



CETECOM ICT Services consulting - testing - certification >>>

Annex E



Appendix to Test Report No.: 1-3851/11-01-20

Testing Laboratory CETECOM ICT Services GmbH Untertürkheimer Straße 6-10 66117 Saarbrücken/Germany + 49 681 5 98 - 0 Phone: Fax: + 49 681 5 98 - 9075 Internet: http://www.cetecom.com e-mail: ict@cetecom.com Accredited Test Laboratory: The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS) The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

Appendix with Calibration data, Phantom certificate and system validation information



1 Table of contents

1	Table o	f contents	2
2	Calibra	tion report "Probe ET3DV6"	3
3	Calibra	tion report "Probe ET3DV6"	14
4	Calibra	tion report "900 MHz System validation dipole"	25
5	Calibra	tion report "1800 MHz System validation dipole"	33
6	Calibra	tion report "1900 MHz System validation dipole"	41
7	Calibra	tion report "2450 MHz System validation dipole"	49
8	Calibra	tion certificate of Data Acquisition Unit (DAE)	57
9	Calibra	tion certificate of Data Acquisition Unit (DAE)	58
10	Ce	rtificate of "SAM Twin Phantom V4.0/V4.0C"	59
11	Ар	plication Note System Performance Check	60
	11.1	Purpose of system performance check	60
	11.2	System Performance check procedure	
	11.3	Uncertainty Budget	
	11.4	Power set-up for validation	
	11.5	Laboratory reflection	
	11.6	Additional system checks	65



2 Calibration report "Probe ET3DV6"

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Clien: Cetecom	- Se 1 85-82	Certificate No:	ET3-1558_Aug11
CALIBRATION	CERTIFICAT	E	
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Collibration procedure(s)		DA CAL-23 v4, DA CAL-25 v4 edura far dasimetric F-field probes	
Collection date:	August 23, 2011		WHERE COME
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Certificate No: ET3-1558_Aug11

Page 1 of 11



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



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Swiss Calibration Service

Accreditation No.: SCS 108

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

Classon

tissue simulating liquid
sensitivity in free space
sensitivity in TSL / NORMX,y,z
dide compression point
crest factor (1/duty_cyclo) of the RF signal
modulation dependent linearization parameters
o rotation around probe axis
9 rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., 9 = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IFEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) In the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003 b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-heid devices used in cluse
- proximity to the ear (frequency range of 300 MHz to 3 GHz)". February 2005

Methods Applied and Interpretation of Parameters:

- NORMx, y.z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-coll; f > 1800 MHz R22 waveguide) NORMx, y,z are only intermediate values, i.e., the uncertainties of NORMx, y,z does not affect the E² field uncertainty inside TSL (see below ConvF).
- $NORM(l)x, y, z = NORMx, y, z * frequency_response$ (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required) DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax.y.z. Bx.y.z. Cx.y.z. VRx.y.z. A, B, C are numerical linearization parameters assassed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and incide waveguide using analytical field distributions based on power measurements for (> 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (a pha, dopth) of which typical uncortainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMX, y,z * ConvF whereby the uncertaintly corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D doviation 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.

Certificate No: ET3-1558_Aug11

Page 2 of 11



ET3DV0 - SN:1558

August 23, 2011

Probe ET3DV6

SN:1558

Calibrated:

Manufactured: September 16, 2003 August 23, 2011

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

Certificate No: ET3-1558 Aug 11

Page 3 of 11



ET3DV6-SN:1558

August 23, 2011

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1558

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (uV/(V/m)2)*	2.03	1.79	1.76	± 10.1 %
DCP (mV) ⁰	96.7	97.9	97.2	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	dB B	C dB	VR mV	Unc ^L (k=2)
10000	CW	C.00	X	0.00	0.00	1.00	116.3	±2.5 %
			Y	0.0C	0.00	1.00	134.7	
			Z	0.00	0.00	1.00	'43.7	

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

⁶ The uncertainties of NormX, Y,Z do not affect the F² field uncertainty inside TSL (see Pages 5 and 6).
 ⁶ Numarical invariation parameter: uncertainty not required.
 ⁶ Uncertainty is determined using the moxil deviation from linear response exploying rectangular distribution and is expressed for the security of the secure security of the security of the secure security of the secu

Certificate No. ET3-1558_Aug11

Page 4 of 11



ETSDV8 SN:1558

August 23, 2011

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1558

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ⁼	Relative Permittivity	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.22	6.22	6,22	0.71	1,89	± 12.0 %
835	41.5	0.90	6.95	5.95	5.95	0.65	1,98	± 12.0 %
900	41.5	0.97	5.87	5.87	5.87	0.68	1.90	± 12.0 %
1750	40.1	1.37	5.09	5.09	5.09	0.49	2.51	± 12.0 %
1900	10.0	1.40	4.86	4.86	4,86	0.51	2.36	1 12.0 %
2450	39.2	1.80	4.15	4.15	4.15	0.70	1.79	1 12.0 %

⁴ Frequency validity of ± 100 MHz only applies for DASY v1.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvE uncertainty at collaration frequency and the uncertainty for the indicated frequency band.
⁵ At frequencies below 3 GHz, the validity of tissue commetters (c and c) can be relaxed to ± 10% if liquid companiation formula is applied to measured GAR values. At frequencies above 3 GHz, the validity of tissue parameters (s and c) is restricted to ± 5%. The uncertainty is the RSS of the ConvE uncertainty for indicates, length issue parameters.

Certificate No: ET3-1568_Aug11

Page 5 of 11



ETSDV8 SN:1558

August 23, 2011

DASY/EASY - Parameters of Probe: ET3DV6- SN:1558

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ⁼	Relative Permittivity	Conductivity (5/m)	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	5.97	5.97	5,97	0.76	1.84	1 12.0 %
835	55.2	0.97	5.85	5.85	5.85	0.66	1.98	± 12.0 %
900	55.0	1.05	5.77	5.77	5.77	0.67	1.99	+ 12.0 %
1750	53.4	1,49	4.52	4.52	4.52	0.53	2.78	± 12.0 %
1900	53.3	1.62	4.30	4.30	4.30	0.56	2.61	± 12.0 %
2450	52.7	1.05	3.00	3.90	3.90	D.86	1.39	± 12.0 %

⁶ Programmy validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), etse it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvE uncertainty to collocation frequency and the uncertainty for the indicated frequency band.
¹ At frequencies below 3 GHz, the validity of tissue parameters (c and c) can be relaxed to ± 10% if liquid componentiation fermula is applied to measured SAR values. At frequencies above 3 GHz, the validity of the validity of tissue parameters (c and c) is restricted to ± 5%. The uncertainty is the RSS of the ConvE uncertainty for indicated larget issue parameters.

Certificate No: ET3-1558 Aug11

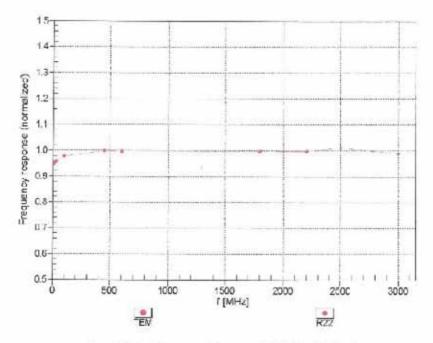
Page 6 o' 11

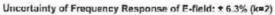


ET3DVG- SN:1558

August 23, 2011

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





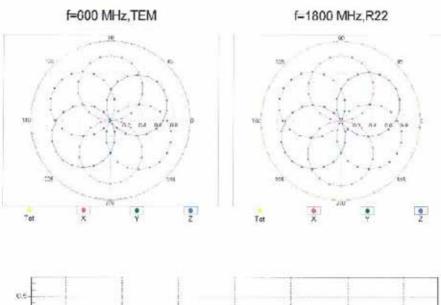
Conificate No: ET3-1550 Aug11

Page 7 of 11

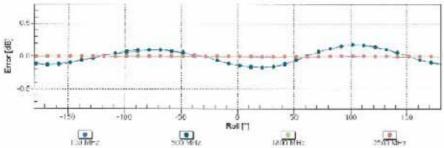


ET3DV8- SN:1558

August 23, 2011



Receiving Pattern (ϕ), $\vartheta = 0^{\circ}$



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

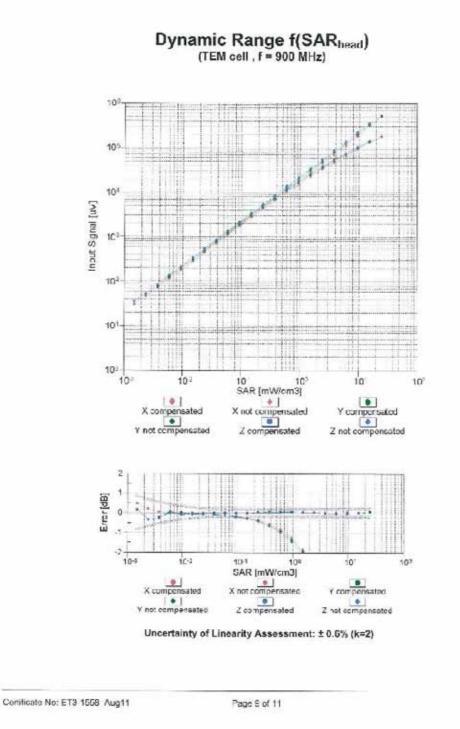
Certificate No: ET3-1550 Aug11

Page 6 of 11

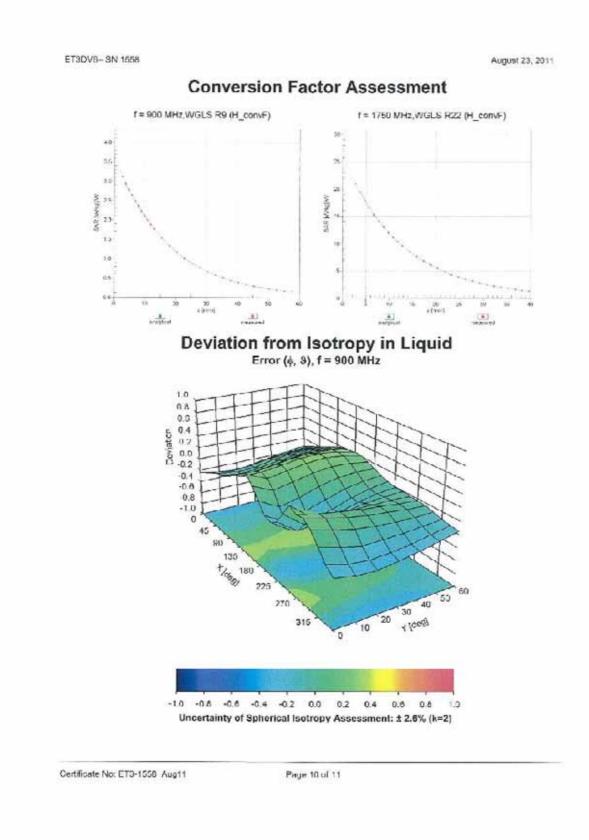




August 23, 2011









ET3DV6-SN:1558

August 23, 20**

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1558

Other Probe Parameters

Sensor Anangement	Triangular
Connector Angle (*)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

Certificate No. ET3-1558_Aug11

Page 11 of 11



3 Calibration report "Probe ET3DV6"

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zur	ory of	Hac MRA	Service suisse d'étalonnage Servizio svizzero di taratura
Accredited by the Swiss Accredit The Swiss Accreditation Servi Multilateral Agreement for the	ce is one of the signator	ies to the EA	n No.: SCS 108
Client Cetecom		Certificate N	lo: ET3-1559_Jan11
CALIBRATION	CERTIFICAT	ſE	n (* 3 36 , 14
Object	ET3DV6 - SN:1	559	
Calibration procedure(s)		QA CAL-12.v6, QA CAL-23.v4 an edure for dosimetric E-field probe	
	January 19, 201	14	
The measurements and the unc	nents the traceability to na entainties with confidence	tional standards, which realize the physical un probability are given on the following pages ar ory facility: environment temperature (22 ± 3) ⁴	nd are part of the certificate.
This calibration certificate docur The measurements and the unc All calibrations have been condi Calibration Equipment used (Ma	nents the traceability to na entainties with confidence acted in the closed laborat kTE critical for calibration)	itional standards, which realize the physical un probability are given on the following pages ar ory facility: environment temperature (22 ± 3)*(nd are part of the certificate. C and humidity < 70%.
This calibration certificate docur The measurements and the unc All calibrations have been cond	nents the traceability to na entainties with confidence acted in the closed laborat kTE critical for calibration)	itional standards, which realize the physical un probability are given on the following pages ar ory facility: environment temperature (22 ± 3) ⁴ Cal Date (Certificate No.)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration
This calibration certificate docur The measurements and the unc All calibrations have been condi Calibration Equipment used (MI Primary Standards	nents the traceability to na entainties with confidence acted in the closed laborat kTE critical for calibration)	itional standards, which realize the physical un probability are given on the following pages ar ory facility: environment temperature (22 ± 3)*(nd are part of the certificate. C and humidity < 70%.
This calibration certificate docur The measurements and the unc All calibrations have been cond Calibration Equipment used (M/ Primary Standards Power meter E4419B	nents the traceability to na entainties with confidence acted in the closed laborat ATE critical for calibration)	itional standards, which realize the physical un probability are given on the following pages ar ory facility: environment temperature (22 ± 3)*4 Cal Date (Certificate No.) 1-Apr-10 (No. 217-01136)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-11
This calibration certificate docur The measurements and the unc All calibrations have been condi Calibration Equipment used (Mil Primary Standards Power sensor E44198 Power sensor E4412A Reference 3 dB Attenuator	nents the traceability to na entainties with confidence acted in the closed laborat NTE critical for calibration) ID # GB41293874 MY41495277	tional standards, which realize the physical un probability are given on the following pages ar ory facility: environment temperature (22 ± 3) ⁴ Cal Date (Certificate No.) 1-Apr-10 (No. 217-01136) 1-Apr-10 (No. 217-01136)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-11 Apr-11
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Swijzerland



Schweizerlscher Kaßbrierdienst

- S Service suisse d'élalonnage
- С Servizio svizzero di faratura s
 - Swiss Calibration Service

Accreditation No.: SCS 108

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

Glossary:	
TSL	Lissue simulating liquid
NORM×,y,z	sensitivity in free space
ConvF	sensitivity in TSL/ NORMX, y, z
DCP	diode compression point
CF	crest factor {1/duty_cycle} of the RF signal
A, B, C	modulation dependent linear zation parameters
Polarization o	o rotation around probe axis
Polarization 3	3 rotation around an axis that is in the plane normal to probe axis (at measurement center).
	i.e., 9 = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

- a) IEEE SId 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 5) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)*, February 2005

Methods Applied and Interpretation of Parameters:

- NORMx, y, z. Assessed for E-field polarization 8 0 (f ≤ 900 MHz in TEM-cell; f > 1600 MHz; R22 waveguide). NORMX, y, z are only intermediate values, i.e., the uncertainties of NORMX, y, z does not effect the E²-field uncertainty inside ISL (see below Convil).
- NORM(I)x y,z = NORMx,y,z * Irequency_response (see Frequency Rosponso Charl). This Incarization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- Ax,y,z; Bx,y,z, Cx,y,z, VRx,y,z; A, B, C 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 like maximum calibration range expressed in RMS vollage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for t > 800 MHz. The same selups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx, y,z * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvFils 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 antennal
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probeit p (on probe axis). No tolerance required.

Certificate No: ET3-1559_Jan11



January 19, 2011

Probe ET3DV6

SN:1559

Manufactured: Last calibrated: Recalibrated: December 1, 2000 January 20, 2010 January 19, 2011

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

Cert Scale No. ET3-1559_Jan 11

Page 3 of 11



ET30V6 SN:1559

January 19, 2011

DASY/EASY - Parameters of Probe: ET3DV6 SN:1559

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Une (k=2)
Norm (uV/(V/m) ²) ⁴	1.79	- 59	1.64	± 10.1%
DCP (mV) [#]	<u>96</u> .9	97.6	96.3	

Modulation Calibration Parameters

lano.	Communication System Name	PAR		A dB	B d⊟uV	С	VR m¥	Unc" (k=2)
10000	CW:	0.00	х	0.00	0.00	1.00	132.1	t29%
			Y	0.00	0.00	1.00	137.8	
			Z	i <u>0.00</u>	0.00	1.00	128.3	

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

 * The uncertainlies of NormX,Y,Z oo not affect the D^{2} -field uncertainly inside TSL (see Pages 5 and 6).

^a Numerical Incanzation parameter luncensibly not required.

⁶ Uncertainty is determined using the inverteent environment in the investigation of the second state of the square of the field value.

Certificate No. ET3-1559 [Jan11]

Page 4 of 11



January 19, 2011

DASY/EASY - Parameters of Probe: ET3DV6 \$N:1559

Calibration Parameter Determined in Head Tissue Simulating Media

I [MHz]	Validity_[KHz] ⁶	Permittivity	Conductivity	CONVEX CO	RWE Y Cor	IVF Z	Alpha	Depth Unc (k=Z)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	7.39	7.39	7.39	0.18	2.07 ± 13.3%
835	± 50 / ± 100	41 S ± 5%	0 90 ± 5%	5 33	6 33	6 33	0.25	3.00 ± 11 ¢%
900	± 50 / ± 100	415±5%	0.97 ± 5%	6.20	6.20	6 20	0.26	3.00 ± 11.0%
1750	$\pm 50 / \pm 100$	40.1±5%	1.37 ± 5%	5.28	5.28	5.28	0.79	1.69 ± 11.0%
1900	\pm 50 / \pm 100	$40.0\pm5\%$	1.40 ± 5%	5 02	5.02	5.02	0.79	1.60 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.8D ± 5%	4.38	4.38	4.3B	0.79	2.02 ± 11.0%

³ The validity of ± 100 MHz dwy appres for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF ancertainty at calibration (recency) and the uncertainty for the indicated frequency sand.

Certificate No: ET3-1559_Jan11

Page 5 of 11



January 19, 2011

DASY/EASY - Parameters of Probe: ET3DV6 SN:1559

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity (MHz) ^C	Permittivity	Conductivity	ConvFX Ca	пуЕУ Сф	nvF Z	Aipha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0 94 + 5%	7,73	7.73	7,73	0.12	2.07 ± 13.3%
835	± 50 / ± 100	55 2 ± 5%	$0.97 \pm 5\%$	6.22	6.22	6.22	0.25	2.98 ±11.0%
900	± 507 ± 100	55.0 ± 5%	1.05 ± 5%	6.10	6 10	6.10	0 29	287 ±11.0%
1750	± 50 / ± 100	53.4 ± 5%	$1.49\pm5\%$	4,68	4 66	4.68	0.79	2.39 ±11.0%
1900	± 50 / ± 100	533(5%)	1.52 ± 5%	4.40	4 40	4.40	0.79	2.32 ± 11.0%
2450	± 60 / ± 100	52.7 ± 5%	$1.95\pm5\%$	3,91	3 91	3.91	0.70	3.00 ± 11.0%

⁵ The validity of ± 100 MHz only applies for DASY will 4 and higher (son Page 2). The uncertainty is the RSS of the ConvE uncertainty at calibrative frequency and the uncertainty for the indicated frequency band.

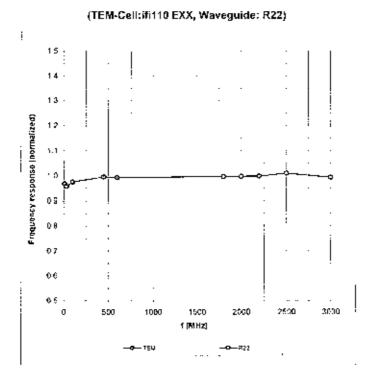
Certificate Nor EY3-1659_Jan11

Page 6 of 11



January 19, 2011

Frequency Response of E-Field



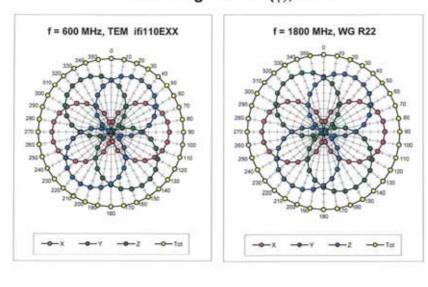


Certificate No: E13-1555, Jan11

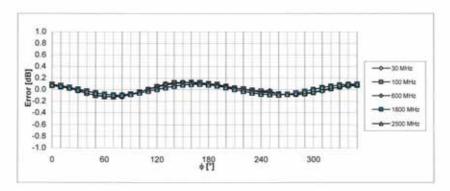
Page 7 cf 15



January 19, 2011



Receiving Pattern (ϕ), $\vartheta = 0^{\circ}$



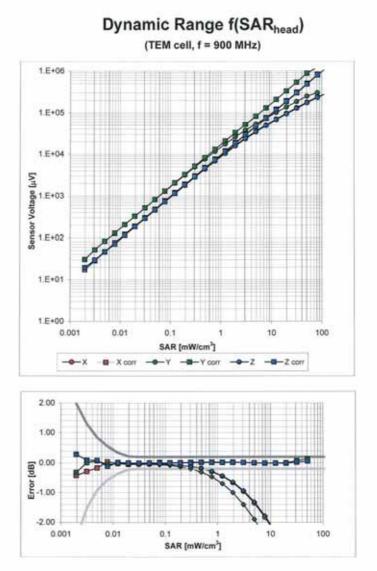
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Certificate No: ET3-1559_Jan11

Page 8 of 11



January 19, 2011



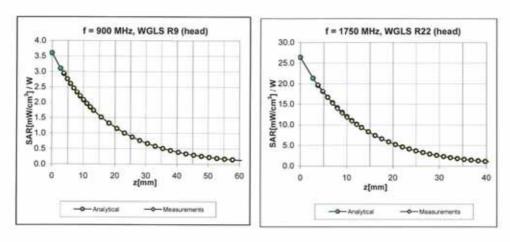
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: ET3-1559_Jan11

Page 9 of 11



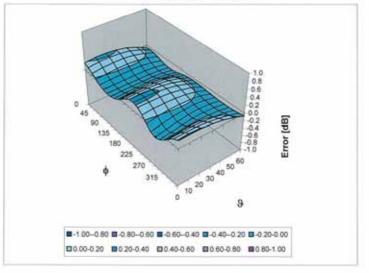
January 19, 2011



Conversion Factor Assessment

Deviation from Isotropy in HSL

Error (¢, ୬), f = 900 MHz



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

Certificate No: ET3-1559_Jan11

Page 10 of 11



January 19, 2011

Other Probe Parameters

Sensor Atrangement	Triangular
Connector Angle (*)	Not applicable
Mechanical Surface Dotoction Mode	enablec
Optical Surface Detection Mode	enabled
Probe Overail Length	337 mm
Probe Body Diameter	:0 mm
Tip Length	10 mm
Tip Diameter	6.8 m m
Probe Tip to Sensor X Calibration Point	2.7 com
Probe Tip to Sensor Y Calibration Point	2.7 cnm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	3.7 min

Page 11 of 11



4 Calibration report "900 MHz System validation dipole"

Zeughausstrasse 43, 8004 Zurk	ch, Switzerland	BOCMRA CO CO CO	Servizio Svizzero di Israiuri
Accredited by the Swiss Accredit The Swiss Accreditation Servic Multilataral Agreement for the r	e is one of the signatorie	es to the EA	n No.: SCS 108
Client Cetecom		Internet we want to be	o: D900V2-102_Aug11
CALIBRATION (CERTIFICATI		
Object	D900V2 • SN: 10	02	
Galibration procedure(s)	QA CAL-05.v8 Calibration proce	dure for dipole validation kits ab	ove 700 MHz
Calibration date:	August 15, 2011		
The measurements and the unco	rtainties with confidence p	ional atenderds, which realize the physical us mhahility are given on the following pages as	nd are part of the certificate.
The measurements and the unco	etainties with confidence p eted in the closed laborate	coul standards, which realize the physical un mhability are given on the following pages or ny facility: environment temporature $(22\pm3)^2$	nd are part of the certificate.
The measurements and the unco All calibrations have been conduc	etainties with confidence p eted in the closed laborate	mhahility are given on the following pages a	nd are part of the certificate.
The measurements and the unco All calibrations have been conduc Calibration Eculipment used (M&' Primary Standards Power meter ENV-442A	International Statement (Confidence point) (Confide	mhability are given on the following pages or ry facility: environment temporature (22 ± 3)* Call Date (Certificate No.) 09-Oct-10 (No. 217-01266)	nd are part of the certificate. C and humidity < 70%, Scheduled Calibration Oct-11
The measurements and the unco All calibrations have been conduc Calibration Eculipment used (M&) Primary Standards Power meter ENV-442A Power consor HP 8431A	etainties with confidence p eted in the closed laboration TE critical for calibration) ID # GB37460704 U637252753	mhability are given on the following pages or ry facility: environment temperature (22 ± 3)* Call Date (Certificate No.) 09-Oct-10 (No. 217-01266) 03-Oct-10 (No. 217-01266)	nd are part of the certificate. C and humidity < 70%, Scheduled Calibration Oct-11 Oct-11
The measurements and the unce All calibrations have been conduc Calibration Eculpment used (M&) Primary Standards Power meter ENV-442A Power sensor HP 8481A Reference 20 dB Attenuator	etainties with confidence p eted in the closed laborate TE critical for calibration) ID # GB37460704 U637292753 SN: S506E (20b)	mhability are given on the following pages or ry facility: environment temperature (22 ± 3)* Call Date (Certificate No.) 09-Oct-10 (No. 217-01266) 03-Oct-10 (No. 217-01266) 20 Mar 11 (No. 217 01037)	nd are part of the certificate. C and humidity < 70%, Scheduled Colibration Oct-11 Oct-11 Apr-12
The measurements and the unce All calibrations have been conduc Calibration Eru Ipment used (M&) Primary Standards Power meter EPV-442A Power sensor HP 8431A Reference 22 dB Attenuator Type-N Internation contribution	International State (Control of Control of C	mhability are given on the following pages or ry facility: environment temporature (22 ± 3)° Call Date (Cartificate No.) 09-Oct-10 (No. 217-01266) 09-Oct-10 (No. 217-01266) 20-Mar 11 (No. 217-01266) 29-Mar-11 (No. 217-01371)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Oct-11 Oct-11 Apr-12 Apr-12
The measurements and the unce All calibrations have been conduc Calibration Eculpment used (M&) Primary Standards Power meter ENV-442A Power sensor HP 8481A Reference 20 dB Attenuator	etainties with confidence p eted in the closed laborate TE critical for calibration) ID # GB37460704 U637292753 SN: S506E (20b)	mhability are given on the following pages or ry facility: environment temperature (22 ± 3)* Call Date (Certificate No.) 09-Oct-10 (No. 217-01266) 03-Oct-10 (No. 217-01266) 20 Mar 11 (No. 217 01037)	nd are part of the certificate. C and humidity < 70%, Scheduled Colibration Oct-11 Oct-11 Apr-12
The measurements and the unce All calibrations have been conduc Calibration Fox Ipment used (M&' Primary Standards Power sensor HV-442A Power sensor HV-442A Power sensor HV-442A Power sensor HV-442A Power sensor HV-442A Power sensor HV-442A Reference 20 dB Attenuator Type-N mismatch contribution Beterence Probe FS3DV3 DAE4 Secondary Standards	International State Stat	mhability are given on the following pages or ry facility: environment temporature (22 ± 3)* Cal Date (Certificate No.) 09-Oct-10 (No. 217-01266) 03-Oct-10 (No. 217-01266) 20 Mor-11 (No. 217-0137) 29-Apr-11 (No. 253-3205_Apr11)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Oct-11 Oct-11 Apr-12 Apr-12 Apr-12 Jul-12 Scheduled Check
The measurements and the unce All calibrations have been conduc Galibration Eculpment used (M&* Primary Standards Power meter EPV-442A Power sonsor HP 8481A Reference 2D dB Attonuctor Type-N Internation Contribution Reference Probe FS30V3 DAE4 Secondary Standards Power sonsor HP 84811 A	International State Stat	mhability are given on the following pages of ry facility: environment temporature (22 ± 3)* Cal Date (Certificate No.) 08-Oct-10 (No. 217-01266) 09-Oct-10 (No. 217-01266) 20-Mar 11 (No. 217-01037) 29-Mar 11 (No. 217-01037) 29-Mar 11 (No. E53-3205_Apr11) 04-Ju -11 (No. DAE4-001_Juli11) Chock Date (in house) 18-Oct-02 (in house check Oct-09)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Oct-11 Oct-11 Apr-12 Apr-12 Apr-12 Jul-12 Scheduled Check In house check: Oct-11
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



SNISC

- Schweizerlscher Kalibrierdienst S Service auisse c'étalonnage C Servizio avizzero di taratura S
 - Swice Calibration Service

Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS)

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

Glossary: TSL

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) In the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Certificate No: D900V2-102_Aug11

Page 2 cf 8



Measurement Conditions

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	16 mm	with Spacar
Zoom Scan Resolution	dx. dy. dz = 5 mm	
Frequency	900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.6	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) "C	40.3 ± 6 %	0.95 mho/m = 6 %
Head TSL temperature change during test	< 0.5 *C		++++0

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAF measured	250 mW input power	2.69 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	10.9 mW /g ± 17.0 % (k=2)
SAR averaged over 10 cm ² (10 g) of Head TSL	cond tion	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 253 mW input power	1.73 mW / g

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.0 ± 6 %	1.05 mbo/m ± 6 %
Body TSL temperature change during test	<0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	260 mW input power	2.83 mW / g
SAR for nominal Body TSL parameters	normal zed to 1W	11.2 mW / g ± 17.0 % (k=2)
SAR averaged over 10 cm ² (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 250 mW input power	1.82 mW / g

Contricato No: D900V2-102_Aug11

Page 3 of 8



Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω - 5.0 JΩ	
Return Loss	- 26.0 dB	

Antenna Parameters with Body TSL

Impedance, transformed to food point	45.8 Ω - 6.4 jΩ	
Roturn Loos	- 22.0 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.407 ns	
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. 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 24, 2001	

Contificate No: D900V2-102 Aug11

Page 4 of 8



DASY5 Validation Report for Head TSL

Date: 15.08.2011

Test Laboratory: SPEAG. Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 102

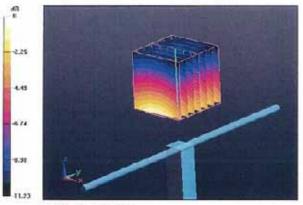
Communication System: CW; Frequency: 900 MHz Medium parameters used: f = 900 MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m² Phantom section: Plat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.97, 5.97, 5.97); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Head Tissuc/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 59.842 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 4.018 W/kg SAR(1 g) = 2.69 mW/g; SAR(10 g) = 1.73 mW/g Maximum value of SAR (measured) = 3.146 mW/g



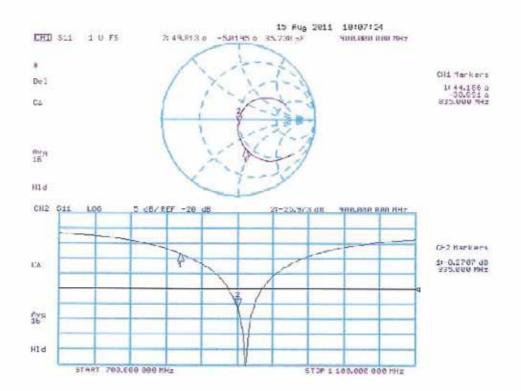


Certificate No: D900V2-102 Aug I

Page 5 of 8



Impedance Measurement Plot for Head TSL



Certificate No: D300V2-102_Aug11

Page 6 cf 6



DASY5 Validation Report for Body TSL

Date: 15.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 102

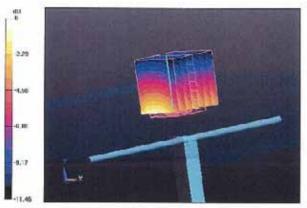
Communication System: CW: Frequency: 900 MHz Medium parameters used: f = 900 MHz; $\sigma = 1.05$ mho/m; $v_r = 52.8$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.94, 5.94, 5.94); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.91.; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 56.479 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 4.331 W/kg SAR(1 g) = 2.83 mW/g; SAR(10 g) = 1.82 mW/g Maximum value of SAR (measured) = 3.319 mW/g



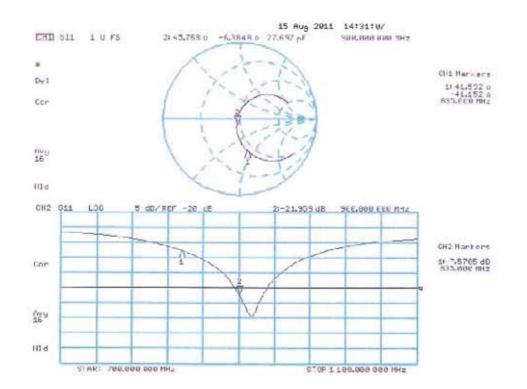
0 dB = 3.320 mW/g

Certilicate No. D90CV2-102_Aug11

Page 7 of 8



Impedance Measurement Plot for Body TSL



Certificate No: D900V2-102_Aug11

Page 8 of 8



5 Calibration report "1800 MHz System validation dipole"

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Accredited by the Swins Accredita The Swiss Accreditation Service Multilateral Agreement for the n	c is one of the signatoric	a to the EA	No.: SCS 108
Client Cetecom	s severe su		» D1800V2-287 Aug11
CALIBRATION C	CERTIFICATE		
Object	D1800V2 - SN: 2	87	
Calibration procedure(s)	QA CAL-05.v8 Calibration proce	dure for dipole validation kits abo	ove 700 MH₂
Calibration date:	August 17, 2011		
The measurements and the unce All calibrations have been cordu	Italities with confidence p	anal standards, which realize the physical un robability are given on the following pages or ny factility, unvironment temperature (22 ± 3) ⁴	ed are part of the contilicate.
The measurements and the unce All calibrations have been cor du Calibration Equipment used (1451 Primary Standards	Internities with confidence p and in this closed laborato TE childral for calibration)	robability are given on the following pages ar ny facility, unvironment temperature (22 ± 3) ⁵ Cal Data (Certificate No.)	d are part of the certificase. C and humidity < 70%. Scheduled Galibration
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The measurements and the unce All calibrations have been cor du Calibration Equipment used (MS1 Primary Standards Power stantor EPM-442A Power stantor EPM-442A Power stantor HP 3481A Poloneme 20 dB Abencemer	Internities with confidence p and in this closed laborator TE childral for calibration) ID 8 GB37480704 US37292783 SN: SSC88 (20b)	robability are given on the following pages ar ty facility: unvironment temperature: (22 ± 3) ¹ Cal Data (Certificate No.) 06-Oct-10 (No. 217-01266) 06-Oct-10 (No. 217-01266) 29-Mar-11 (No. 217-01367)	d are part of the certificase. C and humidity < 70%. Scheduled Calibration Oct-1 Oct-1 Apt-12
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The measurements and the unce All calibrations have been conduc Calibration Equipment used (1431 Primary Standards Power motor EPM-442A Power sensor HP 3481A Peterence 20 dB Atendeord Type N mismatch combination Reference Probe ES30V3 DAE4 Secondary Standards Power concor HP 3481A	Interneties with confidence p and in the closed laborator (E-childraft for calibration) (D-)) (B-))(B-))	cobability are given on the following pages are ry facility: unvironment temperature (22 ± 3) ¹ Cal Data (Certificate No.) 06-Oct-10 (No. 2 7-01266) 06-Oct-10 (No. 2 7-01266) 06-Oct-10 (No. 2 7-01266) 29-Mar-11 (No. 2 7-01266) 29-Mar-11 (No. 2 17-01367) 29-Apr-11 (No. 217-01377) 29-Apr-11 (No. DAE4-601_Joil11) Check Data (in house) 18-Oct-32 (in house check Oct-09)	d are part of the certificate. C and humicity < 70%. Scheduled Calibration Oct-1 Oct-1 Oct-1 Apr-12 Apr-12 Jul-12 Scheduled Check In house check: Oct-11
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 6004 Zurich, Switzerland



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Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS)

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

Glossary: TSL

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximily to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Contificate No: D1800V2-287_Aug1*

Page 2 of 8



Measurement Conditions

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

DASY Version	DASY5	V52 8 2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.7 ± 6 %	1.37 mho/m ± 6 %
Head TSI. 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	9.28 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	37.5 mW /g ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	4.90 m₩ / g

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.0 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	****	

SAR result with Body TSL

SAR averaged over 1 cm ² (1 g) of Body TSL	Condition	
SAR meacured	260 mW input powor	9.58 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	38.7 mW / g = 17.0 % (k=2)
	20 ZA	
SAR averaged over 10 cm ² (10 g) of Body TSL	condition	
SAR averaged over 10 cm ⁸ (10 g) of Body TSL SAR measured	condition 250 mW input power	5.06 mW / g

Certificate No: D1600V2-207_Aug11

Page 3 of 8



Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 5.4 Ω	
Return Loss	- 25.3 dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.3 Ω · 4.8 jΩ
Return Loss	- 23.0 dB

General Antenna Parameters and Design

Electrical De ay (one direction)	1.205 ns
	000,000

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 constal cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antonna is therefore short-circuited for DC-signals. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections non-the

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
Manutactured on	January 24, 2001

Certificate No: E1800V2-287_Aug11

Page 4 of 8



DASY5 Validation Report for Head TSL

Date: 16.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 287

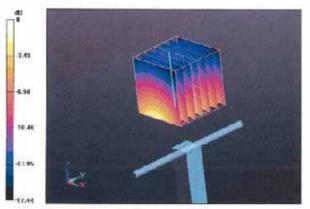
Communication System: CW; Frequency: 1800 MHz Medium parameters used: f = 1800 MHz; $\sigma = 1.37$ mho/m; $\epsilon_r = 39.7$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.07, 5.07, 5.07); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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 = 93.567 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 16.557 W/kg SAR(1 g) = 9.28 mW/g; SAR(10 g) = 4.9 mW/g Maximum value of SAR (measured) = 11.541 mW/g



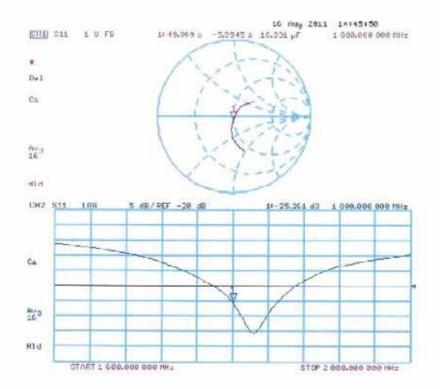


Certificate No: D1800V2-287_Aug11

Page 5 of 8



Impedance Measurement Plot for Head TSL



Certificate No: D18C0V2-287_Aug11

Page 6 of 8



DASY5 Validation Report for Body TSL

Date: 17.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 287

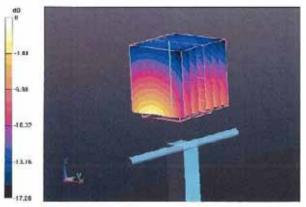
Communication System: CW, Frequency: 1800 MHz Medium parameters used: f = 1800 MHz; $\sigma = 1.5$ mho/m; $\epsilon_r = 54$; p = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Prohe: ES3DV3 SN3205; ConvF(4.74, 4.74, 4.74); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 90.491 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 16.947 W/kg SAR(1 g) = 9.58 mW/g; SAR(10 g) = 5.06 mW/g Maximum value of SAR (measured) = 11.829 mW/g



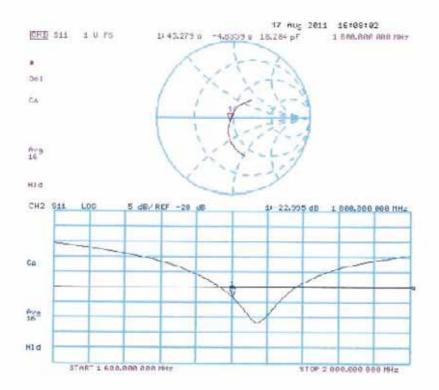
0 dB = 11.830 mW/g

Certificate No: D1800V2-287_Aug11

Page 7 of 8



Impedance Measurement Plot for Body TSL



Certificate No: D1800V2-287_Aug11

Page 8 of 8



6 Calibration report "1900 MHz System validation dipole"

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Accredited by the Swiss Accredit The Swiss Accreditation Servic Multilateral Agreement for the r	e is one of the signatorio	es to the EA	n No.: SCS 108
client Cetecom			le: D1900V2-5d009_Au
CALIBRATION (CERTIFICATE		Sala Managara
Object	D1900V2 - SN: 6	5d009	
Colibration procedure(a)	QA CAL-05.v8 Calibration proce	eture for dipole validation kits ab	ove 700 MHz
Calibration date:	August 17, 2011		
		ional standards, which realize the physical u	
The measurements and the unce	etainties with confidenco p otad in the closed laborate	local standards, which realize the physical u robability are given on the following pages a ry facility: environment temperature (22 ± 0)	nd are part of the partificate.
The measurements and the unce All calibrations have been condu- Calibration Equipment used (M&)	eta nies with confidence p stod in the closed laborate TE critical for calibration)	robability are given on the following pages a ry facility: env ronmant temperature (22 ± 0)'	nd are part of the partificate. 'C and humidity < 70%.
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstraceo 43, 8004 Zurich, Switzerland



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S Schweizerlacher Kalibrierdienst

- C Service suisco d'ótalonnago
- Servizio evizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS)

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) In the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty regulred.
- 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.
- SAH normalized: SAH 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.

Certificate No: D1900V2-5d009_Aug11

Page 2 of 8



Measurement Conditions

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center TEL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5±6%	1.42 mho/m ± 8 %
Hoad 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	10.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.0 mW /g ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	5.2/ mW / g

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mbo/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.9 ± 6 %	1.57 mho/m + 6 %
Body TSL temperature change during test	< 0.5 °C	1	

SAR result with Body TSL

reraged over 1 cm ³ (1 g) of Body TSL	Condition	
casured	250 mW nput power	10.4 mW / g
r nominal Body TSL parameters	normalized to 1W	40.9 mW/g ± 17.0 % (k=2)
eraged over 10 cm ³ (10 g) of Body TSL	condition	
and the second	2 100 10 10 10 10 10 10 10 10 10 10 10 10	5.43 mW / a
benuage	250 mill/ i	input power

normalized to 1W

21.5 mW/g ± 16.5 % (k=2)

Certificate No: D1900V2-5d009 Aug11

SAR for nominal Body TSL parameters

Page 3 of 8



Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.1 Ω + 2.7 jΩ	
Return Loss	- 30 9 dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 (2 + 2.8 J ^c)	
Return Loss	- 26.8 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.188 ns

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

The dipole is made of standard cominigid coaxial cable. The contor conductor of the fooding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

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

Manufacturec by	SPEAG
Manufactured on	February 22, 2002

Certificate No: D1900V2-50009_Aug11

Page 4 of 8



DASY5 Validation Report for Head TSL

Date: 16.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MIIz; Type: D1900V2; Serial: D1900V2 - SN: 5d009

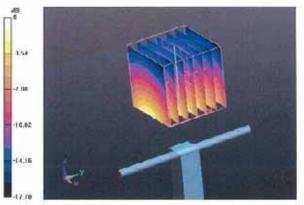
Communication System: CW; Frequency: 1900 MHz Medium parameters used: $\Gamma = 1900 \text{ MHz}$; $\sigma = 1.42 \text{ mho/m}$; $\epsilon = 39.5$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 29.04.2011
- Sensor Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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 = 97,320 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 18,403 W/kg SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.27 mW/g Maximum value of SAR (measured) = 12,504 mW/g



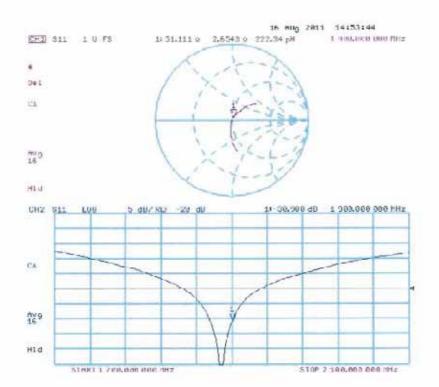
 $0 \, dB = 12.500 \, mW/g$

Certificate No: D (900V2-5cl009, Aug I 1

Page 5 of 8



Impedance Measurement Plot for Head TSL



Cutilicate No: D1900V2 5d009_Aug11

Page 6 of 8



DASY5 Validation Report for Body TSL

Date: 17.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Scrial: D1900V2 - SN: 5d009

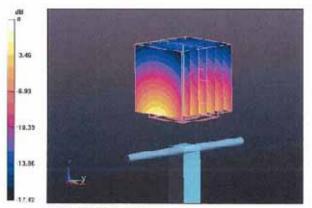
Communication System: CW; Frequency: 1900 MHz Medium parameters used: t = 1900 MHz; σ = 1.57 mho/m; c_t = 53.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 95.260 V/m; Power Drilt = 0.02 dB Peak SAR (extrapolated) = 18.457 W/kg SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.43 mW/g Maximum value of SAR (measured) = 13.111 mW/g



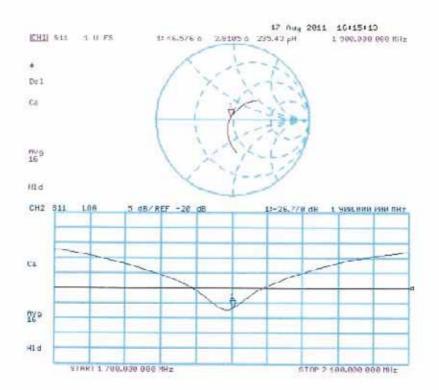
0 dB = 13.110 mW/g

Certilicate No: D1900V2 5d009_Aug11

Page 7 of 8



Impedance Measurement Plot for Body TSL



Certificate No: D1900V2-5dC09_Aug11

Page 8 of 8



7 Calibration report "2450 MHz System validation dipole"

Engineering AG Zoughausstrasso 43, 8004 Zurio	dı, Switzerland	Hac-MRA (SWISg SC	Service sulsse d'étalonnage Servizio svizzero di taratura
Accredited by the Swise Accredite The Swise Accreditation Service Multilateral Agreement for the n	e is one of the signatoric	s to the EA	n No.: SCS 108
cilent Cetecom	11000	Certificate N	o: D2450V2-710_Aug11
CALIBRATION C	ERTIFICATE		
Object	D2450V2 - SN: 7	10	
Col bration procedure(a)	QA CAL-05.v8 Calibration proce	dure for dipole validation kits abo	ovo 700 MHz
Calibration date:	August 19, 2011		
The measurements and the unce	stainties with confidence p	onal standards, which "calizo the physical un robebility are given on the following pages at w facility: environment temperature (22 + 3)"	nd are part of the certificate.
The measurements and the unce All calibrations have been conduc Galibration Equipment used (MB1	stainties with confidence p cted in the clused faturator TE critical for calibration)	robebility are given on the following pages ar w Buallity, environment temperature (22 ± 3)*	nd are part of the certificate. C and humidity < 70%
The measurements and the unce All calibrations have been conduc Calibration Equipment used (MB1 Primary Standards	etainties with confidence p cted in the clused faborator TE critical for calibration)	robebility are given on the following pages ar w facility: excloriment temperature (22 + 3)* Oul Data (Cartificate No.)	nd are part of the certificate. C and humidity < 70% Scheduled Calibration
The measurements and the unce All calibrations have been conduc Calibration Equipment used (MB1 Primary Standards Power motor EPM-442A	etainties with confidence p cted in the closed faborator TE critical for calibration) ID & GB37480704	Out Data (Certificate No.) 06-Oct-10 (No. 217-31268)	nd are part of the certificate. C and humidity < 70% Scheduled Calibration Oct 11
The measurements and the under All calibrations have been conduct Calibration Equipment used (MB1 Primary Standards Power motor EPM-442A Power sensor HP 6401A	etainties with confidence p cted in the closed faborator TE critical for calibration) ID & GB37/80704 US37/292783	Obe billity are given on the following pages at v facility: environment temperature (22 + 3)* Obl Dute (Certificate No.) 06 Oct 10 (No. 217-31266) 06-Oct-10 (No. 217-31266)	nd are part of the certificate. C and humidity < 70% Scheduled Calibration Oct 11 Oct-11
The measurements and the under All calibrations have been conduct Calibration Equipment used (MB1 Primary Standards Power motor EPM-4/2A Power sensor HP 8481A Reference 20 dB Attenuator	etainties with confidence p cted in the closed faborator TE critical for calibration) ID & GB37480704	Coll Date (Certificate No.) OG-Oct-10 (No. 217-01266) 29-M26-11 (No. 217-01266)	nd are part of the certificate. C and humidity < 70% Scheduled Calibration Oct 11 Oct-11 Anr-12
The measurements and the under All calibrations have been conduct Calibration Equipment used (MB1 Primary Standards Power motor EPM-442A Power sensor HP 6401A	etainties with confidence p cted in the closed faborator TE critical for calibration) 1D & GB37/80704 US37/292783 SN: 55066 (200)	Obe billity are given on the following pages at v facility: environment temperature (22 + 3)* Obl Dute (Certificate No.) 06 Oct 10 (No. 217-31266) 06-Oct-10 (No. 217-31266)	nd are part of the certificate. C and humidity < 70% Scheduled Calibration Oct 11 Oct-11
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The measurements and the under All calibrations have been conduct Galibration Equipment used (MBT Primary Standards Power rester EPM-4/2A Power sensor HP 9481A Reference 20 dB Attenuetor Type-N mismatch combination Reference Probe ES3DV3 LAE4 Secondary Standards Power sensor HP 9481A	tainties with confidence p ted in the closed faborator TE critical for calibration) ID # GB37/80704 US37/28763 SN: 55066 (200) SN: 5047.2 / 06327 SN: 5006 SN: 601 ID # MM41092317	Cal Date (Dertificate No.) Gal Date (Dertificate No.) 06 Oct 10 (No. 217-31266) 06 Oct 10 (No. 217-31266) 06 Oct 10 (No. 217-31266) 06 Oct 10 (No. 217-31266) 29-Mar-11 (No. 217-01367) 29-Mar-11 (No. 217-01367) 29-Mar-11 (No. 217-01367) 29-Mar-11 (No. E83-3205 Aur11) 04 Jul 11 (No. DAE4 e01_dul11) Chack Date (in house) 18 Oct-02 (in house)	nd are part of the certificate. C and humidity < 70% Scheduled Calibration Oot 11 Ool-11 Anr-12 Aur-12 Jul-12 Scheduled Check In house check: Oct-11
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Certificate No: D2450V2-710_Aug11

Page 1 of 8



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



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Schweizerischer Köllbrierdionat Service suisse d'étalennage C Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS)

The Swies Accreditation Service is one of the signatories to the EA Multilatoral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rale (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Certificate No: D2450V2-710_Aug11

Page 2 of 8



Measurement Conditions

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

DASY Vorsion	DASYS	V52.6.2
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
Mossurod Hoad TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.65 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 "C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	54.2 mW /g ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	6.42 mW / g

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mbo/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	100	

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Concition	
SAH measured	250 mW input power	13.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.7 mW / g ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 250 mW input power	6.10 mW / g

Cortificate No: D2450V2 710_Aug11



Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.2 Ω + 1.3 jΩ	
Return Loss	- 29.6 dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.5 Ω + 2.5 jΩ	
Return Loss	31.8 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 ns	
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard comingid coaxial cable. The conforcercurcur of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC eignals.

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

Additional EUT Data

Manufactured by	SPEAG	
Manufactured on	July 05, 2002	

Certificate No: D2450V2-710_Aug11

Page 4 of 8



DASY5 Validation Report for Head TSL

Date: 18.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 710

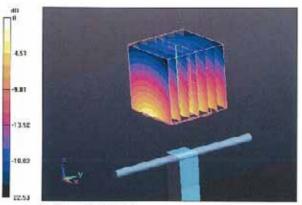
Communication System: CW: Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; $\sigma = 1.85$ mho/m; $c_r = 38.4$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19 2007)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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 = 101.9 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 28.588 W/kg SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.42 mW/g Maximum value of SAR (measured) = 17.763 mW/g



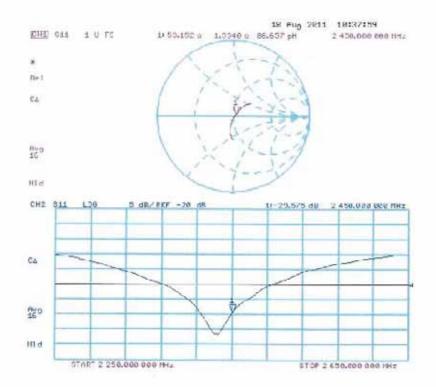
 $0 \, dB = 17.760 \, mW/g$

Certificate No: D2450V2-710_Aug11

Page 5 of 8



Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-710_Aug11

Page 6 of 8



DASY5 Validation Report for Body ISL

Date: 19.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 710

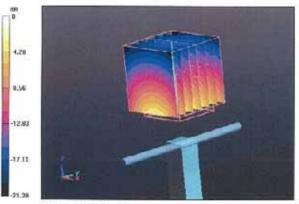
Communication System: CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; $\sigma = 2.02$ mho/m; $c_r = 51.8$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe; ES3DV3 SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 29.04.2011
- Senser-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 95.772 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 26.990 W/kg SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.1 mW/g Maximum value of SAR (measured) = 17.251 mW/g



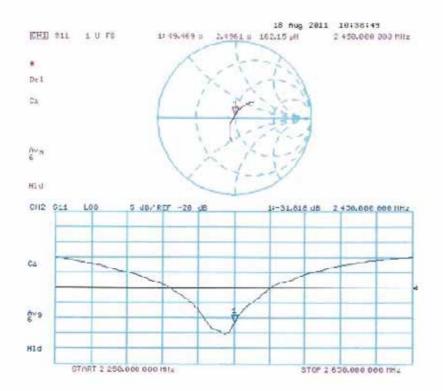
0 dB = 17.250 mW/g

Contificate No: D2450V2-710_Aug11

Page 7 of 8



Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-710_Aug11

Page 8 of 8



8 Calibration certificate of Data Acquisition Unit (DAE)

rugnausstrasse 43, 8004 Zune	ch, Switzerland	The Warks	Servizio svizzero di taratura Servizio svizzero di taratura Swiss Calibration Service
ccredited by the Swiss Accredit he Swiss Accreditation Servic	한 걸음을 다양한 일을 만큼 많은 사람이 있다.		tation No.: SCS 108
fultilateral Agreement for the	recognition of calibration	certificates	
Client Cetecom	1 3 3 4 4 5 1 7	Certifica	ate No: DAE3-413_Jan11
CALIBRATION	CERTIFICATE		
Object	DAE3 - SD 000 D	03 AA - SN: 413	or other states with the
Calibration procedure(s)	QA CAL-06.v22 Calibration proces	dure for the data acquisition	electronics (DAE)
Calibration date:	January 13, 2011		
The measurements and the unce	ertainties with confidence pro	nal standards, which realize the physic obability are given on the following pag	es and are part of the certificate.
The measurements and the unce All calibrations have been condu	ertainties with confidence pro		es and are part of the certificate.
The measurements and the unce All calibrations have been condu Calibration Equipment used (M&	rtainties with confidence protocol of the closed laboratory TE critical for calibration)	obability are given on the following pag r facility: environment temperature (22	es and are part of the certificate. ± 3)*C and humidity < 70%.
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards	ertainties with confidence pro	obability are given on the following pag	es and are part of the certificate.
The measurements and the unce	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration)	obability are given on the following pag r facility: environment temperature (22 Cal Date (Certificate No.)	es and are part of the certificate. ± 3)*C and humidity < 70%. Scheduled Calibration
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards Keithley Multimeter Type 2001	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration) ID # SN: 0810278	bability are given on the following pag facility: environment temperature (22 Cal Date (Certificate No.) 28-Sep-10 (No:10376)	es and are part of the certificate. ± 3)*C and humidity < 70%. Scheduled Calibration Sep-11
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards Keithley Multimeter Type 2001 Secondary Standards	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration) ID # SN: 0810278 ID #	obability are given on the following pag (facility: environment temperature (22 Cal Date (Certificate No.) 28-Sep-10 (No:10376) Check Date (in house)	es and are part of the certificate. ± 3)*C and humidity < 70%. Scheduled Calibration Sep-11 Scheduled Check
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards Keithley Multimeter Type 2001 Secondary Standards	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration) ID # SN: 0810278 ID #	obability are given on the following pag (facility: environment temperature (22 Cal Date (Certificate No.) 28-Sep-10 (No:10376) Check Date (in house)	es and are part of the certificate. ± 3)*C and humidity < 70%. Scheduled Calibration Sep-11 Scheduled Check In house check: Jun-11 Signature
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards Keithley Multimeter Type 2001 Secondary Standards Calibrator Box V1.1	artainties with confidence pro- cted in the closed laboratory TE critical for calibration) ID # SN: 0810278 ID # SE UMS 006 AB 1004	obability are given on the following pag (facility: environment temperature (22 Cal Date (Certificate No.) 28-Sep-10 (No:10376) Check Date (in house) 07-Jun-10 (in house check)	es and are part of the certificate. ± 3)*C and humidity < 70%. Scheduled Calibration Sep-11 Scheduled Check In house check: Jun-11 Signature
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards Keithley Multimeter Type 2001 Secondary Standards	Artainties with confidence pro- cted in the closed laboratory TE critical for calibration) ID # SN: 0810278 ID # SE UMS 006 AB 1004	obability are given on the following pag (facility: environment temperature (22 Cal Date (Certificate No.) 28-Sep-10 (No:10376) Check Date (in house) 07-Jun-10 (in house check) Function	es and are part of the certificate. ± 3)*C and humidity < 70%. <u>Scheduled Calibration</u> Sep-11 <u>Scheduled Check</u> In house check: Jun-11

Certificate No: DAE3-413_Jan11

Page 1 of 5

Annex E to	Test report	t no.: 1-3851/11-01-20
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9 Calibration certificate of Data Acquisition Unit (DAE)

Accredited by the Swiss Accredit The Swiss Accreditation Service	e is one of the signatories	to the EA	S Swiss Calibration Service
Multilateral Agreement for the Client Cetecom	recognition of calibration of		rtificate No: DAE3-477_May11
CALIBRATION	CERTIFICATE		
Object	DAE3 - SD 000 D	03 AA - SN: 477	
Calibration procedure(s)	QA CAL-06.v22 Calibration proceed	lure for the data acquisi	tion electronics (DAE)
Calibration date:	May 4, 2011		
The measurements and the unce All calibrations have been condu	ertainties with confidence pro	obability are given on the following	physical units of measurements (SI). Ig pages and are part of the certificate. Ie (22 ± 3)°C and humidity < 70%.
The measurements and the unce	ertainties with confidence pro	obability are given on the following	g pages and are part of the certificate.
The measurements and the unce All calibrations have been condu Calibration Equipment used (M&	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration)	bability are given on the followin facility: environment temperatur	ng pages and are part of the certificate. re (22 ± 3)°C and humidity < 70%.
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration)	bability are given on the followir facility: environment temperatur Cal Date (Certificate No.)	ig pages and are part of the certificate. re (22 ± 3)°C and humidity < 70%. Scheduled Calibration
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards Keithley Multimeter Type 2001	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration) ID # SN: 0810278 ID #	Cal Date (Certificate No.) 28-Sep-10 (No:10376)	ig pages and are part of the certificate. re (22 ± 3)°C and humidity < 70%. Scheduled Calibration Sep-11
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards Keithley Multimeter Type 2001 Secondary Standards	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration) ID # SN: 0810278 ID # SE UMS 006 AB 1004	Cal Date (Certificate No.) 28-Sep-10 (No:10376) Check Date (in house) 07-Jun-10 (in house check)	ig pages and are part of the certificate. re (22 ± 3)°C and humidity < 70%. Scheduled Calibration Sep-11 Scheduled Check In house check: Jun-11
The measurements and the unce All calibrations have been condu Calibration Equipment used (M& Primary Standards Keithley Multimeter Type 2001 Secondary Standards	ertainties with confidence pro- cted in the closed laboratory TE critical for calibration) ID # SN: 0810278 ID #	Cal Date (Certificate No.) 28-Sep-10 (No:10376) Check Date (in house)	ig pages and are part of the certificate. re (22 ± 3)°C and humidity < 70%. Scheduled Calibration Sep-11 Scheduled Check

Certificate No: DAE3-477_May11

Page 1 of 5



10 Certificate of "SAM Twin Phantom V4.0/V4.0C"

Schmid & Partner Engineering AG

Zeugheusstresse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fex +41 1 245 97 79

Certificate of conformity / First Article Inspection

ltem	SAM Twin Phantom V4.0
Туре No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites
i i	Hauptstr. 69
	CH-8559 Fruthwilen
	Switzerland

Tests

The series production process used allows the limitation to test of first articles. Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 8A, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article. Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz = 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-saries, First article

Standards

- [1] CENELEC EN 50361
- [2] IEEE P1528-200x draft 6.5
- [3] IEC PT 62209 draft 0.9
- The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

18.11.2001 Date Schmid & Partner Fra Brutelt : lat Signature / Stamp Engineering AG Zeughsusstrate 43, CH-BD04 Zurich Tel. 441 1 245 97 00, Féx +41 1 245 97 79

Doc No 881 - QD 000 P40 BA - B

Page 1 (1)



11 Application Note System Performance Check

11.1 Purpose of system performance check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check is performed prior to any usage of the system in order to guarantee reproducible results.

The measurement of the Specific Absorption Rate (SAR) is a complicated task and the result depends on the proper functioning of many components and the correct settings of many parameters. Faulty results due to drift, failures or incorrect parameters might not be recognized, since they often look similar in distribution to the correct ones. The Dosimetric Assessment System DASY4 incorporates a system performance check procedure to test the proper functioning of the system. The system performance check uses normal SAR measurements in a simplified setup (the flat section of the SAM Twin Phantom) with a well characterized source (a matched dipole at a specified distance). This setup was selected to give a high sensitivity to all parameters that might fail or vary over time (e.g., probe, liquid parameters, and software settings) and a low sensitivity to external effects inherent in the system (e.g., positioning uncertainty of the device holder). The system performance check does not replace the calibration of the components. The accuracy of the system performance check is not sufficient for calibration purposes. It is possible to calculate the field quite accurately in this simple setup; however, due to the open field situation some factors (e.g., laboratory reflections) cannot be accounted for. Calibrations in the flat phantom are possible with transfer calibration methods, using either temperature probes or calibrated E-field probes. The system performance check also does not test the system performance for arbitrary field situations encountered during real measurements of mobile phones. These checks are performed at SPEAG by testing the components under various conditions (e.g., spherical isotropy measurements in liquid, linearity measurements, temperature variations, etc.), the results of which are used for an error estimation of the system. The system performance check will indicate situations where the system uncertainty is exceeded due to drift or failure.

11.2 System Performance check procedure

Preparation

The conductivity should be measured before the validation and the measured liquid parameters must be entered in the software. If the measured values differ from targeted values in the dipole document, the liquid composition should be adjusted. If the validation is performed with slightly different (measured) liquid parameters, the expected SAR will also be different. See the application note about SAR sensitivities for an estimate of possible SAR deviations. Note that the liquid parameters are temperature dependent with approximately - 0.5% decrease in permittivity and + 1% increase in conductivity for a temperature decrease of 1° C. The dipole must be placed beneath the flat phantom section of the Generic Twin Phantom with the correct distance holder in place. The distance holder should touch the phantom surface with a light pressure at the reference marking (little hole) and be oriented parallel to the long side of the phantom. Accurate positioning is not necessary, since the system will search for the peak SAR location, except that the dipole arms should be parallel to the surface. The device holder for mobile phones can be left in place but should be rotated away from the dipole. The forward power into the dipole at the dipole SMA connector should be determined as accurately as possible. See section 4 for a description of the recommended setup to measure the dipole input power. The actual dipole input power level can be between 20mW and several watts. The result can later be normalized to any power level. It is strongly recommended to note the actually used power level in the "comment"-window of the measurement file; otherwise you loose this crucial information for later reference.



System Performance Check

The DASY4 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks, so you must save the finished validation under a different name. The validation document requires the Generic Twin Phantom, so this phantom must be properly installed in your system. (You can create your own measurement procedures by opening a new document or editing an existing document file). Before you start the validation, you just have to tell the system with which components (probe, medium, and device) you are performing the validation; the system will take care of all parameters. After the validation, which will take about 20 minutes, the results of each task are displayed in the document window. Selecting all measured tasks and opening the predefined "validation" graphic format displays all necessary information for validation. A description of the different measurement tasks in the predefined document is given below, together with the information that can be deduced from their results:

- The "reference" and "drift" measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the amplifier output power. If it is too high (above ± 0.1dB) the validation should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the DASY4 system below ± 0.02 dB.
- The "surface check" measurement tests the optical surface detection system of the DASY4 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). In that case it is better to abort the validation and stir the liquid. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.) However, varying breaking indices of different liquid compositions might also influence the distance. If the indicated difference varies from the actual setting, the probe parameter "optical surface distance" should be changed in the probe settings (see manual). For more information see the application note about SAR evaluation.
- The "area scan" measures the SAR above the dipole on a parallel plane to the surface. It is used to
 locate the approximate location of the peak SAR with 2D spline interpolation. The proposed scan uses
 large grid spacing for faster measurement; due to the symmetric field the peak detection is reliable. If a
 finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence
 on the SAR result.
- The zoom scan job measures the field in a volume around the peak SAR value assessed in the previous "area" scan (for more information see the application note on SAR evaluation).

If the validation measurements give reasonable results, the peak 1g and 10g spatial SAR values averaged between the two cubes and normalized to 1W dipole input power give the reference data for comparisons. The next section analyzes the expected uncertainties of these values. Section 6 describes some additional checks for further information or troubleshooting.

11.3 Uncertainty Budget

Please note that in the following Tables, the tolerance of the following uncertainty components depends on the actual equipment and setup at the user location and need to be either assessed or verified on-site by the end user of the DASY4 system:

- RF ambient conditions
- · Dipole Axis to Liquid Distance
- Input power and SAR drift measurement
- Liquid permittivity measurement uncertainty
- · Liquid conductivity measurement uncertainty

Note: All errors are given in percent of SAR, so 0.1 dB corresponds to 2.3%. The field error would be half of that. The liquid parameter assessment give the targeted values from the dipole document. All errors are given in percent of SAR, so 0.1dB corresponds to 2.3%. The field error would be half of that.



System validation

In the table below, the system validation uncertainty with respect to the analytically assessed SAR value of a dipole source as given in the P1528 standard is given. This uncertainty is smaller than the expected uncertainty for mobile phone measurements due to the simplified setup and the symmetric field distribution.

Error Sources	Uncertainty Value	Probability Distribution	Divi- sor	c _i 1g	c _i 10g	Standard Uncertainty 1g	Standard Uncertainty 10g	Vi ² Or V _{eff}
Measurement System								
Probe calibration	± 4.8%	Normal	1	1	1	± 4.8%	± 4.8%	∞
Axial isotropy	± 4.7%	Rectangular	√3	0.7	0.7	± 1.9%	± 1.9%	8
Hemispherical isotropy	± 0.0%	Rectangular	√3	0.7	0.7	± 0.0%	± 3.9%	∞
Boundary effects	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Probe linearity	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	8
System detection limits	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	8
Readout electronics	± 1.0%	Normal	1	1	1	± 1.0%	± 1.0%	8
Response time	± 0.0%	Rectangular	√3	1	1	± 0.0%	± 0.0%	8
Integration time	± 0.0%	Rectangular	√3	1	1	± 0.0%	± 0.0%	8
RF ambient conditions	± 3.0%	Rectangular	√3	1	1	± 1.7%	± 1.7%	8
Probe positioner	± 0.4%	Rectangular	√3	1	1	± 0.2%	± 0.2%	8
Probe positioning	± 2.9%	Rectangular	√3	1	1	± 1.7%	± 1.7%	8
Max. SAR evaluation	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	8
Test Sample Related								
Dipole axis to liquid distance	± 2.0%	Normal	1	1	1	± 1.2%	± 1.2%	8
Power drift	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	8
Phantom and Set-up								
Phantom uncertainty	± 4.0%	Rectangular	√3	1	1	± 2.3%	± 2.3%	8
Liquid conductivity (target)	± 5.0%	Rectangular	√3	0.64	0.43	± 1.8%	± 1.2%	∞
Liquid conductivity (meas.)	± 2.5%	Normal	1	0.64	0.43	± 1.6%	± 1.1%	8
Liquid permittivity (target)	± 5.0%	Rectangular	√3	0.6	0.49	± 1.7%	± 1.4%	∞
Liquid permittivity (meas.)	± 2.5%	Normal	1	0.6	0.49	± 1.5%	± 1.2%	8
Combined Uncertainty						± 8.4%	± 8.1%	
Expanded Std. Uncertainty						± 16.8%	± 16.2%	



Performance check repeatability

The repeatability check of the validation is insensitive to external effects and gives an indication of the variations in the DASY4 measurement system, provided that the same power reading setup is used for all validations. The repeatability estimate is given in the following table:

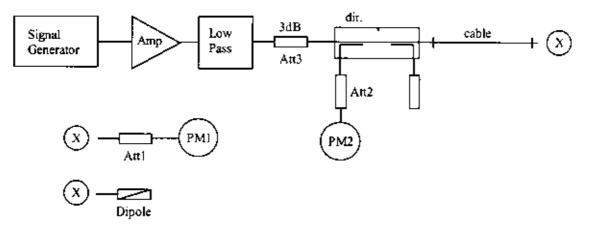
Error Sources	Uncertainty Value	Probability Distribution	Divi- sor	c _i 1g	c _i 10g	Standard Uncertainty 1g	Standard Uncertainty 10g	v _i ² or v _{eff}
						.9	log	·en
Measurement System								
Probe calibration	± 4.8%	Normal	1	1	1	0	0	8
Axial isotropy	± 4.7%	Rectangular	√3	0.7	0.7	0	0	8
Hemispherical isotropy	± 0.0%	Rectangular	√3	0.7	0.7	0	0	8
Boundary effects	± 1.0%	Rectangular	√3	1	1	0	0	8
Probe linearity	± 4.7%	Rectangular	√3	1	1	0	0	8
System detection limits	± 1.0%	Rectangular	√3	1	1	0	0	8
Readout electronics	± 1.0%	Normal	1	1	1	0	0	8
Response time	± 0.0%	Rectangular	√3	1	1	0	0	8
Integration time	± 0.0%	Rectangular	√3	1	1	0	0	8
RF ambient conditions	± 3.0%	Rectangular	√3	1	1	0	0	8
Probe positioner	± 0.4%	Rectangular	√3	1	1	0	0	8
Probe positioning	± 2.9%	Rectangular	√3	1	1	0	0	8
Max. SAR evaluation	± 1.0%	Rectangular	√3	1	1	0	0	8
Test Sample Related								
Dipole axis to liquid	± 2.0%	Normal	1	1	1	± 1.2%	± 1.2%	8
distance								
Power drift	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	8
Phantom and Set-up								
Phantom uncertainty	± 4.0%	Rectangular	√3	1	1	± 2.3%	± 2.3%	8
Liquid conductivity (target)	± 5.0%	Rectangular	√3	0.64	0.43	± 1.8%	± 1.2%	8
Liquid conductivity (meas.)	± 2.5%	Normal	1	0.64	0.43	± 1.6%	± 1.1%	8
Liquid permittivity (target)	± 5.0%	Rectangular	√3	0.6	0.49	± 1.7%	± 1.4%	8
Liquid permittivity (meas.)	± 2.5%	Normal	1	0.6	0.49	± 1.5%	± 1.2%	8
Combined Uncertainty						± 5.3%	± 4.9%	
Expanded Std.						± 10.6%	± 9.7%	
Uncertainty								

The expected repeatability deviation is low. Excessive drift (e.g., drift in liquid parameters), partial system failures or incorrect parameter settings (e.g., wrong probe or device settings) will lead to unexpectedly high repeatability deviations. The repeatability gives an indication that the system operates within its initial specifications. Excessive drift, system failure and operator errors are easily detected.



11.4 Power set-up for validation

The uncertainty of the dipole input power is a significant contribution to the absolute uncertainty and the expected deviation in interlaboratory comparisons. The values in Section 2 for a typical and a sophisticated setup are just average values. Refer to the manual of the power meter and the detector head for the evaluation of the uncertainty in your system. The uncertainty also depends on the source matching and the general setup. Below follows the description of a recommended setup and procedures to increase the accuracy of the power reading:



The figure shows the recommended setup. The PM1 (incl. Att1) measures the forward power at the location of the validation dipole connector. The signal generator is adjusted for the desired forward power at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow a setting in 0.01dB steps, the remaining difference at PM2 must be noted and considered in the normalization of the validation results. The requirements for the components are:

- The signal generator and amplifier should be stable (after warm-up). The forward power to the dipole should be above 10mW to avoid the influence of measurement noise. If the signal generator can deliver 15dBm or more, an amplifier is not necessary. Some high power amplifiers should not be operated at a level far below their maximum output power level (e.g. a 100W power amplifier operated at 250mW output can be quite noisy). An attenuator between the signal generator and amplifier is recommended to protect the amplifier input.
- The low pass filter after the amplifier reduces the effect of harmonics and noise from the amplifier. For most amplifiers in normal operation the filter is not necessary.
- The attenuator after the amplifier improves the source matching and the accuracy of the power head. (See power meter manual.) It can also be used also to make the amplifier operate at its optimal output level for noise and stability. In a setup without directional coupler, this attenuator should be at least 10dB.
- The directional coupler (recommended ³ 20dB) is used to monitor the forward power and adjust the signal generator output for constant forward power. A medium quality coupler is sufficient because the loads (dipole and power head) are well matched. (If the setup is used for reflective loads, a high quality coupler with respect to directivity and output matching is necessary to avoid additional errors.)
- The power meter PM2 should have a low drift and a resolution of 0.01dBm, but otherwise its accuracy has no impact on the power setting. Calibration is not required.
- The cable between the coupler and dipole must be of high quality, without large attenuation and phase changes when it is moved. Otherwise, the power meter head PM1 should be brought to the location of the dipole for measuring.
- The power meter PM1 and attenuator Att1 must be high quality components. They should be calibrated, preferably together. The attenuator (³10dB) improves the accuracy of the power reading. (Some higher power heads come with a built-in calibrated attenuator.) The exact attenuation of the attenuator at the frequency used must be known; many attenuators are up to 0.2dB off from the specified value.



- Use the same power level for the power setup with power meter PM1 as for the actual measurement to avoid linearity and range switching errors in the power meter PM2. If the validation is performed at various power levels, do the power setting procedure at each level.
- The dipole must be connected directly to the cable at location "X". If the power meter has a different connector system, use high quality couplers. Preferably, use the couplers at the attenuator Att1 and calibrate the attenuator with the coupler.
- Always remember: We are measuring power, so 1% is equivalent to 0.04dB.

11.5 Laboratory reflection

In near-field situations, the absorption is predominantly caused by induction effects from the magnetic nearfield. The absorption from reflected fields in the laboratory is negligible. On the other hand, the magnetic field around the dipole depends on the currents and therefore on the feed point impedance. The feed point impedance of the dipole is mainly determined from the proximity of the absorbing phantom, but reflections in the laboratory can change the impedance slightly. A 1% increase in the real part of the feed point impedance will produce approximately a 1% decrease in the SAR for the same forward power. The possible influence of laboratory reflections should be investigated during installation. The validation setup is suitable for this check, since the validation is sensitive to laboratory reflections. The same tests can be performed with a mobile phone, but most phones are less sensitive to reflections due to the shorter distance to the phantom. The fastest way to check for reflection effects is to position the probe in the phantom above the feed point and start a continuous field measurement in the DASY4 multi-meter window. Placing absorbers in front of possible reflectors (e.g. on the ground near the dipole or in front of a metallic robot socket) will reveal their influence immediately. A 10dB absorber (e.g. ferrite tiles or flat absorber mats) is probably sufficient, as the influence of the reflections is small anyway. If you place the absorber too near the dipole, the absorber itself will interact with the reactive near-field. Instead of measuring the SAR, it is also possible to monitor the dipole impedance with a network analyzer for reflection effects. The network analyzer must be calibrated at the SMA connector and the electrical delay (two times the forward delay in the dipole document) must be set in the NWA for comparisons with the reflection data in the dipole document. If the absorber has a significant influence on the results, the absorber should be left in place for validation or measurements. The reference data in the dipole document are produced in a low reflection environment.

11.6 Additional system checks

While the validation gives a good check of the DASY4 system components, it does not include all parameters necessary for real phone measurements (e.g. device modulation or device positioning). For system validation (repeatability) or comparisons between laboratories a reference device can be useful. This can be any mobile phone with a stable output power (preferably a device whose output power can be set through the keyboard). For comparisons, the same device should be sent around, since the SAR variations between samples can be large. Several measurement possibilities in the DASY software allow additional tests of the performance of the DASY system and components. These tests can be useful to localize component failures:

- The validation can be performed at different power levels to check the noise level or the correct compensation of the diode compression in the probe.
- If a pulsed signal with high peak power levels is fed to the dipole, the performance of the diode compression compensation can be tested. The correct crest factor parameter in the DASY software must be set (see manual). The system should give the same SAR output for the same averaged input power.
- The probe isotropy can be checked with a 1D-probe rotation scan above the feed point. The automatic probe alignment procedure must be passed through for accurate probe rotation movements (optional DASY4 feature with a robot-mounted light beam unit). Otherwise the probe tip might move on a small circle during rotation, producing some additional isotropy errors in gradient fields.