

SAR TEST REPORT



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

Equipment Under Test	HUAWEI MateBook		
Brand Name	HUAWEI		
Model No.	PL-W29		
Series Model No.	PL-W09 , PL-W19		
Company Name	Huawei Technologies Co., Ltd.		
Company Address	Administration Building, Headquarters of Huawei		
	Technologies Co., Ltd., Bantian, Longgang District,		
	Shenzhen, 518129, China		
Standards	IEEE/ANSI C95.1-1992, IEEE 1528-2013,		
	KDB248227D01v02r02,KDB865664D01v01r04,		
	KDB865664D02v01r02,KDB447498D01v06,		
	KDB616217D04v01r02		
FCC ID	QISPL-WX9		
Date of Receipt	Jan. 09, 2017		
Date of Test(s)	Jan. 26, 2017 ~ Feb. 02, 2017		
Date of Issue	Mar. 01, 2017		
In the configuration tested the FLIT	complied with the standards specified above		

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

Jimmy Chan

Jimmy Chang Date: Mar. 01, 2017

Supervisor

Kicky Wrang

Ricky Huang Date: Mar. 01, 2017



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Revision History

Revision	Description	Issue Date
Rev.00	Initial creation of document	Mar. 01, 2017
		•



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1. General Information

1.1 Testing Laboratory

SGS Taiwan Ltd. Electronics & Communication Laboratory		
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Tel	+886-2-2299-3279	
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nternet http://www.tw.sgs.com/		

1.2 Details of Applicant

Company Name	Huawei Technologies Co., Ltd.	
	Administration Building, Headquarters of Huawei	
Company Address	Technologies Co., Ltd., Bantian, Longgang District,	
	Shenzhen, 518129, China	



1.3 Description of EUT

Equipment Under Test	HUAWEI MateBook			
Brand Name	HUAWEI			
Model No.	PL-W29			
Series Model No.	PL-W09 , PL-W19			
Model difference	Only Marketing Purpose. Layout and comp	onents	are th	e same.
FCC ID	QISPL-WX9			
Antenna Designation (Maximum Gain)	Main_2.45GHz: 0.94dBi, 5GHz: 0.92d Aux_2.45GHz: -2.30dBi, 5GHz: 0.97dB			
Mode of Operation	WLAN802.11 a/b/g/n(20M/40M)/ac(20M/40)M/80	M)
Duty Cycle	WLAN802.11 a/b/g/n(20M/40M)/ ac(20M/40M/80M)		1	
,	Bluetooth		1	
	WLAN802.11 b/g/n(20M)	2412	_	2462
	WLAN802.11 n(40M)	2422	_	2452
	WLAN802.11 a/n(20M)/ac(20M) 5.2G	5180	_	5240
	WLAN802.11 n(40M)/ac(40M) 5.2G		_	5230
	WLAN802.11 ac(80M) 5.2G	5210		
	WLAN802.11 a/n(20M)/ac(20M) 5.3G	5260	_	5320
	WLAN802.11 n(40M)/ac(40M) 5.3G	5270	_	5310
TX Frequency Range (MHz)	WLAN802.11 ac(80M) 5.3G	5290		
(WLAN802.11 a/n/ac(20M) 5.6G	5500	_	5720
	WLAN802.11 n/ac(40M) 5.6G	5510	_	5710
	WLAN802.11 ac(80M) 5.6G	5530	_	5690
	WLAN802.11 a/n(20M)/ac(20M) 5.8G	5745	_	5825
	WLAN802.11 n(40M)/ac(40M) 5.8G	5710	_	5795
	WLAN802.11 ac(80M) 5.8G		5775	
	Bluetooth	2402	_	2480

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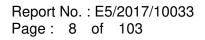
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	WLAN802.11 b/g/n(20M)		—	11
	WLAN802.11 n(40M)	3	—	9
	WLAN802.11 a/n(20M)/ac(20M) 5.2G	36	—	48
	WLAN802.11 n(40M)/ac(40M) 5.2G	38	—	46
	WLAN802.11 ac(80M) 5.2G		42	
	WLAN802.11 a/n(20M)/ac(20M) 5.3G	52	_	64
	WLAN802.11 n(40M)/ac(40M) 5.3G		_	62
Channel Number (ARFCN)	WLAN802.11 ac(80M) 5.3G		58	
	WLAN802.11 a/n/ac(20M) 5.6G	100	_	144
	WLAN802.11 n/ac(40M) 5.6G	102	—	142
	WLAN802.11 ac(80M) 5.6G	106	_	138
	WLAN802.11 a/n(20M)/ac(20M) 5.8G	149	—	165
	WLAN802.11 n(40M)/ac(40M) 5.8G		_	159
	WLAN802.11 ac(80M) 5.8G		155	
	Bluetooth	0	_	78



	Max. SAR (1 g) (Unit: W/Kg)				
Antenna	Band	Measured	Reported	Channel	Position
	WLAN802.11b	0.624	0.634	11	Bottom side
	WLAN802.11 ac(80M) 5.2G	1.160	1.163	42	Bottom side
Main	WLAN802.11 a 5.3G	1.080	1.087	52	Bottom side
Main	WLAN802.11 n(40M) 5.3G	1.120	1.130	54	Bottom side
	WLAN802.11 ac(80M) 5.6G	1.050	1.055	106	Bottom side
	WLAN802.11 ac(80M) 5.8G	0.883	0.899	155	Bottom side
	WLAN802.11b	0.574	0.582	11	Bottom side
	Bluetooth (GFSK)	0.079	0.083	78	Bottom side
	WLAN802.11 ac(80M) 5.2G	0.900	0.917	42	Bottom side
Aux	WLAN802.11 a 5.3G	1.010	1.024	56	Bottom side
	WLAN802.11 n(40M) 5.3G	1.020	1.044	54	Bottom side
	WLAN802.11 ac(80M) 5.6G	1.080	1.113	122	Bottom side
	WLAN802.11 ac(80M) 5.8G	0.969	0.989	155	Bottom side





Antenna	SI	SO	MIMO
Band	Chain 0	Chain 1	Chain0+1
WLAN802.11b	V	V	—
WLAN802.11g	V	V	—
WLAN802.11n(20M)	V	V	V
WLAN802.11n(40M)	V	V	V
WLAN802.11ac	V	V	V
WLAN802.11a	V	V	—
WLAN802.11n(20M) 5G	V	V	V
WLAN802.11n(40M) 5G	V	V	V
WLAN802.11ac(20M) 5G	V	V	V
WLAN802.11ac(40M) 5G	V	V	V
WLAN802.11ac(80M) 5G	V	V	V

WLAN802.11 a/b/g/n(20M/40M)/ac(20M/40M/80M) conducted power table:

Main (CH0)

	802.11 b	Max. Rated Avg.	Average conducted output power (dBm)
СН	Frequency	Power + Max. Tolerance (dBm)	Data Rate (Mbps)
OIT	(MHz)		1
1	2412	19	18.89
6	2437	19	18.92
11	2462	19	18.93

	802.11 g	Max. Rated Avg.	Average conducted output power (dBm)
СН	Frequency	Power + Max. Tolerance (dBm)	Data Rate (Mbps)
СП	(MHz)		6
1	2412	17	16.95
6	2437	17	16.93
11	2462	17	16.96

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Main (CH0)

802	2.11 n(20M)	Max. Rated Avg.	Average conducted output power (dBm)
СН	Frequency	Power + Max. Tolerance (dBm)	Data Rate (Mbps)
СП	(MHz)		6.5
1	2412	19	18.87
6	2437	19	18.92
11	2462	19	18.91

802.11 n(40M)		Max. Rated Avg. Power + Max.	Average conducted output power (dBm)
Frequency	Data Rate (Mbps)		
СП	CH (MHz) Tolerance (dBm)	13.5	
3	2422	18.5	18.47
6	2437	18.5	18.43
9	2452	18.5	18.40



Main (CH0)				
802.11 a		May Dated Ave	Average conducted output	
5.2/5	5.3/5.6/5.8G	Max. Rated Avg. Power + Max.	power(dBm)	
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)	
	(MHz)		6	
36	5180	18	17.93	
40	5200	18	17.95	
44	5220	18	17.98	
48	5240	18	17.94	
52	5260	18	17.97	
56	5280	18	17.91	
60	5300	18	17.99	
64	5320	18	17.90	
100	5500	16.5	16.43	
120	5600	16.5	16.40	
124	5620	16.5	16.33	
128	5640	16.5	16.38	
140	5700	16.5	16.44	
149	5745	16.5	16.42	
157	5785	16.5	16.38	
165	5825	16.5	16.43	



802.11 n(20M)		Max. Rated Avg. Power + Max.	Average conducted output power(dBm)
5.2/5.3/5.6/5.8G			
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)
OIT	(MHz)		6.5
36	5180	18	17.96
40	5200	18	17.91
44	5220	18	17.94
48	5240	18	17.99
52	5260	18	17.98
56	5280	18	17.95
60	5300	18	17.96
64	5320	18	17.93
100	5500	16.5	16.41
120	5600	16.5	16.40
124	5620	16.5	16.36
128	5640	16.5	16.31
140	5700	15.5	15.43
149	5745	16.5	16.43
157	5785	16.5	16.41
165	5825	16.5	16.37



Main (CH0)

802.11 n(40M)			Average conducted output
5.2/5	5.3/5.6/5.8G	Max. Rated Avg. Power + Max. Tolerance (dBm)	power(dBm)
СН	Frequency		Data Rate (Mbps)
	(MHz)		13.5
38	5190	18	17.98
46	5230	18	17.93
54	5270	18	17.96
62	5310	16	15.95
102	5510	16.5	16.35
118	5590	16.5	16.41
126	5630	16.5	16.40
134	5670	16.5	16.44
151	5755	16.5	16.40
159	5795	16.5	16.39



Main (CH0)

802.11 ac(20M)		Max. Rated Avg. Power + Max.	Average conducted output power(dBm)
5.2/5.3/5.6/5.8G			
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)
	(MHz)		6.5
36	5180	18	17.90
40	5200	18	17.96
44	5220	18	17.99
48	5240	18	17.97
52	5260	18	17.94
56	5280	18	17.95
60	5300	18	17.98
64	5320	18	17.92
100	5500	16.5	16.44
120	5600	16.5	16.39
124	5620	16.5	16.39
128	5640	16.5	16.41
140	5700	15.5	15.42
144	5720	16.5	16.38
149	5745	16.5	16.43
157	5785	16.5	16.40
165	5825	16.5	16.42



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802.11 ac(40M)			Average conducted output
5.2/5	5.3/5.6/5.8G	Max. Rated Avg. Power + Max.	power(dBm)
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)
	(MHz)		13.5
38	5190	18	17.90
46	5230	18	17.95
54	5270	18	17.99
62	5310	16	15.96
102	5510	16.5	16.39
118	5590	16.5	16.44
126	5630	16.5	16.42
134	5670	16.5	16.42
142	5710	16.5	16.40
151	5755	16.5	16.41
159	5795	16.5	16.37

802.11 ac(80M)			Average conducted output
5.2/5	5.3/5.6/5.8G	Max. Rated Avg. Power + Max. Tolerance (dBm)	power(dBm)
СН	Frequency		Data Rate (Mbps)
ОП	(MHz)		29.3
42	5210	18	17.99
58	5290	14.5	14.38
106	5530	16.5	16.48
122	5610	16.5	16.45
138	5690	16.5	16.40
155	5775	16.5	16.42

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Aux (CH1)

	802.11 b	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average conducted output power (dBm)
СН	Frequency		Data Rate (Mbps)
СП	(MHz)		1
1	2412	19	18.88
6	2437	19	18.86
11	2462	19	18.94

802.11 g		Max. Rated Avg.	Average conducted output power (dBm)
СЦ	CH Frequency	Power + Max. Tolerance (dBm)	Data Rate (Mbps)
СП	(MHz)		6
1	2412	17	16.87
6	2437	17	16.92
11	2462	17	16.91

802.11 n(20M)		Max. Rated Avg.	Average conducted output power (dBm)
СН	Frequency	Power + Max. Tolerance (dBm)	Data Rate (Mbps)
СП	(MHz)		6.5
1	2412	19	18.93
6	2437	19	18.98
11	2462	19	18.96

802.11 n(40M)		Max. Rated Avg.	Average conducted output power (dBm)
СН	Frequency	Power + Max.	Data Rate (Mbps)
СП	(MHz)	Tolerance (dBm)	13.5
3	2422	18.5	18.44
6	2437	18.5	18.40
9	2452	18.5	18.43

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Aux (CH1)				
802.11 a		Max. Rated Avg.	Average conducted output power(dBm)	
5.2/5	5.3/5.6/5.8G	Power + Max.	power(dBill)	
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)	
ОП	(MHz)		6	
36	5180	18	17.95	
40	5200	18	17.98	
44	5220	18	17.96	
48	5240	18	17.92	
52	5260	18	17.90	
56	5280	18	17.94	
60	5300	18	17.88	
64	5320	18	17.91	
100	5340	16.5	16.39	
120	5600	16.5	16.41	
124	5620	16.5	16.40	
128	5640	16.5	16.39	
140	5700	16.5	16.40	
149	5745	16.5	16.44	
157	5785	16.5	16.43	
165	5825	16.5	16.38	



Aux (CH1)				
802.11 n(20M)			Average conducted output	
5.2/5	5.3/5.6/5.8G	Max. Rated Avg. Power + Max.	power(dBm)	
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)	
	(MHz)		6.5	
36	5180	18	17.87	
40	5200	18	17.90	
44	5220	18	17.94	
48	5240	18	17.92	
52	5260	18	17.97	
56	5280	18	17.98	
60	5300	18	17.96	
64	5320	18	17.99	
100	5500	16.5	16.43	
120	5600	16.5	16.36	
124	5620	16.5	16.42	
128	5640	16.5	16.32	
140	5700	15.5	15.41	
149	5745	16.5	16.44	
157	5785	16.5	16.38	
165	5825	16.5	16.41	



Aux ((CH1)
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802.11 n(40M)			Average conducted output	
5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max.	power(dBm)	
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)	
	(MHz)		13.5	
38	5190	18	17.87	
46	5230	18	17.94	
54	5270	18	17.90	
62	5310	16	15.93	
102	5510	16.5	16.43	
118	5590	16.5	16.37	
126	5630	16.5	16.44	
134	5670	16.5	16.35	
151	5755	16.5	16.41	
159	5795	16.5	16.40	



Aux	(CH1)

802.11 ac(20M)			Average conducted output power(dBm)	
5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max.		
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)	
	(MHz)		6.5	
36	5180	18	17.93	
40	5200	18	17.91	
44	5220	18	17.95	
48	5240	18	17.90	
52	5260	18	17.98	
56	5280	18	17.94	
60	5300	18	17.92	
64	5320	18	17.99	
100	5500	16.5	16.40	
120	5600	16.5	16.42	
124	5620	16.5	16.35	
128	5640	16.5	16.39	
140	5700	15.5	15.44	
144	5720	16.5	16.44	
149	5745	16.5	16.41	
157	5785	16.5	16.39	
165	5825	16.5	16.43	



Aux (C	Aux (CH1)				
802.	11 ac(40M)		Average conducted output		
5.2/5	5.3/5.6/5.8G	Max. Rated Avg. Power + Max.	power(dBm)		
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)		
	(MHz)		13.5		
38	5190	18	17.93		
46	5230	18	17.87		
54	5270	18	17.91		
62	5310	16	15.95		
102	5510	16.5	16.42		
118	5590	16.5	16.35		
126	5630	16.5	16.38		
134	5670	16.5	16.39		
142	5710	16.5	16.43		
151	5755	16.5	16.44		
159	5795	16.5	16.40		

802.11 ac(80M) 5.2/5.3/5.6/5.8G		Max. Rated Avg.	Average conducted output power(dBm)
Frequency		Power + Max. Tolerance (dBm)	Data Rate (Mbps)
СН	(MHz)		29.3
42	5210	18	17.92
58	5290	14.5	14.42
106	5530	16.5	16.38
122	5610	16.5	16.37
138	5690	16.5	16.36
155	5775	16.5	16.41

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Bluetooth conducted power table:

Frequency	Data	Max. power(dBm)	Average conduct	ed output power
(MHz)	Rate		dBm	mW
2402	1	11.5	10.81	12.050
2441	1	11.5	11.04	12.706
2480	1	11.5	11.28	13.428
2402	2	8	7.98	6.281
2441	2	8	7.86	6.109
2480	2	8	7.99	6.295
2402	3	7	6.91	4.909
2441	3	7	6.85	4.842
2480	3	7	6.89	4.887

		Average conducted output power	
Frequency (MHz)	Max. power(dBm)	BT4.0	
		dBm	mW
2402	7	6.91	4.909
2442	7	6.99	5.000
2480	7	6.96	4.966



1.4 Test Environment

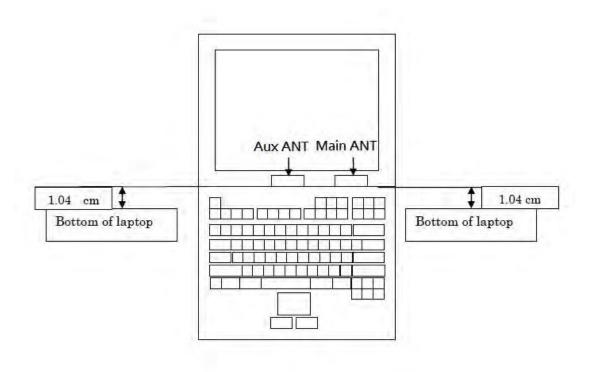
Ambient Temperature: 22±2° C Tissue Simulating Liquid: 22±2° C

1.5 Operation Description

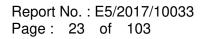
Use chipset specific software to control the EUT, and makes it transmit in maximum power. Measurements are performed respectively on the lowest, middle and highest channels of the operating band(s). The EUT is set to maximum power level during all tests, and at the beginning of each test the battery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

EUT was tested in the following configurations:

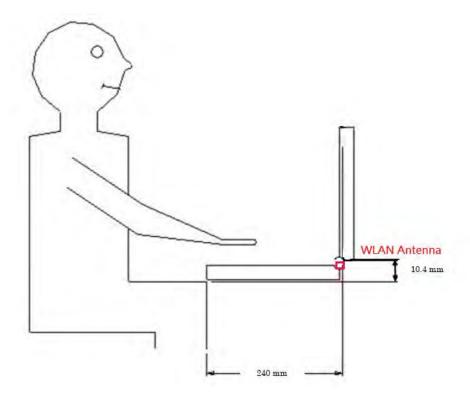
WLAN (Main / Aux): The bottom of keyboard touch the phantom (0mm)



Front view







Antenna-to-user separation distance



Note:

802.11b DSSS SAR Test Requirements:

- SAR is measured for 2.4 GHz 802.11b DSSS mode using the highest measured maximum output power channel, when the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

802.11g/n OFDM SAR Test Exclusion Requirements:

3. SAR is not required for 802.11g/n since the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Initial Test Configuration:

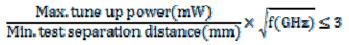
- 4. An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band.
- 5. SAR is measured using the highest measured maximum output power channel. When the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
- 6. For WLAN Main/Aux antenna, 5.2ac(80) / 5.3a/n(40) / 5.6ac(80) / 5.8ac(80) are chosen to be the initial test configurations.
- Since the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is < 1.2 W/kg, SAR is not required for subsequent test configuration.
- 8. BT and WLAN Aux use the same antenna path and Bluetooth can transmit simultaneously with WLAN Main.
- 9. According to KDB447498 D01, testing of other required channels is not required

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when the reported 1-g SAR for the highest output channel is \leq 0.8 W/kg, when the transmission band is \leq 100 MHz.

- 10. 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)
- 11.Based on KDB447498D01,
 - (1) SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances≤ 50 mm are determined by:



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(^{f(MHz)}/_{1E0})](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),



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= σ ($|Ei|^2$)/ ρ 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:

- 1. 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).
- 2. 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.
- 3. 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.

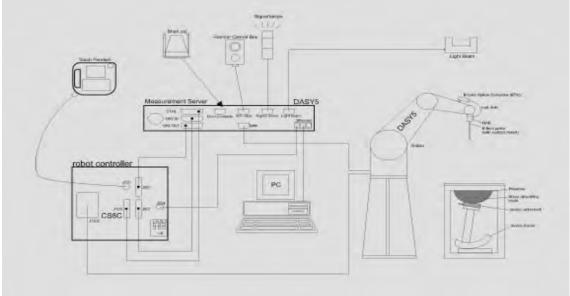


Fig. a The block diagram of SAR system



- 4. 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.
- 5. 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.
- 6. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- 7. A computer operating Windows 7.
- 8. DASY 5 software.
- 9. Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- 10. The SAM twin phantom enabling testing left-hand and right-hand usage.
- 11. The device holder for handheld mobile phones.
- 12. Tissue simulating liquid mixed according to the given recipes.
- 13. 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)	1	
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	\pm 0.3 dB in HSL (rotation around probe a) \pm 0.5 dB in tissue material (rotation normal		
Dynamic	$10 \mu\text{W/g}$ to > 100 mW/g	· · · · · · · · · · · · · · · · · · ·	
Range	Linearity: $\pm 0.2 \text{ dB}$ (noise: typically < 1 μ W/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%.		



PHANTOM

Model	ELI				
Construction	The ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.				
Shell Thickness	2 ± 0.2 mm				
Filling Volume	Approx. 30 liters				
Dimensions	Major axis: 600 mm				
	Minor axis: 400 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/ 5300/5600/5800MHz. 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 \geq 15 cm \pm 5 mm (frequency \leq 3 GHz) or \geq 10 cm \pm 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.

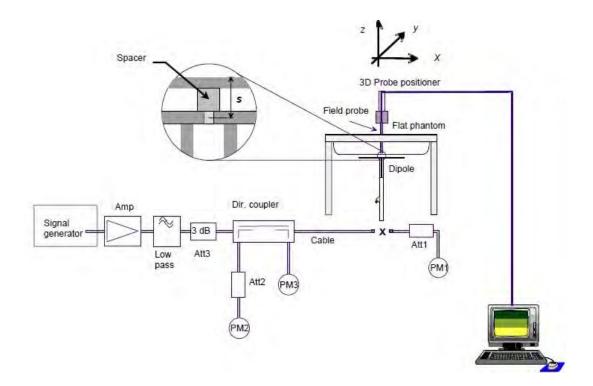
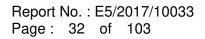


Fig. b The block diagram of system verification



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	49.6	12.5	50	0.81%	Jan. 26, 2017
D5GHzV2	1040	5200	Body	72.9	7.2	72	-1.23%	Jan. 26, 2017
		5300	Body	76.4	7.36	73.6	-3.66%	Jan. 27, 2017
		5600	Body	78.4	7.96	79.6	1.53%	Jan. 27, 2017
		5800	Body	75.2	7.53	75.3	0.13%	Feb. 02, 2017

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 measured conductivity and permittivity are all within \pm 5% of the target values.

		Magging	Tarrat	Taxaat	Magging	Magging		
Tissue Mea	Measuremen	Measured	0	Target	Measured	Measured		% dev σ
	+	Frequenc	Dielectric	Conductivity	Dielectric	Conductivity	% dev εr	
Туре	Data	У	Constant,	,	Constant,	,		
	Date	(MHz)	٤r	σ (S/m)	٤r	σ (S/m)		
		2450	52.700	1.950	50.508	1.964	4.16%	-0.72%
	Jan. 26, 2017	2462	52.685	1.967	50.492	1.979	4.16%	-0.61%
		2480	52.662	1.993	50.435	1.998	4.23%	-0.27%
	lon 26 2017	5200	49.014	5.299	48.318	5.356	1.42%	-1.07%
Body Jan. 2	Jan. 26, 2017	5210	49.001	5.311	48.495	5.387	1.03%	-1.43%
		5260	48.933	5.369	48.517	5.479	0.85%	-2.04%
		5270	48.919	5.381	48.488	5.492	0.88%	-2.06%
	Jan. 27, 2017	5280	48.906	5.393	48.464	5.507	0.90%	-2.12%
		5290	48.892	5.404	48.443	5.521	0.92%	-2.16%
		5300	48.879	5.416	48.407	5.537	0.96%	-2.23%
		5530	48.566	5.685	48.976	5.749	-0.84%	-1.13%
	Jan. 27, 2017	5600	48.471	5.766	48.846	5.853	-0.77%	-1.50%
		5610	48.458	5.778	48.812	5.864	-0.73%	-1.49%
		5690	48.349	5.872	48.648	5.975	-0.62%	-1.76%
	Fab 0 0017	5775	48.234	5.971	48.084	6.161	0.31%	-3.19%
	Feb. 2, 2017	5800	48.200	6.000	48.048	6.197	0.32%	-3.28%

Table 2. Dielectric Parameters of Tissue Simulant Fluid



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

The composition of the tissue simulating liquid:

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.

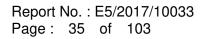
The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration 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.

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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:

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- 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 $\pm 10\%$ (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 $\pm 5\%$ (RSS) when the same liquid is used for the calibration and for actual measurements and $\pm 7-9\%$ (RSS) when not, which is in good agreement with the estimates given in [2].

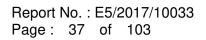
1.11.2 Calibration with Analytical Fields

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.

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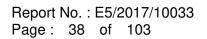




• Due to the small wavelength in liquids with high permittivity, even small setups might be above the resonant cutoff frequencies. The field distribution in the setup must be carefully checked for conformity with the theoretical field distribution.

References

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

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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 W/kg	8.00 W/kg
Spatial Average SAR (Whole Body)	0.08 W/kg	0.40 W/kg
Spatial Peak SAR (Hands/Feet/Ankle/Wrist)	4.00 W/kg	20.00 W/kg

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	Mode	Position	Distance Europe		Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling	Averaged SAR over 1g (W/kg)		Plot	
			((1)(1))		(IVIEZ)	Tolerance	(dBm)		Measured	Reported	page
	WLAN802.11 b	Bottom side	0	11	2462	19.00	18.93	101.62%	0.624	0.634	46
	WLAN802.11 ac(80M) 5.2G	Bottom side	0	42	5210	18.00	17.99	100.23%	1.160	1.163	47
	WLANOUZ. 11 ac(00101) 5.2G	Bottom side*	0	42	5210	18.00	17.99	100.23%	1.130	1.133	-
	WLAN802.11 a 5.3G	Bottom side	0	52	5260	18.00	17.97	100.69%	1.080	1.087	48
		Bottom side	0	60	5300	18.00	17.99	100.23%	1.070	1.072	-
Main		Bottom side	0	54	5270	18.00	17.96	100.93%	1.120	1.130	49
IVIAIII	WLAN802.11 n(40M) 5.3G	Bottom side*	0	54	5270	18.00	17.96	100.93%	0.984	0.993	-
		Bottom side	0	62	5310	16.00	15.95	101.16%	0.803	0.812	-
		Bottom side	0	106	5530	16.50	16.48	100.46%	1.050	1.055	50
	WLAN802.11 ac(80M) 5.6G	Bottom side	0	122	5610	16.50	16.45	101.16%	0.920	0.931	-
		Bottom side	0	138	5690	16.50	16.40	102.33%	0.817	0.836	-
	WLAN802.11 ac(80M) 5.8G	Bottom side	0	155	5775	16.50	16.42	101.86%	0.883	0.899	51

* - repeated at the highest SAR measurement according to the KDB 865664 D01

Aux Antenna

Antenna	Mode	Position	Distance (mm)	СН	Eroa	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling		AR over 1g ′kg)	Plot
			(11111)		(11112)	Tolerance	(dBm)		Measured	Reported	page
	WLAN802.11 b	Bottom side	0	11	2462	19.00	18.94	101.39%	0.574	0.582	52
	Bluetooth (GFSK)	Bottom side	0	78	2480	11.50	11.28	105.20%	0.079	0.083	53
	WLAN802.11 ac(80M) 5.2G	Bottom side	0	42	5210	18.00	17.92	101.86%	0.900	0.917	54
	WLAN802.11 a 5.3G	Bottom side	0	56	5280	18.00	17.94	101.39%	1.010	1.024	55
		Bottom side	0	64	5320	18.00	17.91	102.09%	0.961	0.981	-
	WLAN802.11 n(40M) 5.3G	Bottom side	0	54	5270	18.00	17.90	102.33%	1.020	1.044	56
Aux	WLANOUZ. IT II(40101) 5.3G	Bottom side	0	62	5310	16.00	15.93	101.62%	0.711	0.723	-
		Bottom side	0	106	5530	16.50	16.38	102.80%	0.800	0.822	-
	WLAN802.11 ac(80M) 5.6G	Bottom side	0	122	5610	16.50	16.37	103.04%	1.080	1.113	57
	WLANOUZ. 11 ac(00101) 5.00	Bottom side*	0	122	5610	16.50	16.37	103.04%	1.050	1.082	-
		Bottom side	0	138	5690	16.50	16.36	103.28%	0.821	0.848	-
	WLAN802.11 ac(80M) 5.8G	Bottom side	0	155	5775	16.50	16.41	102.09%	0.969	0.989	58
	WLANOUZ. 11 80(0010) 5.00	Bottom side*	0	155	5775	16.50	16.41	102.09%	0.952	0.972	-

Note:

$$\frac{\Delta R}{\Delta R} = \frac{P_0(mW)}{10} = 10^{\binom{P_0 - P_1}{10}} (dP_m)$$

Scaling = $\frac{reported SAR}{measured SAR} = \frac{P2(mW)}{P3(mW)}$

Reported SAR = measured SAR * (scaling)

Where P2 is maximum specified power, P1 is measured conducted power

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部份複製。

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3. Simultaneous Transmission Analysis

Simultaneous Transmission Scenarios:

Body
Yes
Yes
Yes
Yes

Note:

1. Bluetooth and WLAN Aux share the same antenna path, and BT can transmit with WLAN Main simultaneously.

2. For 2.4/5GHz WLAN Main and Aux antennas, the maximum output power of each antenna during simultaneous transmission (for 802.11n/ac) is the same with or less than that used in standalone transmission (for 802.11a/b/g/n/ac), and we used the sum of 1-g SAR provision in KDB447498D01 to exclude the SAR measurement for 802.11n/ac MIMO.



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:

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

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.

3.2 SPLSR evaluation and 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.



2.4 GHz WLAN MIMO

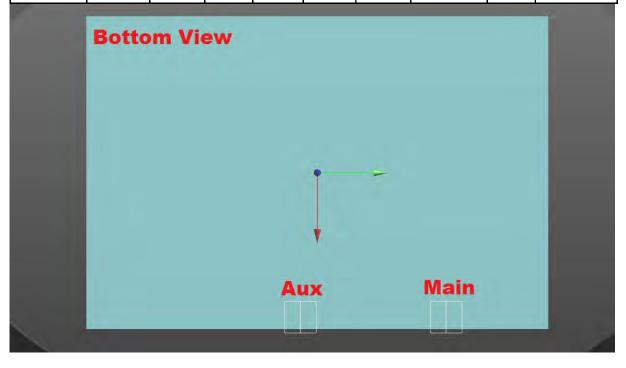
No.	Conditions	Position	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
1	2.4 GHz WLAN Main	Bottom side	0.634	0.582	1.216	ΣSAR<1.6, Not required

5 GHz WLAN MIMO

No.	Conditions	Position	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
2	5 GHz WLAN Main + WLAN Aux	Bottom side	1.163	1.113	2.276	Analyzed as below

WLAN MIMO

Conditions	Position	SAR Value	Coc	Coordinates (cm)		ΣSAR (W/kg)	Peak Location Separation	SPLSR	Simultaneous Transmission
		(W/kg)	х	У	z	(vv /kg)	Distance (mm)		SAR Test
WLAN Main	Bottom	1.163	11.16	9.80	-0.20	2.276	111.8	0.031	SPLSR<0.04,
WLAN Aux	side	1.113	11.16	-1.38	-0.24	2.270	111.0	0.031	Not required





2.4GHz WLAN Main + BT

No	. Conditions	Position	Max. WLAN Main	BT	SAR Sum	SPLSR
3	2.4 GHz WLAN Main	Bottom side	0.634	0.083	0.717	ΣSAR<1.6, Not required

5GHz WLAN Main + BT

No.	Conditions	Position	Max. WLAN Main	BT	SAR Sum	SPLSR
4	5 GHz WLAN Main + BT	Bottom side	1.163	0.083	1.246	ΣSAR<1.6, Not required



4. Instruments List

Manufacturer	Device	Туре	Serial number	Date of last calibration	Date of next calibration
Schmid & Partner Engineering AG	Dosimetric E-Field Probe	EX3DV4	3938	Nov.25,2016	Nov.24,2017
Schmid & Partner	System Validation	D2450V2	727	Apr.19,2016	Apr.18,2017
Engineering AG	Dipole	D5GHzV2	1040	Jun.17,2016	Jun.16,2017
Schmid & Partner Engineering AG	Data acquisition Electronics	DAE4	1374	Aug.23,2016	Aug.22,2017
Schmid & Partner Engineering AG	Software	DASY 52 V52.8.8	N/A	Calibration not required	Calibration not required
Schmid & Partner Engineering AG	Phantom	ELI	N/A	Calibration not required	Calibration not required
Agilent	Network Analyzer	E5071C	MY46107530	Jan.20,2017	Jan.19,2018
Agilent	Dielectric Probe Kit	85070E	MY44300677	Calibration not required	Calibration not required
Agilent	Dual-directional	772D	MY52180142	Apr.13,2016	Apr.12,2017
Aglient	coupler	778D	MY52180302	Apr.13,2016	Apr.12,2017
Agilent	RF Signal Generator	N5181A	MY50145142	Feb.19,2016	Feb.18,2017
Agilent	Power Meter	E4417A	MY52240003	Oct.17,2016	Oct.16,2017
Agilopt	Power Separ	E9301H	MY52200003	Oct.17,2016	Oct.16,2017
Agilent	Power Sensor	E9301H	MY52200004	Oct.17,2016	Oct.16,2017
TECPEL	Digital thermometer	DTM-303A	TP130075	Mar.30,2016	Mar.29,2017

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5. Measurements

Date: 2017/1/26

WLAN 802.11b_Body_Bottom side_CH 11_Main_0mm

Communication System: WLAN 2.4G; Frequency: 2462 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2462 MHz; σ = 1.979 S/m; ϵ_r = 50.492; ρ = 1000 kg/m³ Phantom section: Flat Section Ambient temperature: 22.4° C; Liquid temperature: 21.9° C

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(7.4, 7.4, 7.4); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x141x1): Interpolated grid: dx=10 mm, dy=10 mm

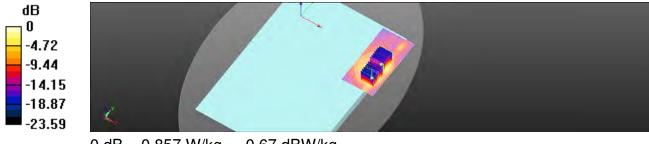
Maximum value of SAR (interpolated) = 0.956 W/kg

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

dy=5mm, dz=5mm Reference Value = 0.2970 V/m; Power Drift = 0.13 dB Peak SAR (extrapolated) = 1.39 W/kg SAR(1 g) = 0.624 W/kg; SAR(10 g) = 0.284 W/kg Maximum value of SAR (measured) = 0.974 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm,

dy=5mm, dz=5mm Reference Value = 0.2970 V/m; Power Drift = 0.13 dB Peak SAR (extrapolated) = 1.36 W/kg SAR(1 g) = 0.519 W/kg; SAR(10 g) = 0.249 W/kg Maximum value of SAR (measured) = 0.857 W/kg



0 dB = 0.857 W/kg = -0.67 dBW/kg



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Date: 2017/1/26

WLAN 802.11ac(80M) 5.2G_Body_Bottom side_CH 42_Main_0mm

Communication System: WLAN 5G; Frequency: 5210 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5210 MHz; σ = 5.387 S/m; ϵ_r = 48.495; ρ = 1000 kg/m³ Phantom section: Flat Section

Ambient temperature: 22.4° C ; Liquid temperature: 22.1° C

DASY5 Configuration:

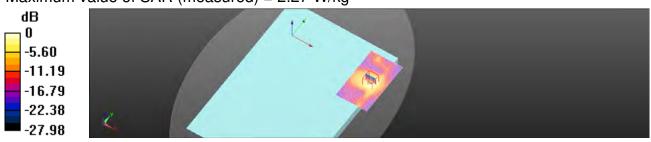
- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x121x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.26 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.2640 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 4.34 W/kg SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.390 W/kg Maximum value of SAR (measured) = 2.27 W/kg



0 dB = 2.27 W/kg = 3.56 dBW/kg



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Date: 2017/1/27

WLAN 802.11a 5.3G_Body_Bottom side_CH 52_Main_0mm

Communication System: WLAN(5G); Frequency: 5260 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5260 MHz; $\sigma = 5.479 \text{ S/m}$; $\epsilon_r = 48.517$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section

Ambient temperature: 22.6° C ; Liquid temperature: 21.8° C

DASY5 Configuration:

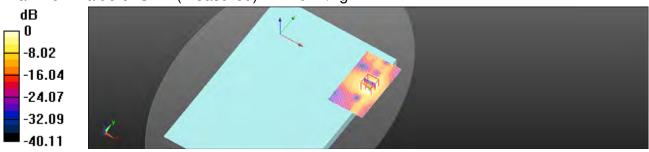
- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x121x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.17 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.4260 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 5.10 W/kg SAR(1 g) = 1.08 W/kg; SAR(10 g) = 0.343 W/kg Maximum value of SAR (measured) = 2.29 W/kg



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



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WLAN 802.11n(40M) 5.3G_Body_Bottom side_CH 54_Main_0mm

Communication System: WLAN(5G); Frequency: 5270 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5270 MHz; σ = 5.492 S/m; ϵ_r = 48.488; ρ = 1000 kg/m³ Phantom section: Flat Section

Ambient temperature: 22.6° C ; Liquid temperature: 21.8° C

DASY5 Configuration:

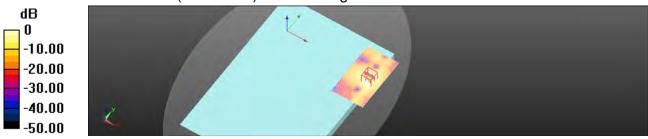
- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x121x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.10 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.6460 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 4.84 W/kg SAR(1 g) = 1.12 W/kg; SAR(10 g) = 0.342 W/kg Maximum value of SAR (measured) = 2.23 W/kg



0 dB = 2.23 W/kg = 3.48 dBW/kg



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Date: 2017/1/27

WLAN 802.11ac(80M) 5.6G_Body_Bottom side_CH 106_Main_0mm

Communication System: WLAN 5G; Frequency: 5530 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5530 MHz; σ = 5.749 S/m; ϵ_r = 48.976; ρ = 1000 kg/m³ Phantom section: Flat Section

Ambient temperature: 22.6° C ; Liquid temperature: 22.0° C

DASY5 Configuration:

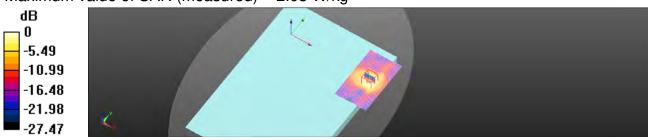
- Probe: EX3DV4 SN3938; ConvF(3.83, 3.83, 3.83); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x121x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.03 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.7790 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 5.81 W/kg SAR(1 g) = 1.05 W/kg; SAR(10 g) = 0.339 W/kg Maximum value of SAR (measured) = 2.03 W/kg



0 dB = 2.03 W/kg = 3.08 dBW/kg



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Date: 2017/2/2

WLAN 802.11ac(80M) 5.8G_Body_Bottom side_CH 155_Main_0mm

Communication System: WLAN 5G; Frequency: 5775 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5775 MHz; σ = 6.161 S/m; ϵ_r = 48.084; ρ = 1000 kg/m³ Phantom section: Flat Section

Ambient temperature: 21.7° C ; Liquid temperature: 22.3° C

DASY5 Configuration:

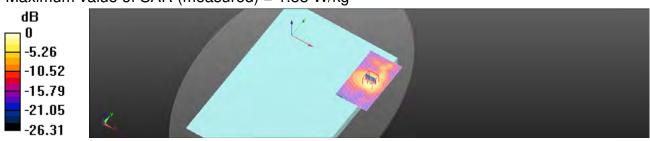
- Probe: EX3DV4 SN3938; ConvF(4.02, 4.02, 4.02); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x121x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.87 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.4650 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 3.67 W/kg SAR(1 g) = 0.883 W/kg; SAR(10 g) = 0.288 W/kg Maximum value of SAR (measured) = 1.88 W/kg



0 dB = 1.88 W/kg = 2.74 dBW/kg



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WLAN 802.11b_Body_Bottom side_CH 11_Aux_0mm

Communication System: WLAN 2.4G; Frequency: 2462 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2462 MHz; σ = 1.979 S/m; ϵ_r = 50.492; ρ = 1000 kg/m³ Phantom section: Flat Section Ambient temperature: 22.4° C; Liquid temperature: 21.9° C

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(7.4, 7.4, 7.4); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x121x1): Interpolated grid: dx=12 mm, dy=12 mm

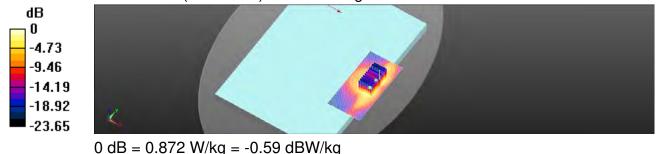
Maximum value of SAR (interpolated) = 0.880 W/kg

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

dy=5mm, dz=5mm Reference Value = 0.7740 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 1.35 W/kg SAR(1 g) = 0.574 W/kg; SAR(10 g) = 0.274 W/kg Maximum value of SAR (measured) = 0.933 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm,

dy=5mm, dz=5mm Reference Value = 0.7740 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 1.22 W/kg SAR(1 g) = 0.526 W/kg; SAR(10 g) = 0.258 W/kg Maximum value of SAR (measured) = 0.872 W/kg





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Bluetooth(GFSK)_Body_Bottom side_CH 78_AUX_0mm

Communication System: Bluetooth; Frequency: 2480 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2480 MHz; σ = 1.998 S/m; ϵ_r = 50.435; ρ = 1000 kg/m³ Phantom section: Flat Section Ambient temperature: 22.4° C; Liquid temperature: 21.9° C

DASY5 Configuration:

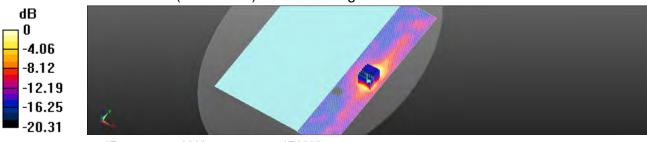
- Probe: EX3DV4 SN3938; ConvF(7.4, 7.4, 7.4); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x301x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.136 W/kg

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

dy=5mm, dz=5mm Reference Value = 0.8990 V/m; Power Drift = -0.16 dB Peak SAR (extrapolated) = 0.207 W/kg SAR(1 g) = 0.079 W/kg; SAR(10 g) = 0.035 W/kg Maximum value of SAR (measured) = 0.135 W/kg



0 dB = 0.135 W/kg = -8.68 dBW/kg



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Date: 2017/1/26

WLAN 802.11ac(80M) 5.2G_Body_Bottom side_CH 42_Aux_0mm

Communication System: WLAN 5G; Frequency: 5210 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5210 MHz; σ = 5.387 S/m; ϵ_r = 48.495; ρ = 1000 kg/m³ Phantom section: Flat Section

Ambient temperature: 22.4° C ; Liquid temperature: 22.1° C

DASY5 Configuration:

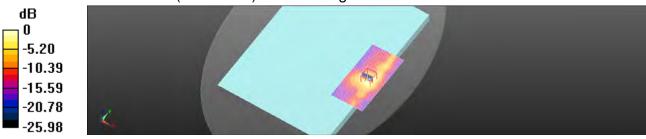
- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x141x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.95 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.4530 V/m; Power Drift = 0.17 dB Peak SAR (extrapolated) = 3.53 W/kg SAR(1 g) = 0.900 W/kg; SAR(10 g) = 0.302 W/kg Maximum value of SAR (measured) = 1.70 W/kg



0 dB = 1.70 W/kg = 2.31 dBW/kg



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Date: 2017/1/27

WLAN 802.11a 5.3G_Body_Bottom side_CH 56_Aux_0mm

Communication System: WLAN(5G); Frequency: 5280 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5280 MHz; $\sigma = 5.507 \text{ S/m}$; $\epsilon_r = 48.464$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section

Ambient temperature: 22.6° C ; Liquid temperature: 21.8° C

DASY5 Configuration:

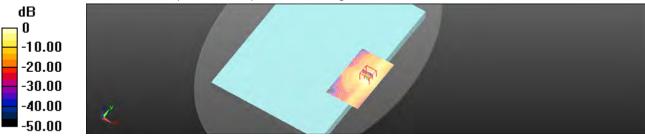
- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x121x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.62 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.7890 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 4.40 W/kg SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.298 W/kg Maximum value of SAR (measured) = 2.15 W/kg



0 dB = 2.15 W/kg = 3.32 dBW/kg



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Date: 2017/1/27

WLAN 802.11n(40M) 5.3G_Body_Bottom side_CH 54_Aux_0mm

Communication System: WLAN(5G); Frequency: 5270 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5270 MHz; $\sigma = 5.492$ S/m; $\epsilon_r = 48.488$; $\rho = 1000$ kg/m³ Phantom section: Flat Section

Ambient temperature: 22.6° C ; Liquid temperature: 21.8° C

DASY5 Configuration:

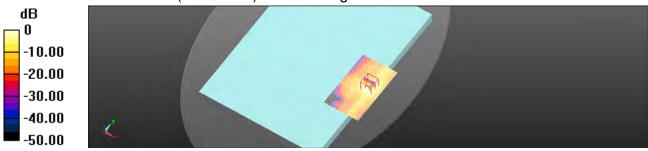
- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x121x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.00 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.7110 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 4.66 W/kg SAR(1 g) = 1.02 W/kg; SAR(10 g) = 0.300 W/kg Maximum value of SAR (measured) = 2.14 W/kg



0 dB = 2.14 W/kg = 3.31 dBW/kg



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Date: 2017/1/27

WLAN 802.11ac(80M) 5.6G_Body_Bottom side_CH 122_Aux_0mm

Communication System: WLAN 5G; Frequency: 5610 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5610 MHz; σ = 5.864 S/m; ϵ_r = 48.812; ρ = 1000 kg/m³ Phantom section: Flat Section

Ambient temperature: 22.6° C ; Liquid temperature: 22.0° C

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(3.83, 3.83, 3.83); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.24 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.4080 V/m; Power Drift = 0.12 dB Peak SAR (extrapolated) = 4.83 W/kg SAR(1 g) = 1.08 W/kg; SAR(10 g) = 0.336 W/kg Maximum value of SAR (measured) = 2.24 W/kg



0 dB = 2.24 W/kg = 3.50 dBW/kg



Report No. : E5/2017/10033 Page : 58 of 103

Date: 2017/2/2

WLAN 802.11ac(80M) 5.8G_Body_Bottom side_CH 155_Aux_0mm

Communication System: WLAN 5G; Frequency: 5775 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5775 MHz; σ = 6.161 S/m; ϵ_r = 48.084; ρ = 1000 kg/m³ Phantom section: Flat Section

Ambient temperature: 21.7° C ; Liquid temperature: 22.3° C

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.02, 4.02, 4.02); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.08 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm,

dy=4mm, dz=2mm Reference Value = 0.7790 V/m; Power Drift = 0.11 dB Peak SAR (extrapolated) = 4.34 W/kg SAR(1 g) = 0.969 W/kg; SAR(10 g) = 0.302 W/kg Maximum value of SAR (measured) = 2.05 W/kg



0 dB = 2.05 W/kg = 3.11 dBW/kg



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6. SAR System Performance Verification

Date: 2017/1/26

Dipole 2450 MHz_SN:727

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; σ = 1.964 S/m; ϵ_r = 50.508; ρ = 1000 kg/m³ Phantom section: Flat Section Ambient temperature: 22.4° C; Liquid temperature: 21.9° C

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(7.4, 7.4, 7.4); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

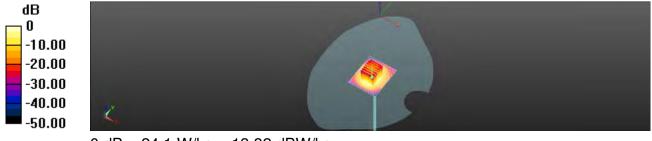
Configuration/Pin=250mW/Area Scan (51x61x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 24.8 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement

grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 105.4 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 34.0 W/kg SAR(1 g) = 12.5 W/kg; SAR(10 g) = 5.67 W/kg





0 dB = 24.1 W/kg = 13.82 dBW/kg



Date: 2017/1/26

Dipole 5200 MHz_SN:1040

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5200 MHz; σ = 5.356 S/m; ϵ_r = 48.318; ρ = 1000 kg/m³ Phantom section: Flat Section Ambient temperature: 22.4° C; Liquid temperature: 22.1° C

DASY5 Configuration:

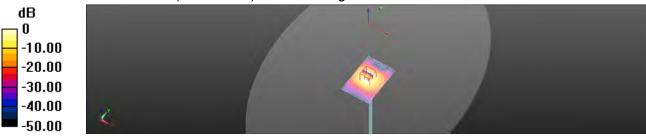
- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

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 = 57.24 V/m; Power Drift = -0.12 dB Peak SAR (extrapolated) = 29.3 W/kg SAR(1 g) = 7.2 W/kg; SAR(10 g) = 2.02 W/kg Maximum value of SAR (measured) = 15.1 W/kg



0 dB = 15.1 W/kg = 11.80 dBW/kg



Date: 2017/1/27

Dipole 5300 MHz_SN:1040

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5300 MHz; σ = 5.537 S/m; ϵ_r = 48.407; ρ = 1000 kg/m³ Phantom section: Flat Section Ambient temperature: 22.6° C; Liquid temperature: 21.8° C

DASY5 Configuration:

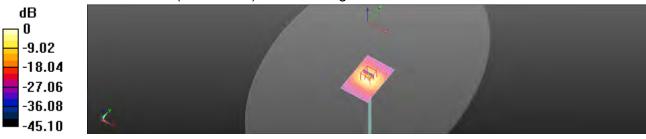
- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 16.3 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 56.39 V/m; Power Drift = -0.12 dB Peak SAR (extrapolated) = 31.9 W/kg SAR(1 g) = 7.36 W/kg; SAR(10 g) = 2.08 W/kg Maximum value of SAR (measured) = 15.2 W/kg



0 dB = 15.2 W/kg = 11.81 dBW/kg



Date: 2017/1/27

Dipole 5600 MHz_SN:1040

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5600 MHz; σ = 5.853 S/m; ϵ_r = 48.846; ρ = 1000 kg/m³ Phantom section: Flat Section Ambient temperature: 22.6° C; Liquid temperature: 22.0° C

DASY5 Configuration:

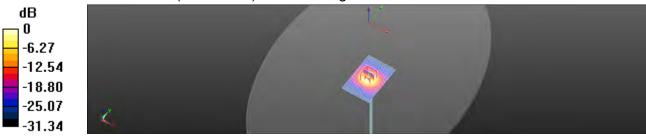
- Probe: EX3DV4 SN3938; ConvF(3.83, 3.83, 3.83); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 16.4 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 57.91 V/m; Power Drift = -0.12 dB Peak SAR (extrapolated) = 25.4 W/kg SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.31 W/kg Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.75 dBW/kg



Date: 2017/2/2

Dipole 5800 MHz_SN:1040

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5800 MHz; σ = 6.197 S/m; ϵ_r = 48.048; ρ = 1000 kg/m³ Phantom section: Flat Section Ambient temperature: 21.7° C; Liquid temperature: 22.3° C

DASY5 Configuration:

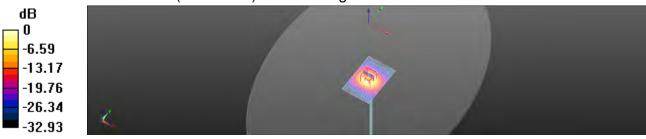
- Probe: EX3DV4 SN3938; ConvF(4.02, 4.02, 4.02); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 15.2 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 55.94 V/m; Power Drift = -0.14 dB Peak SAR (extrapolated) = 25.6 W/kg SAR(1 g) = 7.53 W/kg; SAR(10 g) = 2.21 W/kg Maximum value of SAR (measured) = 14.7 W/kg



0 dB = 14.7 W/kg = 11.66 dBW/kg



7. DAE & Probe Calibration Certificate

redited by the Swiss Accredits Swiss Accreditation Servic blateral Agreement for the r	e is one of the signatories	to the EA	a.: SCS 0108
ent SGS-TW (Aude	in)	Certificate No:	DAE4-1374_Aug16
ALIBRATION (CERTIFICATE		
bject	DAE4 SD 000 D	04 BM - SN: 1374	
albatics procedure(a)	QA CAL-06,v29 Calibration proceed	iure for the data acquisition electro	onics (DAE)
Salibration date:	August 23, 2016		
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughaussirasse 43, 8009 Zurich, Switzerland

Accredited by the Swiss Accreditation Service (SAS)



S Schweizerischer Kallbrierdienti G Service suisee d'étalonnage Servizio avizzero di taretura S suise Calibration Service

Accreditation No.: SCS 0108

Glossary

DAE Connector angle

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

Methods Applied and Interpretation of Parameters

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

- 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 heighbor 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.

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DC Voltage Measurement A/D - Converter Resolution nominal High Range: 1LSB =

6.1µV . full range = 100...+300 mV Low Range: ILSB = 61nV full range = -1+3mV DASY measurement parameters: Auto Zero Time: 3 sec. Measuring time: 3 sec.

Calibration Factors	x	Y	Z
High Bange	403.637 ± 0.02% (k=2)	403.886 ± 0.02% (k=2)	404.160±0.02% (k=2)
Low Range	3.98275 ± 1.50% (k=2)	3.96719 ± 1.50% ()=2)	3.99036 ± 1.50% (I⊫≥)

Connector Angle

2.5°±1°	
ļ	2,5°±1°

Conficate No: DAE4-1374_Aug15

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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	200039.11	0.18	0.00
Channel X + Input	20005.23	0.57	0.00
Channel X - Input	-20004.46	1.52	-0.01
Channel Y + Input	200041 10	3.98	0.00
Channel Y + Input	20002.96	-1,76	-0.01
Channel Y - Input	20007,46	-1.33	0.01
Channel Z + Input	200039.71	2.56	0,00
Channel Z + Input	20002.57	-2.04	-0.01
Channel Z - Input	-20008.39	-2.20	0.01

Low Range	Reading (µV)	Difference (µV)	Errar (%)
Channel X. + Input	2001.14	0.37	0.02
Channel X + Input	200.90	0.07	0.03
Channel X - Input	-198.75	0.41	-0.20
Channel Y + Input	2000.82	0.06	0.00
Channel Y + Input	200.17	-0.51	-0.25
Channel Y - Input	~199.47	-0.29	0.15
Channel Z + Input	2000.50	-0.29	-0.01
Channel Z + Input	199.36	-1,24	-0.62
Channel Z - Input	-200.79	-1.45	0.73

2. Common mode sensitivity

DASY measurement parameters: Auto Zoro 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	6,08	3.93
1	- 200	-2.69	-4.73
Channel Y	200	7,56	7.12
	200	-8.69	8.88
Channel Z	200	5.83	8// c
	- 200	-8.94	-B/16

3. Channel separation

	Input Voltage (mV)	Channel X (µV)	Chennel Y (µV)	Channel Z (µV)
Channel X	200	1	-2.29	-1.91
Channel Y	200	4.85		-1.13
Channel Z	200	10,99	2.02	

Certificate No: DAE4-1374_Aug15

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部份複製。

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4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring lime: 3 sec.

	High Range (LSB)	Low Range (LSB)
Channel X	15938	14709
Channel Y	16155	14646
Channel Z	16005	15566

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	1.17	0.20	1.90	0.33
Channel Y	0.61	-0.17	1.24	0.30
Channel Z	-1,30	-2.42	-0.33	0.37

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	500
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	-6	-B

Certificate No: DAE4-1374_Aug16

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Engineering AG nughwasstrasse 43, 8004 Zura	nry of Ich, Switzerland	S S	Schweizerlischer Kalibrierdienst Service suisse d'étalemage Servicio svizzero di taratura Swiss Calibration Strvice
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Bent SGS-TW (Aud	en)	Certificane. No.	EX3-3938_Nov16
CALIBRATION	CERTIFICATE		
Dept	EX30V4 - SN:393	8	-
Saletation protecture(5)		CAL-14.v4, QA CAL-23.v5, QA ure for dosimetric E-field probes	CAL-25.v6
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	Loted in the closed laboratory ATE critece for calibration ID SN 104776 SN 103244 SN 103245 SN 6502 SN 650 D SN CB41203974 SN 704498067 SN 00116210 SN US3642001700	Cal Date (Cerjičate No.) Cal Date (Cerjičate No.) 06-Apr-16 (No. 217-02283) 06-Apr-16 (No. 217-02283) 06-Apr-16 (No. 217-02283) 06-Apr-16 (No. 217-02283) 07-Dec-15 (No. 217-02283) 08-Apr-16 (No. 217-02283) 09-Apr-16 (No. 217-02283) 09-Apr-16 (No. DAFE-680_Dec15) Check Date (in house) Check Date (in house check Jun-16) 08-Apr-16 (in house check Jun-16) 08-Apr-16 (in house check Jun-16) 09-Apr-16 (in house check Jun-16) 09-Apr-16 (in house check Jun-16) 09-Apr-16 (in house check Jun-16)	and burnisticy < 70% Burnissiand Caterration Apr-17 Apr-17 Apr-17 Deu-18 Deu-18 Deu-18 Scheduled Divects In house check: Jue-18 In house check: Jue-18 In house check: Jue-18 In house check: Jue-18
Ar La Busiene have been corid Cathoriton Equipment unot (Mi Primary Standards Ebeer meter NRP Primer sensor MilP-291 Roferenco 20 dB Attreamor Referenco 20 dB Attreamor Refer	Licted in the closed laboratory ATE critece for calibration() ID SN 104778 SN 103244 SN 103245 SN 55277 (20x) SN 3013 SN 3690 D SN CB41229874 SN 000110210 SN 000110210 SN 000110210 SN 000110210 SN 000110210 SN 000110210 SN 000110210 SN 000110210 SN 000110210 SN 000110210	Cal Date (Cerjičate fin.) Di-Apr-16 (No. 217-02288) Di-Apr-16 (No. 217-02288) Di-Apr-16 (No. 217-02283) Bi-Apr-16 (No. DAF-680, Dec15) Check Date (In house) Di-Apr-16 (In house check Jun-16) Di-Apr-16 (In house check Did-16)	and buorkitivy < 70% Schuckled Calibration Apr-17 Apr-17 Apr-17 Apr-17 Dev-18 Dev-18 Scheckled Check In house check: Jue-18 In house check: Jue-18 In house check: Jue-18 In house check: Jue-18 In house check: Jue-18

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Calibration Laboratory of Schmid & Partner Engineering AG Zeig sstrasse 43, 5004 Zurich, Switzerland



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Accreditation No.: SCS 0108

Advantage by the Swiss Acceptation Service (SAS). The Swiss Accredition Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration contributes

Glosson

CHUBBER Y.	
TBL	tissue simulating liquid.
NORMx.y.z	sensitivity in free space
ConvF	sensitivity in TSL7 NORMx, y,z
DCP	diade compression point
CF	crest factor (1/duty_cycle) of the RF signal
A. B. C. U	modulation dependent linearization parameters
Polarization #	wrotation around probe axis
Polarization 8	A rotation around an axis that is in the plane normal to probe axis (at measurement center),
	Let 9 = 0 is normal to probe axis

information used in DASY system to align probe sensor X to the robol coordinate system Connector Angle

Calibration is Performed According to the Following Standards:

- a) IEEE Ski 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific a) IEEE Ski 1526-2013, "IEEE Recommendadi Prachos for Determining the Pask Spaket-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-heid devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
 c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 300 MHz to 6 GHz)", March 2010
 k) KDR absorption generating for this UMz to 6 GHz)", March 2010

- KDB 865664, 'SAR Measurement Requirements for 100 MHz to 8 GHz

Methods Applied and Interpretation of Parameters:

- NORMs, y, z Assessed for E-field potenzation 8 = 0 (1 ≤ 900 MHz in TEM-cell, 1 > 1800 MHz; R22 waveguide) NORMx, y, z are only intermediate values, i.e., the uncertainties of NORMx, y, z does not affect the E"-field uncertainty inside TSL (see below ConvF).
- NORM/(hx,y,z = NORM/x,y,z 1 /requency_response (see Frequency Response Chart). The Internation E implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DOPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainly 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 . haracteristics
- 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 Ine 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 phontom using E-field (or Temperature Transfer Standard for f < 900 MHz) and inside wavaguide using analytical field distributions based on power measurements for f > 100 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 perameters 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 help 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 NCIRMs (no uncertainty required)

Gentificate No. EX3-3938 Nov16

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EXIDW- 5N 3896

Wavender 25, 2018

Probe EX3DV4

SN:3938

Manufactured: Calibrated: May 2, 2013 November 25, 2016

(Note: non-compatible with DASY2 systems)

Certificate No: EX3-3938_Nov18

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EX30V4- SN:3909

November 25, 2016

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3938

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2) ± 10.1 %	
Norm (µV/IV/mi ²) ⁴	0.51	0.57	0.33		
Norin (µV/(V/m) ²) ^A DCP (mV) ⁴	100,5	101.3	104.0	- 0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B d⊎√µV	c	dB	VR mV	Unc" (k=2)
0	EW	8	0.0	0.0	1.0	0.00	34D.2	12.2 %
		Y	0.0	0.0	10		129.7	
		Z	8.0	0.0	1.0	1000	146.0	100

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%.

⁶ The uncertainties of form 9, 9,2 do not afford the E³ field uncertainty more TSL (see Flages 6 and 8).
⁹ Numercal bioaction partmeter: uncertainty no recurved.
⁹ Uncertainty is determined using the must dovid on from incomesponse applying rectangular distribution and is expressed for the states of pin field yours.

Cumilicale No-EX3-3938_Nov10

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EX3DV4-SN:3938

Neverther 25, 2018

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3938

(Mitz) ²	Relative Permittivity	Conductivity (Sim)	ConvF X	ConvF Y	Gony? Z	Alpha	Depth [®] (mm)	Unc {k=2}
750	41.9	0.89	10.14	10:14	10,14	0,61	0,80	± 120 %
835	41.5	0.90	8,74	9,74	9.74	0.45	0,91	1 12.0 %
900	41.5	0.97	9.64	9.64	9,64	0.51	0.80	± 12.0 %
1450	40.5	1.20	£ 45	845	8.45	0.43	0.80	= 12.0 4
1750	40,1	1.97	B.20	8,20	8.20	0.31	0.63	= 12,0 %
1900	40,0	1.40	6.15	8 15	8.15	0.38	0.80	z 12.0 %
2000	-40.0	1.40	8.06	8.06	8.06	0.35	0.80	± 12.0 %
2300	39.5	1:87	7.74	7.74	7.74	0.35	0.60	± 12.0.9
2450	39.2	1.60	7.36	7.36	736	0,33	0.92	± 12.0 9
2600	39.0	1.96	7.08	7.09	7.09	0.44	0.80	± 12.0 3
5250	35.9	4.71	5.21	5,21	5.21	0,30	1.80	+ 13.1 1
5600	35.5	5.07	4.53	4,53	4.53	3.40	1.80	£ 13.1 5
5750	35.4	5 22	4.79	4:79	4.79	0.40	1.80	= 15.1 3

Calibration Parameter Determined in Head Tissue Simulating Media

⁵⁵ Frequency variably phone that MHz m ± 100 MHz only appleb to DASY valid and higher (see Paper2), time (is restricted to ± 00 MHz, the interstating at calculating incention) and higher (see Paper2), time (is restricted become) validity (at watch interstating at calculating incents) and (in underlamp for the indicated become) validity (at watch is ± 10.2, MD, 20 min 10 MHz to ConvF assessments ± 0.0, MP, 120, 150 and 200 MHz is ± 10.2, MD, 20 min 10 MHz to ConvF assessments ± 0.0, MP, 120, 150 and 200 MHz is a set 0.5, Above 5 GHz features) validity (at the statistic beaux 9 GHz, the validity of texts provide validity) can be estimated to ± 110 MHz.
⁷ At implantise beaux 9 GHz, the validity of lexics provide (a calcular) can be estimated to ± 105, 4 lexic comparisation formula is applied to the measures beaux 9 GHz, the validity of texts provide accurates (a calcular) is restricted in ± 51. The uncentrality is the restricted in ± 558 of the ConvF uncessfully and to estimate the restricted in ± 558. The uncessfully is the restricted in ± 558 of the ConvF uncessfully and to estimate the set of its ConvF uncessfully in the restricted in ± 558 of the ConvF uncessfully for indicated asignificance parameters.
⁷ Aphanologic and convF uncessfully the restricted and restricted in the terminating developed as indicated in the compression is always less than as 11% for frequencies below 3 GHz and below ± 2% for importance parameters is any tistance imper than the probe to diameter.

Centilitatie No: EX3-3938_Nov10

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EX3DV4- SN 3938

Mowember 25, 2016

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3938

f (MHz) ^c	Relative Permittivity ^F	Conductivity (S/m) ¹	ConvEX	ConvF Y	ConvF.Z	Alpha	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	9.51	9.51	9.51	0.38	D.93	± 12.0 %
835	55.2	0.97	9.33	9.35	9.33	0,47	0.80	± 12.0 %
900	:55,0	1,05	9.23	B.28	₽.23	D,35	Q.98.	+ 12.0 %
1450	54.0	1.30	8.18	8.18	8.16	0.39	0.80	£ 12.0 %
1750	53,4	1.49	7.98	7.96	7.98	0,43	0.81	± 12.05
1900	53.3	1.52	7.77	7.77	7.77	0.27	1.06	± 12.0 1
2000	53.3	1,52	7.63	7.63	7.63	0.40	0.80	± \$2,0.5
2300	52.9	T.AT	7.58	7.56	7.56	0.42	0.80	= 12.0 5
2450	52.7	145	7,40	7.40	7,40	0.38	0,80	± 12.0 %
2600	52.5	2.10	7.14	7.14	7.14	0.34	0.80	± 12.0 %
5250	46.9	5.36	4.41	4.41	4.41	0.40	1.90	2 13.1 9
5600	46.5	5.77	3,83	3.83	3.83	0.50	j.90	+12.13
5750	48.3	5.94	4.02	4.02	4.02	0.50	1.50	±13.14

Calibration Parameter Determined in Body Tissue Simulating Media

Final analysis with the paper shall be a set of the paper is the paper of the extended of the paper of the extended of the paper is a set of the extended of the paper is a set of the extended of the paper of the extended of the paper is a set of the paper of the extended of the paper is a set of the paper of the extended of the paper is a set of the paper of the extended of the paper of th

Centilizate No; EX3-3938_Nov10

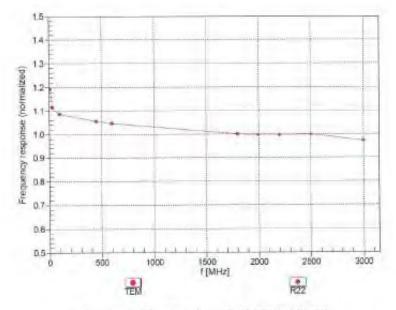
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EX30V4- SN:3938

November 25, 2016

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



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

Certificate No: EX3-3938_Noy16

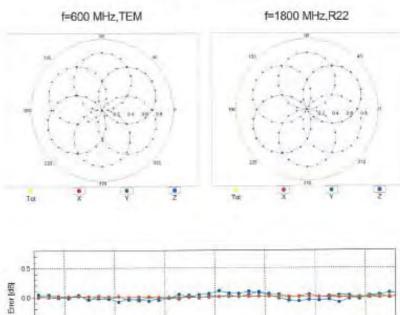
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EX3DV4- SN:3938

November 25, 2016



Receiving Pattern (o), 9 = 0°

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

Certificate No: EX3-3938_Nov16

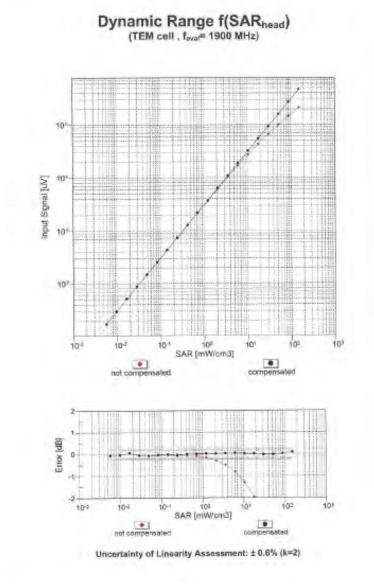
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EX3DV4-SN:3938

November 25, 2016

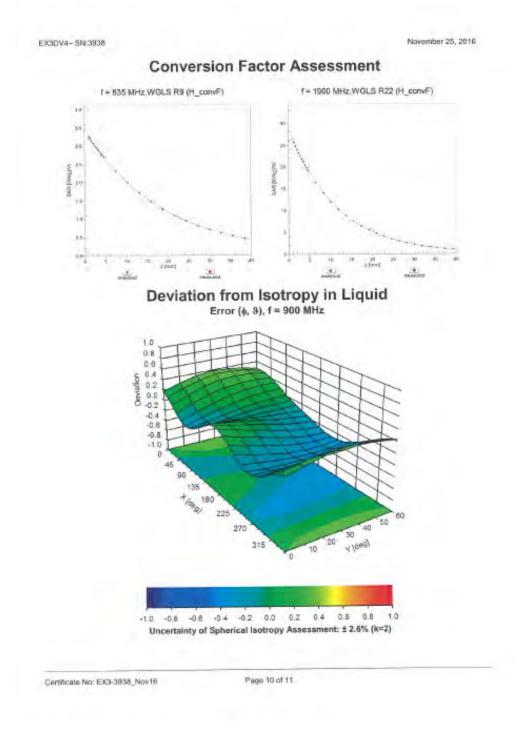


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EA3DV4-SN 3938

November 25, 2016

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3938

Sensor Amergement	Triangular
Connector Angle (*)	-25.9
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 mim
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommanded Measurement Distance from Surface	1.4 mm

Centhcate No: EX3-3933_Nov10

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8. Uncertainty Budget

A	с	D	е		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probabilit v	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%	œ
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	œ
lsotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	œ
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	∞
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	œ
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	00
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	00
Readout Electronics	0.30%	Ν	1	1	1	1	0.30%	0.30%	00
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	00
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	œ
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	œ
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	œ
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	œ
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	œ
Probe Positioning with respect to phantom	2.90%	R	√3	1.732	1	1	1.67%	1.67%	œ
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	œ
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	00
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%	00
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	œ
Liquid permittivity (mea.)	1.42%	N	1	1	0.64	0.43	0.91%	0.61%	М
Liquid Conductivity (mea.)	3.28%	N	1	1	0.6	0.49	1.97%	1.61%	М
Combined standard uncertainty		RSS					11.91%	11.83%	
Expant uncertainty (95% confidence							23.83%	23.66%	

Measurement Uncertainty evaluation template for DUT SAR test (3-6G)

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部份複製。

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			-						
A	с	D	е		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probabilit V	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.00%	N	1	1	1	1	6.00%	6.00%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
lsotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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%	œ
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	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%	Ν	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	Ν	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%	×
Liquid permittivity (mea.)	4.23%	N	1	1	0.64	0.43	2.71%	1.82%	м
Liquid Conductivity (mea.)	0.72%	N	1	1	0.6	0.49	0.43%	0.35%	М
Combined standard uncertainty		RSS					11.74%	11.56%	
Expant uncertainty (95% confidence							23.48%	23.12%	

Measurement Uncertainty evaluation template for DUT SAR test (0.3-3G)

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部份複製。

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9. System Validation from Original Equipment Supplier

	h, Switzerland		Service suisse d'étationnage Servizio svizzero di taratura Swiss Calibration Service
credited by the Swiss Accredite the Swiss Accreditation Service utiliateral Agreement for the n	e is one of the signatorie	s to the EA	coreditation No.: SCS 0108
Ient SGS-TW (Aude	m)	Certificate N	o: D2450V2-727_Apr16
CALIBRATION C	CERTIFICATE	Ð	
loject.	D2450V2 - SN:72	27	
alibratike procedure(a)	OA CAL-05.v9 Calibration proce	dure for dipole validation kits ab	ove 700 MHz
albration date:	April 19, 2016		
		ional standards, which realize the physical u mbability are given on the following pages a	
I calibrations have been condu	cled in the closed suborato	ry lacilly: unvironment tompetature (22 ± 3)	C and humidity = 70%
althration Equipment used (M&	TE critical for calibration)		
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Calibration Laboratory of Schmid & Partner Engineering AG aughauastrasse 43, 8004 Zurich, Switzerland



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ditation No.: SCS 0108

According by the Swiss Accordination Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA. Multiliniaral Agreement for the recognition of calibration certificates Glossary:

TSL

N/A

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held. devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)". February 2005
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Anterina 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%.

Centificate No! D2450V2-727_April 9

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	40.0 ± 6 %	1.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ² (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	51.0 W/kg ± 17.0 % (k=2)
	and then	
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	5.93 W/kg

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mbo/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.7 ± 6 %	1.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ² (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.5 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	49.6 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 250 mW input power	5.86 W/kg

Certificate No: D2450V2-727_Apr16

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.3 Ω + 2.0 jΩ
Return Loss	- 25.4 dB

Antenna Parameters with Body TSL

Impedance, tra	nsformed to feed point	52.1 Ω + 4.8 jΩ
Return Loss		- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 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

Certificate No: D2450V2-727_Apr16

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DASY5 Validation Report for Head TSL

Date: 19.04.2016

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 = 1.83 S/m; ϵ_r = 40; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.76, 7.76, 7.76); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- · Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- · Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 112.1 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 25.7 W/kg SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.93 W/kg

Maximum value of SAR (measured) = 20.8 W/kg



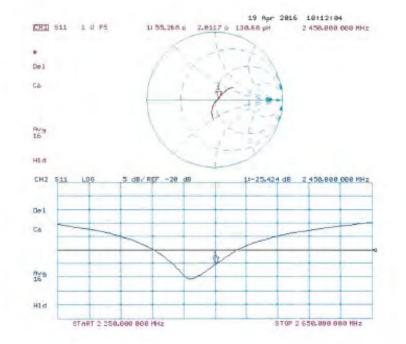
Certificate No: D2450V2-727_Apr16

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Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727_Apr16

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Calibration Laboratory of Schmid & Partner Engineering AG Zeugheusstrasse 43, 800 / Zurich, Switzerland



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Addresitation No.: SCS 0108

Abcredited by the Swiss Accremitation Sectors (SAS).

The Swiss Accorditation Service is one of the argentories to the EA. Multilaienti Agreement for the recognition of collibration contributions 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 Wineless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless b) communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010.
- c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Anterina 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 uncartainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured SAR measured at the stated antenna input power.
- SAR normalized; SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
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 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5600 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
 34.8 ± 6 %
 4.54 mho/m ± 6 %

 Head TSL temperature change during test
 < 0.5 °C</td>
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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	7.68 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	76.2 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ² (10 g) of Head TSL	condition	
SAR averaged over 10 cm ² (10 g) of Head TSL SAR measured	condition 100 mW input power	2.21 W/kg

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Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittiviity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.64 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	8.24 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 averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.36 W/kg

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.4 W/kg ± 19.5 % (k=2)

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Head TSL parameters at 5600 MHz

The following parameters and calculations were applied,

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0±0.2) C	34.2 ± 5 %	4.93 mho/m±6%
Head TSL temperature change during test	× 0.5 °C	-	

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.5 W/kg + 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.32 W/kg

Head TSL parameters at 5800 MHz

The following parameters and calculations ware applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	35.3	5.27 mmo/m
Measured Head TSL parameters	(22.0±0.2) °C	339±6%	5.14 mho/m ± 8.%
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 B6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	75.9 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ² (10 g) of Head TSL	condition	
SAR averaged over 10 cm ² (10 g) of Head TSL SAR measured	condition 100 mW Input power	2 19 W/kg

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Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.41 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	7.35 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.9 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm3 (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 100 mW input power	2.07 W/kg

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittiviity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.53 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	7.70 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	76.4 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 100 mW input power	2.16 W/kg

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Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittiviity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	5.80 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.92 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.6 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 100 mW input power	2.19 W/kg

Body TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	5.95 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ^o (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.9 W/kg ± 19.5 % (k=2)

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Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mha/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.23 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ² (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.2 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 100 mW input power	2.10 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.2 Ω - 8.5 jΩ
Return Loss	- 21.4 dlB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	47.8 Ω - 3.3 jΩ
Return Loss	- 27.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.0 Ω - 5.9 jΩ
Return Loss	- 24.6 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.4 Ω - 3.3 jΩ
Return Loss	- 23.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	54.3 Ω - 2.3 μΩ
Return Loss	- 26.6 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	50.7 Ω - 7.0 jΩ	
Return Loss	- 23.2 dB	

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	48.6 Ω - 16 jΩ
Return Loss	- 33.4 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	50.3 Ω - 4.4 jΩ
Return Loss	- 27.2 dB

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Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	57.9 Ω - 2.3 jΩ
Return Loss	- 22.4 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	54.6 Ω - 0.7 jΩ	
Return Loss	- 27.0 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG	
Manufactured on	December 30, 2005	

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DASY5 Validation Report for Head TSL

Date: 17.06.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1040

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz Medium parameters used: f = 5200 MHz; σ = 4.54 S/m; ϵ_r = 34.8; ρ = 1000 kg/m³, Medium parameters used: f = 5500 MHz; σ = 4.64 S/m; ϵ_r = 34.6; ρ = 1000 kg/m³, Medium parameters used: f = 5500 MHz; σ = 4.83 S/m; ϵ_r = 34.3; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 4.93 S/m; ϵ_r = 34.2; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 4.93 S/m; ϵ_r = 34.2; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 5.14 S/m; ϵ_r = 33.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.59, 5.59, 5.59); Calibrated: 31.12.2015, ConvF(5.25, 5.25, 5.25); Calibrated: 31.12.2015, ConvF(5.18, 5.18, 5.18); Calibrated: 31.12.2015, ConvF(4.99, 4.99); Calibrated: 31.12.2015, ConvF(4.95, 4.95, 4.95); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=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 = 70.41 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 27.7 W/kg SAR(1 g) = 7.68 W/kg; SAR(10 g) = 2.21 W/kg Maximum value of SAR (measured) = 17.3 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 = 72.35 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 30.6 W/kg SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.36 W/kg Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 70.02 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 30.8 W/kg SAR(1 g) = 7.93 W/kg; SAR(10 g) = 2.26 W/kg Maximum value of SAR (measured) = 18.5 W/kg

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Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 71.08 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.32 W/kg Maximum value of SAR (measured) = 19.0 W/kg

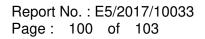
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.92 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 31.4 W/kg SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.19 W/kg Maximum value of SAR (measured) = 18.4 W/kg



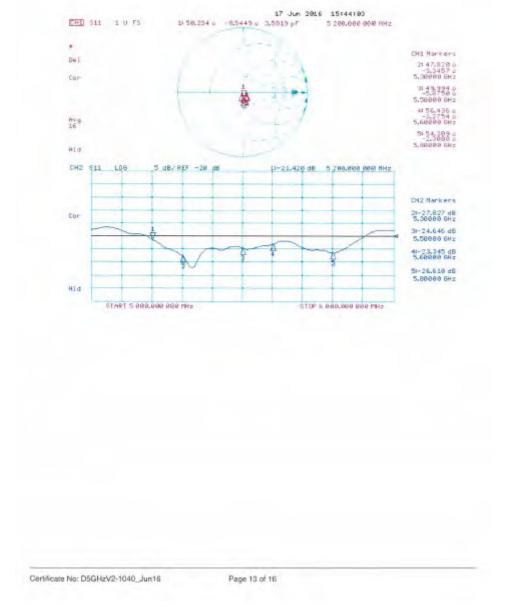
0 dB = 17.3 W/kg = 12.38 dBW/kg

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Impedance Measurement Plot for Head TSL



Date: 16.06.2016

DASY5 Validation Report for Body TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1040

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz Medium parameters used: f = 5200 MHz; σ = 5.41 S/m; ϵ_r = 47.1; ρ = 1000 kg/m³, Medium parameters used: f = 5500 MHz; σ = 5.53 S/m; ϵ_r = 46.9; ρ = 1000 kg/m³, Medium parameters used: f = 5500 MHz; σ = 5.8 S/m; ϵ_r = 46.5; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 5.95 S/m; ϵ_r = 46.3; ρ = 1000 kg/m³, Medium parameters used: f = 5800 MHz; σ = 6.23 S/m; ϵ_r = 46; ρ = 1000 kg/m³

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(4.99, 4.99, 4.99); Calibrated: 31.12.2015, ConvF(4.75, 4.75, 4.75); Calibrated: 31.12.2015, ConvF(4.4, 4.4, 4.4); Calibrated: 31.12.2015, ConvF(4.35, 4.35, 4.35); Calibrated: 31.12.2015, ConvF(4.27, 4.27, 4.27); Calibrated: 31.12.2015;
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=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 = 66.34 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 27.4 W/kg

SAR(1 g) = 7.35 W/kg; SAR(10 g) = 2.07 W/kg Maximum value of SAR (measured) = 16.8 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 = 68.02 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 29.2 W/kg SAR(1 g) = 7.7 W/kg; SAR(10 g) = 2.16 W/kg Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.81 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 31.7 W/kg SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.19 W/kg Maximum value of SAR (measured) = 18.6 W/kg

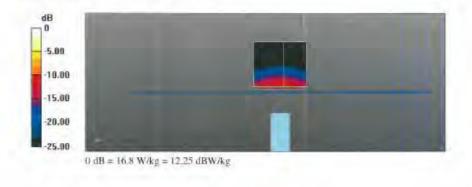
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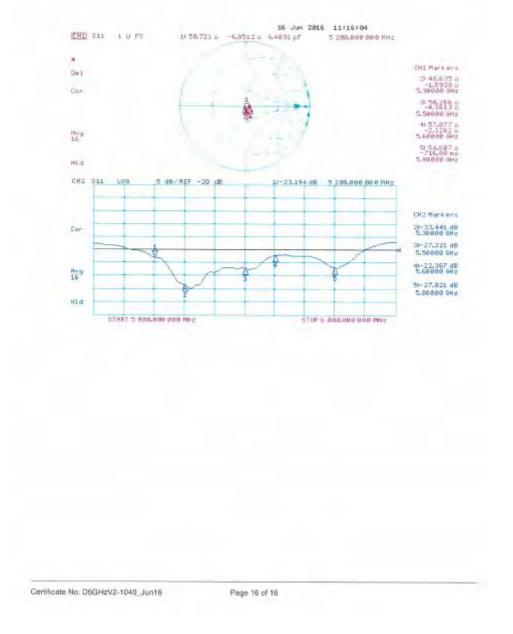
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.28 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 32.5 W/kg SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.21 W/kg Maximum value of SAR (measured) = 18.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1,4mm Reference Value = 65.14 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 32.9 W/kg SAR(1 g) = 7.58 W/kg; SAR(10 g) = 2.1 W/kg Maximum value of SAR (measured) = 18.3 W/kg





Impedance Measurement Plot for Body TSL



- End of 1st part of report -