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## SAR TEST REPORT





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

**Equipment Under Test Notebook Computer** 

HP **Brand Name** 

Model No. HSN-I13C-4

**Company Name** HP Inc.

**Company Address** 3390 East Harmony Road Fort Collins, Colorado 80528

**United States** 

**Standards** IEEE/ANSI C95.1-1992,IEEE 1528-2013,

> KDB248227D01v02r02, KDB865664D01v01r04, KDB447498D01v06, KDB616217D04v01r02,

KDB865664D02v01r02

FCC ID TX2-RTL8822BE

**Date of Receipt** Oct. 16, 2017

Date of Test(s) Oct. 24, 2017 ~ Jun. 15, 2018

**Date of Issue** Jun. 28, 2018

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

#### Remarks:

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

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

#### Signed on behalf of SGS

Clerk / Annie Chang	Asst. Supervisor / Afu Chen	Asst. Manager / John Yeh
Amile Chang	afor Chen	John Teh
		Date: Jun. 28, 2018

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# **Revision History**

Report Number	Revision	Description	Issue Date
E5/2017/A0031A-01	Rev.00	Initial creation of document	Jun. 21, 2018
E5/2017/A0031A-01	Rev.01	1 <sup>st</sup> modification	Jun. 28, 2018

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## 1. General Information

#### 1.1 Testing Laboratory

SGS Taiwan Ltd. Electronics & Communication Laboratory					
1F, No. 8, Alley 15, L	ane 120, Sec. 1, NeiHu Road, Neihu District, Taipei City,				
11493, Taiwan.					
Tel	+886-2-2299-3279				
Fax	+886-2-2298-0488				
Internet	http://www.tw.sgs.com/				

## 1.2 Details of Applicant

Company Name	HP Inc.
II AMNANY AAATAee	3390 East Harmony Road Fort Collins, Colorado 80528 United States

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## 1.3 Description of EUT

Equipment Under Test	Notebook Computer					
Brand Name	HP					
Model No.	HSN-I13C-4					
FCC ID	TX2-RTL8822BE					
Mode of Operation	⊠WLAN802.11 a/b/g/n(20M/40M)/ac( ⊠Bluetooth	20M/40	)M/80	M)		
Duty Cycle	WLAN802.11 a/b/g/n(20M/40M)/ ac(20M/40M/80M)		1			
	Bluetooth		1			
	WLAN802.11 b/g/n(20M)	2412	_	2462		
	WLAN802.11 n(40M)	2422	_	2452		
	WLAN802.11 a/n(20M)/ac(20M) 5.2G	5180	_	5240		
	WLAN802.11 n(40M)/ac(40M) 5.2G	5190	_	5230		
	WLAN802.11 ac(80M) 5.2G	5210				
	WLAN802.11 a/n(20M)/ac(20M) 5.3G	5260	_	5320		
	WLAN802.11 n(40M)/ac(40M) 5.3G	5270	_	5310		
TX Frequency Range (MHz)	WLAN802.11 ac(80M) 5.3G	5290				
(*** 12)	WLAN802.11 a/n/ac(20M) 5.6G	5500	_	5720		
	WLAN802.11 n/ac(40M) 5.6G	5510	_	5710		
	WLAN802.11 ac(80M) 5.6G	5530	_	5690		
	WLAN802.11 a/n(20M)/ac(20M) 5.8G	5745	_	5825		
	WLAN802.11 n(40M)/ac(40M) 5.8G	5710	_	5795		
	WLAN802.11 ac(80M) 5.8G		5775			
	Bluetooth	2402	_	2480		

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	_			
	WLAN802.11 b/g/n(20M)	1	_	11
	WLAN802.11 n(40M)	3	_	9
	WLAN802.11 a/n(20M)/ac(20M) 5.2G	36	_	48
	WLAN802.11 n(40M)/ac(40M) 5.2G	38	_	46
	WLAN802.11 ac(80M) 5.2G		42	
	WLAN802.11 a/n(20M)/ac(20M) 5.3G	52	_	64
	WLAN802.11 n(40M)/ac(40M) 5.3G	54	_	62
Channel Number (ARFCN)	WLAN802.11 ac(80M) 5.3G		58	
	WLAN802.11 a/n/ac(20M) 5.6G		_	144
	WLAN802.11 n/ac(40M) 5.6G		_	142
	WLAN802.11 ac(80M) 5.6G		_	138
	WLAN802.11 a/n(20M)/ac(20M) 5.8G	149	_	165
	WLAN802.11 n(40M)/ac(40M) 5.8G	142	_	159
	WLAN802.11 ac(80M) 5.8G		155	_
	Bluetooth	0	_	78

Antenna peak gain table:

•	HSN-I13C-4(Computron 14)							
Vendor		WI	NC			WNC		
Antenna		Main	(PIFA)			Aux (	PIFA)	
Part Number	6036E	30198201 (	81EAA415	5.GAL)	6036B	0198401 (	81EAA415	.GAM)
Frequency	2.4G	5.2G	5.5G	5.8G	2.4G	5.2G	5.5G	5.8G
Gain (dBi)	-1.18	-2.31	-0.37	-0.37	-2.39	-3.02	-2.37	-2.23
Vendor	ACON ACON							
Antenna		Main	(PIFA)		Aux (PIFA)			
Part Number	6036B0	18501 (P/I	N:ANP6Y-	100180)	6036B0198601 (P/N:ANP6Y-100181)			
Frequency	2.4G	5.2G	5.5G	5.8G	2.4G	5.2G	5.5G	5.8G
Gain (dBi)	-2.52	-1.61	-0.91	0.43	-2.05	-1.68	-0.98	-0.6
Vendor		Hon	g-Bo			Hon	g-Bo	
Antenna	Main (PIFA) Aux (PIFA)							
Part Number	6036B0219201(260-27178)			603	36B021910	1(260-271)	79)	
Frequency	2.4G	5.2G	5.5G	5.8G	2.4G 5.2G 5.5G 5.8G			5.8G
Gain (dBi)	-0.17	-0.09	-0.67	-0.10	-2.15	2.75	0.85	-5.26

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The highest SAR values of WNC Antenna

The mgn	The highest SAR values of wine Antenna						
	Max. SAR (1 g) (Unit: W/Kg)						
Antenna	Band	Measured	Reported	Channel	Position		
	WLAN802.11 b	0.24	0.25	11	Bottom side		
	WLAN802.11 g	0.32	0.33	6	Bottom side		
Main	WLAN802.11 a 5.2G	0.35	0.36	40	Bottom side		
Main	WLAN802.11 a 5.3G	0.37	0.37	52	Bottom side		
	WLAN802.11 a 5.6G	0.50	0.50	116	Bottom side		
	WLAN802.11 a 5.8G	0.64	0.64	157	Bottom side		
	WLAN802.11 b	0.35	0.35	1	Bottom side		
	WLAN802.11 g	0.42	0.43	6	Bottom side		
Λ. IV	WLAN802.11 a 5.2G	0.60	0.61	40	Bottom side		
Aux	WLAN802.11 a 5.3G	0.49	0.49	52	Bottom side		
	WLAN802.11 a 5.6G	0.71	0.71	104	Bottom side		
	WLAN802.11 a 5.8G	0.53	0.54	149	Bottom side		

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## The highest SAR values of ACON Antenna

	Max. SAR (1 g) (Unit: W/Kg)						
Antenna	Band	Measured	Reported	Channel	Position		
	WLAN802.11 b	0.24	0.24	11	Bottom side		
	WLAN802.11 g	0.28	0.29	6	Bottom side		
Main	WLAN802.11 a 5.2G	0.45	0.46	40	Bottom side		
IVIAIII	WLAN802.11 a 5.3G	0.47	0.47	52	Bottom side		
	WLAN802.11 a 5.6G	0.56	0.57	116	Bottom side		
	WLAN802.11 a 5.8G	0.57	0.57	157	Bottom side		
	WLAN802.11 b	0.10	0.11	1	Bottom side		
	WLAN802.11 g	0.41	0.43	6	Bottom side		
Aux	WLAN802.11 a 5.2G	0.42	0.42	40	Bottom side		
Aux	WLAN802.11 a 5.3G	0.44	0.44	52	Bottom side		
	WLAN802.11 a 5.6G	0.45	0.45	104	Bottom side		
	WLAN802.11 a 5.8G	0.47	0.47	149	Bottom side		

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The highest SAR values of Hong-Bo Antenna

Max. SAR (1 g) (Unit: W/Kg)							
Antenna	Band	Measured	Reported	Channel	Position		
	WLAN802.11 b	0.37	0.37	6	Bottom side		
	WLAN802.11 g	0.46	0.46	6	Bottom side		
Main	WLAN802.11 a 5.2G	0.36	0.36	40	Bottom side		
IVIAIII	WLAN802.11 a 5.3G	0.32	0.32	52	Bottom side		
	WLAN802.11 a 5.6G	0.50	0.50	116	Bottom side		
	WLAN802.11 a 5.8G	0.88	0.88	157	Bottom side		
	WLAN802.11 b	0.37	0.37	1	Bottom side		
	WLAN802.11 g	0.46	0.46	6	Bottom side		
Ausz	WLAN802.11 a 5.2G	0.65	0.65	40	Bottom side		
Aux	WLAN802.11 a 5.3G	0.40	0.40	52	Bottom side		
	WLAN802.11 a 5.6G	0.64	0.64	104	Bottom side		
	WLAN802.11 a 5.8G	0.35	0.35	165	Bottom side		

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

1127 (11302111 dr.) grin(20111, 10111)/do(20111, 10111, 00111) outlied porto: tas.					
Antenna	SI	SO	MIMO		
Band	Chain 0	Chain 1	Chain0+1		
WLAN802.11b	V	V	_		
WLAN802.11g	V	V	_		
WLAN802.11n(20M)	V	V	V		
WLAN802.11n(40M)	V	V	V		
WLAN802.11ac	V	V	V		
WLAN802.11a	V	V	_		
WLAN802.11n(20M) 5G	V	V	V		
WLAN802.11n(40M) 5G	V	V	V		
WLAN802.11ac(20M) 5G	V	V	V		
WLAN802.11ac(40M) 5G	V	V	V		
WLAN802.11ac(80M) 5G	V	V	V		

#### For WNC/ACON Antenna WLAN Power table:

Main Antenna									
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)			
		1	2412		17.00	16.85			
	802.11b	6	2437	1Mbps	17.00	16.78			
		11	2462		17.00	16.93			
		1	2412		14.00	13.82			
	802.11g	6	2437	6Mbps	18.00	17.90			
2450 MHz		11	2462		15.00	14.96			
2430 WII IZ		1	2412		14.00	13.76			
	802.11n-HT20	6	2437	MCS0	18.00	17.88			
		11	2462		14.00	13.81			
		3	2422		14.00	13.82			
	802.11n-HT40	6	2437	MCS0	17.00	16.77			
		9	2452		14.00	13.90			

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	Main Antenna									
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)				
		36	5180		16.50	16.41				
	802.11a	40	5200	6Mbps	17.50	17.43				
	002.11a	44	5220	Olvibbs	17.50	17.31				
		48	5240		17.50	17.32				
		36	5180		16.50	16.33				
	802.11n-HT20	40	5200	MCS0	17.50	17.37				
	002.1111-11120	44	5220		17.50	17.40				
		48	5240		17.50	17.35				
5.15-5.25 GHz		36	5180		16.50	16.42				
	802.11n-VHT20	40	5200	MCS0	17.50	17.39				
	002.1111-111120	44	5220	I WICOU	17.50	17.43				
		48	5240		17.50	17.40				
	802.11n-HT40	38	5190	MCS0	12.50	12.43				
	002.1111-11140	46	5230	IVICOU	16.50	16.37				
	802.11n-VHT40	38	5190	MCS0	12.50	12.46				
	1002.1111-VH140	46	5230	IVICOU	16.50	16.39				
	802.11n-VHT80	42	5210	MCS0	11.50	11.44				

Main Antenna									
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)			
		52	5260		17.50	17.47			
	802.11a	56	5280	6Mbps	17.50	17.42			
	002.11a	60	5300	Olvibbs	17.50	17.35			
		64	5320		15.50	15.46			
	802.11n-HT20	52	5260		17.50	17.47			
		56	5280	MCS0	17.50	17.36			
		60	5300	IVICOU	17.50	17.35			
		64	5320		15.50	17.41			
5.25-5.35 GHz		52	5260		17.50	17.46			
	802.11n-VHT20	56	5280	MCS0	17.50	17.42			
	002.1111-111120	60	5300	IVICOU	17.50	17.39			
		64	5320		15.50	15.41			
	802.11n-HT40	54	5270	MCS0	16.50	16.39			
	002.1111-11140	62	5310	IVICOU	13.50	13.35			
	802.11n-VHT40	54	5270	MCS0	16.50	16.38			
	1002. I III-VH I 40	62	5310	IVICSU	13.50	13.42			
	802.11n-VHT80	58	5290	MCS0	11.50	11.44			

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			Main Antenr	na		
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		100	5500		14.50	14.36
		104	5520	1 [	17.50	17.37
		116	5580	] [	17.50	17.43
	802.11a	120	5600	6Mbps	17.50	17.33
	002.114	124	5620	Olvibps	17.50	17.37
		128	5640	] [	17.50	17.43
		136	5680		17.50	17.33
		140	5700		15.50	15.41
		100	5500		14.50	14.37
		104	5520	-	17.50	17.35
		116	5580	<b>↓</b> ↓	17.50	17.44
	802.11n-HT20	120	5600	MCS0	17.50	17.31
		124	5620	<b>.</b>	17.50	17.33
		128	5640		17.50	17.35
		136	5680		17.50	17.43
		140	5700		14.50	14.38
		100 104	5500 5520	-	14.50 17.50	14.40 17.38
		116	5580	1 -	17.50	17.30
		120	5600	MCS0	17.50	17.39
5600 MHz	802.11n-VHT20		5620		17.50	17.37
	002.11.11	128	5640	1	17.50	17.35
		136	5680	1 †	17.50	17.46
		140	5700	1 1	14.50	14.32
		144	5720	1 1	14.50	14.38
		102	5510		13.50	13.45
		110	5550	1 [	16.50	16.36
	802.11n-HT40	118	5590	MCS0	16.50	16.31
	002.1111-1140	126	5630		16.50	16.30
		134	5670	] [	16.50	16.41
		142	5710		16.50	16.32
		102	5510	] [	13.50	13.47
		110	5550	] [	16.50	16.45
	802.11n-VHT40	118	5590	MCS0	16.50	16.32
		120	5630	555	16.50	16.30
		134	5670	] [	16.50	16.38
		142	5710		16.50	16.36
		106	5530	] [	11.50	11.43
	802.11n-VHT80		5610	MCS0	16.50	16.11
		138	5690		16.50	16.38

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	Main Antenna									
Mode	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)				
		149	5745		17.50	17.34				
	802.11a	157	5785	6Mbps	17.50	17.48				
		165	5825		17.50	17.36				
		149	5745		17.50	17.39				
	802.11n-HT20	157	5785	MCS0	17.50	17.43				
		165	5825		17.50	17.30				
5800 MHz		149	5745		17.50	17.36				
3000 WII 12	802.11n-VHT20	157	5785	MCS0	17.50	17.45				
		165	5825		17.50	17.40				
	802.11n-HT40	151	5755	MCS0	16.50	16.34				
	802.11n-H140	159	5795	IVICOU	16.50	16.32				
	802.11n-VHT40	151	5755	MCS0	16.50	16.41				
	002.1111-11140	159	5795	IVICSU	16.50	16.37				
	802.11n-VHT80	155	5775	MCS0	16.50	16.42				

Aux Antenna									
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)			
		1	2412		17.00	16.97			
	802.11b	6	2437	1Mbps	17.00	16.95			
		11	2462		17.00	16.92			
		1	2412	6Mbps	14.00	13.92			
	802.11g	6	2437		18.00	17.85			
2450 MHz		11	2462		15.00	14.89			
2430 1011 12		1	2412		14.00	13.83			
	802.11n-HT20	6	2437	MCS0	18.00	17.92			
		11	2462	] [	14.00	13.94			
		3	2422		14.00	13.86			
	802.11n-HT40	6	2437	MCS0	17.00	16.94			
		9	2452		14.00	13.80			

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			Aux Antenna	a		
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		36	5180		16.50	16.38
	802.11a	40	5200	6Mbps	17.50	17.43
	002.11a	44	5220	Olvibps	17.50	17.39
		48	5240		17.50	17.32
	802.11n-HT20	36	5180		16.50	16.40
		40	5200	MCS0	17.50	17.31
		44	5220		17.50	17.38
		48	5240		17.50	17.42
5.15-5.25 GHz		36	5180		16.50	16.47
	802.11n-VHT20	40	5200	MCS0	17.50	17.43
	002.1111-111120	44	5220	I WICSO	17.50	17.35
		48	5240		17.50	17.29
	802.11n-HT40	38	5190	MCS0	12.50	12.27
ļ	002.1111-11140	46	5230	IVICOU	16.50	16.45
	802.11n-VHT40	38	5190	MCS0	12.50	12.33
	002.1111-711140	46	5230	IVICOU	16.50	16.37
	802.11n-VHT80	42	5210	MCS0	11.50	11.42

	Aux Antenna									
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)				
		52	5260		17.50	17.49				
	802.11a	56	5280	6Mbps	17.50	17.46				
	002.11a	60	5300	Givibps	17.50	17.42				
		64	5320		15.50	15.40				
		52	5260		17.50	17.44				
	802.11n-HT20	56	5280	MCS0	17.50	17.35				
	002.1111-11120	60	5300	IVICSU	17.50	17.46				
		64	5320	] [	15.50	15.38				
5.25-5.35 GHz		52	5260		17.50	17.42				
	802.11n-VHT20	56	5280	MCS0	17.50	17.40				
	002.1111-111120	60	5300	IVICSO	17.50	17.36				
		64	5320	1 [	15.50	15.47				
	802.11n-HT40	54	5270	MCS0	16.50	16.45				
	002.1111-1140	62	5310	IVICSU	13.50	13.29				
	802.11n-VHT40	54	5270	MCS0	16.50	16.41				
	802.11n-VH140	62	5310	IVICSU	13.50	13.37				
	802.11n-VHT80	58	5290	MCS0	11.50	11.43				

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			Aux Antenn	<u></u>		
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		100	5500		14.50	14.43
		104	5520	] [	17.50	17.46
		116	5580		17.50	17.34
	802.11a	120	5600	6Mbps	17.50	17.42
	002.114	124	5620	Olvibps	17.50	17.46
		128	5640		17.50	17.34
		136	5680		17.50	17.42
		140	5700		15.50	15.42
		100	5500		14.50	14.45
		104	5520		17.50	17.48
		116	5580		17.50	17.43
	802.11n-HT20	120	5600	MCS0	17.50	17.32
		124	5620	ļ ļ	17.50	17.34
		128	5640	<b> </b>	17.50	17.36
		136 140	5680 5700	{	17.50 14.50	17.45 14.39
		100	5500		14.50	14.39
		104	5520		17.50	17.36
		116	5580	<b> </b>	17.50	17.45
		120	5600	MCS0	17.50	17.38
5600 MHz	802.11n-VHT20		5620		17.50	17.36
		128	5640		17.50	17.34
		136	5680	1	17.50	17.40
		140	5700	1	14.50	14.37
		144	5720	1	14.50	14.40
		102	5510		13.50	13.42
		110	5550	] [	16.50	16.46
	802.11n-HT40	118	5590	MCS0	16.50	16.36
	002.1111-11140	126	5630	IVICOU	16.50	16.35
		134	5670	[	16.50	16.41
		142	5710		16.50	16.31
		102	5510		13.50	13.37
		110	5550		16.50	16.35
	802.11n-VHT40	118	5590	MCS0	16.50	16.31
		126	5630		16.50	16.30
		134	5670		16.50	16.40
		142	5710		16.50	16.47
		106	5530	,,,,,,,,	11.50	11.33
	802.11n-VHT80		5610	MCS0	16.50	16.30
		138	5690		16.50	16.42

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	Aux Antenna								
Mode	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)			
		149	5745		17.50	17.47			
	802.11a	157	5785	6Mbps	17.50	17.41			
		165	5825		17.50	17.39			
	802.11n-HT20	149	5745	MCS0	17.50	17.30			
		157	5785		17.50	17.41			
		165	5825		17.50	17.45			
5800 MHz		149	5745		17.50	17.44			
3000 1011 12	802.11n-VHT20	157	5785	MCS0	17.50	17.35			
		165	5825		17.50	17.39			
	802.11n-HT40	151	5755	MCS0	16.50	16.43			
	002.1111-11140	159	5795	IVICOU	16.50	16.46			
	802.11n-VHT40	151	5755	MCS0	16.50	16.38			
	002.1111-771140	159	5795		16.50	16.33			
	802.11n-VHT80	155	5775	MCS0	16.50	16.40			

For Hong-Bo Antenna WI AN Power table:

TO Hong-bo Antenna WEANT OWER table.									
Main Antenna									
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)			
		1	2412		17.00	16.84			
	802.11b	6	2437	1Mbps	17.00	16.98			
		11	2462		17.00	16.92			
		1	2412		14.00	13.98			
	802.11g	6	2437	6Mbps	18.00	18.00			
2450 MHz		11	2462		15.00	14.88			
2430 10172		1	2412		14.00	13.76			
	802.11n-HT20	6	2437	MCS0	18.00	17.88			
		11	2462		14.00	13.81			
	802.11n-HT40	3	2422	MCS0	14.00	13.82			
		6	2437		17.00	16.77			
		9	2452		14.00	13.90			

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			Main Antenr	na		
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		36	5180		16.50	16.50
	802.11a	40	5200	6Mbps	17.50	17.50
	002.11a	44	5220	Olvibps	17.50	17.47
		48	5240		17.50	17.42
	802.11n-HT20	36	5180		16.50	16.33
		40	5200	MCS0	17.50	17.37
		44	5220		17.50	17.40
		48	5240	1 [	17.50	17.35
5.15-5.25 GHz		36	5180		16.50	16.42
	802.11n-VHT20	40	5200	MCS0	17.50	17.39
	002.1111-111120	44	5220	I WICSO	17.50	17.43
		48	5240		17.50	17.40
	802.11n-HT40	38	5190	MCS0	12.50	12.43
	002.1111-11140	46	5230	IVICOU	16.50	16.37
	802.11n-VHT40	38	5190	MCS0	12.50	12.46
		46	5230	1 IVICSU	16.50	16.39
	802.11n-VHT80	42	5210	MCS0	11.50	11.44

	Main Antenna								
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)			
		52	5260		17.50	17.50			
	802.11a	56	5280	6Mbps	17.50	17.49			
	002.11a	60	5300	Givibps	17.50	17.45			
		64	5320	1	15.50	15.46			
	802.11n-HT20	52	5260		17.50	17.47			
		56	5280	MCS0	17.50	17.36			
		60	5300		17.50	17.35			
		64	5320		15.50	17.41			
5.25-5.35 GHz		52	5260		17.50	17.46			
	802.11n-VHT20	56	5280	MCS0	17.50	17.42			
	002.1111-711120	60	5300	MCSU	17.50	17.39			
		64	5320	1 [	15.50	15.41			
	802.11n-HT40	54	5270	MCS0	16.50	16.39			
	002.1111-11140	62	5310	IVICOU	13.50	13.35			
	902 11p-\/UT40	54	5270	MCS0	16.50	16.38			
	802.11n-VHT40	62	5310	IVICOU	13.50	13.42			
	802.11n-VHT80	58	5290	MCS0	11.50	11.44			

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			Main Antenr	<u> </u>		
			THAIL THEOLIT			
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		100	5500		14.50	14.36
		104	5520	1 1	17.50	17.47
		116	5580	] [	17.50	17.50
	802.11a	120	5600	6Mbps	17.50	17.33
	002.11a	124	5620	Olvibpa	17.50	17.37
		128	5640		17.50	17.43
		136	5680		17.50	17.49
		140	5700		15.50	15.41
		100	5500		14.50	14.37
		104	5520		17.50	17.35
		116	5580		17.50	17.44
	802.11n-HT20	120	5600	MCS0	17.50	17.31
		124	5620		17.50	17.33
		128	5640	<b> </b>	17.50 17.50	17.35
		136 140	5680 5700	{	14.50	17.43 14.38
		100	5500	MCS0	14.50	14.40
		104	5520		17.50	17.38
		116	5580		17.50	17.40
		120	5600		17.50	17.39
5600 MHz	802.11n-VHT20		5620		17.50	17.37
		128	5640	1 1	17.50	17.35
		136	5680	1 1	17.50	17.46
		140	5700	] [	14.50	14.32
		144	5720		14.50	14.38
		102	5510		13.50	13.45
		110	5550	] [	16.50	16.36
	802.11n-HT40	118	5590	MCS0	16.50	16.31
	002.11.11.10	126	5630		16.50	16.30
		134	5670		16.50	16.41
		142	5710		16.50	16.32
		102	5510		13.50	13.47
		110	5550		16.50	16.45
	802.11n-VHT40	118	5590	MCS0	16.50	16.32
		126	5630	<b> </b>	16.50	16.30
		134	5670		16.50	16.38
		142	5710 5520		16.50	16.36
	802.11n-VHT80	106	5530	MCS0	11.50	11.43
	1002.1111-111100		5610	IVICOU	16.50	16.11
		138	5690		16.50	16.38

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	Main Antenna								
Mode	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)			
		149	5745		17.50	17.48			
	802.11a	157	5785	6Mbps	17.50	17.50			
		165	5825		17.50	17.42			
	802.11n-HT20	149	5745	MCS0	17.50	17.39			
		157	5785		17.50	17.43			
		165	5825		17.50	17.30			
5800 MHz		149	5745		17.50	17.36			
3000 IVII IZ	802.11n-VHT20	157	5785	MCS0	17.50	17.45			
		165	5825		17.50	17.40			
	802.11n-HT40	151	5755	MCS0	16.50	16.34			
	002.1111-11140	159	5795	IVICOU	16.50	16.32			
	802.11n-VHT40	151	5755	MCS0	16.50	16.41			
	002.1111-111140	159	5795	IVICOU	16.50	16.37			
	802.11n-VHT80	155	5775	MCS0	16.50	16.42			

Aux Antenna								
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)		
		1	2412		17.00	17.00		
	802.11b	6	2437	1Mbps	17.00	16.98		
		11	2462		17.00	16.94		
	802.11g	1	2412		14.00	14.00		
		6	2437	6Mbps	18.00	17.96		
2450 MHz		11	2462		15.00	14.98		
2430 10172		1	2412		14.00	13.83		
	802.11n-HT20	6	2437	MCS0	18.00	17.92		
		11	2462		14.00	13.94		
		3	2422		14.00	13.86		
	802.11n-HT40	6	2437	MCS0	17.00	16.94		
		9	2452		14.00	13.80		

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			Aux Antenn	а		
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		36	5180		16.50	16.50
	802.11a	40	5200	6Mbps	17.50	17.50
	002.11a	44	5220	Givibps	17.50	17.49
		48	5240		17.50	17.44
	802.11n-HT20	36	5180		16.50	16.40
		40	5200	MCS0	17.50	17.31
		44	5220		17.50	17.38
		48	5240	1 [	17.50	17.42
5.15-5.25 GHz		36	5180		16.50	16.47
	802.11n-VHT20	40	5200	MCS0	17.50	17.43
	002.1111-111120	44	5220	IVICSO	17.50	17.35
		48	5240		17.50	17.29
	802.11n-HT40	38	5190	MCS0	12.50	12.27
	002.1111-11140	46	5230	IVICOU	16.50	16.45
	802.11n-VHT40	38	5190	MCS0	12.50	12.33
		46	5230	MICOU	16.50	16.37
	802.11n-VHT80	42	5210	MCS0	11.50	11.42

			Aux Antenn	а		
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		52	5260		17.50	17.50
	802.11a	56	5280	6Mbps	17.50	17.46
	002.11a	60	5300	Givibps	17.50	17.39
		64	5320		15.50	15.38
	802.11n-HT20	52	5260		17.50	17.44
		56	5280	MCS0	17.50	17.35
		60	5300		17.50	17.46
		64	5320		15.50	15.38
5.25-5.35 GHz		52	5260		17.50	17.42
	802.11n-VHT20	56	5280	MCS0	17.50	17.40
	002.1111-111120	60	5300	I WICSO	17.50	17.36
		64	5320	] [	15.50	15.47
	802.11n-HT40	54	5270	MCS0	16.50	16.45
	002.1111-11140	62	5310	IVICOU	13.50	13.29
	802.11n-VHT40	54	5270	MCS0	16.50	16.41
		62	5310	IVICOU	13.50	13.37
	802.11n-VHT80	58	5290	MCS0	11.50	11.43

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			Aux Antenn	a		
			, tax / tritoriii			
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		100	5500		14.50	14.43
		104	5520	] [	17.50	17.50
		116	5580		17.50	17.48
	802.11a	120	5600	6Mbps	17.50	17.42
	002.114	124	5620	Olvibps	17.50	17.46
		128	5640		17.50	17.34
		136	5680		17.50	17.39
		140	5700		15.50	15.42
		100	5500		14.50	14.45
		104	5520	ļ ļ	17.50	17.48
		116	5580	ļ ļ	17.50	17.43
	802.11n-HT20	120	5600	MCS0	17.50	17.32
		124	5620		17.50 17.50	17.34
		128 136	5640 5680	<del> </del>	17.50	17.36 17.45
		140	5700	<b> </b>	14.50	14.39
		100	5500		14.50	14.47
		104	5520	1	17.50	17.36
		116	5580	MCS0	17.50	17.45
5000 1411		120	5600		17.50	17.38
5600 MHz	802.11n-VHT20		5620		17.50	17.36
		128	5640	] [	17.50	17.34
		136	5680	] [	17.50	17.40
		140	5700		14.50	14.37
		144	5720		14.50	14.40
		102	5510		13.50	13.42
		110	5550	] [	16.50	16.46
	802.11n-HT40	118	5590	MCS0	16.50	16.36
		126	5630		16.50	16.35
		134	5670		16.50	16.41
		142	5710		16.50	16.31
		102	5510	<b> </b>	13.50	13.37
		110	5550	<b> </b>	16.50	16.35
	802.11n-VHT40	118	5590	MCS0	16.50	16.31
		126	5630	<b> </b>	16.50	16.30
		134 142	5670 5710		16.50 16.50	16.40
						16.47
	802.11n-VHT80	106	5530 5610	MCS0	11.50	11.33
	002.1111-111100	122 138	5610 5690	IVICOU	16.50 16.50	16.30
		138	2090		10.50	16.42

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	Aux Antenna								
Mode	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)			
		149	5745		17.50	17.41			
	802.11a	157	5785	6Mbps	17.50	17.37			
		165	5825		17.50	17.50			
	802.11n-HT20	149	5745	MCS0	17.50	17.30			
		157	5785		17.50	17.41			
		165	5825		17.50	17.45			
5800 MHz		149	5745		17.50	17.44			
3000 1011 12	802.11n-VHT20	157	5785	MCS0	17.50	17.35			
		165	5825		17.50	17.39			
	802.11n-HT40	151	5755	MCS0	16.50	16.43			
	002.1111-11140	159	5795	IVICOU	16.50	16.46			
	802.11n-VHT40	151	5755	MCS0	16.50	16.38			
	002.1111-711140	159	5795	IVICOU	16.50	16.33			
	802.11n-VHT80	155	5775	MCS0	16.50	16.40			

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## Bluetooth conducted power table

Blactoctii conaactea petroi tabio								
Mode	Channel	Frequency	Average	Output Pov	ver (dBm)	Max. Rated Avg. Power + Max.		
iviode	Charmer	(MHz)	1Mbps	2Mbps	3Mbps	Tolerance (dBm)		
	CH 00	2402	5.15	2.65	2.54			
BR/EDR	CH 39	2441	5.32	3.19	2.78	5.5		
	CH 78	2480	5.24	2.83	2.73			

Mode	Channel	Frequency	Average Output Power (dBm)	Max. Rated Avg. Power + Max.
iviode	Channel	(MHz)	GFSK	Tolerance (dBm)
	CH 00	2402	2.87	
LE	CH 19	2440	2.65	5.5
	CH 39	2480	2.43	

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#### 1.4 Test Environment

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

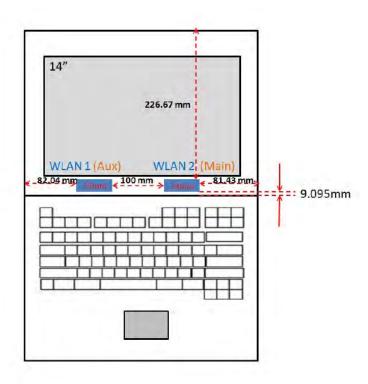
## 1.5 Operation Description

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

There are three antenna vendors for WLAN antennas, and both of them were measured fully, and respectively. EUT was tested in the following configurations:

#### Laptop mode

SAR measurement for laptop mode is performed with keyboard bottom touch against the flat phantom.



**Antenna location** 

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#### Note:

802.11b DSSS SAR Test Requirements:

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

802.11g/n OFDM SAR Test Exclusion Requirements:

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

**Initial Test Configuration:** 

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

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9. Based on KDB447498D01, SAR test exclusion is evaluated as below,

Lap	top Mode	WLAN Main 2.45GHz	WLAN Main 5GHz
Max. tune-	·up power(dBm)	17	17.5
Max. tune	-up power(mW)	50.119	56.234
Pottom	Test separation distance (mm)	9.05	9.05
Bottom side	Calculation value	8.647	14.923
	Require SAR testing?	YES	YES

Laptop Mode		WLAN Aux 2.45GHz	WLAN Aux 5GHz	ВТ
Max. tune-	up power(dBm)	17	17.5	5.5
Max. tune-	Max. tune-up power(mW)		56.234	3.548
Pottom	Test separation distance (mm)	9.05	9.05	9.05
Bottom side	Calculation value	8.647	14.923	0.614
	Require SAR testing?	YES	YES	NO

- 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  $\leq$  0.8 W/kg, when the transmission band is  $\leq$  100 MHz.
- 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)
- 12. For the 2<sup>nd</sup> battery, worst cases spot check were performed separately for main/aux antennas.

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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|²)/  $\rho$  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:

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

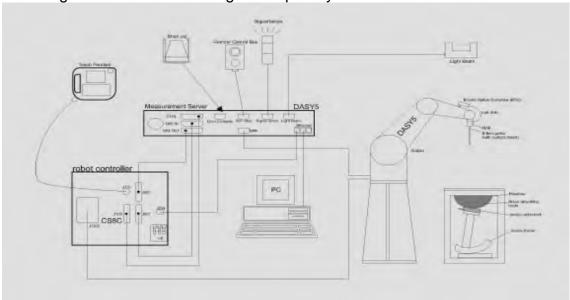


Fig. a The block diagram of SAR system

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- 4. The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- 5. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- 6. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- 7. A computer operating Windows 7.
- 8. DASY 5 software.
- 9. Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- 10. The SAM twin phantom enabling testing left-hand and right-hand usage.
- 11. The device holder for handheld mobile phones.
- 12. Tissue simulating liquid mixed according to the given recipes.
- 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 HSL 2450/5200/5300/5600/5800 MHz Additional CF for other liquids and frequencies upon request						
Frequency	10 MHz to > 6 GHz						
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)						
Dynamic	$10 \mu\text{W/g to} > 100 \text{mW/g}$						
Range	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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#### **PHANTOM**

THAITION		
Model	ELI	
Construction	The ELI phantom is used for complete body-mounted wireless devices in the following standard and all known tissue simple optimized regarding its performance our standard phantom tables. A coviliquid. Reference markings on the placemeasurement grids, by teaching the compatible with all SPEAG dosimeters.	the frequency range of 30 MHz tible with the IEC 62209-2 tulating liquids. ELI has been be and can be integrated into the prevents evaporation of the hantom allow installation of the efined phantom positions and three points. The phantom is
Shell Thickness	2 ± 0.2 mm	
Filling Volume	Approx. 30 liters	
Dimensions	Major axis: 600 mm	
	Minor axis: 400 mm	

#### **DEVICE HOLDER**

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

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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 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.

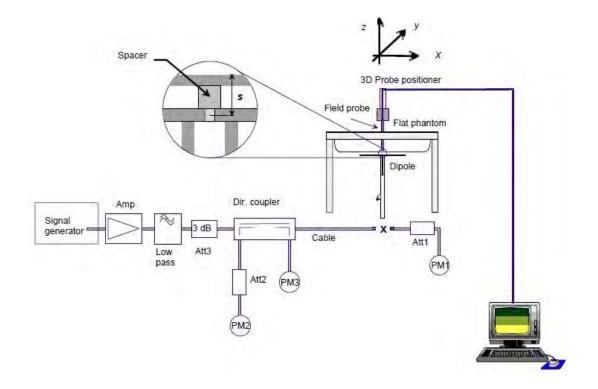


Fig. b The block diagram of system verification

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Validation Kit	S/N	Frequency (MHz)		1W Target SAR-1g (mW/g)	Measured SAR-1g (mW/g)	Measured SAR-1g normalized to 1W (mW/g)	Deviation (%)	Measured Date
D2450V2	727	2450	Body	50.6	12.8	51.2	1.19%	Oct. 24, 2017
D2430V2	121	2430	Боау	50.8	13.3	53.2	4.72%	Jun. 11, 2018
		5200	0 Body	72.8	7.22	72.2	-0.82%	Oct. 27, 2017
				70.9	7.44	74.4	4.94%	Jun. 12, 2018
			0 Body	76.1	7.55	75.5	-0.79%	Nov. 04, 2017
D5GHzV2	1023			72.9	7.48	74.8	2.61%	Jun. 13, 2018
DOGHZVZ		5600	5600 Body	79.6	8.31	83.1	4.40%	Nov. 10, 2017
		3000		77.6	8.15	81.5	5.03%	Jun. 14, 2018
		5800	ESOO Body	75.9	7.91	79.1	4.22%	Nov. 05, 2017
		3600	5800 Body	74.1	7.71	77.1	4.05%	Jun. 15, 2018

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

Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	% dev ɛr	% dev σ
		2412	52.751	1.914	52.536	1.938	0.41%	-1.28%
		2437	52.717	1.938	52.478	1.971	0.45%	-1.74%
	Oct. 24, 2017	2441	52.712	1.941	52.473	1.978	0.45%	-1.89%
		2450	52.700	1.950	52.461	1.985	0.45%	-1.81%
		2462	52.685	1.967	52.389	2.003	0.56%	-1.84%
	Oct. 27, 2017	5200	49.014	5.299	49.726	5.153	-1.45%	2.76%
	Nov. 04, 2017	5260	48.933	5.369	50.039	5.336	-2.26%	0.62%
Body		5300	48.879	5.416	49.974	5.380	-2.24%	0.67%
Body	Nov. 05, 2017	5520	48.580	5.673	47.772	5.636	1.66%	0.66%
		5580	48.499	5.743	47.689	5.706	1.67%	0.65%
		5600	48.471	5.766	47.658	5.730	1.68%	0.64%
		5680	48.363	5.860	47.547	5.825	1.69%	0.60%
		5745	48.275	5.936	47.041	6.033	2.56%	-1.64%
	Nov. 05, 2017	5785	48.220	5.982	46.989	6.080	2.55%	-1.63%
	1100. 03, 2017	5800	48.200	6.000	46.974	6.097	2.54%	-1.62%
		5825	48.166	6.029	46.946	6.126	2.53%	-1.61%

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Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	% dev εr	% dev σ
		2412	52.751	1.914	53.706	1.920	-1.81%	-0.33%
	Jun, 11. 2018	2437	52.717	1.938	53.609	1.951	-1.69%	-0.69%
	Juli, 11. 2016	2450	52.700	1.950	53.582	1.967	-1.67%	-0.87%
		2462	52.685	1.967	53.547	1.986	-1.64%	-0.97%
		5180	49.041	5.276	49.431	5.108	-0.79%	3.18%
	Jun, 12. 2018	5200	49.014	5.299	49.339	5.138	-0.66%	3.04%
		5220	48.987	5.323	49.278	5.167	-0.59%	2.92%
		5240	48.960	5.346	49.175	5.208	-0.44%	2.58%
		5260	48.933	5.369	49.110	5.248	-0.36%	2.26%
Body	Jun. 13. 2018	5280	48.906	5.393	49.062	5.276	-0.32%	2.16%
Dody	Juli, 13. 2016	5300	48.879	5.416	49.032	5.307	-0.31%	2.01%
		5320	48.851	5.439	48.944	5.337	-0.19%	1.88%
		5520	48.580	5.673	48.305	5.661	0.57%	0.21%
	Jun, 14. 2018	5580	48.499	5.743	48.093	5.776	0.84%	-0.57%
	Juli, 14. 2016	5600	48.471	5.766	48.043	5.798	0.88%	-0.55%
		5680	48.363	5.860	47.801	5.943	1.16%	-1.42%
		5745	48.275	5.936	47.596	6.035	1.41%	-1.67%
	Jun. 15. 2018	5785	48.220	5.982	47.424	6.104	1.65%	-2.03%
	Juli, 13. 2010	5800	48.200	6.000	47.395	6.131	1.67%	-2.18%
		5825	48.166	6.029	47.391	6.165	1.61%	-2.25%

Table 2. Dielectric Parameters of Tissue Simulant Fluid

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## The composition of the tissue simulating liquid:

The composition of the ticode chinalating inquitar									
	L		Ingredient						Tatal
	Frequency (MHz)	Mode	DGMBE	Water	Salt	Preventol D-7	Cellulose	Sugar	Total amount
	2450M	Body	301.7ml	698.3ml	_	_	_	_	1.0L(Kg)

Body Simulating Liquids for 5 GHz, Manufactured by SPEAG:

	3	,	<i>1</i>
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.

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

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

#### 1.11 Probe Calibration Procedures

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

#### 1.11.1 Transfer Calibration with Temperature Probes

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

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

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

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

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

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

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

#### 1.11.2 Calibration with Analytical Fields

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

- The setup must enable accurate determination of the incident power.
- The accuracy of the calculated field strength will depend on the assessment of the dielectric parameters of the liquid.

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

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

- (1) Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube).
- (2) Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.
- (3) Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph

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#### (d)(1) of this section. (Table 4.)

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

Table 4. RF exposure limits

#### Notes:

- 1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
- 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

#### **WNC Antenna**

WLAN Main Antenna (Laptop mode)

VVLAI	n Maili Alitelli	ια (Lαριυ	р шос	10 <i>)</i>							
Antenna	Mode	Position	Distance (mm)	СН	Freq.	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling		AR over 1g (kg)	Plot
			(111111)		(1711 12)	Tolerance (dBm)	(dBm)		Measured	Reported	page
	WLAN802.11 b	Bottom side	0	11	2462	17	16.93	101.62%	0.243	0.247	52
	WLAN802.11 g	Bottom side	0	6	2437	18	17.90	102.33%	0.321	0.328	53
	WLAN802.11 a 5.2G	Bottom side	0	40	5200	17.5	17.43	101.62%	0.353	0.359	54
Main	WLAN802.11 a 5.3G	Bottom side	0	52	5260	17.5	17.47	100.69%	0.365	0.368	55
	WLAN802.11 a 5.6G	Bottom side	0	116	5580	17.5	17.43	101.62%	0.495	0.503	56
	WI ANION 11 o F 90	Bottom side	0	157	5785	17.5	17.48	100.46%	0.637	0.640	57
	WLAN802.11 a 5.8G	Bottom side*	0	157	5785	17.5	17.48	100.46%	0.612	0.615	-

<sup>\* - 2&</sup>lt;sup>nd</sup> battery

WLAN Aux Antenna (Laptop mode)

Antenna	Mode	Position	Distance (mm)	СН	Freq.	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling		AR over 1g /kg)	Plot page
			(111111)		(1711 12)	Tolerance (dBm)	(dBm)		Measured	Reported	page
	WLAN802.11 b	Bottom side	0	1	2412	17	16.97	100.69%	0.345	0.347	58
		Bottom side	0	1	2412	14	13.92	101.86%	0.173	0.176	-
	WLAN802.11 g	Bottom side	0	6	2437	18	17.85	103.51%	0.415	0.430	59
		Bottom side	0	11	2462	15	14.89	102.57%	0.229	0.235	-
	WLAN802.11 a 5.2G	Bottom side	0	40	5200	17.5	17.43	101.62%	0.602	0.612	60
Aux	WLAN802.11 a 5.3G	Bottom side	0	52	5260	17.5	17.49	100.23%	0.488	0.489	61
		Bottom side	0	104	5520	17.5	17.46	100.93%	0.707	0.714	62
	WLAN802.11 a 5.6G	Bottom side*	0	104	5520	17.5	17.46	100.93%	0.656	0.662	-
	WLAN602.11 a 5.6G	Bottom side	0	116	5520	17.5	17.34	103.75%	0.633	0.657	-
		Bottom side	0	136	5520	17.5	17.42	101.86%	0.615	0.626	-
	WLAN802.11 a 5.8G	Bottom side	0	149	5745	17.5	17.47	100.69%	0.534	0.538	63

<sup>\* - 2&</sup>lt;sup>nd</sup> battery

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#### **ACON Antenna**

WLAN Main Antenna (Laptop mode)

Antenna	Mode	Position	Distance (mm)	T CH I	Freq. (MHz)	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling	Averaged SAR over 1g (W/kg)		Plot
			(111111)		(1411 12)	Tolerance (dBm) (dl	(dBm)		Measured	Reported	page
	WLAN802.11 b	Bottom side	0	11	2462	17	16.93	101.62%	0.236	0.240	64
	WLAN802.11 g	Bottom side	0	6	2437	18	17.90	102.33%	0.282	0.289	65
	WLAN802.11 a 5.2G	Bottom side	0	40	5200	17.5	17.43	101.62%	0.449	0.456	66
	WLAN802.11 a 5.3G	Bottom side	0	52	5260	17.5	17.47	100.69%	0.465	0.468	67
Main	WLAN802.11 a 5.6G	Bottom side	0	116	5580	17.5	17.43	101.62%	0.560	0.569	68
		Bottom side	0	149	5745	17.5	17.34	103.75%	0.489	0.507	-
	W/I ANI902 11 o E 90	Bottom side	0	157	5785	17.5	17.48	100.46%	0.567	0.570	69
	⊢	Bottom side*	0	157	5785	17.5	17.48	100.46%	0.529	0.531	-
		Bottom side	0	165	5825	17.5	17.36	103.28%	0.457	0.472	-

<sup>\* - 2&</sup>lt;sup>nd</sup> battery

WLAN Aux Antenna (Laptop mode)

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
			(111111)		(IVII IZ)	Tolerance (dBm)	(dBm)		Measured	Reported	paye
	WLAN802.11 b	Bottom side	0	1	2412	17	16.97	100.69%	0.104	0.105	70
		Bottom side	0	1	2412	14	13.92	101.86%	0.259	0.264	-
	WLAN802.11 g	Bottom side	0	6	2437	18	17.85	103.51%	0.411	0.425	71
		Bottom side*	0	6	2437	18	17.85	103.51%	0.409	0.423	-
Aux		Bottom side	0	11	2462	15	14.89	102.57%	0.321	0.329	-
	WLAN802.11 a 5.2G	Bottom side	0	40	5200	17.5	17.43	101.62%	0.417	0.424	72
	WLAN802.11 a 5.3G	Bottom side	0	52	5260	17.5	17.49	100.23%	0.436	0.437	73
	WLAN802.11 a 5.6G	Bottom side	0	104	5520	17.5	17.46	100.93%	0.449	0.453	74
	WLAN802.11 a 5.8G	Bottom side	0	149	5745	17.5	17.47	100.69%	0.469	0.472	75

<sup>- 2&</sup>lt;sup>nd</sup> battery

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#### Hong-Bo Antenna

WLAN Main Antenna (Laptop mode)

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
			(11111)		(1711 12)	Tolerance (dBm)	(dBm)		Measured	Reported	page
	WLAN802.11 b	Bottom side	0	6	2437	17	16.98	100.46%	0.370	0.372	76
		Bottom side	0	1	2412	14	13.98	100.46%	0.156	0.157	-
	WLAN802.11 g	Bottom side	0	6	2437	18	18.00	100.00%	0.460	0.460	77
		Bottom side	0	11	2462	15	14.88	102.80%	0.225	0.231	-
	WLAN802.11 a 5.2G	Bottom side	0	40	5200	17.5	17.50	100.00%	0.364	0.364	78
Main	WLAN802.11 a 5.3G	Bottom side	0	52	5260	17.5	17.50	100.00%	0.322	0.322	79
IVIAIII	WLAN802.11 a 5.6G	Bottom side	0	116	5580	17.5	17.50	100.00%	0.496	0.496	80
		Bottom side	0	149	5745	17.5	17.48	100.46%	0.847	0.851	-
		Bottom side	0	157	5785	17.5	17.50	100.00%	0.879	0.879	81
	WLAN802.11 a 5.8G	Bottom side**	0	157	5785	17.5	17.50	100.00%	0.870	0.870	-
	-	Bottom side*	0	157	5785	17.5	17.50	100.00%	0.861	0.861	-
		Bottom side	0	165	5825	17.5	17.42	101.86%	0.762	0.776	-

<sup>\* - 2&</sup>lt;sup>nd</sup> battery

#### WLAN Aux Antenna (Laptop mode)

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
			(111111)		(1011 12)	Tolerance (dBm)	(dBm)		Measured	Reported	page
	WLAN802.11 b	Bottom side	0	1	2412	17	17.00	100.00%	0.371	0.371	82
		Bottom side	0	1	2412	14	14.00	100.00%	0.159	0.159	-
	WLAN802.11 g	Bottom side	0	6	2437	18	17.96	100.93%	0.459	0.463	83
		Bottom side	0	11	2462	15	14.98	100.46%	0.254	0.255	-
		Bottom side	0	36	5180	16.5	16.50	100.00%	0.532	0.532	-
Aux		Bottom side	0	40	5200	17.5	17.50	100.00%	0.654	0.654	84
Aux	WLAN802.11 a 5.2G	Bottom side*	0	40	5200	17.5	17.50	100.00%	0.650	0.650	-
		Bottom side	0	44	5220	17.5	17.49	100.23%	0.621	0.622	-
		Bottom side	0	48	5240	17.5	17.44	101.39%	0.642	0.651	-
	WLAN802.11 a 5.3G	Bottom side	0	52	5260	17.5	17.50	100.00%	0.400	0.400	85
	WLAN802.11 a 5.6G	Bottom side	0	104	5520	17.5	17.50	100.00%	0.640	0.640	86
	WLAN802.11 a 5.8G	Bottom side	0	165	5825	17.5	17.50	100.00%	0.347	0.347	87

<sup>- 2&</sup>lt;sup>nd</sup> battery

Note:

Scaling =  $\frac{\text{reported SAR}}{\text{measured SAR}} = \frac{\text{P2(mVV)}}{\text{P1(mVV)}} = 10^{\left(\frac{P_0 - P_1}{40}\right)(\text{dBm})}$ 

Reported SAR = measured SAR \* (scaling)

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

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<sup>\*\* -</sup> 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
2.4GHz WLAN MIMO	Yes
5GHz WLAN MIMO	Yes
BT + 2.4GHz WLAN Main	Yes
BT + 5GHz WLAN Main	Yes

#### Note:

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

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#### 3.1 Estimated SAR calculation

According to KDB447498 D01v06 - 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-1g.

Mode / Band	position	test separation distance	Estimated SAR(W/kg)
BT	bottom side	9.095mm	0.082

#### 3.2 SPLSR evaluation and analysis

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

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

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

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

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

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#### **WNC Antenna:**

2.4 GHz WLAN MIMO (Laptop Mode)

=		<u> </u>		-,			
	No.	Conditions	Position	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
	1	2.4 GHz WLAN Main + WLAN Aux	Bottom side	0.328	0.347	0.675	ΣSAR<1.6, Not required

5 GHz WLAN MIMO (Laptop Mode)

No.	Conditions	Position	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
2	5 GHz WLAN Main + WLAN Aux	Bottom side	0.640	0.714	1.354	ΣSAR<1.6, Not required

2.4 GHz WLAN Main + BT (Laptop Mode)

No.	Conditions	Position	Max. WLAN Main	ВТ	SAR Sum	SPLSR
3	2.4 GHz WLAN Main + BT	Bottom side	0.328	0.082	0.410	ΣSAR<1.6, Not required

5 GHz WLAN Main + BT (Laptop Mode)

No.	Conditions	Position	Max. WLAN Main	ВТ	SAR Sum	SPLSR
4	5 GHz WLAN Main + BT	Bottom side	0.640	0.082	0.722	ΣSAR<1.6, Not required

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#### **ACON Antenna:**

2.4 GHz WLAN MIMO (Laptop Mode)

	•	Laptop moa	- /			
No	c. Conditions	Position	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
5	2.4 GHz WLAN Main + WLAN Aux	Bottom side	0.289	0.425	0.714	ΣSAR<1.6, Not required

5 GHz WLAN MIMO (Laptop Mode)

No.	Conditions	Position	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
6	5 GHz WLAN Main + WLAN Aux	Bottom side	0.570	0.472	1.042	ΣSAR<1.6, Not required

2.4 GHz WLAN Main + BT (Laptop Mode)

No	. Conditions	Position	Max. WLAN Main	ВТ	SAR Sum	SPLSR
7	2.4 GHz WLAN Main + BT	Bottom side	0.289	0.082	0.371	ΣSAR<1.6, Not required

5 GHz WLAN Main + BT (Laptop Mode)

No.	Conditions	Position	Max. WLAN Main	ВТ	SAR Sum	SPLSR
8	5 GHz WLAN Main + BT	Bottom side	0.570	0.082	0.652	ΣSAR<1.6, Not required

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#### Hong-Bo Antenna:

2.4 GHz WLAN MIMO (Laptop Mode)

No.	Conditions	Position	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
9	2.4 GHz WLAN Main + WLAN Aux	Bottom side	0.460	0.463	0.923	ΣSAR<1.6, Not required

5 GHz WLAN MIMO (Laptop Mode)

No.	Conditions	Position	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
10	5 GHz WLAN Main + WLAN Aux	Bottom side	0.879	0.654	1.533	ΣSAR<1.6, Not required

2.4 GHz WLAN Main + BT (Laptop Mode)

١	No.	Conditions	Position	Max. WLAN Main	ВТ	SAR Sum	SPLSR
	11	2.4 GHz WLAN Main + BT	Bottom side	0.460	0.082	0.542	ΣSAR<1.6, Not required

5 GHz WLAN Main + BT (Laptop Mode)

No.	Conditions	Position	Max. WLAN Main	ВТ	SAR Sum	SPLSR
12	5 GHz WLAN Main + BT	Bottom side	0.879	0.082	0.961	ΣSAR<1.6, Not required

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# 4. Instruments List

	LIST				
Manufacturer	Device	Туре	Serial number	Date of last calibration	Date of next calibration
SPEAG	Dosimetric E-Field	EX3DV4	7466	Jul.04,2017	Jul.03,2018
OI EAG	Probe	EXOD V 4	3938	Sep.28,2017	Sep.27,2018
		D2450V2	727	Apr.21,2017	Apr.20,2018
	System Validation	BZHOOVZ	121	Apr.24,2018	Apr.23,2019
GFLAG	Dipole	D5GHzV2	1023	Jan.20,2017	Jan.19,2018
		D30112V2	1023	Jan.25,2018	Jan.24,2019
SPEAG	Data acquisition	DAE4	547	Mar.22,2017	Mar.21,2018
SFLAG	Electronics	DALT	1260	Sep.28,2017	Sep.27,2018
SPEAG	Software	DASY 52 V52.8.8	N/A	Calibration not required	Calibration not required
SPEAG	Phantom	ELI	N/A	Calibration not required	Calibration not required
Agilent	Network	E5071C	MY46107530	Jan.20,2017	Jan.19,2018
. ig.io.iii	Analyzer			Feb.26,2018	
Agilent	Dielectric Probe Kit	85070E	MY44300677	Calibration not required	Calibration not required
		772D	MY52180142	Apr.13,2017	Apr.12,2018
Agilent	Agilent Dual-directional		MY46151242	Jul.11,2017	Jul.10,2018
, (g.1011t	coupler	778D	MY52180302	Apr.13,2017	Apr.12,2018
			MY48220468	Aug.28,2017	Aug.27,2018

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Manufacturer	Device	Туре	Serial number	Date of last calibration	Date of next calibration
Agilent	RF Signal	N5181A	MY50144143	1	Feb.28,2018
Generato	Generator	NOTOTA			Mar.13,2019
Agilent	Power Meter	E4417A	MY51410006	Jan.20,2017	Jan.19,2018
Agnorit	1 ower weter		MY52240003	Feb.01,2018	Jan.31,2019
		MY51470001	Jan.20,2017	Jan.19,2018	
Agilent	Power Sensor	E9301H	MY52200003	Dec.21,2017	Dec.20,2018
Agiloni	1 OWEI OCIISOI	2330111	MY51470002	Jan.20,2017	Jan.19,2018
			MY52200004	Dec.21,2017	Dec.20,2018
TECPEL	Digital	DTM-303A	TP130077	Mar.17,2017	Mar.16,2018
	thermometer	D I W-505A	TP130075	Mar.09,2018	Mar.08,2019

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## 5. Measurements

Date: 2017/10/24

# WLAN 802.11b\_Body\_Bottom side\_CH 11\_0mm\_Main

Communication System: WLAN(2.4G); Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2462 MHz;  $\sigma = 2.003 \text{ S/m}$ ;  $\varepsilon_r = 52.389$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

#### **DASY5** Configuration:

Probe: EX3DV4 - SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn547; Calibrated: 2017/3/22

Phantom: Body

• DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x101x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.379 W/kg

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

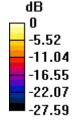
dy=5mm, dz=5mm

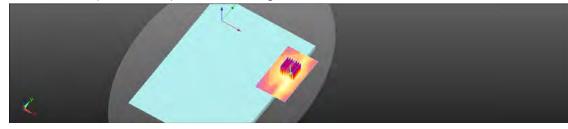
Reference Value = 0.03200 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.524 W/kg

SAR(1 g) = 0.243 W/kg; SAR(10 g) = 0.113 W/kg

Maximum value of SAR (measured) = 0.378 W/kg





0 dB = 0.378 W/kg = -4.23 dBW/kg

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Date: 2017/10/24

# WLAN 802.11g\_Body\_Bottom side\_CH 6\_0mm\_Main

Communication System: WLAN(2.4G); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz;  $\sigma = 1.971$  S/m;  $\epsilon_r = 52.478$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x101x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.460 W/kg

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

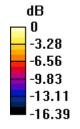
dy=5mm, dz=5mm

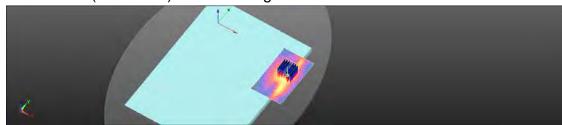
Reference Value = 1.278 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.684 W/kg

SAR(1 g) = 0.321 W/kg; SAR(10 g) = 0.150 W/kg

Maximum value of SAR (measured) = 0.482 W/kg





0 dB = 0.482 W/kg = -3.17 dBW/kg

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Date: 2017/10/27

## WLAN 802.11a 5.2G\_Body\_Bottom side\_CH 40\_0mm\_Main

Communication System: WLAN(5G); Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz;  $\sigma = 5.153 \text{ S/m}$ ;  $\varepsilon_r = 49.726$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.3°C; Liquid temperature: 22.5°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(5.2, 5.2, 5.2); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x111x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.641 W/kg

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

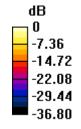
dy=4mm, dz=2mm

Reference Value = 0.5980 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 1.43 W/kg

SAR(1 g) = 0.353 W/kg; SAR(10 g) = 0.125 W/kg

Maximum value of SAR (measured) = 0.689 W/kg





0 dB = 0.689 W/kg = -1.62 dBW/kg

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## WLAN 802.11a 5.3G\_Body\_Bottom side\_CH 52\_0mm\_Main

Communication System: WLAN(5G); Frequency: 5260 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5260 MHz;  $\sigma = 5.336 \text{ S/m}$ ;  $\varepsilon_r = 50.039$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.2°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(5.1, 5.1, 5.1); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.723 W/kg

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

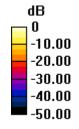
dy=4mm, dz=2mm

Reference Value = 42.64 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.51 W/kg

SAR(1 g) = 0.365 W/kg; SAR(10 g) = 0.129 W/kg

Maximum value of SAR (measured) = 0.714 W/kg





0 dB = 0.714 W/kg = -1.46 dBW/kg

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## WLAN 802.11a 5.6G\_Body\_Bottom side\_CH 116\_0mm\_Main

Communication System: WLAN(5G); Frequency: 5580 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5580 MHz;  $\sigma = 5.706 \text{ S/m}$ ;  $\epsilon_r = 47.689$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.27, 4.27, 4.27); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.08 W/kg

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

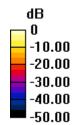
dy=4mm, dz=2mm

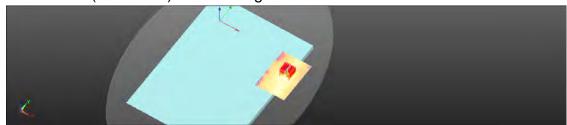
Reference Value = 33.78 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 2.13 W/kg

SAR(1 g) = 0.495 W/kg; SAR(10 g) = 0.153 W/kg

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





0 dB = 1.04 W/kg = 0.18 dBW/kg

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## WLAN 802.11a 5.8G\_Body\_Bottom side\_CH 157\_0mm\_Main

Communication System: WLAN(5G); Frequency: 5785 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5785 MHz;  $\sigma = 6.08 \text{ S/m}$ ;  $\varepsilon_r = 46.989$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.48, 4.48, 4.48); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.30 W/kg

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

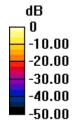
dy=4mm, dz=2mm

Reference Value = 2.772 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 2.80 W/kg

SAR(1 g) = 0.637 W/kg; SAR(10 g) = 0.211 W/kg

Maximum value of SAR (measured) = 1.30 W/kg





0 dB = 1.30 W/kg = 1.15 dBW/kg

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#### WLAN 802.11b Body Bottom side CH 1 0mm Aux

Communication System: WLAN(2.45G); Frequency: 2412 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2412 MHz;  $\sigma = 1.938 \text{ S/m}$ ;  $\varepsilon_r = 52.536$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x91x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.514 W/kg

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

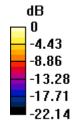
dy=5mm, dz=5mm

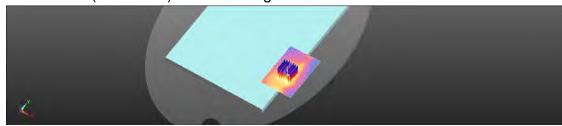
Reference Value = 0.3910 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.756 W/kg

SAR(1 g) = 0.345 W/kg; SAR(10 g) = 0.155 W/kg

Maximum value of SAR (measured) = 0.543 W/kg





0 dB = 0.543 W/kg = -2.65 dBW/kg

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# WLAN 802.11g\_Body\_Bottom side\_CH 6\_0mm\_Aux

Communication System: WLAN(2.4G); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz;  $\sigma = 1.971$  S/m;  $\varepsilon_r = 52.478$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x91x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.609 W/kg

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

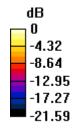
dy=5mm, dz=5mm

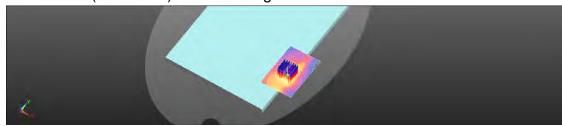
Reference Value = 0.5020 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.914 W/kg

SAR(1 g) = 0.415 W/kg; SAR(10 g) = 0.185 W/kg

Maximum value of SAR (measured) = 0.650 W/kg





0 dB = 0.650 W/kg = -1.87 dBW/kg

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## WLAN 802.11a 5.2G\_Body\_Bottom side\_CH 40\_0mm\_Aux

Communication System: WLAN(5G); Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5260 MHz;  $\sigma = 5.153 \text{ S/m}$ ;  $\varepsilon_r = 49.726$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.3°C; Liquid temperature: 22.5°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(5.1, 5.1, 5.1); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.17 W/kg

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

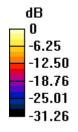
dy=4mm, dz=2mm

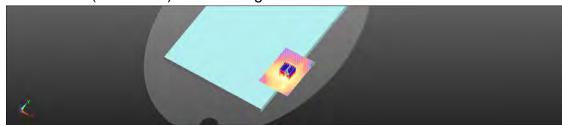
Reference Value = 23.16 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 2.42 W/kg

SAR(1 g) = 0.602 W/kg; SAR(10 g) = 0.220 W/kg

Maximum value of SAR (measured) = 1.17 W/kg





0 dB = 1.17 W/kg = 0.67 dBW/kg

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# WLAN 802.11a 5.3G\_Body\_Bottom side\_CH 52\_0mm\_Aux

Communication System: WLAN(5G); Frequency: 5260 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5260 MHz;  $\sigma = 5.336 \text{ S/m}$ ;  $\varepsilon_r = 50.039$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.2°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(5.1, 5.1, 5.1); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.937 W/kg

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

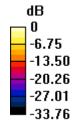
dy=4mm, dz=2mm

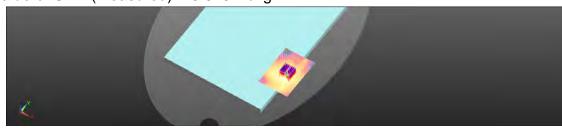
Reference Value = 37.91 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 1.97 W/kg

SAR(1 g) = 0.488 W/kg; SAR(10 g) = 0.173 W/kg

Maximum value of SAR (measured) = 0.929 W/kg





0 dB = 0.929 W/kg = -0.32 dBW/kg

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## WLAN 802.11a 5.6G\_Body\_Bottom side\_CH 104\_0mm\_Aux

Communication System: WLAN(5G); Frequency: 5520 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5520 MHz;  $\sigma = 5.636 \text{ S/m}$ ;  $\varepsilon_r = 47.772$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.27, 4.27, 4.27); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.33 W/kg

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

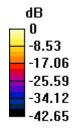
dy=4mm, dz=2mm

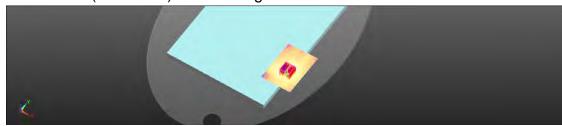
Reference Value = 1.683 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 2.68 W/kg

SAR(1 g) = 0.707 W/kg; SAR(10 g) = 0.262 W/kg

Maximum value of SAR (measured) = 1.32 W/kg





0 dB = 1.32 W/kg = 1.21 dBW/kg

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## WLAN 802.11a 5.8G\_Body\_Bottom side\_CH 149\_0mm\_Aux

Communication System: WLAN(5G); Frequency: 5745 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5745 MHz;  $\sigma = 6.033$  S/m;  $\varepsilon_r = 47.041$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.48, 4.48, 4.48); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.08 W/kg

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

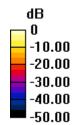
dy=4mm, dz=2mm

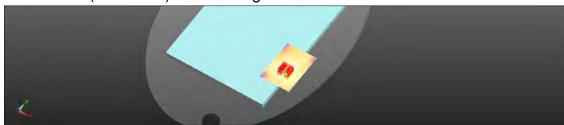
Reference Value = 54.92 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 2.16 W/kg

SAR(1 g) = 0.534 W/kg; SAR(10 g) = 0.193 W/kg

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





0 dB = 1.04 W/kg = 0.18 dBW/kg

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## WLAN 802.11b\_Body\_Bottom side\_CH 11\_0mm\_Main

Communication System: WLAN(2.4G); Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2462 MHz;  $\sigma = 2.003 \text{ S/m}$ ;  $\varepsilon_r = 52.389$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x101x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.384 W/kg

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

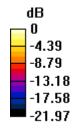
dy=5mm, dz=5mm

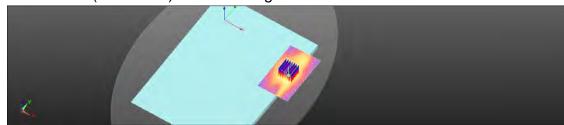
Reference Value = 0.7390 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.508 W/kg

SAR(1 g) = 0.236 W/kg; SAR(10 g) = 0.108 W/kg

Maximum value of SAR (measured) = 0.369 W/kg





0 dB = 0.369 W/kg = -4.33 dBW/kg

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## WLAN 802.11g\_Body\_Bottom side\_CH 6\_0mm\_Main

Communication System: WLAN(2.4G); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz;  $\sigma = 1.971$  S/m;  $\epsilon_r = 52.478$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x101x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.409 W/kg

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

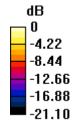
dy=5mm, dz=5mm

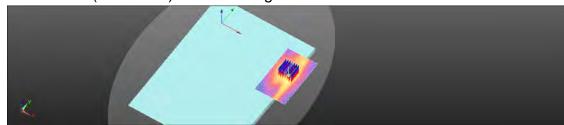
Reference Value = 0.3370 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.604 W/kg

SAR(1 g) = 0.282 W/kg; SAR(10 g) = 0.129 W/kg

Maximum value of SAR (measured) = 0.441 W/kg





0 dB = 0.441 W/kg = -3.55 dBW/kg

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# WLAN 802.11a 5.2G\_Body\_Bottom side\_CH 40\_0mm\_Main

Communication System: WLAN(5G); Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz;  $\sigma = 5.153 \text{ S/m}$ ;  $\varepsilon_r = 49.726$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.3°C; Liquid temperature: 22.5°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(5.2, 5.2, 5.2); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x111x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.833 W/kg

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

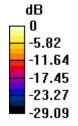
dy=4mm, dz=2mm

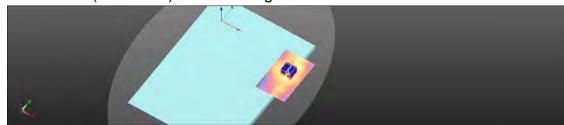
Reference Value = 0.2480 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.89 W/kg

SAR(1 g) = 0.449 W/kg; SAR(10 g) = 0.151 W/kg

Maximum value of SAR (measured) = 0.868 W/kg





0 dB = 0.868 W/kg = -0.61 dBW/kg

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# WLAN 802.11a 5.3G\_Body\_Bottom side\_CH 52\_0mm\_Main

Communication System: WLAN(5G); Frequency: 5260 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5260 MHz;  $\sigma = 5.336 \text{ S/m}$ ;  $\epsilon_r = 50.039$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.2°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(5.1, 5.1, 5.1); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.904 W/kg

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

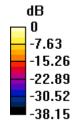
dy=4mm, dz=2mm

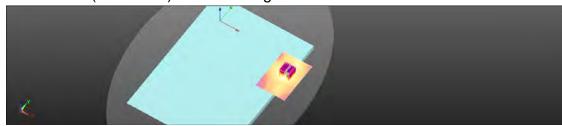
Reference Value = 42.64 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 1.95 W/kg

SAR(1 g) = 0.465 W/kg; SAR(10 g) = 0.158 W/kg

Maximum value of SAR (measured) = 0.894 W/kg





0 dB = 0.894 W/kg = -0.49 dBW/kg

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## WLAN 802.11a 5.6G\_Body\_Bottom side\_CH 116\_0mm\_Main

Communication System: WLAN(5G); Frequency: 5580 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5580 MHz;  $\sigma = 5.706 \text{ S/m}$ ;  $\epsilon_r = 47.689$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.27, 4.27, 4.27); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.13 W/kg

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

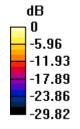
dy=4mm, dz=2mm

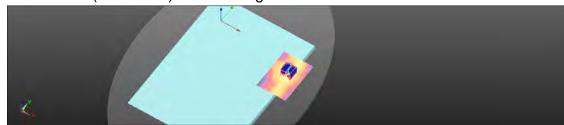
Reference Value = 77.69 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 2.54 W/kg

SAR(1 g) = 0.560 W/kg; SAR(10 g) = 0.179 W/kg

Maximum value of SAR (measured) = 1.11 W/kg





0 dB = 1.11 W/kg = 0.44 dBW/kg

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Date: 2017/11/5

# WLAN 802.11a 5.8G\_Body\_Bottom side\_CH 157\_0mm\_Main

Communication System: WLAN(5G); Frequency: 5785 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5785 MHz;  $\sigma = 6.08 \text{ S/m}$ ;  $\varepsilon_r = 46.989$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.48, 4.48, 4.48); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.09 W/kg

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

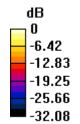
dy=4mm, dz=2mm

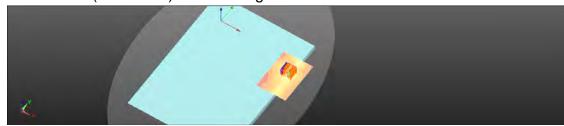
Reference Value = 2.569 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 2.46 W/kg

SAR(1 g) = 0.567 W/kg; SAR(10 g) = 0.217 W/kg

Maximum value of SAR (measured) = 1.09 W/kg





0 dB = 1.09 W/kg = 0.37 dBW/kg

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## WLAN 802.11b Body Bottom side CH 1 0mm Aux

Communication System: WLAN(2.4G); Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2412 MHz;  $\sigma = 1.938 \text{ S/m}$ ;  $\varepsilon_r = 52.536$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

# **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x91x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.155 W/kg

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

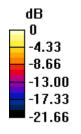
dy=5mm, dz=5mm

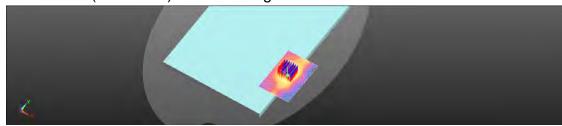
Reference Value = 22.79 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.228 W/kg

SAR(1 g) = 0.104 W/kg; SAR(10 g) = 0.049 W/kg

Maximum value of SAR (measured) = 0.165 W/kg





0 dB = 0.165 W/kg = -7.84 dBW/kg

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## WLAN 802.11g\_Body\_Bottom side\_CH 6\_0mm\_Aux

Communication System: WLAN(2.4G); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz;  $\sigma = 1.971$  S/m;  $\varepsilon_r = 52.478$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

# **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x91x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.611 W/kg

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

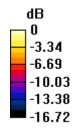
dy=5mm, dz=5mm

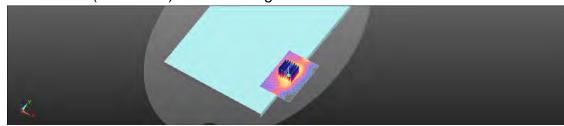
Reference Value = 1.697 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.885 W/kg

## SAR(1 g) = 0.411 W/kg; SAR(10 g) = 0.196 W/kg

Maximum value of SAR (measured) = 0.646 W/kg





0 dB = 0.646 W/kg = -1.90 dBW/kg

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# WLAN 802.11a 5.2G\_Body\_Bottom side\_CH 40\_0mm\_Aux

Communication System: WLAN(5G); Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz;  $\sigma = 5.153 \text{ S/m}$ ;  $\varepsilon_r = 49.726$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.3°C; Liquid temperature: 22.5°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(5.1, 5.1, 5.1); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.808 W/kg

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

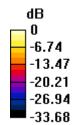
dy=4mm, dz=2mm

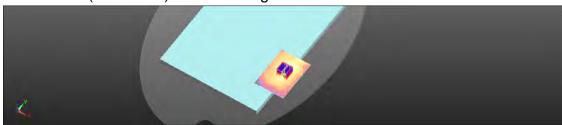
Reference Value = 41.93 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.75 W/kg

SAR(1 g) = 0.417 W/kg; SAR(10 g) = 0.143 W/kg

Maximum value of SAR (measured) = 0.792 W/kg





0 dB = 0.792 W/kg = -1.01 dBW/kg

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Date: 2017/11/4

## WLAN 802.11a 5.3G\_Body\_Bottom side\_CH 52\_0mm\_Aux

Communication System: WLAN(5G); Frequency: 5260 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5260 MHz;  $\sigma = 5.336 \text{ S/m}$ ;  $\varepsilon_r = 50.039$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.2°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(5.1, 5.1, 5.1); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.844 W/kg

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

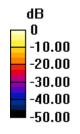
dy=4mm, dz=2mm

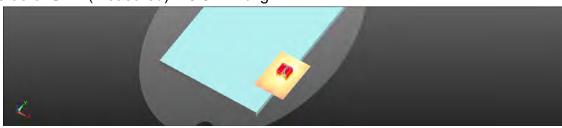
Reference Value = 21.38 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.91 W/kg

SAR(1 g) = 0.436 W/kg; SAR(10 g) = 0.148 W/kg

Maximum value of SAR (measured) = 0.872 W/kg





0 dB = 0.872 W/kg = -0.59 dBW/kg

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# WLAN 802.11a 5.6G\_Body\_Bottom side\_CH 104\_0mm\_Aux

Communication System: WLAN(5G); Frequency: 5520 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5520 MHz;  $\sigma = 5.636 \text{ S/m}$ ;  $\varepsilon_r = 47.772$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.27, 4.27, 4.27); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.876 W/kg

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

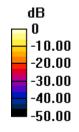
dy=4mm, dz=2mm

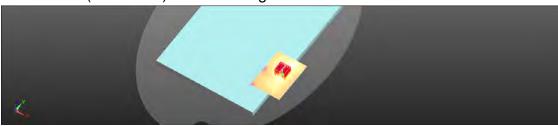
Reference Value = 0.4260 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 1.90 W/kg

SAR(1 g) = 0.449 W/kg; SAR(10 g) = 0.153 W/kg

Maximum value of SAR (measured) = 0.876 W/kg





0 dB = 0.876 W/kg = -0.57 dBW/kg

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## WLAN 802.11a 5.8G\_Body\_Bottom side\_CH 149\_0mm\_Aux

Communication System: WLAN(5G); Frequency: 5745 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5745 MHz;  $\sigma = 6.033 \text{ S/m}$ ;  $\varepsilon_r = 47.041$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.48, 4.48, 4.48); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x101x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.958 W/kg

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

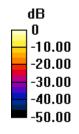
dy=4mm, dz=2mm

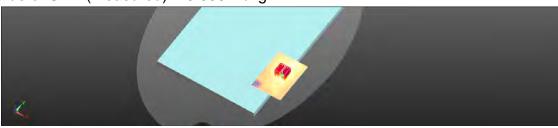
Reference Value = 0.2210 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 2.04 W/kg

SAR(1 g) = 0.469 W/kg; SAR(10 g) = 0.168 W/kg

Maximum value of SAR (measured) = 0.930 W/kg





0 dB = 0.930 W/kg = -0.32 dBW/kg

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Date: 2018/6/11

## WLAN 802.11b\_Body\_Bottom side\_CH 6\_Main

Communication System: WLAN 2.45G; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz;  $\sigma = 1.951$  S/m;  $\varepsilon_r = 53.609$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 21.7°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(7.42, 7.42, 7.42); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x151x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 1.17 W/kg

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

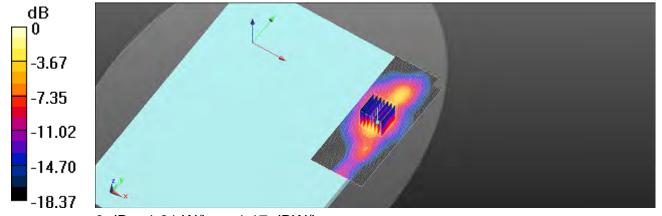
dy=5mm, dz=5mm

Reference Value = 2.786 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 1.76 W/kg

SAR(1 g) = 0.837 W/kg; SAR(10 g) = 0.385 W/kg

Maximum value of SAR (measured) = 1.31 W/kg



0 dB = 1.31 W/kg = 1.17 dBW/kg

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## WLAN 802.11g\_Body\_Bottom side\_CH 6\_Main

Communication System: WLAN 2.45G; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz;  $\sigma = 1.951$  S/m;  $\varepsilon_r = 53.609$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 21.7°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(7.42, 7.42, 7.42); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (61x151x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 1.60 W/kg

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

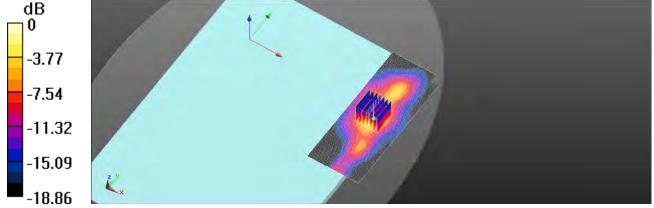
dy=5mm, dz=5mm

Reference Value = 4.183 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 2.38 W/kg

#### SAR(1 g) = 1.12 W/kg; SAR(10 g) = 0.513 W/kg

Maximum value of SAR (measured) = 1.75 W/kg



0 dB = 1.75 W/kg = 2.43 dBW/kg

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# WLAN 802.11a 5.2G\_Body\_Bottom side\_CH 40\_Main

Communication System: WLAN 5G; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz;  $\sigma = 5.138 \text{ S/m}$ ;  $\epsilon_r = 49.339$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.2°C; Liquid temperature: 21.8°C

#### DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x181x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.11 W/kg

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

dy=4mm, dz=2mm

Reference Value = 3.341 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 2.20 W/kg

SAR(1 g) = 0.559 W/kg; SAR(10 g) = 0.199 W/kg

Maximum value of SAR (measured) = 1.05 W/kg

## Configuration/Body/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm,

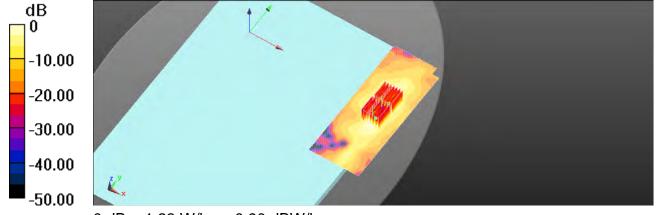
dy=4mm, dz=2mm

Reference Value = 3.341 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 2.95 W/kg

SAR(1 g) = 0.616 W/kg; SAR(10 g) = 0.195 W/kg

Maximum value of SAR (measured) = 1.23 W/kg



0 dB = 1.23 W/kg = 0.90 dBW/kg

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# WLAN 802.11a 5.3G\_Body\_Bottom side\_CH 52\_Main

Communication System: WLAN 5G; Frequency: 5260 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5260 MHz;  $\sigma = 5.248 \text{ S/m}$ ;  $\varepsilon_r = 49.11$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x181x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.14 W/kg

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

dy=4mm, dz=2mm

Reference Value = 3.251 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 3.46 W/kg

SAR(1 g) = 0.685 W/kg; SAR(10 g) = 0.192 W/kg

Maximum value of SAR (measured) = 1.51 W/kg

## Configuration/Body/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm,

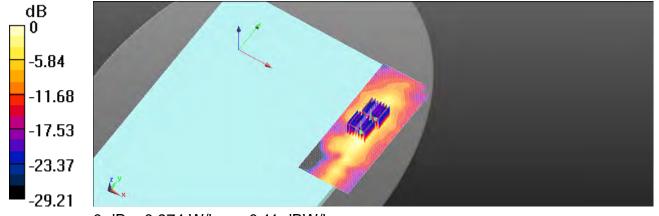
dy=4mm, dz=2mm

Reference Value = 3.251 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 2.08 W/kg

SAR(1 g) = 0.518 W/kg; SAR(10 g) = 0.189 W/kg

Maximum value of SAR (measured) = 0.974 W/kg



0 dB = 0.974 W/kg = -0.11 dBW/kg

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## WLAN 802.11a 5.6G\_Body\_Bottom side\_CH 116\_Main

Communication System: WLAN 5G; Frequency: 5580 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5580 MHz;  $\sigma = 5.776 \text{ S/m}$ ;  $\epsilon_r = 48.093$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.0°C; Liquid temperature: 21.5°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(3.9, 3.9, 3.9); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Configuration/Body/Area Scan (71x181x1):** Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.736 W/kg

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

dy=4mm, dz=2mm

Reference Value = 2.311 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 3.07 W/kg

SAR(1 g) = 0.446 W/kg; SAR(10 g) = 0.121 W/kg

Maximum value of SAR (measured) = 0.920 W/kg

# Configuration/Body/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm,

dy=4mm, dz=2mm

Reference Value = 2.311 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 2.35 W/kg

SAR(1 g) = 0.418 W/kg; SAR(10 g) = 0.107 W/kg Maximum value of SAR (measured) = 0.944 W/kg

-6.40 -12.80 -19.20 -25.60 -32.00

0 dB = 0.944 W/kg = -0.25 dBW/kg

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## WLAN 802.11a 5.8G\_Body\_Bottom side\_CH 157\_Main

Communication System: WLAN 5G; Frequency: 5785 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5785 MHz;  $\sigma = 6.104 \text{ S/m}$ ;  $\varepsilon_r = 47.424$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.3°C; Liquid temperature: 21.9°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.09, 4.09, 4.09); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x181x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.769 W/kg

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

dy=4mm, dz=2mm

Reference Value = 2.542 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 2.31 W/kg

SAR(1 g) = 0.398 W/kg; SAR(10 g) = 0.115 W/kg

Maximum value of SAR (measured) = 0.855 W/kg

## Configuration/Body/Zoom Scan (7x7x12)/Cube 1: Measurement grid: dx=4mm,

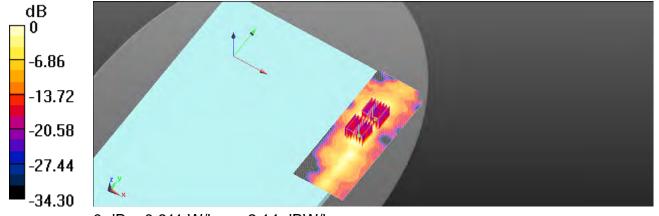
dv=4mm. dz=2mm

Reference Value = 2.542 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 2.32 W/kg

SAR(1 g) = 0.290 W/kg; SAR(10 g) = 0.077 W/kg

Maximum value of SAR (measured) = 0.611 W/kg



0 dB = 0.611 W/kg = -2.14 dBW/kg

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## WLAN 802.11b\_Body\_Bottom side\_CH 1\_Aux

Communication System: WLAN 2.45G; Frequency: 2412 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2412 MHz;  $\sigma = 1.92$  S/m;  $\varepsilon_r = 53.706$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 21.7°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(7.42, 7.42, 7.42); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (51x151x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.644 W/kg

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

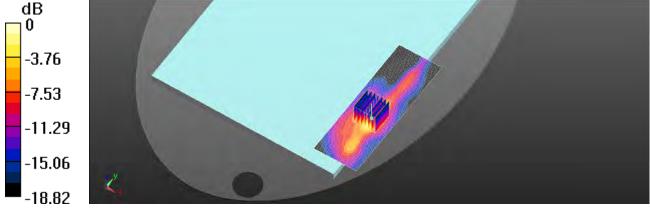
dv=5mm, dz=5mm

Reference Value = 3.491 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.959 W/kg

SAR(1 g) = 0.452 W/kg; SAR(10 g) = 0.200 W/kg

Maximum value of SAR (measured) = 0.701 W/kg



0 dB = 0.701 W/kg = -1.54 dBW/kg

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## WLAN 802.11g\_Body\_Bottom side\_CH 6\_Aux

Communication System: WLAN 2.45G; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz;  $\sigma = 1.951$  S/m;  $\varepsilon_r = 53.609$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient temperature: 21.7°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(7.42, 7.42, 7.42); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (51x151x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.957 W/kg

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

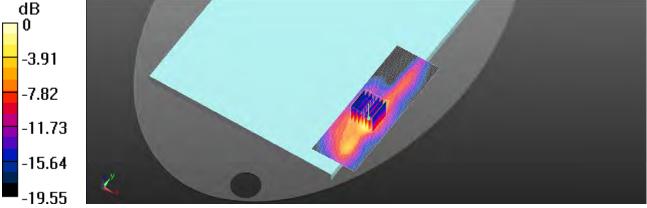
dy=5mm, dz=5mm

Reference Value = 3.267 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 1.49 W/kg

SAR(1 g) = 0.693 W/kg; SAR(10 g) = 0.306 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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# WLAN 802.11a 5.2G\_Body\_Bottom side\_CH 40\_Aux

Communication System: WLAN 5G; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz;  $\sigma = 5.138 \text{ S/m}$ ;  $\epsilon_r = 49.339$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.2°C; Liquid temperature: 21.8°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x181x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 1.56 W/kg

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

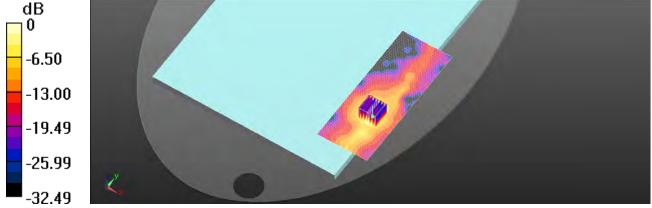
dy=4mm, dz=2mm

Reference Value = 2.791 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 3.57 W/kg

SAR(1 g) = 0.781 W/kg; SAR(10 g) = 0.244 W/kg

Maximum value of SAR (measured) = 1.58 W/kg



0 dB = 1.58 W/kg = 1.99 dBW/kg

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Date: 2018/6/13

# WLAN 802.11a 5.3G\_Body\_Bottom side\_CH 52\_Aux

Communication System: WLAN 5G; Frequency: 5260 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5260 MHz;  $\sigma = 5.248 \text{ S/m}$ ;  $\varepsilon_r = 49.11$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Configuration/Body/Area Scan (71x181x1):** Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.933 W/kg

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

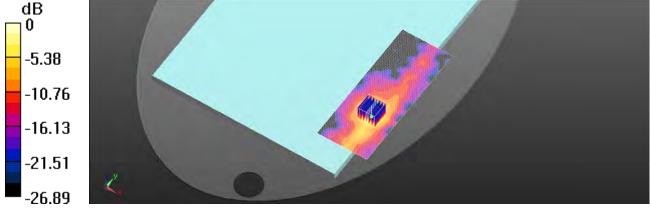
dy=4mm, dz=2mm

Reference Value = 2.379 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 2.16 W/kg

SAR(1 g) = 0.457 W/kg; SAR(10 g) = 0.144 W/kg

Maximum value of SAR (measured) = 0.959 W/kg



0 dB = 0.959 W/kg = -0.18 dBW/kg

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Date: 2018/6/14

# WLAN 802.11a 5.6G\_Body\_Bottom side\_CH 104\_Aux

Communication System: WLAN 5G; Frequency: 5520 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5520 MHz;  $\sigma = 5.661 \text{ S/m}$ ;  $\epsilon_r = 48.305$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.0°C; Liquid temperature: 21.5°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(3.9, 3.9, 3.9); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x181x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 0.991 W/kg

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

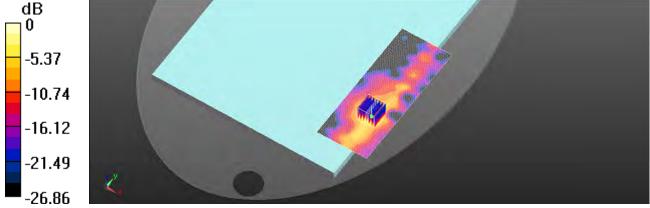
dy=4mm, dz=2mm

Reference Value = 4.831 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 2.22 W/kg

SAR(1 g) = 0.465 W/kg; SAR(10 g) = 0.147 W/kg

Maximum value of SAR (measured) = 0.934 W/kg



0 dB = 0.934 W/kg = -0.30 dBW/kg

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Date: 2018/6/15

# WLAN 802.11a 5.8G\_Body\_Bottom side\_CH 165\_Aux

Communication System: WLAN 5G; Frequency: 5825 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5825 MHz;  $\sigma = 6.165 \text{ S/m}$ ;  $\varepsilon_r = 47.391$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.3°C; Liquid temperature: 21.9°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.09, 4.09, 4.09); Calibrated: 2017/9/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1260; Calibrated: 2017/9/28
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

# Configuration/Body/Area Scan (71x181x1): Interpolated grid: dx=10 mm, dy=10

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

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

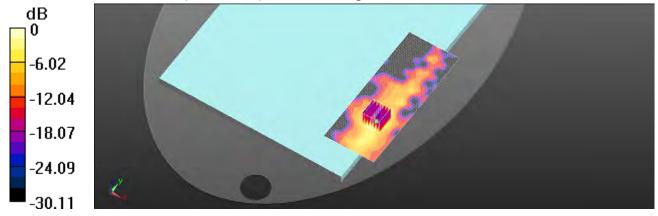
dy=4mm, dz=2mm

Reference Value = 4.254 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 1.08 W/kg

## SAR(1 g) = 0.251 W/kg; SAR(10 g) = 0.082 W/kg

Maximum value of SAR (measured) = 0.543 W/kg



0 dB = 0.543 W/kg = -2.65 dBW/kg

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# 6. SAR System Performance Verification

Date: 2017/10/24

#### Dipole 2450 MHz SN:727

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz;  $\sigma = 1.985 \text{ S/m}$ ;  $\epsilon_r = 52.461$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.5°C; Liquid temperature: 22.4°C

#### DASY5 Configuration:

Probe: EX3DV4 - SN7466; ConvF(7.94, 7.94, 7.94); Calibrated: 2017/7/5;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn547; Calibrated: 2017/3/22

Phantom: Body

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

# Configuration/Pin=250mW/Area Scan (61x131x1): Interpolated grid: dx=12 mm,

dy=12 mm

Maximum value of SAR (interpolated) = 20.7 W/kg

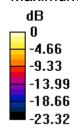
## Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

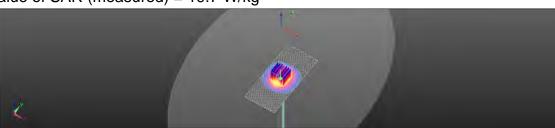
dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.80 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 27.2 W/kg

#### SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.93 W/kg Maximum value of SAR (measured) = 19.7 W/kg





0 dB = 19.7 W/kq = 12.95 dBW/kq

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Date: 2018/6/11

#### Dipole 2450 MHz SN:727

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz;  $\sigma = 1.967 \text{ S/m}$ ;  $\varepsilon_r = 53.582$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 21.7°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

Probe: EX3DV4 - SN3938; ConvF(7.42, 7.42, 7.42); Calibrated: 2017/9/29;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1260; Calibrated: 2017/9/28

Phantom: Body

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

#### Configuration/Pin=250mW/Area Scan (51x51x1): Interpolated grid: dx=12 mm, dv=12 mm

Maximum value of SAR (interpolated) = 22.2 W/kg

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

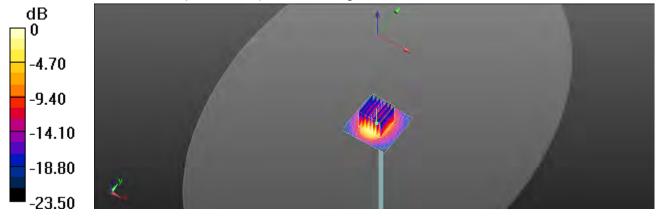
dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.7 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 28.8 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6 W/kg

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



0 dB = 20.8 W/kg = 13.18 dBW/kg

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Date: 2017/10/27

## **Dipole 5200 MHz SN:1023**

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz;  $\sigma = 5.153 \text{ S/m}$ ;  $\varepsilon_r = 49.726$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.3°C; Liquid temperature: 22.5°C

#### **DASY5** Configuration:

Probe: EX3DV4 - SN7466; ConvF(5.2, 5.2, 5.2); Calibrated: 2017/7/5;

Sensor-Surface: 2mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn547; Calibrated: 2017/3/22

Phantom: Body

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

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

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

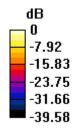
# Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

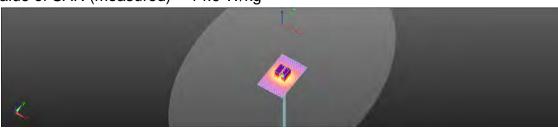
dx=4mm, dy=4mm, dz=2mm

Reference Value = 57.10 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 29.3 W/kg

SAR(1 g) = 7.22 W/kg; SAR(10 g) = 2.07 W/kg Maximum value of SAR (measured) = 14.9 W/kg





0 dB = 14.9 W/kg = 11.73 dBW/kg

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Date: 2018/6/12

## **Dipole 5200 MHz SN:1023**

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz;  $\sigma = 5.138 \text{ S/m}$ ;  $\varepsilon_r = 49.339$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.2°C; Liquid temperature: 21.8°C

#### **DASY5** Configuration:

Probe: EX3DV4 - SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2017/9/29;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1260; Calibrated: 2017/9/28

Phantom: Body

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

#### Configuration/Pin=100mW/Area Scan (51x51x1): Interpolated grid: dx=10 mm, dv=10 mm

Maximum value of SAR (interpolated) = 15.6 W/kg

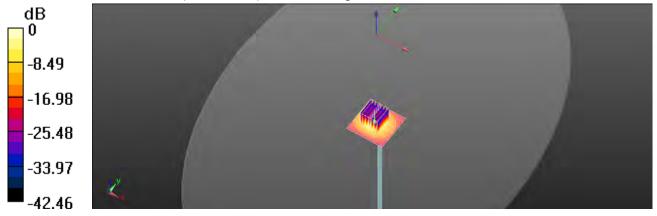
# Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm

Reference Value = 55.71 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 34.6 W/kg

SAR(1 g) = 7.44 W/kg; SAR(10 g) = 2.06 W/kgMaximum value of SAR (measured) = 16.1 W/kg



0 dB = 16.1 W/kg = 12.07 dBW/kg

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Date: 2017/11/4

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

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5300 MHz;  $\sigma = 5.38 \text{ S/m}$ ;  $\varepsilon_r = 49.974$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.2°C; Liquid temperature: 22.1°C

#### **DASY5** Configuration:

Probe: EX3DV4 - SN7466; ConvF(5.1, 5.1, 5.1); Calibrated: 2017/7/5;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn547; Calibrated: 2017/3/22

Phantom: Body

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

# Configuration/Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=10 mm, dv=10 mm

Maximum value of SAR (interpolated) = 15.9 W/kg

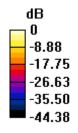
# Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

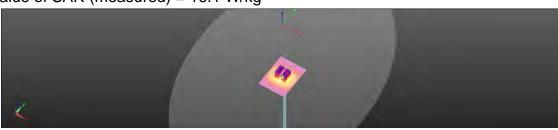
dx=4mm, dy=4mm, dz=2mm

Reference Value = 58.21 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 31.3 W/kg

SAR(1 g) = 7.55 W/kg; SAR(10 g) = 2.12 W/kg Maximum value of SAR (measured) = 16.1 W/kg





0 dB = 16.1 W/kg = 12.07 dBW/kg

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Date: 2018/6/13

## **Dipole 5300 MHz SN:1023**

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5300 MHz;  $\sigma = 5.307 \text{ S/m}$ ;  $\varepsilon_r = 49.032$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

#### **DASY5** Configuration:

Probe: EX3DV4 - SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2017/9/29;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1260; Calibrated: 2017/9/28

Phantom: Body

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

#### Configuration/Pin=100mW/Area Scan (51x51x1): Interpolated grid: dx=10 mm, dv=10 mm

Maximum value of SAR (interpolated) = 15.9 W/kg

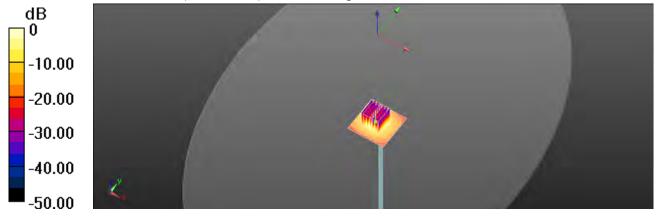
# Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm

Reference Value = 54.94 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 35.5 W/kg

SAR(1 g) = 7.48 W/kg; SAR(10 g) = 2.05 W/kgMaximum value of SAR (measured) = 16.1 W/kg



0 dB = 16.1 W/kg = 12.07 dBW/kg

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Date: 2017/11/5

## **Dipole 5600 MHz\_SN:1023**

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5600 MHz;  $\sigma = 5.73 \text{ S/m}$ ;  $\varepsilon_r = 47.658$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### **DASY5** Configuration:

Probe: EX3DV4 - SN7466; ConvF(4.27, 4.27, 4.27); Calibrated: 2017/7/5;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn547; Calibrated: 2017/3/22

Phantom: Body

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

# Configuration/Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=10 mm,

dy=10 mm

Maximum value of SAR (interpolated) = 18.3 W/kg

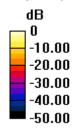
# Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm

Reference Value = 61.06 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 37.0 W/kg

SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.33 W/kg Maximum value of SAR (measured) = 18.3 W/kg





0 dB = 18.3 W/kg = 12.62 dBW/kg

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Date: 2018/6/14

## **Dipole 5600 MHz\_SN:1023**

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5600 MHz;  $\sigma = 5.798 \text{ S/m}$ ;  $\varepsilon_r = 48.043$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.0°C; Liquid temperature: 21.5°C

#### **DASY5** Configuration:

Probe: EX3DV4 - SN3938; ConvF(3.9, 3.9, 3.9); Calibrated: 2017/9/29;

Sensor-Surface: 2mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn1260; Calibrated: 2017/9/28

Phantom: Body

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

# Configuration/Pin=100mW/Area Scan (51x51x1): Interpolated grid: dx=10 mm, dv=10 mm

Maximum value of SAR (interpolated) = 17.7 W/kg

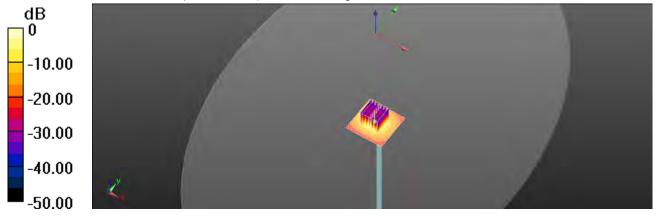
# Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm

Reference Value = 57.16 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 40.8 W/kg

**SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.21 W/kg** Maximum value of SAR (measured) = 17.7 W/kg



0 dB = 17.7 W/kg = 12.48 dBW/kg

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Date: 2017/11/10

## **Dipole 5800 MHz\_SN:1023**

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5800 MHz;  $\sigma = 6.097 \text{ S/m}$ ;  $\varepsilon_r = 46.974$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

#### **DASY5** Configuration:

- Probe: EX3DV4 SN7466; ConvF(4.48, 4.48, 4.48); Calibrated: 2017/7/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn547; Calibrated: 2017/3/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

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

Maximum value of SAR (interpolated) = 18.0 W/kg

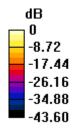
# Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

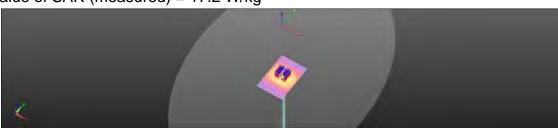
dx=4mm, dy=4mm, dz=2mm

Reference Value = 56.78 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 38.2 W/kg

SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.21 W/kg Maximum value of SAR (measured) = 17.2 W/kg





0 dB = 17.2 W/kg = 12.37 dBW/kg

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Date: 2018/6/15

## **Dipole 5800 MHz SN:1023**

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5800 MHz;  $\sigma = 6.131 \text{ S/m}$ ;  $\varepsilon_r = 47.395$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Ambient temperature: 22.3°C; Liquid temperature: 21.9°C

#### **DASY5** Configuration:

Probe: EX3DV4 - SN3938; ConvF(4.09, 4.09, 4.09); Calibrated: 2017/9/29;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1260; Calibrated: 2017/9/28

Phantom: Body

• DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

# Configuration/Pin=100mW/Area Scan (51x51x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 16.6 W/kg

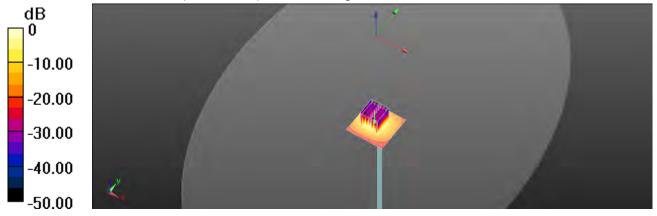
# Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2mm

Reference Value = 49.99 V/m; Power Drift = 0.25 dB

Peak SAR (extrapolated) = 38.6 W/kg

SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.11 W/kg Maximum value of SAR (measured) = 16.8 W/kg



0 dB = 16.8 W/kg = 12.25 dBW/kg

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# 7. DAE & Probe Calibration Certificate

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





Schweizerischer Kallbrierdienst Service suisse d'étatonnage Servizio svizzero di taratura Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA

Multilateral Agreement for the recognition of calibration certificates

SGS - TW (Auden)

Accreditation No.: SCS 0108

#### Certificate No: DAE4-547\_Mar17 CALIBRATION CERTIFICATE Object DAE4 - SD 000 D04 BM - SN: 547 Calibration procedure(s) **DA CAL-06 v29** Calibration procedure for the data acquisition electronics (DAE) Calibration date March 22, 2017 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the confidence All calibrations have been conducted in the closed laboratory facility, environment temperature (22 ± 31°C and furnidity < 70%. Calibration Equipment used (M&TE critical for calibration) 10 # Cal Date (Certificate No.) Scheduled Calibration Primary Standards Keithley Multimeter Type 2001 SN: 0810278 09-Sep-16 (No:19065) Secondary Standards I ID N Check Date (in house) Scheduled Check SE UWS 053 AA 1001 05-Jan-17 (in house check) In house check: Jan-18 Auto DAE Calibration Unit SE UMS 006 AA 1002 05-Jan-17 (in house check) In house check: Jan-18 Calibrator Box V2 I Signatu Eric Hainfeld Deputy Technical Manager Fin Bombatt Approved by: Issuind: March 22, 2017 This celebration certificate shall not be improduced ascept in full without written approval of the laboratory

Certificate No: DAE4-547 Mar17

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Accreditation No.: SCS 0108

Glossary

DAE data acquisition electronics

Connector angle Information used in DASY system to align probe sensor X to the robot

coordinate system.

#### Methods Applied and Interpretation of Parameters

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

Certificate No: DAE4-547 Mar 17

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#### DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = full range = -100...+300 mV Low Range: ILSB = BINV. full range = -1.....+3mV DASY measurement parameters. Auto Zero Time: 3 sec. Measuring time: 3 sec.

Calibration Factors	X	Α.	Z
High Range	403.189 / 0.02% (k=2)	403.093 ± 0.02% (k=2)	402.739 ± 0.02% (k=2)
Low Range	3,95348 ± 1.50% (k=2)	3,90456 ± 1,50% (K=2)	3,96243 ± 1.50% (k=2)

#### Connector Angle

Connector Angle to be used in DASY system	91.0 °±1

Cirtificate No: DAE4-647, Mart 7

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#### Appendix (Additional assessments outside the scope of SCS0108)

#### 1. DC Voltage Linearity

High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	200031.23	0,59	0.00
Channel X + Input	20005,44	2.04	-0.01
Channel X - Input	-20000.97	4,91	-0.02
Channel Y + Input	200029.80	-1.03	-0.00
Channel Y + Input	20000.30	-3.03	-0.02
Channel Y - Input	-20007.73	-1.72	0.01
Channel Z + Input	200030,21	-0.96	-0.00
Channel Z 4 Input	20003.13	-0.21	-0.00
Channel Z - Input	-20005.14	0.81	-0.00

Low Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	2000.02	-0.08	-0.00
Channel X + Input	200 18	0.36	0.18
Channel X - Input	-200.16	0.00	-0.00
Channel Y + Input	2000,10	0.06	0.00
Channel Y + Input	199.43	-0.40	-0.20
Channel Y - Input	-200.77	-0.70	0.35
Channel Z + Input	2000,19	0.28	0.01
Channel Z + Input	198.82	-1,00	-0.50
Channel Z - Input	-201.46	-1,37	0.68

#### 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	-2.09	-5.00
	- 200	6.80	4,50
Channel V	200	-0.67	4.21
	-200	0,37	-0.41
Channel Z	200	5.07	4.93
	- 200	-7,67	-8.12

#### 3. Channel separation

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	2.65	-2.08
Channel Y	200	10,56		3.60
Channel Z	200	4.55	7.85	100

Certificate No: DAE4-547\_Mor17

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

	High Range (LSB)	Low Range (LSB)
Channel X	16364	15364
Channel Y	16476	16801
Channel Z	16077	16468

#### 5. Input Offset Measurement

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

Inexal 10MD

	Average (µV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (µV)
Channel X	-0.53	-1.14	0.26	0.31
Channel Y	-1.03	-2.43	-0.21	0.32
Channel Z	-1.56	-2.31	-0.62	0,35

#### 6. Input Offset Current

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

7. Input Resistance (Typical values for Information)

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

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

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7,6

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	914
Supply (- Voc)	-0.01	~B	-9

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SGS-TW (Auden)

Accreditation No.: SCS 0108

Certificate No: DAE4-1260 Sep17 CALIBRATION CERTIFICATE DAE4 - SD 000 D04 BM - SN: 1260 Calibration procedure(s) QA CAL-06.v29 Calibration procedure for the data acquisition electronics (DAE) Calibration date: September 28, 2017 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%, Calibration Equipment used (M&TE critical for calibration) Primary Standards ID# Cal Date (Certificate No.) Scheduled Calibration Keithley Multimeter Type 2001 SN: 0810278 31-Aug-17 (No:21092) Aug-18 Check Date (in house) Secondary Standards ID# Scheduled Check Auto DAE Calibration Unit SE UWS 053 AA 1001 05-Jan-17 (in house check) In house check: Jan-18 Calibrator Box V2.1 SE UMS 006 AA 1002 05-Jan-17 (in house check) In house check: Jan-18 Name Function Laboratory Technician Calibrated by: Dominique Steffen Approved by: Sven Kühn Deputy Manager Issued; September 28, 2017

Certificate No: DAE4-1260 Sep17

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#### Glossary

DAE data acquisition electronics

Connector angle information used in DASY system to align probe sensor X to the robot

coordinate system.

#### Methods Applied and Interpretation of Parameters

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

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#### DC Voltage Measurement

A/D - Converter Resolution nominal High Range: 1LSB = full range = -100...+300 mV full range = -1.....+3mV 6.1µV Low Range: 1LSB = BinV . DASY measurement parameters; Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Υ	Z
High Range	405.082 ± 0.02% (k=2)	405.133 ± 0.02% (k=2)	404.970 ± 0.02% (k=2)
Low Range	3.98948 ± 1.50% (k=2)	3.95701 ± 1.50% (k=2)	3.98426 ± 1.50% (k=2)

#### Connector Angle

Connector Angle to be used in DASY system	341,5 °±1 "

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#### Appendix (Additional assessments outside the scope of SCS0108)

#### 1. DC Voltage Linearity

High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	200030.04	-3.23	-0.00
Channel X + Input	20005.05	0.72	0.00
Channel X - Input	-20003.19	2,57	-0.01
Channel Y + Input	200031.04	-2.35	-0.00
Channel Y + Input	20004.17	-0.10	-0.00
Channel Y - Input	-20006.05	-0.28	0.00
Channel Z + Input	200033.38	-0.04	-0.00
Channel Z + Input	20003.27	-0.97	-0.00
Channel Z - Input	-20007.67	-1.85	0.01

Low Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	2000.34	-0.06	-0.00
Channel X + Input	201.28	0.95	0.47
Channel X - Input	-198.35	1.25	-0.63
Channel Y + Input	2000.88	0.54	0.03
Channel Y + Input	199.53	-0.80	-0.40
Channel Y - Input	-200.22	-0.64	0.32
Channel Z + Input	2000,27	0.04	0.00
Channel Z + Input	198.83	-1.41	-0.70
Channel Z - Input	-200.94	-1.26	0.63

#### 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	29.02	27.07
	- 200	-24.87	-27.14
Channel Y	200	-18.44	-18.59
	- 200	18.33	18.03
Channel Z	200	15.00	15.39
	- 200	-18,17	-18.23

#### 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-	-1.16	-4.49
Channel Y	200	7.88		1.01
Channel Z	200	10.65	4.72	-

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#### 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	16017	16757
Channel Y	15556	15598
Channel Z	15950	16735

#### 5. Input Offset Measurement

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

Input 10MO

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (µV)
Channel X	0.90	+0.03	1.89	0.40
Channel Y	0.57	-0.29	1.64	0.37
Channel Z	-1.27	-2.75	0.35	0.59

#### 6. Input Offset Current

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

7. Input Resistance (Typical values for Information)

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

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

Typical values	Álarm 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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Certificate No. EX3-7466 Jul 17

## CALIBRATION CERTIFICATE EX3DV4 - SN:7466 Check

Calibration (indexionals).

QA GAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6

Calibration procedure for dosimetric E-field probes

July 4, 2017 Castrition cate

This collination certificate documents the precedebity to network standards, which relates the physical units of measurements (81) asurements and the uncertainties with confidence protability are given on the following pages and are part of the confliction.

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

Calibration Equipment used (MSTE critical for calibration)

Primary Standards	(D	Cal Date (Certificate No.)	Scheduled Caribration
Power meter MRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr:18
Power sensor NRP-Z91	SN: 103244	94-Api-17 (No. 217-02521)	April 18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr.18
Reference 20 dB Attenuator	SN: 58277 (20x)	87-Apr-17 (No. 217-92528)	Apr-18
Reference Probe EB3DV2	SN 3013	21-Dep-16 (No. ES3-3013_Dec16)	Dec-17
DAE4	SN. 660	7-Dan-16 (No. DAE4-650_Dec15)	Dec-17
Secondary Standards	0	Check Date (in house)	Scheduled Check
Power mater E4419B	SN: G841293674	Ob-Apr-16 (in house chack dun-16)	by house chuck: Jun-18
Power sensor E4412A	SN: MY41498087	OB-Apr-18 (in house check dun-16)	In house check: Jun. 18
Power sensor E4412A	SN: 000110210	08-Apr-18 (in house check Jun-16)	In house check, Jun-18
RE generator HP 964BC	EN: US3642U01700	(M-Aug-99 (in fiques check Jun-16)	In house check: Jun-19
Network Analyzes HP 8753E	SN: US37290585	18-Cid-O1 (in house check Oid-16)	In house check: Gd-17

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			issued: July 6, 2017

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#### Glossary:

Connector Angle

lissue simulating fiquid NORMs,y.z. sensitivity in free space sensitivity in TSL / NORMx,y,z. DCP

diode compression point crest factor (1/duty\_cycle) of the RF signal W. B. C. D modulation dependent linearization parameters

protation around probe axis Potenzation o

Polarization 5 It rotation around an owis that is in the plane normal to probe axis (at measurement center).

= 8 = 0 is normal to pribe axis information used in DASY system to sign probe sensor X to the robot coordinate system

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

- a) (EEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013 IEC 02209-1," "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-
- 35 b) IEC 022(9-1, "Measurement procedure for the assessment of specific Assorption Rate (SAR) from nanoheld and body-mounted devices used next to the ser (frequency range of 300 MHz to 6 GHz)", July 2016.
   c) IEC 622(9-2, "Procedure to determine the Specific Absorption Rate (SAR) for weeks communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)". March 2010.
   d) KDB 865664, "SAR Messurement Requirements for 100 MHz to 6 GHz."

# Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization (i = 0 (f < 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx, y, z are only intermediate values, i.e., the uncartainties of NORMx, y, z does not affect the E<sup>1</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
- A<sub>A,Y,Z</sub>, Ex,y,z, Cx,y,z, Dx,y,z, VRx,y,z, A, B, C, D are numerical linearization parameters assessed based on
- Any, Y, Exc, Y, Z, Dx, Y, Z, Vxx, Y, X, X, B, C, D are numerical interaction parameters assessed baset or the date 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 didos.

  ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-feet (or Tempereture Transfer Standard for I < 800 MHz) and inside waveguide using analytical field distributions based on power measurements for I > 800 MHz. The same setups are used for assessment of the parameters applied to boundary companisation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASYA software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z "Convi" whereby the uncertainty corresponds to that given for ConvF. A frequency dependent and in DASY version 4.4 and higher which allows extending the validity from  $\pm$  50 MHz to  $\pm$  100 MHz
- Spherical (sotropy (3D deviation from isotropy); in a field of low gradients realized using a fial phantom exposed by a patch antenna.
- Sensor Offset. The sensor offset corresponds to the offset of virtual measurement center from the probe to
- (on probe axis). No sclerance required.

  Connector Angle: The angle is assessed using the information gained by determining the WORM's (no uncertainty required).

Certificate No: EX3-7466\_Jul 17

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EX3DV4 - SN:7466

July 4, 2017

# Probe EX3DV4

SN:7466

Manufactured: October 25, 2016 Calibrated: July 4, 2017

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

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EX3DV4-SN:7466

July 4, 2017

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7466

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m) <sup>2</sup> ) <sup>A</sup>	0.46	0.40	0.63	± 10.1 %
DCP (mV) <sup>a</sup>	96.7	100.3	93.7	

**Modulation Calibration Parameters** 

UID	Communication System Name		A dB	B dB√μV	С	D dB	VR mV	Uno <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	145.9	±3.0 %
		Y	0.0	0.0	1.0		148.6	
		Z	0.0	0.0	1.0		130.0	

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

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The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).
\*Numerical linearization parameter: uncertainty not required.
\*Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the



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EX3DV4-- SN:7466

July 4, 2017

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7466

#### Calibration Parameter Determined in Head Tissue Simulating Media

alibration	inbration Parameter Determined in nead 11ssue Simulating media									
f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>6</sup> (mm)	Unc (k=2)		
835	41.5	0.90	10.20	10.20	10.20	0.60	0.84	± 12.0 %		
900	41.5	0.97	9.95	9.95	9.95	0.42	0.94	± 12.0 %		
1750	40.1	1.37	8.84	8.84	8.84	0.34	0.80	± 12.0 %		
1900	40.0	1.40	8.52	8.52	8.52	0.35	0.80	± 12.0 %		
2000	40.0	1.40	8.47	8.47	8.47	0.35	0.80	± 12.0 %		
2450	39.2	1.80	7.81	7.81	7.81	0.35	0.99	± 12.0 %		
2600	39.0	1.96	7.58	7.58	7.58	0.37	0.95	± 12.0 %		
5200	36.0	4.66	5.81	5.81	5.81	0.35	1.80	± 13.1 %		
5300	35.9	4.76	5.56	5.56	5.56	0.35	1.80	± 13.1 %		
5600	35.5	6.07	4.98	4.98	4.98	0.40	1.80	±13.1 %		
5800	35.3	5.27	5.17	5.17	5.17	0.40	1.80	± 13.1 %		

<sup>&</sup>lt;sup>0</sup> Frequency validity above 300 MHz of ± 160 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the 1635 of the Conv<sup>2</sup> uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for Conv<sup>2</sup> assessments at 30, 44, 120, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 510 MHz.

\*At frequencies below 3 GHz, the validity of tissue parameters (a and e) can be relaxed to ± 10% if figuid compensation formula is applied to measured SAR values. At frequencies shows 3 GHz, the validity of tissue parameters (a and e) is restricted to ± 5%. The uncertainty for hidded target tissue parameters.

\*AphaCogha are determined during outbrades. SFEAC warrants that the remaining deviation due to the boundary effect after compensation is always lass than ± 1% for frequencies below 3 GHz and below a 2% for frequencies between 3-6 GHz at any distance larger than half the probe 5p dismeter from the boundary.

Certificate No: EX3-7466\_Jul17

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EX3DV4-SN:7466

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7466

#### Calibration Parameter Determined in Body Tissue Simulating Media

alibration	libration Parameter Determined in Body Tissue Simulating Media									
f (MHz) <sup>C</sup>	Relative Permittivity F	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha <sup>6</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)		
835	55.2	0.97	10.24	10.24	10.24	0.39	0.96	± 12.0 %		
900	55.0	1.05	10.06	10.06	10.06	0.34	1.01	± 12.0 %		
1750	53.4	1.49	8.52	8.52	8.52	0.39	0.87	± 12.0 %		
1900	53.3	1.52	8.14	8.14	8.14	0.34	0.91	± 12.0 %		
2000	53.3	1.52	8.30	8.30	8.30	0.33	0.94	± 12.0 %		
2450	52.7	1.95	7.94	7.94	7.94	0.28	1.10	± 12.0 %		
2600	52.5	2.16	7.66	7.66	7.66	0.27	1.15	± 12.0 %		
5200	49.0	5.30	5.20	5.20	5.20	0.40	1.90	± 13.1 %		
5300	48.9	5.42	5.10	5.10	5.10	0.40	1.90	± 13.1 %		
5600	48.5	5.77	4.27	4.27	4.27	0.50	1.90	± 13.1 %		
5800	48.2	6.00	4.48	4.48	4.48	0.50	1.90	±13.1%		

<sup>&</sup>lt;sup>©</sup> Firequency validity above 360 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), alse it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at disfuscion frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity on the extended to ± 110 MHz.

\*At frequencies below 3 GHz, the validity of tissue parameters (e and e) can be relaxed to ± 10% if liquid componsation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (e and e) is restricted to ± 6%. The uncertainty is the RSS of the ConvF uncertainty for indicated torget tissue parameters. If a tissue parameters is the convF uncertainty for indicated torget tissue parameters.

\*Application and the convF uncertainty is the RSS of the ConvF uncertainty is the RSS of the ConvF uncertainty in indicated torget tissue parameters.

\*Application are converted to ± 6%. The uncertainty is the RSS of the ConvF uncertainty in indicated torget tissue parameters.

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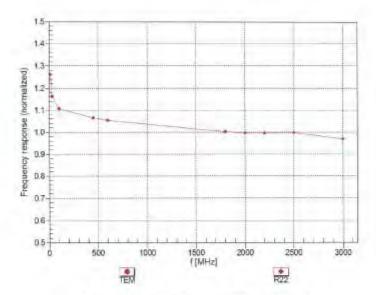


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EX3DV4- SN:7466

July 4, 2017

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



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

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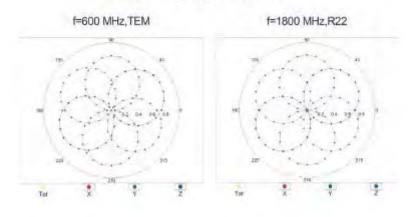
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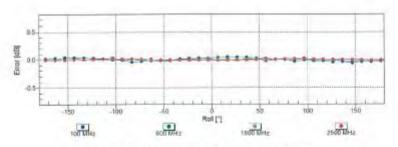


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EX3DV4-SN:7466 July 4, 2017

# Receiving Pattern (6), 9 = 0°





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

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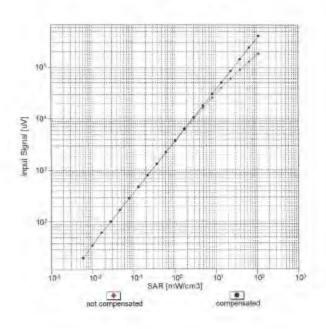


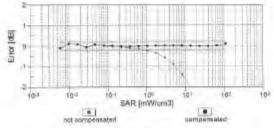
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EX3DV4- SN:7466

July 4, 2017.

# Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)





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

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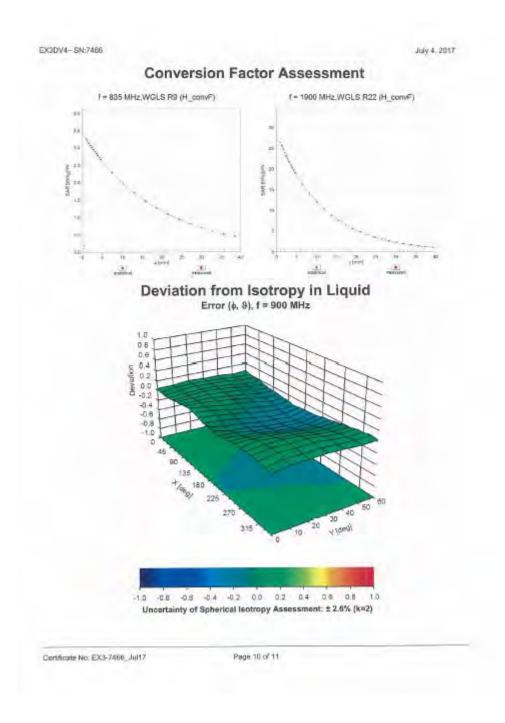
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EX3DV4~ SN:7466

July 4, 2017

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7466

#### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-3.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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SGS-TW (Auden)

Certificate No: EX3-3938\_Sep17

**CALIBRATION CERTIFICATE** EX3DV4 - SN:3938 Object QA CAL-01 v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure(s) Calibration procedure for dosimetric E-field probes Calibration date: September 29, 2017 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate All calibrations have been conducted in the closed laboratory facility, environment temperature (22 ± 3)°C and humidity < 70% Calibration Equipment used (M&TE critical for calibration)

Primary Standards	(D)	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr.18
Power sensor NRP-Z91	SN. 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sersor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr-18
Reference 20 dB Attenuator	SN: S5277 (20x)	07-Apr-17 (No. 217-02528)	Apr-18
Reference Proba ES3DV2	SN: 3013	31-Dec-16 (No. ES3-3013_Dec16)	Dec-17
DAE4	SN: 660	7-Dec-16 (No. DAE4-660_Dec18)	Dec-17
Secondary Standards	10	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	D4-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Jeton Kaştrati	Laboratory Technician	TOTAL
Approved by:	Katja Pokovjc	Technical Manager	Reac
			Issued: October 2, 2017

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#### Calibration Laboratory of Schmid & Partner

Engineering AG aughausstrasse 43, 3004 Zurich, Switzerland





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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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### Glossary:

tissue simulating liquid NORMx,y,z sensitivity in free space sensitivity in TSL / NORMx,y,z ConvF DCP

diode compression point crest factor (1/duty\_cycle) of the RF signal modulation dependent linearization parameters A.B.C.D

Polarization φ in rotation around probe axis

Polarization 9 & rotation around an axis that is in the plane normal to probe axis (at measurement center),

i.e., 4 = 0 is normal to probe axis

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

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

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement
- Techniques", June 2013 IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-b) IEC 62209-1, ", "Measurement procedure for the assessment of specific Absorption Nate (SAN) from near held and body-mounted devices used next to the ear (frequency range of 300 MHz to 5 GHz)", July 2016.
   c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for Wireless communication defused in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010.
   d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Methods Applied and Interpretation of Parameters:

- NORMx,y,z Assessed for E-field polarization 8 = 0 (f  $\leq 900$  MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the  $E^2$ -field uncertainty inside TSL (see below ConvF).
- NORM(f),x,y,z = NORMx,y,z \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included
- in the stated uncertainty of ConvF.

  DCPx;y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.

  PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal has referred.
- Axy z: Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z; A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f < 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z \*\*ConvF\* whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF\* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

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EX3DV4 - SN:3938

September 29, 2017

# Probe EX3DV4

SN:3938

Manufactured: Calibrated:

May 2, 2013

September 29, 2017

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

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September 29, 2017

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

#### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m) <sup>2</sup> ) <sup>A</sup>	0.51	0.57	0.33	± 10.1 %
DCP (mV) <sup>e</sup>	102.0	101.2	103.4	

#### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dBõV	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1:0	0.00	139.3	±2.5 %
		Y	0.0	0.0	1.0		146.0	-
		2	0.0	0.0	1.0		131.9	

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%.

The uncertainties of Norm X,Y,Z,do not affect the E<sup>S</sup>-field uncertainty inside TSL (see Pages 5 and 6).

Numerical linearization parameter, uncertainty not required.

Linearization 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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EX3DV4- SN:3938

September 29, 2017

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

#### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>©</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
750	41.9	0.89	10.26	10.26	10.26	0.53	0.80	± 12.0 %
835	41.5	0.90	9.69	9.69	9.69	0.50	0.83	± 12.0 %
900	41.5	0.97	9.50	9,50	9.50	0.51	0.80	± 12.0 %
1450	40.5	1.20	8.49	8.49	8.49	0.45	0.80	± 12.0 %
1750	40,1	1.37	8.35	8.35	8.35	0.33	0.85	± 12.0 %
1900	40.0	1.40	8.07	8.07	8.07	0.36	0,84	± 12.0 %
2000	40.0	1.40	8.04	8.04	8.04	0.30	0.86	± 12.0 %
2300	39.5	1.67	7.66	7.66	7.66	0.32	0.84	± 12.0 %
2450	39.2	1.80	7.30	7.30	7.30	0.37	0.80	± 12.0 %
2600	39.0	1.96	7.14	7.14	7.14	0.33	0.86	±12.0%
5250	35.9	4.71	5.04	5.04	5.04	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.70	4.70	4.70	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.85	4.85	4.85	0.40	1.80	± 13,1 9

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

At frequencies below 3 GHz, the validity of tissue parameters (a and o) can be reased to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the varidity of tissue parameters (i) and b) is restricted to ± 5%. The uncertainty is the RSS of the CornF uncertainty for indicated target tissue parameters.

Applications of the determined during calibration. SFEAC warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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

f (MHz) c	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
750	55.5	0.96	9.62	9.62	9.62	0,51	0.80	± 12.0 %
835	55.2	0.97	9.48	9.48	9.48	0.50	0.83	± 12.0 %
900	55.0	1.05	9.35	9,35	9.35	0.55	0.80	± 12.0 %
1450	54.0	1,30	8.29	8.29	8.29	0.36	0.80	± 12.0 %
1750	53.4	1.49	7.96	7.96	7.96	0.45	0.80	± 12.0 %
1900	53.3	1.52	7.70	7.70	7.70	0.40	0.80	± 12.0 %
2000	53.3	1.52	7.87	7.87	7.87	0,38	0.86	± 12.0 %
2300	52.9	1,81	7.51	7.51	7.51	0.41	0.85	± 12.0 %
2450	52.7	1,95	7.42	7.42	7.42	0.39	0.80	± 12.0 %
2600	52.5	2.16	7.15	7.15	7.15	0.35	0.89	± 12.0 9
5250	48.9	5.36	4.41	4.41	4.41	0.40	1,90	±13.19
5600	48.5	5.77	3.90	3.90	3.90	0.45	1.90	± 13.1 9
5750	48.3	5.94	4.09	4.09	4.09	0.45	1.90	±13.19

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

At frequencies below 3 GHz, the validity of tissue parameters (is and e) can be released to ± 10%, if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (is and e) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target itssue parameters are the convF uncertainty for indicated target itssue parameters are sufficiently as the RSS of the ConvF uncertainty for indicated target itssue parameters.

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

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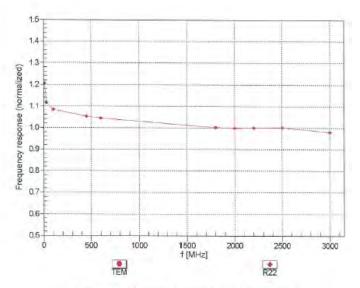


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# Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



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

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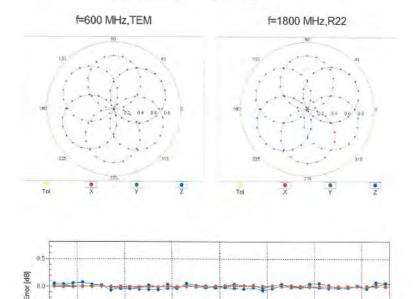
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# Receiving Pattern (\$), 9 = 0°



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

600 MHz

Roll ["]

1800 MHz

2500 MHz

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100 MHz

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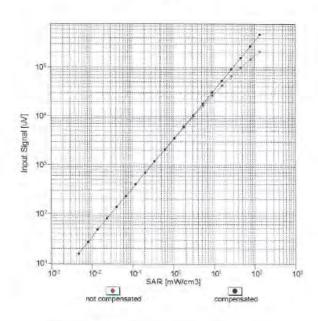


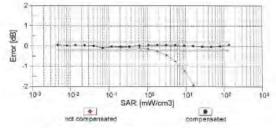
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# Dynamic Range f(SARhead) (TEM cell , feval= 1900 MHz)





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

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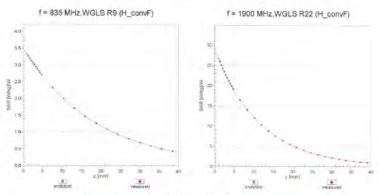
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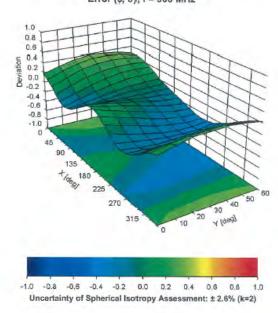
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# Conversion Factor Assessment



# Deviation from Isotropy in Liquid Error (ø, θ), f = 900 MHz



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EX3DV4- SN:3938

September 29, 2017

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

# Other Probe Parameters

Tnangular
-24.6
enabled
disabled
337 mm
10 mm
9 mm
2,5 mm
1 mm
1 mm
1 mm
1.4 mm

Certificate No: EX3-3938\_Sep17

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# 8. Uncertainty Budget

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

Α	С	D	е		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probabilit y	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.55%	N	1	1	1	1	6.55%	6.55%	œ
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	œ
Isotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	œ
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	∞
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	œ
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	∞
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	œ
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	œ
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	œ
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	œ
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	œ
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	œ
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	œ
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	œ
Probe Positioning with respect to phantom	2.90%	R	√3	1.732	1	1	1.67%	1.67%	œ
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	œ
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	œ
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%	œ
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	œ
Liquid permittivity (mea.)	2.56%	N	1	1	0.64	0.43	1.64%	1.10%	М
Liquid Conductivity (mea.)	3.18%	N	1	1	0.6	0.49	1.91%	1.56%	М
Combined standard uncertainty		RSS					11.98%	11.86%	
Expant uncertainty							23.97%	23.72%	

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

A	С	D	е		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probabilit y	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Vef
Measurement system									
Probe calibration	6.00%	N	1	1	1	1	6.00%	6.00%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	∞
lsotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	∞
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	∞
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	∞
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	∞
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	∞
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	∞
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	∞
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	∞
Probe Positioning with respect to phantom	2.90%	R	√3	1.732	1	1	1.67%	1.67%	∞
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Test Sample related									
Test sample positioning	2.90%	N	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	N	1	1	1	1	3.60%	3.60%	M-1
Drift of output power	5.00%	R	√3	1.732	1	1	2.89%	2.89%	∞
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	∞
Liquid permittivity (mea.)	1.81%	N	1	1	0.64	0.43	1.16%	0.78%	М
Liquid Conductivity (mea.)	1.89%	N	1	1	0.6	0.49	1.13%	0.93%	М
Combined standard uncertainty		RSS					11.53%	11.47%	
Expant uncertainty (95% confidence							23.06%	22.94%	

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# 9. System Validation from Original Equipment Supplier

Calibration Laboratory of Schmid & Partner Engineering AG Zeughnusstraser 43, 0004 Zurich, Switzerland





- S Schweizerischer Kallbrierdiens
  C Service suisse d'étalonnage
- Servizio avizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 0108

According by the Swiss According to Service (SAS)

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

Client SGS -TW (Auden)

Total No. D2450V2-727 April 7

Displace	D2450V2 - SN: 7	27	
Calibration procedure(s)	QA CAL-05.v9 Calibration proce	dure for dipole validation kits abo	we 700 MHz
calibration data.	April 21, 2017		
		ional standards, which realize the physical un rebebility are given on the following pages an	
VI calibrations have been conduc Calibration Equipment used (MS)		ry facility; environment temperature (22 ± 3)*(	C and furnicity < 70%.
Primary Standards	I ID #	Cal Date (Certificate No.)	Scheduled Calibration
	SN: 104778		1.0.10
Power sensor NRP-ZB1 Power sensor NRP-ZB1	SN: 100244 SN: 103245	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528)	Apr-18 Apr-18 Apr-18
Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EXSCN4 DAE4	SN: 100244	04-Apr-17 (No. 217-02521)	Apr-18
Pawer sensor NRP-ZB1 Pawer sensor NRP-ZB1 References 20 dB Attanuator Type-N mismatch combination Picterance Probe EXSEV4 DAE4	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7348	04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02529) 31-Dec-16 (NV) EX3-7349_Dec16)	Apr-18 Apr-18 Apr-16 Apr-18 Dec-17
Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attanuator Type-N mismatch combination Reference Probe EX3CW4	SN: 100244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7346 SN: 601	04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02528) 31-Dec-16 (No. EX3-7348 Dec16) 28-Mar-17 (No. DAE4-601 Mer17)	Apr-18 Apr-18 Apr-16 Apr-16 Apr-16 Dec-17 Mar-18 Schedulad Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Pawer sensor NRP-ZB1 Power sensor NRP-ZB1 Returnics 20 dB Attanuator Type-N immisch combination Reterringo Probe EXSEM4 DAE4  Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator P&S SMT-D6	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7348 SN: 601 ID # SN: GB37450704 SN: US37292783 SN: MY41092317 SN: 100972	04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02528) 31-Dec-16 (No. EX3-7346, Dec16) 28-Mar-17 (No. DAE4-601, Mar17) Check Date (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16)	Apr-18 Apr-18 Apr-16 Apr-18 Dec-17 Msr-18
Pawer sensor NRP-ZB1 Pawer sensor NRP-ZB1 References 20 dB Attanuator Type-N mismatch combination Ploterance Probe EXSEM4  DAE4  Secondary Standards Power maler EPM-442A Power sensor HP 8481A  PFOWER SENSOR HP 8481A  RF generator PAS SMT-06	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7946 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092517 SN: 100972 SN: US37290585	04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02529) 31-Det-16 (No. 217-02529) 31-Det-16 (No. EX3-7349_Det-16) 28-Mar-17 (No. DAE-4-601_Mar-17) Check Date (in house) 07-Det-15 (in house check Oct-16) 07-Det-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 19-Oct-01 (in house check Oct-16)	Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Dec-17 Msr-18 Schedulad Check: Oct-18 In house check: Oct-18

Certificate No: D2450V2-727\_Apr17

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#### Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





Service suisse d'étalonnage Servizio svizzero di taratura

Accreditation No.: SCS 0108

Swinn Calibration Service

Accreelled by the Swise Accreditation Service (SAS)

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#### Glossary:

TSL ConvF N/A

tissue simulating liquid

sensitivity in TSL / NORM x,y,z not applicable or not measured

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

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

# Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

Certificate Not D2450V2-T27 April 7

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#### Measurement Conditions

DASY Version	DA\$Y5	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

#### Head TSL parameters

and coloulations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL

SAR averaged over 1 cm <sup>2</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.3 W/kg ± 16.5 % (k=2)

#### **Body TSL parameters**

ng parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	2.03 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

#### SAR result with Body TSL

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.6 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.01 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.8 W/kg ± 16.5 % (k=2)

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.3 Ω + 2.1 jΩ
Return Loss	- 24.0 dB

#### Antenna Parameters with Body TSL

impedance, ti	ransformed to feed point	51.1 Ω + 4.1 jΩ
Return Loss		- 27.5 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 ns
----------------------------------	----------

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

The dipote is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipote. The antenna is therefore short-circuited for DC-signals. On some of the dipotes, small end caps are added to the dipote 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 dipote 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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#### DASY5 Validation Report for Head TSL

Date: 21.04.2017

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;  $\sigma = 1.87 \text{ S/m}$ ;  $\varepsilon_r = 37.7$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

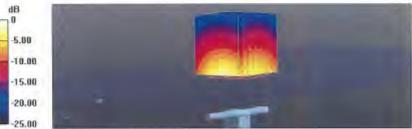
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

#### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.72, 7.72, 7.72); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52,10.0(1442); SEMCAD X 14.6.10(7413)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 109.8 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 27.3 W/kg SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.18 W/kgMaximum value of SAR (measured) = 21.1 W/kg



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

Certificate No: D2450V2-727\_Apr17

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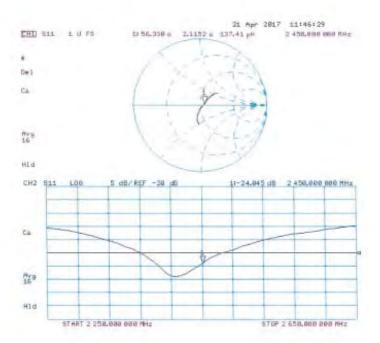
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### Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727\_Apr17

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#### **DASY5 Validation Report for Body TSL**

Date: 21.04.2017

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;  $\sigma = 2.03 \text{ S/m}$ ;  $\epsilon_1 = 52.5$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 31.12,2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

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

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

Reference Value = 105.0 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 25.4 W/kg

SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6.01 W/kg

Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.01 dBW/kg

Certificate No: D2450V2-727\_April7

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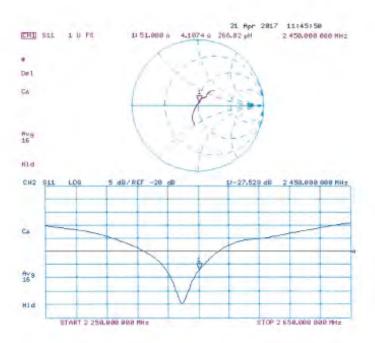
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#### Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-727\_Apr17

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# Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurtch, Switzerland





S Schweizerischer Kallbrundjerd
C Service suisse d'étalomage
S service svizzero di teratura
S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of collection coefficients

#### Glossary:

ConvF

N/A

tissue simulating liquid

sensitivity in TSL / NORM x,y,z not applicable or not measured

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- EC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2018
- EC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)". March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

Certificate No: 02450V2-727\_April 8

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#### Measurement Conditions

DASY Version	DASYS	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz. = 5 mm	
Frequency	2450 MHz = 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	38.3 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	_	

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>5</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13,3 W/kg
SAR for nominal Head TSL parameters	Wt of begilamon	52.1 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	250 mW Input power	8.16 W/kg
SAR for nominal Head TSL parameters	normalized to TW	24.3 W/kg ± 16.5 % (k=2)

# **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	52.5 ± 6 %	2.01 mho/m = 6 %
Body TSL temperature change during test	< 0,5.°C	_	

### SAR result with Body TSL

SAR sveraged over 1 cm <sup>1</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.8 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.8 W/kg ± 16.5 % (k=2)

Certificate No: D2450V2-727\_Apr18

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.2 \Omega + 2.7 \mu\Omega	
Heturn Loss	= 25.1 dB	

#### Antenna Parameters with Body TSL

Impledance, transformed to feed point	51.2 (2 + 5.8   12	
Return Loss	- 25.0 dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 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 semingid 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 cage. 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 SAFI 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 emis, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG	
Manufactured on	January 09, 2003	

Certificate No: D2450V2-727\_Aprile

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#### **DASY5 Validation Report for Head TSL**

Date: 24.04.2018

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;  $\sigma = 1.86 \text{ S/m}$ ;  $\epsilon_t = 38.3$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### DASY52 Configuration:

dB -5.00 -10.00 -15.00 -20.00 25.00

- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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

Measurement grid; dx=5mm, dy=5mm, dz=5mm Reference Value = 116.0 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.16 W/kgMaximum value of SAR (measured) = 22.0 W/kg





0 dB = 22.0 W/kg = 13.42 dBW/kg

Certificate No: D2450V2-727\_April8

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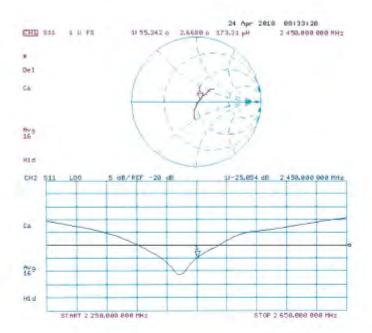
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#### Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727\_Apr18

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#### DASY5 Validation Report for Body TSL

Date: 24.04.2018

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;  $\sigma = 2.01 \text{ S/m}$ ;  $\varepsilon_r = 52.5$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

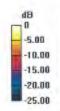
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

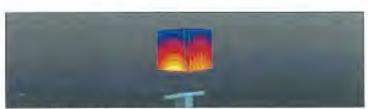
#### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.01, 8.01, 8.01); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 108.4 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 25.5 W/kg SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6 W/kgMaximum value of SAR (measured) = 21.1 W/kg





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

Certificate No: D2450V2-727, April 8

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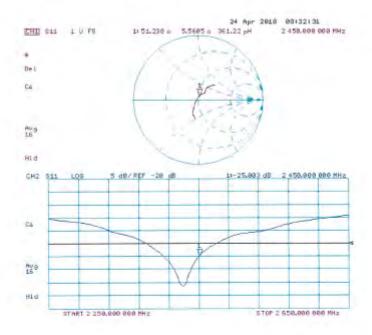
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## Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-727\_Apr18

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## Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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SGS-TW (Auden)

Certificate No: D5GHzV2-1023 Jan17

Object	D5GHzV2 - SN:1	023	
Caribration pricedurals)	QA CAL-22.v2 Calibration proce	dure for dipole validation kits bety	ween 3-6 GHz
Calibration date:	January 20, 2017		
This calibration portificate docume The measurements and the unce	entil the traceability to nati rtainties with confidence p	onal standards, which realize the physical un rehability are given on the hillowing pages an	its of measurements (SI), d are part of the certificate
		ry facility, anwironment temperature (22 $\pm$ 3)°C	Cand humidity < 70%.
Calibration Equipment used (M&T	E ortical for calibration)		
Primary Standards	ID #	Cal Date [Certificate No.]	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02289/02289)	Apr-17
Power sensor NEP-Z91	SNL 103244	96-Apr-16 (No. 217-02288)	Apr-17
PERMIT SHEDGE (ALL: VO)			
	SN 103245	06-Apr-16 (No. 217-02289)	Apr-17
ower sensor NRP-Z91	SN: 5058 (20k)	85-Apr-16 (No. 217-02292)	Apr-17
Power sensor NRP-Z91 Reference 20 dB Attenuator	The Country of the Co	85-Apr-16 (No. 217-02292) 85-Apr-16 (No. 217-02295)	Apr-17 Apr-17
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N internatch combination	SN: 5058 (20k)	05-Apr-16 (No. 217-02392) 05-Apr-16 (No. 217-02295) 31-Dec-16 (No. EXS-8508_Dec16)	Apr-17 Apr-17 Dec-17
Power sensor NRP-Z31 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 5058 (20k) SN: 5047.2 / 06327	85-Apr-16 (No. 217-02292) 85-Apr-16 (No. 217-02295)	Apr-17 Apr-17
Power sensor NRP /234 Reference 20 dB Attenuator Type-N internation combination Reference Probe EX3DV4 DAE4	SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503	05-Apr-16 (No. 217-02392) 05-Apr-16 (No. 217-02295) 31-Dec-16 (No. EXS-8508_Dec16)	Apr-17 Apr-17 Dec-17
Power sensor NRP 4291 Reference 20 dB Attenuator Type-N internation combination Reference Probe EX3DV4 DAE4 Secondary Stancards	SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 501	05-Apr-16 (No. 217-02302) 05-Apr-16 (No. 217-02295) 31-Dec-16 (No. EXG-9503_Dec15) 04-Jen-17 (No. DAE4-601_Jan17)	Apr-17 Apr-17 Dec-17 Jan-18
Power sensor NRP 4291 Reference 20 dB Attenuator Type-N internation orbitration Reference Probe EX30V4 DAE4 Secondary Stanzants Power master EPM-442A	SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 801	05-Apr-16 (No. 217-02902) 05-Apr-16 (No. 217-02905) 31-Dec-16 (No. EXX-9503_Dec-16) 04-Jen-17 (No. DAE4-601_Jen17) Check Date (in house)	Apr-17 Apr-17 Dec-17 Jan-18 Schedulet Check
Power sensor NRP /231 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX30V4 DA64 Secondary Standards Power maser EPM-442A Power sonsor HP 8481A	SN: 5058 (20k) SN: 5047 2 / 06327 SN: 3603 SN: 801	05-Apr-16 (No. 217-0292) 05-Apr-16 (No. 217-0295) 31-Dec-16 (No. EXS-9503_Dec15) 04-Jen-17 (No. DAE4-601_Jan17) Check Date (in house) 07-0ct-16 (in house)	Agr-17 Agr-17 Dec-17 Jan-18 Scheduled Check In house check: Dct-18 In house check: Dct-18 In house check: Dct-10
Power sensor NRP /291 Reference 20 dB Attenuator type-9/ internation combination Reference Probe EX30V4 DAE4 Secondary Standards Power sensor EPM-442A Power sensor HP 8481A	SN: 5086 (204) SN: 5047.2 / 06327 SN: 3609 SN: 801 ED 8 SN: 0837480704 SN: US37282789	05-Apr-16 (No. 217-02202) 05-Apr-16 (No. 217-02205) 31-Dec-16 (No. EXS-9503_Dec-15) 04-Jen-17 (No. DAE4-GO1_Jan17) Check Date (in house) 07-Oct-15 (in house check Oct-15) 07-Oct-15 (in house check Oct-16)	Agr-17 Agr-17 Dec-17 Jan-18 Schedulet Check In Foursi check: Dot-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Power sensor NRP-231 Raterance 20 dB Attenuator Type-N internation combination Reterance Probe EX3DV4 DAE4 Secondary Stanzards Power mater EPM-442A Power sensor HP 8481A RF generator R&S SMT-08	SN: 5089 (20k) SN: 5047 2 / 08327 SN: 3608 SN: 861 ID 8 SN: 6897480704 SN: US37292789 SN: MY41082317	85-Apr-16 (No. 217-02392) 85-Apr-16 (No. 217-02295) 31-Dec-16 (No. EXS-9593, Dec16) 04-Jen-17 (No. DAE4-601_Jan17) Check Date (In house) 07-Oct-16 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Agr-17 Agr-17 Dec-17 Jan-18 Schedulet Check In Foursicheck: Dict-18 In house check: Dict-18 In house check: Dict-18 In house check: Dict-18 In house check: Dict-18
Power sensor NRP 4291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Stanzants	SN: 5087 (20k) SN: 5047 2 / 06327 SN: 3609 SN: 801 SN: 6837480704 SN: US37292789 SN: MY4 (1923) SN: 100972 SN: US37390565	85-Apr-16 (No. 217-02302) 85-Apr-16 (No. 217-02285) 31-Dec-16 (No. DXS-9508) Dec16) 04-Jen-17 (No. DAE4-601 Jan17) Check Date (in house) 07-Oct-16 (in house check Oct-16) 97-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16)	Agr-17 Agr-17 Dec-17 Jan-18 Schedulet Check In Foursicheck: Dict-18 In house check: Dict-18 In house check: Dict-18 In house check: Dict-18 In house check: Dict-18
Power sensor NRP 4291 Reference 20 dB Attenuator Type-N internation combination Reference Probe EX30V4 DAE4 Secondary Stanzands Power inser EPM-442A Power sensor I-P 8481A RE generator R&S SMT-00 Network Analyzer I-P 8753E	SN: 5089 (20k) SN: 5047 2 / 06397 SN: 3608 SN: 8601 SN: 6897480704 SN: US37292789 SN: MY41082317 SN: US37390585 Name	85-Apr-16 (No. 217-02392) 85-Apr-16 (No. 217-02295) 31-Dec-16 (No. EXS-9593, Dec16) 04-Jen-17 (No. DAE4-601_Jan17) Check Date (In house) 07-Oct-16 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 15-Oct-01 (in house check Oct-16)	Agr-17 Apr-17 Dec-17 Jan-18 Scheduled Check In Fourse check: Dch-18 In house check: Dch-18
Power sensor NRP 4291 Reference 20 dB Attenuator Type-N mismatch combination Fellemance Probe EX3DV4 DAE4 Secondary Stanzards Power sensor EPM-442A Power sensor IPP 8481A RE generator R&S SMT-08	SN: 5087 (20k) SN: 5047 2 / 06327 SN: 3609 SN: 801 SN: 6837480704 SN: US37292789 SN: MY4 (1923) SN: 100972 SN: US37390565	05-Apr-16 (No. 217-02302) 05-Apr-16 (No. 217-02395) 31-Dec-16 (No. EXS-9503_Dec-16) 04-Jen-17 (No. DAE-4-601_Jen17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16)	Agr-17 Apr-17 Dec-17 Jan-18 Scheduled Check In house check Oct-18
Power sensor NRP 4231 Reference 20 dB Attenuator Type-N internation combination Reference Probe EX30V4 DAE4 Secondary Stanzands Power sensor HP 8481A Power sensor HP 8481A AF generator R&S SMT-08 Network Analyzer HP 8753E Celibrated by	SN: 5087 (2/k) SN: 5047 2 / 06327 SN: 3609 SN: 801 SN: 6897480704 SN: US37282789 SN: US37282789 SN: US37282789 SN: US37280585 Name Jeton Kastrati	85-Apr-16 (No. 217-02302) 85-Apr-16 (No. 217-02395) 91-Dec-16 (No. 217-02395) 91-Dec-16 (No. DAE4-601_Jan17) Check Date (in house) 97-Oct-15 (in house check Oct-16) 97-Oct-15 (in house check Oct-16) 15-dun-15 (in house check Oct-16)	Agr-17 Apr-17 Dec-17 Jan-18 Scheduled Check In house check Oct-18
Power sensor NRP /231 Reference 20 dB Attenuator Type-N internation combination Reference Probe EX30V4 DAE4 Secondary Stancards Power reser EPM-442A Power sensor I-P 8481A RF generator R&S SMT-00 Network Analyzer I-P 8753E	SN: 5089 (20k) SN: 5047 2 / 06397 SN: 3608 SN: 8601 SN: 6897480704 SN: US37292789 SN: MY41082317 SN: US37390585 Name	85-Apr-16 (No. 217-02392) 85-Apr-16 (No. 217-02295) 31-Dec-16 (No. EXS-9593, Dec16) 04-Jen-17 (No. DAE4-601_Jan17) Check Date (In house) 07-Oct-16 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 15-Oct-01 (in house check Oct-16)	Agr-17 Apr-17 Dec-17 Jan-18 Scheduled Check In Fourse check: Dch-18 In house check: Dch-18

Certificate No: D5GHzV2-1023\_Jan17

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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Pask Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices Measurement Techniques\*, June 2013
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- b) 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 cartilicate. 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.
- Fixed 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 uncortainty 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
- 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%.

Derthicate No: D5GHz/V2 (023 Jan17)

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#### Measurement Conditions

n configuration, as far as not given on page 1

DASY Version	DASYS	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4,0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 5600 MHz ± 1 MHz	

# Head TSL parameters at 5200 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	38.0	4.66 mhp/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.45 mho/m ± 6.%
Hend TSL temperature change during test	<05℃		-

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

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR meresured	100 mW input power	7.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	75.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.16 W/kg
SARI for nominal Head TSL parameters	normalized to 1W	21.5 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1023\_Jan17

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#### Head TSL parameters at 5300 MHz

	Temperature	Pormittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35,2 ± 6 %	4.55 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	8.22 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 measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg ± 19.5 % (k=2)

# Head TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	347 = 6%	4.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5°C	-	

### SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm2 (10 g) of Head TSL	condition	
SAR measured	100 mW Input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1023\_Jan17

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## Head TSL parameters at 5800 MHz

	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	344±6%	5 05 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>2</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.6 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 powr≋	.2.22 W/kg
SAR for nominal Head TSL parameters.	normalized to 1W	22.0 W/kg ± 19.5 % (k=2)

Gertificate No: D5GHzV2-1025\_Jan17

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## Body TSL parameters at 5200 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 0	49.0	5,30 mha/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.5 ± 6 %	5.36 mho/m ± 6 %
Body TSL temperature change during test	<0.5 ℃		_

## 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	7,32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm2 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.05 W/kg
SAR for nominal Body TSL parameters.	normalized to 1W	20.3 W/kg ± 19.5 % (k=2)

## Body TSL parameters at 5300 MHz

	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	47.3±6%	5,50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	-400	-

## SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm2 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.68 W/kg
SAR for nominal Bedy TSL parameters	normalized to 1W	76.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm2 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.15 W/kg
SAR for nominal Body TSL parameters	Normalized to 1V/	21.3 W/kg = 19.5 % (k=2)

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### Body TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mha/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	5.90 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 ℃	_	

### 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	8.02 W/kg
SAR for nominal Body TGL parameters	normalized to 1W	79.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm2 (10 g) of Body TSL	condition	
SAR measured	100 I'MV input power	2.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.4 W/kg ± 19.5 % (k=2)

## Body TSL parameters at 5800 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6,00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.3 ± 6 %	6.17 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	-	-

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

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	100 mW Input power	7.64 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR massured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.1 W/kg ± 19.5 % (k=2)

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#### Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	49.6 Ω - 6.7  Ω
Return Loss	- 23,4 dB

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

Impedance, transformed to feed point	49.0 Ω = 1.8 μΩ	
Return Loss	+33.5 dB	

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

Impediancs, transformed to feed point	54.1 Ω − 0.2 jΩ
Fleturn Loss	- 28.2 dB

## Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.4 Ω + 2.8 <sub>1</sub> Ω	
Fletum Loss	-24.8 dB	

# Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.9 Ω - 7.0 jΩ
Return Loss	- 22.9 dB

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

Impedance, transformed to feed point	51.0 Ω - 1.0 μΩ
Return Loss	- 37.0 dB

### Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	55.6 Ω + 1.5 ½	
Return Loss	- 25.2 dB	

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

Impedance, transformed to feed point	56.6 $\Omega$ + 2.7 $\Omega$	
Return Loss	= 23.6 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: 20.01.2017

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW;

Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: f = 5200 MHz;  $\alpha = 4.45$  S/m;  $\epsilon_c = 35.4$ ;  $\rho = 1000$  kg/m

Medium parameters used: l = 5300 MHz;  $\sigma = 4.55 \text{ S/m}$ ;  $\tilde{\epsilon}_s = 35.2$ ;  $\rho = 1000 \text{ kg/m}^3$ .

Medium parameters used: l = 5600 MHz; n = 4.85 S/m;  $\epsilon_r = 34.7$ ;  $\rho = 1000 \text{ kg/m}^2$ .

Medium parameters used: f = 5800 MHz:  $\pi = 5.05$  S/m;  $\varepsilon_t = 34.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

#### DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.76, 5.76, 5.76); Calibrated: 31.12.2016, ConvF(5.35, 5.35, 5,35); Calibrated. 31.12.2016, ConvF(5.09, 5.09, 5.09); Calibrated: 31.12.2016, ConvF(5.0). 5.01. 5.01); Calibrated: 31.12.2016;
- Sensor-Surface: L4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.01.2017
- Phantom: Flut Phuntom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan.

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.58 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 27.6 W/kg

SAR(1 g) = 7.55 W/kg; SAR(10 g) = 2.16 W/kg

Maximum value of SAR (measured) = 17.4 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 = 73.01 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 31,6 W/kg

SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.35 W/kg

Maximum value of SAR (measured) = 19.3 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 = 71.94 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 33.2 W/kg

SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.33 W/kg

Maximum value of SAR (measured) = 19.8 W/kg

Cemticate No: 05GHzV2-1023\_Jan17.

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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 = 69.84 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 32.7 W/kg

SAR(1 g) = 7.82 W/kg; SAR(10 g) = 2.22 W/kg

Maximum value of SAR (measured) = 19.5 W/kg.



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

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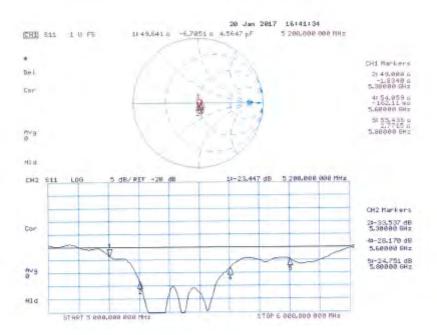
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# Impedance Measurement Plot for Head TSL



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#### DASY5 Validation Report for Body TSL

Date: 19.01.2017

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW;

Frequency: 5200 MHz, Frequency: 5300 MHz, Prequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: f = 5200 MHz;  $\sigma = 5.36$  S/m;  $\varepsilon_r = 47.5$ ;  $\rho = 1000$  kg/m

Medium parameters used: f = 5300 MHz;  $\sigma = 5.5 \text{ S/m}$ ;  $\varepsilon_i = 47.3$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Medium parameters used: f = 5600 MHz;  $\sigma = 5.9 \text{ S/m}$ ;  $\epsilon_i = 46.6$ ;  $\rho = 1000 \text{ kg/m}$ 

Medium parameters used: f = 5800 MHz;  $\sigma = 6.17 \text{ S/m}$ ;  $\epsilon_r = 46.3$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Measurement Standard; DASY5 (IEEE/IEC/ANSI C63,19-2011)

#### DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5,29, 5,29, 5,29); Calibrated: 31 12.2016; ConvF(5.04, 5,04. 5.04); Calibrated: 31.12.2016, ConvF(4.57, 4.57; A.57); Calibrated. 31.12.2016, ConvF(4.48, 4.48; 4.48); Calibrated: 31.12.2016;
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electromes: DAE4 Sn601, Calibrated: 04.01.2017
- Phantom: Flat Phantom 5,0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.54 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 7.32 W/kg; SAR(10 g) = 2.05 W/kg

Maximum value of SAR (measured) = 16.6 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 = 66.93 V/m; Power Drift = -0.07 dB

Penk SAR (extrapolated) = 30.1 W/kg

SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.15 W/kg

Maximum value of SAR (measured) = 17.6 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 = 67.09 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 33.7 W/kg

SAR(1 g) = 8.02 W/kg; SAR(10 g) = 2.26 W/kg

Maximum value of SAR (measured) = 18.9 W/kg

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# Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan,

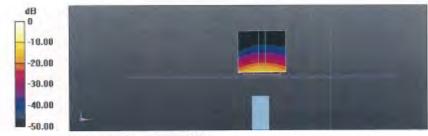
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.14 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 34.0 W/kg

SAR(1 g) = 7.64 W/kg; SAR(10 g) = 2.13 W/kg

Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 16.6 W/kg = 12.20 dBW/kg

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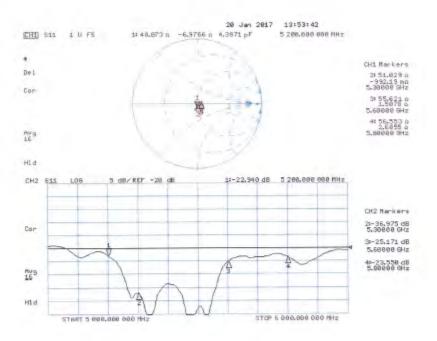
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#### Impedance Measurement Plot for Body TSL



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





Schweizerischer Kalibrierdienst Service suisse d'étalonnage C Servizio avizzero di teratura S Swiss Calibration Service

Appreditation No.: SCS 0108

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

SGS.TW (Auden)

Certificate No: D5GHzV2-1023 Jan18

Dejdo	D5GHzV2 - SN:1	023	
Celibration procedure(s)	QA CAL-22.v2 Calibration proce	dure for dipole validation kits betw	ween 3-6 GHz
Calibration date:	January 25, 2018	1	
		onal standards, which realize the physical uni robability are given on the following pages an	
All calibrations have been conduc	cted in the closed laborator	ry facility, environment temperature (22 ± 3)°C	S and humidity < 70%.
Calibration Equipment used (M&T	TE critical for calibrations		
Daniel Equation price (my			
	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Primary Standards	1D # EN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Primary Standards Power moter NRP Priver sensor NRP-291	ID # EN: 104779 SN: 108244	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521)	Apr-18 Apr-18
Primery Standards Power meler NRP Power sensor NRP-291 Power sensor NRP-291	ID # EN: 104779 SN: 105644 SN: 103645	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522)	Apr-18 Apr-18 Apr-18
Primery Standards Power reser NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	ID # EN: 104779 SN: 105244 SN: 103246 SN: 5058 (20k)	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528)	Apr-18 Apr-18 Apr-18 Apr-18
Primary Standards Power maler NPP Priwit Sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination	ID # EN: 104779 SN: 105544 SN: 105845 SN: 5058 (20k) SN: 5047.2 / 06327	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02528)	Apr-18 Apr-18 Apr-18 Apr-16 Apr-16
Primary Standards Power Inster NRP Priver sensor NRP-Z91 Power sensor NRP-Z91 Federance 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	ID # EN: 104779 SN: 105244 SN: 103246 SN: 5058 (20k)	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528)	Apr-18 Apr-18 Apr-18 Apr-18
Primary Standards Power maler NPP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	ID # BN: 104779 SN: 105544 SN: 105945 SN: 5059 (204) SN: 5047.2 / 06327 SN: 3503	04-Apr-17 (No. 217-02521(02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. EX3-3503_Dec17)	Apr-18 Apr-18 Apr-18 Apr-16 Apr-16 Dec-18
Primary Standards Power rester NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reterance 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	ID # EN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 601	04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17)	Apr-18 Apr-18 Apr-16 Apr-16 Apr-16 Dec-18 Oct-18 Scheduled Check In house check: Oct-18
Primary Standards Primary Standards Primary Standards Primary Sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Primary Manual Standards Primary Standards	ID 8 BN: 104779 SN: 105244 SN: 105245 SN: 5058 (20k) SN: 5047 2 / 06327 SN: 3005 SN: 601	04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-801_Oct17) Check Date (in house)	Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18
Primary Standards Power molet NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Federance 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	ID # BN: 104778 SN: 105644 SN: 105645 SN: 5068 (20k) SN: 5047 2 / 08327 SN: 3005 SN: 601	04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Primary Standards  Primer Inster NPP  Primer sensor NRP-Z01  Primer sensor NRP-Z01  Reference 20 dB Attenuator  Type-N internation combination  Reference Probe EX3DV4  DAE4  Secondary Standards  Power motor EPM-442A  Power sensor HP 8481A.  Power sensor HP 8481A.	ID # EN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047 2 / 05327 SN: 3503 SN: 601 ID # SN: GB37480704 SN: US3728783 SN: MY41882317 SN: 100672	04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 287-3503_Dec-17) 26-Oct-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Oct-18 Oct-18 Scheduled Check In house check: Oct-18
Primary Standards Power resear NRP-Z91 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 6461A AF generator R&S SMT-66	ID #  SN: 104779 SN: 103244 SN: 103245 SN: 5058 (204) SN: 5047 2 / 06327 SN: 3503 SN: 601  ID #  SN: G837480704 SN: US37282783 SN: MY41092317	04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Primary Standards Power meller NPP Priwin sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meller EPM-442A Power meller EPM-441A Power sensor HP 8481A Power sensor HP 6461A RF generator R&S SMT-66 Network Arwelyzer HP 8753E	ID #  BN: 104779 SN: 105244 SN: 105245 SN: 5056 (204) SN: 5047 2 / 06327 SN: 3505 SN: 601  ID #  SN: GB37480704 SN: US37282783 BN: MY4192317 SN: 106972 SN: US37380606	04-Apr-17 (No. 217-02521(02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 23-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 16-Oct-15 (in house check Oct-17) Function	Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Oct-18 Oct-18 Scheduled Check In house check: Oct-18
Primery Standards Power resider NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Proper sensor HP 8481A	ID #  EN: 104778 SN: 105644 SN: 105645 SN: 5056 (20k) SN: 5047 2 / 08327 SN: 3505 SN: 601  ID #  SN: GB37480704 SN: US37282783 SN: MY41082317 SN: 906972 SN: US37360606	04-Apr-17 (No. 217-02521(02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 23-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-17)	Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Oct-18 Scheduled Check In house check: Oct-18

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Engineering AG Zeughausstrasse 43, 8004 Zurich. Switzerland





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Glossary:

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

Calibration is Performed According to the Following Standards:

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

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

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### Measurement Conditions

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

DASY Version	DASY5	V52,10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	With Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1,4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

## Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	38.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	4.50 mha/m ± 6 %
Head TSL temperature change during lest	€0.5 °C	per:	1997

### SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm2 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7:72 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.3 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	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.2 W/kg ± 19.5 % (k=2)

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#### Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	4.60 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>9</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	80.9 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.2 W/kg ± 19.5 % (k=2)

# Head TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 ℃	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	4.90 mha/m ± 6 %
Head TSL temperature change during test	< 0.5°C		+

#### SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	B.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.9 W/kg ± 19.9 % (k=2)

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

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## Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	5.11 mho/m ± 8 %
Head TSL temperature change during test	< 0.5 °C	(tank)	-

## SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm2 (1 g) of Head TSL	Condition	
SAR measured	100 mW Input power	7.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2,25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 W/kg ± 19.5 % (k=2)

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#### Body TSL parameters at 5200 MHz

meters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mha/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3±6%	5.41 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	-	-

## SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	70.9 W/kg ± 19.9 % (k×2)

SAR averaged over 10 cm² (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to fW	19.8 W/kg ± 19.5 % (k=2)

# Body TSL parameters at 5300 MHz

ing 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 1 ± 6 %	5.54 mho/m = 6 %
Body TSL temperature change during test	< 0,5 °C	-	- O-V

## SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	100 mW Input power	7.34 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.4 W/kg ± 19.5 % (k=2)

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### Body TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.94 mha/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	-med	

### SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	-
SAR measured	100 mW input power	7.81 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77,6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.19 W/kg
SAFI for nominal Body TSL parameters	normalized to 1W	21.7 W/kg = 19.5 % (k=2)

# Body TSL parameters at 5800 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mholm
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.2 ± 6 %	6.22 mha/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	_	

# SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.46 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>2</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.5 W/kg ± 19.5 % (k=2)

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# Appendix (Additional assessments outside the scope of SCS 0108)

# Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.1 Ω - 8.1 jΩ	
Return Loss	- 21.9 dB	

### Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	50.5 Ω - 2.3  Ω	
Return Loss	- 32.7 dB	

# Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω - 0.7  Ω	
Return Loss	- 28.4 dB	

### Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.3 Ω + 2.6 jΩ
Heturn Loss	- 25.1 dB

# Antenna Parameters with Body TSL at 5200 MHz

49.8 Ω - 6.9 jΩ
- 23.2 dB

# Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to leed point	50.9 Ω - 0.9 jΩ
Return Loss	- 37.9 dB

# Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	56.0 Ω + 0.5 JΩ
Return Loss	- 24.9 dB

# Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to leed point	56.6 Ω + 2.3 βΩ
Return Loss	→ 23,7 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: 25.01.2018

Test Laboratory; SPEAG, Zurich, Switzerland

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

Communication System: UID () - CW/ Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz,

Frequency: 5800 MHz

Medium parameters used: f = 5200 MHz;  $\sigma = 4.5 \text{ S/m}$ ;  $\epsilon_r = 36.3$ ;  $\rho = 1000 \text{ kg/m}^3$ . Medium parameters used: f = 5300 MHz;  $\sigma = 4.6 \text{ S/m}$ ;  $\epsilon_r = 36.2$ ;  $\rho = 1000 \text{ kg/m}^3$ .

Medium parameters used: i = 5600 MHz;  $\sigma = 4.9$  S/m;  $\epsilon_r = 35.8$ ;  $\rho = 1000$  kg/m

Medium parameters used: f = 5800 MHz;  $\sigma = 5.11$  S/m;  $a_t = 35.5$ ;  $\rho = 1000$  kg/m<sup>2</sup>

Phantom section: Flat Section

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

#### DASY52 Configuration:

- Probe: BX3DV4 SN3503; ConvF(5.75, 5.75, 5.75); Calibrated: 30.12,2017, ConvF(5.5, 5.5, 5.5); Calibrated: 30.12.2017, ConvF(5.05, 5.05, 5.05); Calibrated: 30.12.2017, ConvF(4.96, 4.96, 4.96); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanica) Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm

(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.47 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 27.5 W/kg

SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.22 W/kg

Maximum value of SAR (measured) = 17.7 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 = 74.63 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 29.6 W/kg

SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.32 W/kg

Maximum value of SAR (measured) = 18.6 W/kg.

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm

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

Reference Value = 70.79 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 31.5 W/kg

SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.34 W/kg

Maximum value of SAR (measured) = 19.6 W/kg

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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 = 69.22 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 31.2 W/kg

SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.25 W/kg

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



0 dB = 17.7 W/kg = 12.48 dBW/kg

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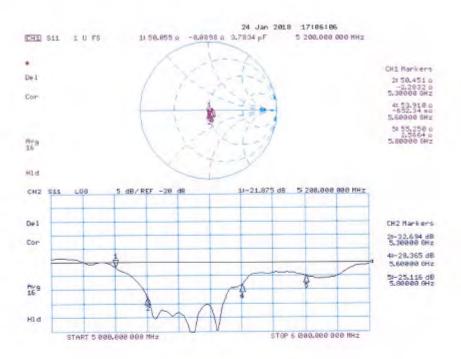
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## Impedance Measurement Plot for Head TSL



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## DASY5 Validation Report for Body TSL

Date: 23.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Frequency: 5800 MHz

Medium parameters used: f = 5200 MHz;  $\sigma = 5.41 \text{ S/m}$ ;  $\epsilon_c = 47.3$ ;  $\rho = 1000 \text{ kg/m}^3$ .

Medium parameters used: f = 5300 MHz;  $\sigma = 5.54$  S/m;  $\varepsilon_r = 47.1$ ; p = 1000 kg/m<sup>2</sup>

Medium parameters used: f = 5600 MHz;  $\sigma = 5.94$  S/m;  $\varepsilon_r = 46.6$ ;  $\rho = 1000$  kg/m<sup>2</sup>. Medium parameters used: f = 5800 MHz;  $\sigma = 6.22 \text{ S/m}$ ;  $\epsilon_r = 46.2$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5,35, 5,35, 5,35); Calibrated: 30.12.2017. ConvF(5.15, 5.15, 5.15); Calibrated: 30.12.2017, ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2017, ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAFA Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52,10.0(1446); SEMCAD X 14.6.10(7417)

# Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm

(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.00 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 26.4 W/kg

SAR(1 g) = 7.14 W/kg; SAR(10 g) = 2 W/kg

Maximum value of SAR (measured) = 16.8 W/kg

# Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm

(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1,4mm

Reference Value = 65.19 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 28.4 W/kg

SAR(1g) - 7.34 W/kg; SAR(10g) = 2.06 W/kg

Maximum value of SAR (measured) = 17.6 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 = 66.21 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 32.8 W/kg

SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.19 W/kg

Maximum value of SAR (measured) = 19.1 W/kg

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Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm

(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.05 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 32.3 W/kg

SAR(1 g) = 7.46 W/kg; SAR(10 g) = 2.07 W/kg

Maximum value of SAR (measured) = 18.8 W/kg



0 dB = 18.8 W/kg = 12.74 dBW/kg

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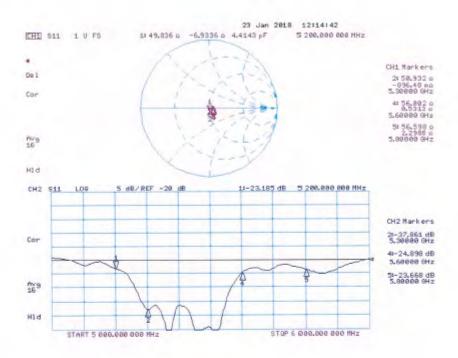
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## Impedance Measurement Plot for Body TSL



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