SAR TEST REPORT

The following samples were submitted and identified on behalf of the client as:

Equipment Under Test of Host	Tablet Computer
Marketing Name of Host	SW3-013
Brand Name of Host	acer
Model No. of Host	P0KCC
Equipment Under Test of Module	802.11abgn+BT4.0 module
Brand Name of Module	FOXCONN
Model No. of Module	T77H462
Company Name	Acer Incorporated
Company Address	8F., No. 88, Sec. 1, Xintai 5th Rd., Xizhi, New Taipei City 22181, Taiwan (R.O.C)
Standards	IEEE /ANSI C95.1 , C95.3, IEEE 1528, KDB447498D01, KDB616217D04, KDB248227D01, KDB865664D01, KDB865664D02
Module FCC ID	MCLT77H462
Date of Receipt	Jan. 15, 2015
Date of Test(s)	Feb. 25, 2015 ~ Mar. 04, 2015
Date of Issue	Mar. 11, 2015

In the configuration tested, the EUT complied with the standards specified above.

Remarks:

This report details the results of the testing carried out on one sample, 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.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS Taiwan Electronic & Communication Laboratory or testing done by SGS Taiwan Electronic & Communication Laboratory in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Electronic & Communication Laboratory in writing.

Signed on behalf of SGS

Engineer	**Sr. Engineer**
Matt Kuo	**John Yeh**
Date: Mar. 11, 2015	**Date: Mar. 11, 2015**

Version

Report Number	Revision	Date	Memo
E5/2015/10003	00	2015/03/11	Initial creation of test report.

This test report contains a reference to the previous version test report that it replaces.

Contents

1. General Information

1.1 Testing Laboratory

SGS Taiwan Ltd. Electronics & Communication Laboratory	
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan	
Tel	+886-2-2299-3279
Fax	+886-2-2298-0488
Internet	http://www.tw.sgs.com/

1.2 Details of Applicant

Company Name	Acer Incorporated
Company Address	8F., No. 88, Sec. 1, Xintai 5th Rd., Xizhi, New Taipei City 22181, Taiwan (R.O.C)

1.3 Description of EUT

General Information of Tablet

<table>
<tr><td>Equipment Under Test of Host</td><td colspan="4">Tablet Computer</td></tr>
<tr><td>Marketing Name</td><td colspan="4">SW3-013</td></tr>
<tr><td>Brand Name of Host</td><td colspan="4">acer</td></tr>
<tr><td>Model No. of Host</td><td colspan="4">P0KCC</td></tr>
<tr><td>Module FCC ID</td><td colspan="4">MCLT77H462</td></tr>
<tr><td>Antenna Designation
(Maximum Gain)</td><td colspan="4">1. Antenna Main: 2.4GHz: -0.04dBi / 5GHz: 1.74dBi
2. Antenna Aux: 2.4GHz: 1.16dBi / 5GHz: 1.4dBi</td></tr>
<tr><td>Mode of Operation</td><td colspan="4">☒WLAN802.11 a/b/g/n(20M/40M) band ☒Bluetooth</td></tr>
<tr><td rowspan="2">Duty Cycle</td><td>WLAN802.11 a/b/g/n(20M/40M)</td><td colspan="3">1</td></tr>
<tr><td>Bluetooth</td><td colspan="3">1</td></tr>
<tr><td rowspan="10">TX Frequency Range (MHz)</td><td>WLAN802.11 b/g/n(20M)</td><td>2412</td><td>—</td><td>2462</td></tr>
<tr><td>WLAN802.11 a/n(20M) 5.2G</td><td>5180</td><td>—</td><td>5240</td></tr>
<tr><td>WLAN802.11 n(40M) 5.2G</td><td>5190</td><td>—</td><td>5230</td></tr>
<tr><td>WLAN802.11 a/n(20M) 5.3G</td><td>5260</td><td>—</td><td>5320</td></tr>
<tr><td>WLAN802.11 n(40M) 5.3G</td><td>5270</td><td>—</td><td>5310</td></tr>
<tr><td>WLAN802.11 a/n(20M) 5.6G</td><td>5500</td><td>—</td><td>5700</td></tr>
<tr><td>WLAN802.11 n(40M) 5.6G</td><td>5510</td><td>—</td><td>5670</td></tr>
<tr><td>WLAN802.11 a/n(20M) 5.8G</td><td>5745</td><td>—</td><td>5825</td></tr>
<tr><td>WLAN802.11 n(40M) 5.8G</td><td>5755</td><td>—</td><td>5795</td></tr>
<tr><td>Bluetooth</td><td>2402</td><td>—</td><td>2480</td></tr>
</table>

Channel Number (ARFCN)	WLAN802.11 b/g/n(20M)	1	—	11
	WLAN802.11 a/n(20M) 5.2G	36	—	48
	WLAN802.11 n(40M) 5.2G	38	—	46
	WLAN802.11 a/n(20M) 5.3G	52	—	64
	WLAN802.11 n(40M) 5.3G	54	—	62
	WLAN802.11 a/n(20M) 5.6G	100	—	140
	WLAN802.11 n(40M) 5.6G	102	—	134
	WLAN802.11 a/n(20M) 5.8G	149	—	165
	WLAN802.11 n(40M) 5.8G	151	—	159
	Bluetooth	0	—	78

Max. SAR (1 g) (Unit: W/Kg)					
Antenna	Band	Measured	Reported	Channel	Position
Main	WLAN802.11b	0.567	0.594	6	Lap-held
	WLAN802.11a 5.2G	0.758	0.769	44	Lap-held
	WLAN802.11a 5.3G	1.13	1.143	60	Top side
	WLAN802.11n (20M) 5.3G	1.28	1.283	64	Top side
	WLAN802.11a 5.6G	0.785	0.816	136	Lap-held
	WLAN802.11a 5.8G	1	1.033	149	Lap-held
Aux	WLAN802.11b	0.627	0.634	11	Lap-held
	WLAN802.11a 5.2G	0.714	0.744	48	Top side
	WLAN802.11n (20M) 5.2G	0.827	0.839	36	Top side
	WLAN802.11a 5.3G	0.695	0.705	60	Top side
	WLAN802.11a 5.6G	0.579	0.612	100	Top side
	WLAN802.11a 5.8G	0.729	0.751	161	Lap-held

#. WLAN802.11 a/b/g/n(20M/40M) conducted power table:

Antenna / Band	SISO		MIMO
	Chain 0	Chain 1	Chain0+1
WLAN802.11b	V	V	—
WLAN802.11g	V	V	—
WLAN802.11n(20M)	V	V	V
WLAN802.11a	V	V	—
WLAN802.11n(20M) 5G	V	V	V
WLAN802.11n(40M) 5G	V	V	V

Main Antenna (CH0)

802.11 b		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			1
1	2412	15	14.72
6	2437	15	14.80
11	2462	15	14.75

802.11 g		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			6
1	2412	10.5	10.22
6	2437	10.5	10.45
11	2462	10.5	10.04

802.11 n(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			6.5
1	2412	9.5	9.30
6	2437	9.5	9.14
11	2462	9.5	9.29

Main Antenna (CH0)

802.11 a 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		6
36	5180	13.5	13.31
40	5200	13.5	13.41
44	5220	13.5	13.44
48	5240	13.5	13.41
52	5260	13.5	13.33
56	5280	13.5	13.40
60	5300	13.5	13.45
64	5320	13.5	13.44
100	5500	12	11.78
104	5520	12	11.76
108	5540	12	11.75
112	5560	12	11.77
116	5580	12	11.72
132	5660	12	11.91
136	5680	12	11.83
140	5700	12	11.74
149	5745	13.5	13.36
153	5765	13.5	13.22
157	5785	13.5	13.40
161	5805	13.5	13.39
165	5825	13.5	12.86

Main Antenna (CH0)

802.11 n(20M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			6.5
36	5180	13.5	13.49
40	5200	13.5	13.43
44	5220	13.5	13.34
48	5240	13.5	13.35
52	5260	13.5	13.40
56	5280	13.5	13.48
60	5300	13.5	13.45
64	5320	13.5	13.49
100	5500	11.5	11.36
104	5520	11.5	11.38
108	5540	11.5	11.32
112	5560	11.5	11.47
116	5580	11.5	11.48
132	5660	11.5	11.34
136	5680	11.5	11.22
140	5700	11.5	11.30
149	5745	11.5	11.49
153	5765	11.5	11.41
157	5785	11.5	11.35
161	5805	11.5	11.27
165	5825	11.5	11.31

Main Antenna (CH0)

802.11 n(40M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			13.5
38	5190	11	10.99
46	5230	11	10.86
54	5270	11	10.98
62	5310	11	10.9
102	5510	8.5	8.21
110	5550	8.5	8.15
134	5670	8.5	8.35
151	5755	12	11.96
159	5795	12	11.82

#. Per FCC KDB443999, transmission on channels which overlap the 5600-5650 MHz is prohibited as a client.

Aux Antenna (CH1)

802.11 b		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		1
1	2412	15	14.85
6	2437	15	14.82
11	2462	15	14.95

802.11 g		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		6
1	2412	10.5	10.45
6	2437	10.5	10.49
11	2462	10.5	10.48

802.11 n(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		6.5
1	2412	9.5	9.41
6	2437	9.5	9.38
11	2462	9.5	9.40

Aux Antenna (CH1)

802.11 a		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
5.2/5.3/5.6/5.8G			Data Rate (Mbps)
CH	Frequency (MHz)		6
36	5180	13.5	13.25
40	5200	13.5	13.21
44	5220	13.5	13.28
48	5240	13.5	13.32
52	5260	13.5	13.31
56	5280	13.5	13.34
60	5300	13.5	13.44
64	5320	13.5	13.25
100	5500	12	11.76
104	5520	12	11.75
108	5540	12	11.71
112	5560	12	11.72
116	5580	12	11.66
132	5660	12	11.84
136	5680	12	11.68
140	5700	12	11.63
149	5745	13.5	13.25
153	5765	13.5	13.21
157	5785	13.5	13.36
161	5805	13.5	13.37
165	5825	13.5	12.81

Aux Antenna (CH1)

802.11 n(20M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
CH	Frequency (MHz)		Data Rate (Mbps) 6.5
36	5180	13.5	13.44
40	5200	13.5	13.28
44	5220	13.5	13.12
48	5240	13.5	13.24
52	5260	13.5	13.25
56	5280	13.5	13.32
60	5300	13.5	13.33
64	5320	13.5	13.30
100	5500	11.5	11.18
104	5520	11.5	11.12
108	5540	11.5	11.23
112	5560	11.5	11.25
116	5580	11.5	11.18
132	5660	11.5	11.31
136	5680	11.5	11.21
140	5700	11.5	11.08
149	5745	11.5	11.44
153	5765	11.5	11.30
157	5785	11.5	11.26
161	5805	11.5	11.05
165	5825	11.5	11.22

Aux Antenna (CH1)

802.11 n(40M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
5.2/5.3/5.6/5.8G			
CH	Frequency (MHz)		Data Rate (Mbps)
			13.5
38	5190	11	10.91
46	5230	11	10.81
54	5270	11	10.95
62	5310	11	10.82
102	5510	8.5	8.2
110	5550	8.5	8.37
134	5670	8.5	8.12
151	5755	12	11.91
159	5795	12	11.79

#. Per FCC KDB443999, transmission on channels which overlap the 5600-5650 MHz is prohibited as a client.

MIMO (CH0+CH1)

802.11 n(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			13
1	2412	12.5	12.21
6	2437	12.5	12.20
11	2462	12.5	12.34

MIMO (CH0+CH1)

802.11 n(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
5.2/5.3/5.6/5.8G			Data Rate (Mbps)
CH	Frequency (MHz)		13
36	5180	16.5	16.42
40	5200	16.5	16.49
44	5220	16.5	16.46
48	5240	16.5	16.35
52	5260	16.5	16.43
56	5280	16.5	16.47
60	5300	16.5	16.49
64	5320	16.5	16.27
100	5500	14.5	14.26
104	5520	14.5	14.23
108	5540	14.5	14.45
112	5560	14.5	14.40
116	5580	14.5	14.35
132	5660	14.5	14.40
136	5680	14.5	14.29
140	5700	14.5	14.47
149	5745	14.5	14.28
153	5765	14.5	14.49
157	5785	14.5	14.31
161	5805	14.5	14.44
165	5825	14.5	14.14

MIMO (CH0+CH1)

802.11 n(40M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
5.2/5.3/5.6/5.8G			
CH	Frequency (MHz)		Data Rate (Mbps)
			27
38	5190	14	13.95
46	5230	14	13.78
54	5270	14	13.92
62	5310	14	13.89
102	5510	11.5	11.45
110	5550	11.5	11.40
134	5670	11.5	11.30
151	5755	14	13.73
159	5795	14	13.92

#. For 802.11 n(20M)/n(40M) 2.4/5G, the maximum tune-up power of CH0 and CH1 is minus 3dBm from the maximum tune-up power of CH0+CH1.

#. For 802.11 n(40M) 5.8G, the maximum tune-up power of CH0 and CH1 is minus 2dBm from the maximum tune-up power of CH0+CH1.

#. Per FCC KDB443999, transmission on channels which overlap the 5600-5650 MHz is prohibited as a client.

#. Bluetooth conducted power table:

Frequency (MHz)	Data Rate	Peak	
		dBm	mW
2402	1	4.59	2.877
2441	1	4.86	3.062
2480	1	4.48	2.805
2402	2	3.69	2.339
2441	2	3.96	2.489
2480	2	3.26	2.118
2402	3	4.32	2.704
2441	3	4.44	2.780
2480	3	3.65	2.317

Frequency (MHz)	Avg. (dBm)
	BT4.0
2402	5.49
2441	6.03
2480	5.81

1.4 Test Environment

Ambient Temperature: 22±2° C
Tissue Simulating Liquid: 22±2° C

1.5 Operation Description

Use chipset specific software to control the EUT, and makes it transmit in maximum power. Measurements are performed respectively on the lowest, middle and highest channels of the operating band(s). The EUT is set to maximum power level during all tests, and at the beginning of each test the battery is fully charged.

The EUT was tested in the following configurations:

Main antenna:

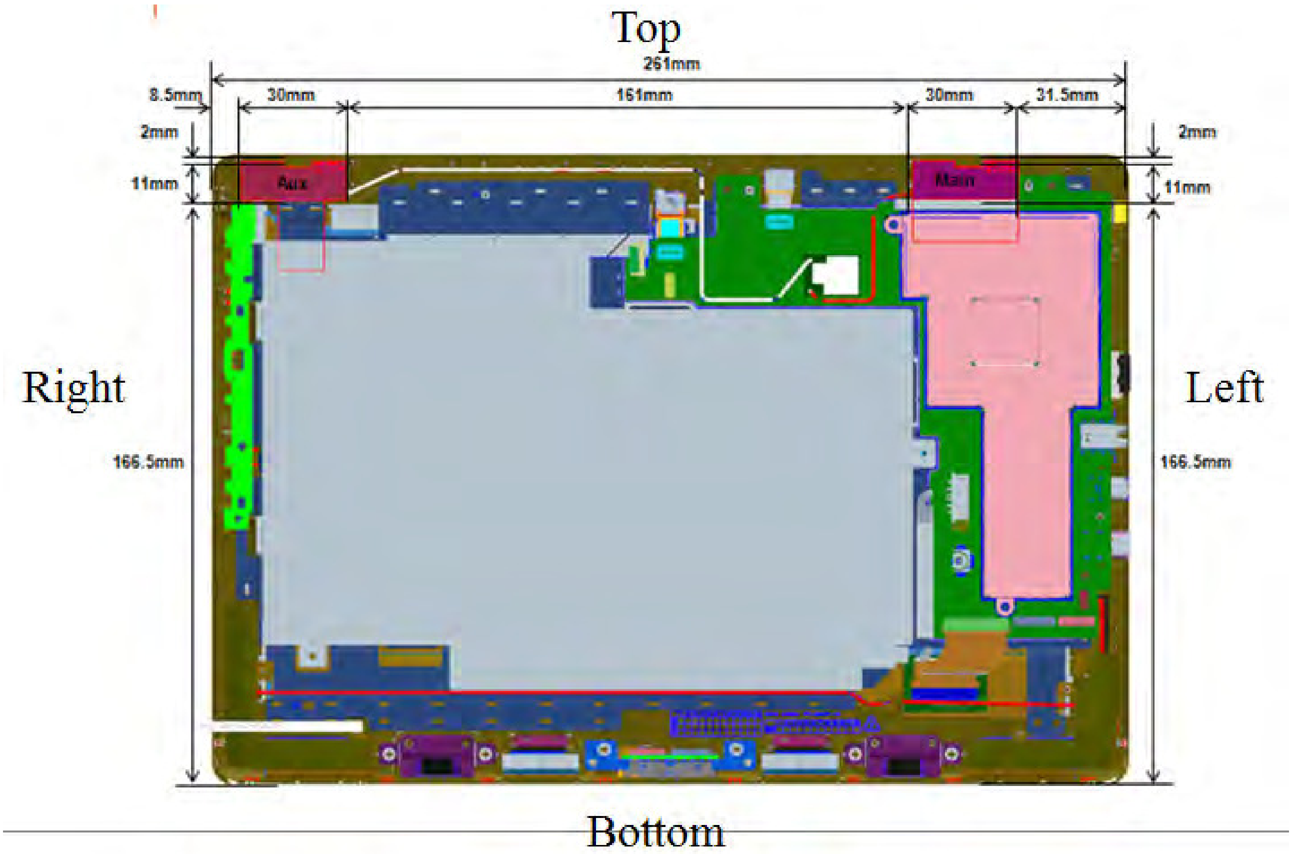
Configurations: Lap-held/ Top side with test distance 0mm.

Right/left/bottom sides were not required to be tested based on the SAR test exclusion thresholds in FCC KDB447498D01.

Aux antenna:

Configurations: Lap-held/ Top / right side with test distance 0mm.

Left/bottom sides were not required to be tested based on the SAR test exclusion thresholds in FCC KDB447498D01.



Back view of the tablet

Note:

1. SAR testing for 802.11g/n is not required since its maximum power is less than 1/4 dB higher than 802.11b.
2. SAR testing for 802.11n 5GHz is not required when its maximum power is less than 1/4 dB higher than 802.11a.
3. Testing at higher data rates is not required since the maximum power is less than 1/4 dB higher than those measured at the lowest data rate.
4. For 2.4GHz 802.11n(20M), the maximum output power of each antenna during simultaneous transmission is the same with that used in standalone transmission, and the maximum output power of 802.11b is larger than that of 802.11n, so we use the sum of 1-g SAR provision in KDB447498D01 to exclude the MIMO SAR measurement in 802.11n(20M).

5. For 5GHz 802.11n(20M), the maximum output power of each antenna during simultaneous transmission is the same with that used in standalone transmission, and the maximum output power of 802.11a is larger than(or equal to) that of 802.11n(20M), so we use the sum of 1-g SAR provision in KDB447498D01 to exclude the MIMO SAR measurement in 802.11n(20M).
6. For 5.2/5.3/5.6GHz 802.11n(40M), the maximum output power of each antenna during simultaneous transmission is the same with that used in standalone transmission, and the maximum output power of 802.11a is larger than that of 802.11n(40M), so we use the sum of 1-g SAR provision in KDB447498D01 to exclude the MIMO SAR measurement in 802.11n(40M).
7. For 5.8GHz 802.11n(40M), the maximum output power of each antenna during simultaneous transmission is smaller than that used in standalone transmission, and the maximum output power of 802.11a is larger than that of 802.11n(40M), so we use the sum of 1-g SAR provision in KDB447498D01 to exclude the MIMO SAR measurement in 5.8GHz 802.11n(40M).
8. For Bluetooth operational modes the transmission is at Aux output. Bluetooth may transmit simultaneously with WLAN Main antenna.
9. According to KDB447498 D01,

(1) The SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances≤ 50 mm are determined by:

$$\frac{\text{Max. tune up power(mW)}}{\text{Min. test separation distance(mm)}} \times \sqrt{f(\text{GHz})} \leq 3$$

When the minimum test separation distance is < 5mm, 5mm is applied to determine SAR test exclusion.

(2) For test separation distances > 50 mm, and the frequency at 100 MHz to 1500MHz, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B of KDB447498 D01.

[(Threshold at 50mm in step1) + (test separation distance-50mm)x($\frac{f(\text{MHz})}{150}$)](mW),

(3) For test separation distances > 50 mm, and the frequency at > 1500MHz to 6GHz, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B of KDB447498 D01.

[(Threshold at 50mm in step1) + (test separation distance-50mm)x10](mW),

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Top side			Right side			Left side		
			Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?
WLAN 2.4G_Main	15	31.623	less than 5	9.924	YES	199.5	1495.99	NO	31.5	1.575	NO
WLAN 5G_Main	13.5	22.387	less than 5	10.806	YES	199.5	1496.081	NO	31.5	1.715	NO

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Lap-held			Bottom side		
			Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?
WLAN 2.4G_Main	15	31.623	less than 5	9.924	YES	166.5	1165.922	NO
WLAN 5G_Main	13.5	22.387	less than 5	10.806	YES	166.5	1166.081	NO

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Top side			Right side			Left side		
			Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	over 200mm	Require SAR testing?
WLAN 2.4G_Aux	15	31.623	less than 5	9.924	YES	8.5	5.837	YES	222.5	YES	NO
WLAN 5G_Aux	13.5	22.387	less than 5	10.806	YES	8.5	6.357	YES	222.5	YES	NO

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Lap-held			Bottom side		
			Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?
WLAN 2.4G_Aux	15	31.623	less than 5	9.924	YES	166.5	1165.922	NO
WLAN 5G_Aux	13.5	22.387	less than 5	10.806	YES	166.5	1166.081	NO

Mode	Maximum power(dBm)	Maximum power(mW)	Top side			Right side			Left side		
			Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	over 200mm	Require SAR testing?
BT	6.03	4.009	less than 5	1.263	NO	8.5	0.743	NO	222.5	YES	NO

Mode	Maximum power(dBm)	Maximum power(mW)	Back side			Bottom side		
			Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?
BT	6.03	4.009	less than 5	1.263	NO	166.5	1165.126	NO

10. Although the standalone SAR test of BT is not required, BT and WLAN Main may transmit simultaneously, so the standalone SAR test of BT is estimated.
11. According to KDB447498 D01, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is ≤ 0.8 W/kg, when the transmission band is ≤ 100 MHz.

12. According to KDB447498 D01, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is ≤ 0.6 W/kg, when the transmission band is between 100 MHz and 200MHz.
13. According to KDB447498 D01, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is ≤ 0.4 W/kg, when the transmission band is ≥ 200MHz.
14. According to KDB865664 D01, SAR measurement variability must be assessed for each frequency band. When the original highest measured SAR is ≥ 0.8 W/kg, repeated that measurement once. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit)

1.6 The SAR Measurement System

A block diagram of the SAR measurement System is given in Fig. a. This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY 5 professional system). The model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= $\sigma (|Ei|^2)/\rho$ where σ and ρ are the conductivity and mass density of the tissue-simulant.

The DASY 5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage intissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

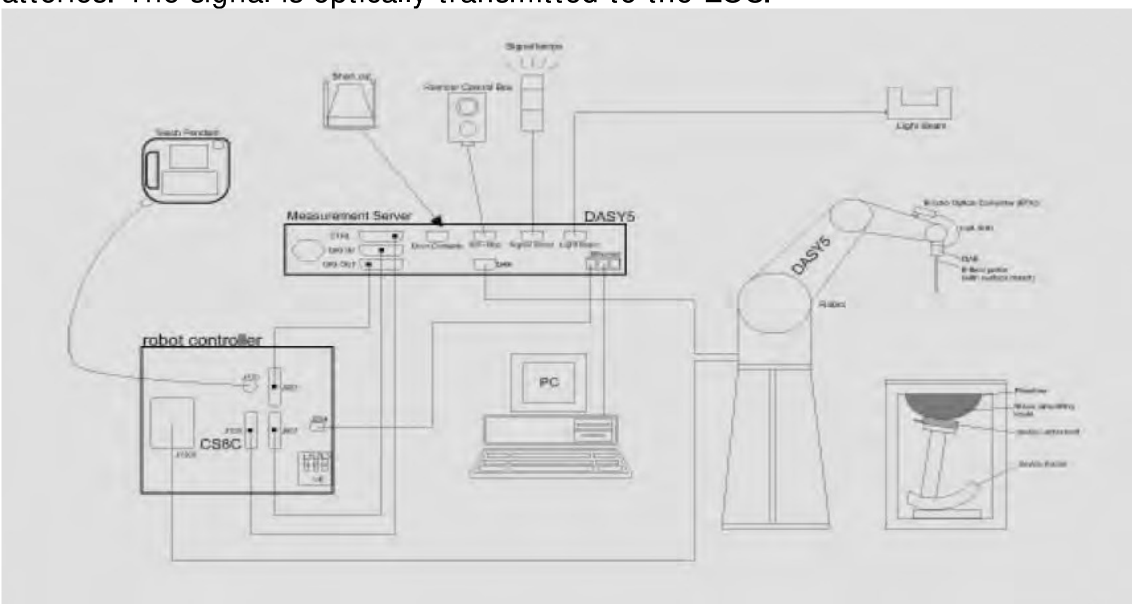


Fig. a The block diagram of SAR system

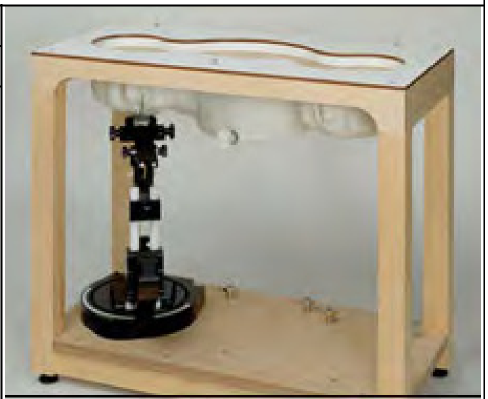
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY 5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validate the proper functioning of the system.

1.7 System Components

EX3DV4 E-Field Probe

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 2450/5200/5300/5600/5800 MHz Additional CF for other liquids and frequencies upon request	
Frequency	10 MHz to > 6 GHz	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Tip diameter: 2.5 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

SAM PHANTOM V4.0C

Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.	
Shell Thickness	2 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Height: 850 mm; Length: 1000 mm; Width: 500 mm	

DEVICE HOLDER

Construction	The device holder (Supporter) for Notebook is made by POM (polyoxymethylene resin) , which is non-metal and non-conductive. The height can be adjusted to fit varies kind of notebooks.	 Device Holder

1.8 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. b. 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 target SAR values. These tests were done at 2450/5200/5300/5600/5800 MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1 (SAR values are normalized to 1W forward power delivered to the dipole). During the tests, the ambient temperature of the laboratory was 21.7°C, the relative humidity was 62% and the liquid depth above the ear reference points was ≥ 15 cm ± 5 mm (frequency ≤ 3 GHz) or ≥ 10 cm ± 5 mm (frequency > 3 G Hz) 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.

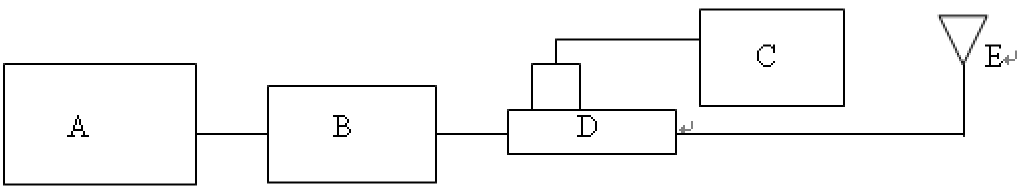
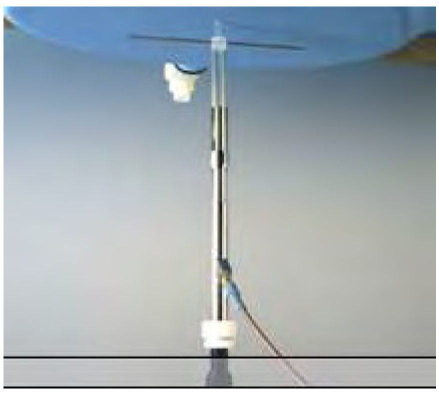


Fig. b The block diagram of system verification

A. Signal generator
B. Amplifier
C. Power meter
D. Dual directional coupling
E. Reference dipole antenna



Photograph of the dipole Antenna

Validation Kit	S/N	Frequency (MHz)		1W Target SAR-1g (mW/g)	Measured SAR-1g (mW/g)	Measured SAR-1g normalized to 1W (mW/g)	Deviation (%)	Measured Date
D2450V2	727	2450	Body	50	12.9	51.6	3.20%	Feb. 25, 2015
D5GHzV2	1023	5200	Body	73.5	7.22	72.2	-1.77%	Feb. 26, 2015
		5300	Body	74.6	7.62	76.2	2.14%	Mar. 02, 2015
		5600	Body	77.9	7.6	76	-2.44%	Mar. 03, 2015
		5800	Body	75.6	7.67	76.7	1.46%	Mar. 04, 2015

Table 1. Results of system validation

1.9 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this body-simulant fluid were measured by using the Agilent Model 85070E Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with Network Analyzer (30 KHz-6000 MHz).

All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The depth of the tissue simulant in the flat section of the phantom was ≥ 15 cm ± 5 mm (Frequency ≤3G) or ≥ 10 cm ± 5 mm (Frequency >3G) during all tests. (Fig. 2)

Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	% dev εr	% dev σ
Body	Feb. 25, 2015	2437	52.717	1.938	51.625	1.98	2.07%	-2.19%
		2450	52.700	1.950	51.553	1.992	2.18%	-2.15%
		2462	52.685	1.967	51.475	2.013	2.30%	-2.34%
	Feb. 26, 2015	5180	49.041	5.276	50.93	5.433	-3.85%	-2.98%
		5200	49.014	5.299	50.495	5.456	-3.02%	-2.96%
		5220	48.987	5.323	50.286	5.475	-2.65%	-2.86%
		5240	48.960	5.346	50.101	5.497	-2.33%	-2.82%
	Mar. 2, 2015	5280	48.906	5.393	48.496	5.566	0.84%	-3.21%
		5300	48.879	5.416	48.419	5.569	0.94%	-2.82%
		5320	48.851	5.439	48.334	5.608	1.06%	-3.11%
	Mar. 3, 2015	5500	48.607	5.650	48.256	5.612	0.72%	0.67%
		5600	48.471	5.766	47.911	5.741	1.16%	0.43%
		5660	48.390	5.837	47.823	5.781	1.17%	0.96%
		5680	48.363	5.860	47.771	5.841	1.22%	0.32%
	Mar. 4, 2015	5745	48.275	5.936	47.079	6.109	2.48%	-2.91%
		5785	48.220	5.982	46.950	6.163	2.63%	-3.03%
		5800	48.200	6.000	46.931	6.167	2.63%	-2.78%
		5805	48.193	6.006	46.909	6.183	2.66%	-2.95%

Table 2. Dielectric Parameters of Tissue Simulant Fluid

The composition of the tissue simulating liquid:

Frequency (MHz)	Mode	Ingredient						Total amount
		DGMBE	Water	Salt	Preventol D-7	Cellulose	Sugar	
2450M	Body	301.7ml	698.3ml	—	—	—	—	1.0L(Kg)

Body Simulating Liquids for 5 GHz, Manufactured by SPEAG:

Ingredients	Water	Esters, Emulsifiers, Inhibitors	Sodium and Salt
(% by weight)	60-80	20-40	0-1.5

Table 3. Recipes for Tissue Simulating Liquid

1.10 Evaluation Procedures

The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan.
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1g and 10g.

The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated. The angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within –2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7x7x7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements.

The measured volume of 30x30x30mm contains about 30g of tissue.

The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

1.11 Probe Calibration Procedures

For the calibration of E-field probes in lossy liquids, an electric field with an accurately known field strength must be produced within the measured liquid. For standardization purposes it would be desirable if all measurements which are necessary to assess the correct field strength would be traceable to standardized measurement procedures. In the following two different calibration techniques are summarized:

1.11.1 Transfer Calibration with Temperature Probes

In lossy liquids the specific absorption rate (SAR) is related both to the electric field (E) and the temperature gradient ($\delta T / \delta t$) in the liquid.

$$SAR = \frac{\sigma}{\rho} \left| E \right|^2 = c \frac{\delta T}{\delta t}$$

whereby σ is the conductivity, ρ the density and c the heat capacity of the liquid.

Hence, the electric field in lossy liquid can be measured indirectly by measuring the temperature gradient in the liquid. Non-disturbing temperature probes (optical probes or thermistor probes with resistive lines) with high spatial resolution (<1-2 mm) and fast reaction time (<1 s) are available and can be easily calibrated with high precision [1]. The setup and the exciting source have no influence on the calibration; only the relative positioning uncertainties of the standard temperature probe and the E-field probe to be calibrated must be considered. However, several problems limit the available accuracy of probe calibrations with temperature probes:

- The temperature gradient is not directly measurable but must be evaluated from temperature measurements at different time steps. Special precaution is necessary to avoid measurement errors caused by temperature gradients due to energy equalizing effects or convection currents in the liquid. Such effects cannot be completely avoided, as the measured field itself destroys the thermal equilibrium in the liquid. With a careful setup these errors can be kept small.

- The measured volume around the temperature probe is not well defined. It is difficult to calculate the energy transfer from a surrounding gradient temperature field into the probe. These effects must be considered, since temperature probes are calibrated in liquid with homogeneous temperatures. There is no traceable standard for temperature rise measurements.
- The calibration depends on the assessment of the specific density, the heat capacity and the conductivity of the medium. While the specific density and heat capacity can be measured accurately with standardized procedures (~ 2% for c; much better for ρ) , there is no standard for the measurement of the conductivity. Depending on the method and liquid, the error can well exceed ±5%.
- Temperature rise measurements are not very sensitive and therefore are often performed at a higher power level than the E-field measurements. The nonlinearities in the system (e.g., power measurements, different components, etc.) must be considered.

Considering these problems, the possible accuracy of the calibration of E-field probes with temperature gradient measurements in a carefully designed setup is about ±10% (RSS) [2]. Recently, a setup which is a combination of the waveguide techniques and the thermal measurements was presented in [3]. The estimated uncertainty of the setup is ±5% (RSS) when the same liquid is used for the calibration and for actual measurements and ±7-9% (RSS) when not, which is in good agreement with the estimates given in [2].

1.11.2 Calibration with Analytical Fields

In this method a technical setup is used in which the field can be calculated analytically from measurements of other physical magnitudes (e.g., input power). This corresponds to the standard field method for probe calibration in air; however, there is no standard defined for fields in lossy liquids.

When using calculated fields in lossy liquids for probe calibration, several points must be considered in the assessment of the uncertainty:

- The setup must enable accurate determination of the incident power.
- The accuracy of the calculated field strength will depend on the assessment of the dielectric parameters of the liquid.
- Due to the small wavelength in liquids with high permittivity, even small setups might be above the resonant cutoff frequencies. The field distribution in the setup must be carefully checked for conformity with the theoretical field distribution.

References

[1] N. Kuster, Q. Balzano, and J.C. Lin, Eds., *Mobile Communications Safety*, Chapman & Hall, London, 1997.

[2] K. Meier, M. Burkhardt, T. Schmid, and N. Kuster, \Broadband calibration of E-field probes in lossy media", *IEEE Transactions on Microwave Theory and Techniques*, vol. 44, no. 10, pp. 1954{1962, Oct. 1996.

[3] K. Jokela, P. Hyysalo, and L. Puranen, \Calibration of specific absorption rate (SAR) probes in waveguide at 900 MHz", *IEEE Transactions on Instrumentation and Measurements*, vol. 47, no. 2, pp. 432{438, Apr. 1998.

1.12 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1–1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 kHz to 6 GHz. Portable devices that transmit at frequencies above 6 GHz are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter. Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 GHz should be made at a minimum distance of 5 cm from the radiating source.

(1) Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube).

(2) Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

(3) Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1)

of this section. (Table 4.)

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR (Brain)	1.60 m W/g	8.00 m W/g
Spatial Average SAR (Whole Body)	0.08 m W/g	0.40 m W/g
Spatial Peak SAR (Hands/Feet/Ankle/Wrist)	4.00 m W/g	20.00 m W/g

Table 4. RF exposure limits

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

2. Summary of Results

Main Antenna

Antenna	Band	Position	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		Plot page
								Measured	Reported	
Main	WLAN802.11 b	Lap-held	6	2437	15.00	14.80	4.71%	0.567	0.594	47
		Top side	6	2437	15.00	14.80	4.71%	0.226	0.237	-
	WLAN802.11 a 5.2G	Lap-held	44	5220	13.50	13.44	1.39%	0.758	0.769	48
		Top side	44	5220	13.50	13.44	1.39%	0.712	0.722	-
	WLAN802.11 a 5.3G	Lap-held	56	5280	13.50	13.40	2.33%	0.984	1.007	-
		Lap-held	60	5300	13.50	13.45	1.16%	0.856	0.866	-
		Top side	56	5280	13.50	13.40	2.33%	1.05	1.074	-
		Top side	60	5300	13.50	13.45	1.16%	1.13	1.143	49
	WLAN802.11 n(20M) 5.3G	Top side	56	5280	13.50	13.48	0.46%	1.12	1.125	-
		Top side	64	5320	13.50	13.49	0.23%	1.28	1.283	50
		Top side*	64	5320	13.50	13.49	0.23%	1.27	1.273	-
	WLAN802.11 a 5.6G	Lap-held	100	5500	12.00	11.78	5.20%	0.594	0.625	-
		Lap-held	132	5660	12.00	11.91	2.09%	0.734	0.749	-
		Lap-held	136	5680	12.00	11.83	3.99%	0.785	0.816	51
		Top side	100	5500	12.00	11.78	5.20%	0.709	0.746	-
		Top side	132	5660	12.00	11.91	2.09%	0.714	0.729	-
		Top side	136	5680	12.00	11.83	3.99%	0.622	0.647	-
	WLAN802.11 a 5.8G	Lap-held	149	5745	13.50	13.36	3.28%	1	1.033	52
		Lap-held	157	5785	13.50	13.40	2.33%	0.994	1.017	-
		Lap-held	161	5805	13.50	13.39	2.57%	0.981	1.006	-
		Lap-held*	149	5745	13.50	13.36	3.28%	0.996	1.029	-
		Top side	157	5785	13.50	13.40	2.33%	0.744	0.761	-

Test distance is 0mm.
* - repeated at the highest SAR measurement according to the FCC KDB 865664

Aux Antenna

Antenna	Band	Position	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		Plot page
								Measured	Reported	
Aux	WLAN802.11 b	Lap-held	11	2462	15.00	14.95	1.16%	0.627	0.634	53
		Top side	11	2462	15.00	14.95	1.16%	0.184	0.186	-
		Right side	11	2462	15.00	14.95	1.16%	0.130	0.132	-
	WLAN802.11 a 5.2G	Lap-held	48	5240	13.5	13.32	4.23%	0.61	0.636	-
		Top side	48	5240	13.5	13.32	4.23%	0.714	0.744	54
		Right side	48	5240	13.5	13.32	4.23%	0.054	0.056	-
	WLAN802.11 n(20M) 5.2G	Top side	36	5180	13.5	13.44	1.39%	0.827	0.839	55
		Top side	48	5240	13.5	13.24	6.17%	0.721	0.765	-
		Top side*	36	5180	13.5	13.44	1.39%	0.819	0.830	-
	WLAN802.11 a 5.3G	Lap-held	60	5300	13.5	13.44	1.39%	0.564	0.572	-
		Top side	60	5300	13.5	13.44	1.39%	0.695	0.705	56
		Right side	60	5300	13.5	13.44	1.39%	0.034	0.034	-
	WLAN802.11 a 5.6G	Lap-held	100	5500	12.00	11.76	5.68%	0.478	0.505	-
		Lap-held	132	5660	12.00	11.84	3.75%	0.485	0.503	-
		Lap-held	136	5680	12.00	11.68	7.65%	0.484	0.521	-
		Top side	100	5500	12.00	11.76	5.68%	0.579	0.612	57
		Top side	132	5660	12.00	11.84	3.75%	0.445	0.462	-
		Top side	136	5680	12.00	11.68	7.65%	0.442	0.476	-
		Right side	132	5660	12.00	11.84	3.75%	0.129	0.134	-
	WLAN802.11 a 5.8G	Lap-held	161	5805	13.50	13.37	3.04%	0.729	0.751	58
		Top side	161	5805	13.50	13.37	3.04%	0.681	0.702	-
		Right side	161	5805	13.50	13.37	3.04%	0.152	0.157	-

Test distance is 0mm.
* - repeated at the highest SAR measurement according to the FCC KDB 865664

3. Simultaneous Transmission Analysis

Simultaneous Transmission Scenarios:

Simultaneous Transmit Configurations	Body
2.4GHz WLAN Main + 2.4GHz WLAN Aux	Yes
5.2GHz WLAN Main + 5.2GHz WLAN Aux	Yes
5.3GHz WLAN Main + 5.3GHz WLAN Aux	Yes
5.6GHz WLAN Main + 5.6GHz WLAN Aux	Yes
5.8GHz WLAN Main + 5.8GHz WLAN Aux	Yes
WLAN Main + BT	Yes

Note:
1. WLAN Main and BT antennas may transmit simultaneously.
2. The simultaneous transmitted SAR measurement is not required based on KDB447498D01

3.1 Estimated SAR calculation

According to KDB447498 D01v05 – When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

$$\text{Estimated SAR} = \frac{\text{Max. tune up power(mW)}}{\text{Min. test separation distance(mm)}} \times \frac{\sqrt{f(GHz)}}{7.5}$$

If the minimum test separation distance is < 5mm, a distance of 5mm is used for estimated SAR calculation. When the test separation distance is >50mm, the 0.4W/kg is used for SAR-1g.

Mode / Band	frequency (GHz)	Maximum power(dBm)	Test position	test separation distance(mm)	Estimated SAR(W/kg)
BT	2.441	6.03	Lap-held	0	0.167
BT	2.441	6.03	top side	0	0.167
BT	2.441	6.03	right side	8.5	0.098

3.2 Simultaneous Transmission analysis

Per KDB447498D01, when the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR sum to peak location separation ratio(SPLSR).

The simultaneous transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion.

The ratio is determined by **(SAR1 + SAR2)^1.5/ Ri**, rounded to two decimal digits, and must be **≤ 0.04** for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

SAR1 and SAR2 are the highest reported or estimated SAR for each antenna in the pair, and Ri is the separation distance between the peak SAR locations for the antenna pair in mm.

When standalone test exclusion applies, SAR is estimated; the peak location is assumed to be at the feed-point or geometric center of the antenna.

WLAN 2.4GHz Main + 2.4GHz Aux

No.	Conditions	Exposure Condition	Position	Distance (mm)	Max. WLAN Main	Max. WLAN Aux	SAR Summation	SPLSR Analysis
1	2.4G Main + Aux	Body	Lap-held	0	0.594	0.634	1.228	ΣSAR< 1.6, Not required
			Top side	0	0.237	0.186	0.423	ΣSAR< 1.6, Not required
			Right side	0	-	0.132	-	ΣSAR< 1.6, Not required

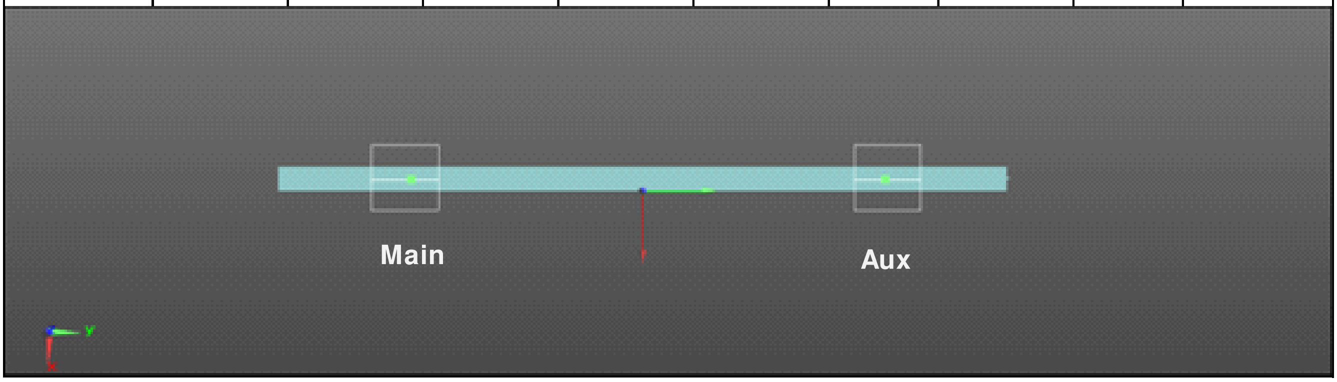
WLAN 5.2GHz Main + 5.2GHz Aux

No.	Conditions	Exposure Condition	Position	Distance (mm)	Max. WLAN Main	Max. WLAN Aux	SAR Summation	SPLSR Analysis
2	5.2G Main + Aux	Body	Lap-held	0	0.769	0.636	1.405	ΣSAR< 1.6, Not required
			Top side	0	0.722	0.839	1.561	ΣSAR< 1.6, Not required
			Right side	0	-	0.056	-	ΣSAR< 1.6, Not required

WLAN 5.3GHz Main + 5.3GHz Aux

No.	Conditions	Exposure Condition	Position	Distance (mm)	Max. WLAN Main	Max. WLAN Aux	SAR Summation	SPLSR Analysis
3	5.3G Main + Aux	Body	Lap-held	0	1.007	0.572	1.579	ΣSAR< 1.6, Not required
			Top side	0	1.283	0.705	**1.988**	Analyzed as below
			Right side	0	-	0.034	-	ΣSAR< 1.6, Not required

Conditions	Position	SAR Value (W/kg)	Coordinates (cm)			ΣSAR (W/kg)	Peak Location Separation Distance (mm)	SPLSR	Simultaneous Transmission SAR Test
			x	y	z				
Main WLAN n(20M)	Top side	1.283	-0.42	-8.26	-0.23	1.988	169.8	0.017	SPLSR< 0.04, Not required
Aux WLAN a CH 60		0.705	-0.42	8.72	-0.03				



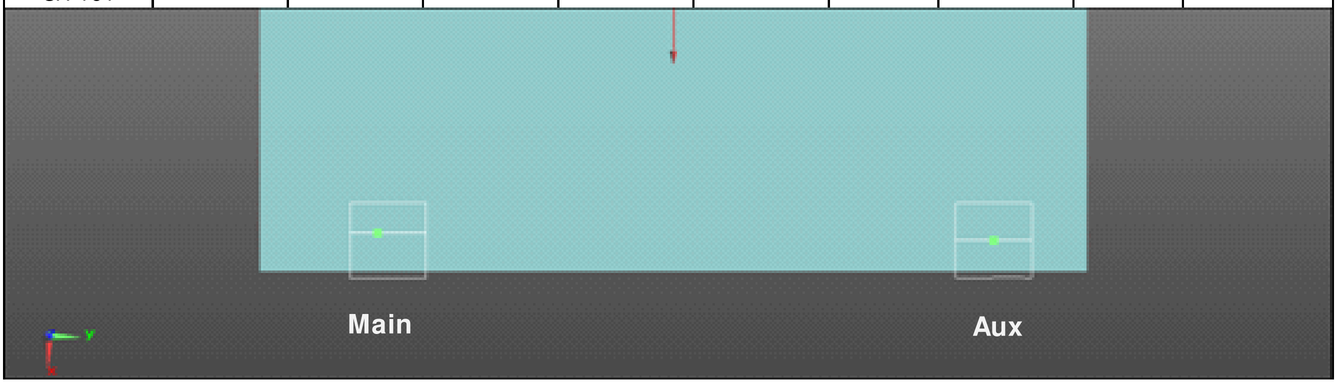
WLAN 5.6GHz Main + 5.6GHz Aux

No.	Conditions	Exposure Condition	Position	Distance (mm)	Max. WLAN Main	Max. WLAN Aux	SAR Summation	SPLSR Analysis
4	5.6G Main + Aux	Body	Lap-held	0	0.816	0.521	1.337	ΣSAR< 1.6, Not required
			Top side	0	0.746	0.612	1.358	ΣSAR< 1.6, Not required
			Right side	0	-	0.134	-	ΣSAR< 1.6, Not required

WLAN 5.8GHz Main + 5.8GHz Aux

No.	Conditions	Exposure Condition	Position	Distance (mm)	Max. WLAN Main	Max. WLAN Aux	SAR Summation	SPLSR Analysis
5	5.8G Main + Aux	Body	Lap-held	0	1.033	0.751	**1.784**	Analyzed as below
			Top side	0	0.761	0.702	1.463	ΣSAR< 1.6, Not required
			Right side	0	-	0.157	-	ΣSAR< 1.6, Not required

Conditions	Position	SAR Value (W/kg)	Coordinates (cm)			ΣSAR (W/kg)	Peak Location Separation Distance (mm)	SPLSR	Simultaneous Transmission SAR Test
			x	y	z				
Main WLAN a CH 149	Lap-held	1.033	7.76	-9.32	0.02	1.784	194.2	0.012	SPLSR< 0.04, Not required
Aux WLAN a CH 161		0.751	8	10.1	-0.01				



WLAN + BT

No.	Conditions	Exposure Condition	Position	Distance (mm)	Max. WLAN Main	Max. BT	SAR Summation	SPLSR Analysis
6	WLAN Main + BT	Body	Lap-held	0	1.033	0.167	1.2	ΣSAR< 1.6, Not required
			Top side	0	1.283	0.167	1.45	ΣSAR< 1.6, Not required
			Right side	0	-	0.098	-	ΣSAR< 1.6, Not required

4. Instruments List

Manufacturer	Device	Type	Serial number	Date of last calibration	Date of next calibration
Schmid & Partner Engineering AG	Dosimetric E-Field Probe	EX3DV4	3820	May.15,2014	May.14,2015
			3831	Jan.29,2015	Jan.28,2016
Schmid & Partner Engineering AG	System Validation Dipole	D2450V2	727	Apr.23,2014	Apr.22,2015
		D5GHzV2	1023	Jan.29,2015	Jan.28,2016
Schmid & Partner Engineering AG	Data acquisition Electronics	DAE4	547	Mar.26,2014	Mar.25,2015
Schmid & Partner Engineering AG	Software	DASY 52 V52.8.8	N/A	Calibration not required	Calibration not required
Schmid & Partner Engineering AG	Phantom	SAM	N/A	Calibration not required	Calibration not required
Agilent	Network Analyzer	8753D	3410A05547	May15,2014	May14,2015
Agilent	Dielectric Probe Kit	85070E	MY44300677	Calibration not required	Calibration not required
Agilent	Dual-directional coupler	772D	MY46151242	Jul.14,2014	Jul.13,2015
Agilent	RF Signal Generator	N5181A	MY50144143	Jun.25.2014	Jun.24.2015
Agilent	Power Meter	E4417A	MY52240003	Apr.30,2014	Apr.29,2015
Agilent	Power Sensor	E9301H	MY52200003	Apr.30,2014	Apr.29,2015
TECPEL	Digital thermometer	DTM-303A	TP130077	Mar.17,2014	Mar.16,2015

5. Measurements

Date: 2015/2/25

WLAN802.11b_Body-worn_Lap-held side_CH 6_Main_0mm

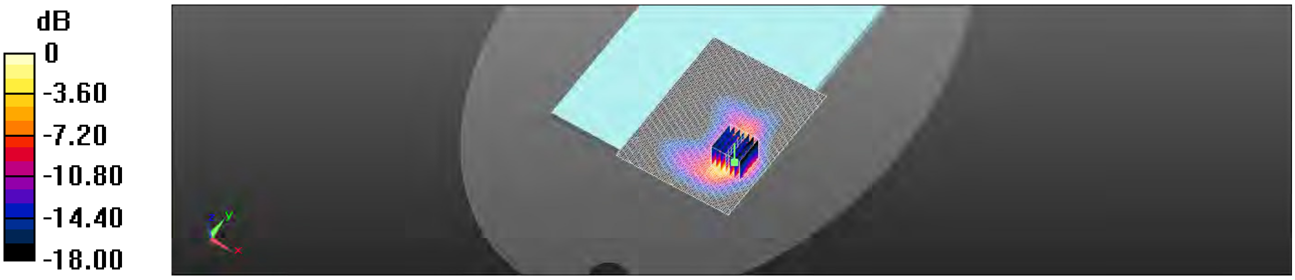
Communication System: WLAN(2.45G); Frequency: 2437 MHz, Duty Factor: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.98 S/m; ε_r = 51.625; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3820; ConvF(6.87, 6.87, 6.87); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (101x131x1): Interpolated grid: dx=12 mm, dy=12 mm
Maximum value of SAR (interpolated) = 0.925 W/kg

Configuration/BODY/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.542 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.567 W/kg; SAR(10 g) = 0.245 W/kg
Maximum value of SAR (measured) = 0.948 W/kg



0 dB = 0.948 W/kg = -0.23 dBW/kg

Date: 2015/2/26

WLAN802.11a 5.2G_Body-worn_Lap-held_CH 44_Main_0mm

Communication System: WLAN(5G); Frequency: 5220 MHz, Duty Factor: 1:1
Medium parameters used: f = 5220 MHz, σ = 5.475 S/m; εr = 50.286; ρ = 1000 kg/m^3
Phantom section: Flat Section

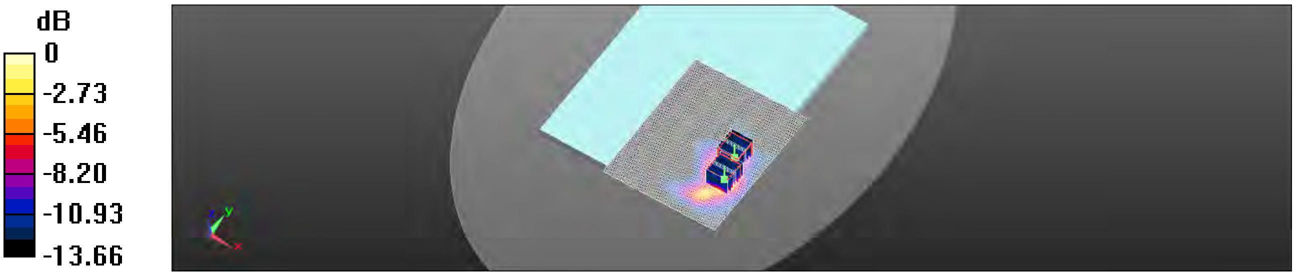
DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (121x151x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 1.27 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.811 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 3.03 W/kg
SAR(1 g) = 0.758 W/kg; SAR(10 g) = 0.267 W/kg
Maximum value of SAR (measured) = 1.48 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.811 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.70 W/kg
SAR(1 g) = 0.475 W/kg; SAR(10 g) = 0.153 W/kg
Maximum value of SAR (measured) = 1.05 W/kg



0 dB = 1.05 W/kg = 0.20 dBW/kg

Date: 2015/3/2

WLAN802.11a 5.3G_Body-worn_Top side_CH 60_Main_0mm

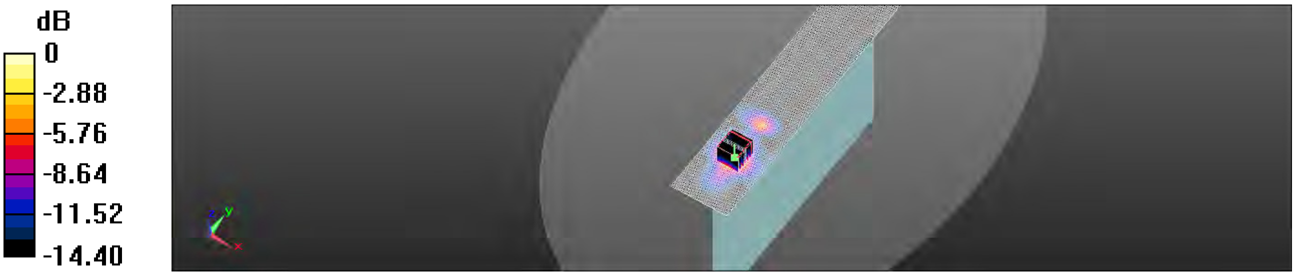
Communication System: WLAN(5G); Frequency: 5300 MHz, Duty Factor: 1:1
Medium parameters used: f = 5300 MHz, σ = 5.569 S/m; εr = 48.419; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (61x291x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 2.33 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 4.858 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 4.05 W/kg
SAR(1 g) = 1.13 W/kg; SAR(10 g) = 0.394 W/kg
Maximum value of SAR (measured) = 2.16 W/kg



0 dB = 2.16 W/kg = 3.34 dBW/kg

Date: 2015/3/2

WLAN802.11n(20M) 5.3G_Body-worn_Top side_CH 64_Main_0mm

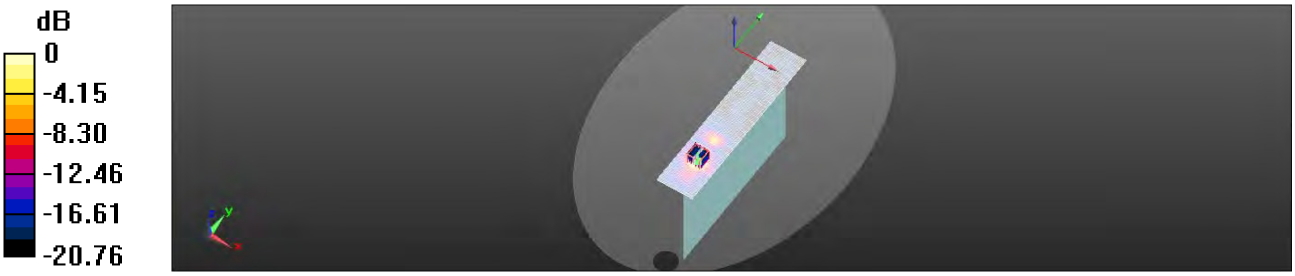
Communication System: WLAN(5G); Frequency: 5320 MHz, Duty Factor: 1:1
Medium parameters used: f = 5320 MHz, σ = 5.608 S/m; εr = 48.334; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (61x291x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 2.55 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.332 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 4.72 W/kg
SAR(1 g) = 1.28 W/kg; SAR(10 g) = 0.407 W/kg
Maximum value of SAR (measured) = 2.49 W/kg



0 dB = 2.55 W/kg = 4.07 dBW/kg

Date: 2015/3/3

WLAN802.11a 5.6G_Body-worn_Lap-held_CH 136_Main_0mm

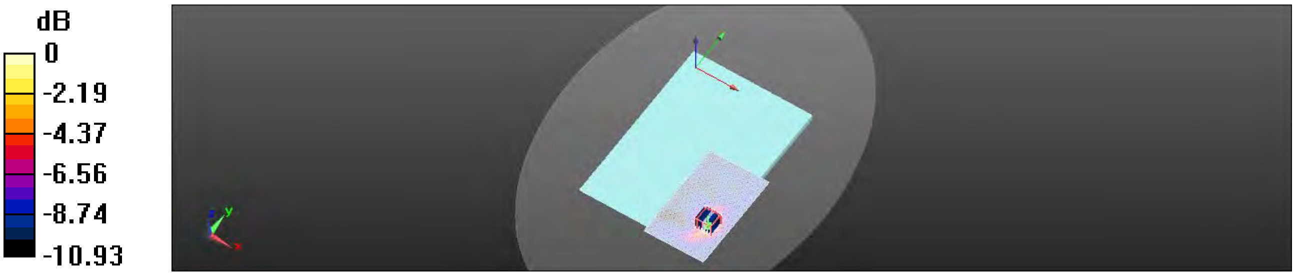
Communication System: WLAN(5G); Frequency: 5680 MHz, Duty Factor: 1:1
Medium parameters used: f = 5680 MHz, σ = 5.841 S/m; εr = 47.771; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.49, 3.49, 3.49); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x151x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 1.28 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 5.892 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 2.79 W/kg
SAR(1 g) = 0.785 W/kg; SAR(10 g) = 0.405 W/kg
Maximum value of SAR (measured) = 1.31 W/kg



0 dB = 1.28 W/kg = 1.07 dBW/kg

Date: 2015/3/4

WLAN802.11a 5.8G_Body-worn_Lap-held_CH 149_Main_0mm

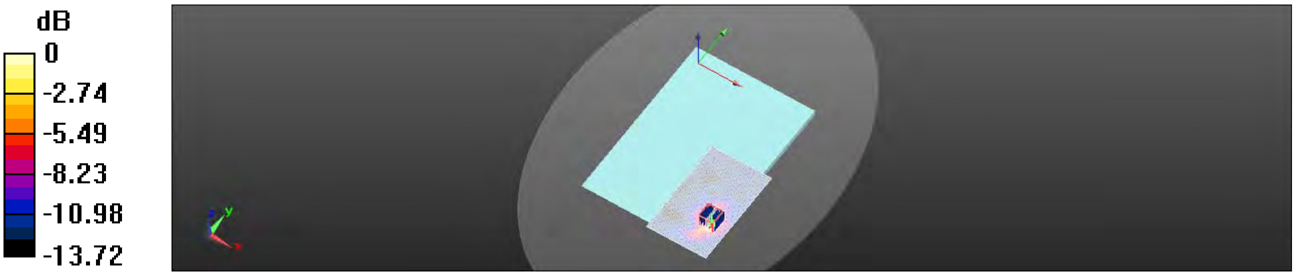
Communication System: WLAN(5G); Frequency: 5745 MHz, Duty Factor: 1:1
Medium parameters used: f = 5745 MHz, σ = 6.109 S/m; εr = 47.079; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.7, 3.7, 3.7); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x151x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 1.83 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 4.787 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.61 W/kg
SAR(1 g) = 1 W/kg; SAR(10 g) = 0.424 W/kg
Maximum value of SAR (measured) = 1.77 W/kg



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

Date: 2015/2/25

WLAN802.11b_Body-worn_Lap-held_CH 11_Aux_0mm

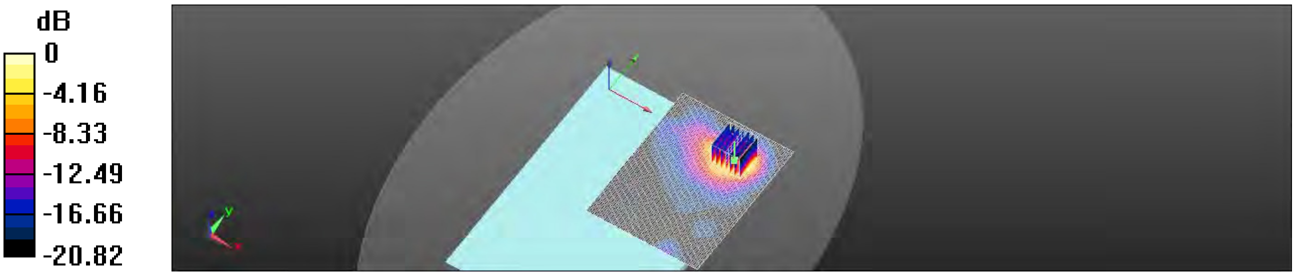
Communication System: WLAN(2.45G); Frequency: 2462 MHz, Duty Factor: 1:1
Medium parameters used: f = 2462 MHz; σ = 2.013 S/m; εr = 51.475; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3820; ConvF(6.87, 6.87, 6.87); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (101x131x1): Interpolated grid: dx=12 mm, dy=12 mm
Maximum value of SAR (interpolated) = 0.908 W/kg

Configuration/BODY/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.714 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 1.29 W/kg
SAR(1 g) = 0.627 W/kg; SAR(10 g) = 0.299 W/kg
Maximum value of SAR (measured) = 0.915 W/kg



0 dB = 0.908 W/kg = -0.42 dBW/kg

Date: 2015/2/26

WLAN802.11a 5.2G_Body-worn_Top side_CH 48_Aux_0mm

Communication System: WLAN(5G); Frequency: 5240 MHz, Duty Factor: 1:1
Medium parameters used: f = 5240 MHz; σ = 5.497 S/m; ε_r = 50.101; ρ = 1000 kg/m^3
Phantom section: Flat Section

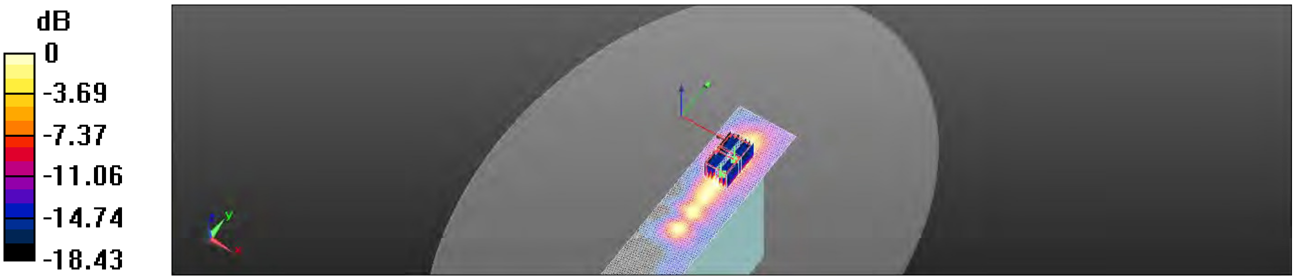
DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (61x291x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 1.28 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.659 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 2.65 W/kg
SAR(1 g) = 0.714 W/kg; SAR(10 g) = 0.230 W/kg
Maximum value of SAR (measured) = 1.46 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.659 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 2.44 W/kg
SAR(1 g) = 0.620 W/kg; SAR(10 g) = 0.221 W/kg
Maximum value of SAR (measured) = 1.20 W/kg



0 dB = 1.20 W/kg = 0.80 dBW/kg

Date: 2015/2/26

WLAN802.11n(20M) 5.2G_Body-worn_Top side_CH 36_Aux_0mm

Communication System: WLAN(5G); Frequency: 5180 MHz, Duty Factor: 1:1
Medium parameters used: f = 5180 MHz, σ = 5.433 S/m; εr = 50.93; ρ = 1000 kg/m^3
Phantom section: Flat Section

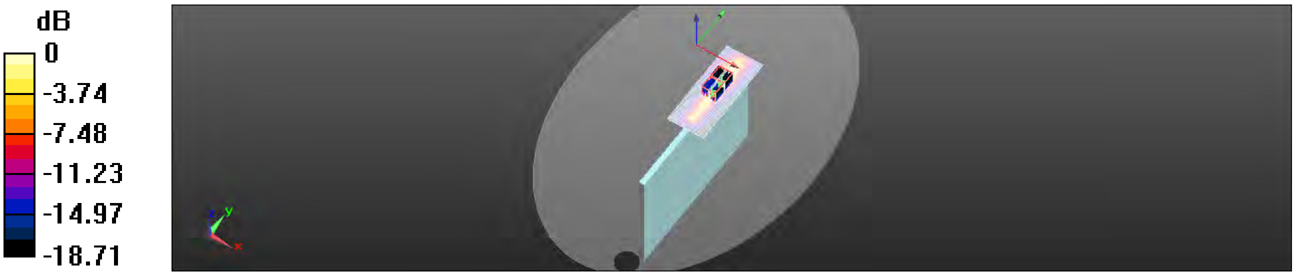
DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (61x151x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 1.73 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 10.69 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 3.08 W/kg
SAR(1 g) = 0.827 W/kg; SAR(10 g) = 0.275 W/kg
Maximum value of SAR (measured) = 1.68 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 10.69 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 2.63 W/kg
SAR(1 g) = 0.670 W/kg; SAR(10 g) = 0.227 W/kg
Maximum value of SAR (measured) = 1.37 W/kg



0 dB = 1.73 W/kg = 2.38 dBW/kg

Date: 2015/3/2

WLAN802.11a 5.3G_Body-worn_Top side_CH 60_Aux_0mm

Communication System: WLAN(5G); Frequency: 5300 MHz, Duty Factor: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.569 S/m; ε_r = 48.419; ρ = 1000 kg/m^3
Phantom section: Flat Section

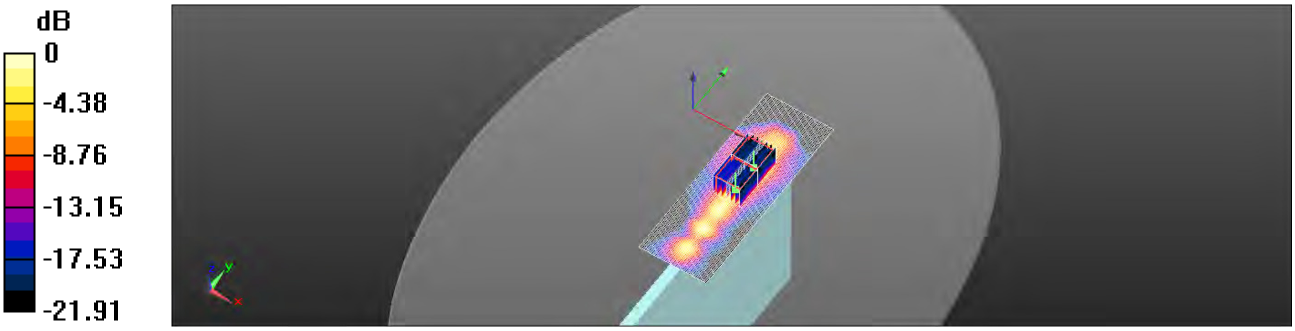
DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (61x171x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 1.37 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 10.97 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 3.09 W/kg
SAR(1 g) = 0.695 W/kg; SAR(10 g) = 0.235 W/kg
Maximum value of SAR (measured) = 1.64 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 10.97 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 2.72 W/kg
SAR(1 g) = 0.653 W/kg; SAR(10 g) = 0.224 W/kg
Maximum value of SAR (measured) = 1.39 W/kg



0 dB = 1.64 W/kg = 2.15 dBW/kg

Date: 2015/3/3

WLAN802.11a 5.6G_Body-worn_Top side_CH 100_Aux_0mm

Communication System: WLAN(5G); Frequency: 5500 MHz, Duty Factor: 1:1
Medium parameters used: f = 5500 MHz, σ = 5.612 S/m; εr = 48.256; ρ = 1000 kg/m^3
Phantom section: Flat Section

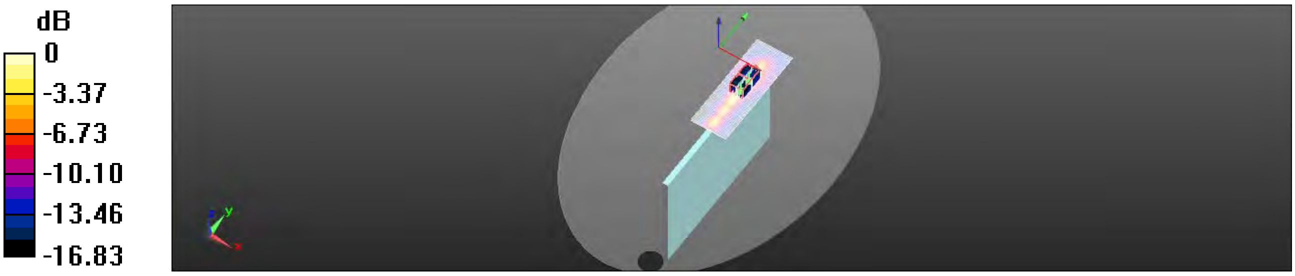
DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.49, 3.49, 3.49); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (61x171x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 1.16 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.139 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 2.06 W/kg
SAR(1 g) = 0.579 W/kg; SAR(10 g) = 0.213 W/kg
Maximum value of SAR (measured) = 1.14 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.139 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 2.02 W/kg
SAR(1 g) = 0.506 W/kg; SAR(10 g) = 0.170 W/kg
Maximum value of SAR (measured) = 1.03 W/kg



0 dB = 1.16 W/kg = 0.64 dBW/kg

Date: 2015/3/4

WLAN802.11a 5.8G_Body-worn_Lap-held_CH 161_Aux_0mm

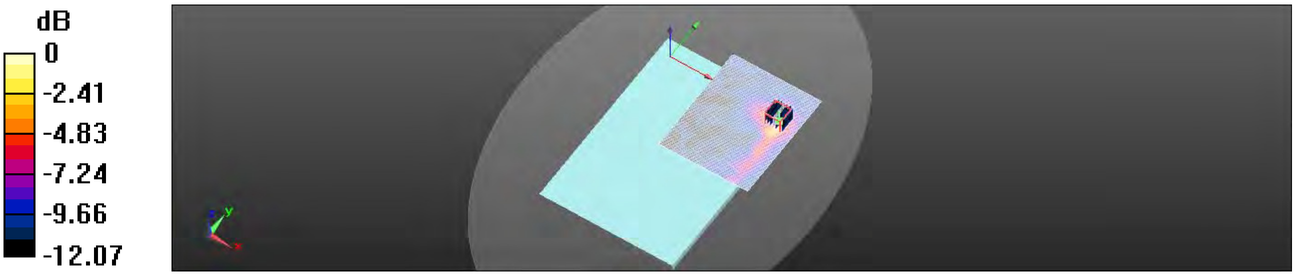
Communication System: WLAN(5G); Frequency: 5805 MHz, Duty Factor: 1:1
Medium parameters used: f = 5805 MHz, σ = 6.183 S/m; εr = 46.909; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.7, 3.7, 3.7); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (121x151x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 1.24 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 4.277 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 2.67 W/kg
SAR(1 g) = 0.729 W/kg; SAR(10 g) = 0.327 W/kg
Maximum value of SAR (measured) = 1.34 W/kg



0 dB = 1.24 W/kg = 0.93 dBW/kg

6. SAR System Performance Verification

Date: 2015/2/25

Dipole 2450MHz_SN:727

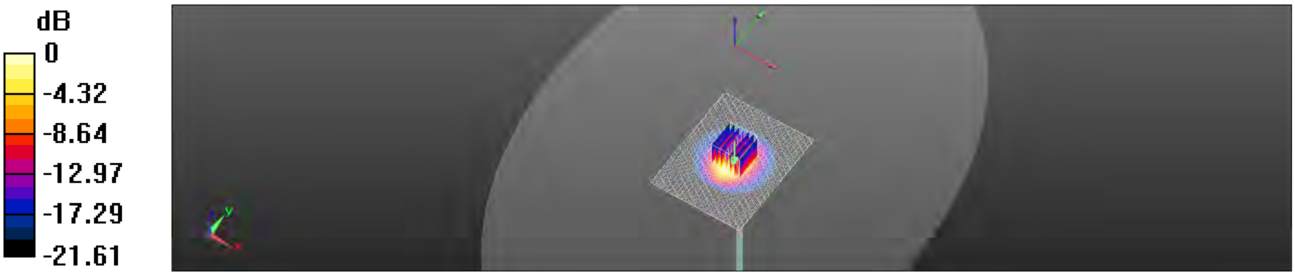
Communication System: CW; Frequency: 2450 MHz, Duty Factor: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.992 S/m; ε_r = 51.553; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3820; ConvF(6.87, 6.87, 6.87); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=250mW/Area Scan (81x101x1): Interpolated grid: dx=12 mm, dy=12 mm
Maximum value of SAR (interpolated) = 19.9 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.13 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 26.2 W/kg
SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.99 W/kg
Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 19.6 W/kg = 12.93 dBW/kg

Date: 2015/2/26

Dipole 5200MHz_SN:1023

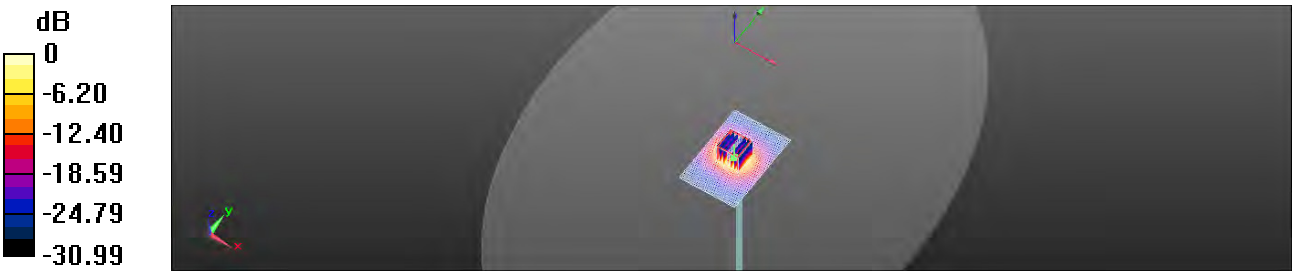
Communication System: CW; Frequency: 5200 MHz, Duty Factor: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.456 S/m; ε_r = 50.495; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 14.9 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 55.36 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 7.22 W/kg; SAR(10 g) = 2.08 W/kg
Maximum value of SAR (measured) = 15.1 W/kg



0 dB = 15.1 W/kg = 11.78 dBW/kg

Date: 2015/3/2

Dipole 5300MHz_SN:1023

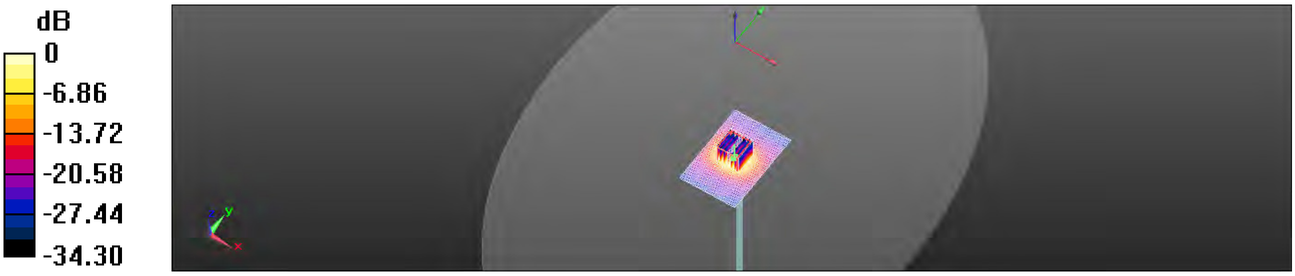
Communication System: CW; Frequency: 5300 MHz, Duty Factor: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.569 S/m; ε_r = 48.419; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 17.0 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 58.66 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 28.9 W/kg
SAR(1 g) = 7.62 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.98 dBW/kg

Date: 2015/3/3

Dipole 5600MHz_SN:1023

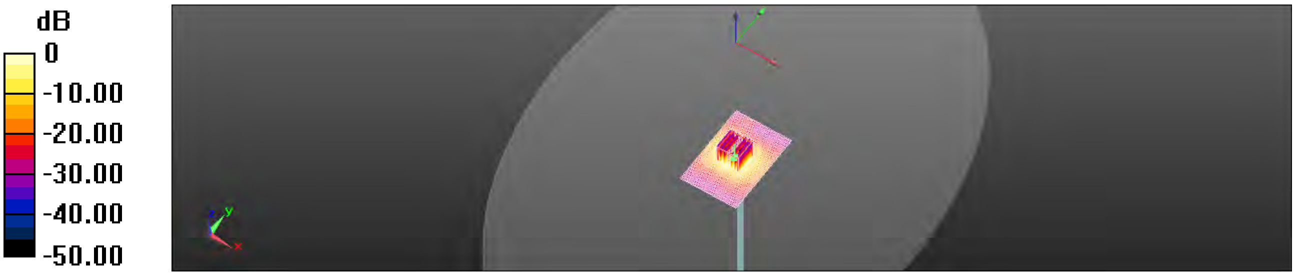
Communication System: CW; Frequency: 5600 MHz, Duty Factor: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.741 S/m; ε_r = 47.911; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.49, 3.49, 3.49); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 15.8 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 56.51 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 7.6 W/kg; SAR(10 g) = 2.15 W/kg
Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 12.18 dBW/kg

Date: 2015/3/4

Dipole 5800MHz_SN:1023

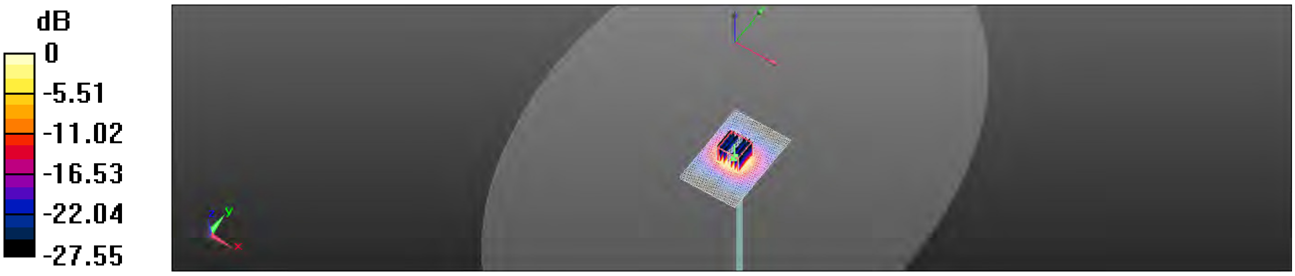
Communication System: CW; Frequency: 5800 MHz, Duty Factor: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.167 S/m; ε_r = 46.931; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.7, 3.7, 3.7); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 17.0 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 55.84 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 33.1 W/kg
SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.18 W/kg
Maximum value of SAR (measured) = 16.7 W/kg



0 dB = 16.7 W/kg = 12.22 dBW/kg

7. DAE & Probe Calibration Certificate

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Accreditation No.: SCS 108

Client: SGS - TW (Auden)

Certificate No: DAE4-547_Mar14

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 547
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	March 26, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	Eric Hainfeld	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V.

Issued: March 26, 2014

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

Certificate No: DAE4-547_Mar14 Page 1 of 5

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Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.032 ± 0.02% (k=2)	404.058 ± 0.02% (k=2)	404.202 ± 0.02% (k=2)
Low Range	3.95713 ± 1.50% (k=2)	3.96202 ± 1.50% (k=2)	3.97561 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	158.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199995.43	-0.60	-0.00
Channel X	+ Input	20004.43	4.15	0.02
Channel X	- Input	-19997.69	3.25	-0.02
Channel Y	+ Input	199994.87	-1.15	-0.00
Channel Y	+ Input	19998.43	-1.93	-0.01
Channel Y	- Input	-20001.87	-0.85	0.00
Channel Z	+ Input	199997.48	1.41	0.00
Channel Z	+ Input	20001.10	0.79	0.00
Channel Z	- Input	-20003.63	-2.53	0.01

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.64	0.17	0.01
Channel X	+ Input	201.77	0.85	0.42
Channel X	- Input	-199.11	-0.24	0.12
Channel Y	+ Input	2000.97	0.62	0.03
Channel Y	+ Input	200.19	-0.69	-0.34
Channel Y	- Input	-199.95	-0.97	0.49
Channel Z	+ Input	2000.53	0.21	0.01
Channel Z	+ Input	200.38	-0.40	-0.20
Channel Z	- Input	-199.62	-0.59	0.29

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	19.65	17.65
	- 200	-14.62	-15.76
Channel Y	200	-6.89	-7.43
	- 200	3.98	4.06
Channel Z	200	20.93	20.96
	- 200	-22.42	-22.42

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	2.53	-2.12
Channel Y	200	9.67	-	3.63
Channel Z	200	5.84	6.75	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16141	15478
Channel Y	16453	16523
Channel Z	15984	17120

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	2.01	0.79	3.52	0.47
Channel Y	-0.51	-1.15	0.66	0.34
Channel Z	-0.87	-1.96	0.11	0.45

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

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Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **EX3-3820_May14**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3820
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	May 15, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: May 17, 2014

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Certificate No: EX3-3820_May14 Page 1 of 11

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Accreditation No.: **SCS 108**

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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

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).

Probe EX3DV4

SN:3820

Manufactured:	September 2, 2011
Repaired:	April 28, 2014
Calibrated:	May 15, 2014

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3820

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)^2)[A]	0.41	0.48	0.51	± 10.1 %
DCP (mV)[B]	101.9	94.0	97.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	144.8	±3.5 %
		Y	0.0	0.0	1.0		131.9	
		Z	0.0	0.0	1.0		142.9	

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 NormX,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:3820

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)	Unct. (k=2)
750	41.9	0.89	9.55	9.55	9.55	0.41	0.88	± 12.0 %
835	41.5	0.90	9.22	9.22	9.22	0.30	1.08	± 12.0 %
900	41.5	0.97	9.23	9.23	9.23	0.47	0.78	± 12.0 %
1450	40.5	1.20	8.49	8.49	8.49	0.27	1.21	± 12.0 %
1750	40.1	1.37	8.26	8.26	8.26	0.80	0.59	± 12.0 %
1900	40.0	1.40	7.73	7.73	7.73	0.58	0.68	± 12.0 %
2100	39.8	1.49	7.71	7.71	7.71	0.75	0.58	± 12.0 %
2450	39.2	1.80	6.85	6.85	6.85	0.41	0.85	± 12.0 %
2600	39.0	1.96	6.73	6.73	6.73	0.40	0.85	± 12.0 %
5200	36.0	4.66	4.94	4.94	4.94	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.66	4.66	4.66	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.70	4.70	4.70	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.47	4.47	4.47	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.29	4.29	4.29	0.40	1.80	± 13.1 %

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3820

Calibration Parameter Determined in Body Tissue Simulating Media

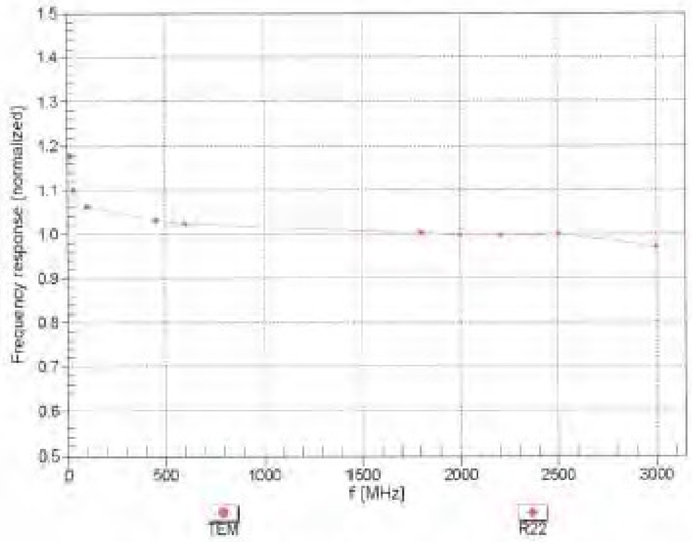
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	9.12	9.12	9.12	0.42	0.92	± 12.0 %
835	55.2	0.97	9.01	9.01	9.01	0.37	0.97	± 12.0 %
900	55.0	1.05	8.83	8.83	8.83	0.59	0.73	± 12.0 %
1450	54.0	1.30	7.88	7.88	7.88	0.58	0.73	± 12.0 %
1750	53.4	1.49	7.48	7.48	7.48	0.80	0.61	± 12.0 %
1900	53.3	1.52	7.23	7.23	7.23	0.63	0.70	± 12.0 %
2100	53.2	1.62	7.54	7.54	7.54	0.53	0.75	± 12.0 %
2450	52.7	1.95	6.87	6.87	6.87	0.80	0.58	± 12.0 %
2600	52.5	2.16	6.63	6.63	6.63	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.44	4.44	4.44	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.25	4.25	4.25	0.40	1.90	± 13.1 %
5500	48.6	5.65	3.99	3.99	3.99	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.83	3.83	3.83	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.00	4.00	4.00	0.50	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[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.

EX3DV4– SN:3820 May 15, 2014

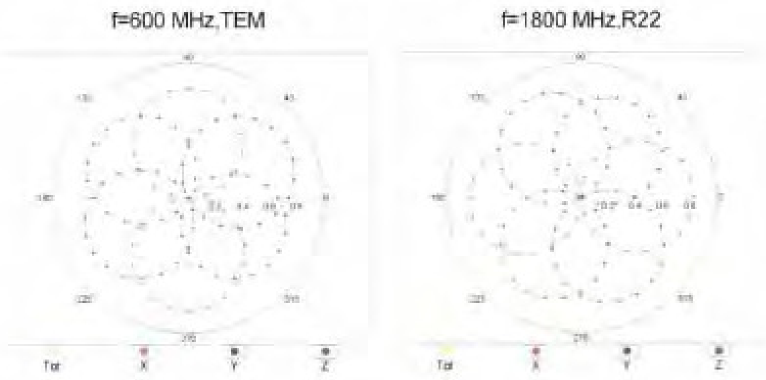
Frequency Response of E-Field

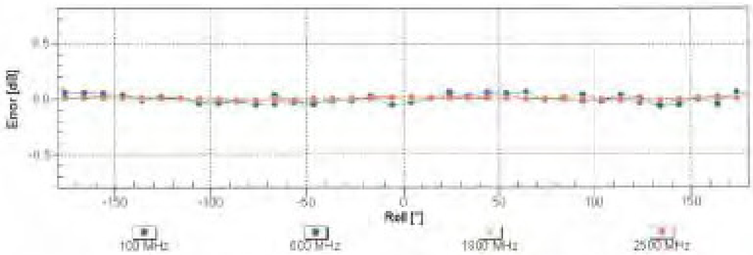
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

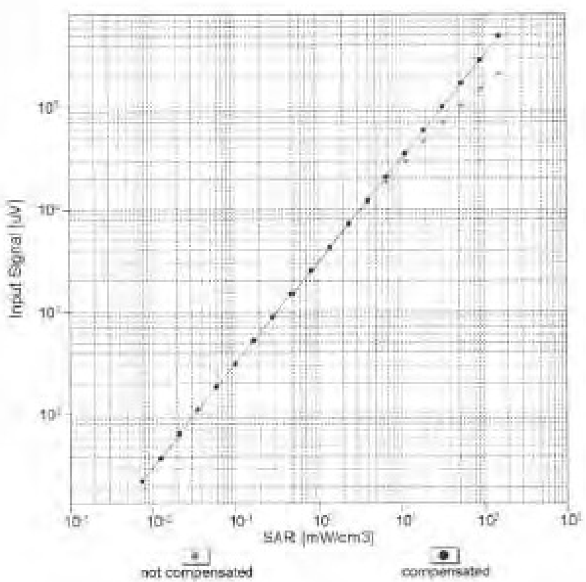
Receiving Pattern (ϕ), $\vartheta = 0°$

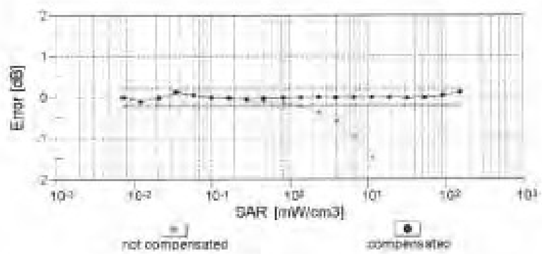




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

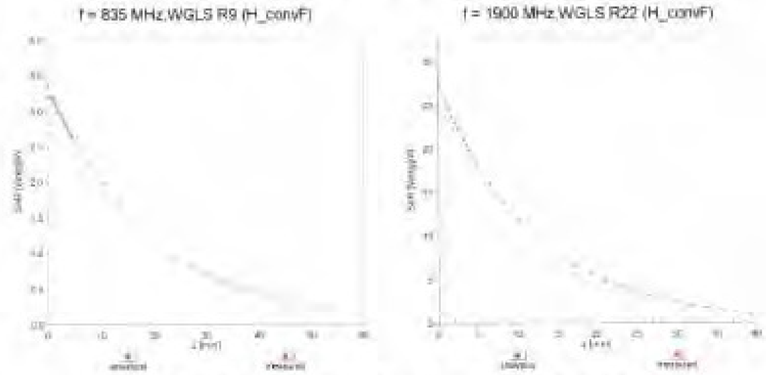




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

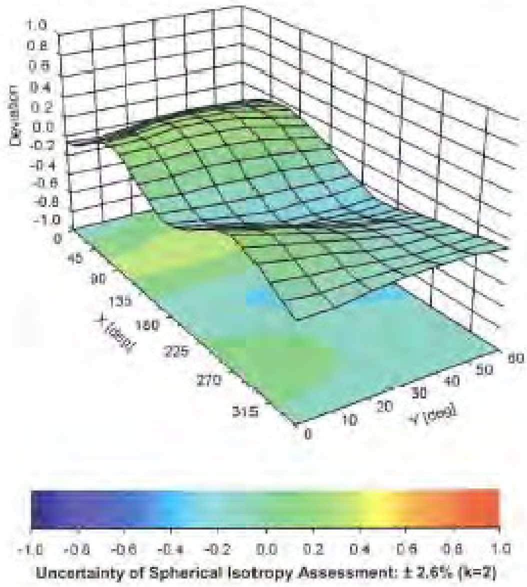
EX3DV4– SN:3820 May 15, 2014

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (φ, θ), f = 900 MHz



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

Certificate No: EX3-3820_May14 Page 10 of 11

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3820

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-56
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	2 mm

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)
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **EX3-3831_Jan15**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3831

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: January 29, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Jason Kastner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 29, 2015

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

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

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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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

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).

Probe EX3DV4

SN:3831

Manufactured: September 6, 2011
Calibrated: January 29, 2015

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3831

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.45	0.42	0.43	± 10.1 %
DCP (mV)[B]	99.7	101.1	100.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	152.6	±3.5 %
		Y	0.0	0.0	1.0		143.5	
		Z	0.0	0.0	1.0		145.4	

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

[A] The uncertainties of NormX,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:3831

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)	Unct. (k=2)
750	41.9	0.89	9.28	9.28	9.28	0.31	0.99	± 12.0 %
835	41.5	0.90	8.95	8.95	8.95	0.28	1.17	± 12.0 %
900	41.5	0.97	8.76	8.76	8.76	0.25	1.23	± 12.0 %
1450	40.5	1.20	7.92	7.92	7.92	0.13	1.92	± 12.0 %
1750	40.1	1.37	7.75	7.75	7.75	0.32	0.89	± 12.0 %
1900	40.0	1.40	7.58	7.58	7.58	0.63	0.65	± 12.0 %
2000	40.0	1.40	7.48	7.48	7.48	0.80	0.57	± 12.0 %
2300	39.5	1.67	7.09	7.09	7.09	0.27	0.99	± 12.0 %
2450	39.2	1.80	6.81	6.81	6.81	0.51	0.68	± 12.0 %
2600	39.0	1.96	6.54	6.54	6.54	0.28	1.01	± 12.0 %
5250	35.9	4.71	4.60	4.60	4.60	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.14	4.14	4.14	0.45	1.80	± 13.1 %
5750	35.4	5.22	4.41	4.41	4.41	0.45	1.80	± 13.1 %

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

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

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3831

Calibration Parameter Determined in Body Tissue Simulating Media

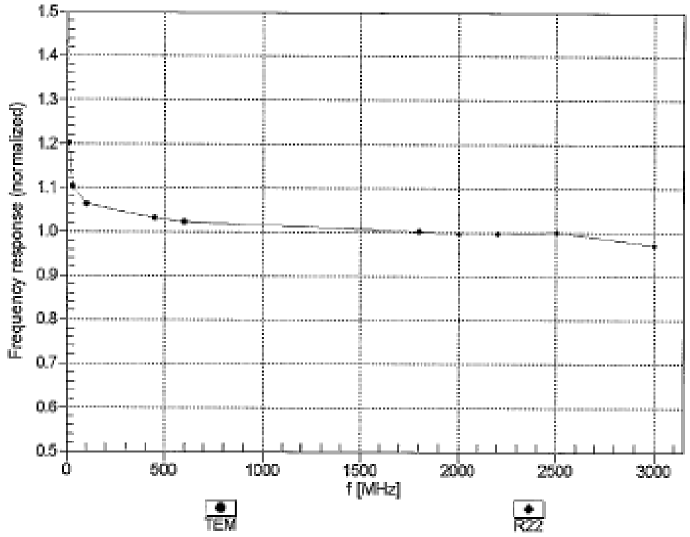
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	9.07	9.07	9.07	0.20	1.58	± 12.0 %
835	55.2	0.97	9.00	9.00	9.00	0.25	1.30	± 12.0 %
900	55.0	1.05	8.87	8.87	8.87	0.33	1.00	± 12.0 %
1450	54.0	1.30	7.68	7.68	7.68	0.19	1.44	± 12.0 %
1750	53.4	1.49	7.50	7.50	7.50	0.40	0.89	± 12.0 %
1900	53.3	1.52	7.34	7.34	7.34	0.31	1.06	± 12.0 %
2000	53.3	1.52	7.41	7.41	7.41	0.33	0.98	± 12.0 %
2300	52.9	1.81	7.08	7.08	7.08	0.40	0.89	± 12.0 %
2450	52.7	1.95	6.81	6.81	6.81	0.44	0.80	± 12.0 %
2600	52.5	2.16	6.65	6.65	6.65	0.80	0.58	± 12.0 %
5250	48.9	5.36	3.92	3.92	3.92	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.49	3.49	3.49	0.55	1.90	± 13.1 %
5750	48.3	5.94	3.70	3.70	3.70	0.55	1.90	± 13.1 %

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

EX3DV4– SN:3831 January 29, 2015

Frequency Response of E-Field

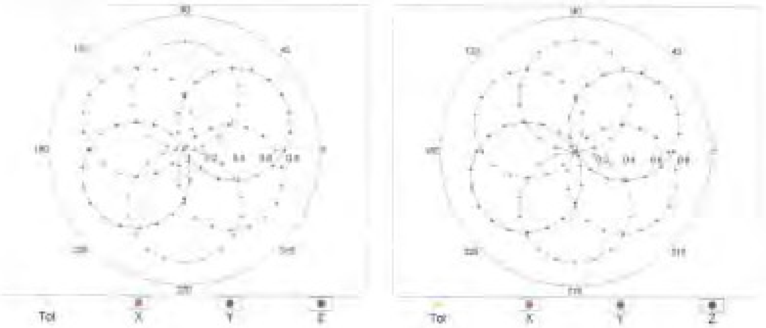
(TEM-Cell:ifi110 EXX, Waveguide: R22)

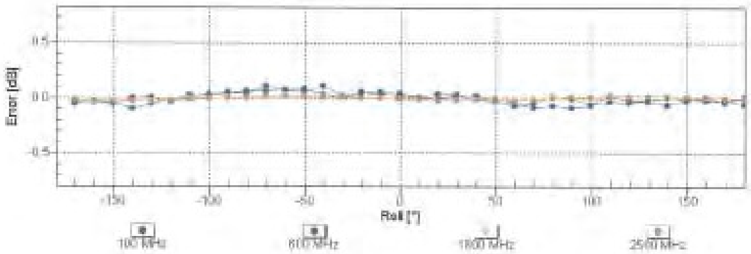


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (φ), ϑ = 0°

f=600 MHz,TEM f=1800 MHz,R22

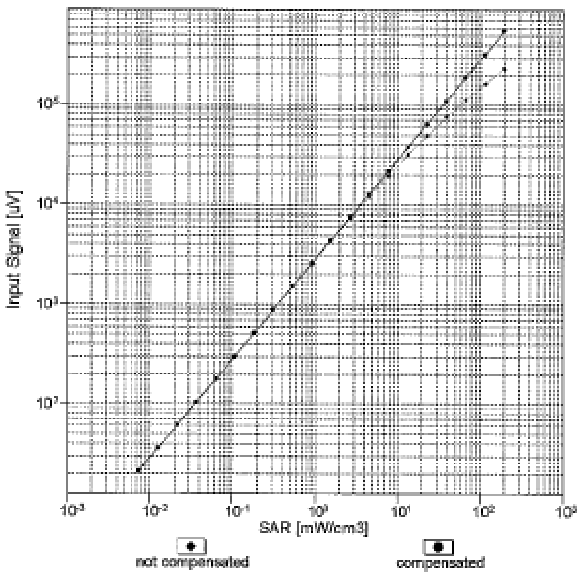


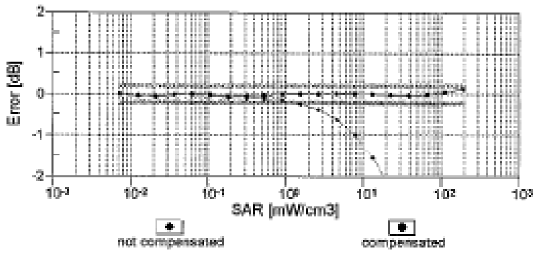


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)

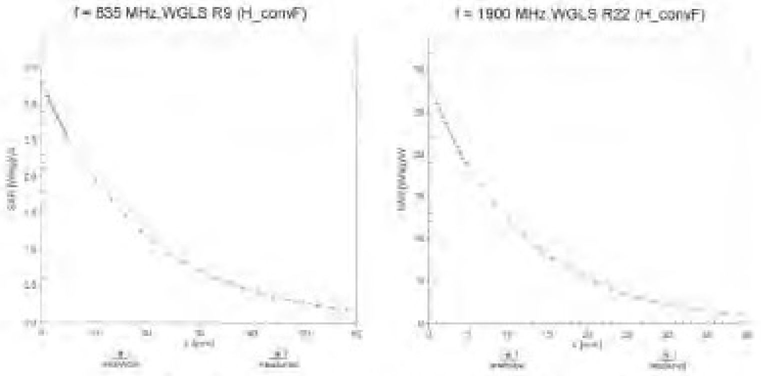
(TEM cell , f_{eval}= 1900 MHz)





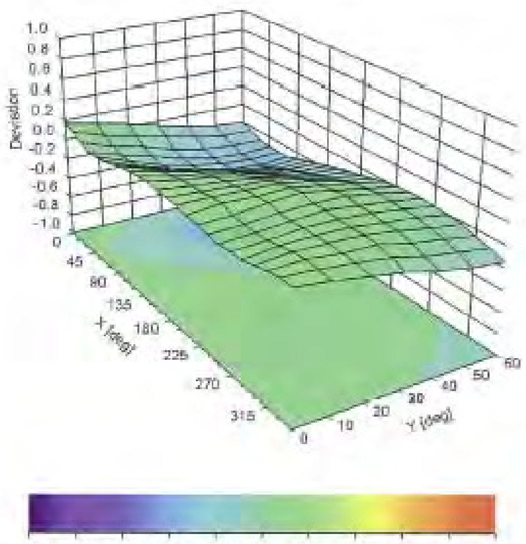
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3831

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-20.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

8. Uncertainty Budget

Measurement Uncertainty evaluation template for DUT SAR test
IEEE 1528

A	c	D	e		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probability Distributioi	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.55%	N	1	1	1	1	6.55%	6.55%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	∞
Isotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	∞
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	∞
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	∞
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	∞
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	∞
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	∞
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	∞
Probe Positioning with respect to phantom shell	2.90%	R	√3	1.732	1	1	1.67%	1.67%	∞
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Test Sample related									
Test sample positioning	2.90%	N	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	N	1	1	1	1	3.60%	3.60%	M-1
Drift of output power	5.00%	R	√3	1.732	1	1	2.89%	2.89%	∞
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	∞
Deviation from reference liquid target ε 'r(Body)	3.85%	N	1	1	0.64	0.43	2.46%	1.66%	M
Deviation from reference liquid target σ (Body)	3.21%	N	1	1	0.6	0.49	1.93%	1.57%	M
Liquid conductivity σ — temperature uncertainty	2.60%	R	√3	1.732	0.78	0.71	1.17%	1.07%	∞
Liquid permittivity ε — temperature uncertainty	1.80%	R	√3	1.732	0.23	0.26	0.24%	0.27%	∞
Combined standard uncertainty		RSS					12.05%	11.84%	
Expant uncertainty (95% confidence interval), K=2							24.09%	23.69%	

9. Phantom Description

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Certificate of Conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer	SPEAG Zeughausstrasse 43 CH-8004 Zürich Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series items (called samples) or are tested at each item.

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness of shell	Compliant with the requirements according to the standards	2mm +/- 0.2mm in flat and specific areas of head section	First article, Samples, TP-1314 ff.
Material thickness at ERP	Compliant with the requirements according to the standards	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	Dielectric parameters for required frequencies	300 MHz – 6 GHz: Relative permittivity < 5, Loss tangent < 0.05	Material samples
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility.	DEGMBE based simulating liquids	Pre-series, First article, Material samples
Sagging	Compliant with the requirements according to the standards. Sagging of the flat section when filled with tissue simulating liquid.	< 1% typical < 0.8% if filled with 155mm of HSL900 and without DUT below	Prototypes, Sample testing

Standards

[1] CENELEC EN 50361
[2] IEEE Std 1528-2003
[3] IEC 62209 Part I
[4] FCC OET Bulletin 65, Supplement C, Edition 01-01
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standards [1] to [4].

Date 07.07.2005

Signature / Stamp

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Doc No 881 – QD 000 P40 C – F Page 1 (1)

10. System Validation from Original Equipment Supplier

Calibration Laboratory of
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Accreditation No.: **SCS 108**

Client **SGS-TW (Auden)**

Certificate No: **D2450V2-727_Apr14**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 727

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

Calibration date: April 23, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: April 23, 2014

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

Certificate No: D2450V2-727_Apr14 Page 1 of 8

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	38.2 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 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	50.6 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.3 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.6 Ω + 1.9 jΩ
Return Loss	- 26.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.1 Ω + 3.5 jΩ
Return Loss	- 28.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.146 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 09, 2003

DASY5 Validation Report for Head TSL

Date: 23.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

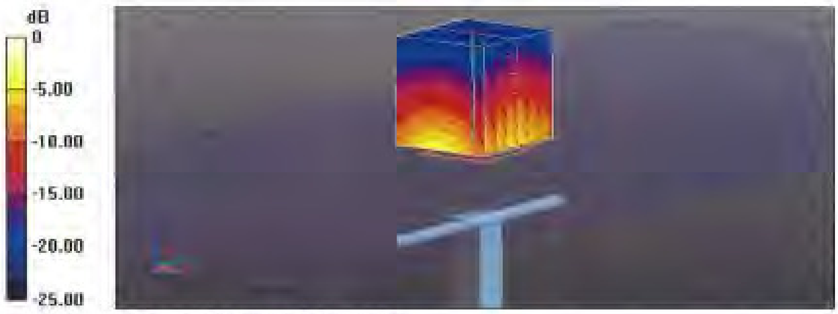
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 727

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.81 S/m; ε_r = 38.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

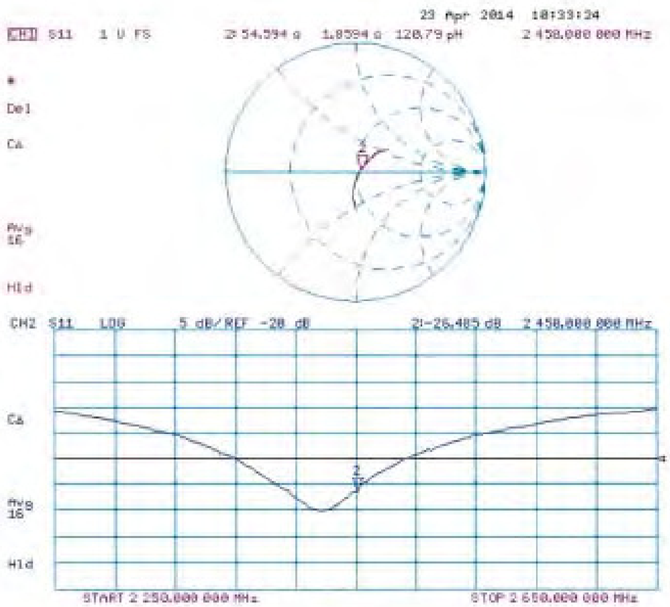
- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.01 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 27.0 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.09 W/kg
Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 12.33 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

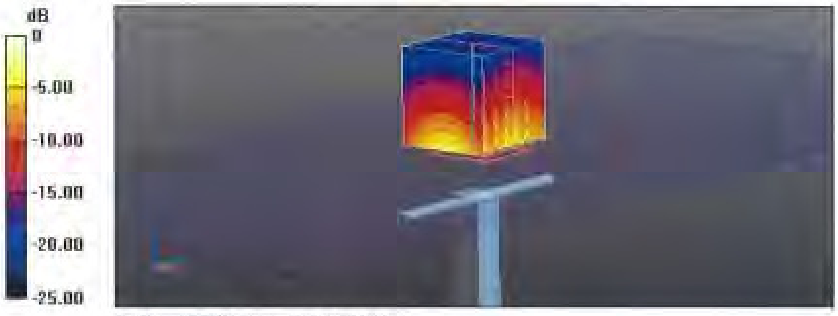
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 727

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.01 S/m; ε_r = 50.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

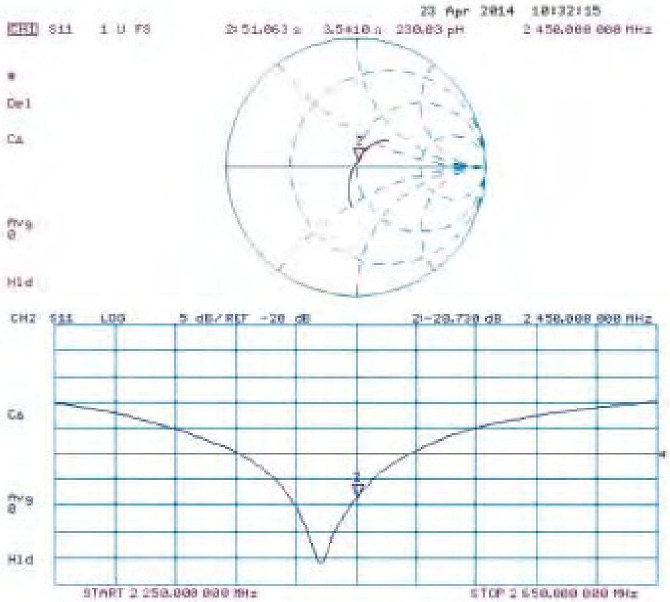
- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.356 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.9 W/kg
Maximum value of SAR (measured) = 16.7 W/kg



0 dB = 16.7 W/kg = 12.23 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **D5GHzV2-1023_Jan15**

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN:1023

Calibration procedure(s): QA CAL-22.v2
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: January 29, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe EX3DV4	SN: 3503	30-Dec-14 (No. EX3-3503_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: January 29, 2015

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
c) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 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	36.3 ± 6 %	4.56 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.78 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.66 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.7 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.7 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	5.16 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.4 ± 6 %	5.42 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.33 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.5 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.2 ± 6 %	5.55 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.7 ± 6 %	5.96 mho/m ± 6 %
Body TSL temperature change during test	≤ 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.4 ± 6 %	6.25 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.54 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	49.2 Ω - 8.5 jΩ
Return Loss	- 21.4 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	51.0 Ω - 3.8 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.4 Ω - 2.7 jΩ
Return Loss	- 27.5 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.6 Ω + 1.0 jΩ
Return Loss	- 25.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.0 Ω - 7.1 jΩ
Return Loss	- 22.8 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.5 Ω - 2.2 jΩ
Return Loss	- 31.7 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	54.0 Ω - 1.5 jΩ
Return Loss	- 26.8 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.8 Ω + 2.8 jΩ
Return Loss	- 24.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 05, 2004

DASY5 Validation Report for Head TSL

Date: 28.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1023

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.56 S/m; ε_r = 36.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.66 S/m; ε_r = 36.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.97 S/m; ε_r = 35.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.18 S/m; ε_r = 35.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

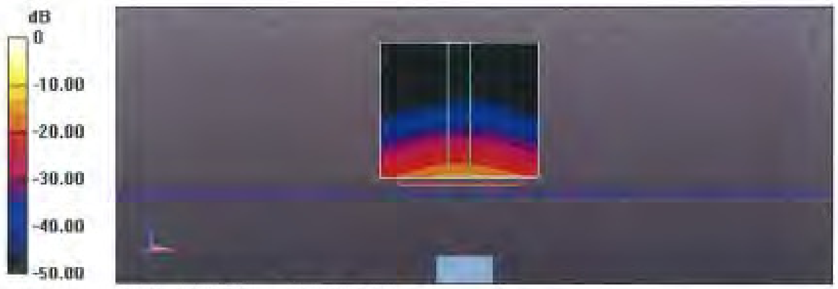
- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51); Calibrated: 30.12.2014, ConvF(5.21, 5.21, 5.21); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.14 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.22 W/kg
Maximum value of SAR (measured) = 17.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.47 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 18.6 W/kg

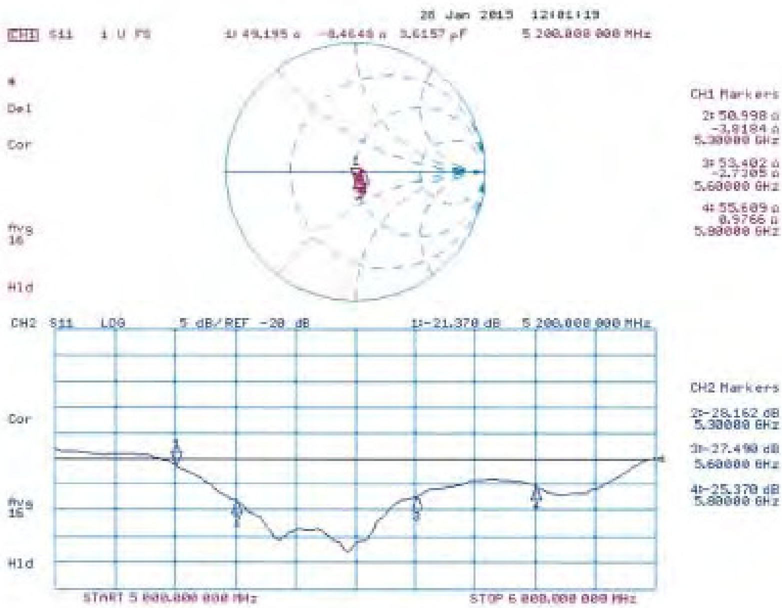
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.68 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 18.9 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 = 61.76 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 7.82 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 18.4 W/kg



0 dB = 17.8 W/kg = 12.50 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 29.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1023

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.42 S/m; ε_r = 49.4; ρ = 1000 kg/m³ , Medium parameters used: f = 5300 MHz; σ = 5.55 S/m; ε_r = 49.2; ρ = 1000 kg/m³ , Medium parameters used: f = 5600 MHz; σ = 5.96 S/m; ε_r = 48.7; ρ = 1000 kg/m³ , Medium parameters used: f = 5800 MHz; σ = 6.25 S/m; ε_r = 48.4; ρ = 1000 kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

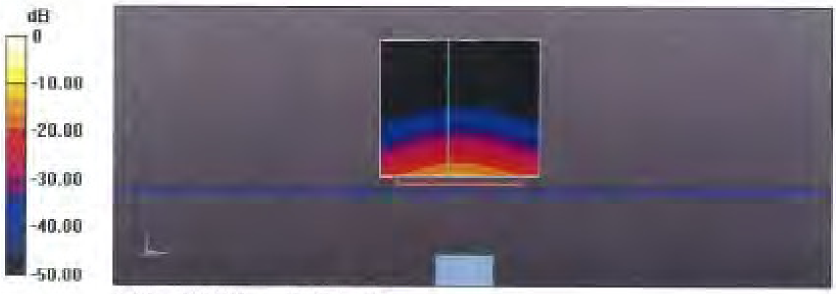
- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95); Calibrated: 30.12.2014, ConvF(4.78, 4.78, 4.78); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 57.97 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 28.6 W/kg
SAR(1 g) = 7.33 W/kg; SAR(10 g) = 2.04 W/kg
Maximum value of SAR (measured) = 17.3 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 = 57.58 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 30.0 W/kg
SAR(1 g) = 7.45 W/kg; SAR(10 g) = 2.07 W/kg
Maximum value of SAR (measured) = 17.8 W/kg

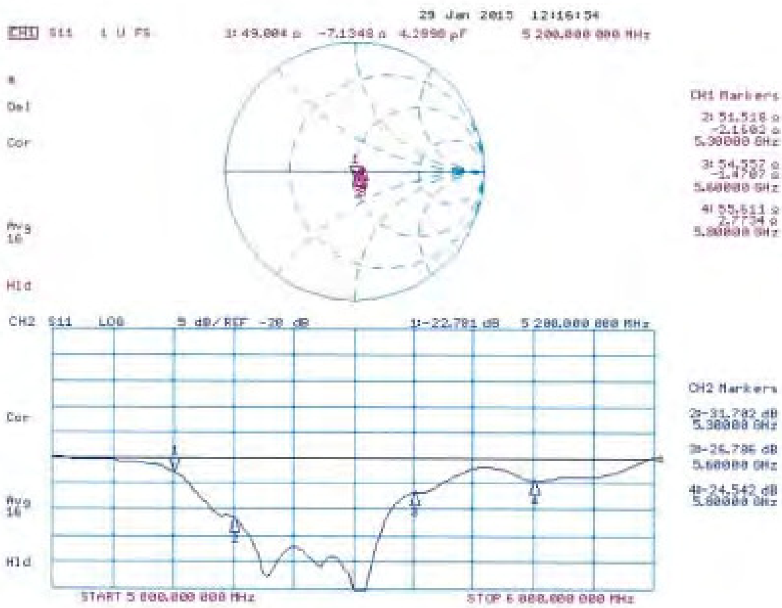
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 56.88 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 34.4 W/kg
SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.15 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.10 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 7.54 W/kg; SAR(10 g) = 2.07 W/kg
Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

Impedance Measurement Plot for Body TSL



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- End of 1st part of report -