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SAR TEST REPORT





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

Equipment Under TestTabletBrand NameTomTomModel No.4FI722

Company Name TomTom International BV

Company Address De Ruijterkade 154, 1011 AC Amsterdam, The Netherlands

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

KDB248227D01v02r02,KDB865664D01v01r04,

KDB865664D02v01r02,KDB447498D01v06,

KDB616217D04v01r02

FCC ID S4L4FI722

Date of Receipt Aug. 01, 2016

Date of Test(s) Aug. 19, 2016 ~ Mar. 15, 2017

Date of Issue Mar. 28, 2017

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.

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Signed on behalf of SGS	
Engineer	Supervisor
Bond Tsai Date: Mar. 28, 2017	John Teh
Dona isai /	John Yen
Date: Mar. 28, 2017	Date: Mar. 28, 2017

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Revision History

Report Number	Revision	Description	Issue Date
E5/2016/80003A-01	Rev.00	Initial creation of document	Mar. 21, 2017
E5/2016/80003A-01	Rev.01	1 st modification	Mar. 24, 2017
E5/2016/80003A-01	Rev.02	2 nd modification	Mar. 28, 2017

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1. General Information

1.1 Testing Laboratory

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

1.2 Details of Applicant

Company Name	TomTom International BV	
Company Address	De Ruijterkade 154, 1011 AC Amsterdam, The Netherlands	

1.2.1 Details of Manufacturer

Company Name	Tech-Com (Shanghai) Computer Co., Ltd	
	No. 68, Sanzhuang Road Songjiang Export Processing Zone Shanghai 201613, P.R.China	

Company Name	Tech-Giant(Shanghai)Computer Co., Ltd	
Company Address	A, B, C Building, No. 68, Sanzhuang Road Songjiang Export Processing Zone Shanghai 201613, P.R.China	

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1.3 Description of EUT

Equipment Under Test	Tablet			
Brand Name	TomTom			
Model No.	4FI722			
FCC ID	S4L4FI722			
Antenna Designation (Maximum Gain)	2.45GHz: -4.45, 5GHz: -3.45			
Mode of Operation	⊠WLAN802.11 a/b/g/n(20M/40M)			
Wode of Operation	⊠Bluetooth			
Duty Cyala	WLAN802.11 a/b/g/n(20M/40M)		1	
Duty Cycle	Bluetooth		1	
	WLAN802.11 b/g/n(20M)	2412	_	2462
	WLAN802.11 a/n(20M) 5.2G	5180	_	5240
	WLAN802.11 n(40M) 5.2G	5190	_	5230
	WLAN802.11 a/n(20M) 5.3G	5260	_	5320
TX Frequency Range	WLAN802.11 n(40M) 5.3G	5270	_	5310
(MHz)	WLAN802.11 a/n(20M) 5.6G	5500	_	5720
	WLAN802.11 n/ac(40M) 5.6G	5510	_	5710
	WLAN802.11 a/n(20M) 5.8G	5745	_	5825
	WLAN802.11 n(40M) 5.8G	5710	_	5795
	Bluetooth	2402	_	2480
	WLAN802.11 b/g/n(20M)	1	_	11
	WLAN802.11 a/n(20M) 5.2G	36	_	48
Channel Number (ARFCN)	WLAN802.11 n(40M) 5.2G	38	_	46
	WLAN802.11 a/n(20M) 5.3G	52		64
	WLAN802.11 n(40M) 5.3G	54	_	62
	WLAN802.11 a/n(20M) 5.6G	100	_	144
	WLAN802.11 n(40M) 5.6G	102	_	142

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Channel Number (ARFCN)	WLAN802.11 n(40M) 5.3G	54	_	62
	WLAN802.11 a/n(20M) 5.6G	100	_	144
	WLAN802.11 n(40M) 5.6G	102	_	142
	WLAN802.11 a/n(20M) 5.8G	149	_	165
	WLAN802.11 n(40M) 5.8G	142	_	159
	Bluetooth	0	_	78

Max. SAR (1 g) (Unit: W/Kg)				
Band Measured Reported Channel Position				Position
WLAN802.11 b	0.154	0.156	1	Top side
WLAN802.11 n(40M) 5.2G	0.820	0.841	46	Top side
WLAN802.11 n(40M) 5.3G	0.813	0.845	62	Top side
WLAN802.11 n(40M) 5.6G	1.170	1.181	102	Top side
WLAN802.11 n(40M) 5.8G	0.804	0.942	151	Top side

1.3.1 Difference description

All the WLAN/BT data are came from 4FI76 (FCC ID: S4L4FI76)

The only changes between 4FI76 and 4FI722 are the components that related to WWAN function, USB HSIC, Camera modules and NFC chip were removed from PCBA.

According to the changes, 4FI722 SAR is tested at the worst case of 4FI76 (Report No.:E5/2016/80003).

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

	802.11 b	Max. Rated Avg.	Average conducted output power (dBm)
СН	Frequency	Power + Max.	Data Rate (Mbps)
Сп	(MHz)	Tolerance (dBm)	1
1	2412	15	14.94
6	2437	15	14.81
11	2462	15	14.63

	802.11 g	Max. Rated Avg.	Average conducted output power (dBm)
СН	Frequency	Power + Max.	Data Rate (Mbps)
СП	(MHz)	Tolerance (dBm)	6
1	2412	12	11.77
6	2437	12	11.89
11	2462	12	11.70

802	2.11 n(20M)	Max. Rated Avg.	Average conducted output power (dBm)		
СН	Frequency	Power + Max. Tolerance (dBm)	Data Rate (Mbps)		
СП	(MHz)	Tolerance (dbiii)	6.5		
1	2412	12	11.76		
6	2437	12	11.92		
11	2462	12	10.52		

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802.11 a			Average conducted output		
5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max.	power (dBm)		
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)		
СП	(MHz)		6		
36	5180	12	11.98		
40	5200	12	11.96		
44	5220	12	11.99		
48	5240	12	11.95		
52	5260	12	11.83		
56	5280	12	11.87		
60	5300	12	11.93		
64	5320	12	11.68		
100	5500	12	11.84		
120	5600	12	11.91		
140	5700	12	11.67		
149	5745	12	11.93		
157	5785	12	11.79		
165	5825	12	11.74		

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802	2.11 n(20M)		Average conducted output		
5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max.	power (dBm)		
СН	Frequency	Tolerance (dBm)	Data Rate (Mbps)		
СП	(MHz)		6.5		
36	5180	12	11.97		
40	5200	12	11.86		
44	5220	12	11.83		
48	5240	12	11.89		
52	5260	12	11.75		
56	5280	12	11.82		
60	5300	12	11.88		
64	5320	12	11.87		
100	5500	12	11.95		
120	5600	12	11.71		
140	5700	12	11.71		
149	5745	12	11.69		
157	5785	12	11.77		
165	5825	12	11.80		

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802	2.11 n(40M)		Average conducted output		
5.2/5	5.3/5.6/5.8G	Max. Rated Avg.	power (dBm)		
СН	Frequency	Power + Max. Tolerance (dBm)	Data Rate (Mbps)		
CIT	(MHz)		13.5		
38	5190	12	11.79		
46	5230	12	11.89		
54	5270	12	11.79		
62	5310	12	11.83		
102	5510	12	11.96		
118	5590	12	11.97		
134	5670	12	11.79		
151	5755	12	11.31		
159	5795	12	11.42		

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Bluetooth conducted power table:

Bidetootii conducted power table.								
Frequency	Data	Max. power(dBm)	Avg. Conducted Output Power					
(MHz)	Rate	mazii potroi (aziii)	dBm	mW				
2402	1	1.5	0.61	1.151				
2441	1	1.5	1.09	1.285				
2480	1	1.5	-0.66	0.859				
2402	2	0	-0.62	0.867				
2441	2	0	-0.10	0.977				
2480	2	0	-2.14	0.611				
2402	3	0	-0.64	0.863				
2441	3	0	-0.19	0.957				
2480	3	0	-2.23	0.598				

		Avg. Conducted Output Power			
Frequency (MHz)	Max. power(dBm)	BT4.0			
		dBm	mW		
2402	0	-0.31	0.931		
2442	0	-0.02	0.995		
2480	0	-1.32	0.738		

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1.4 Test Environment

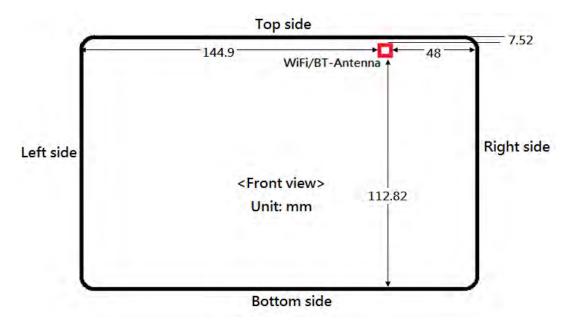
Ambient Temperature: 22±2° C Tissue Simulating Liquid: 22±2° C

1.5 Operation Description

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

EUT was tested in the following configuration:

WLAN: back/top sides with test distance 0mm.



Antenna position plot (Front view)

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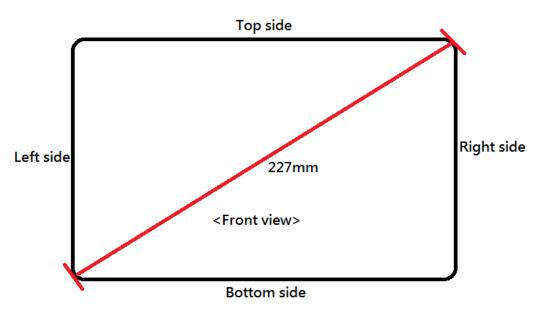
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Diagonal Dimension of EUT (Front view)

Note:

802.11b DSSS SAR Test Requirements:

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

802.11g/n OFDM SAR Test Exclusion Requirements:

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

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Initial Test Configuration:

- 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, 5.2n(40)/5.3n(40)/5.6n(40)/5.8n(40) is chosen to be the initial test configuration.
 - 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 use the same antenna path, and Bluetooth can't transmit with WLAN simultaneously.
 - 9. Based on KDB447498D01,
 - (1) SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances≤ 50 mm are determined by:

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

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

- (2) For test separation distances > 50 mm, and the frequency at 100 MHz to 1500MHz, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B of KDB447498 D01. [(Threshold at 50mm in step1) + (test separation distance-50mm)x($\frac{f(MHz)}{120}$)](mW),
- (3) For test separation distances > 50 mm, and the frequency at >1500MHz to 6GHz, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B of KDB447498 D01.

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			Top side			Right side			Left side			
Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. t surfac (mm	се	Exclusion threshold (mW)	Require SAR testing?
WLAN 2.45GHz	15	31.623	7.52	6.598	YES	48	1.037	NO	144.	9	949.996	NO
WLAN 5GHz	12	15.849	7.52	5.087	YES	48	0.797	NO	144.	9	949.765	NO
ВТ	1.5	1.413	7.52	0.296	NO	48	0.046	NO	144.	9	949.044	NO
			Bottom side				Back	side				

			Bottom side			Back side			
Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	
WLAN Main 2.45GHz	15	31.623	112.82	629.192	NO	8.1	6.148	YES	
WLAN Main 5GHz	12	15.849	112.82	628.965	NO	8.1	4.722	YES	
ВТ	1.5	1.413	112.82	628.244	NO	8.1	0.275	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 ≤ 0.8 W/kg, when the transmission band is ≤ 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).

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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= σ ($|Ei|^2$)/ ρ where σ and ρ are the conductivity and mass density of the tissue-simulant.

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

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

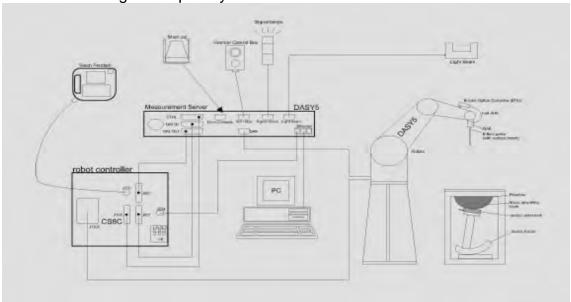


Fig. a The block diagram of SAR system

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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.
- The SAM twin phantom enabling testing left-hand and right-hand usage. 10.
- The device holder for handheld mobile phones. 11.
- Tissue simulating liquid mixed according to the given recipes. 12.
- 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 ax ± 0.5 dB in tissue material (rotation norma	,				
Dynamic Range Dimensions	10 μW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μW/g) 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

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

DEVICE HOLDER

Construction	The device holder (Supporter) for Notebook is made by POM (polyoxymethylene resin), which is non-metal and non-conductive. The height can be adjusted to fit varies kind of notebooks.	基
		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 2450/5200/5300/5600/5800 MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1 (SAR values are normalized to 1W forward power delivered to the dipole). During the tests, the ambient temperature of the laboratory was 21.7°C, the relative humidity was 62% and the liquid depth above the ear reference points was ≥ 15 cm ± 5 mm (frequency \leq 3 GHz) or \geq 10 cm \pm 5 mm (frequency > 3 GHz) 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.

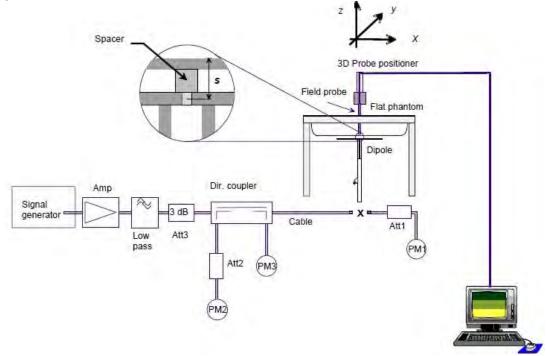


Fig. b The block diagram of system verification

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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	Deviatio n (%)	Measured Date
D2450V2	727	2450	Body	49.6	12.8	51.2	3.23%	Aug. 22, 2016
		5200	Body	71.9	7.18	71.8	-0.14%	Aug. 22, 2016
D5GHzV2	1023	5300	Body	75.1	7.44	74.4	-0.93%	Aug. 22, 2016
DJGHZVZ		5600	Body	78.3	7.79	77.9	-0.51%	Aug. 23, 2016
		5800	Body	75.3	7.65	76.5	1.59%	Aug. 23, 2016
D2450V2	727	2450	Body	49.6	12.6	50.4	1.61%	Mar. 15, 2017
		5200	Body	72.8	7.32	73.2	0.55%	Mar. 15, 2017
D5GHzV2	1023	5300	Body	76.1	7.59	75.9	-0.26%	Mar. 15, 2017
DOGHZVZ	1023	5600	Body	79.6	8.11	81.1	1.88%	Mar. 15, 2017
		5800	Body	75.9	7.71	77.1	1.58%	Mar. 15, 2017

Table 1. Results of system validation

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1.9 Tissue Simulant Fluid for the Frequency Band

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

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

Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, £r	Measured Conductivity, σ (S/m)	% dev εr	% dev σ
		2412	52.751	1.914	53.537	1.951	-1.49%	-1.95%
		2450	52.700	1.950	53.464	1.988	-1.45%	-1.95%
		5190	49.028	5.288	49.979	5.217	-1.94%	1.33%
	Aug. 22, 2016	5200	49.014	5.299	49.970	5.259	-1.95%	0.76%
	Aug. 22, 2016	5230	48.974	5.334	49.919	5.263	-1.93%	1.33%
		5270	48.919	5.381	49.849	5.310	-1.90%	1.32%
		5300	48.879	5.416	49.793	5.348	-1.87%	1.25%
		5310	48.865	5.428	49.789	5.358	-1.89%	1.29%
	Aug. 23, 2016	5510	48.594	5.661	49.702	5.695	-2.28%	-0.59%
		5590	48.485	5.755	49.573	5.790	-2.24%	-0.61%
		5600	48.471	5.766	49.562	5.801	-2.25%	-0.60%
		5670	48.376	5.848	49.484	5.882	-2.29%	-0.57%
Body		5755	48.261	5.947	47.547	5.884	1.48%	1.06%
		5795	48.207	5.994	47.498	5.932	1.47%	1.04%
		5800	48.200	6.000	47.477	5.933	1.50%	1.12%
		2412	52.751	1.914	53.092	1.932	-0.65%	-0.94%
		2450	52.700	1.950	53.004	1.969	-0.58%	-0.97%
		5200	49.014	5.299	48.685	5.256	0.67%	0.82%
		5230	48.974	5.334	48.619	5.287	0.72%	0.89%
	Mar. 15, 2017	5300	48.879	5.416	48.703	5.407	0.36%	0.17%
	IVIAI. 15, 2017	5310	48.865	5.428	48.643	5.421	0.45%	0.13%
		5510	48.594	5.661	49.289	5.638	-1.43%	0.41%
		5600	48.471	5.766	48.885	5.765	-0.85%	0.02%
		5755	48.261	5.947	49.281	5.832	-2.11%	1.94%
		5800	48.200	6.000	49.032	6.095	-1.73%	-1.58%

Table 2. Dielectric Parameters of Tissue Simulant Fluid

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The composition of the body tissue simulating liquid:

_			,	Ingre	dient	<i>y</i> ,		
Frequency (MHz)	Mode	DGMBE	Water	Salt	Preventol D-7	Cellulose	Sugar	Total amount
2450	Body	301.7ml	698.3ml	_	_	-	_	1.0L(Kg)

Simulating Liquids for 5 GHz, Manufactured by SPEAG:

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

Table 3. Recipes for Tissue Simulating Liquid

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1.10 Evaluation Procedures

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

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

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

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

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

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

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

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- 1. 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.
- 2. 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.
- 3. The calibration depends on the assessment of the specific density, the heat capacity and the conductivity of the medium. While the specific density and heat capacity can be measured accurately with standardized procedures (~ 2% for c; much better for p), there is no standard for the measurement of the conductivity. Depending on the method and liquid, the error can well exceed ±5%.
- 4. 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:

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

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3. 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).
- 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

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devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section. (Table 4.)

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

Table 4. RF exposure limits

Notes:

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

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2. Summary of Results

WLAN

The data of 4FI76 from the SAR report No.: E5/2016/80003

Band	Mode	e Position	Distance (mm)	СН	H Freq.	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	page
WLAN 2.45GHz	b	Back sdie	0	1	2412	15	14.94	1.39%	0.118	0.120	-
WEAN 2.45GHZ	b	Top side	0	1	2412	15	14.94	1.39%	0.154	0.156	33
	HT40	Back sdie	0	46	5230	12	11.89	2.57%	0.296	0.304	-
WLAN 5.2GHz	HT40	Top side	0	38	5190	12	11.79	4.95%	0.753	0.790	-
WLAN 5.2GHZ	HT40	Top side	0	46	5230	12	11.89	2.57%	0.820	0.841	34
	HT40	Top side*	0	46	5230	12	11.89	2.57%	0.819	0.840	-
	HT40	Back sdie	0	62	5310	12	11.83	3.99%	0.304	0.316	-
WLAN 5.3GHz	HT40	Top side	0	54	5270	12	11.79	4.95%	0.790	0.829	-
WLAN 5.3GHZ	HT40	Top side	0	62	5310	12	11.83	3.99%	0.813	0.845	35
	HT40	Top side*	0	62	5310	12	11.83	3.99%	0.810	0.842	-
	HT40	Back sdie	0	118	5590	12	11.97	0.69%	0.393	0.396	-
	HT40	Top side	0	102	5510	12	11.96	0.93%	1.170	1.181	36
WLAN 5.6GHz	HT40	Top side*	0	102	5510	12	11.96	0.93%	1.160	1.171	-
	HT40	Top side	0	118	5590	12	11.97	0.69%	1.060	1.067	-
	HT40	Top side	0	134	5670	12	11.79	4.95%	0.978	1.026	-
	HT40	Back sdie	0	159	5795	12	11.42	14.29%	0.290	0.331	-
WLAN 5.8GHz	HT40	Top side	0	151	5755	12	11.31	17.22%	0.804	0.942	37
	HT40	Top side*	0	151	5755	12	11.31	17.22%	0.800	0.938	-
	HT40	Top side	0	159	5795	12	11.42	14.29%	0.778	0.889	-

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

Tested 4FI722 at the worst case position:

Band	Mode Position		Distance (mm)	СН	-roa	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling	Averaged SAR over 1g (W/kg)		Plot
			(111111)		(IVII IZ)	Tolerance (dBm)	(dBm)		Measured	Reported	page
WLAN 2.45GHz	b	Top side	0	1	2412	15	14.94	1.39%	0.149	0.151	-
WLAN 5.2GHz	HT40	Top side	0	46	5230	12	11.89	2.57%	0.713	0.731	-
WLAN 5.3GHz	HT40	Top side	0	62	5310	12	11.83	3.99%	0.732	0.761	-
WLAN 5.6GHz	HT40	Top side	0	102	5510	12	11.96	0.93%	1.070	1.080	-
WLAN 5.8GHz	HT40	Top side	0	151	5755	12	11.31	17.22%	0.707	0.829	-

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3. Instruments List

Manufacturer	Device	Туре	Serial number	Date of last calibration	Date of next calibration
Schmid & Partner	Dosimetric E-Field	EX3DV4	3923	Aug.27,2015	Aug.26,2016
Engineering AG	Probe	LAGDV4	3938	Nov.25,2016	Nov.24,2017
Schmid &		D2450V2	727	Apr.19,2016	Apr.18,2017
Partner	System Validation Dipole	D5GHzV2	1023	Jan.26,2016	Jan.25,2017
Engineering AG		D3G112V2	1023	Jan.20,2017	Jan.19,2018
Schmid & Partner	Data acquisition	DAE4	1374	Oct.23,2015	Oct.22,2016
Engineering AG	Electronics	DAE4	1336	Nov.22,2016	Nov.21,2017
Schmid & Partner Engineering AG	Software	DASY 52 V52.8.8	N/A	Calibration not required	Calibration not required
Schmid & Partner Engineering AG	Phantom	SAM	N/A	Calibration not required	Calibration not required
Agilent	Network Analyzer	E5071C	MY46107530	Jan.07,2016	Jan.06,2017
Agilent	Network Arialyzei	E307 IC	1017330	Jan.20,2017	Jan.19,2018
Agilent	Dielectric Probe Kit	85070E	MY44300677	Calibration not required	Calibration not required
Agilent	Dual-directional coupler	772D	MY46151242	Jul.11,2016	Jul.10,2017
Agilent	RF Signal	N5181A	MY50145142	Feb.19,2016	Feb.18,2017
Agiletit	Generator	NOTOTA	MY50144143	Mar.01,2017	Feb.28,2018
Agilent	Power Meter	E4417A	MY51410006	Jan.07,2016	Jan.06,2017
/ \Glicin	1 OWO! IVIOLO!	□	10000		Jan.19,2018

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Manufacturer	Device	Туре	Serial number	Date of last calibration	Date of next calibration
Agilent			MY51470001	Jan.07,2016	Jan.06,2017
	Power Sensor	E9301H		Jan.20,2017	Jan.19,2018
			NAVE 4 470000		Jan.06,2017
			MY51470002		Jan.19,2018
TECPEL	Digital thermometer	DTM-303A	TP130078	May.30,2016	May.29,2017

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4. Measurements

Date: 2016/8/22

WLAN 802.11b_Body_Top side_CH 1_0mm

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

Medium parameters used: f = 2412 MHz; $\sigma = 1.951$ S/m; $\varepsilon_r = 53.537$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

Probe: EX3DV4 - SN3923; ConvF(7.49, 7.49, 7.49); Calibrated: 2015/8/27;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1374; Calibrated: 2015/10/23

Phantom: Body

DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (71x91x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 0.279 W/kg

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

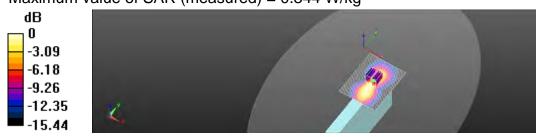
dy=4mm, dz=2mm

Reference Value = 5.806 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.477 W/kg

SAR(1 g) = 0.154 W/kg; SAR(10 g) = 0.091 W/kg

Maximum value of SAR (measured) = 0.344 W/kg



0 dB = 0.344 W/kg = -4.63 dBW/kg

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Date: 2016/8/22

WLAN 802.11 n(40M) 5.2G_Body_Top side_CH 46_0mm

Communication System: WLAN(5G); Frequency: 5230 MHz

Medium parameters used: f = 5230 MHz; $\sigma = 5.263 \text{ S/m}$; $\varepsilon_r = 49.919$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3923; ConvF(4.68, 4.68, 4.68); Calibrated: 2015/8/27;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (81x241x1): Interpolated grid: dx=10 mm, dy=10

Maximum value of SAR (interpolated) = 1.67 W/kg

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

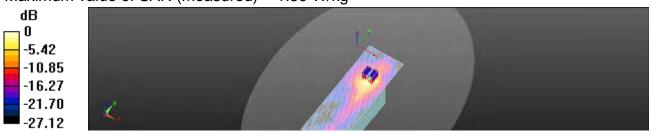
dy=4mm, dz=2mm

Reference Value = 5.894 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 2.80 W/kg

SAR(1 g) = 0.820 W/kg; SAR(10 g) = 0.291 W/kg

Maximum value of SAR (measured) = 1.59 W/kg



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

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Date: 2016/8/22

WLAN 802.11 n(40M) 5.3G_Body_Top side_CH 62_0mm

Communication System: WLAN(5G); Frequency: 5310 MHz

Medium parameters used: f = 5310 MHz; $\sigma = 5.358 \text{ S/m}$; $\varepsilon_r = 49.789$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3923; ConvF(4.56, 4.56, 4.56); Calibrated: 2015/8/27;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (81x101x1): Interpolated grid: dx=10 mm, dy=10

Maximum value of SAR (interpolated) = 1.57 W/kg

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

dy=4mm, dz=2mm

Reference Value = 5.879 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 2.73 W/kg

SAR(1 g) = 0.813 W/kg; SAR(10 g) = 0.304 W/kg

Maximum value of SAR (measured) = 1.55 W/kg



0 dB = 1.55 W/kg = 1.90 dBW/kg

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WLAN 802.11n(40M) 5.6G_Body_Top side_CH 102_0mm

Communication System: WLAN(5G); Frequency: 5510 MHz

Medium parameters used: f = 5510 MHz; $\sigma = 5.695 \text{ S/m}$; $\varepsilon_r = 49.702$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3923; ConvF(4.1, 4.1, 4.1); Calibrated: 2015/8/27;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (81x101x1): Interpolated grid: dx=10 mm, dy=10

Maximum value of SAR (interpolated) = 2.42 W/kg

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

dy=4mm, dz=2mm

Reference Value = 7.451 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 4.31 W/kg

SAR(1 g) = 1.17 W/kg; SAR(10 g) = 0.441 W/kgMaximum value of SAR (measured) = 2.32 W/kg



0 dB = 2.32 W/kg = 3.66 dBW/kg

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Date: 2016/8/23

WLAN 802.11n(40M) 5.8G_Body_Top side_CH 151_0mm

Communication System: WLAN(5G); Frequency: 5755 MHz

Medium parameters used: f = 5755 MHz; $\sigma = 5.884$ S/m; $\varepsilon_r = 47.547$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3923; ConvF(4.3, 4.3, 4.3); Calibrated: 2015/8/27;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

Configuration/Body/Area Scan (81x101x1): Interpolated grid: dx=10 mm, dy=10

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

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

dy=4mm, dz=2mm

Reference Value = 5.588 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.04 W/kg

SAR(1 g) = 0.804 W/kg; SAR(10 g) = 0.294 W/kg

Maximum value of SAR (measured) = 1.59 W/kg



0 dB = 1.59 W/kg = 2.00 dBW/kg

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5. SAR System Performance Verification

Date: 2016/8/22

Dipole 2450 MHz_SN:727

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz; $\sigma = 1.988 \text{ S/m}$; $\varepsilon_r = 53.464$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: EX3DV4 - SN3923; ConvF(7.49, 7.49, 7.49); Calibrated: 2015/8/27;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1374; Calibrated: 2015/10/23

Phantom: Body

DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

Configuration/Pin=250mW/Area Scan (81x101x1): Interpolated grid: dx=12 mm, dv=12 mm

Maximum value of SAR (interpolated) = 19.5 W/kg

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

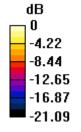
dx=5mm, dy=5mm, dz=5mm

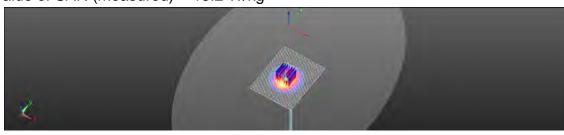
Reference Value = 91.61 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 25.7 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 6.04 W/kg

Maximum value of SAR (measured) = 19.2 W/kg





0 dB = 19.2 W/kg = 12.84 dBW/kg

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prosecuted to the fullest extent of the law.



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Date: 2016/8/22

Dipole 5200 MHz SN:1023

Communication System: CW; Frequency: 5200 MHz

Medium parameters used: f = 5200 MHz; $\sigma = 5.259 \text{ S/m}$; $\varepsilon_r = 49.97$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: EX3DV4 - SN3923; ConvF(4.68, 4.68, 4.68); Calibrated: 2015/8/27;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1374; Calibrated: 2015/10/23

Phantom: Body

DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

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

Maximum value of SAR (interpolated) = 14.1 W/kg

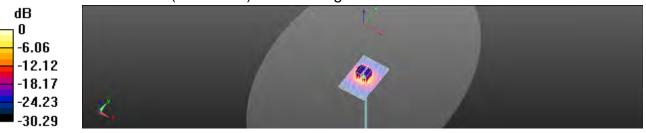
Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

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

Reference Value = 53.46 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 24.8 W/kg

SAR(1 g) = 7.18 W/kg; SAR(10 g) = 1.98 W/kgMaximum value of SAR (measured) = 13.9 W/kg



0 dB = 13.9 W/kg = 11.43 dBW/kg

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Date: 2016/8/22

Dipole 5300 MHz SN:1023

Communication System: CW; Frequency: 5300 MHz

Medium parameters used: f = 5300 MHz; $\sigma = 5.348 \text{ S/m}$; $\varepsilon_r = 49.793$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3923; ConvF(4.56, 4.56, 4.56); Calibrated: 2015/8/27;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

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

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

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

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

Π

Reference Value = 54.93 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 31.1 W/kg

SAR(1 g) = 7.44 W/kg; SAR(10 g) = 2.09 W/kgMaximum value of SAR (measured) = 16.2 W/kg



0 dB = 16.2 W/kg = 12.09 dBW/kg

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Date: 2016/8/23

Dipole 5600 MHz_SN:1023

Communication System: CW; Frequency: 5600 MHz

Medium parameters used: f = 5600 MHz; $\sigma = 5.801 \text{ S/m}$; $\varepsilon_r = 49.562$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: EX3DV4 - SN3923; ConvF(4.1, 4.1, 4.1); Calibrated: 2015/8/27;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1374; Calibrated: 2015/10/23

Phantom: Body

DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

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

Maximum value of SAR (interpolated) = 17.1 W/kg

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

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

Reference Value = 56.54 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 31.9 W/kg

SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.19 W/kg Maximum value of SAR (measured) = 16.7 W/kg



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

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Dipole 5800 MHz SN:1023

Communication System: CW; Frequency: 5800 MHz

Medium parameters used: f = 5800 MHz; $\sigma = 5.933 \text{ S/m}$; $\varepsilon_r = 47.477$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3923; ConvF(4.3, 4.3, 4.3); Calibrated: 2015/8/27;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7373)

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

Maximum value of SAR (interpolated) = 17.1 W/kg

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

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

Π

Reference Value = 55.36 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 33.0 W/kg

SAR(1 g) = 7.65 W/kg; SAR(10 g) = 2.17 W/kgMaximum value of SAR (measured) = 16.4 W/kg



0 dB = 16.4 W/kg = 12.14 dBW/kg

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Dipole 2450 MHz SN:727

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz; $\sigma = 1.969 \text{ S/m}$; $\varepsilon_r = 53.004$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(7.4, 7.4, 7.4); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2016/11/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/Pin=250mW/Area Scan (61x91x1): Interpolated grid: dx=12 mm, dv=12 mm

Maximum value of SAR (interpolated) = 20.9 W/kg

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

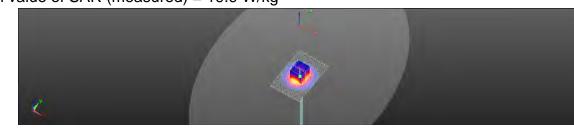
dx=5mm, dy=5mm, dz=5mm

dB N -4.47 -8.94 -13.42 -17.89 -22.36

Reference Value = 101.5 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 27.0 W/kg

SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.91 W/kgMaximum value of SAR (measured) = 19.9 W/kg



0 dB = 19.9 W/kg = 13.00 dBW/kg

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Dipole 5200 MHz SN:1023

Communication System:, CW; Frequency: 5200 MHz

Medium parameters used: f = 5200 MHz; $\sigma = 5.256 \text{ S/m}$; $\varepsilon_r = 48.685$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2016/11/22
- 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) = 15.2 W/kg

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

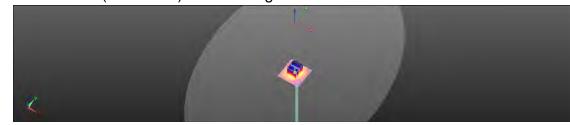
dx=4mm, dy=4mm, dz=2mm

dB Π -7.45 -14.90 -22.36 -29.81 -37.26

Reference Value = 58.28 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.8 W/kg

SAR(1 g) = 7.32 W/kg; SAR(10 g) = 2.06 W/kgMaximum value of SAR (measured) = 15.5 W/kg



0 dB = 15.5 W/kg = 11.91 dBW/kg

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Dipole 5300 MHz SN:1023

Communication System: CW; Frequency: 5300 MHz

Medium parameters used: f = 5300 MHz; $\sigma = 5.407 \text{ S/m}$; $\varepsilon_r = 48.703$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.41, 4.41, 4.41); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2016/11/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

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

Maximum value of SAR (interpolated) = 16.5 W/kg

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

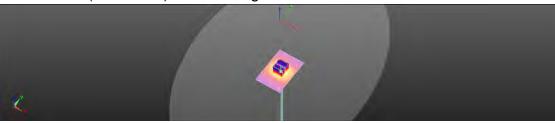
dx=4mm, dy=4mm, dz=2mm

Reference Value = 56.41 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 31.9 W/kg

SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.16 W/kgMaximum value of SAR (measured) = 15.1 W/kg





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

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Dipole 5600 MHz_SN:1023

Communication System: CW; Frequency: 5600 MHz

Medium parameters used: f = 5600 MHz; $\sigma = 5.765 \text{ S/m}$; $\varepsilon_r = 48.885$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(3.83, 3.83, 3.83); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2016/11/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

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

Maximum value of SAR (interpolated) = 18.6 W/kg

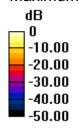
Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid:

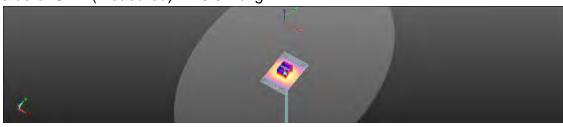
dx=4mm, dy=4mm, dz=2mm

Reference Value = 60.83 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 38.1 W/kg

SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.28 W/kg Maximum value of SAR (measured) = 18.0 W/kg





0 dB = 18.0 W/kg = 12.55 dBW/kg

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Dipole 5800 MHz SN:1023

Communication System: CW; Frequency: 5800 MHz

Medium parameters used: f = 5800 MHz; $\sigma = 6.095 \text{ S/m}$; $\varepsilon_r = 49.032$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 SN3938; ConvF(4.02, 4.02, 4.02); Calibrated: 2016/11/25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2016/11/22
- Phantom: Body
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

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

Maximum value of SAR (interpolated) = 16.8 W/kg

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

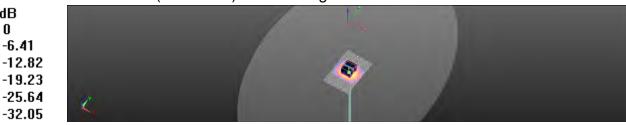
dx=4mm, dy=4mm, dz=2mm

dB Π -6.41

Reference Value = 55.65 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 34.8 W/kg

SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.11 W/kgMaximum value of SAR (measured) = 16.2 W/kg



 $0 ext{ dB} = 16.2 ext{ W/kg} = 12.10 ext{ dBW/kg}$

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6. DAE & Probe Calibration Certificate

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





Schweizerischer Kalibrierdienen Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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

SGS - TW (Auden)

Accreditation No.: SCS 0108

Dartificate No: DAE4-1374_Oct15

CALIBRATION CERTIFICATE Object DAE4 - SD 000 D04 BM - SN: 1374 Cilibration propedure(s) QA CAL-06, v29 Calibration procedure for the data acquisition electronics (DAE) Calibration dele October 23, 2015 Tres calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SL). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the conflicate 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 Cai Dare (Certificate No.) Scheduled Calibration Keithley Multimeter Type 2001 SN: 0810278 09-Sep-15 (No:17153) Sep-16 Secondary Standards Check Date (in house) Scheduled Check SE UWS 053 AA 1001 08-Jan-15 (in house check Auto DAE Calibration Unit In house check: Jen-16 Galibrator Box V2.1 SE UMS 006 AA 1002 06-Jan-15 (in house check) In house check: Jan-16 Name Chilbrated by Dominique Steffen Fedmician Approved by: Fin Bombat Deputy Technical Manager Issued October 23, 2015 This calibration certificate shall not be reproduced except in full without written approve of the laboratory.

Certificate No: DAE4-1374 Oct16

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Calibration Laboratory of Schmid & Partner Engineering AG Zaughausstrasse 43, 8005 Zurich, Switzerland





Schweizerlscher Kalibriertsenst Service station (l'Attrionnage Servizio synzzero di taratura Swiss Colloration Service

According by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatures to the EA.
Muterateral Agreement for the recognition of calibration conditioners.

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.

Contricate No DAE4-1374_Oct18

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DC Voltage Measurement

A/D - Converter Resolution nominal

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

Calibration Factors	x	Y	Z
High Range	403.597 ± 0.02% (k=2)	403.842 ± 0.02% (k=2)	404.121 ± 0.02% (k=2)
Low Range	3.98111 ± 1.50% (k=2)	3.96638 ± 1,50% (k=2)	3.98936 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	41.0°±1°

Certificate No: DAE4-1374_Oct15

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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 + Inp	ut 200033.09	-0.21	-0.00
Channel X + Inp	ut 20006,43	2.25	0.01
Channel X - Inp	rt -20003.08	2.09	-0.01
Channel Y + Inp	ut 200033.11	-0.07	-0.00
Channel Y + Inp	ut 20001.24	-2.89	-0.01
Channel Y - Inp	t -20006.12	-0.87	0.00
Channel Z + Inp	ut 200032.98	-0.38	-0.00
Channel Z + Inp	ut 20001.71	-2.35	-0.01
Channel Z - Inpo	t -20007.05	-1.72	0.01

Low Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	2000.72	0.10	0.00
Channel X + Input	200.90	0.07	0.04
Channel X - Input	-198.32	0.99	-0.50
Channel Y + Input	2000.56	-0.00	-0.00
Channel Y + Input	199.87	-0.82	-0.41
Channel Y - Input	-199.92	-0.51	0.26
Channel Z + Input	2000.72	0.21	0.01
Channel Z + Input	199.48	-1.11	-0.56
Channel Z - Input	-200.66	-1.13	0.57

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	6.36	3.97
	- 200	-2.21	-4.56
Channel Y	200	7.13	6.98
	- 200	-8.29	-8.73
Channel Z	200	6.37	6.35
	- 200	-9.60	-9.25

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	-	-2.02	-1.56
Channel Y	200	4.68		-1.06
Channel Z	200	11.09	1.58	-

Certificate No: DAE4-1374_Oct15

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В.

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4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15850	15957
Channel Y	16166	15762
Channel Z	16101	16123

5. Input Offset Measurement

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

Input	-	ш	ve.	L

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (µV)
Channel X	0.61	-0.78	1.59	0.44
Channel Y	-0.47	-2.13	0.46	0.39
Channel Z	-0.68	-1.72	0.64	0.41

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

Typical values	Alarm Level (VDC)	
Supply (+ Vec)	+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 (- Voc)	-0.01	-8	-9

Certificate No: DAE4-1374_Oct15

Page 5 of 5

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Page: 53 of 118 Issue Date: Mar. 21, 2017

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





Schweizerischer Kalibrierdienst Service suisse d'étationnage Servizio svizzero di tareture Swiss Calibration Service

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SGS - TW (Auden)

Accreditation No.: SCS 0108

Certificate No: DAE4-1336 Nov16 **CALIBRATION CERTIFICATE** DAE4 - SD 000 D04 BM - SN: 1336 Object QA CAL-06.v29 Calibration procedure(s) Calibration procedure for the data acquisition electronics (DAE) Calibration date: November 22, 2016 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidency probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory tability: environment temperature (22 + 3)°C and humidity < 70% Calibration Equipment used (M&TE critical for calibration) Primery Standards ID # Cal Date (Certificate No.) Scheduled Calibration Kethicy Multimeter Type 2001 SN: 0810278 09-Sep-16 (No.19065) Sep-17 Scheduled Check Secondary Standards 10.0 Check Date (In house) In house check: Jan 17 SE UWS 053 AA 1001 05-Jan-15 (in house check) Auto DAE Calibration Unit BE UMB 006 AA 1002 OG-Jan-16 (in house check) In house check, Jan-17 Calibrator Box V2.1 Function Name Adrian Gentino Calibrated by: Tachnician Deputy Technical Manager Fin Bomhelt Approved by: Issued November 22, 2016 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: DAE4-1336_Nov16

Page 1 of 5

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Page: 54 of 118 Issue Date: Mar. 21, 2017

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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.

Delithous No. DAE4-1335 Nov16

Page 2 of 5

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DC Voltage Measurement

A/D - Converter Resolution nominal

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

Calibration Factors	X	Ψ.	2
High Range	403.332 ± 0.02% (k=2)	403.635 ± 0.02% (k=2)	403,121 ± 0.02% (fc=2)
Low Range	3.95216 ± 1.50% (k=2)	3.98718 ± 1.50% (k=2)	3.99680 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	122.0 +± 1 +

Certificate No: DAE4-1336_Nov16

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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	199996.24	0.16	0.00
Channel X + Input	20001.25	-0.04	-0.00
Channel X - Input	-19999.81	1.35	-0.01
Channel Y + Input	199994.04	-1:BB	-0.00
Channel Y + Input	20000.69	-0.82	+0.00
Channel Y - Input	-20002.64	-1.77	0.01
Channel Z + Input	199997.44	1.49	0.00
Channel Z + Input	19999.78	-1.82	-0,01
Channel Z + Input	-20003.24	-2.19	0.01

Low Range	Reading (µV)	Difference (µV)	Eryor (%)
Channel X + Input	2001.87	0.66	0.03
Channel X + Input	201.39	-0.11	-0.06
Channel X - Input	-198.27	0.04	-0.02
Channel Y + Input	2001.34	-0.04	-0.00
Channel Y + Input	201.35	-0.36	-0.18
Channel Y - Input	-198.77	-0.62	0.31
Channel Z + Input	2001.30	0.10	70,0
Channel Z + Input	200,72	-0,71	+0.35
Channel Z - Input	-199.12	-0.78	0.39

2. Common mode sensitivity

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	5.23	3.90
	: 200	-3.72	-5.31
Channel Y	300	-4.23	-3,73
	-300	2.71	18.5
Channel Z	500	20.93	21,36
-	-200	-23,91	-24.44

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	9-1	fi.47	+1.27
Channel Y	200	7.97	-	6.72
Channel Z	200	7.94	5,96	2.00

Certificate No: DAE4-1336_Nov16

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4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15660	15881
Channel Y	15906	15597
Channel Z	15853	15173

5. Input Offset Measurement

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

	6.41	

	Average (µV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (µV)
Channel X	-0.26	-1.07	0.37	0.33
Channel Y	-0.22	-0.92	0.62	0.34
Channel Z	-0.97	-1.73	0.29	0.36

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	500	200
Channel Z	200	200

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

Typical values	Alarm Level (VDC)	
Supply (+ Vcc)	+7,9	
Supply (- Vcc)	-7.6	

9. Power Consumption (Typical values for information)

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

Contribute No: DAE4-1936_Nov16

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clani SGS-TW (Auden)

Certificate No. EX3-3923 Aug 15

Accreditation No.: SCS 0108

CALIBRATION CERTIFICATE Copied EX3DV4 - SN:3923 Calibration procedure of QA CAL-01 v9, QA CAL-14 v4, QA CAL-23 v5, QA CAL-25 v6 Calibration procedure for dosimetric E-field probes Calibration perioded for dosimetric E-field probes This failtration perioded tocaments the tracastally to reticine standards, which reason the physical ants of measurements (SI) The measurements and the uncertainties with curricines profesbility are given on the following pages and are part of the performance All calibrations frage been conducted in the case of substanting tending to interpretations (22 + 8°C and humiday < 70%. Calibration Equipment used (NaTE enters for calibrator)

Primitry Glanidards (D)		Car Date (Certificate No.)	Schalland Caldresian		
Power meter E4419B	G841293874	01-Apr-15 (No. 217-02 (28)	3AH-16		
Power Sensor E4412A	W(Y41498087	01-Apr 15 (No. 217-02128)	Mar-30		
Reference 3 dB Attenuator	SN, 55054 (3c)	01-Apr-15 (No. 217-62129)	Mar 16		
Roberance 20 dil Attenuator	SN: 58277 (20x)	01-Apr-15 (No. 217-62132)	Mar-16		
Forference 30 dB Attenuator	SN 55129 (390)	01-Apr-15 (No. 217-(EF139)	Mac 16		
Roberence Probe ES3CV2	SN 3013	30-Dec-14 (No. ES3-3013 Dec14)	Dep 15		
DAE4	SN: 660	14-3an-15 (No. DAE4-660, Jan15)	Jan 16		
Secondary Standards	ID:	Check Date (in figure)	-Scheduled Chart		
RF generator HF 86450	LB3642U01700	4-Aug-99 (in litruse check Apr-13)	In house check Apr-16		
National Analysis HP 87506	VS37390585	18-Dct-01 (in house theca Oct-14)	In house check Oct-15		

	Nama	Function	Signature
Caterated by	Internal Streets	Ladoratory Technicism	Oscar allegan
Acumined by	Katta Politinio	Taches a Marager	SEE SG-
TWO 1-150-00-00-00-00-00-00-00-00-00-00-00-00-0	SWARF CONTRACTOR	ethod with approval of the laborator	oscied, August 27, 2015

Certificate No: Exp. 3923_Aug15

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Accommune No. SCS 010N

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Glossary:

lesse simulating liquid NORMx,y.E signativity in free space sensitivity in TSL / NORMx, y, z. ConvF DCP diade compression point

CE crest factor (1/duty_cycle) of the RF signal A B.C.D modulation dependent linearization parameters.

Polarization a gretation arraind probe axis

Polarization 9 3 rotation around an axis that is in the plane primal to probe axis (at measurement contex),

(a) 0 = 0 is normal to probe axis information used in DASY system to align probe sensor X to the rottol coordinate system. Corrector Angle

Calibration is Performed According to the Following Standards:

 IEEE Std 1528-2013, "IEEE Recommended Practice to Determining the Peak Spattal-Averaged Spetting Absorption Rate (SAR) in the Human Head from Wireless Communications Devices Measurement. Techniques", June 2013

b). IEC 52209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand neid devices used in close

proximity to the ear (frequency range of 300 MHz to 3 GHz)". February 2005

El EC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wheless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)". March 2010

IKOR 965664, "SAR Messurement Requirements for 100 MHz to 6 GHz."

Methods Applied and Interpretation of Parameters:

- MORMx,y,z: Assessed for E-field polarization a = 0 (f < 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguing). NORMx, y, z are only intermediate values, i.e., the uncertainties of NORMx, y, z does not effect the E-field uncertainty inside TSL (see below ConvF).
- NORM(fix.y,z = NORMx.y,z = frequency_response (see Frequency Response Chart). This linearization is inclemented in DASY4 adhware versions lear than 4.2. The occurrantly of the response response is included in the stated uncertainty of ConvF
- QCPX,y,z* DCP are numerical invariation parameters assessed based on the data of power sweep with CW signal (no uncertainty regulated). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z;Bx,y,z;Cx,y;z;Dx,y,z;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 dioce.
- ConvF and Boundary Effect Personalers: Assessed in flat phantom using E-field (or Temperature Transler Standard for f s 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 probal accuracy close to the boundary. The sensitivity in TSL corresponds to NORMs, 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. MHE
- Spherical isotropy (3D deviation from Isotropy): in a field of live 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 NDRMs (no. uncertainty requirect.

Certificate No. EX3-1903, April 5

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EX3DV4 - 8N:3923

August 27, 2015

Probe EX3DV4

SN:3923

Manufactured: Calibrated: March 8, 2013 August 27, 2015

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

Certificate No: EX3-3923_Aug15

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EX3DV4-SN:3923

August 27, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3923

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m) ²) ^A	0.57	0.48	0.47	± 10.1 %
DCP (mV) ⁸	103.6	96.4	101.3	1

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	Ċ	D dB	VR mV	Une ^t (k=2)
0	CW	X	0.0	0.0	1.0	0.00	153.8	±3.3 %
		Y	0.0	0.0	1.0		155.6	
		Z	0.0	0.0	1.0		157.0	

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%.

Certificate No: EX3-3923, Aug15

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⁵ The uncertainties of Norm X,Y,Z do not affect the E²-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 field unline.



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EX3DV4- SN:3923

August 27, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3923

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvFZ	Alpha ^o	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	10.66	10.66	10.66	0.34	1.00	± 12.0 %
835	41.5	0.90	10.45	10.45	10.45	0.42	0.80	± 12.0 %
900	41.5	0.97	10.07	10.07	10.07	0.35	1.00	± 12.0 %
1750	40.1	1.37	8.71	8.71	8.71	0.19	1.12	± 12.0 %
1900	40.0	1.40_	8.43	8.43	8.43	0.36	0.90	± 12.0 %
2000	40.0	1.40	8.48	8.48	8.48	0.35	0.80	± 12.0 %
2300	39.5	1.67	8.05	8.05	8.05	0.36	0.80	± 12.0 %
2450	39.2_	1.80	7.57	7.57	7.57	0.40	0.80	± 12.0 %
2600	39.0	1.96	7.45	7.45	7.45	0.39	0.80	± 12.0 %
5250	35.9	4.71	5.22	5.22	5.22	0.35	1.80	± 13.1 %
5300	35.9	4.76	5.08	5.08	5.08	0.35	1.80	±13.1%
5600	35.6	5.07	4.78	4.78	4.78	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.81	4.81	4.81	0.40	1.80	± 13.1 %

⁶ Frequency validity above 300 MHz of ± 100 MHz only applies for DASY vt.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the Comif 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 Comif assessments at 30, 64, 123, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz respectively. Above 5 GHz frequencies below 3 GHz, the validity of tissue parameters (a and o) can be referred to ± 10% if liquid compensation formula is applied to measured SAR values. All frequencies above 3 GHz, the validity of tissue parameters (a and o) is restricted to ± 5%. The uncertainty is the RSS of the Comif uncertainty for indicated target fiscue parameters.

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

Certificate No: EX3-3923_Aug15

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EX3DV4-SN:3923 August 27, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3923

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha ⁶	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	10.50	10.50	10.50	0.43	0.86	± 12.0 %
835	55.2	0.97	10.48	10.48	10.48	0.21	1.42	± 12.0 %
900	55.0	1.05	10.33	10.33	10.33	0.30	1.08	± 12.0 %
1750	53.4	1.49	8.40	8.40	8.40	0.39	0.87	± 12.0 %
1900	53.3	1.52	8.11	8.11	8.11	0.41	0.80	± 12.0 %
2000	53.3	1.52	8.31	8.31	8.31	0.29	1.02	± 12.0 %
2300	52.9	1.81	7.90	7.90	7.90	0.30	0.91	± 12.0 %
2450	52.7	1.95	7.63	7.63	7.63	0.29	0.90	± 12.0 %
2600	52.5	2.16	7.49	7.49	7.49	0.25	0.95	± 12.0 %
5250	48.9	5.36	4.68	4.68	4.68	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.56	4.56	4.56	0.40	1.90	± 13.1 %
5600	48.5	5.77	4.10	4.10	4.10	0.45	1.90	± 13.1 %
5750	48.3	5.94	4.30	4.30	4.30	0.45	1.90	± 13.1 %

C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the CornF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 60 and 70 MHz for CornF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity on the extended to ± 110 MHz.

*All frequencies below 3 GHz, the validity of issue parameters (and o) can be released to ± 10% if figuid compensation formula is applied to measured SAR values. All frequencies above 3 GHz, the validity of itssue parameters (s and o) is restricted to ± 5%. The uncertainty is the RSS of the CornF uncertainty for indicated target issue parameters.

*Alpha/Dapth are datarmined during exiltration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-5 GHz at any distance larger than half the probe tip diameter from the boundary.

Certificate No: EX3-3923_Aug15 Page 6 of 11

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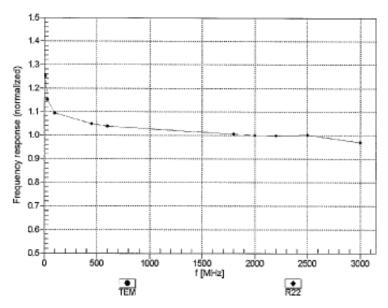
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EX3DV4- SN:3923 August 27, 2015

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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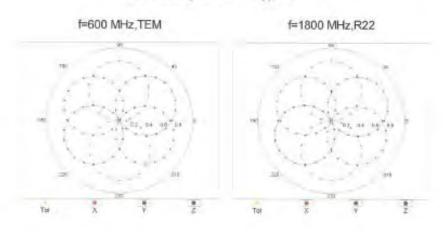


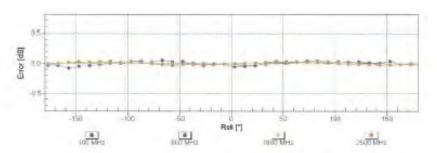
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EX3DV4- SN:3923

August 27, 2015

Receiving Pattern (\$\phi\$), \$\theta = 0°





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

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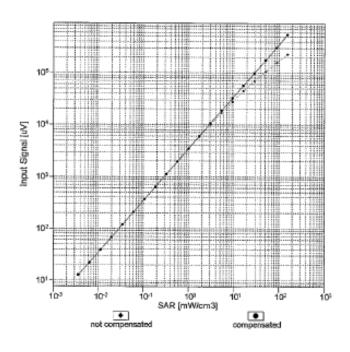


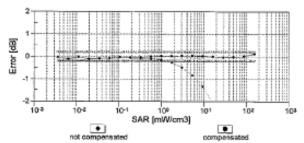
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EX3DV4- SN:3923

August 27, 2015

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





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

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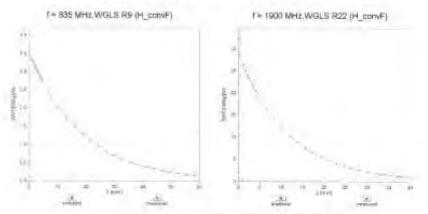
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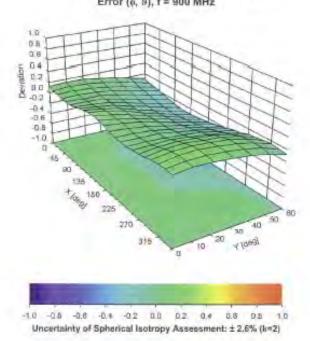
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EX30V4—SN 3923 August 27, 2015

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (6, 9), f = 900 MHz



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EX3DV4-SN:3923

August 27, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3923

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	123
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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Calibration Laboratory of Schmid & Partner Engineering AG Zeughnesstrasse 43, 1994 Zurich, Switzerland





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SG5-TW (Anden)

Certificate No. EX3-3938 Nov16

Calibration procedures Calibration procedures QA CAL-01.v8, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes Calibration procedure for dosimetric E-field probes Calibration procedure for dosimetric E-field probes This calibration pertitions documents the fracestality to national standards, which realize the physical units of managements is (31). This calibrations and the uncertainties with confidence probability and given units following pages and are part of the cartificate. All calibration Equipment used (MATE units) for calibration)

Firming Standards	ID	Cal Date (Genticate No.)	Schooled Calibration
Power meter NRP	SM 104778	06-Apr-16 (No. 217-02288)(02280)	Apr-17
Prover sensor NEP-291	SN 103244	05-Apr-16 (No. 217-02288)	Apr-17
Power sensor NIII - 291	3N 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 85277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN. 3013	31-Dec-15 (No. E53-3513_Dec15)	Dev 1d
DAE4	SN: 680	23-Dec-15 (No. DAE4-680_Dec15)	Deu-16
Secondary Standards	0	Check Date (in house)	Scheduled Direct
Power meter Edd (SE)	SN. G841293874	06-Apr-16 (in house check Jun-16)	In house check: Jan-16
Power sensor E4412A	SN:MY41498087	06-Apr-16 (in house check Jun-15)	In house check: Jue-18
Power sursor E4412A	SN: 000110210	DB-Apr-16 (in house check Jun-16)	In house theck: Jos-18
RF generator HF 6648C	BN: US3642U01700	04-Aug-98 (in house check Jun-16)	In house check: Jun-18
Network Analyze HP 8753E	EN: US37390585	18-Oct-01 (in house check Oct-16)	In Fouse check: Oct-17

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Glossary:

tissun simulating liquid NORMx.y.z sensitivity in free space sensitivity in TSL / NORMx,y,z ConvE diode compression point DCP

crest factor (1/duty_cycle) of the RF signal modulation dependent linearization parameters CF A.B.C.U

Polarization r. wrotation around probe axis

A rotation around an axis that is in the plane normal to probe axis (at measurement center). Polarization 8

Le. 19 = 0 is normal to probe axis

information used in DASY system to align probe sensor X to thin robot coordinate system

Calibration is Performed According to the Following Standards:

iEEE Set 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 2006

c) IEC 62209-Z, "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)", Merch 2010

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

Methods Applied and Interpretation of Parameters:

NORMx, y, z. Assessed for E-field potarization 8 = 0 (f < 900 MHz in TEM-cell, f > 1800 MHz; R22 waveguide) NORMx.y.z are only intermediate values, i.e., the uncertainties of NORMx.y.z closs not affect the E²-field uncertainty inside TSL (see below ConvF).

NORM(IX.y,z = NORMx.y,z * / Inquency_response (see Frequency Response Chart). The investigation is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is implicited. in the stated uncertainty of ConvF

DQPx.y.z: DQP are numerical linearization parameters assessed based on the data of power sweep with QW signal (no uncertainty required). DQP 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

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 phentom using E-held (or Temperature Transfer Standard for f < 300 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 600 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (aipha, depth) of which typical uncertainty values are given. These perameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx, y. z * CorryF whereby the uncertainty corresponds to that given for CorryF. 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 WDRMs (No uncertainty required)

Cedificate No: EX3-3938, Nov16

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Page: 71 of 118 Issue Date: Mar. 21, 2017

EX10W-5N 3896

Www.der25.2016

Probe EX3DV4

SN:3938

Manufactured: Calibrated: May 2, 2013

November 25, 2016

Calibrated for DASY/EASY Systems (Notice non-compatible with DASY/E system)

Destructe two EX3-3938 Nov18

image 5 of t

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Page: 72 of 118 Issue Date: Mar. 21, 2017

EX30V4- SN:3935

November 25, 2016

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dBõV	C	dB	WR mV	Unc (k=2)
0	CW	- X	0.0	0.0	1.0	0.00	140.2	12.2 %
		- 4	0.0	0.0	1.0		129.7	
		Z	0.0	0.0	1.0		146.0	

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%.

Comficate No. EX3-3938_Nov10

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Numerical frigarization partmets: uncertainty no required.

Numerical frigarization partmets: uncertainty no required.

Uncertainty is determined using this must deviation from theoriesponse epolying rectalogular distribution and in expressed for the expanse of the facility vision.



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EXCID-V4-SN:3938

Navarabar 25, 2016

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

Calibration Parameter Determined in Head Tissue Simulating Media

(Mitz)	Relative Permittivity	Conductivity (Sim)	ConvF X	ConvF Y	Gony F Z	Alpha ^{ta}	Depth [©] (mm)	Unc (k=2)
750	41.9	0.89	10.14	10:14	10,14	0.61	0,80	±120%
635	41.5	0.90	8,74	9.74	9.74	0.45	0,91	112.0%
900	41.5	0.97	9.64	9.64	9,64	0.51	0.80	± 12.0 %
1450	40.5	1.20	B 45	8.45	8.45	0.43	0.80	±1204
1750	40,1	1.97	B.20	8.20	8.20	0.31	0.63	± 12.0%
1900	40,0	1.40	8.15	8 15	8.15	0.38	0.80	± 12.6 %
2000	-40.0	1.40	9.06	8.06	8.06	0.35	0.80	± 12.0 %
2300	39.5	1,87	7.74	7.74	7.74	0.35	0.80	±12.0 %
2450	39.2	1.60	7.36	7.36	7:36	0,33	0.92	± 12.0 %
2800	39.0	1.96	7.00	7.09	7.09	0.44	0.80	± 12.0 %
5250	35.9	4.71	5.21	5,21	5.21	0,30	1.80	± 13.1 %
5600	35,5	5.07	4.53	4.53	4.53	0.40	1.80	£ 13.1 %
5750	35.4	522	4.79	4:79	4.79	0.40	1.80	= 13.1 h

Frequency validity above 700 MHz or ± 100 MHz day apoles to DASY will and higher (see Page 2), then it is restricted to ± 00 MHz or ± 100 MHz day apoles to DASY will and higher (see Page 2), then it is restricted to ± 00 MHz or the statement of a calculation frequency and the uncertainty for the indicated frequency wall the uncertainty for the indicated frequency wall the property validity can be extended to ± 110 MHz.

At inspecting the service of the validity of better provincing (a author) can be extended to ± 105 if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of feater potentials is daily in extending to the Convertice of the provincing the provincing the third of the convertice of the convertice of the provincing of the convertice of the convertice of the provincing of the convertice of the convertice of the provincing of the convertice of the provincing of the convertice of the convertic

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EX3DV4-SN:3938

Movember 25, 2016

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

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity	Conductivity (S/m) ¹	ConvFX	ConvF Y	ConvF.Z	Alpha*	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	9.51	9.51	9.51	0.38	0.93	± 12.0 %
835	55.2	0.97	9.33	9:33	H.33	0.47	0.80	± 12.0 %
900	:55,0	1:05	9.23	B.28	P.23	0,35	0.98	± 12.0 %
1450	54.0	1.90	8.18	8.18	8.16	0.39	0.80	£120%
1750	53.4	1.49	7.98	7.96	7.98	0,43	0.81	± 12.0%
1900	53.3	1.52	7.77	7.77	7.77	0.27	1.06	±12.0%
2000	53.3	1,52	7.63	7.63	7.63	0.40	0.80	± \$2,0,%
2500	52.9	Tat	7.58	7.56	7.56	0.42	0.80	± 12.0 %
2450	52.7	1.05	7:40	7.40	7,40	0.38	0.80	± 12.0 %
2600	52.5	2.10	7.14	7.14	7.14	0.34	0.80	± 12.0 %
5250	45.9	5.36	4.41	4.41	4.41	0.40	1.90	213.1%
5600	A6.5	5.77	3,83	3,83	3.83	0:50	1.90	± 01.1 N
5750	48.3	5.94	4.02	4.02	4.02	0.50	1.90	±13.1 %

Frozuming verifity above 400 MHz of ± 100 MHz orly applies for DASY v4 ± and higher (see Page 2), else 4 ± restricted to ± 50 MHz. The provision of the Court encertainty in calminous heaping with the uncertainty for the estimated Sequency Value. Programme strategy and 250 MHz or 20 S. 45. 50 and 70 MHz for Court excessments at 30, 64, 128, 159 and 250 MHz respectively. Above 50 Hz foreign by another in the estimated to ± 110 MHz.

*At highwarders below 5 GHz, the validity of issue parameters (a and a) can be reliased to ± 30% if that compression formula is employd to minimum BAR values. At highwarders strays 3 GHz, the validity of issue parameters is and ± | in restricted to ± 30%. The uncertainty in the RSS of the Court in restricted in the country of the RSS of the Court in restricted in the country of the RSS of the Court in the country of the RSS of the Court in the Court

Certificate No; EX3-3938_Nov10

Page 6 (K11)

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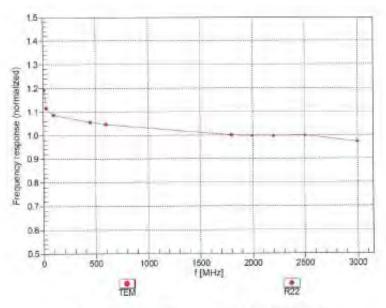


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EX3DV4-SN:3938

November 25, 2016

Frequency Response of E-Field (TEM-Cell:Ifi110 EXX, Waveguide: R22)



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

Certificate No: EX3-3938_Noy16

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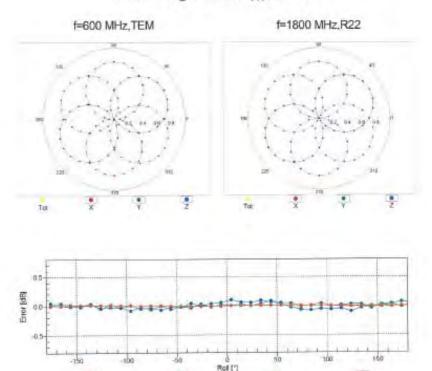
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EX3DV4-SN:3938 November 25, 2016

Receiving Pattern (6), 9 = 0°



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

1805 BHz

800 MHz

Certificate No: EX3-3938_Nov16

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100 MHz

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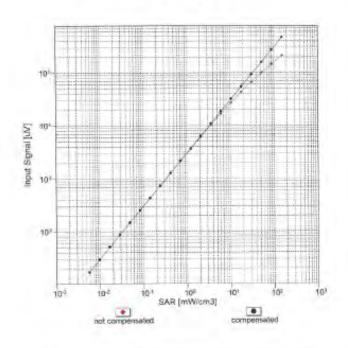


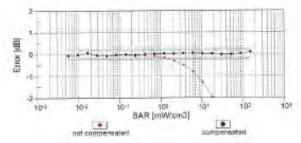
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EX3DV4-SN:3938

November 25, 2016

Dynamic Range f(SAR_{head}) (TEM cell , f_{eval}e 1900 MHz)





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

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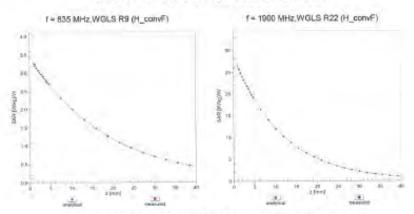
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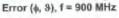
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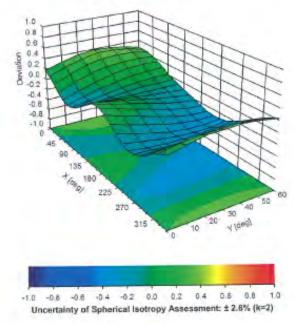
EX3DV4- SN:3938 November 25, 2016

Conversion Factor Assessment



Deviation from Isotropy in Liquid





Certificate No: EX3-3938_Nov16

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EA3DV4-SN 3938

November 25, 2016

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

Other Probe Parameters

Triangular
-25,9
enabled
beldesib
337 mm
10 mm
9 mm
2.5 mm
1 mm
1 mm
1 mm
1.4 mm

Certificate No: EX3-3933, Nov16

Progr. 11 (6.11)

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7. Uncertainty Budget

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

А	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%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	∞
Isotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	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%	∞
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%	œ
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%	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%	∞
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	œ
Liquid permittivity (mea.)	2.29%	N	1	1	0.64	0.43	1.47%	0.98%	М
Liquid Conductivity (mea.)	1.94%	N	1	1	0.6	0.49	1.16%	0.95%	М
Combined standard uncertainty		RSS					11.86%	11.79%	
Expant uncertainty (95% confidence							23.73%	23.57%	

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 台灣檢驗科技股份有限公司
 t (886-2) 2299



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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 Veff
Measurement system									
Probe calibration	6.00%	N	1	1	1	1	6.00%	6.00%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	∞
Isotropy, 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 -	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.)	1.49%	N	1	1	0.64	0.43	0.95%	0.64%	М
Liquid Conductivity (mea.)	1.95%	N	1	1	0.6	0.49	1.17%	0.96%	М
Combined standard uncertainty		RSS					11.52%	11.47%	
Expant uncertainty (95% confidence							23.03%	22.93%	

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8. Phantom Description

Schmid & Parmer Engineering AG Zeughauscheses 43, 8004 Zurich, Switzelland Phona +41 1 245 9700, Fax +41 1 245 9779 Info@spesg.com, http://www.epeeg.com Certificate of Conformity / First Article Inspection SAM Twin Phantom V4.0 Type No QD 000 P40 C TP-1150 and higher Manufacture Zeughausstrasse 43 CH-8004 Zürich Switzerland Tests Tests.

The series production process used allows the limitation to test of first articles.

Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been refested using further series items (called samples) or are tested at each item. Units tested Test Requirement Details IT'IS CAD File (*) Compliant with the geometry according to the CAD model Compliant with the requirement Dimensions First article, Samples Material thickness 2mm +/- 0.2mm in flat First article according to the standards of shell and specific areas of Samples. head section 6mm +/- 0.2mm at ERP TP-1314 ff. Material thickness Compliant with the requirements First article. at ERP Material eccording to the standards All items 300 MHz - 6 GHz: Material Dielectric parsimeters for required Relative permittivity < 5. Loss tangent < 0.05 DEGMBE based parameters Material resistivity Pre-series, First article, The material has been tested to be compatible with the liquids defined in simulating liquids the standards if handled and cleaned according to the instructions. Material samples Observe technical Note for material compatibility
Compliant with the requirements
according to the standards. < 1% typical < 0.8% if filled with 155mm of HSL900 and without Sagging Prototypes, Sample Sagging of the flat section when filled with tissue simulating liquid testing DUT below Standards [1] CENELEC EN 50361 IEEE Std 1528-2003 IEC 62209 Part I FCC OET Sulletin 65, Supplement C, Edition 01-01
The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents. Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standards [1] to [4] 07.07.2005 Seigntit & Parcial Engineering AQ 2909 housesteen 43, 9094 2 vices, Switzerland Phone will 3 be \$1900 Parcial 245 0778 Into Bearing, com. http://www.apering.com Signature / Stamp

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Photo



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9. System Validation from Original Equipment Supplier

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





Schweizerlischer Kallipnerdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Accreditation No.: SCS 0108

SGS-TW (Auden)

Certificate No: D2450V2-727_Apr16

Dispect	D2450V2 - SN:727			
Calibration procedure(s)	OA CAL-05.v9 Calibration proce	ove 700 MHz		
Calibration date:	April 19, 2016			
This calibration certificate docum	ents the traceability to nat	onal standards, which realize the physical un	its of measurements (SI)	
The measurements and the unce	daimies with confidence p	robability are given on the following pages an	d are part of the certificate.	
All calibrations have been coming	ded in the closed siborato	ry lacilly; unvironment temperature (22 ± 3)*	D and humidity = 70%	
La senza Miseria (Merc Page) Wolfell	and the street of the state of the	, and any and any and a		
Calibration Equipment used (M&)	E critical for calibration)			
Primary Standards	ID 4	Cal Date (Certificate No.)	Scheduled Calibration	
Power mister NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17	
	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17	
Power sensor NRP-Z91	THE LINES AND ADDRESS OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN THE PERSON NAMED IN THE PERSON NAMED IN THE PERSON NAMED IN THE PERSON NAMED I			
Control and Control of the Control o	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reterance 20 dB Attenuator	and the state of t	The Table of the Control of the Cont		
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17	
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	SN: 103245 SN: 5058 (20k)	06-Apr-16 (No. 217-02289) 06-Apr-16 (No. 217-02292)	Apr-17 Apr-17	
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX20V4	SN: 103245 SN: 5058 (204) SN: 5047,2 / 06327	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02290) 08-Apr-16 (No. 217-02286)	Apr-17 Apr-17 Apr-17	
Power sensor NRP-Z91 Reference 20 dB Attenuator	SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02292) 06-Apr-16 (No. 217-02295) 31-Dec-15 (No. EX3-7349_Dec16)	Apr-17 Apr-17 Apr-17 Dec-16	
Power sensor NRP-Z91 Reference 29 dB Albertuator Type-N mismatch combination Reference Probe EX30V4 DAE4	SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02282) 06-Apr-16 (No. 217-02282) 31-Dec-15 (No. EX3-7349 Dec15) 30-Dec-15 (No. DAE4-601 Dec15)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Schadulari Chack	
Power sensor NRP-Z91 Reference 20 dB Albertuator Type-N mismatch combination Reference Probe EX30V4 0AE4 Secondary Standards	SN: 103245 SN: 5058 (20k) SN: 5047.2 (76527 SN: 7349 SN: 601	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02292) 96-Apr-16 (No. 217-02292) 31-Dec-15 (No. EX3-7349 Dec15) 30-Dec-15 (No. DAE4-601 Dec15) Check Date (in house)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Schadulad Chack In house check: Oct-16	
Power sensor NRP-Z91 Reterance 20 dB Attenuator Type-N mismatch combination Reterance Probe EX3DV4 DAE4 Secondary Standards Power mater EPM-442A Power sensor HP 8481A	SN: 103245 SN: 9058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02288) 96-Apr-16 (No. 217-02288) 91-Dec-15 (No. EX3-7349_Dec16) 30-Dec-15 (No. EX3-7349_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16	
Power sensor NRP-ZBT Raterance 20 dB Abenuator Type-N mismatch combination Reterance Probe EX30V4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A	SN: 103245 SN: 9058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID 4 SN: 0837460704 SN: US37292793	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02282) 06-Apr-16 (No. 217-02283) 31-Dec-15 (No. EX3-7349_Dec16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16 In house check: Oct-16	
Power sensor NRP-ZBT Reterunce 25 dB Attenuator Type- N mismatch combination Reterunce Probe EX30V4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Propersonsor HP 8481A	SN: 103245 SN: 9058 (20k) SN: 9047.2 / 06327 SN: 7349 SN: 601 ID 4 SN: 0637460704 SN: US37292793 SN: MY4*082317	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02282) 06-Apr-16 (No. 217-02283) 31-Dec-15 (No. EXX-7349_Dec-16) 30-Dec-15 (No. DAE4-601_Dec-15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-16 (No. 217-02222)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16 In house check: Oct-16 In nouse check: Oct-16	
Power sensor NRP-Z91 Reterunce 20 dB Alberuator Type-N mismatch combination Reterunce Probe EX30V4 DAE4 Secondary Standards Power meter EPM-442A	SN: 103245 SN: 9038 (20k) SN: 9047.2 / 06327 SN: 7349 SN: 601 ID 4 SN: 0837480704 SN: US37292703 SN: WY41982317 SN: 100872	06-Apr-16 (No. 217-02289) 06-Apr-16 (No. 217-02280) 05-Apr-16 (No. 217-02280) 05-Apr-16 (No. EX2-7349 Dec16) 30-Dec-15 (No. DAE4-601 Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-16 (No. 217-02222) 15-Jun-15 (in intuse check Jun-15)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16	
Power sensor NRP-ZBT Reference 20 dB Abenuator Type-N mismatch combination reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Prower sensor HP 8481A Prower sensor HP 8481A NF generator R&S SMT-06 Network Analyzer HP 8763E	SN: 103245 SN: 5081 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID 4 SN: 0837460704 SN: US37292733 SN: MY4*082317 SN: 100872 SN: US37390585	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02293) 96-Apr-16 (No. 217-02293) 97-Oct-15 (No. EX3-7349 Dec16) 30-Dec-15 (No. DAE4-601 Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02223) 15-Jun-15 (in house check Jun-15) 18-Oct-01 (in house check Oct-15)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Schadulari Chack In house check: Oct-16 In house chack: Oct-16	
Power sensor NRP-Z91 Reterunce 29 dB Alberuator Type- N mismatch combination Reterunce Probe EX30V4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A RE generator R&S SMT-06	SN: 103245 SN: 9058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID 4 SN: 0837480704 SN: US37292793 SN: MY41082317 SN: 103972 SN: US37390585 Neme	06-Apr-16 (No. 217-0228) 06-Apr-16 (No. 217-02292) 96-Apr-16 (No. EX3-7349 Dec16) 30-Dec-15 (No. EX3-7349 Dec15) 20-Dec-15 (No. DAE4-601 Dec15) Check Bale (in house) 07-Oct-15 (No. 217-02222) 07-Oct-16 (No. 217-02222) 07-Oct-16 (No. 217-02222) 15-Jun-15 (in htuse check Jun-15) 18-Oct-01 (in house check Dct-15)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Schadulari Chack In house check: Oct-16	
Power sensor NRP-ZBT Reference 20 dB Abenuator Type- N mismatch combination Reference Probe EX3DV4 DAE4 Sacondary Standards Power meter EPM-442A Power sensor HP 8481A PF generator R&S SMT-06 Network Analyzer HP 8763E	SN: 103245 SN: 9058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID 4 SN: 0837480704 SN: US37292793 SN: MY41082317 SN: 103972 SN: US37390585 Neme	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02293) 96-Apr-16 (No. 217-02293) 97-Oct-15 (No. EX3-7349 Dec16) 30-Dec-15 (No. DAE4-601 Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02223) 15-Jun-15 (in house check Jun-15) 18-Oct-01 (in house check Oct-15)	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Schadulari Chack In house check: Oct-16 In house chack: Oct-16	
Power sensor NRP-Z91 Reference 29 dB Abenuator Type- N mismatch combination Figliarince Probe EX3DV4 DAE4 Secondary Standards Power mober EPM-442A Power sensor HP 8481A Fif generator R&S SMT-06 Network Analyzer NP 8763E Cellershied by:	SN: 103245 SN: 9088 (20k) SN: 9047.2 / 06327 SN: 7949 SN: 601 ID 4 SN: 0637480704 SN: 0637480704 SN: 100872 SN: 100872 SN: 100872 SN: 100872 SN: 100872	06-Apr-16 (No. 217-02289) 06-Apr-16 (No. 217-02280) 05-Apr-16 (No. 217-02280) 05-Apr-16 (No. EX3-7349 Dec16) 30-Dec-15 (No. DAE4-601 Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-16 (No. 217-02222) 07-Oct-16 (No. 217-02222) 15-Jun-15 (in house check Jun-15) 18-Oct-11 (in nouse check Oct-15) Function Laboratory Technician	Apr-17 Apr-17 Apr-17 Dec-16 Dec-16 Schadulari Chack In house check: Oct-16 In house chack: Oct-16	

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Calibration Laboratory of Schmid & Partner

Engineering AG trasse 43, 8004 Zurich, Switzpriged





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entitution No.: SCS 0108

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Glossary:

N/A

TSL ConvF tissue simulating liquid

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

Calibration is Performed According to the Following Standards:

- 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
- 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)11. February 2005
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)*, March 2010.
- 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 D2450V2-727 April 6

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Measurement Conditions

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

DASY Version	DASY5	V52.8.B
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.0 ± 6 %	1.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

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

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.7 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

¥.1.	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	52.7 ± 6 %	1.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm2 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.5 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	49.6 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.3 W/kg ± 16.5 % (k=2)

Certificate No: D2450V2-727_Apr16

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

E	Electrical Delay (one direction)	1.148 ns

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

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

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

Additional EUT Data

	Manufactured by	SPEAG
-	Manufactured on	January 09, 2003

Certificate No: D2450V2-727_Apr16

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DASY5 Validation Report for Head TSL

Date: 19.04.2016

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz.

Medium parameters used: f = 2450 MHz; $\sigma = 1.83 \text{ S/m}$; $\epsilon_r = 40$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

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

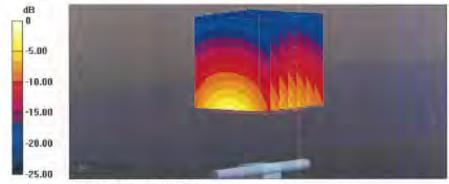
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 112.1 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 25.7 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.93 W/kg

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



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

Certificate No. D2450V2-727 Apr16

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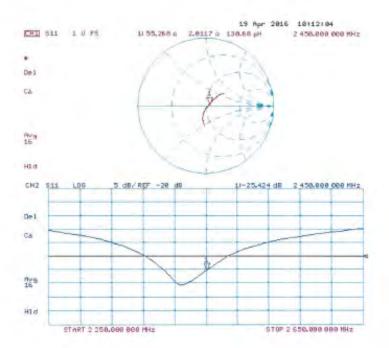
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Impedance Measurement Plot for Head TSL



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





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Accreditation No.: SCS 0108

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

Certificate No. D5GHzV2-1023 Jan 16

SGS-TW (Auden) CALIBRATION CERTIFICATE D5GHzV2 - SN: 1023 QA CAL-22.V2 Calibration procedure(s) Calibration procedure for dipole validation kits between 3-6 GHz January 26, 2016 Calibration date: This carioration certificate documents the traceability to national stendards, which realize the physical units of measurements (Si) The measurements and the uncontainties with confidence probability are given on the following pages and are cart of the certificate, All asilorations have been conducted in the closed laboratory facility: environment temperature (22 s. 81°C and humidity < 70%, Calibration Equipment used (M&TE critical for calibration) Scheduled Calibration Cai Date (Certificate No.) Primary Standards GB37480704 Power meter EPM-442A 07-Oct-15 (No. 217-02222 US37292783 07-Oct-15 (No. 217-02222) Oct-16 Power sensor HP 8481A ower sonsor HP 8481A MY41092317 07-Oct-15 (No. 217-02223) Oct-16 Reference 20 dB Attenuator SN: 5055 (20k) 01-Apr-15 (No. 217-02131) Mar-16 Type-N mismatch combination SN: 5047.2 / 06327 01-Apr-15 (No. 217-02134) May-16 Reference Probe EX3DV4 SM 3503 31 Dec-15 (No. EX3-3503_Dec/15) Dec-18 DAE4 SN. 601 30-Dec-15 (No. DAE4-601_Dec15) Dec-16 Scheduled Check Secondary Standards Check Date (in house) 15-Jun-15 (in house shack Jun-15) In house check: Jun-18 RF generator R&S SMT-06 100972 18-Oct-01 (in house check Oct-15) In house check: Oct-16 HS37390585-\$4205 Nelwork Analyzar HP 8753E Name **Function** Calibrated by Michael Webe Lisboratory Technician Kata Poković Technical Manager Approved by lested: January 28, 2018 This calibration cartificate shall not be reproduced except in full without written approval of the incoratory

Certificate No: 05GHzV2-1023_Jan16

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Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeugneisstraker 11, 1804 Zurich, Switzerland





Schweizenscher Kalibriertites Service subse d'étalonnage Servicie svizzere di teratura Swee Calibration Service

Accreditation No.: SCS 0108

Accounting by the Switte Accounting on Service (SAS)

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Glossary:

TSL ConvF tissue simulating liquid

N/A

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 62209-2, "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
- c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Fued Point Impedence 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%.

Certificare No. D5GHzV2-1023_Jan16

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Measurement Conditions

MST system configuration, as lar as it.	1	1
DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 5600 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 m/no/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	4.51 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.74 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.1 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 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 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 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.03 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.9 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.6 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	34.4 ± 6 %	5.10 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 ² (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.78 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ⁵ (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	22.0 W/kg ± 19.5 % (k=2)

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Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.37 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	71.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.05 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

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.2 W/kg ± 19.5 % (k=2)

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Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

-	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	5.91 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm² (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.1 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.19 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.59 W/kg
SAP for nominal Body TSL parameters	normalized to 1W	75.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.1 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1023_Jan16

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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	49.1 Ω - 8.4 jΩ
Return Loss	- 21.4 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	49.6 Ω · 4.2 jΩ
Return Loss	- 27.4 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.9 Ω - 1.4 jΩ
Return Loss	- 26,3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.9 Ω + 2.2 jΩ
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.4 Ω - 6.8 jΩ
Return Loss	- 23.3 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	50.9 Ω - 2.4 jΩ
Return Loss	- 31.8 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	56.0 Ω - 0.1 jΩ
Return Loss	- 25.0 dB

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Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	56.4 Ω + 2.4 jΩ
Return Loss	- 23.8 dB

General Antenna Parameters and Design

1	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: 26.01.2016

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; $\sigma = 4.51 \text{ S/m}$; $\varepsilon_e = 35.2$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: f = 5300 MHz; $\sigma = 4.6$ S/m; $\epsilon_r = 35.1$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5600 MHz; $\sigma = 1000$ kg/m³ 4.9 S/m; $\varepsilon_r = 34.7$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5800 MHz; $\sigma = 5.1$ S/m; $\varepsilon_r = 34.4$; $\rho = 5.0$ 1000 kg/m3

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.59, 5.59, 5.59); Calibrated: 31.12.2015, ConvF(5.25, 5.25, 5.25); Calibrated: 31.12.2015, ConvF(4.99, 4.99, 4.99); Calibrated: 31.12.2015, ConvF(4.95, 4.95, 4.95); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Scrial: 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 = 72.68 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 7.74 W/kg; SAR(10 g) = 2.23 W/kg

Maximum value of SAR (measured) = 17.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 73.14 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 30.0 W/kg

SAR(1 g) = 8.03 W/kg; SAR(10 g) = 2.33 W/kg

Maximum value of SAR (measured) = 18.7 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 = 73.32 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 32.6 W/kg

SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.38 W/kgMaximum value of SAR (measured) = 19.8 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 = 70.15 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 32.0 W/kg

SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.22 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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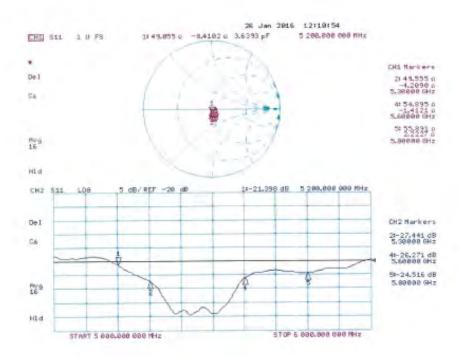
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Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 25.01.2016

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

MHz, Frequency: 5800 MHz

Medium parameters used: f = 5200 MHz; $\sigma = 5.37 \text{ S/m}$; $\varepsilon_r = 47.1$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: f = 5300 MHz; $\sigma = 5.5 \text{ S/m}$; $\epsilon_f = 46.9$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: f = 5600 MHz; $\sigma =$ 5.91 S/m; $\epsilon_c = 46.4$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5800 MHz; $\sigma = 6.19$ S/m; $\epsilon_c = 46$; $\rho = 5.00$ MHz; $\sigma = 6.19$ S/m; $\epsilon_c = 6.19$ 1000 kg/m3

Phantom section: Flat Section

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

DASY52 Configuration:

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

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.72 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 27.1 W/kg

SAR(1 g) = 7.25 W/kg; SAR(10 g) = 2.05 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 = 67.43 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 29.1 W/kg

SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.14 W/kg

Maximum value of SAR (measured) = 17.7 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 = 67.67 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 32.6 W/kg

SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.23 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,

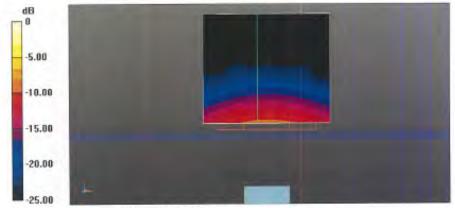
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.76 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 33.0 W/kg

SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.13 W/kg

Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 18.5 W/kg = 12.67 dBW/kg

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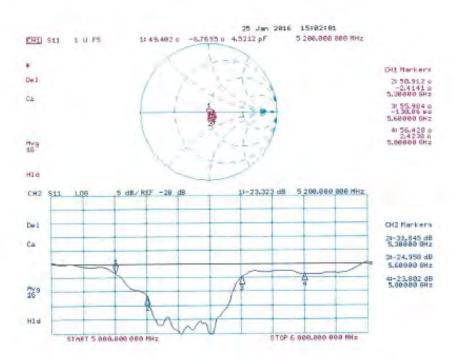
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Impedance Measurement Plot for Body TSL



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Calibration Laboratory of Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland





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

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SGS-TW (Auden)

Certificate No: D5GHzV2-1023 Jan17

Object	D5GHzV2 - SN:1	023	
Caribration pricedural(s)	QA CAL-22.v2 Calibration proce	dure for dipole validation kits bety	ween 3-6 GHz
Calibration date:	January 20, 2017		
The measurements and the unco	ertainties with conflictional p chad in the closed laborator	onel standards, which need as the physical un rebubblity are given on the following pages an ry tackiny, anwironment temperature (22 ± 3)°C	d are part of the certificate
Primary Standards	lip+	Cal Date [Certificate No.]	Scheduled Calibration
Power meter MRP	SN: 104778	06-Apr-16 (No. 217-02289/02289)	Apr-17
Power sensor NEP-Z91	SN: 103244	96-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z31	SN 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	85-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 86327	85-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 3603 SN: 801	31-Dec-16 (No. EX3-8508_Dec15) 04-Jen-17 (No. DAE4-601_Jan17)	Dec-17 Jan-18
DAE4	SN: 501		
Secondary Standards	101	Check Date (in house)	Schedulet Check In house check: Dct-18
	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check, Oct-18
Power mater EPM-442A	Fitting and The Physics	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power meter EPM-442A Power sensor IIP 8481A	SN: US37292783	97-Oct-15 (in house check Oct-16)	STOREST STORES
Power mater EPM-442A Power sonsor HP 8481A Power sonsor HP 8481A	SN: US37292780 SN: MY41092317	15- Juny 15- Co. Bristian Abank Claff 180.	In house check: Cirt-18.
Power maser EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-00	SN: US37292783	15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16)	In house check: Oct-18 In house check: Oct-17
Power meter EPM-442A Power sensor IIP 8481A	SN: US37292789 SN: MY41092317 SN: 100972 SN: US37390585	18-Oct-01 (in house check Oct-16)	
Power raiser EPM-442A Power sonoor HP 8481A Power sonoor HP 8481A RF generator R&S SMT-00 Network Analyzer HP 8753E	SN: US37292783 Sn: MY41092317 SN: 100972 SN: US37390585 Hame	18-Oct-01 (in house check Oct-16) Function	
Power maser EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-00	SN: US37292789 SN: MY41092317 SN: 100972 SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Och 17
Power meer EPM-442A Power sensor HP 8481A Power sensor HP 8481A AF generator R&S SMT-00 Network Analyzer HP 8753E	SN: US37292783 Sn: MY41092317 SN: 100972 SN: US37390585 Hame	18-Oct-01 (in house check Oct-16) Function	In house check Och 17

Certificate No: D5GHzV2-1023_Jan17

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Calibration Laboratory of Schmid & Panner Engineering AG Zeugrapostasse Et. Millet Zurich, Switzerland





Schweizerischer Kalibrierdiene Service suisse dietalennege Serviche witzelse di territure

S Swiss Calibration Service
Accreditation No.: SCS 0108

Accretion by the Source Americalities Service (SAS)
The Swass Accreditation Service is one of the signalorical to the EA
Multiparest Agreement for the recognition of calibration cartificates

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:

 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

 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

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 cartificate. 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 lilled 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 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%.

Centicate No: 05GHz/V2 (023 Jan17

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Measurement Conditions

DASY system 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 5800 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 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	75.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.16 W/kg
SAR for numinal Head TSL parameters	normalized to 1W	21.5 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 %	4.55 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 ³ (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	81.0 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 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

ha following paramoters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	347 = 6%	4.85 mho/m ± 8 %
Head TSL temperature change during test	< 0.5°C	-	100

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAFI 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	numalized to 1W	23.1 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	344±6%	5 05 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	_

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ² (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 ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	.2.22 W/kg
SAR for nominal Head TSL parameters.	normalized to 1W	22.0 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 %	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 cm3 (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 Body 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 ³ (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 INV 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 mno/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 ² (10 g) of Body TSL	condition	
SAF 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	49.8 Ω - 6.7 JΩ	
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 \O + 2.8 \O	
Fletum Loss	−24.8 dB	

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.9 \O - 7.0 j\O
Return Loss	- 22.9 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.0 Ω - 1.0 jΩ
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	$56.6 \Omega + 2.7 j\Omega$	
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 leaded 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 leedpoint 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: 20101.2017

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: f = 5300 MHz; $\sigma = 4.55$ S/m; $\varepsilon_r = 35.2$; $\rho = 1000$ kg/m³.

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/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (JEBE/JEC/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: 1.4mm (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 = 73.0) 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: D5GHzV2-1023_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



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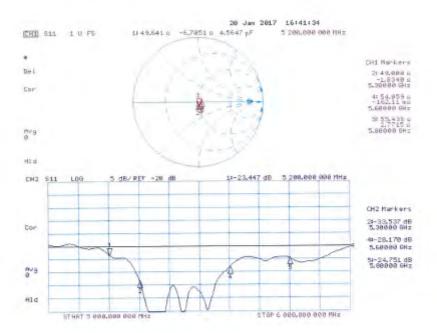
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Impedance Measurement Plot for Head TSL



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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, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: f = 5200 MHz; $\sigma = 5.36$ S/m; $\epsilon_r = 47.5$; $\rho = 1000$ kg/m³.

Medium parameters used: f = 5300 MHz; $\sigma = 5.5$ S/m; $\varepsilon_t = 47.3$; $\rho = 1000$ kg/m³

Medium parameters used: f = 5600 MHz; $\sigma = 5.9 \text{ S/m}$; $\epsilon_0 = 46.6$; $\rho = 1000 \text{ kg/m}^3$

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; CoavF(5,29, 5,29, 5,29); Calibrated: 31.12.2016, ConvF(5,04, 5,04); Calibrated: 31.12.2016, ConvF(4,57, 4,57, 4,57); Calibrated: 31.12.2016, ConvF(4,48, 4,48); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601, Calibrated: 04.01.2017
- Phanton: Flat Phantom 5,0 (buck); 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,

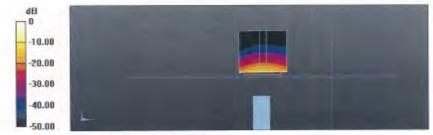
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

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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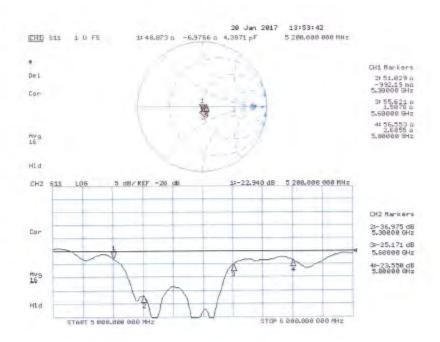
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Impedance Measurement Plot for Body TSL



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- End of 1st part of report -

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