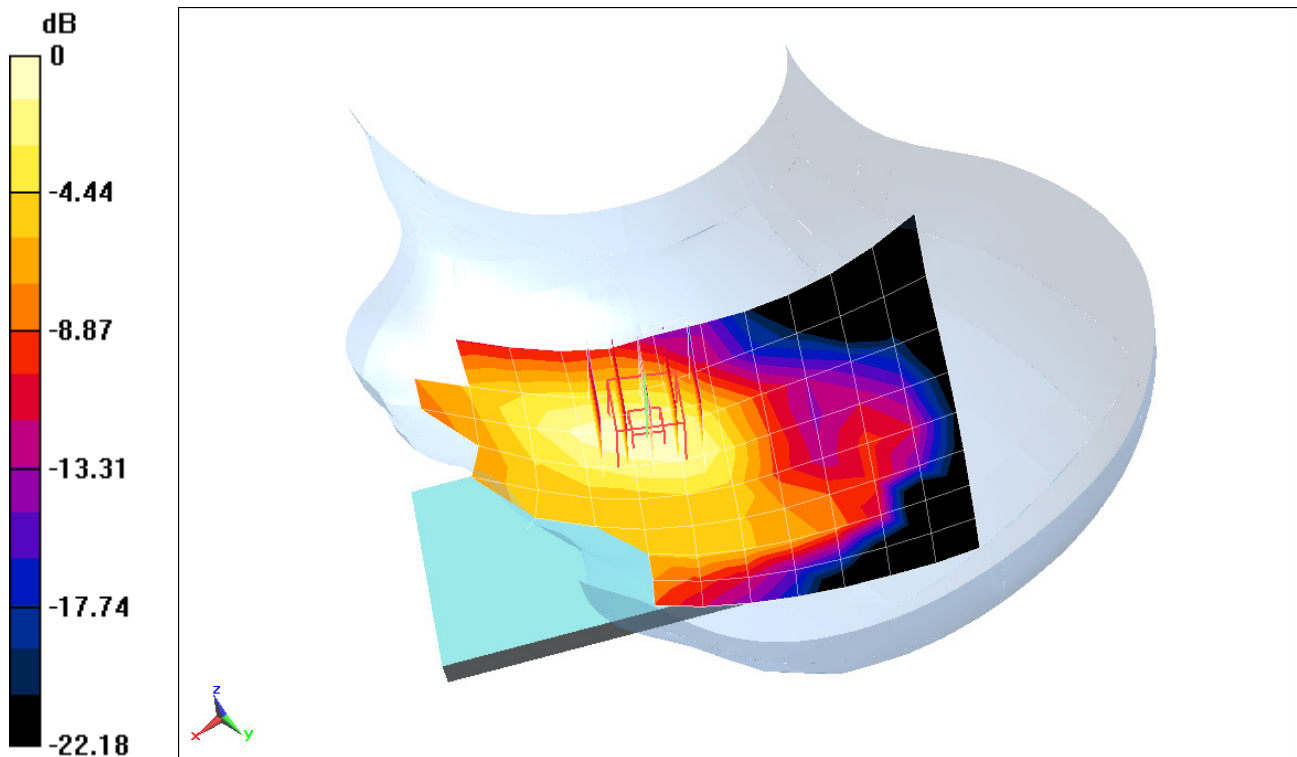
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 8.466 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.142 W/kg

SAR(1 g) = 0.089 W/kg



0 dB = 0.106 W/kg = -9.75 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AD2

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

Medium: 750 Head Medium parameters used (interpolated):

$f = 707.5 \text{ MHz}$; $\sigma = 0.858 \text{ S/m}$; $\epsilon_r = 42.064$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-02-2016; Ambient Temp: 24.0°C; Tissue Temp: 21.7°C

Probe: ES3DV2 - SN3022; ConvF(6.33, 6.33, 6.33); Calibrated: 8/26/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/16/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: TP:7535

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

**Mode: LTE Band 12, Right Head, Cheek, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

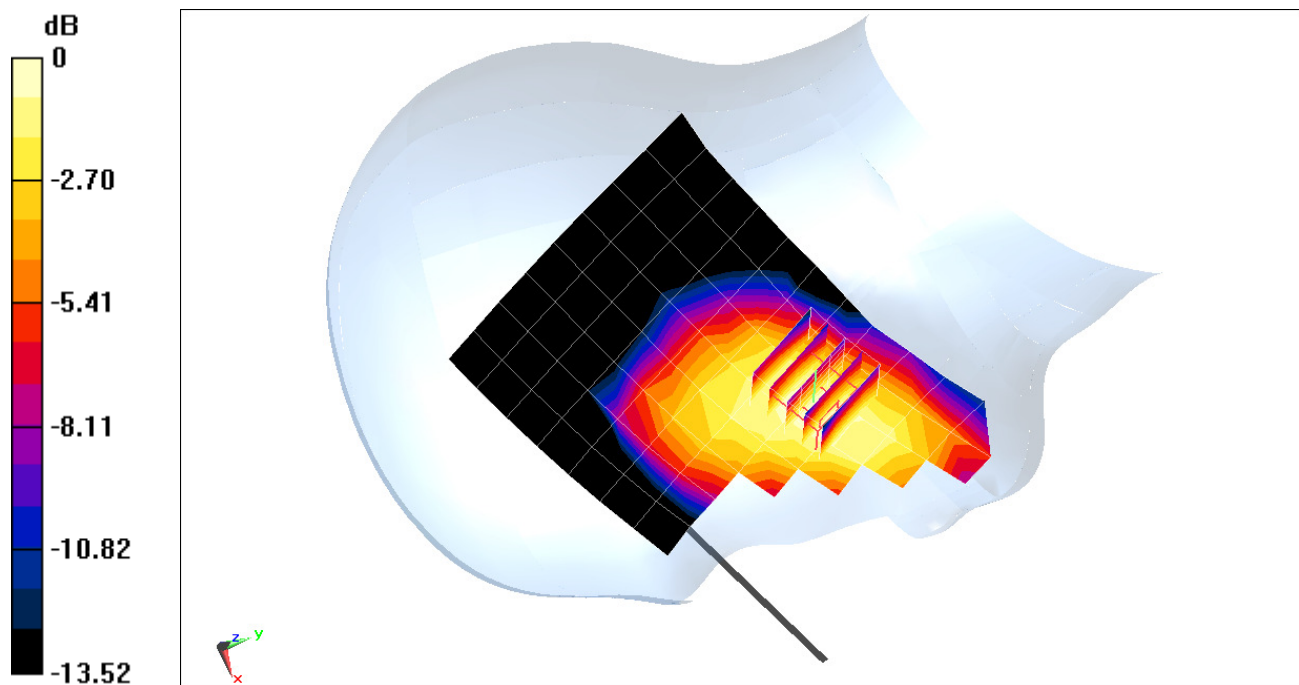
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 3.914 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.0150 W/kg

SAR(1 g) = 0.011 W/kg



0 dB = 0.0125 W/kg = -19.03 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8485A

Communication System: UID 0, LTE Band 26; Frequency: 831.5 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 831.5 \text{ MHz}$; $\sigma = 0.906 \text{ S/m}$; $\epsilon_r = 42.843$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-30-2016; Ambient Temp: 22.8°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3333; ConvF(6.16, 6.16, 6.16); Calibrated: 10/29/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/27/2015

Phantom: SAM Front; Type: QD000P40CD; Serial: TP:1758

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

**Mode: LTE Band 26 (Cell.), Right Head, Cheek, Mid.ch,
15 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

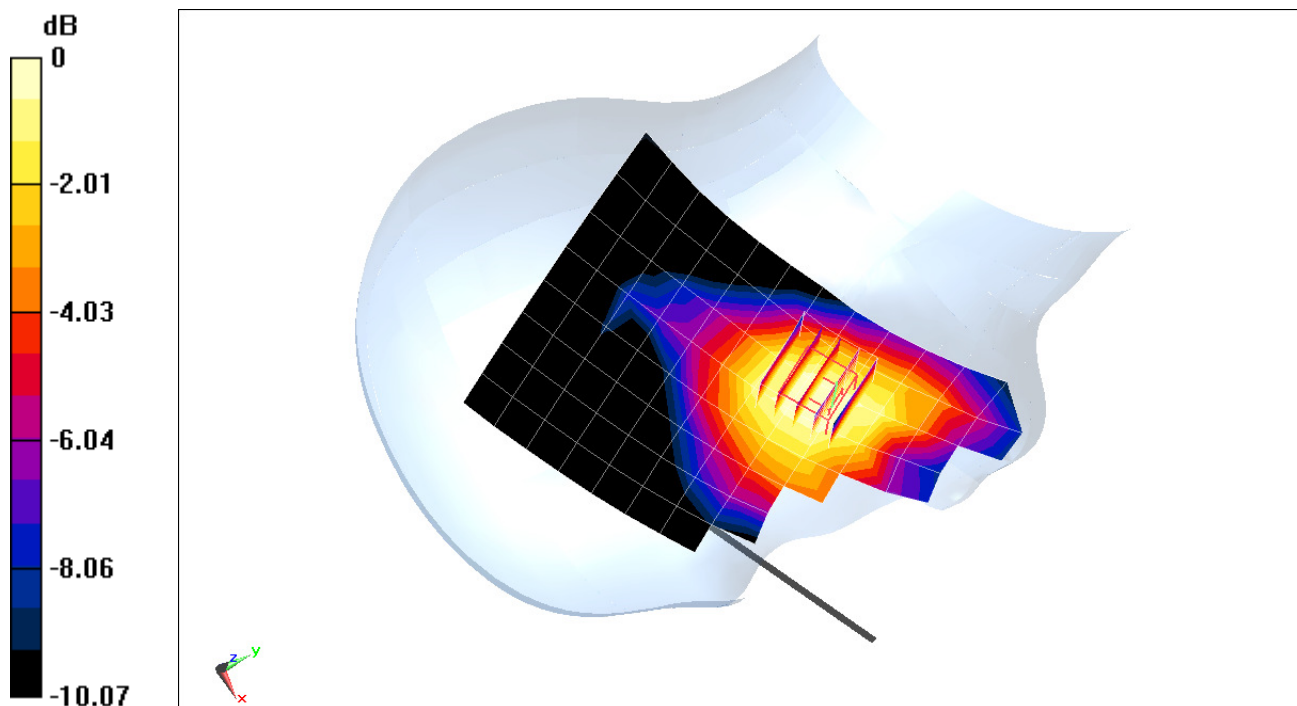
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 14.80 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.210 W/kg

SAR(1 g) = 0.172 W/kg



0 dB = 0.186 W/kg = -7.30 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 0548E

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

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.5 \text{ MHz}$; $\sigma = 0.93 \text{ S/m}$; $\epsilon_r = 42.951$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-06-2016; Ambient Temp: 23.4°C; Tissue Temp: 22.9°C

Probe: ES3DV2 - SN3022; ConvF(6.11, 6.11, 6.11); Calibrated: 8/26/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/16/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: TP:7535

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

**Mode: LTE Band 5 (Cell.), Right Head, Cheek, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset, Ant B**

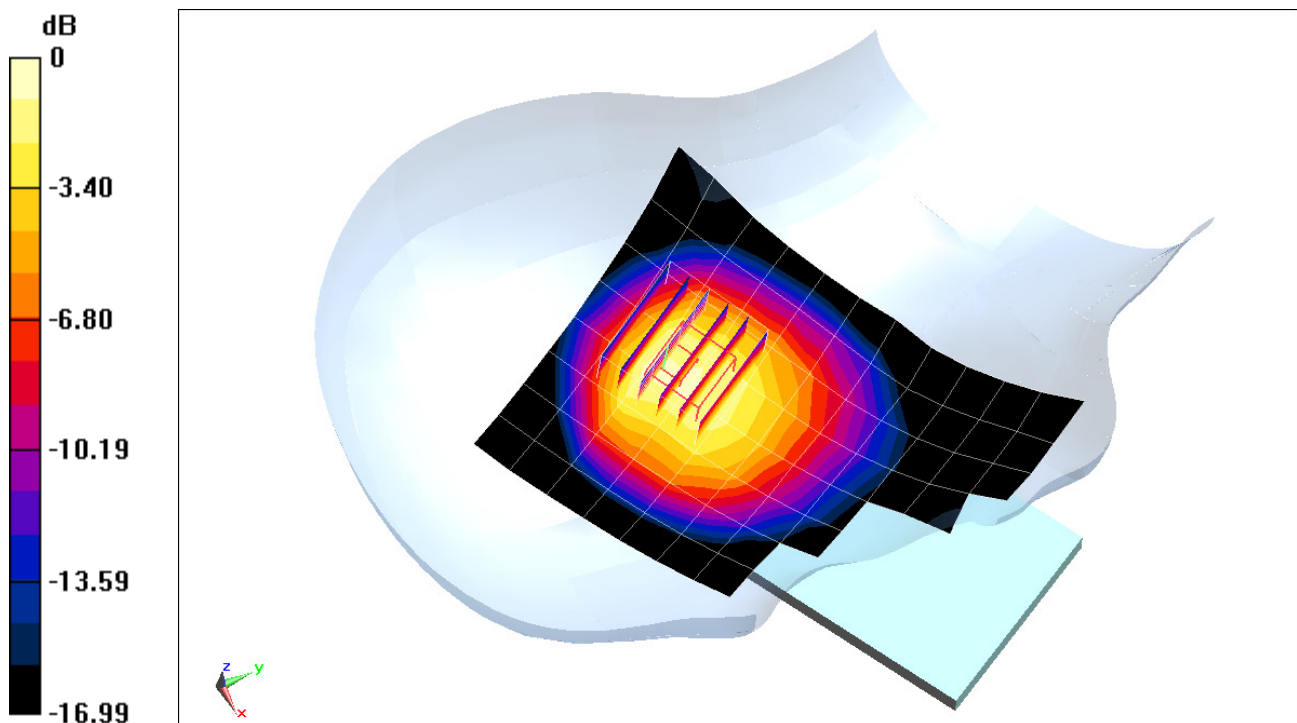
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 15.26 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.298 W/kg

SAR(1 g) = 0.171 W/kg



0 dB = 0.206 W/kg = -6.86 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AA2

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

Medium: 1750 Head Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$; $\sigma = 1.342 \text{ S/m}$; $\epsilon_r = 39.139$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 06-06-2016; Ambient Temp: 23.2°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN7406; ConvF(8.85, 8.85, 8.85); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

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

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

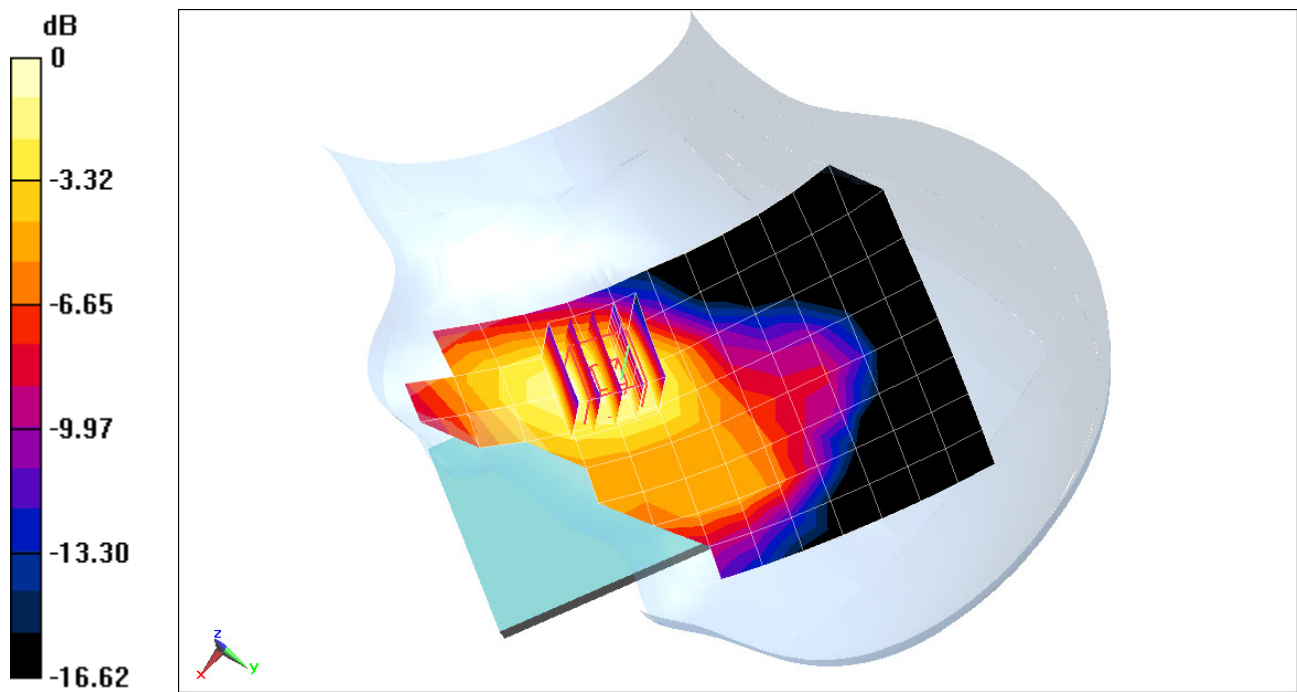
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 9.812 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.165 W/kg

SAR(1 g) = 0.109 W/kg



0 dB = 0.144 W/kg = -8.42 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8433D

Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1882.5 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1882.5$ MHz; $\sigma = 1.401$ S/m; $\epsilon_r = 39.08$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Test Date: 06-03-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/27/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: 1757

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

**Mode: LTE Band 25 (PCS), Left Head, Cheek, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

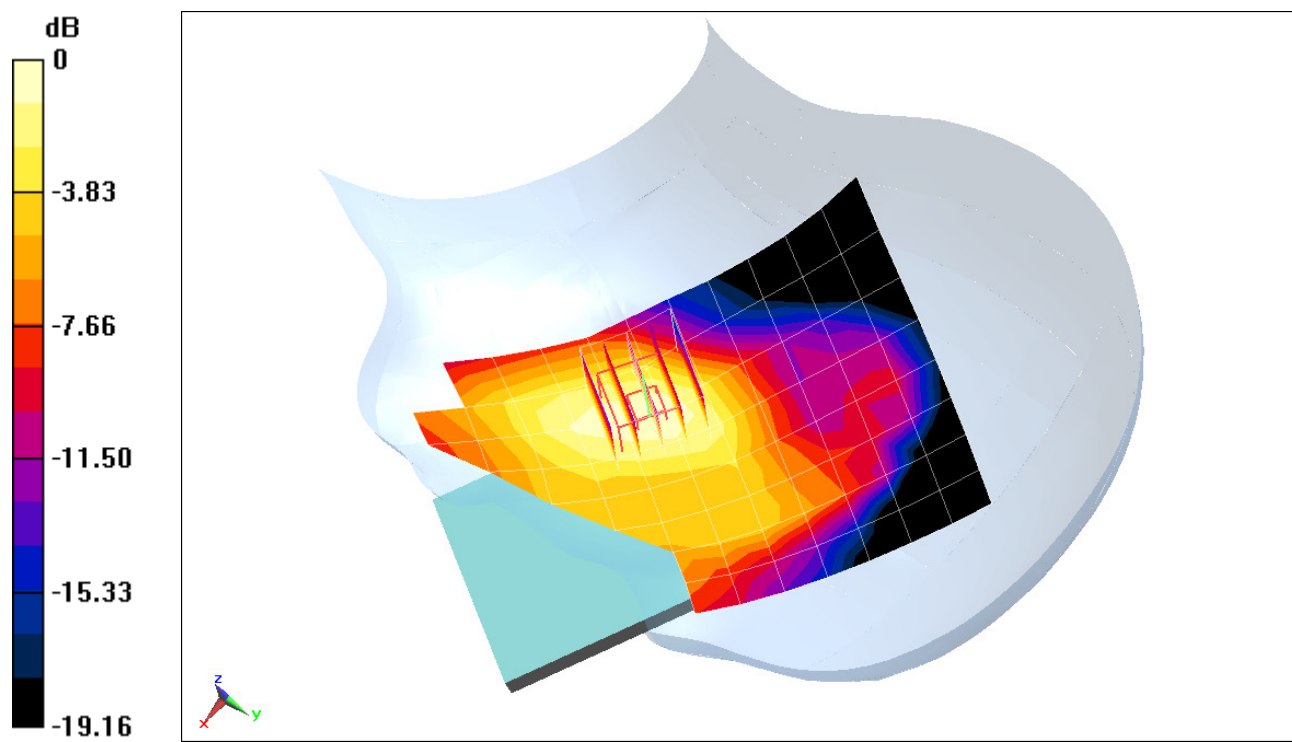
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 10.39 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.185 W/kg

SAR(1 g) = 0.120 W/kg



0 dB = 0.140 W/kg = -8.54 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05A82

Communication System: UID 0, LTE Band 41; Frequency: 2680 MHz; Duty Cycle: 1:1.58

Medium: 2600 Head Medium parameters used (interpolated):

$f = 2680$ MHz; $\sigma = 2.142$ S/m; $\epsilon_r = 39.545$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Test Date: 06-03-2016; Ambient Temp: 24.0°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(4.12, 4.12, 4.12); Calibrated: 8/26/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/16/2015

Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375

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

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

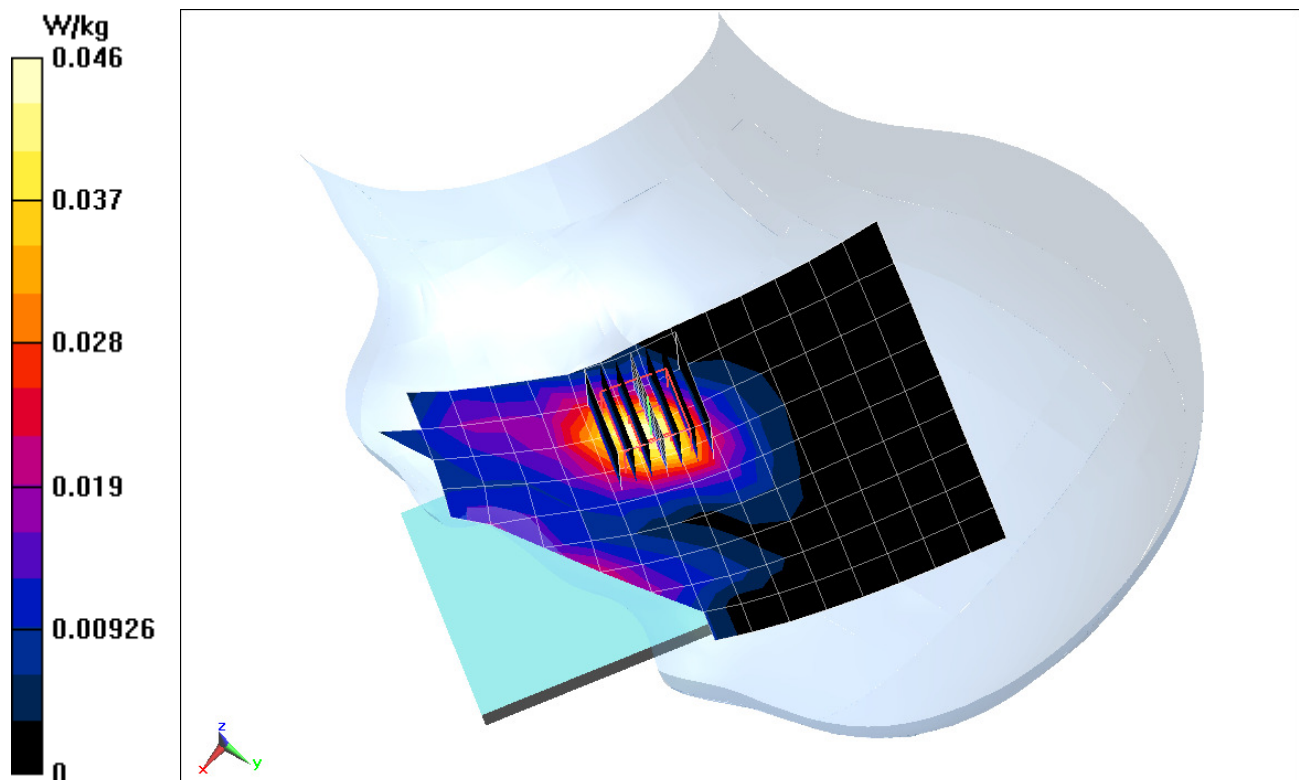
Area Scan (10x17x1): Measurement grid: dx=12mm, dy=12mm

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

Reference Value = 4.851 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.0690 W/kg

SAR(1 g) = 0.036 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 252AF

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

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$; $\sigma = 1.841 \text{ S/m}$; $\epsilon_r = 39.809$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-13-2016; Ambient Temp: 22.4°C; Tissue Temp: 23.4°C

Probe: ES3DV2 - SN3022; ConvF(4.3, 4.3, 4.3); Calibrated: 8/26/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/16/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: TP:7535

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

**Mode: IEEE 802.11b, 22 MHz Bandwidth,
Right Head, Cheek, Ch 06, 1 Mbps, Antenna 1**

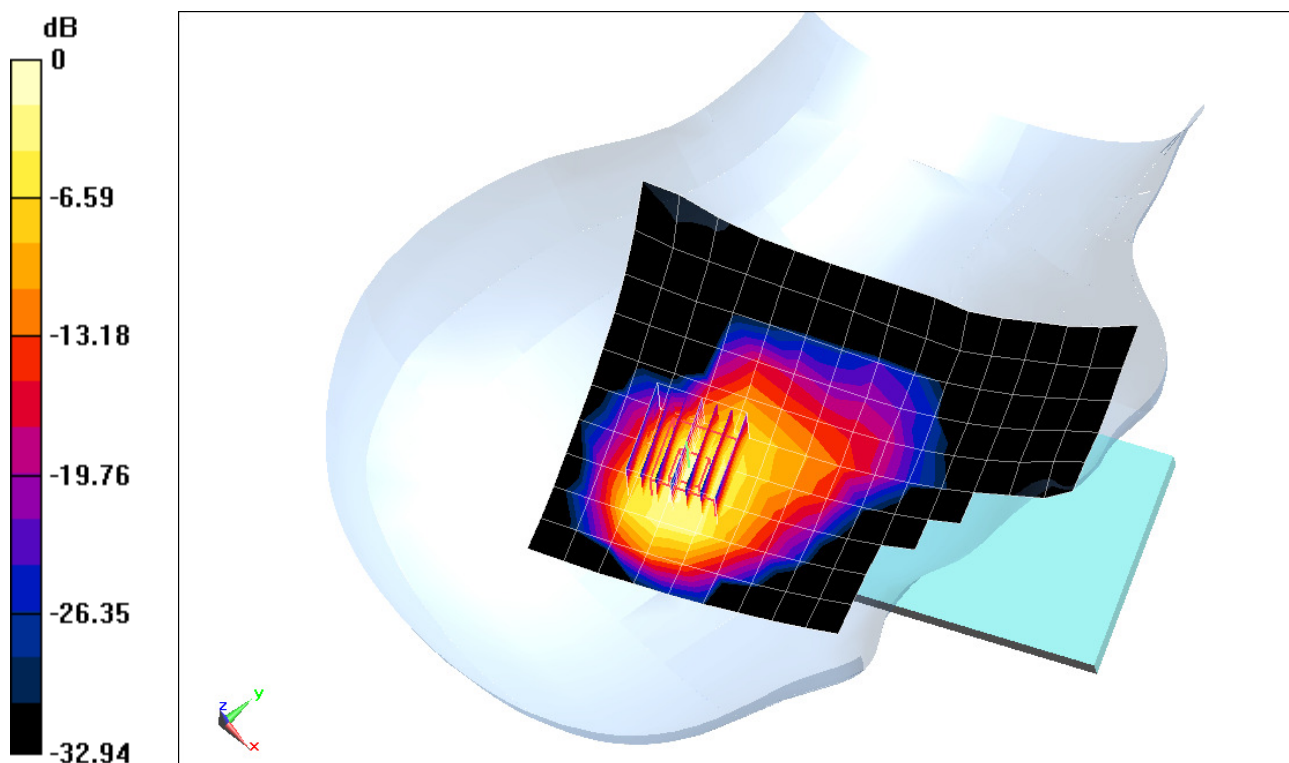
Area Scan (11x18x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Reference Value = 18.16 V/m; Power Drift = -0.21 dB

Peak SAR (extrapolated) = 1.09 W/kg

SAR(1 g) = 0.479 W/kg



0 dB = 0.635 W/kg = -1.97 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 252AE

Communication System: UID 0, IEEE 802.11ac; Frequency: 5290 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used (interpolated):

$f = 5290 \text{ MHz}$; $\sigma = 4.7 \text{ S/m}$; $\epsilon_r = 35.099$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-13-2016; Ambient Temp: 20.4°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7357; ConvF(5.1, 5.1, 5.1); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/19/2016

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

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

**Mode: IEEE 802.11ac, U-NII-2A, 80 MHz Bandwidth,
Right Head, Cheek, Ch 58, 29.3 Mbps, Antenna 1**

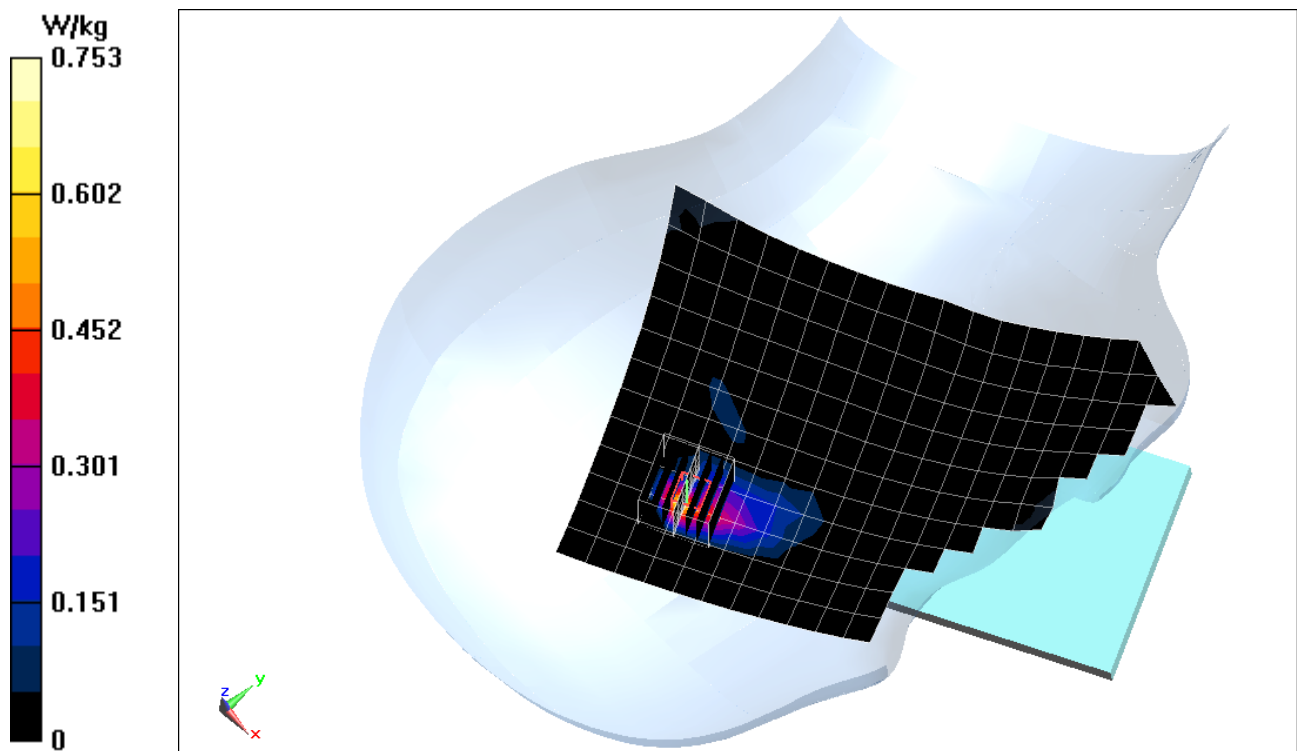
Area Scan (13x22x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

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

Reference Value = 3.241 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.38 W/kg

SAR(1 g) = 0.274 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AA2

Communication System: UID 0, GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.526 \text{ S/m}$; $\epsilon_r = 52.626$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.3°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3319; ConvF(4.7, 4.7, 4.7); Calibrated: 3/18/2016;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/14/2016

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

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

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

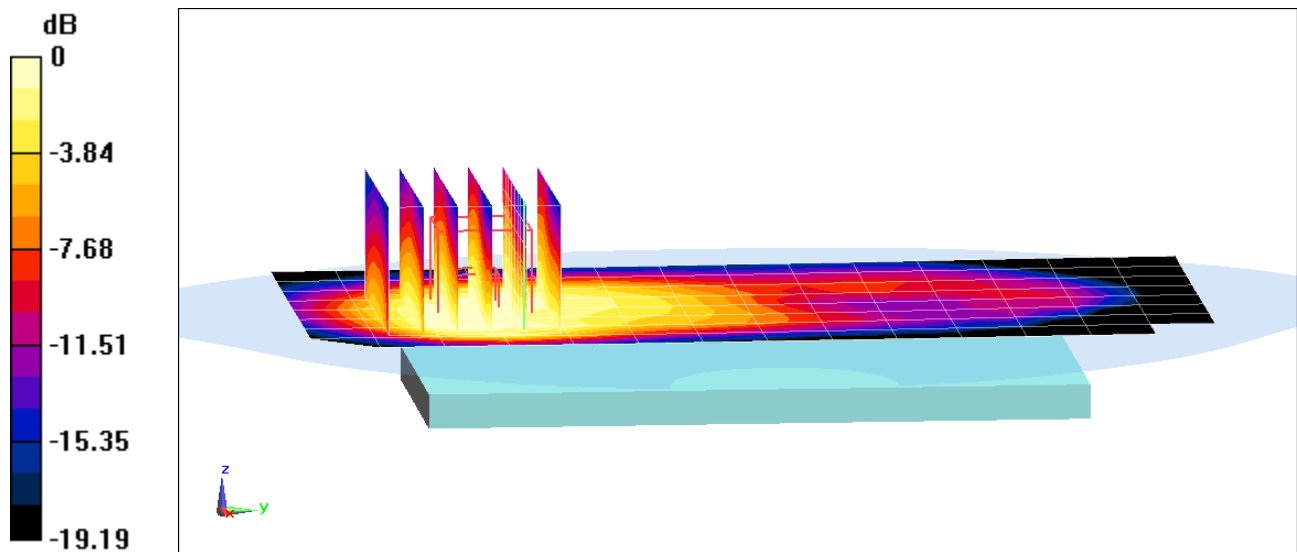
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (9x6x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 10.24 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.322 W/kg

SAR(1 g) = 0.188 W/kg



0 dB = 0.217 W/kg = -6.64 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AA2

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.526 \text{ S/m}$; $\epsilon_r = 52.626$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.3°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3319; ConvF(4.7, 4.7, 4.7); Calibrated: 3/18/2016;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/14/2016

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

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

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

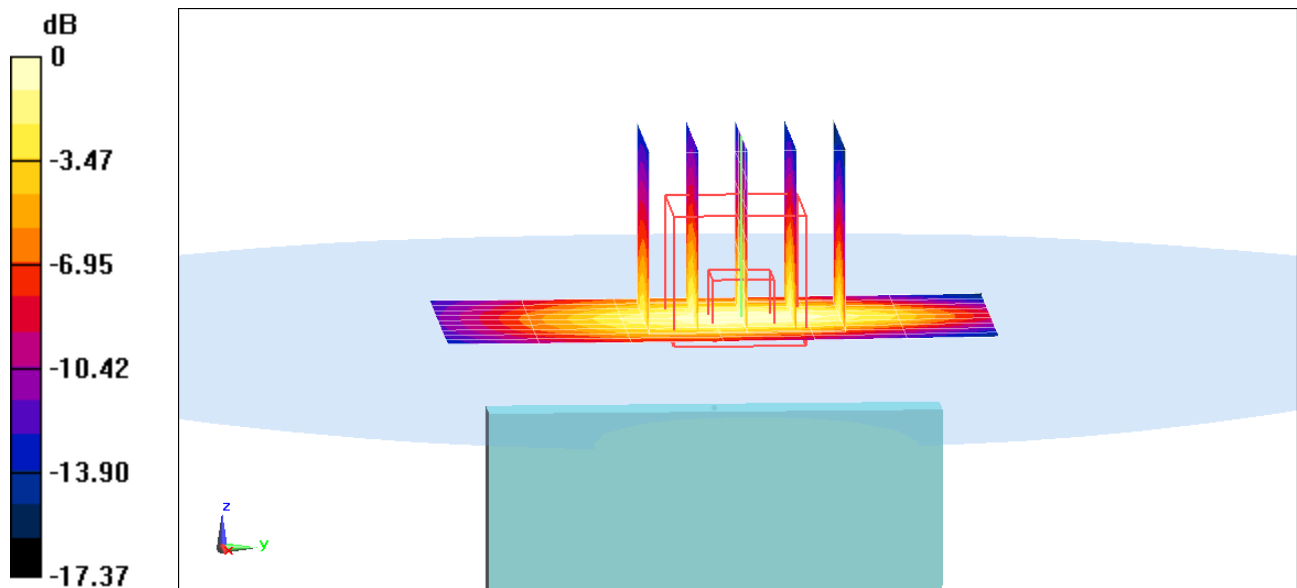
Area Scan (10x7x1): Measurement grid: $dx=5\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 15.45 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.549 W/kg

SAR(1 g) = 0.314 W/kg



0 dB = 0.389 W/kg = -4.10 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8485A

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 1.016 \text{ S/m}$; $\epsilon_r = 54.379$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2016; Ambient Temp: 23.2°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7406; ConvF(9.35, 9.35, 9.35); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

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

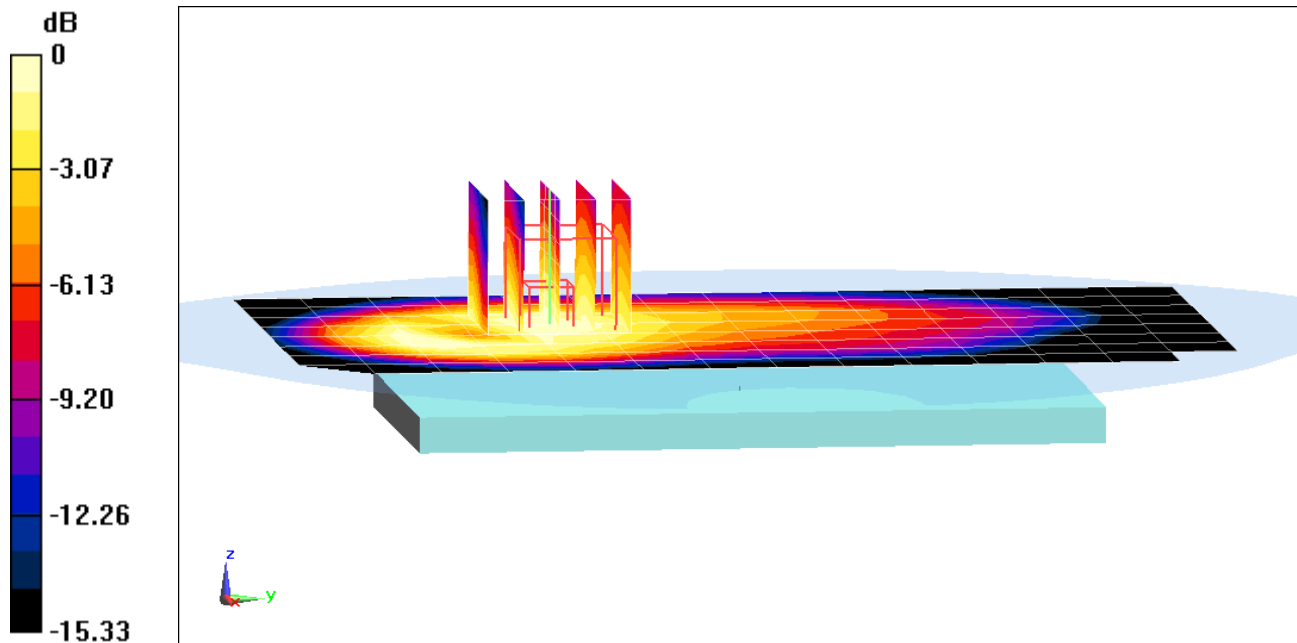
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 21.07 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.611 W/kg

SAR(1 g) = 0.425 W/kg



0 dB = 0.541 W/kg = -2.67 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AD2

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.526 \text{ S/m}$; $\epsilon_r = 52.626$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.3°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3319; ConvF(4.7, 4.7, 4.7); Calibrated: 3/18/2016;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/14/2016

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

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

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

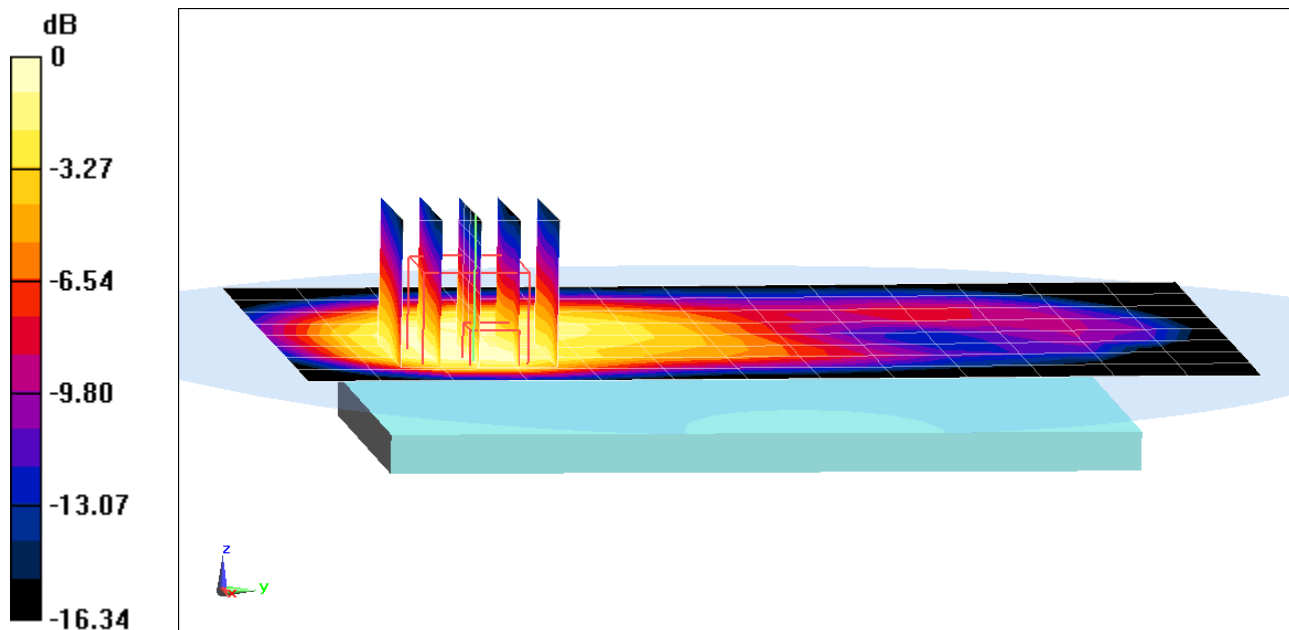
Area Scan (9x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 11.94 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.488 W/kg

SAR(1 g) = 0.255 W/kg



0 dB = 0.327 W/kg = -4.85 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AD2

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

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.526 \text{ S/m}$; $\epsilon_r = 52.626$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.3°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3319; ConvF(4.7, 4.7, 4.7); Calibrated: 3/18/2016;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/14/2016

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

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

Mode: UMTS 1900, Body SAR, Bottom Edge, Mid.ch

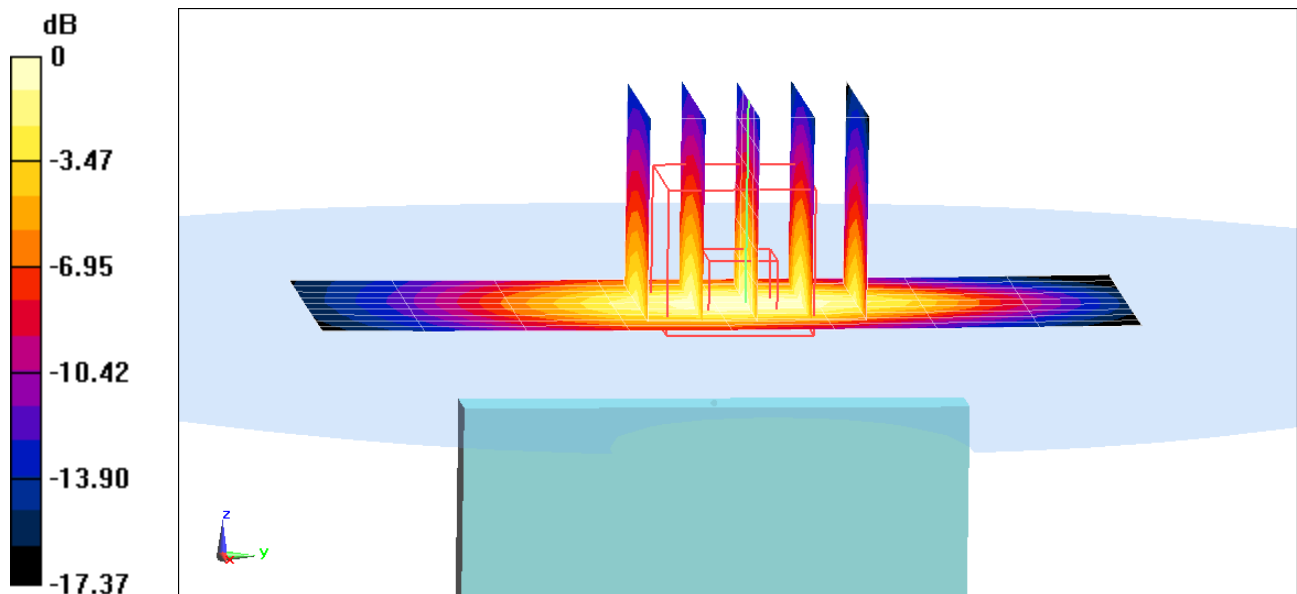
Area Scan (10x9x1): Measurement grid: $dx=5\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 19.32 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.822 W/kg

SAR(1 g) = 0.494 W/kg



0 dB = 0.609 W/kg = -2.15 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AD2

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

Medium: 750 Body Medium parameters used (interpolated):

$f = 707.5 \text{ MHz}$; $\sigma = 0.935 \text{ S/m}$; $\epsilon_r = 55.105$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.8°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3334; ConvF(6.37, 6.37, 6.37); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

**Mode: LTE Band 12, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

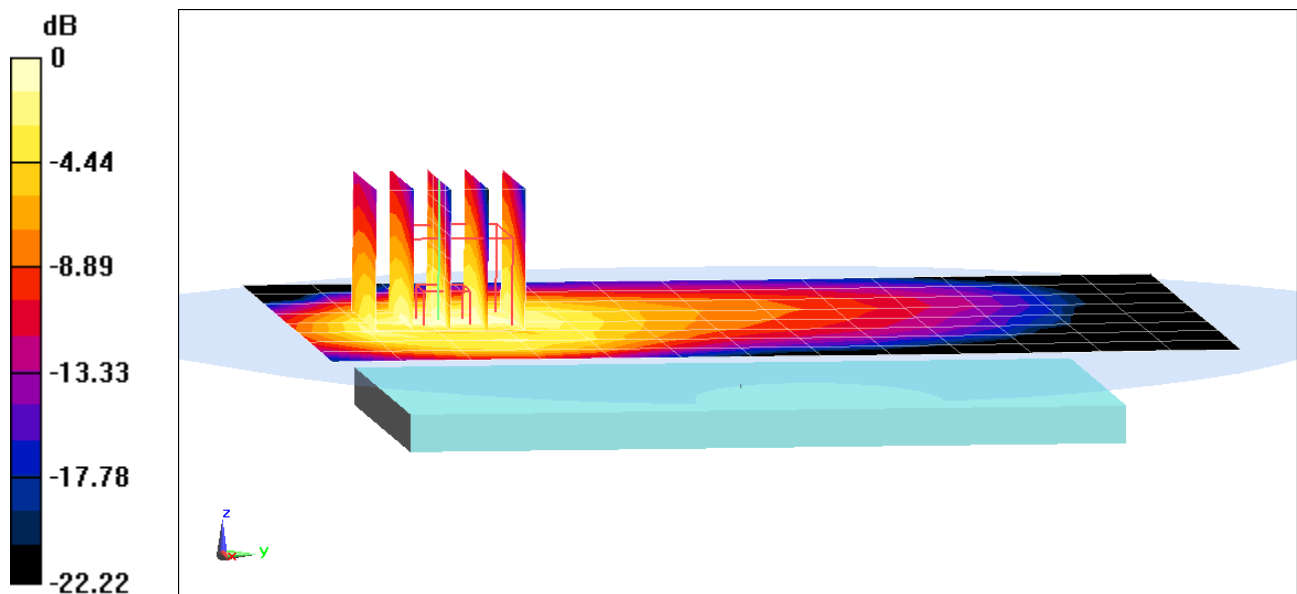
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 10.79 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.173 W/kg

SAR(1 g) = 0.098 W/kg



0 dB = 0.117 W/kg = -9.32 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AD2

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

Medium: 750 Body Medium parameters used (interpolated):

$f = 707.5 \text{ MHz}$; $\sigma = 0.935 \text{ S/m}$; $\epsilon_r = 55.105$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.8°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3334; ConvF(6.37, 6.37, 6.37); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

**Mode: LTE Band 12, Body SAR, Front side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

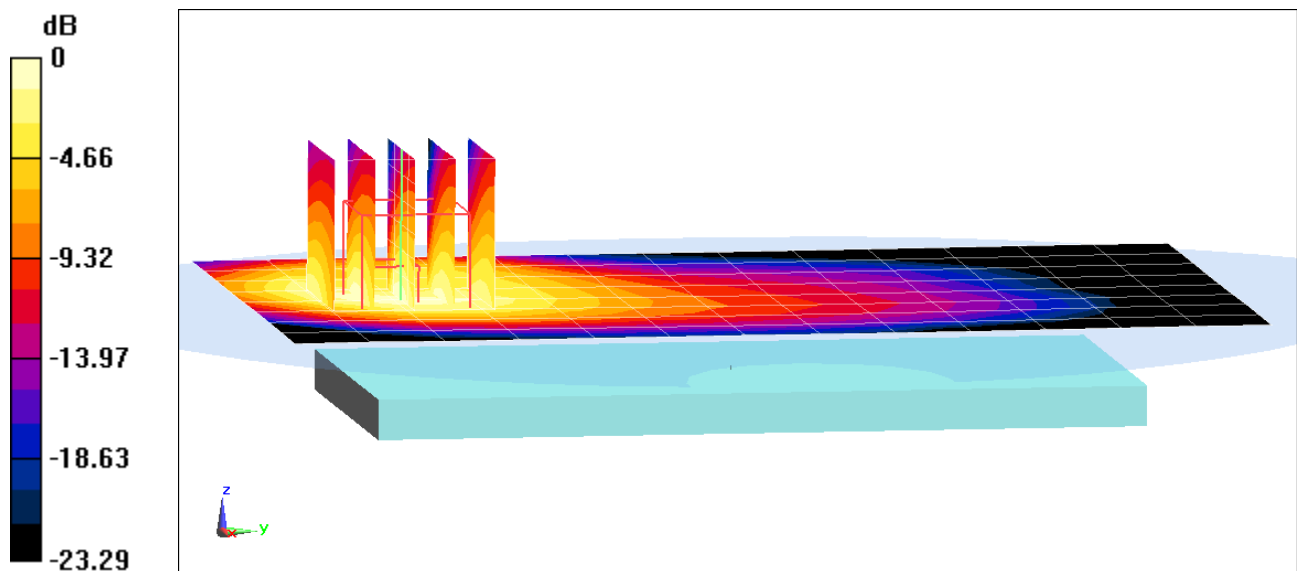
Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 12.30 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.248 W/kg

SAR(1 g) = 0.131 W/kg



0 dB = 0.154 W/kg = -8.12 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8485A

Communication System: UID 0, LTE Band 26; Frequency: 831.5 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 831.5 \text{ MHz}$; $\sigma = 1.011 \text{ S/m}$; $\epsilon_r = 54.434$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2016; Ambient Temp: 23.2°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7406; ConvF(9.35, 9.35, 9.35); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

**Mode: LTE Band 26 (Cell.), Body SAR, Back side, Mid.ch,
15 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

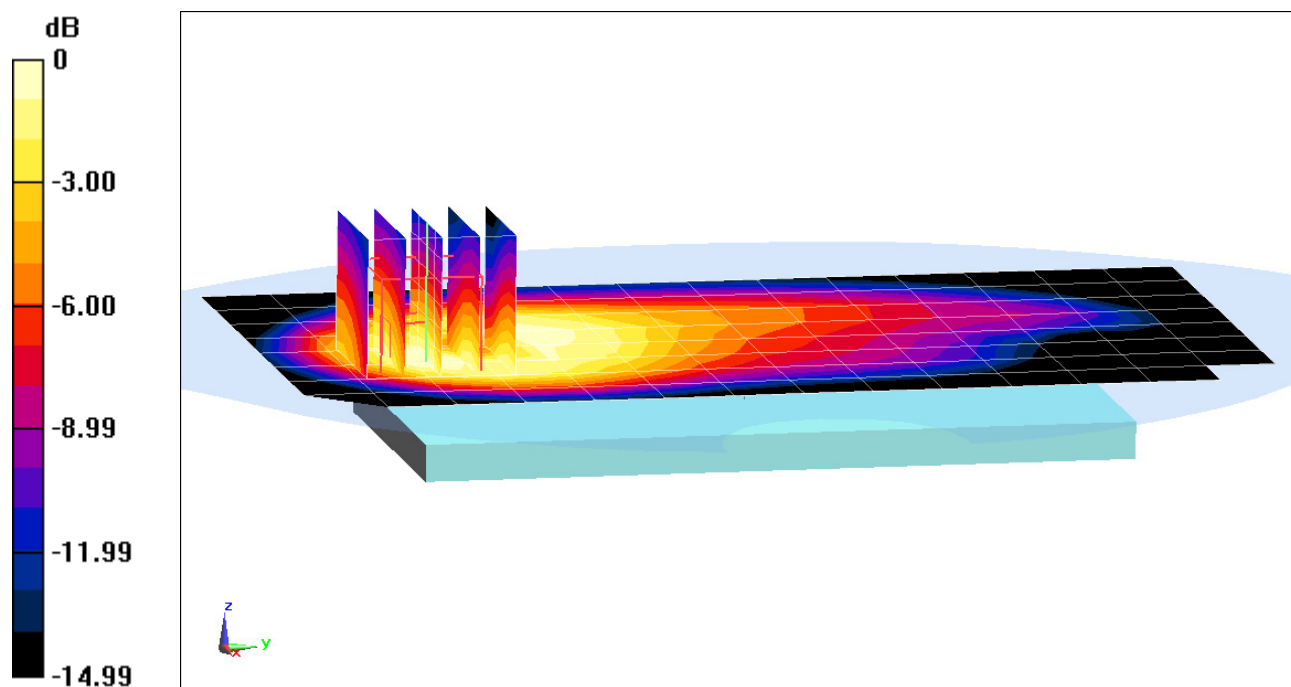
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 22.87 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.827 W/kg

SAR(1 g) = 0.491 W/kg



0 dB = 0.693 W/kg = -1.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8485A

Communication System: UID 0, LTE Band 26; Frequency: 831.5 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 831.5$ MHz; $\sigma = 1.011$ S/m; $\epsilon_r = 54.434$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2016; Ambient Temp: 23.2°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7406; ConvF(9.35, 9.35, 9.35); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

**Mode: LTE Band 26 (Cell.), Body SAR, Front side, Mid.ch,
15 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

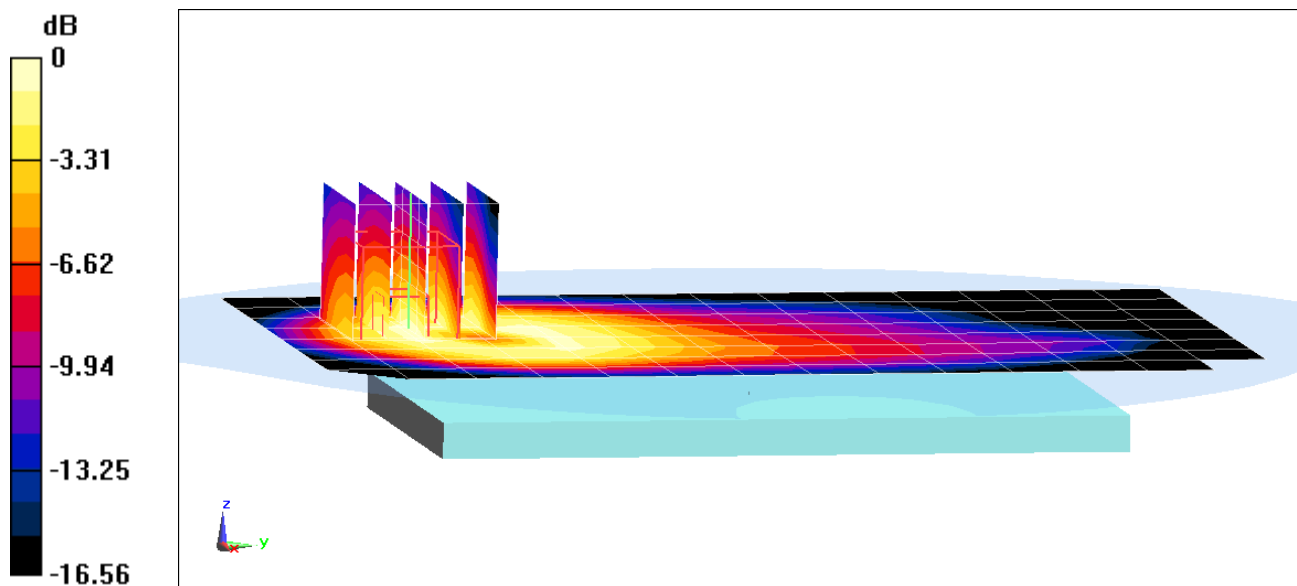
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 24.52 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.969 W/kg

SAR(1 g) = 0.561 W/kg



0 dB = 0.812 W/kg = -0.90 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8485A

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; $\sigma = 1.016$ S/m; $\epsilon_r = 54.38$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2016; Ambient Temp: 23.2°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7406; ConvF(9.35, 9.35, 9.35); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

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

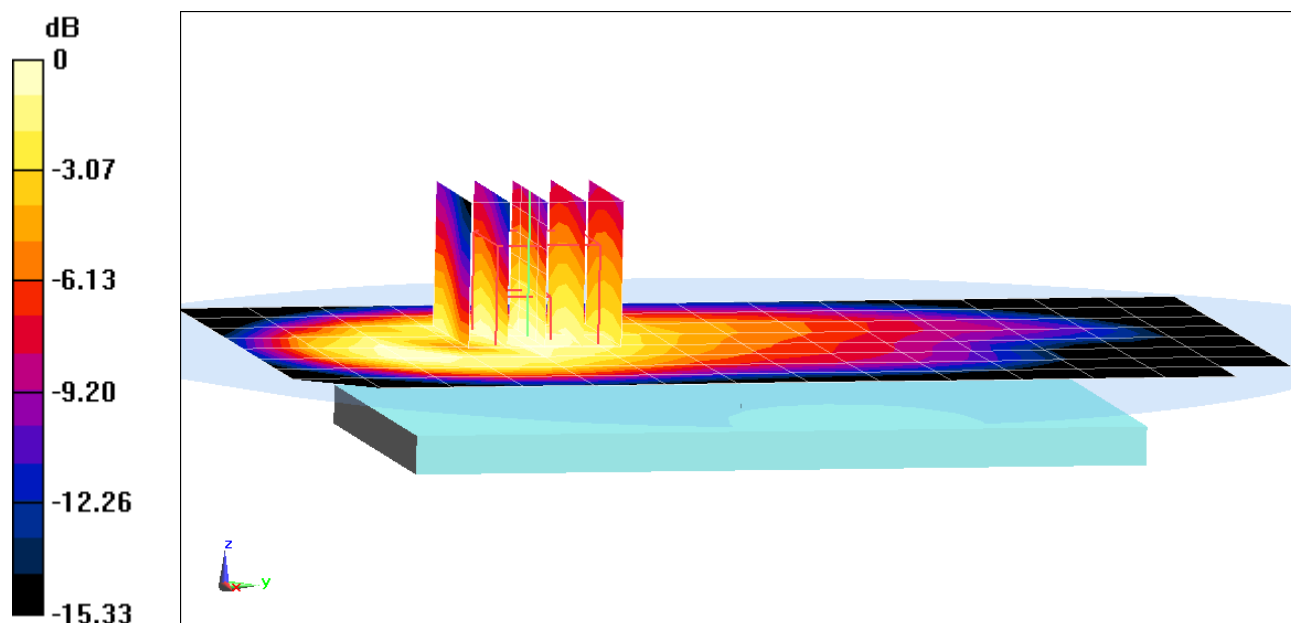
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 24.36 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.830 W/kg

SAR(1 g) = 0.574 W/kg



0 dB = 0.729 W/kg = -1.37 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8485A

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.5$ MHz; $\sigma = 1.016$ S/m; $\epsilon_r = 54.38$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2016; Ambient Temp: 23.2°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7406; ConvF(9.35, 9.35, 9.35); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

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

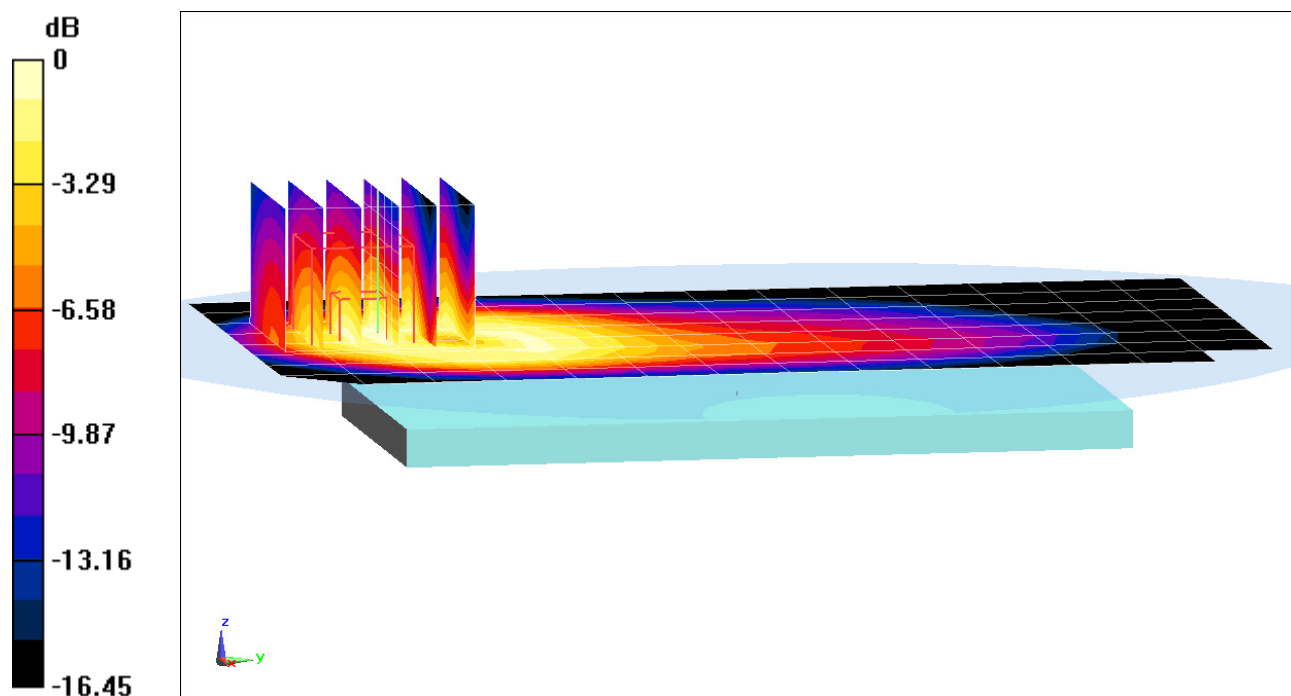
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 25.39 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.11 W/kg

SAR(1 g) = 0.635 W/kg



0 dB = 0.899 W/kg = -0.46 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AA2

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

Medium: 1750 Body Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$; $\sigma = 1.487 \text{ S/m}$; $\epsilon_r = 51.918$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 21.3°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7406; ConvF(7.78, 7.78, 7.78); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

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

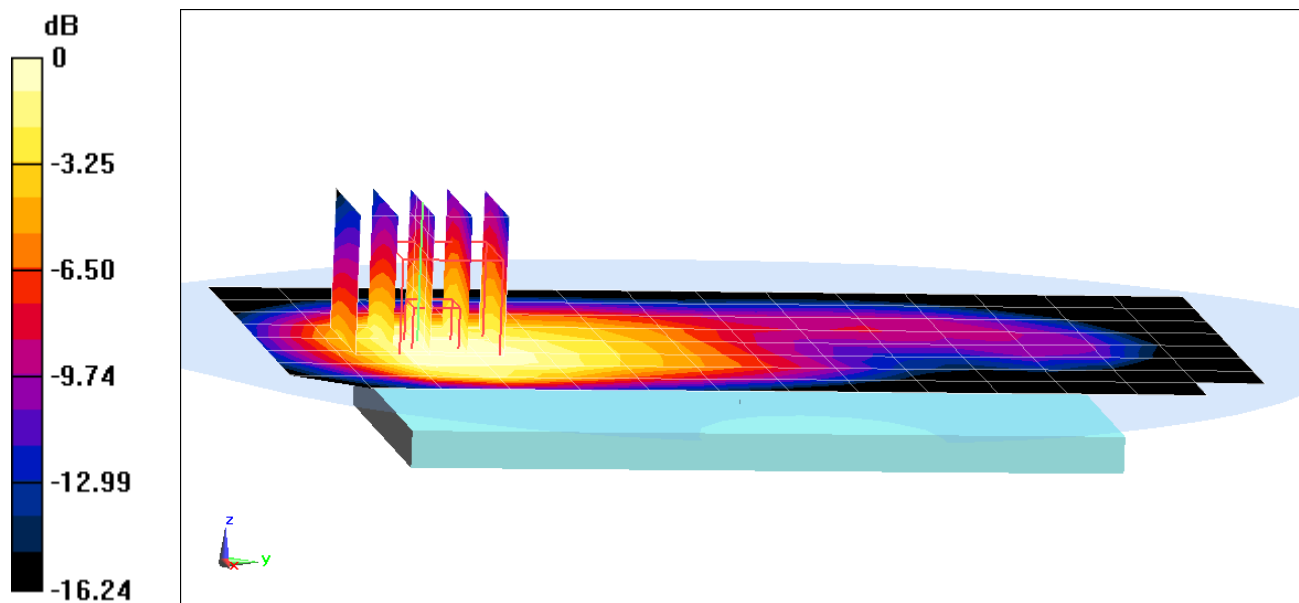
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 16.46 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.588 W/kg

SAR(1 g) = 0.380 W/kg



0 dB = 0.512 W/kg = -2.91 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 05AA2

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

Medium: 1750 Body Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$; $\sigma = 1.487 \text{ S/m}$; $\epsilon_r = 51.918$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 21.3°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7406; ConvF(7.78, 7.78, 7.78); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

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

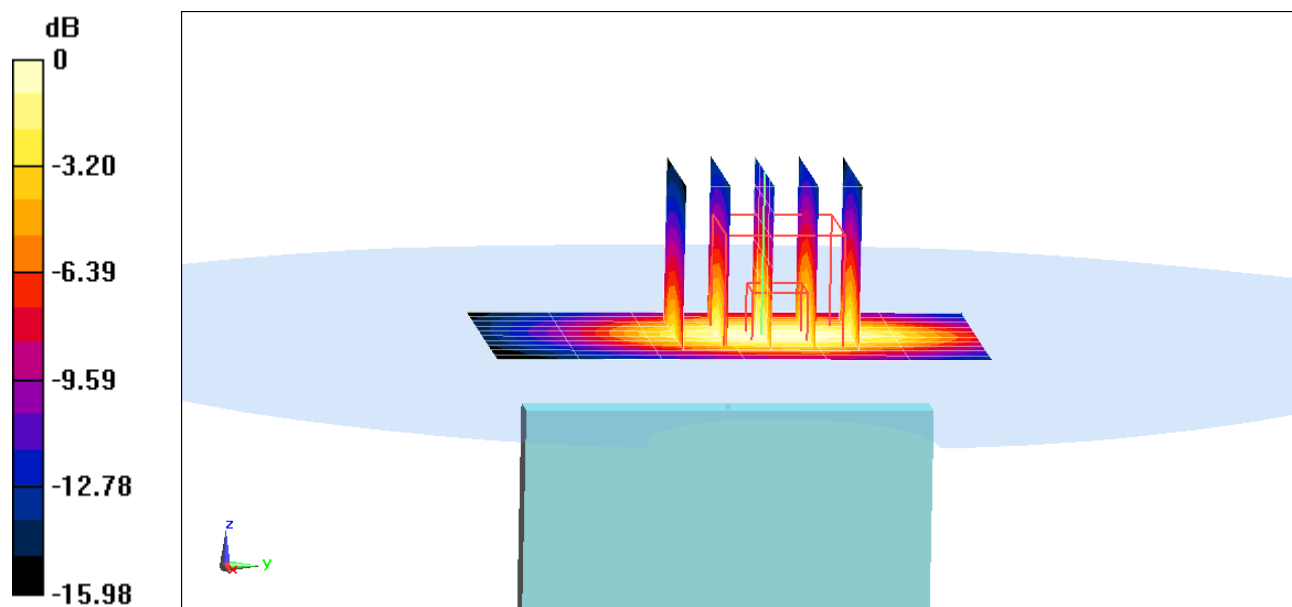
Area Scan (11x7x1): Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 21.73 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 1.09 W/kg

SAR(1 g) = 0.642 W/kg



0 dB = 0.928 W/kg = -0.32 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8433D

Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1882.5 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1882.5 \text{ MHz}$; $\sigma = 1.529 \text{ S/m}$; $\epsilon_r = 52.618$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.3°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3319; ConvF(4.7, 4.7, 4.7); Calibrated: 3/18/2016;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/14/2016

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

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

**Mode: LTE Band 25 (PCS), Body SAR, Back side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

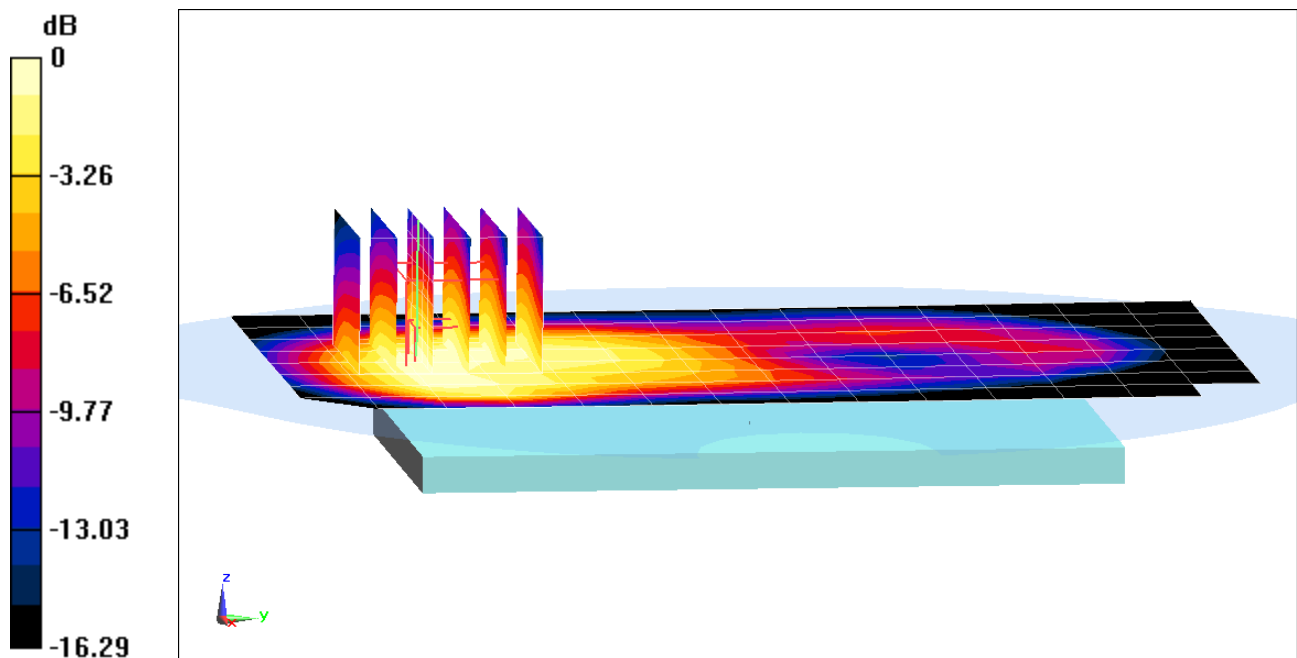
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 16.24 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.581 W/kg

SAR(1 g) = 0.372 W/kg



0 dB = 0.434 W/kg = -3.63 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 8433D

Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1860 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1860 \text{ MHz}$; $\sigma = 1.505 \text{ S/m}$; $\epsilon_r = 52.676$; $\rho = 1000 \text{ kg/m}^3$,

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.3°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3319; ConvF(4.7, 4.7, 4.7); Calibrated: 3/18/2016;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/14/2016

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

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

**Mode: LTE Band 25 (PCS), Body SAR, Bottom Edge, Low.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

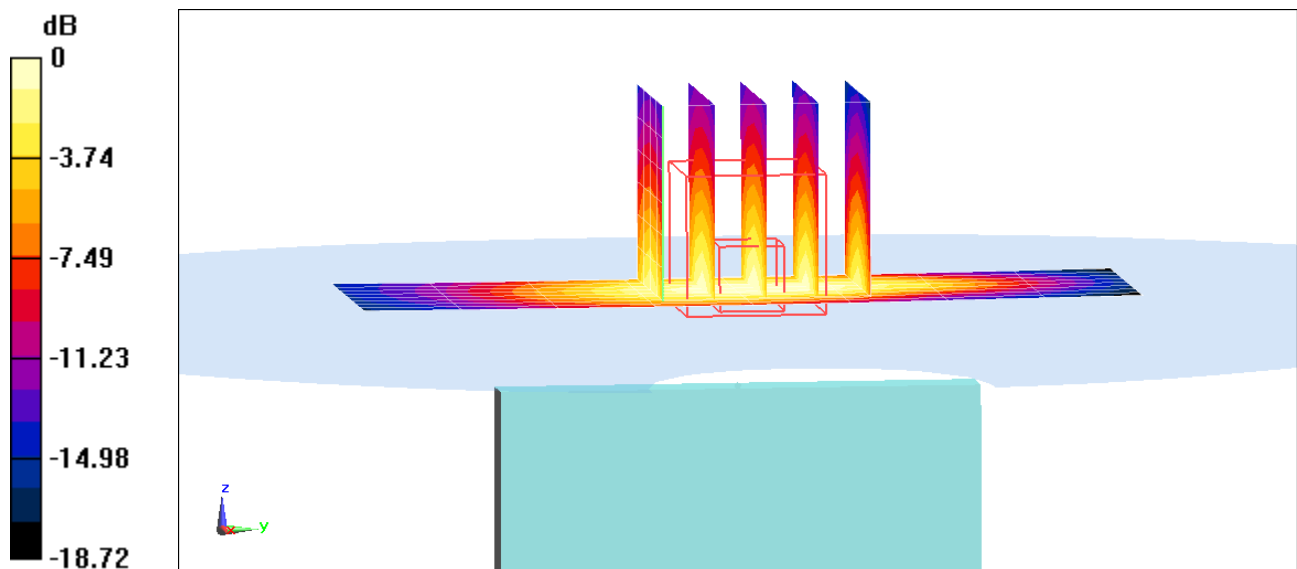
Area Scan (9x9x1): Measurement grid: $dx=5\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 22.96 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.15 W/kg

SAR(1 g) = 0.692 W/kg



0 dB = 0.800 W/kg = -0.97 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 0548E

Communication System: UID 0, LTE Band 41; Frequency: 2680 MHz; Duty Cycle: 1:1.58

Medium: 2600 Body Medium parameters used (interpolated):

$f = 2680$ MHz; $\sigma = 2.325$ S/m; $\epsilon_r = 50.529$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-01-2016; Ambient Temp: 22.0°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3334; ConvF(4.29, 4.29, 4.29); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

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

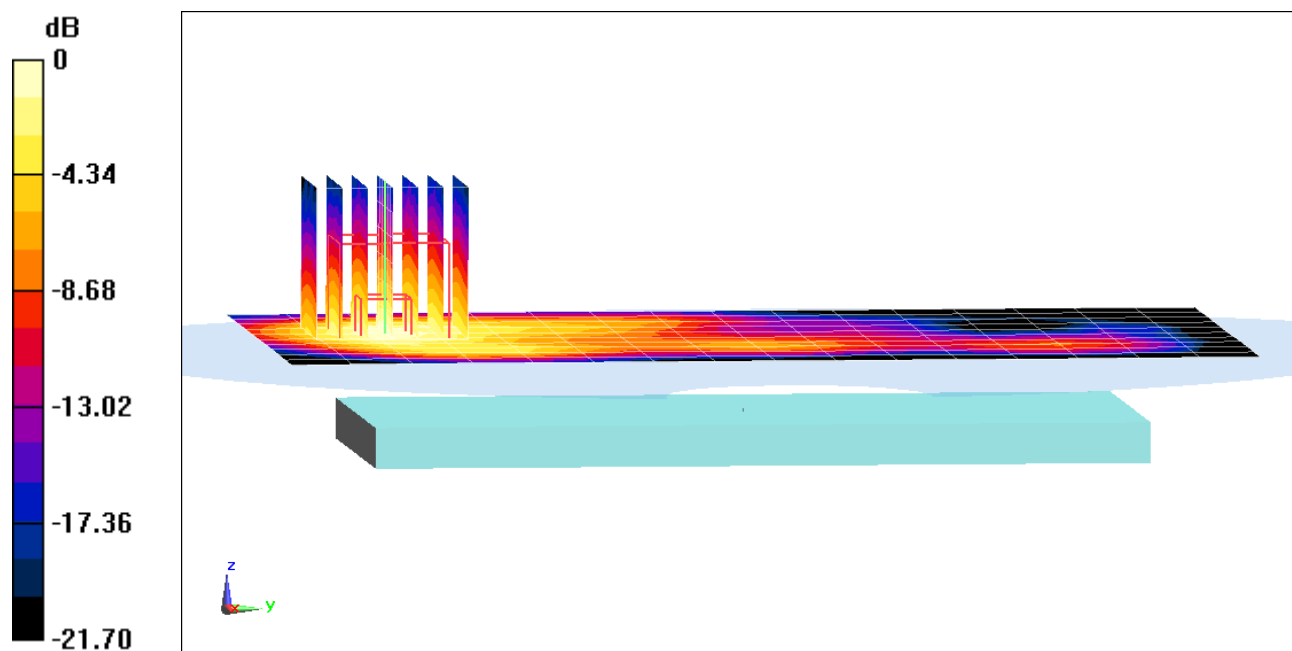
Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm

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

Reference Value = 12.08 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.592 W/kg

SAR(1 g) = 0.300 W/kg



0 dB = 0.380 W/kg = -4.20 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 0548E

Communication System: UID 0, LTE Band 41; Frequency: 2593 MHz; Duty Cycle: 1:1.58

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

$f = 2593 \text{ MHz}$; $\sigma = 2.207 \text{ S/m}$; $\epsilon_r = 50.886$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-01-2016; Ambient Temp: 22.0°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3334; ConvF(4.29, 4.29, 4.29); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

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

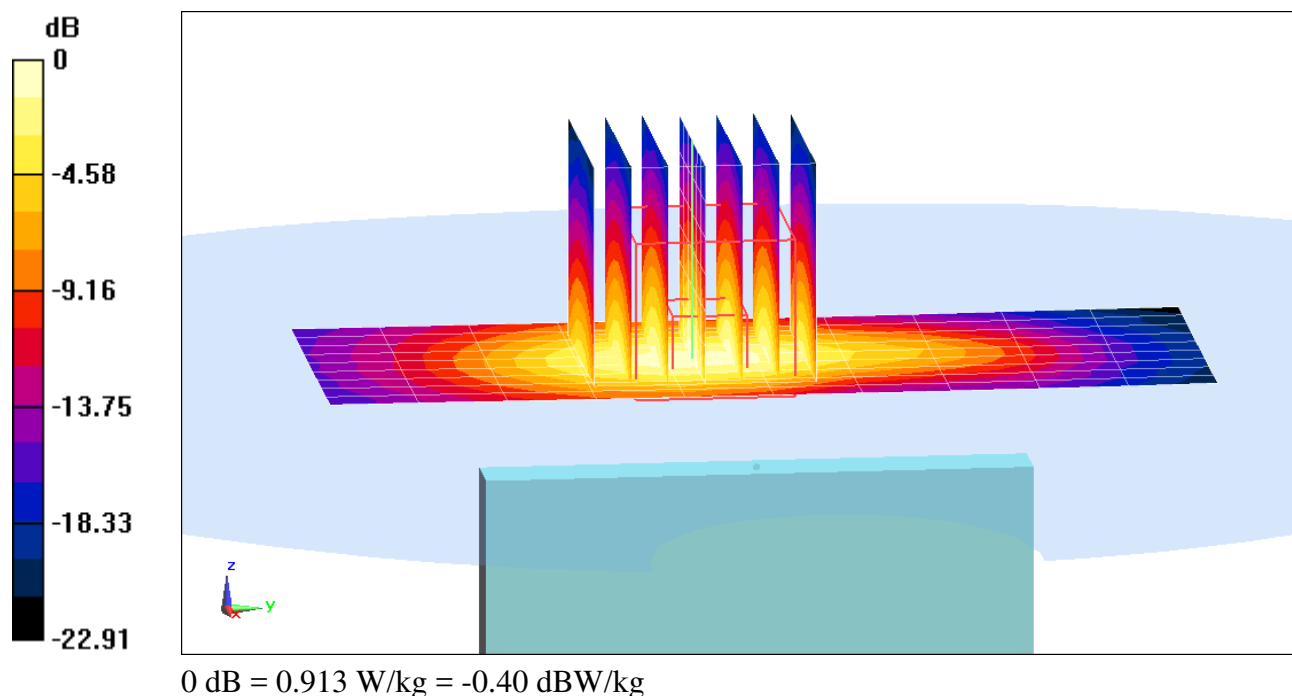
Area Scan (10x11x1): Measurement grid: dx=5mm, dy=12mm

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

Reference Value = 19.43 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 1.43 W/kg

SAR(1 g) = 0.710 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 252AF

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

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$; $\sigma = 1.987 \text{ S/m}$; $\epsilon_r = 51.106$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-04-2016; Ambient Temp: 23.0°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3334; ConvF(4.45, 4.45, 4.45); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

**Mode: IEEE 802.11b, 22 MHz Bandwidth, Body SAR,
Ch 06, 1 Mbps, Back Side, Antenna 1**

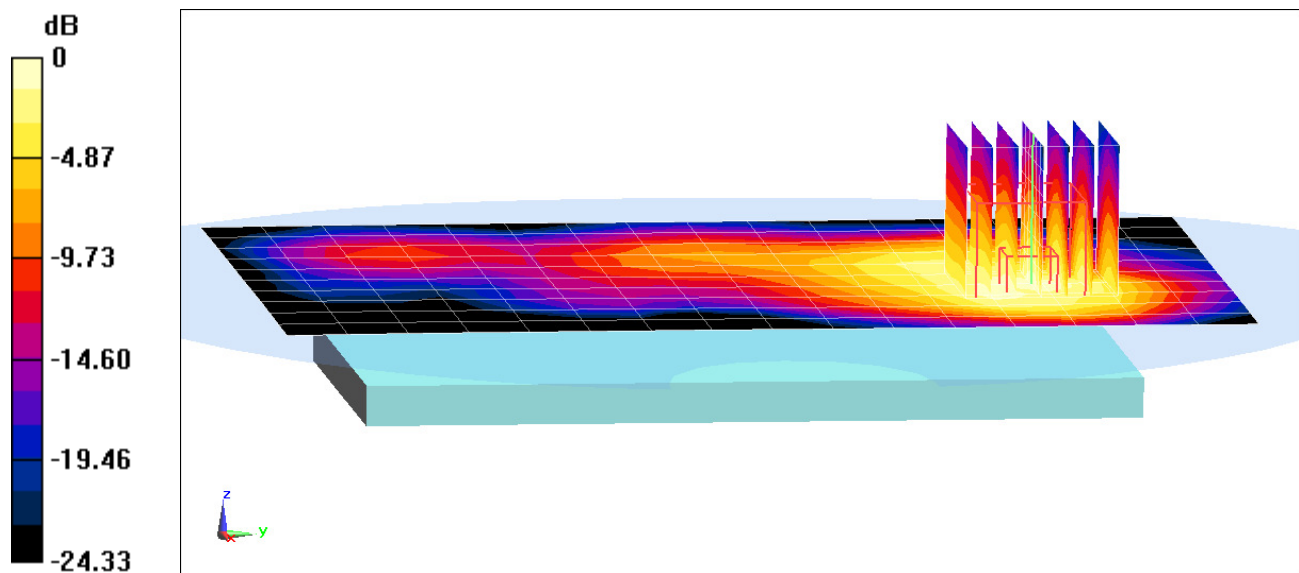
Area Scan (11x17x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Reference Value = 16.66 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.927 W/kg

SAR(1 g) = 0.482 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 252AE

Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5745 \text{ MHz}$; $\sigma = 6.182 \text{ S/m}$; $\epsilon_r = 46.207$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-13-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(3.86, 3.86, 3.86); Calibrated: 2/22/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/18/2016

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

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

**Mode: IEEE 802.11a, UNII-3, 20 MHz Bandwidth, Body SAR,
Ch 149, 6 Mbps, Back Side, Antenna 2**

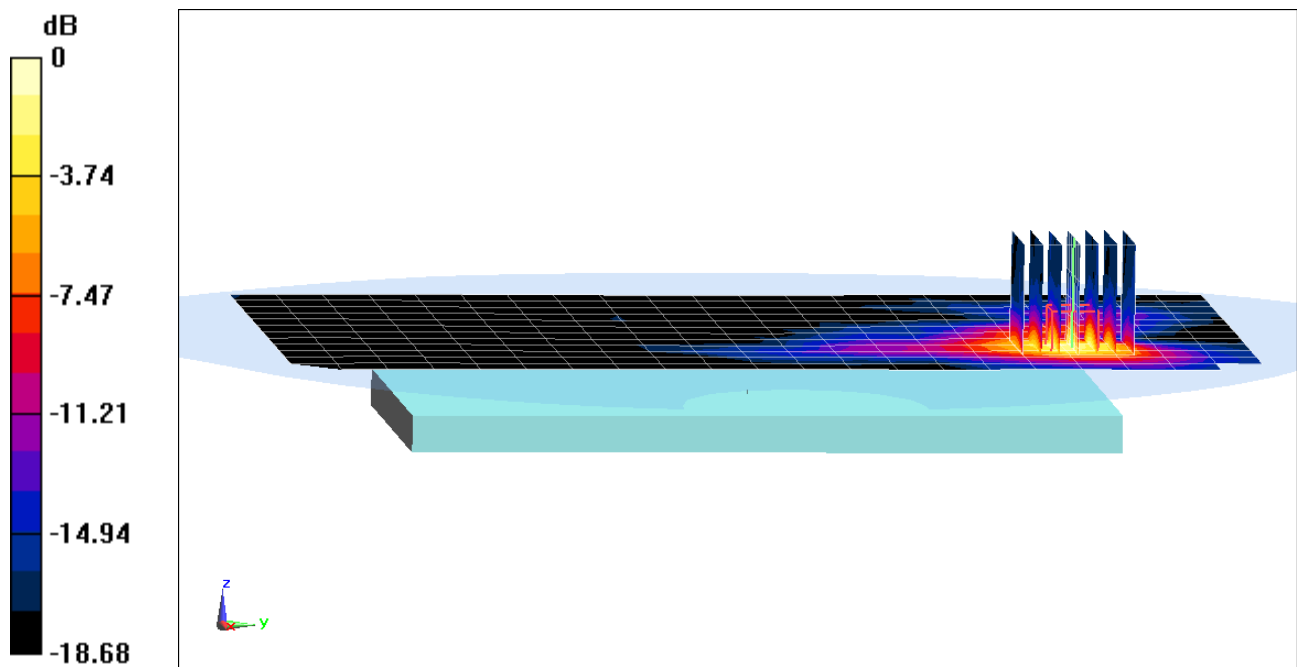
Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm

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

Reference Value = 8.230 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 1.73 W/kg

SAR(1 g) = 0.432 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN930KOR; Type: Portable Handset; Serial: 252AE

Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 5.841 \text{ S/m}$; $\epsilon_r = 46.683$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-13-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(3.63, 3.63, 3.63); Calibrated: 2/22/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/18/2016

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

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

**Mode: IEEE 802.11a, UNII-2C, 20 MHz Bandwidth, Phablet SAR,
Ch 100, 6 Mbps, Back Side, Antenna 2**

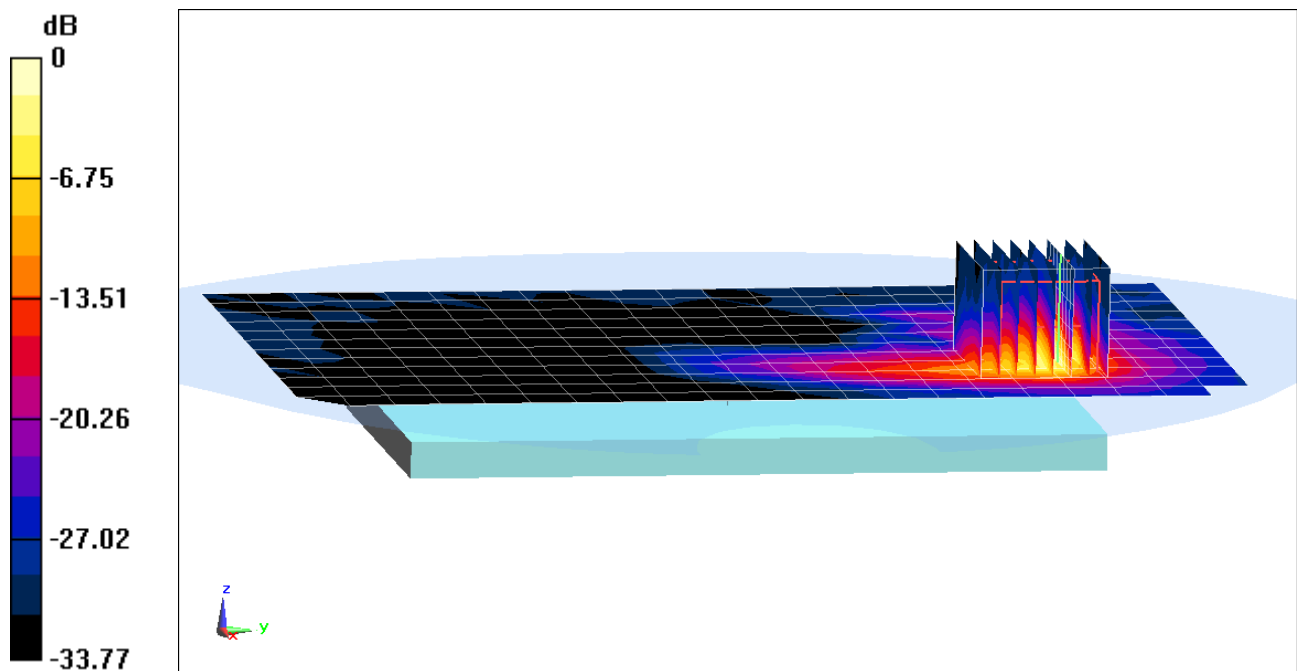
Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 1.732 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 36.2 W/kg

SAR(10 g) = 1.64 W/kg



0 dB = 21.0 W/kg = 13.22 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1046

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

Medium: 750 Head Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.897 \text{ S/m}$; $\epsilon_r = 41.48$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-02-2016; Ambient Temp: 24.0°C; Tissue Temp: 21.7°C

Probe: ES3DV2 - SN3022; ConvF(6.33, 6.33, 6.33); Calibrated: 8/26/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/16/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: TP:7535

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

750 MHz System Verification at 23.0 dBm (200 mW)

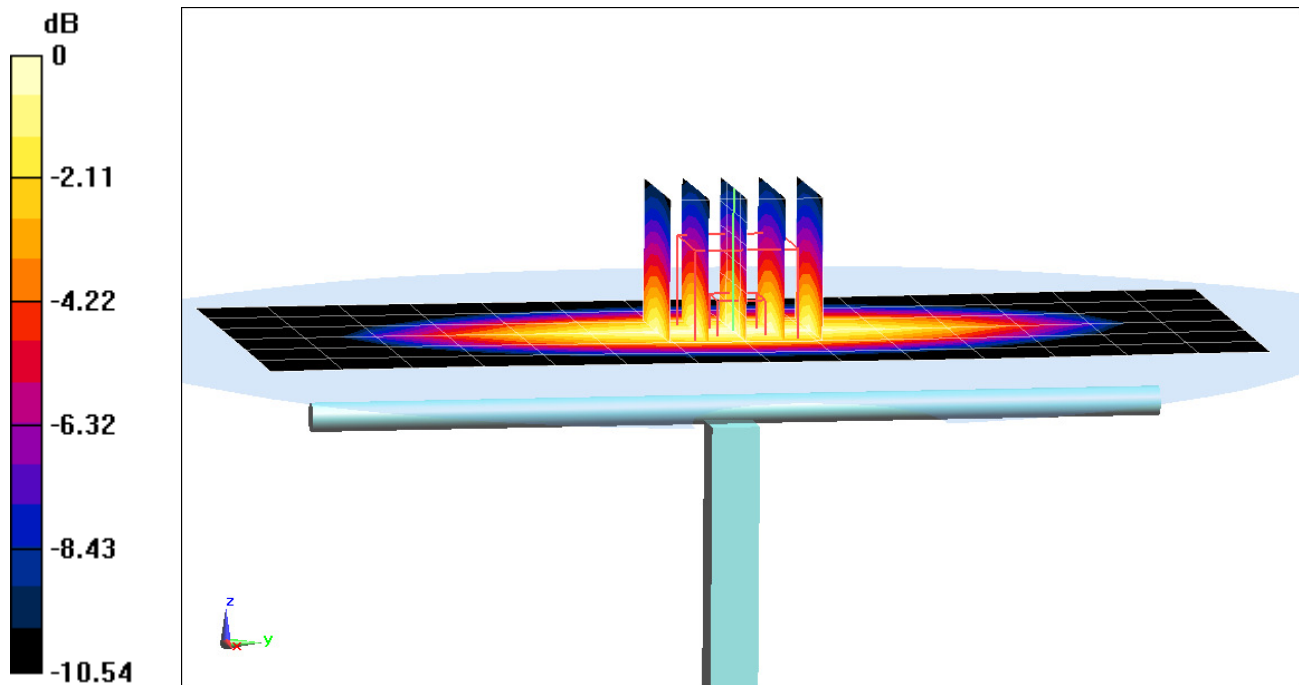
Area Scan (7x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 2.35 W/kg

SAR(1 g) = 1.58 W/kg

Deviation(1 g) = -3.66%



0 dB = 1.85 W/kg = 2.67 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119

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

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.928 \text{ S/m}$; $\epsilon_r = 42.969$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-06-2016; Ambient Temp: 23.4°C; Tissue Temp: 22.9°C

Probe: ES3DV2 - SN3022; ConvF(6.11, 6.11, 6.11); Calibrated: 8/26/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/16/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: TP:7535

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

835 MHz System Verification at 23.0 dBm (200 mW)

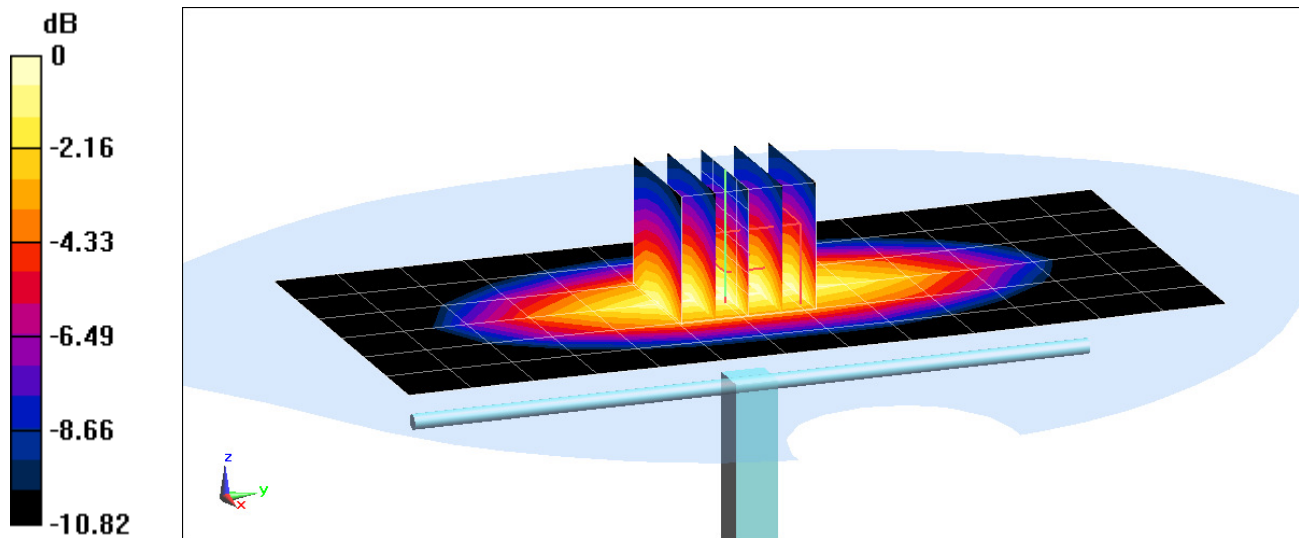
Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 2.61 W/kg

SAR(1 g) = 1.75 W/kg

Deviation(1 g) = -4.27%



0 dB = 2.04 W/kg = 3.10 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119

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

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.907 \text{ S/m}$; $\epsilon_r = 42.814$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-30-2016; Ambient Temp: 22.8°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3333; ConvF(6.16, 6.16, 6.16); Calibrated: 10/29/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/27/2015

Phantom: SAM Front; Type: QD000P40CD; Serial: TP:1758

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

835 MHz System Verification at 23.0 dBm (200 mW)

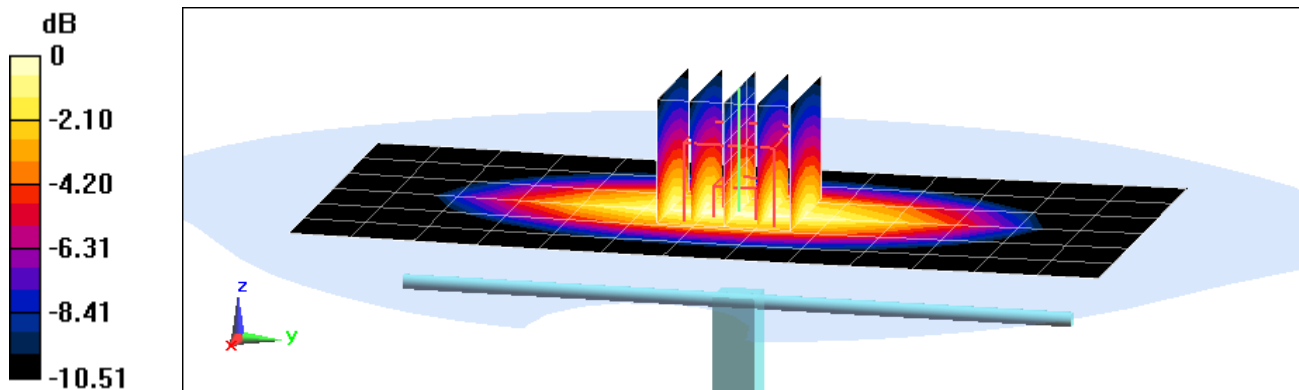
Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 2.66 W/kg

SAR(1 g) = 1.78 W/kg

Deviation(1 g) = -2.63%



0 dB = 2.08 W/kg = 3.18 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 Head Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.359 \text{ S/m}$; $\epsilon_r = 39.049$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 23.2°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN7406; ConvF(8.85, 8.85, 8.85); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

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

1750 MHz System Verification at 20.0 dBm (100 mW)

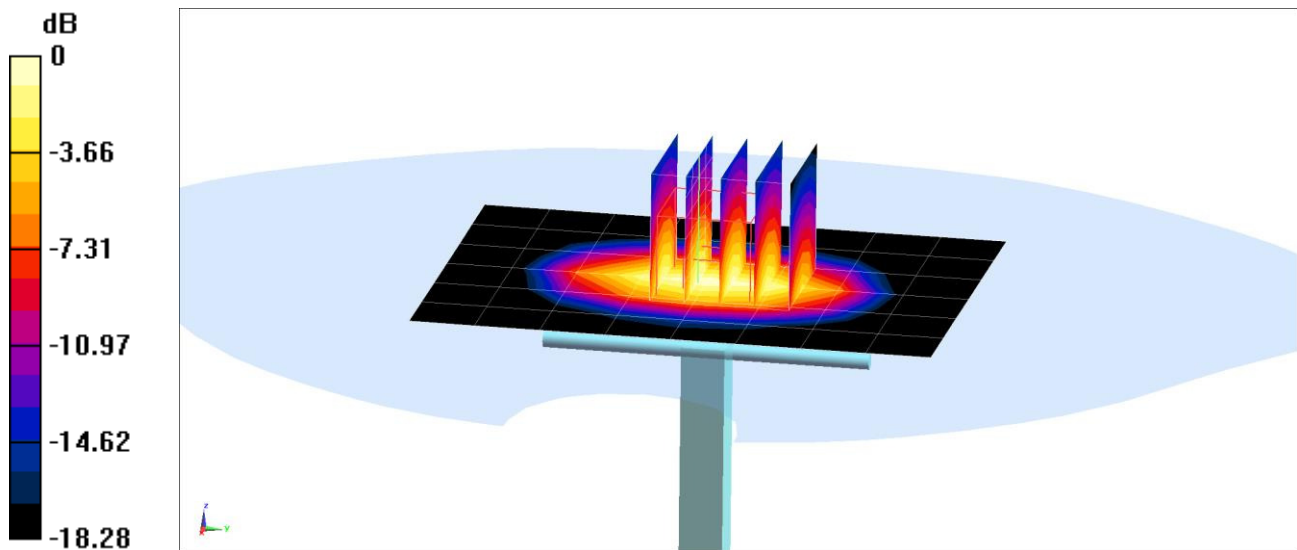
Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

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

Peak SAR (extrapolated) = 6.13 W/kg

SAR(1 g) = 3.40 W/kg

Deviation(1 g) = -7.36%



0 dB = 4.25 W/kg = 6.28 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.423 \text{ S/m}$; $\epsilon_r = 39.03$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-03-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1333; Calibrated: 10/27/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: 1757

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

1900 MHz System Verification at 20.0 dBm (100 mW)

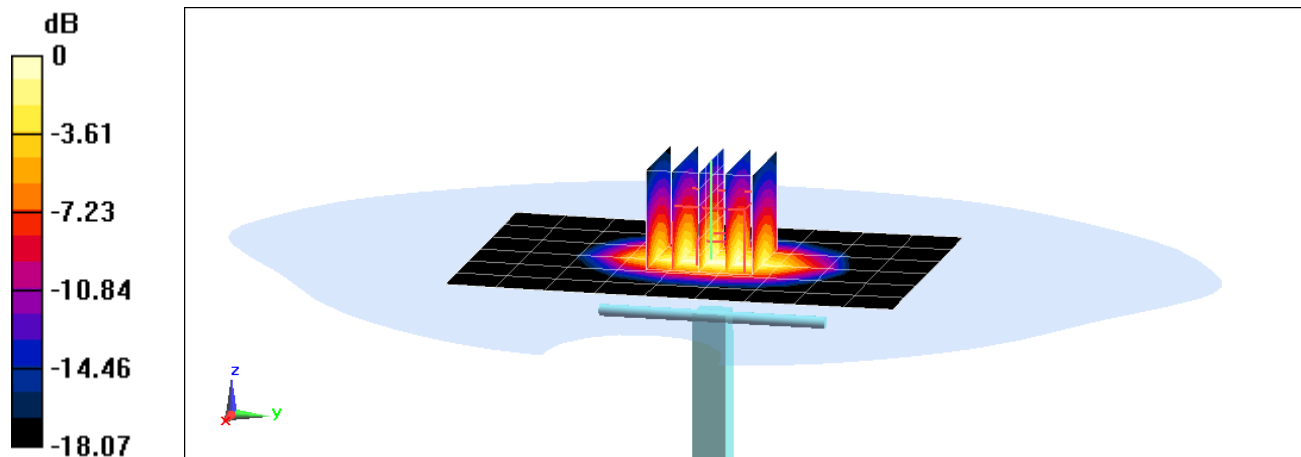
Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

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

Peak SAR (extrapolated) = 7.53 W/kg

SAR(1 g) = 4.15 W/kg

Deviation(1 g) = 7.79%



0 dB = 5.26 W/kg = 7.21 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:

$f = 2450 \text{ MHz}$; $\sigma = 1.857 \text{ S/m}$; $\epsilon_r = 39.758$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-13-2016; Ambient Temp: 22.4°C; Tissue Temp: 23.4°C

Probe: ES3DV2 - SN3022; ConvF(4.3, 4.3, 4.3); Calibrated: 8/26/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/16/2015

Phantom: SAM Right; Type: QD000P40CD; Serial: TP:7535

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

2450 MHz System Verification at 20.0 dBm (100 mW)

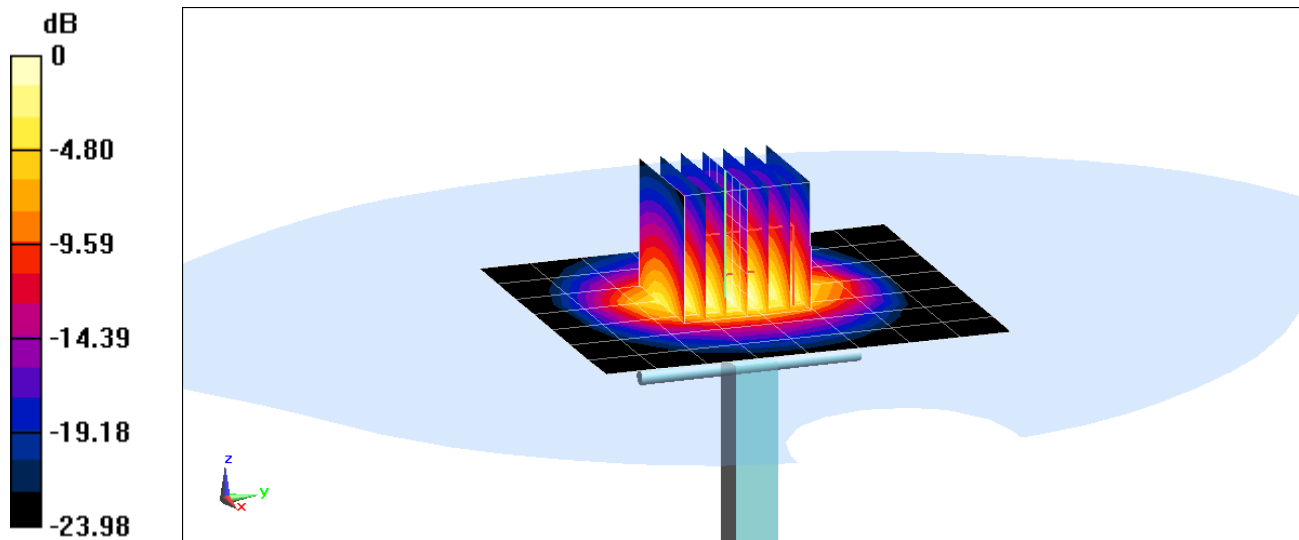
Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

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

Peak SAR (extrapolated) = 11.5 W/kg

SAR(1 g) = 5.32 W/kg

Deviation(1 g) = -1.85%



0 dB = 7.00 W/kg = 8.45 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1004

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: 2600 Head Medium parameters used:

$f = 2600 \text{ MHz}$; $\sigma = 2.04 \text{ S/m}$; $\epsilon_r = 39.88$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-03-2016; Ambient Temp: 24.0°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(4.12, 4.12, 4.12); Calibrated: 8/26/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/16/2015

Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375

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

2600 MHz System Verification at 20.0 dBm (100 mW)

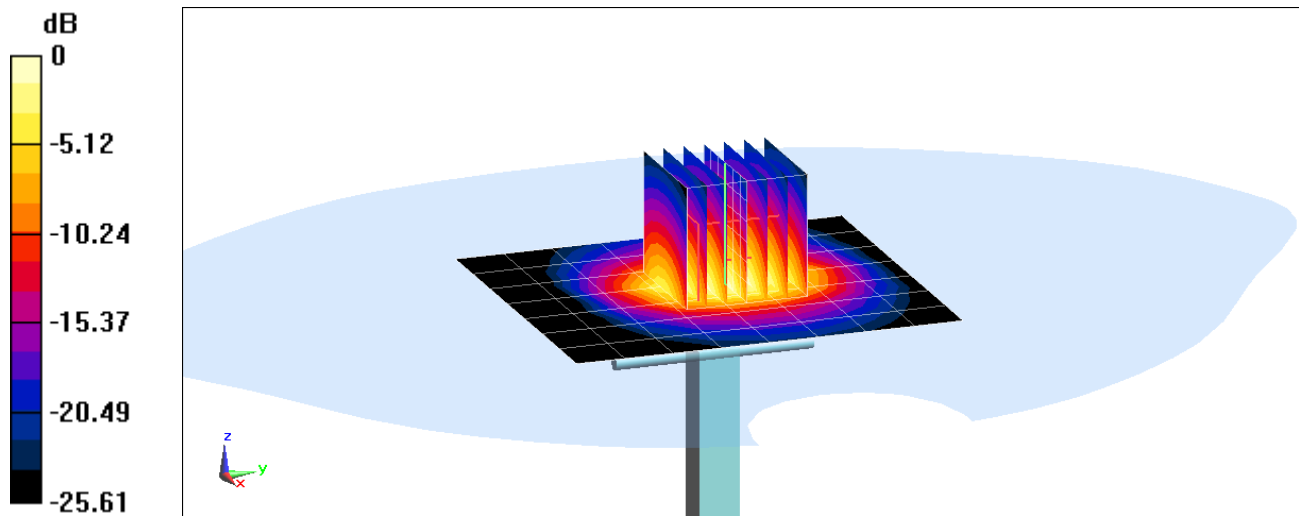
Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

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

Peak SAR (extrapolated) = 13.1 W/kg

SAR(1 g) = 5.84 W/kg

Deviation(1 g) = 4.85%



0 dB = 7.70 W/kg = 8.86 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: 5 GHz Head Medium parameters used (interpolated):

$f = 5250 \text{ MHz}$; $\sigma = 4.658 \text{ S/m}$; $\epsilon_r = 35.155$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-13-2016; Ambient Temp: 20.4°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7357; ConvF(5.1, 5.1, 5.1); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/19/2016

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

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

5250 MHz System Verification at 17.0 dBm (50 mW)

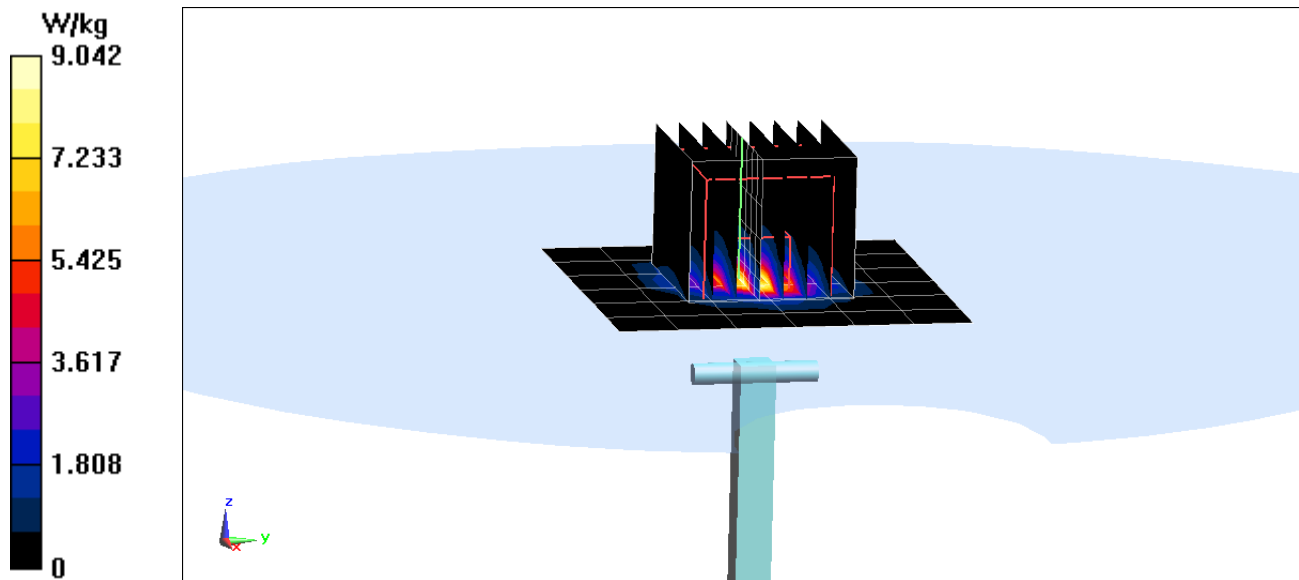
Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Peak SAR (extrapolated) = 15.8 W/kg

SAR(1 g) = 3.88 W/kg

Deviation(1 g) = -5.94%



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: 5 GHz Head Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 4.999 \text{ S/m}$; $\epsilon_r = 34.662$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-13-2016; Ambient Temp: 20.4°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7357; ConvF(4.41, 4.41, 4.41); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/19/2016

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

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

5600 MHz System Verification at 17.0 dBm (50 mW)

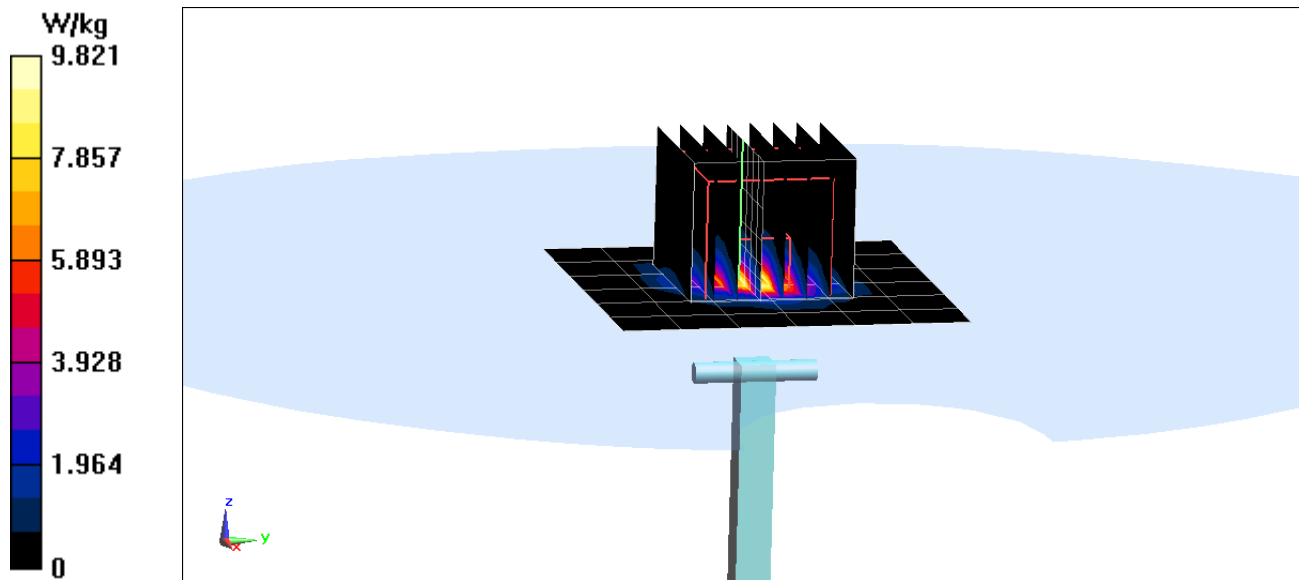
Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Peak SAR (extrapolated) = 17.1 W/kg

SAR(1 g) = 4.11 W/kg

Deviation(1 g) = -2.72%



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: 5 GHz Head Medium parameters used (interpolated):

$f = 5750 \text{ MHz}$; $\sigma = 5.177 \text{ S/m}$; $\epsilon_r = 34.426$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-13-2016; Ambient Temp: 20.4°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7357; ConvF(4.65, 4.65, 4.65); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/19/2016

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

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

5750 MHz System Verification at 17.0 dBm (50 mW)

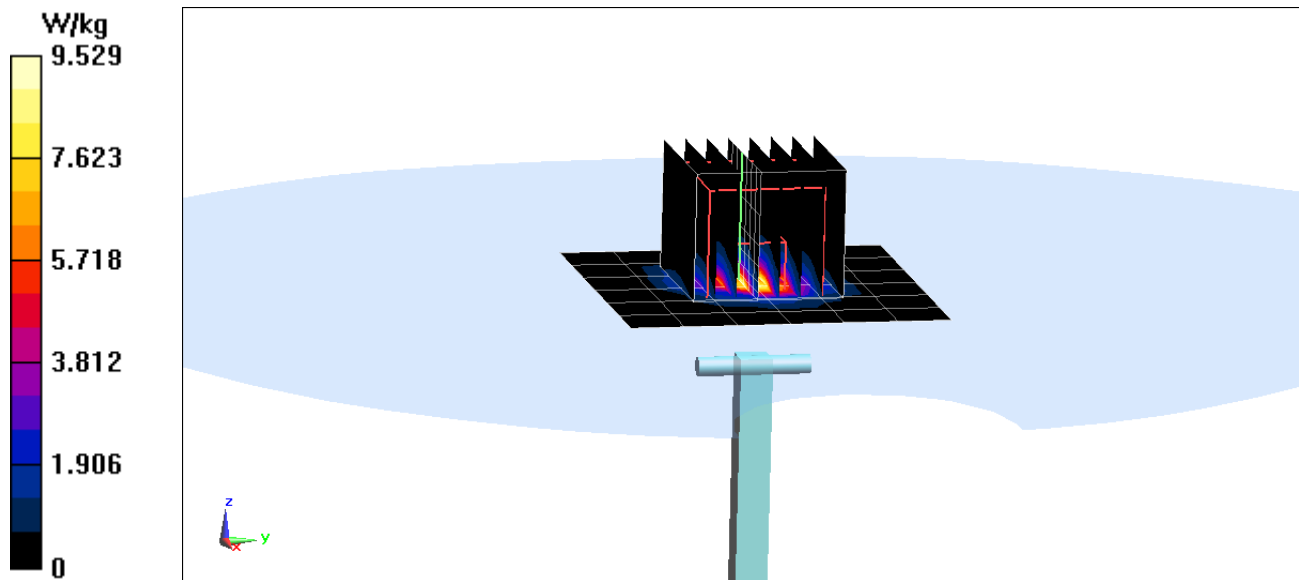
Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 3.94 W/kg

Deviation(1 g) = -1.50%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1054

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

Medium: 750 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.975 \text{ S/m}$; $\epsilon_r = 54.677$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-06-2016; Ambient Temp: 22.8°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3334; ConvF(6.37, 6.37, 6.37); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

750 MHz System Verification at 23.0 dBm (200 mW)

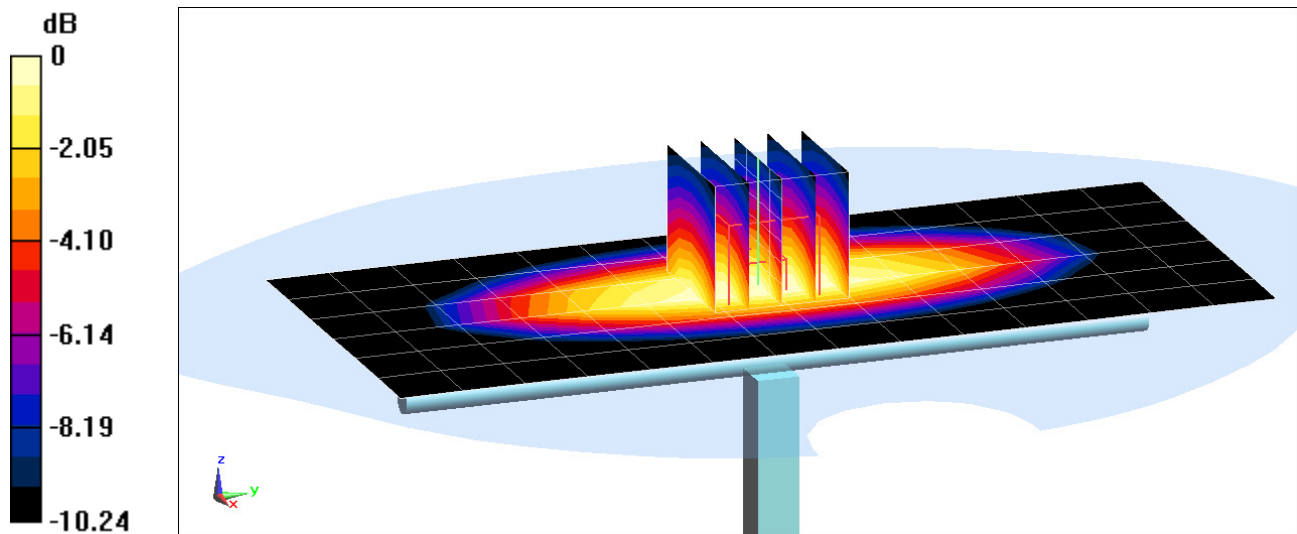
Area Scan (7x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 2.52 W/kg

SAR(1 g) = 1.71 W/kg

Deviation(1 g) = -0.12%



0 dB = 2.01 W/kg = 3.03 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119

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

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 1.014 \text{ S/m}$; $\epsilon_r = 54.395$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-29-2016; Ambient Temp: 23.2°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7406; ConvF(9.35, 9.35, 9.35); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

835 MHz System Verification at 23.0 dBm (200 mW)

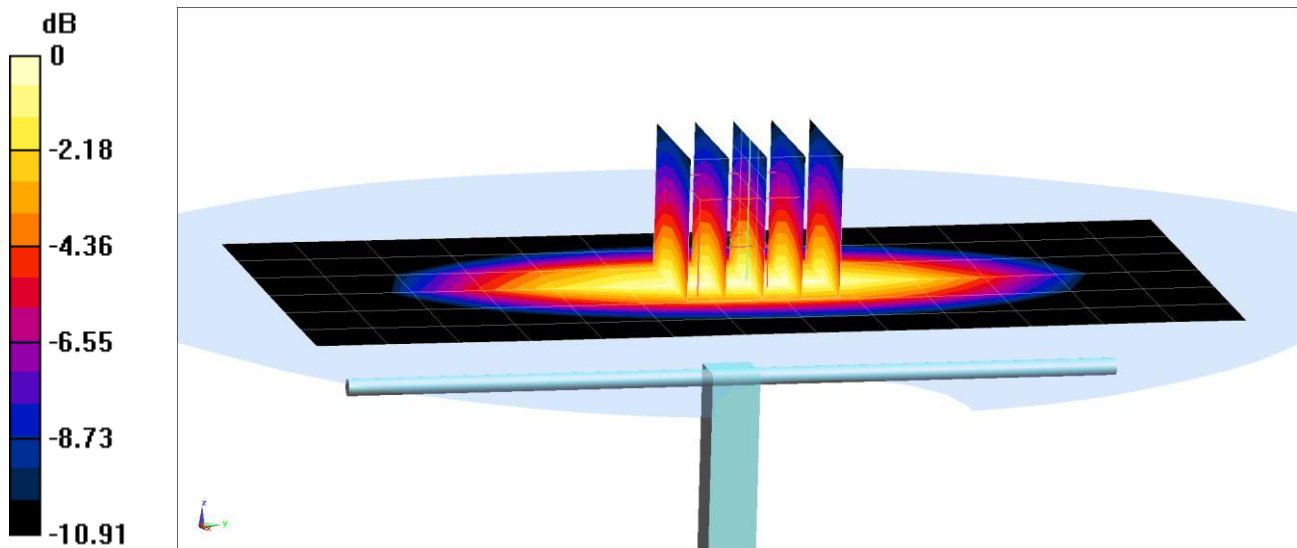
Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 2.85 W/kg

SAR(1 g) = 1.83 W/kg

Deviation(1 g) = 0.11%



0 dB = 2.49 W/kg = 3.96 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 1750 Body Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.507 \text{ S/m}$; $\epsilon_r = 51.834$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 21.3°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7406; ConvF(7.78, 7.78, 7.78); Calibrated: 4/19/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/14/2016

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

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

1750 MHz System Verification at 20.0 dBm (100 mW)

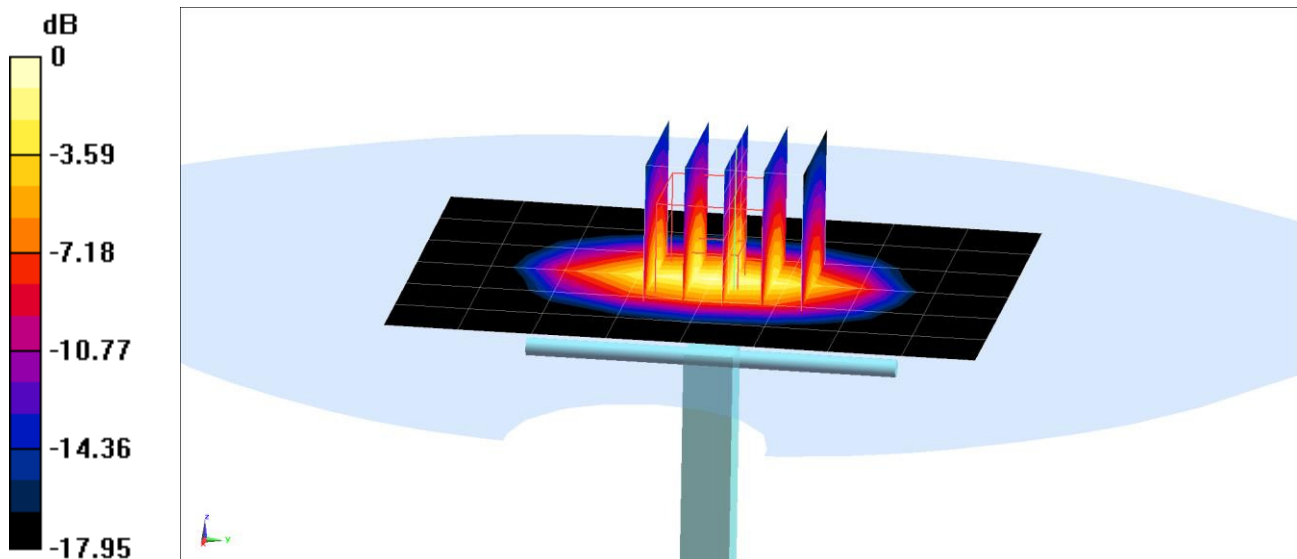
Area Scan (7x9x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 7.01 W/kg

SAR(1 g) = 3.80 W/kg

Deviation(1 g) = 1.88%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900$ MHz; $\sigma = 1.548$ S/m; $\epsilon_r = 52.566$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-06-2016; Ambient Temp: 22.3°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3319; ConvF(4.7, 4.7, 4.7); Calibrated: 3/18/2016;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 3/14/2016

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

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

1900 MHz System Verification at 20.0 dBm (100 mW)

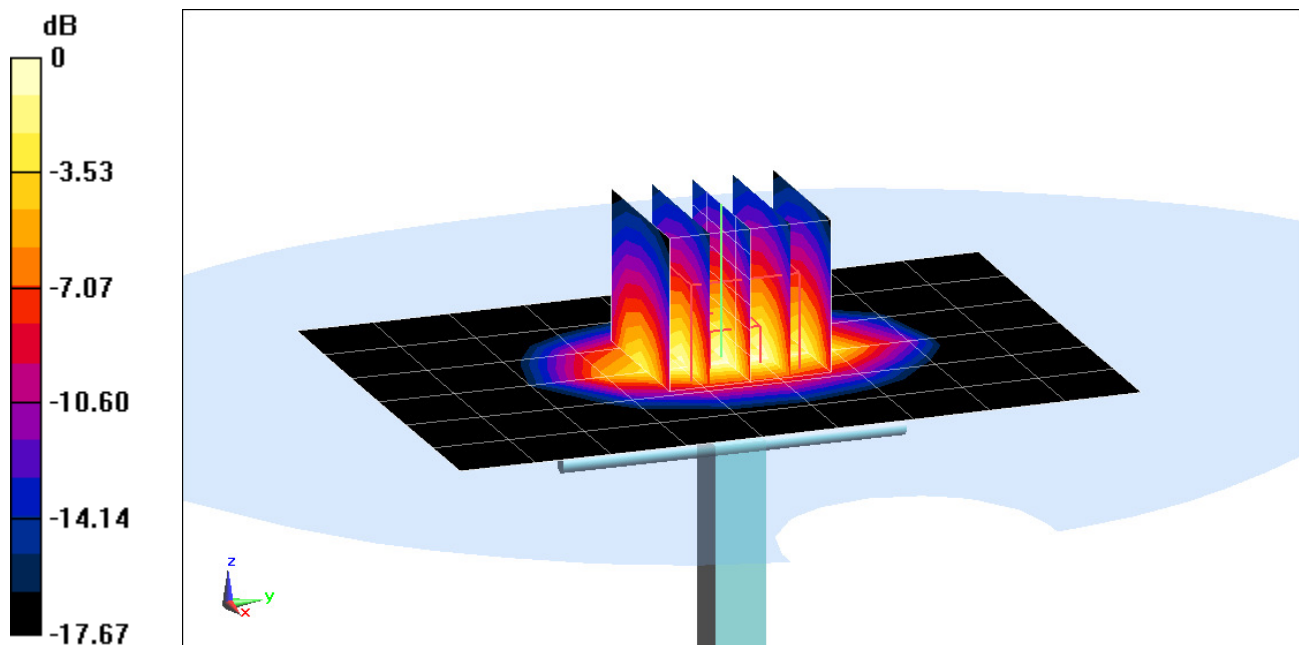
Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

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

Peak SAR (extrapolated) = 7.41 W/kg

SAR(1 g) = 4.10 W/kg

Deviation(1 g) = 3.54%



0 dB = 5.21 W/kg = 7.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450$ MHz; $\sigma = 2.012$ S/m; $\epsilon_r = 51.444$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-01-2016; Ambient Temp: 22.0°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3334; ConvF(4.45, 4.45, 4.45); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

2450 MHz System Verification at 20.0 dBm (100 mW)

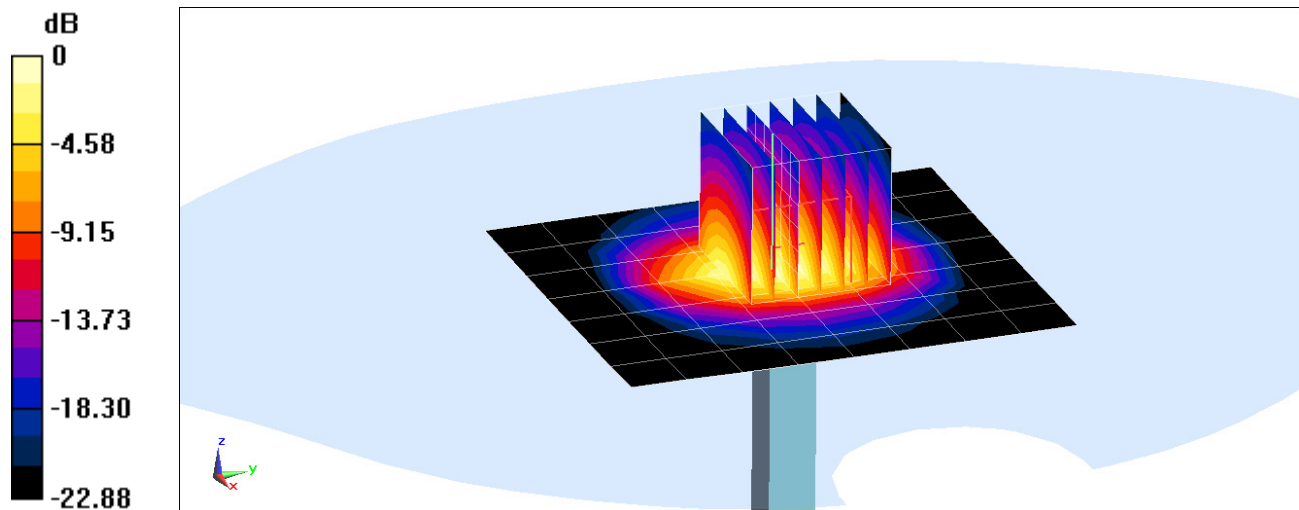
Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

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

Peak SAR (extrapolated) = 11.0 W/kg

SAR(1 g) = 5.2 W/kg

Deviation(1 g) = 5.26%



0 dB = 7.03 W/kg = 8.47 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450$ MHz; $\sigma = 2.004$ S/m; $\epsilon_r = 51.048$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-04-2016; Ambient Temp: 23.0°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3334; ConvF(4.45, 4.45, 4.45); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

2450 MHz System Verification at 20.0 dBm (100 mW)

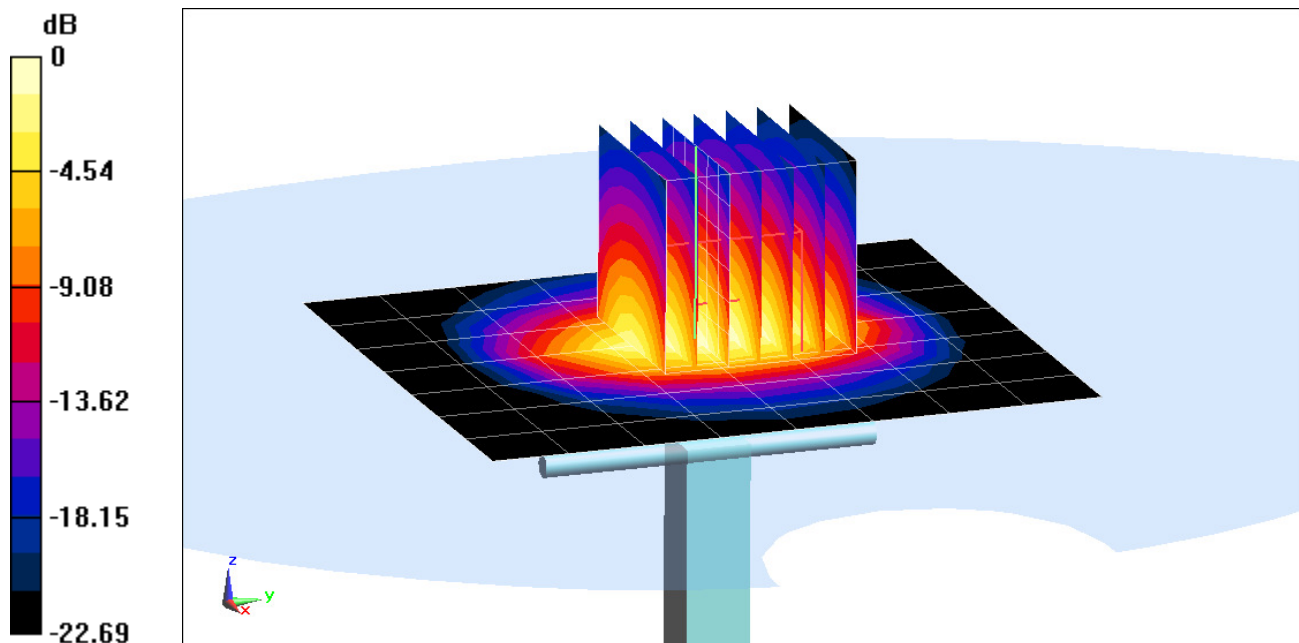
Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

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

Peak SAR (extrapolated) = 11.1 W/kg

SAR(1 g) = 5.28 W/kg

Deviation(1 g) = 6.88%



0 dB = 7.38 W/kg = 8.68 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: 2600 Body Medium parameters used:

$f = 2600 \text{ MHz}$; $\sigma = 2.216 \text{ S/m}$; $\epsilon_r = 50.857$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-01-2016; Ambient Temp: 22.0°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3334; ConvF(4.29, 4.29, 4.29); Calibrated: 11/17/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1415; Calibrated: 11/11/2015

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

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

2600 MHz System Verification at 20.0 dBm (100 mW)

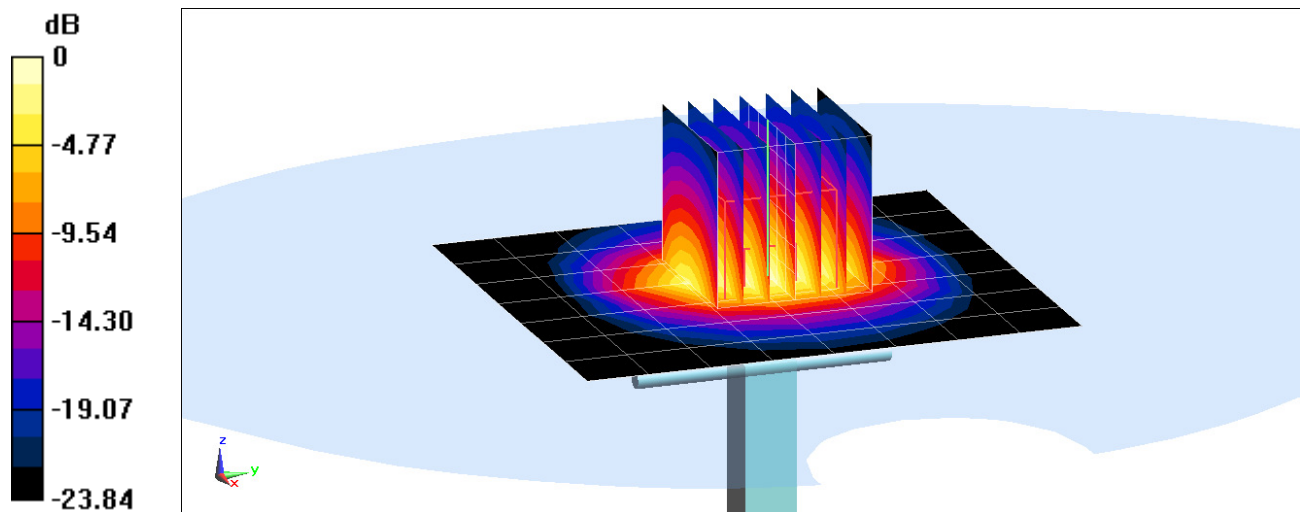
Area Scan (8x9x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Peak SAR (extrapolated) = 12.4 W/kg

SAR(1 g) = 5.77 W/kg

Deviation(1 g) = 5.10%



0 dB = 7.80 W/kg = 8.92 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1120

Communication System: UID 0, CW; Frequency: 5250 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used (interpolated):

$f = 5250 \text{ MHz}$; $\sigma = 5.527 \text{ S/m}$; $\epsilon_r = 47.111$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-13-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(4.32, 4.32, 4.32); Calibrated: 2/22/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/18/2016

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

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

5250 MHz System Verification at 17.0 dBm (50 mW)

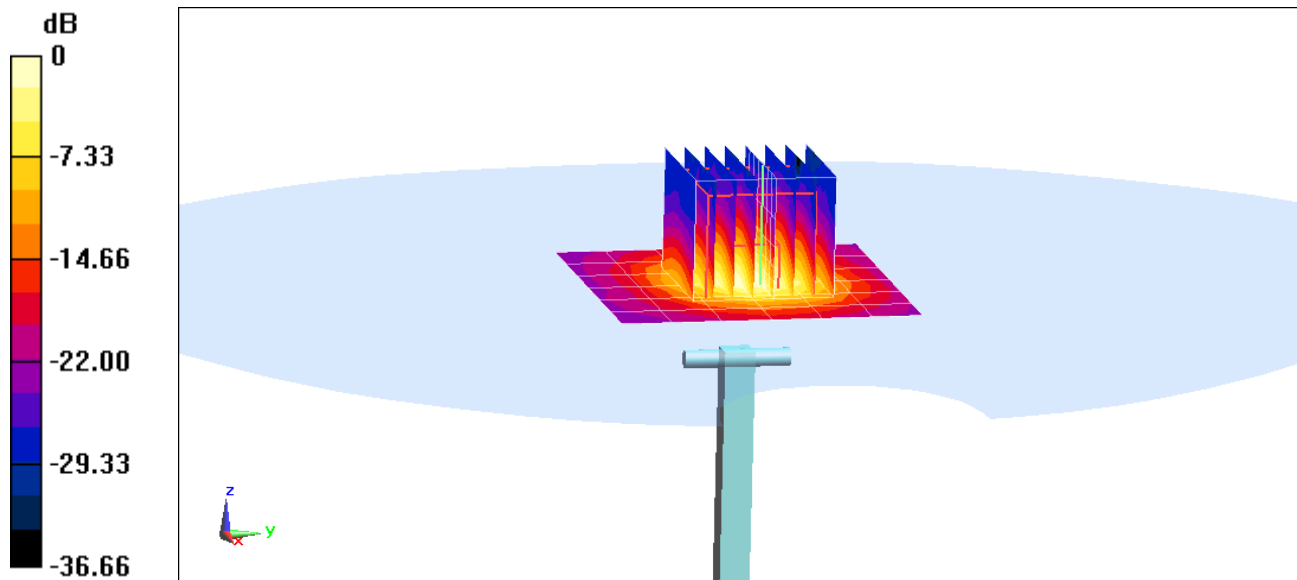
Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Peak SAR (extrapolated) = 15.0 W/kg

SAR(1 g) = 3.69 W/kg; SAR(10 g) = 1.04 W/kg

Deviation(1 g) = -2.38%; Deviation(10 g) = -1.89%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1120

Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 5.969 \text{ S/m}$; $\epsilon_r = 46.504$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-13-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(3.63, 3.63, 3.63); Calibrated: 2/22/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/18/2016

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

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

5600 MHz System Verification at 17.0 dBm (50 mW)

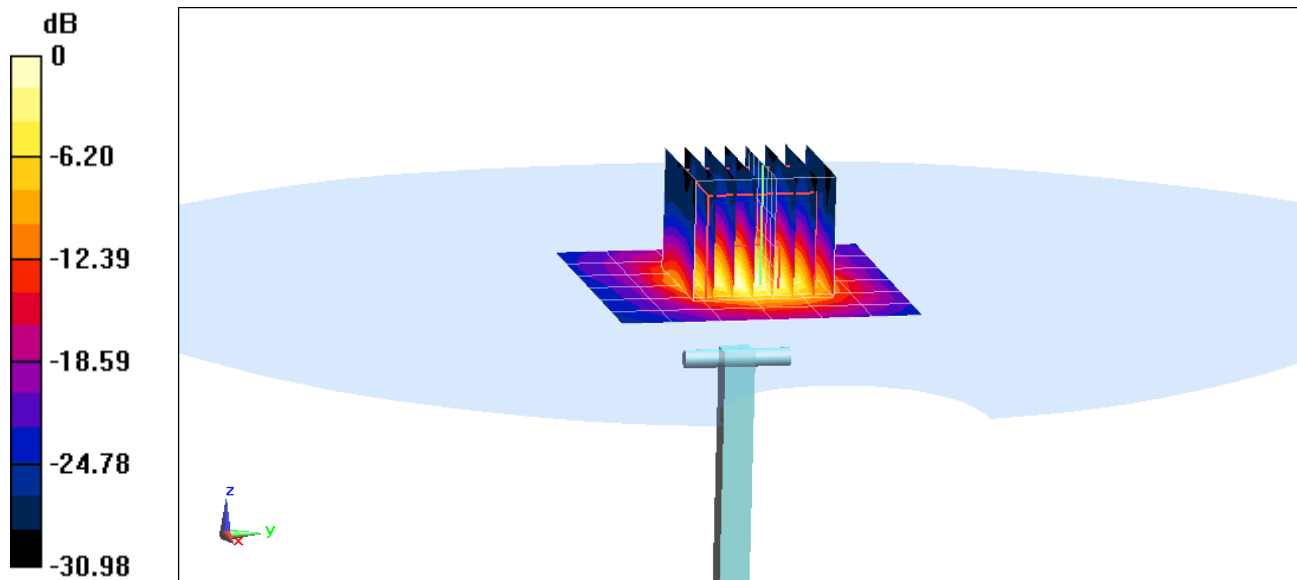
Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Peak SAR (extrapolated) = 15.6 W/kg

SAR(1 g) = 3.84 W/kg; SAR(10 g) = 1.08 W/kg

Deviation(1 g) = -4.95%; Deviation(10 g) = -4.42%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1120

Communication System: UID 0, CW; Frequency: 5750 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used (interpolated):

$f = 5750 \text{ MHz}$; $\sigma = 6.19 \text{ S/m}$; $\epsilon_r = 46.202$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-13-2016; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(3.86, 3.86, 3.86); Calibrated: 2/22/2016;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/18/2016

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

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

5750 MHz System Verification at 17.0 dBm (50 mW)

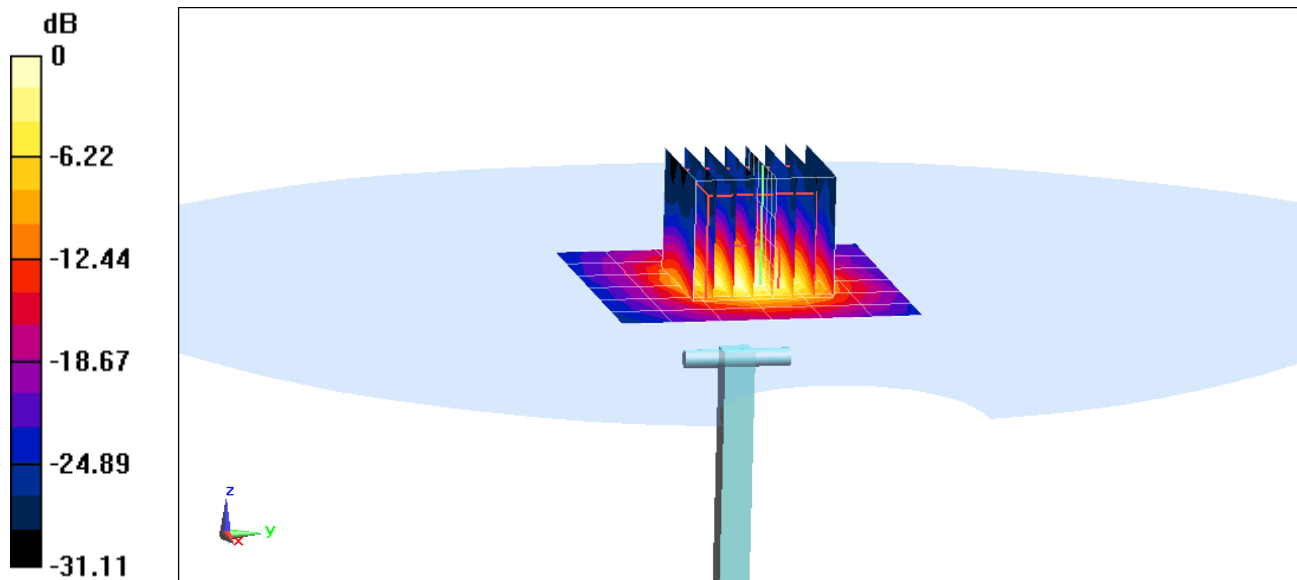
Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Peak SAR (extrapolated) = 14.9 W/kg

SAR(1 g) = 3.48 W/kg

Deviation(1 g) = -9.02%



APPENDIX C: PROBE CALIBRATION



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: **ES3-3022_Aug15**

CALIBRATION CERTIFICATE

Object **ES3DV2 - SN:3022**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

Calibration date: **August 26, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

BN ✓
 9/3/2015

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by:	Name Michael Weber	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	
Issued: August 27, 2015 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below **ConvF**).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of **ConvF**.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for **ConvF**. A frequency dependent **ConvF** is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe ES3DV2

SN:3022

Manufactured: April 15, 2003
Calibrated: August 26, 2015

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.00	1.03	0.95	$\pm 10.1 \%$
DCP (mV) ^B	99.9	99.7	100.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	179.6	$\pm 3.3 \%$
		Y	0.0	0.0	1.0		183.9	
		Z	0.0	0.0	1.0		179.0	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	3.60	65.9	14.2	10.00	43.5	$\pm 2.2 \%$
		Y	2.84	63.5	13.0		43.3	
		Z	2.76	63.7	12.7		41.7	
10011- CAB	UMTS-FDD (WCDMA)	X	3.32	67.0	18.7	2.91	144.4	$\pm 0.7 \%$
		Y	3.24	66.3	18.0		147.3	
		Z	3.19	66.3	18.0		143.5	
10012- CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.15	69.9	19.5	1.87	146.1	$\pm 0.7 \%$
		Y	2.88	67.7	18.0		147.9	
		Z	2.78	67.4	17.8		145.6	
10013- CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.40	71.3	23.8	9.46	144.9	$\pm 3.3 \%$
		Y	11.15	70.5	23.1		146.9	
		Z	10.95	70.5	23.3		140.3	
10021- DAB	GSM-FDD (TDMA, GMSK)	X	20.66	99.8	29.2	9.39	132.6	$\pm 2.2 \%$
		Y	14.36	93.3	26.6		145.3	
		Z	17.17	97.2	27.8		145.4	
10023- DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	17.22	96.5	28.2	9.57	125.4	$\pm 1.9 \%$
		Y	11.06	88.6	25.0		136.0	
		Z	8.71	84.6	23.4		130.7	
10024- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	31.05	99.5	25.9	6.56	135.2	$\pm 2.2 \%$
		Y	25.28	97.4	25.0		132.5	
		Z	21.58	95.7	24.5		144.4	
10027- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	42.88	99.9	24.0	4.80	129.5	$\pm 1.9 \%$
		Y	40.80	99.6	23.7		124.9	
		Z	38.42	99.7	23.7		137.8	
10028- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	44.48	100.0	23.2	3.55	138.2	$\pm 1.9 \%$
		Y	44.03	99.7	22.8		133.0	
		Z	41.36	99.8	22.8		147.5	
10032- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	16.08	99.5	23.3	1.16	127.5	$\pm 1.4 \%$
		Y	79.69	99.6	19.3		146.2	
		Z	45.81	99.9	20.4		138.2	
10100- CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.43	67.4	19.8	5.67	138.7	$\pm 1.4 \%$
		Y	6.27	66.8	19.2		134.9	
		Z	6.16	66.6	19.2		127.6	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.13	75.0	25.9	9.29	129.4	±3.3 %
		Y	9.46	73.0	24.5		131.8	
		Z	9.52	74.0	25.4		137.0	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.27	66.9	19.7	5.80	137.0	±1.7 %
		Y	6.24	66.7	19.3		140.0	
		Z	6.06	66.3	19.2		127.1	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.16	68.7	21.3	8.07	127.7	±2.2 %
		Y	9.99	68.2	20.9		131.5	
		Z	10.22	69.1	21.4		141.6	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.34	73.4	25.2	9.28	125.0	±3.3 %
		Y	8.92	72.2	24.3		127.2	
		Z	8.95	73.1	25.1		131.9	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.95	66.4	19.4	5.75	134.4	±1.4 %
		Y	5.92	66.2	19.1		137.0	
		Z	5.98	66.7	19.5		146.8	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.39	66.9	19.6	5.82	139.9	±1.7 %
		Y	6.35	66.7	19.3		141.9	
		Z	6.15	66.2	19.2		128.4	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.96	66.6	19.8	5.73	137.3	±1.4 %
		Y	4.85	66.1	19.3		139.8	
		Z	4.85	66.6	19.7		146.7	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.75	78.7	28.3	9.21	138.9	±3.0 %
		Y	7.69	75.1	26.1		140.1	
		Z	7.80	76.6	27.2		144.0	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.88	66.2	19.6	5.72	132.0	±1.4 %
		Y	4.77	65.8	19.1		132.6	
		Z	4.83	66.5	19.6		146.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.91	66.3	19.7	5.72	131.7	±1.4 %
		Y	4.82	66.0	19.2		138.4	
		Z	4.86	66.7	19.7		145.7	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.04	69.1	21.7	8.10	140.9	±2.2 %
		Y	9.62	67.9	20.8		125.2	
		Z	9.74	68.6	21.3		133.3	
10225-CAB	UMTS-FDD (HSPA+)	X	7.01	67.1	19.6	5.97	143.7	±1.4 %
		Y	6.78	66.2	19.0		129.3	
		Z	6.80	66.7	19.3		136.5	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.55	78.0	27.9	9.21	134.6	±3.0 %
		Y	7.79	75.6	26.3		141.6	
		Z	7.89	76.9	27.4		145.2	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.30	74.8	26.1	9.24	134.8	±3.3 %
		Y	8.65	72.5	24.5		136.4	
		Z	8.33	72.3	24.8		126.6	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	10.20	76.2	26.8	9.30	144.8	±3.3 %
		Y	9.41	73.7	25.1		145.9	
		Z	9.18	73.9	25.6		138.6	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.45	66.7	18.9	3.96	147.0	±0.9 %
		Y	4.21	65.5	17.9		126.5	
		Z	4.36	66.5	18.5		148.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.57	66.3	18.5	3.46	134.3	±0.7 %
		Y	3.48	65.6	17.8		136.8	
		Z	3.51	66.2	18.3		136.4	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.53	66.4	18.6	3.39	135.8	±0.7 %
		Y	3.45	65.8	17.9		140.4	
		Z	3.50	66.5	18.5		137.0	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.18	66.5	19.5	5.81	129.4	±1.4 %
		Y	6.15	66.3	19.1		133.6	
		Z	6.13	66.5	19.3		131.2	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.77	67.2	19.9	6.06	134.8	±1.7 %
		Y	6.81	67.3	19.7		144.8	
		Z	6.68	67.1	19.7		136.7	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.30	69.4	22.0	8.37	142.0	±2.5 %
		Y	9.90	68.2	21.1		126.8	
		Z	10.15	69.3	21.9		142.6	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.72	68.1	18.9	3.76	147.8	±0.7 %
		Y	4.56	67.5	18.2		133.6	
		Z	4.61	68.2	18.7		147.4	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.57	67.8	18.8	3.77	144.3	±0.7 %
		Y	4.43	67.3	18.1		131.3	
		Z	4.57	68.3	18.8		145.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.64	67.9	18.7	1.54	142.1	±0.5 %
		Y	2.36	65.4	16.8		130.3	
		Z	2.50	66.7	17.7		145.0	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.04	69.0	21.7	8.23	138.8	±2.2 %
		Y	9.71	68.0	20.9		125.6	
		Z	9.94	69.0	21.6		140.4	

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 7 and 8).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	6.33	6.33	6.33	0.46	1.43	± 12.0 %
835	41.5	0.90	6.11	6.11	6.11	0.24	2.08	± 12.0 %
1750	40.1	1.37	5.08	5.08	5.08	0.45	1.47	± 12.0 %
1900	40.0	1.40	4.93	4.93	4.93	0.59	1.25	± 12.0 %
2300	39.5	1.67	4.63	4.63	4.63	0.55	1.39	± 12.0 %
2450	39.2	1.80	4.30	4.30	4.30	0.51	1.47	± 12.0 %
2600	39.0	1.96	4.12	4.12	4.12	0.57	1.46	± 12.0 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	6.16	6.16	6.16	0.50	1.34	± 12.0 %
835	55.2	0.97	6.13	6.13	6.13	0.25	2.16	± 12.0 %
1750	53.4	1.49	4.79	4.79	4.79	0.61	1.33	± 12.0 %
1900	53.3	1.52	4.56	4.56	4.56	0.31	2.02	± 12.0 %
2300	52.9	1.81	4.32	4.32	4.32	0.79	1.19	± 12.0 %
2450	52.7	1.95	4.08	4.08	4.08	0.80	1.12	± 12.0 %
2600	52.5	2.16	3.96	3.96	3.96	0.80	1.10	± 12.0 %

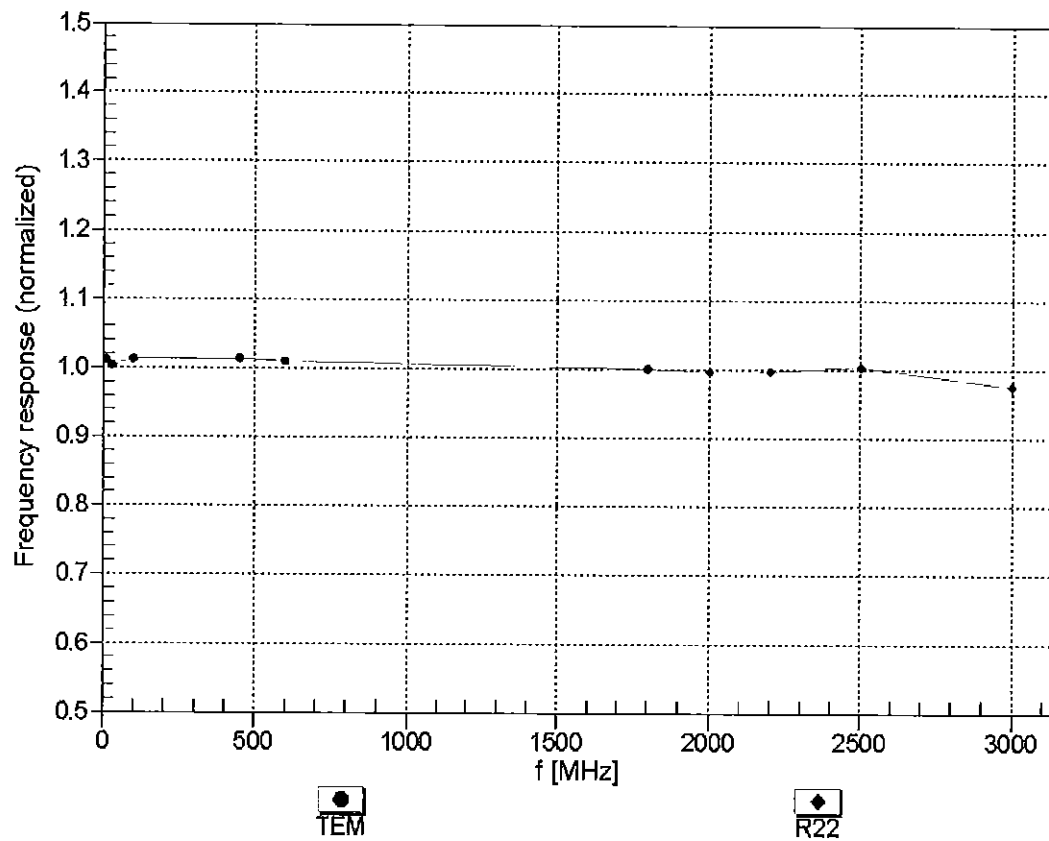
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

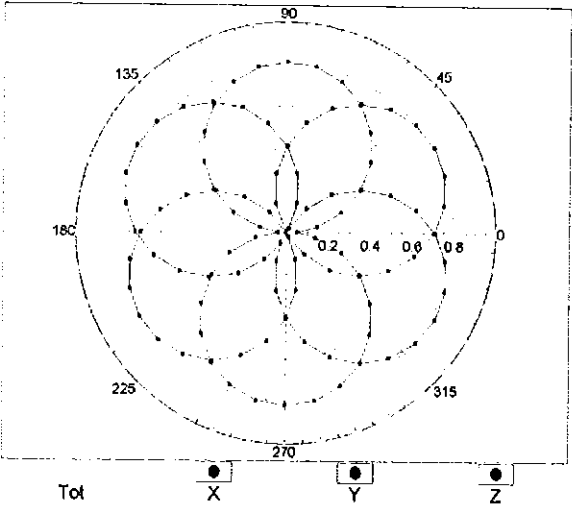
(TEM-Cell: ifi110 EXX, Waveguide: R22)



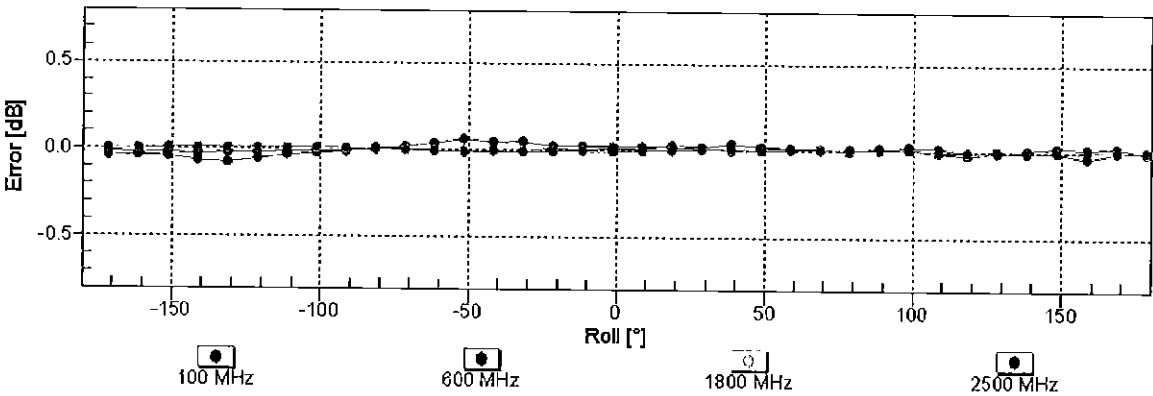
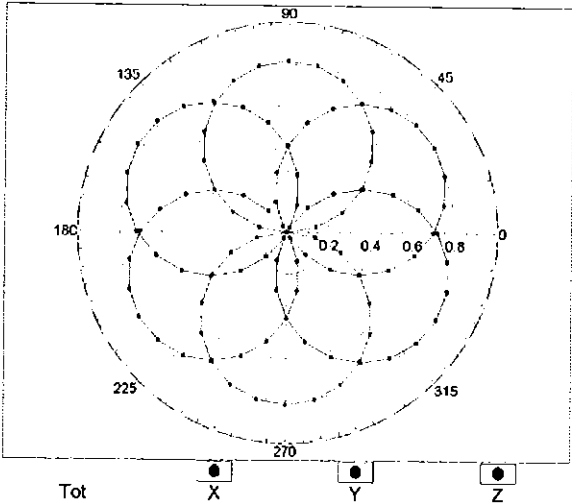
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

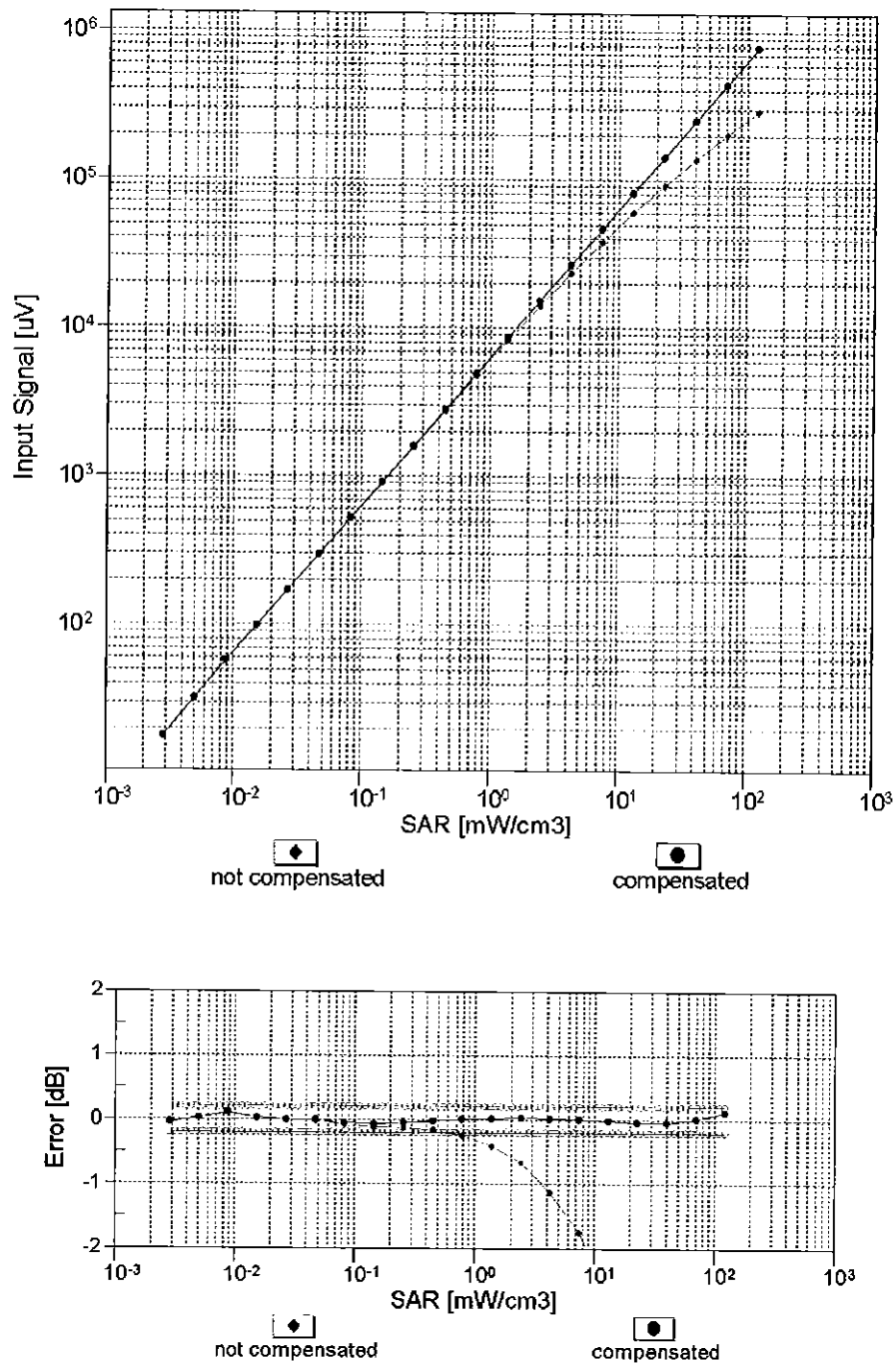


f=1800 MHz,R22



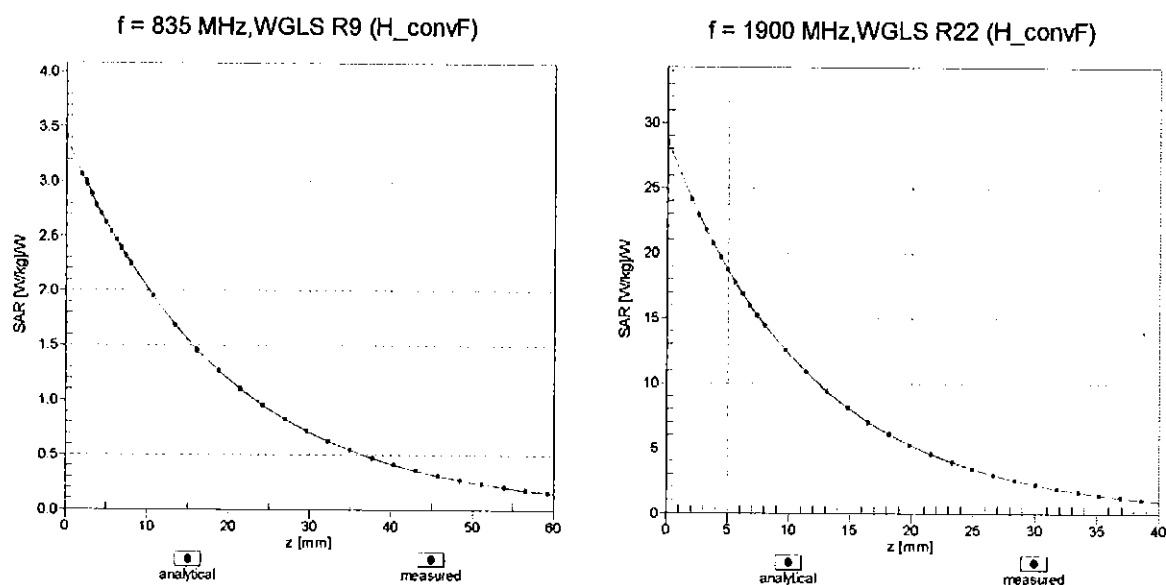
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$
(TEM cell , $f_{\text{eval}}= 1900 \text{ MHz}$)



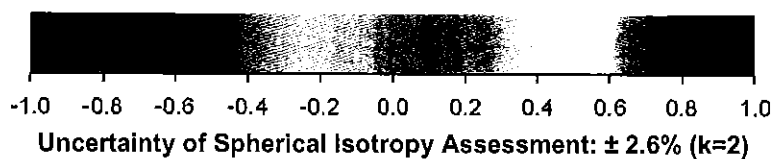
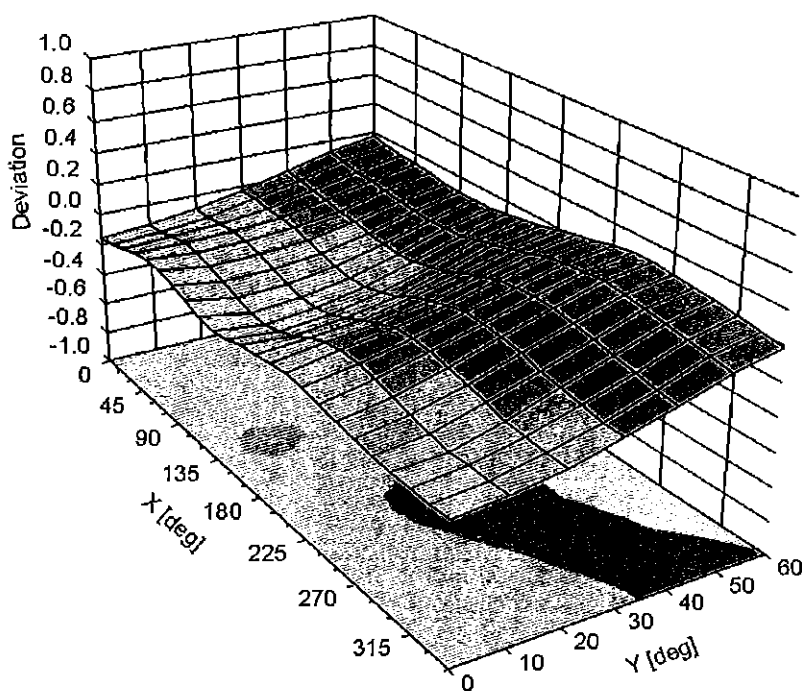
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	98.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **EX3-7406_Apr16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7406**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

BN 04/26/2d6

Calibration date: **April 19, 2016**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter 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: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (No. 217-02285/02284)	In house check: Jun-16
Power sensor E4412A	SN: MY41498087	06-Apr-16 (No. 217-02285)	In house check: Jun-16
Power sensor E4412A	SN: 000110210	06-Apr-16 (No. 217-02284)	In house check: Jun-16
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Apr-13)	In house check: Jun-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	
			Issued: April 20, 2016
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(*f*)_{x,y,z}** = NORM_{x,y,z} * *frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe EX3DV4

SN:7406

Manufactured: November 24, 2015
Calibrated: April 19, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7406

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.48	0.44	0.47	$\pm 10.1 \%$
DCP (mV) ^B	100.7	97.9	98.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	120.4	$\pm 3.3 \%$
		Y	0.0	0.0	1.0		148.3	
		Z	0.0	0.0	1.0		146.7	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	0.81	54.6	7.4	10.00	50.3	$\pm 2.2 \%$
		Y	0.68	55.1	7.9		47.9	
		Z	1.34	61.0	11.0		46.8	
10012- CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.83	68.0	18.3	1.87	127.8	$\pm 0.5 \%$
		Y	2.82	68.4	18.4		117.8	
		Z	3.00	69.2	19.0		115.9	
10100- CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.54	67.4	19.5	5.67	142.1	$\pm 1.2 \%$
		Y	6.19	66.7	19.3		127.6	
		Z	6.37	66.7	19.2		125.7	
10103- CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	7.58	67.9	21.8	9.29	114.4	$\pm 1.7 \%$
		Y	7.34	68.3	22.5		144.3	
		Z	7.53	67.7	21.8		139.5	
10108- CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.34	66.9	19.4	5.80	137.5	$\pm 1.2 \%$
		Y	5.90	65.9	19.0		123.8	
		Z	6.24	66.4	19.2		123.7	
10151- CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	7.17	67.2	21.5	9.28	109.5	$\pm 1.7 \%$
		Y	6.83	67.6	22.3		137.0	
		Z	7.23	67.4	21.7		135.1	
10154- CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.99	66.4	19.2	5.75	132.4	$\pm 0.9 \%$
		Y	5.61	65.8	19.1		119.4	
		Z	5.91	65.9	19.0		120.1	
10160- CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.47	67.0	19.5	5.82	137.0	$\pm 1.2 \%$
		Y	5.96	66.0	19.1		123.9	
		Z	6.33	66.3	19.1		124.2	
10169- CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.71	65.5	18.9	5.73	113.2	$\pm 1.2 \%$
		Y	4.60	66.2	19.6		144.2	
		Z	4.93	66.5	19.5		143.2	
10172- CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.68	68.2	22.4	9.21	117.6	$\pm 1.7 \%$
		Y	5.56	70.1	24.1		146.1	
		Z	5.87	69.4	23.2		143.7	
10175- CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.75	65.7	19.1	5.72	112.3	$\pm 0.9 \%$
		Y	4.58	66.1	19.5		143.2	
		Z	4.95	66.7	19.6		142.0	

10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.71	65.5	18.9	5.72	110.2	±0.9 %
		Y	4.53	65.8	19.4		141.4	
		Z	4.90	66.5	19.5		138.1	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.69	68.3	22.5	9.21	117.3	±1.7 %
		Y	5.47	69.5	23.8		145.1	
		Z	5.85	69.3	23.1		142.0	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	7.04	68.1	22.2	9.24	141.2	±1.9 %
		Y	6.35	67.2	22.2		125.4	
		Z	6.82	67.1	21.7		127.5	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	7.45	68.3	22.2	9.30	148.0	±1.9 %
		Y	6.84	67.5	22.3		132.0	
		Z	7.24	67.4	21.8		134.6	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.35	66.9	19.4	5.81	135.3	±1.2 %
		Y	5.92	65.9	19.0		122.9	
		Z	6.26	66.4	19.2		122.1	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.92	67.4	19.7	6.06	139.3	±1.2 %
		Y	6.52	66.6	19.5		127.9	
		Z	6.82	66.9	19.5		126.8	

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 6 and 7).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7406

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	10.52	10.52	10.52	0.52	0.89	± 12.0 %
835	41.5	0.90	9.83	9.83	9.83	0.54	0.80	± 12.0 %
1750	40.1	1.37	8.85	8.85	8.85	0.49	0.85	± 12.0 %
1900	40.0	1.40	8.22	8.22	8.22	0.40	0.88	± 12.0 %
2300	39.5	1.67	7.67	7.67	7.67	0.36	0.89	± 12.0 %
2450	39.2	1.80	7.29	7.29	7.29	0.40	0.80	± 12.0 %
2600	39.0	1.96	7.08	7.08	7.08	0.37	0.95	± 12.0 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7406

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	9.54	9.54	9.54	0.46	0.80	± 12.0 %
835	55.2	0.97	9.35	9.35	9.35	0.45	0.84	± 12.0 %
1750	53.4	1.49	7.78	7.78	7.78	0.37	0.85	± 12.0 %
1900	53.3	1.52	7.49	7.49	7.49	0.33	0.91	± 12.0 %
2300	52.9	1.81	7.37	7.37	7.37	0.42	0.80	± 12.0 %
2450	52.7	1.95	7.24	7.24	7.24	0.37	0.88	± 12.0 %
2600	52.5	2.16	6.94	6.94	6.94	0.27	0.99	± 12.0 %

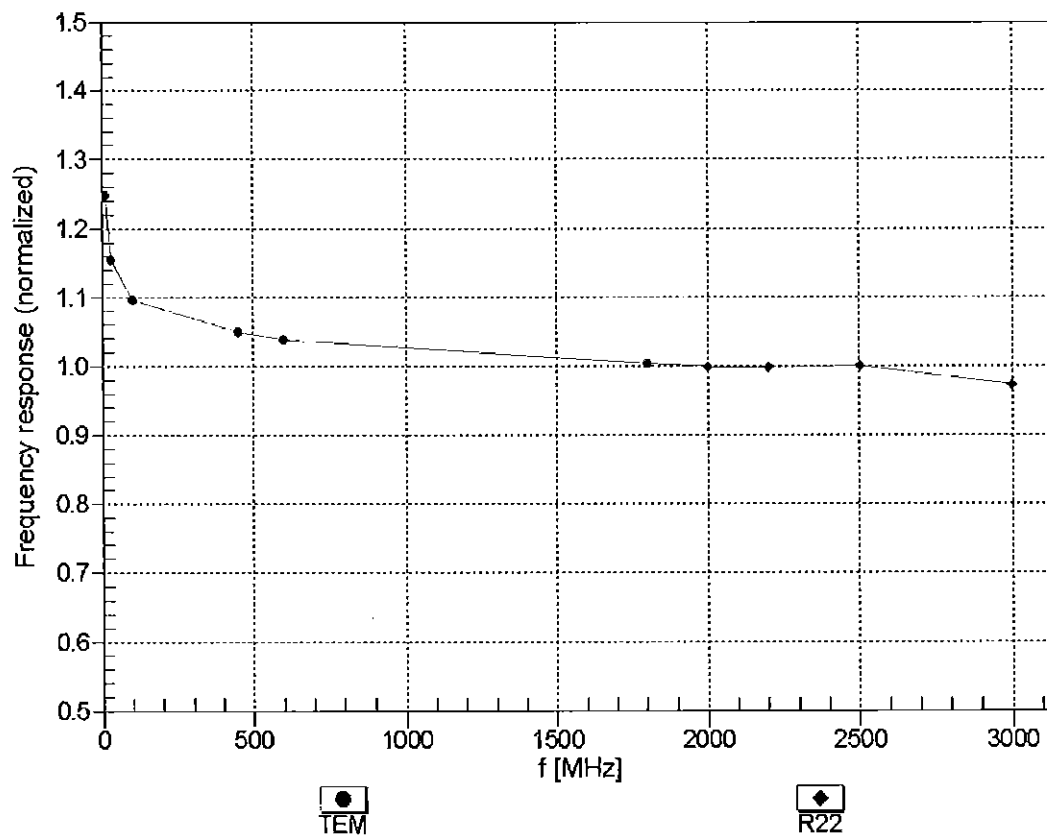
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

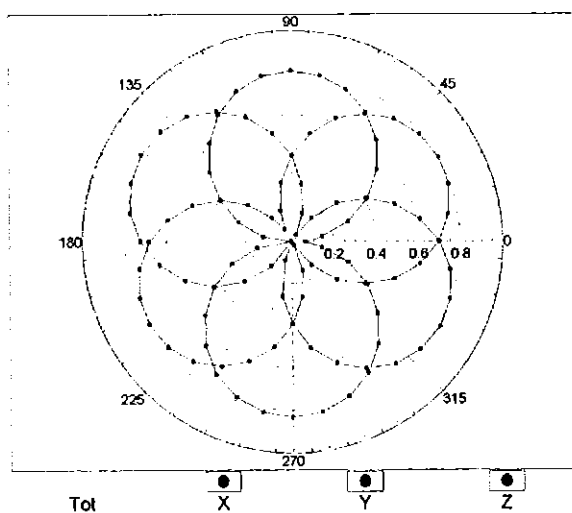
(TEM-Cell:ifi110 EXX, Waveguide: R22)



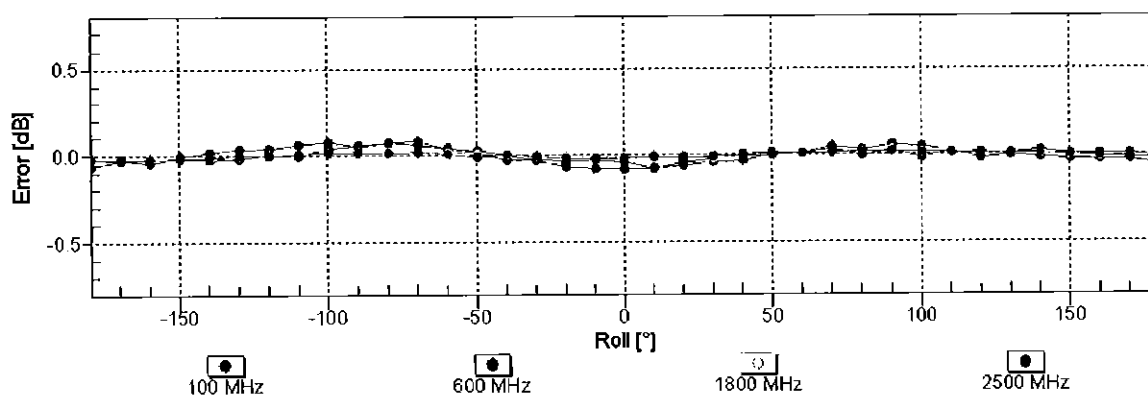
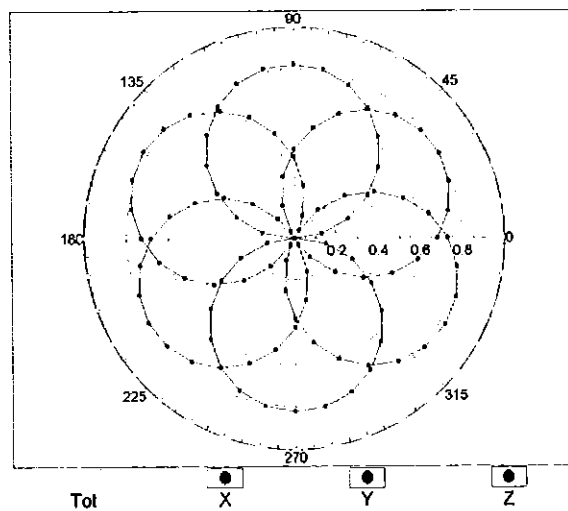
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

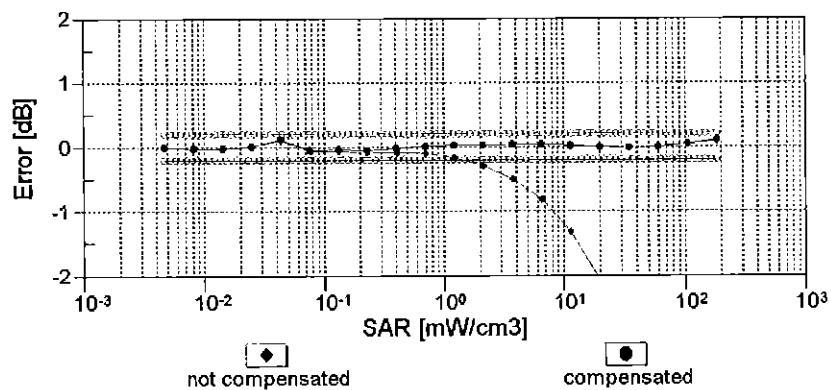
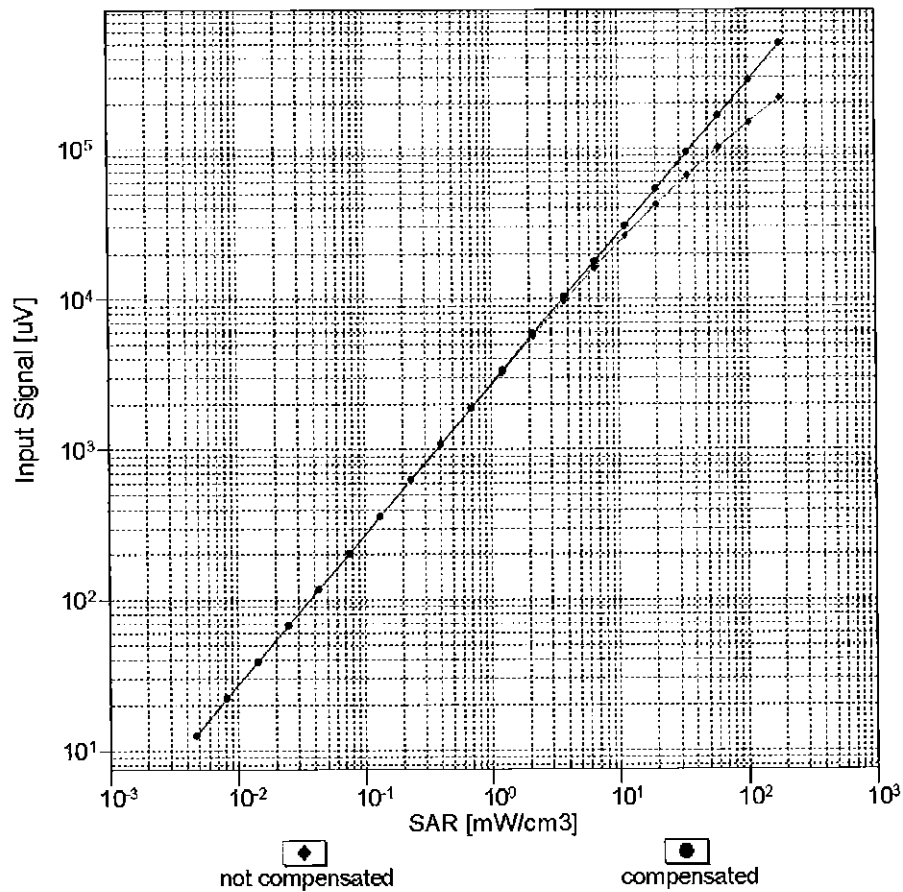


f=1800 MHz,R22



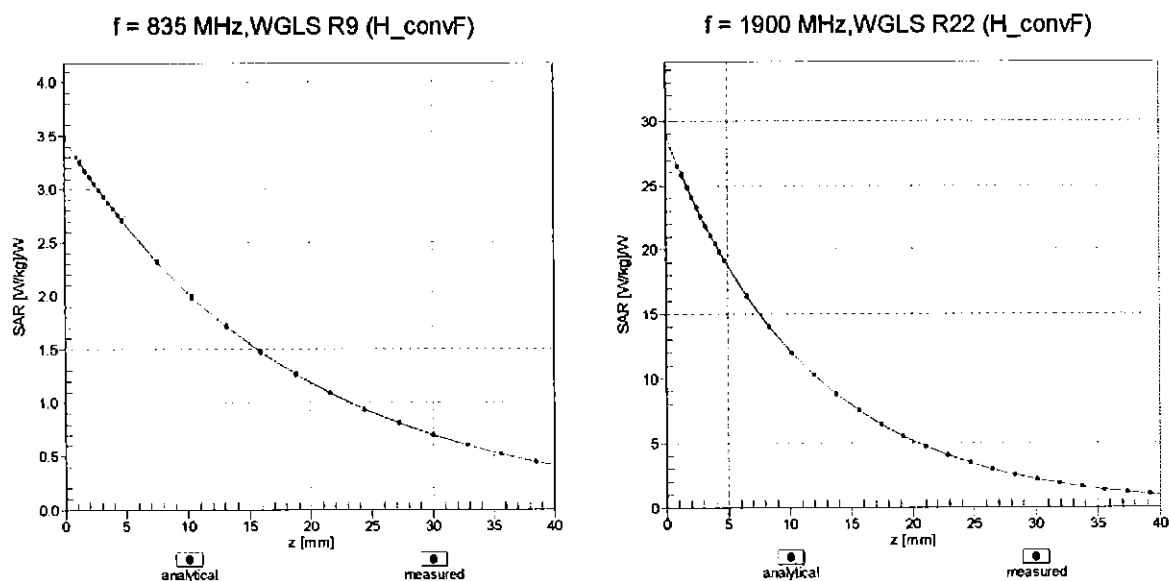
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$)



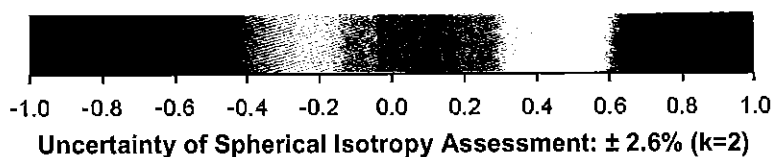
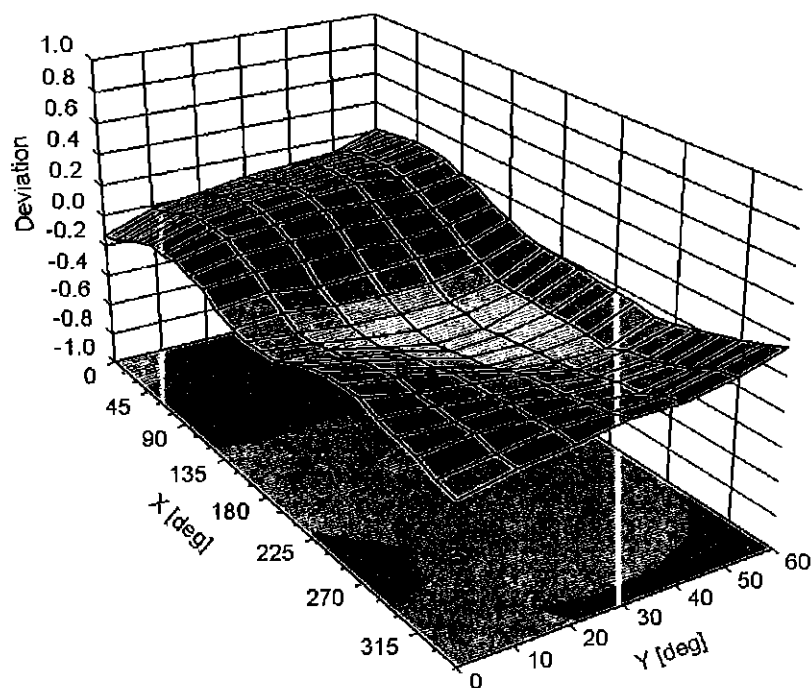
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: EX3DV4 - SN:7406**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	0.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Client **PC Test**

Certificate No: **ES3-3333_Oct15**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3333**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

*DN ✓
14/03/15*

Calibration date: **October 29, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (In house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by:	Name Lutz Klysner	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Technical Manager	

Issued: October 29, 2015

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	ϕ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe ES3DV3

SN:3333

Manufactured: January 24, 2012
Calibrated: October 29, 2015

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.07	0.90	0.88	$\pm 10.1 \%$
DCP (mV) ^B	106.8	108.5	106.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	201.0	$\pm 3.5 \%$
		Y	0.0	0.0	1.0		187.1	
		Z	0.0	0.0	1.0		184.8	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	2.43	80.7	11.4	10.00	41.6	$\pm 2.2 \%$
		Y	4.35	67.4	13.2		35.6	
		Z	1.46	57.0	8.7		36.2	
10011- CAB	UMTS-FDD (WCDMA)	X	3.35	67.9	19.1	2.91	138.2	$\pm 0.5 \%$
		Y	3.48	68.8	19.2		127.5	
		Z	3.37	67.6	18.6		149.0	
10012- CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.80	72.8	20.8	1.87	141.0	$\pm 0.7 \%$
		Y	3.68	73.3	20.8		128.0	
		Z	3.01	69.3	18.8		128.2	
10013- CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.52	71.7	23.9	9.46	139.3	$\pm 3.0 \%$
		Y	10.94	70.4	22.9		147.1	
		Z	10.95	70.8	23.4		144.5	
10021- DAB	GSM-FDD (TDMA, GMSK)	X	21.45	95.2	26.5	9.39	139.9	$\pm 2.5 \%$
		Y	9.12	82.9	21.9		142.0	
		Z	11.47	88.1	23.9		127.6	
10023- DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	20.81	95.6	27.0	9.57	135.8	$\pm 2.2 \%$
		Y	9.78	84.4	22.7		135.3	
		Z	9.12	83.5	22.1		144.6	
10024- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	39.84	99.8	25.2	6.56	140.9	$\pm 1.9 \%$
		Y	35.07	100.0	25.0		128.4	
		Z	35.20	99.8	24.7		131.9	
10027- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	47.16	99.8	23.9	4.80	124.9	$\pm 2.5 \%$
		Y	49.75	99.6	22.8		145.4	
		Z	45.37	99.9	23.1		148.5	
10028- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	56.24	99.6	22.6	3.55	140.4	$\pm 2.7 \%$
		Y	56.95	99.7	21.9		129.1	
		Z	48.45	99.6	22.1		133.2	
10032- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	18.03	98.1	22.8	1.16	127.5	$\pm 1.9 \%$
		Y	35.17	99.6	20.7		141.1	
		Z	21.08	99.9	21.9		127.5	
10100- CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.36	67.6	19.8	5.67	137.5	$\pm 1.2 \%$
		Y	6.29	67.4	19.6		128.9	
		Z	6.35	67.5	19.7		139.5	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.85	76.6	28.4	9.29	130.8	±2.7 %
		Y	9.58	73.7	24.8		143.0	
		Z	9.94	75.6	26.2		149.3	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	8.21	67.0	19.7	5.80	128.9	±1.2 %
		Y	6.16	66.9	19.5		129.2	
		Z	6.22	67.2	19.7		138.0	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.05	68.7	21.2	8.07	126.1	±2.5 %
		Y	10.13	69.0	21.3		146.1	
		Z	9.97	68.7	21.1		126.2	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	10.11	75.5	26.0	9.28	125.8	±3.3 %
		Y	9.08	73.2	24.7		138.2	
		Z	9.32	74.8	26.0		143.1	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.97	66.8	19.6	5.75	133.4	±1.2 %
		Y	5.92	66.7	19.5		127.0	
		Z	5.91	68.7	19.5		134.2	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.40	67.3	19.9	5.82	137.8	±1.2 %
		Y	6.31	67.1	19.6		130.7	
		Z	6.32	67.1	19.8		139.8	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.05	67.3	20.1	5.73	136.8	±1.2 %
		Y	4.89	67.0	19.9		131.1	
		Z	4.93	67.2	20.0		137.4	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	10.74	83.9	30.3	9.21	136.8	±2.7 %
		Y	7.34	74.3	25.5		125.9	
		Z	7.74	76.6	27.1		131.2	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.97	66.9	19.9	5.72	130.8	±1.2 %
		Y	4.86	66.9	19.8		128.5	
		Z	4.97	67.3	20.1		137.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.99	67.0	19.9	5.72	130.1	±1.2 %
		Y	4.88	67.0	19.9		127.6	
		Z	4.95	67.2	20.0		136.2	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.00	69.2	21.7	8.10	137.9	±2.2 %
		Y	9.75	68.7	21.2		137.5	
		Z	9.94	69.4	21.7		145.3	
10225-CAB	UMTS-FDD (HSPA+)	X	7.08	67.5	19.8	5.97	147.1	±1.4 %
		Y	7.06	67.7	19.8		142.3	
		Z	7.04	67.7	19.9		148.8	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	10.66	83.5	30.1	9.21	144.0	±3.0 %
		Y	7.43	74.7	25.7		127.6	
		Z	7.86	77.1	27.4		132.3	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	10.81	78.7	27.9	9.24	139.7	±3.0 %
		Y	8.48	72.4	24.4		130.1	
		Z	8.71	74.1	25.8		135.2	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	11.73	79.9	28.3	9.30	148.6	±3.3 %
		Y	9.11	73.2	24.8		139.0	
		Z	9.38	74.9	26.1		142.7	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Ref8.4)	X	4.52	67.6	19.3	3.96	144.5	±0.7 %
		Y	4.67	68.3	19.6		146.0	
		Z	4.41	67.0	18.9		130.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.66	67.2	19.0	3.46	134.5	±0.5 %
		Y	3.91	68.9	19.9		133.2	
		Z	3.86	68.5	19.6		146.9	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.63	67.5	19.1	3.39	134.9	±0.5 %
		Y	3.93	69.3	20.0		136.0	
		Z	3.81	68.5	19.6		148.6	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.20	67.1	19.7	5.81	129.0	±1.2 %
		Y	6.20	67.0	19.6		128.0	
		Z	6.32	67.5	19.9		142.7	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.76	67.6	20.0	6.06	134.7	±1.4 %
		Y	6.75	67.5	19.9		133.5	
		Z	6.90	68.1	20.3		149.2	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.30	69.7	22.1	8.37	140.1	±2.5 %
		Y	10.05	69.0	21.5		141.2	
		Z	9.94	69.0	21.7		126.3	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.80	68.5	19.0	3.76	129.3	±0.5 %
		Y	5.30	71.1	20.2		148.4	
		Z	5.10	70.4	19.9		135.2	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.77	68.8	19.2	3.77	127.3	±0.7 %
		Y	5.35	71.7	20.5		145.4	
		Z	5.03	70.6	20.1		133.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.77	69.7	19.7	1.54	147.0	±0.7 %
		Y	3.73	75.4	22.2		143.7	
		Z	3.25	72.2	20.7		133.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 8 Mbps, 99pc duty cycle)	X	10.11	69.4	21.8	8.23	144.7	±2.5 %
		Y	9.86	68.8	21.4		139.3	
		Z	9.72	68.6	21.3		126.0	

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 7 and 8).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Calibration Parameter Determined In Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	6.46	6.46	6.46	0.75	1.22	± 12.0 %
835	41.5	0.90	6.16	6.16	6.16	0.36	1.67	± 12.0 %
1750	40.1	1.37	5.21	5.21	5.21	0.80	1.19	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.73	1.25	± 12.0 %
2300	39.5	1.67	4.73	4.73	4.73	0.60	1.43	± 12.0 %
2450	39.2	1.80	4.53	4.53	4.53	0.80	1.28	± 12.0 %
2600	39.0	1.96	4.39	4.39	4.39	0.80	1.29	± 12.0 %

^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth (mm) ^g	Unc (k=2)
750	55.5	0.98	6.31	6.31	6.31	0.70	1.26	± 12.0 %
835	55.2	0.97	6.25	6.25	6.25	0.47	1.54	± 12.0 %
1750	53.4	1.49	4.90	4.90	4.90	0.49	1.63	± 12.0 %
1900	53.3	1.52	4.70	4.70	4.70	0.54	1.49	± 12.0 %
2300	52.9	1.81	4.51	4.51	4.51	0.80	1.15	± 12.0 %
2450	52.7	1.95	4.34	4.34	4.34	0.80	1.15	± 12.0 %
2600	52.5	2.16	4.23	4.23	4.23	0.80	1.03	± 12.0 %

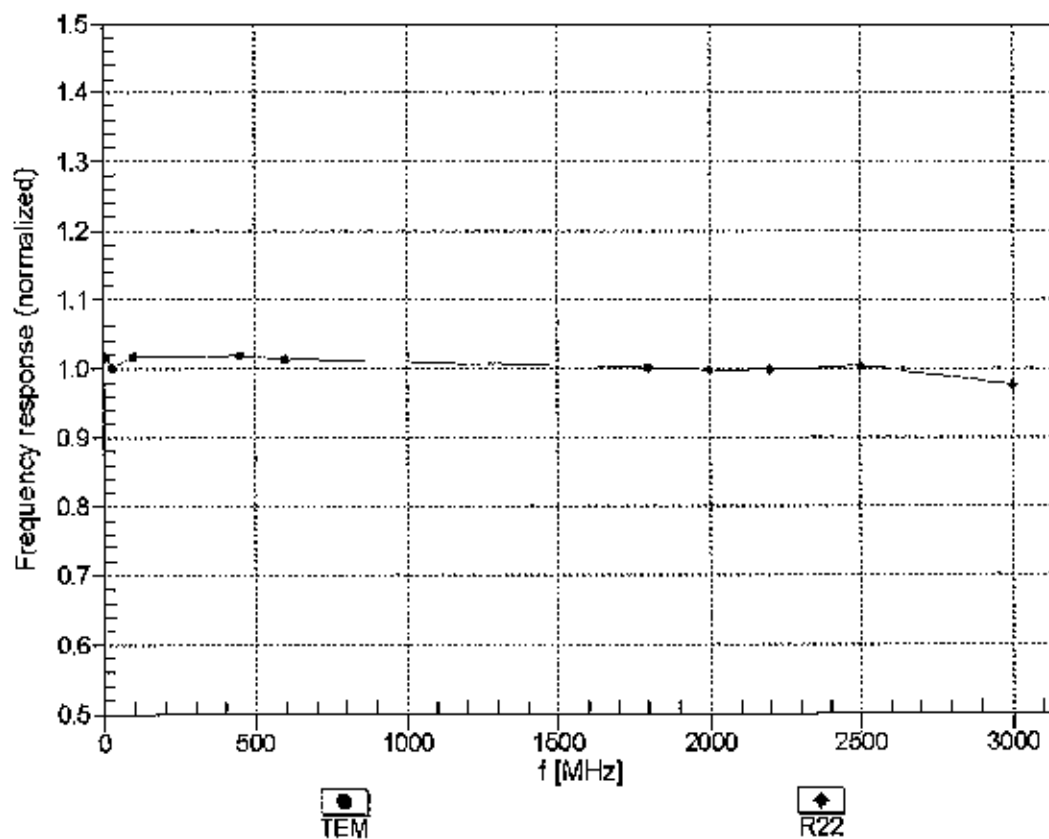
^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 160 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^g Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

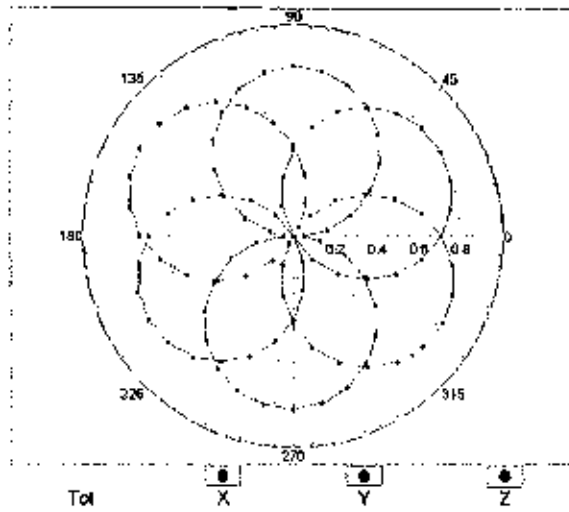
(TEM-Cell:ifi110 EXX, Waveguide: R22)



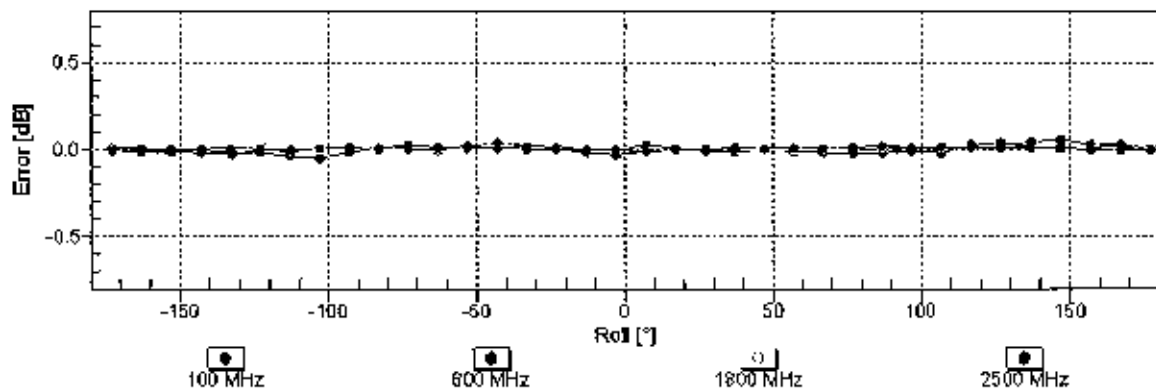
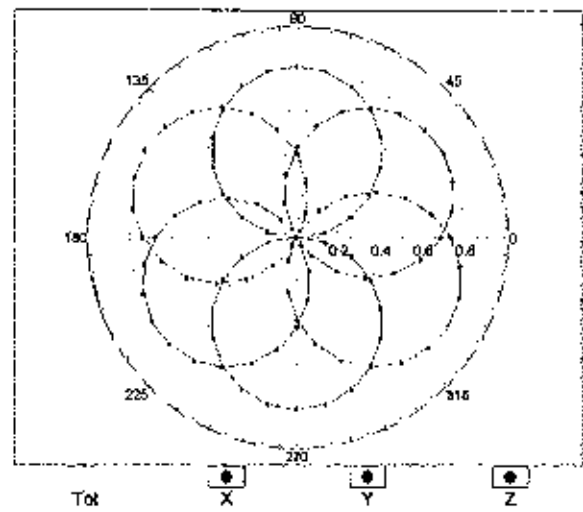
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

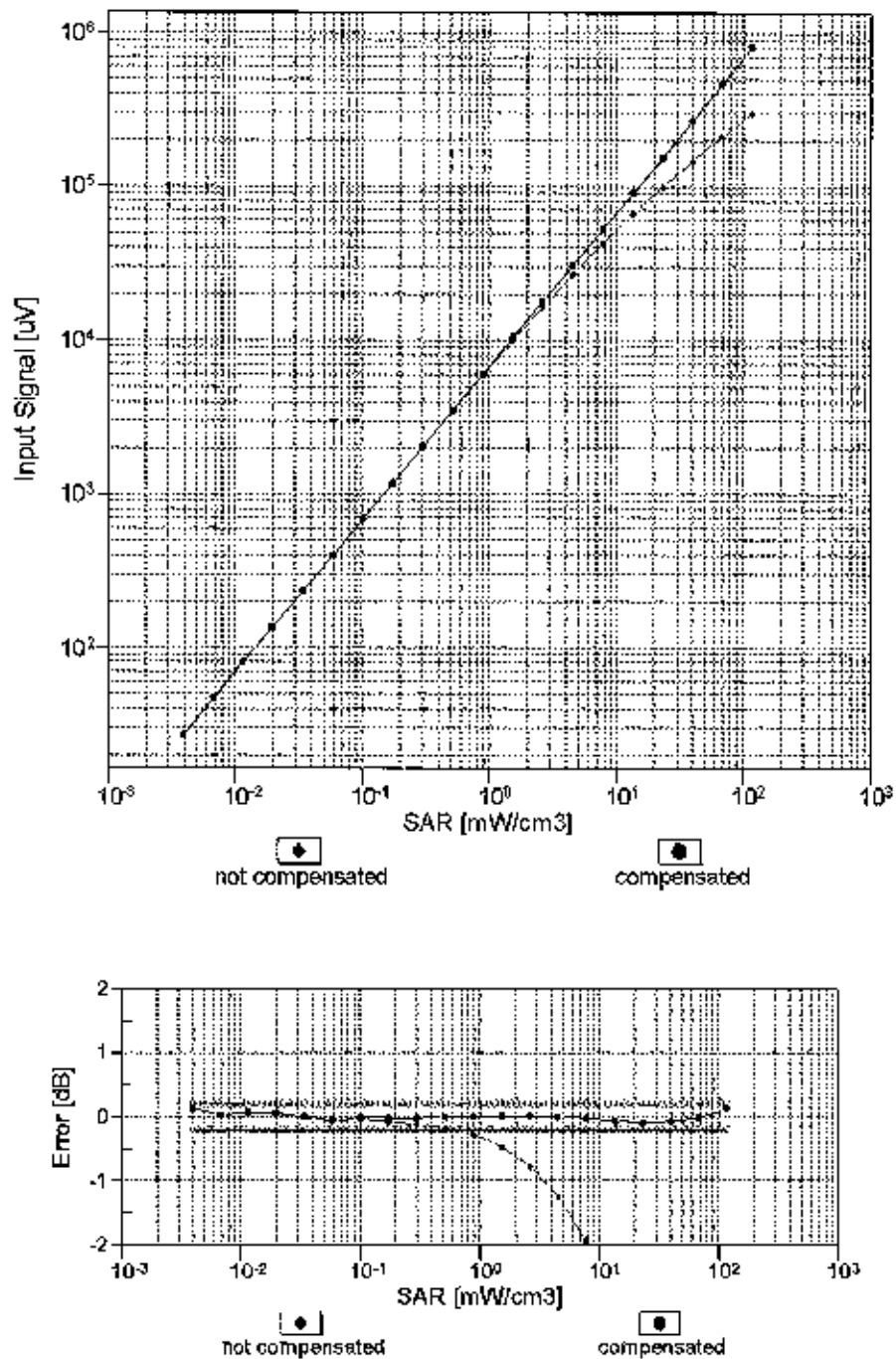


f=1800 MHz,R22



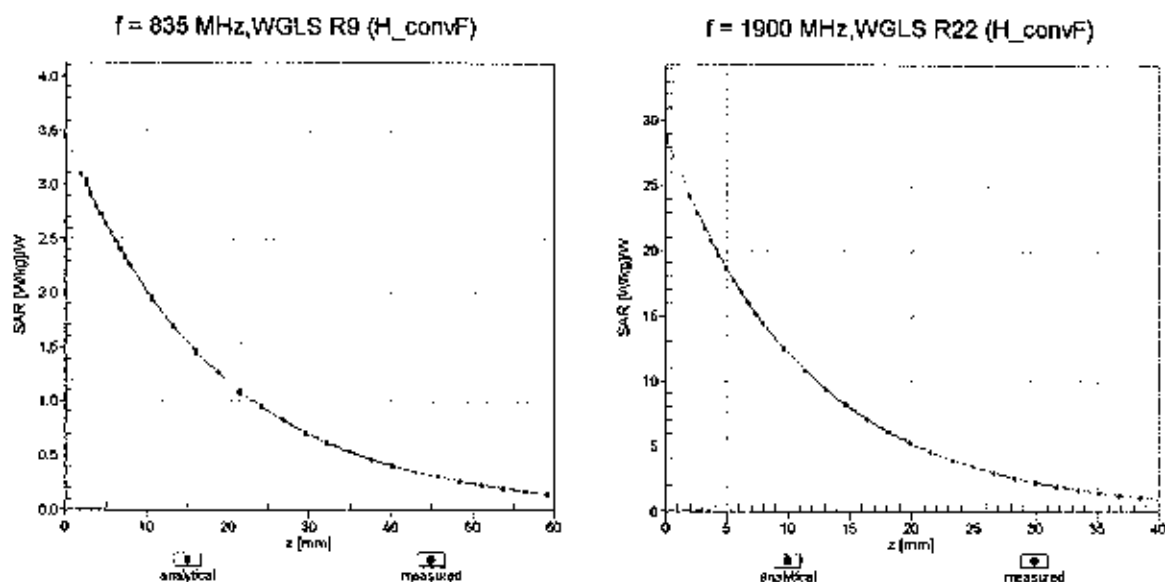
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f_{\text{eval}} = 1900 \text{ MHz}$)



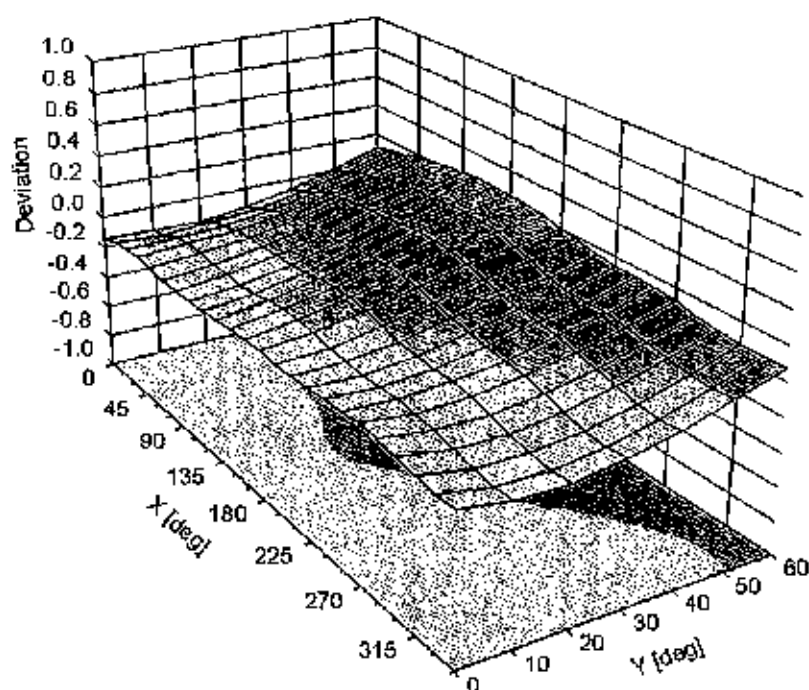
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	-32.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm



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: **EX3-7357_Apr16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7357**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

BN 04126116

Calibration date: **April 19, 2016**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter 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: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (No. 217-02285/02284)	In house check: Jun-16
Power sensor E4412A	SN: MY41498087	06-Apr-16 (No. 217-02285)	In house check: Jun-16
Power sensor E4412A	SN: 000110210	06-Apr-16 (No. 217-02284)	In house check: Jun-16
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Apr-13)	In house check: Jun-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by:	Name Leif Klysner	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	
			Issued: April 21, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below **ConvF**).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of **ConvF**.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe EX3DV4

SN:7357

Manufactured: February 5, 2015
Calibrated: April 19, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7357

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.41	0.49	0.41	$\pm 10.1 \%$
DCP (mV) ^B	100.8	97.2	96.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	153.4	$\pm 3.5 \%$
		Y	0.0	0.0	1.0		128.2	
		Z	0.0	0.0	1.0		136.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	0.91	56.3	8.7	10.00	47.8	$\pm 0.9 \%$
		Y	4.06	72.5	15.7		44.9	
		Z	1.42	61.4	10.6		43.6	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	10.02	67.8	20.9	8.68	112.1	$\pm 2.7 \%$
		Y	10.67	69.9	22.4		141.6	
		Z	10.36	68.8	21.5		139.7	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.12	68.1	20.6	8.07	121.4	$\pm 2.2 \%$
		Y	10.75	69.9	21.9		149.3	
		Z	10.43	68.9	21.1		147.5	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.77	67.9	20.6	8.10	116.1	$\pm 2.2 \%$
		Y	10.28	69.5	21.8		141.5	
		Z	10.05	68.6	21.0		138.3	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.02	68.1	20.9	8.37	116.5	$\pm 2.2 \%$
		Y	10.56	69.7	22.1		142.1	
		Z	10.23	68.6	21.2		137.4	
10401-AAC	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	10.73	68.6	21.1	8.60	123.1	$\pm 2.5 \%$
		Y	10.37	67.9	21.0		99.7	
		Z	11.03	69.3	21.6		147.8	
10402-AAC	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	10.70	68.5	20.9	8.53	121.8	$\pm 2.2 \%$
		Y	10.46	68.2	21.0		99.9	
		Z	10.94	69.1	21.3		146.0	

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7357

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
5250	35.9	4.71	5.10	5.10	5.10	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.41	4.41	4.41	0.50	1.80	± 13.1 %
5750	35.4	5.22	4.65	4.65	4.65	0.50	1.80	± 13.1 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7357

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	9.90	9.90	9.90	0.53	0.80	± 12.0 %
835	55.2	0.97	9.82	9.82	9.82	0.46	0.80	± 12.0 %
1750	53.4	1.49	8.06	8.06	8.06	0.39	0.80	± 12.0 %
1900	53.3	1.52	7.84	7.84	7.84	0.40	0.80	± 12.0 %
2300	52.9	1.81	7.20	7.20	7.20	0.38	0.86	± 12.0 %
2450	52.7	1.95	7.14	7.14	7.14	0.30	0.90	± 12.0 %
2600	52.5	2.16	6.82	6.82	6.82	0.29	0.95	± 12.0 %
5250	48.9	5.36	4.28	4.28	4.28	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.63	3.63	3.63	0.60	1.90	± 13.1 %
5750	48.3	5.94	3.77	3.77	3.77	0.60	1.90	± 13.1 %

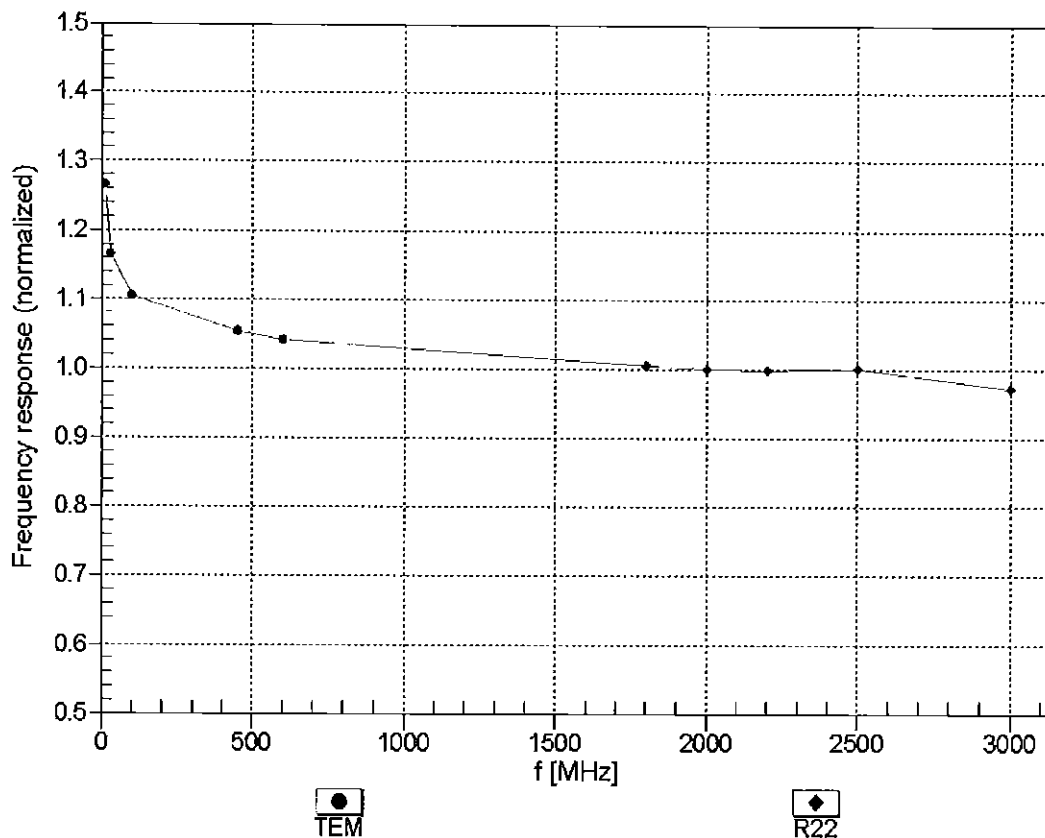
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

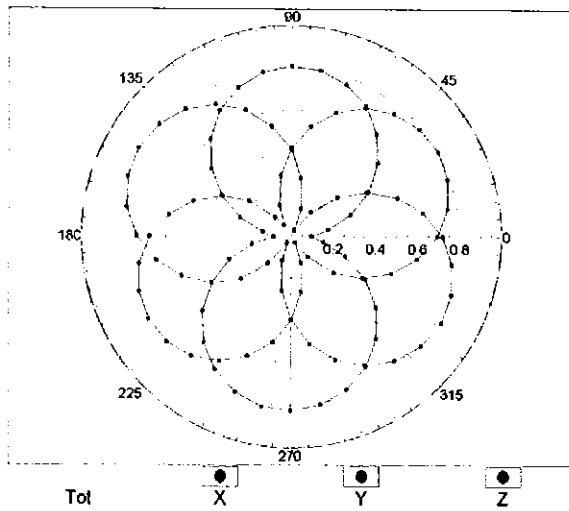
(TEM-Cell:ifi110 EXX, Waveguide: R22)



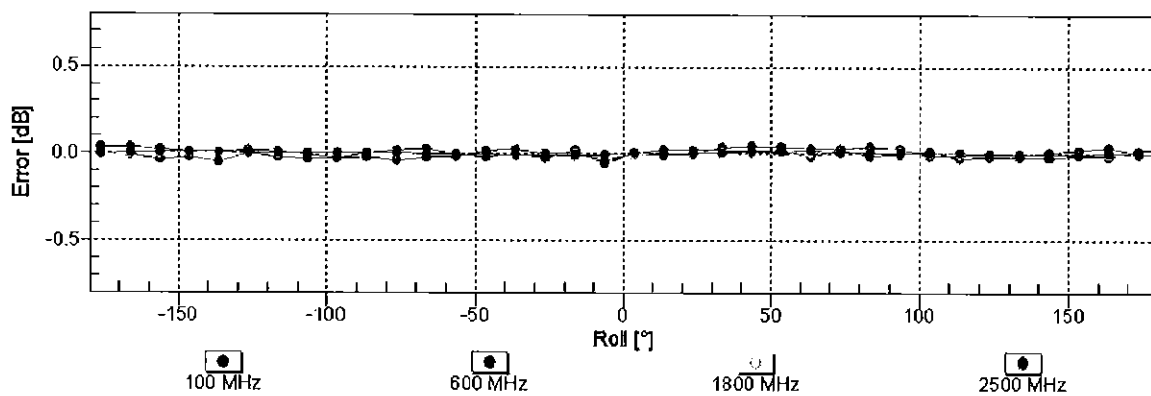
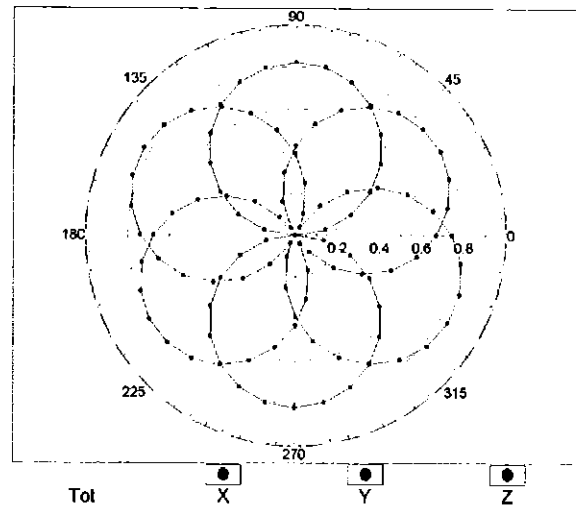
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

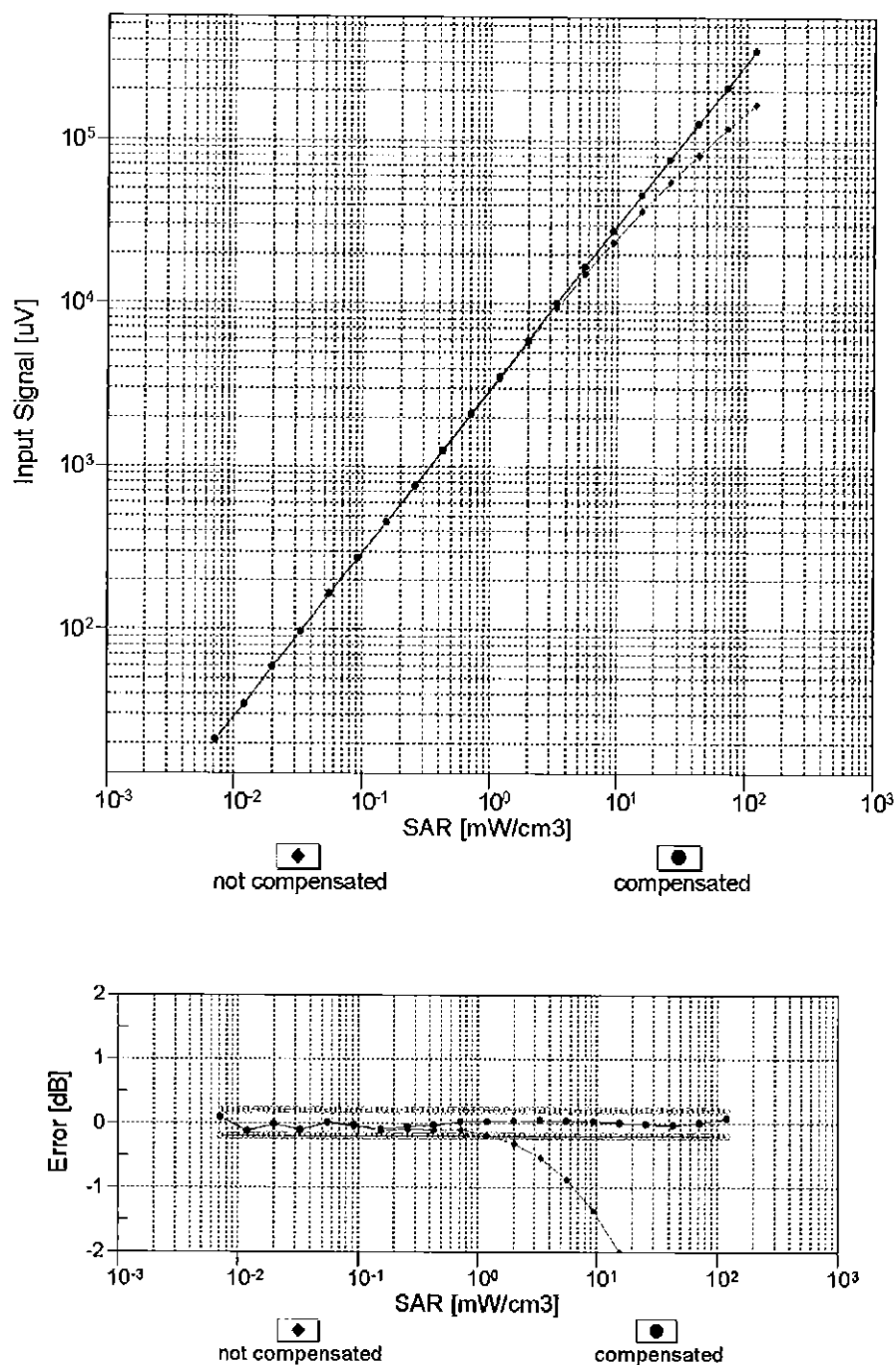


f=1800 MHz,R22



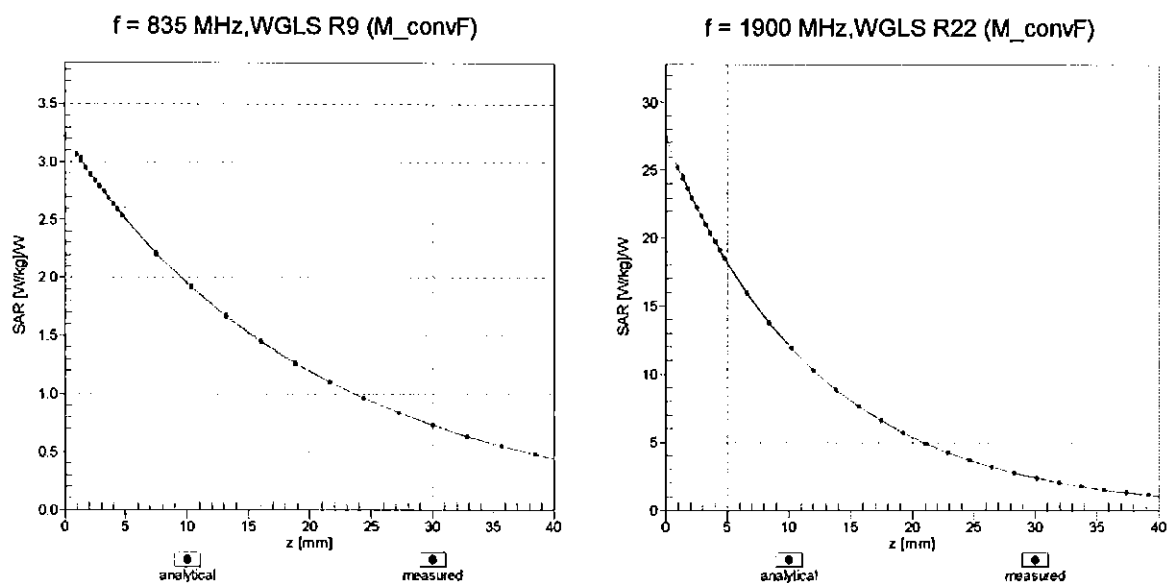
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f_{\text{eval}} = 1900 \text{ MHz}$)



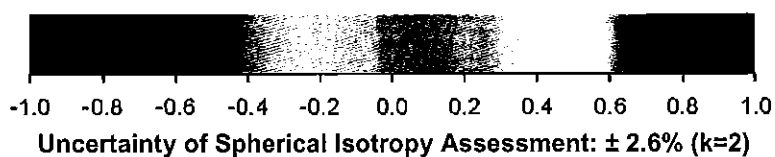
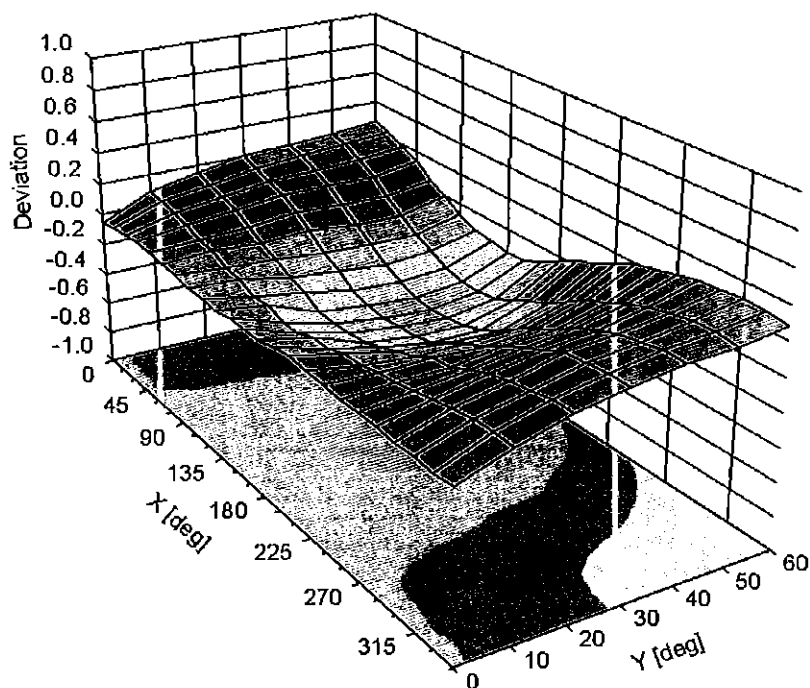
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: EX3DV4 - SN:7357

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	13.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm



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 **PG Test**

Certificate No: **ES3-3334_Nov15**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3334**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

BV ✓
 11/24/15

Calibration date: **November 17, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US3739J585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by:	Name Jeton Kasrafi	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature

Issued: November 17, 2015

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Accreditation No.: **SCS 0108**

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 Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
$NORM_{x,y,z}$	sensitivity in free space
$ConvF$	sensitivity in TSL / $NORM_{x,y,z}$
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- $NORM_{x,y,z}$: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). $NORM_{x,y,z}$ are only intermediate values, i.e., the uncertainties of $NORM_{x,y,z}$ does not affect the E^2 -field uncertainty inside TSL (see below $ConvF$).
- $NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response$ (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of $ConvF$.
- $DCP_{x,y,z}$: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- $A_{x,y,z}$; $B_{x,y,z}$; $C_{x,y,z}$; $D_{x,y,z}$; $VR_{x,y,z}$; A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- $ConvF$ and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to $NORM_{x,y,z} * ConvF$ whereby the uncertainty corresponds to that given for $ConvF$. A frequency dependent $ConvF$ is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the $NORM_x$ (no uncertainty required).

Probe ES3DV3

SN:3334

Manufactured: January 24, 2012
Calibrated: November 17, 2015

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3334

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.03	1.03	0.99	$\pm 10.1 \%$
DCP (mV) ^B	107.6	105.3	107.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	192.1	$\pm 2.7 \%$
		Y	0.0	0.0	1.0		183.6	
		Z	0.0	0.0	1.0		183.3	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	2.27	60.1	10.2	10.00	38.6	$\pm 1.4 \%$
		Y	1.99	59.3	10.2		38.4	
		Z	5.38	67.8	12.9		37.2	
10011- CAB	UMTS-FDD (WCDMA)	X	3.40	68.0	18.9	2.91	131.7	$\pm 0.5 \%$
		Y	3.27	67.0	18.2		130.2	
		Z	3.41	68.3	19.1		148.5	
10012- CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.93	68.9	18.7	1.87	132.9	$\pm 0.7 \%$
		Y	3.12	69.6	18.8		130.2	
		Z	3.24	71.1	19.7		128.2	
10013- CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.90	70.3	23.0	9.46	133.5	$\pm 3.3 \%$
		Y	10.53	69.0	22.1		124.6	
		Z	11.14	71.2	23.6		147.1	
10021- DAB	GSM-FDD (TDMA, GMSK)	X	15.05	91.0	24.4	9.39	139.5	$\pm 1.9 \%$
		Y	10.11	85.5	23.3		131.9	
		Z	11.84	87.6	23.4		130.0	
10023- DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	10.42	84.9	22.6	9.57	131.5	$\pm 3.0 \%$
		Y	13.29	89.7	24.6		141.1	
		Z	14.17	90.2	24.2		148.7	
10024- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	11.26	83.1	19.4	6.56	140.7	$\pm 1.9 \%$
		Y	26.29	95.5	23.8		134.7	
		Z	16.82	88.9	21.3		131.6	
10027- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	64.74	99.9	22.2	4.80	131.5	$\pm 2.2 \%$
		Y	56.71	99.8	22.7		124.7	
		Z	63.10	99.9	22.2		124.1	
10028- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	62.11	99.6	21.6	3.55	146.1	$\pm 1.9 \%$
		Y	77.61	99.8	21.2		132.0	
		Z	72.33	99.7	21.2		133.3	
10032- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	96.24	92.7	15.9	1.16	137.2	$\pm 1.7 \%$
		Y	95.69	93.1	16.2		129.5	
		Z	98.67	94.1	16.4		149.7	
10100- CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.14	66.8	19.2	5.67	126.2	$\pm 1.7 \%$
		Y	6.21	66.8	19.1		139.9	
		Z	6.41	67.9	19.9		145.9	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.07	75.4	25.8	9.29	138.2	±2.5 %
		Y	9.54	73.3	24.5		130.5	
		Z	9.84	75.1	25.8		130.6	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.34	67.6	19.8	5.80	149.5	±1.4 %
		Y	6.13	66.6	19.1		132.1	
		Z	6.19	67.2	19.7		137.8	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.13	68.9	21.2	8.07	138.8	±2.7 %
		Y	10.16	68.9	21.1		149.6	
		Z	9.96	68.7	21.1		127.1	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.42	74.4	25.5	9.28	132.9	±3.0 %
		Y	9.50	74.0	25.0		143.7	
		Z	9.01	73.4	25.0		126.5	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.03	67.1	19.6	5.75	145.5	±1.4 %
		Y	5.81	66.0	18.9		128.9	
		Z	5.91	66.8	19.5		135.1	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.19	66.5	19.2	5.82	126.7	±1.4 %
		Y	6.20	66.4	19.0		132.8	
		Z	6.39	67.5	19.8		141.1	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.05	67.6	20.0	5.73	146.8	±1.4 %
		Y	4.82	66.2	19.2		132.2	
		Z	4.96	67.4	20.0		143.8	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.88	79.7	28.3	9.21	147.9	±3.0 %
		Y	8.00	76.1	26.2		138.9	
		Z	8.39	78.5	27.8		141.5	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.99	67.3	19.9	5.72	140.7	±1.2 %
		Y	4.80	66.2	19.1		131.3	
		Z	4.90	67.1	19.8		136.1	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.99	67.3	19.9	5.72	145.4	±1.4 %
		Y	4.81	66.2	19.2		130.9	
		Z	4.89	67.1	19.8		136.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.78	68.8	21.3	8.10	131.0	±2.5 %
		Y	9.73	68.4	21.0		140.7	
		Z	9.94	69.4	21.6		146.6	
10225-CAB	UMTS-FDD (HSPA+)	X	6.88	66.9	19.3	5.97	133.9	±1.7 %
		Y	6.96	67.1	19.3		144.8	
		Z	6.71	66.6	19.2		125.7	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	9.00	80.2	28.5	9.21	148.2	±3.0 %
		Y	7.73	75.1	25.7		131.6	
		Z	8.27	78.2	27.7		136.1	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.59	76.3	26.7	9.24	144.1	±2.7 %
		Y	8.74	72.9	24.5		133.4	
		Z	9.14	75.2	26.1		136.9	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.25	73.9	25.3	9.30	124.8	±3.0 %
		Y	9.40	73.7	24.9		142.1	
		Z	9.86	76.1	26.5		145.3	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.38	66.9	18.7	3.96	133.3	±0.9 %
		Y	4.44	66.9	18.6		148.2	
		Z	4.30	66.7	18.6		128.9	
10291-AAB	CDMA2000, RC3, SQ55, Full Rate	X	3.68	67.3	18.7	3.46	145.8	±0.7 %
		Y	3.58	66.6	18.2		136.3	
		Z	3.62	67.3	18.8		139.4	
10292-AAB	CDMA2000, RC3, SQ32, Full Rate	X	3.73	68.0	19.1	3.39	147.5	±0.7 %
		Y	3.55	66.7	18.3		138.5	
		Z	3.60	67.6	18.9		143.0	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.30	67.4	19.7	5.81	141.4	±1.2 %
		Y	6.11	66.5	19.1		130.3	
		Z	6.17	67.0	19.5		136.8	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.88	68.0	20.1	6.06	147.0	±1.7 %
		Y	6.68	67.1	19.5		136.0	
		Z	6.75	67.7	20.0		141.6	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	9.97	68.8	21.4	8.37	126.9	±2.7 %
		Y	10.07	68.9	21.4		143.6	
		Z	10.21	69.7	22.0		147.4	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.77	68.5	18.8	3.76	134.9	±0.5 %
		Y	4.69	68.1	18.5		126.7	
		Z	4.74	68.8	18.9		129.4	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.72	68.7	18.8	3.77	132.9	±0.7 %
		Y	4.78	68.9	18.9		147.4	
		Z	4.63	68.7	18.9		127.1	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.72	68.9	18.8	1.54	131.9	±0.5 %
		Y	2.65	68.0	18.1		145.9	
		Z	2.72	69.3	19.0		127.3	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.81	68.6	21.2	8.23	131.6	±2.7 %
		Y	9.90	68.7	21.2		144.1	
		Z	9.97	69.3	21.7		146.0	

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 7 and 8).

^B Numerical linearization parameter: uncertainty not required.

^C Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3334

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^e	Conductivity (S/m) ^e	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth (mm) ^g	Unc (k=2)
6	55.5	0.75	6.13	6.13	6.13	0.00	1.00	± 13.3 %
13	55.5	0.75	5.76	5.76	5.76	0.00	1.00	± 13.3 %
750	41.9	0.89	6.56	6.56	6.56	0.24	2.36	± 12.0 %
835	41.5	0.90	6.37	6.37	6.37	0.37	1.70	± 12.0 %
1750	40.1	1.37	5.39	5.39	5.39	0.58	1.32	± 12.0 %
1900	40.0	1.40	5.18	5.18	5.18	0.77	1.20	± 12.0 %
2300	39.5	1.67	4.85	4.85	4.85	0.71	1.28	± 12.0 %
2450	39.2	1.80	4.58	4.58	4.58	0.79	1.17	± 12.0 %
2600	39.0	1.96	4.46	4.46	4.46	0.80	1.26	± 12.0 %

^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^e At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^g Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3334

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth ^g (mm)	Unc (k=2)
750	55.5	0.96	6.37	6.37	6.37	0.74	1.22	± 12.0 %
835	55.2	0.97	6.24	6.24	6.24	0.31	1.94	± 12.0 %
1750	53.4	1.49	5.03	5.03	5.03	0.50	1.57	± 12.0 %
1900	53.3	1.52	4.84	4.84	4.84	0.50	1.58	± 12.0 %
2300	52.9	1.81	4.61	4.61	4.61	0.74	1.23	± 12.0 %
2450	52.7	1.95	4.45	4.45	4.45	0.74	1.20	± 12.0 %
2600	52.5	2.16	4.29	4.29	4.29	0.80	1.20	± 12.0 %

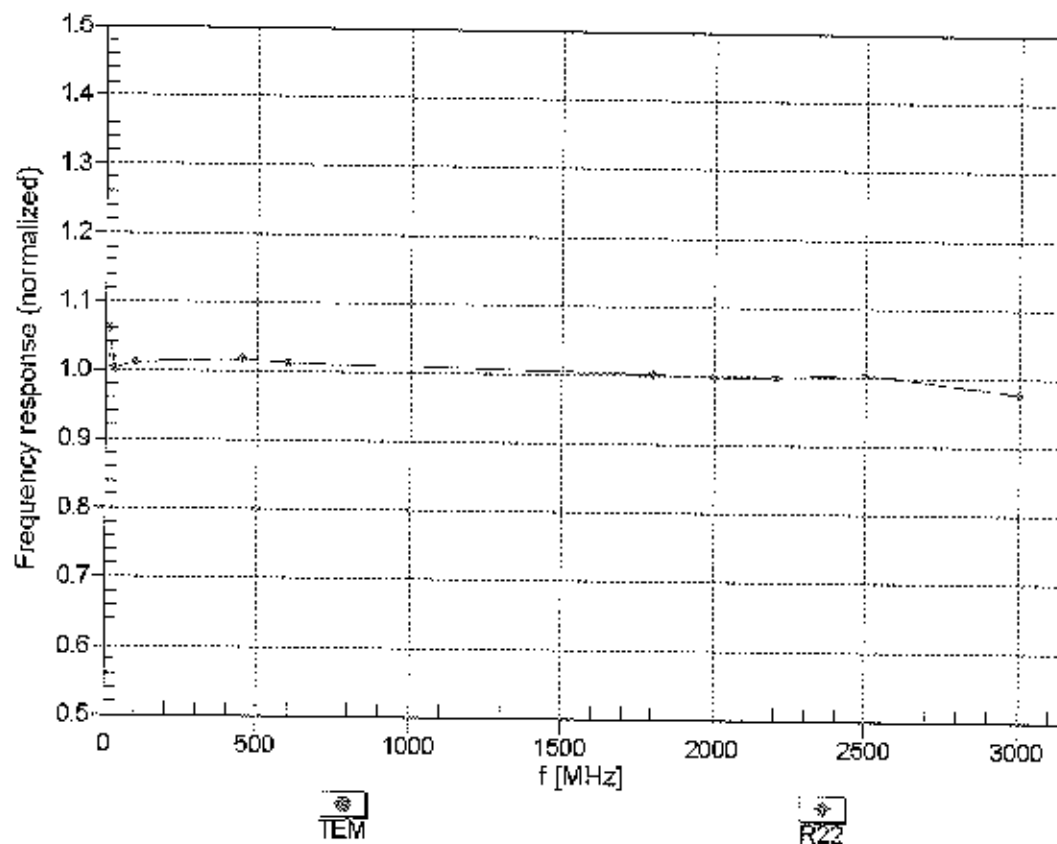
^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^f At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^g Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

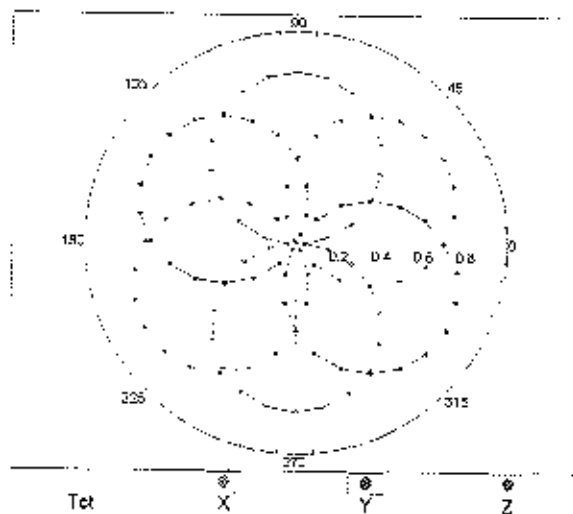
(TEM-Cell:ifi110 EXX, Waveguide: R22)



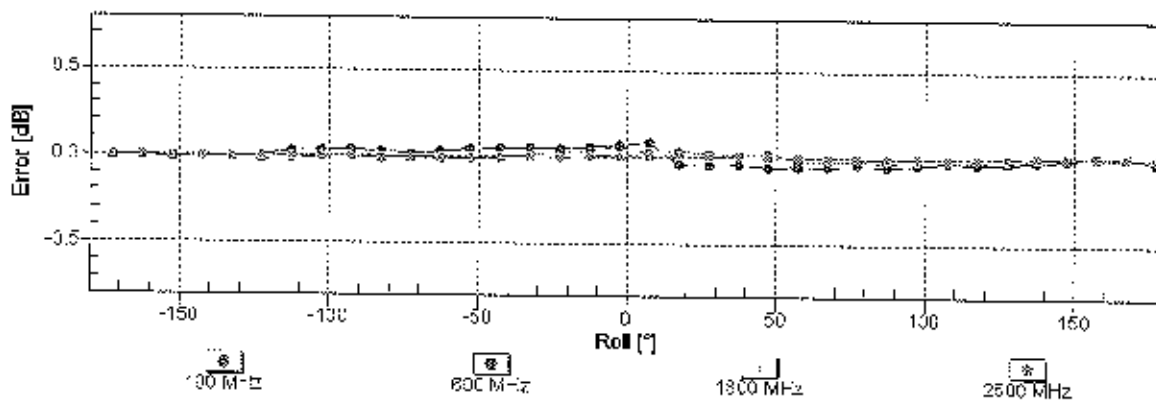
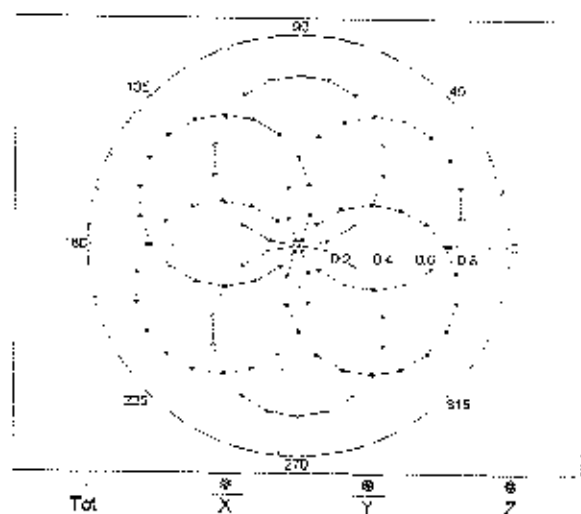
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

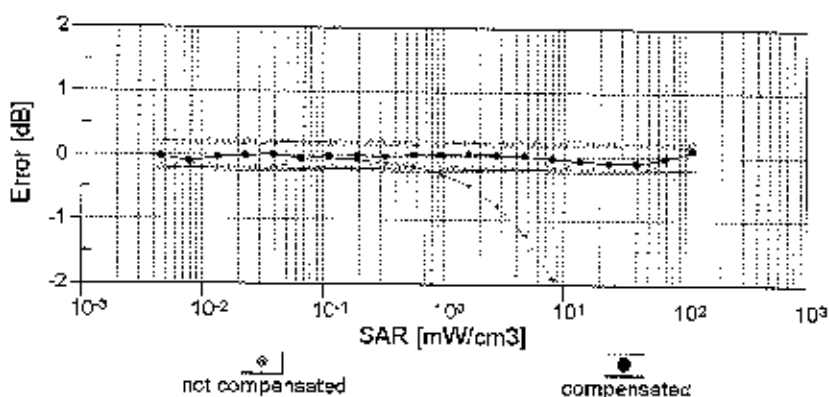
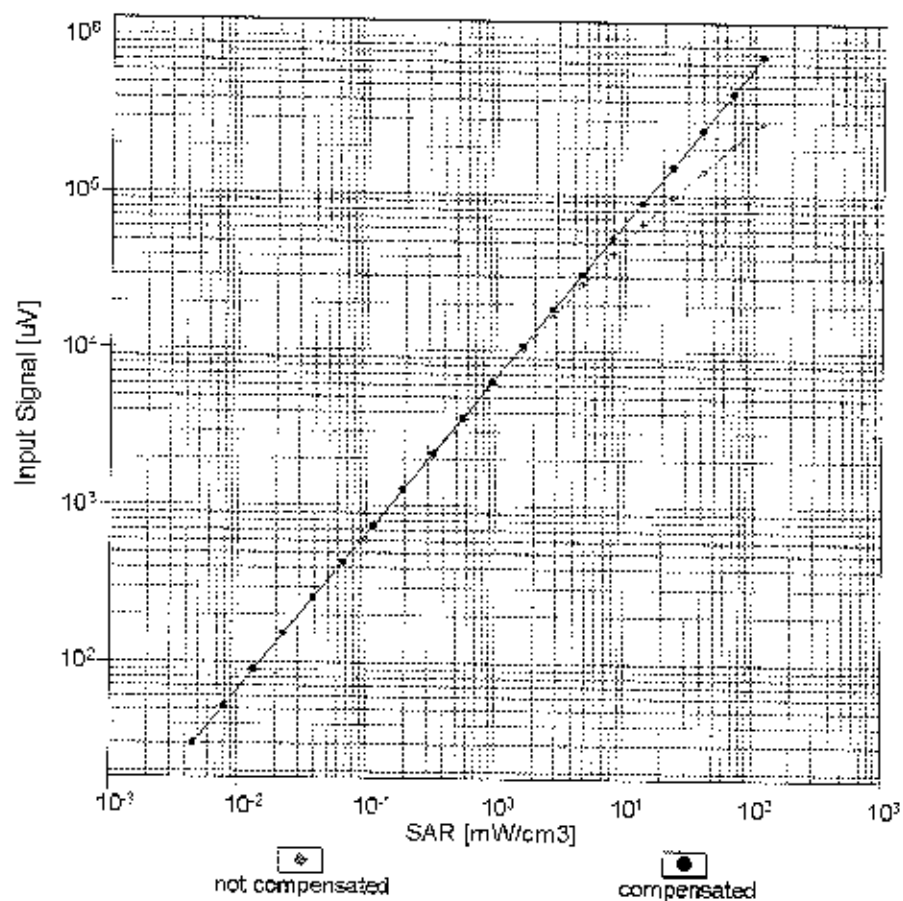


f=1800 MHz,R22



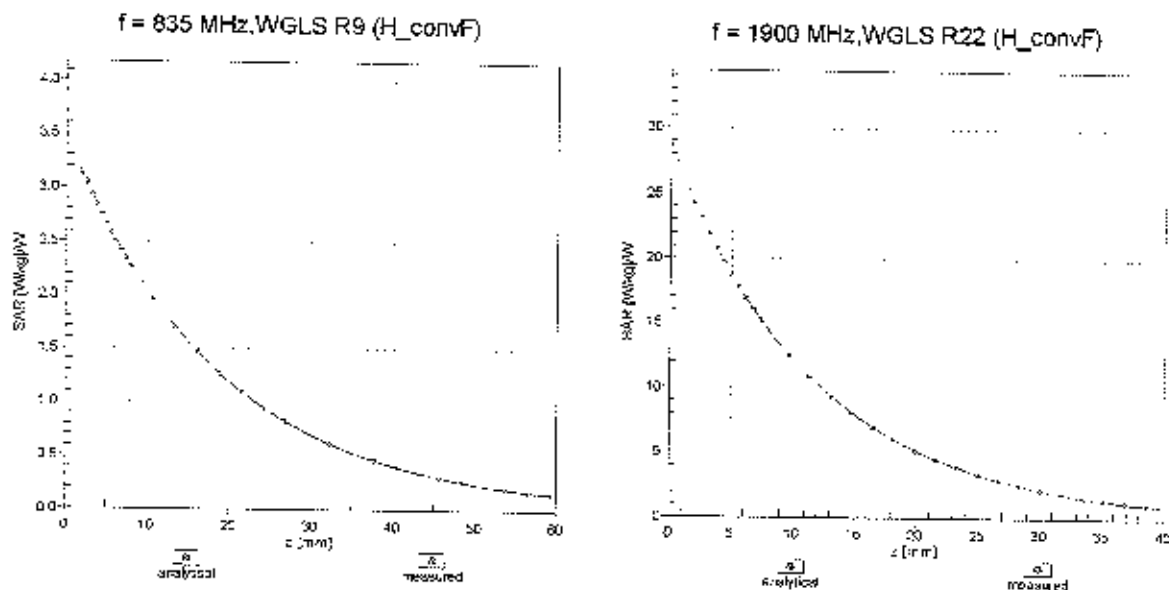
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f_{\text{eval}} = 1900 \text{ MHz}$)



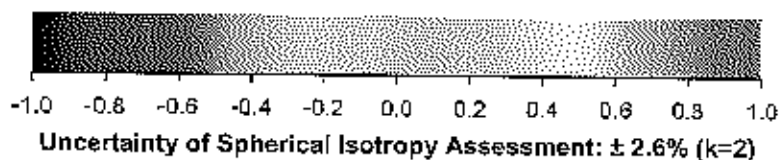
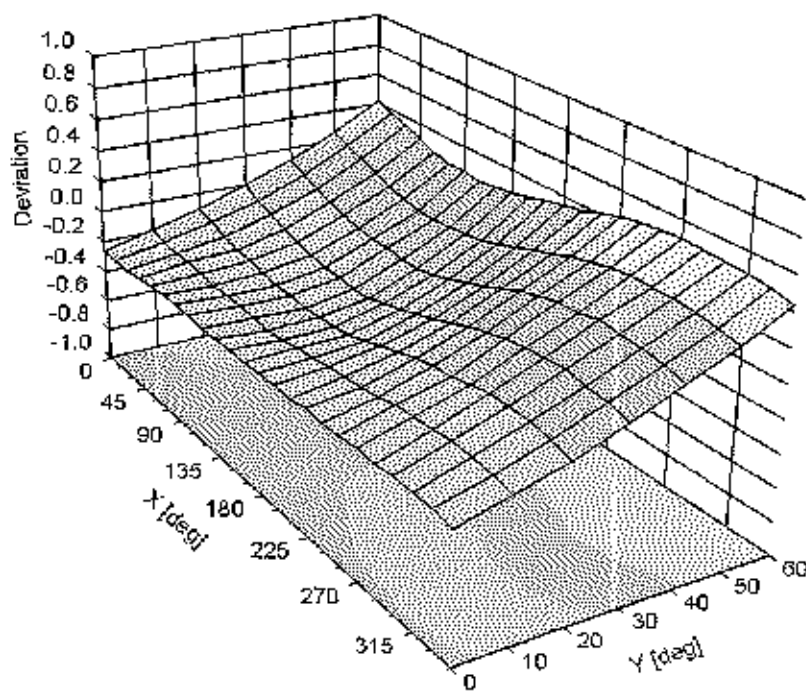
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3334

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	17.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Client **PC Test**

Certificate No: **ES3-3319_Mar16**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3319**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

Calibration date: **March 18, 2016**

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)

BN
03/20/2016

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: March 21, 2016			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe ES3DV3

SN:3319

Manufactured: January 10, 2012
Calibrated: March 18, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3319

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$) ^A	1.12	1.08	1.16	$\pm 10.1 \%$
DCP (mV) ^B	104.1	104.5	103.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu V}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	203.1	$\pm 3.5 \%$
		Y	0.0	0.0	1.0		203.8	
		Z	0.0	0.0	1.0		200.4	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	2.29	60.1	11.2	10.00	42.0	$\pm 1.2 \%$
		Y	1.95	58.7	10.4		42.0	
		Z	3.15	62.5	12.1		42.9	
10012- CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.45	71.5	19.9	1.87	122.0	$\pm 0.5 \%$
		Y	2.88	68.4	18.6		122.8	
		Z	3.35	70.8	19.5		120.5	
10100- CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.39	67.3	19.5	5.67	132.3	$\pm 1.2 \%$
		Y	6.54	68.2	20.1		134.5	
		Z	6.40	67.4	19.6		130.2	
10103- CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.41	75.3	25.6	9.29	124.2	$\pm 2.2 \%$
		Y	10.45	76.3	26.6		122.6	
		Z	10.82	75.9	25.8		124.8	
10108- CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.30	67.1	19.5	5.80	130.7	$\pm 1.2 \%$
		Y	6.35	67.5	19.9		131.5	
		Z	6.33	67.1	19.6		128.5	
10151- CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.70	74.1	25.2	9.28	118.8	$\pm 2.2 \%$
		Y	9.65	74.9	26.0		117.1	
		Z	10.15	75.0	25.5		119.2	
10154- CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.00	66.6	19.3	5.75	127.4	$\pm 1.2 \%$
		Y	6.01	66.9	19.6		128.9	
		Z	6.02	66.6	19.3		125.6	
10160- CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.45	67.2	19.6	5.82	132.2	$\pm 1.2 \%$
		Y	6.47	67.5	19.9		133.5	
		Z	6.45	67.1	19.5		130.0	
10169- CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.76	65.7	19.0	5.73	110.8	$\pm 0.9 \%$
		Y	4.80	66.3	19.5		112.0	
		Z	4.84	65.9	19.1		109.2	
10172- CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.98	78.7	27.7	9.21	132.0	$\pm 2.5 \%$
		Y	9.71	82.4	30.0		132.2	
		Z	9.79	80.4	28.4		133.4	
10175- CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.76	65.6	19.0	5.72	109.8	$\pm 0.9 \%$
		Y	4.76	66.1	19.4		111.4	
		Z	4.83	65.8	19.1		108.9	

10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.77	65.7	19.1	5.72	109.2	±0.9 %
		Y	4.78	66.2	19.4		111.9	
		Z	5.24	67.7	20.2		149.0	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.93	78.5	27.6	9.21	131.4	±2.5 %
		Y	9.48	81.7	29.7		131.7	
		Z	9.69	80.3	28.3		131.6	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	8.94	73.0	24.7	9.24	111.2	±2.2 %
		Y	9.05	74.3	25.9		111.8	
		Z	9.29	73.6	24.9		111.3	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.62	73.9	25.1	9.30	117.4	±2.2 %
		Y	9.73	75.1	26.1		118.2	
		Z	10.08	74.8	25.5		118.2	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.31	67.1	19.6	5.81	128.6	±1.2 %
		Y	6.39	67.6	20.0		132.2	
		Z	6.33	67.1	19.6		127.2	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.87	67.6	19.9	6.06	132.8	±1.4 %
		Y	6.96	68.2	20.3		137.0	
		Z	6.88	67.6	19.9		131.3	

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 6 and 7).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3319

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	6.44	6.44	6.44	0.49	1.80	± 12.0 %
835	41.5	0.90	6.16	6.16	6.16	0.46	1.80	± 12.0 %
1750	40.1	1.37	5.20	5.20	5.20	0.51	1.45	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.58	1.40	± 12.0 %
2300	39.5	1.67	4.69	4.69	4.69	0.80	1.21	± 12.0 %
2450	39.2	1.80	4.47	4.47	4.47	0.75	1.32	± 12.0 %
2600	39.0	1.96	4.33	4.33	4.33	0.80	1.31	± 12.0 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3319

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	6.06	6.06	6.06	0.47	1.45	± 12.0 %
835	55.2	0.97	6.04	6.04	6.04	0.63	1.27	± 12.0 %
1750	53.4	1.49	4.91	4.91	4.91	0.46	1.66	± 12.0 %
1900	53.3	1.52	4.70	4.70	4.70	0.80	1.24	± 12.0 %
2300	52.9	1.81	4.36	4.36	4.36	0.74	1.33	± 12.0 %
2450	52.7	1.95	4.20	4.20	4.20	0.80	1.25	± 12.0 %
2600	52.5	2.16	3.99	3.99	3.99	0.80	1.20	± 12.0 %

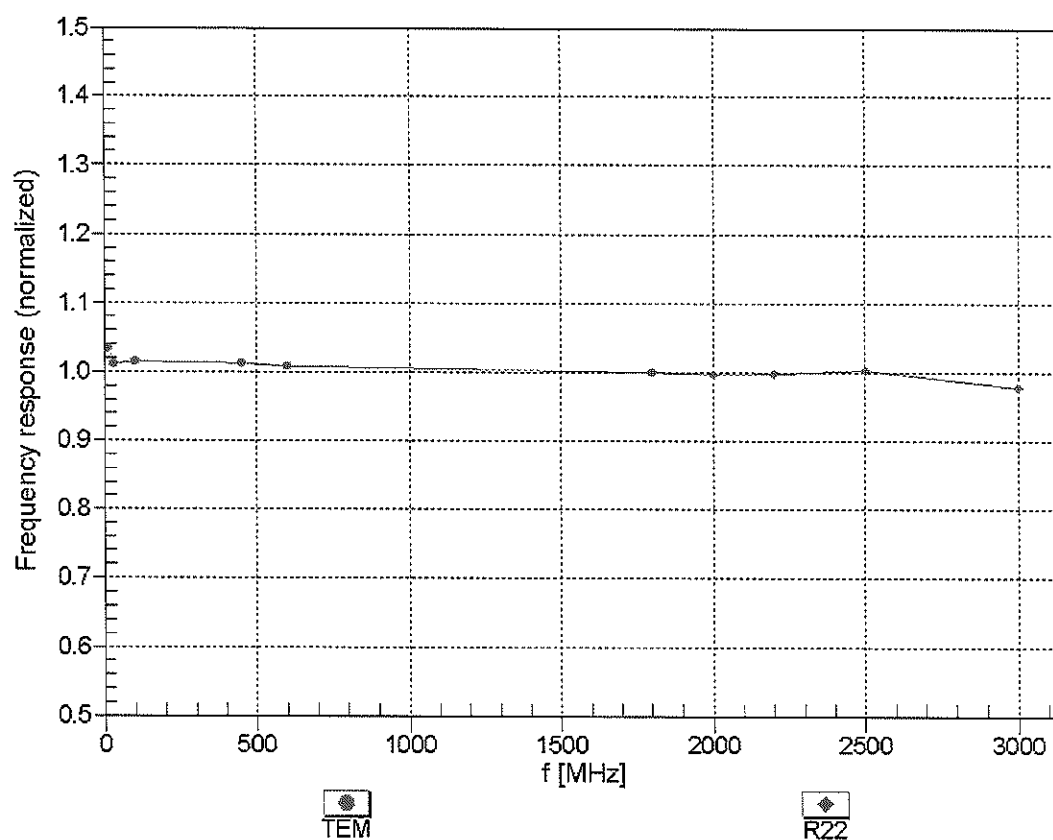
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

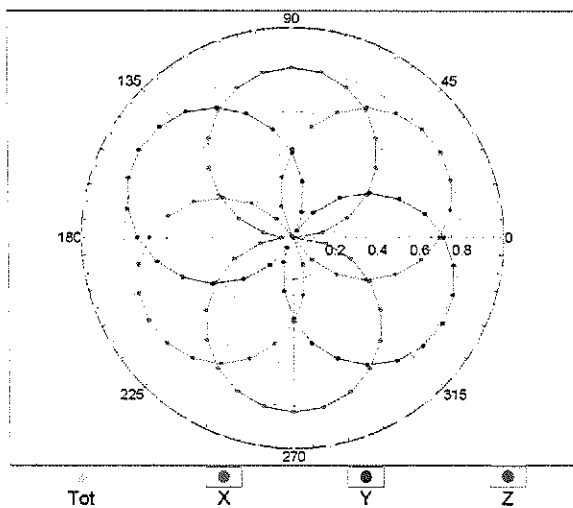
(TEM-Cell:ifi110 EXX, Waveguide: R22)



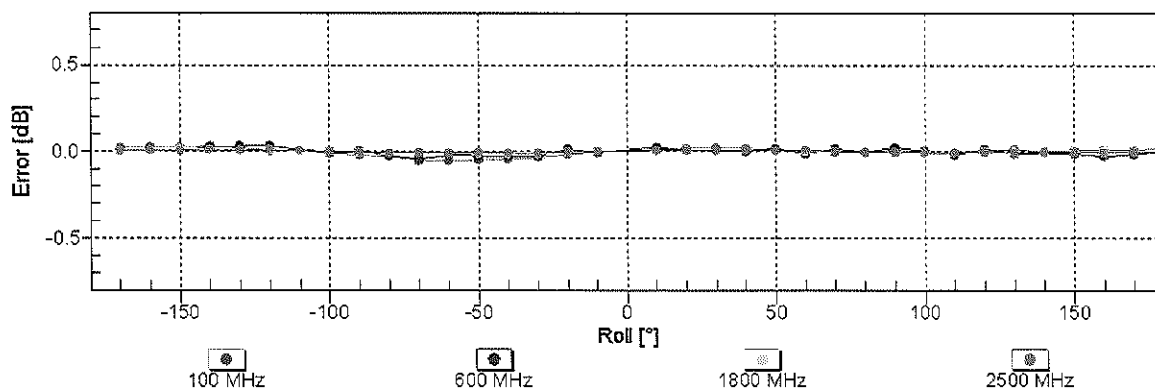
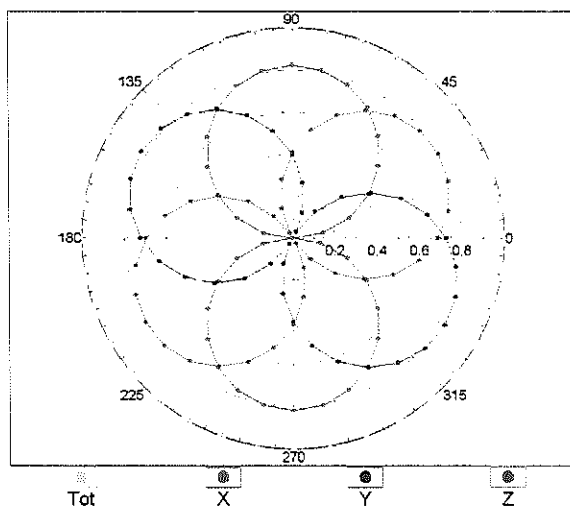
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz, TEM

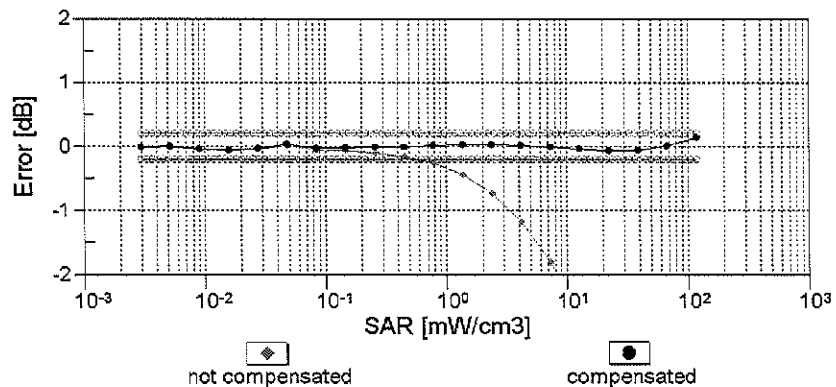
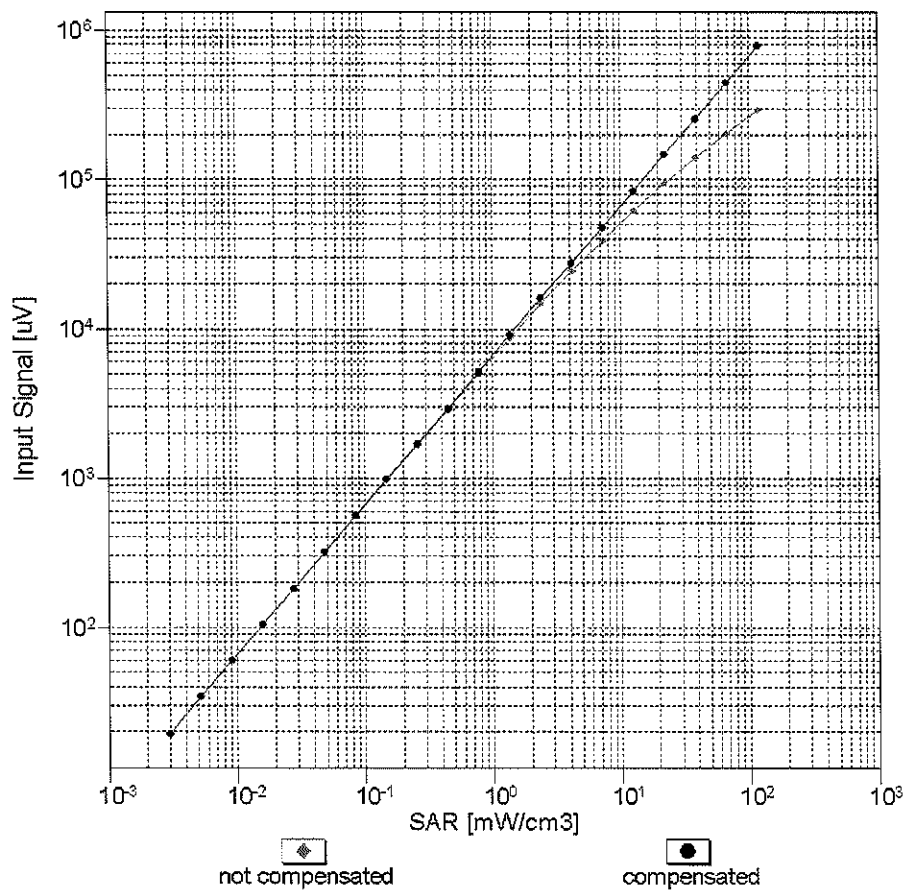


f=1800 MHz, R22



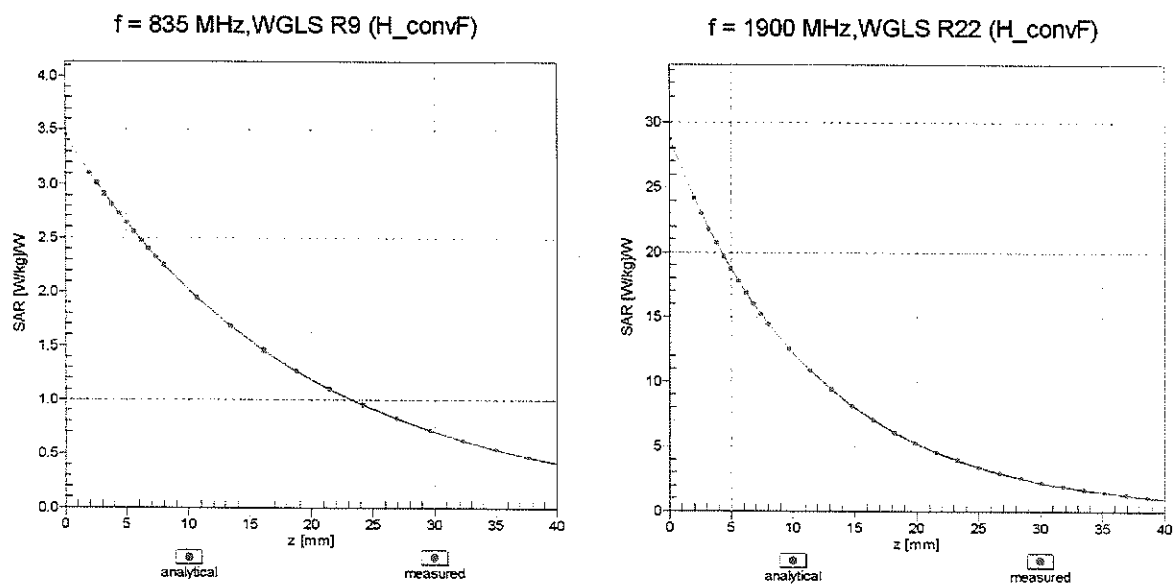
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$)



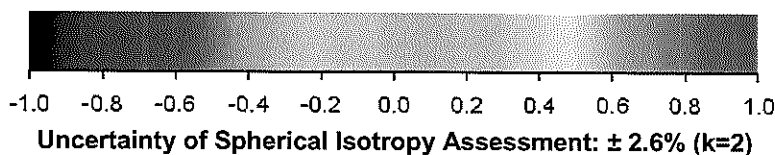
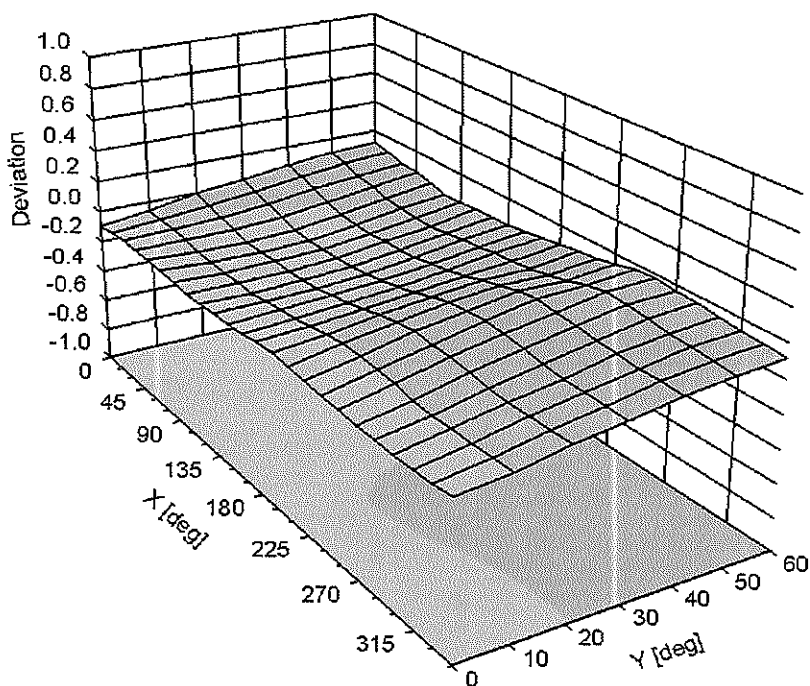
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3319

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	60
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm



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Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **EX3-3914_Feb16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3914**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

BN
03/01/2016

Calibration date: **February 22, 2016**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by:	Name Jeon Kastrati	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature
Issued: February 22, 2016 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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Accreditation No.: **SCS 0108**

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe EX3DV4

SN:3914

Manufactured: December 18, 2012
Calibrated: February 22, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.48	0.42	0.46	$\pm 10.1 \%$
DCP (mV) ^B	100.1	102.6	97.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	137.4	$\pm 2.7 \%$
		Y	0.0	0.0	1.0		139.7	
		Z	0.0	0.0	1.0		133.7	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	4.02	69.7	14.2	10.00	41.0	$\pm 0.9 \%$
		Y	2.42	64.8	12.4		41.8	
		Z	2.11	63.9	12.8		44.9	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	10.26	68.5	21.3	8.68	127.9	$\pm 3.3 \%$
		Y	10.16	68.6	21.4		127.8	
		Z	10.42	68.8	21.4		144.6	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.15	68.2	20.7	8.07	129.4	$\pm 3.3 \%$
		Y	10.18	68.5	20.9		131.7	
		Z	10.42	68.8	20.9		148.3	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.13	68.8	21.1	8.10	146.4	$\pm 2.7 \%$
		Y	9.80	68.3	20.9		126.3	
		Z	9.98	68.3	20.8		139.8	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.33	68.8	21.3	8.37	145.0	$\pm 2.7 \%$
		Y	10.13	68.7	21.3		132.0	
		Z	10.21	68.5	21.0		140.2	
10401-AAC	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	10.67	68.4	21.1	8.60	125.8	$\pm 3.3 \%$
		Y	10.92	69.3	21.6		140.7	
		Z	10.94	69.0	21.3		148.7	
10402-AAC	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	10.64	68.4	20.8	8.53	125.5	$\pm 3.3 \%$
		Y	11.11	69.7	21.6		142.1	
		Z	10.93	69.0	21.1		149.2	

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%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
5250	35.9	4.71	5.07	5.07	5.07	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.66	4.66	4.66	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.74	4.74	4.74	0.40	1.80	± 13.1 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	9.57	9.57	9.57	0.47	0.85	± 12.0 %
835	55.2	0.97	9.44	9.44	9.44	0.47	0.85	± 12.0 %
1750	53.4	1.49	7.82	7.82	7.82	0.42	0.83	± 12.0 %
1900	53.3	1.52	7.50	7.50	7.50	0.45	0.80	± 12.0 %
2300	52.9	1.81	7.27	7.27	7.27	0.48	0.80	± 12.0 %
2450	52.7	1.95	7.22	7.22	7.22	0.46	0.80	± 12.0 %
2600	52.5	2.16	6.90	6.90	6.90	0.32	0.99	± 12.0 %
5250	48.9	5.36	4.32	4.32	4.32	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.63	3.63	3.63	0.60	1.90	± 13.1 %
5750	48.3	5.94	3.86	3.86	3.86	0.60	1.90	± 13.1 %

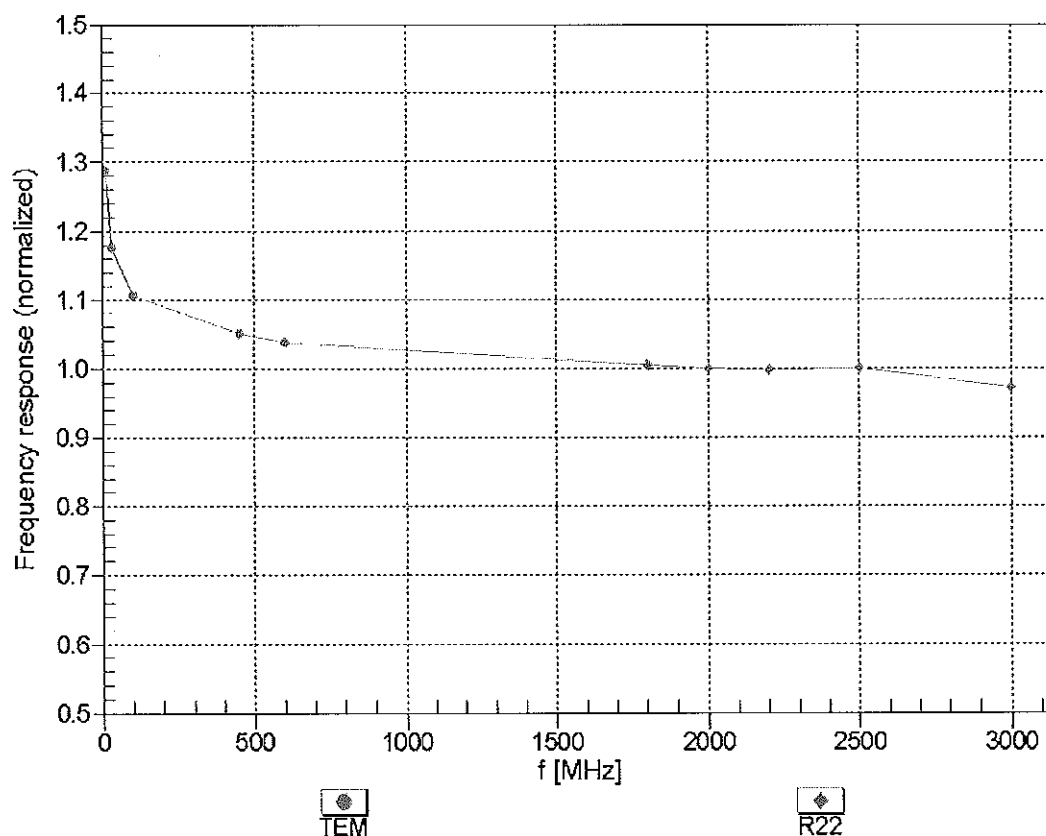
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

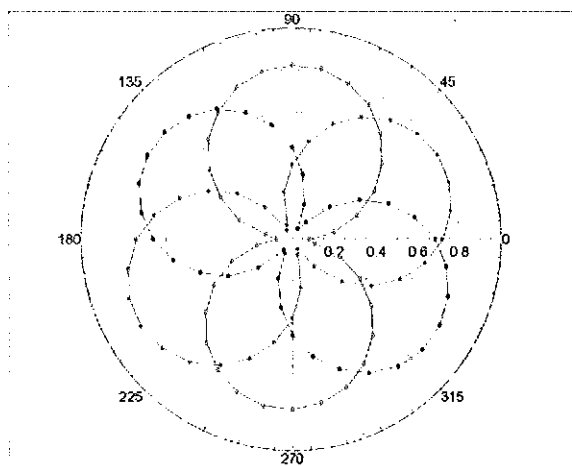
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$

f=600 MHz,TEM



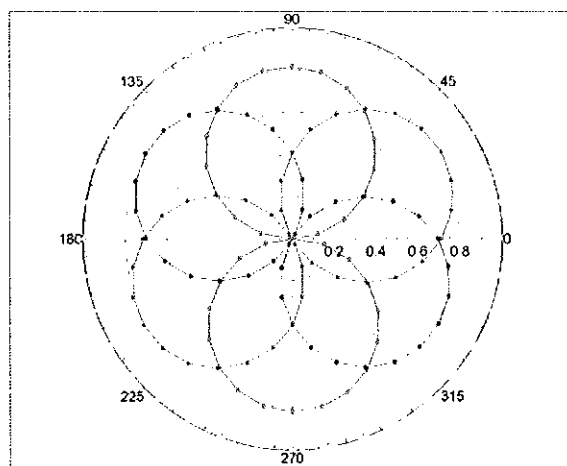
Tot

X

Y

Z

f=1800 MHz,R22

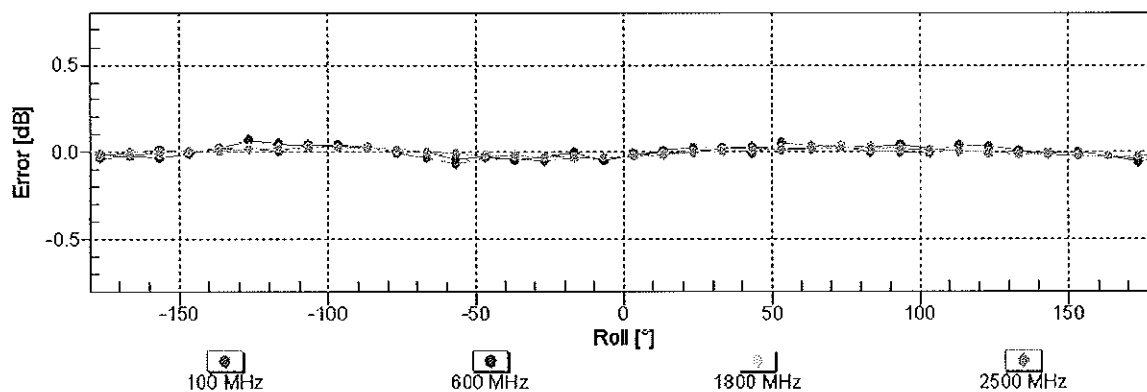


Tot

X

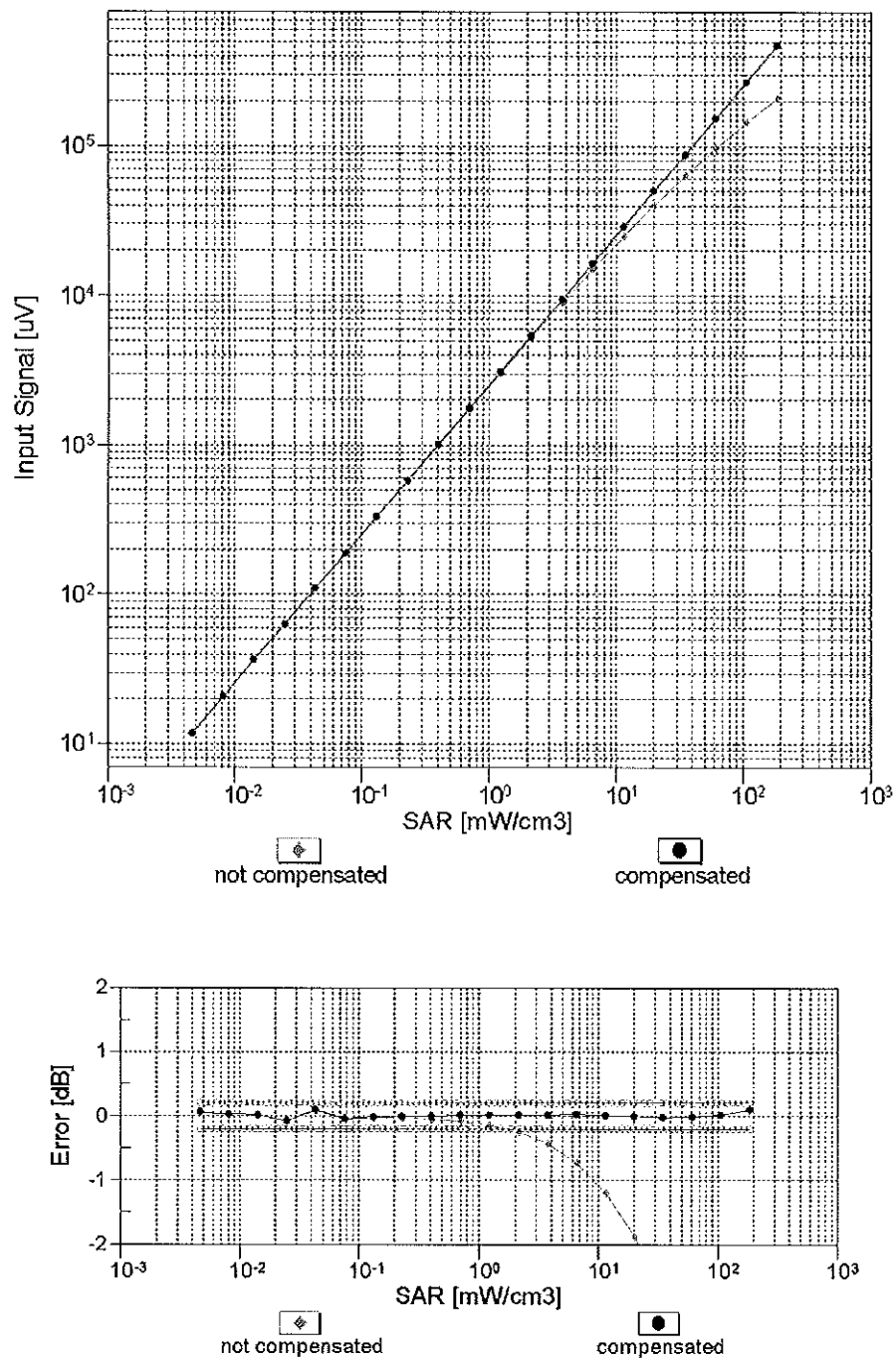
Y

Z



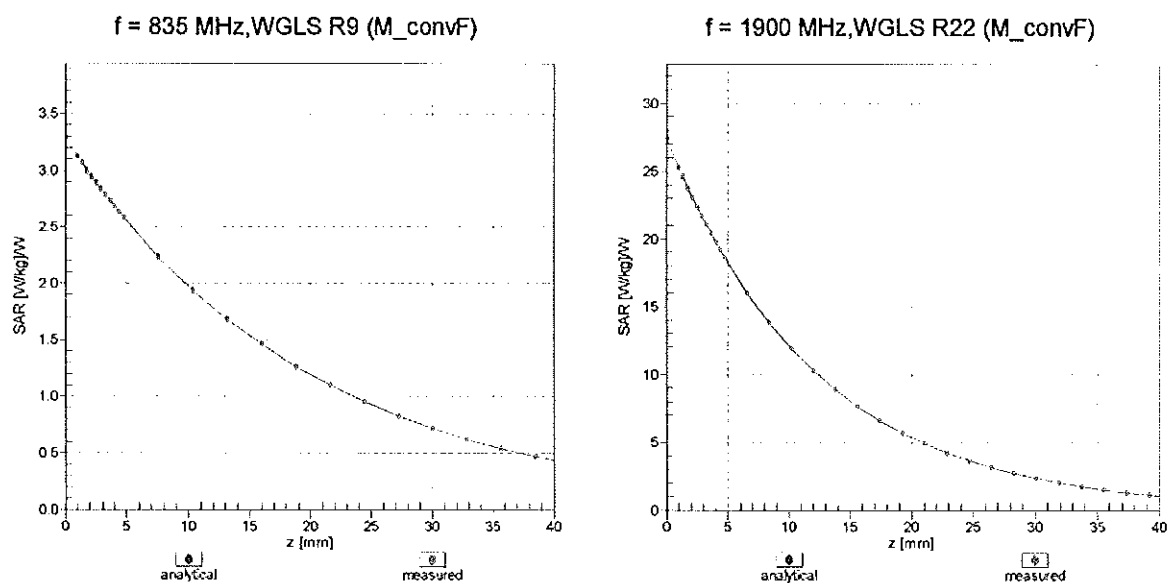
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$)



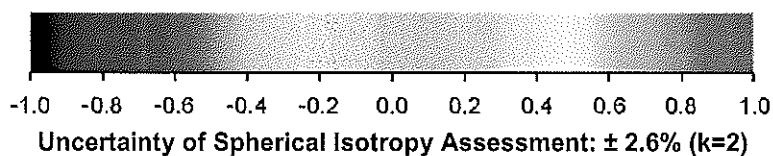
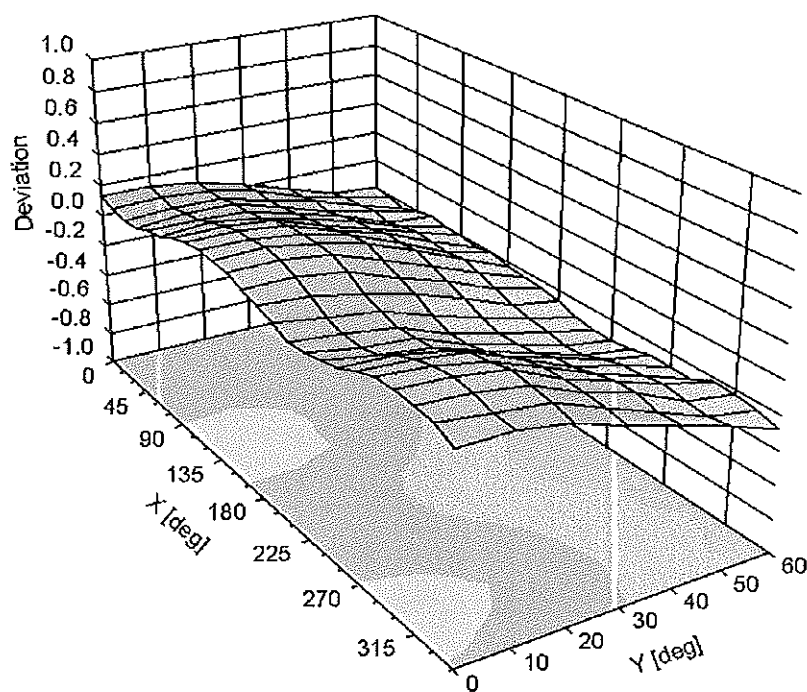
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	133.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm



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Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D750V3-1046_Feb16**

CALIBRATION CERTIFICATE

Object **D750V3 - SN:1046**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **February 16, 2016**

BN ✓
3/1/2016

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by: **Name** Michael Weber **Function** Laboratory Technician

Signature

Approved by: **Name** Katja Pokovic **Technical Manager**

Issued: February 17, 2016

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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:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.8 $\pm$ 6 %	0.90 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.20 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.36 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	55.1 $\pm$ 6 %	0.98 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.77 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.47 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.80 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.7 Ω + 2.3 j Ω
Return Loss	- 23.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.7 Ω - 0.8 j Ω
Return Loss	- 34.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.037 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 02, 2011

DASY5 Validation Report for Head TSL

Date: 16.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1046

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.9 \text{ S/m}$; $\epsilon_r = 41.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.28, 10.28, 10.28); Calibrated: 31.12.2015;
- 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, $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:

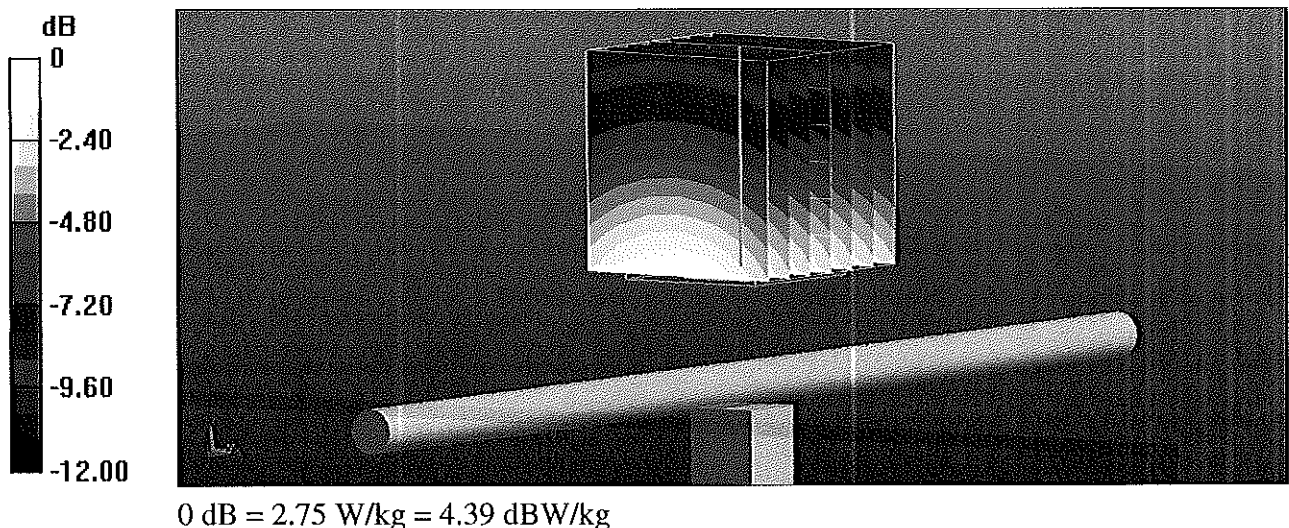
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 58.40 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.11 W/kg

SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.35 W/kg

Maximum value of SAR (measured) = 2.75 W/kg



Impedance Measurement Plot for Head TSL

16 Feb 2016 12:19:20
 [CH1] S11 1 U FS 1: 56.666 Ω 2.3223 Ω 492.80 pF 750.000 000 MHz

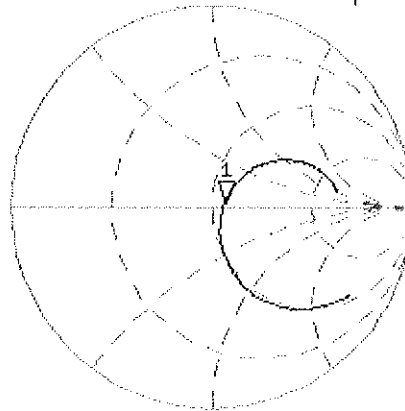
*

De1

CA

Avg
16

H1d



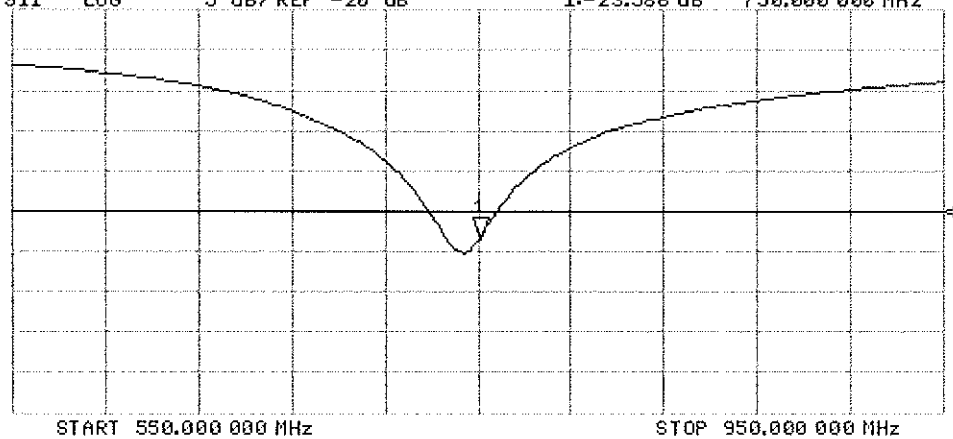
CH2 S11 LOG 5 dB/REF -20 dB 1: -23.586 dB 750.000 000 MHz

De1

CA

Avg
16

H1d



DASY5 Validation Report for Body TSL

Date: 16.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1046

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.98$ S/m; $\epsilon_r = 55.1$; $\rho = 1000$ kg/m³

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: 31.12.2015;
- 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/ $P_{in}=250$ mW, $d=15$ mm/Zoom Scan (7x7x7)/Cube 0:

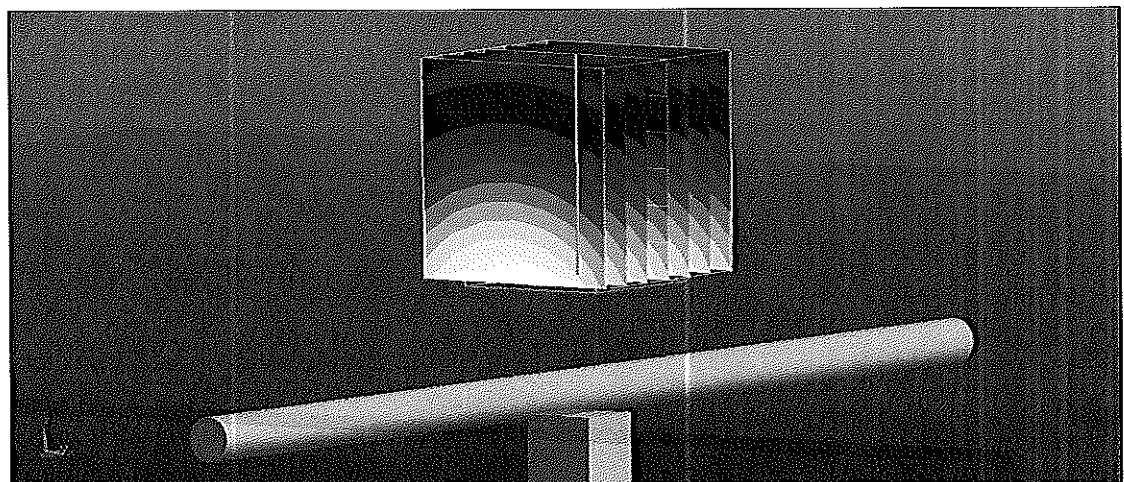
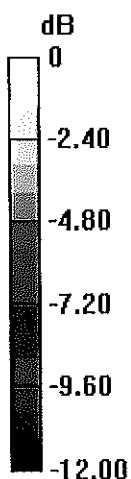
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 57.48 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.31 W/kg

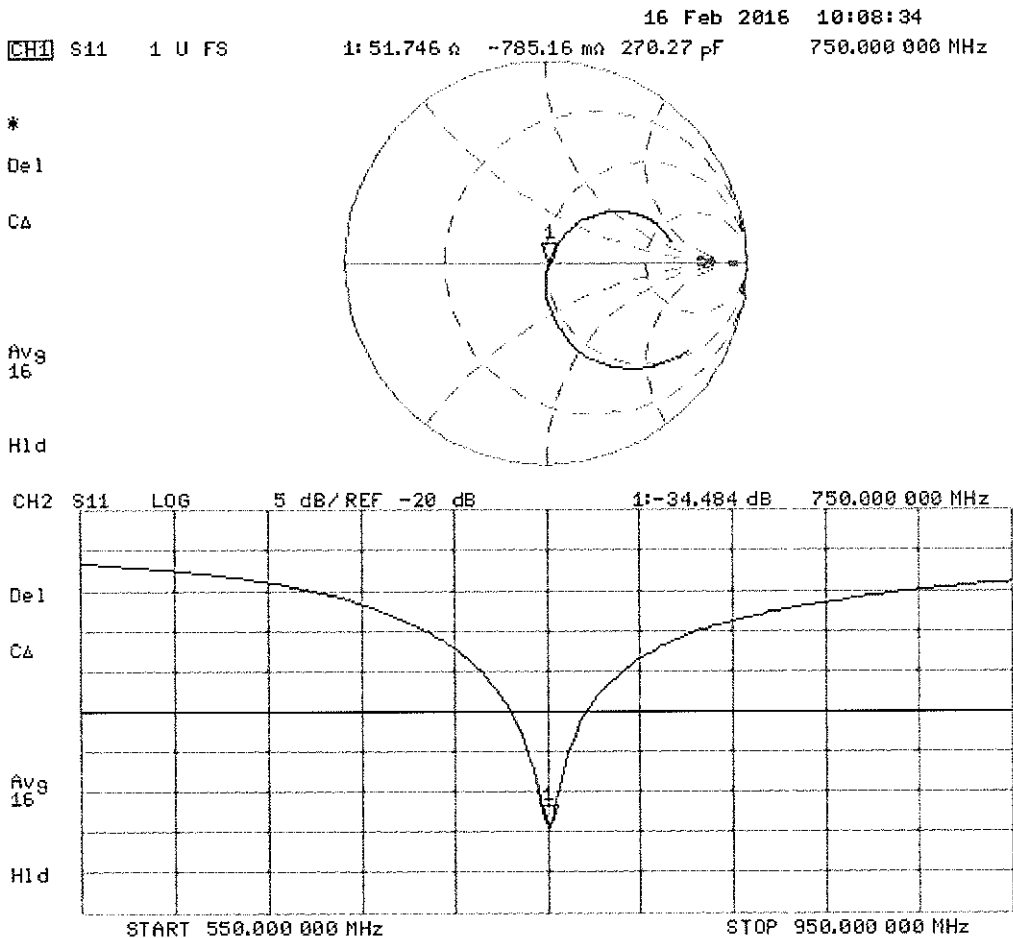
SAR(1 g) = 2.23 W/kg; SAR(10 g) = 1.47 W/kg

Maximum value of SAR (measured) = 2.94 W/kg



0 dB = 2.94 W/kg = 4.68 dBW/kg

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D1765V2-1008_May16**

CALIBRATION CERTIFICATE

Object **D1765V2 - SN:1008**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

*BNV
05/23/16*

Calibration date: **May 11, 2016**

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	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
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

Calibrated by: **Michael Weber** Name: **Michael Weber** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Technical Manager

Signature

M. Weber

Katja Pokovic

Issued: May 17, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.8 $\pm$ 6 %	1.36 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.7 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.81 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.3 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.50 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.8 $\pm$ 6 %	1.50 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.3 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.8 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.8 Ω - 6.0 j Ω
Return Loss	- 24.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.8 Ω - 6.8 j Ω
Return Loss	- 21.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.211 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2005

DASY5 Validation Report for Head TSL

Date: 11.05.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN: 1008

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.36$ S/m; $\epsilon_r = 39.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.54, 8.54, 8.54); Calibrated: 31.12.2015;
- 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:

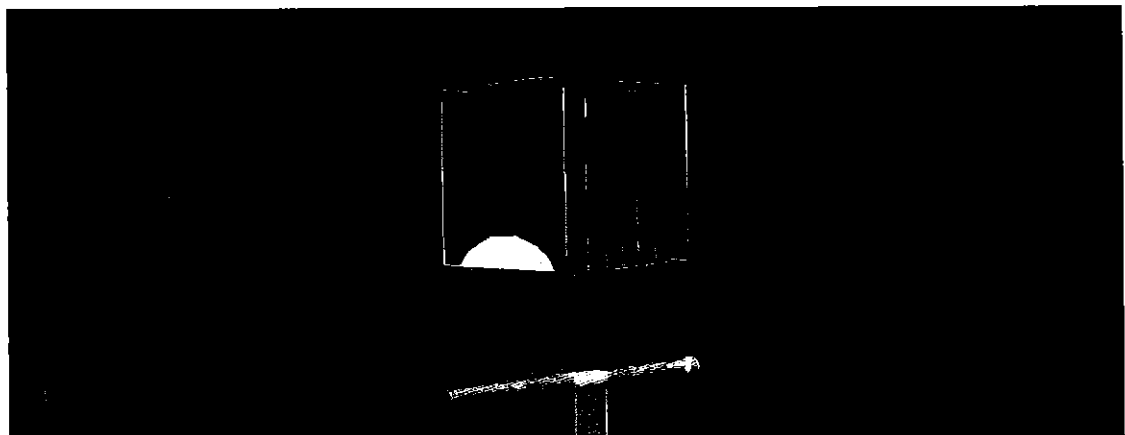
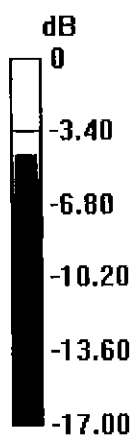
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.4 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 16.7 W/kg

SAR(1 g) = 9.1 W/kg; SAR(10 g) = 4.81 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 Head TSL

11 May 2016 13:10:14
 [CH1] S11 1 U FS 1: 48.842 Ω -6.0117 Ω 15.128 pF 1 750.000 000 MHz

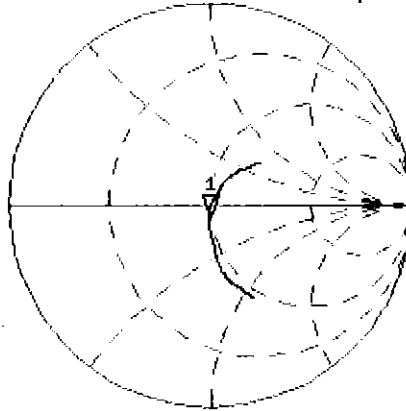
*

De1

Cor

Avg
16

H1d



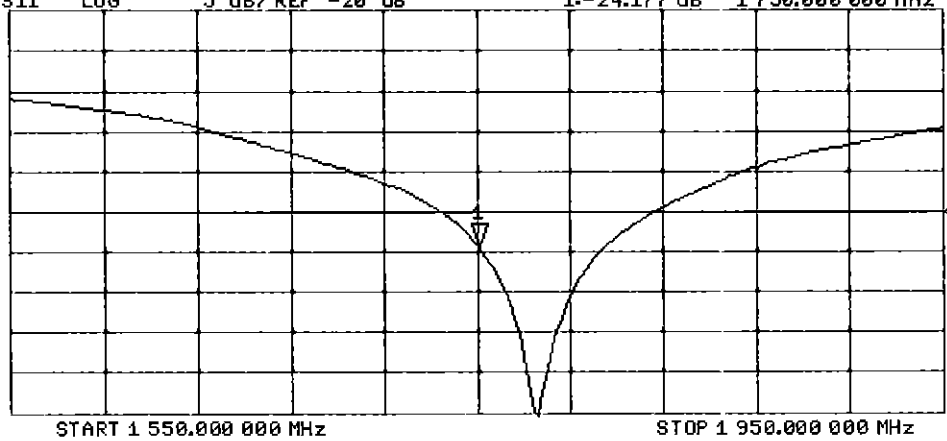
CH2 S11 LOG 5 dB/REF -20 dB 1:-24.177 dB 1 750.000 000 MHz

De1

Cor

Avg
16

H1d



DASY5 Validation Report for Body TSL

Date: 11.05.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN: 1008

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.5$ S/m; $\epsilon_r = 53.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.25, 8.25, 8.25); Calibrated: 31.12.2015;
- 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:

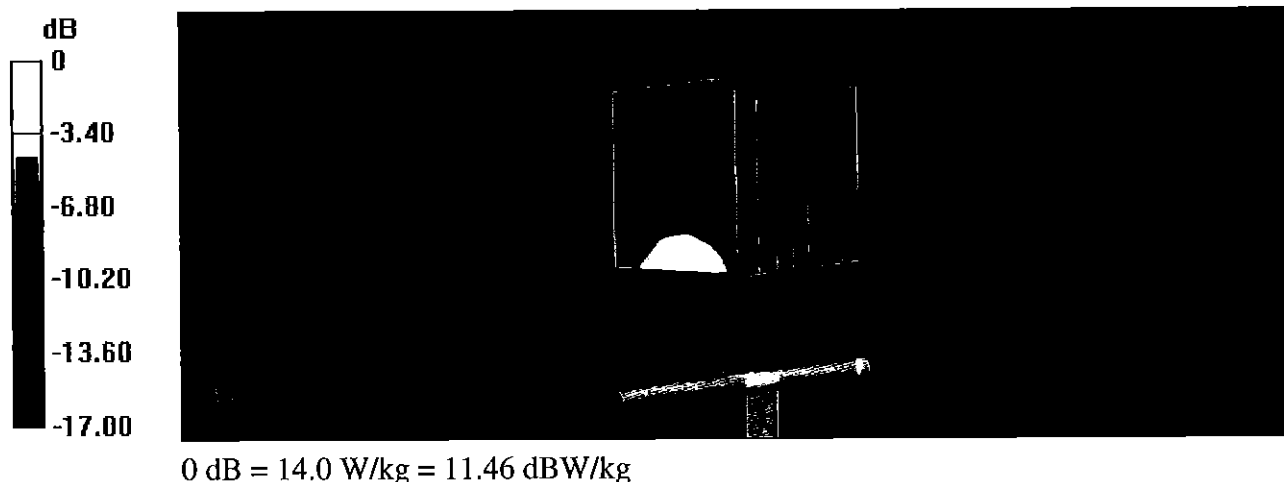
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.9 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 16.4 W/kg

SAR(1 g) = 9.3 W/kg; SAR(10 g) = 4.94 W/kg

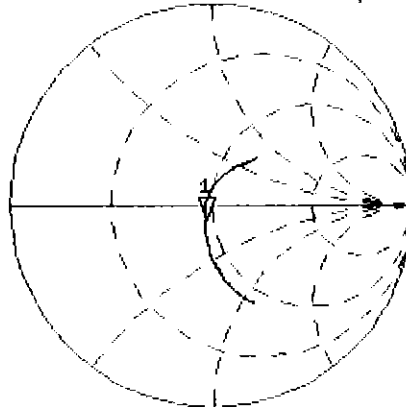
Maximum value of SAR (measured) = 14.0 W/kg



Impedance Measurement Plot for Body TSL

11 May 2016 13:08:31
 [CH1] S11 1 U FS 1: 45.803 Ω -6.7695 Ω 13.435 pF 1 750.000 000 MHz

*
 Del
 Cor



Avg
 16

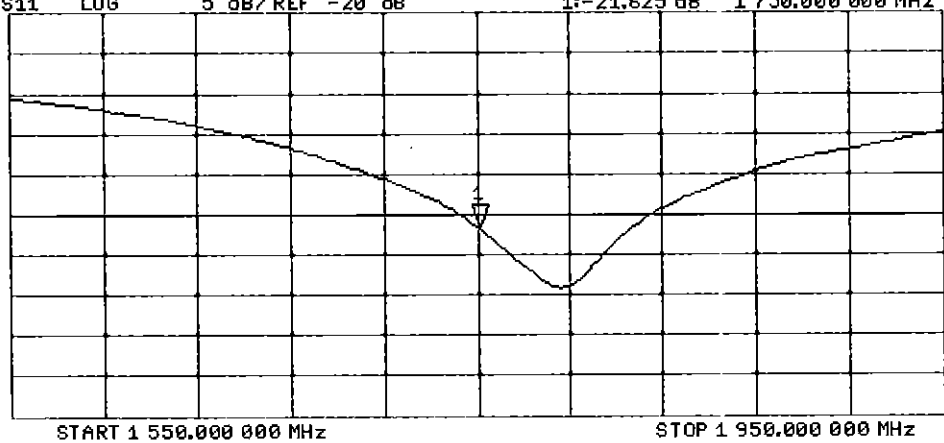
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-21.625 dB 1 750.000 000 MHz

Del
 Cor

Avg
 16

H1d



START 1 550.000 000 MHz

STOP 1 950.000 000 MHz