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TEST REPORT

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1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2019-07-25

2. Use of Report : Certification

3. Name of Product and Model : Mobile phone

- Model Number : SC-02M, SCV46
- Manufacturer and Country of Origin : SAMSUNG ELECTRONICS VIETNAM CO.,LTD. / Vietnam

4. FCC ID Number : A3LSMA102JPN

5. Date of Test : 2019-08-05 ~ 2019-09-06

6. Test Standards : IEEE 1528-2013, KDB Publication

7. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Hosik Sim (Signature)	Technical Manager Name : Gyuhyun Shim (Signature)

2019-09-09

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

Report revision history

Date	Revision	Page No
2019-08-23	Initial report	-
2019-09-09	Updated Simultaneous Transmission Configurations Notes and Deleted Appendix(validation of the power reduction) Added LTE Band 12 and 17	5,6,7,9,13,29, 30,40,41,43,44, 46,48,51,57,63, 73,88,100,110, 114, 154~161, 210~212, 214

Please note: Report KR19-SPF0021-B issued on 2019-09-09 supersedes previously issued report KR19-SPF0021-A issued on 2019-08-23

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1. General information

Client	:	Samsung Electronics Co., Ltd.
Address	:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Manufacturer	:	SAMSUNG ELECTRONICS VIETNAM CO.,LTD.
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Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-3327, G-198, C-3706, T-1849 Industry Canada Registration No. : 8035A KOLAS No.: KT231

1.1 Report Overview

This report details the results of testing carried out on the samples listed in section 2, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2. Device information

2.1 Basic description

Product Name		Mobile phone		
Product Model Number		SC-02M, SCV46		
Product Manufacturer		Samsung Electronics		
Product Serial Number	Radiation	R38M50A2ESV		
		R38M50A2HZZ		
		R38M50A2HJB		
	Conduction	R38M50A27RN		
Device Overview		Band & Mode	Operating Modes	Tx Frequency (㎒)
		GSM/GPRS/EDGE 850	Voice/Data	824.2 ~ 848.8
		GSM/GPRS/EDGE 1900	Voice/Data	1 850.2 ~ 1 909.8
		UMTS 850	Voice/Data	826.4 ~ 846.6
		LTE Band 5	Voice/Data	824.7 ~ 848.3
		LTE Band 12	Voice/Data	699.7 ~ 715.3
		LTE Band 17	Voice/Data	706.5 ~ 713.5
		LTE Band 26	Voice/Data	814.7 ~ 848.3
		LTE Band 41	Voice/Data	2 498.5 ~ 2 687.5
		2.4 ㎓ WLAN	Voice/Data	2 412.0 ~ 2 462.0
		U-NII-1	Voice/Data	5 180.0 ~ 5 240.0
		U-NII-2A	Voice/Data	5 260.0 ~ 5 320.0
		U-NII-2C	Voice/Data	5 500.0 ~ 5 720.0
		U-NII-3	Voice/Data	5 745.0 ~ 5 825.0
		Bluetooth	Data	2 402.0 ~ 2 480.0
		NFC	Data	13.56

2.2 Summary of SAR Test Results

Band	Equipment Class	Highest Reported 1g SAR (W/kg)		
		Head	Body-Worn	Hotspot
GSM/GPRS/EDGE 850	PCE	0.28	**0.44**	0.55
GSM/GPRS/EDGE 1900	PCE	< 0.1	0.21	0.14
UMTS 850	PCE	0.18	0.35	0.46
LTE Band 5	PCE	N/A	N/A	N/A
LTE Band 12	PCE	< 0.1	0.17	0.22
LTE Band 17	PCE	N/A	N/A	N/A
LTE Band 26	PCE	0.20	0.41	0.51
LTE Band 41	PCE	0.10	0.32	**0.58**
2.4㎓ WLAN	DTS	0.20	0.21	0.48
U-NII-1	NII	N/A	N/A	N/A
U-NII-2A	NII	0.29	< 0.1	N/A
U-NII-2C	NII	0.32	< 0.1	N/A
U-NII-3	NII	**0.37**	0.10	N/A
Bluetooth	DSS/DTS	N/A	N/A	N/A
Simultaneous SAR per KDB 690783 D01v01r03		0.95	0.66	0.94

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2.3 Power Reduction for SAR

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

2.4 Maximum Tune-up power

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

2.4.1 Maximum 2G/3G/4G Output Power

Band	Mode	Output Power (dBm)		
		Target	Max. Allowed	SAR Test
GSM 850	GSM Voice	33.00	**34.00**	**Yes**
	GPRS 1 TX	33.00	**34.00**	No
	GPRS 2 TX	31.50	**32.50**	No
	GPRS 3 TX	30.00	**31.00**	**Yes**
	GPRS 4 TX	28.00	**29.00**	No
	EGPRS 1 TX	27.00	**28.00**	No
	EGPRS 2 TX	25.00	**26.00**	No
	EGPRS 3 TX	24.00	**25.00**	No
	EGPRS 4 TX	22.50	**23.50**	No
GSM 1900	GSM Voice	30.00	**31.00**	**Yes**
	GPRS 1 TX	30.00	**31.00**	No
	GPRS 2 TX	27.50	**28.50**	No
	GPRS 3 TX	26.00	**27.00**	**Yes**
	GPRS 4 TX	24.50	**25.50**	No
	EGPRS 1 TX	26.00	**27.00**	No
	EGPRS 2 TX	24.00	**25.00**	No
	EGPRS 3 TX	23.00	**24.00**	No
	EGPRS 4 TX	21.50	**22.50**	No
WCDMA V	RMC	24.00	**25.00**	**Yes**
	HSDPA	23.00	**24.00**	No
	HSUPA	20.00	**21.00**	No
	DC-HSDPA	23.00	**24.00**	No
LTE Band 5		24.50	**25.50**	*No
LTE Band 12		23.00	**24.00**	**Yes**
LTE Band 17		23.00	**24.00**	*No
LTE Band 26		24.50	**25.50**	**Yes**
LTE Band 41		24.00	**25.00**	**Yes**

Notes:

LTE Band 5 Measured Results

SAR for LTE Band 5 (Frequency range: 824.0 - 849.0 ㎒) is covered by LTE Band 26 (Frequency range: 814.0 - 849.0 ㎒) due to overlapping frequency range, same maximum tune-up limit and smaller channel bandwidth.

LTE Band 17 Measured Results

SAR for LTE Band 17 (Frequency range: 706.5 – 713.5 ㎒) is covered by LTE Band 12 (Frequency range: 699.7 - 715.3 ㎒) due to overlapping frequency range, same maximum tune-up limit and smaller channel bandwidth.

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2.4.2 Maximum WLAN and Bluetooth Output Power

Band	Mode	Channel	Output Power (dB m)		
			Target	Max. Allowed	SAR Test
WLAN 2.4 GHz	802.11b	1 ~ 11	18.00	**19.00**	Yes
	802.11g	1 ~ 10	16.00	**17.00**	No
		11	11.00	**12.00**	
	802.11n(HT20)	1	14.00	**15.00**	No
		2 ~ 10	16.00	**17.00**	
		11	11.00	**12.00**	

Band	Mode	Channel	Output Power (dB m)		
			Target	Max. Allowed	SAR Test
WLAN 5 GHz	802.11a	36 ~ 165	16.00	**17.00**	Yes
	802.11n(HT20)	36 ~ 165	15.00	**16.00**	No
	802.11n(HT40)	38 ~ 159	14.00	**15.00**	No
	802.11ac(VHT20)	36 ~ 165	15.00	**16.00**	No
	802.11ac(VHT40)	38 ~ 159	14.00	**15.00**	No
	802.11ac(VHT80)	42 ~ 155	13.00	**14.00**	No

Band	Mode	Channel	Output Power (dB m)		
			Target	Max. Allowed	SAR Test
Bluetooth	BDR(GFSK)	All Channel	7.50	**8.50**	No
	EDR (π/4DQPSK)	All Channel	6.50	**7.50**	No
	EDR(8DPSK)	All Channel	6.50	**7.50**	No
	LE(GFSK)	All Channel	5.50	**6.50**	No

2.4.3 Reduced WLAN Output Power

Band	Mode	Channel	Output Power (dB m)		
			Target	Max. Allowed	SAR Test
WLAN 2.4 GHz	802.11b	1 ~ 11	11.00	**12.00**	Yes
	802.11g	1 ~ 11	11.00	**12.00**	No
	802.11n(HT20)	1 ~ 11	11.00	**12.00**	No

Band	Mode	Channel	Output Power (dB m)		
			Target	Max. Allowed	SAR Test
WLAN 5 GHz	802.11a	36 ~ 165	11.00	**12.00**	No
	802.11n(HT20)	36 ~ 165	11.00	**12.00**	No
	802.11n(HT40)	38 ~ 159	11.00	**12.00**	No
	802.11ac(VHT20)	36 ~ 165	11.00	**12.00**	No
	802.11ac(VHT40)	38 ~ 159	11.00	**12.00**	No
	802.11ac(VHT80)	42 ~ 155	11.00	**12.00**	Yes

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2.5 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.

Mode	Device Edge for SAR Testing					
	Front	Rear	Left Edge	Right Edge	Top	Bottom
GPRS 850	Yes	Yes	Yes	Yes	No	Yes
GPRS 1900	Yes	Yes	Yes	Yes	No	Yes
UMTS 850	Yes	Yes	Yes	Yes	No	Yes
LTE Band 12	Yes	Yes	Yes	Yes	No	Yes
LTE Band 26	Yes	Yes	Yes	Yes	No	Yes
LTE Band 41	Yes	Yes	Yes	No	No	Yes
2.4 ㎓ WLAN	Yes	Yes	Yes	No	Yes	No
5 ㎓ WLAN	Yes	Yes	No	No	No	No

Note: Particular DUT edges were not required to be evaluated for Hotspot SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v02r01. The antenna document shows the distances between the transmit antennas and the edges of the device. When Hotspot mode is enabled, NII operations is disabled

2.6 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the device for the model. Therefore, all SAR test 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 B.

2.7 Simultaneous Transmission Configurations

According to FCC KDB 447498 D01v06, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.
This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.

No	Scenario	RF Exposure Condition		
		Head	Body-Worn	Hotspot
1	GSM Voice + WLAN 2.4 ㎓	Yes	Yes	No
2	GSM Voice + WLAN 5 ㎓	Yes	Yes	No
3	GSM Voice + 2.4 ㎓ Bluetooth	Yes	Yes	No
4	GSM Voice + 2.4 ㎓ Bluetooth + WLAN 5 ㎓	Yes	Yes	No
5	WCDMA + WLAN 2.4 ㎓	Yes	Yes	Yes
6	WCDMA + WLAN 5 ㎓	Yes	Yes	No
7	WCDMA + 2.4 ㎓ Bluetooth	Yes	Yes	Yes
8	WCDMA + 2.4 ㎓ Bluetooth + WLAN 5 ㎓	Yes	Yes	No
9	LTE + WLAN 2.4 ㎓	Yes	Yes	Yes
10	LTE + WLAN 5 ㎓	Yes	Yes	No
11	LTE + 2.4 ㎓ Bluetooth	Yes	Yes	Yes
12	LTE + 2.4 ㎓ Bluetooth + WLAN 5 ㎓	Yes	Yes	No
13	GPRS/EDGE + WLAN 2.4 ㎓	Yes	Yes	Yes
14	GPRS/EDGE + WLAN 5 ㎓	Yes	Yes	No
15	GPRS/EDGE + 2.4 ㎓ Bluetooth	Yes	Yes	Yes
16	GPRS/EDGE + 2.4 ㎓ Bluetooth + WLAN 5 ㎓	Yes	Yes	No

Notes:

- It does not to transmit simultaneously the Bluetooth and 2.4 ㎓ WLAN.
- It is to use the Bluetooth and 2.4 ㎓ WLAN same antenna path.
- Only WLAN 2.4 ㎓ is supported Hotspot.
- This device supports Bluetooth Tethering.

2.8 Miscellaneous SAR Test Considerations

(A) WIFI/BT

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

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

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

$$\frac{\textbf{Max Power of Channel(mW)}}{\textbf{Test Separation Distance(mm)}} \times \sqrt{\textbf{Frequency(GHz)}} \leq \textbf{3.0(1g-SAR), 7.5(10g-SAR)}$$

Mode	Position	Frequency	Maximum Allowed Power	Separation Distance	≤ 3.0 Not Required
		MHz	mW	mm	1g-SAR
Bluetooth	Head	2 480.0	7	5	2.2
	Body-Worn	2 480.0	7	15	0.7
	Hotspot	2 480.0	7	10	1.1
Bluetooth LE	Head	2 480.0	4	5	1.4
	Body-Worn	2 480.0	4	15	0.5
	Hotspot	2 480.0	4	10	0.7

Formulas round separation distance to nearest mm and power to nearest ㎽ before calculating thresholds or exemption values.

(B) Licensed Transmitter(s)

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

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

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

This device supports LTE Carrier Aggregation (CA) in the downlink only. 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.

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

2.9 SAR Test Methods and Procedures

The tests documented in this report were performed in accordance with IEEE 1528-2013 and the following published KDB procedures:

- IEEE 1528-2013
- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 865664 D01 SAR measurement 100 ㎒ to 6 ㎓ v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D01 3G SAR Procedures v03r01
- 941225 D05 SAR for LTE Devices v02r05
- 941225 D06 Hotspot Mode v02r01
- October 2014 TCB Workshop Notes (Other LTE Considerations)
- April 2015 TCB Workshop Notes (Overlapping LTE Bands)
- April 2018 TCB Workshop Notes (LTE Carrier Aggregation)

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3. LTE Information

LTE Information					
Form Factor	Portable Handset				
Frequency Range of each LTE transmission band	LTE Band 12 (699.7 ~ 715.3 ㎒) LTE Band 17 (706.5 ~ 713.5 ㎒) LTE Band 26 (814.7 ~ 848.3 ㎒) LTE Band 5 (824.7 ~ 848.3 ㎒) LTE Band 41 (2498.5 ~ 2687.5 ㎒)				
Channel Bandwidths	LTE Band 12: 1.4 ㎒, 3 ㎒, 5 ㎒, 10 ㎒ LTE Band 17: 5 ㎒, 10 ㎒ LTE Band 26: 1.4 ㎒, 3 ㎒, 5 ㎒, 10 ㎒, 15 ㎒ LTE Band 5: 1.4 ㎒, 3 ㎒, 5 ㎒, 10 ㎒ LTE Band 41: 5 ㎒, 10 ㎒, 15 ㎒, 20 ㎒				
Channel Numbers and Frequencies (㎒)	Low	Low-Mid	Mid	Mid-High	High
LTE Band 12: 1.4 ㎒	699.7 (23017)		707.5 (23095)		715.3 (23173)
LTE Band 12: 3 ㎒	700.5 (23025)		707.5 (23095)		714.5 (23655)
LTE Band 12: 5 ㎒	701.5 (23035)		707.5 (23095)		713.5 (23155)
LTE Band 12: 10 ㎒	704.0 (23060)		707.5 (23095)		711.0 (23130)
LTE Band 17: 5 ㎒	706.5 (23755)		710.0 (23790)		713.5 (23825)
LTE Band 17: 10 ㎒	709.0 (23780)		710.0 (23790)		711.0 (23800)
LTE Band 26: 1.4 ㎒	814.7 (26697)		831.5 (26865)		848.3 (27033)
LTE Band 26: 3 ㎒	815.5 (26705)		831.5 (26865)		847.5 (27025)
LTE Band 26: 5 ㎒	816.5 (26715)		831.5 (26865)		846.5 (27015)
LTE Band 26: 10 ㎒	819.0 (26740)		831.5 (26865)		844.0 (26990)
LTE Band 26: 15 ㎒	821.5 (26765)		831.5 (26865)		841.5 (26965)
LTE Band 5: 1.4 ㎒	824.7 (20407)		836.5 (20525)		848.3 (20643)
LTE Band 5: 3 ㎒	825.5 (20415)		836.5 (20525)		847.5 (20635)
LTE Band 5: 5 ㎒	826.5 (20425)		836.5 (20525)		846.5 (20625)
LTE Band 5: 10 ㎒	829.0 (20450)		836.5 (20525)		844.0 (20600)
LTE Band 41: 5 ㎒	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 10 ㎒	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 15 ㎒	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 20 ㎒	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
UE Category	6				
Modulations Supported in UL	QPSK, 16QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3 ~ 6.2.5?(manufacturer attestation to be provided)	YES				
A-MPR(Additional MPR) disabled for SAR Testing?	YES				
LTE Carrier Aggregation Possible Combinations	LTE Carrier Aggregation is supported in Downlink 41C.				
LTE Additional Information	This device does not support full CA features on 3GPP Release 10. It supports carrier aggregation as shown in Appendix E. Uplink communications are done on the PCC. The following LTE Release 10 Features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, MDH, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.				

4. Specific Absorption Rate

4.1 Introduction

The SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational / controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

4.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

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

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = C\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength. However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

5. SAR Measurement Procedures

5.1 SAR Scan Procedures

Step 1: Power Reference Measurement
The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 1.4 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.
Step 2: Area Scan & Zoom Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot and Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing1 g and 10 g of simulated tissue. If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly. Area Scan & Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 mm ± 1 mm	½ δ·ln(2) mm 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

Step 3: Power drift measurement
The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

6. SAR Measurement Configurations

6.1 Ear Reference Point

Figure 1shows the front, back and side views of the SAM phantom. The “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 ERPs are 15 mm posterior to the entrance to the Ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 1. The plane Passing, through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck – Front) is perpendicular to the reference plane and passing through the LE (or RE) is called the Reference Pivoting Line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning.

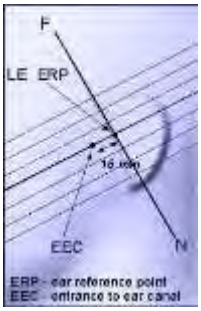

Figure 1
Close-Up Side view of ERP

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

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

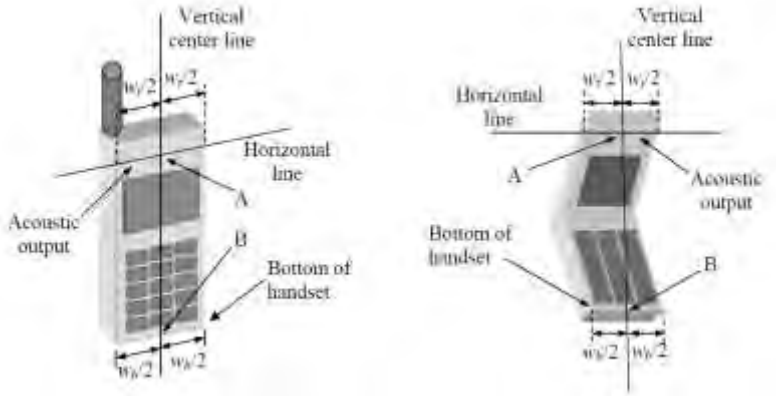

Figure 3
Handset Vertical Center & Horizontal Line Reference Points

6.3 Device Holder

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

6.4 Positioning for Cheek/Touch

1. The test device was positioned with the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 4), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

Figure 4: Front, Side and Top View of Cheek Position

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

6.5 Positioning for Ear / 15˚ Tilt

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

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 5).

Figure 5: Front, Side and Top View of Ear/ 15˚ Tilt

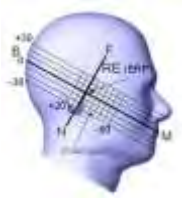

Figure 6: Side view w/ relevant markings

6.6 Body-Worn Accessory Configurations

Figure 7
Sample Body-Worn Diagram

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 7). Per FCC KDB Publication 648474 D04v01r03, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.
Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

6.7 Wireless Router Configurations

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

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

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6.8 Wireless Router Configurations

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

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7. RF Exposure Limits

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.

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.

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Partial Peak SAR [1] (Partial)	1.60 mW/g	8.00 mW/g
Partial Average SAR [2] (Whole Body)	0.08 mW/g	0.40 mW/g
Partial Peak SAR [3] (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

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

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8. FCC SAR General Measurement Procedures

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

8.4.2 Head SAR Measurements

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

8.4.3 Body SAR measurements

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

8.4.4 SAR Measurements with Rel. 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSDPA is measured using and FRC with H-SET 1 in Sub-test and a 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to release 6 HSPA test procedures. 8.4.5 SAR Measurement 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 12.2kbps RMC configured in Test Loop Mode 1 and Power Control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing.

8.4.5 SAR Measurements with Rel. 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set1 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.

8.4.6 SAR Measurements with Rel. 8 DC-HSDPA

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

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8.5 SAR Measurement Conditions for LTE

LTE modes are tested according to FCC KDB 941225 D05v02r05 publication. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluation SAR [4]. The R&S CMW500 or Anritsu MT8820C simulators are used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

8.5.1 Spectrum Plots for RB Configurations

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

8.5.2 MPR

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

8.5.3 A-MPR

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

8.5.4 Required RB Size and RB offsets for SAR testing

According to FCC KDB 941225 D05v02r05

1. Per sec 4.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
   a. The required channel and offset combination with the highest maximum output power is required for SAR.
   b. 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.
   c. 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
2. Per Sec 4.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Sec 4.2.1.
3. Per Sec. 4.2.3, QPSK SAR is not required for the 100% all0cation 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.
4. Per Sec. 4.2.4 and 4.3, SAR test for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sec. 4.2.1 through 4.2.3 is less than or equal to 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 LTE(TDD) Considerations

According to KDB 941225 D05v02r05, for Time-Division Duplex (TDD) systems, SAR must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP LTE TDD configurations.

SAR was tested with the highest transmission duty factor (63.33 %) using Uplink-downlink configuration 0 and Special sub-frame configuration 6.

LTE TDD Band supports 3GPP TS 36.211 section 4.2 for Type 2 Frame and Table 4.2-2 for uplink-downlink configurations and Table 4.2-1 for Special sub frame configurations.

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$(1+X) \cdot 2192 \cdot T_s$	$(1+X) \cdot 2560 \cdot T_s$	$7680 \cdot T_s$	$(1+X) \cdot 2192 \cdot T_s$	$(1+X) \cdot 2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$			$7680 \cdot T_s$	$(2+X) \cdot 2192 \cdot T_s$	$(2+X) \cdot 2560 \cdot T_s$
5	$6592 \cdot T_s$	$(2+X) \cdot 2192 \cdot T_s$	$(2+X) \cdot 2560 \cdot T_s$	$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-
10	$13168 \cdot T_s$	$13152 \cdot T_s$	$12800 \cdot T_s$	-	-	-

Table 4.2-2: Uplink-downlink configurations

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Calculated Duty Cycle – Extended cyclic prefix in uplink x (Ts) x # of S + # of U
Example for calculated Duty Cycle for Uplink-Downlink Configuration 0:
Calculated Duty Cycle = (5120 x [1/(15000 x 2048)] x 2 + 0.006)/0.01 = 63.33 %
Ts = 1/(15000 x 2048) seconds

8.6 SAR Testing with 802.11 Transmitters

The normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable.

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 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 ㎒ (5.47 – 5.85 ㎓), 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 ㎓ 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. When band gap channels are disabled, each band is tested independently according to the normally required OFDM SAR measurement and probe calibration frequency point requirements.

8.6.4 Initial Test Position Procedure

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

8.6.5 2.4 ㎓ SAR Test Requirement

SAR is measured for 2.4 ㎓ 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; i.e., all channels require testing.

2.4 ㎓ 802.11g/n OFDM are additionally evaluated for SAR if 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 ㎓ band, the Initial Test Configuration Procedures should be followed.

8.6.6 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 ㎓ and 5 ㎓ band, 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 band width, 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 maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

8.6.7 Initial Test Configuration Procedure

For OFDM, in both 2.4 and 5 ㎓ bands, 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, and lowest data rate. If the average RF output powers of the highest identical transmission modes are within 0.25 ㏈ of each other, mid channel of the transmission mode with highest average RF output power is the initial test channel. Otherwise, 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.

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8.6.8 Subsequent Test Configuration Procedures

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

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9. RF Average Conducted Output Power

9.1 GSM Average Conducted Output Power

Maximum Burst-Average Output Power (dB m)										
Band	Channel	GSM	GPRS (GMSK)				EGPRS (8-PSK)			
		Voice	1Tx	2Tx	3Tx	4Tx	1Tx	2Tx	3Tx	4Tx
GSM 850	128	32.94	32.76	30.76	29.60	28.20	27.20	25.32	23.40	22.30
	190	33.12	32.95	31.18	29.70	28.30	27.57	25.72	23.60	22.40
	251	33.11	32.86	31.08	29.70	28.20	27.46	25.51	23.50	22.30
GSM 1900	512	29.81	29.80	27.09	25.90	24.40	25.41	23.06	22.10	20.90
	661	29.60	29.61	27.20	25.80	24.20	25.46	23.22	22.20	21.00
	810	29.60	29.59	27.06	25.70	24.20	25.48	23.29	22.30	21.10

Maximum Frame-Average Output Power (dB m)										
Band	Channel	GSM	GPRS (GMSK)				EGPRS (8-PSK)			
		Voice	1Tx	2Tx	3Tx	4Tx	1Tx	2Tx	3Tx	4Tx
GSM 850	128	23.91	23.73	24.74	25.34	25.19	18.17	19.30	19.14	19.29
	190	24.09	23.92	25.16	25.44	25.29	18.54	19.70	19.34	19.39
	251	24.08	23.83	25.06	25.44	25.19	18.43	19.49	19.24	19.29
GSM 1900	512	20.78	20.77	21.07	21.64	21.39	16.38	17.04	17.84	17.89
	661	20.57	20.58	21.18	21.54	21.19	16.43	17.20	17.94	17.99
	810	20.57	20.56	21.04	21.44	21.19	16.45	17.27	18.04	18.09
GSM 850	Frame Avg, Target	24.97	24.97	26.48	**26.74**	25.99	18.97	19.98	20.74	20.49
GSM 1900		21.97	21.97	22.48	**22.74**	22.49	17.97	18.98	19.74	19.49

9.2 WCDMA Average Conducted Output Power

Band	Mode	Average Conducted Power (dB m)			3GPP MPR [dB]
		Channel			
		4 132	4 183	4 233	
WCDMA B5	RMC	24.66	24.63	24.72	-
	HSDPA-Subtest 1	23.69	23.63	23.71	0
	HSDPA-Subtest 2	23.45	23.45	23.30	0
	HSDPA-Subtest 3	23.50	23.48	23.28	0.5
	HSDPA-Subtest 4	23.50	23.50	23.32	0.5
	HSUPA-Subtest 1	19.82	19.78	19.90	0
	HSUPA-Subtest 2	18.83	18.90	18.88	2
	HSUPA-Subtest 3	19.72	19.65	19.78	1
	HSUPA-Subtest 4	18.89	18.96	18.98	2
	HSUPA-Subtest 5	20.96	20.91	20.93	0
	DC-HSDPA-Subtest 1	23.57	23.62	23.45	0
	DC-HSDPA-Subtest 2	21.82	21.92	21.63	0
	DC-HSDPA-Subtest 3	21.68	21.77	21.79	0.5
	DC-HSDPA-Subtest 4	21.71	21.76	21.68	0.5

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9.3 LTE Average Conducted Output Power

9.3.1 LTE Band 12

Band width	Modulation	RB Size	RB offset	Maximum Average Power	MPR
				23 095	
				707.5 ㎒	
10 ㎒	QPSK	1	0	23.70	0
		1	25	23.69	0
		1	49	23.67	0
		25	0	22.62	1
		25	12	22.60	1
		25	25	22.59	1
		50	0	22.54	1
	16QAM	1	0	22.78	1
		1	25	22.84	1
		1	49	22.77	1
		25	0	21.59	2
		25	12	21.59	2
		25	25	21.61	2
		50	0	21.52	2

Notes:

10 ㎒ Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. 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 per KDB 941225 D05 SAR for LTE Devices.

Band width	Modulation	RB Size	RB offset	Maximum Average Power			MPR
				23 035	23 095	23 155	
				701.5 ㎒	707.5 ㎒	713.5 ㎒	
5 ㎒	QPSK	1	0	23.63	23.65	23.66	0
		1	12	23.61	23.63	23.64	0
		1	24	23.61	23.61	23.67	0
		12	0	22.47	22.56	22.60	1
		12	7	22.49	22.54	22.62	1
		12	13	22.48	22.57	22.63	1
		25	0	22.45	22.51	22.60	1
	16QAM	1	0	22.43	22.50	22.43	1
		1	12	22.46	22.55	22.42	1
		1	24	22.45	22.55	22.43	1
		12	0	21.38	21.53	21.53	2
		12	7	21.37	21.56	21.52	2
		12	13	21.40	21.55	21.55	2
		25	0	21.47	21.51	21.60	2

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Band width	Modulation	RB Size	RB offset	Maximum Average Power			MPR
				23 025	23 095	23 655	
				700.5 MHz	707.5 MHz	714.5 MHz	
3 MHz	QPSK	1	0	23.58	23.57	23.59	0
		1	8	23.56	23.56	23.59	0
		1	14	23.58	23.57	23.61	0
		8	0	22.43	22.50	22.56	1
		8	4	22.46	22.50	22.58	1
		8	7	22.47	22.56	22.55	1
		15	0	22.45	22.50	22.53	1
	16QAM	1	0	22.47	22.62	22.61	1
		1	8	22.49	22.62	22.61	1
		1	14	22.46	22.61	22.62	1
		8	0	21.46	21.58	21.59	2
		8	4	21.44	21.55	21.57	2
		8	7	21.47	21.58	21.59	2
		15	0	21.39	21.50	21.52	2

Band width	Modulation	RB Size	RB offset	Maximum Average Power			MPR
				23 017	23 095	23 173	
				699.7 MHz	707.5 MHz	715.3 MHz	
1.4 MHz	QPSK	1	0	23.38	23.60	23.60	0
		1	3	23.39	23.59	23.60	0
		1	5	23.37	23.62	23.58	0
		3	0	23.47	23.55	23.56	0
		3	1	23.44	23.56	23.56	0
		3	3	23.44	23.55	23.56	0
		6	0	22.41	22.47	22.51	1
	16QAM	1	0	22.55	22.54	22.72	1
		1	3	22.59	22.54	22.72	1
		1	5	22.55	22.54	22.71	1
		3	0	22.24	22.60	22.48	1
		3	1	22.22	22.62	22.47	1
		3	3	22.21	22.59	22.47	1
		6	0	21.49	21.42	21.59	2

9.3.2 LTE Band 26

Band width	Modulation	RB Size	RB offset	Maximum Average Power	MPR
				26 865	
				831.5 ㎒	
15 ㎒	QPSK	1	0	25.34	0
		1	36	25.30	0
		1	74	25.30	0
		36	0	24.21	1
		36	18	24.19	1
		36	37	24.20	1
		75	0	24.15	1
	16QAM	1	0	24.38	1
		1	36	24.40	1
		1	74	24.40	1
		36	0	23.24	2
		36	18	23.23	2
		36	37	23.25	2
		75	0	23.17	2

Notes:

15 ㎒ Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. 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 per KDB 941225 D05 SAR for LTE Devices.

Band width	Modulation	RB Size	RB offset	Maximum Average Power			MPR
				26 740	26 865	26 990	
				819.0 ㎒	831.5 ㎒	844.0 ㎒	
10 ㎒	QPSK	1	0	25.27	25.12	25.19	0
		1	25	25.27	25.13	25.14	0
		1	49	25.29	25.16	25.15	0
		25	0	24.22	24.11	24.19	1
		25	12	24.22	24.12	24.14	1
		25	25	24.24	24.10	24.13	1
		50	0	24.21	24.07	24.11	1
	16QAM	1	0	24.29	24.06	24.22	1
		1	25	24.27	24.05	24.16	1
		1	49	24.25	24.07	24.15	1
		25	0	23.36	23.10	23.15	2
		25	12	23.34	23.11	23.08	2
		25	25	23.34	23.09	23.05	2
		50	0	23.22	23.16	23.05	2

Band width	Modulation	RB Size	RB offset	Maximum Average Power			MPR
				26 715	26 865	27 015	
				816.5 MHz	831.5 MHz	846.5 MHz	
5 MHz	QPSK	1	0	25.22	25.21	25.25	0
		1	12	25.20	25.21	25.24	0
		1	24	25.22	25.21	25.23	0
		12	0	24.23	24.08	24.22	1
		12	7	24.24	24.10	24.23	1
		12	13	24.21	24.07	24.24	1
		25	0	24.19	24.09	24.18	1
	16QAM	1	0	24.14	23.82	24.26	1
		1	12	24.13	23.79	24.28	1
		1	24	24.15	23.86	24.28	1
		12	0	23.20	23.07	23.17	2
		12	7	23.20	23.03	23.15	2
		12	13	23.21	23.05	23.16	2
		25	0	23.21	23.11	23.18	2

Band width	Modulation	RB Size	RB offset	Maximum Average Power			MPR
				26 705	26 865	27 025	
				815.5 MHz	831.5 MHz	847.5 MHz	
3 MHz	QPSK	1	0	25.31	25.05	25.31	0
		1	8	25.31	25.05	25.31	0
		1	14	25.31	25.05	25.30	0
		8	0	24.21	24.08	24.20	1
		8	4	24.22	24.08	24.21	1
		8	7	24.22	24.08	24.22	1
		15	0	24.20	24.05	24.18	1
	16QAM	1	0	24.23	24.00	24.48	1
		1	8	24.25	23.98	24.46	1
		1	14	24.26	23.98	24.41	1
		8	0	23.21	23.21	23.25	2
		8	4	23.23	23.22	23.27	2
		8	7	23.19	23.20	23.26	2
		15	0	23.17	23.06	23.19	2

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Band width	Modulation	RB Size	RB offset	Maximum Average Power			MPR
				26 697	26 865	27 033	
				814.7 MHz	831.5 MHz	848.3 MHz	
1.4 MHz	QPSK	1	0	25.28	25.10	25.24	0
		1	3	25.27	25.08	25.26	0
		1	5	25.26	25.07	25.29	0
		3	0	25.12	25.05	25.13	0
		3	1	25.13	25.03	25.13	0
		3	3	25.14	25.03	25.11	0
		6	0	24.18	24.05	24.18	1
	16QAM	1	0	24.39	23.86	24.28	1
		1	3	24.38	23.81	24.27	1
		1	5	24.36	23.83	24.30	1
		3	0	23.97	24.16	24.22	1
		3	1	23.96	24.15	24.24	1
		3	3	23.93	24.16	24.24	1
		6	0	23.14	23.07	23.31	2

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9.3.3 LTE Band 41

Band width	Modulation	RB Size	RB offset	Maximum Average Power					MPR
				39 750	40 185	40 620	41 055	41 490	
				2506.0 MHz	2549.5 MHz	2593.0 MHz	2636.5 MHz	2680.0 MHz	
20 MHz	QPSK	1	0	24.09	24.36	24.16	24.08	24.22	0
		1	49	24.01	24.29	24.15	23.98	24.18	0
		1	99	23.88	24.21	24.11	23.83	24.14	0
		50	0	23.12	23.26	23.11	23.15	23.23	1
		50	24	23.03	23.21	23.09	23.08	23.17	1
		50	50	22.96	23.14	23.06	23.03	23.13	1
		100	0	23.03	23.18	23.11	23.06	23.11	1
	16QAM	1	0	22.21	23.03	22.57	22.78	23.06	1
		1	49	22.13	23.03	22.63	22.74	23.02	1
		1	99	22.13	23.01	22.63	22.72	23.01	1
		50	0	21.56	21.63	21.53	22.19	22.22	2
		50	24	21.57	21.62	21.53	22.17	22.25	2
		50	50	21.56	21.64	21.47	22.16	22.30	2
		100	0	21.44	21.57	21.52	22.06	22.21	2

Band width	Modulation	RB Size	RB offset	Maximum Average Power					MPR
				39 750	40 185	40 620	41 055	41 490	
				2506.0 MHz	2549.5 MHz	2593.0 MHz	2636.5 MHz	2680.0 MHz	
15 MHz	QPSK	1	0	24.20	24.30	24.14	24.11	24.12	0
		1	36	24.14	24.18	24.08	24.10	24.11	0
		1	74	23.95	24.16	24.05	24.06	24.06	0
		36	0	23.23	23.32	23.01	23.10	23.19	1
		36	18	23.15	23.23	23.00	23.08	23.15	1
		36	37	23.11	23.30	22.97	23.06	23.16	1
		75	0	23.09	23.19	22.94	23.03	23.14	1
	16QAM	1	0	22.52	22.72	22.24	22.90	23.66	1
		1	36	22.46	22.74	22.24	22.94	23.68	1
		1	74	22.45	22.75	22.22	22.92	23.67	1
		36	0	21.53	21.65	21.57	22.14	22.35	2
		36	18	21.50	21.67	21.58	22.14	22.34	2
		36	37	21.56	21.65	21.57	22.13	22.34	2
		75	0	21.49	21.59	21.57	22.10	22.30	2

Band width	Modulation	RB Size	RB offset	Maximum Average Power					MPR
				39 750	40 185	40 620	41 055	41 490	
				2506.0 MHz	2549.5 MHz	2593.0 MHz	2636.5 MHz	2680.0 MHz	
10 MHz	QPSK	1	0	23.60	23.69	23.63	24.13	24.01	0
		1	25	23.60	23.66	23.61	24.12	24.00	0
		1	49	23.60	23.69	23.58	24.15	23.97	0
		25	0	22.51	22.62	22.59	23.05	23.09	1
		25	12	22.52	22.63	22.57	23.03	23.04	1
		25	25	22.49	22.63	22.61	23.02	23.01	1
		50	0	22.47	22.57	22.56	23.00	23.03	1
	16QAM	1	0	22.29	22.31	22.44	22.86	22.92	1
		1	25	22.27	22.38	22.41	22.87	22.95	1
		1	49	22.34	22.29	22.42	22.85	22.98	1
		25	0	21.58	21.62	21.49	22.07	22.41	2
		25	12	21.57	21.62	21.48	22.06	22.42	2
		25	25	21.61	21.61	21.50	22.05	22.38	2
		50	0	21.48	21.57	21.52	22.05	22.30	2

Band width	Modulation	RB Size	RB offset	Maximum Average Power					MPR
				39 750	40 185	40 620	41 055	41 490	
				2506.0 MHz	2549.5 MHz	2593.0 MHz	2636.5 MHz	2680.0 MHz	
5 MHz	QPSK	1	0	23.57	23.68	23.64	24.11	23.97	0
		1	12	23.56	23.74	23.47	24.11	23.91	0
		1	24	23.58	23.72	23.50	24.09	23.92	0
		12	0	22.52	22.63	22.53	23.04	23.05	1
		12	7	22.50	22.63	22.54	23.04	23.03	1
		12	13	22.51	22.63	22.55	23.05	23.01	1
		25	0	22.50	22.60	22.53	23.03	23.00	1
	16QAM	1	0	22.05	22.87	22.68	22.80	23.08	1
		1	12	22.11	22.87	22.62	22.78	23.33	1
		1	24	22.13	22.86	22.62	22.82	23.34	1
		12	0	21.55	21.58	21.54	22.12	22.31	2
		12	7	21.56	21.59	21.57	22.12	22.32	2
		12	13	21.55	21.61	21.56	22.11	22.33	2
		25	0	21.57	21.64	21.49	22.13	22.35	2

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9.4 WLAN Average Conducted Output Power(Sensor inactive-Maximum Average Power)

Band	Freq. [MHz]	Channel	Mode		
			802.11b	802.11g	802.11n
WLAN 2.4 GHz	2 412.0	1	18.41	15.44	14.36
	2 437.0	6	18.58	15.80	15.67
	2 462.0	11	17.80	10.80	10.70

Band	Freq. [MHz]	Channel	Mode		
			802.11a	802.11n	802.11ac
WLAN 5 GHz (20 MHz)	5 180.0	36	16.27	15.24	15.35
	5 200.0	40	16.27	15.00	15.41
	5 220.0	44	16.01	14.88	14.88
	5 240.0	48	16.01	14.93	15.26
	5 260.0	52	16.06	15.12	15.06
	5 280.0	56	16.15	15.28	15.27
	5 300.0	60	16.04	15.09	15.01
	5 320.0	64	15.92	15.04	15.07
	5 500.0	100	16.22	15.46	15.46
	5 600.0	120	16.10	15.26	15.41
	5 620.0	124	16.05	15.28	15.33
	5 720.0	144	15.83	15.15	15.13
	5 745.0	149	15.86	15.16	14.99
	5 785.0	157	16.40	15.36	15.50
	5 825.0	165	16.38	15.49	15.42

Band	Freq. [MHz]	Channel	Mode	
			802.11n	802.11ac
WLAN 5 GHz (40 MHz)	5 190.0	38	13.54	13.59
	5 230.0	46	14.38	14.17
	5 270.0	54	14.37	14.13
	5 310.0	62	13.01	13.50
	5 510.0	102	13.89	14.05
	5 590.0	118	14.03	14.02
	5 630.0	126	14.02	14.02
	5 710.0	142	14.34	14.28
	5 755.0	151	14.33	14.08
	5 795.0	159	14.14	14.04

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Band	Freq. [MHz]	Channel	Mode
			802.11ac
WLAN 5 GHz (80 MHz)	5 210.0	42	12.25
	5 290.0	58	12.93
	5 530.0	106	12.45
	5 610.0	122	13.12
	5 690.0	138	13.22
	5 775.0	155	13.42

9.5 WLAN Average Conducted Output Power (Sensor active-Reduced Average Power)

Band	Freq. [MHz]	Channel	Mode		
			802.11b	802.11g	802.11n
WLAN 2.4 GHz	2 412.0	1	11.57	11.21	11.03
	2 437.0	6	11.21	11.76	11.56
	2 462.0	11	11.12	10.69	10.51

Band	Freq. [MHz]	Channel	Mode		
			802.11a	802.11n	802.11ac
WLAN 5 GHz (20 MHz)	5 180.0	36	11.15	11.00	11.07
	5 200.0	40	10.97	11.24	11.01
	5 220.0	44	10.79	10.97	10.96
	5 240.0	48	10.94	10.93	10.82
	5 260.0	52	10.89	11.12	11.07
	5 280.0	56	11.20	11.21	11.06
	5 300.0	60	10.87	11.10	10.85
	5 320.0	64	11.02	11.06	10.89
	5 500.0	100	11.12	11.30	11.35
	5 600.0	120	10.95	11.27	11.21
	5 620.0	124	11.06	11.27	11.16
	5 720.0	144	10.96	11.10	10.99
	5 745.0	149	11.02	11.17	11.12
	5 785.0	157	11.27	11.33	11.35
	5 825.0	165	11.35	11.17	11.31

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Band	Freq. [MHz]	Channel	Mode	
			802.11n	802.11ac
WLAN 5 GHz (40 MHz)	5 190.0	38	11.32	11.38
	5 230.0	46	11.63	11.08
	5 270.0	54	11.41	11.04
	5 310.0	62	11.22	11.04
	5 510.0	102	11.17	11.28
	5 590.0	118	10.95	10.88
	5 630.0	126	10.97	10.97
	5 710.0	142	11.49	11.07
	5 755.0	151	11.36	11.06
	5 795.0	159	11.05	10.96

Band	Freq. [MHz]	Channel	Mode
			802.11ac
WLAN 5 GHz (80 MHz)	5 210.0	42	10.86
	5 290.0	58	10.88
	5 530.0	106	11.00
	5 610.0	122	10.97
	5 690.0	138	11.05
	5 775.0	155	11.29

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.

Power Measurement Setup

9.6 Bluetooth Average Conducted Output Power

Mode	Freq. [MHz]	Channel	Conducted Powers (dBm)
BDR_DH5 (1 Mbps)	2 402.0	0	6.55
	2 441.0	39	7.42
	2 480.0	78	6.99
BDR_2-DH5 (2 Mbps)	2 402.0	0	5.54
	2 441.0	39	6.49
	2 480.0	78	6.18
EDR_3-DH5 (3 Mbps)	2 402.0	0	5.64
	2 441.0	39	6.59
	2 480.0	78	6.22
LE (1 Mbps)	2 402.0	0	5.32
	2 440.0	19	6.12
	2 480.0	39	5.21
LE (2 Mbps)	2 402.0	0	5.29
	2 440.0	19	6.19
	2 480.0	39	5.21

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10. System Verification

10.1 Tissue Verification

The dielectric properties for this Tissue Simulant Liquids were measured by using the SPEAG Model DAK3.5 Dielectric Probe in conjunction with Agilent E5071B Network Analyzer (300 kHz – 8 500 ㎒). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1.For the SAR measurement given in this report. The temperature variation of the Tissue Simulant Liquids was (22 ± 2) ℃.

Freq. (㎒)	Limit/Measured		Permittivity (ρ)	Conductivity (σ)	Temp. (°C)
750.0 Head	Recommended Limit		41.90 ± 5 % (39.81 ~ 44.00)	0.89 ± 5 % (0.85 ~ 0.93)	22 ± 2
	Measured	2019-09-06	40.37	0.92	21.50
835.0 Head	Recommended Limit		41.50 ± 5 % (39.43 ~ 43.58)	0.90 ± 5 % (0.86 ~ 0.95)	22 ± 2
	Measured	2019-08-07	40.82	0.92	20.58
835.0 Head	Recommended Limit		41.50 ± 5 % (39.43 ~ 43.58)	0.90 ± 5 % (0.86 ~ 0.95)	22 ± 2
	Measured	2019-08-06	41.25	0.89	20.19
835.0 Head	Recommended Limit		41.50 ± 5 % (39.43 ~ 43.58)	0.90 ± 5 % (0.86 ~ 0.95)	22 ± 2
	Measured	2019-08-05	40.56	0.92	20.72
1 900.0 Head	Recommended Limit		40.00 ± 5 % (38.00 ~ 42.00)	1.40 ± 5 % (1.33 ~ 1.47)	22 ± 2
	Measured	2019-08-14	40.34	1.44	20.99
2 450.0 Head	Recommended Limit		39.20 ± 5 % (37.24 ~ 41.16)	1.80 ± 5 % (1.71 ~ 1.89)	22 ± 2
	Measured	2019-08-09	38.93	1.88	20.98
2 600.0 Head	Recommended Limit		39.00 ± 5 % (37.05 ~ 40.95)	1.96 ± 5 % (1.86 ~ 2.06)	22 ± 2
	Measured	2019-08-12	39.83	2.01	21.31
5 300.0 Head	Recommended Limit		35.90 ± 5 % (34.11 ~ 37.70)	4.76 ± 5 % (4.52 ~ 5.00)	22 ± 2
	Measured	2019-08-08	36.43	4.69	20.44
5 600.0 Head	Recommended Limit		35.50 ± 5 % (33.73 ~ 37.28)	5.07 ± 5 % (4.82 ~ 5.32)	22 ± 2
	Measured	2019-08-13	35.83	5.20	21.31
5 800.0 Head	Recommended Limit		35.30 ± 5 % (33.54 ~ 37.07)	5.27 ± 5 % (5.01 ~ 5.53)	22 ± 2
	Measured	2019-08-12	34.96	5.36	20.66

<Table 1. Measurement result of Head Tissue electric parameters>

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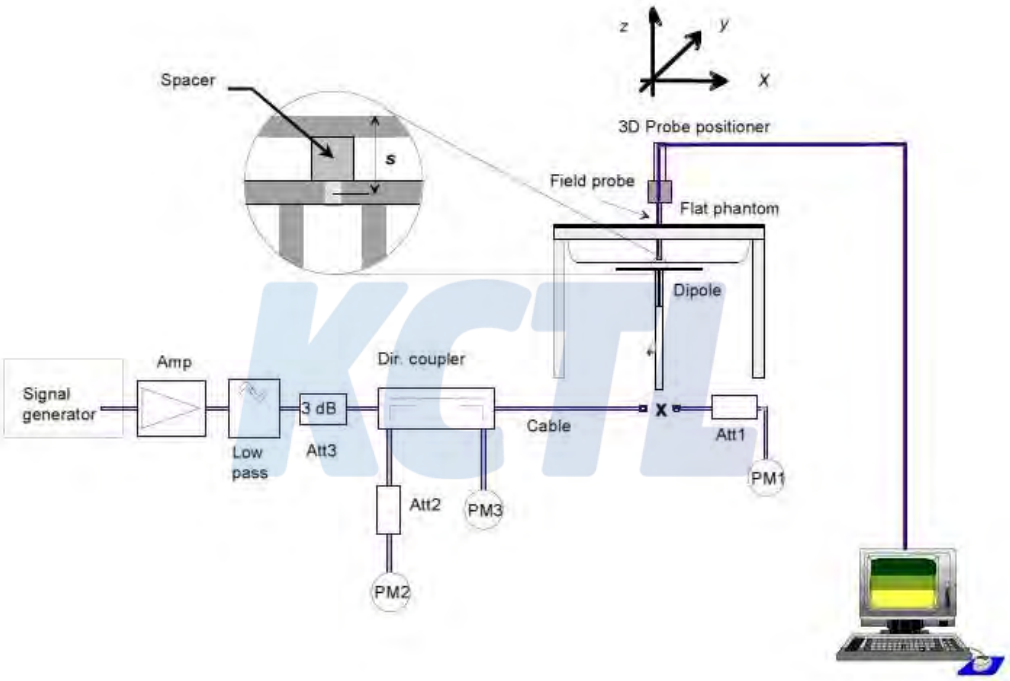
Freq. (㎒)	Limit/Measured		Permittivity (ρ)	Conductivity (σ)	Temp. (°C)
750.0 Body	Recommended Limit		55.53 ± 5 % (52.75 ~ 58.31)	0.96 ± 5 % (0.91 ~ 1.01)	22 ± 2
	Measured	2019-09-06	53.54	0.99	21.50
835.0 Body	Recommended Limit		55.20 ± 5 % (52.44 ~ 57.96)	0.97 ± 5 % (0.92 ~ 1.02)	22 ± 2
	Measured	2019-08-07	53.29	0.97	20.99
835.0 Body	Recommended Limit		55.20 ± 5 % (52.44 ~ 57.96)	0.97 ± 5 % (0.92 ~ 1.02)	22 ± 2
	Measured	2019-08-06	53.22	1.00	21.16
835.0 Body	Recommended Limit		55.20 ± 5 % (52.44 ~ 57.96)	0.97 ± 5 % (0.92 ~ 1.02)	22 ± 2
	Measured	2019-08-05	53.15	0.97	20.88
1 900.0 Body	Recommended Limit		53.30 ± 5 % (50.64 ~ 55.97)	1.52 ± 5 % (1.44 ~ 1.60)	22 ± 2
	Measured	2019-08-14	51.89	1.55	20.18
2 450.0 Body	Recommended Limit		52.70 ± 5 % (50.07 ~ 55.34)	1.95 ± 5 % (1.85 ~ 2.05)	22 ± 2
	Measured	2019-08-09	52.14	2.00	20.81
2 600.0 Body	Recommended Limit		52.47 ± 5 % (49.85 ~ 55.09)	2.21 ± 5 % (2.10 ~ 2.32)	22 ± 2
	Measured	2019-08-12	51.48	2.22	21.23
5 300.0 Body	Recommended Limit		48.88 ± 5 % (46.44 ~ 51.32)	5.42 ± 5 % (5.15 ~ 5.69)	22 ± 2
	Measured	2019-08-08	48.05	5.42	20.07
5 600.0 Body	Recommended Limit		48.47 ± 5 % (46.05 ~ 50.89)	5.77 ± 5 % (5.48 ~ 6.06)	22 ± 2
	Measured	2019-08-13	47.19	5.94	20.47
5 800.0 Body	Recommended Limit		48.20 ± 5 % (45.79 ~ 50.61)	6.00 ± 5 % (5.70 ~ 6.30)	22 ± 2
	Measured	2019-08-12	46.81	6.10	20.18

<Table 2. Measurement result of Body Tissue electric parameters>

10.2 Test System Verification

The microwave circuit arrangement for system verification is sketched below picture.
The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within ± 10% from the t arget SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the Table 2. During the tests, the ambient temperature of the laboratory was in the range (22 ± 2) ℃, th e relative humidity was in the range(50 ± 20)% and the liquid depth Above the ear/grid refer ence points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



Verification Kit	Probe S/N	Frequency (㎒)	Tissue Type	Limit/Measured (Normalized to 1 W)		
D750V3 SN: 1183	EX3DV4 SN: 3697	750.0	HSL	Recommended Limit 1g (Normalized)		8.19± 10 % (7.37 ~ 9.01)
				Measured	2019-09-06	8.16
D835V2 SN: 4d138	EX3DV4 SN: 3879	835.0	HSL	Recommended Limit 1g (Normalized)		9.77± 10 % (8.79 ~ 10.75)
				Measured	2019-08-07	10.16
D835V2 SN: 4d138	EX3DV4 SN: 3879	835.0	HSL	Recommended Limit 1g (Normalized)		9.77± 10 % (8.79 ~ 10.75)
				Measured	2019-08-06	9.56
D835V2 SN: 4d138	EX3DV4 SN: 3879	835.0	HSL	Recommended Limit 1g (Normalized)		9.77± 10 % (8.79 ~ 10.75)
				Measured	2019-08-05	10.20
D1900V2 SN: 5d158	EX3DV4 SN: 3928	1 900.0	HSL	Recommended Limit 1g (Normalized)		39.8 ± 10 % (35.82~ 43.78)
				Measured	2019-08-14	42.00
D2450V2 SN: 892	EX3DV4 SN: 3879	2 450.0	HSL	Recommended Limit 1g (Normalized)		52.6 ± 10 % (47.34 ~ 57.86)
				Measured	2019-08-09	52.40
D2600V2 SN: 1038	EX3DV4 SN: 3879	2 600.0	HSL	Recommended Limit 1g (Normalized)		58.3 ± 10 % (52.47 ~ 64.13)
				Measured	2019-08-12	54.40
D5㎓V2 SN: 1134	EX3DV4 SN: 3928	5 300.0	HSL	Recommended Limit 1g (Normalized)		82.30 ± 10 % (74.07 ~ 90.53)
				Measured	2019-08-08	86.50
D5㎓V2 SN: 1134	EX3DV4 SN: 3928	5 600.0	HSL	Recommended Limit 1g (Normalized)		85.30 ± 10 % (76.77 ~ 93.83)
				Measured	2019-08-13	84.90
D5㎓V2 SN: 1134	EX3DV4 SN: 3928	5 800.0	HSL	Recommended Limit 1g (Normalized)		79.20 ± 10 % (71.28 ~ 87.12)
				Measured	2019-08-12	81.40

<Table 3. Head Test System Verification Result>

Verification Kit	Probe S/N	Frequency (㎒)	Tissue Type	Limit/Measured (Normalized to 1 W)		
D750V3 SN: 1183	EX3DV4 SN: 3697	750.0	MSL	Recommended Limit 1g (Normalized)		8.50 ± 10 % (7.65 ~ 9.35)
				Measured	2019-09-06	8.08
D835V2 SN: 4d138	EX3DV4 SN: 3697	835.0	MSL	Recommended Limit 1g (Normalized)		9.49 ± 10 % (8.54 ~ 10.44)
				Measured	2019-08-07	10.16
D835V2 SN: 4d138	EX3DV4 SN: 3697	835.0	MSL	Recommended Limit 1g (Normalized)		9.49 ± 10 % (8.54 ~ 10.44)
				Measured	2019-08-06	10.12
D835V2 SN: 4d138	EX3DV4 SN: 3697	835.0	MSL	Recommended Limit 1g (Normalized)		9.49 ± 10 % (8.54 ~ 10.44)
				Measured	2019-08-05	9.96
D1900V2 SN: 5d158	EX3DV4 SN: 3928	1 900.0	MSL	Recommended Limit 1g (Normalized)		39.9 ± 10 % (35.91 ~ 43.89)
				Measured	2019-08-14	38.88
D2450V2 SN: 892	EX3DV4 SN: 3697	2 450.0	MSL	Recommended Limit 1g (Normalized)		49.9 ± 10 % (44.91 ~ 54.89)
				Measured	2019-08-09	49.40
D2600V2 SN: 1038	EX3DV4 SN: 3697	2 600.0	MSL	Recommended Limit 1g (Normalized)		56.1 ± 10 % (50.49 ~ 61.71)
				Measured	2019-08-12	56.00
D5 ㎓ V2 SN: 1134	EX3DV4 SN: 3928	5 300.0	MSL	Recommended Limit 1g (Normalized)		75.00 ± 10 % (67.50 ~ 82.50)
				Measured	2019-08-08	80.80
D5 ㎓ V2 SN: 1134	EX3DV4 SN: 3928	5 600.0	MSL	Recommended Limit 1g (Normalized)		79.60 ± 10 % (71.64 ~ 87.56)
				Measured	2019-08-13	82.60
D5 ㎓ V2 SN: 1134	EX3DV4 SN: 3928	5 800.0	MSL	Recommended Limit 1g (Normalized)		73.90 ± 10 % (66.51 ~ 81.29)
				Measured	2019-08-12	76.60

<Table 4. Body Test System Verification Result>

11. SAR Test Results

11.1 Standalone Head SAR Test Results

GSM 850 Head SAR

Mode	EUT Position	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
Voice	Right Cheek	836.6	33.12	34.00	1.225	0.171	**0.209**	#1
	Right Tilt	836.6	33.12	34.00	1.225	0.096	0.117	
	Left Cheek	836.6	33.12	34.00	1.225	0.124	0.152	
	Left Tilt	836.6	33.12	34.00	1.225	0.072	0.089	
GPRS 3Tx	Right Cheek	836.6	29.70	31.00	1.349	0.208	**0.281**	#2
	Right Tilt	836.6	29.70	31.00	1.349	0.114	0.154	
	Left Cheek	836.6	29.70	31.00	1.349	0.151	0.204	
	Left Tilt	836.6	29.70	31.00	1.349	0.075	0.101	

GSM 1900 Head SAR

Mode	EUT Position	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
Voice	Right Cheek	1 880.0	29.60	31.00	1.380	0.025	0.034	
	Right Tilt	1 880.0	29.60	31.00	1.380	0.013	0.017	
	Left Cheek	1 880.0	29.60	31.00	1.380	0.033	**0.045**	#3
	Left Tilt	1 880.0	29.60	31.00	1.380	0.012	0.017	
GPRS 3Tx	Right Cheek	1 880.0	25.80	27.00	1.318	0.007	**0.010**	#4
	Right Tilt	1 880.0	25.80	27.00	1.318	0.004	0.005	
	Left Cheek	1 880.0	25.80	27.00	1.318	0.004	0.005	
	Left Tilt	1 880.0	25.80	27.00	1.318	0.002	0.002	

UMTS 850 Head SAR

Mode	EUT Position	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
RMC	Right Cheek	836.6	24.63	25.00	1.089	0.169	**0.184**	#5
	Right Tilt	836.6	24.63	25.00	1.089	0.087	0.095	
	Left Cheek	836.6	24.63	25.00	1.089	0.136	0.148	
	Left Tilt	836.6	24.63	25.00	1.089	0.091	0.099	

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LTE Band 12 Head SAR

Mode	EUT Position	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 10M 1RB 0Offset	Right Cheek	707.5	23.70	24.00	1.072	0.087	**0.094**	#6
QPSK 10M 25RB 0Offset	Right Cheek	707.5	22.62	23.00	1.091	0.074	0.081	
QPSK 10M 1RB 0Offset	Right Tilt	707.5	23.70	24.00	1.072	0.048	0.052	
QPSK 10M 25RB 0Offset	Right Tilt	707.5	22.62	23.00	1.091	0.037	0.040	
QPSK 10M 1RB 0Offset	Left Cheek	707.5	23.70	24.00	1.072	0.086	0.092	
QPSK 10M 25RB 0Offset	Left Cheek	707.5	22.62	23.00	1.091	0.069	0.076	
QPSK 10M 1RB 0Offset	Left Tilt	707.5	23.70	24.00	1.072	0.050	0.053	
QPSK 10M 25RB 0Offset	Left Tilt	707.5	22.62	23.00	1.091	0.048	0.052	

LTE Band 26 Head SAR

Mode	EUT Position	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 15M 1RB 0Offset	Right Cheek	831.5	25.34	25.50	1.038	0.189	**0.196**	#7
QPSK 15M 36RB 0Offset	Right Cheek	831.5	24.21	24.50	1.069	0.155	0.166	
QPSK 15M 1RB 0Offset	Right Tilt	831.5	25.34	25.50	1.038	0.110	0.114	
QPSK 15M 36RB 0Offset	Right Tilt	831.5	24.21	24.50	1.069	0.091	0.097	
QPSK 15M 1RB 0Offset	Left Cheek	831.5	25.34	25.50	1.038	0.179	0.186	
QPSK 15M 36RB 0Offset	Left Cheek	831.5	24.21	24.50	1.069	0.140	0.150	
QPSK 15M 1RB 0Offset	Left Tilt	831.5	25.34	25.50	1.038	0.141	0.146	
QPSK 15M 36RB 0Offset	Left Tilt	831.5	24.21	24.50	1.069	0.107	0.114	

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LTE Band 41 Head SAR

Mode	EUT Position	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 20M 1RB 0Offset	Right Cheek	2 549.5	24.36	25.00	1.159	0.087	**0.101**	#8
QPSK 20M 50RB 0Offset	Right Cheek	2 549.5	23.26	24.00	1.186	0.084	0.099	
QPSK 20M 1RB 0Offset	Right Tilt	2 549.5	24.36	25.00	1.159	0.063	0.073	
QPSK 20M 50RB 0Offset	Right Tilt	2 549.5	23.26	24.00	1.186	0.065	0.077	
QPSK 20M 1RB 0Offset	Left Cheek	2 549.5	24.36	25.00	1.159	0.087	0.101	
QPSK 20M 50RB 0Offset	Left Cheek	2 549.5	23.26	24.00	1.186	0.085	0.101	
QPSK 20M 1RB 0Offset	Left Tilt	2 549.5	24.36	25.00	1.159	0.030	0.035	
QPSK 20M 50RB 0Offset	Left Tilt	2 549.5	23.26	24.00	1.186	0.030	0.035	

DTS Head SAR

Mode	EUT Position	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
802.11b	Right Cheek	2 412.0	11.57	12.00	1.104	1.014	0.173	0.194	
	Right Tilt	2 412.0	11.57	12.00	1.104	1.014	0.177	**0.198**	#9
	Left Cheek	2 412.0	11.57	12.00	1.104	1.014	0.096	0.107	
	Left Tilt	2 412.0	11.57	12.00	1.104	1.014	0.097	0.109	

NII Head SAR

Mode	EUT Position	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
802.11ac VHT80	Right Cheek	5 290.0	10.88	12.00	1.294	1.078	0.209	**0.291**	#10
	Right Tilt	5 290.0	10.88	12.00	1.294	1.078	0.138	0.192	
	Left Cheek	5 290.0	10.88	12.00	1.294	1.078	0.064	0.090	
	Left Tilt	5 290.0	10.88	12.00	1.294	1.078	0.057	0.079	
	Right Cheek	5 690.0	11.05	12.00	1.245	1.078	0.241	**0.323**	#11
	Right Tilt	5 690.0	11.05	12.00	1.245	1.078	0.204	0.274	
	Left Cheek	5 690.0	11.05	12.00	1.245	1.078	0.067	0.090	
	Left Tilt	5 690.0	11.05	12.00	1.245	1.078	0.083	0.111	
	Right Cheek	5 775.0	11.29	12.00	1.178	1.078	0.292	**0.371**	#12
	Right Tilt	5 775.0	11.29	12.00	1.178	1.078	0.215	0.273	
	Left Cheek	5 775.0	11.29	12.00	1.178	1.078	0.084	0.107	
	Left Tilt	5 775.0	11.29	12.00	1.178	1.078	0.091	0.116	

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11.2 Standalone Body-Worn SAR Test Results

GSM 850 Body-Worn SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
Voice	Front	15	836.6	33.12	34.00	1.225	0.275	0.337	
	Rear	15	836.6	33.12	34.00	1.225	0.311	**0.381**	#13
GPRS 3Tx	Front	15	836.6	29.70	31.00	1.349	0.277	0.374	
	Rear	15	836.6	29.70	31.00	1.349	0.327	**0.441**	#14

GSM 1900 Body-Worn SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
Voice	Front	15	1 880.0	29.60	31.00	1.380	0.151	**0.208**	#15
	Rear	15	1 880.0	29.60	31.00	1.380	0.145	0.200	
GPRS 3Tx	Front	15	1 880.0	25.80	27.00	1.318	0.027	0.035	
	Rear	15	1 880.0	25.80	27.00	1.318	0.029	**0.038**	#16

UMTS 850 Body-Worn SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
RMC	Front	15	836.6	24.63	25.00	1.089	0.300	0.327	
	Rear	15	836.6	24.63	25.00	1.089	0.320	**0.348**	#17

LTE Band 12 Body-Worn SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 10M 1RB 0Offset	Front	15	707.5	23.70	24.00	1.072	0.129	0.138	
QPSK 10M 25RB 0Offset	Front	15	707.5	22.62	23.00	1.091	0.112	0.122	
QPSK 10M 1RB 0Offset	Rear	15	707.5	23.70	24.00	1.072	0.155	**0.166**	#18
QPSK 10M 25RB 0Offset	Rear	15	707.5	22.62	23.00	1.091	0.131	0.143	

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LTE Band 26 Body-Worn SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 15M 1RB 0Offset	Front	15	831.5	25.34	25.50	1.038	0.330	0.342	
QPSK 15M 36RB 0Offset	Front	15	831.5	24.21	24.50	1.069	0.270	0.289	
QPSK 15M 1RB 0Offset	Rear	15	831.5	25.34	25.50	1.038	0.395	**0.410**	#19
QPSK 15M 36RB 0Offset	Rear	15	831.5	24.21	24.50	1.069	0.310	0.331	

LTE Band 41 Body-Worn SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 20M 1RB 0Offset	Front	15	2 549.5	24.36	25.00	1.159	0.178	0.206	
QPSK 20M 50RB 0Offset	Front	15	2 549.5	23.26	24.00	1.186	0.173	0.205	
QPSK 20M 1RB 0Offset	Rear	15	2 549.5	24.36	25.00	1.159	0.273	0.316	
QPSK 20M 50RB 0Offset	Rear	15	2 549.5	23.26	24.00	1.186	0.271	**0.321**	#20

DTS Body-Worn SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
802.11b	Front	15	2 437.0	18.58	19.00	1.102	1.014	0.103	0.115	
	Rear	15	2 437.0	18.58	19.00	1.102	1.014	0.192	**0.214**	#21

NII Body-Worn SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
802.11a	Front	15	5 280.0	16.15	17.00	1.216	1.087	0.046	**0.060**	#22
	Rear	15	5 280.0	16.15	17.00	1.216	1.087	0.039	0.052	
	Front	15	5 500.0	16.22	17.00	1.197	1.087	0.030	0.038	
	Rear	15	5 500.0	16.22	17.00	1.197	1.087	0.067	**0.088**	#23
	Front	15	5 785.0	16.40	17.00	1.148	1.087	0.081	**0.101**	#24
	Rear	15	5 785.0	16.40	17.00	1.148	1.087	0.063	0.078	

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11.3 Standalone Hotspot SAR Test Results

GSM 850 Hotspot SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
GPRS 3Tx	Front	10	836.6	29.70	31.00	1.349	0.316	0.426	
	Rear	10	836.6	29.70	31.00	1.349	0.365	0.492	
	Left	10	836.6	29.70	31.00	1.349	0.215	0.290	
	Right	10	836.6	29.70	31.00	1.349	0.410	**0.553**	#25
	Bottom	10	836.6	29.70	31.00	1.349	0.216	0.291	

GSM 1900 Hotspot SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
GPRS 3Tx	Front	10	1 880.0	25.80	27.00	1.318	0.056	0.073	
	Rear	10	1 880.0	25.80	27.00	1.318	0.061	0.080	
	Left	10	1 880.0	25.80	27.00	1.318	0.009	0.012	
	Right	10	1 880.0	25.80	27.00	1.318	0.016	0.021	
	Bottom	10	1 880.0	25.80	27.00	1.318	0.107	**0.141**	#26

UMTS 850 Hotspot SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
RMC	Front	10	836.6	24.63	25.00	1.089	0.299	0.326	
	Rear	10	836.6	24.63	25.00	1.089	0.392	0.427	
	Left	10	836.6	24.63	25.00	1.089	0.164	0.179	
	Right	10	836.6	24.63	25.00	1.089	0.422	**0.460**	#27
	Bottom	10	836.6	24.63	25.00	1.089	0.213	0.232	

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LTE Band 12 Hotspot SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 10M 1RB 0Offset	Front	10	707.5	23.70	24.00	1.072	0.160	0.171	
QPSK 10M 25RB 0Offset	Front	10	707.5	22.62	23.00	1.091	0.134	0.146	
QPSK 10M 1RB 0Offset	Rear	10	707.5	23.70	24.00	1.072	0.201	**0.215**	#28
QPSK 15M 25RB 0Offset	Rear	10	707.5	22.62	23.00	1.091	0.165	0.180	
QPSK 10M 1RB 0Offset	Left	10	707.5	23.70	24.00	1.072	0.086	0.092	
QPSK 15M 25RB 0Offset	Left	10	707.5	22.62	23.00	1.091	0.076	0.083	
QPSK 10M 1RB 0Offset	Right	10	707.5	23.70	24.00	1.072	0.097	0.104	
QPSK 15M 25RB 0Offset	Right	10	707.5	22.62	23.00	1.091	0.085	0.092	
QPSK 10M 1RB 0Offset	Bottom	10	707.5	23.70	24.00	1.072	0.093	0.100	
QPSK 15M 25RB 0Offset	Bottom	10	707.5	22.62	23.00	1.091	0.079	0.086	

LTE Band 26 Hotspot SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 15M 1RB 0Offset	Front	10	831.5	25.34	25.50	1.038	0.339	0.352	
QPSK 15M 36RB 0Offset	Front	10	831.5	24.21	24.50	1.069	0.269	0.288	
QPSK 15M 1RB 0Offset	Rear	10	831.5	25.34	25.50	1.038	0.397	0.412	
QPSK 15M 36RB 0Offset	Rear	10	831.5	24.21	24.50	1.069	0.304	0.325	
QPSK 15M 1RB 0Offset	Left	10	831.5	25.34	25.50	1.038	0.237	0.246	
QPSK 15M 36RB 0Offset	Left	10	831.5	24.21	24.50	1.069	0.175	0.187	
QPSK 15M 1RB 0Offset	Right	10	831.5	25.34	25.50	1.038	0.492	**0.510**	#29
QPSK 15M 36RB 0Offset	Right	10	831.5	24.21	24.50	1.069	0.385	0.412	
QPSK 15M 1RB 0Offset	Bottom	10	831.5	25.34	25.50	1.038	0.243	0.252	
QPSK 15M 36RB 0Offset	Bottom	10	831.5	24.21	24.50	1.069	0.200	0.214	

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LTE Band 41 Hotspot SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
QPSK 20M 1RB 0Offset	Front	10	2 549.5	24.36	25.00	1.159	0.283	0.328	
QPSK 20M 50RB 0Offset	Front	10	2 549.5	23.26	24.00	1.186	0.285	0.338	
QPSK 20M 1RB 0Offset	Rear	10	2 549.5	24.36	25.00	1.159	0.473	0.548	
QPSK 20M 50RB 0Offset	Rear	10	2 549.5	23.26	24.00	1.186	0.487	**0.577**	#30
QPSK 20M 1RB 0Offset	Left	10	2 549.5	24.36	25.00	1.159	0.272	0.315	
QPSK 20M 50RB 0Offset	Left	10	2 549.5	23.26	24.00	1.186	0.281	0.333	
QPSK 20M 1RB 0Offset	Bottom	10	2 549.5	24.36	25.00	1.159	0.436	0.505	
QPSK 20M 50RB 0Offset	Bottom	10	2 549.5	23.26	24.00	1.186	0.446	0.529	

DTS Hotspot SAR

Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
802.11b	Front	10	2 437.0	18.58	19.00	1.102	1.014	0.188	0.210	
	Rear	10	2 437.0	18.58	19.00	1.102	1.014	0.325	0.363	
	Left	10	2 437.0	18.58	19.00	1.102	1.014	0.150	0.168	
	Top	10	2 437.0	18.58	19.00	1.102	1.014	0.433	**0.484**	#31
	Front	10	2 437.0	18.58	19.00	1.102	1.014	0.188	0.210	

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General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings and the standard batteries are the only options.
4. Liquid tissue depth was at least 15 cm.
5. 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.
6. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
7. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 15 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
8. Per FCC KDB Publication 648474 D04v01r03, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required.
9. This device utilizes power reduction for some wireless modes, as outlined in Section 1.3. The maximum output power allowed for each transmitter and exposure condition was evaluated for SAR compliance based on expected use conditions and simultaneous transmission scenarios.

GSM Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. This device supports GSM VOIP in the head and body-worn configurations; therefore GPRS was additionally evaluated for head and body-worn compliance.
3. 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.
4. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). Since the maximum output power variation across the required test channels is not > ½ dB, the middle channel was used for testing.

WCDMA 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. 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).

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LTE Notes:

1. Justification Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
2. When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
3. Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
4. Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
5. Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.
6. A-MPR was disabled for all SAR tests by setting NS=01 and MCC=001 on the base station simulator.
7. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
8. TDD LTE was tested using UL-DL configuration 0 with 6 UL sub frames and 2S sub-frames using extended cyclic prefix only and special sub frame configuration 6. SAR tests were performed at maximum output power and worst-case transmission duty factor in extended cyclic prefix. Per 3GPP 36.211 Sec. 4, the duty factor using extended cyclic prefix is 0.633(cf=1.58).
9. For LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. 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; therefore, the requirement for H, M and L channels may not fully apply.

WLAN & Bluetooth Notes:

1. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4GHz WIFI operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR.
2. 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.
3. When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected.
4. When the specified maximum output power is the same for both UNII Band1 and UNII Band 2A, begins SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is ≤ 1.2W/kg, SAR is not required for UNII band1 > 1.2W/kg, both bands should be tested independently for SAR.
5. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.

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12. Simultaneous Transmission

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.
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 or 10g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is within SAR limits. 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.

12.1 Estimated SAR

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

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

Mode	Position	Frequency	Maximum Allowed Power	Separation Distance	Estimated 1g SAR
		MHz	mW	mm	W/kg
Bluetooth	Head	2 480.0	7.08	5	0.297
	Body-Worn	2 480.0	7.08	15	0.099
	Hotspot	2 480.0	7.08	10	0.149

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

12.2 Simultaneous Transmission Analysis

Exposure Condition /Position		licensed	WLAN		Bluetooth	Summation			
			2.4 GHz	5 GHz					
		[①]	[②]	[③]	[④]	[①+②]	[①+③]	[①+④]	[①+③+④]
GSM/GPRS 850 Band									
Head	Right Cheek	0.281	0.194	0.371	0.297	0.475	0.652	0.578	**0.949**
	Right Tilt	0.154	0.198	0.274	0.297	0.352	0.428	0.451	0.725
	Left Cheek	0.204	0.107	0.107	0.297	0.311	0.311	0.501	0.608
	Left Tilt	0.101	0.109	0.116	0.297	0.210	0.217	0.398	0.514
Body-Worn	Front	0.374	0.115	0.101	0.099	0.489	0.475	0.473	0.574
	Rear	0.441	0.214	0.088	0.099	**0.655**	0.529	0.540	0.628
Hotspot	Front	0.426	0.210	N/A	0.149	0.636	N/A	0.575	N/A
	Rear	0.492	0.363	N/A	0.149	**0.855**	N/A	0.641	N/A
	Left Edge	0.290	0.168	N/A	0.149	0.458	N/A	0.439	N/A
	Right Edge	0.553	-	N/A	0.149	0.553	N/A	0.702	N/A
	Top	-	0.484	N/A	0.149	0.484	N/A	0.149	N/A
	Bottom	0.291	-	N/A	0.149	0.291	N/A	0.440	N/A
GSM/GPRS 1900 Band									
Head	Right Cheek	0.034	0.194	0.371	0.297	0.228	0.405	0.331	**0.702**
	Right Tilt	0.017	0.198	0.274	0.297	0.215	0.291	0.314	0.588
	Left Cheek	0.045	0.107	0.107	0.297	0.152	0.152	0.342	0.449
	Left Tilt	0.017	0.109	0.116	0.297	0.126	0.133	0.314	0.430
Body-Worn	Front	0.208	0.115	0.101	0.099	0.323	0.309	0.307	0.408
	Rear	0.200	0.214	0.088	0.099	**0.414**	0.288	0.299	0.387
Hotspot	Front	0.073	0.210	N/A	0.149	0.283	N/A	0.222	N/A
	Rear	0.080	0.363	N/A	0.149	0.443	N/A	0.229	N/A
	Left Edge	0.012	0.168	N/A	0.149	0.180	N/A	0.161	N/A
	Right Edge	0.021	-	N/A	0.149	0.021	N/A	0.170	N/A
	Top	-	0.484	N/A	0.149	**0.484**	N/A	0.149	N/A
	Bottom	0.141	-	N/A	0.149	0.141	N/A	0.290	N/A
UMTS 850 Band									
Head	Right Cheek	0.184	0.194	0.371	0.297	0.378	0.555	0.481	**0.852**
	Right Tilt	0.095	0.198	0.274	0.297	0.293	0.369	0.392	0.666
	Left Cheek	0.148	0.107	0.107	0.297	0.255	0.255	0.445	0.552
	Left Tilt	0.099	0.109	0.116	0.297	0.208	0.215	0.396	0.512
Body-Worn	Front	0.327	0.115	0.101	0.099	0.442	0.428	0.426	0.527
	Rear	0.348	0.214	0.088	0.099	**0.562**	0.436	0.447	0.535
Hotspot	Front	0.326	0.210	N/A	0.149	0.536	N/A	0.475	N/A
	Rear	0.427	0.363	N/A	0.149	**0.790**	N/A	0.576	N/A
	Left Edge	0.179	0.168	N/A	0.149	0.347	N/A	0.328	N/A
	Right Edge	0.460	-	N/A	0.149	0.460	N/A	0.609	N/A
	Top	-	0.484	N/A	0.149	0.484	N/A	0.149	N/A
	Bottom	0.232	-	N/A	0.149	0.232	N/A	0.381	N/A

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Exposure Condition /Position		licensed	WLAN		Bluetooth	Summation			
			2.4 GHz	5 GHz					
		[①]	[②]	[③]	[④]	[①+②]	[①+③]	[①+④]	[①+③+④]
LTE Band 12									
Head	Right Cheek	0.094	0.194	0.371	0.297	0.288	0.465	0.391	**0.762**
	Right Tilt	0.052	0.198	0.274	0.297	0.250	0.326	0.349	0.623
	Left Cheek	0.092	0.107	0.107	0.297	0.199	0.199	0.389	0.496
	Left Tilt	0.053	0.109	0.116	0.297	0.162	0.169	0.350	0.466
Body-Worn	Front	0.138	0.115	0.101	0.099	0.253	0.239	0.237	0.338
	Rear	0.166	0.214	0.088	0.099	**0.380**	0.254	0.265	0.353
Hotspot	Front	0.171	0.210	N/A	0.149	0.381	N/A	0.320	N/A
	Rear	0.215	0.363	N/A	0.149	**0.578**	N/A	0.364	N/A
	Left Edge	0.092	0.168	N/A	0.149	0.260	N/A	0.241	N/A
	Right Edge	0.104	-	N/A	0.149	0.104	N/A	0.253	N/A
	Top	-	0.484	N/A	0.149	0.484	N/A	0.149	N/A
	Bottom	0.100	-	N/A	0.149	0.100	N/A	0.249	N/A
LTE Band 26									
Head	Right Cheek	0.196	0.194	0.371	0.297	0.390	0.567	0.493	**0.864**
	Right Tilt	0.114	0.198	0.274	0.297	0.312	0.388	0.411	0.685
	Left Cheek	0.186	0.107	0.107	0.297	0.293	0.293	0.483	0.590
	Left Tilt	0.146	0.109	0.116	0.297	0.255	0.262	0.443	0.559
Body-Worn	Front	0.410	0.115	0.101	0.099	0.525	0.511	0.509	**0.610**
	Rear	0.331	0.214	0.088	0.099	0.545	0.419	0.430	0.518
Hotspot	Front	0.352	0.210	N/A	0.149	0.562	N/A	0.501	N/A
	Rear	0.412	0.363	N/A	0.149	**0.775**	N/A	0.561	N/A
	Left Edge	0.246	0.168	N/A	0.149	0.414	N/A	0.395	N/A
	Right Edge	0.510	-	N/A	0.149	0.510	N/A	0.659	N/A
	Top	-	0.484	N/A	0.149	0.484	N/A	0.149	N/A
	Bottom	0.252	-	N/A	0.149	0.252	N/A	0.401	N/A
LTE Band 41									
Head	Right Cheek	0.101	0.194	0.371	0.297	0.295	0.472	0.398	**0.769**
	Right Tilt	0.077	0.198	0.274	0.297	0.275	0.351	0.374	0.648
	Left Cheek	0.101	0.107	0.107	0.297	0.208	0.208	0.398	0.505
	Left Tilt	0.035	0.109	0.116	0.297	0.144	0.151	0.332	0.448
Body-Worn	Front	0.206	0.115	0.101	0.099	0.321	0.307	0.305	0.406
	Rear	0.321	0.214	0.088	0.099	**0.535**	0.409	0.420	0.508
Hotspot	Front	0.338	0.210	N/A	0.149	0.548	N/A	0.487	N/A
	Rear	0.577	0.363	N/A	0.149	**0.940**	N/A	0.726	N/A
	Left Edge	0.333	0.168	N/A	0.149	0.501	N/A	0.482	N/A
	Right Edge	-	-	N/A	0.149	-	N/A	0.149	N/A
	Top	-	0.484	N/A	0.149	0.484	N/A	0.149	N/A
	Bottom	0.529	-	N/A	0.149	0.529	N/A	0.678	N/A

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Notes: Simultaneous transmission SAR test exclusion considerations

- Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneously transmitting antenna. When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration. Per KDB Publication 447498 D01v06.
- When the sum of SAR1g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (SAR1g 1.6 W/kg), the SPLSR procedures is not required. When the sum of SAR1g is greater than the SAR limit (SAR1g 1.6 W/kg), SAR test exclusion is determined by the SPLSR.

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13. SAR 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) **Repeated measurements are not required when the original highest measured SAR is < 0.80 W/㎏.**
2) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
3) 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 1-g SAR limit).
4) 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.

Band	Frequency (㎒)	EUT Position	Separation Distance (㎜)	Measured 1 g SAR (W/kg)	Repeated 1g SAR (W/kg)	Ratio
N/A						

14. Measurement Uncertainty

Per KDB 865664 D01 SAR measurement 100㎒ to 6㎓, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of *k* = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Standard 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

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15. Test Equipment Information

Test Platform	SPEAG DASY5 System			
Version	DASY52: 52.10.1.1476 SEMCAD: 14.6.11 (7439)			
Location	KCTL Inc, 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea			
Manufacture	SPEAG			
Hardware Reference				
Equipment	Model	Serial Number	Date of Calibration	Due date of next Calibration
Shield Room	-	8F - #1	N/A	N/A
Shield Room	-	8F - #2	N/A	N/A
DASY5 Robot	TX90XL	F12/5L7FA1/A/01	N/A	N/A
DASY5 Robot	TX90XL speag	F07/554JA1/A/01	N/A	N/A
Phantom	Twin SAM Phantom	1362	N/A	N/A
Phantom	Twin SAM Phantom	1363	N/A	N/A
Phantom	Twin SAM Phantom	1724	N/A	N/A
Phantom	Twin SAM Phantom	1728	N/A	N/A
Mounting Device	Laptop Holder	-	N/A	N/A
DAE	DAE4	1342	2019-05-23	2020-05-23
DAE	DAE4	1567	2019-02-05	2020-02-05
Probe	EX3DV4	3697	2019-03-28	2020-03-28
Probe	EX3DV4	3928	2019-01-31	2020-01-31
Probe	EX3DV4	3879	2019-03-27	2020-03-27
ESG Vector Signal Generator	E4438C	MY42080486	2019-05-13	2020-05-13
Dual Power Meter	E4419B	GB43312301	2019-05-13	2020-05-13
Power Sensor	8481H	3318A 19379	2019-05-13	2020-05-13
Power Sensor	8481H	3318A 19377	2019-05-13	2020-05-13
Attenuator	8491B 3dB	17387	2019-05-13	2020-05-13
Attenuator	8491B-6dB	MY39270294	2019-05-13	2020-05-13
Attenuator	8491B 10dB	29425	2019-05-13	2020-05-13
Power Amplifier	2055-BBS3Q7E9I	1005D/C0521	2019-03-08	2020-03-08
Power Amplifier	5190FE	1012	2019-05-14	2020-05-14
Dual Directional Coupler	772D	2839A00719	2019-05-13	2020-05-13
Dual Directional Coupler	778D	16059	2019-05-13	2020-05-13
Low Pass Filter	LA-15N	36543	2019-05-13	2020-05-13
Low Pass Filter	LA-30N	40058	2019-05-13	2020-05-13
Low Pass Filter	LA-60N	40059	2019-05-13	2020-05-13
Dipole Validation Kits	D750V3	1183	2018-09-03	2020-09-03

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Equipment	Model	Serial Number	Date of Calibration	Due date of next Calibration
Dipole Validation Kits	D835V2	4d138	2019-04-23	2021-04-23
Dipole Validation Kits	D1900V2	5d158	2019-04-23	2021-04-23
Dipole Validation Kits	D2450V2	892	2019-04-24	2021-04-24
Dipole Validation Kits	D2600V2	1038	2019-05-28	2021-05-28
Dipole Validation Kits	D5GHzV2	1134	2019-05-23	2021-05-23
Network Analyzer	E5071B	MY42403524	2019-01-04	2020-01-04
Dielectric Assessment Kit	DAK-3.5	1078	2019-05-22	2020-05-22
Humidity/Temp.	MHB-382SD	73871	2019-05-16	2020-05-16
Humidity/Temp.	MHB-382SD	23107	2019-05-16	2020-05-16
Spectrum Analyzer	FSP7	100289	2019-01-04	2020-01-04
Wideband Radio Communication Tester	CMW500	132021	2019-07-17	2020-07-17

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16. Test System Verification Results

Date: 2019-09-06

Test Laboratory: KCTL Inc.
File Name: 750 MHz Head Verification Input Power 250 mW 2019-09-06.da52:0

DUT: Dipole 750 MHz D750V3, Type: D750V3, Serial: D750V3 - SN:1183

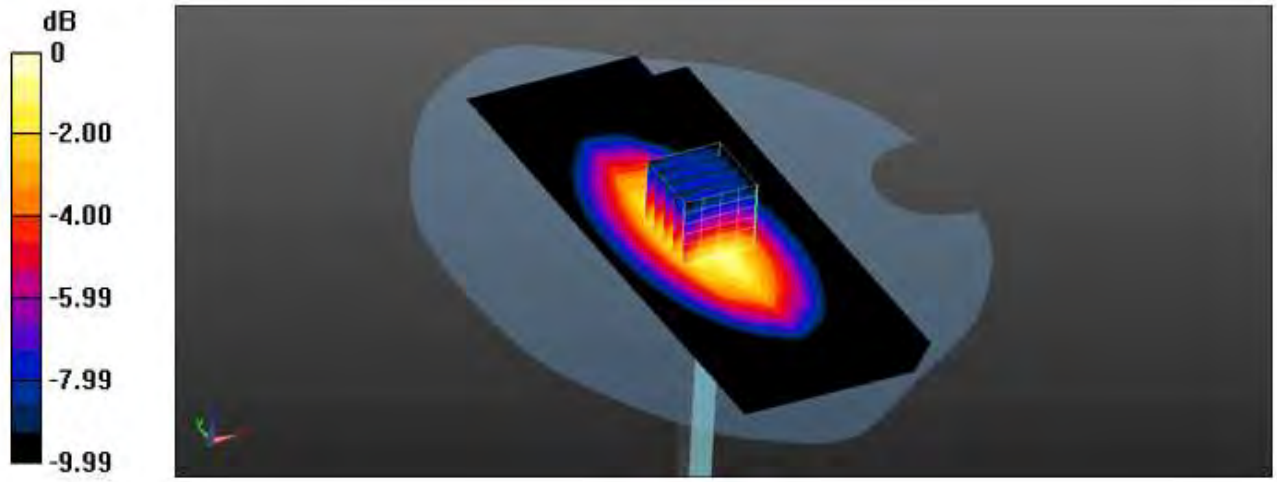
Communication System: UID 0, CW (0); Frequency: 750 MHz; Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.918 S/m; ε_r = 40.367; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(9, 9, 9) @ 750 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check/750 MHz Head Verification Input Power 250 mW 2019-09-06/Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.47 W/kg

System Performance Check/750 MHz Head Verification Input Power 250 mW 2019-09-06/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 53.80 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 3.04 W/kg
SAR(1 g) = 2.04 W/kg; SAR(10 g) = 1.36 W/kg
Maximum value of SAR (measured) = 2.70 W/kg



0 dB = 2.70 W/kg = 4.31 dBW/kg

Date: 2019-08-07

Test Laboratory: KCTL Inc.
File Name: 835 MHz Head Verification Input Power 250 mW 2019-08-07.da52:0

DUT: Dipole 835 MHz D835V2, Type: D835V2, Serial: D835V2 - SN:4d138

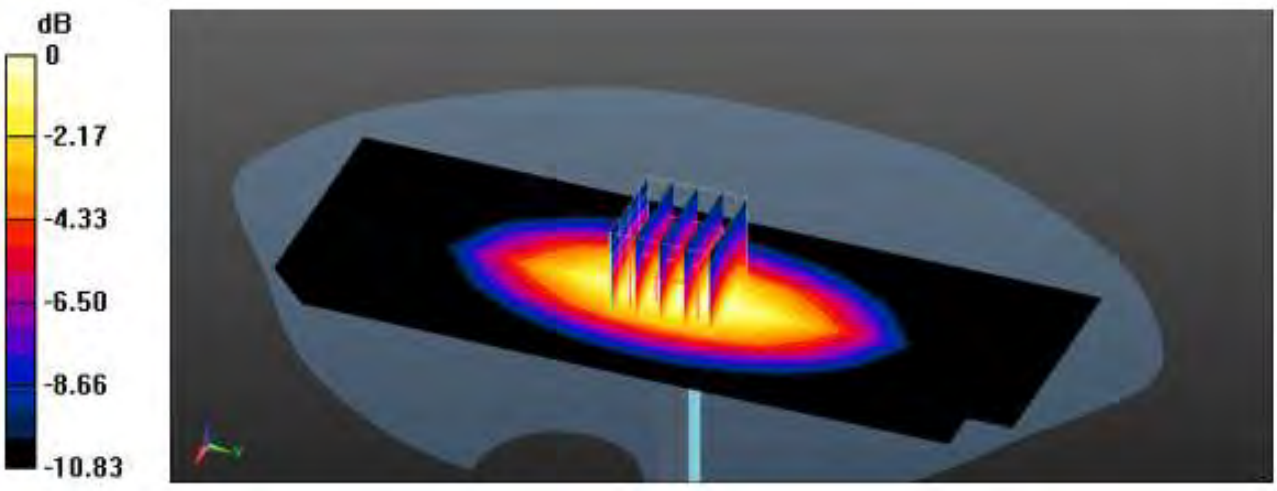
Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.918 S/m; ε_r = 40.82; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(9.36, 9.36, 9.36) @ 835 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check/835 MHz Head Verification Input Power 250 mW 2019-08-07/Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.39 W/kg

System Performance Check/835 MHz Head Verification Input Power 250 mW 2019-08-07/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 63.93 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.78 W/kg
SAR(1 g) = 2.54 W/kg; SAR(10 g) = 1.66 W/kg
Maximum value of SAR (measured) = 3.37 W/kg



0 dB = 3.37 W/kg = 5.28 dBW/kg

Date: 2019-08-06

Test Laboratory: KCTL Inc.
File Name: 835 MHz Head Verification Input Power 250 mW 2019-08-06.da52:0

DUT: Dipole 835 MHz D835V2, Type: D835V2, Serial: D835V2 - SN:4d138

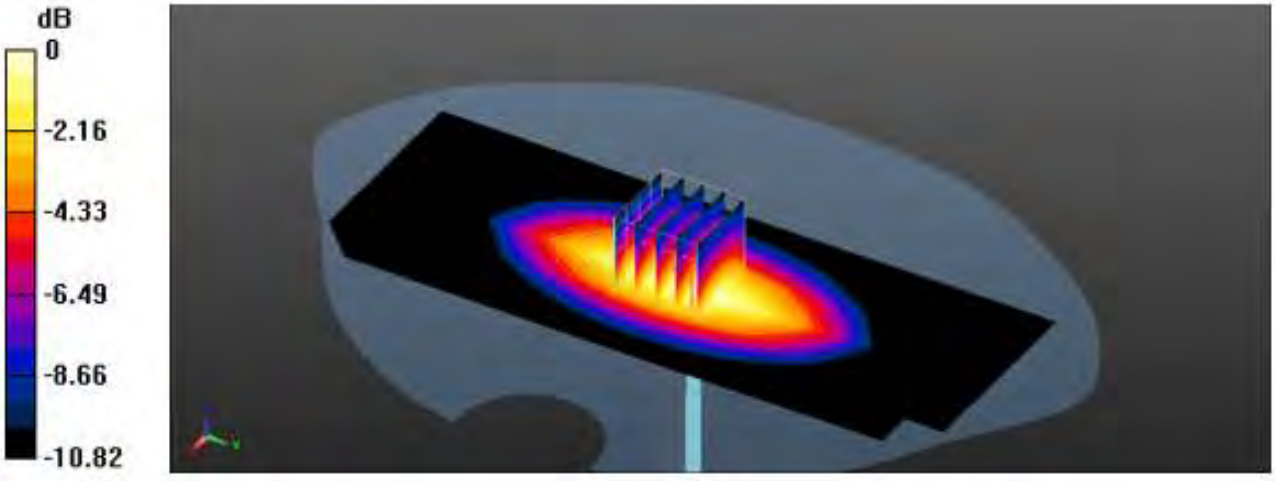
Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.889 S/m; ε_r = 41.25; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(9.36, 9.36, 9.36) @ 835 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check/835 MHz Head Verification Input Power 250 mW 2019-08-06/Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.16 W/kg

System Performance Check/835 MHz Head Verification Input Power 250 mW 2019-08-06/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 62.80 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 3.17 W/kg



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

Date: 2019-08-05

Test Laboratory: KCTL Inc.
File Name: 835 MHz Head Verification Input Power 250 mW 2019-08-05.da52:0

DUT: Dipole 835 MHz D835V2, Type: D835V2, Serial: D835V2 - SN:4d138

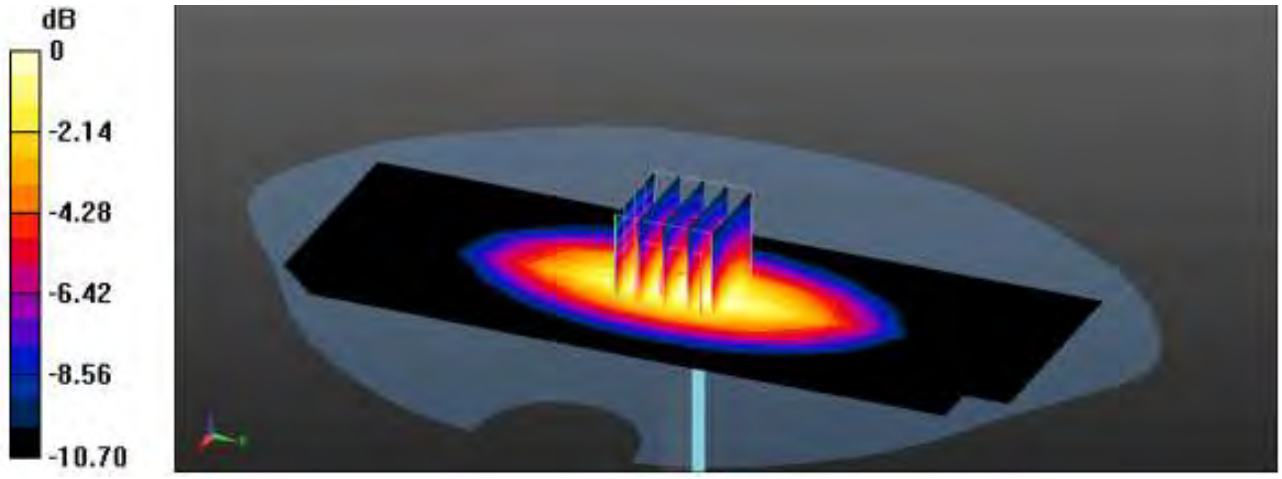
Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.917 S/m; ε_r = 40.557; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(9.36, 9.36, 9.36) @ 835 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check/835 MHz Head Verification Input Power 250 mW 2019-08-05/Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.33 W/kg

System Performance Check/835 MHz Head Verification Input Power 250 mW 2019-08-05/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 63.78 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 3.80 W/kg
SAR(1 g) = 2.55 W/kg; SAR(10 g) = 1.67 W/kg
Maximum value of SAR (measured) = 3.39 W/kg



0 dB = 3.39 W/kg = 5.30 dBW/kg

Date: 2019-08-14

Test Laboratory: KCTL Inc.
File Name: 1900 MHz Head Verification Input Power 250 mW 2019-08-14.da5:0

DUT: Dipole 1900 MHz, Type: D1900V2, Serial: D1900V2 - SN:5d158

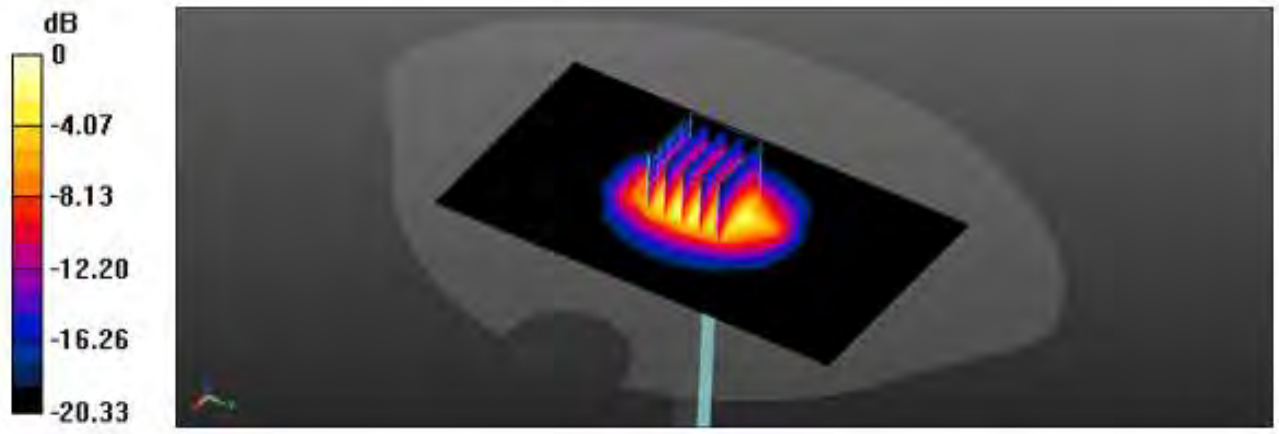
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.435 S/m; ε_r = 40.343; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(7.79, 7.79, 7.79) @ 1900 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_4_20180808; Type: QD 000 P40 CC; Serial: 1362
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/1900 MHz Head Verification Input Power 250 mW 2019-08-14/Area Scan (8x13x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 15.6 W/kg

Configuration/1900 MHz Head Verification Input Power 250 mW 2019-08-14/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 107.7 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 21.7 W/kg
SAR(1 g) = 10.5 W/kg; SAR(10 g) = 5.22 W/kg
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

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Date: 2019-08-09

Test Laboratory: KCTL Inc.
File Name: 2450 MHz Head Verification Input Power 100 mW 2019-08-09.da53:0

DUT: Dipole 2450 MHz D2450V2, Type: D2450V2, Serial: D2450V2 - SN:892

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2450 MHz; σ = 1.875 S/m; ε_r = 38.934; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

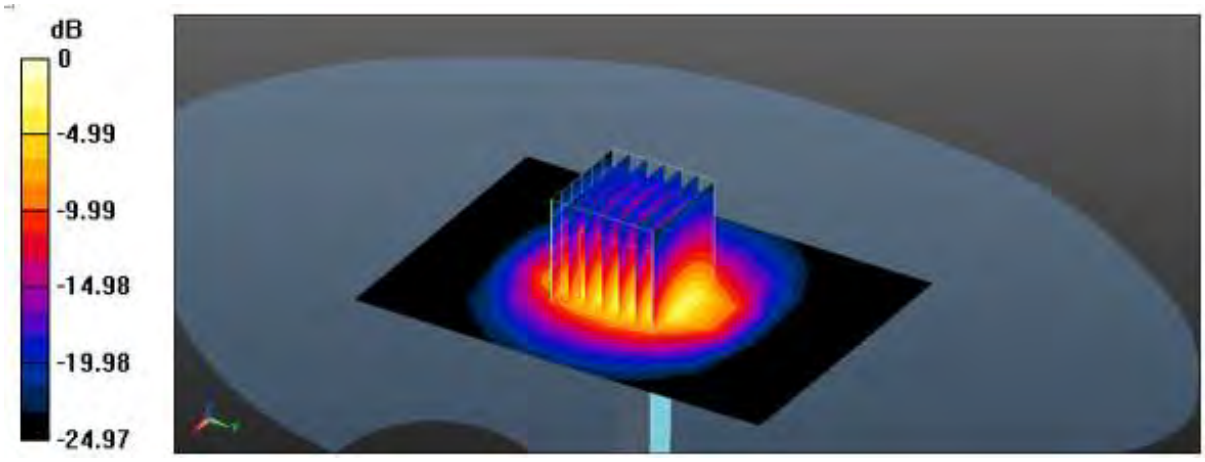
- Probe: EX3DV4 - SN3879; ConvF(7.2, 7.2, 7.2) @ 2450 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check (without Area Scan)/2450 MHz Head Verification Input Power 100 mW 2019-08-09/Area Scan (8x11x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 7.10 W/kg

System Performance Check (without Area Scan)/2450 MHz Head Verification Input Power 100 mW 2019-08-09/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 72.08 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 11.6 W/kg
SAR(1 g) = 5.24 W/kg; SAR(10 g) = 2.32 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 9.15 W/kg



0 dB = 9.15 W/kg = 9.61 dBW/kg

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 2600 MHz Head Verification Input Power 100 mW 2019-08-12.da53:0

DUT: Dipole 2600 MHz D2600V2, Type: D2600V2, Serial: D2600V2 - SN:1038

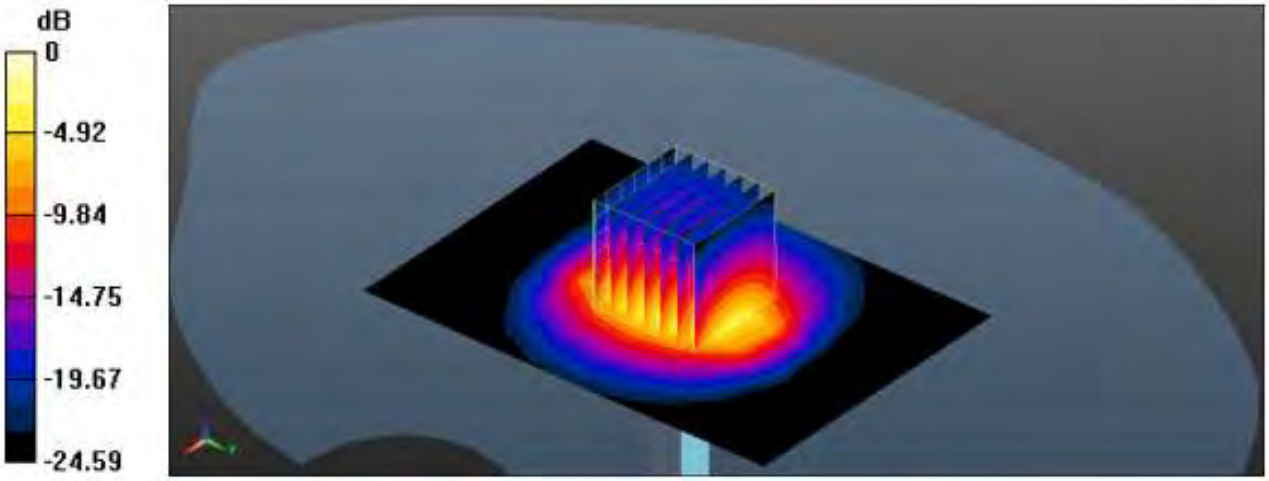
Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 2.005 S/m; ε_r = 39.828; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.07, 7.07, 7.07) @ 2600 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check (without Area Scan)/2600 MHz Head Verification Input Power 100 mW 2019-08-12/Area Scan (8x11x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 7.40 W/kg

System Performance Check (without Area Scan)/2600 MHz Head Verification Input Power 100 mW 2019-08-12/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 71.46 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 12.3 W/kg
SAR(1 g) = 5.44 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 9.62 W/kg



0 dB = 9.62 W/kg = 9.83 dBW/kg

Date: 2019-08-08

Test Laboratory: KCTL Inc.
File Name: 5300 MHz Head Verification Input Power 100 mW 2019-08-08.da5:0

DUT: Dipole D5GHzV2, Type: D5GHzV2, Serial: D5GHzV2 - SN:1134

Communication System: UID 0, CW (0); Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5300 MHz; σ = 4.693 S/m; ε_r = 36.425; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

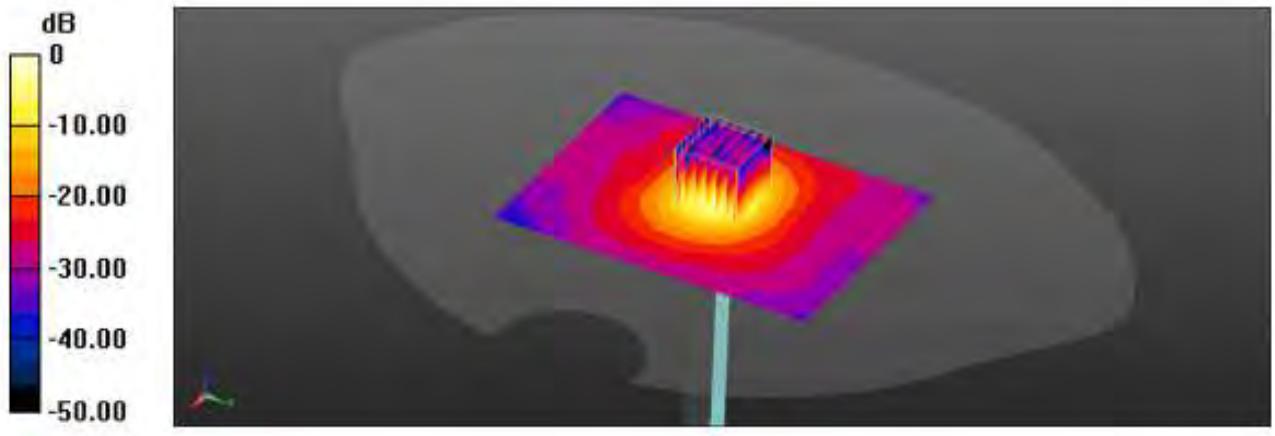
- Probe: EX3DV4 - SN3928;ConvF(4.95, 4.95, 4.95) @ 5300 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/5300 MHz Head Verification Input Power 100 mW 2019-08-08/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 20.7 W/kg

Configuration/5300 MHz Head Verification Input Power 100 mW 2019-08-08/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 53.42 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 39.2 W/kg
SAR(1 g) = 8.65 W/kg; SAR(10 g) = 2.41 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 23.0 W/kg



0 dB = 23.0 W/kg = 13.62 dBW/kg

Date: 2019-08-13

Test Laboratory: KCTL Inc.
File Name: 5600 MHz Head Verification Input Power 100 mW 2019-08-13.da5:0

DUT: Dipole D5GHzV2, Type: D5GHzV2, Serial: D5GHzV2 - SN:1134

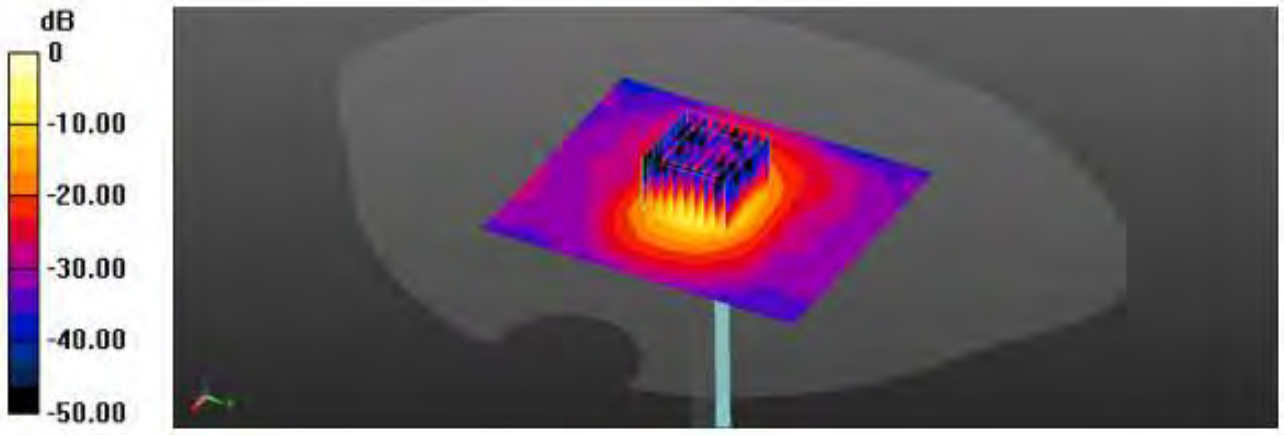
Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.197 S/m; ε_r = 35.828; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(4.78, 4.78, 4.78) @ 5600 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/5600 MHz Head Verification Input Power 100 mW 2019-08-13/Area Scan (11x13x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 21.9 W/kg

Configuration/5600 MHz Head Verification Input Power 100 mW 2019-08-13/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.56 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 39.6 W/kg
SAR(1 g) = 8.49 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 22.9 W/kg



0 dB = 22.9 W/kg = 13.60 dBW/kg

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 5800 MHz Head Verification Input Power 100 mW 2019-08-12.da5:0

DUT: Dipole D5GHzV2, Type: D5GHzV2, Serial: D5GHzV2 - SN:1134

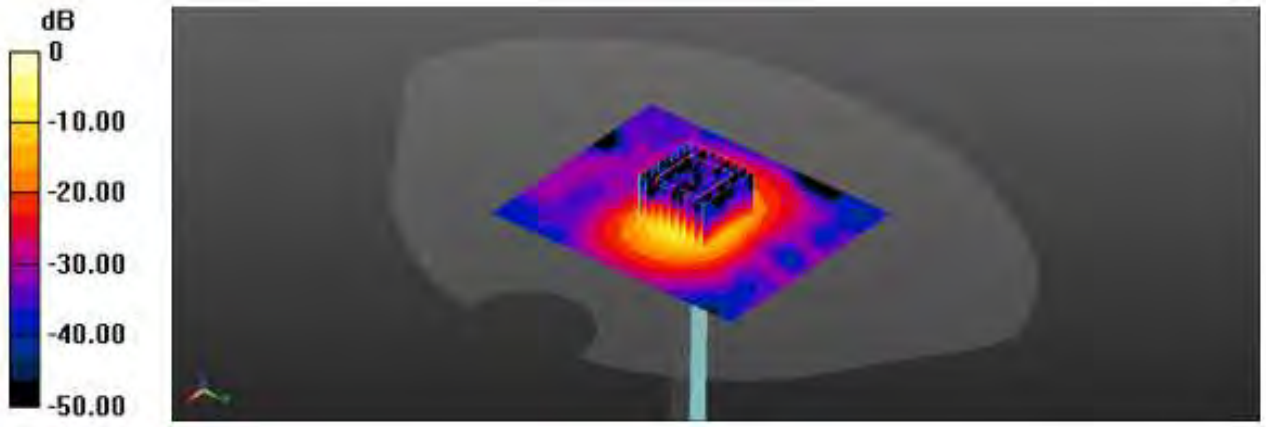
Communication System: UID 0, CW (0); Frequency: 5800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.355 S/m; ε_r = 34.964; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(4.7, 4.7, 4.7) @ 5800 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/5800 MHz Head Verification Input Power 100 mW 2019-08-12/Area Scan (11x13x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 18.0 W/kg

Configuration/5800 MHz Head Verification Input Power 100 mW 2019-08-12/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.13 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 40.2 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 22.3 W/kg



0 dB = 22.3 W/kg = 13.48 dBW/kg

Date: 2019-09-06

Test Laboratory: KCTL Inc.
File Name: 750 MHz Body Verification Input Power 250 mW 2019-09-06.da52:0

DUT: Dipole 750 MHz D750V3, Type: D750V3, Serial: D750V3 - SN:1183

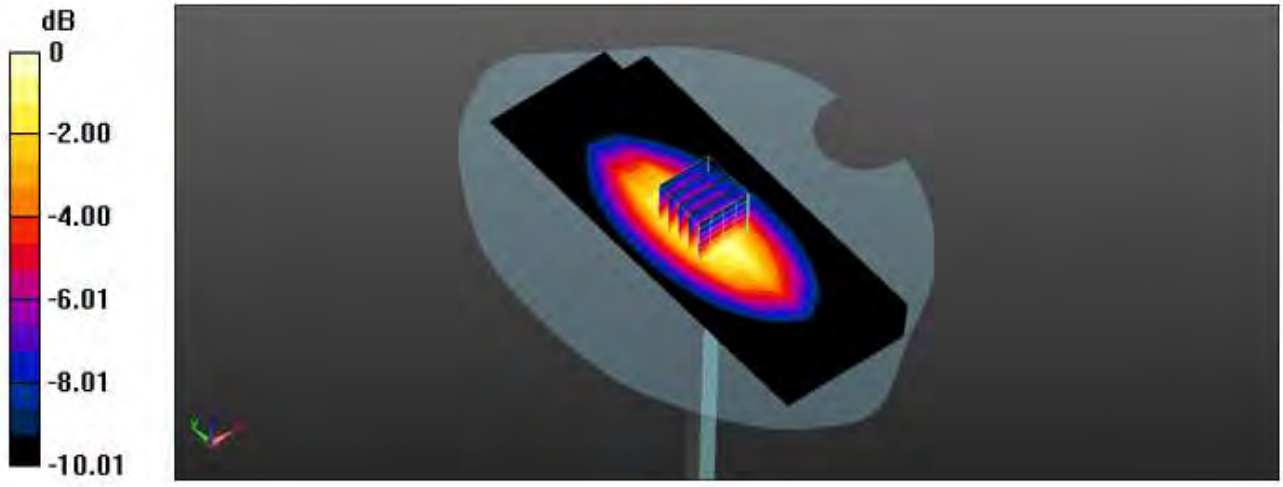
Communication System: UID 0, CW (0); Frequency: 750 MHz; Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.994 S/m; ε_r = 53.541; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.9, 8.9, 8.9) @ 750 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check/750 MHz Body Verification Input Power 250 mW 2019-09-06/Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.55 W/kg

System Performance Check/750 MHz Body Verification Input Power 250 mW 2019-09-06/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 52.71 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.04 W/kg
SAR(1 g) = 2.02 W/kg; SAR(10 g) = 1.35 W/kg
Maximum value of SAR (measured) = 2.69 W/kg



0 dB = 2.69 W/kg = 4.30 dBW/kg

Date: 2019-08-07

Test Laboratory: KCTL Inc.
File Name: 835 MHz Body Verification Input Power 250 mW 2019-08-07.da52:0

DUT: Dipole 835 MHz D835V2, Type: D835V2, Serial: D835V2 - SN:4d138

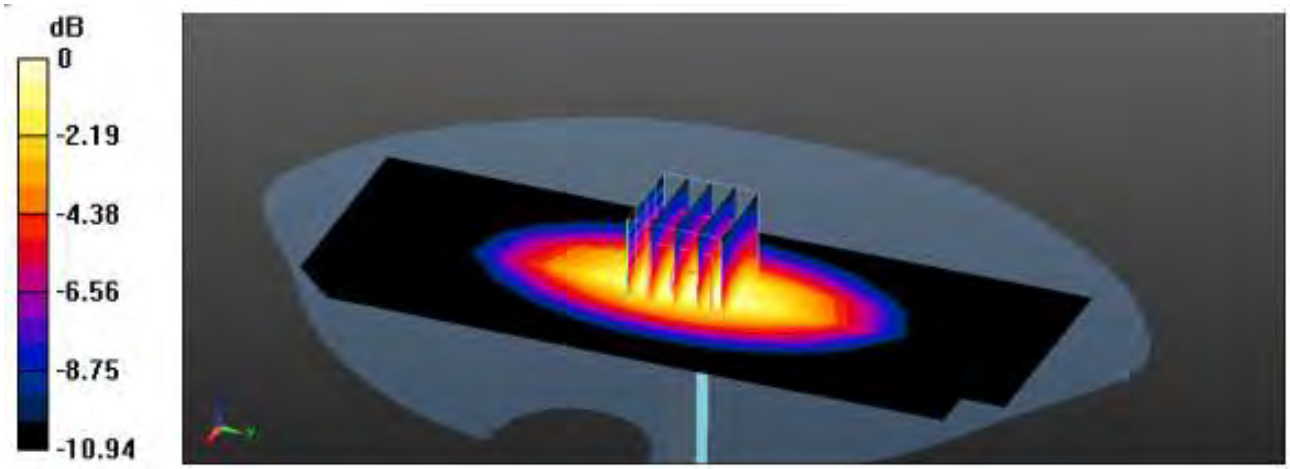
Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.97 S/m; ε_r = 53.285; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 835 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check/835 MHz Body Verification Input Power 250 mW 2019-08-07/Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.23 W/kg

System Performance Check/835 MHz Body Verification Input Power 250 mW 2019-08-07/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 60.23 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 3.91 W/kg
SAR(1 g) = 2.54 W/kg; SAR(10 g) = 1.65 W/kg
Maximum value of SAR (measured) = 3.45 W/kg



0 dB = 3.45 W/kg = 5.38 dBW/kg

Date: 2019-08-06

Test Laboratory: KCTL Inc.
File Name: 835 MHz Body Verification Input Power 250 mW 2019-08-06.da52:0

DUT: Dipole 835 MHz D835V2, Type: D835V2, Serial: D835V2 - SN:4d138

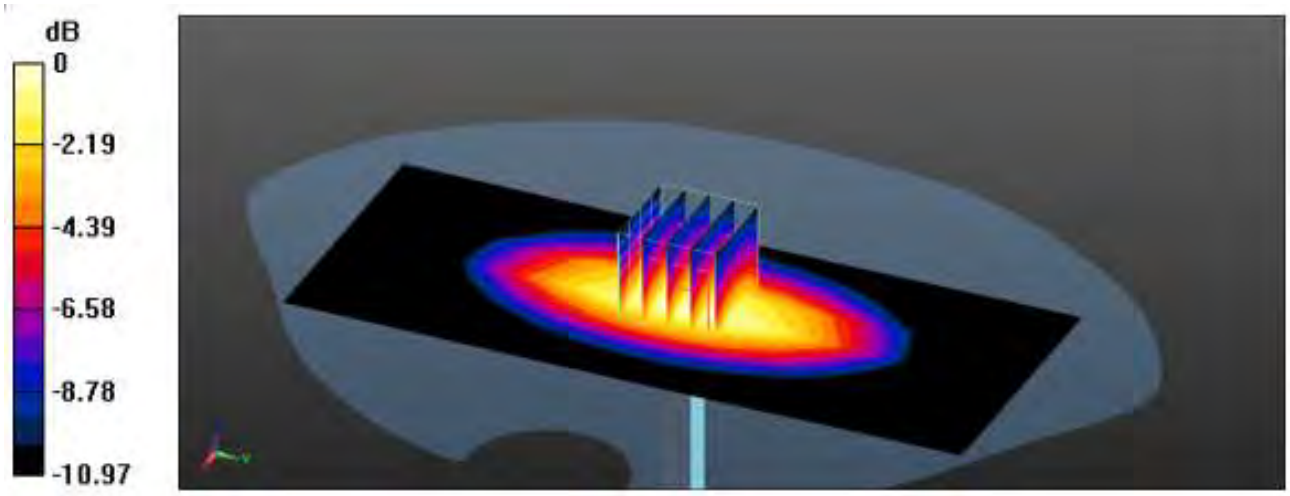
Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.996 S/m; ε_r = 53.224; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 835 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check/835 MHz Body Verification Input Power 250 mW 2019-08-06/Area Scan (7x16x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.15 W/kg

System Performance Check/835 MHz Body Verification Input Power 250 mW 2019-08-06/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 59.55 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.86 W/kg
SAR(1 g) = 2.53 W/kg; SAR(10 g) = 1.64 W/kg
Maximum value of SAR (measured) = 3.40 W/kg



0 dB = 3.40 W/kg = 5.31 dBW/kg

Date: 2019-08-05

Test Laboratory: KCTL Inc.
File Name: 835 MHz Body Verification Input Power 250 mW 2019-08-05.da52:0

DUT: Dipole 835 MHz D835V2, Type: D835V2, Serial: D835V2 - SN:4d138

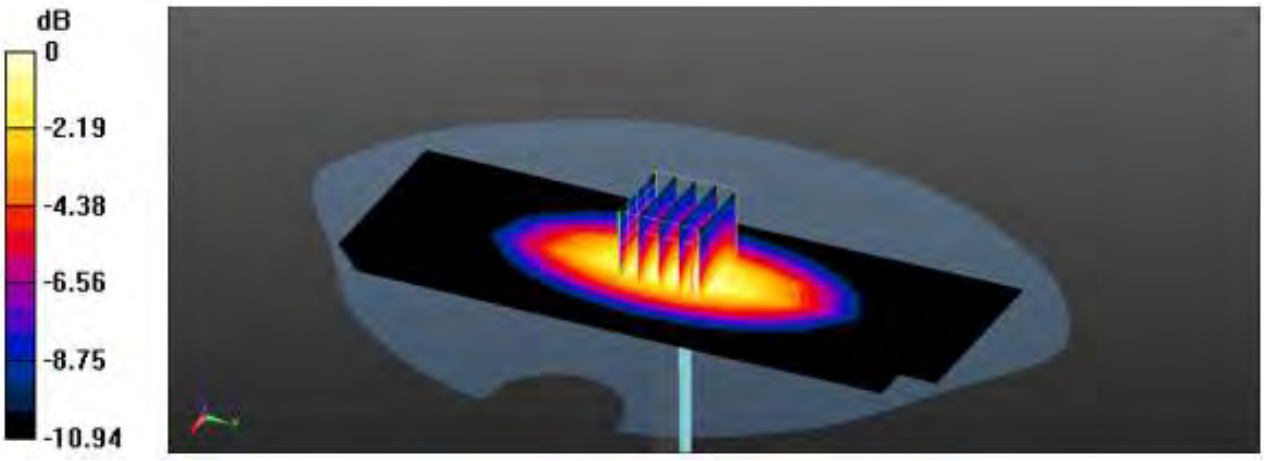
Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.966 S/m; ε_r = 53.146; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 835 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check/835 MHz Body Verification Input Power 250 mW 2019-08-05/Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 3.15 W/kg

System Performance Check/835 MHz Body Verification Input Power 250 mW 2019-08-05/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 59.59 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 3.84 W/kg
SAR(1 g) = 2.49 W/kg; SAR(10 g) = 1.62 W/kg
Maximum value of SAR (measured) = 3.38 W/kg



0 dB = 3.38 W/kg = 5.29 dBW/kg

Date: 2019-08-14

Test Laboratory: KCTL Inc.
File Name: 1900 MHz Body Verification Input Power 250 mW 2019-08-14.da5:0

DUT: Dipole 1900 MHz, Type: D1900V2, Serial: D1900V2 - SN:5d158

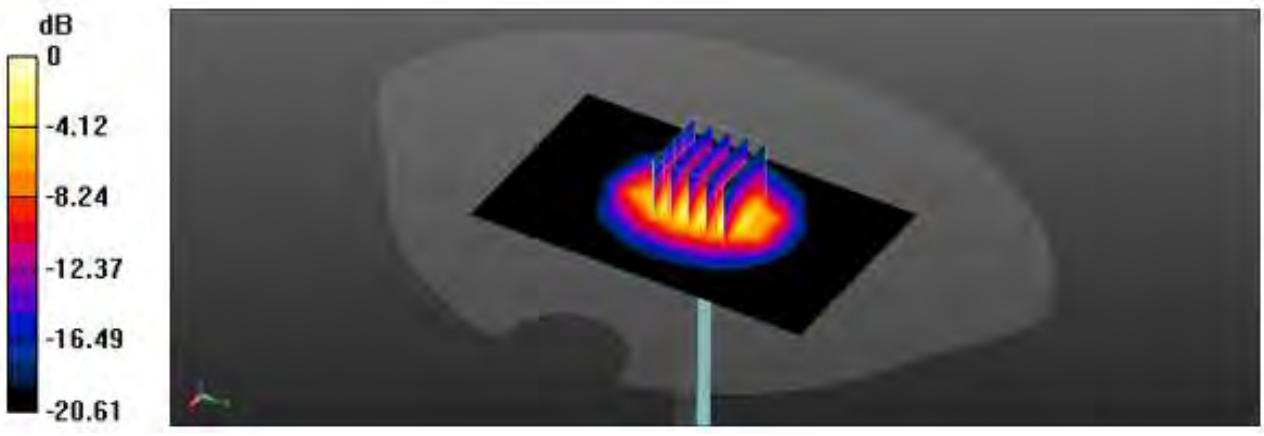
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.546 S/m; ε_r = 51.889; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(7.46, 7.46, 7.46) @ 1900 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_4_20180808; Type: QD 000 P40 CC; Serial: 1362
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/1900 MHz Body Verification Input Power 250 mW 2019-08-14/Area Scan (7x11x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 13.0 W/kg

Configuration/1900 MHz Body Verification Input Power 250 mW 2019-08-14/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 96.40 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 19.6 W/kg
SAR(1 g) = 9.72 W/kg; SAR(10 g) = 4.84 W/kg
Maximum value of SAR (measured) = 15.9 W/kg



0 dB = 15.9 W/kg = 12.01 dBW/kg

Date: 2019-08-09

Test Laboratory: KCTL Inc.
File Name: 2450 MHz Body Verification Input Power 100 mW 2019-08-09.da53:0

DUT: Dipole 2450 MHz D2450V2, Type: D2450V2, Serial: D2450V2 - SN:892

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2450 MHz; σ = 1.998 S/m; ε_r = 52.141; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

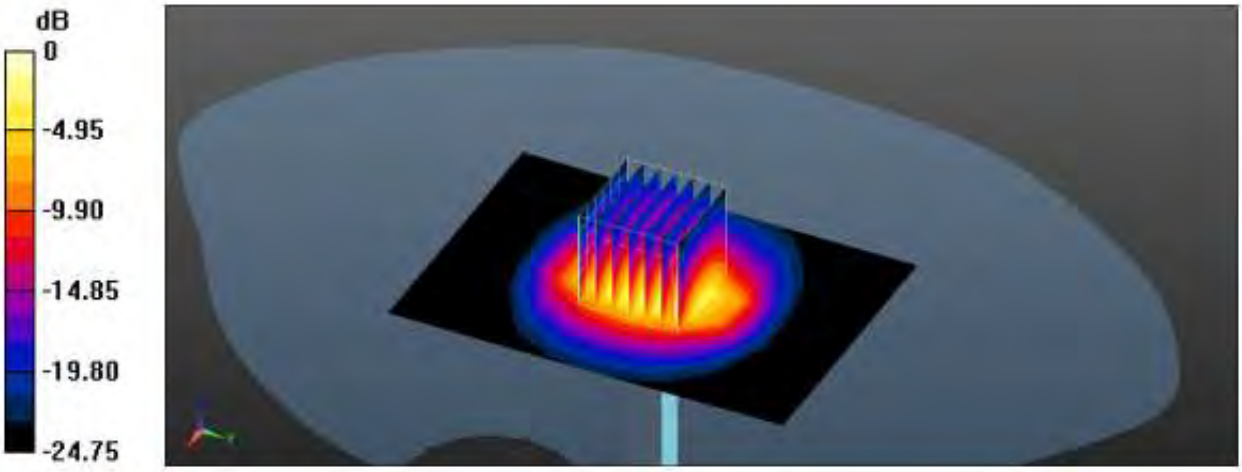
- Probe: EX3DV4 - SN3697; ConvF(6.96, 6.96, 6.96) @ 2450 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check (without Area Scan)/2450 MHz Verification Input Power 100 mW 2019-08-09/Area Scan (8x11x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 6.66 W/kg

System Performance Check (without Area Scan)/2450 MHz Verification Input Power 100 mW 2019-08-09/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 68.55 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 11.3 W/kg
SAR(1 g) = 4.94 W/kg; SAR(10 g) = 2.18 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 8.73 W/kg



0 dB = 8.73 W/kg = 9.41 dBW/kg

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 2600 MHz Body Verification Input Power 100 mW 2019-08-12.da53:0

DUT: Dipole 2600 MHz D2600V2, Type: D2600V2, Serial: D2600V2 - SN:1038

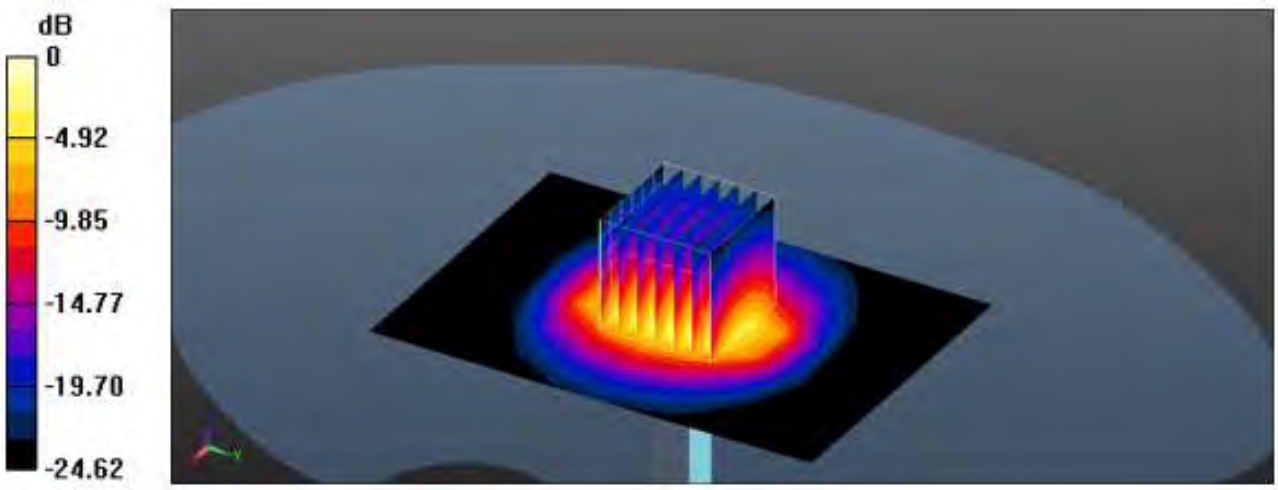
Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 2.22 S/m; ε_r = 51.483; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(6.78, 6.78, 6.78) @ 2600 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

System Performance Check (without Area Scan)/2600 MHz Body Verification Input Power 100 mW 2019-08-12/Area Scan (8x11x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 7.65 W/kg

System Performance Check (without Area Scan)/2600 MHz Body Verification Input Power 100 mW 2019-08-12/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 69.71 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 12.6 W/kg
SAR(1 g) = 5.6 W/kg; SAR(10 g) = 2.49 W/kg
Maximum value of SAR (measured) = 9.85 W/kg



0 dB = 9.85 W/kg = 9.93 dBW/kg

Date: 2019-08-08

Test Laboratory: KCTL Inc.
File Name: 5300 MHz Body Verification Input Power 100 mW 2019-08-08.da5:0

DUT: Dipole D5GHzV2, Type: D5GHzV2, Serial: D5GHzV2 - SN:1134

Communication System: UID 0, CW (0); Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5300 MHz; σ = 5.42 S/m; ε_r = 48.046; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

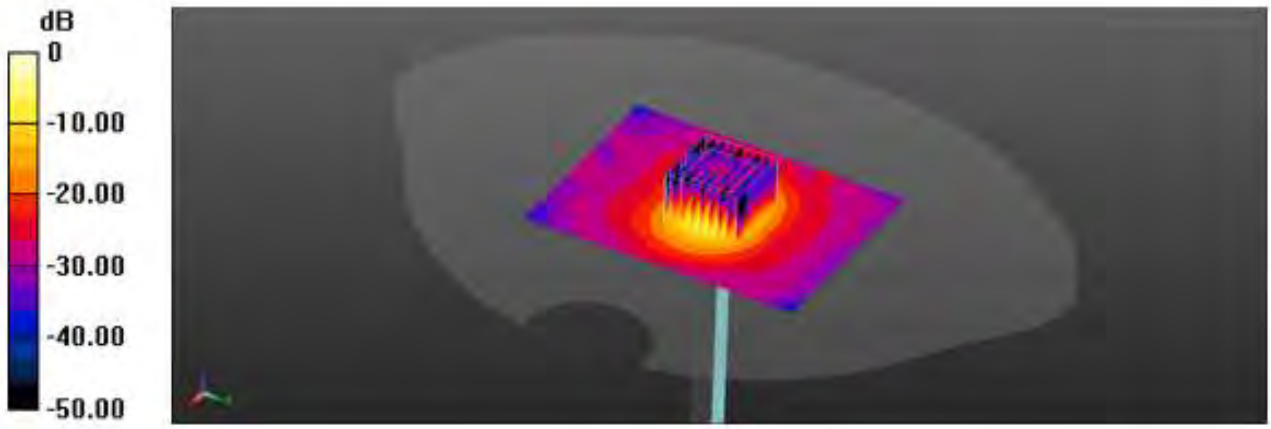
- Probe: EX3DV4 - SN3928;ConvF(4.3, 4.3, 4.3) @ 5300 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/5300 MHz Body Verification Input Power 100 mW 2019-08-08/Area Scan (10x13x1):
Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 16.3 W/kg

Configuration/5300 MHz Body Verification Input Power 100 mW 2019-08-08/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.87 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 35.4 W/kg
SAR(1 g) = 8.08 W/kg; SAR(10 g) = 2.22 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

Date: 2019-08-13

Test Laboratory: KCTL Inc.
File Name: 5600 MHz Body Verification Input Power 100 mW 2019-08-13.da5:0

DUT: Dipole D5GHzV2, Type: D5GHzV2, Serial: D5GHzV2 - SN:1134

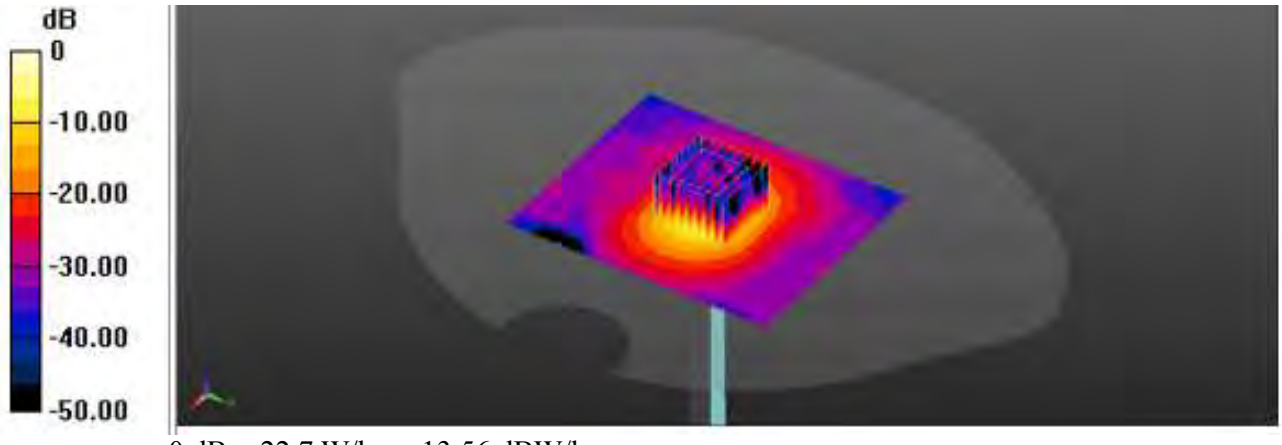
Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.942 S/m; ε_r = 47.19; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(3.91, 3.91, 3.91) @ 5600 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/5600 MHz Body Verification Input Power 100 mW 2019-08-13/Area Scan (11x13x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 21.1 W/kg

Configuration/5600 MHz Body Verification Input Power 100 mW 2019-08-13/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.19 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 39.1 W/kg
SAR(1 g) = 8.26 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 22.7 W/kg



0 dB = 22.7 W/kg = 13.56 dBW/kg

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 5800 MHz Body Verification Input Power 100 mW 2019-08-12.da5:0

DUT: Dipole D5GHzV2, Type: D5GHzV2, Serial: D5GHzV2 - SN:1134

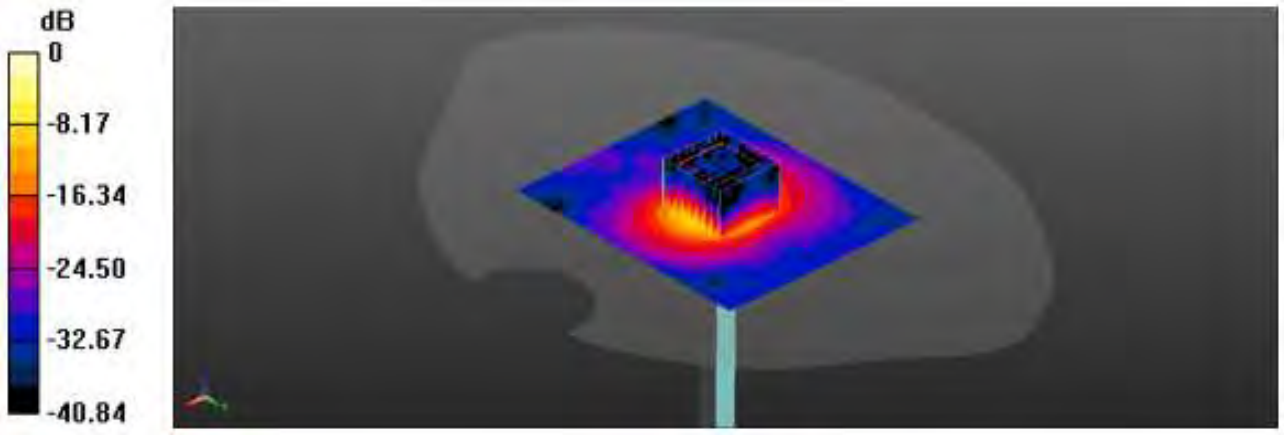
Communication System: UID 0, CW (0); Frequency: 5800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.103 S/m; ε_r = 46.814; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(4, 4, 4) @ 5800 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/5800 MHz Body Verification Input Power 100 mW 2019-08-12/Area Scan (11x13x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 21.0 W/kg

Configuration/5800 MHz Body Verification Input Power 100 mW 2019-08-12/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.34 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 37.4 W/kg
SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg = 13.26 dBW/kg

17. Test Results

#1

Date: 2019-08-07

Test Laboratory: KCTL Inc.
File Name: 1.GSM 850_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

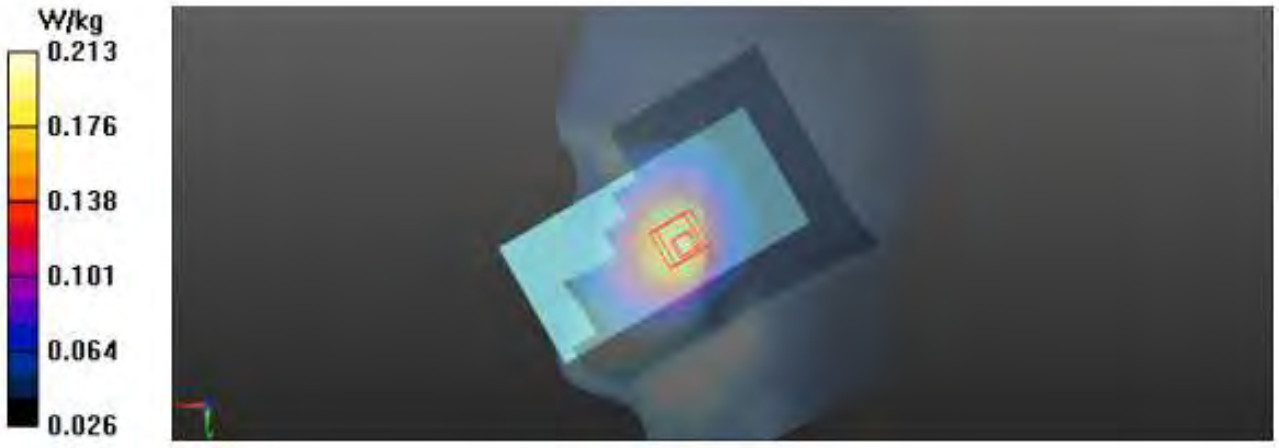
Communication System: UID 0, GSM850 (0); Frequency: 836.6 MHz; Duty Cycle: 1:8.30042
Medium parameters used: f = 836.6 MHz; σ = 0.919 S/m; ε_r = 40.812; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(9.36, 9.36, 9.36) @ 836.6 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/GSM 850_CH190_Right Cheek/Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.197 W/kg

Configuration/GSM 850_CH190_Right Cheek/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.97 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.230 W/kg
SAR(1 g) = 0.171 W/kg; SAR(10 g) = 0.129 W/kg
Maximum value of SAR (measured) = 0.213 W/kg



#2

Date: 2019-08-07

Test Laboratory: KCTL Inc.
File Name: 1.GSM 850_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

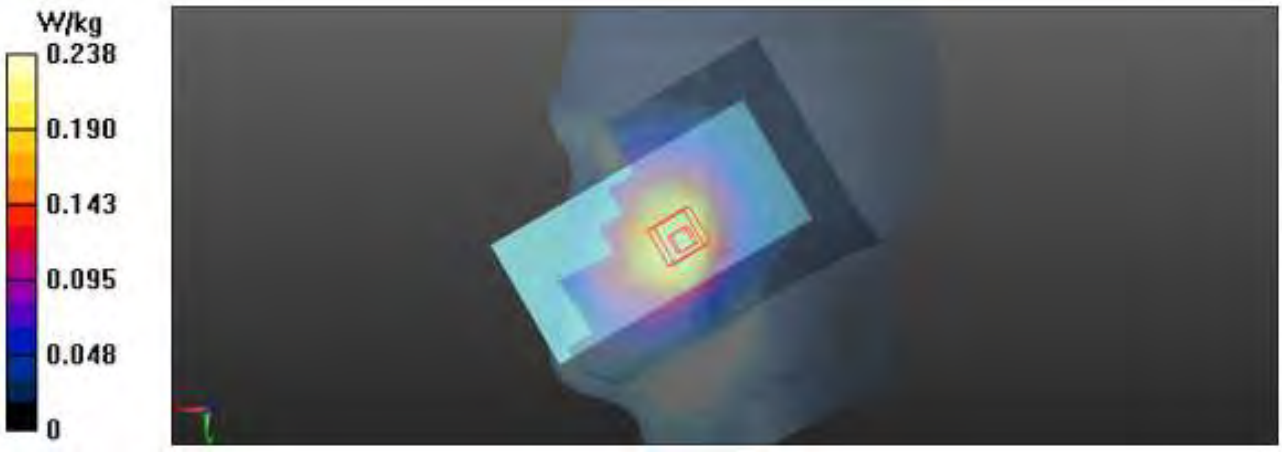
Communication System: UID 0, GSM850_3TX (0); Frequency: 836.6 MHz; Duty Cycle: 1:2.76694
Medium parameters used: f = 836.6 MHz; σ = 0.919 S/m; ε_r = 40.812; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(9.36, 9.36, 9.36) @ 836.6 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/GSM 850_CH190_3Tx_Right Cheek/Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.238 W/kg

Configuration/GSM 850_CH190_3Tx_Right Cheek/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.54 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.276 W/kg
SAR(1 g) = 0.208 W/kg; SAR(10 g) = 0.159 W/kg
Maximum value of SAR (measured) = 0.255 W/kg



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#3

Date: 2019-08-14

Test Laboratory: KCTL Inc.
File Name: 1.GSM 1900_Head.da53:1

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

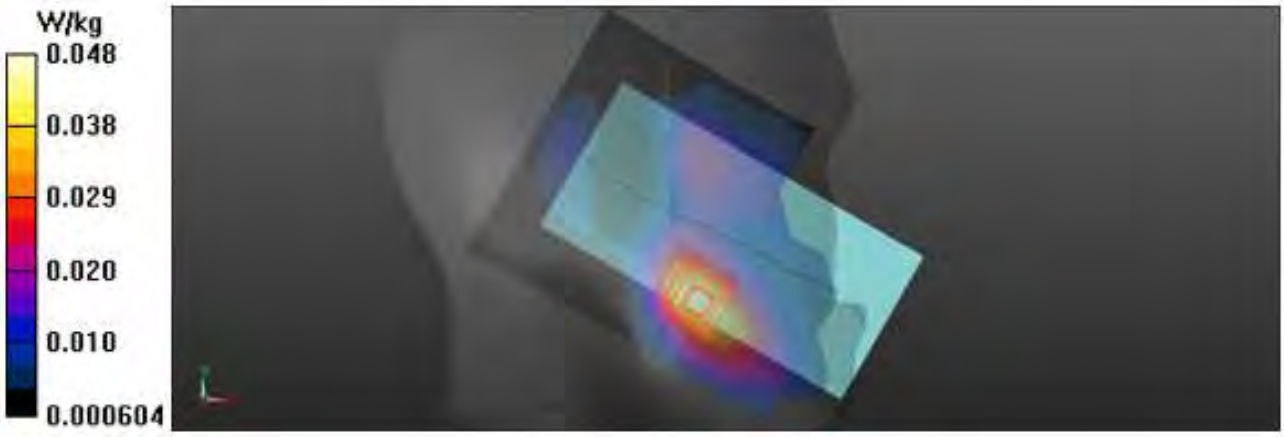
Communication System: UID 0, GSM 1900 (0); Frequency: 1880 MHz; Duty Cycle: 1:8.30042
Medium parameters used: f = 1880 MHz; σ = 1.414 S/m; ε_r = 40.424; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(7.79, 7.79, 7.79) @ 1880 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_4_20180808; Type: QD 000 P40 CC; Serial: 1362
- Measurement SW: DASY52, Version 52.10 (2);

Configuration 2/GSM 1900_CH661_Left Cheek/Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.0466 W/kg

Configuration 2/GSM 1900_CH661_Left Cheek/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.693 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.0590 W/kg
SAR(1 g) = 0.033 W/kg; SAR(10 g) = 0.019 W/kg
Maximum value of SAR (measured) = 0.0479 W/kg



#4

Date: 2019-08-14

Test Laboratory: KCTL Inc.
File Name: 1.GSM 1900_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HZZ

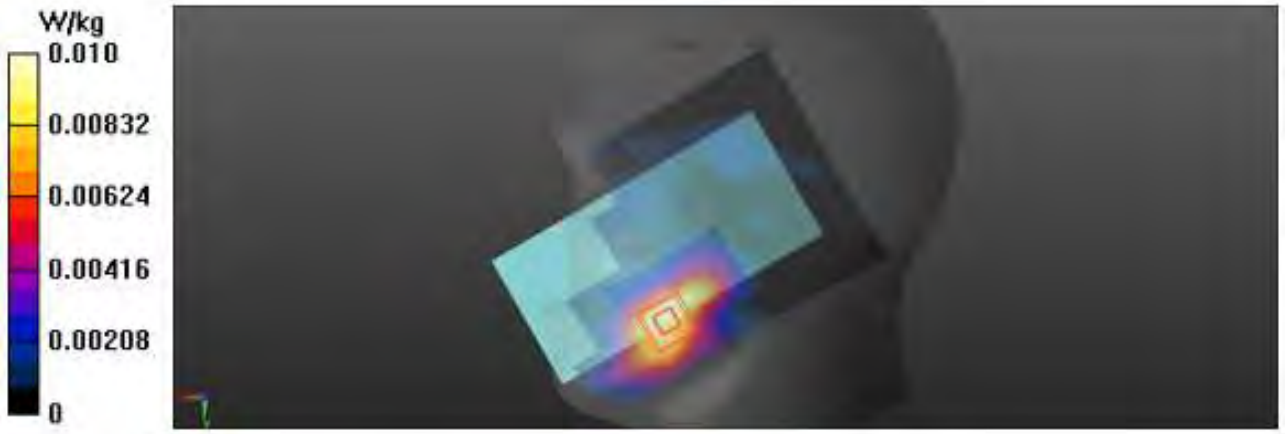
Communication System: UID 0, GSM 1900_3Tx (0); Frequency: 1880 MHz; Duty Cycle: 1:2.76694
Medium parameters used: f = 1880 MHz; σ = 1.414 S/m; ε_r = 40.424; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(7.79, 7.79, 7.79) @ 1880 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_4_20180808; Type: QD 000 P40 CC; Serial: 1362
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/GSM 1900_CH661_3Tx_Right Cheek/Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.0103 W/kg

Configuration/GSM 1900_CH661_3Tx_Right Cheek/Zoom Scan (7x9x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.0120 W/kg
SAR(1 g) = 0.00745 W/kg; SAR(10 g) = 0.00314 W/kg
Maximum value of SAR (measured) = 0.0104 W/kg



#5

Date: 2019-08-06

Test Laboratory: KCTL Inc.
File Name: 1.WCDMA Band V_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

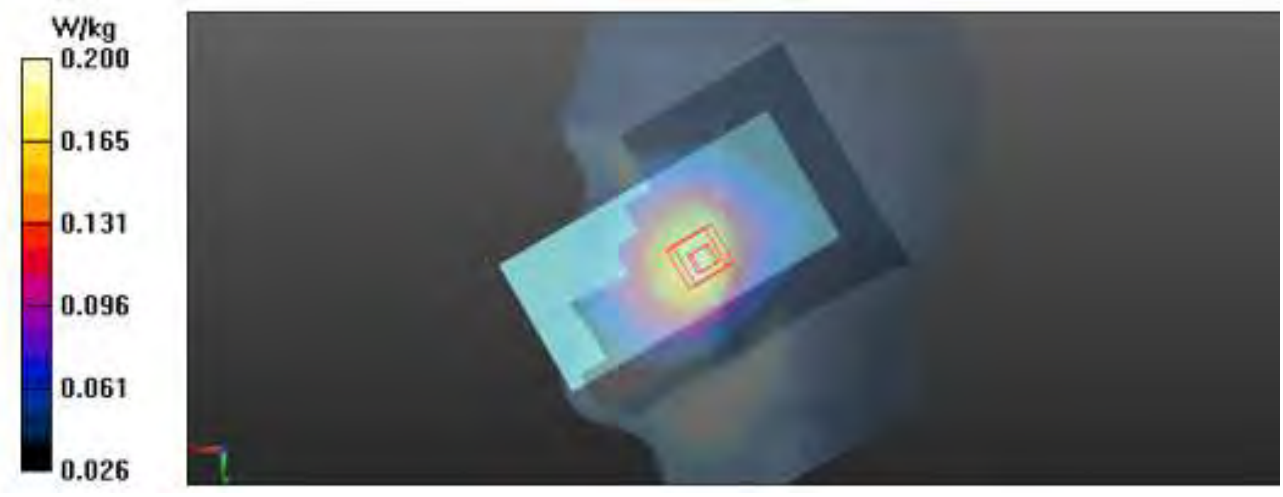
Communication System: UID 0, W-CDMA 850 (Band 5) (0); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used: f = 836.6 MHz; σ = 0.891 S/m; ε_r = 41.237; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(9.36, 9.36, 9.36) @ 836.6 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/WCDMA FDD V_CH4183_Right Cheek/Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.196 W/kg

Configuration/WCDMA FDD V_CH4183_Right Cheek/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.401 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.218 W/kg
SAR(1 g) = 0.169 W/kg; SAR(10 g) = 0.128 W/kg
Maximum value of SAR (measured) = 0.200 W/kg



#6

Date: 2019-09-06

Test Laboratory: KCTL Inc.
File Name: 1.LTE Band 12_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

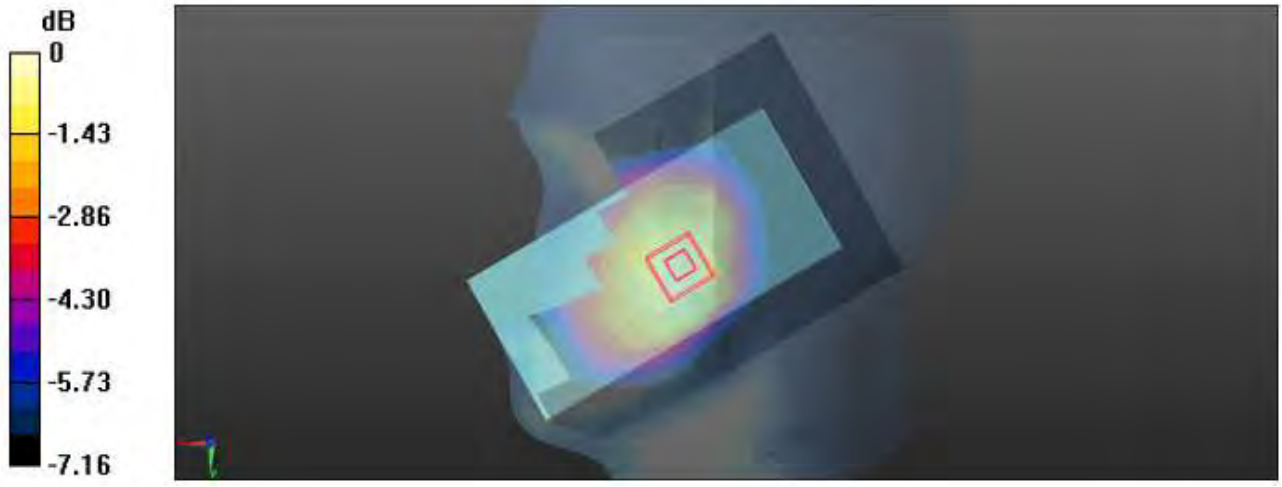
Communication System: UID 0, LTE Band 12 (0); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium parameters used: f = 707.5 MHz; σ = 0.851 S/m; ε_r = 42.496; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(9, 9, 9) @ 707.5 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/LTE Band 12_QPSK_10MHz_1RB_0offset_CH23095_Right Cheek/Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.0997 W/kg

Configuration/LTE Band 12_QPSK_10MHz_1RB_0offset_CH23095_Right Cheek/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.480 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.110 W/kg
SAR(1 g) = 0.087 W/kg; SAR(10 g) = 0.070 W/kg
Maximum value of SAR (measured) = 0.102 W/kg



0 dB = 0.102 W/kg = -9.91 dBW/kg

#7

Date: 2019-08-05

Test Laboratory: KCTL Inc.
File Name: 1.LTE Band 26_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

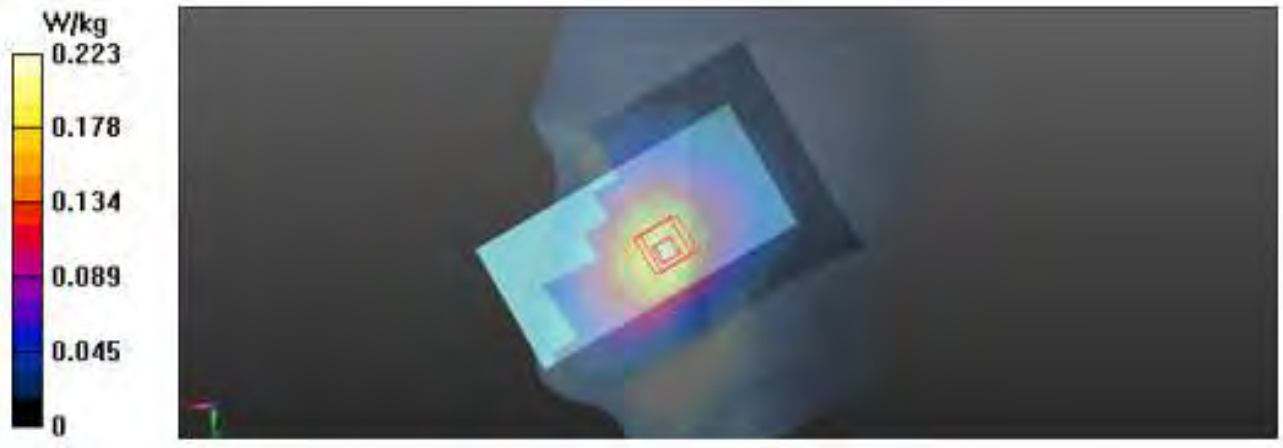
Communication System: UID 0, LTE Band 26 (0); Frequency: 831.5 MHz; Duty Cycle: 1:1
Medium parameters used: f = 831.5 MHz; σ = 0.914 S/m; ε_r = 40.605; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(9.36, 9.36, 9.36) @ 831.5 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/LTE Band 26_QPSK_15MHz_1RB_0offset_CH26865_Right Cheek/Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.223 W/kg

Configuration/LTE Band 26_QPSK_15MHz_1RB_0offset_CH26865_Right Cheek/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.749 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.246 W/kg
SAR(1 g) = 0.189 W/kg; SAR(10 g) = 0.143 W/kg
Maximum value of SAR (measured) = 0.223 W/kg



#8

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 1.LTE Band 41_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

Communication System: UID 0, LTE Band41 (0); Frequency: 2549.5 MHz; Duty Cycle: 1:1.58016
Medium parameters used (interpolated): f = 2549.5 MHz; σ = 1.93 S/m; ε_r = 39.628; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.07, 7.07, 7.07) @ 2549.5 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/LTE Band 41_QPSK_20MHz_1RB_0offset_CH40185_Right Cheek/Area Scan (11x16x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.121 W/kg

Configuration/LTE Band 41_QPSK_20MHz_1RB_0offset_CH40185_Right Cheek/Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.560 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.173 W/kg
SAR(1 g) = 0.087 W/kg; SAR(10 g) = 0.042 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.138 W/kg

#9

Date: 2019-08-09

Test Laboratory: KCTL Inc.
File Name: 1.802.11b_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

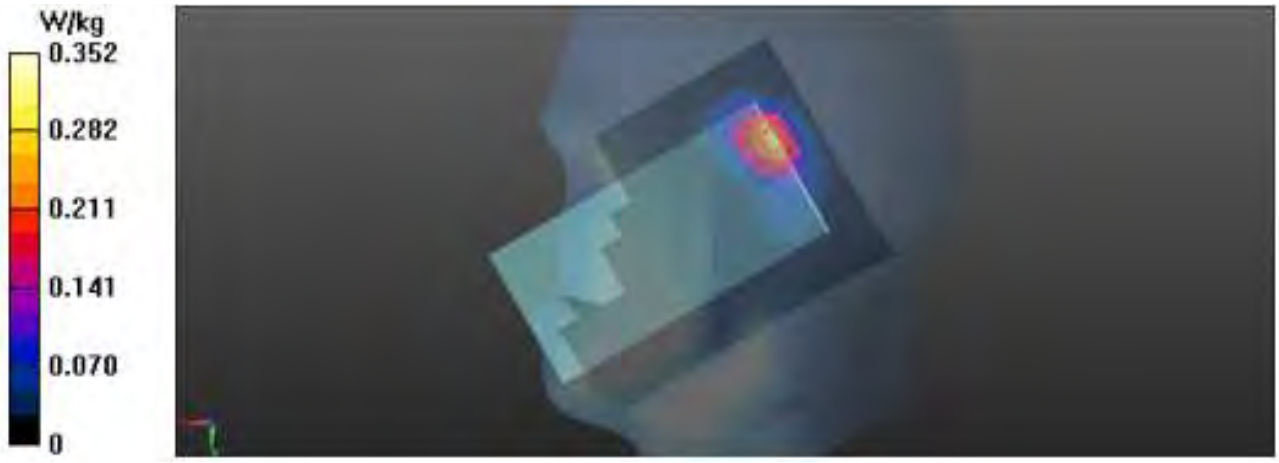
Communication System: UID 0, 2.4GWLAN (0); Frequency: 2412 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2412 MHz; σ = 1.827 S/m; ε_r = 38.956; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.2, 7.2, 7.2) @ 2412 MHz; ; Calibrated: 2019-03-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11b_CH1_Right Tilt/Area Scan (11x16x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.300 W/kg

Configuration/802.11b_CH1_Right Tilt/Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.18 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.476 W/kg
SAR(1 g) = 0.177 W/kg; SAR(10 g) = 0.077 W/kg
Maximum value of SAR (measured) = 0.352 W/kg



#10

Date: 2019-08-08

Test Laboratory: KCTL Inc.
File Name: 1.802.11 ac_VHT80_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HZZ

Communication System: UID 0, 5GWLAN (0); Frequency: 5290 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5290 MHz; σ = 4.682 S/m; ε_r = 36.411; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(4.95, 4.95, 4.95) @ 5290 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11 ac_VHT80_CH58_Right Cheek/Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.621 W/kg

Configuration/802.11 ac_VHT80_CH58_Right Cheek/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 4.522 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 1.11 W/kg
SAR(1 g) = 0.209 W/kg; SAR(10 g) = 0.055 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.595 W/kg

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#11

Date: 2019-08-13

Test Laboratory: KCTL Inc.
File Name: 1.802.11 ac_VHT80_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HZZ

Communication System: UID 0, 5GWLAN (0); Frequency: 5690 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5690 MHz; σ = 5.271 S/m; ε_r = 35.695; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(4.78, 4.78, 4.78) @ 5690 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11 ac_VHT80_CH138_Right Cheek/Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.538 W/kg

Configuration/802.11 ac_VHT80_CH138_Right Cheek/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 3.356 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.22 W/kg
SAR(1 g) = 0.241 W/kg; SAR(10 g) = 0.062 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.694 W/kg

#12

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 1.802.11 ac_VHT80_Head.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HZZ

Communication System: UID 0, 5GWLAN (0); Frequency: 5775 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5775 MHz; σ = 5.327 S/m; ε_r = 35.022; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(4.7, 4.7, 4.7) @ 5775 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11 ac_VHT80_CH155_Right Cheek/Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.806 W/kg

Configuration/802.11 ac_VHT80_CH155_Right Cheek/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 3.116 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.77 W/kg
SAR(1 g) = 0.292 W/kg; SAR(10 g) = 0.077 W/kg
Maximum value of SAR (measured) = 0.882 W/kg

#13

Date: 2019-08-07

Test Laboratory: KCTL Inc.
File Name: 2.GSM 850_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

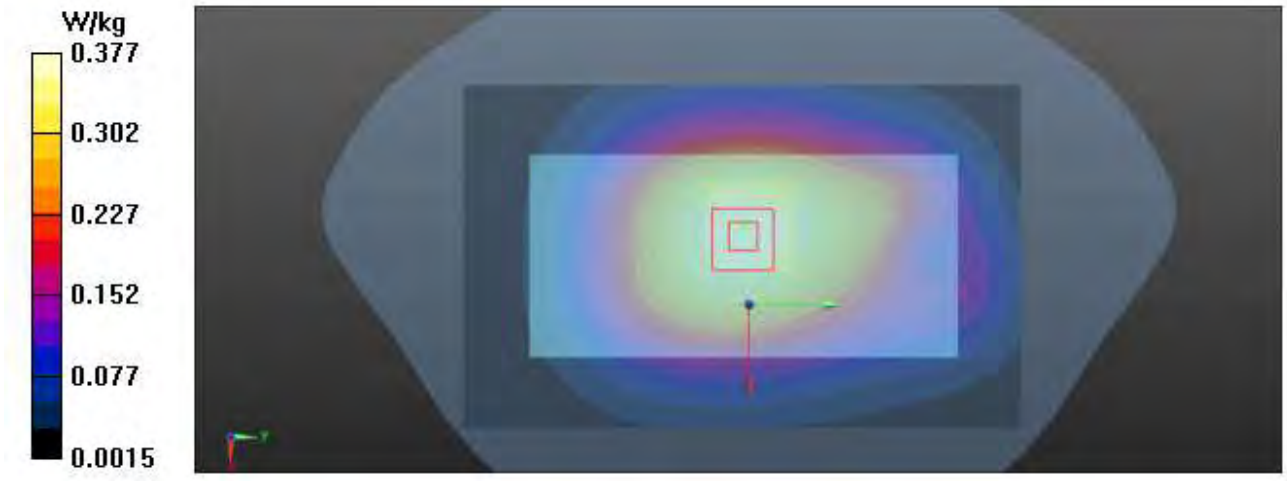
Communication System: UID 0, GSM850_3TX (0); Frequency: 836.6 MHz; Duty Cycle: 1:2.76694
Medium parameters used: f = 836.6 MHz; σ = 0.972 S/m; ε_r = 53.254; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 836.6 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/GSM 850_CH190_3Tx_Front 15mm/Area Scan (81x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.377 W/kg

Configuration/GSM 850_CH190_3Tx_Front 15mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.71 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.411 W/kg
SAR(1 g) = 0.311 W/kg; SAR(10 g) = 0.235 W/kg
Maximum value of SAR (measured) = 0.378 W/kg



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#14

Date: 2019-08-07

Test Laboratory: KCTL Inc.
File Name: 2.GSM 850_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

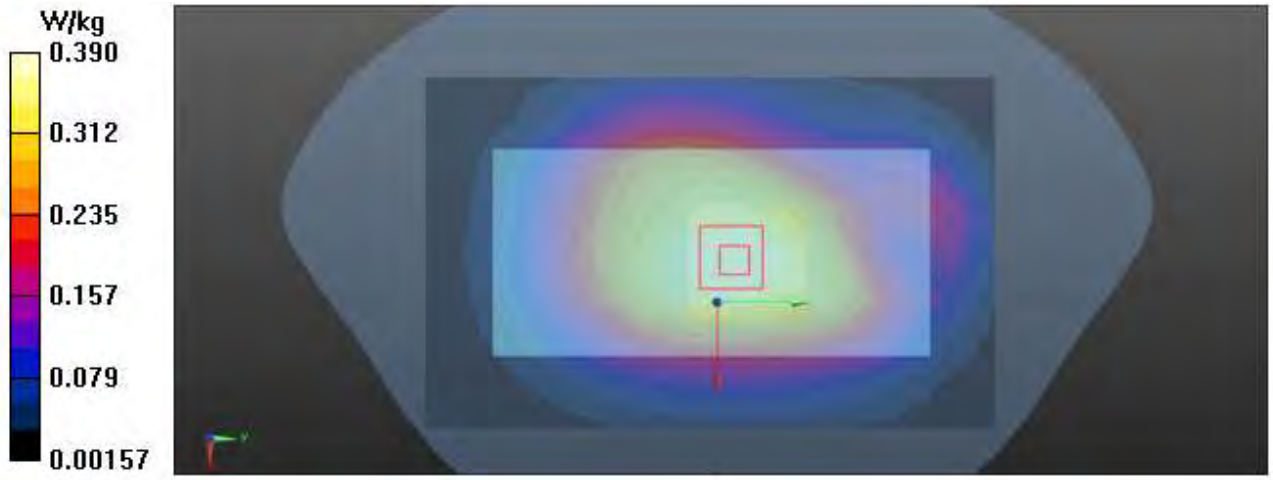
Communication System: UID 0, GSM850_3TX (0); Frequency: 836.6 MHz; Duty Cycle: 1:2.76694
Medium parameters used: f = 836.6 MHz; σ = 0.972 S/m; ε_r = 53.254; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 836.6 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/GSM 850_CH190_3Tx_Rear 15mm/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.390 W/kg

Configuration/GSM 850_CH190_3Tx_Rear 15mm/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.82 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.435 W/kg
SAR(1 g) = 0.327 W/kg; SAR(10 g) = 0.248 W/kg
Maximum value of SAR (measured) = 0.394 W/kg



#15

Date: 2019-08-14

Test Laboratory: KCTL Inc.
File Name: 2.GSM 1900_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

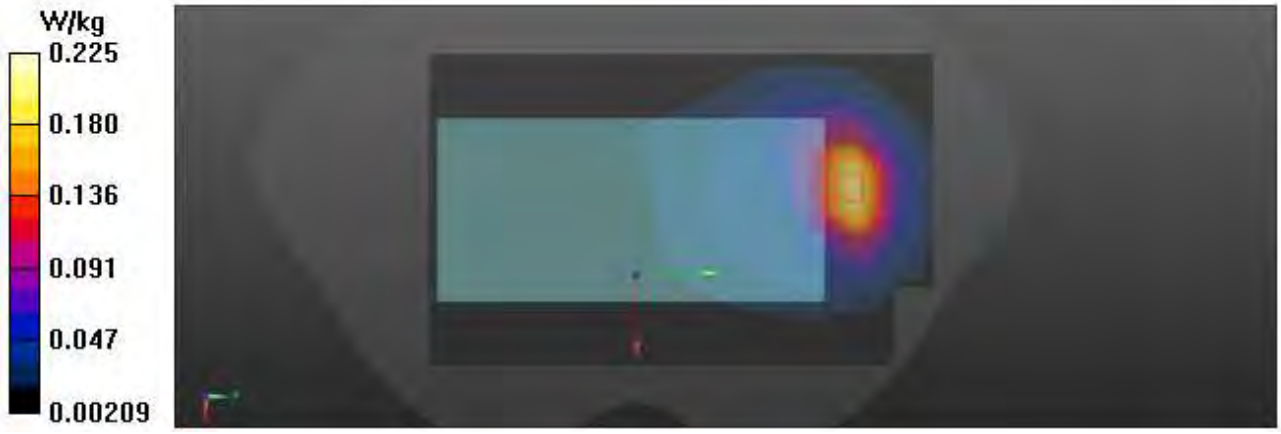
Communication System: UID 0, GSM 1900 (0); Frequency: 1880 MHz; Duty Cycle: 1:8.30042
Medium parameters used: f = 1880 MHz; σ = 1.527 S/m; ε_r = 51.965; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(7.46, 7.46, 7.46) @ 1880 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_4_20180808; Type: QD 000 P40 CC; Serial: 1362
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/GSM 1900_CH661_Front 15mm/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.203 W/kg

Configuration/GSM 1900_CH661_Front 15mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.909 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.271 W/kg
SAR(1 g) = 0.151 W/kg; SAR(10 g) = 0.081 W/kg
Maximum value of SAR (measured) = 0.225 W/kg



#16

Date: 2019-08-14

Test Laboratory: KCTL Inc.
File Name: 2.GSM 1900_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

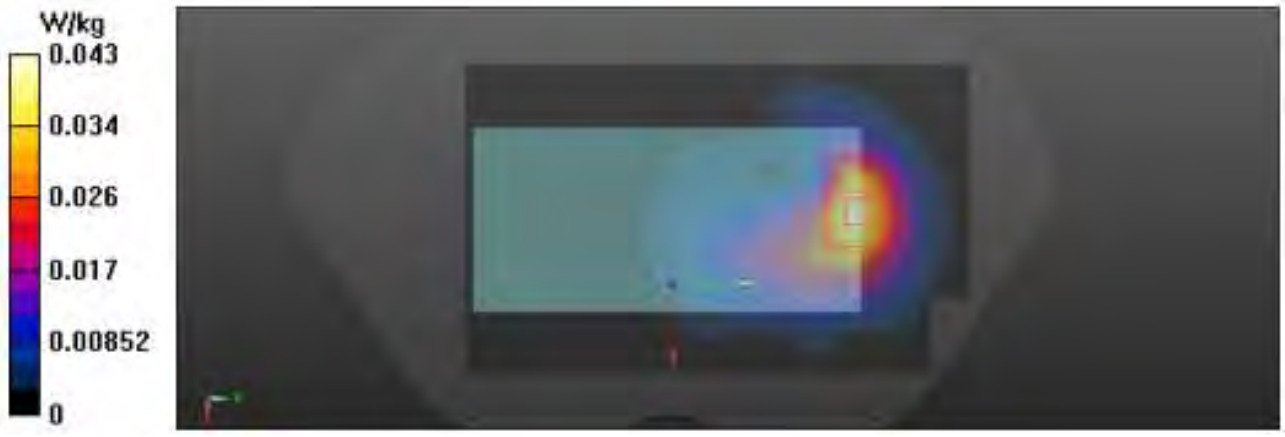
Communication System: UID 0, GSM 1900_3Tx (0); Frequency: 1880 MHz; Duty Cycle: 1:2.76694
Medium parameters used: f = 1880 MHz; σ = 1.527 S/m; ε_r = 51.965; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(7.46, 7.46, 7.46) @ 1880 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_4_20180808; Type: QD 000 P40 CC; Serial: 1362
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/GSM 1900_CH661_3Tx_Rear 15mm 2/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.0418 W/kg

Configuration/GSM 1900_CH661_3Tx_Rear 15mm 2/Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.881 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.0520 W/kg
SAR(1 g) = 0.029 W/kg; SAR(10 g) = 0.016 W/kg
Maximum value of SAR (measured) = 0.0426 W/kg



#17

Date: 2019-08-06

Test Laboratory: KCTL Inc.
File Name: 2.WCDMA Band V_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

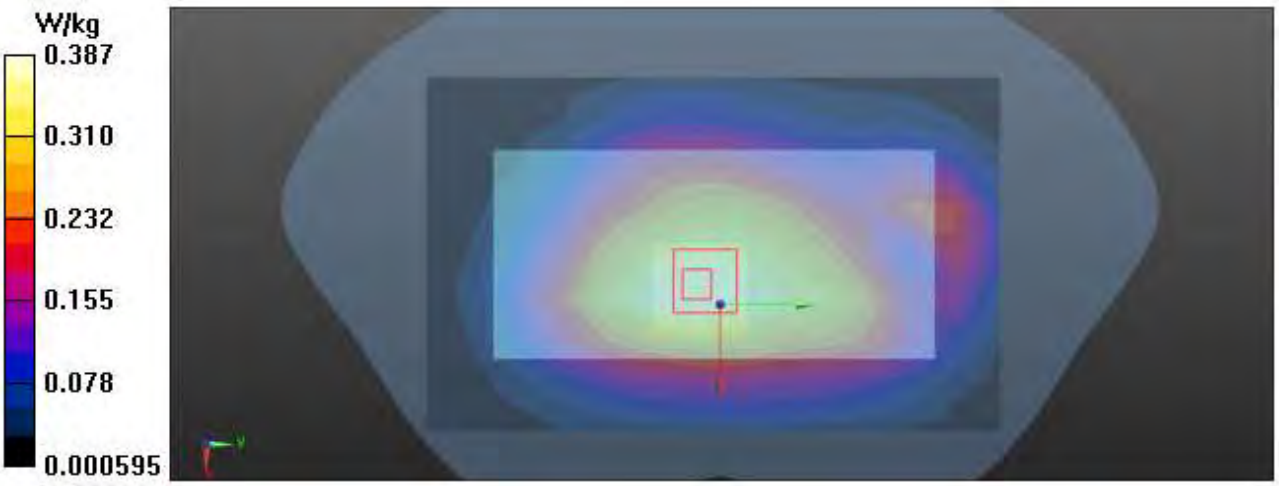
Communication System: UID 0, W-CDMA 850 (Band 5) (0); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used: f = 836.6 MHz; σ = 0.998 S/m; ε_r = 53.171; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 836.6 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/WCDMA FDD V_CH4183_Rear 15mm/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.387 W/kg

Configuration/WCDMA FDD V_CH4183_Rear 15mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.75 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.438 W/kg
SAR(1 g) = 0.320 W/kg; SAR(10 g) = 0.237 W/kg
Maximum value of SAR (measured) = 0.396 W/kg



#18

Date: 2019-09-06

Test Laboratory: KCTL Inc.
File Name: 2.LTE Band 12_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HJB

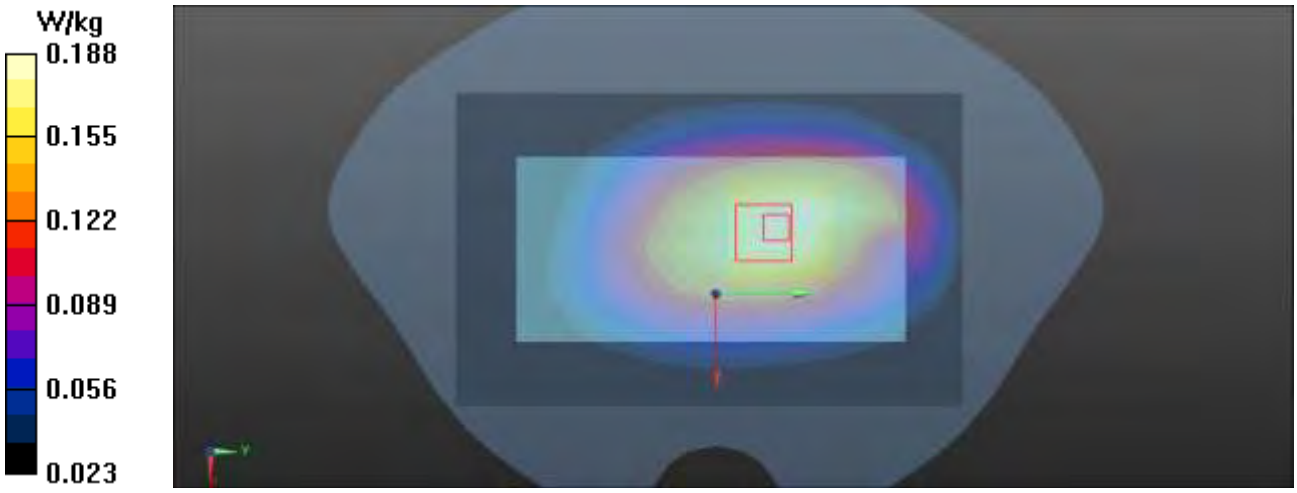
Communication System: UID 0, LTE Band 12 (0); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium parameters used: f = 707.5 MHz; σ = 0.972 S/m; ε_r = 53.766; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.9, 8.9, 8.9) @ 707.5 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/LTE Band 12_QPSK_10MHz_1RB_0offset_CH23095_Rear 15mm/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.184 W/kg

Configuration/LTE Band 12_QPSK_10MHz_1RB_0offset_CH23095_Rear 15mm/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.58 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.207 W/kg
SAR(1 g) = 0.155 W/kg; SAR(10 g) = 0.120 W/kg
Maximum value of SAR (measured) = 0.188 W/kg



#19

Date: 2019-08-05

Test Laboratory: KCTL Inc.
File Name: 2.LTE Band 26_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HJB

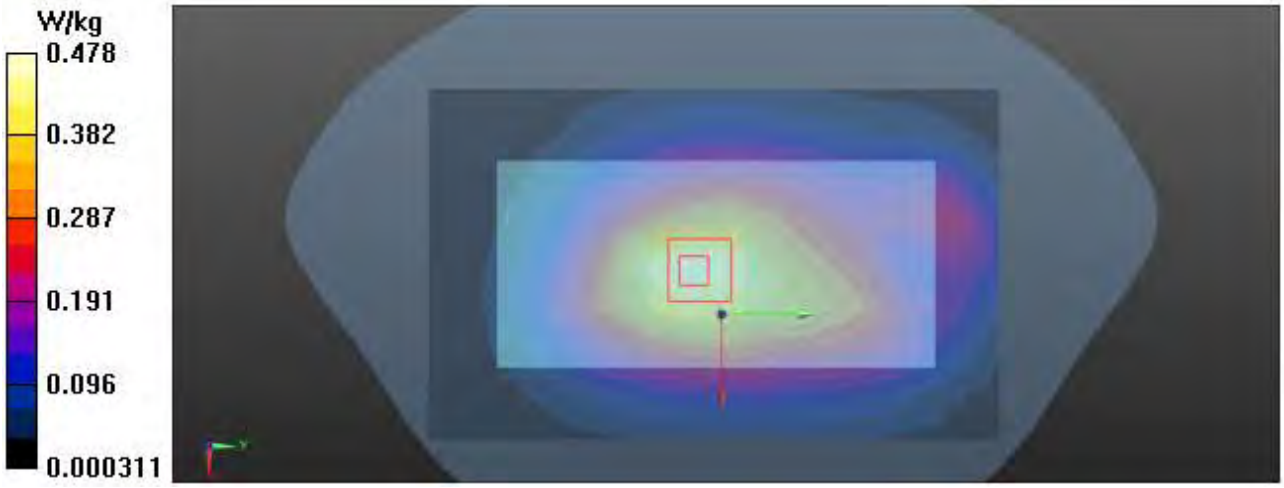
Communication System: UID 0, LTE Band 26 (0); Frequency: 831.5 MHz; Duty Cycle: 1:1
Medium parameters used: f = 831.5 MHz; σ = 0.961 S/m; ε_r = 53.184; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 831.5 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/LTE Band 26_QPSK_15MHz_1RB_0offset_CH26865_Rear 15mm/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.478 W/kg

Configuration/LTE Band 26_QPSK_15MHz_1RB_0offset_CH26865_Rear 15mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.98 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.542 W/kg
SAR(1 g) = 0.395 W/kg; SAR(10 g) = 0.287 W/kg
Maximum value of SAR (measured) = 0.487 W/kg



#20

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 2.LTE Band 41_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HJB

Communication System: UID 0, LTE Band41 (0); Frequency: 2549.5 MHz; Duty Cycle: 1:1.58016
Medium parameters used (interpolated): f = 2549.5 MHz; σ = 2.163 S/m; ε_r = 51.568; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

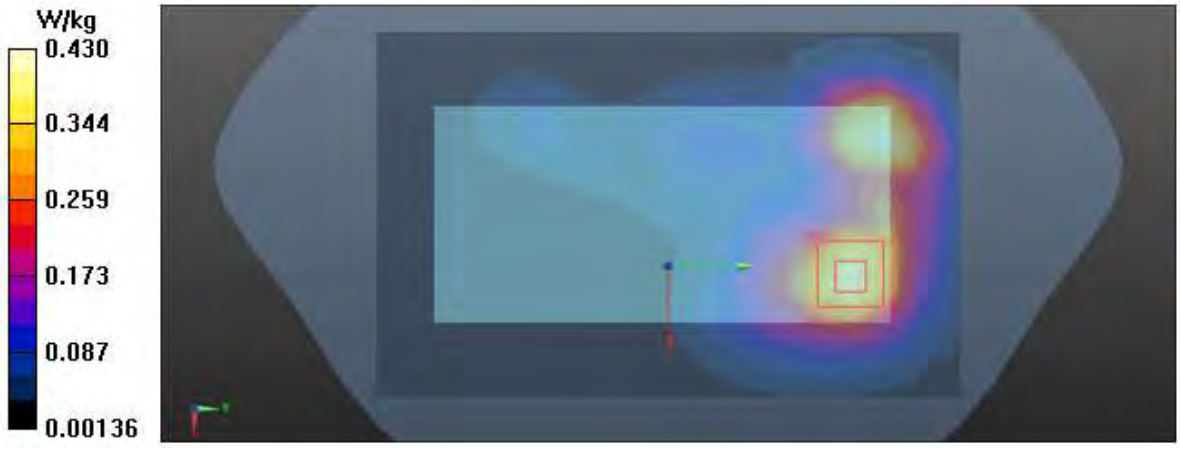
- Probe: EX3DV4 - SN3697; ConvF(6.78, 6.78, 6.78) @ 2549.5 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/LTE Band 41_QPSK_20MHz_50RB_0offset_CH40185_Rear 15mm/Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.440 W/kg

Configuration/LTE Band 41_QPSK_20MHz_50RB_0offset_CH40185_Rear 15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.417 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.534 W/kg
SAR(1 g) = 0.271 W/kg; SAR(10 g) = 0.143 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.430 W/kg



#21

Date: 2019-08-09

Test Laboratory: KCTL Inc.
File Name: 2.802.11b_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

Communication System: UID 0, 2.4GWLAN (0); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.983 S/m; ε_r = 52.207; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

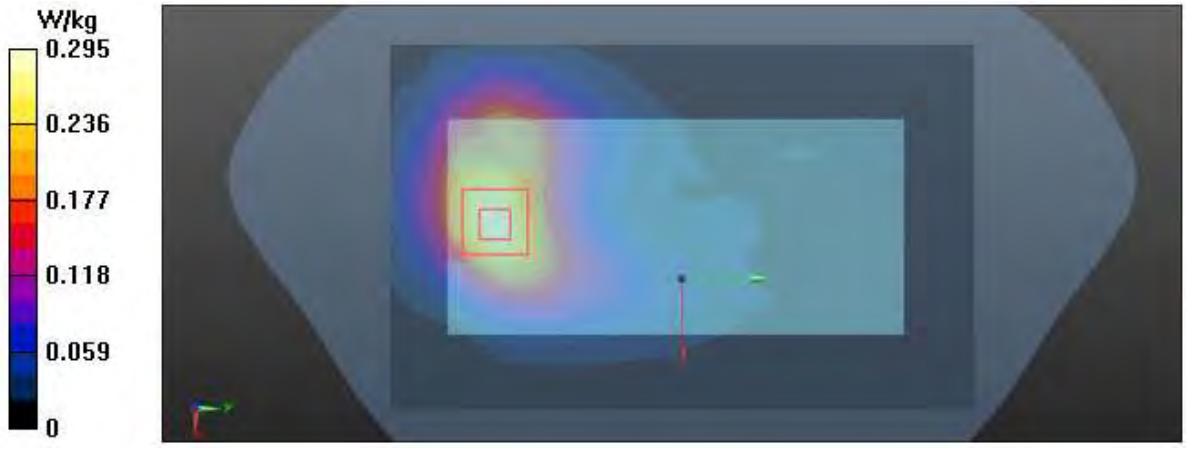
- Probe: EX3DV4 - SN3697; ConvF(6.96, 6.96, 6.96) @ 2437 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11b_CH6_Rear 15mm/Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.295 W/kg

Configuration/802.11b_CH6_Rear 15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.64 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.363 W/kg
SAR(1 g) = 0.192 W/kg; SAR(10 g) = 0.104 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.296 W/kg



#22

Date: 2019-08-08

Test Laboratory: KCTL Inc.
File Name: 2.802.11 a_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

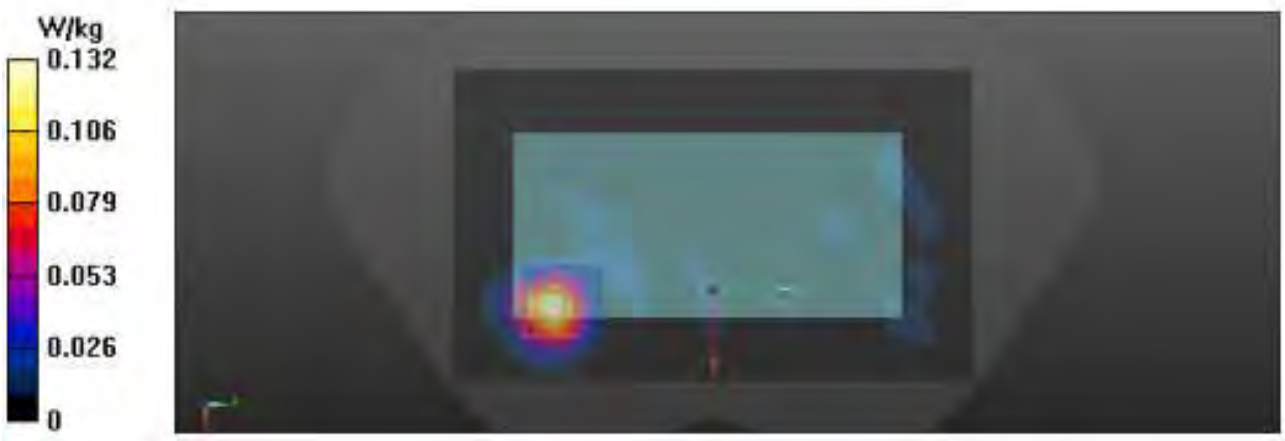
Communication System: UID 0, 5GWLAN (0); Frequency: 5280 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5280 MHz; σ = 5.378 S/m; ε_r = 48.133; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(4.3, 4.3, 4.3) @ 5280 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11 a_CH56_Front 15mm/Area Scan (13x21x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.140 W/kg

Configuration/802.11 a_CH56_Front 15mm/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 4.561 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.213 W/kg
SAR(1 g) = 0.046 W/kg; SAR(10 g) = 0.015 W/kg
Maximum value of SAR (measured) = 0.132 W/kg



#23

Date: 2019-08-13

Test Laboratory: KCTL Inc.
File Name: 2.802.11 a_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

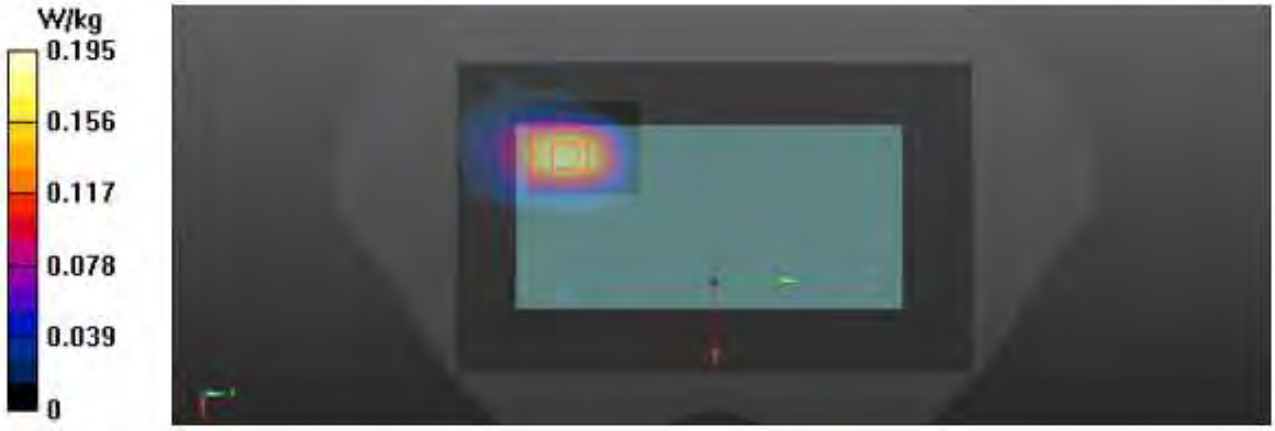
Communication System: UID 0, 5GWLAN (0); Frequency: 5500 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5500 MHz; σ = 5.799 S/m; ε_r = 47.43; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(4.03, 4.03, 4.03) @ 5500 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11 a_CH100_Rear 15mm/Area Scan (13x21x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.178 W/kg

Configuration/802.11 a_CH100_Rear 15mm/Zoom Scan (10x12x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 6.531 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.331 W/kg
SAR(1 g) = 0.067 W/kg; SAR(10 g) = 0.023 W/kg
Maximum value of SAR (measured) = 0.195 W/kg



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#24

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 2.802.11 a_Body-Worn.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

Communication System: UID 0, 5GWLAN (0); Frequency: 5785 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5785 MHz; σ = 6.084 S/m; ε_r = 46.863; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

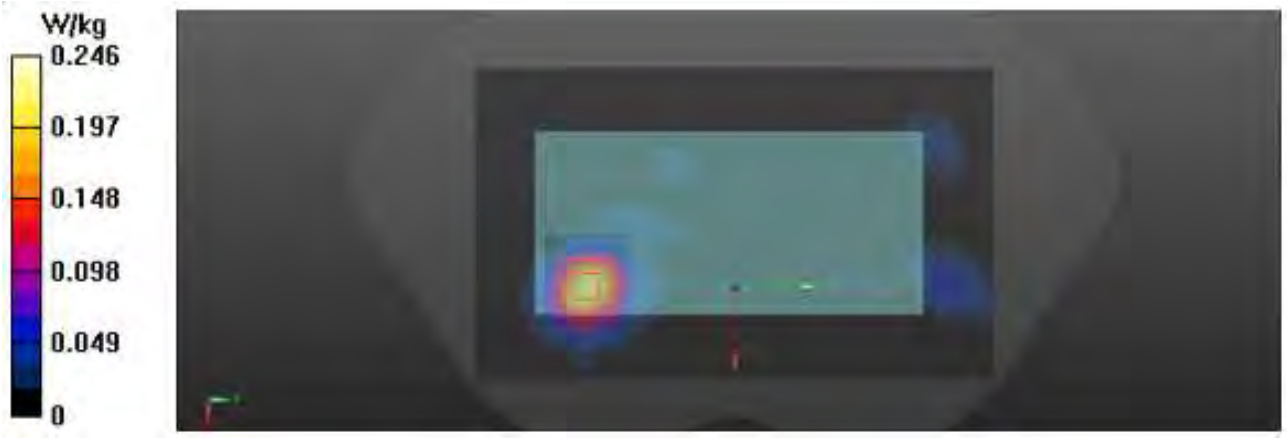
- Probe: EX3DV4 - SN3928;ConvF(4, 4, 4) @ 5785 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 _1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11 a_CH157_Front 15mm/Area Scan (13x21x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.221 W/kg

Configuration/802.11 a_CH157_Front 15mm/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 6.814 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.412 W/kg
SAR(1 g) = 0.081 W/kg; SAR(10 g) = 0.028 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.246 W/kg



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#25

Date: 2019-08-07

Test Laboratory: KCTL Inc.
File Name: 3.GSM 850_Hotspot.da53:1

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

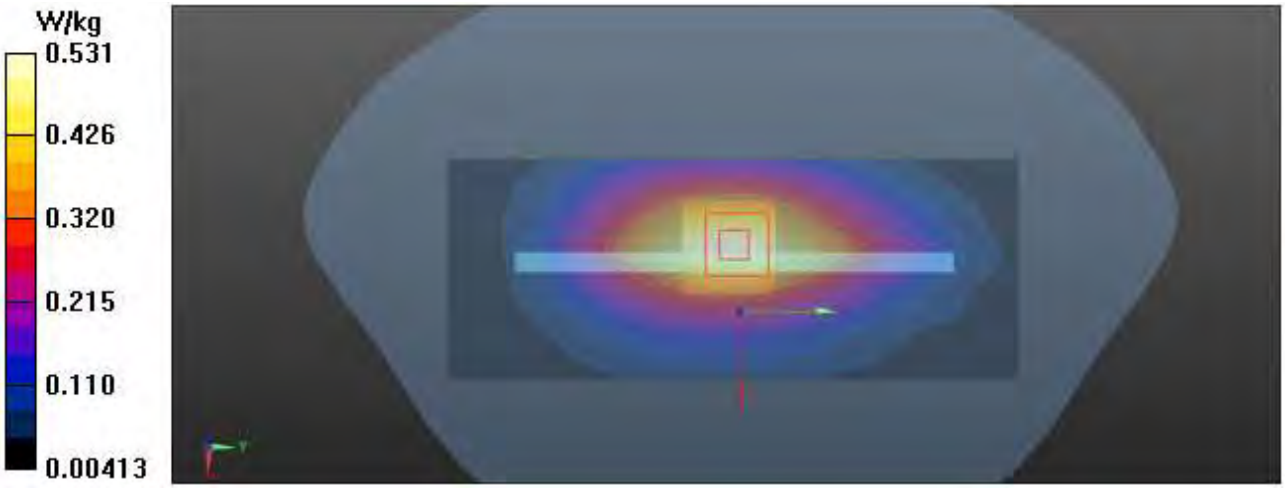
Communication System: UID 0, GSM850_3TX (0); Frequency: 836.6 MHz; Duty Cycle: 1:2.76694
Medium parameters used: f = 836.6 MHz; σ = 0.972 S/m; ε_r = 53.254; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 836.6 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration 2/GSM850_CH190_3Tx_Right 10mm/Area Scan (6x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.531 W/kg

Configuration 2/GSM850_CH190_3Tx_Right 10mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.10 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.601 W/kg
SAR(1 g) = 0.410 W/kg; SAR(10 g) = 0.280 W/kg
Maximum value of SAR (measured) = 0.531 W/kg



#26

Date: 2019-08-14

Test Laboratory: KCTL Inc.
File Name: 3.GSM 1900_Hotspot.da53:2

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

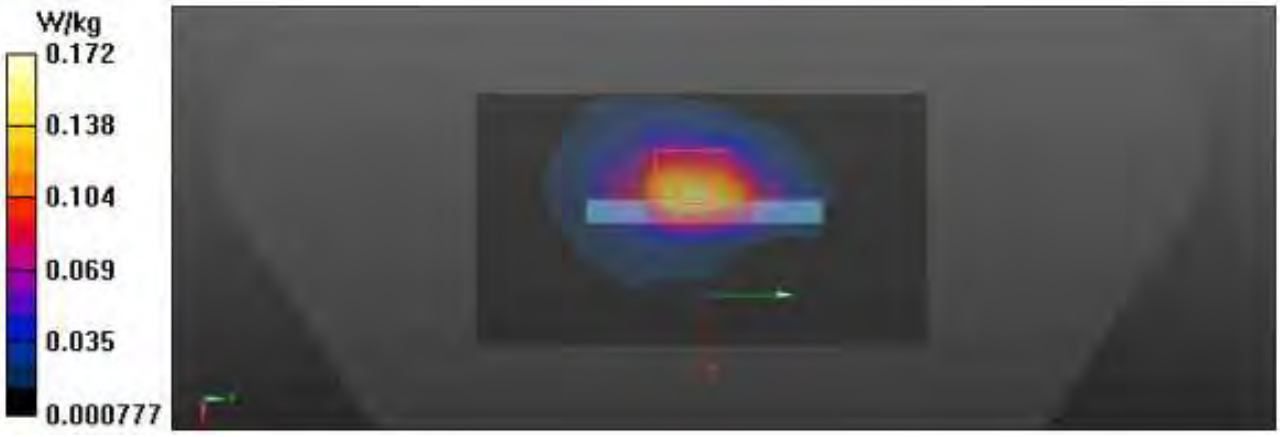
Communication System: UID 0, GSM 1900_3Tx (0); Frequency: 1880 MHz; Duty Cycle: 1:2.76694
Medium parameters used: f = 1880 MHz; σ = 1.527 S/m; ε_r = 51.965; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928;ConvF(7.46, 7.46, 7.46) @ 1880 MHz; Calibrated: 2019-01-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2019-05-23
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_4_20180808; Type: QD 000 P40 CC; Serial: 1362
- Measurement SW: DASY52, Version 52.10 (2);

Configuration 3/GSM1900_CH661_3Tx_Bottom 10mm/Area Scan (6x10x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.156 W/kg

Configuration 3/GSM1900_CH661_3Tx_Bottom 10mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.83 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.210 W/kg
SAR(1 g) = 0.107 W/kg; SAR(10 g) = 0.053 W/kg
Maximum value of SAR (measured) = 0.172 W/kg



#27

Date: 2019-08-06

Test Laboratory: KCTL Inc.
File Name: 3.WCDMA Band V_Hotspot.da53:1

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

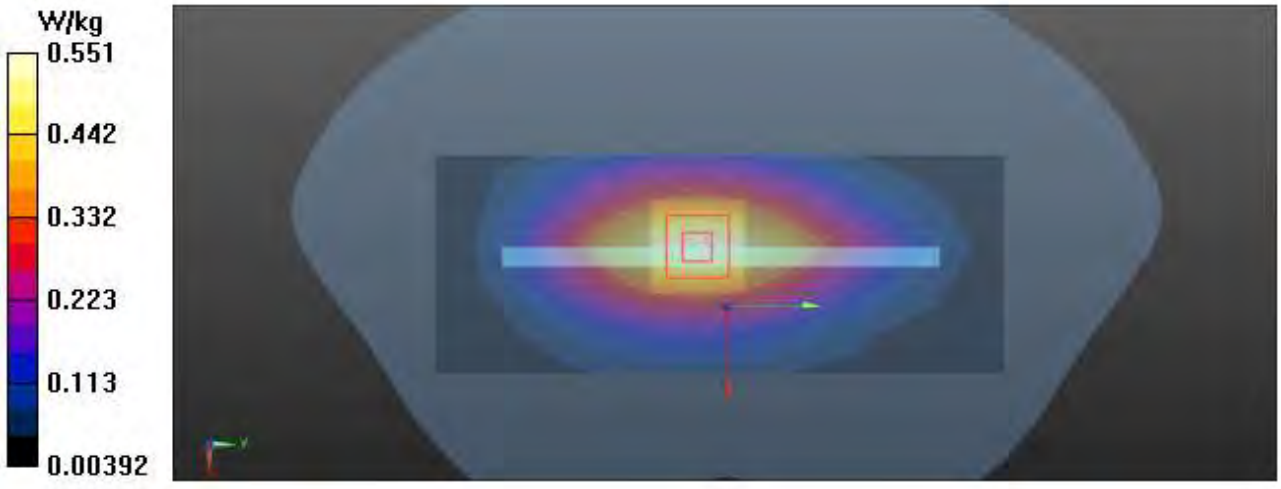
Communication System: UID 0, W-CDMA 850 (Band 5) (0); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used: f = 836.6 MHz; σ = 0.998 S/m; ε_r = 53.171; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 836.6 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration 2/WCDMA FDD V_CH4183_Right 10mm/Area Scan (6x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.551 W/kg

Configuration 2/WCDMA FDD V_CH4183_Right 10mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.70 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.626 W/kg
SAR(1 g) = 0.422 W/kg; SAR(10 g) = 0.289 W/kg
Maximum value of SAR (measured) = 0.554 W/kg



#28

Date: 2019-09-06

Test Laboratory: KCTL Inc.
File Name: 3.LTE Band 12_Hotspot.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HJB

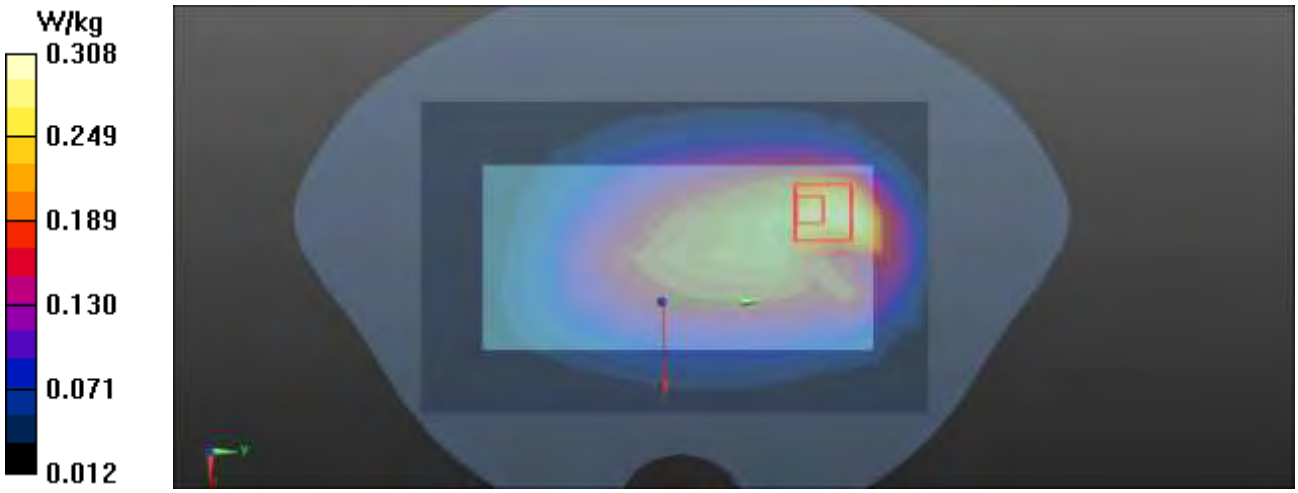
Communication System: UID 0, LTE Band 12 (0); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium parameters used: f = 707.5 MHz; σ = 0.972 S/m; ε_r = 53.766; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.9, 8.9, 8.9) @ 707.5 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/LTE Band 12_QPSK_10MHz_1RB_0offset_CH23095_Rear 10mm 2/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.297 W/kg

Configuration/LTE Band 12_QPSK_10MHz_1RB_0offset_CH23095_Rear 10mm 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.72 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.393 W/kg
SAR(1 g) = 0.201 W/kg; SAR(10 g) = 0.128 W/kg
Maximum value of SAR (measured) = 0.308 W/kg



#29

Date: 2019-08-05

Test Laboratory: KCTL Inc.
File Name: 3.LTE Band 26_Hotspot.da53:1

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HJB

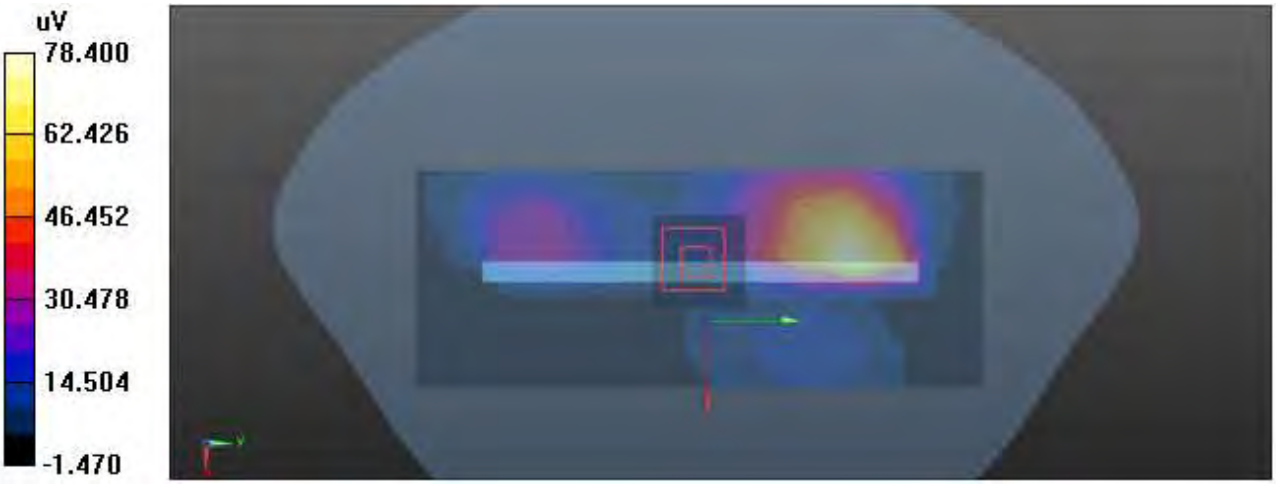
Communication System: UID 0, LTE Band 26 (0); Frequency: 831.5 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0.961382$ S/m, $\varepsilon_r = 53.1842$; $\rho = 1$ kg/m^3 , Medium parameters used: f = 831.5 MHz; $\sigma = 0.961$ S/m; $\varepsilon_r = 53.184$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(8.81, 8.81, 8.81) @ 831.5 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration 2/LTE Band 26_QPSK_15MHz_1RB_0offset_CH26865_Right 10mm/Area Scan (6x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of Ux (measured) = 78.43 uV

Configuration 2/LTE Band 26_QPSK_15MHz_1RB_0offset_CH26865_Right 10mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.74 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.724 W/kg
SAR(1 g) = 0.492 W/kg; SAR(10 g) = 0.340 W/kg
Maximum value of SAR (measured) = 0.641 W/kg



#30

Date: 2019-08-12

Test Laboratory: KCTL Inc.
File Name: 3.LTE Band 41_Hotspot.da53:0

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2HJB

Communication System: UID 0, LTE Band41 (0); Frequency: 2549.5 MHz; Duty Cycle: 1:1.58016
Medium parameters used (interpolated): f = 2549.5 MHz; σ = 2.163 S/m; ε_r = 51.568; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

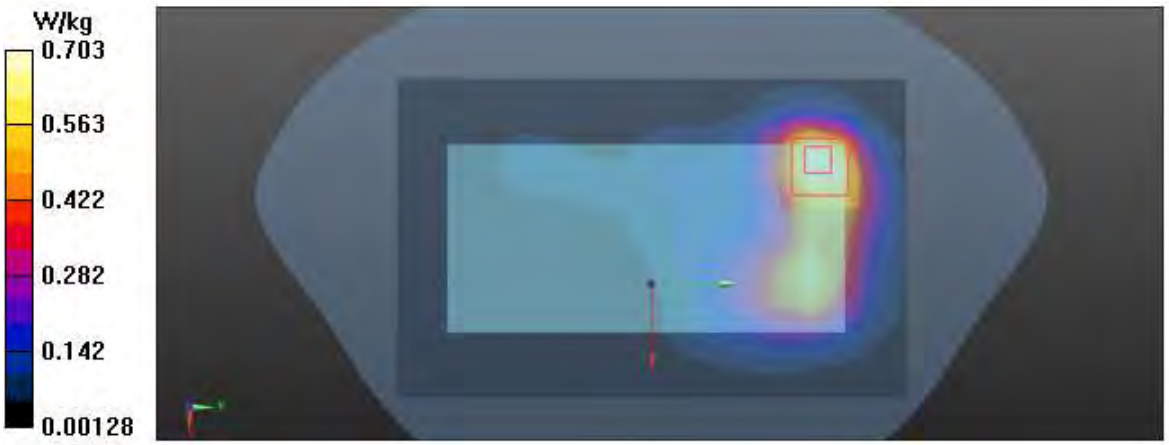
- Probe: EX3DV4 - SN3697; ConvF(6.78, 6.78, 6.78) @ 2549.5 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/LTE Band 41_QPSK_20MHz_50RB_0offset_CH40185_Rear 10mm/Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.703 W/kg

Configuration/LTE Band 41_QPSK_20MHz_50RB_0offset_CH40185_Rear 10mm/Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.071 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.15 W/kg
SAR(1 g) = 0.487 W/kg; SAR(10 g) = 0.229 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.864 W/kg



#31

Date: 2019-08-09

Test Laboratory: KCTL Inc.
File Name: 3.802.11b_Hotspot.da53:2

DUT: SC-02M, SCV46, Type: Mobile Phone, Serial: R38M50A2ESV

Communication System: UID 0, 2.4GWLAN (0); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.983 S/m; ε_r = 52.207; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

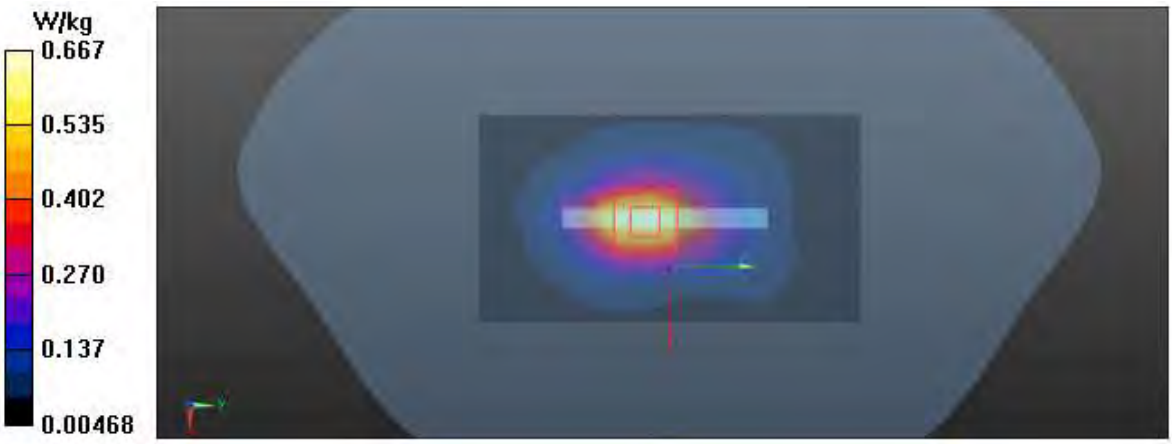
- Probe: EX3DV4 - SN3697; ConvF(6.96, 6.96, 6.96) @ 2437 MHz; ; Calibrated: 2019-03-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.10 (2);

Configuration 3/802.11b_CH6_Top 10mm/Area Scan (7x12x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.667 W/kg

Configuration 3/802.11b_CH6_Top 10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.30 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.910 W/kg
SAR(1 g) = 0.433 W/kg; SAR(10 g) = 0.213 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.712 W/kg



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Appendix A. Calibration certificate

Appendix A.1 Probe Calibration certificate (EX3DV4_3879)

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 KES (Dymstec) Certificate No: EX3-3879_Mar19

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3879

Calibration procedure(s) QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes

Calibration date March 27, 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: 55277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
DAE4	SN: 660	19-Dec-18 (No. DAE4-660_Dec18)	Dec-19
Reference Probe ES3DV2	SN: 3013	31-Dec-18 (No. ES3-3013_Dec18)	Dec-19
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-15)	In house check: Oct-19

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

Issued: March 28, 2019

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Certificate No: EX3-3879_Mar19 Page 1 of 19

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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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
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode
- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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KCTL-TIA002-004/2

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3879

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)²)[A]	0.29	0.41	0.39	± 10.1 %
DCP (mV)[B]	102.3	102.3	100.3	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Max Unc[E] (k=2)
0	CW	X	0.00	0.00	1.00	0.00	179.9	± 3.5 %	± 4.7 %
		Y	0.00	0.00	1.00		197.5		
		Z	0.00	0.00	1.00		169.0		
10352-AAA	Pulse Waveform (200Hz, 10%)	X	1.77	61.15	9.38	10.00	60.0	± 2.7 %	± 9.6 %
		Y	15.00	88.38	20.63		80.0		
		Z	15.00	86.30	19.70		80.0		
10353-AAA	Pulse Waveform (200Hz, 20%)	X	1.79	64.00	9.16	6.99	80.0	± 1.5 %	± 9.6 %
		Y	15.00	89.51	19.91		80.0		
		Z	15.00	86.83	18.49		80.0		
10354-AAA	Pulse Waveform (200Hz, 40%)	X	0.78	61.21	6.21	3.98	95.0	± 1.0 %	± 9.6 %
		Y	15.00	91.81	19.50		95.0		
		Z	15.00	88.13	16.37		95.0		
10355-AAA	Pulse Waveform (200Hz, 60%)	X	0.39	60.00	4.03	2.22	120.0	± 1.2 %	± 9.6 %
		Y	15.00	99.22	21.63		120.0		
		Z	4.32	75.00	11.25		120.0		
10387-AAA	QPSK Waveform, 1 MHz	X	0.44	60.00	5.21	0.00	150.0	± 3.9 %	± 9.6 %
		Y	0.73	62.26	8.73		150.0		
		Z	0.53	60.00	7.29		150.0		
10388-AAA	QPSK Waveform, 10 MHz	X	1.97	67.70	15.41	0.00	150.0	± 1.1 %	± 9.6 %
		Y	2.25	69.34	15.94		150.0		
		Z	2.04	67.25	15.21		150.0		
10396-AAA	64-QAM Waveform, 100 kHz	X	2.71	68.85	17.72	3.01	150.0	± 0.9 %	± 9.6 %
		Y	3.27	71.78	19.18		150.0		
		Z	3.14	70.86	18.96		150.0		
10399-AAA	64-QAM Waveform, 40 MHz	X	3.30	66.85	15.63	0.00	150.0	± 2.7 %	± 9.6 %
		Y	3.51	67.23	15.87		150.0		
		Z	3.50	67.33	15.85		150.0		
10414-AAA	WLAN CCDF, 64-QAM, 40MHz	X	4.77	66.14	15.85	0.00	150.0	± 4.8 %	± 9.6 %
		Y	4.88	65.65	15.57		150.0		
		Z	4.91	65.96	15.76		150.0		

Note: For details on UID parameters see Appendix

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 5).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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KCTL-TIA002-004/2

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3879

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	35.2	270.61	37.49	8.16	1.10	5.01	0.00	0.58	1.01
Y	46.6	347.45	35.44	14.01	0.62	5.06	1.51	0.31	1.01
Z	45.4	350.86	37.69	14.45	1.00	5.07	0.00	0.63	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-15.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3879

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
450	43.5	0.87	10.22	10.22	10.22	0.10	1.20	± 13.3 %
835	41.5	0.90	9.36	9.36	9.36	0.42	0.99	± 12.0 %
900	41.5	0.97	9.30	9.30	9.30	0.50	0.87	± 12.0 %
1750	40.1	1.37	8.41	8.41	8.41	0.37	0.80	± 12.0 %
1900	40.0	1.40	7.99	7.99	7.99	0.39	0.80	± 12.0 %
1950	40.0	1.40	7.67	7.67	7.67	0.38	0.80	± 12.0 %
2450	39.2	1.80	7.20	7.20	7.20	0.42	0.85	± 12.0 %
2600	39.0	1.96	7.07	7.07	7.07	0.40	0.85	± 12.0 %
5200	36.0	4.66	4.99	4.99	4.99	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.84	4.84	4.84	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.74	4.74	4.74	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.53	4.53	4.53	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.66	4.66	4.66	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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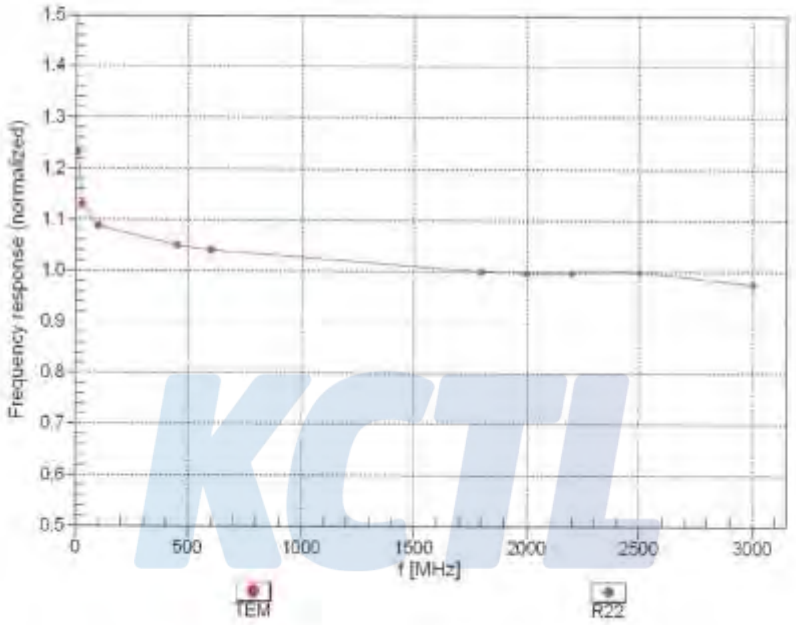
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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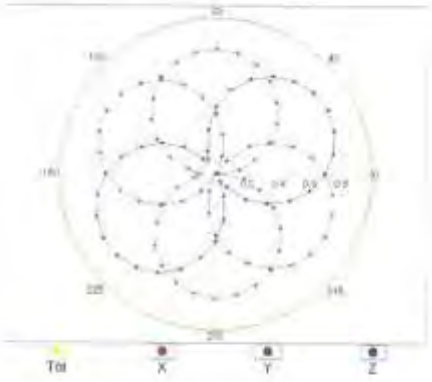
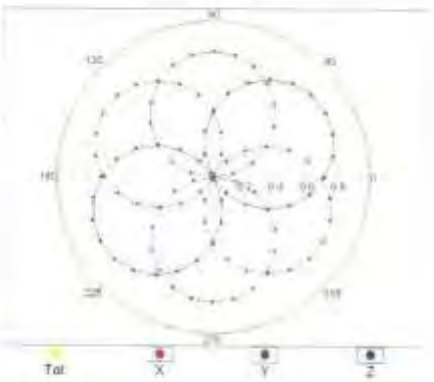
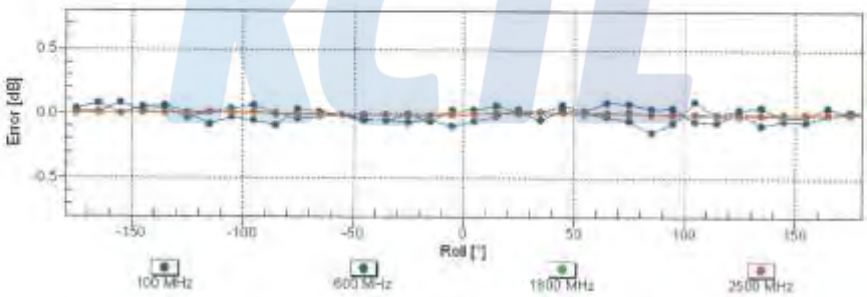
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22





Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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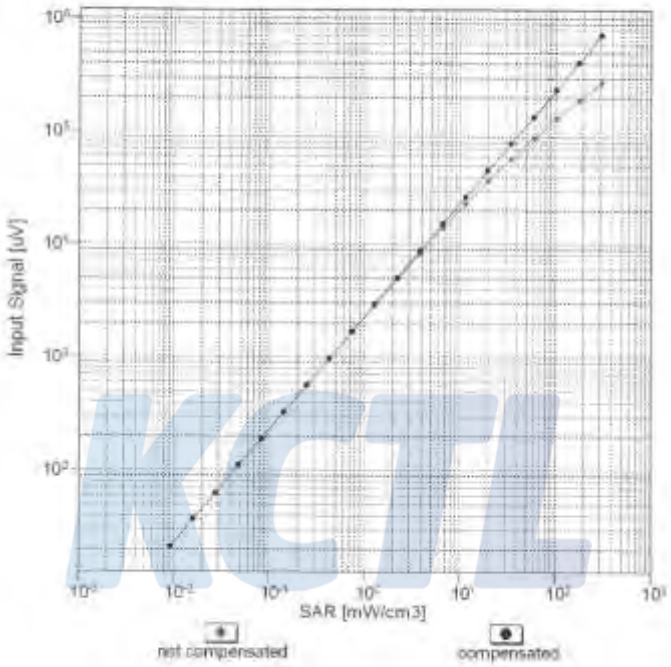
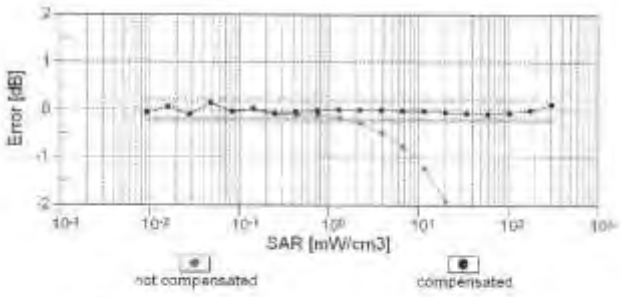
Dynamic Range f(SAR$_{head}$)
(TEM cell , f_{eval}= 1900 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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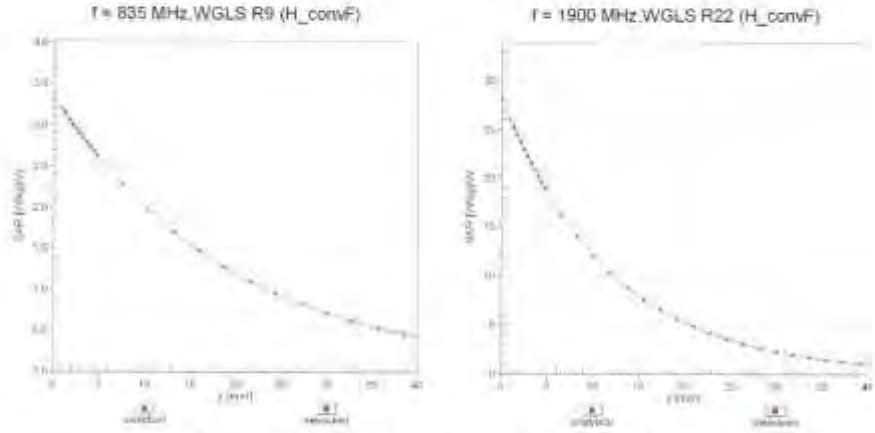
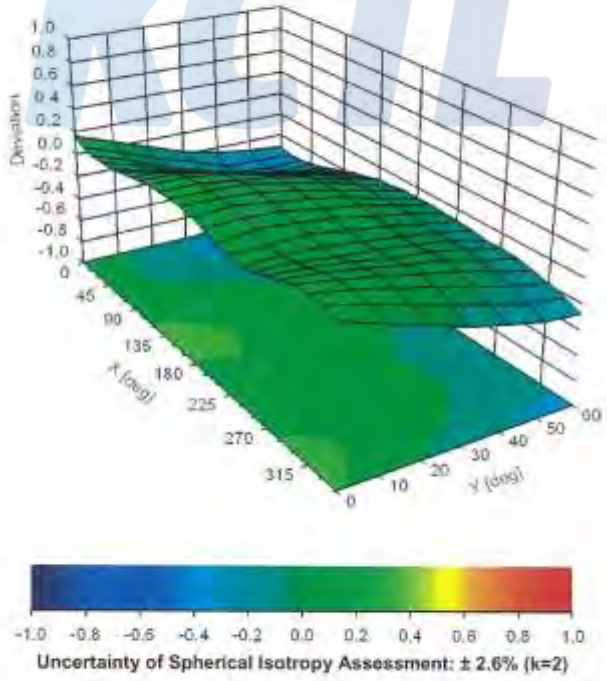
Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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Appendix: Modulation Calibration Parameters

UID	Rev	Communication System Name	Group	PAR (dB)	Unc[E] (k=2)
0		CW	CW	0.00	± 4.7 %
10010	CAA	SAR Validation (Square, 100ms, 10ms)	Test	10.00	± 9.6 %
10011	CAB	UMTS-FDD (WCDMA)	WCDMA	2.91	± 9.6 %
10012	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	± 9.6 %
10013	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	9.46	± 9.6 %
10021	DAC	GSM-FDD (TDMA, GMSK)	GSM	9.39	± 9.6 %
10023	DAC	GPRS-FDD (TDMA, GMSK, TN 0)	GSM	9.57	± 9.6 %
10024	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56	± 9.6 %
10025	DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	GSM	12.62	± 9.6 %
10026	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	GSM	9.55	± 9.6 %
10027	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	GSM	4.80	± 9.6 %
10028	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	3.55	± 9.6 %
10029	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	GSM	7.78	± 9.6 %
10030	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	± 9.6 %
10031	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	Bluetooth	1.87	± 9.6 %
10032	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	Bluetooth	1.16	± 9.6 %
10033	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	Bluetooth	7.74	± 9.6 %
10034	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	Bluetooth	4.53	± 9.6 %
10035	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	Bluetooth	3.83	± 9.6 %
10036	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	Bluetooth	8.01	± 9.6 %
10037	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	Bluetooth	4.77	± 9.6 %
10038	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	Bluetooth	4.10	± 9.6 %
10039	CAB	CDMA2000 (1xRTT, RC1)	CDMA2000	4.57	± 9.6 %
10042	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	AMPS	7.78	± 9.6 %
10044	CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	AMPS	0.00	± 9.6 %
10048	CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	DECT	13.80	± 9.6 %
10049	CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	DECT	10.79	± 9.6 %
10056	CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	TD-SCDMA	11.01	± 9.6 %
10058	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	GSM	6.52	± 9.6 %
10059	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	± 9.6 %
10060	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	± 9.6 %
10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.60	± 9.6 %
10062	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	± 9.6 %
10063	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	± 9.6 %
10064	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	WLAN	9.09	± 9.6 %
10065	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	± 9.6 %
10066	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	± 9.6 %
10067	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	± 9.6 %
10068	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	± 9.6 %
10069	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	± 9.6 %
10071	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	WLAN	9.83	± 9.6 %
10072	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	WLAN	9.62	± 9.6 %
10073	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	WLAN	9.94	± 9.6 %
10074	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	WLAN	10.30	± 9.6 %
10075	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	WLAN	10.77	± 9.6 %
10076	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	WLAN	10.94	± 9.6 %
10077	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	WLAN	11.00	± 9.6 %
10081	CAB	CDMA2000 (1xRTT, RC3)	CDMA2000	3.97	± 9.6 %
10082	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	AMPS	4.77	± 9.6 %
10090	DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	± 9.6 %
10097	CAB	UMTS-FDD (HSDPA)	WCDMA	3.98	± 9.6 %
10098	CAB	UMTS-FDD (HSUPA, Subtest 2)	WCDMA	3.98	± 9.6 %
10099	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	GSM	9.55	± 9.6 %
10100	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-FDD	5.67	± 9.6 %
10101	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10102	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10103	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10104	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-TDD	9.97	± 9.6 %
10105	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-TDD	10.01	± 9.6 %
10108	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-FDD	5.80	± 9.6 %

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10109	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10110	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-FDD	5.75	± 9.6 %
10111	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-FDD	6.44	± 9.6 %
10112	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-FDD	6.59	± 9.6 %
10113	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10114	CAC	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10115	CAC	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	WLAN	8.46	± 9.6 %
10116	CAC	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	WLAN	8.15	± 9.6 %
10117	CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	WLAN	8.07	± 9.6 %
10118	CAC	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	WLAN	8.59	± 9.6 %
10119	CAC	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	WLAN	8.13	± 9.6 %
10140	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10141	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-FDD	6.53	± 9.6 %
10142	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10143	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-FDD	6.35	± 9.6 %
10144	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-FDD	6.65	± 9.6 %
10145	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-FDD	5.76	± 9.6 %
10146	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.41	± 9.6 %
10147	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.72	± 9.6 %
10148	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10150	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10151	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-TDD	9.28	± 9.6 %
10152	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10153	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-TDD	10.05	± 9.6 %
10154	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-FDD	5.75	± 9.6 %
10155	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10156	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-FDD	5.79	± 9.6 %
10157	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10158	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10159	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-FDD	6.56	± 9.6 %
10160	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-FDD	5.82	± 9.6 %
10161	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10162	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-FDD	6.58	± 9.6 %
10166	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-FDD	5.46	± 9.6 %
10167	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.21	± 9.6 %
10168	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.79	± 9.6 %
10169	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10170	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10171	AAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-FDD	6.49	± 9.6 %
10172	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10173	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10174	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10175	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10176	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10177	CAI	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10178	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10179	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10180	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10181	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10182	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10183	AAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10184	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10185	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-FDD	6.51	± 9.6 %
10186	AAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10187	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10188	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10189	AAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10193	CAC	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	WLAN	8.09	± 9.6 %
10194	CAC	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	WLAN	8.12	± 9.6 %
10195	CAC	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	WLAN	8.21	± 9.6 %
10196	CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10197	CAC	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10198	CAC	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10219	CAC	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	WLAN	8.08	± 9.6 %

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10220	CAC	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10221	CAC	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10222	CAC	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	WLAN	8.06	± 9.6 %
10223	CAC	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	WLAN	8.48	± 9.6 %
10224	CAC	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	WLAN	8.08	± 9.6 %
10225	CAB	UMTS-FDD (HSPA+)	WCDMA	5.97	± 9.6 %
10226	CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.49	± 9.6 %
10227	CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.26	± 9.6 %
10228	CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.22	± 9.6 %
10229	CAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10230	CAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10231	CAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	± 9.6 %
10232	CAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10233	CAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10234	CAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10235	CAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10236	CAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10237	CAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10238	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10239	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10240	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10241	CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	± 9.6 %
10242	CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.86	± 9.6 %
10243	CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	± 9.6 %
10244	CAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10245	CAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	± 9.6 %
10246	CAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10247	CAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9.91	± 9.6 %
10248	CAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.06	± 9.6 %
10249	CAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10250	CAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-TDD	9.81	± 9.6 %
10251	CAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-TDD	10.17	± 9.6 %
10252	CAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10253	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	± 9.6 %
10254	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	± 9.6 %
10255	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	± 9.6 %
10256	CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.96	± 9.6 %
10257	CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	± 9.6 %
10258	CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	± 9.6 %
10259	CAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.96	± 9.6 %
10260	CAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	± 9.6 %
10261	CAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10262	CAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.63	± 9.6 %
10263	CAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.16	± 9.6 %
10264	CAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	± 9.6 %
10265	CAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10266	CAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-TDD	10.07	± 9.6 %
10267	CAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10268	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10269	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.13	± 9.6 %
10270	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.58	± 9.6 %
10274	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8 10)	WCDMA	4.67	± 9.6 %
10275	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	WCDMA	3.96	± 9.6 %
10277	CAA	PHS (QPSK)	PHS	11.81	± 9.6 %
10278	CAA	PHS (QPSK, BW 884MHz, Rolloff 0.5)	PHS	11.81	± 9.6 %
10279	CAA	PHS (QPSK, BW 884MHz, Rolloff 0.38)	PHS	12.19	± 9.6 %
10290	AAB	CDMA2000, RC1, SO55, Full Rate	CDMA2000	3.91	± 9.6 %
10291	AAB	CDMA2000, RC3, SO55, Full Rate	CDMA2000	3.46	± 9.6 %
10292	AAB	CDMA2000, RC3, SO32, Full Rate	CDMA2000	3.39	± 9.6 %
10293	AAB	CDMA2000, RC3, SO3, Full Rate	CDMA2000	3.50	± 9.6 %
10295	AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	CDMA2000	12.49	± 9.6 %
10297	AAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.81	± 9.6 %
10298	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10299	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-FDD	6.39	± 9.6 %

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10300	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-FDD	6.80	± 9.6 %
10301	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	WiMAX	12.03	± 9.6 %
10302	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3 CTRL symbols)	WiMAX	12.67	± 9.6 %
10303	AAA	IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	WiMAX	12.52	± 9.6 %
10304	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	WiMAX	11.88	± 9.6 %
10305	AAA	IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC, 18 symbols)	WiMAX	15.24	± 9.6 %
10306	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC, 18 symbols)	WiMAX	14.67	± 9.6 %
10307	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC, 18 symbols)	WiMAX	14.49	± 9.6 %
10308	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	WiMAX	14.46	± 9.6 %
10309	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3, 18 symbols)	WiMAX	14.58	± 9.6 %
10310	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3, 18 symbols)	WiMAX	14.57	± 9.6 %
10311	AAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-FDD	6.06	± 9.6 %
10313	AAA	iDEN 1:3	iDEN	10.51	± 9.6 %
10314	AAA	iDEN 1:6	iDEN	13.48	± 9.6 %
10315	AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	WLAN	1.71	± 9.6 %
10316	AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10317	AAC	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10352	AAA	Pulse Waveform (200Hz, 10%)	Generic	10.00	± 9.6 %
10353	AAA	Pulse Waveform (200Hz, 20%)	Generic	6.99	± 9.6 %
10354	AAA	Pulse Waveform (200Hz, 40%)	Generic	3.98	± 9.6 %
10355	AAA	Pulse Waveform (200Hz, 60%)	Generic	2.22	± 9.6 %
10356	AAA	Pulse Waveform (200Hz, 80%)	Generic	0.97	± 9.6 %
10387	AAA	QPSK Waveform, 1 MHz	Generic	5.10	± 9.6 %
10388	AAA	QPSK Waveform, 10 MHz	Generic	5.22	± 9.6 %
10396	AAA	64-QAM Waveform, 100 kHz	Generic	6.27	± 9.6 %
10399	AAA	64-QAM Waveform, 40 MHz	Generic	6.27	± 9.6 %
10400	AAD	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	WLAN	8.37	± 9.6 %
10401	AAD	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	WLAN	8.60	± 9.6 %
10402	AAD	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	WLAN	8.53	± 9.6 %
10403	AAB	CDMA2000 (1xEV-DO, Rev. 0)	CDMA2000	3.76	± 9.6 %
10404	AAB	CDMA2000 (1xEV-DO, Rev. A)	CDMA2000	3.77	± 9.6 %
10406	AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	CDMA2000	5.22	± 9.6 %
10410	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9, Subframe Conf=4)	LTE-TDD	7.82	± 9.6 %
10414	AAA	WLAN CCDF, 64-QAM, 40MHz	Generic	8.54	± 9.6 %
10415	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	WLAN	1.54	± 9.6 %
10416	AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	WLAN	8.23	± 9.6 %
10417	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	WLAN	8.23	± 9.6 %
10418	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble)	WLAN	8.14	± 9.6 %
10419	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble)	WLAN	8.19	± 9.6 %
10422	AAB	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	WLAN	8.37	± 9.6 %
10423	AAB	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	WLAN	8.47	± 9.6 %
10424	AAB	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	WLAN	8.40	± 9.6 %
10425	AAB	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	WLAN	8.41	± 9.6 %
10426	AAB	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	WLAN	8.45	± 9.6 %
10427	AAB	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	WLAN	8.41	± 9.6 %
10430	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	LTE-FDD	8.28	± 9.6 %
10431	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.38	± 9.6 %
10432	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10433	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10434	AAA	W-CDMA (BS Test Model 1, 64 DPCH)	WCDMA	8.60	± 9.6 %
10435	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10447	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.58	± 9.6 %
10448	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clippin 44%)	LTE-FDD	7.53	± 9.6 %
10449	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.51	± 9.6 %
10450	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.48	± 9.6 %

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10451	AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	WCDMA	7.59	± 9.6 %
10456	AAB	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc duty cycle)	WLAN	8.63	± 9.6 %
10457	AAA	UMTS-FDD (DC-HSDPA)	WCDMA	6.62	± 9.6 %
10458	AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	CDMA2000	6.55	± 9.6 %
10459	AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	CDMA2000	8.25	± 9.6 %
10460	AAA	UMTS-FDD (WCDMA, AMR)	WCDMA	2.39	± 9.6 %
10461	AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10462	AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.30	± 9.6 %
10463	AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.56	± 9.6 %
10464	AAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10465	AAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10466	AAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	± 9.6 %
10467	AAE	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10468	AAE	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10469	AAE	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.56	± 9.6 %
10470	AAE	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10471	AAE	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10472	AAE	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	± 9.6 %
10473	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10474	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10475	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	± 9.6 %
10477	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10478	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	± 9.6 %
10479	AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %
10480	AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.18	± 9.6 %
10481	AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.45	± 9.6 %
10482	AAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.71	± 9.6 %
10483	AAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.39	± 9.6 %
10484	AAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.47	± 9.6 %
10485	AAE	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.59	± 9.6 %
10486	AAE	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.38	± 9.6 %
10487	AAE	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.60	± 9.6 %
10488	AAE	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.70	± 9.6 %
10489	AAE	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.31	± 9.6 %
10490	AAE	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	± 9.6 %
10491	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %

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10492	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.41	± 9.6 %
10493	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.55	± 9.6 %
10494	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %
10495	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.37	± 9.6 %
10496	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	± 9.6 %
10497	AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.67	± 9.6 %
10498	AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.40	± 9.6 %
10499	AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.68	± 9.6 %
10500	AAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.67	± 9.6 %
10501	AAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.44	± 9.6 %
10502	AAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.52	± 9.6 %
10503	AAE	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.72	± 9.6 %
10504	AAE	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.31	± 9.6 %
10505	AAE	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	± 9.6 %
10506	AAE	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %
10507	AAE	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.36	± 9.6 %
10508	AAE	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.55	± 9.6 %
10509	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.99	± 9.6 %
10510	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.49	± 9.6 %
10511	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.51	± 9.6 %
10512	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %
10513	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.42	± 9.6 %
10514	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.45	± 9.6 %
10515	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	WLAN	1.58	± 9.6 %
10516	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc duty cycle)	WLAN	1.57	± 9.6 %
10517	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc duty cycle)	WLAN	1.58	± 9.6 %
10518	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	WLAN	8.23	± 9.6 %
10519	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc duty cycle)	WLAN	8.39	± 9.6 %
10520	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc duty cycle)	WLAN	8.12	± 9.6 %
10521	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc duty cycle)	WLAN	7.97	± 9.6 %
10522	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10523	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc duty cycle)	WLAN	8.08	± 9.6 %
10524	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc duty cycle)	WLAN	8.27	± 9.6 %
10525	AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10526	AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10527	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc duty cycle)	WLAN	8.21	± 9.6 %
10528	AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10529	AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10531	AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc duty cycle)	WLAN	8.43	± 9.6 %
10532	AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10533	AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 99pc duty cycle)	WLAN	8.38	± 9.6 %
10534	AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	WLAN	8.45	± 9.6 %

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10535	AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10536	AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 99pc duty cycle)	WLAN	8.32	± 9.6 %
10537	AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 99pc duty cycle)	WLAN	8.44	± 9.6 %
10538	AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 99pc duty cycle)	WLAN	8.54	± 9.6 %
10540	AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 99pc duty cycle)	WLAN	8.39	± 9.6 %
10541	AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 99pc duty cycle)	WLAN	8.46	± 9.6 %
10542	AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 99pc duty cycle)	WLAN	8.65	± 9.6 %
10543	AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 99pc duty cycle)	WLAN	8.65	± 9.6 %
10544	AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	WLAN	8.47	± 9.6 %
10545	AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	WLAN	8.55	± 9.6 %
10546	AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 99pc duty cycle)	WLAN	8.35	± 9.6 %
10547	AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 99pc duty cycle)	WLAN	8.49	± 9.6 %
10548	AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 99pc duty cycle)	WLAN	8.37	± 9.6 %
10550	AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 99pc duty cycle)	WLAN	8.38	± 9.6 %
10551	AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 99pc duty cycle)	WLAN	8.50	± 9.6 %
10552	AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10553	AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10554	AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 99pc duty cycle)	WLAN	8.48	± 9.6 %
10555	AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 99pc duty cycle)	WLAN	8.47	± 9.6 %
10556	AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 99pc duty cycle)	WLAN	8.50	± 9.6 %
10557	AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 99pc duty cycle)	WLAN	8.52	± 9.6 %
10558	AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 99pc duty cycle)	WLAN	8.61	± 9.6 %
10560	AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 99pc duty cycle)	WLAN	8.73	± 9.6 %
10561	AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 99pc duty cycle)	WLAN	8.56	± 9.6 %
10562	AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 99pc duty cycle)	WLAN	8.69	± 9.6 %
10563	AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 99pc duty cycle)	WLAN	8.77	± 9.6 %
10564	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	WLAN	8.25	± 9.6 %
10565	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10566	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc duty cycle)	WLAN	8.13	± 9.6 %
10567	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc duty cycle)	WLAN	8.00	± 9.6 %
10568	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc duty cycle)	WLAN	8.37	± 9.6 %
10569	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc duty cycle)	WLAN	8.10	± 9.6 %
10570	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc duty cycle)	WLAN	8.30	± 9.6 %
10571	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	WLAN	1.99	± 9.6 %
10572	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	WLAN	1.99	± 9.6 %
10573	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc duty cycle)	WLAN	1.98	± 9.6 %
10574	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc duty cycle)	WLAN	1.98	± 9.6 %
10575	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	WLAN	8.59	± 9.6 %
10576	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	WLAN	8.60	± 9.6 %
10577	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10578	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc duty cycle)	WLAN	8.49	± 9.6 %
10579	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc duty cycle)	WLAN	8.36	± 9.6 %
10580	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10581	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc duty cycle)	WLAN	8.35	± 9.6 %
10582	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc duty cycle)	WLAN	8.67	± 9.6 %
10583	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	WLAN	8.59	± 9.6 %
10584	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	WLAN	8.60	± 9.6 %
10585	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10586	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc duty cycle)	WLAN	8.49	± 9.6 %
10587	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc duty cycle)	WLAN	8.36	± 9.6 %

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10588	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10589	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc duty cycle)	WLAN	8.35	± 9.6 %
10590	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc duty cycle)	WLAN	8.67	± 9.6 %
10591	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	WLAN	8.63	± 9.6 %
10592	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	WLAN	8.79	± 9.6 %
10593	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc duty cycle)	WLAN	8.84	± 9.6 %
10594	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10595	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10596	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc duty cycle)	WLAN	8.71	± 9.6 %
10597	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc duty cycle)	WLAN	8.72	± 9.6 %
10598	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc duty cycle)	WLAN	8.50	± 9.6 %
10599	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	WLAN	8.79	± 9.6 %
10600	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	WLAN	8.86	± 9.6 %
10601	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10602	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc duty cycle)	WLAN	8.84	± 9.6 %
10603	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc duty cycle)	WLAN	9.03	± 9.6 %
10604	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10605	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc duty cycle)	WLAN	8.97	± 9.6 %
10606	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10607	AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	WLAN	8.64	± 9.6 %
10608	AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	WLAN	8.77	± 9.6 %
10609	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc duty cycle)	WLAN	8.57	± 9.6 %
10610	AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10611	AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10612	AAB	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc duty cycle)	WLAN	8.77	± 9.6 %
10613	AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc duty cycle)	WLAN	8.84	± 9.6 %
10614	AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc duty cycle)	WLAN	8.59	± 9.6 %
10615	AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc duty cycle)	WLAN	8.62	± 9.6 %
10616	AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10617	AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10618	AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc duty cycle)	WLAN	8.58	± 9.6 %
10619	AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc duty cycle)	WLAN	8.86	± 9.6 %
10620	AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc duty cycle)	WLAN	8.87	± 9.6 %
10621	AAB	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc duty cycle)	WLAN	8.77	± 9.6 %
10622	AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc duty cycle)	WLAN	8.68	± 9.6 %
10623	AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10624	AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc duty cycle)	WLAN	8.56	± 9.6 %
10625	AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc duty cycle)	WLAN	8.66	± 9.6 %
10626	AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	WLAN	8.83	± 9.6 %
10627	AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	WLAN	8.88	± 9.6 %
10628	AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc duty cycle)	WLAN	8.71	± 9.6 %
10629	AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc duty cycle)	WLAN	8.85	± 9.6 %
10630	AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc duty cycle)	WLAN	8.72	± 9.6 %
10631	AAB	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10632	AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10633	AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc duty cycle)	WLAN	8.83	± 9.6 %
10634	AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc duty cycle)	WLAN	8.80	± 9.6 %
10635	AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10636	AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc duty cycle)	WLAN	8.83	± 9.6 %
10637	AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 90pc duty cycle)	WLAN	8.79	± 9.6 %
10638	AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 90pc duty cycle)	WLAN	8.86	± 9.6 %
10639	AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 90pc duty cycle)	WLAN	8.85	± 9.6 %
10640	AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 90pc duty cycle)	WLAN	8.98	± 9.6 %
10641	AAC	IEEE 802.11ac WiFi (160MHz, MCS5, 90pc duty cycle)	WLAN	9.06	± 9.6 %
10642	AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 90pc duty cycle)	WLAN	9.06	± 9.6 %
10643	AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 90pc duty cycle)	WLAN	8.89	± 9.6 %
10644	AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 90pc duty cycle)	WLAN	9.05	± 9.6 %
10645	AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 90pc duty cycle)	WLAN	9.11	± 9.6 %
10646	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,7)	LTE-TDD	11.96	± 9.6 %
10647	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,7)	LTE-TDD	11.96	± 9.6 %
10648	AAA	CDMA2000 (1x Advanced)	CDMA2000	3.45	± 9.6 %
10652	AAD	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.91	± 9.6 %
10653	AAD	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.42	± 9.6 %
10654	AAD	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.96	± 9.6 %

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10655	AAE	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.21	± 9.6 %
10656	AAA	Pulse Waveform (200Hz, 10%)	Test	10.00	± 9.6 %
10658	AAA	Pulse Waveform (200Hz, 20%)	Test	6.99	± 9.6 %
10660	AAA	Pulse Waveform (200Hz, 40%)	Test	3.98	± 9.6 %
10661	AAA	Pulse Waveform (200Hz, 60%)	Test	2.22	± 9.6 %
10662	AAA	Pulse Waveform (200Hz, 80%)	Test	0.97	± 9.6 %
10670	AAA	Bluetooth Low Energy	Bluetooth	2.19	± 9.6 %
10671	AAA	IEEE 802.11ax (20MHz, MCS0, 90pc duty cycle)	WLAN	9.09	± 9.6 %
10672	AAA	IEEE 802.11ax (20MHz, MCS1, 90pc duty cycle)	WLAN	8.57	± 9.6 %
10673	AAA	IEEE 802.11ax (20MHz, MCS2, 90pc duty cycle)	WLAN	8.78	± 9.6 %
10674	AAA	IEEE 802.11ax (20MHz, MCS3, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10675	AAA	IEEE 802.11ax (20MHz, MCS4, 90pc duty cycle)	WLAN	8.90	± 9.6 %
10676	AAA	IEEE 802.11ax (20MHz, MCS5, 90pc duty cycle)	WLAN	8.77	± 9.6 %
10677	AAA	IEEE 802.11ax (20MHz, MCS6, 90pc duty cycle)	WLAN	8.75	± 9.6 %
10678	AAA	IEEE 802.11ax (20MHz, MCS7, 90pc duty cycle)	WLAN	8.78	± 9.6 %
10679	AAA	IEEE 802.11ax (20MHz, MCS8, 90pc duty cycle)	WLAN	8.89	± 9.6 %
10680	AAA	IEEE 802.11ax (20MHz, MCS9, 90pc duty cycle)	WLAN	8.80	± 9.6 %
10681	AAA	IEEE 802.11ax (20MHz, MCS10, 90pc duty cycle)	WLAN	8.62	± 9.6 %
10682	AAA	IEEE 802.11ax (20MHz, MCS11, 90pc duty cycle)	WLAN	8.83	± 9.6 %
10683	AAA	IEEE 802.11ax (20MHz, MCS0, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10684	AAA	IEEE 802.11ax (20MHz, MCS1, 99pc duty cycle)	WLAN	8.26	± 9.6 %
10685	AAA	IEEE 802.11ax (20MHz, MCS2, 99pc duty cycle)	WLAN	8.33	± 9.6 %
10686	AAA	IEEE 802.11ax (20MHz, MCS3, 99pc duty cycle)	WLAN	8.26	± 9.6 %
10687	AAA	IEEE 802.11ax (20MHz, MCS4, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10688	AAA	IEEE 802.11ax (20MHz, MCS5, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10689	AAA	IEEE 802.11ax (20MHz, MCS6, 99pc duty cycle)	WLAN	8.55	± 9.6 %
10690	AAA	IEEE 802.11ax (20MHz, MCS7, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10691	AAA	IEEE 802.11ax (20MHz, MCS8, 99pc duty cycle)	WLAN	8.25	± 9.6 %
10692	AAA	IEEE 802.11ax (20MHz, MCS9, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10693	AAA	IEEE 802.11ax (20MHz, MCS10, 99pc duty cycle)	WLAN	8.25	± 9.6 %
10694	AAA	IEEE 802.11ax (20MHz, MCS11, 99pc duty cycle)	WLAN	8.57	± 9.6 %
10695	AAA	IEEE 802.11ax (40MHz, MCS0, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10696	AAA	IEEE 802.11ax (40MHz, MCS1, 90pc duty cycle)	WLAN	8.91	± 9.6 %
10697	AAA	IEEE 802.11ax (40MHz, MCS2, 90pc duty cycle)	WLAN	8.61	± 9.6 %
10698	AAA	IEEE 802.11ax (40MHz, MCS3, 90pc duty cycle)	WLAN	8.69	± 9.6 %
10699	AAA	IEEE 802.11ax (40MHz, MCS4, 90pc duty cycle)	WLAN	8.62	± 9.6 %
10700	AAA	IEEE 802.11ax (40MHz, MCS5, 90pc duty cycle)	WLAN	8.73	± 9.6 %
10701	AAA	IEEE 802.11ax (40MHz, MCS6, 90pc duty cycle)	WLAN	8.66	± 9.6 %
10702	AAA	IEEE 802.11ax (40MHz, MCS7, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10703	AAA	IEEE 802.11ax (40MHz, MCS8, 90pc duty cycle)	WLAN	8.62	± 9.6 %
10704	AAA	IEEE 802.11ax (40MHz, MCS9, 90pc duty cycle)	WLAN	8.56	± 9.6 %
10705	AAA	IEEE 802.11ax (40MHz, MCS10, 90pc duty cycle)	WLAN	8.59	± 9.6 %
10706	AAA	IEEE 802.11ax (40MHz, MCS11, 90pc duty cycle)	WLAN	8.66	± 9.6 %
10707	AAA	IEEE 802.11ax (40MHz, MCS0, 99pc duty cycle)	WLAN	8.32	± 9.6 %
10708	AAA	IEEE 802.11ax (40MHz, MCS1, 99pc duty cycle)	WLAN	8.55	± 9.6 %
10709	AAA	IEEE 802.11ax (40MHz, MCS2, 99pc duty cycle)	WLAN	8.33	± 9.6 %
10710	AAA	IEEE 802.11ax (40MHz, MCS3, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10711	AAA	IEEE 802.11ax (40MHz, MCS4, 99pc duty cycle)	WLAN	8.39	± 9.6 %
10712	AAA	IEEE 802.11ax (40MHz, MCS5, 99pc duty cycle)	WLAN	8.67	± 9.6 %
10713	AAA	IEEE 802.11ax (40MHz, MCS6, 99pc duty cycle)	WLAN	8.33	± 9.6 %
10714	AAA	IEEE 802.11ax (40MHz, MCS7, 99pc duty cycle)	WLAN	8.26	± 9.6 %
10715	AAA	IEEE 802.11ax (40MHz, MCS8, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10716	AAA	IEEE 802.11ax (40MHz, MCS9, 99pc duty cycle)	WLAN	8.30	± 9.6 %
10717	AAA	IEEE 802.11ax (40MHz, MCS10, 99pc duty cycle)	WLAN	8.49	± 9.6 %
10719	AAA	IEEE 802.11ax (40MHz, MCS11, 99pc duty cycle)	WLAN	8.24	± 9.6 %
10719	AAA	IEEE 802.11ax (80MHz, MCS0, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10720	AAA	IEEE 802.11ax (80MHz, MCS1, 90pc duty cycle)	WLAN	8.67	± 9.6 %
10721	AAA	IEEE 802.11ax (80MHz, MCS2, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10722	AAA	IEEE 802.11ax (80MHz, MCS3, 90pc duty cycle)	WLAN	8.55	± 9.6 %
10723	AAA	IEEE 802.11ax (80MHz, MCS4, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10724	AAA	IEEE 802.11ax (80MHz, MCS5, 90pc duty cycle)	WLAN	8.90	± 9.6 %
10725	AAA	IEEE 802.11ax (80MHz, MCS6, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10726	AAA	IEEE 802.11ax (80MHz, MCS7, 90pc duty cycle)	WLAN	8.72	± 9.6 %
10727	AAA	IEEE 802.11ax (80MHz, MCS8, 90pc duty cycle)	WLAN	8.66	± 9.6 %

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10728	AAA	IEEE 802.11ax (80MHz, MCS9, 90pc duty cycle)	WLAN	8.65	± 9.6 %
10729	AAA	IEEE 802.11ax (80MHz, MCS10, 90pc duty cycle)	WLAN	8.64	± 9.6 %
10730	AAA	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	WLAN	8.67	± 9.6 %
10731	AAA	IEEE 802.11ax (80MHz, MCS0, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10732	AAA	IEEE 802.11ax (80MHz, MCS1, 99pc duty cycle)	WLAN	8.46	± 9.6 %
10733	AAA	IEEE 802.11ax (80MHz, MCS2, 99pc duty cycle)	WLAN	8.40	± 9.6 %
10734	AAA	IEEE 802.11ax (80MHz, MCS3, 99pc duty cycle)	WLAN	8.25	± 9.6 %
10735	AAA	IEEE 802.11ax (80MHz, MCS4, 99pc duty cycle)	WLAN	8.33	± 9.6 %
10736	AAA	IEEE 802.11ax (80MHz, MCS5, 99pc duty cycle)	WLAN	8.27	± 9.6 %
10737	AAA	IEEE 802.11ax (80MHz, MCS6, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10738	AAA	IEEE 802.11ax (80MHz, MCS7, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10739	AAA	IEEE 802.11ax (80MHz, MCS8, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10740	AAA	IEEE 802.11ax (80MHz, MCS9, 99pc duty cycle)	WLAN	8.48	± 9.6 %
10741	AAA	IEEE 802.11ax (80MHz, MCS10, 99pc duty cycle)	WLAN	8.40	± 9.6 %
10742	AAA	IEEE 802.11ax (80MHz, MCS11, 99pc duty cycle)	WLAN	8.43	± 9.6 %
10743	AAA	IEEE 802.11ax (160MHz, MCS0, 90pc duty cycle)	WLAN	8.94	± 9.6 %
10744	AAA	IEEE 802.11ax (160MHz, MCS1, 90pc duty cycle)	WLAN	9.16	± 9.6 %
10745	AAA	IEEE 802.11ax (160MHz, MCS2, 90pc duty cycle)	WLAN	8.93	± 9.6 %
10746	AAA	IEEE 802.11ax (160MHz, MCS3, 90pc duty cycle)	WLAN	9.11	± 9.6 %
10747	AAA	IEEE 802.11ax (160MHz, MCS4, 90pc duty cycle)	WLAN	9.04	± 9.6 %
10748	AAA	IEEE 802.11ax (160MHz, MCS5, 90pc duty cycle)	WLAN	8.93	± 9.6 %
10749	AAA	IEEE 802.11ax (160MHz, MCS6, 90pc duty cycle)	WLAN	8.90	± 9.6 %
10750	AAA	IEEE 802.11ax (160MHz, MCS7, 90pc duty cycle)	WLAN	8.79	± 9.6 %
10751	AAA	IEEE 802.11ax (160MHz, MCS8, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10752	AAA	IEEE 802.11ax (160MHz, MCS9, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10753	AAA	IEEE 802.11ax (160MHz, MCS10, 90pc duty cycle)	WLAN	9.00	± 9.6 %
10754	AAA	IEEE 802.11ax (160MHz, MCS11, 90pc duty cycle)	WLAN	8.94	± 9.6 %
10755	AAA	IEEE 802.11ax (160MHz, MCS0, 99pc duty cycle)	WLAN	8.64	± 9.6 %
10756	AAA	IEEE 802.11ax (160MHz, MCS1, 99pc duty cycle)	WLAN	8.77	± 9.6 %
10757	AAA	IEEE 802.11ax (160MHz, MCS2, 99pc duty cycle)	WLAN	8.77	± 9.6 %
10758	AAA	IEEE 802.11ax (160MHz, MCS3, 99pc duty cycle)	WLAN	8.69	± 9.6 %
10759	AAA	IEEE 802.11ax (160MHz, MCS4, 99pc duty cycle)	WLAN	8.58	± 9.6 %
10760	AAA	IEEE 802.11ax (160MHz, MCS5, 99pc duty cycle)	WLAN	8.49	± 9.6 %
10761	AAA	IEEE 802.11ax (160MHz, MCS6, 99pc duty cycle)	WLAN	8.58	± 9.6 %
10762	AAA	IEEE 802.11ax (160MHz, MCS7, 99pc duty cycle)	WLAN	8.49	± 9.6 %
10763	AAA	IEEE 802.11ax (160MHz, MCS8, 99pc duty cycle)	WLAN	8.53	± 9.6 %
10764	AAA	IEEE 802.11ax (160MHz, MCS9, 99pc duty cycle)	WLAN	8.54	± 9.6 %
10765	AAA	IEEE 802.11ax (160MHz, MCS10, 99pc duty cycle)	WLAN	8.54	± 9.6 %
10766	AAA	IEEE 802.11ax (160MHz, MCS11, 99pc duty cycle)	WLAN	8.51	± 9.6 %

[1] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Appendix A.2 Probe Calibration certificate (EX3DV4_3928)

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 KCTL (Dymstec) Certificate No: EX3-3928_Jan19

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3928

Calibration procedure(s) QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes

Calibration date: January 31, 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: BS277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
DAE4	SN: 660	19-Dec-18 (No. DAE4-660_Dec18)	Dec-19
Reference Probe ES3DV2	SN: 3013	31-Dec-18 (No. ES3-3013_Dec18)	Dec-19
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: February 2, 2019

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Certificate No: EX3-3928_Jan19 Page 1 of 10

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**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical Isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3928

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.48	0.22	0.55	± 10.1 %
DCP (mV)[B]	94.9	94.8	96.3	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Max dev.	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	135.8	±3.0 %	±4.7 %
		Y	0.0	0.0	1.0		135.4		
		Z	0.0	0.0	1.0		143.6		

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3928

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	70.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3928

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [D]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	9.34	9.34	9.34	0.55	0.90	± 12.0 %
850	41.5	0.92	9.27	9.27	9.27	0.60	0.85	± 12.0 %
900	41.5	0.97	9.02	9.02	9.02	0.47	0.89	± 12.0 %
1750	40.1	1.37	7.97	7.97	7.97	0.38	0.84	± 12.0 %
1900	40.0	1.40	7.79	7.79	7.79	0.25	0.85	± 12.0 %
2300	39.5	1.67	7.51	7.51	7.51	0.28	0.84	± 12.0 %
2450	39.2	1.80	7.21	7.21	7.21	0.31	0.85	± 12.0 %
2600	39.0	1.96	6.92	6.92	6.92	0.35	0.89	± 12.0 %
3500	37.9	2.91	6.86	6.86	6.86	0.25	1.20	± 13.1 %
3700	37.7	3.12	6.70	6.70	6.70	0.25	1.20	± 13.1 %
5200	36.0	4.66	5.16	5.16	5.16	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.95	4.95	4.95	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.86	4.86	4.86	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.78	4.78	4.78	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.70	4.70	4.70	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[D] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3928

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	9.55	9.55	9.55	0.51	0.80	± 12.0 %
850	55.2	0.99	9.32	9.32	9.32	0.39	0.84	± 12.0 %
900	55.0	1.05	9.28	9.28	9.28	0.46	0.86	± 12.0 %
1750	53.4	1.49	7.70	7.70	7.70	0.37	0.84	± 12.0 %
1900	53.3	1.52	7.46	7.46	7.46	0.37	0.84	± 12.0 %
2300	52.9	1.81	7.25	7.25	7.25	0.38	0.86	± 12.0 %
2450	52.7	1.95	7.22	7.22	7.22	0.24	0.93	± 12.0 %
2600	52.5	2.16	6.95	6.95	6.95	0.25	0.94	± 12.0 %
3500	51.3	3.31	6.66	6.66	6.66	0.25	1.20	± 13.1 %
3700	51.0	3.55	6.64	6.64	6.64	0.25	1.25	± 13.1 %
5200	49.0	5.30	4.43	4.43	4.43	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.30	4.30	4.30	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.03	4.03	4.03	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.91	3.91	3.91	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.00	4.00	4.00	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 8 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10%, if liquid compensation formula is applied to measured SAR values. At frequencies above 5 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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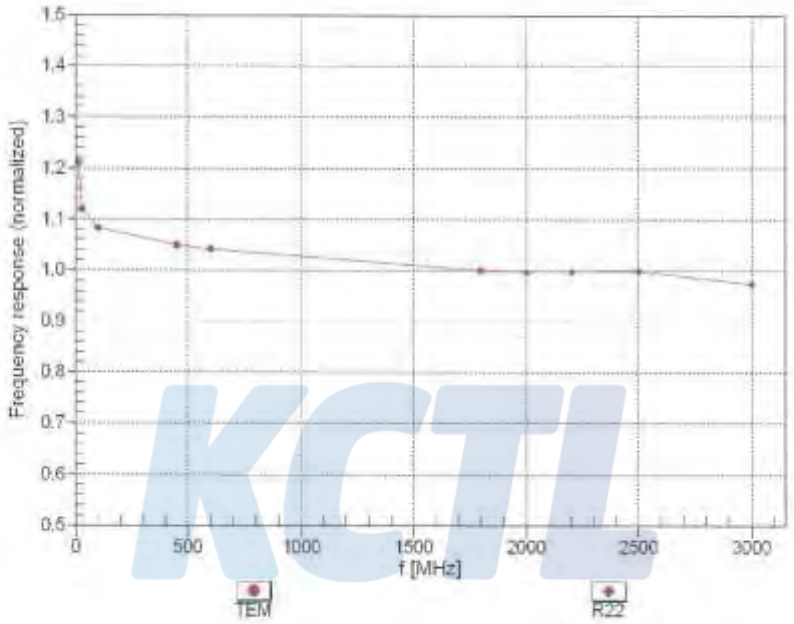
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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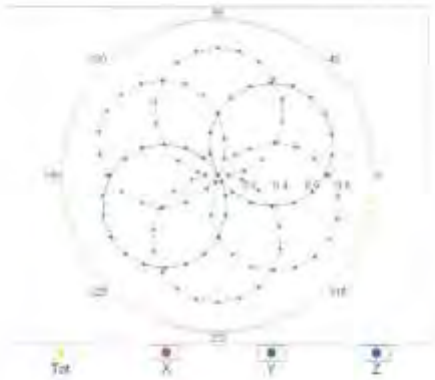
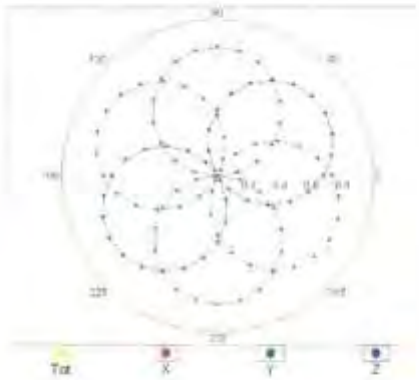
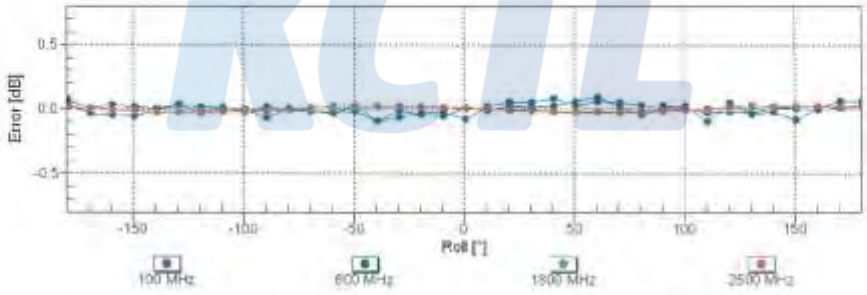
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22





Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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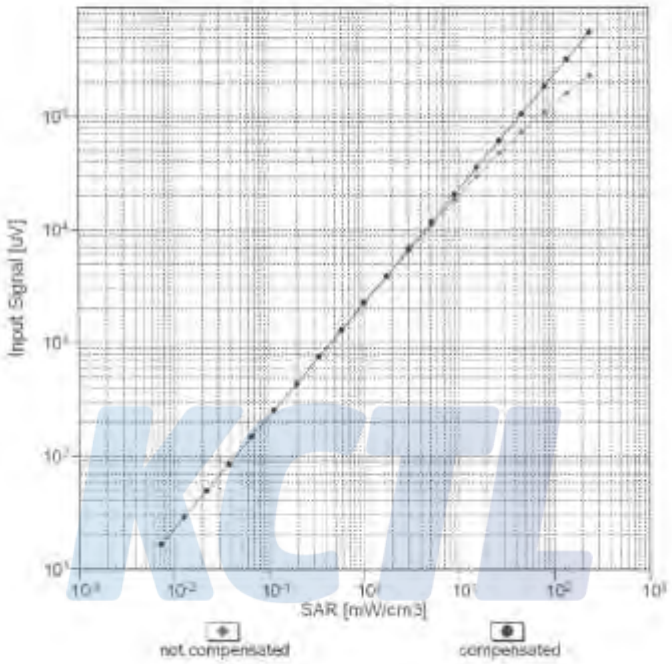
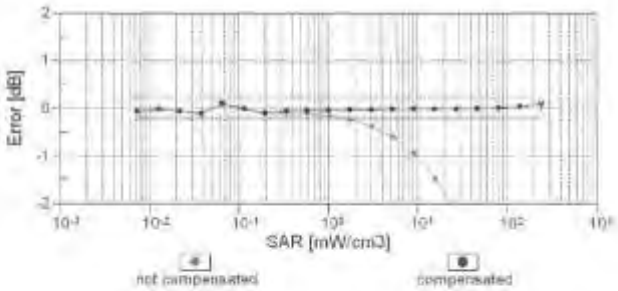
Dynamic Range f(SAR$_{head}$)
(TEM cell , f_{eval}= 1900 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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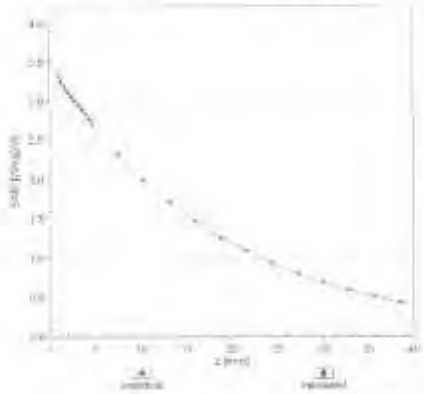
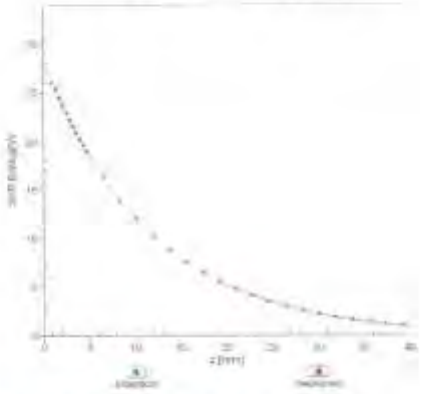
Conversion Factor Assessment

f = 850 MHz,WGLS R9 (H_convF)

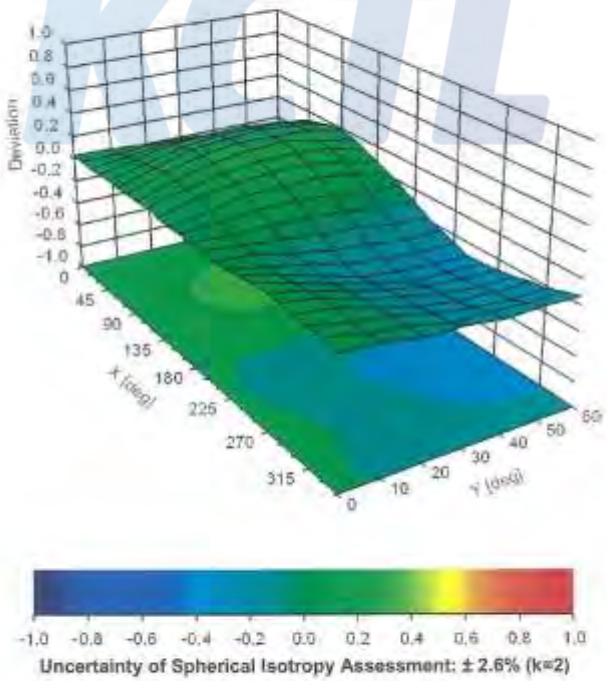


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (φ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Appendix A.3 Probe Calibration certificate (EX3DV4_3697)

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 KCTL (Dymstec) Certificate No: EX3-3697_Mar19

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3697

Calibration procedure(s) QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes

Calibration date: March 28, 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: 55277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
DAE4	SN: 660	19-Dec-18 (No. DAE4-660_Dec18)	Dec-19
Reference Probe ES3DV2	SN: 3013	31-Dec-18 (No. ES3-3013_Dec18)	Dec-19
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: March 28, 2019

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

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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

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3697

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)²)[A]	0.35	0.38	0.34	± 10.1 %
DCP (mV)[B]	102.3	105.3	104.3	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	149.5	±3.3 %	± 4.7 %
		Y	0.0	0.0	1.0		157.6		
		Z	0.0	0.0	1.0		143.0		

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3697

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-25.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3697

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	9.00	9.00	9.00	0.50	0.80	± 12.0 %
850	41.5	0.92	8.73	8.73	8.73	0.40	0.95	± 12.0 %
900	41.5	0.97	8.59	8.59	8.59	0.49	0.80	± 12.0 %
1640	40.2	1.31	7.78	7.78	7.78	0.30	0.80	± 12.0 %
1750	40.1	1.37	7.62	7.62	7.62	0.39	0.80	± 12.0 %
1900	40.0	1.40	7.47	7.47	7.47	0.25	0.80	± 12.0 %
2300	39.5	1.67	7.11	7.11	7.11	0.36	0.86	± 12.0 %
2450	39.2	1.80	6.86	6.86	6.86	0.36	0.86	± 12.0 %
2600	39.0	1.96	6.71	6.71	6.71	0.40	0.87	± 12.0 %
3500	37.9	2.91	6.61	6.61	6.61	0.25	1.20	± 13.1 %
3700	37.7	3.12	6.32	6.32	6.32	0.25	1.20	± 13.1 %
5200	36.0	4.66	4.83	4.83	4.83	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.70	4.70	4.70	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.46	4.46	4.46	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.32	4.32	4.32	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.39	4.39	4.39	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3697

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	8.90	8.90	8.90	0.44	0.81	± 12.0 %
850	55.2	0.99	8.81	8.81	8.81	0.47	0.82	± 12.0 %
900	55.0	1.05	8.79	8.79	8.79	0.52	0.82	± 12.0 %
1640	53.7	1.42	7.69	7.69	7.69	0.44	0.80	± 12.0 %
1750	53.4	1.49	7.44	7.44	7.44	0.43	0.82	± 12.0 %
1900	53.3	1.52	7.21	7.21	7.21	0.40	0.80	± 12.0 %
2300	52.9	1.81	7.05	7.05	7.05	0.35	0.94	± 12.0 %
2450	52.7	1.95	6.96	6.96	6.96	0.32	0.90	± 12.0 %
2600	52.5	2.16	6.78	6.78	6.78	0.33	0.95	± 12.0 %
3500	51.3	3.31	6.28	6.28	6.28	0.23	1.25	± 13.1 %
3700	51.0	3.55	6.10	6.10	6.10	0.27	1.25	± 13.1 %
5200	49.0	5.30	4.16	4.16	4.16	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.00	4.00	4.00	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.78	3.78	3.78	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.73	3.73	3.73	0.50	1.90	± 13.1 %
5800	48.2	6.00	3.85	3.85	3.85	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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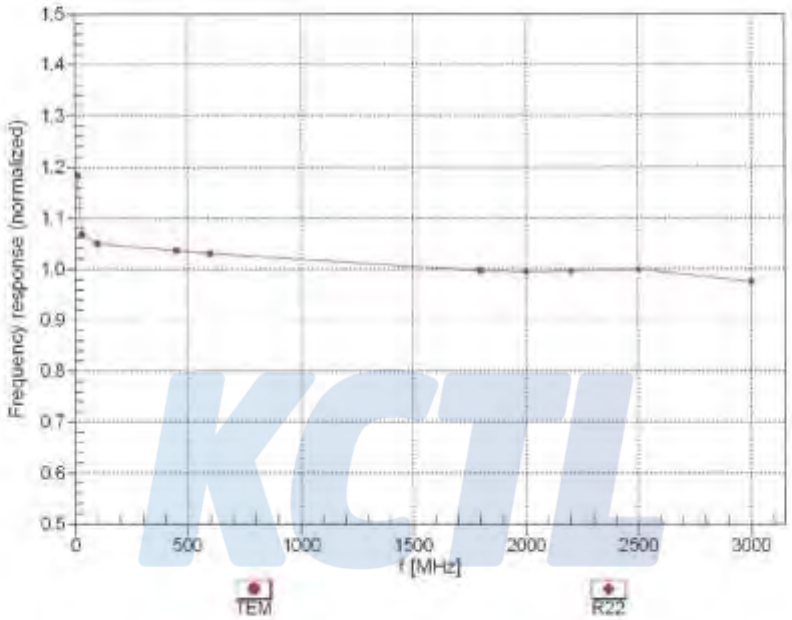
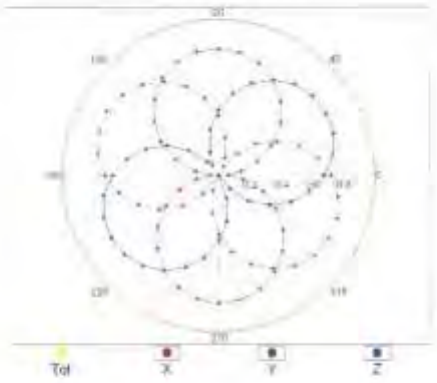
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



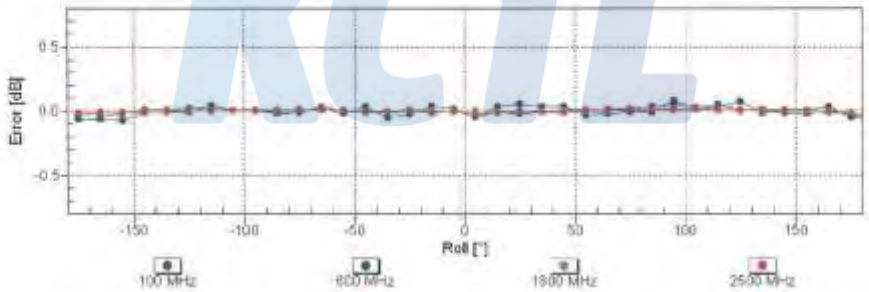
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22



Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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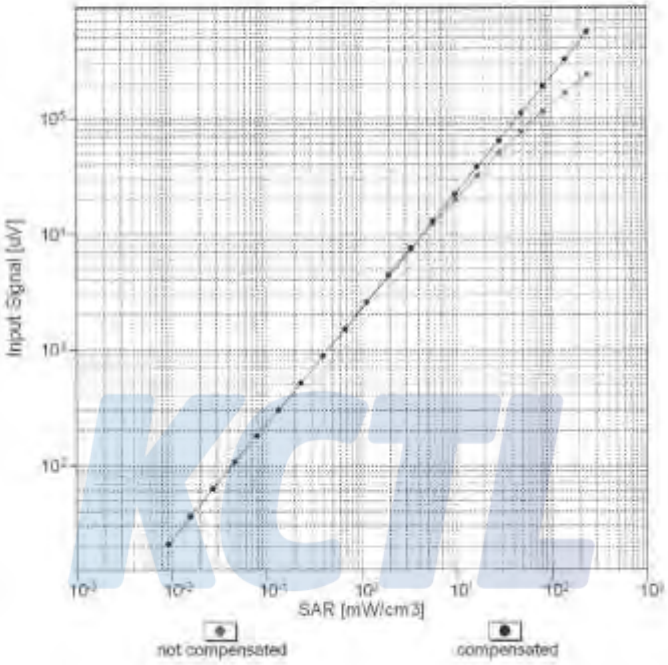
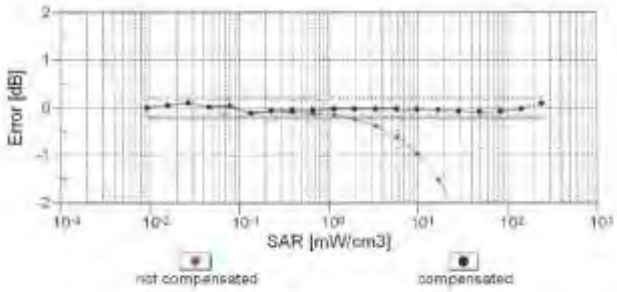
Dynamic Range f(SAR$_{head}$)
(TEM cell , f_{eval}= 1900 MHz)

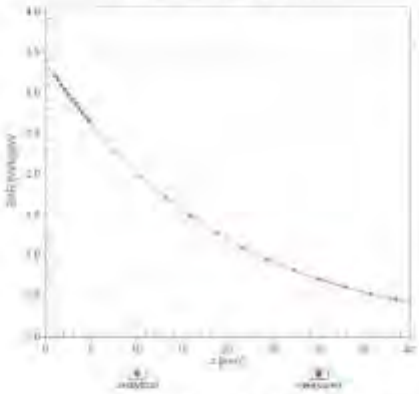




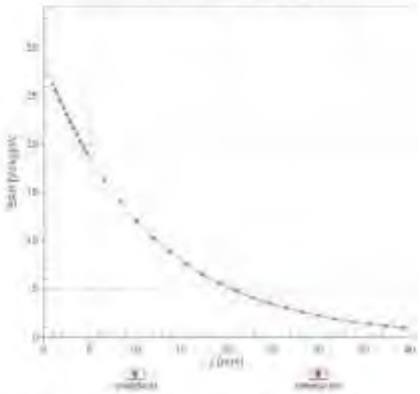
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 850 MHz,WGLS R9 (H_convF)

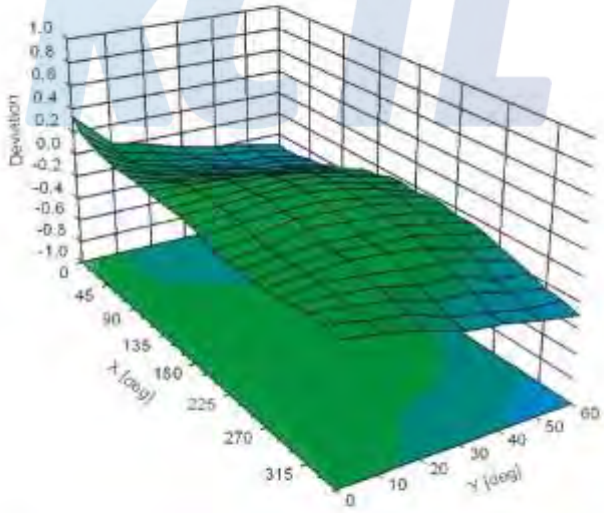


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Appendix A.4 Dipole Calibration certificate (D750V3_1183)

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 KCTL (Dymstec) Certificate No: D750V3-1183_Sep18

CALIBRATION CERTIFICATE

Object	D750V3 - SN:1183
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 03, 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. 217-02672)	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-18)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 4, 2018

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Certificate No: D750V3-1183_Sep18 Page 1 of 8

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**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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Measurement Conditions

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

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.19 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.34 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.50 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.59 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.2 Ω - 2.1 jΩ
Return Loss	-26.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.5 Ω - 5.3 jΩ
Return Loss	-25.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.030 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 07, 2017

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DASY5 Validation Report for Head TSL

Date: 03.09.2018

Test Laboratory: SPEAG, Zurich, Switzerland

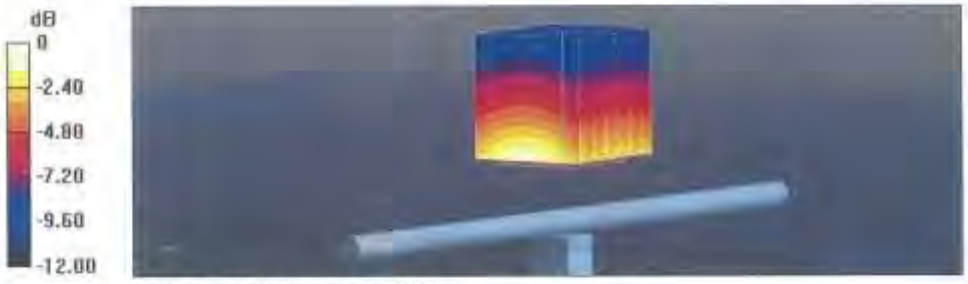
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1183

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.22, 10.22, 10.22) @ 750 MHz; 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 52.10.1(1476); SEMCAD X 14.6.11(7439)

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 = 59.07 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.08 W/kg
SAR(1 g) = 2.06 W/kg; SAR(10 g) = 1.34 W/kg
Maximum value of SAR (measured) = 2.75 W/kg



0 dB = 2.75 W/kg = 4.39 dBW/kg

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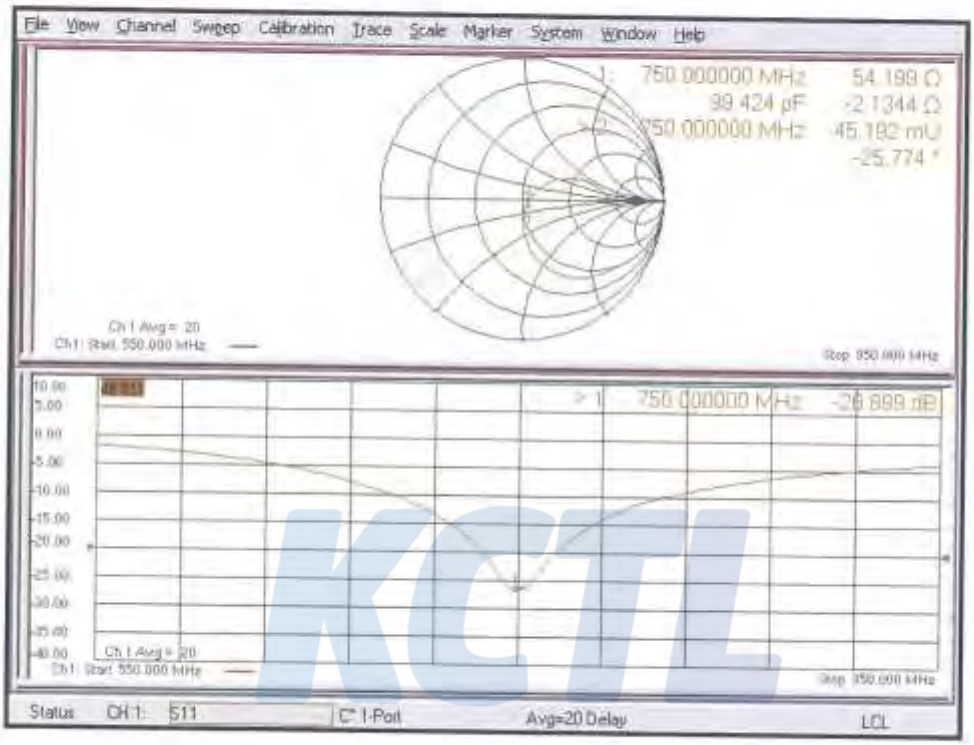
Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1183_Sep18 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 03.09.2018

Test Laboratory: SPEAG, Zurich, Switzerland

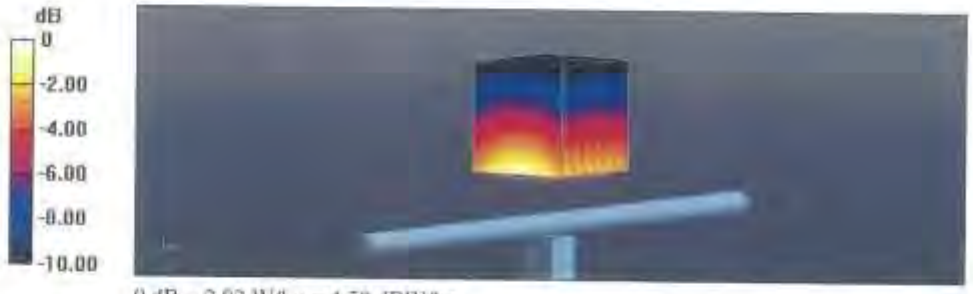
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1183

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.96 S/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.19, 10.19, 10.19) @ 750 MHz; 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 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.83 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.15 W/kg
SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.4 W/kg
Maximum value of SAR (measured) = 2.82 W/kg



0 dB = 2.82 W/kg = 4.50 dBW/kg

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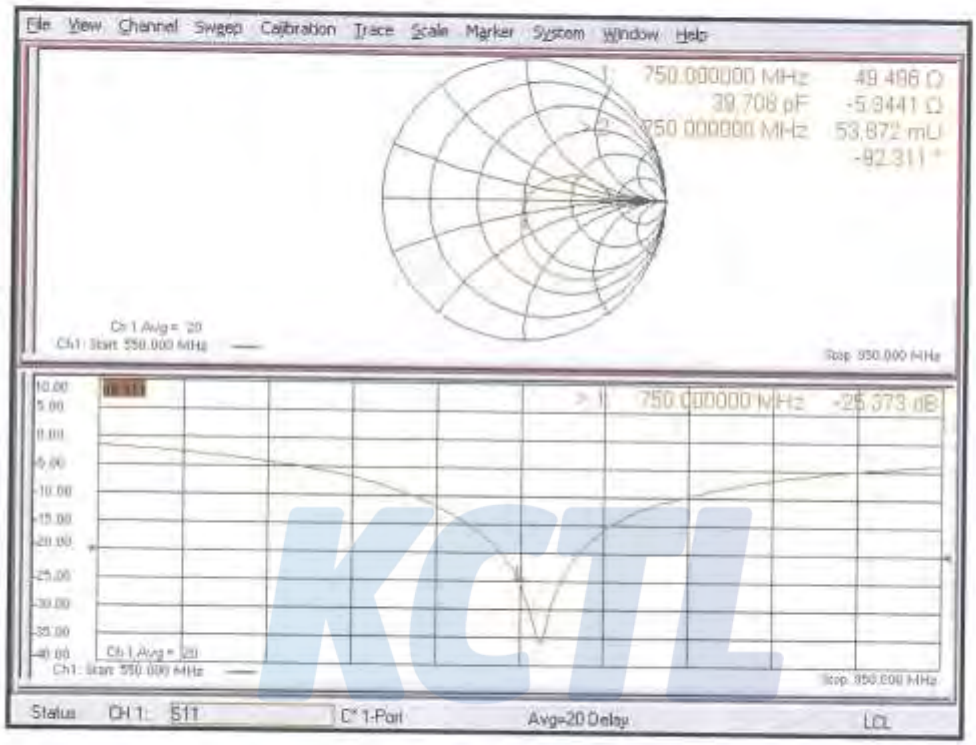
Impedance Measurement Plot for Body TSL



Appendix A.5 Dipole Calibration certificate (D835V2_4d138)

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 SGS Korea (Dymstec)

Certificate No: D835V2-4d138_Apr19

CALIBRATION CERTIFICATE

Object D835V2 - SN:4d138

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

Calibration date April 23, 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	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
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: GB39511478	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 8753ES	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 22, 2019

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

Certificate No: D835V2-4d138_Apr19 Page 1 of 8

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

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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions*: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL*: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss*: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay*: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured*: SAR measured at the stated antenna input power.
- *SAR normalized*: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters*: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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KCTL-TIA002-004/2

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 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.8 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.77 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.32 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.7 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.49 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.22 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω - 2.8 jΩ
Return Loss	- 30.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.4 Ω - 6.1 jΩ
Return Loss	- 22.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.402 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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DASY5 Validation Report for Head TSL

Date: 23.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

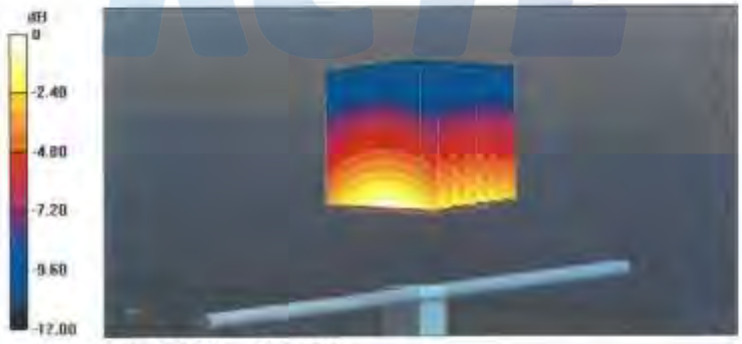
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d138

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz, σ = 0.91 S/m; ε_r = 41.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10, 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 000 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=5mm, dy=5mm, dz=5mm
Reference Value = 63.28 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.77 W/kg
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 3.30 W/kg



0 dB = 3.30 W/kg = 5.19 dBW/kg

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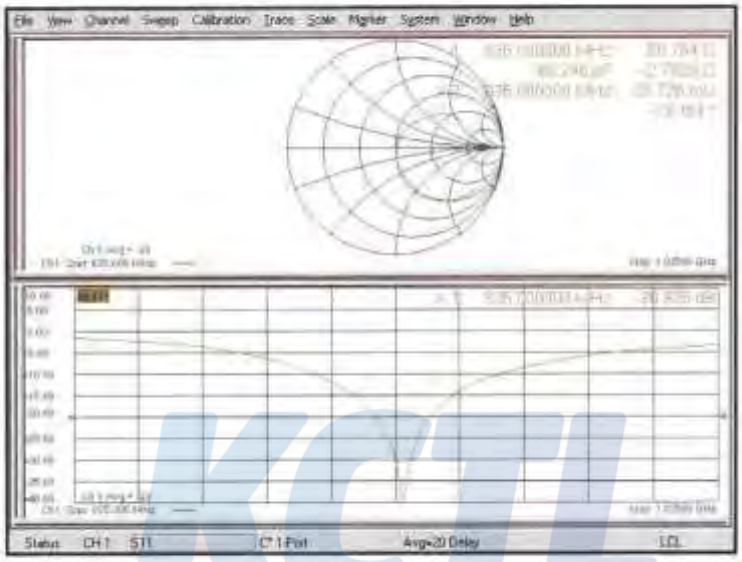
Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

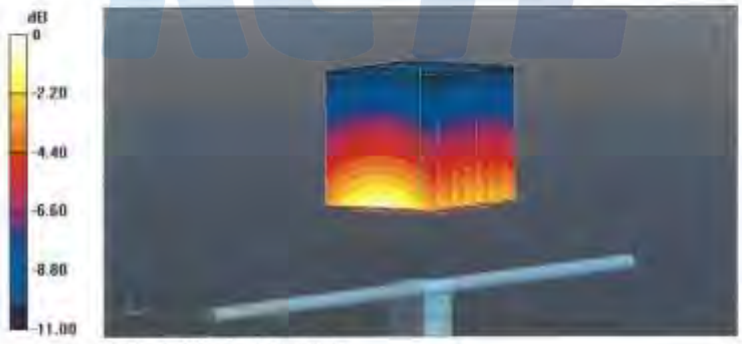
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d138

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 53.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(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 000R 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=5mm, dy=5mm, dz=5mm
Reference Value = 59.45 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.68 W/kg
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.6 W/kg
Maximum value of SAR (measured) = 3.29 W/kg



0 dB = 3.29 W/kg = 5.17 dBW/kg

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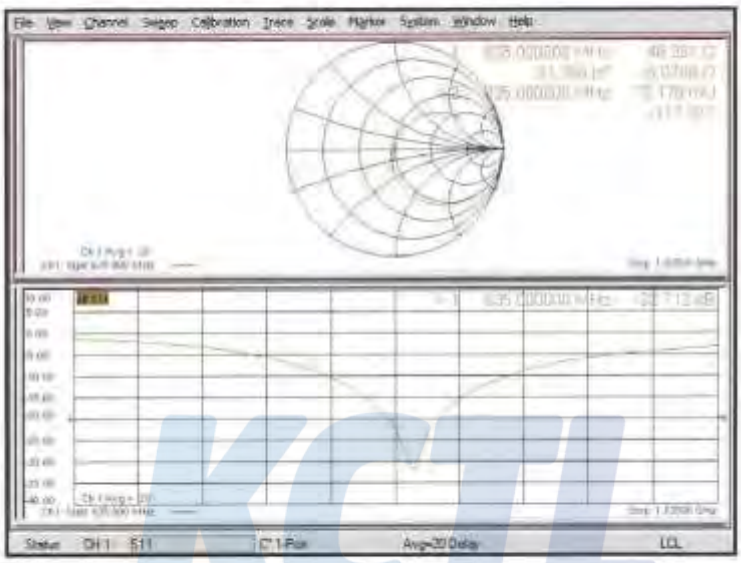
Impedance Measurement Plot for Body TSL



Appendix A.6 Dipole Calibration certificate (D1900V2_5d158)

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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client SGS Korea (Dymstec) Certificate No: D1900V2-5d158_Apr19

CALIBRATION CERTIFICATE

Object D1900V2 - SN:5d158

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

Calibration date April 23, 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	03-Apr-19 (No. 217-02850/02853)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02852)	Apr-20
Power sensor NRP-Z91	SN: 103245	05-Apr-19 (No. 217-02853)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
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: GB39511475	07-Oct-15 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37295783	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	
Approved by	Katja Pokovic	Technical Manager	

Issued: April 23, 2019

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

Certificate No: D1900V2-5d158_Apr19 Page 1 of 8

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

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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Measurement Conditions

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

DASY Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.6 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**39.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.8 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.9 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.87 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 Ω + 5.3 jΩ
Return Loss	-24.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.1 Ω + 8.2 jΩ
Return Loss	-23.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 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 semi-rigid 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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DASY5 Validation Report for Head TSL

Date: 23.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

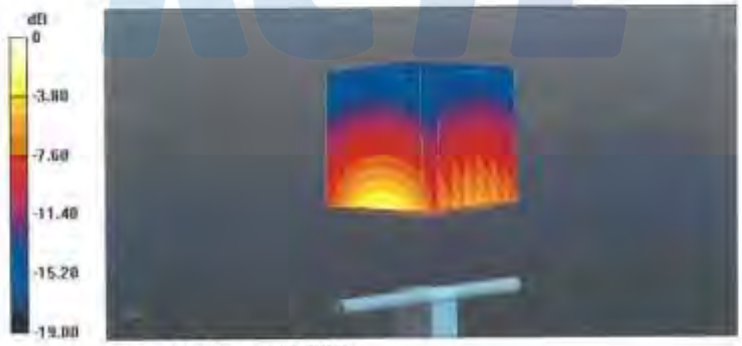
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d158

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 40.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

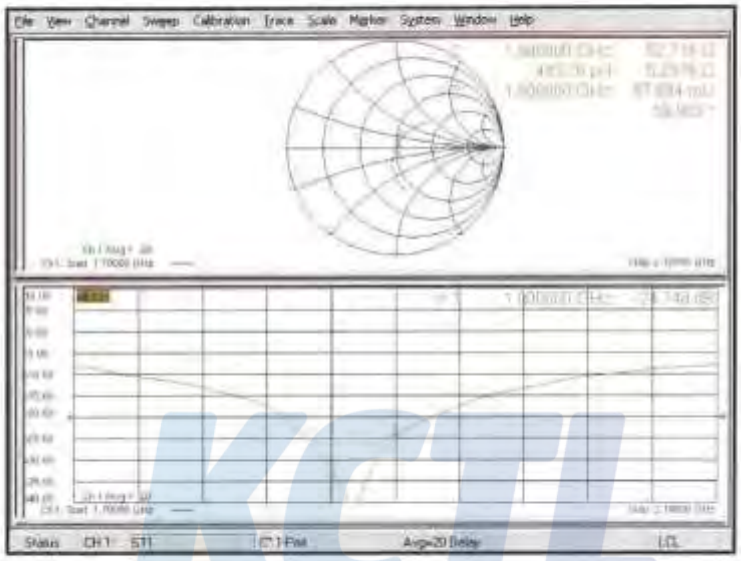
- Probe: EX3DV4 - SN7349; ConvF(8.26, 8.26, 8.26) @ 1900 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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 = 109.5 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 18.1 W/kg
SAR(1 g) = 9.84 W/kg; SAR(10 g) = 5.17 W/kg
Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

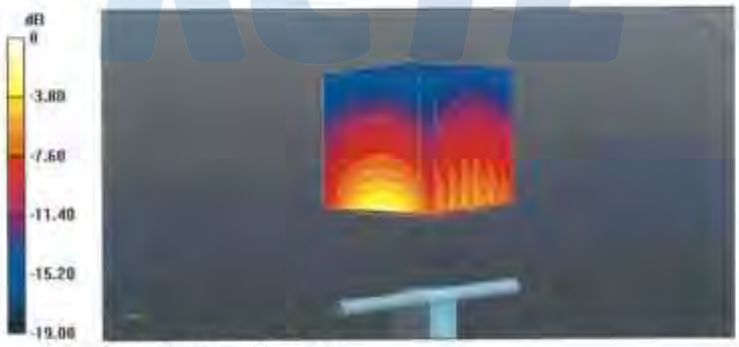
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d158

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.5 S/m; ε_r = 53.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.23, 8.23, 8.23) @ 1900 MHz; Calibrated: 31.12.2018
- 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 = 104.8 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 9.87 W/kg; SAR(10 g) = 5.22 W/kg
Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

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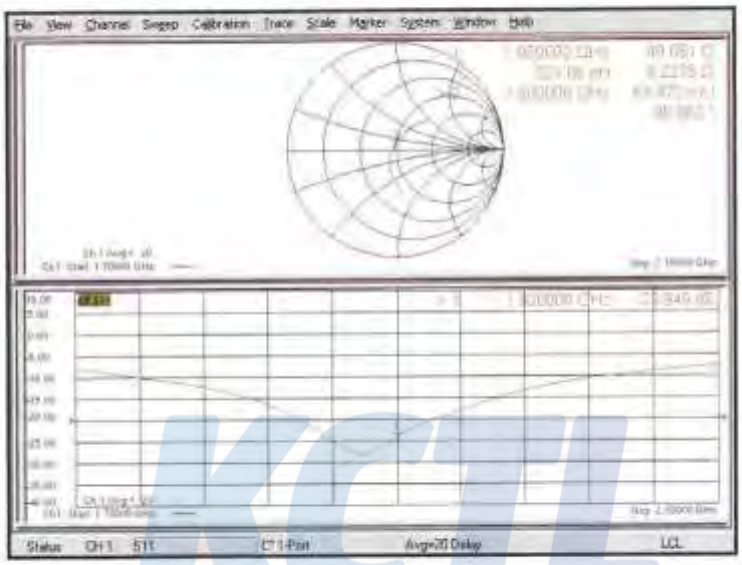
Impedance Measurement Plot for Body TSL



Certificate No: D1900V2-5d158_Apr19 Page 8 of 8

Appendix A.7 Dipole Calibration certificate (D2450V2_892)

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: SGS Korea (Dymstec)

Certificate No: D2450V2-892_Apr19

CALIBRATION CERTIFICATE

Object: D2450V2 - SN:892

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

Calibration date: April 24, 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	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
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: GB39511478	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

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

Issued: April 24, 2019

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

Certificate No: D2450V2-892_Apr19 Page 1 of 8

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

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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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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	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.6 ± 6 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.6 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.1 ± 6 %	2.09 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.6 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.98 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.6 W/kg ± 16.5 % (k=2)**

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KCTL-TIA002-004/2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.8 Ω + 3.8 jΩ
Return Loss	-25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.7 Ω + 6.2 jΩ
Return Loss	-24.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 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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DASY5 Validation Report for Head TSL

Date: 24.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

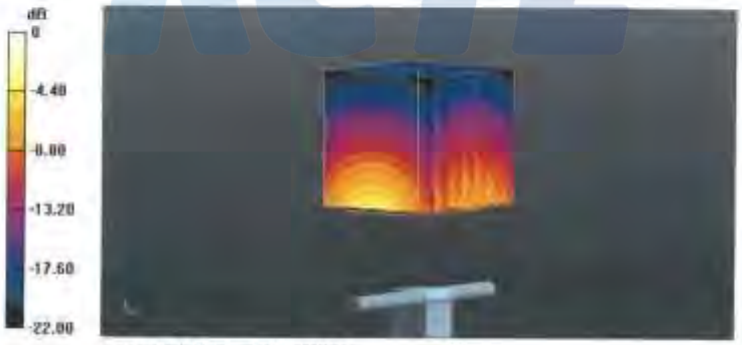
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:892

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.87 S/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 31.12.2018
- 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 = 116.0 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.4 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.24 W/kg
Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg = 13.38 dBW/kg

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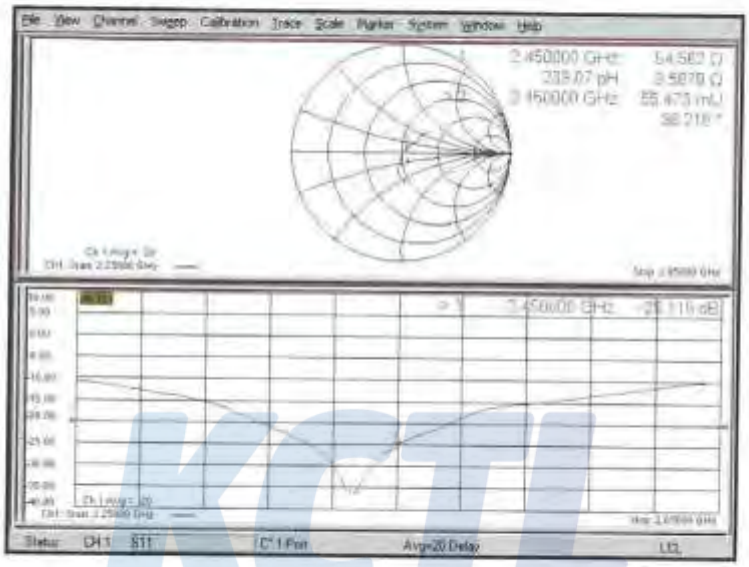
Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

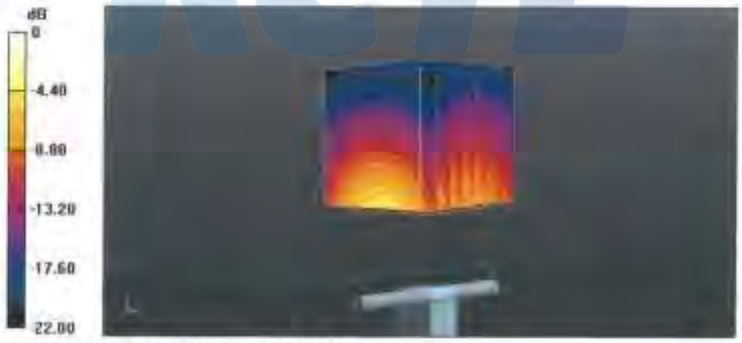
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:892

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.09, 8.09, 8.09) @ 2450 MHz; Calibrated: 31.12.2018
- 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: 1003
- 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 = 108.1 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 25.5 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.98 W/kg
Maximum value of SAR (measured) = 21.1 W/kg



0 dB = 21.1 W/kg = 13.24 dBW/kg

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Impedance Measurement Plot for Body TSL

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Appendix A.8 Dipole Calibration certificate (D2600V2_1038)

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

S C S Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
Servizio svizzero di taratura
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: SGS Korea (Dymstec)

Certificate No: D2600V2-1038_May19

CALIBRATION CERTIFICATE

Object: D2600V2 - SN:1038

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

Calibration date: May 28, 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 calibration 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	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7406	25-Mar-19 (No. EX3-7406_Mar19)	Mar-20
DAE4	SN: 901	30-Apr-19 (No. DAE4-901_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39511475	30-Oct-14 (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

	Name	Function	Signature
Calibrated by:	Manu Seid	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 29, 2019

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Certificate No: D2600V2-1038_May19 Page 1 of 8

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

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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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KCTL-TIA002-004/2

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	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.2 ± 6 %	2.01 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**58.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**26.0 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.3 ± 6 %	2.21 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**56.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**25.1 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.3 Ω - 2.4 jΩ
Return Loss	- 26.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.5 Ω - 1.1 jΩ
Return Loss	- 24.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 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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DASY5 Validation Report for Head TSL

Date: 28.05.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1038

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.01 S/m; ε_r = 37.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7405; ConvF(7.54, 7.54, 7.54) @ 2600 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- 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 = 119.8 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 14.9 W/kg; SAR(10 g) = 6.58 W/kg
Maximum value of SAR (measured) = 25.5 W/kg

0 dB = 25.5 W/kg = 14.07 dBW/kg

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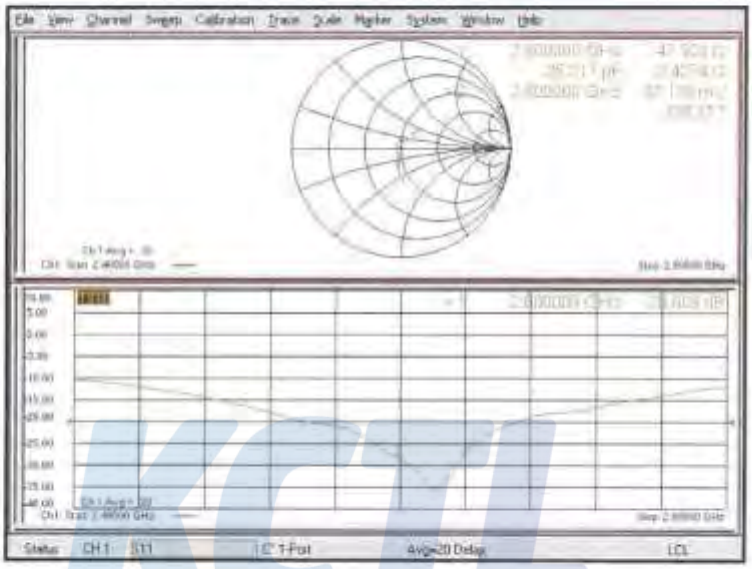
Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 28.05.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1038

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.21 S/m; ε_r = 50.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

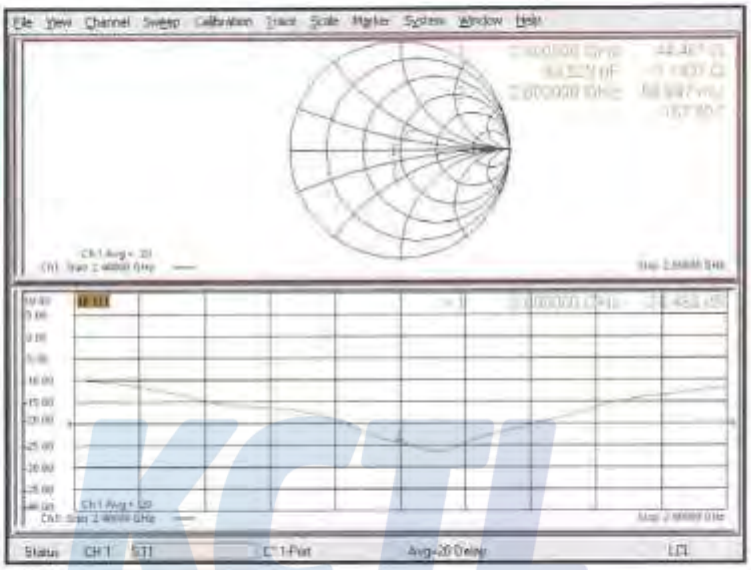
DASY52 Configuration:

- Probe: EX3DV4 - SN7405; ConvF(7.54, 7.54, 7.54) @ 2600 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- 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 = 109.9 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 29.8 W/kg
SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.36 W/kg
Maximum value of SAR (measured) = 24.2 W/kg

0 dB = 24.2 W/kg = 13.84 dBW/kg

Impedance Measurement Plot for Body TSL



Appendix A.9 Dipole Calibration certificate (D5GHzV2 1134)

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

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

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Accreditation No.: **SCS 0108**

Client **KCTL (Dymstec)** Certificate No: **D5GHzV2-1134_May19**

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN:1134

Calibration procedure(s): QA CAL-22.v4
Calibration Procedure for SAR Validation Sources between 3-6 GHz

Calibration date: May 23, 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	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 3503	25-Mar-19 (No. EX3-3503_Mar19)	Mar-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (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

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

Issued: May 27, 2019

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Certificate No: D5GHzV2-1134_May19 Page 1 of 15

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

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

a) 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%.

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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 V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.47 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	—	—

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

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Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	4.57 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	—	—

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.0 ± 6 %	4.77 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	—	—

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**85.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.0 W/kg ± 19.5 % (k=2)**

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Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	—	—

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**85.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	5.07 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	—	—

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.5 W/kg ± 19.5 % (k=2)**

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Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.45 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.0 ± 6 %	5.58 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 19.5 % (k=2)**

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Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.85 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	5.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.02 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.1 W/kg ± 19.5 % (k=2)**

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Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.1 ± 6 %	6.27 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.4 W/kg ± 19.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	48.0 Ω - 9.5 jΩ
Return Loss	- 20.2 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	46.8 Ω - 6.5 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.1 Ω - 4.1 jΩ
Return Loss	- 27.8 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.1 Ω - 2.8 jΩ
Return Loss	- 26.5 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.2 Ω - 4.0 jΩ
Return Loss	- 24.1 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.7 Ω - 7.9 jΩ
Return Loss	- 22.0 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	49.5 Ω - 5.3 jΩ
Return Loss	- 25.5 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	52.1 Ω - 2.6 jΩ
Return Loss	- 29.8 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	55.6 Ω - 1.7 jΩ
Return Loss	- 25.1 dB

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Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.5 Ω - 3.2 jΩ
Return Loss	- 24.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 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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DASY5 Validation Report for Head TSL

Date: 22.05.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1134

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.47 S/m; ε_r = 35.4; ρ = 1000 kg/m^3,
Medium parameters used: f = 5300 MHz; σ = 4.57 S/m; ε_r = 35.3; ρ = 1000 kg/m^3,
Medium parameters used: f = 5500 MHz; σ = 4.77 S/m; ε_r = 35; ρ = 1000 kg/m^3,
Medium parameters used: f = 5600 MHz; σ = 4.87 S/m; ε_r = 34.9; ρ = 1000 kg/m^3,
Medium parameters used: f = 5800 MHz; σ = 5.07 S/m; ε_r = 34.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.64, 5.64, 5.64) @ 5200 MHz, ConvF(5.39, 5.39, 5.39) @ 5300 MHz, ConvF(5.1, 5.1, 5.1) @ 5500 MHz, ConvF(4.95, 4.95, 4.95) @ 5600 MHz, ConvF(4.96, 4.96, 4.96) @ 5800 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- 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=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.08 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 28.5 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 18.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 77.28 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 8.27 W/kg; SAR(10 g) = 2.36 W/kg
Maximum value of SAR (measured) = 19.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.91 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 8.55 W/kg; SAR(10 g) = 2.42 W/kg
Maximum value of SAR (measured) = 20.1 W/kg

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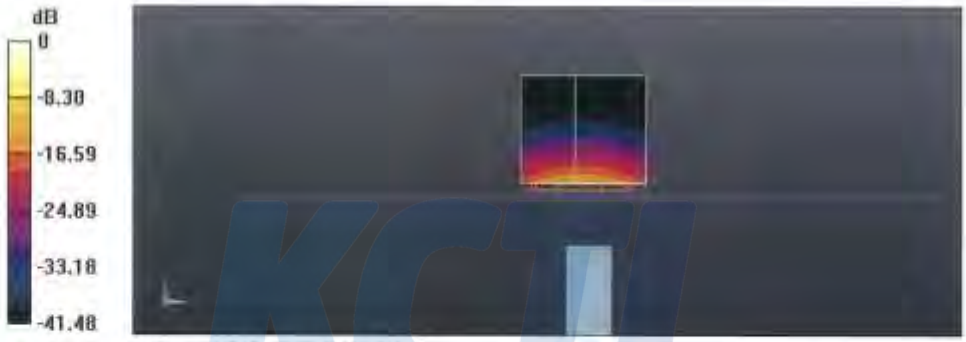
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 77.68 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 8.57 W/kg; SAR(10 g) = 2.44 W/kg
Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.08 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 7.97 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

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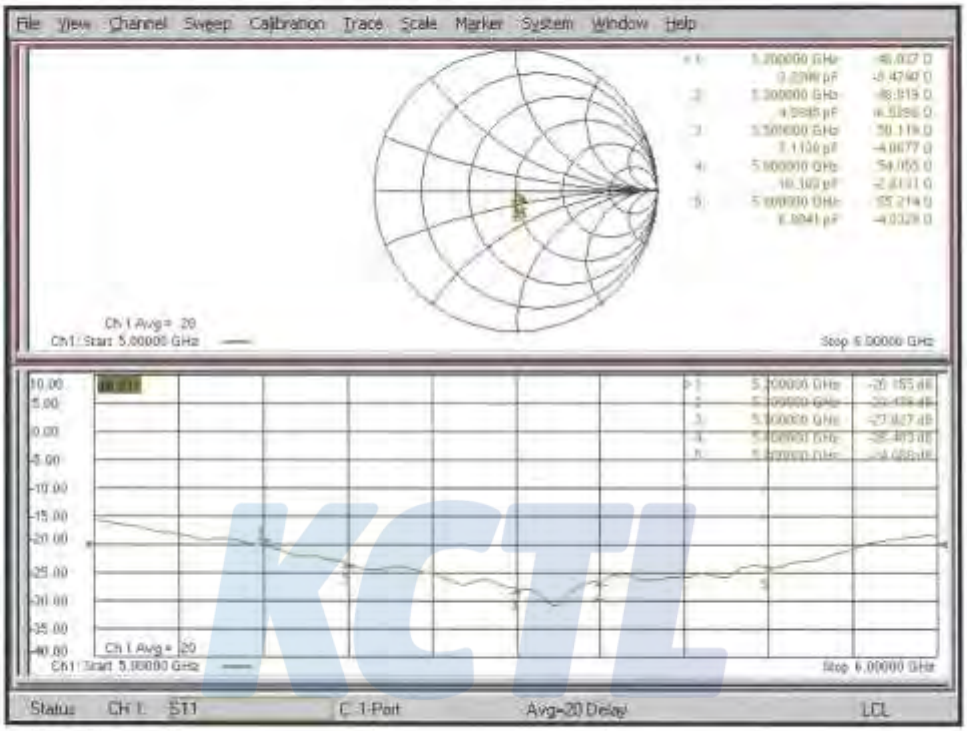
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 23.05.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1134

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.45 S/m; ε_r = 47.2; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5300 MHz; σ = 5.58 S/m; ε_r = 47; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 5.85 S/m; ε_r = 46.6; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 5.99 S/m; ε_r = 46.5; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 6.27 S/m; ε_r = 46.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.14, 5.14, 5.14) @ 5200 MHz, ConvF(5.25, 5.25, 5.25) @ 5300 MHz, ConvF(4.79, 4.79, 4.79) @ 5500 MHz, ConvF(4.74, 4.74, 4.74) @ 5600 MHz, ConvF(4.62, 4.62, 4.62) @ 5800 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- 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=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 69.01 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 28.7 W/kg
SAR(1 g) = 7.55 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 17.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.76 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 30.0 W/kg
SAR(1 g) = 7.55 W/kg; SAR(10 g) = 2.1 W/kg
Maximum value of SAR (measured) = 17.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.53 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.18 W/kg
Maximum value of SAR (measured) = 19.1 W/kg

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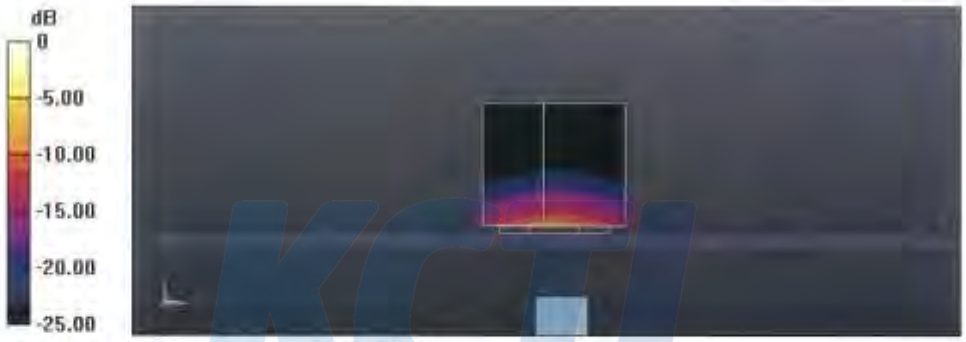
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.29 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 34.8 W/kg
SAR(1 g) = 8.02 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 19.7 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.93 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 32.8 W/kg
SAR(1 g) = 7.44 W/kg; SAR(10 g) = 2.06 W/kg
Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 18.3 W/kg = 12.62 dBW/kg

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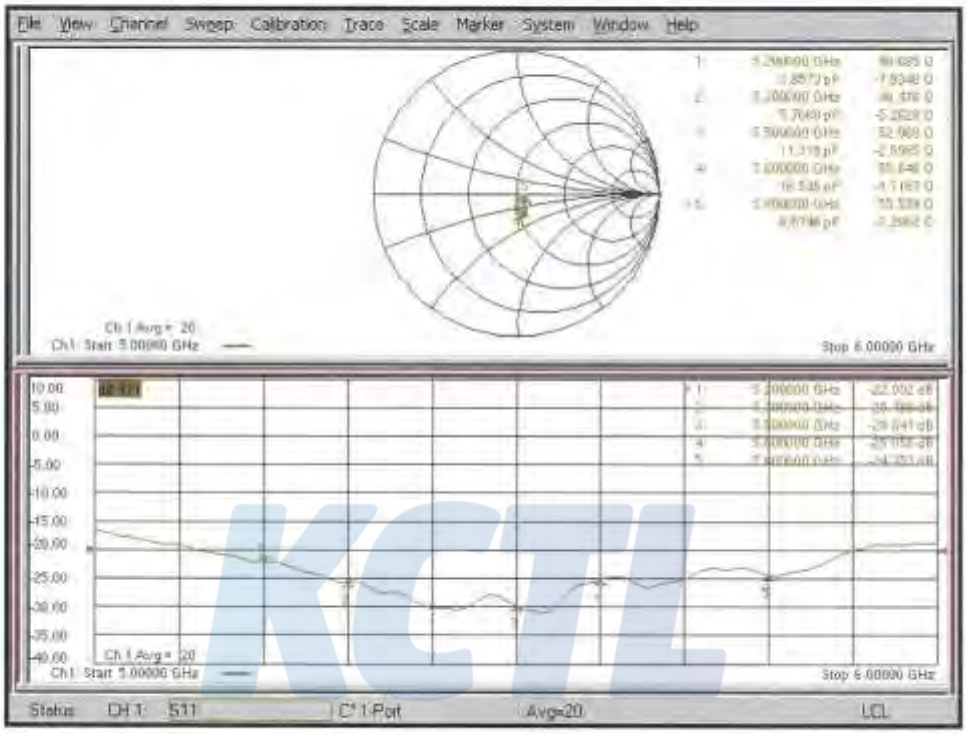
Impedance Measurement Plot for Body TSL



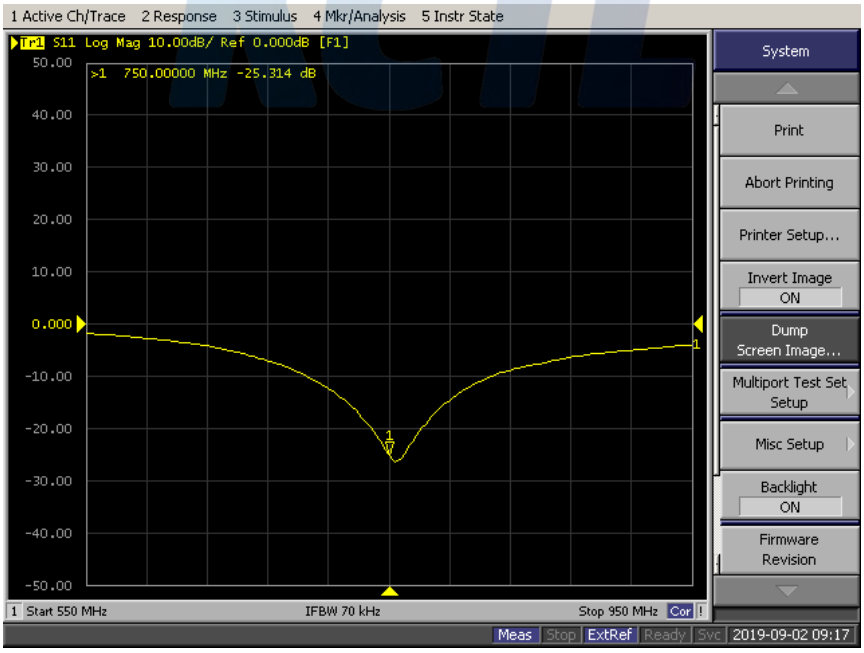
Appendix A.10 Justification for Extended SAR Dipole Calibrations

Instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements

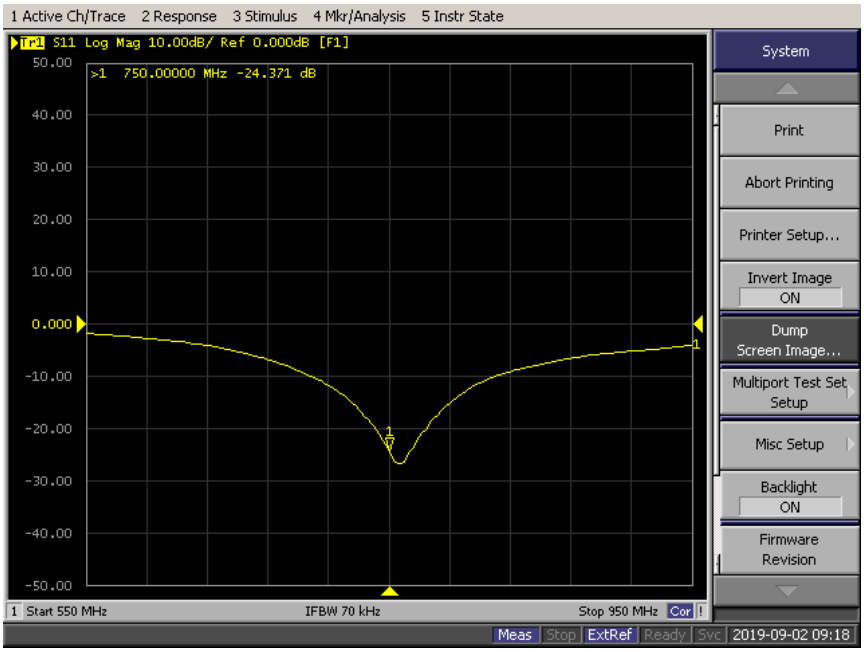
KDB 865664 D01v01r04 requirements
a) Return loss: < - 20 dB, within 20 % of previous measurement
b) Impedance: within 5 Ω from previous measurement.

750 MHz

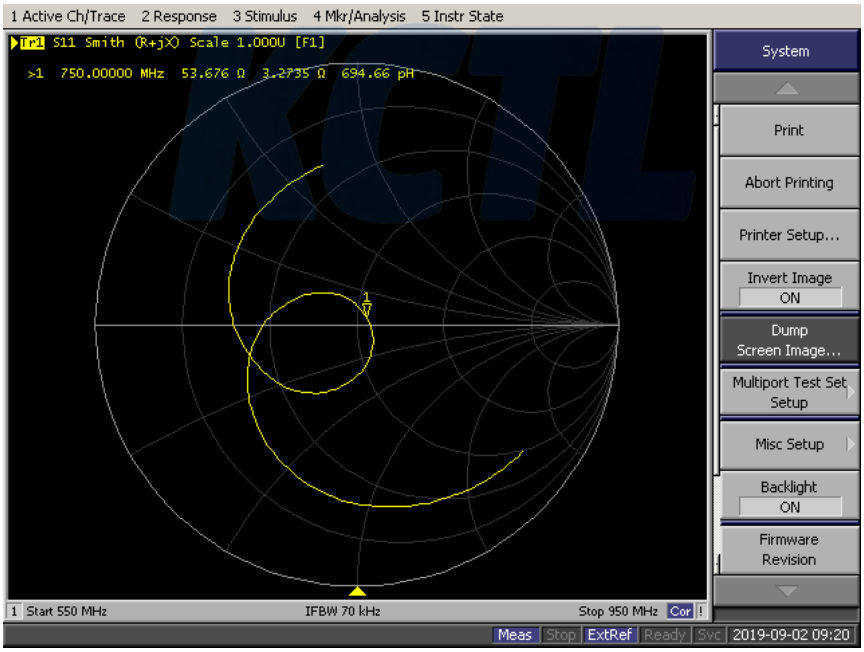
Dipole Antenna	Head/Body	Date of Measurement	Return Loss (dB)	Δ %	Impedance (Ω)	Δ Ω
D750V3 SN 1138	Head	2018.09.03	-26.9	5.95	54.2	- 0.5
		2019.09.02	-25.3		53.7	
D750V3 SN 1138	Body	2018.09.03	-25.4	3.94	49.5	- 0.9
		2019.09.02	-24.4		48.6	



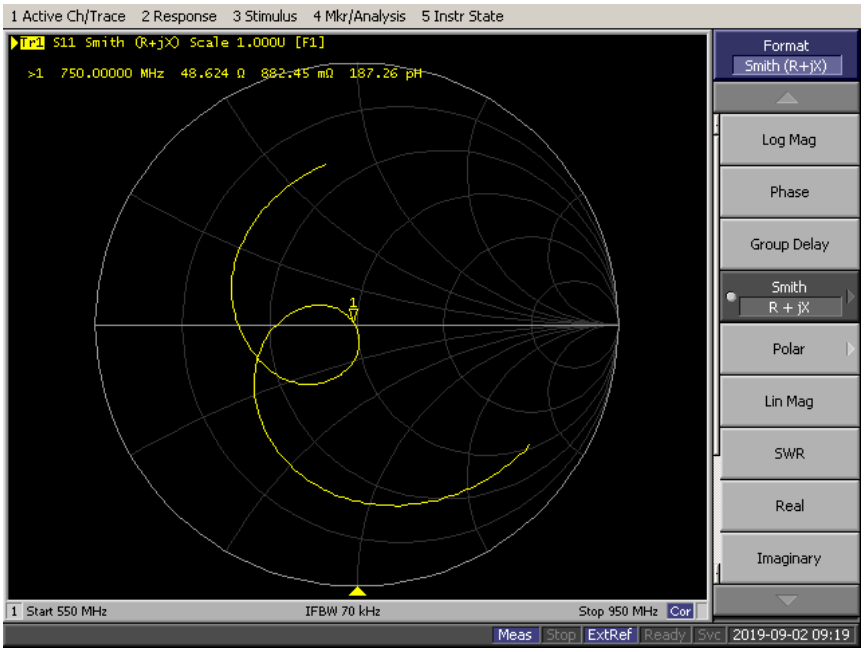
< Figure 1. Measurement result of Head Return Loss>



< Figure 2. Measurement result of Body Return Loss>



< Figure 3. Measurement result of Head Impedance>



< Figure 4. Measurement result of Body Impedance>

c) Extrapolated peak SAR: within 15% of that reported in the calibration data

750 MHz

Dipole Antenna	Head/Body	Date of Measurement	Extrapolated peak SAR (W/kg)	Δ %
D750V3 SN 1138	Head	2018.09.03	3.08	- 1.30
		2019.09.06	3.04	
D750V3 SN 1138	Body	2018.09.03	3.15	- 3.49
		2019.09.06	3.04	

Appendix B. SAR Tissue Specification

The brain mixtures consist of a viscous gel using hydrox-ethl cellullose(HEC) gelling agent and saline solution. Preservation with a bacteriacide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue.

Frequency (㎒)	**750 ~ 835**		**1 750**		**1 900**		**2 450**		**5 200 ~ 5 800**	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Ingredient	**% by weight**									
Water	40.29	51.97	53.00	68.00	55.00	70.50	72.00	73.00	65.52	80.00
Salt (NaCl)	1.38	0.93	0.40	0.20	0.35	0.30	0.10	0.10	0	0
Sugar	57.90	47.00	0	0	0	0	0	0	0	0
HEC	0.24	0	0	0	0	0	0	0	0	0
Bactericide	0.19	0.10	0	0	0	0	0	0	0	0
Triton X-100	0	0	0	0	0	0	20.00	0	17.24	0
DGBE	0	0	46.60	31.80	44.65	29.20	0	26.90	0	0
Diethylene glycol hexyl ether	0	0	0	0	0	0	7.90	0	17.24	0
Polysorbate (Tween) 80	0	0	0	0	0	0	0	0	0	20.00
Tissue parameter target by C. Gabriel and G. Harts grove.										

Salt: 99 % Pure Sodium Chloride
Sucrose: 98 % Pure Sucrose
Water: De-ionized, 16 M resistivity
HEC: Hydroxyethyl Cellulose
DGBE: 99 % Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy) ethanol]
Triton X-100(ultra-pure): Polyethylene glycol mono[4-(1,1,3,3-tetramethybutyl)phenyl] ether

Appendix C. SAR System Validation

Per FCC KDB 865664 D02v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue-equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D01v04r04 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

SAR System	Date	Probe		Probe Calibration Point	Dielectric Parameters		CW Validation			Modulation Validation		
		S/N	Type		(ρ)	(σ)	Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	PAR
B	2019/04/17	3697	Head	750	41.55	0.87	PASS	PASS	PASS	N/A	N/A	N/A
B	2019/07/22	3879	Head	835	41.05	0.91	PASS	PASS	PASS	GMSK	PASS	N/A
A	2019/02/22	3928	Head	1900	40.51	1.42	PASS	PASS	PASS	GMSK	PASS	N/A
B	2019/07/24	3879	Head	2450	39.18	1.83	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
B	2019/07/24	3879	Head	2600	39.58	2.03	PASS	PASS	PASS	TDD	PASS	N/A
A	2019/02/25	3928	Head	5300	36.14	4.81	PASS	PASS	PASS	OFDM	N/A	PASS
A	2019/02/25	3928	Head	5600	35.41.	5.25	PASS	PASS	PASS	OFDM	N/A	PASS
A	2019/02/25	3928	Head	5800	34.76	5.41	PASS	PASS	PASS	OFDM	N/A	PASS
B	2019/04/18	3697	Body	750	55.44	0.94	PASS	PASS	PASS	N/A	N/A	N/A
B	2019/04/19	3697	Body	850	54.84	0.98	PASS	PASS	PASS	GMSK	PASS	N/A
A	2019/02/22	3928	Body	1900	52.42	1.49	PASS	PASS	PASS	GMSK	PASS	N/A
B	2019/04/23	3697	Body	2450	52.15	1.99	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
B	2019/04/23	3697	Body	2600	53.42	2.15.	PASS	PASS	PASS	TDD	PASS	N/A
A	2019/02/26	3928	Body	5300	49.20	5.38	PASS	PASS	PASS	OFDM	N/A	PASS
A	2019/02/26	3928	Body	5600	48.90	5.77	PASS	PASS	PASS	OFDM	N/A	PASS
A	2019/02/26	3928	Body	5800	48.16	5.95	PASS	PASS	PASS	OFDM	N/A	PASS

Note: While the probes have been calibrated for both a CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01r04 for scenarios when CW probe calibrations are used with other signal types. SAR systems sere validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (> 5 dB), such as OFDM according to KDB 864664.

Appendix D. Downlink LTE CA RF Conducted Power

D.1 LTE Downlink Carrier Aggregation

The tables below show the supported frequency bands of the device for DL Inter-band and DL Intra-band combinations.

Power measurements were performed on the channel with the highest maximum output power from Tune-up Procedure.

In applying the power measurement procedures of KDB 941225 D05A for DL CA to qualify for UL SAR test exclusion, power measurement is required only for the subset in each row with the largest combination of frequency bands and CCs

Index	2CC	Restriction	Completely Covered by Measurement Superset
Intra-Band Contiguous			
2CC #1	CA_41C	N/A	NO

In applying the power measurement procedures of KDB 941225 D05A for DL CA to qualify for UL SAR test exclusion, power measurement is required only for the CA configuration with the largest aggregated DL CA BW in each frequency band, independently for contiguous and non-contiguous CA; however, if the same frequency band is used for both contiguous and non-contiguous CA, power measurement was performed using the configuration with the largest aggregated BW and maximum output power among contiguous and non-contiguous CA.

D.2 Downlink Carrier Aggregation RF Conducted Powers

Combination	PCC									SCC				Power	
	Band	BW [MHz]	(UL) Ch.	(UL) Freq. [MHz]	Mod.	(UL) RB Size	(UL) RB Offset	(DL) Ch.	(DL) Freq. [MHz]	Band	BW [MHz]	(DL) Ch.	(DL) Freq. [MHz]	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA_41C (0)(1)(2)(3)	LTE B41	20	40185	2 549.5	QPSK	1	0	40185	2 549.5	LTE B41	20	40383	2 569.3	24.32	24.36