



SAR EVALUATION REPORT

Applicant Name:

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

Date of Testing:

07/22/19 - 08/20/19

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

1M1907080115-01.A3L

FCC ID:

A3LSMT545

APPLICANT:

SAMSUNG ELECTRONICS CO., LTD.

DUT Type:

Portable Tablet

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093

Model:

SM-T545

Additional Model(s):

SM-T547

Equipment Class	Band & Mode	Tx Frequency	SAR
			1g Body (W/kg)
PCB	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	0.53
PCB	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	1.26
PCB	UMTS 850	826.40 - 846.60 MHz	0.56
PCB	UMTS 1750	1712.4 - 1752.6 MHz	1.39
PCB	UMTS 1900	1852.4 - 1907.6 MHz	1.13
PCB	LTE Band 12	699.7 - 715.3 MHz	0.30
PCB	LTE Band 17	706.5 - 713.5 MHz	0.36
PCB	LTE Band 13	779.5 - 784.5 MHz	0.31
PCB	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.55
PCB	LTE Band 66 (AWS)	1710.7 - 1779.3 MHz	1.21
PCB	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	1.25
PCB	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	0.97
PCB	LTE Band 41	2498.5 - 2687.5 MHz	0.86
DTS	2.4 GHz WLAN	2412 - 2472 MHz	1.01
NII	U-NII-1	5180 - 5240 MHz	N/A
NII	U-NII-2A	5260 - 5320 MHz	0.97
NII	U-NII-2C	5500 - 5720 MHz	0.53
NII	U-NII-3	5745 - 5825 MHz	0.64
DSS/DTS	Bluetooth	2402 - 2480 MHz	0.43
Simultaneous SAR per KDB 690783 D01v01r03:			1.57

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 850	Voice/Data	824.20 - 848.80 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.6 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 12	Data	699.7 - 715.3 MHz
LTE Band 17	Data	706.5 - 713.5 MHz
LTE Band 13	Data	779.5 - 784.5 MHz
LTE Band 5 (Cell)	Data	824.7 - 848.3 MHz
LTE Band 66 (AWS)	Data	1710.7 - 1779.3 MHz
LTE Band 4 (AWS)	Data	1710.7 - 1754.3 MHz
LTE Band 2 (PCS)	Data	1850.7 - 1909.3 MHz
LTE Band 41	Data	2498.5 - 2687.5 MHz
2.4 GHz WLAN	Data	2412 - 2472 MHz
U-NII-1	Data	5180 - 5240 MHz
U-NII-2A	Data	5260 - 5320 MHz
U-NII-2C	Data	5500 - 5720 MHz
U-NII-3	Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
ANT+	Data	2402 - 2480 MHz

1.2 Power Reduction for SAR

This device uses a power reduction mechanism for SAR compliance. The power reduction mechanism is activated when the device is used in close proximity to the user's body. FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device. 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 PCB Output Power

Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		1 TX Slot	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots
GSM/GPRS/EDGE 850	Maximum	33.5	33.5	31.0	29.5	28.7	27.0	25.0	24.0	23.0
	Nominal	32.5	32.5	30.0	28.5	27.7	26.0	24.0	23.0	22.0
GSM/GPRS/EDGE 1900	Maximum	30.5	30.5	28.5	27.0	26.5	26.0	24.0	23.5	22.0
	Nominal	29.5	29.5	27.5	26.0	25.5	25.0	23.0	22.5	21.0

Mode / Band		Modulated Average (dBm)		
		3GPP WCDMA	3GPP HSDPA	3GPP HSUPA
UMTS Band 5 (850 MHz)	Maximum	24.5	23.5	23.5
	Nominal	23.5	22.5	22.5
UMTS Band 4 (1750 MHz)	Maximum	24.5	23.5	23.5
	Nominal	23.5	22.5	22.5
UMTS Band 2 (1900 MHz)	Maximum	24.5	23.5	23.5
	Nominal	23.5	22.5	22.5

Mode / Band		Modulated Average (dBm)
LTE Band 12	Maximum	24.5
	Nominal	23.5
LTE Band 17	Maximum	25.0
	Nominal	24.0
LTE Band 13	Maximum	24.5
	Nominal	23.5
LTE Band 5 (Cell)	Maximum	25.0
	Nominal	24.0
LTE Band 66 (AWS)	Maximum	24.0
	Nominal	23.0
LTE Band 4 (AWS)	Maximum	25.0
	Nominal	24.0
LTE Band 2 (PCS)	Maximum	25.0
	Nominal	24.0
LTE Band 41	Maximum	24.5
	Nominal	23.5

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1.3.2

Reduced PCB Output Power

Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		1 TX Slot	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots
GSM/GPRS/EDGE 850	Maximum	27.0	27.0	23.0	21.5	19.5	21.5	20.0	18.0	16.5
	Nominal	26.0	26.0	22.0	20.5	18.5	20.5	19.0	17.0	15.5
GSM/GPRS/EDGE 1900	Maximum	23.5	23.5	20.5	18.0	17.5	17.0	16.0	14.5	14.5
	Nominal	22.5	22.5	19.5	17.0	16.5	16.0	15.0	13.5	13.5

Mode / Band		Modulated Average (dBm)		
		3GPP WCDMA	3GPP HSDPA	3GPP HSUPA
UMTS Band 5 (850 MHz)	Maximum	17.0	17.0	17.0
	Nominal	16.0	16.0	16.0
UMTS Band 4 (1750 MHz)	Maximum	14.0	14.0	14.0
	Nominal	13.0	13.0	13.0
UMTS Band 2 (1900 MHz)	Maximum	14.0	14.0	14.0
	Nominal	13.0	13.0	13.0

Mode / Band		Modulated Average (dBm)
LTE Band 12	Maximum	17.0
	Nominal	16.0
LTE Band 17	Maximum	17.0
	Nominal	16.0
LTE Band 13	Maximum	17.0
	Nominal	16.0
LTE Band 5 (Cell)	Maximum	17.0
	Nominal	16.0
LTE Band 66 (AWS)	Maximum	12.0
	Nominal	11.0
LTE Band 4 (AWS)	Maximum	14.0
	Nominal	13.0
LTE Band 2 (PCS)	Maximum	14.0
	Nominal	13.0
LTE Band 41	Maximum	15.0
	Nominal	14.0

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1.3.3 Maximum Bluetooth and WLAN Output Power

Mode / Band		Modulated Average - Single Tx Chain (dBm)				
Channel		1	2-10	11	12	13
IEEE 802.11b (2.4 GHz)	Maximum	20.0			19.0	16.5
	Nominal	19.0			18.0	15.5
IEEE 802.11g (2.4 GHz)	Maximum	18.0	19.0	17.0	14.0	10.5
	Nominal	17.0	18.0	16.0	13.0	9.5
IEEE 802.11n (2.4 GHz)	Maximum	18.0		17.0	14.0	10.5
	Nominal	17.0		16.0	13.0	9.5

Mode / Band		Modulated Average (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11a (5 GHz)	Maximum	17.0		
	Nominal	16.0		
IEEE 802.11n (5 GHz)	Maximum	16.0	13.0	
	Nominal	15.0	12.0	
IEEE 802.11ac (5 GHz)	Maximum	16.0	12.0	11.0
	Nominal	15.0	11.0	10.0

Mode / Band		Modulated Average (dBm)
Bluetooth	Maximum	9.5
	Nominal	8.5
Bluetooth EDR	Maximum	8.5
	Nominal	7.5
Bluetooth LE 2Mbps	Maximum	7.5
	Nominal	6.5

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1.3.4 Reduced WLAN Output Power

Mode / Band		Modulated Average (dBm)				
Channel		1	2 - 10	11	12	13
IEEE 802.11b (2.4 GHz)	Maximum	12.0				
	Nominal	11.0				
IEEE 802.11g (2.4 GHz)	Maximum	12.0				10.5
	Nominal	11.0				9.5
IEEE 802.11n (2.4 GHz)	Maximum	12.0				10.5
	Nominal	11.0				9.5

Mode / Band		Modulated Average (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11a (5 GHz)	Maximum	9.0		
	Nominal	8.0		
IEEE 802.11n (5 GHz)	Maximum	9.0	9.0	
	Nominal	8.0	8.0	
IEEE 802.11ac (5 GHz)	Maximum	9.0	9.0	9.0
	Nominal	8.0	8.0	8.0

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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. Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC filings.

Table 1-1
Device Edges/Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	No	Yes	No	Yes	No
GPRS 1900	Yes	No	Yes	No	Yes	No
UMTS 850	Yes	No	Yes	No	Yes	No
UMTS 1750	Yes	No	Yes	No	Yes	No
UMTS 1900	Yes	No	Yes	No	Yes	No
LTE Band 12	Yes	No	Yes	No	Yes	No
LTE Band 17	Yes	No	Yes	No	Yes	No
LTE Band 13	Yes	No	Yes	No	Yes	No
LTE Band 5 (Cell)	Yes	No	Yes	No	Yes	No
LTE Band 66 (AWS)	Yes	No	Yes	No	Yes	No
LTE Band 4 (AWS)	Yes	No	Yes	No	Yes	No
LTE Band 2 (PCS)	Yes	No	Yes	No	Yes	No
LTE Band 41	Yes	No	Yes	No	Yes	No
2.4 GHz WLAN	Yes	No	Yes	No	No	Yes
5 GHz WLAN	Yes	No	Yes	No	No	Yes
Bluetooth	Yes	No	Yes	No	No	Yes

Note: Per FCC KDB Publication 616217 D04v01r01, particular edges were not required to be evaluated for SAR based on the SAR exclusion threshold in KDB 447498 D01V06. Additional edges may have been evaluated for simultaneous transmission analysis.

1.5 Near Field Communications (NFC) Antenna

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

1.6 Simultaneous Transmission Capabilities

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

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

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Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Body
1	UMTS + 2.4 GHz Wi-Fi	Yes
2	UMTS + 5 GHz Wi-Fi	Yes
3	UMTS + 2.4 GHz Bluetooth	Yes
4	LTE + 2.4 GHz Wi-Fi	Yes
5	LTE + 5 GHz Wi-Fi	Yes
6	LTE + 2.4 GHz Bluetooth	Yes
7	GPRS/EDGE + 2.4 GHz Wi-Fi	Yes
8	GPRS/EDGE + 5 GHz Wi-Fi	Yes
9	GPRS/EDGE + 2.4 GHz Bluetooth	Yes

- 2.4 GHz WLAN, 5 GHz WLAN, and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
- All licensed modes share the same antenna path and cannot transmit simultaneously.
- When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [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.
- This device supports Bluetooth Tethering.

1.7 Miscellaneous SAR Test Considerations

Per KDB Publication 616217, the non-metallic device edge protrusions were removed in order to allow for SAR measurement with the device in direct contact with the phantom.

(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.

This device supports IEEE 802.11ac with the following features:

- Up to 80 MHz Bandwidth only
- No aggregate channel configurations
- 1 Tx antenna output
- 256 QAM is supported
- TDWR and Band gap channels are supported

(B) Licensed Transmitter(s)

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

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

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

This device supports LTE Carrier Aggregation (CA) in the downlink. All uplink communications are identical to Release 8 specifications. Per FCC KDB Publication 941225 D05A v01r02, SAR for LTE CA operations was not needed since the maximum average output power in LTE CA mode was not >0.25 dB higher than the maximum output power when downlink carrier aggregation was inactive. The downlink carrier aggregation exclusion analysis can be found in Appendix H.

This device supports 64QAM on the uplink and 256QAM on the downlink for LTE Operations. Conducted powers for 64QAM uplink configurations were measured per Section 5.1 of FCC KDB Publication 941225 D05v02r05. SAR was not required for 64QAM since the highest maximum output power for 64QAM is $\leq \frac{1}{2}$ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg, per Section 5.2.4 of FCC KDB Publication 941225 D05v02r05.

1.8 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01, D05v02r04, D05Av01r02, D06v02r01 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 616217 D04v01r02 (Tablet)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)
- April 2018 TCB Workshop Notes (LTE Carrier Aggregation)

1.9 Device Serial Numbers

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

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2 LTE INFORMATION

LTE Information					
Form Factor	Portable Tablet				
Frequency Range of each LTE transmission band	LTE Band 12 (699.7 - 715.3 MHz)				
	LTE Band 17 (706.5 - 713.5 MHz)				
	LTE Band 13 (779.5 - 784.5 MHz)				
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)				
	LTE Band 66 (AWS) (1710.7 - 1779.3 MHz)				
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)				
	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)				
Channel Bandwidths	LTE Band 41 (2498.5 - 2687.5 MHz)				
	LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 17: 5 MHz, 10 MHz				
	LTE Band 13: 5 MHz, 10 MHz				
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 66 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
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 13: 5 MHz	779.5 (23205)		782 (23230)	784.5 (23255)	
LTE Band 13: 10 MHz	N/A		782 (23230)	N/A	
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)		836.5 (20525)	848.3 (20643)	
LTE Band 5 (Cell): 3 MHz	825.5 (20415)		836.5 (20525)	847.5 (20635)	
LTE Band 5 (Cell): 5 MHz	826.5 (20425)		836.5 (20525)	846.5 (20625)	
LTE Band 5 (Cell): 10 MHz	829 (20450)		836.5 (20525)	844 (20600)	
LTE Band 66 (AWS): 1.4 MHz	1710.7 (131979)		1745 (132322)	1779.3 (132665)	
LTE Band 66 (AWS): 3 MHz	1711.5 (131987)		1745 (132322)	1778.5 (132657)	
LTE Band 66 (AWS): 5 MHz	1712.5 (131997)		1745 (132322)	1777.5 (132647)	
LTE Band 66 (AWS): 10 MHz	1715 (132022)		1745 (132322)	1775 (132622)	
LTE Band 66 (AWS): 15 MHz	1717.5 (132047)		1745 (132322)	1772.5 (132597)	
LTE Band 66 (AWS): 20 MHz	1720 (132072)		1745 (132322)	1770 (132572)	
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)		1732.5 (20175)	1754.3 (20393)	
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)		1732.5 (20175)	1753.5 (20385)	
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)		1732.5 (20175)	1752.5 (20375)	
LTE Band 4 (AWS): 10 MHz	1715 (20000)		1732.5 (20175)	1750 (20350)	
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)		1732.5 (20175)	1747.5 (20325)	
LTE Band 4 (AWS): 20 MHz	1720 (20050)		1732.5 (20175)	1745 (20300)	
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)		1880 (18900)	1909.3 (19193)	
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)		1880 (18900)	1908.5 (19185)	
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)		1880 (18900)	1907.5 (19175)	
LTE Band 2 (PCS): 10 MHz	1855 (18650)		1880 (18900)	1905 (19150)	
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)		1880 (18900)	1902.5 (19125)	
LTE Band 2 (PCS): 20 MHz	1860 (18700)		1880 (18900)	1900 (19100)	
LTE Band 41: 5 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 10 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 15 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 20 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
UE Category	DL UE Cat 11, UL UE Cat 5				
Modulations Supported in UL	QPSK, 16QAM, 64QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3-6.2.5? (manufacturer attestation to be provided)	YES				
A-MPR (Additional MPR) disabled for SAR Testing?	YES				
LTE Carrier Aggregation Possible Combinations	The technical description includes all the possible carrier aggregation combinations				
LTE Additional Information	This device does not support full CA features on 3GPP Release 12. It supports carrier aggregation features are shown in Appendix H. All uplink communications are identical to Release 8 specifications. Uplink communications are done on the PCC. The following LTE Release 12 Features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, WiFi Offloading, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.				

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3 INTRODUCTION

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

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

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

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

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

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4 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.

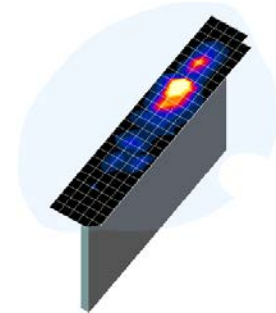


Figure 4-1
Sample SAR Area Scan

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].

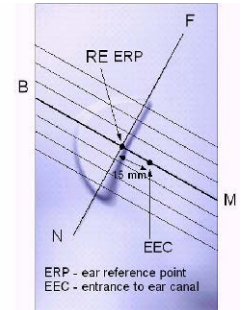


Figure 5-1
Close-Up Side view
of ERP

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

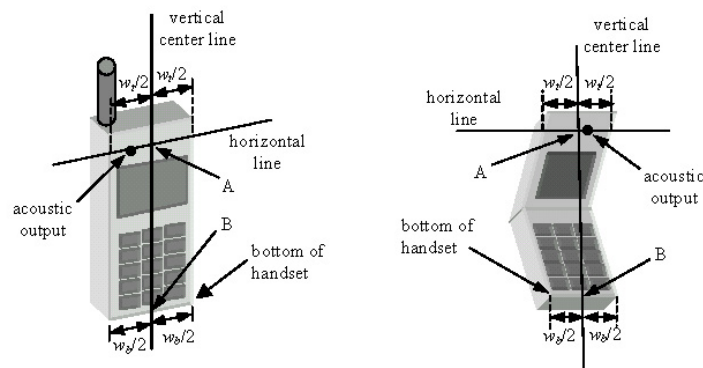


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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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 SAR Testing for Tablet per KDB Publication 616217 D04v01r02

Per FCC KDB Publication 616217 D04v01r02, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

6.3 Proximity Sensor Considerations

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

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

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

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

8.1 Measured and Reported SAR

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

8.2 3G SAR Test Reduction Procedure

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

8.3 Procedures Used to Establish RF Signal for SAR

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

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

8.4 SAR Measurement Conditions for UMTS

8.4.1 Output Power Verification

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

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8.4.2 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.

8.4.3 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.

8.4.4 SAR Measurements with Rel 6 HSUPA

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

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

8.5 SAR Measurement Conditions for LTE

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

8.5.1 Spectrum Plots for RB Configurations

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

8.5.2 MPR

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

8.5.3 A-MPR

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

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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.

8.5.6 Downlink Only Carrier Aggregation

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

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

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in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v02r02 for more details.

8.6.1 General Device Setup

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

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

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

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

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

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

8.6.4 2.4 GHz SAR Test Requirements

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

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

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

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8.6.5 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.

8.6.6 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 8.6.5). When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

8.6.7 Subsequent Test Configuration Procedures

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

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9 RF CONDUCTED POWERS

9.1 GSM Conducted Powers

Table 9-1
Maximum Conducted Power

Maximum Burst-Averaged Output Power										
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 850	128	32.70	32.69	30.45	29.11	28.45	26.21	23.84	22.48	21.72
	190	32.70	32.68	30.68	29.27	28.43	26.20	24.10	22.78	22.13
	251	32.63	32.63	30.42	28.85	28.05	25.98	23.87	22.53	21.71
GSM 1900	512	29.90	29.93	27.35	25.10	25.37	25.12	23.02	21.73	20.83
	661	29.82	29.82	27.55	25.19	25.46	24.98	23.01	21.85	21.07
	810	29.55	29.59	27.24	25.00	25.01	24.68	22.70	21.55	20.33

Calculated Maximum Frame-Averaged Output Power										
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 850	128	23.67	23.66	24.43	24.85	25.44	17.18	17.82	18.22	18.71
	190	23.67	23.65	24.66	25.01	25.42	17.17	18.08	18.52	19.12
	251	23.60	23.60	24.40	24.59	25.04	16.95	17.85	18.27	18.70
GSM 1900	512	20.87	20.90	21.33	20.84	22.36	16.09	17.00	17.47	17.82
	661	20.79	20.79	21.53	20.93	22.45	15.95	16.99	17.59	18.06
	810	20.52	20.56	21.22	20.74	22.00	15.65	16.68	17.29	17.32

GSM 850	Frame Avg.Targets:	23.47	23.47	23.98	24.24	24.69	16.97	17.98	18.74	18.99
GSM 1900		20.47	20.47	21.48	21.74	22.49	15.97	16.98	18.24	17.99

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Table 9-2
Reduced Conducted Power

Maximum Burst-Averaged Output Power										
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 850	128	26.44	26.52	22.29	20.74	18.69	21.04	19.29	17.26	16.49
	190	26.62	26.59	22.51	20.98	18.83	21.06	19.38	17.65	16.50
	251	26.43	26.48	22.43	20.77	18.71	21.08	19.39	17.20	16.45
GSM 1900	512	23.05	23.21	20.18	17.62	17.09	16.60	15.78	14.16	14.06
	661	22.94	22.73	20.15	17.64	17.05	16.32	15.53	14.26	14.23
	810	22.51	22.62	19.57	17.16	16.61	15.77	15.01	13.80	13.75

Calculated Maximum Frame-Averaged Output Power										
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	GPRS [dBm] 3 Tx Slot	GPRS [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
GSM 850	128	17.41	17.49	16.27	16.48	15.68	12.01	13.27	13.00	13.48
	190	17.59	17.56	16.49	16.72	15.82	12.03	13.36	13.39	13.49
	251	17.40	17.45	16.41	16.51	15.70	12.05	13.37	12.94	13.44
GSM 1900	512	14.02	14.18	14.16	13.36	14.08	7.57	9.76	9.90	11.05
	661	13.91	13.70	14.13	13.38	14.04	7.29	9.51	10.00	11.22
	810	13.48	13.59	13.55	12.90	13.60	6.74	8.99	9.54	10.74

GSM 850	Frame Avg.Targets:	16.97	16.97	15.98	16.24	15.49	11.47	12.98	12.74	12.49
GSM 1900		13.47	13.47	13.48	12.74	13.49	6.97	8.98	9.24	10.49

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Note:

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

GSM Class: B
GPRS Multislot class: 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

Table 9-3
Maximum Conducted Power

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	1312	1412	1513	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	24.28	24.28	24.13	24.32	24.17	24.07	24.07	24.20	24.10	-
99		12.2 kbps AMR	24.11	23.83	23.62	23.80	23.85	23.65	23.86	23.74	23.82	-
6	HSDPA	Subtest 1	23.33	23.26	23.10	23.16	23.18	23.04	23.49	23.21	22.92	0
6		Subtest 2	23.30	23.31	23.13	23.16	23.18	23.03	23.46	23.28	22.90	0
6		Subtest 3	22.82	22.75	22.66	22.67	22.71	22.65	22.99	22.79	22.40	0.5
6		Subtest 4	22.86	22.66	22.61	22.68	22.70	22.52	23.00	22.81	22.41	0.5
6	HSPA	Subtest 1	23.33	23.30	23.13	23.20	23.20	23.05	23.49	23.27	22.90	0
6		Subtest 2	21.36	21.28	21.12	21.21	21.23	21.03	21.50	21.28	20.92	2
6		Subtest 3	22.32	22.29	22.35	22.19	22.20	22.04	22.47	22.32	21.96	1
6		Subtest 4	21.32	21.28	21.11	21.22	21.21	21.03	21.18	21.29	20.94	2
6		Subtest 5	23.31	23.29	23.13	23.20	23.20	23.07	23.48	23.33	22.94	0

Table 9-4
Reduced Conducted Power

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	1312	1412	1513	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	16.47	16.31	16.34	13.34	13.19	13.39	13.24	13.24	13.08	-
99		12.2 kbps AMR	16.60	16.59	16.33	13.21	13.32	13.18	13.18	13.23	13.14	-
6	HSDPA	Subtest 1	15.49	15.47	15.26	12.31	12.32	12.12	12.57	12.47	12.14	0
6		Subtest 2	15.29	15.45	15.33	12.17	12.31	12.18	12.57	12.48	12.10	0
6		Subtest 3	14.76	15.01	14.80	11.66	11.80	11.68	12.08	12.01	11.66	0.5
6		Subtest 4	14.87	14.97	14.88	11.68	11.83	11.67	12.06	11.98	11.63	0.5
6	HSPA	Subtest 1	15.53	15.48	15.28	12.33	12.33	12.18	12.57	12.49	12.13	0
6		Subtest 2	13.53	13.50	13.28	10.31	10.34	10.20	10.60	10.51	10.15	2
6		Subtest 3	14.52	14.50	14.28	11.33	11.37	11.20	11.62	11.55	11.17	1
6		Subtest 4	13.49	13.46	13.27	10.35	10.33	10.20	10.61	10.52	10.13	2
6		Subtest 5	15.52	15.49	15.33	12.34	12.36	12.22	12.58	12.52	12.16	0

DC-HSDPA is not supported for this device.

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.

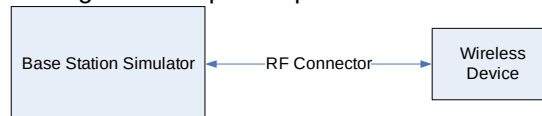


Figure 9-2
Power Measurement Setup

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9.3 LTE Conducted Powers

9.3.1

LTE Band 12

Table 9-5
LTE Band 12 Maximum 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	23.95	0	0
	1	25	23.81		0
	1	49	23.86		0
	25	0	22.89	0-1	1
	25	12	22.93		1
	25	25	22.88		1
	50	0	22.91		1
16QAM	1	0	23.48	0-1	1
	1	25	23.42		1
	1	49	23.47		1
	25	0	22.02	0-2	2
	25	12	22.01		2
	25	25	21.98		2
	50	0	22.06		2
64QAM	1	0	22.43	0-2	2
	1	25	22.38		2
	1	49	22.37		2
	25	0	21.12	0-3	3
	25	12	21.07		3
	25	25	21.04		3
	50	0	21.05		3

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

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Table 9-6
LTE Band 12 Maximum Conducted Powers - 5 MHz Bandwidth

LTE Band 12 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23035 (701.5 MHz)	23095 (707.5 MHz)	23155 (713.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.82	23.75	23.63	0	0
	1	12	23.75	23.79	23.61		0
	1	24	23.79	23.72	23.66		0
	12	0	22.89	22.77	22.77	0-1	1
	12	6	22.85	22.82	22.73		1
	12	13	22.81	22.75	22.73		1
	25	0	22.83	22.77	22.81		1
16QAM	1	0	22.85	23.00	22.89	0-1	1
	1	12	22.84	22.97	22.86		1
	1	24	22.84	22.97	22.89		1
	12	0	21.96	21.93	21.89	0-2	2
	12	6	21.93	21.93	21.88		2
	12	13	21.93	21.84	21.85		2
	25	0	21.93	21.90	21.88		2
64QAM	1	0	22.18	21.89	21.90	0-2	2
	1	12	22.15	21.89	21.85		2
	1	24	22.12	21.88	21.92		2
	12	0	20.99	20.91	20.90	0-3	3
	12	6	20.99	20.90	20.87		3
	12	13	20.93	20.85	20.78		3
	25	0	20.91	20.96	20.88		3

Table 9-7
LTE Band 12 Maximum 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	23.69	23.65	23.63	0	0
	1	7	23.75	23.71	23.76		0
	1	14	23.68	23.65	23.70		0
	8	0	22.77	22.63	22.70	0-1	1
	8	4	22.83	22.72	22.83		1
	8	7	22.74	22.65	22.73		1
	15	0	22.78	22.68	22.72		1
16QAM	1	0	22.99	22.49	22.92	0-1	1
	1	7	23.07	22.53	23.13		1
	1	14	22.96	22.42	22.97		1
	8	0	21.74	21.62	21.88	0-2	2
	8	4	21.81	21.68	21.99		2
	8	7	21.75	21.56	21.91		2
	15	0	21.95	21.77	21.90		2
64QAM	1	0	21.84	21.57	22.35	0-2	2
	1	7	21.96	21.73	22.50		2
	1	14	21.83	21.57	22.43		2
	8	0	20.90	20.88	20.90	0-3	3
	8	4	20.90	20.93	21.08		3
	8	7	20.89	20.88	21.00		3
	15	0	20.92	20.88	20.86		3

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Table 9-8
LTE Band 12 Maximum 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	23.65	23.69	23.62	0	0
	1	2	23.73	23.77	23.66		0
	1	5	23.67	23.68	23.60		0
	3	0	23.71	23.62	23.69		0
	3	2	23.79	23.71	23.78		0
	3	3	23.73	23.63	23.70		0
	6	0	22.62	22.50	22.59	0-1	1
16QAM	1	0	22.44	22.77	22.42	0-1	1
	1	2	22.54	22.82	22.47		1
	1	5	22.48	22.75	22.43		1
	3	0	22.90	22.75	22.86		1
	3	2	22.94	22.83	22.95		1
	3	3	22.86	22.77	22.88		1
	6	0	21.69	21.56	21.63	0-2	2
64QAM	1	0	21.64	22.13	21.58	0-2	2
	1	2	21.72	22.21	21.69		2
	1	5	21.61	22.06	21.55		2
	3	0	21.89	21.74	21.88		2
	3	2	21.98	21.79	21.98		2
	3	3	21.91	21.74	21.90		2
	6	0	20.70	20.70	20.74	0-3	3

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Table 9-9
LTE Band 12 Reduced 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	15.67	0	0
	1	25	15.62		0
	1	49	15.69		0
	25	0	15.72	0-1	0
	25	12	15.73		0
	25	25	15.66		0
	50	0	15.68		0
16QAM	1	0	15.94	0-1	0
	1	25	15.95		0
	1	49	16.01		0
	25	0	15.82	0-2	0
	25	12	15.81		0
	25	25	15.72		0
	50	0	15.79		0
64QAM	1	0	15.87	0-2	0
	1	25	15.90		0
	1	49	15.88		0
	25	0	15.79	0-3	0
	25	12	15.83		0
	25	25	15.76		0
	50	0	15.74		0

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

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Table 9-10
LTE Band 12 Reduced Conducted Powers - 5 MHz Bandwidth

LTE Band 12 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23035 (701.5 MHz)	23095 (707.5 MHz)	23155 (713.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	15.73	15.66	15.63	0	0
	1	12	15.70	15.57	15.62		0
	1	24	15.63	15.59	15.67		0
	12	0	15.87	15.78	15.84	0-1	0
	12	6	15.89	15.77	15.82		0
	12	13	15.85	15.72	15.76		0
	25	0	15.86	15.81	15.85		0
16QAM	1	0	16.10	15.98	15.98	0-1	0
	1	12	16.06	15.88	15.98		0
	1	24	16.00	15.89	16.03		0
	12	0	16.05	15.95	15.98	0-2	0
	12	6	16.01	15.91	15.97		0
	12	13	15.96	15.89	15.94		0
	25	0	16.02	15.89	15.95		0
64QAM	1	0	16.02	15.94	15.98	0-2	0
	1	12	15.99	15.87	15.91		0
	1	24	15.97	15.85	16.02		0
	12	0	16.01	15.90	15.92	0-3	0
	12	6	15.94	15.88	15.91		0
	12	13	15.88	15.85	15.84		0
	25	0	15.99	15.88	15.92		0

Table 9-11
LTE Band 12 Reduced 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	15.77	15.67	15.69	0	0
	1	7	15.86	15.73	15.85		0
	1	14	15.73	15.64	15.75		0
	8	0	15.87	15.78	15.76	0-1	0
	8	4	15.89	15.76	15.88		0
	8	7	15.82	15.72	15.80		0
	15	0	15.87	15.77	15.80		0
16QAM	1	0	16.17	16.03	16.04	0-1	0
	1	7	16.10	16.12	15.64		0
	1	14	16.05	15.99	16.05		0
	8	0	16.04	15.94	15.96	0-2	0
	8	4	16.05	15.94	16.05		0
	8	7	15.99	15.88	15.98		0
	15	0	16.05	15.95	15.97		0
64QAM	1	0	15.77	15.65	15.62	0-2	0
	1	7	15.65	15.35	15.77		0
	1	14	15.75	15.74	15.67		0
	8	0	16.08	16.00	15.96	0-3	0
	8	4	16.16	16.03	16.00		0
	8	7	16.05	15.96	16.04		0
	15	0	16.04	15.91	15.94		0

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Table 9-12
LTE Band 12 Reduced 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	15.91	15.56	15.65	0	0
	1	2	15.97	15.67	15.72		0
	1	5	15.91	15.52	15.62		0
	3	0	15.83	15.70	15.77		0
	3	2	15.89	15.76	15.90		0
	3	3	15.81	15.70	15.82	0	
	6	0	15.73	15.66	15.75	0-1	0
16QAM	1	0	16.01	15.87	15.96	0-1	0
	1	2	16.09	15.92	16.02		0
	1	5	16.07	15.86	15.96		0
	3	0	16.02	15.85	15.93		0
	3	2	16.05	15.90	16.03		0
	3	3	16.02	15.84	15.95	0	
	6	0	15.84	15.77	15.90	0-2	0
64QAM	1	0	15.87	15.75	15.87	0-2	0
	1	2	15.78	15.81	15.93		0
	1	5	15.85	15.73	15.89		0
	3	0	15.91	15.75	15.85		0
	3	2	16.05	15.80	15.97		0
	3	3	15.95	15.73	15.90	0	
	6	0	15.87	15.76	15.87	0-3	0

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LTE Band 17

Table 9-13
LTE Band 17 Maximum Conducted Powers - 10 MHz Bandwidth

LTE Band 17 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23790 (710.0 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	24.17	0	0
	1	25	24.06		0
	1	49	24.04		0
	25	0	23.21	0-1	1
	25	12	23.20		1
	25	25	23.20		1
	50	0	23.15		1
16QAM	1	0	23.52	0-1	1
	1	25	23.49		1
	1	49	23.50		1
	25	0	22.32	0-2	2
	25	12	22.30		2
	25	25	22.24		2
	50	0	22.28		2
64QAM	1	0	22.37	0-2	2
	1	25	22.29		2
	1	49	22.30		2
	25	0	21.38	0-3	3
	25	12	21.42		3
	25	25	21.30		3
	50	0	21.32		3

Note: LTE Band 17 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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Table 9-14
LTE Band 17 Maximum Conducted Powers - 5 MHz Bandwidth

LTE Band 17 5 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23790 (710.0 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	24.02	0	0
	1	12	23.99		0
	1	24	24.05		0
	12	0	23.17	0-1	1
	12	6	23.15		1
	12	13	23.13		1
	25	0	23.17		1
16QAM	1	0	23.35	0-1	1
	1	12	23.28		1
	1	24	23.33		1
	12	0	22.34	0-2	2
	12	6	22.35		2
	12	13	22.33		2
	25	0	22.28		2
64QAM	1	0	22.14	0-2	2
	1	12	22.09		2
	1	24	22.17		2
	12	0	21.37	0-3	3
	12	6	21.33		3
	12	13	21.30		3
	25	0	21.28		3

Note: LTE Band 17 at 5 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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Table 9-15
LTE Band 17 Reduced Conducted Powers - 10 MHz Bandwidth

LTE Band 17 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23790 (710.0 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	16.15	0	0
	1	25	16.03		0
	1	49	16.05		0
	25	0	16.16	0-1	0
	25	12	16.14		0
	25	25	16.09		0
	50	0	16.13		0
16QAM	1	0	16.62	0-1	0
	1	25	16.53		0
	1	49	16.57		0
	25	0	16.30	0-2	0
	25	12	16.26		0
	25	25	16.23		0
	50	0	16.27		0
64QAM	1	0	16.39	0-2	0
	1	25	16.33		0
	1	49	16.33		0
	25	0	16.34	0-3	0
	25	12	16.38		0
	25	25	16.31		0
	50	0	16.29		0

Note: LTE Band 17 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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Table 9-16
LTE Band 17 Reduced Conducted Powers - 5 MHz Bandwidth

LTE Band 17 5 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23790 (710.0 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	16.01	0	0
	1	12	15.97		0
	1	24	16.02		0
	12	0	16.14	0-1	0
	12	6	16.11		0
	12	13	16.05		0
	25	0	16.13		0
16QAM	1	0	16.37	0-1	0
	1	12	16.33		0
	1	24	16.42		0
	12	0	16.31	0-2	0
	12	6	16.32		0
	12	13	16.29		0
	25	0	16.25		0
64QAM	1	0	16.14	0-2	0
	1	12	16.11		0
	1	24	16.16		0
	12	0	16.30	0-3	0
	12	6	16.28		0
	12	13	16.25		0
	25	0	16.21		0

Note: LTE Band 17 at 5 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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LTE Band 13

Table 9-17
LTE Band 13 Conducted Powers - 10 MHz Bandwidth

LTE Band 13 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23230 (782.0 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	23.69	0	0
	1	25	23.59		0
	1	49	23.63		0
	25	0	22.76	0-1	1
	25	12	22.73		1
	25	25	22.69		1
	50	0	22.72		1
16QAM	1	0	22.76	0-1	1
	1	25	22.76		1
	1	49	22.82		1
	25	0	21.68	0-2	2
	25	12	21.72		2
	25	25	21.70		2
	50	0	21.70		2
64QAM	1	0	21.61	0-2	2
	1	25	21.72		2
	1	49	21.76		2
	25	0	20.79	0-3	3
	25	12	20.77		3
	25	25	20.76		3
	50	0	20.78		3

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Table 9-18
LTE Band 13 Conducted Powers - 5 MHz Bandwidth

LTE Band 13 5 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23230 (782.0 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	23.70	0	0
	1	12	23.61		0
	1	24	23.62		0
	12	0	22.77	0-1	1
	12	6	22.75		1
	12	13	22.74		1
	25	0	22.77		1
16QAM	1	0	22.81	0-1	1
	1	12	22.81		1
	1	24	22.80		1
	12	0	21.86	0-2	2
	12	6	21.87		2
	12	13	21.81		2
	25	0	21.85		2
64QAM	1	0	21.87	0-2	2
	1	12	21.81		2
	1	24	21.83		2
	12	0	20.82	0-3	3
	12	6	20.84		3
	12	13	20.79		3
	25	0	20.85		3

Note: LTE Band 13 at 5 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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Table 9-19
LTE Band 13 Reduced Conducted Powers - 10 MHz Bandwidth

LTE Band 13 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23230 (782.0 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	15.75	0	0
	1	25	15.70		0
	1	49	15.71		0
	25	0	15.79	0-1	0
	25	12	15.76		0
	25	25	15.70		0
	50	0	15.73		0
16QAM	1	0	15.98	0-1	0
	1	25	16.01		0
	1	49	15.99		0
	25	0	15.84	0-2	0
	25	12	15.86		0
	25	25	15.75		0
	50	0	15.83		0
64QAM	1	0	15.96	0-2	0
	1	25	15.98		0
	1	49	16.01		0
	25	0	15.89	0-3	0
	25	12	15.87		0
	25	25	15.81		0
	50	0	15.85		0

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Table 9-20
LTE Band 13 Reduced Conducted Powers - 5 MHz Bandwidth

LTE Band 13 5 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			23230 (782.0 MHz)		
			Conducted Power [dBm]		
QPSK	1	0	15.63	0	0
	1	12	15.62		0
	1	24	15.56		0
	12	0	15.81	0-1	0
	12	6	15.82		0
	12	13	15.77		0
	25	0	15.81		0
16QAM	1	0	15.93	0-1	0
	1	12	15.92		0
	1	24	15.88		0
	12	0	15.89	0-2	0
	12	6	15.90		0
	12	13	15.90		0
	25	0	15.91		0
64QAM	1	0	15.91	0-2	0
	1	12	15.91		0
	1	24	15.87		0
	12	0	15.88	0-3	0
	12	6	15.88		0
	12	13	15.86		0
	25	0	15.92		0

Note: LTE Band 13 at 5 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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LTE Band 5 (Cell)

Table 9-21
LTE Band 5 (Cell) Maximum Conducted Powers - 10 MHz Bandwidth

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	24.53	0	0
	1	25	24.60		0
	1	49	24.54		0
	25	0	23.61	0-1	1
	25	12	23.65		1
	25	25	23.58		1
	50	0	23.63		1
16QAM	1	0	24.00	0-1	1
	1	25	23.95		1
	1	49	23.92		1
	25	0	22.73	0-2	2
	25	12	22.77		2
	25	25	22.71		2
	50	0	22.70		2
64QAM	1	0	23.00	0-2	2
	1	25	22.94		2
	1	49	22.89		2
	25	0	21.78	0-3	3
	25	12	21.83		3
	25	25	21.72		3
	50	0	21.72		3

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

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Table 9-22
LTE Band 5 (Cell) Maximum Conducted Powers - 5 MHz Bandwidth

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	24.53	24.53	24.39	0	0
	1	12	24.56	24.54	24.38		0
	1	24	24.61	24.53	24.43		0
	12	0	23.49	23.60	23.38	0-1	1
	12	6	23.61	23.62	23.39		1
	12	13	23.54	23.56	23.36		1
	25	0	23.58	23.54	23.34		1
16QAM	1	0	23.60	23.54	23.58	0-1	1
	1	12	23.57	23.52	23.50		1
	1	24	23.61	23.50	23.46		1
	12	0	22.59	22.68	22.46	0-2	2
	12	6	22.69	22.67	22.46		2
	12	13	22.65	22.60	22.42		2
	25	0	22.66	22.66	22.42		2
64QAM	1	0	22.64	22.90	22.51	0-2	2
	1	12	22.58	22.85	22.46		2
	1	24	22.66	22.85	22.38		2
	12	0	21.54	21.72	21.50	0-3	3
	12	6	21.67	21.69	21.48		3
	12	13	21.62	21.64	21.42		3
	25	0	21.67	21.67	21.50		3

Table 9-23
LTE Band 5 (Cell) Maximum Conducted Powers - 3 MHz Bandwidth

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	24.41	24.52	24.28	0	0
	1	7	24.53	24.48	24.39		0
	1	14	24.32	24.51	24.31		0
	8	0	23.47	23.53	23.35	0-1	1
	8	4	23.50	23.55	23.35		1
	8	7	23.42	23.50	23.34		1
	15	0	23.50	23.50	23.37		1
16QAM	1	0	23.62	23.33	23.48	0-1	1
	1	7	23.70	23.33	23.52		1
	1	14	23.59	23.22	23.34		1
	8	0	22.45	22.43	22.45	0-2	2
	8	4	22.48	22.47	22.45		2
	8	7	22.41	22.41	22.39		2
	15	0	22.55	22.58	22.45		2
64QAM	1	0	22.57	22.43	22.90	0-2	2
	1	7	22.60	22.51	22.97		2
	1	14	22.50	22.42	22.76		2
	8	0	21.52	21.71	21.54	0-3	3
	8	4	21.58	21.73	21.54		3
	8	7	21.50	21.67	21.48		3
	15	0	21.59	21.73	21.42		3

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Table 9-24
LTE Band 5 (Cell) Maximum Conducted Powers -1.4 MHz Bandwidth

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	24.31	24.55	24.16	0	0
	1	2	24.30	24.59	24.18		0
	1	5	24.32	24.57	24.17		0
	3	0	24.39	24.47	24.18		0
	3	2	24.47	24.50	24.26		0
	3	3	24.39	24.44	24.12		0
	6	0	23.38	23.44	23.30	0-1	1
16QAM	1	0	23.55	23.59	23.35	0-1	1
	1	2	23.60	23.64	23.36		1
	1	5	23.57	23.58	23.33		1
	3	0	23.42	23.54	23.17		1
	3	2	23.53	23.61	23.25		1
	3	3	23.47	23.59	23.15		1
	6	0	22.45	22.40	22.26	0-2	2
64QAM	1	0	22.46	22.56	22.20	0-2	2
	1	2	22.46	22.62	22.24		2
	1	5	22.43	22.87	22.18		2
	3	0	22.41	22.54	22.17		2
	3	2	22.52	22.63	22.28		2
	3	3	22.46	22.51	22.17		2
	6	0	21.43	21.53	21.29	0-3	3

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Table 9-25
LTE Band 5 (Cell) Reduced Conducted Powers - 10 MHz Bandwidth

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	15.78	0	0
	1	25	15.83		0
	1	49	15.74		0
	25	0	15.91	0-1	0
	25	12	15.84		0
	25	25	15.83		0
	50	0	15.80		0
16QAM	1	0	16.10	0-1	0
	1	25	16.06		0
	1	49	15.98		0
	25	0	15.91	0-2	0
	25	12	15.90		0
	25	25	15.83		0
	50	0	15.91		0
64QAM	1	0	16.06	0-2	0
	1	25	16.05		0
	1	49	16.01		0
	25	0	16.00	0-3	0
	25	12	15.94		0
	25	25	15.89		0
	50	0	15.93		0

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

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

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	15.78	15.85	15.67	0	0
	1	12	15.73	15.80	15.59		0
	1	24	15.80	15.79	15.62		0
	12	0	15.91	16.01	15.77	0-1	0
	12	6	16.01	15.97	15.81		0
	12	13	15.96	15.97	15.77		0
	25	0	16.00	16.04	15.82		0
16QAM	1	0	16.04	16.10	15.90	0-1	0
	1	12	15.99	16.13	15.89		0
	1	24	16.05	16.05	15.84		0
	12	0	15.98	16.08	15.90	0-2	0
	12	6	16.11	16.13	15.89		0
	12	13	16.02	16.03	15.83		0
	25	0	16.08	16.09	15.88		0
64QAM	1	0	15.98	16.15	15.89	0-2	0
	1	12	16.00	16.11	15.87		0
	1	24	16.05	16.06	15.88		0
	12	0	15.99	16.11	15.90	0-3	0
	12	6	16.06	16.07	15.86		0
	12	13	16.06	16.05	15.81		0
	25	0	16.12	16.08	15.88		0

Table 9-27
LTE Band 5 (Cell) Reduced Conducted Powers - 3 MHz Bandwidth

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	15.83	15.91	15.69	0	0
	1	7	15.87	15.98	15.75		0
	1	14	15.76	15.86	15.64		0
	8	0	15.90	15.99	15.74	0-1	0
	8	4	15.90	16.01	15.76		0
	8	7	15.84	15.95	15.72		0
	15	0	15.90	16.00	15.77		0
16QAM	1	0	16.10	16.21	15.95	0-1	0
	1	7	16.23	16.31	16.05		0
	1	14	16.02	16.13	15.87		0
	8	0	16.04	16.10	15.90	0-2	0
	8	4	16.05	16.11	15.90		0
	8	7	16.03	16.08	15.86		0
	15	0	16.05	16.15	15.90		0
64QAM	1	0	16.02	16.03	15.77	0-2	0
	1	7	16.07	16.09	15.92		0
	1	14	15.97	16.10	15.78		0
	8	0	16.08	16.23	15.98	0-3	0
	8	4	16.14	16.28	16.00		0
	8	7	16.07	16.23	15.94		0
	15	0	16.04	16.12	15.91		0

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Table 9-28
LTE Band 5 (Cell) Reduced Conducted Powers -1.4 MHz Bandwidth

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	15.71	15.76	15.75	0	0
	1	2	15.72	15.84	15.80		0
	1	5	15.65	15.77	15.75		0
	3	0	15.83	15.88	15.68		0
	3	2	15.88	15.96	15.73		0
	3	3	15.83	15.90	15.69		0
	6	0	15.78	15.89	15.66	0-1	0
16QAM	1	0	15.94	16.06	15.82	0-1	0
	1	2	16.01	16.08	15.89		0
	1	5	15.97	16.03	15.82		0
	3	0	15.93	15.98	15.75		0
	3	2	15.97	16.04	15.86		0
	3	3	15.92	16.00	15.80		0
	6	0	15.86	15.97	15.66	0-2	0
64QAM	1	0	15.82	15.96	16.15	0-2	0
	1	2	15.93	16.05	16.29		0
	1	5	15.89	16.01	16.10		0
	3	0	15.84	15.92	15.77		0
	3	2	15.94	16.03	15.86		0
	3	3	15.85	15.94	15.77		0
	6	0	15.92	16.00	15.76	0-3	0

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LTE Band 66 (AWS)

Table 9-29
LTE Band 66 (AWS) Maximum Conducted Powers - 20 MHz Bandwidth

LTE Band 66 (AWS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132072 (1720.0 MHz)	132322 (1745.0 MHz)	132572 (1770.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.12	23.14	23.28	0	0
	1	50	23.03	23.09	23.20		0
	1	99	23.10	23.13	23.21		0
	50	0	22.21	22.21	22.28	0-1	1
	50	25	22.13	22.18	22.22		1
	50	50	22.12	22.15	22.26		1
	100	0	22.10	22.18	22.22		1
16QAM	1	0	22.49	22.34	22.46	0-1	1
	1	50	22.39	22.35	22.45		1
	1	99	22.31	22.47	22.25		1
	50	0	21.27	21.28	21.33	0-2	2
	50	25	21.26	21.24	21.29		2
	50	50	21.23	21.24	21.36		2
	100	0	21.25	21.30	21.28		2
64QAM	1	0	21.49	21.42	21.45	0-2	2
	1	50	21.40	21.47	21.43		2
	1	99	21.36	21.48	21.40		2
	50	0	20.32	20.30	20.34	0-3	3
	50	25	20.34	20.31	20.30		3
	50	50	20.22	20.25	20.40		3
	100	0	20.27	20.28	20.34		3

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Table 9-30
LTE Band 66 (AWS) Maximum Conducted Powers - 15 MHz Bandwidth

LTE Band 66 (AWS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132047 (1717.5 MHz)	132322 (1745.0 MHz)	132597 (1772.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.95	22.92	23.10	0	0
	1	36	22.90	23.09	23.07		0
	1	74	22.96	22.99	23.04		0
	36	0	21.90	22.01	22.02	0-1	1
	36	18	22.01	21.93	22.11		1
	36	37	21.99	21.99	22.07		1
	75	0	21.97	22.00	22.05		1
16QAM	1	0	22.25	22.20	22.44	0-1	1
	1	36	22.19	22.34	22.35		1
	1	74	22.20	22.27	22.33		1
	36	0	21.02	21.19	21.12	0-2	2
	36	18	21.09	21.17	21.16		2
	36	37	21.03	21.03	21.20		2
	75	0	21.05	21.08	21.12		2
64QAM	1	0	21.23	21.33	21.51	0-2	2
	1	36	21.02	21.19	21.23		2
	1	74	21.37	21.29	21.32		2
	36	0	20.00	20.11	20.20	0-3	3
	36	18	20.09	20.12	20.31		3
	36	37	20.10	20.07	20.21		3
	75	0	20.08	20.09	20.08		3

Table 9-31
LTE Band 66 (AWS) Maximum Conducted Powers - 10 MHz Bandwidth

LTE Band 66 (AWS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132022 (1715.0 MHz)	132322 (1745.0 MHz)	132622 (1775.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.86	22.97	23.10	0	0
	1	25	22.79	22.88	22.98		0
	1	49	22.87	22.94	23.01		0
	25	0	21.86	21.98	22.08	0-1	1
	25	12	21.83	21.93	22.06		1
	25	25	21.94	21.97	22.07		1
	50	0	21.92	21.94	22.10		1
16QAM	1	0	22.19	21.78	22.40	0-1	1
	1	25	22.13	22.08	22.36		1
	1	49	22.22	22.34	22.32		1
	25	0	20.96	21.00	21.18	0-2	2
	25	12	20.98	21.03	21.17		2
	25	25	20.99	20.98	21.12		2
	50	0	21.03	21.03	21.15		2
64QAM	1	0	21.18	21.35	21.55	0-2	2
	1	25	21.07	21.21	21.27		2
	1	49	21.17	21.14	21.30		2
	25	0	19.93	20.09	20.25	0-3	3
	25	12	19.94	20.03	20.24		3
	25	25	20.01	20.02	20.15		3
	50	0	20.07	20.06	20.21		3

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Table 9-32
LTE Band 66 (AWS) Maximum Conducted Powers - 5 MHz Bandwidth

LTE Band 66 (AWS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131997 (1712.5 MHz)	132322 (1745.0 MHz)	132647 (1777.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	23.10	23.09	23.24	0	0
	1	12	22.82	23.05	23.18		0
	1	24	22.84	23.09	23.24		0
	12	0	21.94	22.16	22.26	0-1	1
	12	6	21.98	22.15	22.27		1
	12	13	21.94	22.15	22.26		1
	25	0	21.98	22.07	22.25		1
16QAM	1	0	22.12	22.15	22.43	0-1	1
	1	12	22.10	22.06	22.42		1
	1	24	22.08	22.19	22.47		1
	12	0	21.07	21.19	21.35	0-2	2
	12	6	21.10	21.22	21.33		2
	12	13	21.06	21.19	21.32		2
	25	0	21.07	21.24	21.33		2
64QAM	1	0	21.15	21.43	21.40	0-2	2
	1	12	21.08	21.44	21.35		2
	1	24	21.10	21.45	21.38		2
	12	0	20.04	20.23	20.37	0-3	3
	12	6	20.03	20.23	20.37		3
	12	13	20.02	20.18	20.33		3
	25	0	20.04	20.17	20.38		3

Table 9-33
LTE Band 66 (AWS) Maximum Conducted Powers - 3 MHz Bandwidth

LTE Band 66 (AWS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131987 (1711.5 MHz)	132322 (1745.0 MHz)	132657 (1778.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.78	23.02	23.12	0	0
	1	7	22.90	23.11	23.19		0
	1	14	22.78	23.02	23.10		0
	8	0	21.93	22.06	22.17	0-1	1
	8	4	21.95	22.07	22.23		1
	8	7	21.86	21.97	22.17		1
	15	0	21.93	22.07	22.20		1
16QAM	1	0	22.11	21.89	22.43	0-1	1
	1	7	22.22	21.93	22.52		1
	1	14	22.12	21.77	22.38		1
	8	0	20.90	20.98	21.34	0-2	2
	8	4	20.95	21.02	21.40		2
	8	7	20.85	20.98	21.30		2
	15	0	21.04	21.10	21.39		2
64QAM	1	0	21.03	20.92	21.84	0-2	2
	1	7	21.13	21.07	21.96		2
	1	14	20.95	20.95	21.85		2
	8	0	20.02	20.20	20.42	0-3	3
	8	4	20.03	20.27	20.44		3
	8	7	19.97	20.22	20.35		3
	15	0	20.10	20.24	20.32		3

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Table 9-34
LTE Band 66 (AWS) Maximum Conducted Powers -1.4 MHz Bandwidth

LTE Band 66 (AWS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131979 (1710.7 MHz)	132322 (1745.0 MHz)	132665 (1779.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	22.93	22.96	22.99	0	0
	1	2	23.03	23.00	23.03		0
	1	5	22.95	22.95	22.98		0
	3	0	22.88	22.97	23.10		0
	3	2	22.95	23.06	23.16		0
	3	3	22.87	23.01	23.09		0
	6	0	21.82	21.93	22.11		0-1
16QAM	1	0	22.00	21.75	22.28	0-1	1
	1	2	22.09	21.87	22.32		1
	1	5	22.08	21.82	22.28		1
	3	0	22.00	22.21	22.19		1
	3	2	22.08	22.26	22.28		1
	3	3	22.03	22.19	22.22		1
	6	0	20.86	21.00	21.23	0-2	2
64QAM	1	0	21.39	20.90	21.14	0-2	2
	1	2	21.49	21.01	21.21		2
	1	5	21.30	20.86	21.16		2
	3	0	20.97	21.11	21.14		2
	3	2	21.04	21.21	21.22		2
	3	3	20.98	21.20	21.15		2
	6	0	19.95	20.07	20.19	0-3	3

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Table 9-35
LTE Band 66 (AWS) Reduced Conducted Powers - 20 MHz Bandwidth

LTE Band 66 (AWS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132072 (1720.0 MHz)	132322 (1745.0 MHz)	132572 (1770.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	11.12	11.11	11.28	0	0
	1	50	11.04	11.06	11.24		0
	1	99	11.11	11.18	11.24		0
	50	0	11.18	11.25	11.26	0-1	0
	50	25	11.18	11.22	11.19		0
	50	50	11.16	11.18	11.35		0
	100	0	11.14	11.24	11.21		0
16QAM	1	0	11.41	11.30	11.45	0-1	0
	1	50	11.29	11.32	11.46		0
	1	99	11.23	11.38	11.48		0
	50	0	11.24	11.26	11.31	0-2	0
	50	25	11.19	11.20	11.24		0
	50	50	11.15	11.15	11.34		0
	100	0	11.19	11.20	11.26		0
64QAM	1	0	11.37	11.36	11.48	0-2	0
	1	50	11.29	11.33	11.44		0
	1	99	11.34	11.49	11.32		0
	50	0	11.24	11.28	11.26	0-3	0
	50	25	11.22	11.24	11.29		0
	50	50	11.19	11.19	11.31		0
	100	0	11.21	11.22	11.26		0

Table 9-36
LTE Band 66 (AWS) Reduced Conducted Powers - 15 MHz Bandwidth

LTE Band 66 (AWS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132047 (1717.5 MHz)	132322 (1745.0 MHz)	132597 (1772.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	11.18	11.19	11.19	0	0
	1	36	11.09	11.09	11.24		0
	1	74	11.14	11.04	11.17		0
	36	0	11.08	11.21	11.18	0-1	0
	36	18	11.14	11.19	11.27		0
	36	37	11.09	11.14	11.26		0
	75	0	11.15	11.19	11.13		0
16QAM	1	0	11.20	11.47	11.11	0-1	0
	1	36	11.16	11.38	11.04		0
	1	74	11.19	11.35	11.22		0
	36	0	11.20	11.33	11.26	0-2	0
	36	18	11.25	11.34	11.44		0
	36	37	11.19	11.28	11.37		0
	75	0	11.20	11.25	11.26		0
64QAM	1	0	11.34	11.41	11.17	0-2	0
	1	36	11.31	11.42	11.20		0
	1	74	11.38	11.37	11.10		0
	36	0	11.15	11.42	11.37	0-3	0
	36	18	11.23	11.41	11.46		0
	36	37	11.17	11.34	11.38		0
	75	0	11.27	11.21	11.25		0

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Table 9-37
LTE Band 66 (AWS) Reduced Conducted Powers - 10 MHz Bandwidth

LTE Band 66 (AWS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			132022 (1715.0 MHz)	132322 (1745.0 MHz)	132622 (1775.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	11.08	11.08	11.24	0	0
	1	25	11.06	11.00	11.15		0
	1	49	11.02	11.07	11.11		0
	25	0	11.05	11.17	11.28	0-1	0
	25	12	11.05	11.19	11.28		0
	25	25	11.06	11.12	11.25		0
	50	0	11.14	11.16	11.25		0
16QAM	1	0	11.24	11.32	11.58	0-1	0
	1	25	11.33	11.25	11.48		0
	1	49	11.28	11.24	11.45		0
	25	0	11.15	11.24	11.39	0-2	0
	25	12	11.12	11.20	11.39		0
	25	25	11.14	11.20	11.38		0
	50	0	11.15	11.16	11.35		0
64QAM	1	0	11.08	11.20	11.33	0-2	0
	1	25	11.04	11.13	11.38		0
	1	49	11.12	11.10	11.48		0
	25	0	11.18	11.35	11.32	0-3	0
	25	12	11.18	11.32	11.31		0
	25	25	11.22	11.30	11.28		0
	50	0	11.21	11.18	11.34		0

Table 9-38
LTE Band 66 (AWS) Reduced Conducted Powers - 5 MHz Bandwidth

LTE Band 66 (AWS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131997 (1712.5 MHz)	132322 (1745.0 MHz)	132647 (1777.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	11.15	11.12	11.22	0	0
	1	12	11.17	11.08	11.14		0
	1	24	11.05	11.09	11.08		0
	12	0	11.08	11.17	11.25	0-1	0
	12	6	11.08	11.17	11.26		0
	12	13	11.01	11.13	11.21		0
	25	0	11.04	11.14	11.25		0
16QAM	1	0	11.28	11.16	11.39	0-1	0
	1	12	11.23	11.11	11.34		0
	1	24	11.22	11.14	11.35		0
	12	0	11.10	11.21	11.34	0-2	0
	12	6	11.09	11.21	11.36		0
	12	13	11.06	11.17	11.27		0
	25	0	11.06	11.17	11.30		0
64QAM	1	0	11.19	11.32	11.33	0-2	0
	1	12	11.14	11.41	11.26		0
	1	24	11.12	11.26	11.31		0
	12	0	11.13	11.34	11.22	0-3	0
	12	6	11.10	11.24	11.23		0
	12	13	11.06	11.20	11.20		0
	25	0	11.14	11.14	11.25		0

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Table 9-39
LTE Band 66 (AWS) Reduced Conducted Powers - 3 MHz Bandwidth

LTE Band 66 (AWS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131987 (1711.5 MHz)	132322 (1745.0 MHz)	132657 (1778.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	11.14	11.09	11.20	0	0
	1	7	11.05	11.04	11.17		0
	1	14	11.12	11.17	11.09		0
	8	0	11.22	11.05	11.18	0-1	0
	8	4	11.21	11.07	11.24		0
	8	7	11.19	11.03	11.14		0
	15	0	11.11	11.06	11.17		0
16QAM	1	0	11.17	11.23	11.42	0-1	0
	1	7	11.18	11.28	11.49		0
	1	14	11.04	11.21	11.34		0
	8	0	11.13	11.01	11.31	0-2	0
	8	4	11.16	11.04	11.35		0
	8	7	11.13	11.15	11.29		0
	15	0	11.18	11.18	11.31		0
64QAM	1	0	11.13	11.14	11.23	0-2	0
	1	7	11.07	11.18	11.35		0
	1	14	11.22	11.22	11.32		0
	8	0	11.14	11.23	11.34	0-3	0
	8	4	11.17	11.16	11.34		0
	8	7	11.09	11.09	11.30		0
	15	0	11.12	11.18	11.26		0

Table 9-40
LTE Band 66 (AWS) Reduced Conducted Powers -1.4 MHz Bandwidth

LTE Band 66 (AWS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			131979 (1710.7 MHz)	132322 (1745.0 MHz)	132665 (1779.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	11.18	11.22	11.20	0	0
	1	2	11.17	11.14	11.23		0
	1	5	11.22	11.21	11.17		0
	3	0	11.21	11.08	11.08		0
	3	2	11.19	11.02	11.12		0
	3	3	11.13	11.22	11.06		0
	6	0	11.20	11.18	11.14	0-1	0
16QAM	1	0	11.23	11.12	11.25	0-1	0
	1	2	11.10	11.19	11.31		0
	1	5	11.17	11.10	11.26		0
	3	0	11.15	11.23	11.17		0
	3	2	11.23	11.08	11.26		0
	3	3	11.14	11.02	11.22		0
	6	0	11.16	11.07	11.15	0-2	0
64QAM	1	0	11.12	10.98	11.48	0-2	0
	1	2	11.22	11.05	11.62		0
	1	5	11.25	11.00	11.47		0
	3	0	11.26	11.12	11.14		0
	3	2	11.05	11.05	11.15		0
	3	3	11.19	11.22	11.08		0
	6	0	11.29	11.08	11.16	0-3	0

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LTE Band 4 (AWS)

Table 9-41
LTE Band 4 (AWS) Maximum 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	24.38	0	0
	1	50	24.25		0
	1	99	24.19		0
	50	0	23.30	0-1	1
	50	25	23.25		1
	50	50	23.22		1
	100	0	23.24		1
16QAM	1	0	23.76	0-1	1
	1	50	23.61		1
	1	99	23.59		1
	50	0	22.39	0-2	2
	50	25	22.37		2
	50	50	22.33		2
	100	0	22.36		2
64QAM	1	0	22.86	0-2	2
	1	50	22.72		2
	1	99	22.74		2
	50	0	21.47	0-3	3
	50	25	21.45		3
	50	50	21.36		3
	100	0	21.36		3

Note: LTE Band 4 (AWS) at 20 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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Table 9-42
LTE Band 4 (AWS) Maximum Conducted Powers - 15 MHz Bandwidth

LTE Band 4 (AWS) 15 MHz Bandwidth							
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	24.28	24.37	24.28	0	0
	1	36	24.15	24.34	24.22		0
	1	74	24.29	24.36	24.26		0
	36	0	23.26	23.30	23.25	0-1	1
	36	18	23.29	23.28	23.28		1
	36	37	23.36	23.25	23.23		1
	75	0	23.33	23.31	23.24		1
16QAM	1	0	23.62	23.58	23.13	0-1	1
	1	36	23.52	23.42	23.02		1
	1	74	23.67	23.51	23.10		1
	36	0	22.44	22.49	22.43	0-2	2
	36	18	22.37	22.44	22.38		2
	36	37	22.44	22.41	22.39		2
	75	0	22.46	22.39	22.39		2
64QAM	1	0	22.74	22.98	22.30	0-2	2
	1	36	22.87	22.83	22.19		2
	1	74	22.86	22.90	22.25		2
	36	0	21.51	21.43	21.52	0-3	3
	36	18	21.46	21.41	21.47		3
	36	37	21.53	21.41	21.44		3
	75	0	21.45	21.49	21.44		3

Table 9-43
LTE Band 4 (AWS) Maximum Conducted Powers - 10 MHz Bandwidth

LTE Band 4 (AWS) 10 MHz Bandwidth							
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	24.13	24.26	24.27	0	0
	1	25	24.09	24.24	24.14		0
	1	49	24.06	24.22	24.16		0
	25	0	23.28	23.28	23.23	0-1	1
	25	12	23.25	23.32	23.23		1
	25	25	23.26	23.31	23.24		1
	50	0	23.28	23.30	23.25		1
16QAM	1	0	23.47	23.12	23.55	0-1	1
	1	25	23.37	23.03	23.52		1
	1	49	23.34	23.06	23.55		1
	25	0	22.37	22.45	22.41	0-2	2
	25	12	22.38	22.43	22.41		2
	25	25	22.31	22.41	22.41		2
	50	0	22.35	22.40	22.40		2
64QAM	1	0	22.33	22.26	22.97	0-2	2
	1	25	22.23	22.21	22.93		2
	1	49	22.23	22.21	22.93		2
	25	0	21.48	21.51	21.40	0-3	3
	25	12	21.46	21.50	21.34		3
	25	25	21.46	21.50	21.34		3
	50	0	21.36	21.43	21.42		3

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Table 9-44
LTE Band 4 (AWS) Maximum Conducted Powers - 5 MHz Bandwidth

LTE Band 4 (AWS) 5 MHz Bandwidth							
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	24.21	24.33	24.12	0	0
	1	12	24.19	24.29	24.09		0
	1	24	24.19	24.34	24.12		0
	12	0	23.29	23.28	23.22	0-1	1
	12	6	23.30	23.32	23.24		1
	12	13	23.27	23.26	23.20		1
	25	0	23.25	23.28	23.22		1
16QAM	1	0	23.29	23.52	23.40	0-1	1
	1	12	23.28	23.51	23.34		1
	1	24	23.31	23.52	23.39		1
	12	0	22.39	22.38	22.30	0-2	2
	12	6	22.35	22.45	22.38		2
	12	13	22.34	22.38	22.32		2
	25	0	22.33	22.35	22.37		2
64QAM	1	0	22.61	22.44	22.39	0-2	2
	1	12	22.55	22.43	22.32		2
	1	24	22.55	22.43	22.36		2
	12	0	21.41	21.42	21.30	0-3	3
	12	6	21.37	21.40	21.29		3
	12	13	21.34	21.41	21.28		3
	25	0	21.31	21.40	21.33		3

Table 9-45
LTE Band 4 (AWS) Maximum Conducted Powers - 3 MHz Bandwidth

LTE Band 4 (AWS) 3 MHz Bandwidth							
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	24.11	24.22	24.11	0	0
	1	7	24.18	24.32	24.22		0
	1	14	24.11	24.23	24.12		0
	8	0	23.18	23.19	23.17	0-1	1
	8	4	23.23	23.23	23.22		1
	8	7	23.18	23.21	23.15		1
	15	0	23.24	23.24	23.18		1
16QAM	1	0	23.43	23.11	23.43	0-1	1
	1	7	23.51	23.13	23.59		1
	1	14	23.38	22.98	23.46		1
	8	0	22.16	22.19	22.34	0-2	2
	8	4	22.23	22.23	22.37		2
	8	7	22.15	22.18	22.34		2
	15	0	22.33	22.29	22.35		2
64QAM	1	0	22.27	22.19	22.88	0-2	2
	1	7	22.37	22.29	22.95		2
	1	14	22.23	22.14	22.88		2
	8	0	21.28	21.40	21.40	0-3	3
	8	4	21.33	21.49	21.42		3
	8	7	21.29	21.38	21.40		3
	15	0	21.35	21.44	21.34		3

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Table 9-46
LTE Band 4 (AWS) Maximum Conducted Powers -1.4 MHz Bandwidth

LTE Band 4 (AWS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	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	24.07	24.09	24.27	0	0
	1	2	24.18	24.14	24.32		0
	1	5	24.09	24.08	24.27		0
	3	0	24.13	24.21	24.14		0
	3	2	24.21	24.27	24.21		0
	3	3	24.15	24.19	24.16		0
	6	0	23.10	23.18	23.08	0-1	1
16QAM	1	0	22.89	23.37	23.31	0-1	1
	1	2	22.94	23.42	23.38		1
	1	5	22.92	23.40	23.31		1
	3	0	23.30	23.28	23.30		1
	3	2	23.39	23.35	23.39		1
	3	3	23.34	23.29	23.33		1
	6	0	22.15	22.27	22.11	0-2	2
64QAM	1	0	22.05	22.19	22.65	0-2	2
	1	2	22.18	22.30	22.75		2
	1	5	22.04	22.24	22.60		2
	3	0	22.31	22.22	22.26		2
	3	2	22.39	22.30	22.32		2
	3	3	22.34	22.22	22.24		2
	6	0	21.19	21.27	21.24	0-3	3

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Table 9-47
LTE Band 4 (AWS) Reduced 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	13.36	0	0
	1	50	13.19		0
	1	99	13.22		0
	50	0	13.31	0-1	0
	50	25	13.25		0
	50	50	13.25		0
	100	0	13.29		0
16QAM	1	0	13.73	0-1	0
	1	50	13.54		0
	1	99	13.56		0
	50	0	13.40	0-2	0
	50	25	13.31		0
	50	50	13.32		0
	100	0	13.35		0
64QAM	1	0	13.85	0-2	0
	1	50	13.65		0
	1	99	13.64		0
	50	0	13.39	0-3	0
	50	25	13.40		0
	50	50	13.33		0
	100	0	13.29		0

Note: LTE Band 4 (AWS) at 20 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

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Table 9-48
LTE Band 4 (AWS) Reduced Conducted Powers - 15 MHz Bandwidth

LTE Band 4 (AWS) 15 MHz Bandwidth							
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	13.22	13.16	13.09	0	0
	1	36	13.09	13.07	13.02		0
	1	74	13.15	13.05	13.04		0
	36	0	13.05	13.19	13.16	0-1	0
	36	18	13.07	13.17	13.09		0
	36	37	13.11	13.09	13.09		0
	75	0	13.15	13.14	13.10		0
16QAM	1	0	13.25	13.17	13.43	0-1	0
	1	36	13.17	13.15	13.38		0
	1	74	13.24	13.19	13.28		0
	36	0	13.25	13.28	13.26	0-2	0
	36	18	13.19	13.25	13.24		0
	36	37	13.31	13.25	13.18		0
	75	0	13.21	13.23	13.23		0
64QAM	1	0	13.65	13.15	13.83	0-2	0
	1	36	13.55	13.16	13.74		0
	1	74	13.64	13.12	13.70		0
	36	0	13.18	13.41	13.37	0-3	0
	36	18	13.21	13.39	13.33		0
	36	37	13.23	13.32	13.28		0
	75	0	13.32	13.29	13.19		0

Table 9-49
LTE Band 4 (AWS) Reduced Conducted Powers - 10 MHz Bandwidth

LTE Band 4 (AWS) 10 MHz Bandwidth							
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	13.22	13.21	13.30	0	0
	1	25	13.17	13.18	13.28		0
	1	49	13.10	13.05	13.11		0
	25	0	13.05	13.18	13.16	0-1	0
	25	12	13.23	13.16	13.15		0
	25	25	13.05	13.10	13.04		0
	50	0	13.02	13.14	13.24		0
16QAM	1	0	13.26	13.22	13.38	0-1	0
	1	25	13.15	13.09	13.27		0
	1	49	13.13	13.12	13.26		0
	25	0	13.14	13.26	13.18	0-2	0
	25	12	13.14	13.25	13.20		0
	25	25	13.27	13.18	13.17		0
	50	0	13.10	13.19	13.15		0
64QAM	1	0	13.24	13.30	13.55	0-2	0
	1	25	13.10	13.03	13.49		0
	1	49	13.00	13.21	13.50		0
	25	0	13.28	13.32	13.18	0-3	0
	25	12	13.23	13.30	13.27		0
	25	25	13.22	13.30	13.17		0
	50	0	13.21	13.28	13.13		0

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

LTE Band 4 (AWS) 5 MHz Bandwidth							
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	13.18	13.13	13.22	0	0
	1	12	13.15	13.22	13.18		0
	1	24	13.14	13.14	13.12		0
	12	0	13.06	13.16	13.22	0-1	0
	12	6	13.16	13.11	13.20		0
	12	13	13.13	13.10	13.14		0
	25	0	13.21	13.12	13.10		0
16QAM	1	0	13.17	13.41	13.17	0-1	0
	1	12	13.06	13.35	13.21		0
	1	24	13.05	13.34	13.13		0
	12	0	13.16	13.21	13.14	0-2	0
	12	6	13.17	13.23	13.13		0
	12	13	13.09	13.19	13.12		0
	25	0	13.21	13.20	13.08		0
64QAM	1	0	13.42	13.29	13.20	0-2	0
	1	12	13.38	13.25	13.10		0
	1	24	13.35	13.25	13.15		0
	12	0	13.15	13.20	13.08	0-3	0
	12	6	13.16	13.22	13.07		0
	12	13	13.13	13.19	13.06		0
	25	0	13.19	13.25	13.24		0

Table 9-51
LTE Band 4 (AWS) Reduced Conducted Powers - 3 MHz Bandwidth

LTE Band 4 (AWS) 3 MHz Bandwidth							
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	13.21	13.31	13.22	0	0
	1	7	13.18	13.14	13.24		0
	1	14	13.22	13.00	13.23		0
	8	0	13.26	13.04	13.27	0-1	0
	8	4	13.24	13.25	13.26		0
	8	7	13.26	13.24	13.26		0
	15	0	13.17	13.06	13.23		0
16QAM	1	0	13.19	13.28	13.25	0-1	0
	1	7	13.27	12.94	13.34		0
	1	14	13.17	12.82	13.20		0
	8	0	13.22	13.30	13.27	0-2	0
	8	4	13.27	13.26	13.14		0
	8	7	13.25	13.29	13.24		0
	15	0	13.30	13.26	13.28		0
64QAM	1	0	13.26	13.40	13.67	0-2	0
	1	7	13.38	13.37	13.75		0
	1	14	13.29	13.39	13.64		0
	8	0	13.30	13.24	13.20	0-3	0
	8	4	13.25	13.31	13.26		0
	8	7	13.22	13.21	13.18		0
	15	0	13.14	13.30	13.27		0

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Table 9-52
LTE Band 4 (AWS) Reduced Conducted Powers -1.4 MHz Bandwidth

LTE Band 4 (AWS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	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	13.28	13.26	13.23	0	0
	1	2	13.23	13.27	13.30		0
	1	5	13.17	13.28	13.22		0
	3	0	13.16	13.26	13.23		0
	3	2	13.14	13.22	13.26		0
	3	3	13.21	13.26	13.30		0
	6	0	13.20	13.25	13.24	0-1	0
16QAM	1	0	13.23	13.37	13.29	0-1	0
	1	2	13.29	13.41	13.35		0
	1	5	13.31	13.37	13.31		0
	3	0	13.21	13.24	13.19		0
	3	2	13.32	13.30	13.33		0
	3	3	13.22	13.24	13.24		0
	6	0	13.24	13.28	13.30	0-2	0
64QAM	1	0	13.27	13.22	13.62	0-2	0
	1	2	13.23	13.33	13.74		0
	1	5	13.24	13.27	13.57		0
	3	0	13.26	13.19	13.24		0
	3	2	13.32	13.27	13.28		0
	3	3	13.30	13.21	13.19		0
	6	0	13.20	13.32	13.26	0-3	0

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LTE Band 2 (PCS)

Table 9-53
LTE Band 2 (PCS) Maximum Conducted Powers - 20 MHz Bandwidth

LTE Band 2 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18700 (1860.0 MHz)	18900 (1880.0 MHz)	19100 (1900.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.62	24.71	24.24	0	0
	1	50	24.31	24.42	24.07		0
	1	99	24.43	24.44	23.95		0
	50	0	23.64	23.52	23.20	0-1	1
	50	25	23.58	23.43	23.16		1
	50	50	23.48	23.41	23.07		1
	100	0	23.53	23.43	23.12		1
16QAM	1	0	24.00	23.96	23.60	0-1	1
	1	50	23.85	23.77	23.36		1
	1	99	23.96	23.79	23.29		1
	50	0	22.71	22.62	22.26	0-2	2
	50	25	22.70	22.58	22.23		2
	50	50	22.62	22.54	22.17		2
	100	0	22.57	22.56	22.26		2
64QAM	1	0	23.00	23.00	22.49	0-2	2
	1	50	22.89	22.87	22.25		2
	1	99	22.92	22.86	22.16		2
	50	0	21.72	21.66	21.34	0-3	3
	50	25	21.68	21.64	21.28		3
	50	50	21.58	21.54	21.26		3
	100	0	21.57	21.55	21.22		3

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Table 9-54
LTE Band 2 (PCS) Maximum Conducted Powers - 15 MHz Bandwidth

LTE Band 2 (PCS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18675 (1857.5 MHz)	18900 (1880.0 MHz)	19125 (1902.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.46	24.29	24.12	0	0
	1	36	24.42	24.23	23.95		0
	1	74	24.38	24.15	23.89		0
	36	0	23.45	23.32	23.03	0-1	1
	36	18	23.46	23.33	23.01		1
	36	37	23.39	23.24	22.89		1
	75	0	23.48	23.32	23.00		1
16QAM	1	0	23.25	23.66	23.21	0-1	1
	1	36	23.24	23.57	23.04		1
	1	74	23.17	23.51	22.99		1
	36	0	22.59	22.48	22.19	0-2	2
	36	18	22.59	22.51	22.19		2
	36	37	22.57	22.39	22.05		2
	75	0	22.60	22.49	22.09		2
64QAM	1	0	22.40	22.97	22.62	0-2	2
	1	36	22.39	22.96	22.42		2
	1	74	22.31	22.90	22.41		2
	36	0	21.68	21.55	21.16	0-3	3
	36	18	21.70	21.54	21.14		3
	36	37	21.63	21.45	21.01		3
	75	0	21.62	21.39	21.19		3

Table 9-55
LTE Band 2 (PCS) Maximum Conducted Powers - 10 MHz Bandwidth

LTE Band 2 (PCS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18650 (1855.0 MHz)	18900 (1880.0 MHz)	19150 (1905.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.61	24.52	23.97	0	0
	1	25	24.34	24.23	23.77		0
	1	49	24.53	24.39	23.75		0
	25	0	23.50	23.32	23.01	0-1	1
	25	12	23.48	23.33	22.92		1
	25	25	23.45	23.29	22.86		1
	50	0	23.49	23.33	23.02		1
16QAM	1	0	23.84	23.33	23.33	0-1	1
	1	25	23.62	23.04	23.15		1
	1	49	23.82	23.20	23.09		1
	25	0	22.58	22.48	22.14	0-2	2
	25	12	22.59	22.44	22.06		2
	25	25	22.53	22.41	22.03		2
	50	0	22.58	22.44	22.14		2
64QAM	1	0	22.77	22.50	22.69	0-2	2
	1	25	22.51	22.19	22.53		2
	1	49	22.65	22.38	22.53		2
	25	0	21.70	21.52	21.12	0-3	3
	25	12	21.73	21.53	21.05		3
	25	25	21.70	21.45	21.04		3
	50	0	21.57	21.47	21.13		3

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Table 9-56
LTE Band 2 (PCS) Maximum Conducted Powers - 5 MHz Bandwidth

LTE Band 2 (PCS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18625 (1852.5 MHz)	18900 (1880.0 MHz)	19175 (1907.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.47	24.31	23.76	0	0
	1	12	24.41	24.29	23.70		0
	1	24	24.43	24.28	23.74		0
	12	0	23.48	23.29	22.89	0-1	1
	12	6	23.49	23.30	22.91		1
	12	13	23.45	23.32	22.88		1
	25	0	23.44	23.32	22.91		1
16QAM	1	0	23.56	23.58	23.05	0-1	1
	1	12	23.48	23.57	23.00		1
	1	24	23.51	23.54	22.97		1
	12	0	22.60	22.43	22.00	0-2	2
	12	6	22.56	22.41	22.01		2
	12	13	22.54	22.40	21.99		2
	25	0	22.55	22.35	21.99		2
64QAM	1	0	22.84	22.51	22.03	0-2	2
	1	12	22.79	22.44	21.95		2
	1	24	22.80	22.45	21.99		2
	12	0	21.63	21.45	20.96	0-3	3
	12	6	21.63	21.47	20.94		3
	12	13	21.59	21.43	20.93		3
	25	0	21.53	21.46	20.96		3

Table 9-57
LTE Band 2 (PCS) Maximum Conducted Powers - 3 MHz Bandwidth

LTE Band 2 (PCS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18615 (1851.5 MHz)	18900 (1880.0 MHz)	19185 (1908.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.45	24.13	23.82	0	0
	1	7	24.44	24.20	23.89		0
	1	14	24.31	24.12	23.83		0
	8	0	23.44	23.25	22.82	0-1	1
	8	4	23.45	23.28	22.85		1
	8	7	23.42	23.23	22.84		1
	15	0	23.40	23.28	22.89		1
16QAM	1	0	23.67	23.43	22.65	0-1	1
	1	7	23.79	23.53	22.70		1
	1	14	23.62	23.39	22.61		1
	8	0	22.61	22.25	21.78	0-2	2
	8	4	22.58	22.26	21.84		2
	8	7	22.58	22.24	21.78		2
	15	0	22.61	22.39	21.95		2
64QAM	1	0	22.25	22.35	21.74	0-2	2
	1	7	22.19	22.42	21.86		2
	1	14	22.07	22.27	21.72		2
	8	0	21.65	21.38	21.02	0-3	3
	8	4	21.66	21.40	21.10		3
	8	7	21.63	21.35	21.00		3
	15	0	21.55	21.39	21.04		3

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Table 9-58
LTE Band 2 (PCS) Maximum Conducted Powers -1.4 MHz Bandwidth

LTE Band 2 (PCS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18607 (1850.7 MHz)	18900 (1880.0 MHz)	19193 (1909.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	24.30	24.06	23.92	0	0
	1	2	24.39	24.14	23.95		0
	1	5	24.31	24.06	23.89		0
	3	0	24.33	24.17	23.81		0
	3	2	24.44	24.28	23.86		0
	3	3	24.37	24.17	23.80		0
	6	0	23.32	23.18	22.74		0-1
16QAM	1	0	23.13	23.37	22.97	0-1	1
	1	2	23.17	23.42	23.03		1
	1	5	23.18	23.35	23.02		1
	3	0	23.54	23.29	22.93		1
	3	2	23.59	23.37	23.01		1
	3	3	23.56	23.29	22.96		1
	6	0	22.35	22.29	21.80	0-2	2
64QAM	1	0	22.31	22.25	22.30	0-2	2
	1	2	22.37	22.31	22.39		2
	1	5	22.28	22.27	22.27		2
	3	0	22.54	22.20	21.92		2
	3	2	22.62	22.31	21.96		2
	3	3	22.59	22.23	21.92		2
	6	0	21.44	21.31	20.89	0-3	3

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Table 9-59
LTE Band 2 (PCS) Reduced Conducted Powers - 20 MHz Bandwidth

LTE Band 2 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18700 (1860.0 MHz)	18900 (1880.0 MHz)	19100 (1900.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	13.73	13.57	13.21	0	0
	1	50	13.44	13.31	12.99		0
	1	99	13.46	13.30	12.97		0
	50	0	13.60	13.46	13.18	0-1	0
	50	25	13.53	13.39	13.12		0
	50	50	13.39	13.35	13.09		0
	100	0	13.46	13.36	13.15		0
16QAM	1	0	13.98	13.84	13.40	0-1	0
	1	50	13.66	13.58	13.20		0
	1	99	13.78	13.56	13.15		0
	50	0	13.64	13.48	13.19	0-2	0
	50	25	13.62	13.42	13.16		0
	50	50	13.46	13.37	13.11		0
	100	0	13.48	13.43	13.19		0
64QAM	1	0	13.95	13.80	13.41	0-2	0
	1	50	13.65	13.50	13.20		0
	1	99	13.67	13.52	13.15		0
	50	0	13.66	13.50	13.23	0-3	0
	50	25	13.67	13.49	13.18		0
	50	50	13.50	13.38	13.16		0
	100	0	13.54	13.43	13.19		0

Table 9-60
LTE Band 2 (PCS) Reduced Conducted Powers - 15 MHz Bandwidth

LTE Band 2 (PCS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18675 (1857.5 MHz)	18900 (1880.0 MHz)	19125 (1902.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	13.70	13.48	13.16	0	0
	1	36	13.71	13.42	13.05		0
	1	74	13.59	13.34	13.02		0
	36	0	13.58	13.47	13.24	0-1	0
	36	18	13.61	13.46	13.23		0
	36	37	13.58	13.42	13.10		0
	75	0	13.62	13.45	13.21		0
16QAM	1	0	13.73	13.24	13.43	0-1	0
	1	36	13.74	13.19	13.37		0
	1	74	13.64	13.12	13.32		0
	36	0	13.74	13.55	13.31	0-2	0
	36	18	13.73	13.53	13.32		0
	36	37	13.71	13.49	13.21		0
	75	0	13.67	13.53	13.31		0
64QAM	1	0	13.90	13.42	13.87	0-2	0
	1	36	13.89	13.35	13.67		0
	1	74	13.92	13.32	13.70		0
	36	0	13.73	13.63	13.39	0-3	0
	36	18	13.69	13.63	13.40		0
	36	37	13.67	13.58	13.29		0
	75	0	13.73	13.53	13.27		0

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Table 9-61
LTE Band 2 (PCS) Reduced Conducted Powers - 10 MHz Bandwidth

LTE Band 2 (PCS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18650 (1855.0 MHz)	18900 (1880.0 MHz)	19150 (1905.0 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	13.74	13.65	13.10	0	0
	1	25	13.53	13.39	12.93		0
	1	49	13.68	13.54	12.95		0
	25	0	13.62	13.42	13.33	0-1	0
	25	12	13.67	13.42	13.13		0
	25	25	13.60	13.39	13.24		0
	50	0	13.62	13.41	13.16		0
16QAM	1	0	13.96	13.43	13.34	0-1	0
	1	25	13.74	13.15	13.25		0
	1	49	13.90	13.29	13.25		0
	25	0	13.66	13.50	13.22	0-2	0
	25	12	13.66	13.49	13.24		0
	25	25	13.64	13.46	13.39		0
	50	0	13.64	13.47	13.23		0
64QAM	1	0	13.92	13.58	13.75	0-2	0
	1	25	13.66	13.33	13.60		0
	1	49	13.78	13.52	13.64		0
	25	0	13.76	13.55	13.43	0-3	0
	25	12	13.83	13.58	13.47		0
	25	25	13.75	13.52	13.40		0
	50	0	13.66	13.53	13.30		0

Table 9-62
LTE Band 2 (PCS) Reduced Conducted Powers - 5 MHz Bandwidth

LTE Band 2 (PCS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18625 (1852.5 MHz)	18900 (1880.0 MHz)	19175 (1907.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	13.61	13.47	12.94	0	0
	1	12	13.53	13.43	12.85		0
	1	24	13.58	13.46	12.91		0
	12	0	13.62	13.45	13.02	0-1	0
	12	6	13.61	13.40	13.02		0
	12	13	13.59	13.41	12.99		0
	25	0	13.56	13.38	13.26		0
16QAM	1	0	13.62	13.65	13.16	0-1	0
	1	12	13.58	13.63	13.07		0
	1	24	13.61	13.59	13.31		0
	12	0	13.65	13.50	13.08	0-2	0
	12	6	13.66	13.43	13.07		0
	12	13	13.63	13.41	13.03		0
	25	0	13.60	13.41	13.09		0
64QAM	1	0	13.96	13.57	13.27	0-2	0
	1	12	13.92	13.53	13.05		0
	1	24	13.95	13.54	13.21		0
	12	0	13.72	13.51	13.04	0-3	0
	12	6	13.67	13.49	13.30		0
	12	13	13.66	13.48	13.23		0
	25	0	13.66	13.50	13.28		0

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Table 9-63
LTE Band 2 (PCS) Reduced Conducted Powers - 3 MHz Bandwidth

LTE Band 2 (PCS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18615 (1851.5 MHz)	18900 (1880.0 MHz)	19185 (1908.5 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	13.47	13.31	12.90	0	0
	1	7	13.54	13.44	12.97		0
	1	14	13.44	13.34	12.91		0
	8	0	13.58	13.37	12.98	0-1	0
	8	4	13.58	13.37	13.02		0
	8	7	13.54	13.32	12.97		0
	15	0	13.58	13.32	13.02		0
16QAM	1	0	13.72	13.15	13.16	0-1	0
	1	7	13.77	13.18	13.27		0
	1	14	13.67	13.10	13.16		0
	8	0	13.51	13.29	13.09	0-2	0
	8	4	13.54	13.31	13.10		0
	8	7	13.47	13.25	13.09		0
	15	0	13.67	13.38	13.12		0
64QAM	1	0	13.66	13.28	13.58	0-2	0
	1	7	13.73	13.40	13.66		0
	1	14	13.59	13.23	13.57		0
	8	0	13.64	13.51	13.13	0-3	0
	8	4	13.65	13.56	13.17		0
	8	7	13.61	13.50	13.11		0
	15	0	13.68	13.49	13.08		0

Table 9-64
LTE Band 2 (PCS) Reduced Conducted Powers -1.4 MHz Bandwidth

LTE Band 2 (PCS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			18607 (1850.7 MHz)	18900 (1880.0 MHz)	19193 (1909.3 MHz)		
			Conducted Power [dBm]				
QPSK	1	0	13.63	13.20	12.90	0	0
	1	2	13.67	13.30	12.94		0
	1	5	13.64	13.21	12.88		0
	3	0	13.47	13.22	12.89		0
	3	2	13.55	13.37	12.96		0
	3	3	13.47	13.25	12.92		0
	6	0	13.50	13.34	12.95	0-1	0
16QAM	1	0	13.64	13.45	12.67	0-1	0
	1	2	13.69	13.51	13.57		0
	1	5	13.68	13.46	12.69		0
	3	0	13.53	13.28	13.02		0
	3	2	13.66	13.43	13.10		0
	3	3	13.57	13.29	13.04		0
	6	0	13.49	13.40	12.95	0-2	0
64QAM	1	0	13.96	13.35	13.30	0-2	0
	1	2	13.90	13.39	12.88		0
	1	5	13.93	13.35	12.79		0
	3	0	13.56	13.23	13.12		0
	3	2	13.63	13.35	13.21		0
	3	3	13.51	13.24	13.22		0
	6	0	13.58	13.42	13.17	0-3	0

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LTE Band 41

Table 9-65
LTE Band 41 Maximum Conducted Powers - 20 MHz Bandwidth

LTE Band 41 20 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	23.98	23.28	23.10	22.98	23.06	0	0
	1	50	23.75	23.08	22.81	22.74	22.98		0
	1	99	23.56	22.95	22.72	22.73	22.95		0
	50	0	22.95	22.27	21.97	21.97	22.08	0-1	1
	50	25	22.76	22.23	21.90	21.88	22.05		1
	50	50	22.68	22.07	21.83	21.82	22.07		1
	100	0	22.75	22.13	21.91	21.91	22.03		1
16QAM	1	0	23.11	22.40	22.26	22.16	22.21	0-1	1
	1	50	22.88	22.22	21.96	21.91	22.13		1
	1	99	22.67	22.10	21.88	21.90	22.09		1
	50	0	22.03	21.35	21.04	21.08	21.16	0-2	2
	50	25	21.86	21.28	20.99	20.98	21.14		2
	50	50	21.79	21.14	20.90	20.89	21.15		2
	100	0	21.87	21.23	21.00	21.03	21.14		2
64QAM	1	0	21.96	21.25	21.08	20.98	21.02	0-2	2
	1	50	21.73	21.05	20.81	20.73	20.98		2
	1	99	21.50	20.91	20.71	20.75	20.94		2
	50	0	21.06	20.36	20.07	20.07	20.19	0-3	3
	50	25	20.86	20.30	20.00	20.00	20.16		3
	50	50	20.78	20.15	19.93	19.91	20.18		3
	100	0	20.82	20.17	19.96	19.95	20.09		3

Table 9-66
LTE Band 41 Maximum Conducted Powers - 15 MHz Bandwidth

LTE Band 41 15 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	23.82	23.30	22.71	23.04	23.29	0	0
	1	36	23.74	23.23	22.70	23.00	23.33		0
	1	74	23.50	22.97	22.68	23.00	23.17		0
	36	0	22.76	22.19	21.73	21.99	22.27	0-1	1
	36	18	22.68	22.19	21.75	21.99	22.24		1
	36	37	22.55	22.02	21.64	21.92	22.24		1
	75	0	22.61	22.05	21.72	21.92	22.17		1
16QAM	1	0	22.78	22.58	21.69	22.30	22.22	0-1	1
	1	36	22.71	22.53	21.66	22.30	22.23		1
	1	74	22.46	22.28	21.65	22.26	22.12		1
	36	0	21.94	21.36	20.96	21.07	21.41	0-2	2
	36	18	21.88	21.34	20.96	21.07	21.41		2
	36	37	21.74	21.17	20.83	21.02	21.47		2
	75	0	21.70	21.19	20.80	21.05	21.31		2
64QAM	1	0	21.64	21.16	20.56	21.06	21.06	0-2	2
	1	36	21.54	21.09	20.52	21.05	21.13		2
	1	74	21.31	20.82	20.51	21.05	20.99		2
	36	0	20.94	20.33	19.92	20.01	20.40	0-3	3
	36	18	20.80	20.32	19.93	20.00	20.39		3
	36	37	20.75	20.14	19.89	19.95	20.44		3
	75	0	20.75	20.19	19.84	20.12	20.32		3

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Table 9-67
LTE Band 41 Maximum Conducted Powers - 10 MHz Bandwidth

LTE Band 41 10 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	23.93	23.30	22.90	23.03	23.38	0	0
	1	25	23.83	23.23	22.76	22.97	23.38		0
	1	49	23.67	23.20	22.73	23.04	23.40		0
	25	0	22.80	22.25	21.79	22.01	22.26	0-1	1
	25	12	22.76	22.25	21.83	22.04	22.21		1
	25	25	22.59	22.15	21.74	21.94	22.32		1
16QAM	50	0	22.67	22.22	21.78	22.04	22.20	0-1	1
	1	0	22.69	22.57	21.63	22.26	22.14		1
	1	25	22.59	22.46	21.55	22.19	22.12		1
	1	49	22.42	22.43	21.53	22.30	22.17	0-2	1
	25	0	21.89	21.29	20.95	21.03	21.35		2
	25	12	21.92	21.31	20.91	21.02	21.32		2
64QAM	25	25	21.74	21.24	20.86	20.98	21.39	0-2	2
	50	0	21.75	21.30	20.89	21.07	21.33		2
	1	0	21.92	21.16	20.87	21.11	21.45		2
	1	25	21.89	21.09	20.82	21.02	21.42	0-2	2
	1	49	21.72	21.01	20.80	21.11	21.47		2
	25	0	20.90	20.35	19.91	20.00	20.34		0-3
25	12	20.87	20.34	19.91	20.02	20.32	3		
25	25	20.72	20.31	19.87	19.96	20.39	3		
50	0	20.73	20.36	19.87	20.11	20.31		3	

Table 9-68
LTE Band 41 Maximum Conducted Powers - 5 MHz Bandwidth

LTE Band 41 5 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	23.85	23.25	22.82	22.96	23.28	0	0
	1	12	23.84	23.23	22.77	22.93	23.39		0
	1	24	23.79	23.20	22.76	22.94	23.37		0
	12	0	22.77	22.21	21.75	22.02	22.24	0-1	1
	12	6	22.77	22.24	21.77	22.03	22.37		1
	12	13	22.74	22.16	21.76	21.96	22.27		1
16QAM	25	0	22.74	22.20	21.81	22.00	22.20	0-1	1
	1	0	22.89	22.06	21.83	21.79	22.34		1
	1	12	22.84	22.02	21.81	21.73	22.40		1
	1	24	22.82	22.00	21.82	21.73	22.38	0-2	2
	12	0	21.92	21.33	20.97	21.18	21.38		2
	12	6	21.95	21.33	20.96	21.18	21.49		2
64QAM	12	13	21.89	21.31	20.93	21.13	21.45	0-2	2
	25	0	21.78	21.27	20.79	21.10	21.23		2
	1	0	22.19	21.28	21.18	21.14	21.66		0-3
	1	12	22.16	21.23	21.16	21.10	21.71	2	
	1	24	22.12	21.22	21.09	21.12	21.70	3	
	12	0	20.85	20.36	19.88	20.06	20.30	3	
12	6	20.87	20.38	19.90	20.11	20.43	3		
12	13	20.83	20.33	19.85	20.04	20.40	3		
25	0	20.74	20.26	19.76	20.03	20.20	3		

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Table 9-69
LTE Band 41 Reduced Conducted Powers - 20 MHz Bandwidth

LTE Band 41 20 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	14.59	14.15	13.89	14.06	14.11	0	0
	1	50	14.34	14.01	13.55	13.90	13.96		0
	1	99	14.18	13.84	13.54	13.86	13.90		0
	50	0	14.49	14.18	13.70	14.01	14.04	0-1	0
	50	25	14.30	14.08	13.61	13.94	14.00		0
	50	50	14.27	13.94	13.49	13.86	14.04		0
	100	0	14.34	13.99	13.64	13.95	14.00		0
16QAM	1	0	14.77	14.36	14.07	14.25	14.30	0-1	0
	1	50	14.51	14.22	13.74	14.09	14.16		0
	1	99	14.39	14.04	13.75	14.02	14.13		0
	50	0	14.64	14.29	13.82	14.10	14.18	0-2	0
	50	25	14.46	14.22	13.72	14.02	14.12		0
	50	50	14.42	14.05	13.66	13.95	14.14		0
	100	0	14.50	14.13	13.75	14.05	14.13		0
64QAM	1	0	14.42	14.01	13.70	13.86	13.90	0-2	0
	1	50	14.16	13.85	13.37	13.67	13.80		0
	1	99	13.98	13.69	13.37	13.62	13.69		0
	50	0	14.70	14.33	13.88	14.12	14.18	0-3	0
	50	25	14.50	14.25	13.81	14.07	14.14		0
	50	50	14.43	14.12	13.74	14.00	14.17		0
	100	0	14.49	14.12	13.76	14.04	14.09		0

Table 9-70
LTE Band 41 Reduced Conducted Powers - 15 MHz Bandwidth

LTE Band 41 15 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	14.65	14.29	13.81	14.00	14.23	0	0
	1	36	14.70	14.25	13.76	13.96	14.31		0
	1	74	14.51	14.03	13.80	14.05	14.20		0
	36	0	14.60	14.24	13.79	14.01	14.25	0-1	0
	36	18	14.68	14.21	13.83	14.03	14.20		0
	36	37	14.57	14.04	13.76	13.98	14.26		0
	75	0	14.62	14.06	13.73	13.94	14.19		0
16QAM	1	0	14.72	14.51	13.69	14.29	14.13	0-1	0
	1	36	14.65	14.41	13.67	14.23	14.24		0
	1	74	14.45	14.23	13.69	14.32	14.15		0
	36	0	15.00	14.37	13.99	14.08	14.40	0-2	0
	36	18	14.87	14.34	13.97	14.11	14.37		0
	36	37	14.77	14.16	13.92	14.03	14.45		0
	75	0	14.78	14.19	13.86	14.05	14.33		0
64QAM	1	0	14.60	14.09	13.61	14.04	14.05	0-2	0
	1	36	14.58	14.01	13.58	14.05	14.12		0
	1	74	14.35	13.83	13.59	14.06	13.99		0
	36	0	14.92	14.31	14.01	14.04	14.34	0-3	0
	36	18	14.85	14.35	13.96	14.06	14.35		0
	36	37	14.77	14.17	13.91	14.00	14.43		0
	75	0	14.63	14.18	13.89	14.17	14.32		0

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Table 9-71
LTE Band 41 Reduced Conducted Powers - 10 MHz Bandwidth

LTE Band 41 10 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	14.78	14.31	13.92	14.02	14.33	0	0
	1	25	14.80	14.26	13.86	13.94	14.36		0
	1	49	14.64	14.17	13.85	14.05	14.35		0
	25	0	14.79	14.20	13.84	14.00	14.22	0-1	0
	25	12	14.77	14.21	13.82	14.04	14.23		0
	25	25	14.66	14.21	13.80	13.98	14.27		0
16QAM	50	0	14.66	14.22	13.84	13.99	14.22	0	
	1	0	14.63	14.51	13.65	14.31	14.08	0-1	0
	1	25	14.58	14.41	13.58	14.23	14.12		0
	1	49	14.39	14.39	13.56	14.35	14.11		0
	25	0	14.89	14.29	13.91	14.03	14.33	0-2	0
	25	12	14.88	14.29	13.90	14.08	14.33		0
25	25	14.77	14.29	13.89	14.00	14.38	0		
64QAM	50	0	14.77	14.30	13.92	14.04	14.31	0	
	1	0	14.88	14.07	13.88	14.09	14.32	0-2	0
	1	25	14.78	14.02	13.86	14.04	14.37		0
	1	49	14.68	13.96	13.83	14.09	14.35		0
	25	0	14.88	14.36	13.98	14.02	14.30	0-3	0
	25	12	14.91	14.35	13.98	14.07	14.33		0
25	25	14.72	14.38	13.90	13.99	14.38	0		
	50	0	14.67	14.35	13.92	14.07	14.30	0	

Table 9-72
LTE Band 41 Reduced Conducted Powers - 5 MHz Bandwidth

LTE Band 41 5 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed per 3GPP [dB]	MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)		
			Conducted Power [dBm]						
QPSK	1	0	14.84	14.23	13.88	13.92	14.27	0	0
	1	12	14.83	14.22	13.87	13.92	14.37		0
	1	24	14.80	14.21	13.85	13.90	14.33		0
	12	0	14.79	14.22	13.85	14.00	14.27	0-1	0
	12	6	14.78	14.25	13.83	14.04	14.34		0
	12	13	14.77	14.16	13.80	13.99	14.31		0
16QAM	25	0	14.74	14.20	13.82	14.04	14.20	0	
	1	0	14.89	14.00	13.91	13.74	14.31	0-1	0
	1	12	14.84	13.95	13.89	13.72	14.43		0
	1	24	14.81	13.94	13.89	13.69	14.38		0
	12	0	14.95	14.34	14.02	14.16	14.35	0-2	0
	12	6	14.94	14.36	13.99	14.21	14.51		0
12	13	14.92	14.29	13.98	14.12	14.48	0		
64QAM	25	0	14.75	14.25	13.81	14.11	14.22	0	
	1	0	14.81	14.23	14.28	14.10	14.64	0-2	0
	1	12	14.88	14.22	14.26	14.09	14.72		0
	1	24	14.89	14.16	14.22	14.08	14.71		0
	12	0	14.87	14.37	13.92	14.07	14.30	0-3	0
	12	6	14.90	14.40	13.99	14.11	14.43		0
12	13	14.81	14.32	13.91	14.05	14.41	0		
	25	0	14.69	14.27	13.84	14.06	14.18	0	

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9.4 WLAN Conducted Powers

Table 9-73
2.4 GHz WLAN Maximum Average RF Power

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	19.97	17.55	17.57
2417	2	N/A	18.61	N/A
2437	6	19.99	18.92	17.97
2457	10	N/A	18.62	17.52
2462	11	19.93	16.55	16.58

Table 9-74
5 GHz WLAN Maximum Average RF Power

5GHz (20MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11a	802.11n	802.11ac
		Average	Average	Average
5180	36	16.76	15.74	15.71
5200	40	16.75	15.68	15.62
5220	44	16.73	15.73	15.77
5240	48	16.68	15.75	15.74
5260	52	16.90	15.86	15.89
5280	56	16.71	15.94	15.97
5300	60	16.78	15.68	15.68
5320	64	16.98	15.96	15.95
5500	100	16.99	15.99	15.99
5600	120	16.80	15.76	15.78
5620	124	16.91	15.90	15.89
5720	144	16.69	15.74	15.72
5745	149	16.86	15.88	15.91
5785	157	16.92	15.97	15.98
5825	165	16.97	15.92	15.99

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Table 9-75
2.4 GHz WLAN Reduced Average RF Power

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	11.98	11.69	11.97
2437	6	11.67	11.80	11.63
2462	11	11.91	11.58	11.93

Table 9-76
5 GHz WLAN Reduced Average RF Power

5GHz (80MHz) Conducted Power [dBm]		
Freq [MHz]	Channel	IEEE Transmission Mode
		802.11ac
		Average
5210	42	8.67
5290	58	8.98
5530	106	8.86
5610	122	8.89
5690	138	8.76
5775	155	8.98

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.

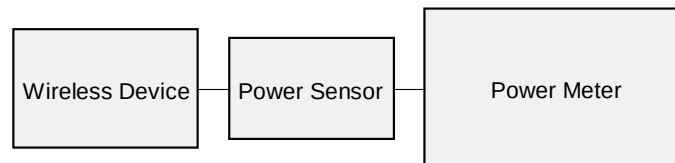


Figure 9-3
Power Measurement Setup

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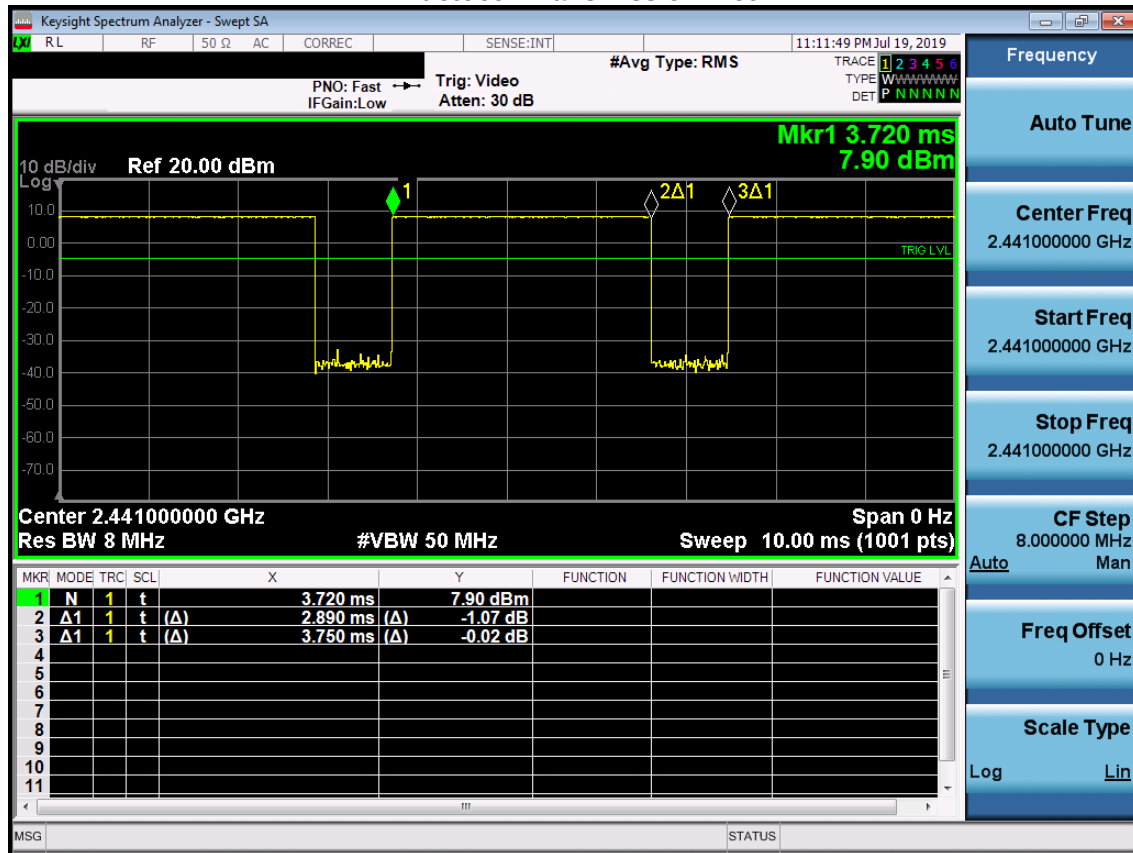
9.5 Bluetooth Conducted Powers

Table 9-77
Bluetooth Average RF Power

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
			[dBm]	[mW]
2402	1.0	0	9.01	7.961
2441	1.0	39	7.93	6.205
2480	1.0	78	8.54	7.144
2402	2.0	0	8.38	6.893
2441	2.0	39	7.37	5.451
2480	2.0	78	7.93	6.206
2402	3.0	0	8.45	6.992
2441	3.0	39	7.42	5.526
2480	3.0	78	7.99	6.290

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Figure 9-4
Bluetooth Transmission Plot



Equation 9-1
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.89ms}{3.75ms} * 100\% = 77.1\%$$

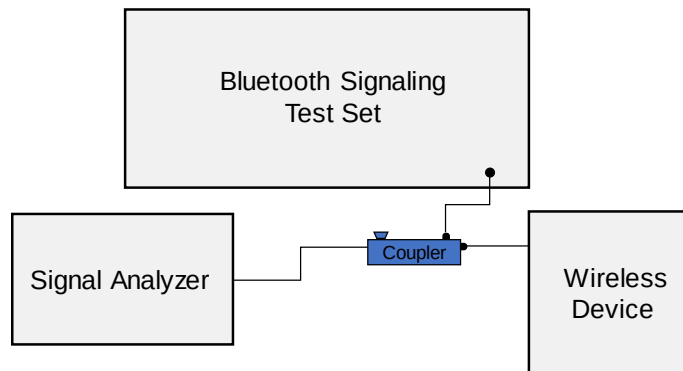


Figure 9-5
Power Measurement Setup

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10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (°C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ϵ	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ϵ	% dev σ	% dev ϵ
7/23/2019	750B	22.7	700	0.923	56.176	0.959	55.726	-3.75%	0.81%
			710	0.926	56.151	0.960	55.687	-3.54%	0.83%
			720	0.930	56.134	0.961	55.648	-3.23%	0.87%
			725	0.932	56.123	0.961	55.629	-3.02%	0.89%
			740	0.937	56.095	0.963	55.570	-2.70%	0.94%
			755	0.943	56.063	0.964	55.512	-2.18%	0.99%
			770	0.948	56.026	0.965	55.453	-1.76%	1.03%
			785	0.954	55.981	0.966	55.395	-1.24%	1.06%
			700	0.933	56.761	0.959	55.726	-2.71%	1.86%
			710	0.937	56.726	0.960	55.687	-2.40%	1.87%
8/20/2019	750B	22.8	720	0.940	56.709	0.961	55.648	-2.19%	1.91%
			725	0.943	56.699	0.961	55.629	-1.87%	1.92%
			740	0.948	56.679	0.963	55.570	-1.56%	2.00%
			755	0.954	56.666	0.964	55.512	-1.04%	2.08%
			770	0.959	56.606	0.965	55.453	-0.62%	2.08%
			785	0.963	56.580	0.966	55.395	-0.31%	2.14%
			820	0.938	54.089	0.969	55.258	-3.20%	-2.12%
			835	0.953	53.952	0.970	55.200	-1.75%	-2.26%
			850	0.967	53.812	0.988	55.154	-2.13%	-2.43%
			1710	1.486	52.617	1.463	53.537	1.57%	-1.72%
7/22/2019	1750B	20.8	1750	1.532	52.448	1.488	53.432	2.96%	-1.84%
			1790	1.577	52.284	1.514	53.326	4.16%	-1.95%
7/29/2019	1750B	21.1	1710	1.419	53.174	1.463	53.537	-3.01%	-0.68%
			1750	1.446	53.118	1.488	53.432	-2.82%	-0.59%
			1790	1.472	53.062	1.514	53.326	-2.77%	-0.50%
7/31/2019	1750B	22.0	1710	1.459	53.423	1.463	53.537	-0.27%	-0.21%
			1750	1.487	53.356	1.488	53.432	-0.07%	-0.14%
			1790	1.513	53.301	1.514	53.326	-0.07%	-0.05%
7/25/2019	1900B	23.2	1850	1.518	53.199	1.520	53.300	-0.13%	-0.19%
			1880	1.552	53.125	1.520	53.300	2.11%	-0.33%
			1910	1.582	53.016	1.520	53.300	4.08%	-0.53%
			1850	1.519	52.283	1.520	53.300	-0.07%	-1.91%
8/12/2019	1900B	23.2	1880	1.554	52.179	1.520	53.300	2.24%	-2.10%
			1910	1.587	52.080	1.520	53.300	4.41%	-2.29%
			2400	1.942	52.008	1.902	52.767	2.10%	-1.44%
7/29/2019	2450B	22.2	2450	2.011	51.790	1.950	52.700	3.13%	-1.73%
			2500	2.081	51.634	2.021	52.636	2.97%	-1.90%
			2400	1.980	51.827	1.902	52.767	4.10%	-1.78%
8/5/2019	2450B	21.8	2450	2.047	51.621	1.950	52.700	4.97%	-2.05%
			2500	2.118	51.416	2.021	52.636	4.80%	-2.32%
			2550	2.186	51.219	2.092	52.573	4.49%	-2.58%
			2600	2.256	51.020	2.163	52.509	4.30%	-2.84%
			2650	2.324	50.826	2.234	52.445	4.03%	-3.09%
			2700	2.396	50.614	2.305	52.382	3.95%	-3.38%
			5240	5.180	47.097	5.346	48.960	-3.11%	-3.81%
			5260	5.210	47.075	5.369	48.933	-2.96%	-3.80%
			5280	5.235	47.046	5.393	48.906	-2.93%	-3.80%
			5300	5.259	47.008	5.416	48.879	-2.90%	-3.83%
08/05/2019	5200B-5800B	22.1	5320	5.282	46.970	5.439	48.851	-2.89%	-3.85%
			5500	5.526	46.684	5.650	48.607	-2.19%	-3.96%
			5520	5.556	46.643	5.673	48.580	-2.06%	-3.99%
			5540	5.593	46.598	5.696	48.553	-1.81%	-4.03%
			5560	5.622	46.566	5.720	48.526	-1.71%	-4.04%
			5580	5.653	46.563	5.743	48.499	-1.57%	-3.99%
			5600	5.671	46.518	5.766	48.471	-1.65%	-4.03%
			5620	5.698	46.452	5.790	48.444	-1.59%	-4.11%
			5640	5.727	46.412	5.813	48.417	-1.48%	-4.14%
			5660	5.762	46.385	5.837	48.390	-1.28%	-4.14%
			5680	5.794	46.361	5.860	48.363	-1.13%	-4.14%
			5700	5.821	46.355	5.883	48.336	-1.05%	-4.10%
			5745	5.880	46.252	5.936	48.275	-0.94%	-4.19%
			5765	5.913	46.212	5.959	48.248	-0.77%	-4.22%
			5785	5.947	46.188	5.982	48.220	-0.59%	-4.21%
			5800	5.970	46.172	6.000	48.200	-0.50%	-4.21%
			5805	5.976	46.166	6.006	48.193	-0.50%	-4.21%
			5825	5.996	46.148	6.029	48.166	-0.55%	-4.19%

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

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10.2 Test System Verification

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

Table 10-2
System Verification Results

System Verification												
TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation _{1g} (%)
G	750	BODY	07/23/2019	23.2	22.7	0.200	1003	7409	1.700	8.580	8.500	-0.93%
H	750	BODY	08/20/2019	23.5	21.5	0.200	1054	7406	1.790	8.550	8.950	4.68%
D	835	BODY	07/24/2019	22.6	22.3	0.200	4d132	3914	2.080	9.670	10.400	7.55%
I	1750	BODY	07/22/2019	21.0	20.8	0.100	1150	7357	3.890	36.600	38.900	6.28%
G	1750	BODY	07/29/2019	22.4	21.1	0.100	1150	7409	3.640	36.600	36.400	-0.55%
G	1750	BODY	07/31/2019	22.6	22.0	0.100	1150	7409	3.690	36.600	36.900	0.82%
J	1900	BODY	07/25/2019	19.7	23.2	0.100	5d080	7488	4.170	39.200	41.700	6.38%
J	1900	BODY	08/12/2019	20.0	21.3	0.100	5d080	7488	4.160	39.200	41.600	6.12%
I	2450	BODY	07/29/2019	21.9	20.6	0.100	797	7357	5.140	51.100	51.400	0.59%
I	2450	BODY	08/05/2019	20.6	21.0	0.100	797	7357	5.120	51.100	51.200	0.20%
I	2600	BODY	08/05/2019	20.6	21.0	0.100	1004	7357	5.550	54.800	55.500	1.28%
L	5250	BODY	08/05/2019	20.3	21.1	0.050	1057	7410	3.480	75.900	69.600	-8.30%
L	5600	BODY	08/05/2019	20.3	21.1	0.050	1057	7410	3.810	79.900	76.200	-4.63%
L	5750	BODY	08/05/2019	20.3	21.1	0.050	1057	7410	3.560	76.700	71.200	-7.17%

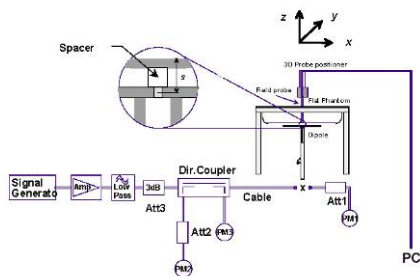


Figure 10-1
System Verification Setup Diagram



Figure 10-2
System Verification Setup Photo

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11 SAR DATA SUMMARY

11.1 Standalone Body SAR Data

Table 11-1
GSM 850 Body SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GPRS	28.7	28.43	-0.05	15 mm	1471M	4	1:2.076	back	0.305	1.064	0.325	
836.60	190	GSM 850	GPRS	28.7	28.43	-0.04	15 mm	1471M	4	1:2.076	top	0.133	1.064	0.142	
836.60	190	GSM 850	GPRS	28.7	28.43	0.01	0 mm	1471M	4	1:2.076	right	0.494	1.064	0.526	A1
836.60	190	GSM 850	GPRS	27.0	26.59	0.08	0 mm	1471M	1	1:8.3	back	0.362	1.099	0.398	
836.60	190	GSM 850	GPRS	27.0	26.59	-0.02	0 mm	1471M	1	1:8.3	top	0.257	1.099	0.282	
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 11-2
GSM 1900 Body SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GPRS	26.5	25.46	0.04	15 mm	1504M	4	1:2.076	back	0.399	1.271	0.507	
1880.00	661	GSM 1900	GPRS	26.5	25.46	-0.06	15 mm	1504M	4	1:2.076	top	0.409	1.271	0.520	
1880.00	661	GSM 1900	GPRS	26.5	25.46	0.11	0 mm	1504M	4	1:2.076	right	0.185	1.271	0.235	
1850.20	512	GSM 1900	GPRS	17.5	17.09	-0.14	0 mm	6020M	4	1:2.076	back	1.060	1.099	1.165	A2
1880.00	661	GSM 1900	GPRS	17.5	17.05	-0.03	0 mm	6020M	4	1:2.076	back	0.997	1.109	1.106	
1909.80	810	GSM 1900	GPRS	17.5	16.61	-0.20	0 mm	6020M	4	1:2.076	back	1.030	1.227	1.264	
1880.00	661	GSM 1900	GPRS	17.5	17.05	-0.07	0 mm	6020M	4	1:2.076	top	0.708	1.109	0.785	
1850.20	512	GSM 1900	GPRS	17.5	17.09	-0.14	0 mm	6020M	4	1:2.076	back	0.988	1.099	1.086	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

Note: Blue entry represents variability measurement.

Table 11-3
UMTS 850 Body SAR Data

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	24.5	24.28	0.04	15 mm	1471M	1:1	back	0.356	1.052	0.375	
836.60	4183	UMTS 850	RMC	24.5	24.28	-0.02	15 mm	1471M	1:1	top	0.133	1.052	0.140	
836.60	4183	UMTS 850	RMC	24.5	24.28	0.00	0 mm	1471M	1:1	right	0.530	1.052	0.558	A3
836.60	4183	UMTS 850	RMC	17.0	16.31	-0.03	0 mm	1471M	1:1	back	0.347	1.172	0.407	
836.60	4183	UMTS 850	RMC	17.0	16.31	-0.07	0 mm	1471M	1:1	top	0.216	1.172	0.253	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram							

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Table 11-4
UMTS 1750 Body SAR Data

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1712.40	1312	UMTS 1750	RMC	24.5	24.32	0.05	15 mm	1461M	1:1	back	1.000	1.042	1.042	
1732.40	1412	UMTS 1750	RMC	24.5	24.17	0.03	15 mm	1461M	1:1	back	1.180	1.079	1.273	
1752.60	1513	UMTS 1750	RMC	24.5	24.07	0.04	15 mm	1461M	1:1	back	1.260	1.104	1.391	A4
1712.40	1312	UMTS 1750	RMC	24.5	24.32	0.01	15 mm	1461M	1:1	top	0.907	1.042	0.945	
1732.40	1412	UMTS 1750	RMC	24.5	24.17	-0.01	15 mm	1461M	1:1	top	1.040	1.079	1.122	
1752.60	1513	UMTS 1750	RMC	24.5	24.07	0.01	15 mm	1461M	1:1	top	1.130	1.104	1.248	
1732.40	1412	UMTS 1750	RMC	24.5	24.17	0.02	0 mm	1461M	1:1	right	0.426	1.079	0.460	
1712.40	1312	UMTS 1750	RMC	14.0	13.34	0.04	0 mm	1461M	1:1	back	1.030	1.164	1.199	
1732.40	1412	UMTS 1750	RMC	14.0	13.19	0.03	0 mm	1461M	1:1	back	1.130	1.205	1.362	
1752.60	1513	UMTS 1750	RMC	14.0	13.39	0.03	0 mm	1461M	1:1	back	1.160	1.151	1.335	
1712.40	1312	UMTS 1750	RMC	14.0	13.34	0.02	0 mm	1461M	1:1	top	0.838	1.164	0.975	
1732.40	1412	UMTS 1750	RMC	14.0	13.19	-0.01	0 mm	1461M	1:1	top	0.950	1.205	1.145	
1752.60	1513	UMTS 1750	RMC	14.0	13.39	0.01	0 mm	1461M	1:1	top	0.999	1.151	1.150	
1752.60	1513	UMTS 1750	RMC	24.5	24.07	0.04	15 mm	1461M	1:1	back	1.200	1.104	1.325	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram							

Note: Blue entry represents variability measurement

Table 11-5
UMTS 1900 Body SAR Data

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1852.40	9262	UMTS 1900	RMC	24.5	24.07	0.03	15 mm	1504M	1:1	back	0.979	1.104	1.081	A5
1880.00	9400	UMTS 1900	RMC	24.5	24.20	0.00	15 mm	1504M	1:1	back	0.764	1.072	0.819	
1907.60	9538	UMTS 1900	RMC	24.5	24.10	0.06	15 mm	1504M	1:1	back	0.647	1.096	0.709	
1880.00	9400	UMTS 1900	RMC	24.5	24.20	-0.06	15 mm	1504M	1:1	top	0.728	1.072	0.780	
1880.00	9400	UMTS 1900	RMC	24.5	24.20	-0.04	0 mm	1504M	1:1	right	0.290	1.072	0.311	
1852.40	9262	UMTS 1900	RMC	14.0	13.24	-0.16	0 mm	1504M	1:1	back	0.946	1.191	1.127	
1880.00	9400	UMTS 1900	RMC	14.0	13.24	-0.13	0 mm	1504M	1:1	back	0.856	1.191	1.019	
1907.60	9538	UMTS 1900	RMC	14.0	13.08	-0.13	0 mm	1504M	1:1	back	0.753	1.236	0.931	
1852.40	9262	UMTS 1900	RMC	14.0	13.24	-0.04	0 mm	1504M	1:1	top	0.827	1.191	0.985	
1880.00	9400	UMTS 1900	RMC	14.0	13.24	-0.09	0 mm	1504M	1:1	top	0.761	1.191	0.906	
1907.60	9538	UMTS 1900	RMC	14.0	13.08	-0.02	0 mm	1504M	1:1	top	0.724	1.236	0.895	
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 11-6
LTE Band 12 Body SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
707.50	23095	Mid	LTE Band 12	10	24.5	23.95	-0.05	0	1471M	QPSK	1	0	15 mm	back	1:1	0.125	1.135	0.142	
707.50	23095	Mid	LTE Band 12	10	23.5	22.93	0.00	1	1471M	QPSK	25	12	15 mm	back	1:1	0.113	1.140	0.129	
707.50	23095	Mid	LTE Band 12	10	24.5	23.95	0.12	0	1471M	QPSK	1	0	15 mm	top	1:1	0.047	1.135	0.053	
707.50	23095	Mid	LTE Band 12	10	23.5	22.93	0.07	1	1471M	QPSK	25	12	15 mm	top	1:1	0.042	1.140	0.048	
707.50	23095	Mid	LTE Band 12	10	24.5	23.95	0.09	0	1471M	QPSK	1	0	0 mm	right	1:1	0.126	1.135	0.143	
707.50	23095	Mid	LTE Band 12	10	23.5	22.93	-0.04	1	1471M	QPSK	25	12	0 mm	right	1:1	0.107	1.140	0.122	
707.50	23095	Mid	LTE Band 12	10	17.0	15.69	0.02	0	1471M	QPSK	1	49	0 mm	back	1:1	0.217	1.352	0.293	
707.50	23095	Mid	LTE Band 12	10	17.0	15.73	-0.02	0	1471M	QPSK	25	12	0 mm	back	1:1	0.223	1.340	0.299	A6
707.50	23095	Mid	LTE Band 12	10	17.0	15.69	-0.05	0	1471M	QPSK	1	49	0 mm	top	1:1	0.092	1.352	0.124	
707.50	23095	Mid	LTE Band 12	10	17.0	15.73	-0.07	0	1471M	QPSK	25	12	0 mm	top	1:1	0.090	1.340	0.121	
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 11-7
LTE Band 17 Body 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)		
710.00	23790	Mid	LTE Band 17	10	25.0	24.17	0.03	0	1461M	QPSK	1	0	15 mm	back	1:1	0.167	1.211	0.202	
710.00	23790	Mid	LTE Band 17	10	24.0	23.21	-0.04	1	1461M	QPSK	25	0	15 mm	back	1:1	0.134	1.199	0.161	
710.00	23790	Mid	LTE Band 17	10	25.0	24.17	0.02	0	1461M	QPSK	1	0	15 mm	top	1:1	0.053	1.211	0.064	
710.00	23790	Mid	LTE Band 17	10	24.0	23.21	0.00	1	1461M	QPSK	25	0	15 mm	top	1:1	0.048	1.199	0.058	
710.00	23790	Mid	LTE Band 17	10	25.0	24.17	-0.09	0	1461M	QPSK	1	0	0 mm	right	1:1	0.209	1.211	0.253	
710.00	23790	Mid	LTE Band 17	10	24.0	23.21	-0.15	1	1461M	QPSK	25	0	0 mm	right	1:1	0.168	1.199	0.201	
710.00	23790	Mid	LTE Band 17	10	17.0	16.15	0.16	0	1461M	QPSK	1	0	0 mm	back	1:1	0.293	1.216	0.356	
710.00	23790	Mid	LTE Band 17	10	17.0	16.16	0.15	0	1461M	QPSK	25	0	0 mm	back	1:1	0.294	1.213	0.357	A7
710.00	23790	Mid	LTE Band 17	10	17.0	16.15	-0.09	0	1461M	QPSK	1	0	0 mm	top	1:1	0.127	1.216	0.154	
710.00	23790	Mid	LTE Band 17	10	17.0	16.16	-0.14	0	1461M	QPSK	25	0	0 mm	top	1:1	0.130	1.213	0.158	
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 11-8
LTE Band 13 Body 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 #
																(W/kg)		(W/kg)	
782.00	23230	Mid	LTE Band 13	10	24.5	23.69	-0.01	0	1471M	QPSK	1	0	15 mm	back	1:1	0.230	1.205	0.277	
782.00	23230	Mid	LTE Band 13	10	23.5	22.76	0.02	1	1471M	QPSK	25	0	15 mm	back	1:1	0.179	1.186	0.212	
782.00	23230	Mid	LTE Band 13	10	24.5	23.69	-0.02	0	1471M	QPSK	1	0	15 mm	top	1:1	0.089	1.205	0.107	
782.00	23230	Mid	LTE Band 13	10	23.5	22.76	0.06	1	1471M	QPSK	25	0	15 mm	top	1:1	0.060	1.186	0.071	
782.00	23230	Mid	LTE Band 13	10	24.5	23.69	-0.06	0	1471M	QPSK	1	0	0 mm	right	1:1	0.217	1.205	0.261	
782.00	23230	Mid	LTE Band 13	10	23.5	22.76	-0.05	1	1471M	QPSK	25	0	0 mm	right	1:1	0.173	1.186	0.205	
782.00	23230	Mid	LTE Band 13	10	17.0	15.75	-0.02	0	1471M	QPSK	1	0	0 mm	back	1:1	0.231	1.334	0.308	
782.00	23230	Mid	LTE Band 13	10	17.0	15.79	-0.03	0	1471M	QPSK	25	0	0 mm	back	1:1	0.236	1.321	0.312	A8
782.00	23230	Mid	LTE Band 13	10	17.0	15.75	-0.05	0	1471M	QPSK	1	0	0 mm	top	1:1	0.126	1.334	0.168	
782.00	23230	Mid	LTE Band 13	10	17.0	15.79	-0.02	0	1471M	QPSK	25	0	0 mm	top	1:1	0.130	1.321	0.172	
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 11-9
LTE Band 5 (Cell) Body SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.0	24.60	-0.01	0	1471M	QPSK	1	25	15 mm	back	1:1	0.330	1.096	0.362	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.65	0.04	1	1471M	QPSK	25	12	15 mm	back	1:1	0.268	1.084	0.291	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.0	24.60	-0.01	0	1471M	QPSK	1	25	15 mm	top	1:1	0.123	1.096	0.135	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.65	0.04	1	1471M	QPSK	25	12	15 mm	top	1:1	0.100	1.084	0.108	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.0	24.60	-0.01	0	1471M	QPSK	1	25	0 mm	right	1:1	0.499	1.096	0.547	A9
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.0	23.65	0.00	1	1471M	QPSK	25	12	0 mm	right	1:1	0.408	1.084	0.442	
836.50	20525	Mid	LTE Band 5 (Cell)	10	17.0	15.83	0.01	0	1471M	QPSK	1	25	0 mm	back	1:1	0.329	1.309	0.431	
836.50	20525	Mid	LTE Band 5 (Cell)	10	17.0	15.91	0.00	0	1471M	QPSK	25	0	0 mm	back	1:1	0.342	1.285	0.439	
836.50	20525	Mid	LTE Band 5 (Cell)	10	17.0	15.83	-0.06	0	1471M	QPSK	1	25	0 mm	top	1:1	0.201	1.309	0.263	
836.50	20525	Mid	LTE Band 5 (Cell)	10	17.0	15.91	-0.05	0	1471M	QPSK	25	0	0 mm	top	1:1	0.203	1.285	0.261	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak								Body 1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

Table 11-10
LTE Band 66 (AWS) Body SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.0	23.12	-0.02	0	1471M	QPSK	1	0	15 mm	back	1:1	0.790	1.225	0.968	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.0	23.14	-0.01	0	1471M	QPSK	1	0	15 mm	back	1:1	0.991	1.219	1.208	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.0	23.28	-0.01	0	1471M	QPSK	1	0	15 mm	back	1:1	1.000	1.180	1.180	A10
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.0	22.21	-0.01	1	1471M	QPSK	50	0	15 mm	back	1:1	0.667	1.199	0.800	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.0	22.21	-0.01	1	1471M	QPSK	50	0	15 mm	back	1:1	0.772	1.199	0.926	
1770.00	132572	High	LTE Band 66 (AWS)	20	23.0	22.28	0.03	1	1471M	QPSK	50	0	15 mm	back	1:1	0.809	1.180	0.955	
1770.00	132572	High	LTE Band 66 (AWS)	20	23.0	22.22	0.03	1	1471M	QPSK	100	0	15 mm	back	1:1	0.816	1.197	0.977	
1720.00	132072	Low	LTE Band 66 (AWS)	20	24.0	23.12	-0.06	0	1471M	QPSK	1	0	15 mm	top	1:1	0.720	1.225	0.882	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.0	23.14	-0.07	0	1471M	QPSK	1	0	15 mm	top	1:1	0.830	1.219	1.012	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.0	23.28	-0.04	0	1471M	QPSK	1	0	15 mm	top	1:1	0.963	1.180	1.136	
1720.00	132072	Low	LTE Band 66 (AWS)	20	23.0	22.21	-0.05	1	1471M	QPSK	50	0	15 mm	top	1:1	0.596	1.199	0.715	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	23.0	22.21	-0.06	1	1471M	QPSK	50	0	15 mm	top	1:1	0.693	1.199	0.831	
1770.00	132572	High	LTE Band 66 (AWS)	20	23.0	22.28	-0.05	1	1471M	QPSK	50	0	15 mm	top	1:1	0.787	1.180	0.929	
1770.00	132572	High	LTE Band 66 (AWS)	20	23.0	22.22	-0.06	1	1471M	QPSK	100	0	15 mm	top	1:1	0.799	1.197	0.956	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.0	23.28	-0.05	0	1471M	QPSK	1	0	0 mm	right	1:1	0.382	1.180	0.451	
1770.00	132572	High	LTE Band 66 (AWS)	20	23.0	22.28	-0.03	1	1471M	QPSK	50	0	0 mm	right	1:1	0.313	1.180	0.369	
1720.00	132072	Low	LTE Band 66 (AWS)	20	12.0	11.12	-0.07	0	1471M	QPSK	1	0	0 mm	back	1:1	0.598	1.225	0.733	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	12.0	11.18	-0.06	0	1471M	QPSK	1	99	0 mm	back	1:1	0.668	1.208	0.807	
1770.00	132572	High	LTE Band 66 (AWS)	20	12.0	11.28	-0.03	0	1471M	QPSK	1	0	0 mm	back	1:1	0.699	1.180	0.825	
1720.00	132072	Low	LTE Band 66 (AWS)	20	12.0	11.18	-0.07	0	1471M	QPSK	50	0	0 mm	back	1:1	0.618	1.208	0.747	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	12.0	11.25	-0.06	0	1471M	QPSK	50	0	0 mm	back	1:1	0.673	1.189	0.800	
1770.00	132572	High	LTE Band 66 (AWS)	20	12.0	11.35	0.00	0	1471M	QPSK	50	50	0 mm	back	1:1	0.706	1.161	0.820	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	12.0	11.24	-0.03	0	1471M	QPSK	100	0	0 mm	back	1:1	0.664	1.191	0.791	
1770.00	132572	High	LTE Band 66 (AWS)	20	12.0	11.28	0.00	0	1471M	QPSK	1	0	0 mm	top	1:1	0.637	1.180	0.752	
1770.00	132572	High	LTE Band 66 (AWS)	20	12.0	11.35	-0.02	0	1471M	QPSK	50	50	0 mm	top	1:1	0.642	1.161	0.745	
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 11-11
LTE Band 4 (AWS) Body 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	25.0	24.38	0.00	0	1504M	QPSK	1	0	15 mm	back	1:1	1.080	1.153	1.245	A11
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.0	23.30	0.02	1	1504M	QPSK	50	0	15 mm	back	1:1	0.873	1.175	1.026	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.0	23.24	-0.01	1	1504M	QPSK	100	0	15 mm	back	1:1	0.871	1.191	1.037	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	25.0	24.38	-0.04	0	1504M	QPSK	1	0	15 mm	top	1:1	0.997	1.153	1.150	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.0	23.30	-0.02	1	1504M	QPSK	50	0	15 mm	top	1:1	0.823	1.175	0.967	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.0	23.24	-0.06	1	1504M	QPSK	100	0	15 mm	top	1:1	0.824	1.191	0.981	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	25.0	24.38	-0.10	0	1504M	QPSK	1	0	0 mm	right	1:1	0.415	1.153	0.478	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.0	23.30	0.02	1	1504M	QPSK	50	0	0 mm	right	1:1	0.342	1.175	0.402	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	14.0	13.36	-0.16	0	1504M	QPSK	1	0	0 mm	back	1:1	0.637	1.159	0.738	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	14.0	13.31	-0.16	0	1504M	QPSK	50	0	0 mm	back	1:1	0.676	1.172	0.792	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	14.0	13.36	-0.06	0	1504M	QPSK	1	0	0 mm	top	1:1	0.797	1.159	0.924	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	14.0	13.31	-0.07	0	1504M	QPSK	50	0	0 mm	top	1:1	0.836	1.172	0.980	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	14.0	13.29	-0.05	0	1504M	QPSK	100	0	0 mm	top	1:1	0.839	1.178	0.988	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak								Body 1.6 W/kg (mW/g) averaged over 1 gram											
Uncontrolled Exposure/General Population																			

Table 11-12
LTE Band 2 (PCS) Body SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR[dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.0	24.62	-0.01	0	1504M	QPSK	1	0	15 mm	back	1:1	0.880	1.091	0.960	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	25.0	24.71	-0.02	0	1504M	QPSK	1	0	15 mm	back	1:1	0.771	1.069	0.824	
1900.00	19100	High	LTE Band 2 (PCS)	20	25.0	24.24	0.00	0	1504M	QPSK	1	0	15 mm	back	1:1	0.673	1.191	0.802	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.0	23.64	-0.04	1	1504M	QPSK	50	0	15 mm	back	1:1	0.655	1.086	0.711	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.0	23.53	-0.05	1	1504M	QPSK	100	0	15 mm	back	1:1	0.621	1.114	0.692	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	25.0	24.71	0.03	0	1504M	QPSK	1	0	15 mm	top	1:1	0.737	1.069	0.788	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.0	23.64	-0.03	1	1504M	QPSK	50	0	15 mm	top	1:1	0.632	1.086	0.686	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	25.0	24.71	-0.01	0	1504M	QPSK	1	0	0 mm	right	1:1	0.344	1.069	0.368	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.0	23.64	-0.01	1	1504M	QPSK	50	0	0 mm	right	1:1	0.258	1.086	0.280	
1860.00	18700	Low	LTE Band 2 (PCS)	20	14.0	13.73	-0.17	0	1504M	QPSK	1	0	0 mm	back	1:1	0.915	1.064	0.974	A12
1880.00	18900	Mid	LTE Band 2 (PCS)	20	14.0	13.57	-0.17	0	1504M	QPSK	1	0	0 mm	back	1:1	0.869	1.104	0.959	
1900.00	19100	High	LTE Band 2 (PCS)	20	14.0	13.21	-0.16	0	1504M	QPSK	1	0	0 mm	back	1:1	0.761	1.199	0.912	
1860.00	18700	Low	LTE Band 2 (PCS)	20	14.0	13.60	-0.15	0	1504M	QPSK	50	0	0 mm	back	1:1	0.875	1.096	0.959	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	14.0	13.46	-0.14	0	1504M	QPSK	50	0	0 mm	back	1:1	0.832	1.132	0.942	
1900.00	19100	High	LTE Band 2 (PCS)	20	14.0	13.18	-0.15	0	1504M	QPSK	50	0	0 mm	back	1:1	0.748	1.208	0.904	
1860.00	18700	Low	LTE Band 2 (PCS)	20	14.0	13.46	-0.16	0	1504M	QPSK	100	0	0 mm	back	1:1	0.856	1.132	0.969	
1860.00	18700	Low	LTE Band 2 (PCS)	20	14.0	13.73	-0.04	0	1504M	QPSK	1	0	0 mm	top	1:1	0.782	1.064	0.832	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	14.0	13.57	-0.04	0	1504M	QPSK	1	0	0 mm	top	1:1	0.749	1.104	0.827	
1900.00	19100	High	LTE Band 2 (PCS)	20	14.0	13.21	-0.07	0	1504M	QPSK	1	0	0 mm	top	1:1	0.681	1.199	0.817	
1860.00	18700	Low	LTE Band 2 (PCS)	20	14.0	13.60	-0.06	0	1504M	QPSK	50	0	0 mm	top	1:1	0.749	1.096	0.821	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	14.0	13.46	-0.04	0	1504M	QPSK	50	0	0 mm	top	1:1	0.729	1.132	0.825	
1900.00	19100	High	LTE Band 2 (PCS)	20	14.0	13.18	-0.07	0	1504M	QPSK	50	0	0 mm	top	1:1	0.682	1.208	0.824	
1860.00	18700	Low	LTE Band 2 (PCS)	20	14.0	13.46	-0.06	0	1504M	QPSK	100	0	0 mm	top	1:1	0.741	1.132	0.839	
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 Band 41 Body 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)		
2506.00	39750	Low	LTE Band 41	20	24.5	23.98	0.04	0	1466M	QPSK	1	0	15 mm	back	1:1.58	0.344	1.127	0.388	
2506.00	39750	Low	LTE Band 41	20	23.5	22.95	0.02	1	1466M	QPSK	50	0	15 mm	back	1:1.58	0.262	1.135	0.297	
2506.00	39750	Low	LTE Band 41	20	24.5	23.98	-0.14	0	1466M	QPSK	1	0	15 mm	top	1:1.58	0.323	1.127	0.364	
2506.00	39750	Low	LTE Band 41	20	23.5	22.95	0.02	1	1466M	QPSK	50	0	15 mm	top	1:1.58	0.246	1.135	0.279	
2506.00	39750	Low	LTE Band 41	20	24.5	23.98	0.15	0	1466M	QPSK	1	0	0 mm	right	1:1.58	0.021	1.127	0.024	
2506.00	39750	Low	LTE Band 41	20	23.5	22.95	0.14	1	1466M	QPSK	50	0	0 mm	right	1:1.58	0.012	1.135	0.014	
2506.00	39750	Low	LTE Band 41	20	15.0	14.59	0.01	0	1466M	QPSK	1	0	0 mm	back	1:1.58	0.781	1.099	0.858	A13
2549.50	40185	Low-Mid	LTE Band 41	20	15.0	14.15	0.08	0	1466M	QPSK	1	0	0 mm	back	1:1.58	0.661	1.216	0.804	
2593.00	40620	Mid	LTE Band 41	20	15.0	13.89	0.11	0	1466M	QPSK	1	0	0 mm	back	1:1.58	0.607	1.291	0.784	
2636.50	41055	Mid-High	LTE Band 41	20	15.0	14.06	0.10	0	1466M	QPSK	1	0	0 mm	back	1:1.58	0.604	1.242	0.750	
2680.00	41490	High	LTE Band 41	20	15.0	14.11	0.09	0	1466M	QPSK	1	0	0 mm	back	1:1.58	0.582	1.227	0.714	
2506.00	39750	Low	LTE Band 41	20	15.0	14.49	0.06	0	1466M	QPSK	50	0	0 mm	back	1:1.58	0.744	1.125	0.837	
2549.50	40185	Low-Mid	LTE Band 41	20	15.0	14.18	0.11	0	1466M	QPSK	50	0	0 mm	back	1:1.58	0.643	1.208	0.777	
2593.00	40620	Mid	LTE Band 41	20	15.0	13.70	0.11	0	1466M	QPSK	50	0	0 mm	back	1:1.58	0.582	1.349	0.785	
2636.50	41055	Mid-High	LTE Band 41	20	15.0	14.01	0.09	0	1466M	QPSK	50	0	0 mm	back	1:1.58	0.588	1.256	0.739	
2680.00	41490	High	LTE Band 41	20	15.0	14.04	0.11	0	1466M	QPSK	50	0	0 mm	back	1:1.58	0.572	1.247	0.713	
2506.00	39750	Low	LTE Band 41	20	15.0	14.34	-0.01	0	1466M	QPSK	100	0	0 mm	back	1:1.58	0.739	1.164	0.860	
2506.00	39750	Low	LTE Band 41	20	15.0	14.59	-0.01	0	1466M	QPSK	1	0	0 mm	top	1:1.58	0.190	1.099	0.209	
2506.00	39750	Low	LTE Band 41	20	15.0	14.49	-0.01	0	1466M	QPSK	50	0	0 mm	top	1:1.58	0.187	1.125	0.210	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT																			
Spatial Peak								Body											
Uncontrolled Exposure/General Population								1.6 W/kg (mW/g)											
								averaged over 1 gram											

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Table 11-14
WLAN Body SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												(W/kg)			(W/kg)	
2437	6	802.11b	DSSS	22	20.0	19.99	0.03	8 mm	1198G	1	back	98.9	0.633	1.002	1.011	0.641	
2437	6	802.11b	DSSS	22	20.0	19.99	0.04	6 mm	1198G	1	top	98.9	0.386	1.002	1.011	0.391	
2437	6	802.11b	DSSS	22	20.0	19.99	0.06	0 mm	1198G	1	left	98.9	0.302	1.002	1.011	0.306	
2412	1	802.11b	DSSS	22	12.0	11.98	0.00	0 mm	6020M	1	back	98.9	0.973	1.005	1.011	0.989	A14
2437	6	802.11b	DSSS	22	12.0	11.67	0.17	0 mm	6020M	1	back	98.9	0.928	1.079	1.011	1.012	
2462	11	802.11b	DSSS	22	12.0	11.91	0.17	0 mm	6020M	1	back	98.9	0.703	1.021	1.011	0.726	
2412	1	802.11b	DSSS	22	12.0	11.98	0.12	0 mm	6020M	1	top	98.9	0.124	1.005	1.011	0.126	
2412	1	802.11b	DSSS	22	12.0	11.98	-0.05	0 mm	6020M	1	back	98.9	0.917	1.005	1.011	0.932	
5320	64	802.11a	OFDM	20	17.0	16.98	-0.19	8 mm	1198G	6	back	97.6	0.376	1.005	1.025	0.387	
5260	52	802.11a	OFDM	20	17.0	16.90	0.19	6 mm	1198G	6	top	97.6	0.898	1.023	1.025	0.942	
5300	60	802.11a	OFDM	20	17.0	16.78	0.13	6 mm	1198G	6	top	97.6	0.857	1.052	1.025	0.924	
5320	64	802.11a	OFDM	20	17.0	16.98	-0.03	6 mm	1198G	6	top	97.6	0.945	1.005	1.025	0.973	A15
5320	64	802.11a	OFDM	20	17.0	16.98	0.21	0 mm	1198G	6	left	97.6	0.125	1.005	1.025	0.129	
5290	58	802.11ac	OFDM	80	9.0	8.98	-0.17	0 mm	1198G	29.3	back	90.3	0.532	1.005	1.107	0.592	
5290	58	802.11ac	OFDM	80	9.0	8.98	-0.19	0 mm	1198G	29.3	top	90.3	0.671	1.005	1.107	0.747	
5500	100	802.11a	OFDM	20	17.0	16.99	-0.04	8 mm	1198G	6	back	97.6	0.376	1.002	1.025	0.386	
5500	100	802.11a	OFDM	20	17.0	16.99	-0.13	6 mm	1198G	6	top	97.6	0.519	1.002	1.025	0.533	
5500	100	802.11a	OFDM	20	17.0	16.99	0.16	0 mm	1198G	6	left	97.6	0.044	1.002	1.025	0.045	
5610	122	802.11ac	OFDM	80	9.0	8.89	-0.13	0 mm	1198G	29.3	back	90.3	0.287	1.026	1.107	0.326	
5610	122	802.11ac	OFDM	80	9.0	8.89	-0.13	0 mm	1198G	29.3	top	90.3	0.405	1.026	1.107	0.460	
5825	165	802.11a	OFDM	20	17.0	16.97	0.01	8 mm	1198G	6	back	97.6	0.488	1.007	1.025	0.504	
5825	165	802.11a	OFDM	20	17.0	16.97	-0.10	6 mm	1198G	6	top	97.6	0.617	1.007	1.025	0.637	
5825	165	802.11a	OFDM	20	17.0	16.97	0.17	0 mm	1198G	6	left	97.6	0.227	1.007	1.025	0.234	
5775	155	802.11ac	OFDM	80	9.0	8.98	0.05	0 mm	1198G	29.3	back	90.3	0.273	1.005	1.107	0.304	
5775	155	802.11ac	OFDM	80	9.0	8.98	-0.21	0 mm	1198G	29.3	top	90.3	0.407	1.005	1.107	0.453	
5320	64	802.11a	OFDM	20	17.0	16.98	0.10	6 mm	1198G	6	top	97.6	0.884	1.005	1.025	0.911	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body									
Spatial Peak								1.6 W/kg (mW/g)									
Uncontrolled Exposure/General Population								averaged over 1 gram									

Note: Blue entries represent variability measurements

Table 11-15
DSS Body SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
MHz	Ch.											(W/kg)				
2402	0	Bluetooth	FHSS	9.5	9.01	0.20	0 mm	1198G	1	back	77.1	0.299	1.119	1.297	0.434	A16
2402	0	Bluetooth	FHSS	9.5	9.01	-0.14	0 mm	1198G	1	top	77.1	0.041	1.119	1.297	0.060	
2402	0	Bluetooth	FHSS	9.5	9.01	0.12	0 mm	1198G	1	left	77.1	0.022	1.119	1.297	0.032	
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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11.2 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in FCC KDB Publication 616217 D04v01r02 and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. Per FCC KDB 865664 D01v01r04, variability SAR tests were performed when the measured SAR results for a frequency band were greater than or equal to 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 13 for variability analysis.
7. FCC KDB Publication 616217 D04v01r02 Section 4.3, SAR tests are required for the back surface and edges of the tablet with the tablet touching the phantom. The SAR Exclusion Threshold in FCC KDB 447498 D01v06 was applied to determine SAR test exclusion for adjacent edge configurations.

GSM Test Notes:

1. 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.
2. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.

UMTS Notes:

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

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r04. The general test procedures used for testing can be found in Section 8.5.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
4. Per FCC KDB Publication 447498 D01v06, when the reported LTE Band 41 SAR measured at the highest output power channel in a given a test configuration was > 0.6 W/kg for 1g evaluations, testing at the other channels was required for such test configurations.

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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.
6. Per KDB Publication 941225 D05Av01r02, SAR for downlink only LTE CA operations was not needed since the maximum average output power in LTE CA mode was not >0.25 dB higher than the maximum output power when downlink carrier aggregation was inactive.

WLAN Notes:

1. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 8.6.4 for more information.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg for 1g evaluations. See Section 8.6.5 for more information.
3. When the maximum reported 1g averaged SAR is ≤ 0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.
4. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.

Bluetooth Notes

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

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12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

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

12.2 Simultaneous Transmission Procedures

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

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Table 12-1
Simultaneous Transmission Scenario with 2.4 GHz WLAN

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	GPRS 850	0.526	1.012	1.538
	GPRS 1900	1.264	1.012	See Table Below
	UMTS 850	0.558	1.012	1.570
	UMTS 1750	1.391	1.012	See Table Below
	UMTS 1900	1.127	1.012	See Table Below
	LTE Band 12	0.299	1.012	1.311
	LTE Band 17	0.357	1.012	1.369
	LTE Band 13	0.312	1.012	1.324
	LTE Band 5 (Cell)	0.547	1.012	1.559
	LTE Band 66 (AWS)	1.208	1.012	See Table Below
	LTE Band 4 (AWS)	1.245	1.012	See Table Below
	LTE Band 2 (PCS)	0.974	1.012	See Table Below
	LTE Band 41	0.860	1.012	See Table Below

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.264	1.012	See Note 1	0.02
	Top	0.785	0.391	1.176	N/A
	Right	0.235	0.400	0.635	N/A
	Left	0.400	0.306	0.706	N/A
Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.391	1.012	See Note 1	0.02
	Top	1.248	0.391	See Note 1	0.01
	Right	0.460	0.400	0.860	N/A
	Left	0.400	0.306	0.706	N/A
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.127	1.012	See Note 1	0.02
	Top	0.985	0.391	1.376	N/A
	Right	0.311	0.400	0.711	N/A
	Left	0.400	0.306	0.706	N/A
Simult Tx	Configuration	LTE Band 66 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.208	1.012	See Note 1	0.02
	Top	1.136	0.391	1.527	N/A
	Right	0.451	0.400	0.851	N/A
	Left	0.400	0.306	0.706	N/A
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.245	1.012	See Note 1	0.02
	Top	1.150	0.391	1.541	N/A
	Right	0.478	0.400	0.878	N/A
	Left	0.400	0.306	0.706	N/A
Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	0.974	1.012	See Note 1	0.02
	Top	0.839	0.391	1.230	N/A
	Right	0.368	0.400	0.768	N/A
	Left	0.400	0.306	0.706	N/A

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	0.860	1.012	See Note 1	0.02
	Top	0.364	0.391	0.755	N/A
	Right	0.024	0.400	0.424	N/A
	Left	0.400	0.306	0.706	N/A

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Table 12-2
Simultaneous Transmission Scenario with 5 GHz WLAN

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	GPRS 850	0.526	0.973	1.499
	GPRS 1900	1.264	0.973	See Table Below
	UMTS 850	0.558	0.973	1.531
	UMTS 1750	1.391	0.973	See Table Below
	UMTS 1900	1.127	0.973	See Table Below
	LTE Band 12	0.299	0.973	1.272
	LTE Band 17	0.357	0.973	1.330
	LTE Band 13	0.312	0.973	1.285
	LTE Band 5 (Cell)	0.547	0.973	1.520
	LTE Band 66 (AWS)	1.208	0.973	See Table Below
	LTE Band 4 (AWS)	1.245	0.973	See Table Below
	LTE Band 2 (PCS)	0.974	0.973	See Table Below
	LTE Band 41	0.860	0.973	See Table Below

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.264	0.592	See Note 1	0.01
	Top	0.785	0.973	See Note 1	0.01
	Right	0.235	0.400	0.635	N/A
	Left	0.400	0.234	0.634	N/A
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.127	0.592	See Note 1	0.01
	Top	0.985	0.973	See Note 1	0.02
	Right	0.311	0.400	0.711	N/A
	Left	0.400	0.234	0.634	N/A
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.245	0.592	See Note 1	0.01
	Top	1.150	0.973	See Note 1	0.02
	Right	0.478	0.400	0.878	N/A
	Left	0.400	0.234	0.634	N/A

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	Back	0.860	0.592	1.452
	Top	0.364	0.973	1.337
	Right	0.024	0.400	0.424
	Left	0.400	0.234	0.634

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Table 12-3
Simultaneous Transmission Scenario with Bluetooth

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body SAR	GPRS 850	0.526	0.434	0.960
	GPRS 1900	1.264	0.434	See Table Below
	UMTS 850	0.558	0.434	0.992
	UMTS 1750	1.391	0.434	See Table Below
	UMTS 1900	1.127	0.434	1.561
	LTE Band 12	0.299	0.434	0.733
	LTE Band 17	0.357	0.434	0.791
	LTE Band 13	0.312	0.434	0.746
	LTE Band 5 (Cell)	0.547	0.434	0.981
	LTE Band 66 (AWS)	1.208	0.434	See Table Below
	LTE Band 4 (AWS)	1.245	0.434	See Table Below
	LTE Band 2 (PCS)	0.974	0.434	1.408
	LTE Band 41	0.860	0.434	1.294

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.264	0.434	See Note 1	0.01
	Top	0.785	0.060	0.845	N/A
	Right	0.235	0.400	0.635	N/A
	Left	0.400	0.032	0.432	N/A
Simult Tx	Configuration	LTE Band 66 (AWS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.208	0.434	See Note 1	0.01
	Top	1.136	0.060	1.196	N/A
	Right	0.451	0.400	0.851	N/A
	Left	0.400	0.032	0.432	N/A

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.391	0.434	See Note 1	0.01
	Top	1.248	0.060	1.308	N/A
	Right	0.460	0.400	0.860	N/A
	Left	0.400	0.032	0.432	N/A
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
		1	2	1+2	1+2
Body SAR	Back	1.245	0.434	See Note 1	0.01
	Top	1.150	0.060	1.210	N/A
	Right	0.478	0.400	0.878	N/A
	Left	0.400	0.032	0.432	N/A

Notes:

1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D01v06. See Section 12.3 for detailed SPLS ratio analysis.
2. When the antenna separation distance was > 50 mm, an estimated SAR of 0.4 W/kg was used to determine the simultaneous transmission SAR exclusion for test positions excluded per FCC KDB Publication 447498 D01v06.

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12.1 SPLSR Evaluation and Analysis

Per FCC KDB Publication 447498 D01v06, when the sum of the standalone transmitters is more than 1.6 W/kg for 1g, the SAR sum to peak locations can be analyzed to determine SAR distribution overlaps. When the SAR peak to location ratio (shown below) for each pair of antennas is ≤ 0.04 for 1g, simultaneous SAR evaluation is not required. The distance between the transmitters was calculated using the following formula.

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

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

12.1.1 Back Side SPLSR Evaluation and Analysis

Table 12-4
Peak SAR Locations for Body Back Side

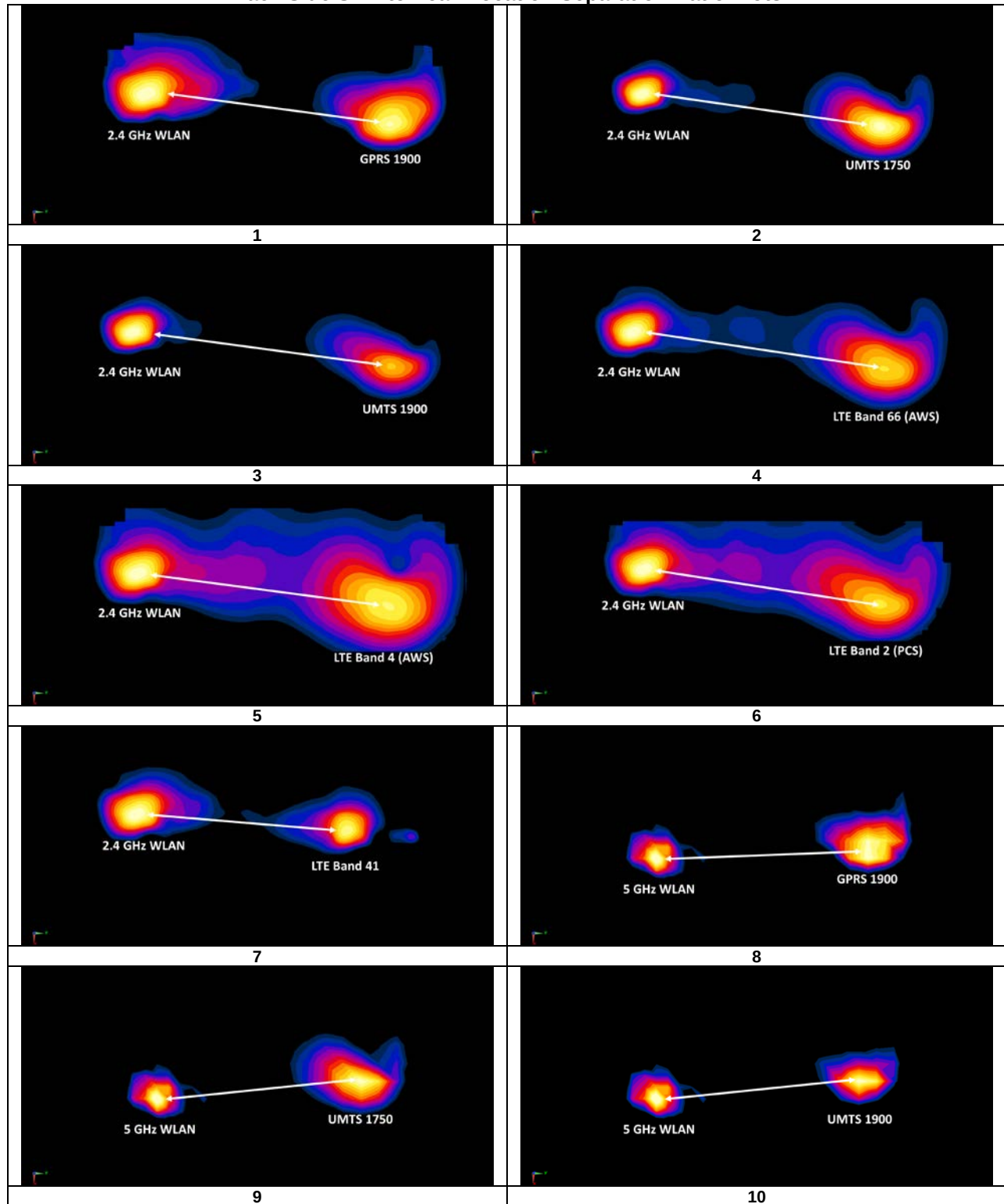
Mode/Band	x (mm)	y (mm)
2.4 GHz WLAN	-39.60	-81.20
Bluetooth	-34.60	-87.20
5 GHz WLAN	-22.00	-95.00
GPRS 1900	-29.50	85.00
UMTS 1750	-28.50	81.00
UMTS 1900	-30.00	87.00
LTE Band 66 (AWS)	-29.50	76.00
LTE Band 4 (AWS)	-31.00	79.00
LTE Band 2 (PCS)	-31.50	85.50
LTE Band 41	-36.00	59.20

Table 12-5
Back Side SAR to Peak Location Separation Ratio Calculations

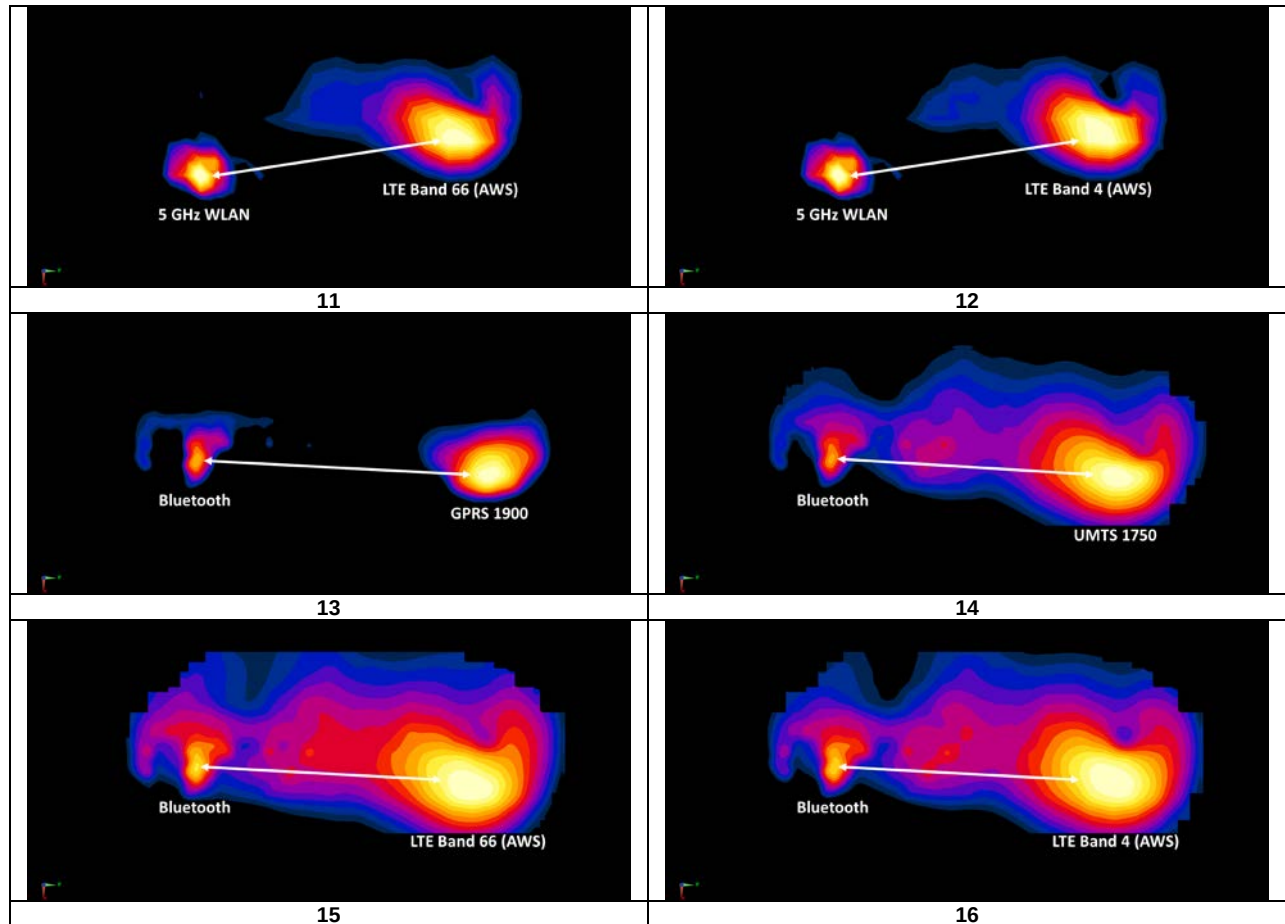
Antenna Pair		Standalone SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio	Plot Number
Ant "a"	Ant "b"	a	b	a+b	D _{a-b}	(a+b) ^{1.5} /D _{a-b}	
GPRS 1900	2.4 GHz WLAN	1.264	1.012	2.276	166.51	0.02	1
UMTS 1750	2.4 GHz WLAN	1.391	1.012	2.403	162.58	0.02	2
UMTS 1900	2.4 GHz WLAN	1.127	1.012	2.139	168.47	0.02	3
LTE Band 66 (AWS)	2.4 GHz WLAN	1.208	1.012	2.22	157.52	0.02	4
LTE Band 4 (AWS)	2.4 GHz WLAN	1.245	1.012	2.257	160.43	0.02	5
LTE Band 2 (PCS)	2.4 GHz WLAN	0.974	1.012	1.986	166.90	0.02	6
LTE Band 41	2.4 GHz WLAN	0.860	1.012	1.872	140.45	0.02	7
GPRS 1900	5 GHz WLAN	1.264	0.592	1.856	187.02	0.01	8
UMTS 1750	5 GHz WLAN	1.391	0.592	1.983	183.01	0.02	9
UMTS 1900	5 GHz WLAN	1.127	0.592	1.719	189.02	0.01	10
LTE Band 66 (AWS)	5 GHz WLAN	1.208	0.592	1.8	178.02	0.01	11
LTE Band 4 (AWS)	5 GHz WLAN	1.245	0.592	1.837	181.04	0.01	12
GPRS 1900	Bluetooth	1.264	0.434	1.698	172.28	0.01	13
UMTS 1750	Bluetooth	1.391	0.434	1.825	168.31	0.01	14
LTE Band 66 (AWS)	Bluetooth	1.208	0.434	1.642	163.28	0.01	15
LTE Band 4 (AWS)	Bluetooth	1.245	0.434	1.679	166.24	0.01	16

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Table 12-6
Back Side SAR to Peak Location Separation Ratio Plots



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12.1.2 Top Edge SPLSR Evaluation and Analysis

Table 12-7
Peak SAR Locations for Body Top Edge

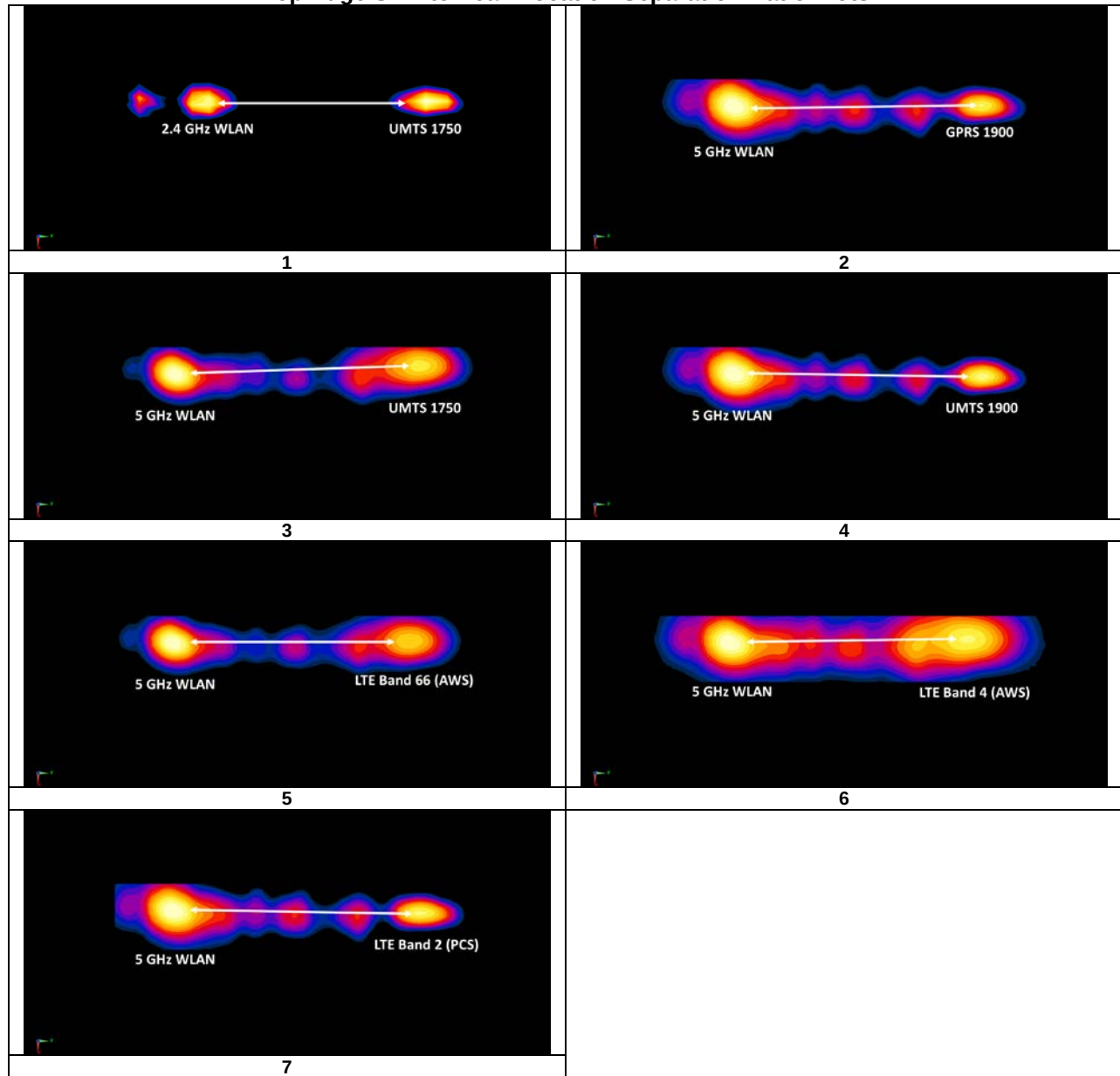
Mode/Band	x (mm)	y (mm)
2.4 GHz WLAN	-23.00	-60.80
5 GHz WLAN	-24.50	-83.00
GPRS 1900	-29.50	86.00
UMTS 1750	-35.00	85.00
UMTS 1900	-27.50	87.50
LTE Band 66 (AWS)	-31.00	79.50
LTE Band 4 (AWS)	-32.00	81.00
LTE Band 2 (PCS)	-27.50	85.50

Table 12-8
Top Edge SAR to Peak Location Separation Ratio Calculations

Antenna Pair		Standalone SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio	Plot Number
Ant "a"	Ant "b"	a	b	a+b	D _{a-b}	$(a+b)^{1.5}/D_{a-b}$	
UMTS 1750	2.4 GHz WLAN	1.248	0.391	1.639	146.29	0.01	1
GPRS 1900	5 GHz WLAN	0.785	0.973	1.758	169.07	0.01	2
UMTS 1750	5 GHz WLAN	1.248	0.973	2.221	168.33	0.02	3
UMTS 1900	5 GHz WLAN	0.985	0.973	1.958	170.53	0.02	4
LTE Band 66 (AWS)	5 GHz WLAN	1.136	0.973	2.109	162.63	0.02	5
LTE Band 4 (AWS)	5 GHz WLAN	1.150	0.973	2.123	164.17	0.02	6
LTE Band 2 (PCS)	5 GHz WLAN	0.839	0.973	1.812	168.53	0.01	7

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Table 12-9
Top Edge SAR to Peak Location Separation Ratio Plots



12.2 Simultaneous Transmission Conclusion

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

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13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

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

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

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

Table 13-1
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS													
Band	FREQUENCY		Mode	Service	Data Rate (Mbps)	Side	Spacing	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)
	MHz	Ch.						(W/kg)	(W/kg)		(W/kg)		(W/kg)
1750	1752.60	1513	UMTS 1750	RMC	N/A	back	15 mm	1.260	1.200	1.05	N/A	N/A	N/A
1900	1850.20	512	GSM 1900	GPRS	N/A	back	0 mm	1.060	0.988	1.07	N/A	N/A	N/A
2450	2412.00	1	802.11b, 22 MHz Bandwidth	DSSS	1	back	0 mm	0.973	0.917	1.06	N/A	N/A	N/A
5250	5320.00	64	802.11a, 20 MHz Bandwidth	OFDM	6	top	6 mm	0.945	0.884	1.07	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT							Body						
Spatial Peak							1.6 W/kg (mW/g)						
Uncontrolled Exposure/General Population							averaged over 1 gram						

13.2 Measurement Uncertainty

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

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14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8753E	(30kHz-6GHz) Network Analyzer	9/28/2018	Annual	9/28/2019	JP38020182
Agilent	8753ES	S-Parameter Network Analyzer	10/2/2018	Annual	10/2/2019	US39170118
Agilent	8753ES	S-Parameter Network Analyzer	3/11/2019	Annual	3/11/2020	US39170122
Agilent	E4438C	ESG Vector Signal Generator	3/8/2019	Biennial	3/8/2021	MY42082385
Agilent	E4438C	ESG Vector Signal Generator	6/1/2019	Biennial	6/1/2021	MY42082659
Agilent	E4440A	PSA Series Spectrum Analyzer	11/14/2018	Annual	11/14/2019	MY46186272
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB44450273
Agilent	N5182A	MXG Vector Signal Generator	11/28/2018	Annual	11/28/2019	MY47420603
Agilent	N9020A	MXA Signal Analyzer	4/20/2019	Annual	4/20/2020	US46470561
Amplifier Research	150A100C	Amplifier	CBT	N/A	CBT	350132
Amplifier Research	1551G6	Amplifier	CBT	N/A	CBT	343971
Amplifier Research	1551G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	MA24106A	USB Power Sensor	5/22/2019	Annual	5/22/2020	1231535
Anritsu	MA24106A	USB Power Sensor	5/6/2019	Annual	5/6/2020	1231538
Anritsu	MA24106A	USB Power Sensor	6/21/2019	Annual	6/21/2020	1244515
Anritsu	MA24106A	USB Power Sensor	1/31/2019	Annual	1/31/2020	1244524
Anritsu	MA24106A	USB Power Sensor	7/8/2019	Annual	7/8/2020	1248508
Anritsu	MA24106A	USB Power Sensor	9/20/2018	Annual	9/20/2019	1344545
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1126066
Anritsu	MA2411B	Pulse Power Sensor	6/11/2019	Annual	6/11/2020	1207364
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Anritsu	MT8820C	Radio Communication Analyzer	3/29/2019	Annual	3/29/2020	6201300731
Anritsu	MT8821C	Radio Communication Analyzer	11/6/2018	Annual	11/6/2019	6200901190
Control Company	4040	Therm./ Clock/ Humidity Monitor	1/8/2019	Annual	1/8/2020	160473909
Control Company	4040	Therm./ Clock/ Humidity Monitor	1/8/2019	Annual	1/8/2020	160574418
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647802
Control Company	4352	Ultra Long Stem Thermometer	2/28/2018	Biennial	2/28/2020	170330158
Control Company	4352	Ultra Long Stem Thermometer	2/28/2018	Biennial	2/28/2020	170330160
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
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
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mitutoyo	CD-6"CSX	Digital Caliper	4/18/2018	Biennial	4/18/2020	13264165
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-53W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	NC-100	Torque Wrench	11/1/2017	Biennial	11/1/2019	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	CMW500	Wideband Radio Communication Tester	6/6/2019	Annual	6/6/2020	161662
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	7/24/2019	Annual	7/24/2020	151849
Seekonk	NC-100	Torque Wrench (8" lb)	5/10/2018	Biennial	5/10/2020	21053
Seekonk	NC-100	Torque Wrench (8" lb)	5/23/2018	Biennial	5/23/2020	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/7/2019	Annual	5/7/2020	1070
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091
SPEAG	D750V3	750 MHz SAR Dipole	1/15/2018	Biennial	1/15/2020	1003
SPEAG	D750V3	750 MHz SAR Dipole	3/18/2019	Annual	3/18/2020	1054
SPEAG	D835V2	835 MHz SAR Dipole	1/22/2019	Annual	1/22/2020	4d132
SPEAG	D1750V2	1750 MHz SAR Dipole	10/22/2018	Annual	10/22/2019	1150
SPEAG	D1900V2	1900 MHz SAR Dipole	10/23/2018	Annual	10/23/2019	5d080
SPEAG	D2450V2	2450 MHz SAR Dipole	9/11/2017	Biennial	9/11/2019	797
SPEAG	D2600V2	2600 MHz SAR Dipole	4/11/2018	Biennial	4/11/2020	1004
SPEAG	D56HzV2	5 GHz SAR Dipole	1/16/2018	Biennial	1/16/2020	1057
SPEAG	EX3DV4	SAR Probe	6/19/2019	Annual	6/19/2020	7409
SPEAG	EX3DV4	SAR Probe	5/16/2019	Annual	5/16/2020	7406
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	EX3DV4	SAR Probe	4/24/2019	Annual	4/24/2020	7357
SPEAG	EX3DV4	SAR Probe	1/24/2019	Annual	1/24/2020	7488
SPEAG	EX3DV4	SAR Probe	7/16/2019	Annual	7/16/2020	7410
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/20/2019	Annual	6/20/2020	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/8/2019	Annual	5/8/2020	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/18/2019	Annual	4/18/2020	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/15/2019	Annual	1/15/2020	1530
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1322

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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15 MEASUREMENT UNCERTAINTIES

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

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16 CONCLUSION

16.1 Measurement Conclusion

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

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

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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1471M

Communication System: UID 0, _GSM GPRS; 4 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:2.076

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.954 \text{ S/m}$; $\epsilon_r = 53.937$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-24-2019; Ambient Temp: 22.6°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(9.46, 9.46, 9.46) @ 836.6 MHz; Calibrated: 2/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/14/2019

Phantom: Twin-SAM V5.0 Front 30; Type: QD 000 P40 CD; Serial: 1646

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

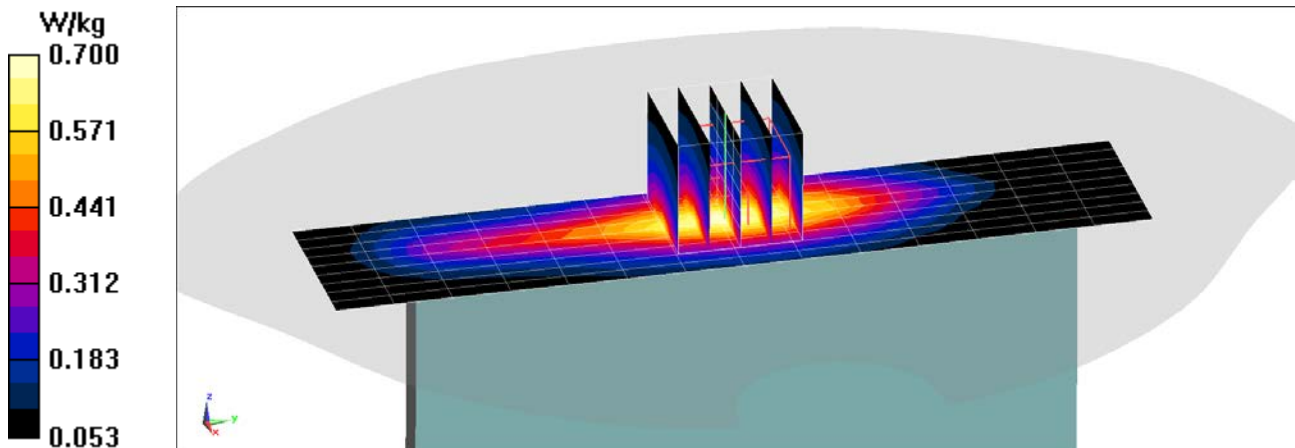
Area Scan (10x15x1): Measurement grid: $dx=5\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 23.39 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.812 W/kg

SAR(1 g) = 0.494 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 6020M

Communication System: UID 0, _GSM GPRS; 4 Tx slots; Frequency: 1850.2 MHz; Duty Cycle: 1:2.076

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1850.2 \text{ MHz}$; $\sigma = 1.519 \text{ S/m}$; $\epsilon_r = 52.282$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 08-12-2019; Ambient Temp: 20.0°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7488; ConvF(8.37, 8.37, 8.37) @ 1850.2 MHz; Calibrated: 1/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1530; Calibrated: 1/15/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

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

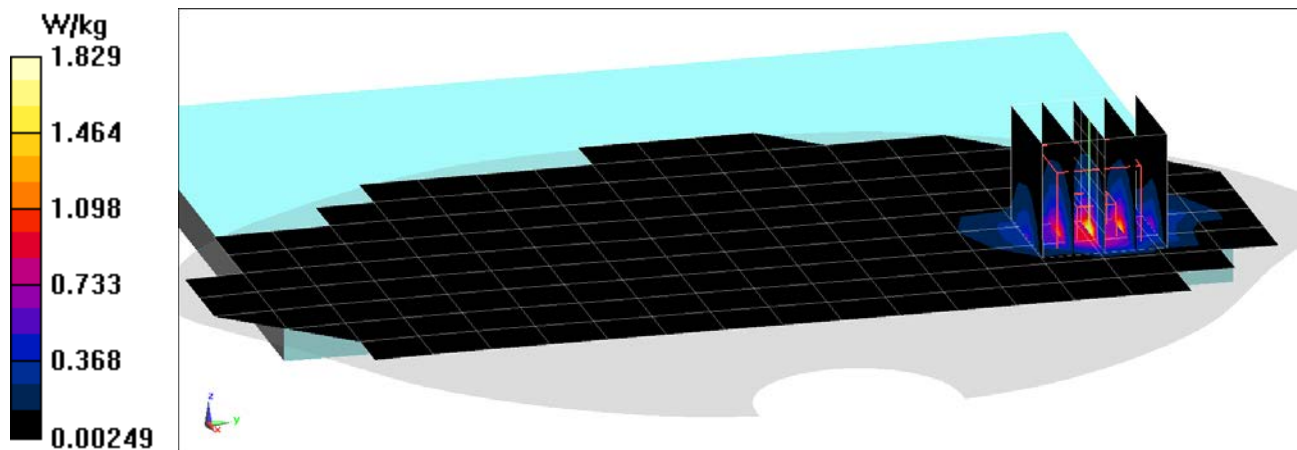
Area Scan (11x19x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 28.57 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 2.29 W/kg

SAR(1 g) = 1.06 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1471M

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.954 \text{ S/m}$; $\epsilon_r = 53.937$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-24-2019; Ambient Temp: 22.6°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(9.46, 9.46, 9.46) @ 836.6 MHz; Calibrated: 2/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/14/2019

Phantom: Twin-SAM V5.0 Front 30; Type: QD 000 P40 CD; Serial: 1646

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

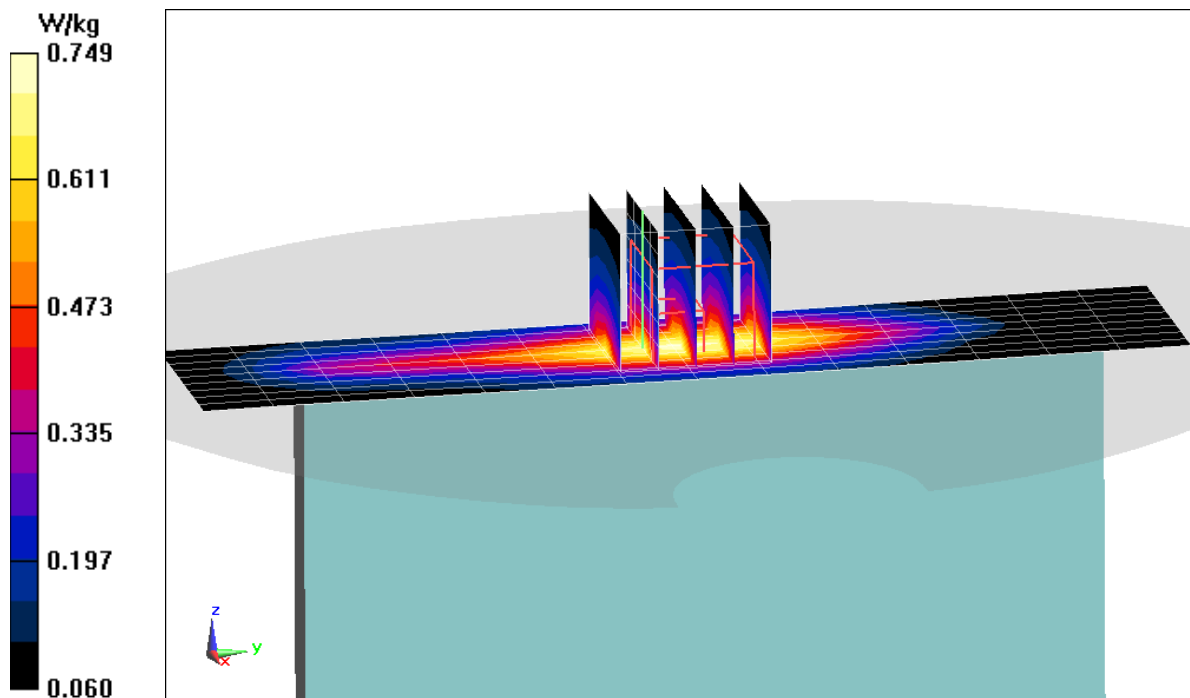
Area Scan (10x15x1): Measurement grid: $dx=5\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 24.36 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.875 W/kg

SAR(1 g) = 0.530 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1461M

Communication System: UID 0, UMTS; Frequency: 1752.6 MHz; Duty Cycle: 1:1

Medium: 1750 Body Medium parameters used (interpolated):

$f = 1752.6 \text{ MHz}$; $\sigma = 1.535 \text{ S/m}$; $\epsilon_r = 52.437$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-22-2019; Ambient Temp: 21.0°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7357; ConvF(8.26, 8.26, 8.26) @ 1752.6 MHz; Calibrated: 4/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/18/2019

Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

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

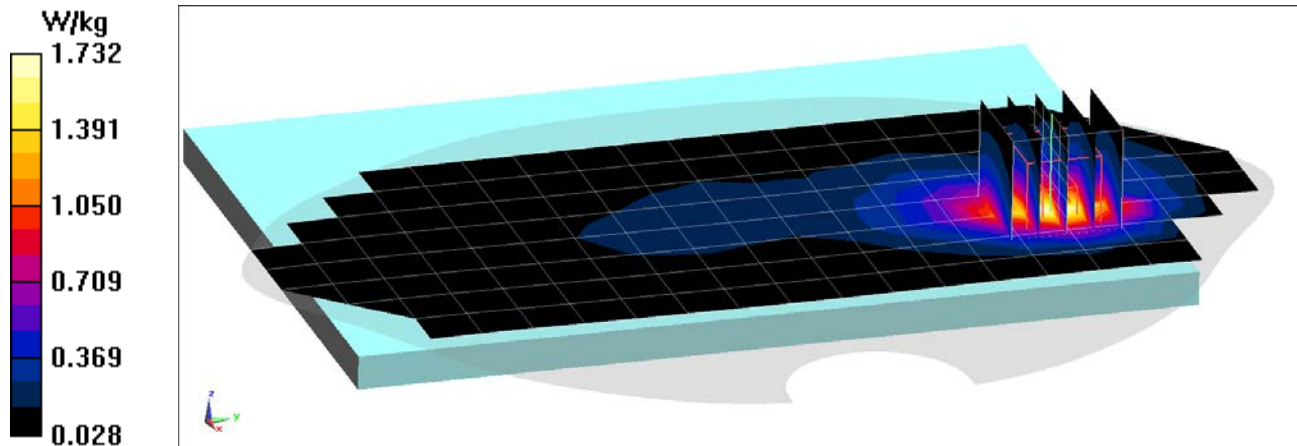
Area Scan (9x20x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 29.65 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 2.08 W/kg

SAR(1 g) = 1.26 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1504M

Communication System: UID 0, UMTS; Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1852.4 \text{ MHz}$; $\sigma = 1.521 \text{ S/m}$; $\epsilon_r = 53.193$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-25-2019; Ambient Temp: 19.7°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN7488; ConvF(8.37, 8.37, 8.37) @ 1852.4 MHz; Calibrated: 1/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1530; Calibrated: 1/15/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

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

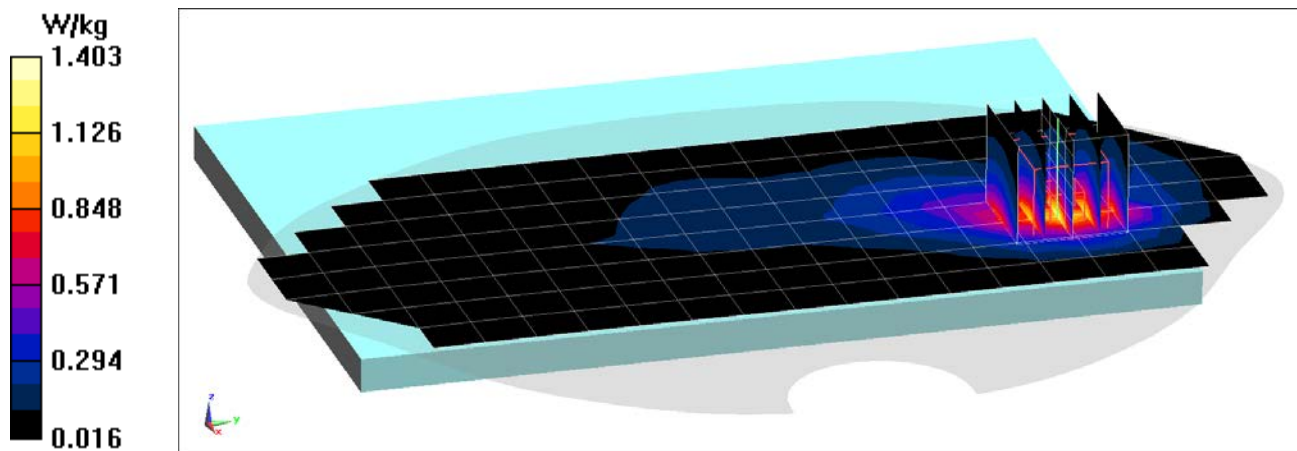
Area Scan (9x20x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 26.56 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.64 W/kg

SAR(1 g) = 0.979 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1471M

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

Medium: 750 Body Medium parameters used (interpolated):

$f = 707.5 \text{ MHz}$; $\sigma = 0.925 \text{ S/m}$; $\epsilon_r = 56.157$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-23-2019; Ambient Temp: 23.2°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN7409; ConvF(9.96, 9.96, 9.96) @ 707.5 MHz; Calibrated: 6/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 6/20/2019

Phantom: SAM Left; Type: QD000P40CA; Serial: TP:82355

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

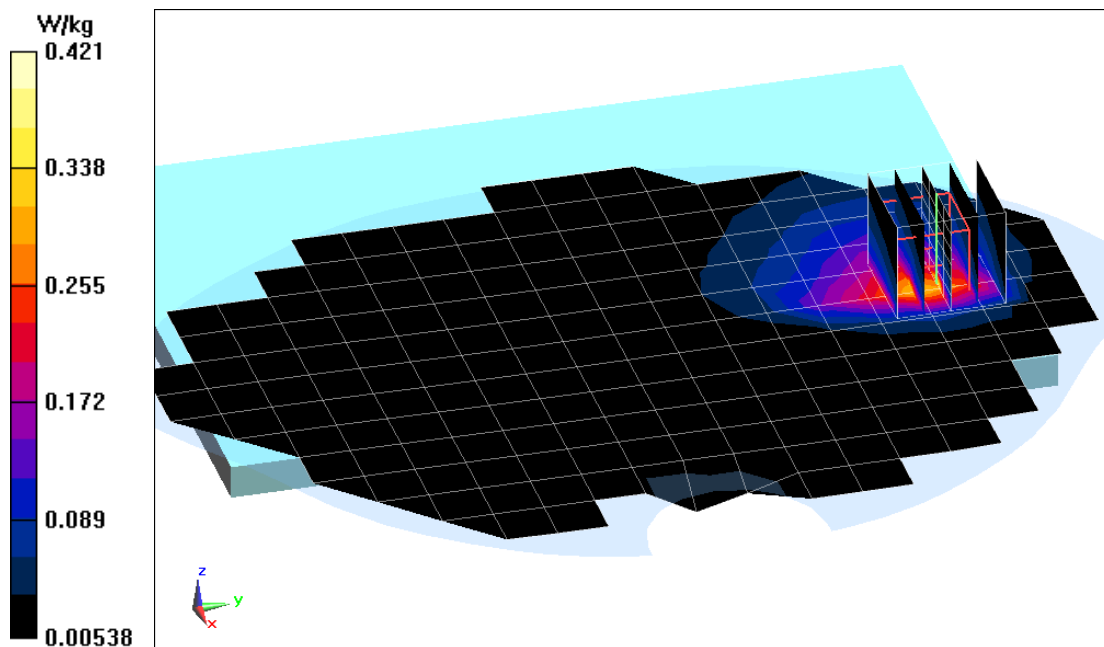
Area Scan (15x19x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 15.99 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.570 W/kg

SAR(1 g) = 0.223 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1461M

Communication System: UID 0, LTE Band 17; Frequency: 710 MHz; Duty Cycle: 1:1

Medium: 750 Body Medium parameters used:

$f = 710 \text{ MHz}$; $\sigma = 0.937 \text{ S/m}$; $\epsilon_r = 56.726$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 08-20-2019; Ambient Temp: 23.5°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7406; ConvF(10.05, 10.05, 10.05) @ 710 MHz; Calibrated: 5/16/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/8/2019

Phantom: Twin-SAM V5.0 Left 30; Type: QD 000 P40 CD; Serial: 1715

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

**Mode: LTE Band 17, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 25 RB, 0 RB Offset**

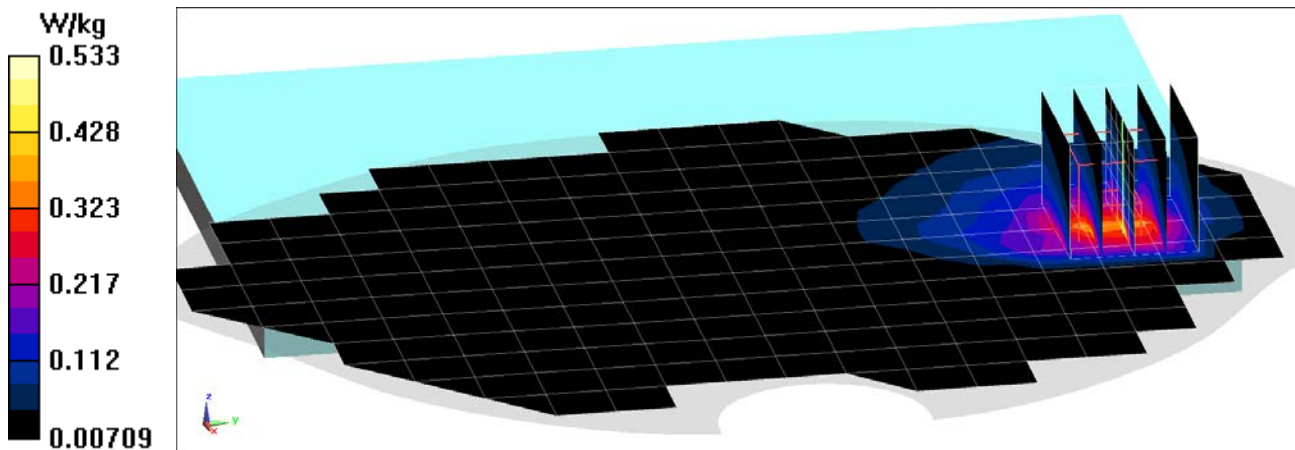
Area Scan (15x19x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 18.11 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.724 W/kg

SAR(1 g) = 0.294 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1471M

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

Medium: 750 Body Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 0.953 \text{ S/m}$; $\epsilon_r = 55.99$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-23-2019; Ambient Temp: 23.2°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN7409; ConvF(9.96, 9.96, 9.96) @ 782 MHz; Calibrated: 6/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 6/20/2019

Phantom: SAM Left; Type: QD000P40CA; Serial: TP:82355

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

**Mode: LTE Band 13, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 25 RB, 0 RB Offset**

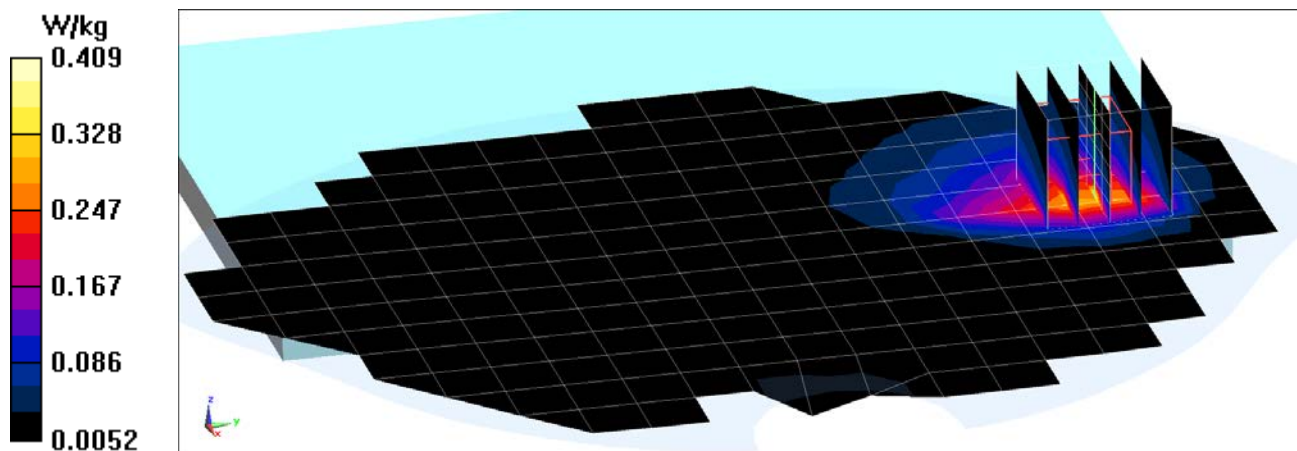
Area Scan (15x19x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 16.06 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.660 W/kg

SAR(1 g) = 0.236 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1471M

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

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.5 \text{ MHz}$; $\sigma = 0.954 \text{ S/m}$; $\epsilon_r = 53.938$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-24-2019; Ambient Temp: 22.6°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(9.46, 9.46, 9.46) @ 836.5 MHz; Calibrated: 2/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/14/2019

Phantom: Twin-SAM V5.0 Front 30; Type: QD 000 P40 CD; Serial: 1646

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

**Mode: LTE Band 5 (Cell.), Body SAR, Right Edge, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset**

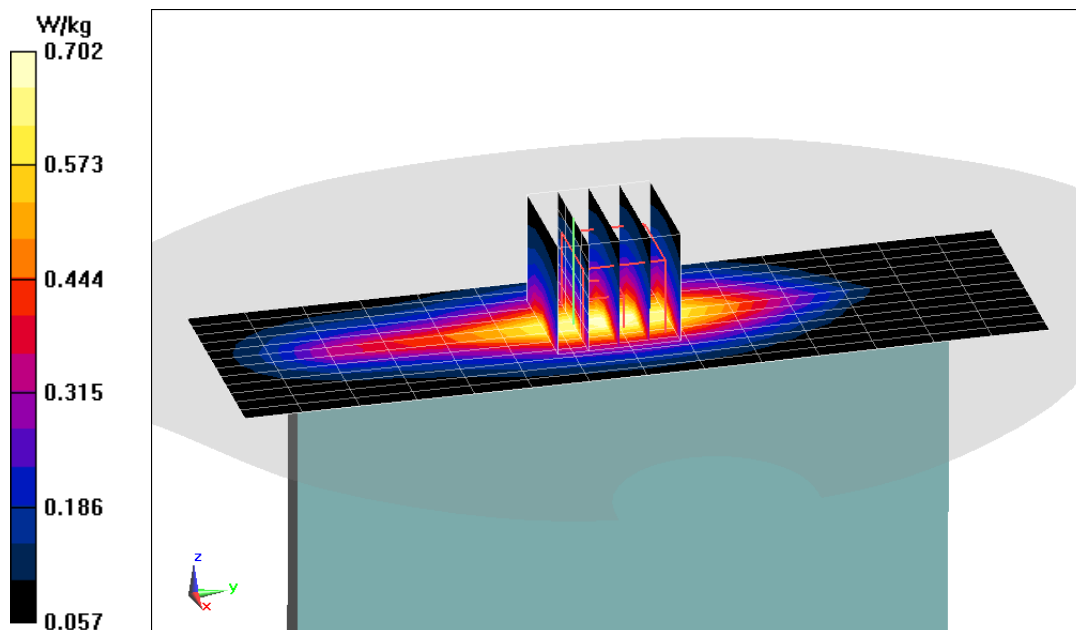
Area Scan (13x15x1): Measurement grid: dx=5mm, dy=15mm

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

Reference Value = 23.71 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.819 W/kg

SAR(1 g) = 0.499 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1471M

Communication System: UID 0, LTE Band 66 (AWS); Frequency: 1770 MHz; Duty Cycle: 1:1

Medium: 1750 Body Medium parameters used (interpolated):

$f = 1770 \text{ MHz}$; $\sigma = 1.5 \text{ S/m}$; $\epsilon_r = 53.329$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-31-2019; Ambient Temp: 22.6°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN7409; ConvF(7.85, 7.85, 7.85) @ 1770 MHz; Calibrated: 6/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 6/20/2019

Phantom: Front; Type: QD 000 P40 CD; Serial: 1686

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

**Mode: LTE Band 66 (AWS), Body SAR, Back side, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

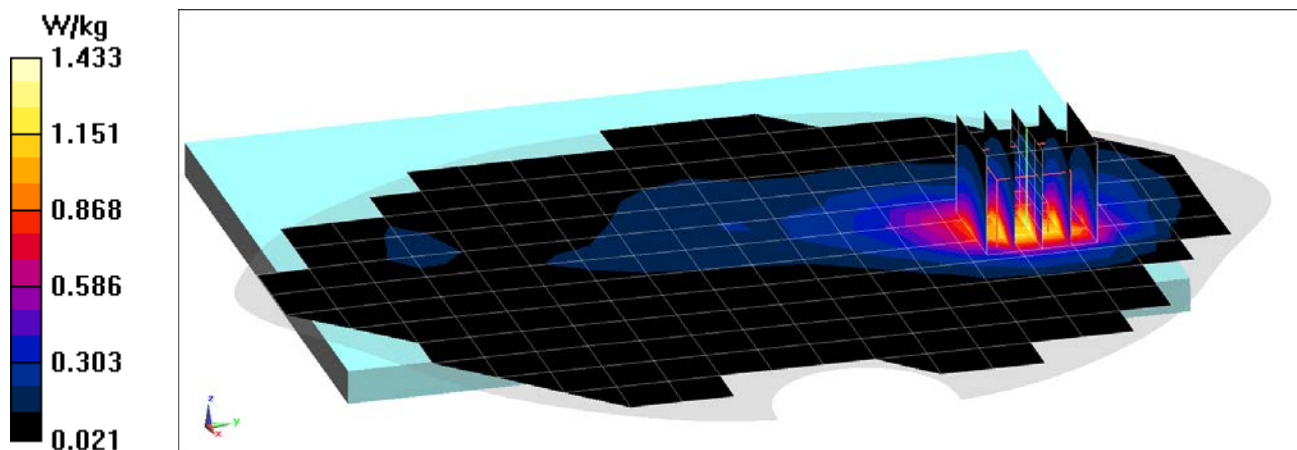
Area Scan (15x19x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 26.99 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.67 W/kg

SAR(1 g) = 1.000 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1504M

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

Medium: 1750 Body Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$; $\sigma = 1.434 \text{ S/m}$; $\epsilon_r = 53.142$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-29-2019; Ambient Temp: 22.4°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7409; ConvF(7.85, 7.85, 7.85) @ 1732.5 MHz; Calibrated: 6/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 6/20/2019

Phantom: Front; Type: QD 000 P40 CD; Serial: 1686

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

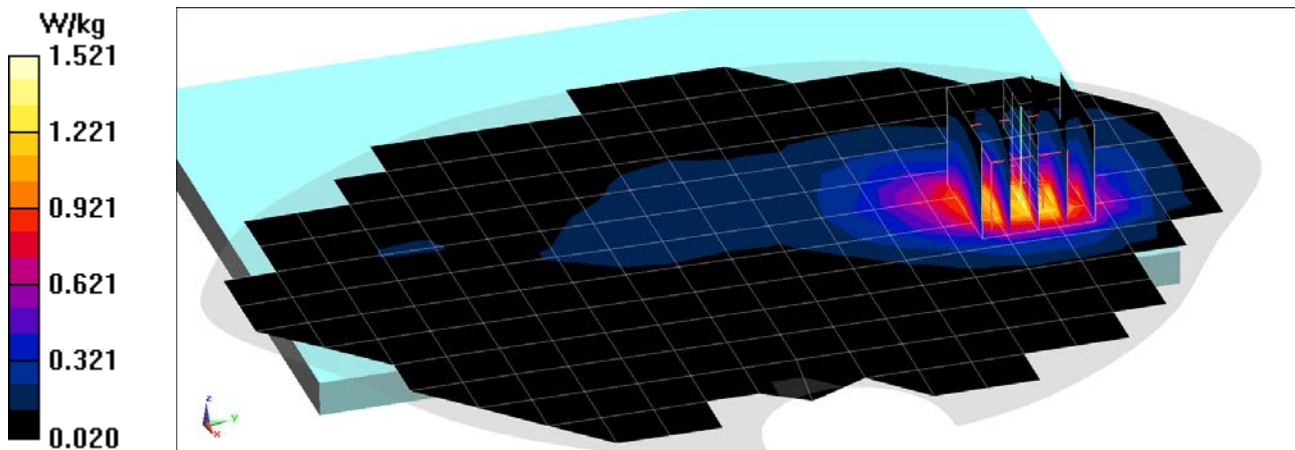
Area Scan (15x19x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 28.58 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 1.77 W/kg

SAR(1 g) = 1.080 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1504M

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1860 \text{ MHz}$; $\sigma = 1.529 \text{ S/m}$; $\epsilon_r = 53.174$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-25-2019; Ambient Temp: 19.7°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN7488; ConvF(8.37, 8.37, 8.37) @ 1860 MHz; Calibrated: 1/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1530; Calibrated: 1/15/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

**Mode: LTE Band 2 (PCS), Body SAR, Back side, Low.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

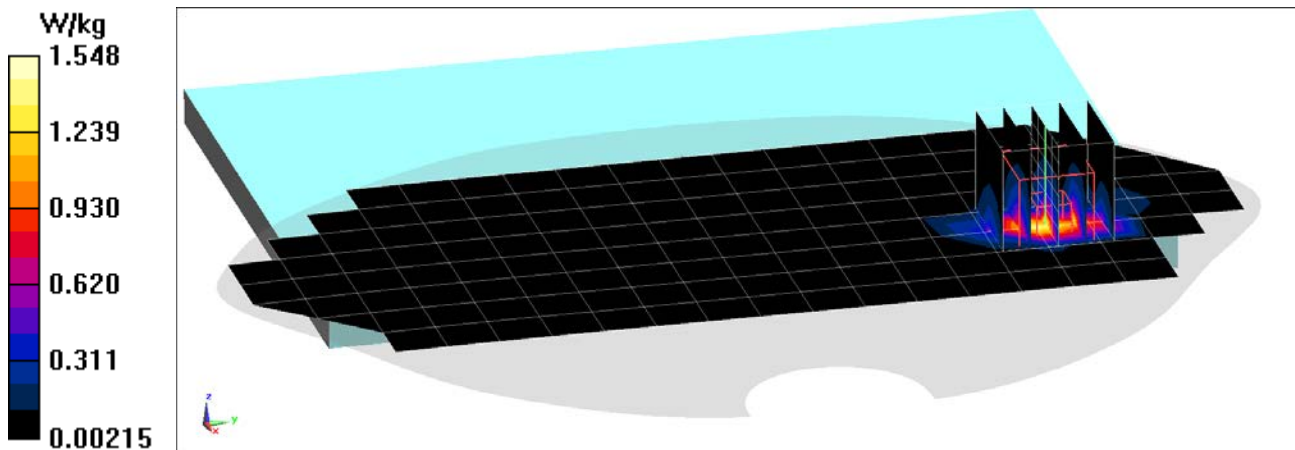
Area Scan (9x20x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 26.09 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 1.97 W/kg

SAR(1 g) = 0.915 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1466M

Communication System: UID 0, LTE Band 41; Frequency: 2506 MHz; Duty Cycle: 1:1.58

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2506 \text{ MHz}$; $\sigma = 2.126 \text{ S/m}$; $\epsilon_r = 51.392$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 08-05-2019; Ambient Temp: 20.6°C; Tissue Temp: 21.0°C

Probe: EX3DV4 - SN7357; ConvF(7.59, 7.59, 7.59) @ 2506 MHz; Calibrated: 4/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/18/2019

Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

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

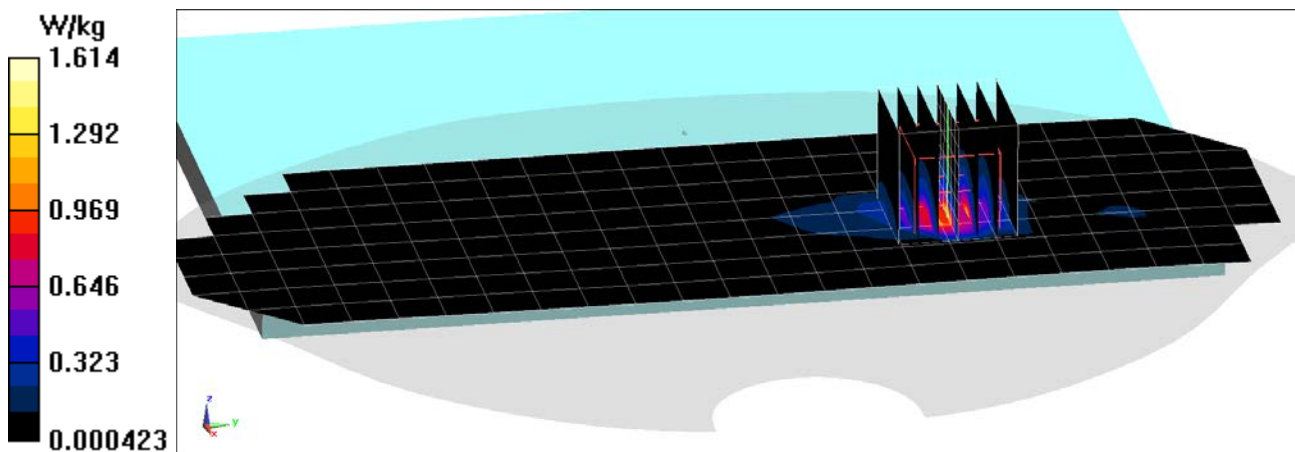
Area Scan (9x24x1): Measurement grid: dx=12mm, dy=12mm

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

Reference Value = 20.72 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 2.26 W/kg

SAR(1 g) = 0.781 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 6020M

Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$; $\sigma = 1.996 \text{ S/m}$; $\epsilon_r = 51.778$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 08-05-2019; Ambient Temp: 20.6°C; Tissue Temp: 21.0°C

Probe: EX3DV4 - SN7357; ConvF(7.59, 7.59, 7.59) @ 2412 MHz; Calibrated: 4/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/18/2019

Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

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

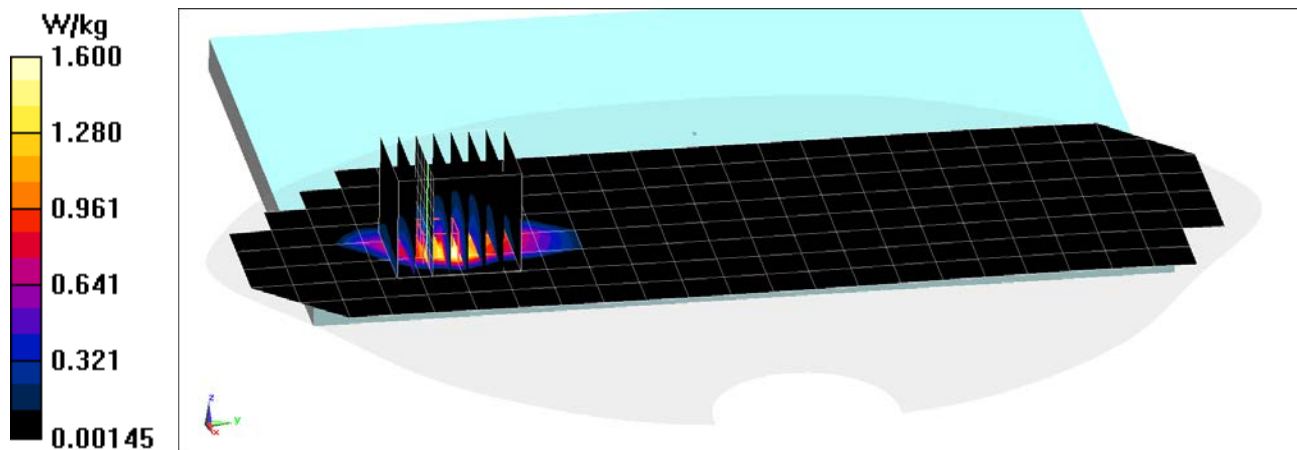
Area Scan (9x24x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 24.40 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 2.81 W/kg

SAR(1 g) = 0.973 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1198G

Communication System: UID 0, 802.11a 5.2-5.8 GHz Band; Frequency: 5320 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5320 \text{ MHz}$; $\sigma = 5.282 \text{ S/m}$; $\epsilon_r = 46.97$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.6 cm

Test Date:08-05-2019 Ambient Temp: 20.3°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7410; ConvF(4.95, 4.95, 4.95) @ 5320 MHz; Calibrated: 7/16/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/11/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1630

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

Mode: IEEE 802.11a, U-NII-2A, 20 MHz Bandwidth, Body SAR, Ch 64, 6 Mbps, Top Edge

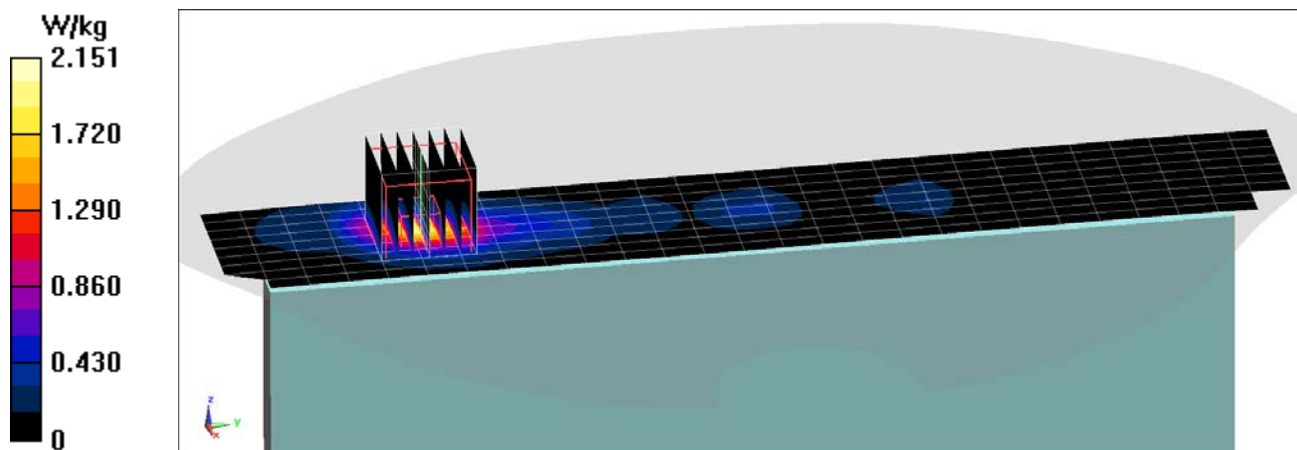
Area Scan (10x28x1): Measurement grid: dx=5mm, dy=10mm

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

Reference Value = 14.31 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.31 W/kg

SAR(1 g) = 0.945 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT545; Type: Portable Tablet; Serial: 1198G

Communication System: UID 0, Bluetooth; Frequency: 2402 MHz; Duty Cycle: 1:1.297

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2402 \text{ MHz}$; $\sigma = 1.945 \text{ S/m}$; $\epsilon_r = 51.999$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-29-2019; Ambient Temp: 21.9°C; Tissue Temp: 20.6°C

Probe: EX3DV4 - SN7357; ConvF(7.59, 7.59, 7.59) @ 2402 MHz; Calibrated: 4/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/18/2019

Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

Mode: Bluetooth, Body SAR, Ch 0, 1 Mbps, Back Side

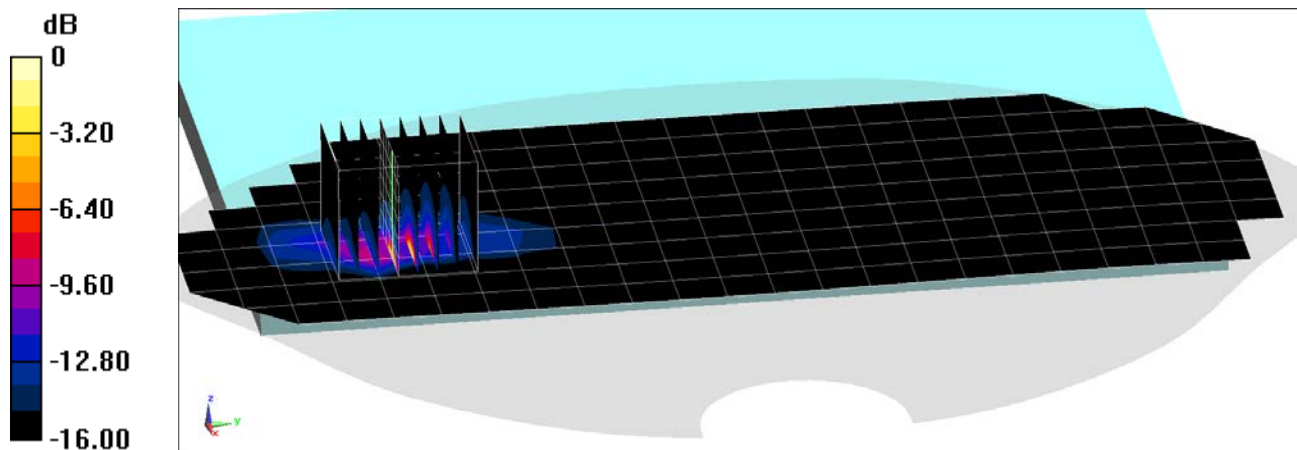
Area Scan (10x24x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.994 V/m; Power Drift = 0.20 dB

Peak SAR (extrapolated) = 0.914 W/kg

SAR(1 g) = 0.299 W/kg



0 dB = 0.566 W/kg = -2.47 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 750 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.941 \text{ S/m}$; $\epsilon_r = 56.074$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2019; Ambient Temp: 23.2°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN7409; ConvF(9.96, 9.96, 9.96) @ 750 MHz; Calibrated: 6/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 6/20/2019

Phantom: SAM Left; Type: QD000P40CA; Serial: TP:82355

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

750 MHz System Verification at 23.0 dBm (200 mW)

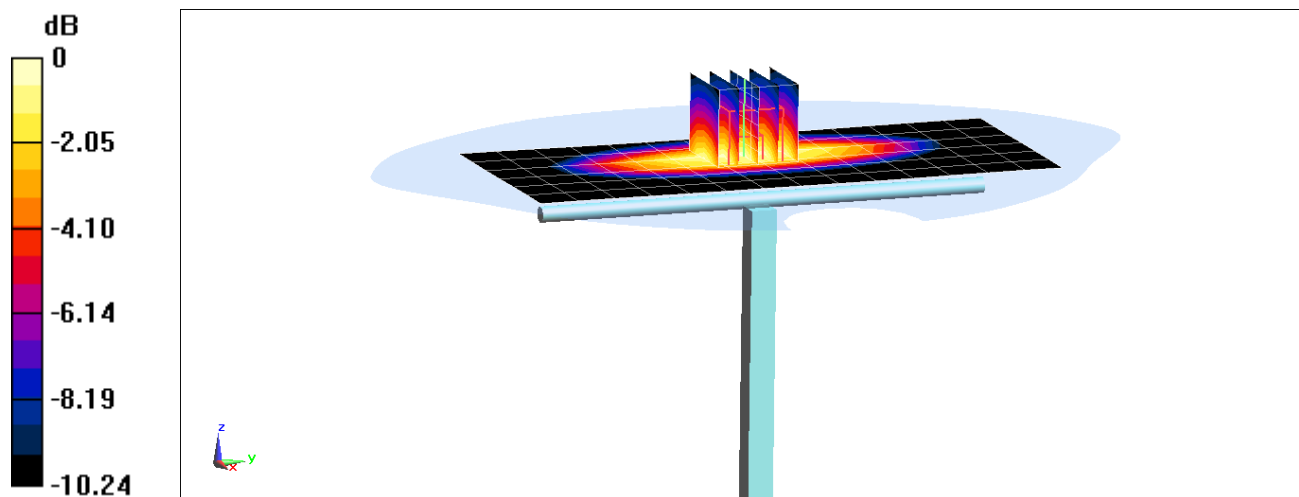
Area Scan (7x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 2.60 W/kg

SAR(1 g) = 1.7 W/kg

Deviation(1 g) = -0.93%



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

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):

$f = 750 \text{ MHz}$; $\sigma = 0.952 \text{ S/m}$; $\epsilon_r = 56.67$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 08-20-2019; Ambient Temp: 23.5°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7406; ConvF(10.05, 10.05, 10.05) @ 750 MHz; Calibrated: 5/16/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/8/2019

Phantom: Twin-SAM V5.0 Left 30; Type: QD 000 P40 CD; Serial: 1715

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

750 MHz System Verification at 23.0 dBm (200 mW)

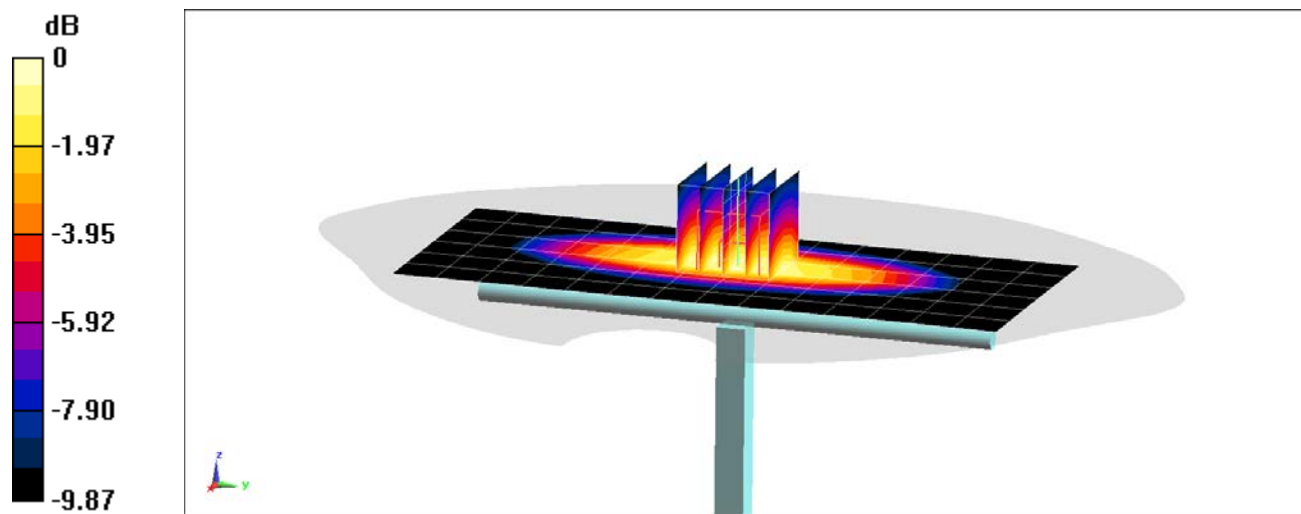
Area Scan (7x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 2.66 W/kg

SAR(1 g) = 1.79 W/kg

Deviation(1 g) = 4.68%



0 dB = 2.37 W/kg = 3.75 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d132

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

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.953 \text{ S/m}$; $\epsilon_r = 53.952$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-24-2019; Ambient Temp: 22.6°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3914; ConvF(9.46, 9.46, 9.46) @ 835 MHz; Calibrated: 2/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 2/14/2019

Phantom: Twin-SAM V5.0 Front 30; Type: QD 000 P40 CD; Serial: 1646

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

835 MHz System Verification at 23.0 dBm (200 mW)

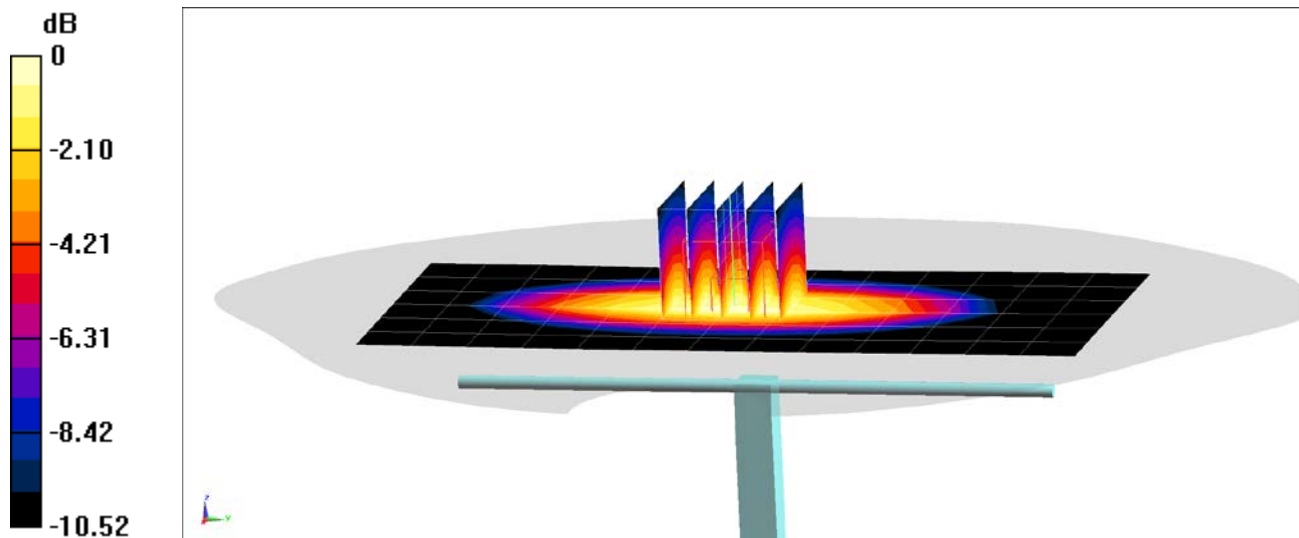
Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 3.23 W/kg

SAR(1 g) = 2.08 W/kg

Deviation(1 g) = 7.55%



0 dB = 2.81 W/kg = 4.49 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1150

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

Medium: 1750 Body; Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.532 \text{ S/m}$; $\epsilon_r = 52.448$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-22-2019; Ambient Temp: 21.0°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN7357; ConvF(8.26, 8.26, 8.26) @ 1750 MHz; Calibrated: 4/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/18/2019

Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

1750 MHz System Verification at 20.0 dBm (100 mW)

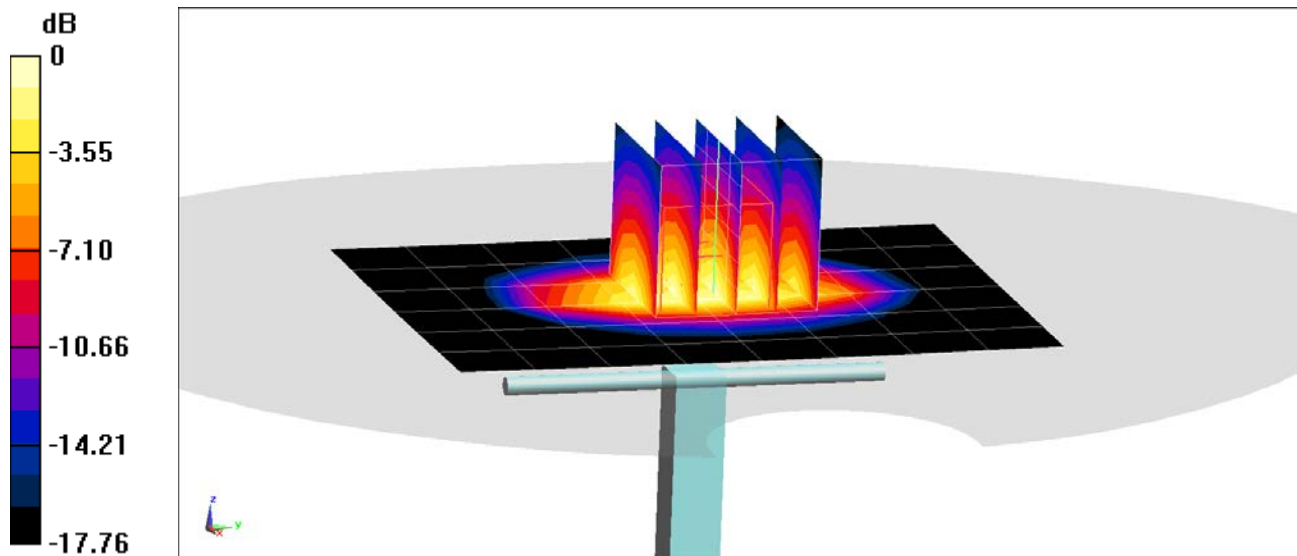
Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

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

Peak SAR (extrapolated) = 7.36 W/kg

SAR(1 g) = 3.89 W/kg

Deviation(1 g) = 6.28%



0 dB = 6.07 W/kg = 7.83 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1150

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

Medium: 1750 Body Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.446 \text{ S/m}$; $\epsilon_r = 53.118$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-29-2019; Ambient Temp: 22.4°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7409; ConvF(7.85, 7.85, 7.85) @ 1750 MHz; Calibrated: 6/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 6/20/2019

Phantom: Front; Type: QD 000 P40 CD; Serial: 1686

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

1750 MHz System Verification at 20.0 dBm (100 mW)

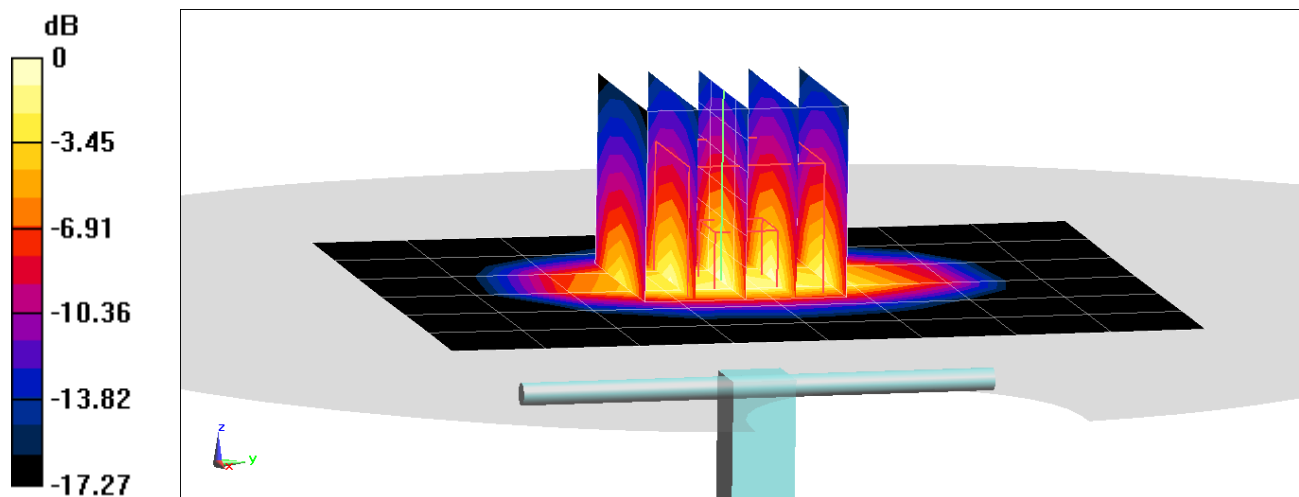
Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

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

Peak SAR (extrapolated) = 6.90 W/kg

SAR(1 g) = 3.64 W/kg

Deviation(1 g) = -0.55%



0 dB = 5.67 W/kg = 7.54 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1150

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

Medium: 1750 Body Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.487 \text{ S/m}$; $\epsilon_r = 53.356$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-31-2019; Ambient Temp: 22.6°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN7409; ConvF(7.85, 7.85, 7.85) @ 1750 MHz; Calibrated: 6/19/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 6/20/2019

Phantom: Front; Type: QD 000 P40 CD; Serial: 1686

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

1750 MHz System Verification at 20.0 dBm (100 mW)

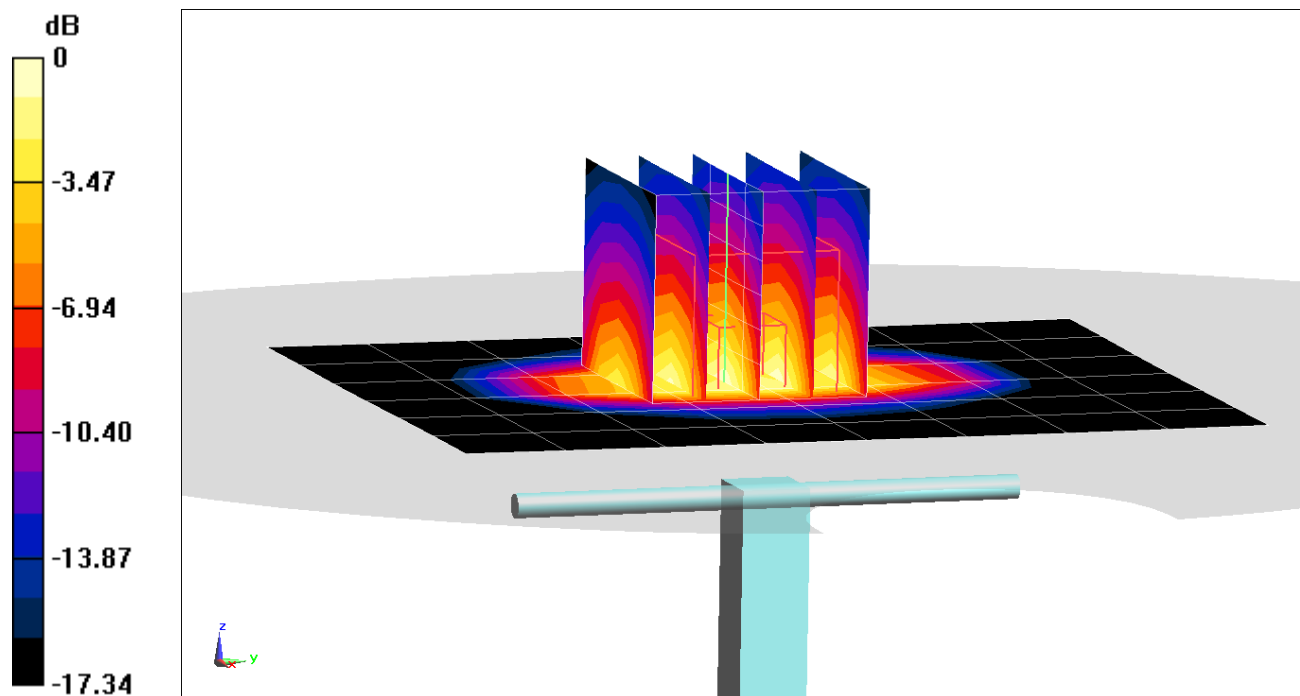
Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

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

Peak SAR (extrapolated) = 7.01 W/kg

SAR(1 g) = 3.69 W/kg

Deviation(1 g) = 0.82%



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

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.572 \text{ S/m}$; $\epsilon_r = 53.052$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-25-2019; Ambient Temp: 19.7°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN7488; ConvF(8.37, 8.37, 8.37) @ 1900 MHz; Calibrated: 1/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1530; Calibrated: 1/15/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

1900 MHz System Verification at 20.0 dBm (100 mW)

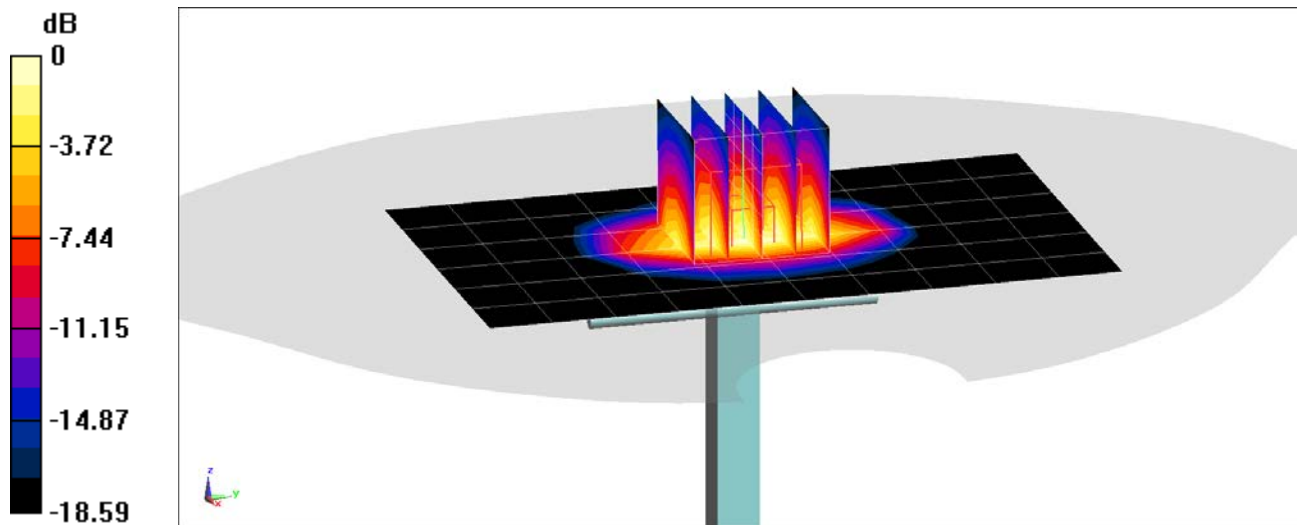
Area Scan (7x11x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 7.83 W/kg

SAR(1 g) = 4.17 W/kg

Deviation(1 g) = 6.38%



0 dB = 6.58 W/kg = 8.18 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.576 \text{ S/m}$; $\epsilon_r = 52.113$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-12-2019; Ambient Temp: 20.0°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN7488; ConvF(8.37, 8.37, 8.37) @ 1900 MHz; Calibrated: 1/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1530; Calibrated: 1/15/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1800

Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

1900 MHz System Verification at 20.0 dBm (100 mW)

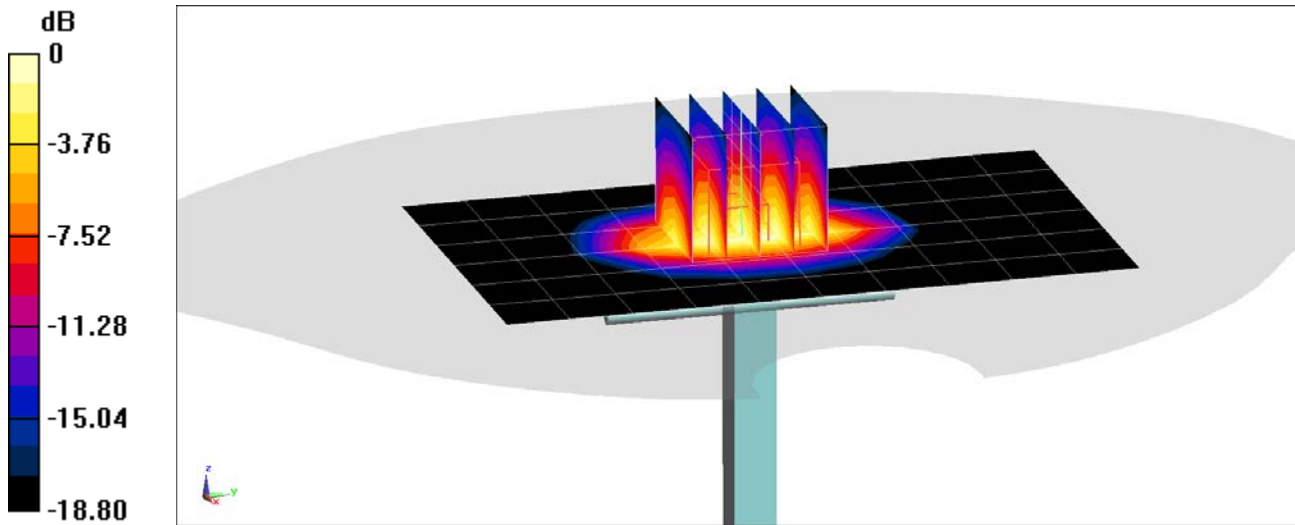
Area Scan (7x11x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Peak SAR (extrapolated) = 7.90 W/kg

SAR(1 g) = 4.16 W/kg

Deviation(1 g) = 6.12%



0 dB = 6.62 W/kg = 8.21 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body; Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 2.011 \text{ S/m}$; $\epsilon_r = 51.79$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-29-2019; Ambient Temp: 21.9°C; Tissue Temp: 20.6°C

Probe: EX3DV4 - SN7357; ConvF(7.59, 7.59, 7.59) @ 2450 MHz; Calibrated: 4/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/18/2019

Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

2450 MHz System Verification at 20.0 dBm (100 mW)

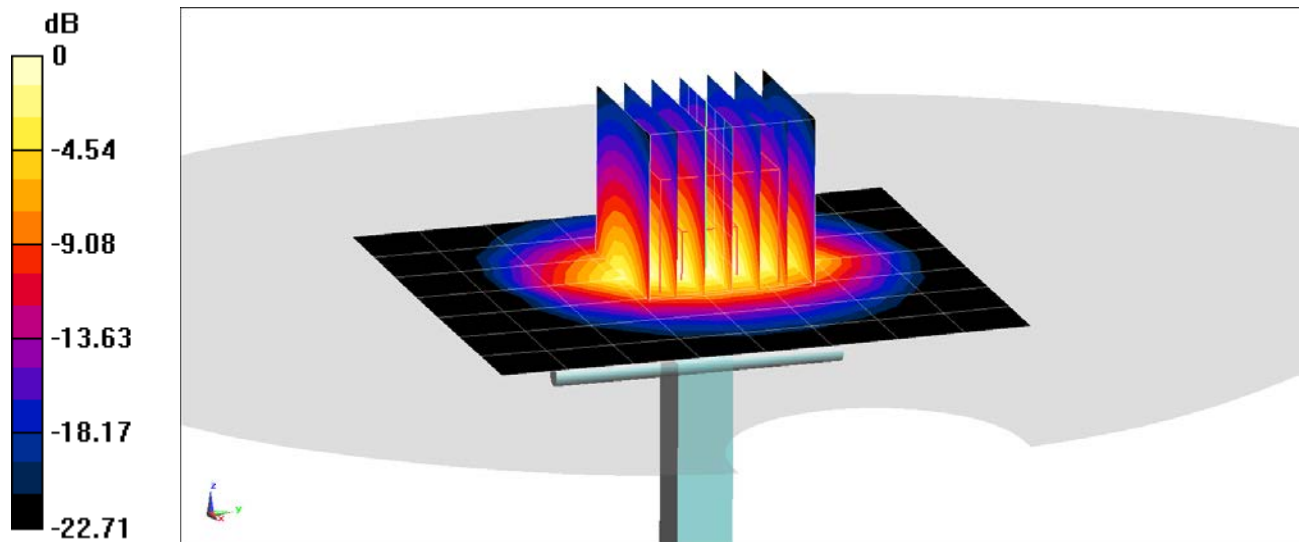
Area Scan (8x9x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Peak SAR (extrapolated) = 11.0 W/kg

SAR(1 g) = 5.14 W/kg

Deviation(1 g) = 0.59%



0 dB = 8.75 W/kg = 9.42 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 2.047 \text{ S/m}$; $\epsilon_r = 51.621$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-05-2019; Ambient Temp: 20.6°C; Tissue Temp: 21.0°C

Probe: EX3DV4 - SN7357; ConvF(7.59, 7.59, 7.59) @ 2450 MHz; Calibrated: 4/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/18/2019

Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

2450 MHz System Verification at 20.0 dBm (100 mW)

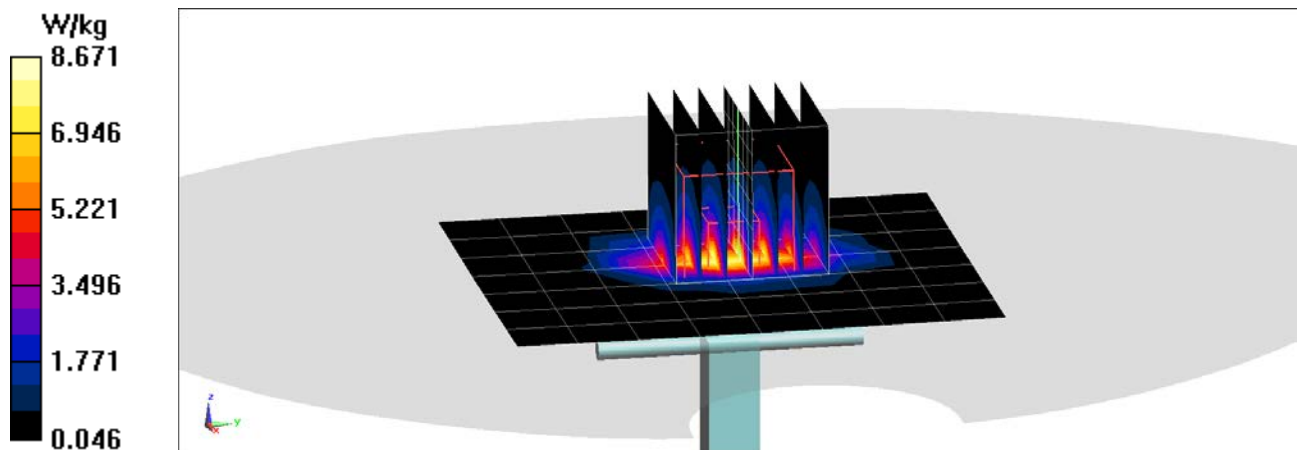
Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

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

Peak SAR (extrapolated) = 11.1 W/kg

SAR(1 g) = 5.12 W/kg

Deviation(1 g) = 0.20%



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: 2450 Body Medium parameters used:

$f = 2600 \text{ MHz}$; $\sigma = 2.256 \text{ S/m}$; $\epsilon_r = 51.02$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-05-2019; Ambient Temp: 20.6°C; Tissue Temp: 21.0°C

Probe: EX3DV4 - SN7357; ConvF(7.39, 7.39, 7.39) @ 2600 MHz; Calibrated: 4/24/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 4/18/2019

Phantom: Twin-SAM V4.0 Front Right; Type: QD 000 P40 CC; Serial: 1167

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

2600 MHz System Verification at 20.0 dBm (100 mW)

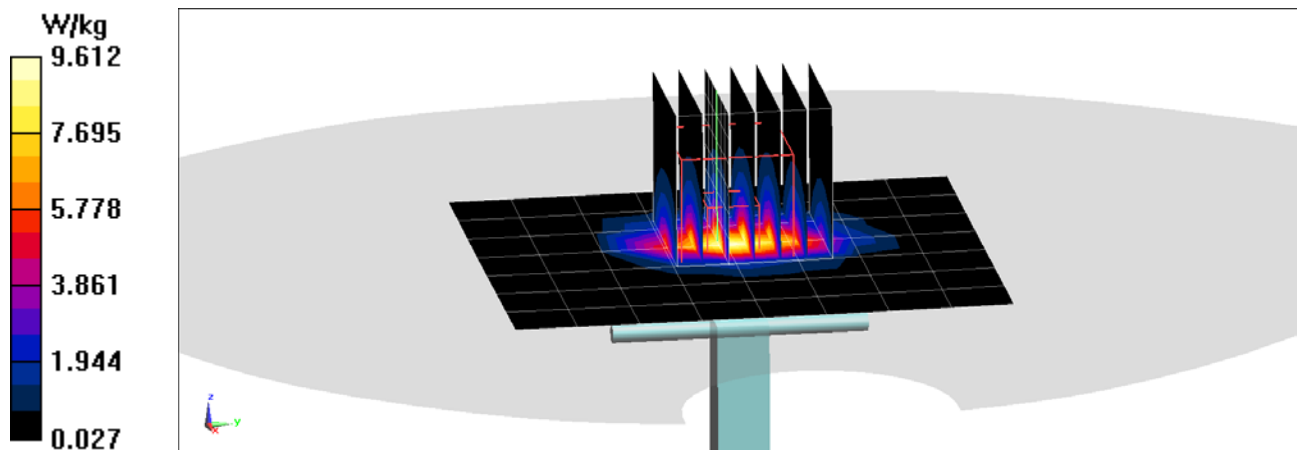
Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

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

Peak SAR (extrapolated) = 12.7 W/kg

SAR(1 g) = 5.55 W/kg

Deviation(1 g) = 1.28%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1057

Communication System: UID 0, CW; Frequency: 5250 MHz; Duty Cycle: 1:1

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

$f = 5250 \text{ MHz}$; $\sigma = 5.195 \text{ S/m}$; $\epsilon_r = 47.086$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-05-2019 Ambient Temp: 20.3°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7410; ConvF(4.95, 4.95, 4.95) @ 5250 MHz; Calibrated: 7/16/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/11/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1630

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

5250 MHz System Verification at 17.0 dBm (50 mW)

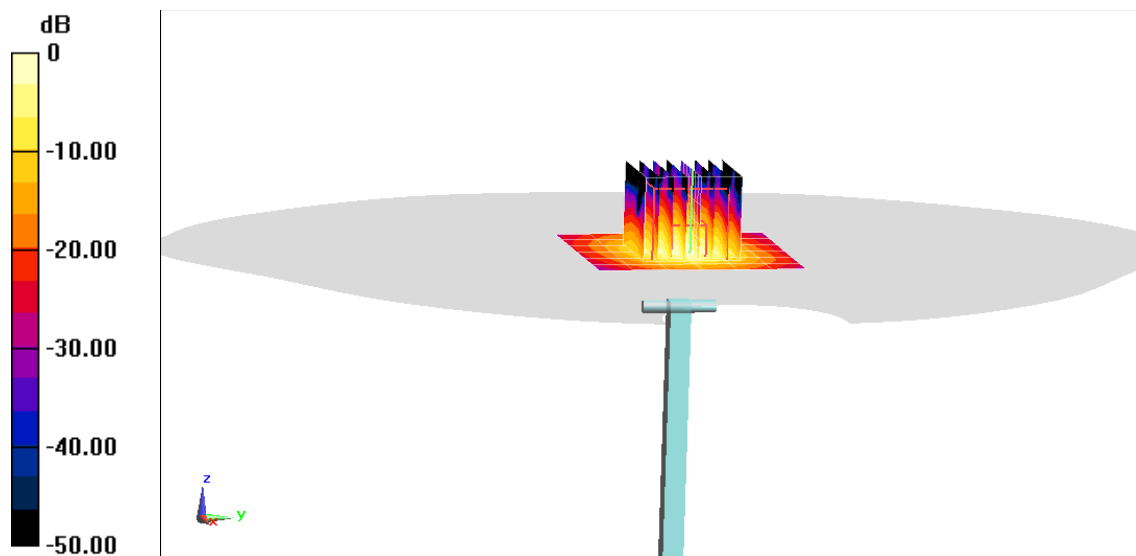
Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

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

Peak SAR (extrapolated) = 14.0 W/kg

SAR(1 g) = 3.48 W/kg

Deviation(1 g) = -8.30%



0 dB = 8.20 W/kg = 9.14 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1057

Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 5.671 \text{ S/m}$; $\epsilon_r = 46.518$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-05-2019 Ambient Temp: 20.3°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7410; ConvF(4.42, 4.42, 4.42) @ 5600 MHz; Calibrated: 7/16/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/11/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1630

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

5600 MHz System Verification at 17.0 dBm (50 mW)

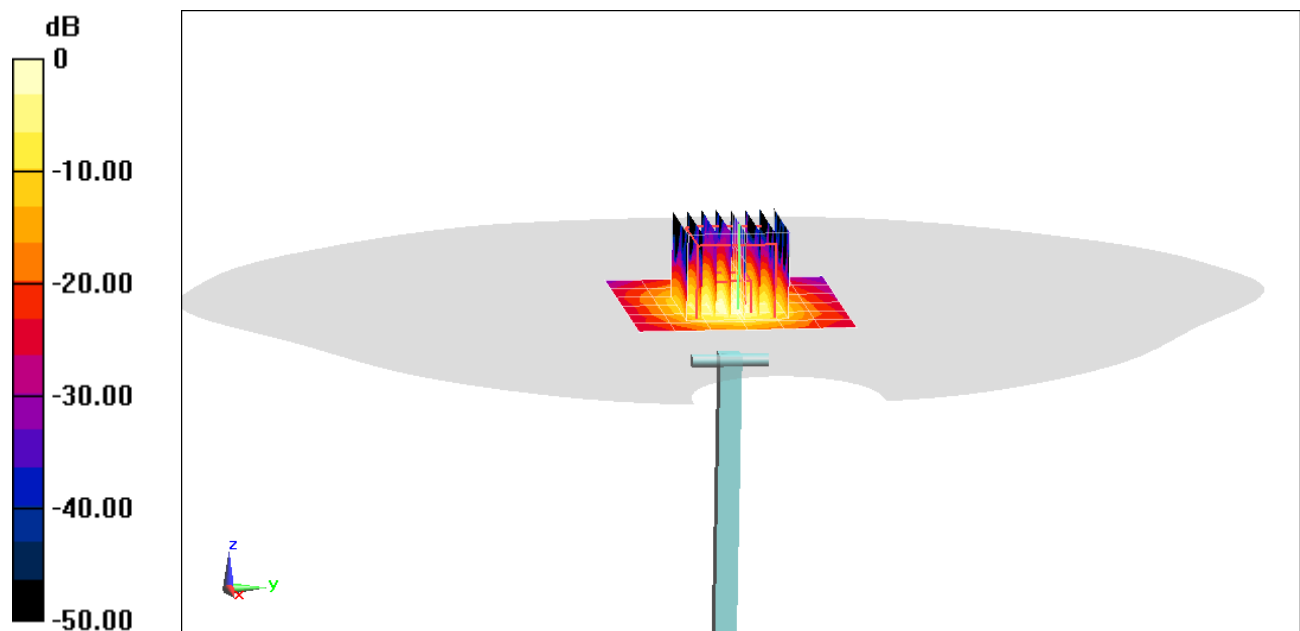
Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

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

Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 3.81 W/kg

Deviation(1 g) = -4.63%



0 dB = 9.18 W/kg = 9.63 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: 1057

Communication System: UID 0, CW; Frequency: 5750 MHz; Duty Cycle: 1:1

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

$f = 5750 \text{ MHz}$; $\sigma = 5.888 \text{ S/m}$; $\epsilon_r = 46.242$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-05-2019 Ambient Temp: 20.3°C; Tissue Temp: 21.1°C

Probe: EX3DV4 - SN7410; ConvF(4.6, 4.6, 4.6) @ 5750 MHz; Calibrated: 7/16/2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/11/2019

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1630

Measurement SW: DASY52, Version 52.10 (2);SEMCAD X Version 14.6.12 (7470)

5750 MHz System Verification at 17.0 dBm (50 mW)

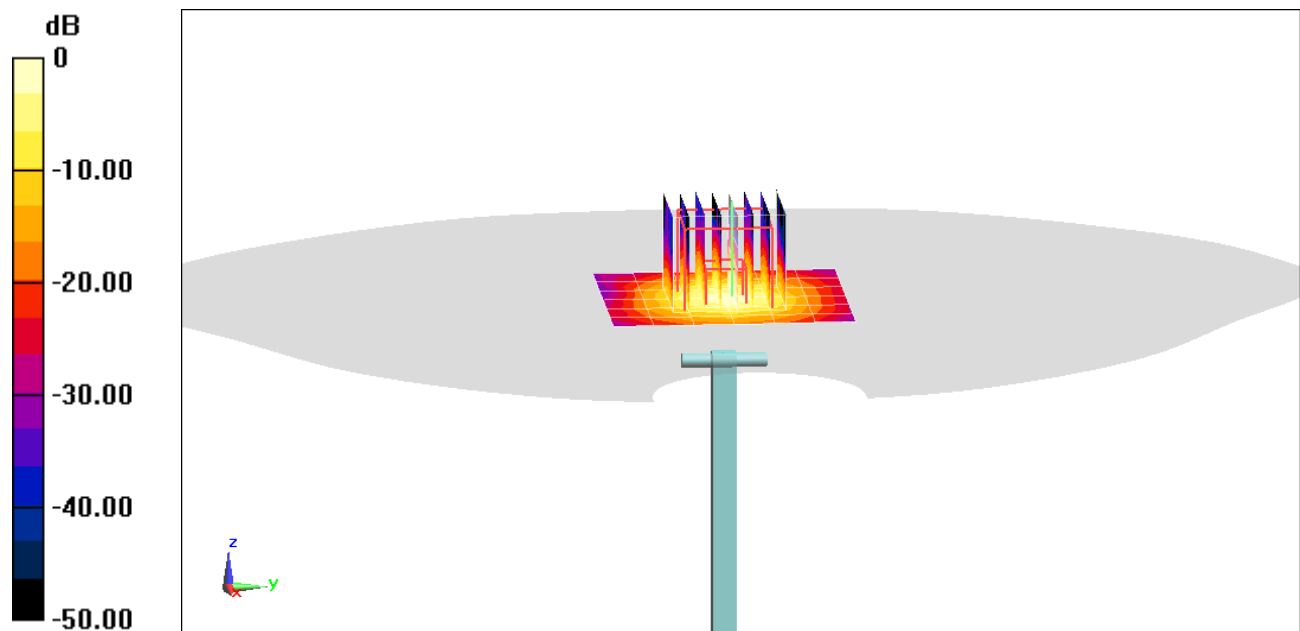
Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

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

Peak SAR (extrapolated) = 16.6 W/kg

SAR(1 g) = 3.56 W/kg

Deviation(1 g) = -7.17%



0 dB = 8.78 W/kg = 9.43 dBW/kg

APPENDIX C: PROBE CALIBRATION

**Calibration Laboratory of
Schmid & Partner
Engineering AG**

Zeughausstrasse 43, 8004 Zurich, Switzerland



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

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D750V3-1003_Jan18**

CALIBRATION CERTIFICATE

Object **D750V3 - SN:1003**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **January 15, 2018**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

Calibrated by: **Leli Klysner** Name
Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name
Function: **Technical Manager**

Signature

Leli Klysner

Katja Pokovic

Issued: January 15, 2018

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of

Schmid & Partner

Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5.0 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	40.9 $\pm$ 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	2.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.28 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	1.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.42 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	55.0 $\pm$ 6 %	0.96 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	2.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.58 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	1.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.71 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	53.8 Ω - 2.1 j Ω
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2 Ω - 6.2 j Ω
Return Loss	- 24.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.043 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	January 21, 2009

Appendix (Additional assessments outside the scope of SCS 0108)

Measurement Conditions

DASY system configuration, as far as not given on page 1 and 3.

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L
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SAR result with SAM Head (Top)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.98 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	7.94 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.32 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.22 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.52 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Neck)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.01 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.06 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.52 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Ear)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.67 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.70 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.60 W/kg ± 16.9 % (k=2)

DASY5 Validation Report for Head TSL

Date: 12.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.9$ S/m; $\epsilon_r = 40.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.22, 10.22, 10.22); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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

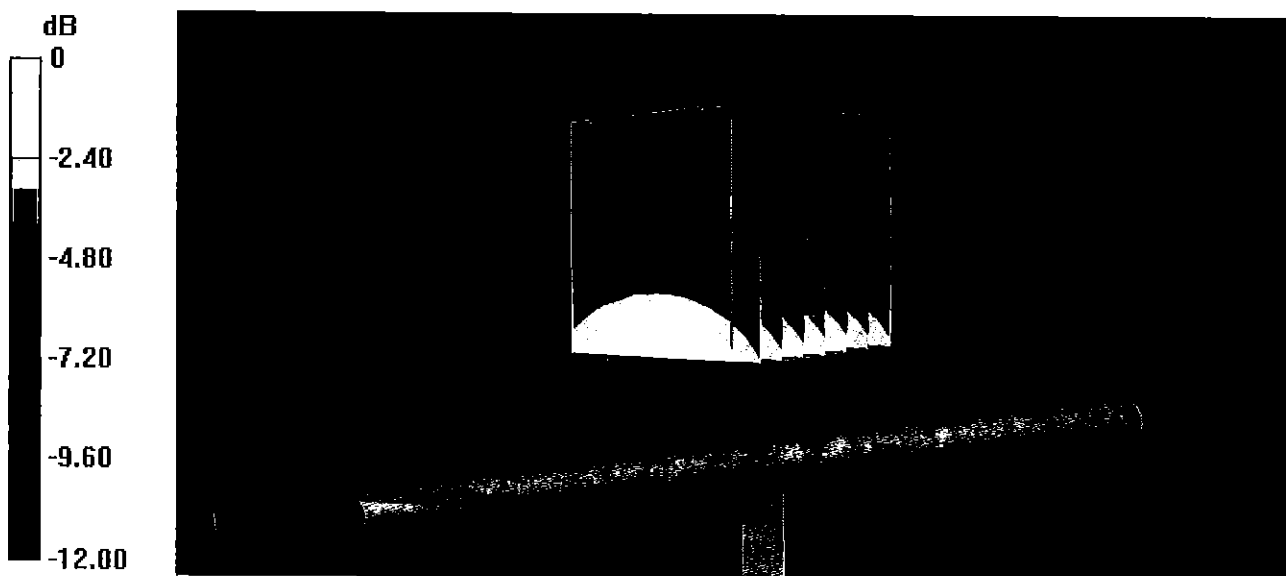
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.11 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.15 W/kg

SAR(1 g) = 2.1 W/kg; SAR(10 g) = 1.37 W/kg

Maximum value of SAR (measured) = 2.80 W/kg

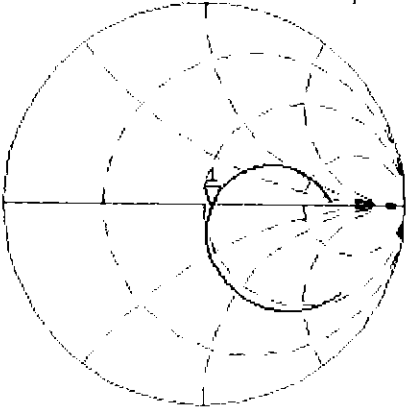


0 dB = 2.80 W/kg = 4.47 dBW/kg

Impedance Measurement Plot for Head TSL

12 Jan 2018 13:14:07
CH1 S11 1 U FS 1: 53.754 Ω -2.0996 Ω 101.07 pF 750.000 000 MHz

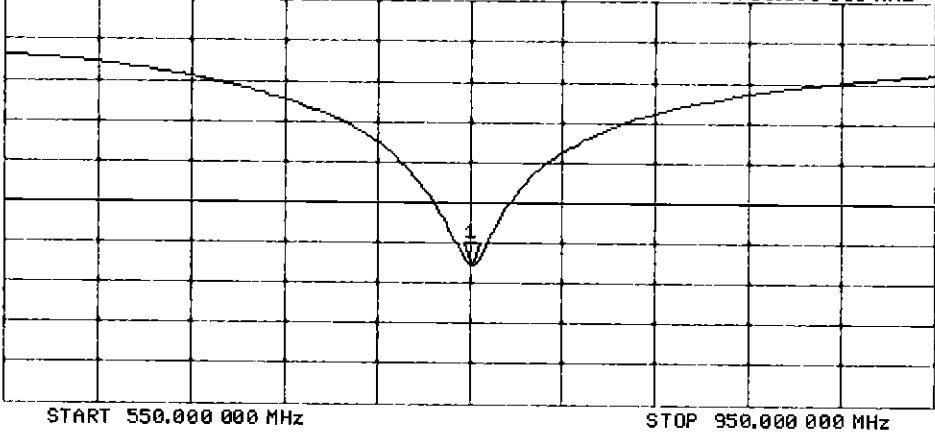
*
De1
CA



Avg
16
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-27.643 dB 750.000 000 MHz

CA
Avg
16
H1d



DASY5 Validation Report for Body TSL

Date: 12.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.96 \text{ S/m}$; $\epsilon_r = 55$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.19, 10.19, 10.19); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x8x7)/Cube 0:

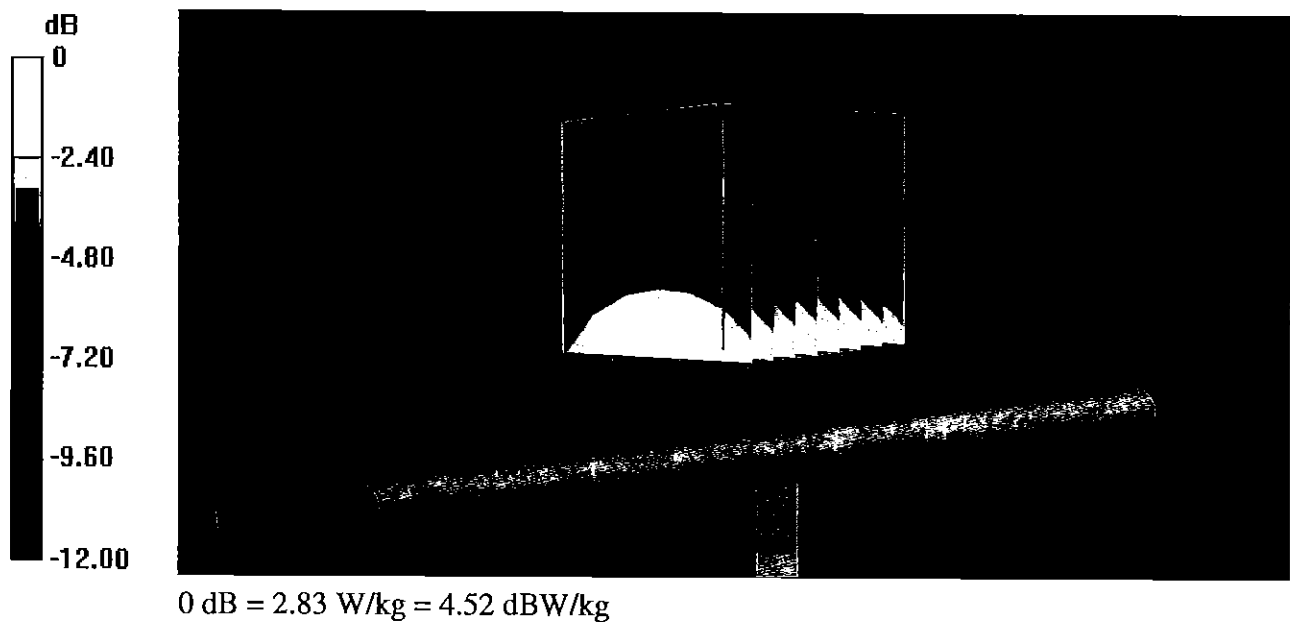
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 57.31 V/m; Power Drift = -0.01 dB

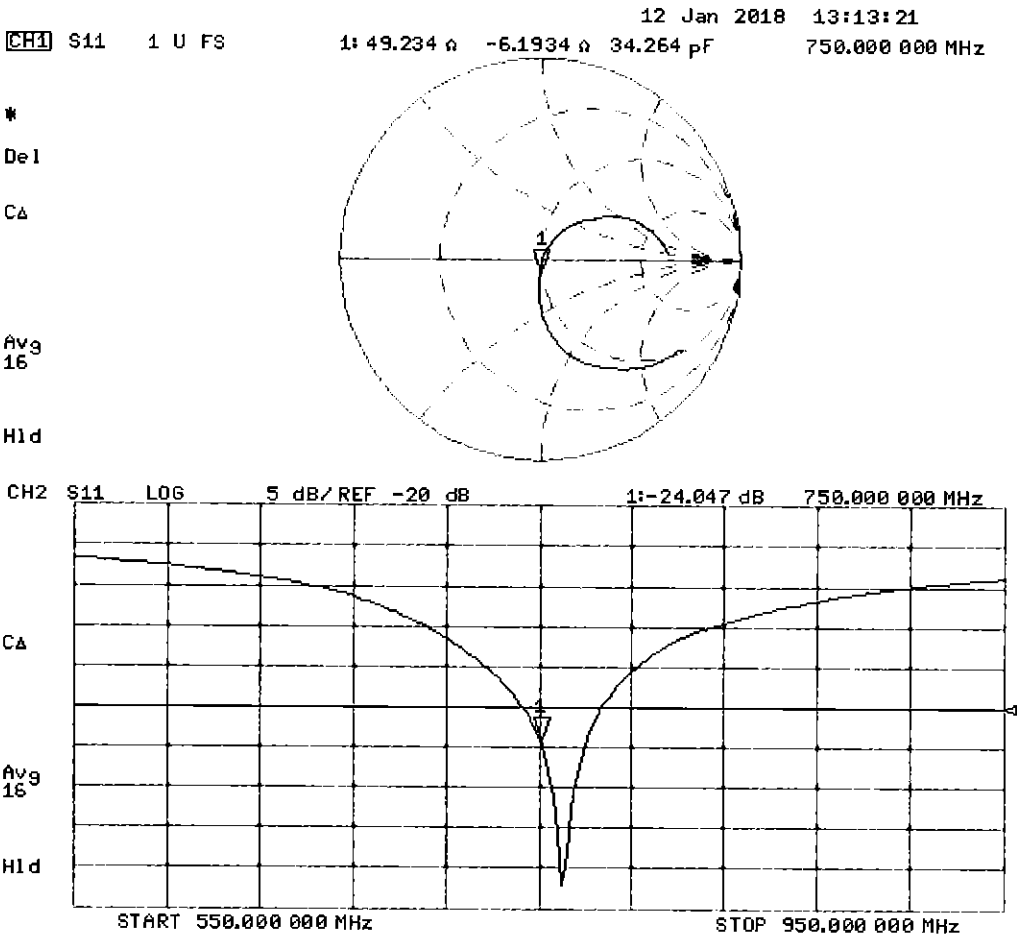
Peak SAR (extrapolated) = 3.17 W/kg

SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.43 W/kg

Maximum value of SAR (measured) = 2.83 W/kg



Impedance Measurement Plot for Body TSL



DASY5 Validation Report for SAM Head

Date: 15.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.9 \text{ S/m}$; $\epsilon_r = 44.2$; $\rho = 1000 \text{ kg/m}^3$

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.22, 10.22, 10.22); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: SAM Head
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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

Reference Value = 56.79 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 2.89 W/kg

SAR(1 g) = 1.98 W/kg; SAR(10 g) = 1.33 W/kg

Maximum value of SAR (measured) = 2.58 W/kg

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

Reference Value = 56.85 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 2.94 W/kg

SAR(1 g) = 2.05 W/kg; SAR(10 g) = 1.38 W/kg

Maximum value of SAR (measured) = 2.62 W/kg

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

Reference Value = 56.29 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 2.78 W/kg

SAR(1 g) = 2.01 W/kg; SAR(10 g) = 1.38 W/kg

Maximum value of SAR (measured) = 2.56 W/kg

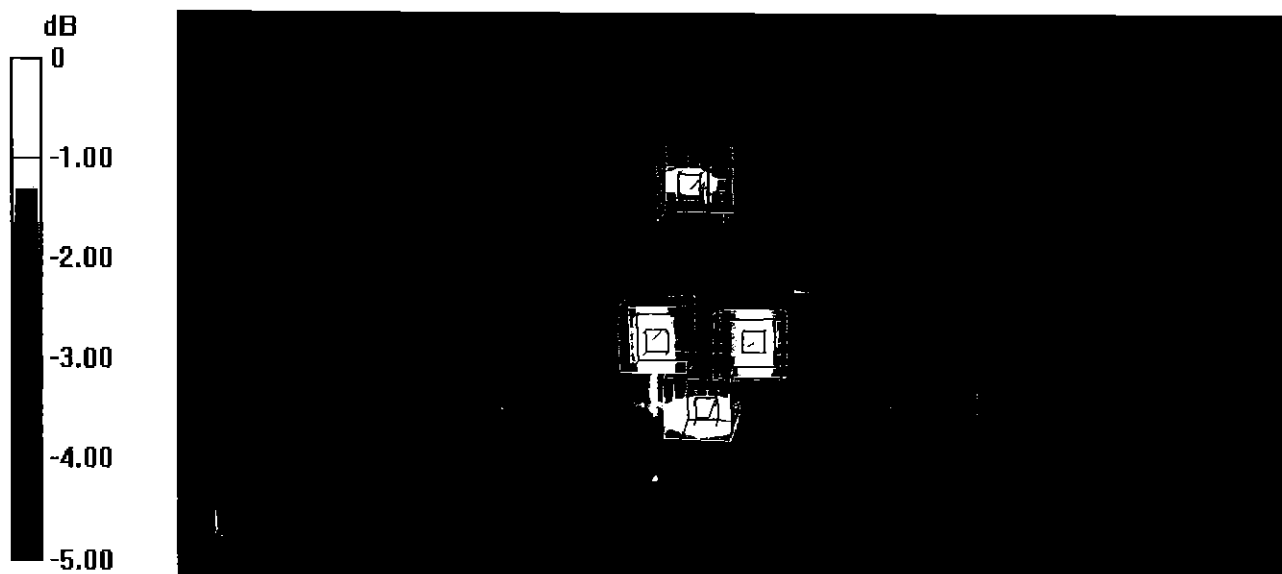
SAM Head/Ear/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 51.01 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 2.31 W/kg

SAR(1 g) = 1.67 W/kg; SAR(10 g) = 1.15 W/kg

Maximum value of SAR (measured) = 2.11 W/kg



0 dB = 2.58 W/kg = 4.12 dBW/kg

Certification of Calibration

Object D750V3 – SN: 1003

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

Extension Calibration date: 1/15/2019

Description: SAR Validation Dipole at 750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	2/8/2018	Annual	2/8/2019	US39170122
Agilent	N5182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1339018
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/11/2018	Annual	7/11/2019	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/3/2018	Annual	10/3/2019	1558
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091
SPEAG	EX3DV4	SAR Probe	8/23/2018	Annual	8/23/2019	7308
SPEAG	EX3DV4	SAR Probe	6/25/2018	Annual	6/25/2019	7409

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halfoster	Test Engineer	<i>BRODIE HALFOSTER</i>
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	<i>KOK</i>

DIPOLE CALIBRATION EXTENSION

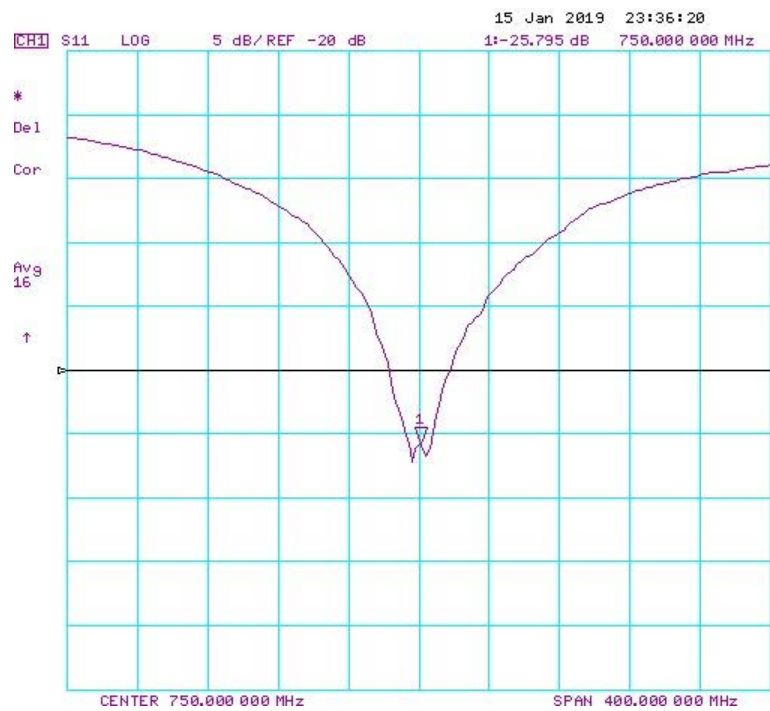
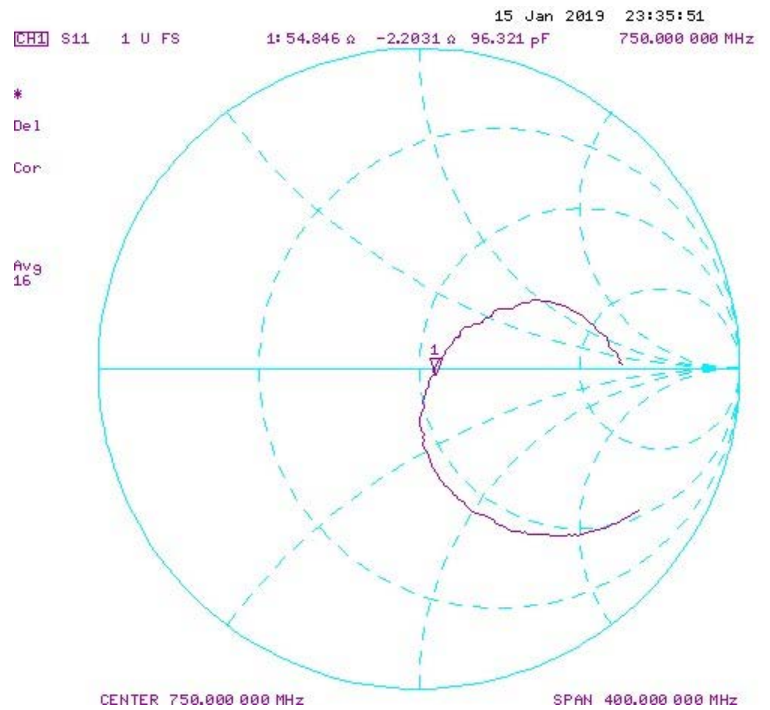
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

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

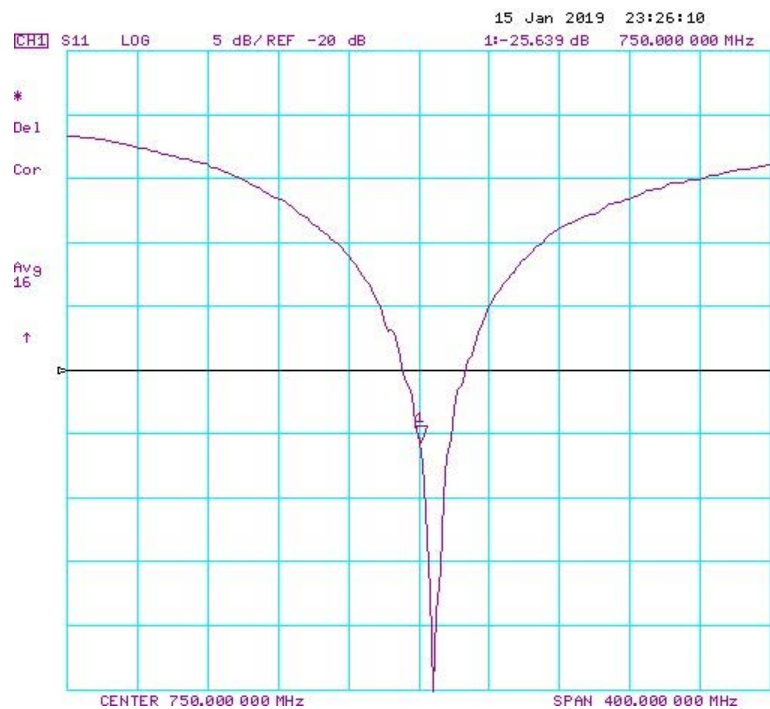
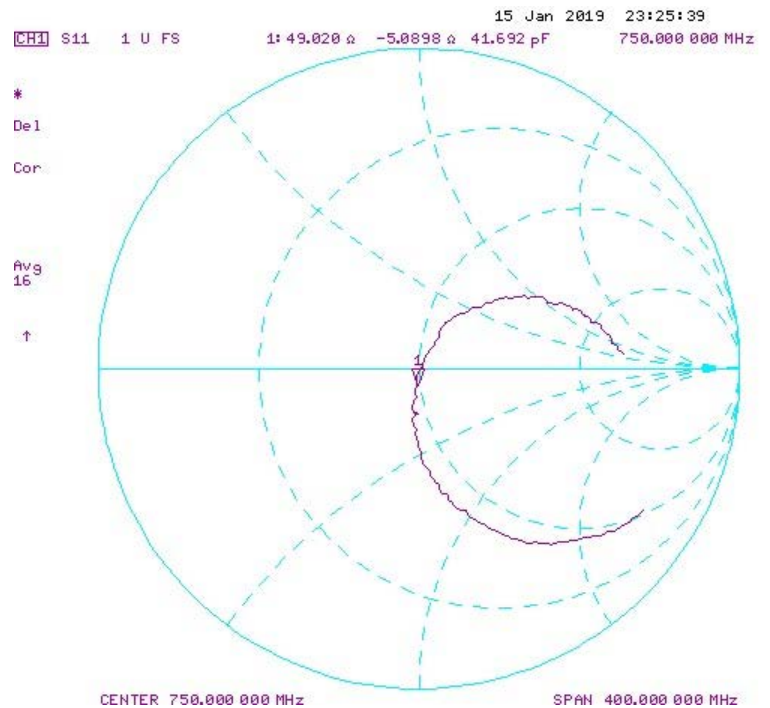
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
1/15/2018	1/15/2019	1.043	1.656	1.75	5.88%	1.08	1.15	6.09%	53.8	54.8	1	-2.1	-2.2	0.1	-27.6	-25.8	6.50%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
1/15/2018	1/15/2019	1.043	1.716	1.84	7.23%	1.14	1.23	7.71%	49.2	49	0.2	-6.2	-5.1	1.1	-24	-25.6	-6.80%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL



Impedance & Return-Loss Measurement Plot for Body TSL





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 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D750V3-1054_Mar19/2**

CALIBRATION CERTIFICATE (Replacement of No:D750V3-1154_Mar19)

Object **D750V3 - SN:1054**

Calibration procedure(s) **QA CAL-05.v11**
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

BNV
4-29-2019

Calibration date: **March 18, 2019**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	31-Dec-18 (No. EX3-7349_Dec18)	Dec-19
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	07-Oct-15 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

Calibrated by: **Manu Seitz** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: April 12, 2019

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5.0 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	42.1 $\pm$ 6 %	0.89 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	8.29 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	1.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.48 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	54.5 $\pm$ 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	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.55 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	1.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.67 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	54.5 Ω - 0.3 j Ω
Return Loss	- 27.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.2 Ω - 3.0 j Ω
Return Loss	- 30.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.035 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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Appendix (Additional assessments outside the scope of SCS 0108)

Measurement Conditions

DASY system configuration, as far as not given on page 1 and 3.

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L
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SAR result with SAM Head (Top)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	7.72 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.23 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.20 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.55 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Neck)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.00 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.00 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.51 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Ear)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.66 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.64 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.55 W/kg ± 16.9 % (k=2)

DASY5 Validation Report for Head TSL

Date: 13.03.2019

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.89 \text{ S/m}$; $\epsilon_r = 42.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.32, 10.32, 10.32) @ 750 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

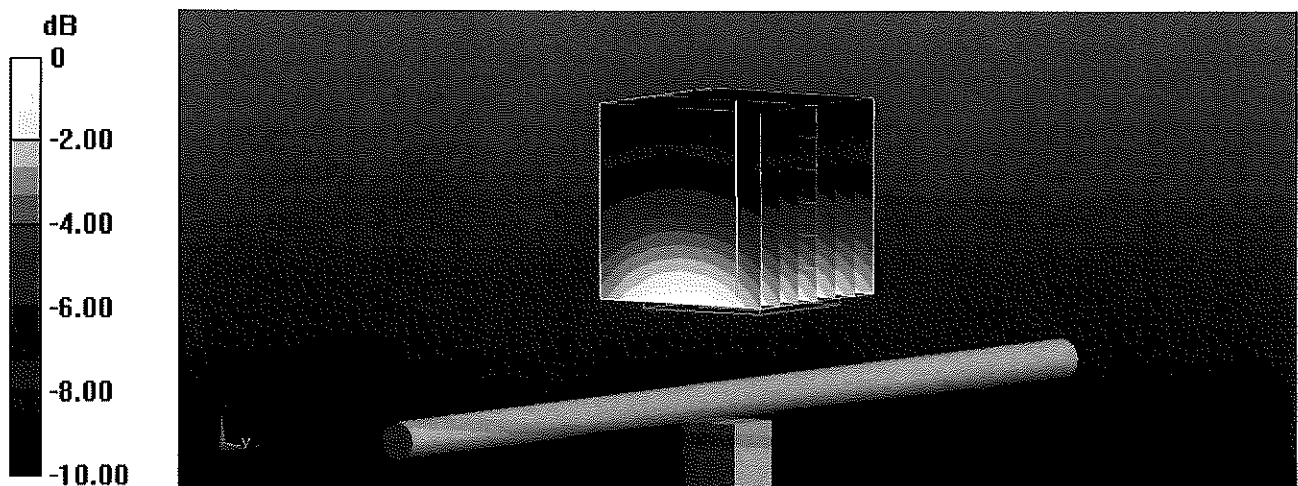
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 58.96 V/m; Power Drift = 0.00 dB

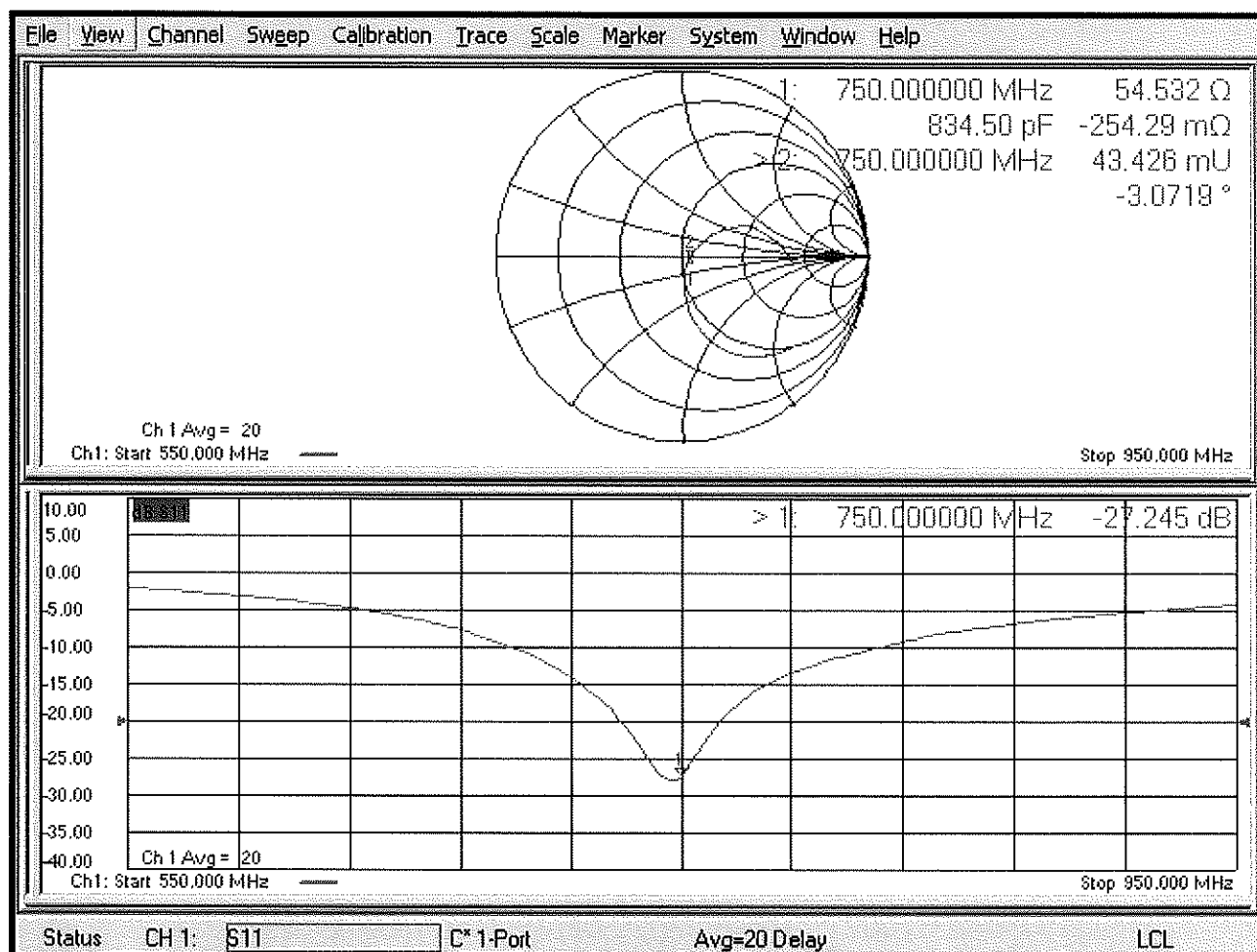
Peak SAR (extrapolated) = 3.06 W/kg

SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.37 W/kg

Maximum value of SAR (measured) = 2.73 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.03.2019

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.98 \text{ S/m}$; $\epsilon_r = 54.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.29, 10.29, 10.29) @ 750 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

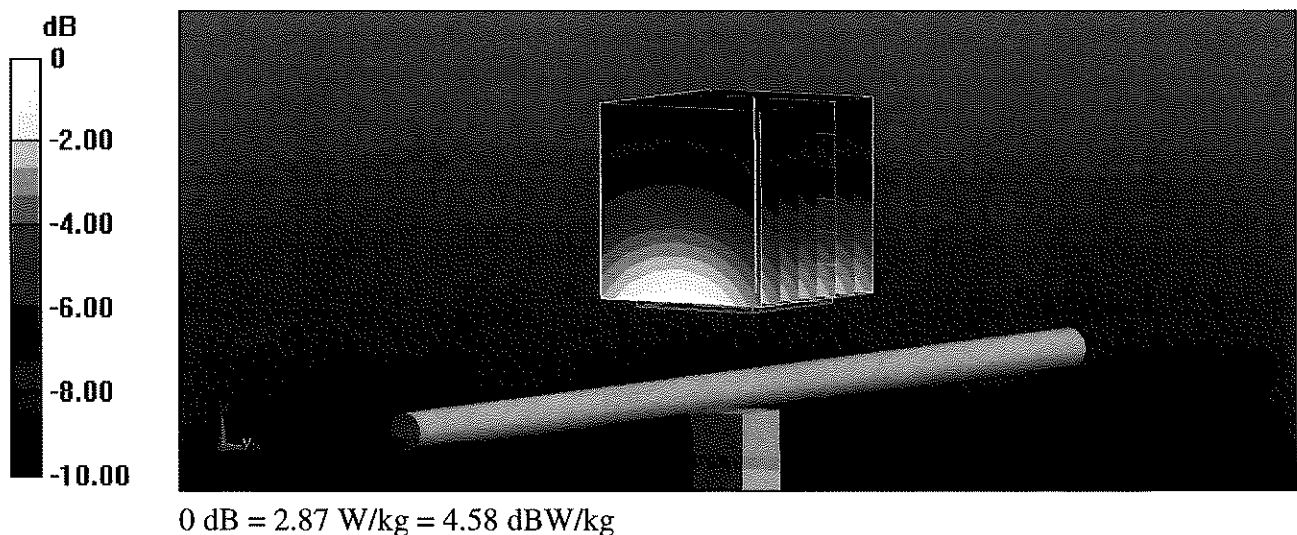
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 57.37 V/m; Power Drift = -0.01 dB

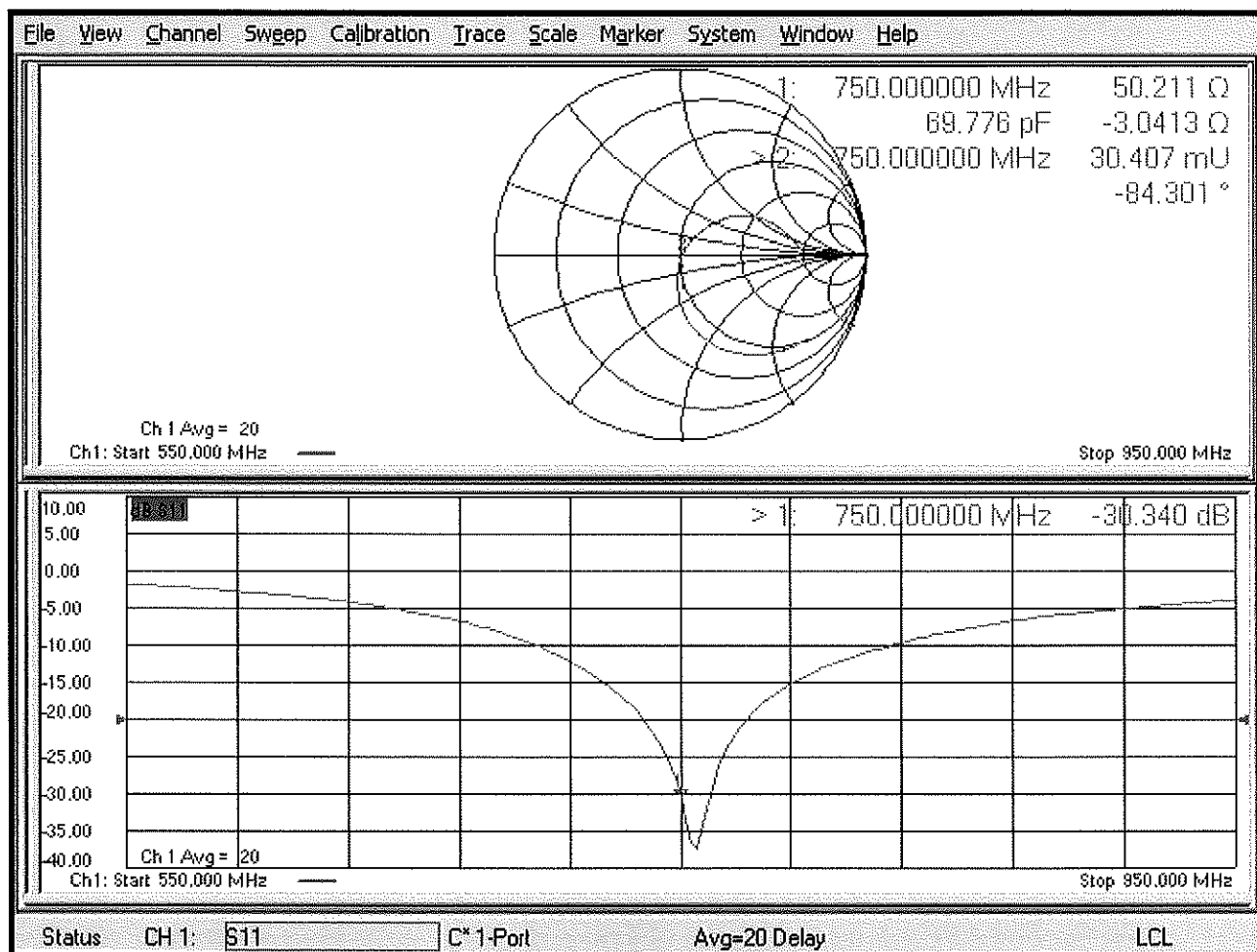
Peak SAR (extrapolated) = 3.19 W/kg

SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.44 W/kg

Maximum value of SAR (measured) = 2.87 W/kg



Impedance Measurement Plot for Body TSL



DASY5 Validation Report for SAM Head

Date: 18.03.2019

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.904$ S/m; $\epsilon_r = 44.22$; $\rho = 1000$ kg/m³

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.32, 10.32, 10.32) @ 750 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: SAM Head
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

Reference Value = 55.66 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 2.80 W/kg

SAR(1 g) = 1.93 W/kg; SAR(10 g) = 1.31 W/kg

Maximum value of SAR (measured) = 2.52 W/kg

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

Reference Value = 57.68 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 2.98 W/kg

SAR(1 g) = 2.05 W/kg; SAR(10 g) = 1.39 W/kg

Maximum value of SAR (measured) = 2.68 W/kg

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

Reference Value = 56.23 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 2.82 W/kg

SAR(1 g) = 2 W/kg; SAR(10 g) = 1.38 W/kg

Maximum value of SAR (measured) = 2.56 W/kg

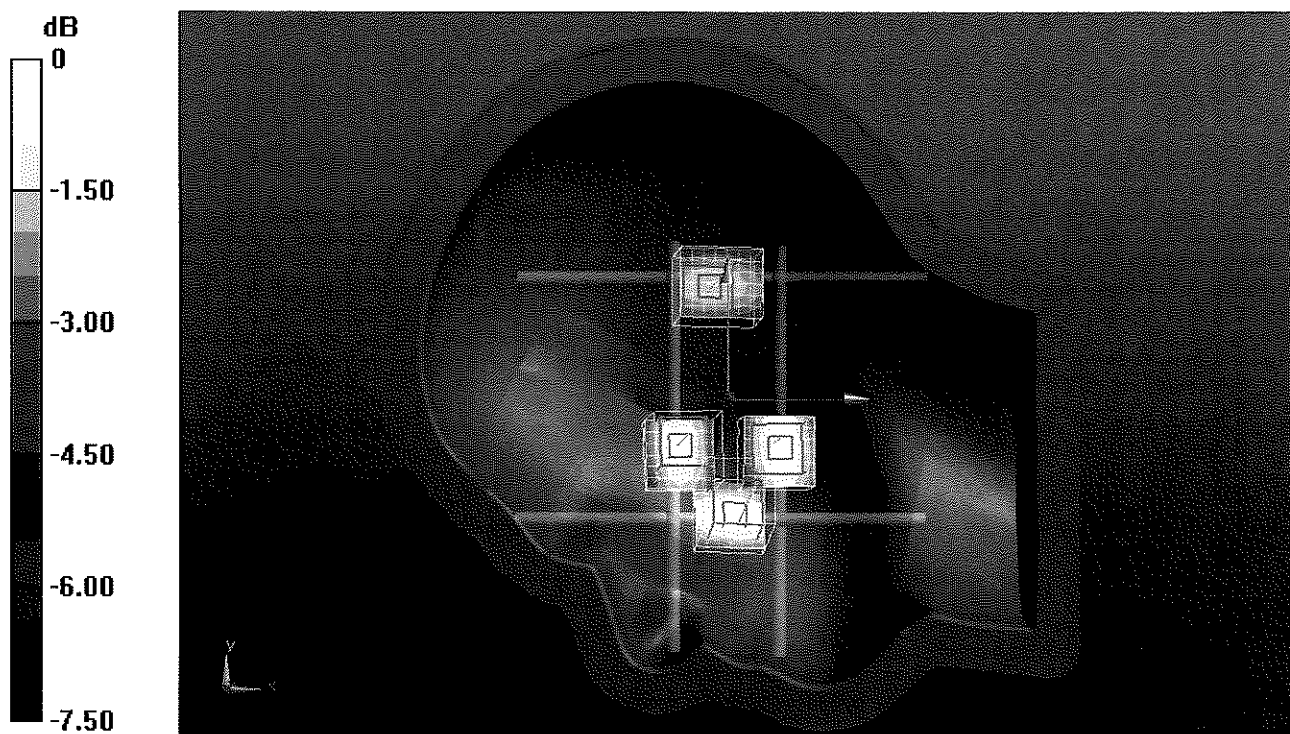
SAM Right/Head/Ear/Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.76 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 2.32 W/kg

SAR(1 g) = 1.66 W/kg; SAR(10 g) = 1.14 W/kg

Maximum value of SAR (measured) = 2.11 W/kg



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



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D835V2-4d132_Jan19**

CALIBRATION CERTIFICATE

Object **D835V2 - SN:4d132**

Calibration procedure(s) **QA CAL-05.v11**
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

BN ✓
02/06/2019

Calibration date: **January 22, 2019**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	31-Dec-18 (No. EX3-7349_Dec18)	Dec-19
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

Calibrated by: **Leif Klysner** **Laboratory Technician**

Signature

Leif Klysner

Approved by: **Katja Pokovic** **Technical Manager**

Katja Pokovic

Issued: January 22, 2019

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5.0 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.3 $\pm$ 6 %	0.92 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.59 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.23 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.6 $\pm$ 6 %	0.99 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.67 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.35 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	49.6 Ω - 3.6 j Ω
Return Loss	- 28.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 Ω - 6.2 j Ω
Return Loss	- 23.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.387 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
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Appendix (Additional assessments outside the scope of SCS 0108)

Measurement Conditions

DASY system configuration, as far as not given on page 1 and 3.

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L
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SAR result with SAM Head (Top)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.38 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.26 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.86 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.65 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.58 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Neck)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.42 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.38 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Ear)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.06 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.42 W/kg ± 16.9 % (k=2)

DASY5 Validation Report for Head TSL

Date: 17.01.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d132

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.92 \text{ S/m}$; $\epsilon_r = 41.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10, 10, 10) @ 835 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

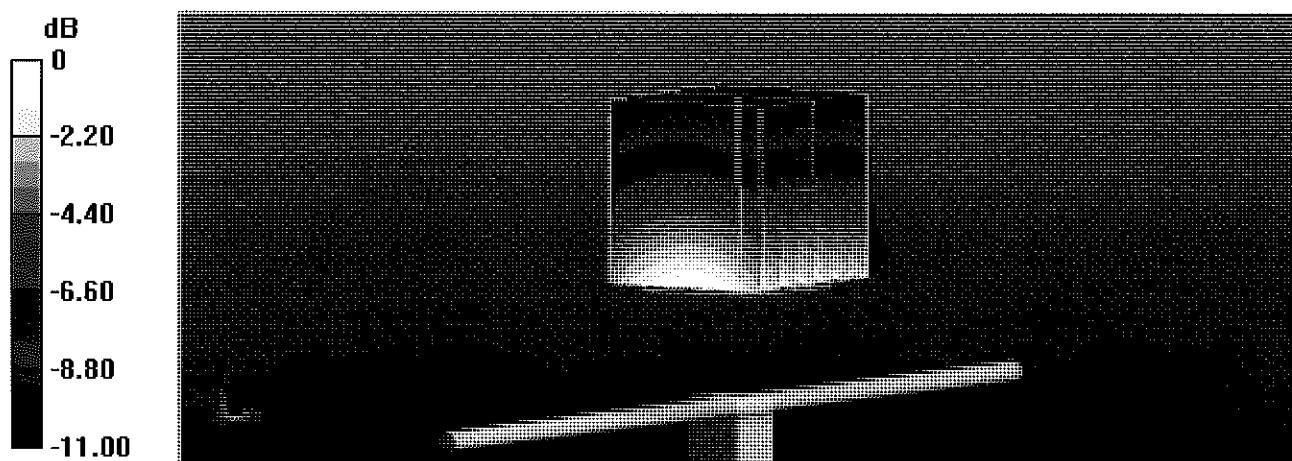
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 34.24 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.73 W/kg

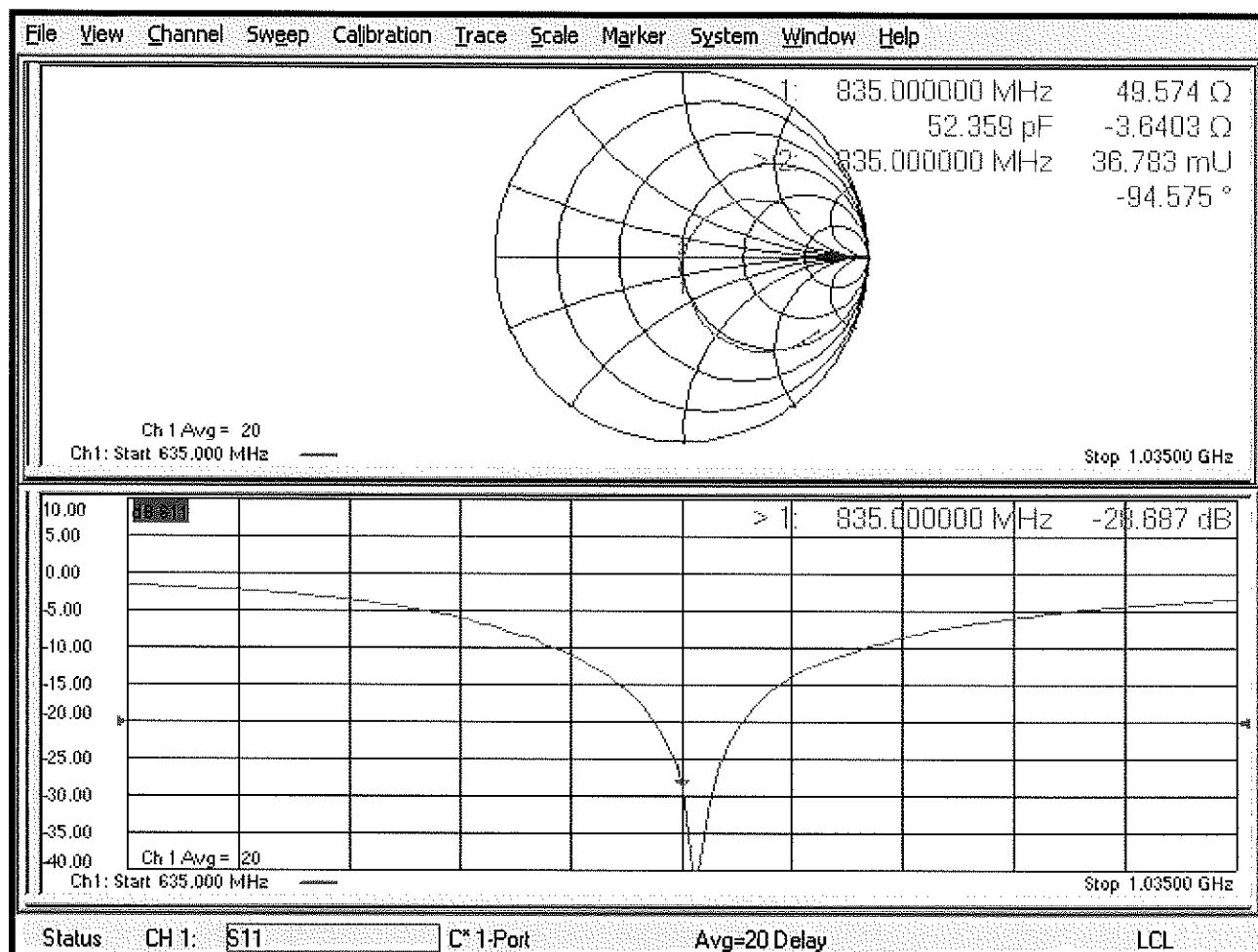
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 3.28 W/kg



0 dB = 3.28 W/kg = 5.16 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.01.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d132

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.99 \text{ S/m}$; $\epsilon_r = 54.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.15, 10.15, 10.15) @ 835 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

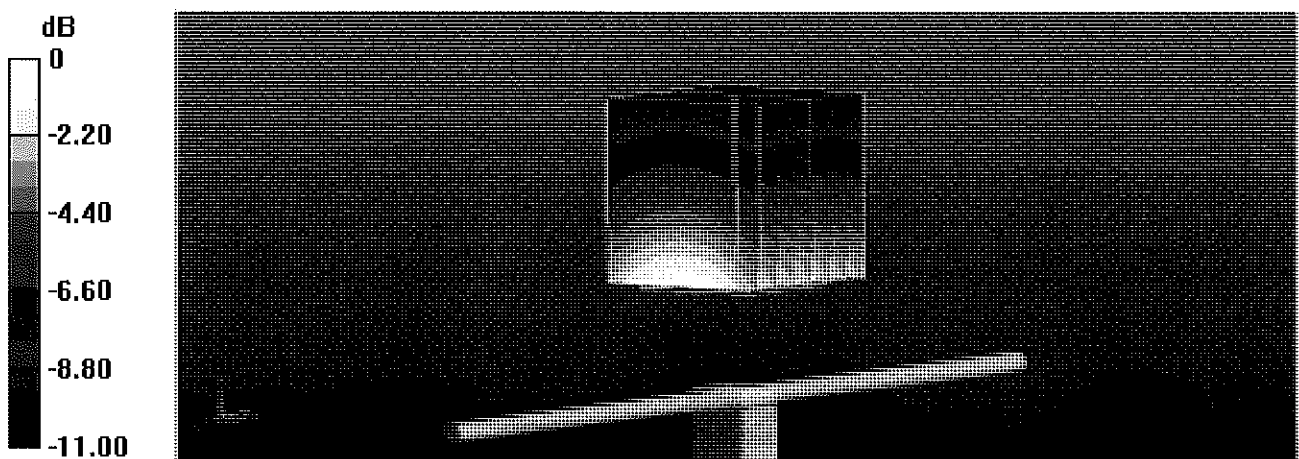
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 63.32 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 3.64 W/kg

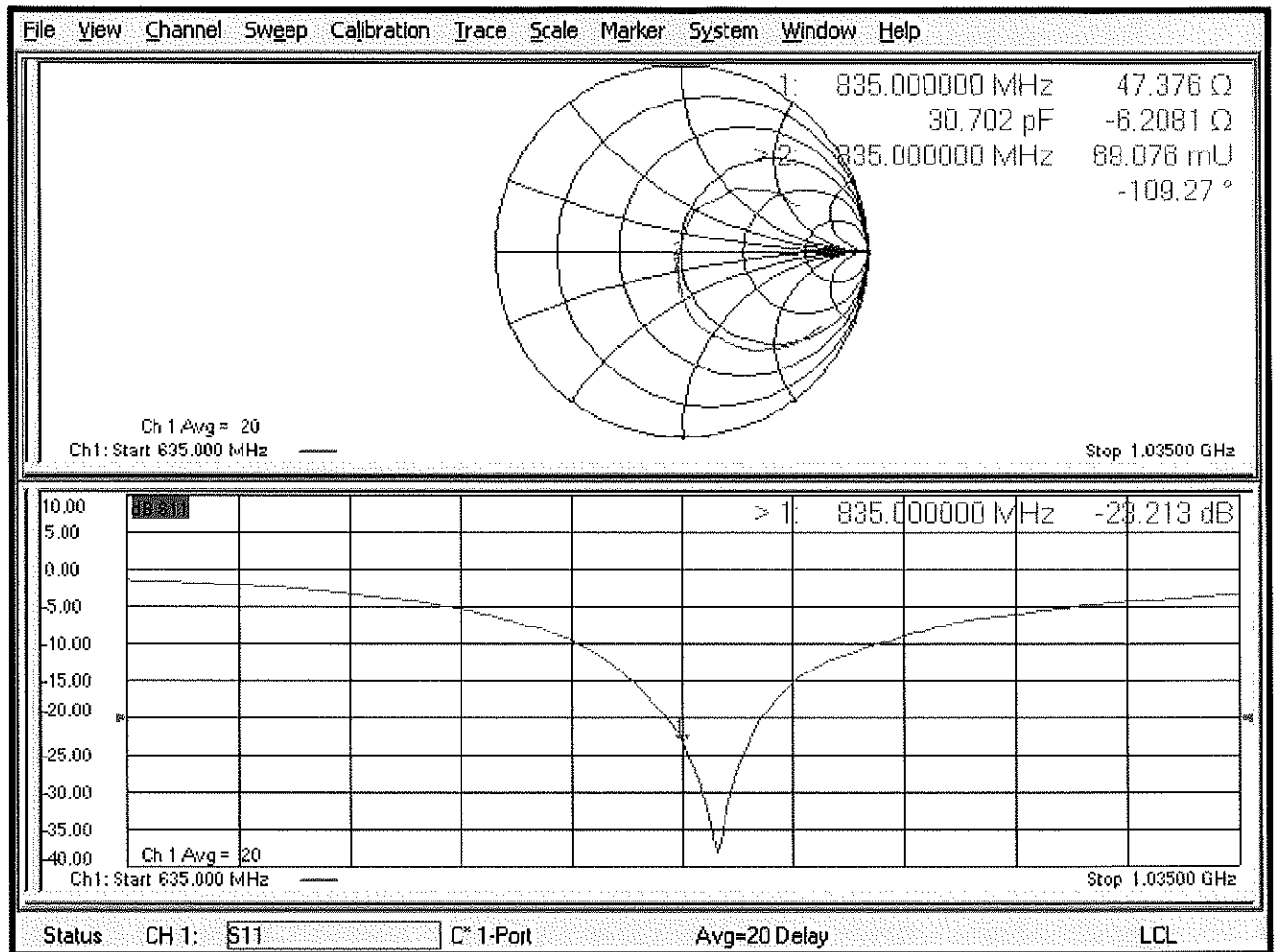
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.61 W/kg

Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.13 dBW/kg

Impedance Measurement Plot for Body TSL



DASY5 Validation Report for SAM Head

Date: 22.01.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d132

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.92 \text{ S/m}$; $\epsilon_r = 44.4$; $\rho = 1000 \text{ kg/m}^3$

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10, 10, 10) @ 835 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: SAM Head
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

Reference Value = 61.32 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.51 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 3.12 W/kg

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

Reference Value = 62.25 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.67 W/kg

SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.65 W/kg

Maximum value of SAR (measured) = 3.24 W/kg

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

Reference Value = 60.69 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 3.43 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.6 W/kg

Maximum value of SAR (measured) = 3.08 W/kg

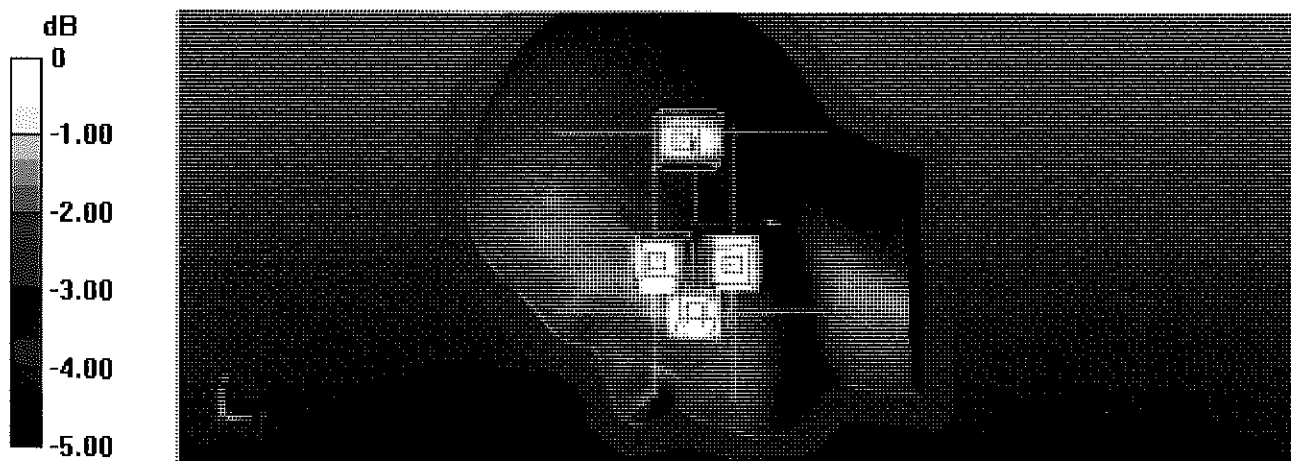
SAM/Head/Ear/Zoom Scan (8x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.79 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 2.94 W/kg

SAR(1 g) = 2.02 W/kg; SAR(10 g) = 1.36 W/kg

Maximum value of SAR (measured) = 2.62 W/kg



0 dB = 2.62 W/kg = 4.18 dBW/kg



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D1750V2-1150_Oct18**

CALIBRATION CERTIFICATE

Object **D1750V2 - SN:1150**

Calibration procedure(s) **QA CAL-05.v10**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **October 22, 2018**

BN ✓
10/30/2018

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	<i>M. Weber</i>
Approved by:	Katja Pokovic	Technical Manager	<i>K. Pokovic</i>

Issued: October 22, 2018

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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	V52.10.2
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	38.8 $\pm$ 6 %	1.33 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.5 $\pm$ 6 %	1.46 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	9.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	36.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.82 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.4 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	50.9 Ω - 0.4 j Ω
Return Loss	- 40.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 Ω - 0.1 j Ω
Return Loss	- 29.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.217 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 10, 2015

DASY5 Validation Report for Head TSL

Date: 22.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1150

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.33$ S/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

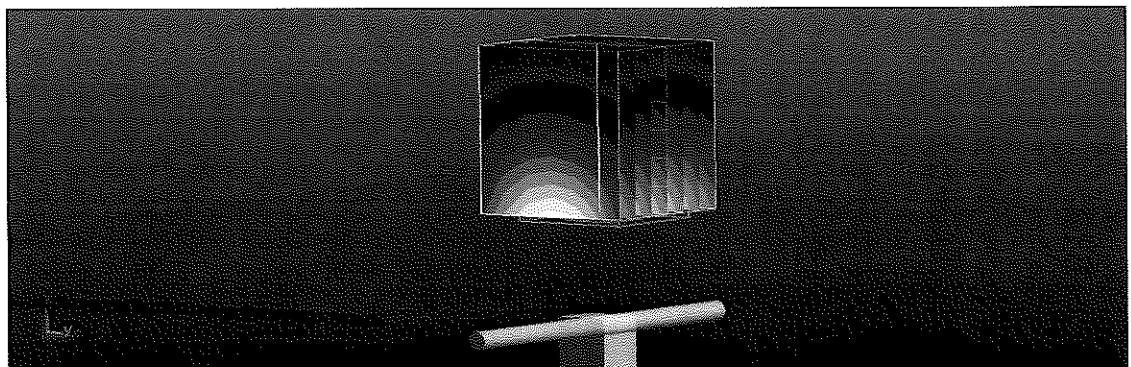
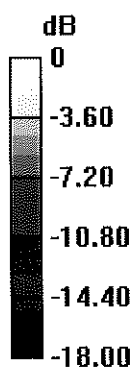
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 108.1 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 16.7 W/kg

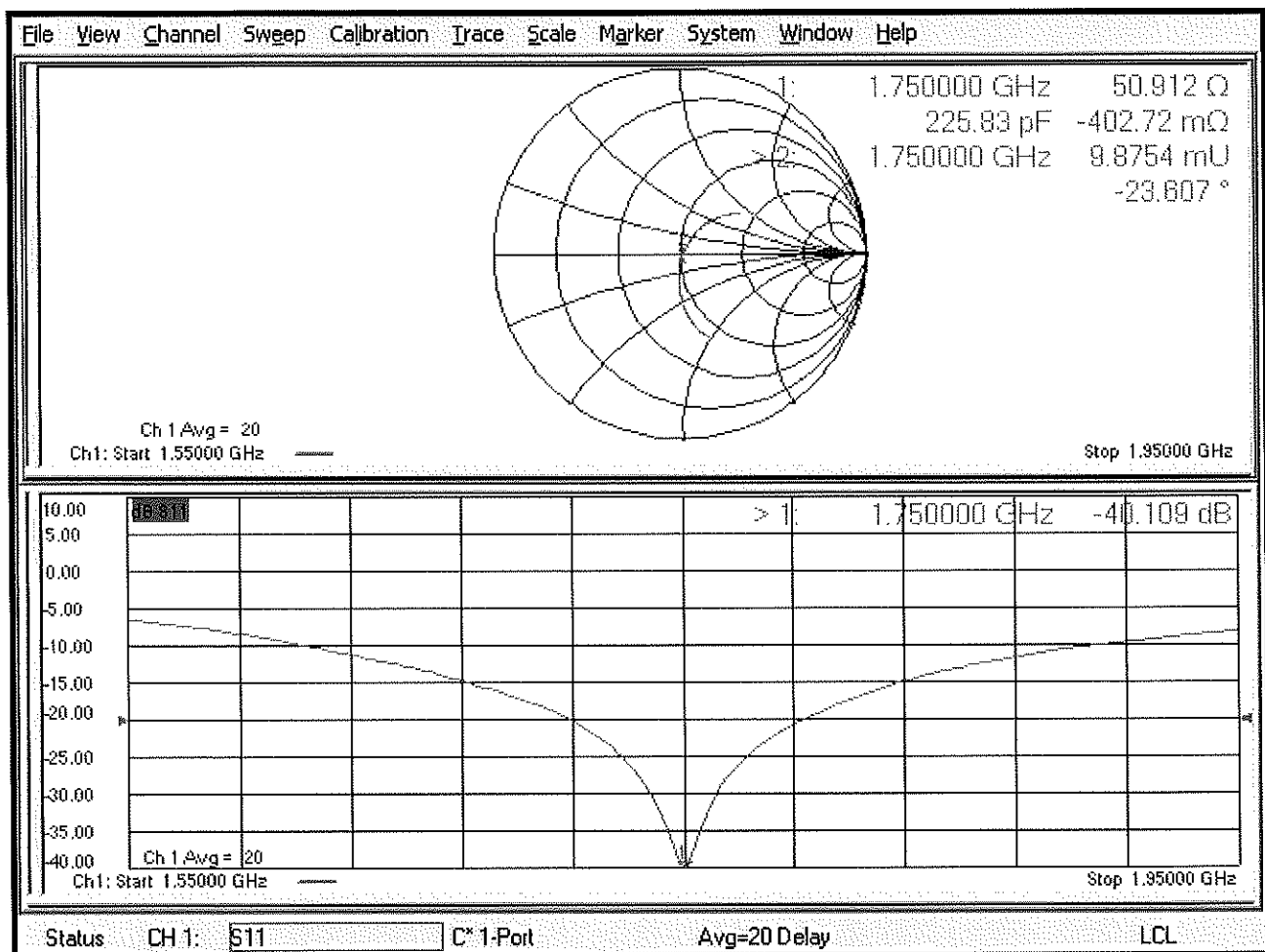
SAR(1 g) = 9.02 W/kg; SAR(10 g) = 4.76 W/kg

Maximum value of SAR (measured) = 14.0 W/kg



0 dB = 14.0 W/kg = 11.46 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1150

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.46$ S/m; $\epsilon_r = 53.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

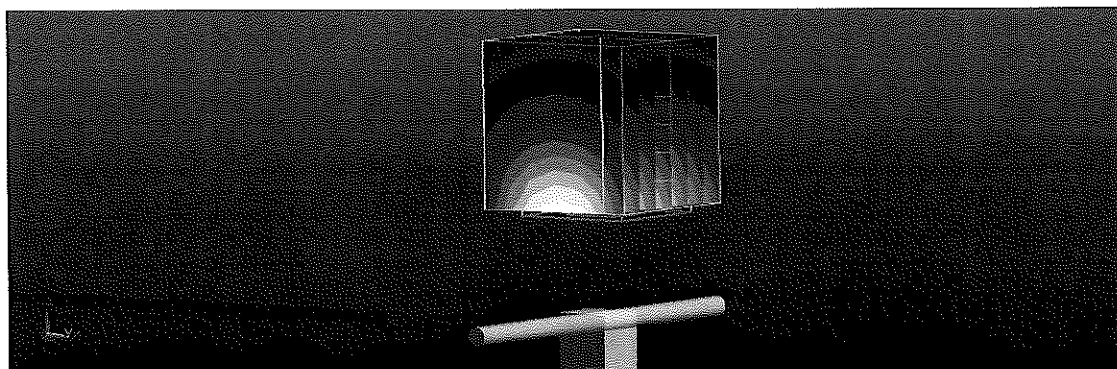
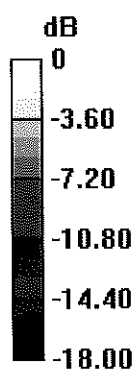
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.1 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 16.0 W/kg

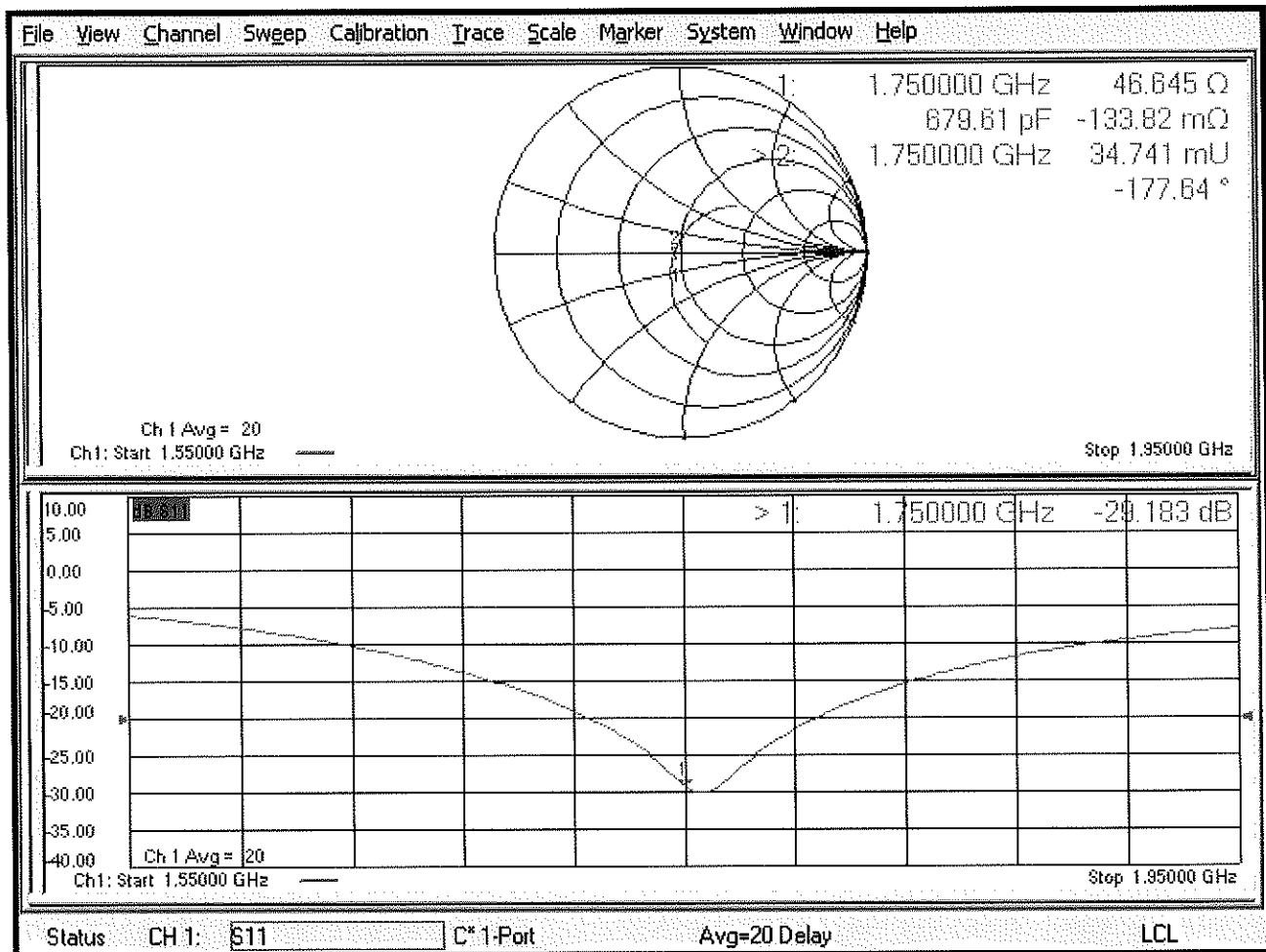
SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.82 W/kg

Maximum value of SAR (measured) = 13.6 W/kg



0 dB = 13.6 W/kg = 11.34 dBW/kg

Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D1900V2-5d080_Oct18**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN:5d080**

Calibration procedure(s) **QA CAL-05.v10
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **October 23, 2018**

*BN ✓
10-30-2018*

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

Calibrated by: **Jeton Kastrati** Function: **Laboratory Technician** Signature: *[Signature]*

Approved by: **Katja Pokovic** Technical Manager

Issued: October 23, 2018

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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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.3 $\pm$ 6 %	1.40 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.8 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.7 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.9 $\pm$ 6 %	1.47 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	39.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 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	$52.5 \Omega + 7.9 j\Omega$
Return Loss	- 21.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.1 \Omega + 8.1 j\Omega$
Return Loss	- 21.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 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	June 28, 2006

DASY5 Validation Report for Head TSL

Date: 23.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ S/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.18, 8.18, 8.18) @ 1900 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

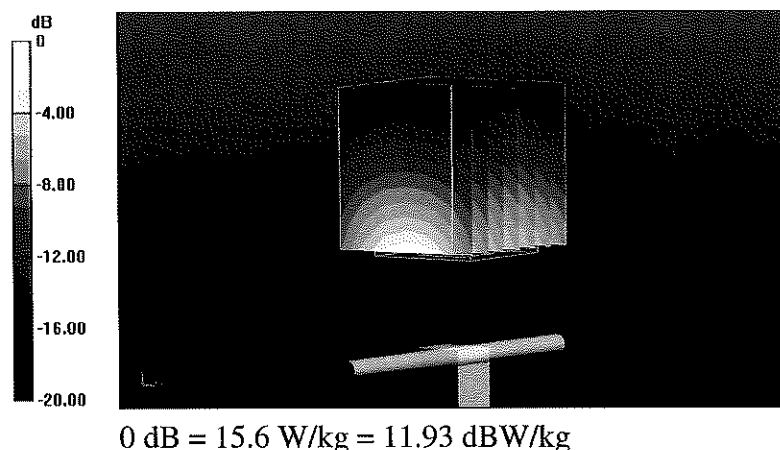
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 110.0 V/m; Power Drift = -0.05 dB

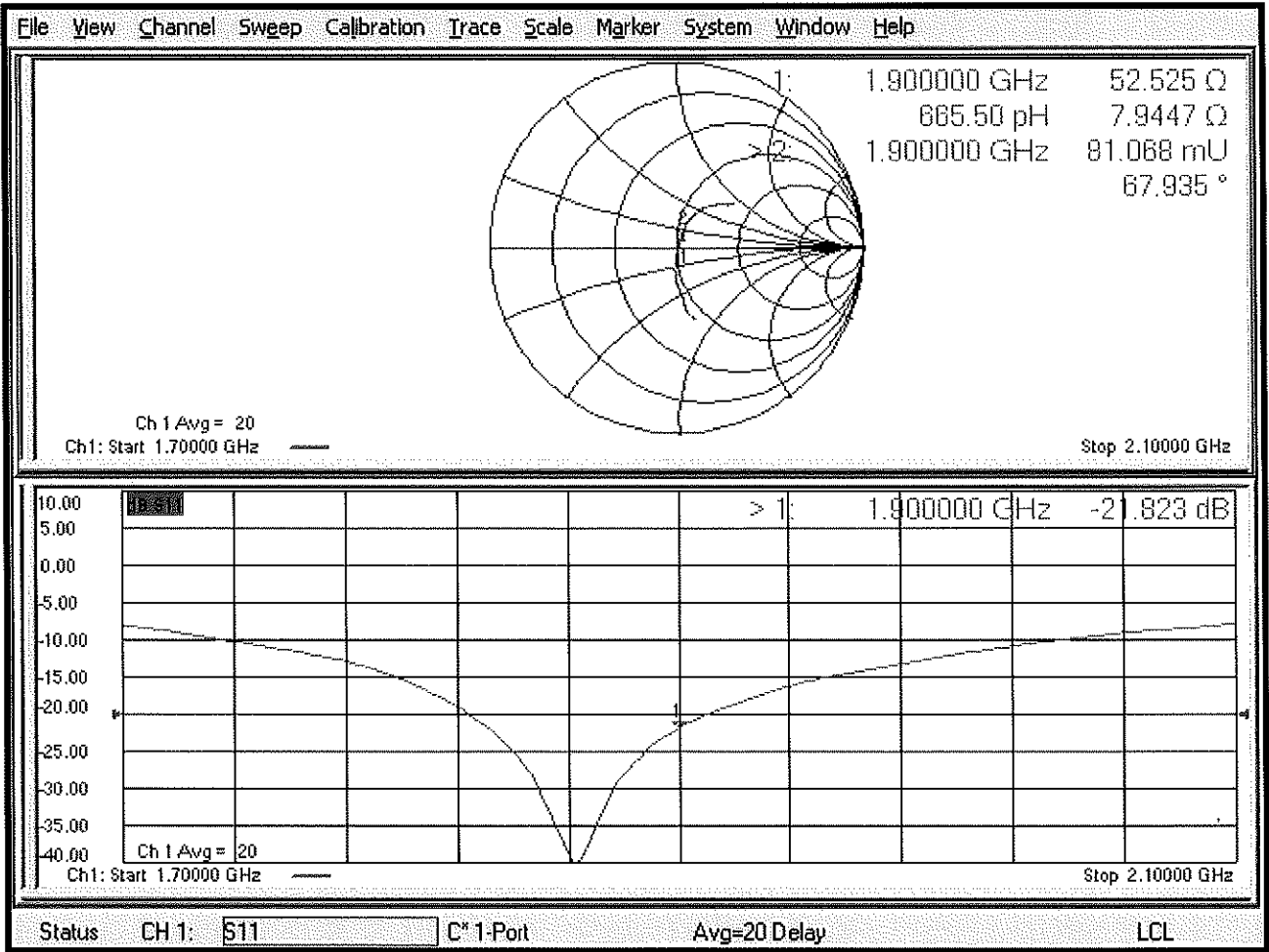
Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 9.93 W/kg; SAR(10 g) = 5.18 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.47$ S/m; $\epsilon_r = 52.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.15, 8.15, 8.15) @ 1900 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

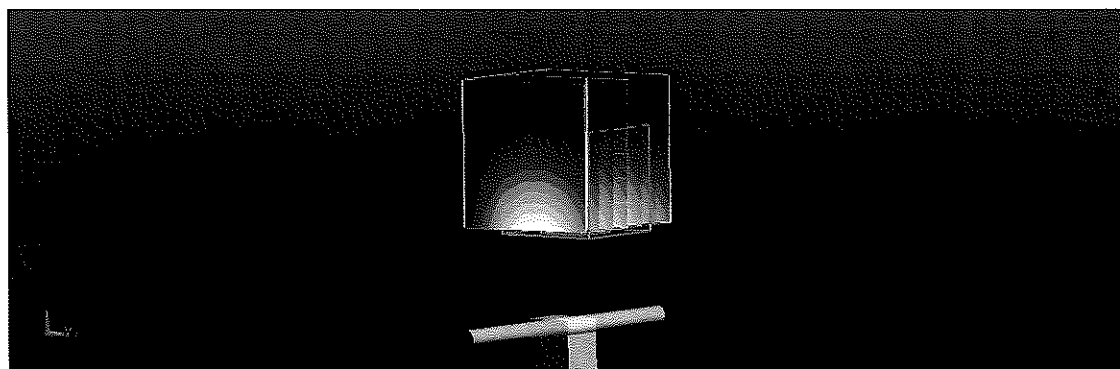
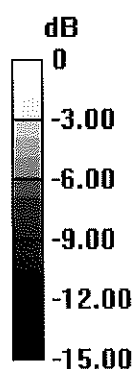
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.86 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 17.3 W/kg

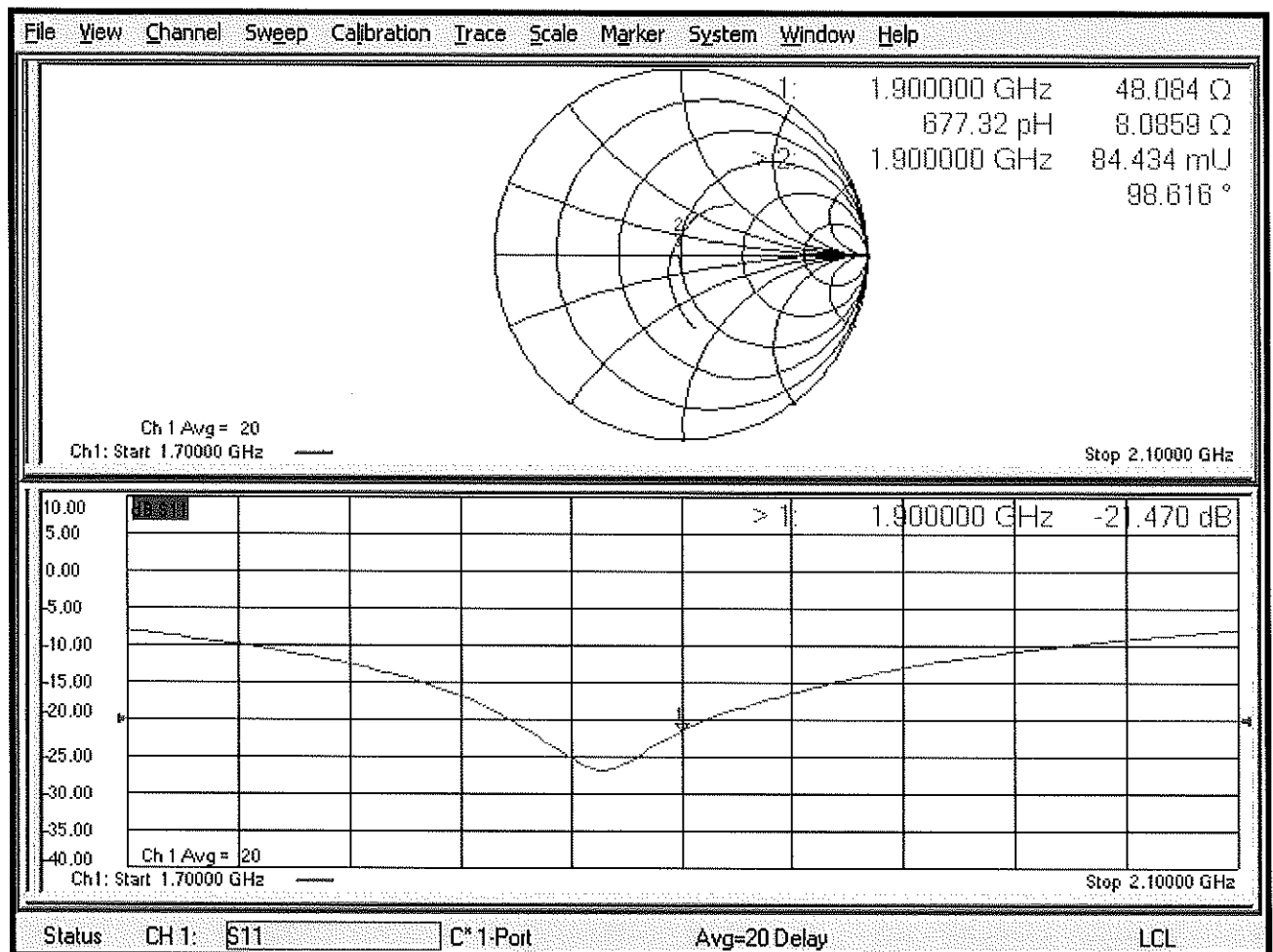
SAR(1 g) = 9.62 W/kg; SAR(10 g) = 5.09 W/kg

Maximum value of SAR (measured) = 14.1 W/kg



0 dB = 14.1 W/kg = 11.49 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: **D2450V2-797_Sep17**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:797**

Calibration procedure(s) **QA CAL-05.v9**
 Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **September 11, 2017**

SCV
10/03/2017
Extended PMV
9/20/2018

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 08327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-May-17 (No. EX3-7349_May17)	May-18
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-08	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

Calibrated by: **Michael Weber** Name: **Michael Weber** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature

Issued: September 11, 2017

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.8 $\pm$ 6 %	1.86 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	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.7 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	6.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.8 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.9 $\pm$ 6 %	2.04 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	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.1 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.2 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	$53.8 \Omega + 7.4 j\Omega$
Return Loss	- 21.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$49.7 \Omega + 9.1 j\Omega$
Return Loss	- 20.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 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	January 24, 2006

DASY5 Validation Report for Head TSL

Date: 11.09.2017

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.86$ S/m; $\epsilon_r = 37.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.12, 8.12, 8.12); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 113.5 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 26.9 W/kg

SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.28 W/kg

Maximum value of SAR (measured) = 21.6 W/kg

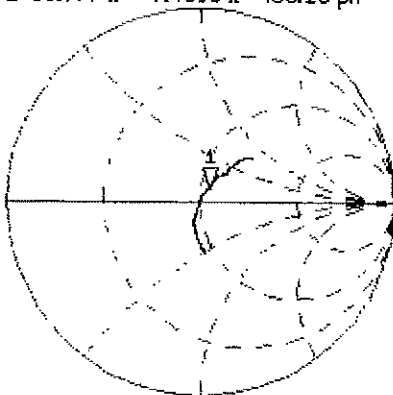


0 dB = 21.6 W/kg = 13.34 dBW/kg

Impedance Measurement Plot for Head TSL

11 Sep 2017 11:52:57
 CH1 S11 1 U FS 1: 53.777 Ω 7.4395 Ω 483.28 μ H 2 450.000 000 MHz

*
 Del
 CA



Avg
 16

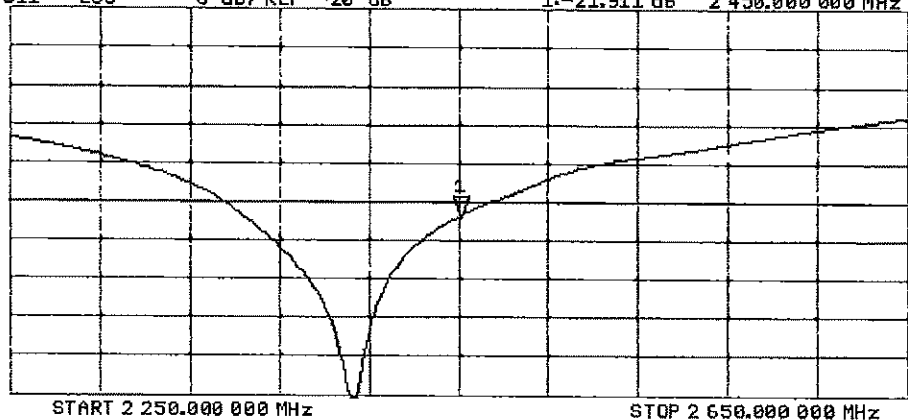
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -21.911 dB 2 450.000 000 MHz

CA

Avg
 16

H1d



DASY5 Validation Report for Body TSL

Date: 11.09.2017

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.04$ S/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.1, 8.1, 8.1); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAB4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

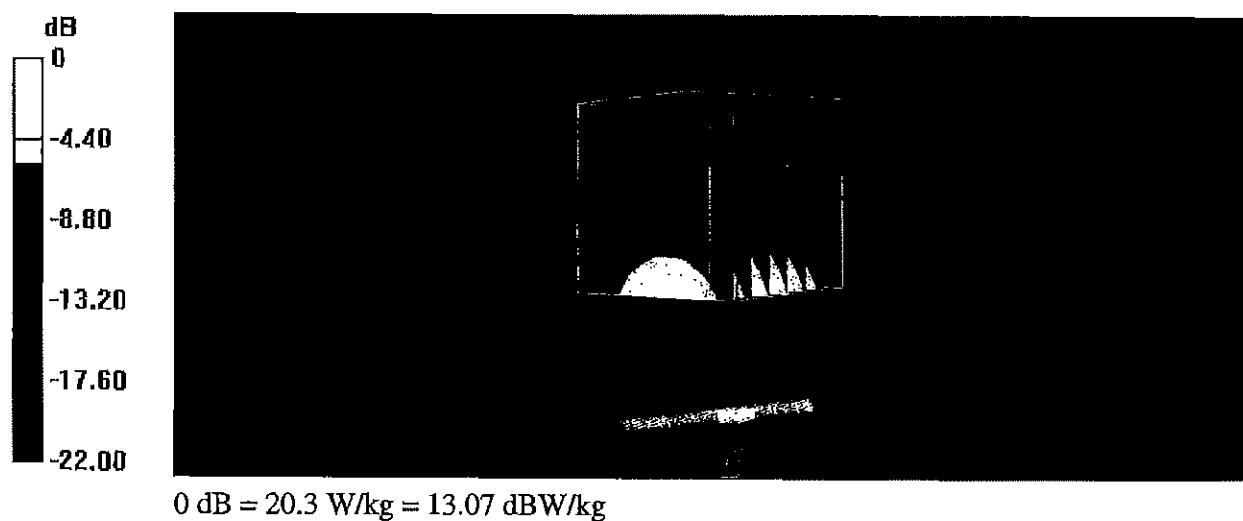
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 105.4 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 25.6 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.14 W/kg

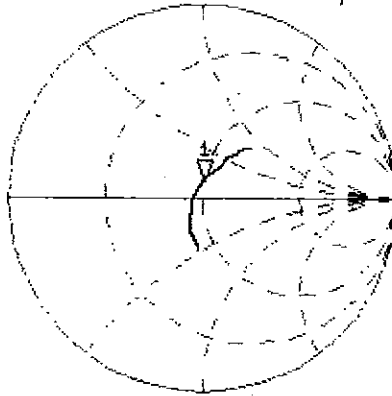
Maximum value of SAR (measured) = 20.3 W/kg



Impedance Measurement Plot for Body TSL

11 Sep 2017 11:52:10
 CH1 S11 1 U FS 1: 49.725 Ω 9.0703 Ω 589.22 pH 2 450.000 000 MHz

 Del
 CA



Avg
 16

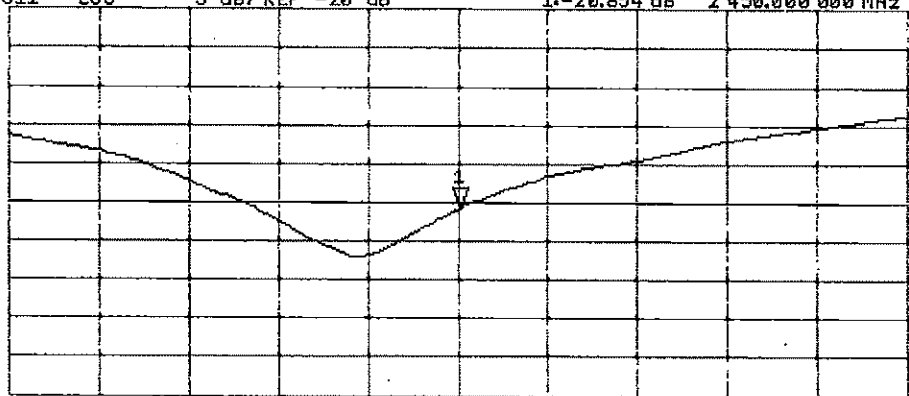
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.854 dB 2 450.000 000 MHz

CA

Avg
 16

H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

Certification of Calibration

Object: D2450V2 – SN: 797

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

Extended Calibration date: September 11, 2018

Description: SAR Validation Dipole at 2450 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Amplifier Research	1551G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
Agilent	8753ES	S-Parameter Vector Network Analyzer	8/30/2018	Annual	8/30/2019	MY40003841
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/15/2018	Annual	5/15/2019	1070
SPEAG	EX3DV4	SAR Probe	7/20/2018	Annual	7/20/2019	7410
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2018	Annual	7/11/2019	1322
SPEAG	ES3DV3	SAR Probe	3/13/2018	Annual	3/13/2019	3319
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/7/2018	Annual	3/7/2019	1368
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1339018
Anritsu	ML2495A	Power Meter	10/22/2017	Annual	10/22/2018	1328004
Agilent	NS182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Seekonk	NC-100	Torque Wrench	7/11/2018	Annual	7/11/2019	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path.

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halfoster	Team Lead Engineer	<i>BRODIE HALFOSTER</i>
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	<i>KOK</i>

DIPOLE CALIBRATION EXTENSION

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

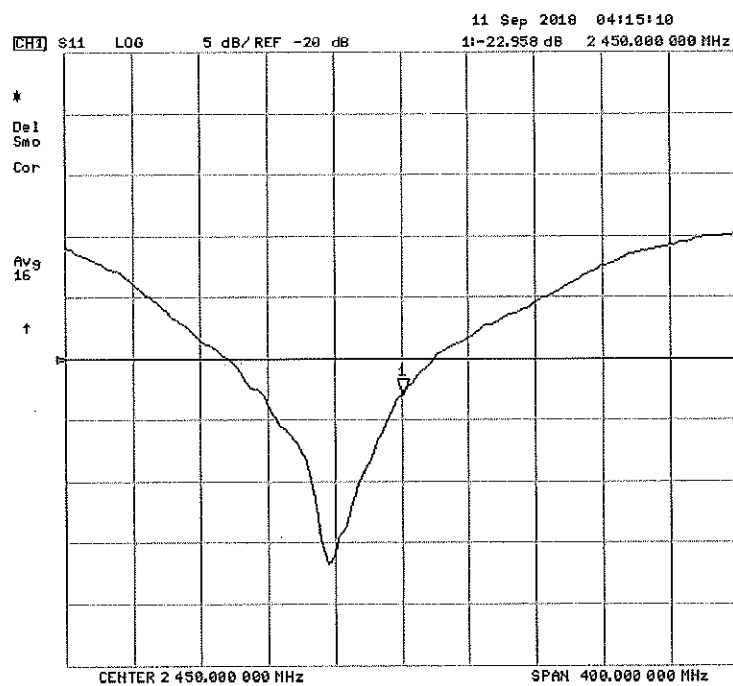
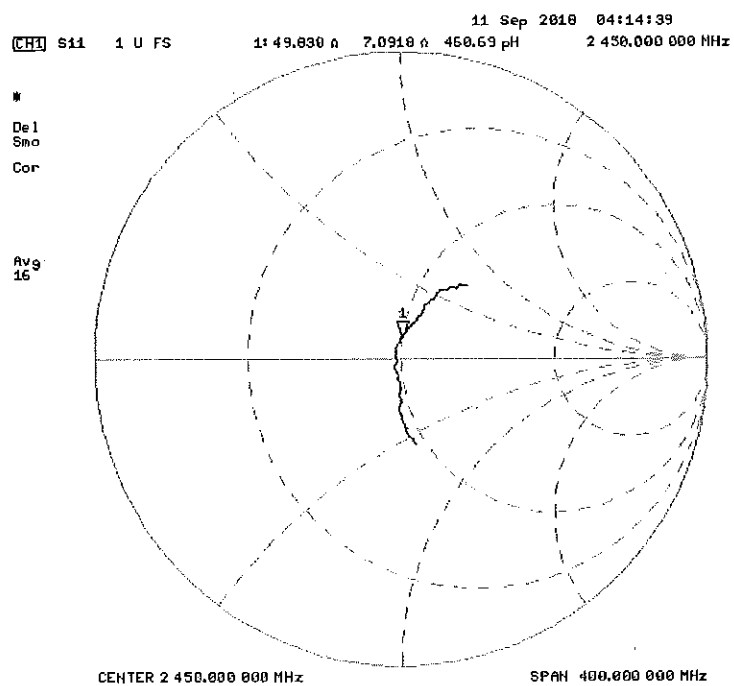
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does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

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

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
9/11/2017	9/11/2018	1.152	5.27	5.52	4.74%	2.48	2.54	2.42%	53.8	49.8	4	7.4	7.1	0.3	-21.9	-23	-4.80%	PASS

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
9/11/2017	9/11/2018	1.152	5.11	5.17	1.17%	2.42	2.37	-2.07%	49.7	49.8	0.1	9.1	7.2	1.9	-20.9	-22.6	-8.20%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL



Object:

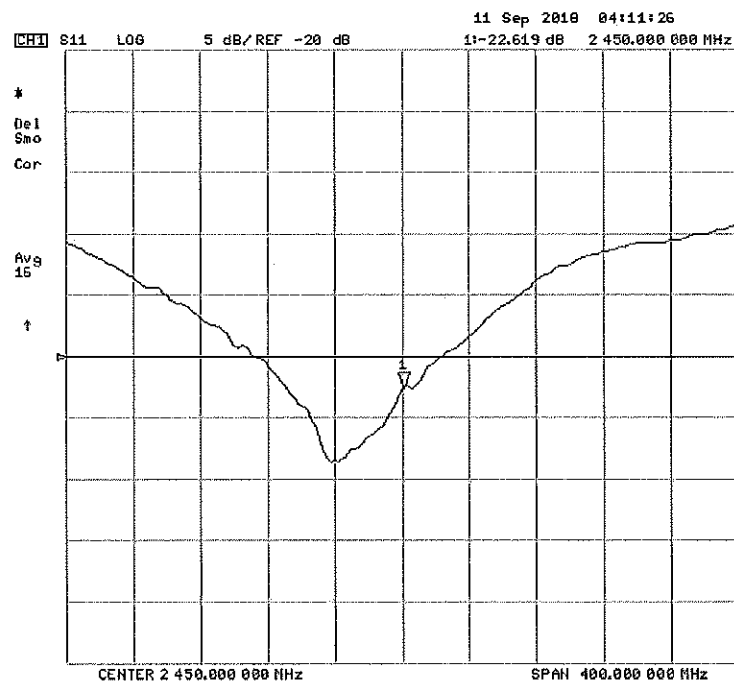
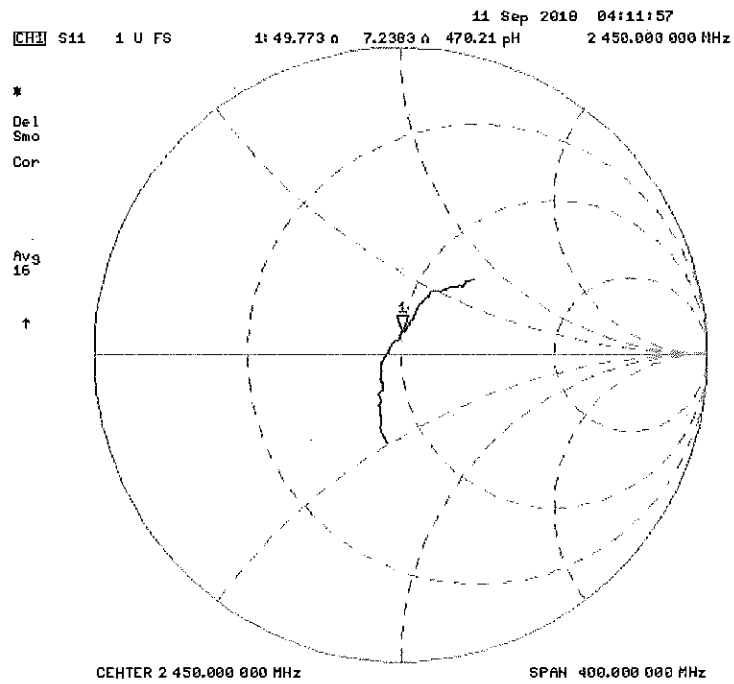
D2450V2 -- SN: 797

Date Issued:

09/11/2018

Page 3 of 4

Impedance & Return-Loss Measurement Plot for Body TSL





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D2600V2-1004_Apr18**

CALIBRATION CERTIFICATE

Object **D2600V2 - SN:1004**

Calibration procedure(s)

OPTICAL BEAM
 Calibration procedure for optical beam splitter with 100 MHz

Calibration date: **April 11, 2018**

BN ✓
05-01-2018
Extended
04-20-2019

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

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

Calibrated by:	Name Michael Weber	Function Laboratory Technician	Signature <i>[Signature]</i>
Approved by:	Name Katja Pokovic	Technical Manager	<i>[Signature]</i>

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Issued: April 12, 2018



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.8 $\pm$ 6 %	2.03 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	55.9 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.1 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.1 $\pm$ 6 %	2.19 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	54.8 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.7 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	47.7 Ω - 5.7 j Ω
Return Loss	- 24.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.0 Ω - 3.8 j Ω
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 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	December 23, 2006

DASY5 Validation Report for Head TSL

Date: 11.04.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.03$ S/m; $\epsilon_r = 37.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.7, 7.7, 7.7); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

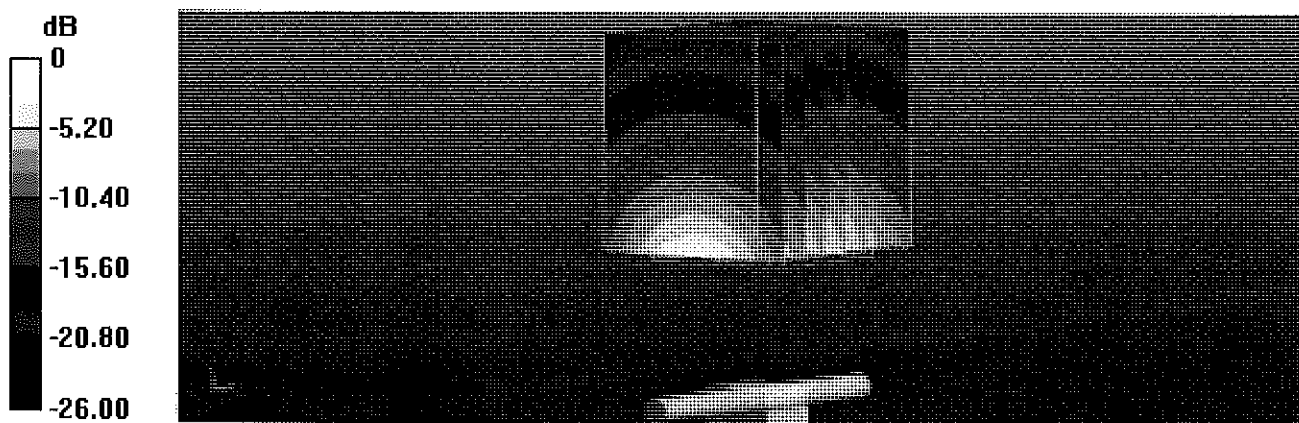
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 118.5 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 28.6 W/kg

SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.35 W/kg

Maximum value of SAR (measured) = 23.9 W/kg



Impedance Measurement Plot for Head TSL

11 Apr 2018 11:25:16
 [CH1] S11 1 U FS 1: 47.721 Ω -5.6836 Ω 10.770 pF 2 500.000 000 MHz

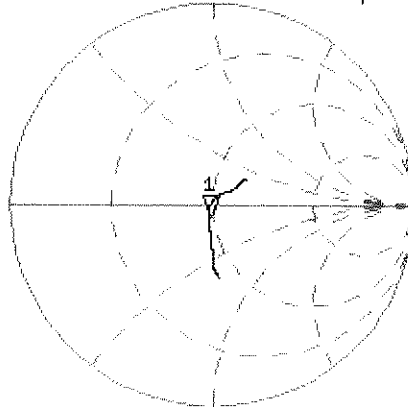
*

De1

CA

Avg
16

H1d

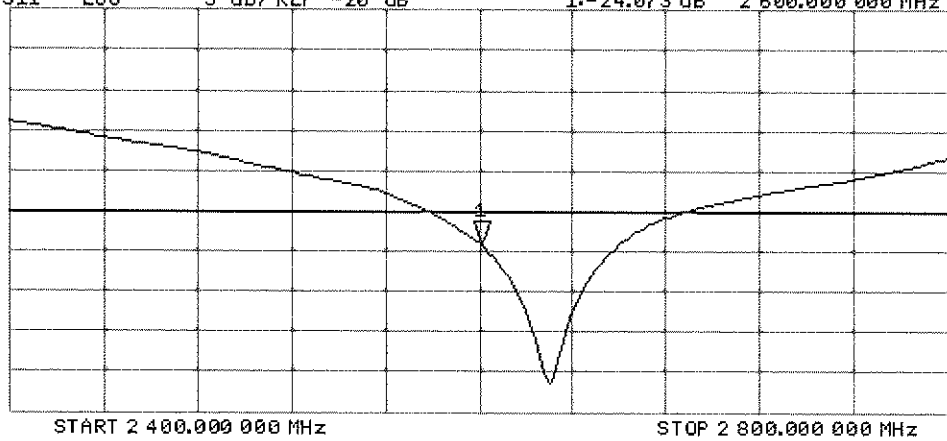


CH2 S11 LOG 5 dB/REF -20 dB 1:-24.073 dB 2 500.000 000 MHz

CA

Avg
16

H1d



DASY5 Validation Report for Body TSL

Date: 11.04.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.19$ S/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.81, 7.81, 7.81); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

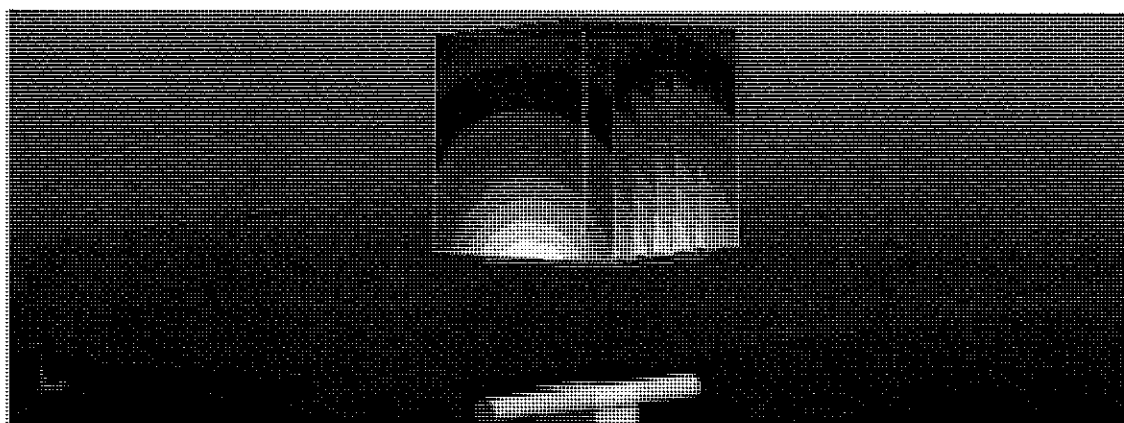
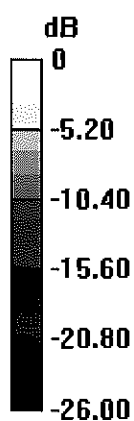
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 108.5 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 28.3 W/kg

SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.2 W/kg

Maximum value of SAR (measured) = 22.9 W/kg

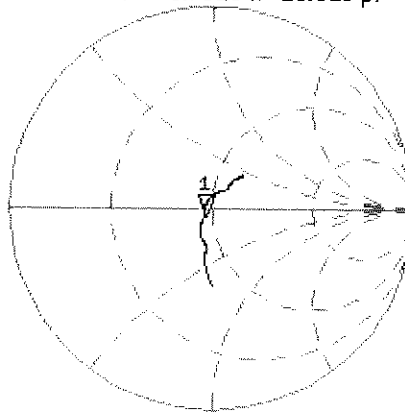


0 dB = 22.9 W/kg = 13.60 dBW/kg

Impedance Measurement Plot for Body TSL

CH1 S11 1 U FS 11 Apr 2018 11:24:36
 1: 46.039 Ω -3.7520 Ω 16.315 pF 2 600.000 000 MHz

*
 Del
 CA



Avg
 16

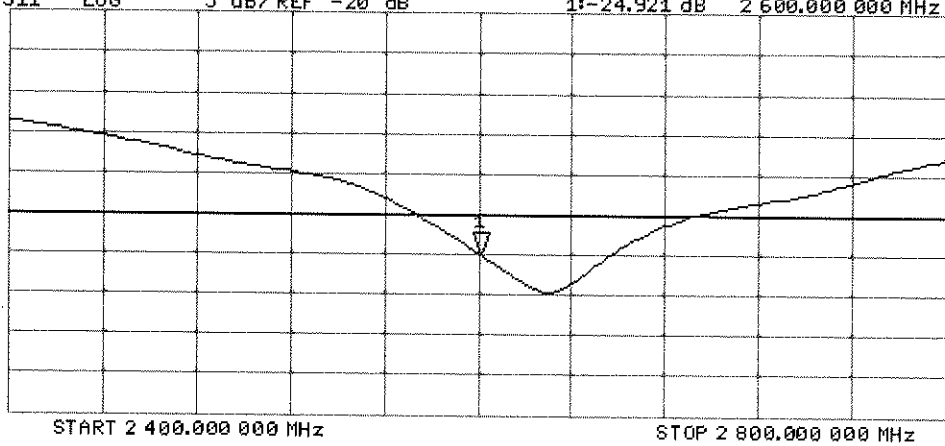
H1 d

CH2 S11 LOG 5 dB/REF -20 dB 1: -24.921 dB 2 600.000 000 MHz

CA

Avg
 16

H1 d



Certification of Calibration

Object D2600V2 – SN: 1004

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

Extension Calibration date: 4/11/2019

Description: SAR Validation Dipole at 2600 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	3/11/2019	Annual	3/11/2020	US39170122
Agilent	N5182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1027293
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1126066
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647811
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/11/2018	Annual	7/11/2019	N/A
SPEAG	EX3DV4	SAR Probe	6/25/2018	Annual	6/25/2019	7409
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2019	Annual	2/13/2020	665
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	7417
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halfoster	Test Engineer	<i>BRODIE HALFOSTER</i>
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	<i>KOK</i>

DIPOLE CALIBRATION EXTENSION

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

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

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

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
4/11/2018	4/11/2019	1.140	5.59	5.51	-1.43%	2.51	2.47	-1.59%	47.7	48.5	0.8	-5.7	-5.1	0.6	-24.1	-25.6	-6.30%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
4/11/2018	4/11/2019	1.140	5.48	5.65	3.10%	2.47	2.48	0.40%	46	46.6	0.6	-3.8	-4.7	0.9	-24.9	-24.5	1.60%	PASS