

# SAR TEST REPORT

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

Equipment Under Test	Tablet
Module	802.11abgn+BT4.0 module
Brand Name of Host	hp
Brand Name of Module	FOXCONN
Model No. of Host	HSTNH-I508OC / HSTNH-I508O
Model No. of Module	T77H462
Company Name	HON HAI PRECISION IND. CO., LTD.
Company Address	5F-1, 5 Hsin-An Rd, Hsinchu Science- Based Industrial Park Hsinchu Taiwan
Standards	IEEE /ANSI C95.1 , C95.3, IEEE 1528,
	KDB248227 D01, KDB616217 D04, KDB865664 D01,
	KDB865664 D02, KDB447498 D01
FCC ID	MCLT77H462
Date of Receipt	Nov. 18, 2014
Date of Test(s)	Dec. 05, 2014 ~ Dec. 10, 2014
Date of Issue	Dec. 31, 2014
In the configuration tested, the E	UT 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.

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#### Signed on behalf of SGS

Engineer

Mason Wu

台灣檢驗科技股份有限公司

ason Wu

Date: Dec. 31, 2014

Sr. Engineer

John Teh

John Yeh Date: Dec. 31, 2014

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# Version

Report Number	Revision	Date	Memo
EN/2014/B0016	00		Initial creation of test report.
EN/2014/B0016	01	2014/12/23	1 <sup>st</sup> modification
EN/2014/B0016	02	2014/12/24	2 <sup>nd</sup> modification
EN/2014/B0016	03	2014/12/31	3 <sup>rd</sup> modification
EN/2014/B0016	04	2014/12/31	4 <sup>th</sup> modification

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

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## 1. General Information

## 1.1 Testing Laboratory

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No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei					
City, Taiwan	City, Taiwan				
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Internet	http://www.tw.sgs.com/				

## 1.2 Details of Applicant

Company Name	HON HAI PRECISION IND. CO., LTD.
Company Address	5F-1, 5 Hsin-An Rd, Hsinchu Science- Based Industrial Park Hsinchu Taiwan
	Industrial Park Hsinchu Taiwan

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## **1.3 Description of EUT**

Faulomont Under Test	Tablet							
Equipment Under Test	Tablet							
Module	302.11abgn+BT4.0 module							
Brand Name of Host	р							
Brand Name of Module	FOXCONN	OXCONN						
Model No. of Host	HSTNH-1508OC / HSTNH-1508O							
Model Difference of Host	HSTNH-I508OC = WWAN+WLAN HSTNH-I508O = WLAN							
Model No. of Module	Т77Н462							
FCC ID	MCLT77H462							
Mode of Operation	⊠WLAN802.11 a/b/g/n(20M/40 ⊠Bluetooth	WLAN802.11 a/b/g/n(20M/40M)						
Dutu Quela	WLAN802.11 a/b/g/n(20M/40M)		1					
Duty Cycle	Bluetooth		1					
	WLAN802.11 b/g/n(20M)	2412		2462				
	WLAN802.11 a 5.2G	5180		5240				
	WLAN802.11 n (20M) 5.2G	5180		5240				
	WLAN802.11 n (40M) 5.2G	5190		5230				
	WLAN802.11 a 5.3G	5260		5320				
	WLAN802.11 n (20M) 5.3G	5260		5320				
TX Frequency Range	WLAN802.11 n (40M) 5.3G	5270		5310				
(MHz)	WLAN802.11 a 5.6G	5500		5700				
	WLAN802.11 n (20M) 5.6G	5500		5700				
	WLAN802.11 n (40M) 5.6G	5510		5670				
	WLAN802.11 a 5.8G	5745		5825				
	WLAN802.11 n (20M) 5.8G	5745		5825				
	WLAN802.11 n (40M) 5.8G	5755		5795				
	Bluetooth	2402		2480				

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

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	Max. SAR (1	I g) (Unit: W	/Kg)		
Antenna	Band	Measured	Reported	Channel	Position
	WLAN802.11 b	1.03	1.052	1	Top side
	WLAN802.11 n(20M)	0.679	0.696	6	Top side
	WLAN802.11 a 5.2G	1.26	1.322	44	Back side
	WLAN802.11 n(40M) 5.2G	1.13	1.175	46	Back side
Main	WLAN802.11 a 5.3G	1.4	1.429	60	Back side
IVIAILI	WLAN802.11 n(40M) 5.3G	1.33	1.409	62	Back side
	WLAN802.11 a 5.6G	1.31	1.536	100	Back side
	WLAN802.11 n(40M) 5.6G	1.24	1.287	102	Back side
	WLAN802.11 a 5.8G	1.18	1.513	165	Back side
	WLAN802.11 n(40M) 5.8G	0.951	1.012	159	Back side
	WLAN802.11 b	1.28	1.307	6	Back side*
	WLAN802.11 n(20M)	0.763	0.767	1	Back side
	WLAN802.11 a 5.2G	0.871	1.274	44	Back side*
	WLAN802.11 n(40M) 5.2G	0.78	0.789	38	Back side
Διιχ	WLAN802.11 a 5.3G	0.857	1.271	52	Back side*
Aux	WLAN802.11 n(40M) 5.3G	0.959	0.972	54	Back side
	WLAN802.11 a 5.6G	0.684	1.019	136	Back side
	WLAN802.11 n(40M) 5.6G	0.726	0.753	134	Back side
	WLAN802.11 a 5.8G	0.608	0.628	161	Back side
	WLAN802.11 n(40M) 5.8G	0.58	0.588	151	Back side

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

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#.	WLAN802.11	a/b/a/n(2)	20M/40M)	conducted	power table:
<i></i>		u/ b/ g/ II(		oonaaotea	

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

8	02.11 b	Max. Rated Avg.	Average Power Output (dBm)					
CU	Frequency	Power + Max.		Data Rat	e (Mbps)			
СН	(MHz)			2	5.5	11		
1	2412	17	16.91	16.89	16.87	16.86		
6	2437	17	16.96	16.94	16.93	16.91		
11	2462	17	16.71	16.68	16.66	16.65		

8	02.11 g	Max. Rated Avg.	Average Power Output(dBm)							
СН	Frequency	Power + Max.			D	ata Rat	e (Mbp	s)		
СП	(MHz)	Tolerance (dBm)	6	9	12	18	24	36	48	54
1	2412	10.5	10.46	10.35	10.18	10.06	9.85	9.64	9.37	9.11
6	2437	10.5	10.48	10.39	10.28	10.12	9.91	9.69	9.41	9.17
11	2462	10.5	10.35	10.22	10.09	9.97	9.76	9.53	9.26	9.04

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802.	11 n (20M)	Max. Rated Avg.			Average	e Powe	r Outpu	ıt(dBm)		
	Frequency	Power + Max.			D	ata Rat	e (Mbp	s)		
СН	(MHz)	Tolerance (dBm)	6.5	13	19.5	26	39	52	58.5	65
1	2412	15.5	15.47	15.30	15.11	14.93	14.74	14.56	14.39	14.27
6	2437	15.5	15.39	15.20	15.01	14.83	14.65	14.48	14.30	14.21
11	2462	15.5	15.33	15.16	14.97	14.80	14.61	14.43	14.25	14.02

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	02.11 a				Averan		r Outou	ıt(dBm)		
5.2/5	.3/5.6/5.8G	Max. Rated Avg. Power + Max.			menug					
СН		Tolerance (dBm)	Ter + Max. ance (dBm)Ter + Max. $6$ 912Rate (Mbps)12.512.3012.1812.0111.832436412.512.3012.1812.0111.8311.6311.4311.12.512.3912.2312.0611.8911.7311.5711.12.512.2012.0911.9511.7911.6511.5111.12.512.2012.0711.8711.7211.5911.4111.12.512.4512.3012.1811.9911.8111.6411.12.512.4112.2912.1311.9711.8111.6311.12.512.4112.2912.1311.9711.8111.6311.12.512.1912.0111.8511.7111.5311.3711.1312.3112.0611.9211.7511.6211.4111.1312.2912.1712.0511.8911.7711.6311.1312.2912.0411.9011.7611.5811.4111.1312.2912.1712.0511.8811.7111.5611.1312.2912.1712.0111.8811.7111.5611.1312.2912.1712.0111.8811.7111.5611.1312.2912.1712.0111.8811.7211.5911.			1				
	(MHz)		6	9	12	18	24	36	48	54
36	5180	12.5	12.30	12.18	12.01	11.83	11.63	11.43	11.25	11.07
40	5200	12.5	12.39	12.23	12.06	11.89	11.73	11.57	11.38	11.23
44	5220	12.5	12.29	12.09	11.95	11.79	11.65	11.51	11.31	11.16
48	5240	12.5	12.20	12.07	11.87	11.72	11.59	11.41	11.23	11.03
52	5260	12.5	12.45	12.30	12.18	11.99	11.81	11.64	11.52	11.36
56	5280	12.5	12.26	12.13	11.98	11.86	11.66	11.49	11.37	11.25
60	5300	12.5	12.41	12.29	12.13	11.97	11.81	11.63	11.46	11.26
64	5320	12.5	12.19	12.01	11.85	11.71	11.53	11.37	11.20	11.04
100	5500	13	12.31	12.06	11.92	11.75	11.62	11.48	11.35	11.16
104	5520	13	12.27	12.11	11.96	11.82	11.64	11.52	11.38	11.23
108	5540	13	12,29	12.17	12.05	11.89	11.77	11.63	11.48	11.35
112	5560	13	12.22	12.04	11.90	11.76	11.58	11.44	11.26	11.13
116	5580	13	12.42	12.28	12.15	11.99	11.79	11.59	11.40	11.28
132	5660	13	12.27	12.09	11.89	11.77	11.64	11.47	11.29	11.14
136	5680	13	12.29	12.17	12.01	11.88	11.71	11.56	11.43	11.27
140	5700	13	12.31	12.15	11.99	11.85	11.72	11.59	11.42	11.27
149	5745	13.5	12.29	12.10	11.95	11.75	11.61	11.44	11.29	11.15
153	5765	13.5	12.25	12.06	11.93	11.78	11.66	11.50	11.33	11.13
157	5785	13.5	12.45	12.30	12.11	11.99	11.82	11.63	11.45	11.31
161	5805	13.5	12.36	12.19	12.02	11.84	11.71	11.57	11.45	11.32
165	5825	13.5	12.42	12.23	12.06	11.94	11.78	11.61	11.49	11.34

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	.11 n(20M)	Max Dated Ava			Average	e Powe	r Outpu	ıt(dBm)	1		
5.2/5	.3/5.6/5.8G	Power + Max.					· ·	· ·			
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)6.51319.52639521211.9511.7711.5711.4211.2011.0411211.9611.7911.6011.3911.2211.0011211.8911.7411.5611.3411.1410.9511211.8511.6911.5411.3511.1410.9811211.9411.7311.5311.3111.1210.9211211.7611.5811.3711.1811.0110.8311211.8811.7311.5511.3911.2411.071								
	(MHz)		6.5	13	19.5	26	39	52	58.5	65	
36	5180	12	11.95	11.77	11.57	11.42	11.20	11.04	10.84	10.69	
40	5200	12	11.96	11.79	11.60	11.39	11.22	11.00	10.80	10.59	
44	5220	12	11.89	11.74	11.56	11.34	11.14	10.95	10.74	10.55	
48	5240	12	11.85	11.69	11.54	11.35	11.14	10.98	10.83	10.68	
52	5260	12	11.76 11.58 11.37 11.18 11.01 10.83 10.67 10.51								
56	5280	12	11.76	11.58	11.37	11.18	11.01	10.83	10.67	10.51	
60	5300	12	11.88	11.73	11.55	11.39	11.24	11.07	10.85	10.64	
64	5320	12	11.93	11.75	11.58	11.39	11.19	10.97	10.82	10.64	
100	5500	12	11.86	11.71	11.54	11.38	11.19	10.99	10.83	10.63	
104	5520	12	11.91	11.74	11.57	11.41	11.23	11.08	10.91	10.71	
108	5540	12	11.90	11.68	11.49	11.32	11.12	10.90	10.74	10.56	
112	5560	12	11.72	11.56	11.40	11.19	11.04	10.87	10.66	10.50	
116	5580	12	11.84	11.65	11.48	11.31	11.10	10.92	10.70	10.55	
132	5660	12	11.95	11.74	11.54	11.35	11.18	10.98	10.77	10.57	
136	5680	12	11.96	11.76	11.60	11.44	11.24	11.04	10.89	10.70	
140	5700	12	11.82	11.67	11.46	11.25	11.10	10.89	10.71	10.51	
149	5745	12	11.80	11.61	11.43	11.21	11.01	10.82	10.62	10.42	
153	5765	12	11.76	11.57	11.40	11.19	11.01	10.79	10.62	10.45	
157	5785	12	11.70	11.53	11.31	11.10	10.95	10.75	10.54	10.34	
161	5805	12	11.97	11.78	11.57	11.37	11.15	10.97	10.80	10.62	
165	5825	12	11.87	11.70	11.55	11.40	11.20	11.05	10.84	10.69	

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	.11 n(40M)				Average	e Power	Outpu	t (dBm)	)	
5.2/5	.3/5.6/5.8G	Max. Rated Avg. Power + Max.		-	neuge		0 0110 0	. (		
СН	Frequency	Tolerance (dBm)			D	ata Rat	e (Mbp	s)		
СП	(MHz)	· · ·	13.5     27     40.5     54     81     108     121.5       12     11.94     11.64     11.37     11.07     10.81     10.48     10.15							
38	5190	12	11.94 11.64 11.37 11.07 10.81 10.48 10.17 9.84							
46	5230	12	11.83 11.51 11.21 10.88 10.61 10.28 10.01 9.87							
54	5270	12	11.91	11.64	11.32	11.05	10.78	10.45	10.19	9.90
62	5310	12	11.75	11.43	11.11	10.85	10.52	10.26	9.96	9.67
102	5510	12	11.84	11.53	11.21	10.88	10.58	10.31	10.04	9.73
110	5550	12	11.97	11.66	11.39	11.12	10.85	10.52	10.25	9.95
134	5670	12	11.92	11.59	11.30	10.98	10.69	10.43	10.17	9.95
151	5755	12	11.85 11.56 11.24 10.98 10.67 10.41 10.12 9.85							
159	5795	12	11.73	11.40	11.10	10.82	10.51	10.20	9.94	9.64

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

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8	02.11 b	Max. Rated Avg.	I	Average Power	Output (dBm)	)
СЦ	Frequency	Power + Max.		Data Rat	e (Mbps)	
CH	(MHz)	Tolerance (dBm)	1	2	5.5	11
1	2412	17	16.88	16.88 16.84		16.75
6	2437	17	16.93	16.88	16.82	16.79
11	2462	17	16.91	16.86	16.80	16.77

8	02.11 g	Max. Rated Avg.			Average	e Powei	r Outpu	ıt(dBm)		
СН	Frequency	Power + Max.			D	ata Rat	e (Mbp	s)		
СП	(MHz)	Tolerance (dBm)	6	9	12	18	24	36	48	54
1	2412	10.5	10.43	10.29	10.16	10.04	9.88	9.71	9.56	9.34
6	2437	10.5	10.36	10.21	10.08	9.91	9.77	9.59	9.39	9.22
11	2462	10.5	10.32	10.16	10.03	9.85	9.66	9.43	9.18	9.06

802.	11 n (20M)	Max. Rated Avg.			Average	e Powe	r Outpu	ıt(dBm)		
СН	Frequency	Power + Max.			D	ata Rat	e (Mbp	s)		
СП	(MHz)	Tolerance (dBm)	6.5	13	19.5	26	39	52	58.5	65
1	2412	15.5	15.48	15.30	15.11	14.93	14.75	14.56	14.37	14.15
6	2437	15.5	15.39	15.21	15.02	14.84	14.65	14.46	14.27	14.04
11	2462	15.5	15.46	15.28	15.10	14.89	14.67	14.44	14.24	13.96

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	02.11 a		Average Power Output(dBm) Power + Max. Delerance (dBm) Data Rate (Mbps)							
5.2/5	.3/5.6/5.8G	Max. Rated Avg.		1	Average		outpu			
СН	Frequency	Tolerance (dBm)			D	ata Rat	e (Mbp	s)	r	
	(MHz)		6	9	12	18	24	36	48	54
36	5180	14	12.25	12.07	11.88	11.70	11.55	11.40	11.19	11.01
40	5200	14	12.33	12.15	11.95	11.78	11.58	11.37	11.15	10.95
44	5220	14	12.35	12.16	12.01	11.84	11.66	11.46	11.25	11.06
48	5240	14	12.35	12.17	12.02	11.81	11.59	11.43	11.24	11.04
52	5260	14	12.29	12.09	11.92	11.76	11.56	11.40	11.23	11.05
56	5280	14	12.25	12.03	11.81	11.66	11.47	11.30	11.11	10.95
60	5300	14	12.39	12.18	12.00	11.79	11.59	11.44	11.25	11.05
64	5320	14	12.27	12.10	11.95	11.76	11.59	11.40	11.22	11.03
100	5500	14	12.38	12.19	12.00	11.85	11.64	11.48	11.30	11.12
104	5520	14	12.31	12.15	11.96	11.79	11.60	11.43	11.28	11.08
108	5540	14	12.26	12.09	11.90	11.75	11.55	11.36	11.21	11.03
112	5560	14	12.40	12.21	12.05	11.83	11.64	11.48	11.27	11.11
116	5580	14	12.49	12.28	12.10	11.90	11.70	11.54	11.38	11.19
132	5660	14	12.21	12.00	11.85	11.68	11.47	11.25	11.06	10.84
136	5680	14	12.27	12.11	11.89	11.72	11.53	11.31	11.12	10.95
140	5700	14	12.26	12.06	11.87	11.72	11.54	11.36	11.16	10.97
149	5745	12.5	12.31	12.15	12.00	11.82	11.62	11.44	11.24	11.03
153	5765	12.5	12.33	12.16	11.98	11.78	11.58	11.37	11.15	10.93
157	5785	12.5	12.44	12.22	12.05	11.84	11.62	11.41	11.19	10.98
161	5805	12.5	12.36	12.21	12.01	11.80	11.65	11.47	11.28	11.09
165	5825	12.5	12.22	12.05	11.88	11.71	11.52	11.35	11.16	11.01

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	11 n(20M)				Averad	- Powe	r Outpu	ıt(dBm)		
5.2/5	.3/5.6/5.8G	Max. Rated Avg. Power + Max.			nverug		outpu			
СН	Frequency	Tolerance (dBm)			D	ata Rat	e (Mbp	s)	<b>-</b>	
	(MHz)		6.5	13	19.5	26	39	52	58.5	65
36	5180	12	11.84	11.67	11.47	11.30	11.15	10.97	10.83	10.66
40	5200	12	11.92	11.78	11.63	11.42	11.27	11.12	10.91	10.74
44	5220	12	11.82	11.61	11.42	11.22	11.03	10.82	10.62	10.41
48	5240	12	11.78	11.59	11.39	11.21	11.00	10.83	10.69	10.48
52	5260	12	11.87	11.72	11.53	11.34	11.18	10.99	10.81	10.60
56	5280	12	11.88	11.70	11.51	11.37	11.21	11.03	10.89	10.72
60	5300	12	11.98	11.80	11.65	11.48	11.30	11.15	10.96	10.76
64	5320	12	11.91	11.75	11.56	11.40	11.24	11.06	10.89	10.72
100	5500	12	11.78	11.63	11.42	11.22	11.03	10.89	10.72	10.58
104	5520	12	11.71	11.57	11.40	11.23	11.06	10.86	10.69	10.53
108	5540	12	11.70	11.54	11.38	11.19	11.00	10.80	10.59	10.39
112	5560	12	11.85	11.71	11.54	11.40	11.19	11.01	10.82	10.64
116	5580	12	11.73	11.53	11.36	11.19	11.01	10.84	10.66	10.51
132	5660	12	11.83	11.67	11.46	11.31	11.16	11.00	10.81	10.60
136	5680	12	11.74	11.59	11.44	11.30	11.11	10.95	10.79	10.62
140	5700	12	11.91	11.75	11.58	11.43	11.25	11.11	10.90	10.69
149	5745	12	11.88	11.67	11.46	11.25	11.04	10.88	10.69	10.52
153	5765	12	11.89	11.68	11.49	11.31	11.16	10.96	10.77	10.63
157	5785	12	11.77	11.56	11.40	11.23	11.06	10.91	10.72	10.57
161	5805	12	11.90	11.75	11.54	11.36	11.22	11.01	10.84	10.70
165	5825	12	11.86	11.66	11.46	11.25	11.06	10.92	10.77	10.62

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	.11 n(40M)				Muorado	e Power	Outou	t (dBm)	N		
5.2/5	.3/5.6/5.8G	Max. Rated Avg. Power + Max.		,	Average	FOWEI	Outpu	t (ubiii,	)		
СН	Frequency	Tolerance (dBm)			D	ata Rat	e (Mbp	s)			
СП	(MHz)		13.5         27         40.5         54         81         108         121.5         13           2         11.05         11.68         11.40         11.14         10.85         10.55         10.24         0								
38	5190	12	11.95 11.68 11.40 11.14 10.85 10.55 10.24 9.96								
46	5230	12	11.88	11.58	11.28	10.99	10.67	10.40	10.11	9.81	
54	5270	12	11.94	11.63	11.33	11.01	10.72	10.40	10.09	9.84	
62	5310	12	11.84	11.58	11.33	11.02	10.77	10.45	10.14	9.86	
102	5510	12	11.85	11.56	11.30	11.01	10.69	10.43	10.17	9.86	
110	5550	12	11.75	11.45	11.17	10.85	10.56	10.30	10.04	9.75	
134	5670	12	11.84	11.55	11.27	11.00	10.69	10.39	10.12	9.84	
151	5755	12	11.94 11.69 11.44 11.18 10.93 10.64 10.33 10.06								
159	5795	12	11.87	11.56	11.24	10.93	10.62	10.31	10.03	9.77	

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

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MIMO (CHO + CH1)

	802.11 n(20M)	Max.				A۱	verage	Powe	r Outp	ut(dBr	n)			
		Rated Avg.		Data Rate (Mbps)										
СН	Frequency	Power +		13 26 39										
	(MHz)	Tolerance (dBm)	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1
1	2412	15.5	12.42	11.37	14.94	12.19	11.25	14.76	11.98	10.97	14.51	11.75	10.79	14.31
6	2437	15.5	12.51	11.15	14.89	12.18	10.93	14.61	11.86	10.71	14.33	11.54	10.48	14.05
11	2462	15.5	12.68	10.75	14.83	12.35	10.56	14.56	12.03	10.37	14.29	11.69	10.16	14.00

	802.11 n(20M)	Max.				Av	erage	Power	Outpu	ut(dBm	ı)			
		Rated Avg.					ta Rate	e (Mbp	s)					
СН	Frequency	Power +		78 104 117							130			
	(MHz)	Tolerance (dBm)	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1
1	2412	15.5	11.51	10.55	14.07	11.26	10.28	13.81	11.31	10.09	13.75	10.31	9.85	13.10
6	2437	15.5	11.21	10.24	13.76	10.88	10.02	13.48	10.54	9.78	13.19	10.23	9.55	12.91
11	2462	15.5	11.37	9.98	13.74	11.05	9.77	13.47	10.72	9.58	13.20	10.35	9.42	12.92

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MIMO (CHO + CH1)

	.11 n(20M)	Max.				۸.		David	- Ot.,						
5.2/5	5.3/5.6/5.8G	Rated		Average Power Output(dBm)											
		Avg. Power +				_	Da	ita Rat	e (Mb	os)		_			
СН	Frequency	Max.		13			26			39					
011	(MHz)	Tolerance (dBm)	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	
36	5180	15	11.94	10.79	14.41	11.65	10.52	14.13	11.36	10.25	13.85	11.08	9.98	13.58	
40	5200	15	11.85	10.66	14.31	11.60	10.39	14.05	11.35	10.14	13.80	11.09	9.87	13.53	
44	5220	15	11.71	10.63	14.21	11.45	10.36	13.95	11.20	10.09	13.69	10.92	9.81	13.41	
48	5240	15	11.91	10.81	14.41	11.65	10.55	14.15	11.38	10.29	13.88	11.09	10.04	13.61	
52	5260	15	11.83	10.98	14.44	11.57	10.69	14.16	11.28	10.44	13.89	11.01	10.19	13.63	
56	5280	15	11.82	10.63	14.28	11.56	10.37	14.02	11.30	10.12	13.76	11.05	9.84	13.50	
60	5300	15	11.94	10.18	14.16	11.66	9.89	13.87	11.40	9.63	13.61	11.12	9.37	13.34	
64	5320	15	11.40	11.01	14.22	11.15	10.72	13.95	10.87	10.47	13.68	10.60	10.20	13.41	
100	5500	15	11.91	10.67	14.34	11.62	10.39	14.06	11.35	10.10	13.78	11.10	9.84	13.53	
104	5520	15	11.81	10.59	14.25	11.53	10.33	13.98	11.24	10.08	13.71	10.98	9.82	13.45	
108	5540	15	11.83	10.88	14.39	11.54	10.62	14.11	11.27	10.34	13.84	11.01	10.05	13.57	
112	5560	15	11.91	11.05	14.51	11.66	10.76	14.24	11.41	10.47	13.98	11.16	10.21	13.72	
116	5580	15	11.83	10.36	14.17	11.56	10.11	13.91	11.28	9.84	13.63	11.00	9.58	13.36	
132	5660	15	11.88	10.35	14.19	11.59	10.08	13.91	11.32	9.79	13.63	11.07	9.51	13.37	
136	5680	15	11.81	10.39	14.17	11.54	10.13	13.90	11.27	9.86	13.63	11.02	9.58	13.37	
140	5700	15	11.79	10.48	14.19	11.51	10.21	13.92	11.25	9.93	13.65	11.00	9.64	13.38	
149	5745	15	11.88	10.33	14.18	11.63	10.07	13.93	11.36	9.80	13.66	11.08	9.54	13.39	
153	5765	15	11.97	10.76	14.42	11.72	10.47	14.15	11.47	10.22	13.90	11.20	9.96	13.63	
157	5785	15	11.88	10.72	14.35	11.61	10.47	14.09	11.35	10.22	13.83	11.07	9.94	13.55	
161	5805	15	11.78	11.08	14.45	11.51	10.79	14.18	11.26	10.52	13.92	11.00	10.25	13.65	
165	5825	15	11.86	10.87	14.40	11.60	10.59	14.13	11.32	10.32	13.86	11.05	10.05	13.59	

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MIMO (CH0+CH1)

802	.11 n(20M)	Max.				Δνα	erade	e Powe	r Outr	out(dF	3m)			
5.2/5	5.3/5.6/5.8G	Rated					crage	, 1 0 000	i Outp	Jar(al	511)			
		Avg. Power +					Da	ata Rat	te (Mb	ps)				
СН	Frequency	Max.		78			104			117			130	
011	(MHz)	Tolerance (dBm)		ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1
36	5180	15	10.81	9.70	13.30	10.52	9.42	13.02	10.25	9.17	12.75	9.96	8.88	12.46
40	5200	15	10.80	9.60	13.25	10.54	9.31	12.98	10.28	9.04	12.71	10.01	8.77	12.44
44	5220	15	10.67	9.52	13.14	10.39	9.27	12.88	10.10	9.00	12.60	9.82	8.75	12.33
48	5240	15	10.81	9.78	13.34	10.56	9.52	13.08	10.27	9.27	12.81	10.02	8.99	12.55
52	5260	15	10.74	9.90	13.35	10.45	9.62	13.07	10.17	9.36	12.79	9.89	9.11	12.53
56	5280	15	10.76	9.55	13.21	10.47	9.28	12.93	10.18	9.02	12.65	9.93	8.73	12.38
60	5300	15	10.86	9.10	13.08	10.60	8.84	12.82	10.34	8.55	12.55	10.09	8.28	12.29
64	5320	15	10.34	9.93	13.15	10.07	9.68	12.89	9.78	9.42	12.61	9.49	9.16	12.34
100	5500	15	10.84	9.59	13.27	10.57	9.32	13.00	10.28	9.03	12.71	10.00	8.76	12.43
104	5520	15	10.73	9.53	13.18	10.44	9.28	12.91	10.17	9.02	12.64	9.89	8.76	12.37
108	5540	15	10.75	9.78	13.30	10.49	9.53	13.05	10.20	9.28	12.77	9.94	8.99	12.50
112	5560	15	10.91	9.95	13.47	10.65	9.67	13.20	10.37	9.40	12.92	10.09	9.11	12.64
116	5580	15	10.72	9.29	13.07	10.43	9.03	12.80	10.14	8.76	12.51	9.86	8.49	12.24
132	5660	15	10.79	9.22	13.09	10.54	8.93	12.82	10.28	8.65	12.55	10.02	8.40	12.30
136	5680	15	10.73	9.29	13.08	10.47	9.03	12.82	10.20	8.78	12.56	9.92	8.51	12.28
140	5700	15	10.71	9.36	13.10	10.44	9.07	12.82	10.17	8.80	12.55	9.90	8.52	12.27
149	5745	15	10.81	9.29	13.13	10.52	9.01	12.84	10.27	8.72	12.57	10.02	8.45	12.32
153	5765	15	10.93	9.69	13.36	10.67	9.42	13.10	10.39	9.13	12.82	10.12	8.84	12.54
157	5785	15	10.81	9.66	13.28	10.52	9.40	13.01	10.24	9.15	12.74	9.98	8.89	12.48
161	5805	15	10.73	9.97	13.38	10.45	9.72	13.11	10.16	9.47	12.84	9.88	9.19	12.56
165	5825	15	10.76	9.80	13.32	10.49	9.51	13.04	10.24	9.25	12.78	9.96	8.99	12.51

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MIMO (CH0 + CH1)

802	.11 n(40M)	Mov						2	0.1		,			
5.2/5	5.3/5.6/5.8G	Nateu		Average Power Output(dBm)										
		Avg. Power +		Data Rate (Mbps)										
СН	Frequency	Max.	Max. 27			54				81		108		
	(MHZ)	(MHz) Tolerance (dBm)		ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1	ch 0	ch 1	ch 0+1
38	5190	15	11.87	11.53	14.71	11.52	11.16	14.35	11.17	10.83	14.01	10.81	10.46	13.65
46	5230	15	11.73	11.30	14.53	11.36	10.96	14.17	10.99	10.60	13.81	10.63	10.25	13.45
54	5270	15	11.58	11.35	14.48	11.26	10.99	14.14	10.92	10.64	13.79	10.58	10.28	13.44
62	5310	15	11.91	11.54	14.74	11.58	11.20	14.40	11.26	10.86	14.07	10.94	10.49	13.73
102	5510	15	11.75	11.30	14.54	11.40	10.97	14.20	11.03	10.63	13.84	10.70	10.28	13.51
110	5550	15	11.76	11.72	14.75	11.44	11.37	14.42	11.11	11.03	14.08	10.78	10.67	13.74
134	5670	15	11.50	10.75	14.15	11.17	10.42	13.82	10.84	10.10	13.50	10.49	9.74	13.14
151	5755	15	11.93	11.24	14.61	11.60	10.88	14.27	11.26	10.51	13.91	10.93	10.16	13.57
159	5795	15	11.66	11.35	14.52	11.32	11.03	14.19	10.97	10.68	13.84	10.63	10.33	13.49

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151

159

5755

5795

15

15

10.57

10.30

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9.14 12.53 9.51

12.44 9.22

9.27

ch

0 + 1

8.77 12.17

8.93 12.09

MIMO (CH0+CH1) 802.11 n(40M) Max. Average Power Output(dBm) 5.2/5.3/5.6/5.8G Rated Avg. Data Rate (Mbps) Power + Max. 270 162 216 243 Frequency CH Tolerance (MHz) ch ch ch (dBm) ch 0 ch 1 ch 0 ch 1 ch 0 ch 1 ch 0 ch 1 0 + 10 + 10 + 110.45 10.09 13.28 10.08 9.73 12.92 9.73 5190 9.41 12.58 9.39 9.04 12.23 38 15 10.31 9.92 13.13 9.96 9.60 12.79 9.64 9.27 12.47 9.32 8.91 12.13 46 5230 15 9.89 9.63 12.77 54 5270 15 10.24 9.96 13.11 9.52 9.27 12.41 9.19 8.93 12.07 10.61 10.15 13.40 10.26 9.82 13.06 9.94 9.49 12.73 62 5310 15 9.58 9.13 12.37 13.17 10.03 9.57 12.82 9.69 102 5510 15 10.38 9.93 9.23 12.48 9.32 8.90 12.13 10.43 10.34 13.40 10.07 9.97 13.03 9.74 110 5550 15 9.65 12.71 9.41 9.31 12.37 5670 15 9.81 9.06 12.46 9.48 8.70 12.12 9.16 8.35 11.78 134 10.17 9.38 12.80

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

9.84 13.23 10.20 9.47 12.86 9.86

9.96 13.14 9.95 9.61 12.79 9.59

#. The maximum power of CH0 and CH1 in 5G MIMO is minus 3dB from the maximum power of CH0+CH1

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#### #. Bluetooth conducted power table:

Frequency	Data	Ре	ak
(MHz)	Rate	dBm	mW
2402	1	4.72	2.965
2441	1	5.85	3.846
2480	1	5.54	3.581
2402	2	3.93	2.472
2441	2	4.75	2.985
2480	2	5.1	3.236
2402	3	4.42	2.767
2441	3	5.34	3.420
2480	3	4.79	3.013

Frequency	Avg. (dBm)
(MHz)	BT4.0
2402	4.52
2442	5.14
2480	5.25

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## 1.4 Test Environment

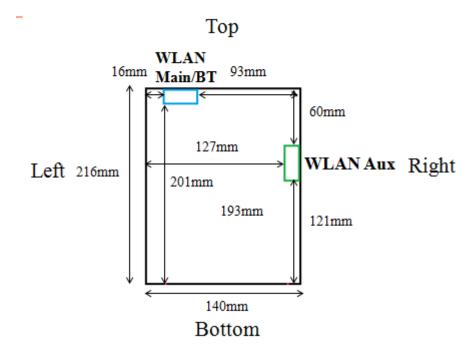
Ambient Temperature: 22±2° C Tissue Simulating Liquid: 22±2° C

## **1.5 Operation Description**

## 1. WLAN (802.11 a/b/g/n):

Use chipset specific software to control the EUT, and makes it transmit in maximum power. The EUT was tested in five configurations:

## Configurations: Back/Right/Left/Bottom/Top side\_0mm.



Front view of the tablet

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Note:

- **1.** The SAR measurement is not required for 802.11g/n since its maximum output power is less than 1/4 dB higher than 802.11b.
- **2.** The SAR measurement is not required for 802.11n since its maximum output power is less than 1/4 dB higher than 802.11a.
- **3.** Testing at higher data rates is not required since the maximum output power is less than 1/4 dB higher than those measured at the lowest data rate.
- **4.** BT and WLAN technology can't transmit simultaneously according to client's description.
- **5.** For 2.4GHz WLAN Main and Aux antennas, the maximum output power for 802.11b is larger than that for 802.11n and the maximum output power of each antenna during simultaneous transmission for 802.11n is less than that used in standalone transmission for 802.11n, so it is more conservative to use the sum of 1-g SAR provision in KDB447498D01 for 802.11b to exclude the SAR measurement for 802.11n MIMO.
- **6.** For 5GHz WLAN Main and Aux antennas, the maximum output power for 802.11a is larger than that for 802.11n, so it is more conservative to use the sum of 1-g SAR provision in KDB447498D01 for 802.11a to exclude the SAR measurement for 802.11n MIMO.
- 7. According to KDB447498 D01,
  - (1) The SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances≤
     50 mm are determined by:

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

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

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

[(Threshold at 50mm in step1) + (test separation distance-50mm)x( $\frac{f[WHz]}{160}$ )](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.

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				Top side				Right s	ide			Left side		
Mode	Max. tune-up power(dBm)	Bm)         power(mW)           50.119           50.119           Max. tune-up	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	surf	to face m)	Exclu thres (m\	hold	Require SAR testing?	surface	Exclusion threshold (mW)	Require SAR testing?	
WLAN Main	AN Main 17 50.119		less than 5	15.728	YES	9	93 431.5		573	NO	16	4.915	YES	
WLAN Aux	17	50.119	60	101.573	NO		than 5	15.7	28	YES	127	771.573	NO	
					Botton	n side					Back side			
Mode			Max. tune-up power(mW)	Ant. to surface (mm)	Exclu thres (m <sup>1</sup>	hold		ire SAR ting?	sur	t. to face nm)	Exclusion threshold (mW)	Require SAF testing?	२	
WLAN Main	1	7	50.119	201	-		Ν	10	less	than 5	15.728	YES		
WLAN Aux	1	7	50.119	121	711.	573	Ν	10	less	than 5	15.728	YES		

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

		Maximum power(mW)		Top side			ight side		Left side		
Mode	Maximum power(dBm)		Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	surface	Exclusion threshol d (mW)	Require SAR testing?		Exclusion threshold (mW)	
BT	5.85	3.846	less than 5	1.211	NO	93	430.12	NO	16	0.379	NO
			Bottom side			В	ack side				
Mode	Maximum power(dBm)	Maximum power(mW)	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	over 200mm	Require SAR testing?			
BT	5.85	3.846	201	-	NO	less than 5	1.211	NO			

- 8. According to KDB447498 D01, testing of other required channels is not required 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.
- 9. According to KDB447498 D01, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is  $\leq$  0.6 W/kg, when the transmission band is between 100 MHz and 200MHz.
- **10.** According to KDB447498 D01, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is  $\leq$  0.4 W/kg, when the transmission band is  $\geq$  200MHz.

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11. 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)

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### 1.6 The SAR Measurement System

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

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

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

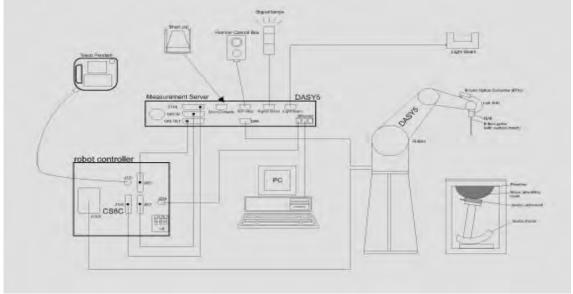


Fig. a The block diagram of SAR system

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

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## **1.7 System Components**

#### EX3DV4 E-Field Probe

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL2450/ 5200/5300/5600/5800 MHz Additional CF for other liquids and frequencies upon request
Frequency	10 MHz to > 6 GHz
Directivity	<ul> <li>± 0.3 dB in HSL (rotation around probe axis)</li> <li>± 0.5 dB in tissue material (rotation normal to probe axis)</li> </ul>
Dynamic Range	10 μW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μW/g)
Dimensions	Tip diameter: 2.5 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

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#### **SAM PHANTOM V4.0C**

Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. cover prevents evaporation of the liquid. Reference markings on th phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three point with the robot. $2 \pm 0.2 \text{ mm}$									
Shell Thickness										
Filling Volume Dimensions	Approx. 25 liters Height: 850 mm; Length: 1000 mm; Width: 500 mm									

#### **DEVICE HOLDER**

DEVICENCEDE		
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

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## **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.

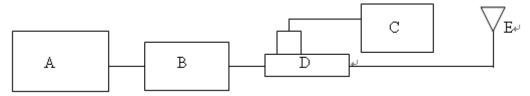


Fig. b The block diagram of system verification

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



Photograph of the dipole Antenna

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Validation Kit	S/N (MH	-	Target SAR (1g) (Pin=250mW) (m)//(g)	Measured SAR (1g)(mW/g)	Deviation (%)	Measured Date	
D2450V2	727	2450	Body	12.8	12.1	5.47%	Dec. 5, 2014
		5200	Body	7.39	7.76	-5.01%	Dec. 6, 2014
D5GHzV2	1023	5300	Body	7.62	7.39	3.02%	Dec. 7, 2014
	1023	5600	Body	8.04	8.45	-5.10%	Dec. 8, 2014
		5800	Body	7.44	7.36	1.08%	Dec. 10, 2014

Table 1. Results of system validation

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## 1.9 Tissue Simulant Fluid for the Frequency Band

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

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

Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, sr	Target Conductivity, σ (S/m)	Measured Dielectric Constant,	Measured Conductivity, σ (S/m)	% dev <b>ε</b> r	% dev σ
		2412	52.751	1.914	53.618	1.94	-1.64%	-1.36%
		2437	52.717	1.938	53.445	1.969	-1.38%	-1.62%
	Dec. 05, 2014	2450	52.700	1.950	53.416	1.997	-1.36%	-2.41%
		2462	52.685	1.967	53.318	2.003	-1.20%	-1.83%
		5200	49.014	5.299	47.940	5.215	2.19%	1.59%
	Dec. 6, 2014	5220	48.987	5.323	47.918	5.241	2.18%	1.54%
		5230	48.974	5.334	47.874	5.248	2.25%	1.61%
		5260	48.933	5.369	47.837	5.293	2.24%	1.42%
	Dec 7 2014	5270	48.919	5.381	47.795	5.303	2.30%	1.45%
	Dec. 7, 2014	5300	48.879	5.416	47.700	5.388	2.41%	0.52%
		5310	48.865	5.428	47.585	5.391	2.62%	0.68%
		5500	48.607	5.650	47.522	5.694	2.23%	-0.78%
		5510	48.594	5.661	47.492	5.713	2.27%	-0.91%
Body		5550	48.539	5.708	47.365	5.764	2.42%	-0.98%
	Dec. 8, 2014	5580	48.499	5.743	47.316	5.830	2.44%	-1.51%
	Dec. 0, 2014	5600	48.471	5.766	47.150	5.838	2.73%	-1.25%
		5670	48.376	5.848	47.031	5.948	2.78%	-1.71%
		5680	48.363	5.860	46.979	5.992	2.86%	-2.26%
		5700	48.336	5.883	46.921	6.017	2.93%	-2.28%
		5745	48.275	5.936	46.551	6.112	3.57%	-2.96%
		5755	48.261	5.947	46.486	6.141	3.68%	-3.25%
		5765	48.248	5.959	46.397	6.172	3.84%	-3.57%
	Doc 10 2014	5785	48.220	5.982	46.322	6.182	3.94%	-3.34%
	Dec. 10, 2014	5795	48.207	5.994	46.273	6.200	4.01%	-3.43%
		5800	48.200	6.000	46.238	6.217	4.07%	-3.62%
		5805	48.193	6.006	46.217	6.236	4.10%	-3.83%
		5825	48.166	6.029	46.180	6.278	4.12%	-4.13%

Table 2. Dielectric Parameters of Tissue Simulant Fluid

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### The composition of the body tissue simulating liquid:

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

#### 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

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## 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.

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

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

#### 1.11 Probe Calibration Procedures

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

## 1.11.1 Transfer Calibration with Temperature Probes

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

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

whereby  $\sigma$  is the conductivity,  $\rho$  the density and c the heat capacity of the liquid.

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

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

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- 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 p), 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.
- 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.

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#### References

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

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#### 1.12 Test Standards and Limits

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

- Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the (1) 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).
- Occupational/Controlled limits apply when persons are exposed as a consequence (2) 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.
- Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over (3) the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1)

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#### of this section. (Table 4.)

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

Table 4. RF exposure limits

Notes:

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

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## 2. Summary of Results

Antenna	Mode	Position	Distance	СН	Freq.	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling	Averaged S (W/		Plot
			(mm)		(MHz)	Tolerance (dBm)	(dBm)		Measured	Reported	page
		Back side	-	6	2437	17.00	16.96	0.93%	0.725	0.732	-
		Top side	-	1	2412	17.00	16.91	2.09%	1.03	1.052	50
		Top side	-	6	2437	17.00	16.96	0.93%	0.952	0.961	-
	WLAN802.11 b	Top side	-	11	2462	17.00	16.71	6.91%	0.883	0.944	-
	WLANOUZ.IID	Top side*	-	1	2412	17.00	16.91	2.09%	0.965	0.985	-
		Left side	-	6	2437	17.00	16.96	0.93%	0.069	0.070	-
		Right side	-	6	2437	17.00	16.96	0.93%	0.041	0.041	-
		Bottom side	-	6	2437	17.00	16.96	0.93%	0.016	0.016	-
	WLAN802.11 n (20M)	Top side	-	6	2437	15.50	15.39	2.57%	0.679	0.696	51
		Back side	-	40	5200	12.50	12.39	2.57%	1.27	1.303	52
		Back side	-	44	5220	12.50	12.29	4.95%	1.26	1.322	-
		Back side*	-	40	5200	12.50	12.39	2.57%	1.22	1.251	-
	WLAN802.11 a 5.2G	Top side	-	40	5200	12.50	12.39	2.57%	0.213	0.218	-
		Left side	-	40	5200	12.50	12.39	2.57%	0.042	0.043	-
		Right side	-	40	5200	12.50	12.39	2.57%	0.014	0.014	-
		Bottom side	-	40	5200	12.50	12.39	2.57%	0.0059	0.006	-
	WLAN802.11 n(40M)	Back side	-	38	5190	12.00	11.94	1.39%	1.12	1.136	-
Main	5.2G	Back side	-	46	5230	12.00	11.83	3.99%	1.13	1.175	53
		Back side	-	52	5260	12.50	12.45	1.16%	1.4	1.416	-
		Back side	-	60	5300	12.50	12.41	2.09%	1.4	1.429	54
		Back side*	-	60	5300	12.50	12.41	2.09%	1.38	1.409	-
	WLAN802.11 a 5.3G	Top side	-	52	5260	12.50	12.45	1.16%	0.314	0.318	-
		Left side	-	52	5260	12.50	12.45	1.16%	0.04	0.040	-
		Right side	-	52	5260	12.50	12.45	1.16%	0.0112	0.011	-
		Bottom side	-	52	5260	12.50	12.45	1.16%	0.00232	0.002	-
	WLAN802.11 n(40M)	Back side	-	54	5270	12.00	11.91	2.09%	1.23	1.256	-
	5.3G	Back side	-	62	5310	12.00	11.75	5.93%	1.33	1.409	55
		Back side	-	100	5500	13.00	12.31	17.22%	1.31	1.536	56
		Back side	-	116	5580	13.00	12.42	14.29%	1.31	1.497	-
		Back side	-	140	5700	13.00	12.31	17.22%	0.945	1.108	-
	WLAN802.11 a 5.6G	Back side*	-	116	5580	13.00	12.42	14.29%	1.27	1.451	-
	WLANOUZ. II & 3.0G	Top side	-	116	5580	13.00	12.42	14.29%	0.198	0.226	-
		Left side	-	116	5580	13.00	12.42	14.29%	0.071	0.081	-
		Right side	-	116	5580	13.00	12.42	14.29%	0.0117	0.013	-
		Bottom side	-	116	5580	13.00	12.42	14.29%	0.00263	0.003	-

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

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Antenna	Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling	•	AR over 1g /kg)	Plot
			(((((((((((((((((((((((((((((((((((((((			Tolerance (dBm)	(dBm)		Measured	Reported	page
		Back side	-	102	5510	12.00	11.84	3.75%	1.24	1.287	57
	WLAN802.11 n(40M) 5.6G	Back side	-	110	5550	12.00	11.97	0.69%	1.16	1.168	-
	5.00	Back side	-	134	5670	12.00	11.92	1.86%	1.02	1.039	-
		Back side	-	149	5745	13.50	12.29	32.13%	0.955	1.262	-
		Back side	-	157	5785	13.50	12.45	27.35%	1.09	1.388	-
		Back side	-	165	5825	13.50	12.42	28.23%	1.17	1.500	-
Main	WLAN802.11 a 5.8G	Back side*	-	165	5825	13.50	12.42	28.23%	1.18	1.513	58
	WLAINOUZ.II a 5.0G	Top side	-	157	5785	13.50	12.45	27.35%	0.184	0.234	-
		Left side	-	157	5785	13.50	12.45	27.35%	0.052	0.066	-
		Right side	-	157	5785	13.50	12.45	27.35%	0.0124	0.016	-
		Bottom side	-	157	5785	13.50	12.45	27.35%	0.00318	0.004	-
	WLAN802.11 n(40M)	Back side	-	151	5755	12.00	11.85	3.51%	0.919	0.951	-
	5.8G	Back side	-	159	5795	12.00	11.73	6.41%	0.951	1.012	59

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

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Antenna	Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling	Averaged S (W/	-	Plot
			(((((((((((((((((((((((((((((((((((((((			Tolerance (dBm)	(dBm)		Measured	Reported	page
		Back side	-	1	2412	17.00	16.88	2.80%	1.15	1.182	-
		Back side	-	6	2437	17.00	16.93	1.62%	1.12	1.138	-
		Back side	-	11	2462	17.00	16.91	2.09%	1.23	1.256	-
	WLAN802.11 b	Back side*	-	11	2462	17.00	16.91	2.09%	1.28	1.307	60
		Top side	-	6	2437	17.00	16.93	1.62%	0.088	0.089	-
		Right side	-	6	2437	17.00	16.93	1.62%	0.542	0.551	-
		Bottom side	-	6	2437	17.00	16.93	1.62%	0.027	0.027	-
	WLAN802.11 n (20M)	Back side	-	1	2412	15.50	15.48	0.46%	0.763	0.767	61
		Back side	-	40	5200	14.00	12.33	46.89%	0.807	1.185	-
		Back side	-	44	5220	14.00	12.35	46.22%	0.863	1.262	-
	WLAN802.11 a 5.2G	Back side*	-	44	5220	14.00	12.35	46.22%	0.871	1.274	62
	WLAN002.11 a 5.20	Top side	-	44	5220	14.00	12.35	46.22%	0.045	0.066	-
		Right side	-	44	5220	14.00	12.35	46.22%	0.403	0.589	-
		Bottom side		44	5220	14.00	12.35	46.22%	0.014	0.020	-
	WLAN802.11 n(40M) 5.2G	Back side	-	38	5190	12.00	11.95	1.16%	0.78	0.789	63
		Back side	-	52	5260	14.00	12.29	48.25%	0.852	1.263	-
Aux		Back side	-	60	5300	14.00	12.39	44.88%	0.822	1.191	-
	WLAN802.11 a 5.3G	Back side*	-	52	5260	14.00	12.29	48.25%	0.857	1.271	64
	WLANOUZ.TT a 5.3G	Top side	-	60	5300	14.00	12.39	44.88%	0.00584	0.008	-
		Right side	-	60	5300	14.00	12.39	44.88%	0.552	0.800	-
		Bottom side	-	60	5300	14.00	12.39	44.88%	0.0737	0.107	-
	WLAN802.11 n(40M)	Back side	-	54	5270	12.00	11.94	1.39%	0.959	0.972	65
	5.3G	Back side	-	62	5310	12.00	11.84	3.75%	0.872	0.905	-
		Back side	-	100	5500	14.00	12.38	45.21%	0.676	0.982	-
		Back side	-	116	5580	14.00	12.49	41.58%	0.677	0.958	-
		Back side	-	136	5680	14.00	12.27	48.94%	0.684	1.019	66
	WLAN802.11 a 5.6G	Top side	-	116	5580	14.00	12.49	41.58%	0.0044	0.006	-
	WLANOUZ. IT a 5.00	Right side	-	100	5500	14.00	12.38	45.21%	0.392	0.569	-
		Right side	-	116	5580	14.00	12.49	41.58%	0.422	0.597	-
		Right side	-	136	5680	14.00	12.27	48.94%	0.47	0.700	-
		Bottom side	-	116	5580	14.00	12.49	41.58%	0.0239	0.034	-
	MI ANOOD 11 (1011)	Back side	-	102	5510	12.00	11.85	3.51%	0.713	0.738	-
	WLAN802.11 n(40M) 5.6G	Back side	-	110	5550	12.00	11.75	5.93%	0.687	0.728	-
	5.00	Back side	-	134	5670	12.00	11.84	3.75%	0.726	0.753	67

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

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Antenna	Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling	Averaged SAR over 1g (W/kg)		Plot page
			((()))		(11112)	Tolerance (dBm)	(dBm)		Measured	Reported	page
		Back side	-	153	5765	12.50	12.33	3.99%	0.528	0.549	-
		Back side	-	157	5785	12.50	12.44	1.39%	0.548	0.556	-
	WLAN802.11 a 5.8G	Back side	-	161	5805	12.50	12.36	3.28%	0.608	0.628	68
Aux	WLANOUZ.TT a 5.00	Top side	-	157	5785	12.50	12.44	1.39%	0.0148	0.015	-
Aux		Right side	-	157	5785	12.50	12.44	1.39%	0.403	0.409	-
		Bottom side	-	157	5785	12.50	12.44	1.39%	0.00153	0.002	-
	WLAN802.11 n(40M) 5.8G	Back side	-	151	5755	12.00	11.94	1.39%	0.58	0.588	69

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

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## 3. Simultaneous Transmission Analysis

Simultaneous Transmission Scenarios:

Simultaneous Transmit Configurations	Body
WLAN 802.11n MIMO 2.4G	Yes
WLAN 802.11n MIMO 5G	Yes

Note:

1. Bluetooth and WLAN technologies cannot transmit simultaneously.

2. For 2.4GHz WLAN Main and Aux antennas, the maximum output power for 802.11b is larger than that for 802.11n and the maximum output power of each antenna during simultaneous transmission for 802.11n is less than that used in standalone transmission for 802.11n, so it is more conservative to use the sum of 1-g SAR provision in KDB447498D01 for 802.11b to exclude the SAR measurement for 802.11n MIMO.

3. For 5GHz WLAN Main and Aux antennas, the maximum output power for 802.11a is larger than that for 802.11n, so it is more conservative to use the sum of 1-g SAR provision in KDB447498D01 for 802.11a to exclude the SAR measurement for 802.11n MIMO.

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

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-1q.

Mode / Band	frequency(GHz)	Max. tune-up power(dBm)	Test position	test separation distance(mm)	Estimated SAR(W/kg)
WLAN(Aux)	2.462	17	Left	127	0.4
WLAN(Aux)	5.825	14	Left	127	0.4

#### 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  $\leq 0.04$  for all antenna pairs in the configuration to gualify 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.

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#### 2.4GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR WLAN Main & WLAN Aux
		Back side	0	0.732	1.307	2.039	Analyzed as below
		Top side	0	1.052	0.089	1.141	ΣSAR<1.6, Not required
1	2.4GHz WLAN MIMO	Left side	0	0.07	0.4 (Estimated SAR)	0.47	ΣSAR<1.6, Not required
		Right side	0	0.041	0.551	0.592	ΣSAR<1.6, Not required
		Bottom side	0	0.016	0.027	0.043	ΣSAR<1.6, Not required

#### SPLSR WLAN Main & WLAN Aux

			Co	oordinates (cr	n)		Peak		
Conditions	Position	SAR Value (W/kg)	х	у	Z	ΣSAR (W/kg)	Location Separation Distance (mm)	SPLSR	Simultaneous Transmission SAR Test
802.11b CH 6	Back side	0.732	-3.28	-9.56	0.45	2.039	122.4	0.024	SPLSR<0.04,
802.11b CH 11	DACK SILLE	1.307	6.18	-1.8	0.6	2.039	122.4	0.024	Not required
Ţ	y								

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#### **5GHz WLAN MIMO**

No.	Conditions	Position	Distance (mm)	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR WLAN Main & WLAN Aux
		Back side	0	1.536	1.274	2.81	Analyzed as below
		Top side	0	0.318	0.107	0.425	ΣSAR<1.6, Not required
2	5GHz WLAN MIMO	Left side	0	0.081	0.4 (Estimated SAR)	0.481	ΣSAR<1.6, Not required
		Right side	0	0.016	0.8	0.816	ΣSAR<1.6, Not required
		Bottom side	0	0.006	0.02	0.026	ΣSAR<1.6, Not required

#### SPLSR WLAN Main & WLAN Aux

				oordinates (cr	2)				
Conditions	Position	SAR Value (W/kg)	x	y	Z	ΣSAR (W/kg)	Peak Location Separation Distance (mm)	SPLSR	Simultaneous Transmission SAR Test
802.11a CH 100	Back side	1.536	-2.76	-9.44	0.48	2.81	119.49	0.039	SPLSR<0.04,
802.11a CH 44	Dack Side	1.274	7.2	-2.84	0.59	2.01	119.49	0.039	Not required
Ţ	-×								

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## 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	3820	May.15,2014	May.14,2015
Schmid & Partner	System Validation	D2450V2	727	Apr.23,2014	Apr.22,2015
Engineering AG	Dipole	D5GHzV2	1023	Jan.30,2014	Jan.29,2015
Schmid & Partner Engineering AG	Data acquisition Electronics	DAE4	547	Mar.26,2014	Mar.25,2015
Schmid & Partner Engineering AG	Software	DASY 52 V52.8.8	N/A	Calibration not required	Calibration not required
Schmid & Partner Engineering AG	Phantom	SAM	N/A	Calibration not required	Calibration not required
Agilent	Network Analyzer	E5071C	MY46107530	Feb.14,2014	Feb.13,2015
Agilent	Dielectric Probe Kit	85070E	MY44300677	Calibration not required	Calibration not required
Agilant	Dual-directional	772D	MY46151242	Jul.14,2014	Jul.13,2015
Agilent	coupler	778D	MY48220468	Apr.01,2014	Mar.31,2015
Agilent	RF Signal Generator	N5181A	MY50144143	Jun.25.2014	Jun.24.2015
Agilent	Power Meter	E4417A	MY51410006	Oct.25,2013	Oct.24,2015
Agilent	Power Sensor	E9301H	MY51470001	Dec.16,2013	Dec.15,2014
TECPEL	Digital thermometer	DTM-303A	TP130077	Mar.17,2014	Mar.16,2015
Anritsu	Power Meter	ML2495A	1005007	Jan.13,2014	Jan.12,2015
Anritsu	Power Sensor	MA2411B	917032	Jan.13,2014	Jan.12,2015
Mini-Circuit	Attenuator	BW-S10W2+	002	Feb.27,2014	Feb.26,2015

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### 5. Measurements

Date: 2014/12/5

### WLAN802.11b\_Body-worn\_Top side\_CH 1\_Main

Communication System: WLAN(2.45G); Frequency: 2412 MHz Medium parameters used: f = 2412 MHz;  $\sigma$  = 1.94 S/m;  $\epsilon_r$  = 53.618;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

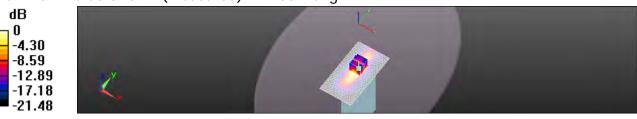
- Probe: EX3DV4 SN3820; ConvF(6.87, 6.87, 6.87); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (71x131x1):** Interpolated grid: dx=12 mm, dy=12 mm

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

### Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm Reference Value = 27.00 V/m; Power Drift = 0.17 dB Peak SAR (extrapolated) = 2.06 W/kg SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.475 W/kg Maximum value of SAR (measured) = 1.56 W/kg



0 dB = 1.56 W/kg = 1.93 dBW/kg

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### WLAN802.11n(20M)\_Body-worn\_ Top side\_CH 6\_Main

Communication System: WLAN(2.45G); Frequency: 2437 MHz Medium parameters used: f = 2437 MHz;  $\sigma$  = 1.969 S/m;  $\epsilon_r$  = 53.445;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

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

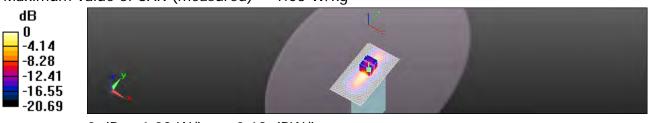
# **Configuration/Body/Area Scan (71x131x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 1.04 W/kg

### Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm Reference Value = 22.10 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 1.37 W/kg SAR(1 g) = 0.679 W/kg; SAR(10 g) = 0.312 W/kg

Maximum value of SAR (measured) = 1.03 W/kg



0 dB = 1.03 W/kg = 0.13 dBW/kg

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### WLAN802.11a 5.2G\_Body-worn\_Back side\_CH 40\_Main

Communication System: WLAN(5G); Frequency: 5200 MHz Medium parameters used: f = 5200 MHz;  $\sigma$  = 5.215 S/m;  $\epsilon_r$  = 47.94;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.44, 4.44, 4.44); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (101x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.25 W/kg

### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 3.953 V/m; Power Drift = 0.16 dB Peak SAR (extrapolated) = 5.04 W/kg SAR(1 g) = 1.27 W/kg; SAR(10 g) = 0.534 W/kg Maximum value of SAR (measured) = 2.30 W/kg



0 dB = 2.30 W/kg = 3.62 dBW/kg

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#### WLAN802.11n(40M) 5.2G\_Body-worn\_Back side\_CH 46\_Main

Communication System: WLAN(5G); Frequency: 5230 MHz Medium parameters used: f = 5230 MHz;  $\sigma$  = 5.248 S/m;  $\epsilon_r$  = 47.874;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.44, 4.44, 4.44); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

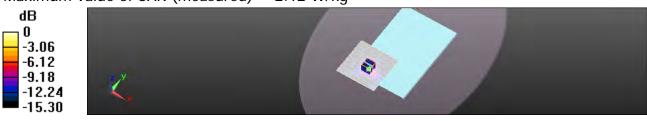
# **Configuration/Body/Area Scan (101x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.29 W/kg

#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 4.113 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 4.61 W/kg SAR(1 g) = 1.13 W/kg; SAR(10 g) = 0.429 W/kg

Maximum value of SAR (measured) = 2.12 W/kg



0 dB = 2.12 W/kg = 3.26 dBW/kg

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### WLAN802.11a 5.3G\_Body-worn\_Back side\_CH 60\_Main

Communication System: WLAN(5G); Frequency: 5300 MHz Medium parameters used: f = 5300 MHz;  $\sigma$  = 5.388 S/m;  $\epsilon_r$  = 47.7;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.25, 4.25, 4.25); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

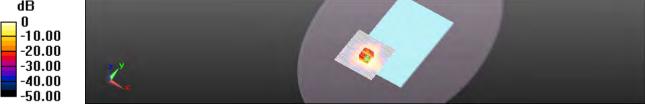
# **Configuration/Body/Area Scan (101x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.90 W/kg

### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 4.245 V/m; Power Drift = 0.19 dB Peak SAR (extrapolated) = 5.69 W/kg SAR(1 g) = 1.4 W/kg; SAR(10 g) = 0.450 W/kg





0 dB = 2.76 W/kg = 4.41 dBW/kg

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#### WLAN802.11n(40M) 5.3G\_Body-worn\_Back side\_CH 62\_Main

Communication System: WLAN(5G); Frequency: 5310 MHz Medium parameters used: f = 5310 MHz;  $\sigma$  = 5.391 S/m;  $\epsilon_r$  = 47.585;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.25, 4.25, 4.25); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

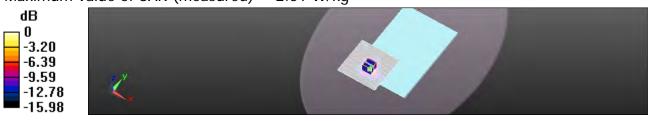
# **Configuration/Body/Area Scan (101x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.76 W/kg

#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 4.731 V/m; Power Drift = -0.17 dB Peak SAR (extrapolated) = 5.24 W/kg SAR(1 g) = 1.33 W/kg; SAR(10 g) = 0.508 W/kg

Maximum value of SAR (measured) = 2.51 W/kg



0 dB = 2.51 W/kg = 4.00 dBW/kg

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### WLAN802.11a 5.6G\_Body-worn\_Back side\_CH 100\_Main

Communication System: WLAN(5G); Frequency: 5500 MHz Medium parameters used: f = 5500 MHz;  $\sigma$  = 5.694 S/m;  $\epsilon_r$  = 47.522;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(3.99, 3.99, 3.99); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (101x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.59 W/kg

### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 4.836 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 5.68 W/kg SAR(1 g) = 1.31 W/kg; SAR(10 g) = 0.519 W/kg

Maximum value of SAR (measured) = 2.41 W/kg



0 dB = 2.41 W/kg = 3.82 dBW/kg

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### WLAN802.11n(40M) 5.6G\_Body-worn\_Back side\_CH 102\_Main

Communication System: WLAN(5G); Frequency: 5510 MHz Medium parameters used: f = 5510 MHz;  $\sigma$  = 5.713 S/m;  $\epsilon_r$  = 47.492;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(3.99, 3.99, 3.99); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (101x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.46 W/kg

#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 4.258 V/m; Power Drift = -0.12 dB Peak SAR (extrapolated) = 5.23 W/kg SAR(1 g) = 1.24 W/kg; SAR(10 g) = 0.483 W/kg

Maximum value of SAR (measured) = 2.31 W/kg



0 dB = 2.31 W/kg = 3.64 dBW/kg

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# WLAN802.11a 5.8G\_Body-worn\_Back side\_CH 165\_Main\_repeat SAR test at the highest SAR measurement

Communication System: WLAN(5G); Frequency: 5825 MHz Medium parameters used: f = 5825 MHz;  $\sigma$  = 6.278 S/m;  $\epsilon_r$  = 46.18;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4, 4, 4); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (101x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

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

### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 4.382 V/m; Power Drift = -0.19 dB Peak SAR (extrapolated) = 5.52 W/kg SAR(1 g) = 1.18 W/kg; SAR(10 g) = 0.404 W/kg Maximum value of SAR (measured) = 2.35 W/kg



0 dB = 2.35 W/kg = 3.71 dBW/kg

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### WLAN802.11n(40M) 5.8G\_Body-worn\_Back side\_CH 159\_Main

Communication System: WLAN(5G); Frequency: 5795 MHz Medium parameters used: f = 5795 MHz;  $\sigma$  = 6.2 S/m;  $\epsilon_r$  = 46.273;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4, 4, 4); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (101x101x1):** Interpolated grid: dx=10 mm, dy=10 mm

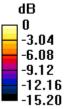
Maximum value of SAR (interpolated) = 1.96 W/kg

#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mmReference Value = 4.258 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 4.58 W/kg

SAR(1 g) = 0.951 W/kg; SAR(10 g) = 0.344 W/kg

Maximum value of SAR (measured) = 1.85 W/kg





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

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# WLAN802.11b\_Body-worn\_Back side\_CH 11\_Aux\_repeat SAR test at the highest SAR measurement

Communication System: WLAN(2.45G); Frequency: 2462 MHz Medium parameters used: f = 2462 MHz;  $\sigma$  = 2.003 S/m;  $\epsilon_r$  = 53.318;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

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

# **Configuration/Body/Area Scan (81x141x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 2.05 W/kg

### Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm Reference Value = 3.400 V/m; Power Drift = 0.16 dB Peak SAR (extrapolated) = 2.62 W/kg SAR(1 g) = 1.28 W/kg; SAR(10 g) = 0.636 W/kg Maximum value of SAR (measured) = 1.96 W/kg



0 dB = 1.96 W/kg = 2.92 dBW/kg

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### WLAN802.11n(20M)\_Body-worn\_Back side\_CH 1\_Aux

Communication System: WLAN(2.45G); Frequency: 2412 MHz Medium parameters used: f = 2412 MHz;  $\sigma$  = 1.94 S/m;  $\epsilon_r$  = 53.618;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

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

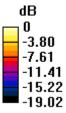
# **Configuration/Body/Area Scan (81x141x1):** Interpolated grid: dx=12 mm, dy=12 mm

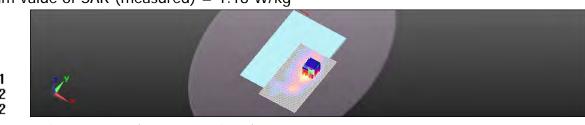
Maximum value of SAR (interpolated) = 1.13 W/kg

### Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm Reference Value = 3.361 V/m; Power Drift = 0.13 dBPeak SAR (extrapolated) = 1.60 W/kgSAR(1 g) = 0.763 W/kg; SAR(10 g) = 0.383 W/kg

Maximum value of SAR (measured) = 1.18 W/kg





0 dB = 1.18 W/kg = 0.72 dBW/kg

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# WLAN802.11a 5.2G\_Body-worn\_Back side\_CH 44\_Aux\_repeat SAR test at the highest SAR measurement

Communication System: WLAN(5G); Frequency: 5220 MHz Medium parameters used: f = 5220 MHz;  $\sigma$  = 5.241 S/m;  $\epsilon_r$  = 47.918;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.44, 4.44, 4.44); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (91x141x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.69 W/kg

### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 3.480 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 3.23 W/kg SAR(1 g) = 0.871 W/kg; SAR(10 g) = 0.367 W/kg Maximum value of SAR (measured) = 1.59 W/kg



0 dB = 1.59 W/kg = 2.01 dBW/kg

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#### WLAN802.11n(40M) 5.2G\_Body-worn\_Back side\_CH 38\_Aux

Communication System: WLAN(5G); Frequency: 5190 MHz Medium parameters used: f = 5190 MHz;  $\sigma$  = 5.203 S/m;  $\epsilon_r$  = 47.969;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

**DASY5** Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.44, 4.44, 4.44); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26 •
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

#### Configuration/Body/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm

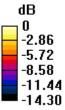
Maximum value of SAR (interpolated) = 1.43 W/kg

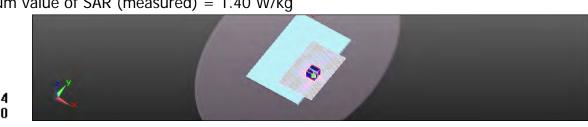
#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mmReference Value = 3.098 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 2.84 W/kg

SAR(1 q) = 0.780 W/kq; SAR(10 q) = 0.330 W/kq

Maximum value of SAR (measured) = 1.40 W/kg





0 dB = 1.40 W/kq = 1.46 dBW/kq

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# WLAN802.11a 5.3G\_Body-worn\_Back side\_CH 52\_Aux\_repeat SAR test at the highest SAR measurement

Communication System: WLAN(5G); Frequency: 5260 MHz Medium parameters used: f = 5260 MHz;  $\sigma$  = 5.293 S/m;  $\epsilon_r$  = 47.837;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

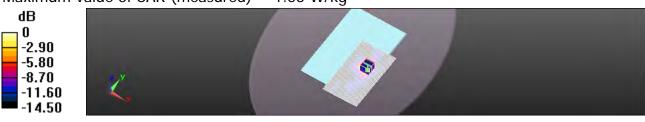
- Probe: EX3DV4 SN3820; ConvF(4.25, 4.25, 4.25); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (91x161x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.45 W/kg

### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 3.847 V/m; Power Drift = 0.13 dB Peak SAR (extrapolated) = 3.15 W/kg SAR(1 g) = 0.857 W/kg; SAR(10 g) = 0.336 W/kg Maximum value of SAR (measured) = 1.53 W/kg



0 dB = 1.53 W/kg = 1.85 dBW/kg

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### WLAN802.11n(40M) 5.3G\_Body-worn\_Back side\_CH 54\_Aux

Communication System: WLAN(5G); Frequency: 5270 MHz Medium parameters used: f = 5270 MHz;  $\sigma$  = 5.303 S/m;  $\epsilon_r$  = 47.795;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.25, 4.25, 4.25); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# **Configuration/Body/Area Scan (91x161x1):** Interpolated grid: dx=10 mm, dy=10 mm

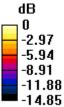
Maximum value of SAR (interpolated) = 1.64 W/kg

### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mmReference Value = 4.449 V/m; Power Drift = -0.13 dB Peak SAR (extrapolated) = 3.61 W/kg

SAR(1 g) = 0.959 W/kg; SAR(10 g) = 0.370 W/kg

Maximum value of SAR (measured) = 1.70 W/kg





0 dB = 1.70 W/kg = 2.30 dBW/kg

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### WLAN802.11a 5.6G\_Body-worn\_Back side\_CH 136\_Aux

Communication System: WLAN(5G); Frequency: 5680 MHz Medium parameters used: f = 5680 MHz;  $\sigma$  = 5.992 S/m;  $\epsilon_r$  = 46.979;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

**DASY5** Configuration:

- Probe: EX3DV4 SN3820; ConvF(3.83, 3.83, 3.83); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

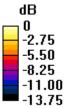
#### Configuration/Body/Area Scan (91x161x1): Interpolated grid: dx=10 mm, dy=10 mm

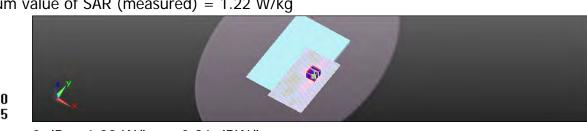
Maximum value of SAR (interpolated) = 1.12 W/kg

#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mmReference Value = 5.768 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 2.71 W/kg SAR(1 q) = 0.684 W/kq; SAR(10 q) = 0.306 W/kq

Maximum value of SAR (measured) = 1.22 W/kg





0 dB = 1.22 W/kq = 0.86 dBW/kq

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### WLAN802.11n(40M) 5.6G\_Body-worn\_Back side\_CH 134\_Aux

Communication System: WLAN(5G); Frequency: 5670 MHz Medium parameters used: f = 5670 MHz;  $\sigma$  = 5.948 S/m;  $\epsilon_r$  = 47.031;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(3.83, 3.83, 3.83); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

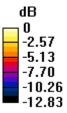
# **Configuration/Body/Area Scan (91x141x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.27 W/kg

#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 4.775 V/m; Power Drift = -0.19 dB Peak SAR (extrapolated) = 2.83 W/kg SAR(1 g) = 0.726 W/kg; SAR(10 g) = 0.326 W/kg

Maximum value of SAR (measured) = 1.38 W/kg





0 dB = 1.38 W/kg = 1.40 dBW/kg

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#### WLAN802.11a 5.8G\_Body-worn\_Back side\_CH 161\_Aux

Communication System: WLAN(5G); Frequency: 5805 MHz Medium parameters used: f = 5805 MHz;  $\sigma$  = 6.236 S/m;  $\epsilon_r$  = 46.217;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4, 4, 4); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

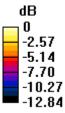
# **Configuration/Body/Area Scan (91x161x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.911 W/kg

#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 3.731 V/m; Power Drift = 0.11 dB Peak SAR (extrapolated) = 2.35 W/kg SAR(1 g) = 0.608 W/kg; SAR(10 g) = 0.260 W/kg

Maximum value of SAR (measured) = 1.10 W/kg





0 dB = 1.10 W/kg = 0.41 dBW/kg

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#### WLAN802.11n(40M) 5.8G\_Body-worn\_Back side\_CH 151\_Aux

Communication System: WLAN(5G); Frequency: 5755 MHz Medium parameters used: f = 5755 MHz;  $\sigma$  = 6.141 S/m;  $\epsilon_r$  = 46.486;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4, 4, 4); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

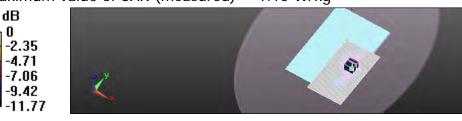
# **Configuration/Body/Area Scan (91x161x1):** Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.921 W/kg

#### Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm Reference Value = 4.023 V/m; Power Drift = -0.17 dB Peak SAR (extrapolated) = 2.24 W/kg SAR(1 g) = 0.580 W/kg; SAR(10 g) = 0.250 W/kg

Maximum value of SAR (measured) = 1.10 W/kg



0 dB = 1.10 W/kg = 0.41 dBW/kg

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## 6. SAR System Performance Verification

Date: 2014/12/5

### Dipole 2450 MHz\_SN:727\_Body

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz;  $\sigma$  = 1.997 S/m;  $\epsilon_r$  = 53.416;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

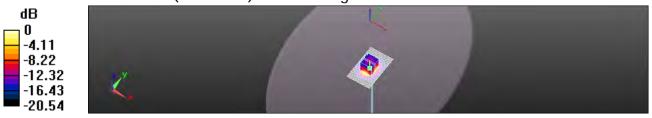
- Probe: EX3DV4 SN3820; ConvF(6.87, 6.87, 6.87); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Configuration/Pin=250mW/Area Scan (51x81x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 19.0 W/kg

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

grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 96.26 V/m; Power Drift = -0.16 dB Peak SAR (extrapolated) = 24.1 W/kg SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.78 W/kg Maximum value of SAR (measured) = 18.1 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

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### Dipole 5200 MHz\_SN:1023\_Body

Communication System: CW; Frequency: 5200 MHz Medium parameters used: f = 5200 MHz;  $\sigma$  = 5.215 S/m;  $\epsilon_r$  = 47.94;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

#### DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.44, 4.44, 4.44); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

#### Configuration/Pin=100mW/Area Scan (61x101x1): Interpolated grid:

dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 16.0 W/kg

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

grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 57.17 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 27.8 W/kg SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.18 W/kg Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

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### Dipole 5300 MHz\_SN:1023\_Body

Communication System: CW; Frequency: 5300 MHz Medium parameters used: f = 5300 MHz;  $\sigma$  = 5.388 S/m;  $\epsilon_r$  = 47.7;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4.25, 4.25, 4.25); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Configuration/Pin=100mW/Area Scan (61x101x1): Interpolated grid:

dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 15.4 W/kg

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

grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 57.18 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 26.9 W/kg SAR(1 g) = 7.39 W/kg; SAR(10 g) = 2.11 W/kg Maximum value of SAR (measured) = 15.1 W/kg



0 dB = 15.1 W/kg = 11.79 dBW/kg

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Date: 2014/12/8

# Dipole 5600 MHz\_SN:1023\_Body

Communication System: CW; Frequency: 5600 MHz Medium parameters used: f = 5600 MHz;  $\sigma$  = 5.838 S/m;  $\epsilon_r$  = 47.15;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(3.99, 3.99, 3.99); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# Configuration/Pin=100mW/Area Scan (61x101x1): Interpolated grid:

dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 18.9 W/kg

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

grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 63.52 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 34.2 W/kg SAR(1 g) = 8.45 W/kg; SAR(10 g) = 2.3 W/kg Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.76 dBW/kg

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# Dipole 5800 MHz\_SN:1023\_Body

Communication System: CW; Frequency: 5800 MHz

Medium parameters used: f = 5800 MHz;  $\sigma$  = 6.217 S/m;  $\epsilon_r$  = 46.238;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section

# DASY5 Configuration:

- Probe: EX3DV4 SN3820; ConvF(4, 4, 4); Calibrated: 2014/5/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2014/3/26
- Phantom: Body;
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

# Configuration/Pin=100mW/Area Scan (61x101x1): Interpolated grid:

dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 15.7 W/kg

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

grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 55.62 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 7.36 W/kg; SAR(10 g) = 2.08 W/kg Maximum value of SAR (measured) = 15.7 W/kg



0 dB = 15.7 W/kg = 11.96 dBW/kg

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# 7. DAE & Probe Calibration Certificate

chmid & Partner Engineering AG rughausstrasse 43, 9004 Zurich	y of h, Switzerland	Hacinea (Surgers) S	Schweizerischer Kallbrierdienst Service suisse d'datomage Servizio svizzero di tantuna Swiss Calibration Service
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CALIBRATION C	ERTIFICATE		
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Calibration data:	March 26, 2014		
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### Report No. : EN/2014/B0016 Page : 76 of 114

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Accreditation No.: SCS 108

Glossary

DAE Connector angle

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

#### Methods Applied and Interpretation of Parameters

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

Certificate No: DAE4-547\_Mar14

Page 2 of 5

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# DC Voltage Measurement

AVD - Converter Presolucion norminal	
High Range: 1LSB = 6.1µV	, full range = -100+300 mV
Low Range: 1LSB = 61nV	, full range = -1+3mV
DASY measurement parameters: Auto Zero Tim	ne: 3 sec; Measuring time: 3 sec

Calibration Factors	x	Y	z
High Range	$404.032\pm0.02\%~(k{=}2)$	404.058 ± 0.02% (k=2)	404.202 ± 0.02% (k=2)
Low Range	3.95713 ± 1.50% (k=2)	3.96202 ± 1.50% (k=2)	3.97561 ± 1.50% (k=2)

#### Connector Angle

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

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

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

#### 2. Common mode sensitivity

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

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

#### 3. Channel separation

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

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

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#### 4. AD-Converter Values with inputs shorted

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

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

#### 5. Input Offset Measurement

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

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

#### 6. Input Offset Current

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

#### 7. Input Resistance (Typical values for information)

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

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

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

#### 9. Power Consumption (Typical values for information)

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

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Accreditation No.: SCS 108

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

#### Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization $\phi$	φ rotation around probe axis
Polarization 8	9 rotation around an axis that is in the plane normal to probe axis (at measurement center),
	i.e., 9 = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

#### Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization 8 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx, y, z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f < 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for measurements for t > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alphs, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

Certificate No: EX3-3820\_May14

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May 15, 2014

# Probe EX3DV4

# SN:3820

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

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

Certificate No: EX3-3820\_May14

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May 15, 2014

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

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)2) <sup>A</sup>	0.41	0.48	0.51	± 10.1 %
DCP (mV) <sup>8</sup>	101.9	94.0	97.6	

#### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dBõV	С	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	144.8	±3.5 %
		Y	0.0	0.0	1.0		131.9	
		Z	0.0	0.0	1.0		142.9	

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

<sup>6</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>1</sup>-field uncertainty inside TSL (see Pages 5 and 6).
<sup>6</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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May 15, 2014

f (MHz) <sup>c</sup>	Relative Permittivity <sup>r</sup>	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	9.55	9.55	9.55	0.41	0.88	± 12.0
835	41.5	0.90	9.22	9.22	9.22	0.30	1.08	± 12.0
900	41.5	0.97	9.23	9.23	9.23	0.47	0.78	± 12.0
1450	40.5	1.20	8.49	8.49	B.49	0.27	1.21	± 12.0
1750	40.1	1.37	8.26	8.26	8.26	0.80	0.59	± 12.0
1900	40.0	1.40	7.73	7.73	7.73	0.58	0.68	± 12.0
2100	39.8	1.49	7.71	7.71	7.71	0.75	0.58	± 12.0
2450	39.2	1.80	6.85	6.85	6.85	0.41	0.85	± 12.0
2600	39.0	1.96	6.73	6.73	6.73	0.40	0.85	± 12.0
5200	36.0	4.66	4.94	4.94	4.94	0.35	1.80	± 13.1
5300	35.9	4.76	4.66	4.66	4.66	0.35	1.80	± 13.1
5500	35.6	4.96	4.70	4.70	4.70	0.35	1.80	± 13.1
5600	35.5	5.07	4.47	4.47	4.47	0.35	1.80	± 13.1
5800	35.3	5.27	4.29	4.29	4.29	0.40	1.80	± 13.1

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

<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), etse it is restricted to ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
<sup>C</sup> All frequencies below 3 GHz, the validity of tissue parameters (c and e) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. All frequences above 3 GHz, the validity of tissue parameters (c and e) can be relaxed to ± 10% if liquid compensation formula is applied to the ConvF uncertainty for this sue parameters (c and e) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for idicated target tossue parameters.
<sup>C</sup> All pharDepth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always lass than = 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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May 15, 2014

f (MHz) <sup>c</sup>	Relative Permittivity	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	9.12	9.12	9.12	0.42	0.92	± 12.0 %
835	55.2	0.97	9.01	9.01	9.01	0.37	0.97	± 12.0 %
900	55.0	1.05	8.83	8.83	8.83	0.59	0.73	± 12.0 %
1450	54.0	1.30	7.88	7.88	7.88	0.58	0.73	± 12.0 %
1750	53.4	1.49	7.48	7.48	7.48	0.80	0.61	± 12.0 %
1900	53.3	1.52	7.23	7.23	7.23	0.63	0.70	± 12.0 9
2100	53.2	1.62	7.54	7.54	7.54	0.53	0.75	± 12.0 %
2450	52.7	1.95	6.87	6.87	6.87	0.80	0.58	± 12.0 9
2600	52.5	2.16	6.63	6.63	6.63	0.80	0.50	± 12.0 9
5200	49.0	5.30	4.44	4.44	4.44	0.40	1.90	± 13.1 9
5300	48.9	5.42	4.25	4.25	4.25	0.40	1.90	± 13.1 9
5500	48.6	5.65	3.99	3.99	3.99	0.45	1.90	± 13.1 9
5600	48.5	5.77	3.83	3.83	3.83	0.45	1.90	± 13.1 9
5800	48.2	6.00	4.00	4.00	4.00	0.50	1.90	± 13.1 9

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

Calibration Paramete	r Determined in Body	Tissue Simulating Media
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<sup>6</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
<sup>7</sup> At frequencies below 3 GHz, the validity of tissue parameters (c and o) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. All frequencies to the validity of tissue parameters (c and o) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. All frequencies below 3 GHz, the validity of tissue parameters (c and o) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
<sup>6</sup> AlphaCapth are datamined during calibration. SPEAQ warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz any distance larger than half the probe tip diameter from the boundary.

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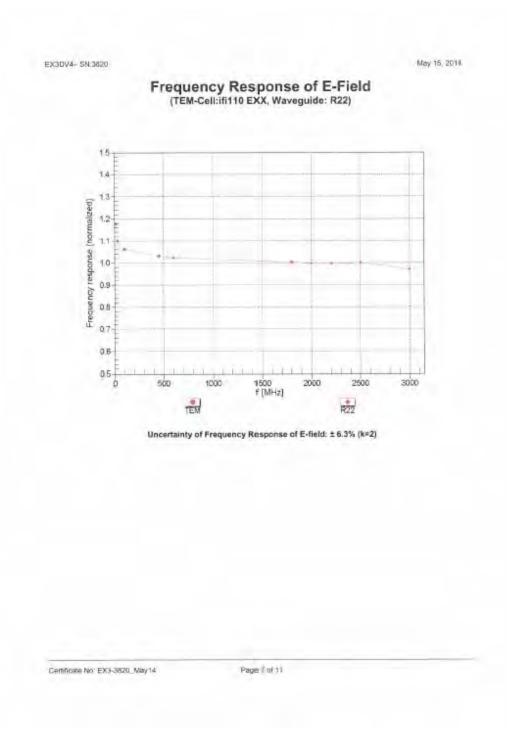
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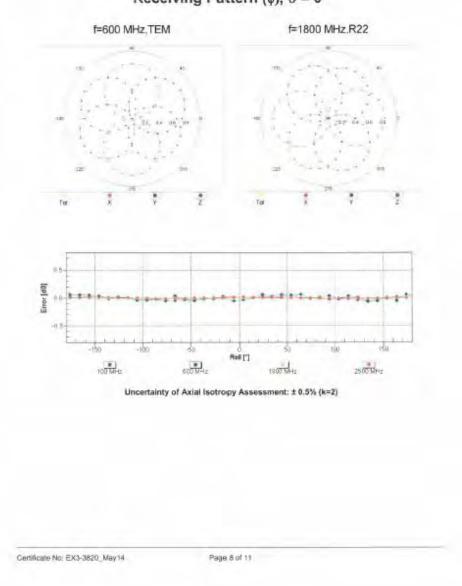
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EX30V4- SN:3820

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Receiving Pattern (\$), 9 = 0°

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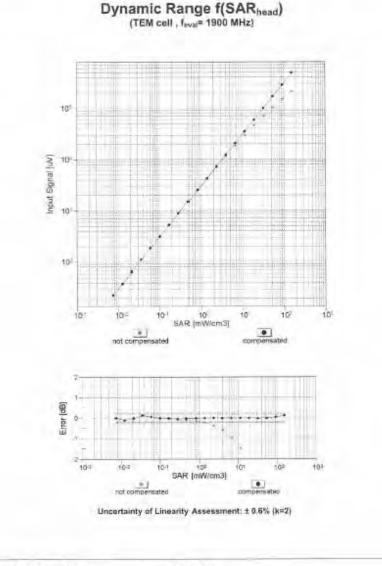
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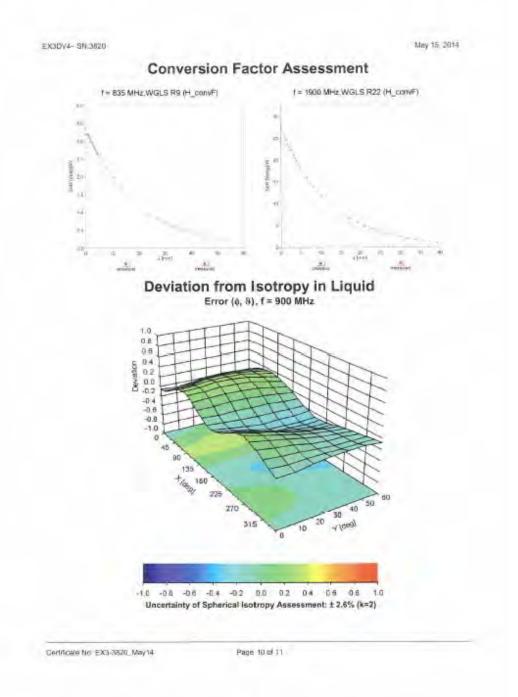
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May 15, 2014

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

#### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (*)	-56
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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# 8. Uncertainty Budget

Measurement Uncertainty evaluation template for DUT SAR test IFFE 1528

IEEE 1528			0						
А	с	D	е		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertaintv	Probabilit v	Div	Div Value	ci (1g)	ci (10g)	Standard uncertaintv	Standard uncertaintv	vi, or Veff
Measurement system									
Probe calibration	6.55%	Ν	1	1	1	1	6.55%	6.55%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	$\infty$
Isotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	$\infty$
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%	$\infty$
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	$\infty$
Readout Electronics	0.30%	Ν	1	1	1	1	0.30%	0.30%	$\infty$
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%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
<i>Measurement drift (class A evaluation)</i>	1.75%	R	√3	1.732	1	1	1.01%	1.01%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
RF ambient condition -	3.00%	R	√3	1.732	1	1	1.73%	1.73%	$\infty$
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	$\infty$
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%	$\infty$
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	$\infty$
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	$\infty$
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%	$\infty$
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	$\infty$
Deviation from reference	4.12%	N	1	1	0.64	0.43	2.64%	1.77%	М
Deviation from reference	4.13%	N	1	1	0.6	0.49	2.48%	2.02%	Μ
Combined standard uncertainty		RSS					12.12%	11.88%	
Expant uncertainty (95% confidence							24.25%	23.76%	

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# 9. Phantom Description

Schmid & Panner Engineering AG е D а

Zeughausstasse 42, 8004 Zunch, Switzerland Phone +41 1 245 9700, Pax +41 1 245 9779 Hol@gasag.com, http://www.spag.com

Certificate of Conformity / First Article Inspection

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

#### Tests

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

Test	Requirement	Details	Units tested
Dimensions Compliant with the geometry according to the CAD model.		IT'IS CAD File (*)	First article, Samples
Material thickness Compliant with the regulrements according to the standards		2mm +/- 0.2mm in flat and specific areas of head section	First article, Samples, TP-1314 ff.
Material thickness at ERP	Compliant with the requirements according to the standarda	6mm +/- 0.2mm at ERP	First article, All itema
Material Dielectric parameters for required parameters frequencies		300 MHz – 6 GHz: Relative psrmittivity < 5, Loss tangent < 0.05	Material samples
Material resistivity The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility.		DEGMBE based simulating liquids	Pre-series, First article, Material samples
Sagging	Compliant with the requirements according to the standards. Sagging of the flat section when filled with tissue simulating liquid	< 1% typical < 0.8% if filled with 155mm of HSL000 and without DUT below	Prototypes, Sample testing

Standards [1] CENELEC EN 50361 [2] IEEE Std 1528-2003

IEC 62209 Part I

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The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

Conformity

13

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

Date 07.07.2005	speag
Signature / Stamp	Subjects & Parsair Enginearing AQ 2015 Jacobs (San 43, 805) 2016 Scitters Phone and Sector Sector Phone Phone Phone and Sector Sector Phone Phone Into Report, Com

Diversion 881-00 000 P40 C-F

t (886-2) 2299-3279

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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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# **10. System Validation from Original Equipment Supplier**

CALIBRATION CERTIFICATE       Detect     D2450V2 - SN: 727       Detection     D2450V2 - SN: 727       Detection     QA CAL-05.v9 Calibration proceedure for dipole validation kits above 700 MHz       Detection date     April 23, 2014	Engineering AG sughausstrasse 43, 8004 Zunct	y of	ROCHRA (PAILS) S	Service suisse d'étaionnage Servicio avizzero di taraturo
CALIBRATION CERTIFICATE           Deter         D2450V2 - SN: 727           Celezation proceduration         QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz           Celezation date         April 23, 2014           This calibration centrosee documents the traceability to national standards. which resides the docessed unes of measurements (S). The measurements and the uncertainties were contracted probability are given on the following pages are are part of the certificate All calibration have been conducted in the doced laboratory facility: serverscenteri (empondure (22 ± 3)°C and humidity < 70%.           Calibration Equiponell used (MSTE circles for calibration)         Both Calibration (22 ± 3)°C and humidity < 70%.           Calibration Equiponell used (MSTE circles for calibration)         Both Calibration (22 ± 3)°C and humidity < 70%.           Calibration Equiponell used (MSTE circles for calibration)         Both Calibration (22 ± 3)°C and humidity < 70%.           Calibration Equiponell used (MSTE circles for calibration)         Both Calibration (22 ± 3)°C and humidity < 70%.           Prover sensor HP 64817.         BIS 7460704         Gel Calibration (27 + 71827)         Calibration (22 ± 3)°C and humidity < 70%.           Prover sensor HP 64817.         MYA 1082317         Gel Calibration (27 + 71827)         Calibration (27 + 71	he Swiss Accreditation Service	i is one of the signatorie	s to the EA	1 No.1 SCS 108
Detect         D2450V2 - SN: 727           Cateration procedure(i)         QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz           Cateration date         April 23, 2014           This cateration control of the trapset/http://origitational.sendents.which réstres the proposed une or messurements (SI). The messurements and the uncertainties are combined excluded, which réstres the proposed une or messurements (SI). The messurements and the uncertainties are combined probability are given on the following pages and are part of the certificate.           All celebration Equipment laws Deem conducted in the closed laboratory facility: environment temperature (32 ± 3)*C and hamidity = 70%.           Cateration Equipment laws Deem conducted in the closed laboratory facility: environment temperature (32 ± 3)*C and hamidity = 70%.           Cateration Equipment laws Deem conducted in the closed laboratory facility: environment temperature (32 ± 3)*C and hamidity = 70%.           Cateration Equipment laws Deem conducted in the closed laboratory facility: environment temperature (32 ± 3)*C and hamidity = 70%.           Cateration Equipment laws Deem conducted in the closed laboratory facility: environment (amperature (32 ± 3)*C and hamidity = 70%.           Cateration Equipment laws Deem conducted in the closed laboratory facility: environment (amperature (32 ± 3)*C and hamidity = 70%.           Cateration Equipment laws Deem conducted in the closed laboratory facility. To (30 ± 2)*C and hamidity = 70%.           Prover sense the Health May Mark 1002317 0104 02-0-13 (No. 217-01027) De-14           Prover sensera the Bala A mark 20 × 200	tient SGS-TW (Aude	in)	Cartificato N	D2450V2-727_Apr14
Categorium procedure(s)         CAC CAL-05.v9 Californation procedure for dipole validation kits above 700 MHz           Categorium dure         April 23, 2014           This categorium continues documents the traceability to national sundants, which resize the process unce of measurements (S). The measurements and the uncertainties with containing probability are given on the following pages and are part of the certificate All categorium in the dosed laboratory facility: environment temperature (32 ± 3)*C and number y 70%.           Categorium Equipments and environments in the categorium in the dosed laboratory facility: environment temperature (32 ± 3)*C and number y 70%.           Categorium Equipment used MMSTE citical for categorium (32 ± 3)*C and number y 70%.           Categorium Equipment used MMSTE citical for categorium           Permany Standards         10 4         Cat Date (Centificate No.)         Scheiduled Categorium           Permany Standards         10 4         Categorium (No. 217-21(827))         Dat 14           Permany Standards         Nix 5008 (20h)         03-4014 (No. 217-21(827))         Dat 14           Permany Standards         Nix 5008 (20h)         03-4014 (No. 217-21(827))         Dat 14           Permany Standards         10 4         Categorium (No. 217-21(827))         April 3           Standards         10 4         Order 14 (No. 217-21(827))         April 3           Protein mater categorium in Standards (No. 217-21(828))         April 3         Apr	CALIBRATION C	ERTIFICATE	2	
Calibration procedure for dipole validation kits above 700 MHz       Caleveron date     April 23, 2014       This calibration perturbate documents the trapset/mit to net/crait sundants, which resize the divescal unre of measurements (SI). The measurements and the uncertainties with combining pages and are part of the certificate.       All calibration have been conducted in the closed laboratory bubility are given on the following pages and are part of the certificate.       All calibration have been conducted in the closed laboratory bubility are given on the following pages and are part of the certificate.       All calibration flower been conducted in the closed laboratory bubility are given on the following pages and are part of the certificate.       Pamary Standards     01 *       Permary Standards     02 *       Permary Standards     03 *       Permary Standards     03 *       Permary Standards     01 *       Permary Standards     04 *	Duest	D2450V2 - SN: 7	27	
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Power sensor HP 6481A         US37292783         D9-Oct-13 (No. 217-01827)         DCI 14           Power sensor HP 6481A         MV41082917         09-Oct-13 (No. 217-01827)         Dc1 14           Reference 20 dB Attenuator         SNL 5056 (20k)         Dc1 14         Dc1 14           SNL 5056 (20k)         SNL 5056 (20k)         Dc1 14         April 5           Type-M instruction         SNL 5056 (20k)         Dc3 24         April 5           Reference 20 dB Attenuator         SNL 5057 (20k)         Dc3 24         April 5           SNL 5047 2 / 08327         D3-Dac-13 (No. E33-3205_Dec13)         Dac-14           SNL 3205         30-Dac-13 (No. E33-3205_Dec13)         Dac-14           DAE-4         SRL 601         25 April 15 (No. DAE-4651_April 3)         April 3           Sectoridary Standarde         ID V         Offseck Date (in flowse)         Scheduled Check           RF generator R&S SMT-06i         100015         D4-Acg-26 (in house check Dc1-13)         In house check Dc1-13)         In house check Oct-13)           Name         Function         Signature         Signature	The measurements and the unce All calibrational have been conduc	enantiles with contribution p offed in the closed laborator	robability are given on the following pages ar	ni are part of the pertificate
Power sensor HP 8481A         MV41090317         06-0c1-13 (No. 217-01826)         Dch-14           Reference 20 dB Attenuator         SN: 5058 (20k)         03-Apri 14 (No. 217-01918)         Apri 15           Type N mismatch combination         SN: 5047.2 / 08587         03-Apri 14 (No. 217-01918)         Apri 15           Reference Probe ES30V3         SN: 5047.2 / 08587         03-Apri 14 (No. 217-01927)         Acri 15           Reference Probe ES30V3         SN: 5047.2 / 08587         03-Apri 15 (No. DAE-1-05), Dec13)         Dac-14           SN: 3205         30-Dac-13 (No. ES3-3205, Dec13)         Dac-14         SN: 3205         Dac-14           SR: 601         25-Apri 15 (No. DAE-4-601, Apri 15)         Apri 14         Sciendary Standards         ID V         Check Date (In fluxise)         Sciendard Check           RF generative Acalyzer HP 5753E         ID 3/37390585 54206         18-Och 01 (In house check Dcl-13)         In house check Ocl-14           Name         Function         Stignature         Stignature	The messurements and the unce All calibrations have been conduc Calibration Equipment used (MST	roanties was confidence p cleid in the closed laborator FE colocal for calibration	robability are given on the following pages ar 14 facility: environment tempendure (32 ± 3)4	nd ani part of the pertilicato C and foundably < 70%
Belsence 20 dB Attenuator         SN: 505E (20k)         03-Apr 14 (Nz, 217-01918)         Apr-15           Type N mematch combination         SN: 5047.2 / 08327         03-Apr 14 (Nz, 217-01928)         Apr-15           Brideence Probe ES36V3         SN: 5047.2 / 08327         03-Apr 14 (Nz, 217-01928)         Apr-15           SN: 5047.2 / 08327         03-Apr 14 (Nz, 217-01928)         Apr-15           SN: 5047.3 / 08587         30-Doc-13 (No. E33-3205, Dec13)         Doc-14           SR: 691         25-Apr-15 (No. E33-3205, Dec13)         Doc-14           Secondary Standards         10 k         Check Date (in floase)         Schodulod Check           RF gammaior R&S SMT-04         100015         D4-Apr-26 (in floase) check Dd-13)         In house check Dd-14           Nateoxik Analyzer HP \$753E         US37390585 54206         18-Op-01 (in house check Dd-13)         In house check Dd-14           Name         Function         Signature         Signature	The messurements and the unce All calibrations have been obedur Calibration E-transmitt used (M&T Pomary Standerds Power meter EPM-442A	reambles with confidence p cleft in the closed laborator FE collect for calibration (10 4	robability are given on the following pages ar y facility: environment temperature (32 ± 3)* Cel Date (Centricate No.)	no are part of the pertilicate C and framidity < 70% Echelolied Castrontion
Type-N mismatch combination         SN: 5047.2 / 08327         C3-Apr:14 (No. 217-01327)         Apr:15           Reference Probe ES30V3         SN: 3205         30-Dec-13 (No. E33-3205, Dec13)         Dac-14           DAE-I         SN: 3205         30-Dec-13 (No. E33-3205, Dec13)         Dac-14           SR: ED1         25: Apr:15 (No. E33-3205, Dec13)         Dac-14           Secondary Standards         10 //         Check Date (in flows)         School/dod Check           RF generation RAS SMT-06         100015         D4-Apr:26 (in house check Dd-13)         In house check Dd-14           Name         Function         Signature	The messurements and the unce All calibrations have been obridue Calibration E-doctment used (M&T Pomary Standerds Power meter EPM-442A	mambles with combinities p atteil in (Ne closed laborator FE childeal for calibration) IID 4 CIB37480704	robability are given on the following pages ar n tability: environment temperature (22 ± 3)* Cel Dote (Centricate No ) 09-0cs-13 (No 217-31627)	to are part of the pertitione C and numidity < 70% Scheiduled Contration Dot-14
Bitlesence Probe ES30V3         SN: 3285         30-Dac-15 (No. ES3-3205_Dec13)         Dac-14           DAE-4         SR: 601         25-Apr-15 (No. ES3-3205_Dec13)         Apr-14           Secondary Standards         ID V         Check Date (in flowse)         School/dod Check           RF generation PAS SMT-04         1000/15         D4-Aeg-26 (in house check Dc-13)         In house check Dc-13)         In house check Dc-13)           Name         Function         Signalure         Signalure	The measurements and the under All contrations have been conduct Calibration Equipment used (M&T Permany Standards, Power sensor HP 64817A	mantiles with combinities p ded in the closed laborator TE chilesi for calibration ID 4 CB37480704 US37292783	robability are given on the following pages ar ny fability: enversement temperature (22 ± 3)* Cel Date (Centricate No.) 09-0ct-13 (No. 217-01627) 09-0ct-13 (No. 217-01627)	to are part of the pertitione C and number 70% Scheduled Contraction Oct-14 Doi:14
DAEA         SR: ED1         25-April15 (No. DAE4-601, April3)         April4           Secondary Standards         ID V         Check Date (in flouse)         Schoduled Check           RF generator R&S SMT-06         100 V         Check Date (in flouse)         Schoduled Check           Name         Function         Stignalure	The messurements and the unice All calibration Equipment used (MAT Calibration Equipment used (MAT Pomary Standards, Power sensor HP 4481A Power sensor HP 4481A Reference 20 dB Attenuator	Institles with confidence p aded in (Ive closed laborator FE chice) for calibration) ID 4 CB37480704 US37280283 MV41082317	robability are given on the following pages at $\gamma$ facility: environment temperature (32 ± 3) Cel Date (Centricate No ) 09-0c-13 (No 217-31627) 09-0c-13 (No 217-31627) 09-0c-13 (No 217-31626)	no are part of the pertilicate C and found day < 70% Scheduled Cashination Doi-14 Doi-14 Doi-14 Doi-14
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Namo Function Signature	The messurements and the unce All colombonic have been conduct Calibration Equipment used (MAT Pomary Standards, Power sensor HP 6481A Power sensor HP 6481A Reference 20 dB Attenuator Type-N mamatch combination Parlemes Probe ES30V3 DAE4	roamilies with combinities p defining for calibration FE chilosil for calibration (B37480704 U637480704 U637480704 U637480704 U637480704 SN: 5068 (20k) SN: 5047.2 / 06327 SN: 3205 SN: 3205	robability are given on the following pages at (a) facility: environment temperature (32 ± 3)* Cel Date (Centificate No.) (9-06-13 (No. 217-01827) 09-06-13 (No. 217-01828) 03-06-13 (No. 217-01828) 03-06-13 (No. 217-01928) 03-06-13 (No. 217-01928) 03-06-13 (No. 233-0705, Dec18) 25-06-15 (No. DAE4-661, Ap+13)	to are part of the pertilicate C and humidity < 70% Scheiduled Cashination Det-14 Det-14 Det-14 Det-14 Apr-15 Apr-15 Dec-14 Apr-14
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# Report No. : EN/2014/B0016 Page : 94 of 114

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



S Schweizerischer Kalibrierdiens C Service suisse d'étalonnage Servizio svizzero di teratura S Swiss Calibration Service

Accreditation No.: SCS 108

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

#### Glossary:

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

#### Calibration is Performed According to the Following Standards:

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

#### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

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#### Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	1.81 mho/m ±6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>8</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.0 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL		
SAH averaged over 10 cm (10 g) or nead 15L	condition	
SAR averaged over 10 cm (10 g) of Head TSL SAR measured	250 mW input power	6.09 W/kg

#### Body TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.6 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

vi calculations were applied

#### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.0 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over to ciril (to g) of Body Tac	condition	
SAR measured	250 mW input power	5.90 W/kg

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#### Appendix

#### Antenna Parameters with Head TSL

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

#### Antenna Parameters with Body TSL

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

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 ns
Electrical belay (one direction)	1.140 115

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

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Date: 23.04.2014

#### DASY5 Validation Report for Head TSL

Test Laboratory: SPEAG, Zurich, Switzerland

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

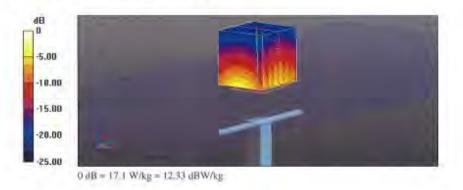
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma$  = 1.81 S/m;  $\epsilon_r$  = 38.2;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 SN3205: ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04,2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

#### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid; dx=5mm, dy=5mm, dz=5mm Reference Value = 100.01 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 27.0 W/kg SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.09 W/kg Maximum value of SAR (measured) = 17.1 W/kg



Certificate No: D2450V2-727\_Apr14

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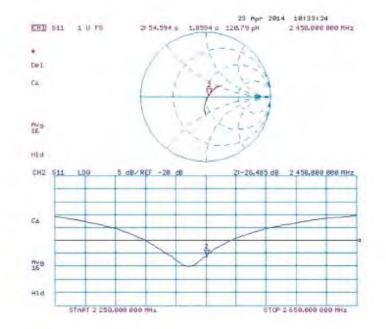
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#### Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727\_Apr14

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Date: 23.04.2014

#### DASY5 Validation Report for Body TSL

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;  $\sigma = 2.01$  S/m;  $\epsilon_r = 50.6$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section; Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration

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

#### Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 94.356 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 26.9 W/kg SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.9 W/kg Maximum value of SAR (measured) = 16.7 W/kg



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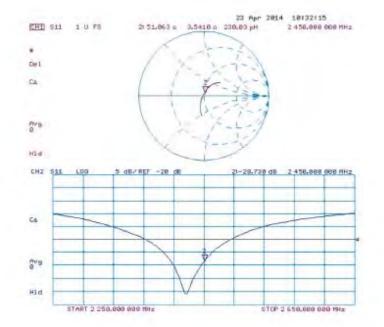
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#### Impedance Measurement Plot for Body TSL



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CALIBRATION C	ENTIFICATE		
Object	D5GHzV2 - SN:	1023	
Calibration procedure(e)	QA CAL-22.v2 Calibration proce	dure for dipole validation kits b	etween 3-6 GHz
Claitbroileus aiatus	January 30, 2014	í.	
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

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Glossary:

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

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

#### Calibration is Performed According to the Following Standards:

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

#### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

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#### Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 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	37.2±6%	4.54 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition		
SAR measured	100 mW input power	7.67 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	77.2 W/kg ± 19.9 % (k=2)	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	condition		
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.19 W/kg	

#### Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.0 ± 6 %	4.65 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 <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.8 W / kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.32 W/kg

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Conductivity

#### Head TSL parameters at 5600 MHz

The following parameters and calculations were applied	3.	
	Temperature	Permittivity
Nambral Haad 701 annual an		

Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.6 ± 6 %	4.96 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

### SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.3 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg

#### Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	5.18 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition		
SAR measured	100 mW input power	7.77 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	78.1 W/kg ± 19.9 % (k=2)	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	condition		
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.20 W/kg	

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#### Body TSL parameters at 5200 MHz

The following	parameters an	d calculations	were applied.
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	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	47.8 ± 6 %	5.40 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.39 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	73.6 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.06 W/kg

#### Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 *C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.6 ± 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.8 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.13 W/kg

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#### Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.93 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	80.0 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.23 W/kg

#### Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	6.21 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.1 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.05 W/kg

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#### Appendix

#### Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	49.9 Ω - 7.7 jΩ
Return Loss	- 22.3 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	51.2 Ω - 4.0 jΩ
Return Loss	- 27.6 dB

#### Antenna Parameters with Head TSL at 5600 MHz

Impe	dance, transformed to feed point	53.8 Ω - 2.5 jΩ
Retur	m Loss	- 27.1 dB

#### Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.5 Ω + 0.5 jΩ
Return Loss	- 24.3 dB

#### Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	50.0 Ω - 6.1 jΩ
Return Loss	- 24.3 dB

#### Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.3 Ω - 1.9 jΩ
Return Loss	- 32.7 dB

#### Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	54.3 Ω - 0.4 jΩ
Return Loss	- 27.6 dB

#### Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	57.1 Ω + 3.3 jΩ
Return Loss	- 22.7 dB

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#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns

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

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

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

#### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 05, 2004

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#### DASY5 Validation Report for Head TSL

Date: 30.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz Medium parameters used: f = 5200 MHz;  $\sigma = 4.54$  S/m;  $\varepsilon_r = 37.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used: f = 5300 MHz;  $\sigma = 4.65$  S/m;  $\varepsilon_r = 37$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used: f = 5600 MHz;  $\sigma = 4.96$  S/m;  $\varepsilon_r = 36.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used: f = 5800 MHz;  $\sigma = 5.18$  S/m;  $\varepsilon_r = 36.3$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.52, 5.52, 5.52); Calibrated: 30.12.2013, ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2013, ConvF(4.86, 4.86, 4.86); Calibrated: 30.12.2013, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

#### Dipole Calibration for Head Tissue/Pin=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 = 62.583 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 28.2 W/kg SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.19 W/kg Maximum value of SAR (measured) = 18.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.619 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 30.8 W/kg SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.32 W/kg Maximum value of SAR (measured) = 19.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 61.852 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 32.3 W/kg SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.3 W/kg Maximum value of SAR (measured) = 19.7 W/kg

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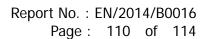
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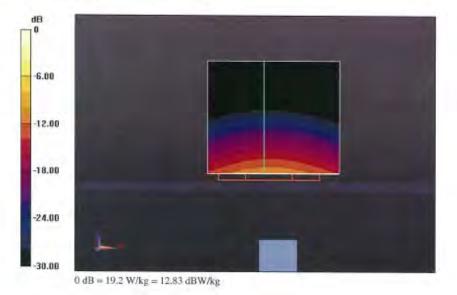
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Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 59.398 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 32.6 W/kg SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.2 W/kg Maximum value of SAR (measured) = 19.2 W/kg



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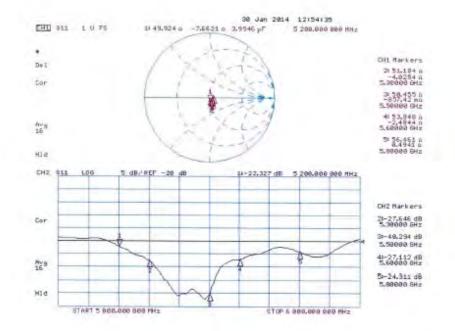
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#### Impedance Measurement Plot for Head TSL



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#### DASY5 Validation Report for Body TSL

Date: 29.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: f=5200 MHz;  $\sigma=5.4$  S/m;  $\varepsilon_r=47.8;$   $\rho=1000$  kg/m<sup>3</sup>, Medium parameters used: f=5300 MHz;  $\sigma=5.53$  S/m;  $\epsilon_r=47.6;$   $\rho=1000$  kg/m<sup>3</sup>, Medium parameters used: f=5600 MHz;  $\sigma=5.93$  S/m;  $\epsilon_r=47.1;$   $\rho=1000$  kg/m<sup>3</sup>, Medium parameters used: f=5800 MHz;  $\sigma=6.21$  S/m;  $\epsilon_r=46.8;$   $\rho=1000$  kg/m<sup>3</sup>

Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013, ConvF(4.3, 4.3, 4.3); Calibrated: 30.12.2013, ConvF(4.47, 4.47, 4.47); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

#### Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 57.977 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 29.2 W/kg

SAR(1 g) = 7.39 W/kg; SAR(10 g) = 2.06 W/kg Maximum value of SAR (measured) = 17.6 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 = 58.404 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 30.9 W/kg SAR(1 g) = 7.62 W/kg; SAR(10 g) = 2.13 W/kg Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 58.115 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 35.7 W/kg SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.23 W/kg Maximum value of SAR (measured) = 20.0 W/kg

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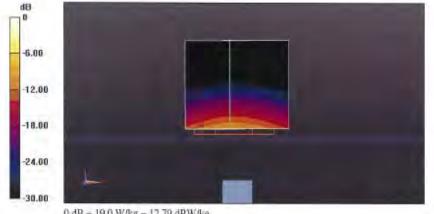
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Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 54.877 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 34.9 W/kg SAR(1 g) = 7.44 W/kg; SAR(10 g) = 2.05 W/kg Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 19.0 W/kg = 12.79 dBW/kg

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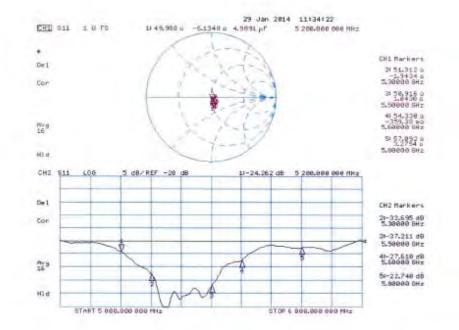
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#### Impedance Measurement Plot for Body TSL





# - End of 1<sup>st</sup> part of report -

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